COPING WITH UNCERTAINTY: CULTURAL RESPONSES TO RESOURCE FLUCTUATIONS IN THE NORTHERN PLAINS

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ABSTRACT

This dissertation examines hunting and gathering subsistence systems as they cope with food supplies which fluctuated between extreme abundance and scarcity. The focus is the aboriginal and European-derived cultures which occupied the Northern Plains in the late 17th through late 19th centuries. The study was directed towards the development of middle range theory to be used in archaeological interpretation.

The study began with a cross-cultural overview of research on hunger, famine, seasonal resource stress and related phenomena. Then it moved to a survey of resource stress in hunting and gathering subsistence systems at which time a model explicating adjustments in the economic, social, political and idelogical realms was developed. This model was initially applied to a sample of 38 hunting and gathering subsistence systems living in different environmental regions and described in the Human Relations Area Files. Then it was applied to the aboriginal and European social systems which provisioned themselves through hunting and gathering in the Northern Plains in the Early Historic Period. The archaeological utility of the model was evaluated through examination of empirical indicators of resource stress which appear in the archaeological record of the Mid-Holocene Climatic Optimum.

DEDICATION

For Sarah

(Everything I Do, I Do It For You)

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I have been the student of many teachers of anthropology, archaeology, and sociology, both formally in seminars and classrooms and informally through acquaintance and reading. I recognize an intellectual debt to each of them. My interest in archaeology began in 1958 when I spent a magical week visiting archaeological sites in east-central Alberta with Claude May, a well-respected avocational archaeologist. When I returned home, my mother, Annie Milne, suggested that we look for surface sites west of Bowden, Alberta. On our first reconnaissance we discovered 7 sites which we revisted many times in the ensuing years. The establishment in 1964 of the first Archaeology department in North America at the University of Calgary made the dream of a career in archaeology a possibility. I became one of the first students, studying with Dr. Richard S. MacNeish, Dr. Richard Forbis and Dr. Brian O. K. Reeves. My first introduction to method and theory was provided by Scotty MacNeish, whose feisty personality, enthusiasm and support convinced me that a 12 year-old's dream of a career in archaeology was not only possible but realizable. The MacNeishian approach stressed cultural reconstruction or as we students thought, "fairytale formation". Dick and Barney provided complementary backgrounds to Plains prehistory. Whereas the former facilitated an understanding of ethnological and ethnohistorical dimensions to Plains archaeology, the latter provided an opportunity to undertake fieldwork. A delight in the finer points of field methodology was learned from the late Dr. Iain Walker of the National Historic Sites Service, Ottawa, during 1966 excavations at historic military sites in Ontario and New Brunswick. My introduction to human ecology came in 1979 and was provided by Dr. Al Olmsted of the Department of Sociology at the University of Calgary, whose advocacy of the POET Model led me to explore interrelationships amongst population, social organization, environment and technology on the prehistoric Northern Plains in general, as well as the Suffield Military Reserve, in particular. To Dr. Brian Hayden of the Archaeology Department at

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TABLE OF CONTENTS

Page

6. SUMMARY AND CONCLUSIONS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

SETTING THE STAGE

1.1 Introduction

> What men eat and drink is shaped not only by cooking techniques and equipment, but by agriculture and animal husbandry, by the availability of water and fuel, by knowledge of botany, biology, and the ecology of plants, insects and animals. Success or failure in the quest for food has dictated population growth and urban development, as well as economic, social and political theory. And the quest itself has been the catalyst of exploration, trade, technological development, and - not infrequently - war and dominion . . .
> When he obtains food . . . It is a phrase with the widest implications, because the history of food is inextricably linked with the history of mankind. In the last analysis, without food there would be no history - and no mankind (Tannahill 1968: 5-7).

The history of humankind is in large part the chronicle of our quest for food. Hunger, or the fear of it, has always played a major role in determining the actions and attitudes of humans. The contemplation of scarcity may come as a shock to us, but uncertainty in food supply was a fact of life accepted by our ancestors and it still is an expected phenomenon among most of the world's peoples. Its root causes lie in "climatic and environmental variability, the growth of human populations, their social organization and technologies, and the interrelations between populations and their environments" (Millman and Kates 1990:3). Human responses to hunger or the fear of hunger can serve to prevent or reduce it or its consequences. It would appear that human beings typically have inbuilt mechanisms, at both the biological and cultural levels, to cope with the vagaries that are part of every environment. It has become common for anthropologists to regard fluctuations in food supply and the associated coping strategies as having had a significant impact on social and cultural evolution (eg. Binford 1968; Shnirelman 1992).

This dissertation will investigate the relationship between food supply fluctuations and technological and organizational responses in societies largely dependent on the hunting and gathering of wild foods. The research will be directed towards: a) production of a model of hunter-gatherer response to fluctuating food supplies in arid temperate environments and b) evaluation of said model in terms of archaeological visibility and middle range theory. The Northern Plains in the 18th and 19th centuries is the focus of the current study.

1.2 Prior Research

While fluctuations in food supply have considerable time depth and various disciplines acknowledge their existence the problem of acute shortages alternating with abundance, has not been dealt with systematically by the social scientific community. Gradual change has occurred in the past decade but there generally remains a paucity of longitudinal research on the interrelationship between uncertainty in food supply and social behavior. Although researchers from a variety of disciplines including biology, economics, history, geography, sociology, and anthropology have become involved, their research has generally emphasized the study of acute episodic food shortages, otherwise known as famine, rather than chronic recurring food shortages or, alternatively, oscillating abundance and insufficiency.

1.2.1 Comprehensive Studies: A Review

Most social scientists are in agreement that **Essay on Population** by Thomas Malthus (1970), which recognized famine, war and pestilence as constant regulators of human population growth, initiated studies of the relationship between food systems and population. Many years later, Sorokin's (1975) **Hunger As A Factor in Human Affairs**, published in Russia in 1922, examined the biological and behavioral changes experienced by humans under the acute food stress of the Russian famine of 1918-21.

Later still, in **The Biology of Human Starvation**, the United States military documented the extensive physiological effects of starvation using human volunteers (Keys et al 1950). In their analysis of 357 known famines extending from 1708 B.C. to A.D. 1933, Keys et al (1950) concluded that the vast majority had their immediate origins in crop failures from drought, excessive rain, or unseasonable frosts and that famine has been a causal agent in human affairs.

In the past three decades a number of factors have conspired to raise the profile of famine as a worldwide social problem. Contributing factors have been the social consciousness of the 1960's, famine in the Sahel and the Horn of Africa, the high profile of organizations such as United Nations Food and Agriculture Organization, the work of Mother Teresa and Bob Geldoff, and the realization that the gap between the rich and the poor is growing and is responsible for political conflict. The result has been increasing awareness of the role of food shortages in shaping human history and prehistory.

Famine has been identified as a concern by researchers whose focus is "disaster research". In **Communities in Disaster: A Sociological Analysis of Collective Stress Situations**, Bartow (1969) used the Irish Famine of 1845-49 in developing a general theory of behavior under collective stress. **Famine: A Symposium Dealing With Nutrition and Relief Operations in Times of Disaster** (Blix et al 1971) explored the biological and social correlates of acute food shortages. A paper by Jelliffe and Jelliffe (1971) examined the biological and psychological consequences of communal starvation on the function of the family and society. One of the first and most comprehensive summaries of different human coping strategies is included in this article.

"Hazards research" has been recently developed by geographers. Burton and Hewitt (1974) and more recently Burton, Kates and White (1978) have isolated environmental factors responsible for food shortages, amongst them drought, frosts, vulcanism, and floods. Of utmost importance was the recognition that,

> the most vulnerable societies are neither the poorest and least developed, nor the wealthiest and most highly developed, but those societies in process of rapid transition or modernization, where the traditional social mechanisms for absorbing losses and sharing them among the community have been eroded away and have not yet been replaced by the accumulated wealth and response capacities of more modern societies (Burton, Kates and White 1978: 16).

Landurie (1971) in **Times of Feast, Times of Famine** linked climatic change to food shortages in western Europe, but cautioned against seeing environmental factors as the sole agent. In **The Geography of Famine**, Dando (1980) looked at the causes of past famines as a means of providing mitigation for future food shortages. Robson (1981) in **Famine: Its Causes, Effects and Management** attempted to dispel the myth that a prime mover such as drought, flood, locusts, earthquake, plant disease or war is responsible for famine. **Hunger and History: The Impact of Changing Food Production and Consumption Patterns on Society** (Rotberg and Rabb 1983) derived from a meeting of historians, demographers, economists, food scientists and nutritionists who were concerned with the role of food in history and the real or false impact of its sufficiency or insufficiency on variables such as fertility, morbidity and mortality. **Famine: A Heritage of Hunger** (Golkin 1987) is a guide to issues relating to famine and contains a comprehensive bibliography of famine related literature. In **Famine: Social Crisis and Historical Change**, Arnold (1988:3) tried to show that " historically food was one of the principal sinews of power." The most recent tome, **Hunger in History: Food Shortages, Poverty and Deprivation** (Newman 1990), is a report from another interdisciplinary seminar convened to discuss the history of hunger and the present hunger problem.

Most research on food shortages has focused on massive famines experienced by agriculturalists and pastoralists living in Third World countries. There has been a tendency to deal with each situation separately though attempts at formulating a general theory of famine are emerging (Arnold 1988). The problems of oscillating shortages and abundance have been dealt with in contemporary Africa (Huss-Ashmore et al 1989) but remain generally absent for other regions and for the past.

1.2.2 Anthropological Studies: A Review

The current spate of theory building in anthropology and growth of the ecological anthropological paradigm have led to renewed interest in resource fluctuations in both prehistoric and contemporary non-industrial societies and it is in anthropology where one sees theoretical models explicating the effects of fluctuating food supplies. Prior to reviewing the literature, it is, however, important to understand the reasons underlying the sluggishness with which these developments have occurred.

Anthropologists have long studied people exposed to severe ecological stresses. There are numerous references in the ethnographic literature to hunger and famine resulting from environmental disturbance brought about by earthquakes, volcanism, disease, drought, floods, pestilence and mobile animal resources that failed to materialize when expected. There are many reasons why anthropologists have failed to investigate the importance of such events. Social scientists, in general, and anthropologists, in particular, have viewed resource fluctuations as disruptive but nothing more than occasional perturbations and have failed to see their significance to long-term adaptation. Ignoring the variability within societies has typified hunter and gatherer ecology for over 20 years (Lee and DeVore 1968a; Wilmsen and Denbow 1990; Jochim 1991). In addition, general systems theory, through the concept of homeostasis, reinforced the notion that resource fluctuations were unusual and have to be quickly overcome in order to return cultural-environmental systems to stability. The short-term nature of most ethnographic fieldwork has also hindered research . According to Colson (1979:18),

> We ought to assume therefore, that in thinking about how to exploit their environment, they take into consideration longer periods than the annual cycle. But we seem to be rather poorly equipped to discover what that longer period may be, because anthropological field work in the past has been geared to the year and to the assumption

> that if we saw the annual cycle through, we would know the normal run of behavior. It is only through repeated visits that you discover that there is no such thing as a normal year.

Other reasons for the dearth of resource fluctuation studies are the ethical problems of studying people currently suffering the effects of disastrous food shortages, the unpredictability of disasters, the expense of longitudinal research, and the offensive field conditions. Furthermore, during famine episodes researchers' travel gets restricted, informants disappear, problems of survey ethics and etiquette deepen, and officials alter statistics to deflect unfavorable attention or attract aid (Shipton 1990). Lastly, resource fluctuations usually are multicausal, thereby necessitating complex interdiscipinary research. Colson (1979) and Huss-Ashmore (1989) also suggest that anthropologists come from social settings where they themselves are buffered from resource fluctuations and thus simply do not recognize their importance. There is also a widely-held assumption that long-term average conditions rather than episodic extremes dictate human adaptation (Dunlap 1980). To conclude, anthropologists have permitted unproven assumptions about hunting and gathering subsistence systems and the problems of fieldwork to hinder consideration of the impact of resource fluctuations on these societies.

It might be said that an interest in fluctuating resources in contemporary hunting and gathering subsistence systems goes back to 1972 when Colin Turnbull published **The Mountain People**. This controversial account of the hunger experienced by the Ik of Uganda led to a vigorous debate in **Current Anthropology** in the mid 1970s. In a subsequent article, Turnbull (1978:49) emphasized that "the Ik are adapted and adjusted to prolonged environmental disruption and stress and as such exemplify much of the profound resiliency of human adaptive infrastructures in selecting successfully for some measure of population survival and sociocultural continuity under extremely adverse environmental conditions." Turnbull's work paved the way for a proliferation of articles on resource fluctuations in hunting and gathering subsistence systems; these studies will be reviewed in Chapter 2.

Comparative analysis of food shortages began with a definitive article by Colson (1979) who recognized that we must balance our own perceptions about scarcity and abundance against the reality, "Only during the past century have we been able to entertain the assumption that each year must be a good one. . . Our predecessors cherished no such illusion. . . They hoped to make up during the good years for the losses of the bad, to survive through the bad" (Colson 1979:18). In building theory, Colson reviewed famine coping strategies employed by self-reliant societies noting that assessment of damage preceded action and actions were hierarchically ranked and geared to the perceived temporal and spatial characteristics of the problem.

In **Extinction and Survival in Human Populations**, Laughlin and Brady (1978) presented a model linking environmental disruption or stress with predictable variations in behavior. They suggested that successful adaptation to such stress involves society-wide responses and is manifest in sociability, exchange, food production, political behavior and ritual action. They also identified two types of ecological stress, disaster and deprivation, as major conditions for cultural change. These two phenomenon were examined in subsequent case studies of hunting and gathering, horticultural and agricultural societies.

Continuing in this direction, Dirks (1980) examined cross-cultural regularities in social behavior during periods of severe scarcity. Dirks saw starvation and famine as points on a single continuum and as simultaneously biological and social phenomena. Using stress as his perspective, Dirks borrowed from Selye (1956) the notion of a "general adaptation syndrome" whereby responses to stressors are divisible into three chronological stages- alarm, resistance and exhaustion.

Torry looked at anthropological studies of hazardous environments (Torry 1979) and social science research on famine (Torry 1984), concluding that research has barely begun and emphasizing the uniqueness of such research,

Even a little insight will tempt one to concur with

> sociologists who liken disaster settings to natural laboratories. Nature produces a degree of social tampering, forbidden to the experimenter, that reveals the institutional moorings of communities or entire nations. Roles and groups, and their tasks and functions, that were formerly compartmentalized suddenly merge within a common frame of activity, revealing aspects of social control, integration, resilience and change less conspicuous in more routine crises. . . Disaster situations would seem, then, an ideal medium to spawn and test a medley of social theories. Prospects here far overshadow concrete achievements, however, because of a dismaying paucity of in-depth field study (Torry 1979:529).

In the late 1980's anthropological interest in food supply uncertainty expanded. Garnsey's (1988), **Famine and Food Supply in the Graeco-Roman World: Responses to Risk and Crises** looked at food supply problems in Athens and Rome from 600 B.C. to A.D. 250. He began by distinguishing between famine and food shortage. In his review of the relevant literature, Garnsey looked at the following specifics of food shortage- immediate causes, geographic range, location, duration, price movements, incidence of disease, response of authorities, behavior of the people, categories of victim, and mortality. He then explored coping strategies in the realms of production, social and economic relationships, and demographic behavior.

Coping With Uncertainty in Food Supply (de Garine and Harrison 1988) is a group of papers presented at a 1982 conference held in Bad Homburg by the International Commission on the Anthropology of Food, a subgroup of the International Union of Anthropological and Ethnological Sciences. Participants reaffirmed that "the question of fluctuating food supplies...is not only of great academic significance in understanding both the biological and social structures of human populations, but is of considerable practical relevance to malnutrition and underfeeding" (de Garine and Harrison 1988:v). The conference focused on seasonal fluctuations and the consequent shortages in food supply amongst nonhuman primates, hunting and gathering societies, pastoralists, horticulturalists, and non-industrial agriculturalists. Questions relating to fluctuations in specific food resources; relationships between these fluctuations and the natural environment and human economies; the biological and cultural characteristics that help peoples to cope with uncertainties in their food supply; and, the impact of advanced modern societies on traditional ones, were explored.

Famine is a collection of four papers which looked at the causes of famine as well as the nutritional biology of the phenomenon, with a focus on African case studies (Harrison 1988). Though acknowledging that little attention has been given to the factors which lead up to full-fledged famine conditions, the authors emphasized that famine is multicausal. Socioeconomic and biophysical causes were identified as far more significant than environmental factors.

In **Coping With Seasonal Constraint** (Huss-Ashmore et al 1989), the impact of climatic seasonality on food supply was examined, once again with an African focus. The author viewed "seasonal fluctuation as an obvious and important aspect of most human environments, producing changes not only in climate but also in patterns of child growth, fertility, disease, and resource variability. . . Most societies have built up patterns of labor, storage, and exchange to deal with seasonal constraints" (Huss-Ashmore 1989:6). While acknowledging that linkages between environmental seasonality and the seasonality of human responses are not well understood, it was suggested that many of the coping strategies that evolved to deal with seasonal constraints form the basis of response to long-term stress as well. That coping strategies may in some instances complement or perhaps even conflict with one another, was also noted.

Bad Year Economics: Cultural Responses to Risk and Uncertainty (Halstead and O' Shea 1989) is a collection of 9 papers that view unpredictable resource fluctuations as important as population growth, technological innovation, and political conflict in explaining the transformation of society which occurred with domestication and the rise of the state. The individual case studies examined the mechanisms used by societies to buffer themselves against periodic variation in food availability; the impact of these strategies on other aspects of cultural organization; and the extent to which these coping strategies provide the impetus for social change.

Ecological and economic anthropologists evaluated the responses of different types of societies in **Risk and Uncertainty in Tribal and Peasant Economies** (Cashdan 1990). Lacking in the formal institutions that industrial nations use to buffer risk and uncertainty, tribal and peasant societies were found to have evolved unique coping strategies.

Half the papers published in **Hunger in History** (Newman 1990) have an anthropological focus. A causal model of hunger that considered food deprivation at the individual level, food poverty at the household or group level, and food shortage at the regional level was developed. The causes of hunger were seen as food system breakdown, entitlement failure, and environmental hazard.

Despite the acknowledged importance of food patterns to human evolution (Harris and Ross 1987), the study of prehistoric food shortages is limited. Several exceptions are noted. Cohen (1977) linked the domestication of plants and animals to population pressure coupled with food stress and Minnis (1981) examined the economic and organizational responses to food stress by non-stratified societies in prehistoric New Mexico. Recently, Moore (1991) explored cultural responses to marine-terrestrial resource fluctuations caused by environmental catastrophes in prehistoric coastal Peru. In addition, papers in volumes by Cohen and Armelagos (1984) and Gilbert and Mielke (1985) look at nutritional deficiencies in prehistoric diet as revealed by osteological data.

The study of resource fluctuations in all types of subsistence systems has substantial merit. It leads to improved understanding of political behavior, social mechanisms and economic relationships of past and present social systems. Resource stress is increasingly seen as a causal agent in social and cultural evolution. The academic study of resource fluctuations may be of immense practical importance in developing early warning systems of impending shortages and even famines. Furthermore, the opportunity for setting up and testing social theories is considerable since fluctuating food supplies expose strengths and weaknesses of socioeconomic systems. Ultimately, the core of human dietary practice must be regarded in terms of the emergence of the hominidae and the co-evolution of human diet and our physical potential for cultural behavior (Harris and Ross 1987).

1.3 The Study Area

The northern plains comprise the lands lying between the North Saskatchewan River of central Alberta and Saskatchewan and the Missouri River of northern Montana and North Dakota and extending east from the foothills of the Rocky Mountains to southwestern Manitoba (Figure 1). Prior to the 1880s, large herds of ungulates, most notably bison, deer, elk, moose, pronghorn antelope and perhaps even mountain sheep, occupied the area. This region was occupied almost exclusively by Native Americans until the mid 18th century when the Hudson's Bay Company, Northwest Company, XY Company and American Fur Company penetrated the Plains in search of furs and provisions. The Saskatchewan River system permitted rapid encroachment into the area from the east and the Missouri facilitated invasion from the south. Ten tribes of equestrian nomads, including the Sioux, Plains Cree, Plains Ojibwa, Crow, Assiniboine, Gros Ventre, Blood, Piegan, Blackfoot, and Sarsi, and the 3 tribes of semi-sedentary horticulturalists, including the Mandan, Hidatsa and Arikara, occupied the area (Figure 2). The Métis emerged as a new ethnic group in the early historic period.

Ethnohistorical, historical and ethnographical data provides documention of ongoing resource stress linked directly to a resource base which fluctuated in terms of productivity, predictability and patchiness.

1.4 Research Summary

In the following chapters a model of cultural response to resource fluctuations, particularly scarcity, is developed and evaluated.

In Chapter 2 the theoretical perspective, terminology, research summary and methodology are reviewed. The utility of the socioecological perspective and the ecological anthropological paradigm is evaluated and the methodology reviewed.

Chapter 3 is oriented to the development of the model which will guide the subsequent research. Its focus is on societies which provision themselves largely through the hunting and gathering of wild foods. The chapter begins with a comprehensive survey of the literature on hunter-gatherer adaptations. From this is developed a model which proposes that coping strategies occur in four separate domains: the economic, social, political, and ideological. Groups of coping strategies in each of these realms are identified and described. A sample of 38 societies drawn from the **Human Relations Area Files** provides additional examples of resource stressors and coping strategies. The chapter closes with a suite of predictions drawn from this model.

In Chapters 4 and 5 the model is applied to the early historic northern plains and the peoples who occupied the region and who provisioned themselves largely through the hunting and gathering of wild foods. Chapter 4 looks at the grassland ecology of the region emphasizing environmental variability and its impact on humankind. Resource structure and the major stressors which modify this structure are the focus. Data on the early historic period deriving from ethnohistorical, historical, and ethnographical sources plus contemporary studies in the field of grassland ecology provide the data base.

Having set the environmental stage in Chapter 4, Chapter 5 moves on to examine the subsistence systems of the people who hunted and gathered in the area in the 18th and 19th centuries. This included a dozen or more Indian tribes, Eurocanadians and Euroamericans involved in the fur trade, and a new ethnic group, the Métis. A qualitative and quantitative analysis of specific resource stressors facing these groups and the associated coping strategies they devised are discussed. A comparison of the similarities and differences in coping strategies of the long-term aboriginal inhabitants and the recent Eurocanadian and Euroamerican peoples is undertaken.

In Chapter 6 the paradigm, methodology, and model are reviewed and evaluated. The utility of the model as middle range theory is assessed. It is proposed that paleoenvironmental indicators of resource stress, plus archaeological evidence of coping strategies can in some cases be identified in the paleoenvironmental/paleocultural record, while in other cases they are not visible. A specific test of the model was outlined through an examination of environmental and cultural changes that accompanied the paleoenvironmental period known as the Mid-Holocene Climatic Optimum. The dissertation concludes with a social commentary on the place of hunting and gathering activities in contemporary food-producing societies faced with severe resource stress.

CHAPTER 2

THEORY AND METHOD IN THE STUDY OF RESOURCE STRESS

2.1 Introduction

> Mankind is a species of animal. Human beings are part of the ecosystem of the earth, and dependent upon it for all things necessary to life (Hughes 1975:20).
>
> Features of the natural habitat become significant only when and as they are introduced into cultural systems and become incorporated in them as cultural elements (White 1959a).
>
> The ecological view of culture is among the most productive of systemic frameworks in archeology and anthropology (Watson, LeBlanc and Redman 1971:88).

Human societies rely on the biophysical environment for sustenance and, as a result they have developed various cultural mechanisms for coping with provisioning problems. In so doing, they have created a social milieu, which, taken together with the biophysical phenomena, form the environment with which they interact. Despite criticism by Bargatzky (1984) and others of the "adaptationist programme" in cultural anthropology, the concept of adaptation remains a parsimonious explanation of that complex of interrelationships that unite physical and social environments and humankind (Earle 1984; Peoples 1984; Petersen 1984). Using the concept of adaptation, the perspective of socioecology and the broader ecological anthropological paradigm, this dissertation is a study in human adaptability, focusing on selected functional and structural features of human populations that facilitated their coping with environmental variability. The purpose of this chapter is to explicate the theoretical and methodological stance used herein. First, an outline of the basic premises of ecological anthropology is presented, including examination of the phenomena of adaptation, culture, variation, selection, environment, and adaptive strategy. Second, paradigmatic approaches to northern plains anthropology are reviewed. Last, the methology used to gather quantitative and qualitative data is described.

2.2 A Theoretical Stance

2.2.1 Socioecology and the Ecological Anthropological Paradigm

The writer has selected the socioecological perspective (Winterhalder and Smith 1981b) and the ecological anthropological paradigm (Vayda and McCay 1975; Hardesty 1977; Orlove 1980; Moran 1982) as providing the most theoretically satisfactory approach for the following study. Ecological anthropology is "the study of the relations among the population dynamics, social organization, and culture of human populations and the environments in which they live" (Orlove 1980:235). Using comparative research as well as analyses of specific populations, plus synchronic and diachronic perspectives, ecological anthropology looks at the linkage of systems of production with population dynamics, social organization, culture and environment. Socioecology studies the interrelationship between environment, economic strategies and social interactions (Winterhalder and Smith 1981b).

An ecological paradigm provides an image of human societies that entails recognition that, despite their possession of exceptional characteristics humans are not immune to ecological constraints and cannot evade ecological laws (Dunlap 1980). Adherence to this paradigm leads one to view human beings as members of a finite global ecosystem, whose existence is ultimately dependent upon that system. In addition to having currency in the social and biological sciences, the ecological paradigm is popular in the study of international relations and modernization (Dunlap 1980). Current ecological anthropology has its legacy in theoretical developments of the past 150 years, having emerged from the negative reaction of scholars to 19th century cultural evolutionism associated with Sir Edward B. Tylor and Lewis Henry Morgan. Their view that cultures passed through the stages of savagery, barbarism and civilization was not supported by data and gave rise to historical particularism, which rejected environmental determinism; adopted an interest in cultural process and change; and looked at the mechanisms underlying individual cases of culture change. Ecological anthropology emerged as a reaction against the tenets of the Boasian school of historical particularism. Orlove (1980) has suggested that ecological anthropology has passed through three stages, each dependent to a large degree on the precursor.

Stage I, which lasted from 1930 to 1960, included the cultural ecology and multilineal evolution of Julian Steward (1955) and the universal evolution of Leslie White (1959a). Stage II, which lasted from approximately 1960 to the early 1970s, saw neoevolutionists supporting Steward and White and neofunctionalists criticizing the two. Neofunctionalism, as espoused by Marvin Harris (1979) and Andrew Vayda and Roy Rappaport (1968), explained specific aspects of social organization and culture through the functions they served in adapting local populations to their environments. Borrowing such terms as adaptation, niche and carrying capacity from biological ecology, they examined the dynamic interaction between environments and populations. A legacy of this era has been the pervasive influence of functionalism and the use of materialism to explain sociocultural features of human groups. The processual approach emerged in the late 1970s as Stage III. Emphasizing diachronic studies and the mechanisms of change, processual studies examine changes in individual and group activities and the mechanisms by which behavior and external constraints influence each other. Processualists study the relationship between demographic variables and production systems; the response of populations to environmental stress; and the formation and consolidation of adaptive strategies (Orlove 1980). Also typical is the movement from (1) treating populations as homogenous, to examining diversity and variability within them, and (2) from a normative to a behavioral approach to social relations. Processualists also acknowledge that variability influences decision making and that social systems contain options among which individuals may choose. They examine the ways in which human actions affect ecosystems and environmental constraints influence human decision making. This approach allows interdisciplinary research to proceed more readily, and it offers useful perspectives on productive activities, settlement patterns and other cultural phenomena without recourse to homeostatic explanations. It facilitates the study of adaptation as a dynamic phenomena.

Processual ecological approaches offer other benefits as well. They account for a wider range of social organization than do previous models; they permit a more precise analysis of the parameters of behavior and the variation of behavior within populations; they admit more readily an examination of conflict and competition; and they offer the potential of examining change through an analysis of the processes that generate economic, political, and social relations (Orlove 1980). The ultimate goal of ecological anthropology is the development of a body of theory capable of generating explanations for cross-cultural and historical variation in human social behavior (Smith 1988).

This dissertation will utilize the processual approach of ecological anthropology, albeit recognizing the continuing impact of earlier ecological approaches. In particular it will take a socioecological perspective as it studies social behavior in relation to ecology. This means that uncertain resources are viewed from two perspectives, variance in natural resources and variance in social resources(Winterhalder 1980a). For this reason socioecology permits one to understand resource stress as a product of both environmental and social factors. Whereas the former examines resource structure within the natural environment as it relates to resource fluctuation, the latter looks at the organization of people in relation to production.

2.2.2 Terminology

Adaptation is the central concept in all ecological studies and the process whereby organism/environment relationships are forged. Commenting on the utility of this concept, Kirch (1982:102) says, "Adaptation, I submit, is a robust concept capable of integrating disparate methodological orientations and of relating them to a central theme of culture as man's unique method of meeting environmental challenges."

Evolutionary theory, which focuses on change, and ecological theory, which looks at the integration of physical and organic components of environment, are united by the notion of adaptation. Evolution is caused by changes in the adaptive responses of organisms to challenges in the environment, mediated by natural selection (Dobzhansky 1968). **Adaptation** (cf. Latin, *aptus*, "fit", our English word *apt*) is the modification of an organism or its parts that fits it better for the conditions of its environment (Webster's 1965:10). **Adaptive processes** are those "by which organisms through responsive changes in their own states, structures, or compositions, maintain [homeorhesis] in and among themselves in the face of both short-term environmental fluctuations and long-term changes in the composition or structure of their environments" (Rappaport 1971:60). Through adaptive processes organisms develop **adaptive strategies** with which they interface with their environment.

Adaptation has been used in reference to a particular structure of an organism; as a state of being; and as a process of change or modification (Kirch 1982). Adaptation as a process acknowledges the importance of variability; the differential fitness of variants under the selection pressures of environment; and, the importance of stability and heterogeneity of specific environments as they relate to selective pressure (Kirch 1982).

Adaptation may take place at three hierarchically ranked levels: behavioral, physiological and genetic/demographic (Hardesty 1977). Rapid adjustments to sudden environmental perturbations occur at the behavioral level, involve learning, and are particularly responsive to temporary fluctuations in the environment. Physiological responses are considerably slower and may involve acclimatization to environmental changes. Genetic/demographic adaptation occurs when environmental changes are ongoing, profound, and involve changes in the genetic structure of an organism over many generations. Only behavioral adaptive responses will be considered in this dissertation.

Two types of behavioral response are considered adaptive (Hardesty 1977). Idiosyncratic responses include unique psychological methods used by individuals to cope with environmental problems, while cultural responses involve individuals and groups governed by their culture. Behavioral adaptation takes place in three cultural realms: technological, organizational and ideological (Hardesty 1977). Technology is the equipment used by humans in the quest for subsistence and protection. Organizational culture is the network of social cleavages that bind or, alternately, bifurcate individuals and groups. Ideology includes values, norms, beliefs, worldview, ethos and the like. These behavior patterns help humans adapt, (1) by providing basic solutions to environmental problems; (2) by improving the effectiveness of these solutions; (3) by providing adaptability; and (4) by providing awareness or recognition of environmental problems (Hardesty 1977:24). Though ideological responses are considered, technological and organizational responses are the focus of this study.

Behavioral adaptations are based upon learned behavior, otherwise known as **culture**. Culture is a unifying concept in the science of anthropology whose meaning has evolved as the science of anthropology has developed (Tylor 1871; Kroeber and Kluckhohn 1952; White 1959a; Binford 1964). As used herein, culture is "all those means whose forms are not under direct genetic control (that is, extrasomatic[White 1959a:8]) which serve to adjust individuals and groups within their ecological communities" (Binford 1968:323).

Cultural systems are nonbiological mechanisms that articulate human communities directly with their physical and social environments (Thomas 1989:652-3). Those aspects of cultural systems that are especially meaningful from an adaptive perspective are modes of economic organization, settlement pattern, forms of social groupings and political institutions. Commenting on the linkage between **cultural**

systems and **adaptation**, Binford (1964:426) has argued that "changes in cultural systems must be investigated with regard to the adaptive or coping situations which are presented to human populations. If we are profitably to study process, we must be able to isolate cultural systems and study them in their adaptive milieu conceived in terms of physical, biological, and social dimensions."

Another key concept is **variation**, for it is variation that facilitates adaptation. Variation provides the raw material of evolution by natural selection (Jochim 1991). Variation is "the divergence in qualities of an organism or biotype from those typical or usual to its group" (Webster's 1965:982). Variation has a number of meanings in this dissertation. It refers to variability in the environment and resources as well as variation in the behavioral responses of individuals and groups. Different typological schemes have been developed that acknowledge the divergence of hunter-gatherer adaptations as they map on to different environments (Watanabe 1978; Binford 1980; Hayden 1981a; Gould 1982; Testart 1982; Woodburn 1982; Keeley 1988). It has been observed that in stable environments selection will act to decrease behavioral variation while diversified coping strategies will be favored in unstable environments. Also associated with environmental heterogeneity is increased resilience.

Selection is the mechanism whereby a living system, genetic or cultural, "tracks its environment and continually attempts to maintain a state of adaptedness" (Kirch 1982:117). Energy (White 1959a), inclusive fitness (Durham 1978), and population growth (Alland 1975) have been suggested as the standard currency upon which success may be measured.

Concerned with the level at which selection operates, some anthropologists have argued that it is similar to genetic selection, which operates on the individual (Richerson 1977; Flinn and Alexander 1982), while others have suggested that the study of behavioral response to natural hazards must consider the roles of both individuals and groups (Vayda and McCay 1975; Kirch 1982). The latter approach is supported by this writer for several reasons. First, cultural behavior is rapidly disseminated through communication. Second, individuals participate in the body of cultural behavior but never are fully aware of all the variations within their cultural realm. Third, all members of a group face similar environmental pressures. And, fourth, individual behavior is constrained by the group as a whole.

Evolutionary biologists recognize different types of selection- stabilizing, directional and diversifying (Kirch 1982). Stabilizing selection is a function of stable environments in which peripheral variants are eliminated. Directional selection, the principle mechanism of evolutionary change, favors formerly peripheral variants which are selected because they confer survival value on individuals or populations. Diversifying selection occurs in situations of environmental heterogeneity and leads to the coexistence of two or more adaptive norms within the same population. It is argued that directional and diversifying selection are operative in the northern plains and that selection is opportunistic, offering immediate rather than longterm advantage.

Physical and social environments are the primary source of selective pressures in cultural/behavioral adaptation. **Physical environment** refers to "the complex of climatic, edaphic and biotic factors that act upon an organism or an ecological community and ultimately determine its form and survival" whereas **social environment** is "the aggregate of social and cultural conditions that influence the life of an individual or community" (Webster's 1965:278). Environments are described as homogenous when there is little variation and heterogenous when variation is considerable. Holling (1973) suggested that areas subjected to extreme climatic conditions have populations that fluctuate widely but they also have a high capability of absorbing periodic extremes of fluctuation and are considered highly resilient. Flexibility in the face of hazards is a system property that enhances the resilience and chance of survival of systems possessing it (Alland 1975; Hardesty 1977; Vayda and McKay 1975). The so-called marginal environments inhabited by many recent hunting and gathering subsistence systems are subject to great variation and a plethora of buffering mechanisms developed by these people is clearly indicative of the resiliency of their adaptation. The continuous dialectic between human and natural environments that characterizes cultural adaptation sees humans not only adapting to physical and social environments but also transforming them as well.

The kind of selective pressures operating in an environment depend on its structure, including stability versus change; heterogeneity versus homogeneity; and whether the extant population has achieved a state of adaptedness. **Environmental constraint** consists of limiting factors, which set boundaries on the range of potential behavior. Important concepts in this regard are Liebig's Law of the Minimum and Shelford's Law of Tolerance (Hardesty 1977). Liebig showed that organisms will be limited by materials that are in the shortest supply relative to their need. Shelford subsequently argued that animals could survive only under conditions that they could tolerate and that the availability of critical materials is only one of those conditions; others include temperature, sunlight and hazards. Ensuing research has shown that the concept of limiting factors is useful but must be used with care. Other factors abundantly present in the environment may moderate the effects of potentially limiting factors. And the Law of the Minimum may not hold when the ecological system is unstable and undergoing change, for in such situations the interaction amongst elements may assume the ultimate importance.

In summary, the systemic-adaptive perspective views culture as a complex of interacting parts where the interactions between the elements are as important as the elements themselves. It regards culture as an open, rather than a closed, system in which complex feedback occurs between cultural systems, environment and the somatic-genetic system. And cultural adaptation is a responsive process whereby changes in the cultural system, environment and/or somatic-genetic system impact their partner systems. Lastly, in concordance with natural selection, behaviors are selected for, retained and transmitted from one generation to the next if they are adaptive, conferring selective advantage upon the population.

2.3 Paradigmatic Approaches in Northern Plains Anthropology

The study of aboriginal cultures on the northern plains has a long history in American anthropology. A substantial body of ethnographic, ethnohistorical and archaeological research has accumulated due to the temporal persistence of aboriginal lifeways; to the influence of the Bureau of American Ethnology and the Boasian School; to the journals of explorers, missionaries and traders; to growing interest in prehistory necessitated by cultural resource management legislation; and to enduring romantic notions of the Old West. This information has been used to produce normative descriptions of the aboriginal inhabitants and to reconstruct the culture history of the area. The concept of culture as an adaptive mechanism and the explication of culture process have been minimally considered in Plains anthropological studies. Osborn (1983) has argued that the prevailing perspectives have emphasized description and historical analysis with limited interest in the development of a unified ecological view of aboriginal life on the Great Plains. Another problem is the manner in which Plains anthropologists have allowed the culture area construct to orient their research, thereby hindering movement beyond normative descriptions of environments and culture traits. As a result, students of anthropology have a tendency to perceive the Great Plains Culture Area as environmentally and culturally homogenous. In analyzing similarities and differences amongst aboriginal Plains peoples, Oliver (1962) accepted historical associations as causal, and dismissed ecological explanations. Similarly Secoy's (1953) reconstruction of military patterns on the Plains considered the introduction of the horse and gun as proximate causes with no consideration given to ecological factors. Lastly, the international border between Canada and the United States has and continues to preclude a holistic treatment of the historical, archaeological and ethnographical cultures of the area (Gordon 1979; Duke 1991).

There are, however, indications that a few archaeologists and ethnologists in the past, and increasing numbers today, are concerned with culture as an adaptive mechanism.

Following the trends in their discipline, Plains anthropologists are beginning to abandon the normative approach and are moving towards the study of culture process. In so doing, they are coming to recognize the topographic, climatic, floral and faunal variability of the Plains environment. Furthermore, they are increasingly cognizant of the effect of this variability, particularly the risk and uncertainty, on human attempts to provision themselves. They are also aware of the limitations of the early 20th century ethnographies written by researchers present in the area for but a short time and whose limited experience could in no way prepare them to discern the myriad of stresses typical of the region.

Of interest to the present study is the research that deals with recurrent resource fluctuations in the Plains Culture Area. As early as the 1940s, Wedel (1941) analyzed the effects of fluctuations in precipitation and effective moisture over time on Plains horticulturalists and hunter-gatherers. Blakeslee (1975) linked fluctuating resources to the development of a complex trade system linking the Plains culture area to the Plateau, Great Basin, Southwest, Subarctic and Woodland culture areas. Reher (1978) has linked climatic variation, specifically moisture conditions, to shortgrass productivity and ultimately to bison carrying capacity. Furthermore, he suggested that the numbers killed at a site, the thickness and frequency of levels in a kill midden, bison population structure and specifics of butchering are archaeological indicators of resource abundance and scarcity. Osborn (1983) viewed winter severity as a causal factor affecting forage and thus limiting the size of horse herds in the early historic period in the Great Basin, Columbia Plateau and Plains culture areas. A recent ecological anthropological and processual analysis is Bamforth's (1986) study of the impact of the predictability, productivity and patchiness of Plains bison on organizational strategies of Plains hunters and gatherers. Fawcett (1987) used a structuralist paradigm, proposing that communal hunts mediated social and political tensions by providing food and exchangable items for human aggregations. Feasting, ceremonies, and exchanges were seen to instill a sense of solidarity among participants and contribute to the mediation of tensions created by age, gender, wealth and power differences. More recently, Duke (1991) has combined the 3 major paradigms, culture history, processual archaeology and post-processual archaeology, to explore the structural continuity that characterized late prehistoric cultures of southern Alberta. It is hoped that the present study, that uses an "adaptation as process" perspective, will add to our understanding of the exigencies of life in hunting and gathering subsistence systems in general and amongst Plains hunters and gatherers in particular.

2.4 Methodology

The data base for this dissertation is drawn from existing ethnohistorical, historical, and ethnographical sources. While there are inevitable problems with existing sources, in the case of the present study they provide the only available information on the time period in question. The following discussion explores a number of methodological issues relating to this data base.

The first issue is the source of information for the cross-cultural study of 38 subsistence systems that forms the initial application of the model and that is found at the end of Chapter 3. This information was drawn exclusively from references in the **Human Relations Area Files** at Simon Fraser University and the University of Calgary. The 38 groups were not selected randomly but rather to include groups from a variety of environmental types. They represent 11.4% of the individual societal listings in the files at these two institutions. It bears mentioning that the data in the **Human Relations Area Files** generally predates 1980; is from a variety of sources, including descriptions by ethnologists, historians, linguists, explorers, missionaries, traders and others; and does not include all extant literature on the individual groups. As a consequence there is considerable variation in the accuracy, detail and coverage of the topics of concern. For example, it was disappointing to discover that the coping strategies and subsistence pursuits of Plains Indians, other than their communal bison hunting, are minimally represented while those of the Montagnais-Naskapi, Ojibwa and Koyukon are described in great detail. Observer bias is common in 17th and 18th century accounts, particularly those of missionaries who seem to delight in using adjectives such as, "improvident," "wasteful" and "lazy" to describe the subsistence pursuits of aboriginal peoples (eg. Le Clerq 1910:93-122). Some of the authors spent years amongst their subjects while others relied on secondary information. While remaining cognizant of the inconsistencies between observers and the shortcomings of the data base, the available data was sufficient for an extensive analysis (Tables 1-12; Figures 3,4).

A second issue was the delimitation of the study area (Figures 1,2). Obviously it was imperative that this encompass a meaningful cultural/ecological entity. The writer decided at the outset that the Canada-United States border would not dictate the boundaries of this study as has been the case for many anthropological (Gordon 1979; Morgan 1979; Gilbert 1980) and geographical (Webb 1931; Malin 1947) investigations. A strong argument supporting this approach is that the political border did not exist until near the end of the time period considered herein. Furthermore, the life zones exploited by hunters and gatherers in the region, existed long before artificial political boundaries and are independent and in fact crosscut them. Lastly, the range of the fur trade companies and the territorial movements of Indian tribes during the fur trade era led the researcher to delimit the study area to that region extending from the Missouri River to the North Saskatchewan River and from the Rocky Mountains east to southwestern Manitoba and central North Dakota. To facilitate contrasts and comparisons, this area was divided into 4 sub-regions that were focused on drainage/transportation areas- the North Saskatchewan River Region, the South Saskatchewan River Region, the Missouri River Region, and the Red/Assiniboine River Region (Figures 5-7). The former two are exclusively in Canadian territory; the Missouri River is exclusively in the United States; and the Red/Assiniboine bridges the two.

A third issue relates to the nature of the ethnohistorical and historical documents that provided a significant part of the data base. These are described and evaluated. Consisting of daily journals, district reports, search files account books and correspondence from fur trade companies and daily journals and books authored by casual visitors, missionaries, and scientists, the ethnohistorical and historical sources were invaluable for providing an understanding of the environment, subsistence activities, resource stressors, and coping strategies of all northern plains occupants (Table 13-50). One of the most important was the **daily journals** of Hudson's Bay Company (eg. Johnson 1967), North West Company (eg. Coues 1965) and American Fur Company (eg. Abel 1932) employees, as well as those kept by visitors to the plains, such as Paul Kane (Harper 1971; MacLaren 1989), The Earl of Southesk (1969); and Maximilian (Thwaites 1905a, 1905b, 1906). The government exploring expeditions led by Lewis and Clark (Thwaites 1959a, 1959b, 1959c), Captain John Palliser (Spry 1968) and Henry Youle Hind (1971a, 1971b) provided the most detailed accounts due to the presence of different scientists. All of these journals are composed of dated daily entries recorded while the observers were actually in the area under consideration. Descriptions are complete enough to permit one to approximate or even explicitly locate the geographic position on a daily basis. Journalists regularly included descriptions of the trading establishments and their immediate vicinity; trade between the company and the Indians; weather conditions; agricultural, horticultural and hunting activities; disease, casualties, and condition of dogs and horses; holidays; plans for future economic endeavors; native activities; and occasionally estimates of the number of Indians in the area. This infornation enabled the writer to produce a series of tables that document resource activities and stressors on a daily, monthly or seasonal basis. In addition to daily entries, several other individuals kept notes which they transformed into travel accounts many years later. The journals of John McDougall (1895, 1896, 1898, 1983) and Henry Moberly (1929) contain useful information but are not as definitive about the date, season or even year as the daily diaries.

Hudson's Bay Company records also include **district reports** (eg. HBCA B.27/e/1), **search files** on individual posts (eg. HBCA-Touchwood Hills Post), **correspondence** (Johnson 1967) and annual **account books** (eg. HBCA B.60/d/2a). District reports and correspondence directed to the London Office mention drought, shortages of food, problems with prairie fire, native unrest, fur trade returns, and company policy. Account books detail fur returns; provision returns; expenditures; goods imported; goods transferred to other posts; employees and their wages and debts; equipment in use; items in stores; tallies of domestic stock; and, tallies of horticultural and agricultural production. Account book data is a little-used source of information on the fur trade although its potential in historical, economic and anthropological research has been recognized (Ray 1976). For this study documents from Brandon House, Touchwood Hills Post, Carlton House, Fort Edmonton, Chesterfield House, Rocky Mountain House and Piegan Post were consulted.

Table 13 provides a chronological summary of the key individuals who produced journals; the years they sojourned in the northern plains; their occupations or employment affiliation; the general locations that they visited; and references to their published and unpublished journals. Table 14 is a frequency distribution of these early historic accounts by decade, while Table 15 is a timeline of important local, national and international events which impinged on the North American fur trade.

As with most data bases this one is biased in a number of respects. First, many documents have not survived. Documentation by North West Company personnel was never centralized as it was for the Hudson's Bay Company so there is a general paucity of information about the operations of that company. In the case of the Hudson's Bay Company documentation may be spotty because of differential preservation of documents. For example, Fort Edmonton was continuously occupied between 1795 and 1885 ; however, only 42 yearly journals are available. Twenty-three Brandon House journals span the period from 1793 to 1830 but the account books only cover the period from 1810 to 1832. This uneven coverage poses a problem if a long, unbroken account of activities and/or returns at a particular post is desired and if one wishes to undertake comparisons of operations between posts.

Second, the accounting procedures and journal documentation varied between fur trading companies. While the Hudson's Bay Company provided some directives to clerks responsible for these tasks, the North West Company did not and thus few useful records from the latter company survive. Among the exceptions, which were important for the present work, were the journals of Alexander Henry the Younger (Coues 1965) and Duncan McGillivray (Morton 1929).

A third problem is the variability in journal content owing to different writers but also to different directives from the London Office (in the case of the HBC) and to the need to conceal some types of information and emphasize others. William Tomison the clerk at Fort Edmonton in 1795-96 and 1798-99 produced more useful journals than did James Bird, who was clerk in 1799-1800 (Johnson 1967). Whereas the former gave abundant detail about trading and other activities, the latter was very cursory in his treatment of all aspects ot company endeavors (Johnson 1967). Similarly, the descriptions provided by scientists were far more comprehensive than accounts by those less well educated (Spry 1968). The requirements of the Company for record-keeping varied through the years, fueled no doubt by personnel changes, the success or lack of success of the trading operations, and competition. This same inconsistency affected the account books in that accounting procedures varied among clerks and across time (HBCA B.60/d/25-179). Lastly, information about dependants is almost completely absent in the journals consulted for this study. The only indication which one has that the employees of the Hudson's Bay Company had wives and children is the infrequent post censuses and casual reference to their deaths in daily diaries. Neither appear in the post account books under servant's wages or debts despite the fact that the Native wives were largely responsible for producing provisions, manufacturing moccasins, gathering firewood, and processing hides and furs. No doubt this was a deliberate oversight because of company policy discouraging interracial and intercultural marriages (Van Kirk 1980).

Fourth, it is evident from Table 14 that the decades spanning the period of 1690 to 1880 are differentially represented by the number of extant journals. The decades from 1700 to 1739 and 1760 to 1769 lack documentation. Of 71 sources, only 1 falls in the 17th century, while 15 occur in the 18th century and 55 are from the 19th century.

A fifth factor is the differential rate of settlement and development. The Missouri River region did not open up until 1804-06 with the coming of Lewis and Clark, while the North Saskatchewan River region at that time was the scene of a massive expansion program for personnel and productivity. Furthermore, the northern part of the study area was the scene of a competitive struggle between different fur trading companies in the late 18th and early 19th centuries, while a single company dominated the fur trade in the southern part of the study area.

A sixth observation relating to the sample is the difference in perspective of the individuals who produced written documentation of their travels. Alexander Henry the Younger spent the first decade of the 19th century at Pembina River Post where his bias against the natives came clearly to the fore in his journal (Coues 1965). Similarly, while Pierre-Jean De Smet, S. J. has been described as "among the great missionaries of North America" (Kowrach 1977 in De Smet 1978:IX), his journal is vague and filled with biased comments about the lifeway and morality of the aboriginal peoples and the landscape in general. He said that ". . . the day will come when some laboring hand will give them value: a strong, active, and enterprising people are destined to fill this spacious void"(De Smet 1978:184). Those individuals with a strong trophy hunting interest went to great lengths to describe the details of their hunting exploits and completely ignored other potentially important observations. The Lewis and Clark Journals are an excellent source of information about waste because a tally of game taken is provided on a daily basis (Thwaites 1959a, 1959b, 1959c); however, little is said about aboriginal culture, other than concern with the military power of different Indian tribes. In noting the differences between George Catlin's description of a Mandan Village and his own observations, John James Audubon said "But different travellers have different eyes!"(Audubon 1960b:10). Recently, scholars relying on these documents have come to realize that the cultural background of early European observers very much shaped what they saw, what they interpreted, and what they described in their journals.

Seventh, these ethnohistorical sources have differential value for researchers using early historic data to reconstruct prehistoric conditions. For example, 18th or early 19th century documents of Anthony Henday (Burpee 1907), Matthew Cocking (Burpee 1908), Alexander Henry the Younger (Coues 1965), Peter Fidler (Haig 1991) and Duncan McGillivray (Morton 1929) were written in the early years of the interior fur trade when European immigrants were relatively few in number; when bison were still abundant in many parts of the country; and when aboriginal pursuits still took precedence over fur trade life. Since reliance on buffalo products to provision the fur trade did not begin until the 1780s, it is reasonable to assume that the impact of the fur trade on bison herds was probably minor before that time. This contrasted to the situation prevailing in the late 1850s and depicted by Hind (1971a, 1971b) and Palliser (Spry 1968). By the 1850s European immigrants numbered in the thousands and fur trade provisioning had dramatically reduced the number of bison. When one is examining resource structure, one must be cognizant of the date of the ethnohistorical sources. For example, Gordon (1979) relied heavily on Hind's observations of bison movements and behavior to produce a model of bison migratory behavior, yet Hind was describing a time only twenty years before the disappearance of the great herds. Hind and Palliser admitted that the herds which they encountered were far different in location, movements and other behavior than those of an earlier time and suggested that intensive predation had wrought these changes. It is suggested that researchers might more profitably focus on the earliest parts of the historic period in seeking to reconstruct features of the late prehistoric period.

Similarly, one must acknowledge deficiencies in the ethnographic sources which provide the bulk of our information about aboriginal lifeways. The ethnographies of the dozen Indian tribes who resided in the northern plains are typically reconstructed baseline ethnographies in which anthropologists and other writers gathered data from Indians who were attempting to remember the past but who had either not experienced the "old ways" themselves, or were remembering the days of their youth (eg. Ewers 1958; Mandelbaum 1979). In the case of Ewers (1955, 1958) the ethnographic fieldwork was undertaken in the late 1940s and early 1950s, some 60 or more years after the hunting and gathering lifeway focused on bison had ended. Ethnographic fieldwork in the region did not begin until the early 20th century.

In embarking on the present study, the researcher remained cognizant of these problems, while at the same time mindful of the fact that these documents provide the only temporally specific descriptions of the environment, resource stressors, subsistence activities, and coping strategies which exist. Collectively the historical, ethnohistorical and ethnographical sources provided valuable information which was used in describing northern plains resource structure and resource stressors in Chapter 4 and subsistence systems and coping strategies in Chapter 5.

CHAPTER 3

MODELING THE RESPONSES OF HUNTING AND GATHERING SUBSISTENCE SYSTEMS TO RESOURCE FLUCTUATIONS

3.1 Introduction

> Cultural Man has been on earth for some 2,000,000 years; for over 99 per cent of this period he has lived as a hunter-gatherer (Lee and DeVore 1968b:3).
>
> . . . life among contemporary and ancient hunter gatherers was no picnic (Gould 1982:70).
>
> Models are simplifications of reality which keep intact the essential features of a problem and its proposed solution (Moore 1981:196).

This dissertation is about people who acquire the bulk of their sustenance through hunting and gathering activities. It is about their attempts to ameliorate the fluctuating resources that comprise their subsistence base. In chapter 3 a model predicting the responses of hunting and gathering groups to resource stress is developed. The chapter begins with an overview of studies of hunting and gathering societies in order to evaluate the influence of theoretical perspectives and assumptions on anthropological understandings of resource stress. It then looks at the phenomena of resource abundance and resource scarcity. Buffering mechanisms in the economic, social, political and ideological domains and the relationships amongst them are detailed. The coping strategies of 38 predominantly, but not exclusively hunting and gathering subsistence systems, are surveyed. Finally, the model is evaluated and a series of predictions presented.

3.2 The Study of Hunting and Gathering Subsistence Systems

The study of "food-collecting," "foraging," "hunting and gathering" or "gathering and hunting" societies, as they are variously known, has become a mainstream interest in anthropology in the past 25 years and hunter- gatherer research has played a historically central role in the development of anthropological and evolutionary theory. Hunters and gatherers constitute "the subject matter that, in the last instance, separates anthropology from its sister disciplines: psychology, sociology, economics, and political science" (Bettinger 1991:v).

Hunter-gatherer studies have an established tradition. Two international conferences held in Ottawa in the mid 1960s saw researchers gather, present individual papers and discuss the theoretical underpinnings of their discipline. While the first conference focused exclusively on band societies (Damas 1969a), the second had a broad ecological anthropological orientation (Damas 1969b).

In 1966 hunter-gatherer specialists gathered in Chicago. In **Man the Hunter** (Lee and DeVore 1968a), the definitive publication derived from this meeting, papers examined ecology and economics, social and territorial organization, marriage, demography and population ecology, prehistoric hunters and gatherers, hunting and human evolution and the concept of primitiveness. Lee and DeVore (1968a:ix) speculated on the attraction of hunter-gatherer studies to anthropologists, saying "We cannot avoid the suspicion that many of us were led to live and work among hunters because of a feeling that the human condition was likely to be more clearly drawn here than among other kinds of societies." It was with this volume that the !Kung Bushmen began to be viewed as the epitome of all hunting and gathering societies. The papers and discussion in Lee and DeVore (1968a) laid the foundation and orientation for subsequent research. This base, while examining old theories and providing productive directions for future research, also contained contradictions which this writer suggests has impacted the orientation of hunter-gatherer studies. These problems are detailed below.

Although acknowledging that "the majority of peoples considered subsisted primarily on sources *other than meatt* " conference participants in using the name "hunter" to identify all such peoples (Lee and DeVore 1968b:4), continued to obscure the tremendous variability that they had acknowledged exists. Although recognizing that all hunting and gathering societies did not have band sociopolitical organization, the "trial formulation of the nomadic style" (Lee and DeVore 1968b:11,12) agreed upon by conference participants was restricted to hunter-gatherers who live in small groups and are nomadic. Although acknowledging so-called hunting peoples who "failed" at agriculture, no attempt was made to evaluate the impact these alternative subsistence regimes may have had on other aspects of culture (Lee and DeVore 1968b:4). Lee and DeVore also explicitly stated that ethnographic hunting and gathering societies should not be considered representative of the prehistoric pattern yet they also emphasized the evolutionary significance of contemporary hunting and gathering in understanding the past. The widespread portrayal, in textbooks and scholarly articles, of the !Kung San as the archetype for hunter-gatherers has allowed the wealth of carefully collected information on a single ethnographic case to obscure the incredible diversity found among foraging societies. Lastly, the papers were essentially synchronic so that the historical underpinnings of contemporary hunting and gathering societies were not appreciated until many years later (Wilmsen and Denbow 1990).

Seven subsequent conferences on hunting and gathering societies (CHAGS) have been held. At Chags-1 held in Paris in 1978 archaeologists were underrepresented, and papers linking ethnography and archaeology limited in number. Papers on social change (Bender and Morris 1988) formed the nucleus of the resultant publication, **Politics and History in Band Societies** (Leacock and Lee 1982). A number of issues were considered. First, papers examining the interrelationships between hunting and gathering societies and pastoralists, agriculturalists and others attempted to demolish the notion that the former were pristine. A second issue was examination of the political action taken by hunting and gathering societies whose lifeways are threatened by state expansion.

The 1982 conference in Quebec City (CHAGS-2) did not lead to a published volume. Bad Homburg was the site of the 1983 conference (CHAGS-3). The conference publication, **Past and Present in Hunter and Gatherer Societies** (Schrire 1984a), contained mainly American and South African contributions. Social change, most notably that wrought by outside forces, was a theme. In an opening essay, Schrire (1984b) critiqued not only the confines imposed by hunter-gatherer studies over the years, most notably the outmoded view that the !Kung San were typical of all such people but also the asssumption that hunting and gathering societies do not have a history.

London was the site for the 4th international conference held in 1986 (CHAGS-4). **Hunters and Gatherers I: History, Evolution and Social Change** and **Hunters and Gatherers II: Property, Power and Ideology** (Ingold, Riches and Woodburn 1988a, 1988b) are the associated publications. The realization that it was unlikely that subsistence practices and mating strategies of prehistoric hunter-gatherers resembled those of present-day hunter-gatherers was reiterated (Bender and Morris 1988).

Darwin (CHAGS- 5,1988), Fairbanks (CHAGS-6, 1990), and Moscow (CHAGS-7, 1993) have been the venues of the most recent conferences where issues addressed included the relationship of hunter-gatherers to other sociopolitical systems, human/land rights of aboriginal peoples, relations between aboriginal peoples and non-aboriginal society, hunter-gatherer demography, and the role of the anthropologist in hunter-gatherer self-determination. Two publications derived from CHAGS-5, **Emergent Inequalities in Aboriginal Australia** (Altman 1989) and **Hunter-Gatherer Demography: Past and Present** (Meehan and White 1990). The latter focuses upon reconstructing past populations and demographic studies of contemporary hunter-gatherers. **Key Issues in Hunter-Gatherer Studies** (Burch and Ellanna 1993) is the publication of CHAGS-6.

Five other volumes devoted to hunter-gatherer studies also have had a profound impact on the current status of this discipline. **Hunter-Gatherer Foraging Strategies: Ethnographic and Archaeological Analyses** (Winterhalder and Smith 1981a) derived from a symposium on hunter-gatherer socioecology held at the 77th annual meeting of the American Anthropological Association in Los Angeles in 1978. Papers in this volume applied optimal foraging theory derived from evolutionary ecology to the analysis of human foraging behavior. The use of mathematical models and quantitative data from hunting gathering societies is an important trend.

A session on regulation of environmental resources by hunter- gatherers at the annual meeting of the American Association for the Advancement of Science in San Francisco (1980) led to publication of **Resource Managers: North American And Australian Hunter-Gatherers** (Williams and Hunn 1982). A unifying theme in this collection is the belief that hunter-gatherers actively manage their resources through strategic ecological or economic courses of action, by social controls and political maneuver, and by the power of symbol and ritual (Hunn and Williams 1980:1).

Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity (Price and Brown 1985) is one of the most important studies to emerge in recent years. Following the earlier conclusion that substantial variability exists amongst hunters and gatherers, particularly the recognition that some hunters and gatherers have complex sociopolitical systems, a symposium on this topic was held at the XIth International Congress of Anthropological and Ethnological Sciences held in Vancouver in 1983. Explicit recognition of social complexity among recent hunter-gatherers from Northwestern North America and Australia, as well as among prehistoric hunter-gatherers from Scandanavia and the Mediterranean, has led to re-evaluation of the assumption that social complexity was tied to agricultural intensification. That some hunter-gatherers were typically small scale societies while others were large scale was once again reexamined.

In **Farmers As Hunters** (Kent 1989), the notion of purity of hunting and gathering versus horticulture was demolished through analysis of the incorporation of huntering and hunting within small-scale farming societies.

Recently, Bettinger (1991) reviewed and evaluated paradigmatic approaches to the study of hunters and gatherers in **Hunter-Gatherers: Archaeological and Evolutionary Theory**. He has accused researchers of portraying hunter-gatherers in ways congruent with the theoretical assumptions of the researchers. The following comments support Bettinger's charges.

As one peruses the literature of the past 20 years, it is evident that theoretical assumptions deriving from the original volume, **Man the Hunter** (Lee and DeVore 1968a) continue to impact hunter-gatherer research. There appears to be an anthropological need to view hunter-gatherers in a certain light, thus the Kalahari Bushmen continue to be regarded by some ethnologists, physical anthropologists and archaeologists as living representatives of a stage of human sociopolitical development going back millions of years. To hold this view, one must deny their history and the contacts that they have had with surrounding pastoralists, horticulturalists and agriculturalists. This approach is currently the subject of an ardent debate (Headland and Reid 1989; Solway and Lee 1990; Wilmsen and Denbow 1990; Lee 1992; Bird-David 1992a). In a similar vein, one reads of the recent "discoveries" of "isolated" tribal groups (Headland and Reid 1989) which allowed the discipline to accept, for a time, the Tasaday as "stone age" people in the Philippine rain forest (Nance 1976).

Many anthropologists have adopted the general systems approach and its dichotomy of "open" versus "closed" systems. While general systems theory views human systems as "open" such that information and energy flows from the outside in and vice versa, the isolate model of hunter-gatherers, as applied to the Tasaday and Kalahari Bushmen, persists, thereby relegating them to the status of "closed" systems, very much at odds with the fundamental assumption of the general systems perspective and with extant information (Fox 1969; Headland and Reid 1989; Wilmsen and Denbow 1990; Lee 1992). Furthermore, the emphasis on the maintenance of equilibrium between parts of the system leads anthropologists to view equilibrium as desirable and disequilibrium as temporary and disagreeable. It also causes researchers to overlook the magnitude of forces producing disequilibrium. Isolating models must be abandoned if the study of hunter-gatherers is to be realistic and future research productive. For as Fox (1969) and Gregg (1988) have shown, there is considerable time depth to hunter-gatherer and farmer interaction.

Another problem relates to the short-term nature of most ethnographic research. Usually lasting less than two years, the full range of environmental and cultural behavior may not have been observed. This leads to descriptions of hunter-gatherers as dismal and destitute on the one hand or the "original affluent society" on the other. Barnard (1983:197) in referring to the work of Sahlins (1968a, 1972), says that "one such model emphasized the economic and social advantages of hunting and gathering and completely reversed the exaggerated assumption that foragers were perpetually on the verge of starvation. . . foragers were more affluent than the armchair speculators had realized." Sahlins (1968a:85) contended that the notion of subsistence economy where "the specter of starvation stalks the stalker" is incorrect. Rather he viewed hunter-gatherers as the "original affluent society" where the environment is abundantly productive and wants are easily satisfied. Scarcity is seen as a peculiar obsession of a business economy. Testart (1988) brought another perspective to the discussion, arguing that storing hunter-gatherers do not have to cope with food supply uncertainty, because scarcity is perfectly predictable in their environments. To view hunter-gatherers in either manner is to ignore unpredictable temporal and spatial variability, whether of environmental or social origin. This dissertation provides ample data to support Herskovits' (1952) contention that only intense exploitation of resources makes survival possible for many hunter-gatherers.

The goal of 20th century anthropology to identify cross-cultural parallels as a prerequisite to formulating laws describing human behavior has led anthropologists to identify "types" of hunting and gathering societies. These typologies began in the 1930s with Julian Steward's identification of patrilineal, matrilineal and composite bands (Steward 1955). Elman Service (1962) subsequently modified this scheme by recognizing patrilocal, composite and anomalous bands. Band sociopolitical organization was seen as typical of hunting and gathering societies. These typologies were designed to organize data and to facilitate nomothetic research; however, they obscured real situations. Just as boundaries are the weakest part of the culture area concept, so too are the borders between different categories of human society, be they economically, socially, politically or ideologically based.

Ellen (1982: 170-76) has declared that economic distinctions between societies are difficult to describe: "Much confusion has been caused in the ethnographic and comparative literature by assuming ostensibly predominant subsistence techniques represent total subsistence strategies, and by a general use of excessively simple criteria for the description of life- support techniques."

Some typologies attempt to address this issue (Watanabe 1968, 1978; Binford 1980; Hayden 1981a; Gould 1982; Testart 1982; Woodburn 1982; Keeley 1988). They have in common a focus on environmental variation, the challenges of subsistence pursuits, and they are even somewhat congruent. Binford (1980), Hayden (1981a), and Gould (1982) bring resource fluctuations into their schema, while Watanabe (1968, 1978), Testart (1982), Woodburn (1982), Keeley (1988), Price and Brown (1985) and Hayden (1990) describe resource extraction processes.

These anthropologists recognize that not all hunting and gathering societies share the same basic organization. They believe that ecological relations are of fundamental importance in understanding cultural processes. They link specific ecological factors with economic, social, political and ideological features to produce suites of integrated cultural patterns. And they acknowledge resource stress as impacting subsistence strategies. With the exception of perhaps Hayden (1990) their schemes identify a limited variety of social types and do not accommodate those that participate in the husbandry of plants and animals.

Another trend in hunter-gatherer studies has seen scholars embracing theoretical models from evolutionary ecology. Using energy as currency, optimal foraging models examine the costs and benefits associated with different subsistence activities and predict that selective advantage is conferred upon those individuals who maximize their efficiency of energy capture (Winterhalder and Smith 1981a). Optimal foraging theory has been attractive because it allows the anthropologist to understand the factors that influence where people lived and what they ate rather than simply describing their subsistence. The models are appealing because they use mathematical and graphic representations to simplify complex relationships and as well they generate testable hypotheses, that are imperative to processual anthropology. Although used widely by many hunter-gatherer specialists (Winterhalder and Smith 1981a; Hames and Vickers 1982; Hawkes, Hill and O'Connell 1982), the early models had limitations. "They ignored the existence of stochastic variation of environments; assumed that foragers could obtain perfect knowledge of relevant features of the environment; and were concerned only with maximizing mean returns, regardless of variation around the means" (Smith 1983:638). Responses to these limitations, particularly the fact that risk and uncertainty were not incorporated in the earlier models, has led to a new generation of optimal foraging models that incorporate these concepts (Winterhalder 1987, 1990; Cashdan 1990; Smith 1991). Anthropologists are becoming increasingly cognizant of the impact of fluctuating resources on human society; nevertheless, optimality models have their detractors. Foley (1985) suggests that they are still incapable of testing the principle of adaptation. This writer concurs with Keene (1983) who suggests that in using such models we may forget the questions that we should be asking of our data, questions about resource and behavioral variability and adaptive response. Furthermore, optimal foraging models describe ideal rather than real behavior.

Despite the *a priori* assumptions and theoretical models that have constrained hunter-gatherer studies, researchers are examining the impact of resource fluctuations on hunting and gathering society. Binford (1980), Hayden (1981a) and Gould (1982) considered the structure of resources as it relates to temporal and spatial variability, productivity and predictability. Other linkages also have been explored. Campbell

(1966) suggested that the male/female group may have developed in response to seasonal food shortages in a savanna environment. Resource stress among hunter-gatherers also has been linked to the status of women (Hayden et al 1986); to cooperative subsistence strategies (Hayden 1986); to alliance formation (Dyson-Hudson and Smith 1978, Spielmann 1986, Hayden 1987); to the emergence of elites (Hayden and Gargett 1990); to territoriality (Cashdan 1983); and to population pressure and the emergence of complex hunter-gatherers (Keeley 1988). Archaeologically, food stress has been linked with the emergence of domestication (Cohen 1977); discrete regionalization of artifact styles (Hodder 1979); and the distribution of large burial mounds and monuments (Renfrew 1976). And most recently it has been linked to the emergence of the hominids (Kerr 1994).

One issue bears closer examination: the problem of identifying and describing hunter-gatherer societies. One must consider the substantial variations amongst them as testimony to the broad range of activities in which they engage(d). That existing hunting and gathering societies are known in the past and/or in the present to have mixed hunting with gathering, pastoralism, horticulture or agriculture (Fox 1969) or to have traded with these subsistence regimes is testimony to the flexibility of their lifeway. This very flexibility has permitted them to cope with fluctuating food supplies. As stated by Bicchieri (1972:92), "the chance of productive failure, everything else being equal, is halved by a mixed hunting-gathering exploitation. Practicing such mixed exploitation, a group can more often than not, fall back on the alternative technique when necessary." And as D. Harris (1979) argues, the boundary between foraging and cultivation is not easily definable, and trade networks further blur the distinction between social types. Yet Wobst (1978:303-304) suggests that the ethnographic "literature is remarkably silent on the behavior of hunter-gatherers as it articulates with larger social and spatial entities."

Hamilton (1982:236-237) offers another perspective

> . . . it is time to re-assess the whole question of defining food-collecting societies , and replace the implicit either/or classification

> with a more flexible and dynamic view. 'Food-collecting' is a potential strategy for people existing within any imaginable production system. Horticulturalists and agriculturalists everywhere rely to some extent on collected resources. . .
>
> Such mixed strategy systems can possess great stability through time; on the other hand there is mounting evidence of change.

A succinct examination of the plurality of subsistence activities of so-called hunting and gathering societies was provided by Fox (1969) in an article on South Asian hunter-gatherers. Fox suggested that the sociological environment of South Asian groups, whereby they are involved in complex interrelationships with agricultural tribes and Hindu castes, has radically altered not only their economic organization but their social organization as well. Forest goods are collected and valued primarily for external barter or trade, and necessary subsistence or ceremonial items such as iron tools, rice, arrow-heads are only obtainable via trade. The corollary is that when the collection of forest produce is no longer economically rewarding, the group will revert to some other form of less specialized economic activity and it will not be pure hunting and gathering since this is only attractive when it produces goods valued by the larger society. Fox (1969) identified a number of social changes that accompanied the economic shifts. These included a move from communal to family-oriented economic units; the lack of kin patterning in the composition of settlements; and the lack of extensive reciprocity and sharing among family groups. As Fox (1969:142) said, "The social organization of these groups is transformed to meet the expectation of collection and exchange with the outside world. . . Indian hunters-and-gatherers as marginal economic specialists for traditional Indian civilization." Last, Fox (1969) suggested that acculturative pressures in a pre-industrial contact situation clearly lead to different results than similar pressures in an industrial contact situation. One is compelled to compare Plains Indian interactions with the European traders to the South Asian situation. Many societies labelled by anthropologists as hunting and gathering exist because of their patterned interaction with the larger society. Continued existence in their particular niches requires maintenance of this interaction. Wood (1991:33) has suggested that the many contrasts between nomadic bison hunters and sedentary horticulturalists on the Great Plains have been overdrawn, "Whether one was a Plains nomad or a villager, the organization of their annual hunts varied only in minor details from tribe to tribe, and in every case were regulated by military societies." In referring to the strategies employed by the *ciboleros* of the southwest and the *Metis* of Canada, he said that if one is to hunt bison on the Plains, and to defend oneself from potential enemies while doing so, the appropriate organization is not likely to differ significantly from ones developed long ago by Plains Indians.

With these thoughts in mind, it is postulated that our view of hunting and gathering societies needs revision. Perhaps it is time that we view subsistence variation amongst hunting and gathering peoples as an adaptation to exigencies wrought by environmental and sociocultural factors; that we abandon rigid typologies that obscure the extant variability and thus, flexibility, which is so typical of these societies. It is time to thoroughly examine why hunters and gatherers hunt and gather; to investigate the conditions that lead pastoralists, horticulturalists and agriculturalists to hunt and/or gather; and to explore those traditional hunting and gathering societies who in the present or the past have planted domestic crops and raised domestic animals or who are engaged in trade with non-hunting and gathering systems. It is time to evaluate what effect fluctuating food acquisition and production strategies have in the economic, social, political and ideological domains.

The focus of this dissertation is **hunting and gathering subsistence systems** which exploit wild resources. Wild plants and animals are those "which reproduce without human intervention and whose critical habitats can regenerate without human intervention" (Prescott-Allen and Prescott-Allen 1986:2). However, the distinction between wild and domesticated is not always clearcut. For example, wild game may be given supplementary feed and wild seeds may be intentionally broadcast. Wild resources are acquired by hunting, trapping, snaring, netting, hooking, gathering and related activities as well as through trade. It is acknowledged however that plants and animals formed the bulk of, but were not the only, food consumed. The subsistence systems considered in this dissertation exhibit subsistence versatility which may lead to limited cultivation of plants and husbandry of animals and even wage labor.

The following research is based on a number of assumptions. First, it is assumed that fluctuation of resources is typical of all environments but that the predictability of these fluctuations varies as does the number of resources which experience oscillations. Marginal environments tend to have lower resource diversity; a greater number of important resources which fluctuate; and less predictability as regards fluctuations. In contrast, benevolent environments have greater resource diversity; fewer fluctuations among key resources; and resource productivity is more predictable. The overall cultural patterns and buffering responses will be different.

Despite the problems of quantifying the carrying capacity of a geographical area (Hayden 1975), it is assumed that some areas, namely those referred to as benevolent, have a greater carrying capacity than do marginal regions. For hunting and gathering subsistence systems this means greater diversity and productivity of wild plants and animals.

It is assumed that considerable diversity is reflected in the cultural adaptations of hunting and gathering subsistence systems. Some are nomadic, others are sedentary; some live in bands, others in tribes or even chiefdoms; some practiced storage, others did not; some occupy marginal environments, others live in benevolent environments; some are generalized hunter-gatherers, others are complex hunter-gatherers. It is expected that coping strategies will vary according to these characteristics. Furthermore, systems exposed to the same stressor do not always react in the same way (Dirks 1980).

It is assumed that all subsistence systems, be they predominantly hunting and gathering or pastoral or industrial, have developed mechanisms to buffer resource fluctuations.

It is assumed that foraging groups as part of complex regional systems traded with pastoralists, horticulturalists and agriculturalists. Furthermore, with the possible exception of the arctic and subarctic peoples and those of Australia and Tierra del Fuego, it is believed that most late Holocene hunter-gatherer societies were not isolated at all but engaged to some degree in interethnic trade with neighboring societies and in some cases, part-time food producers. These contacts facilitated new and led to modification of old coping strategies.

It is also assumed that the societies in question have been profoundly altered through their contact with industrial European civilization. The alterations began with material innovations and extended into subsistence orientation and social, political and ideological adjustments were ultimately made as well.

Lastly, it is assumed that since anthropological studies postdate colonial impact, our knowledge of pre-colonial systems is imperfect; therefore, we do not presently, nor may we in the future, know precisely how buffering strategies have evolved.

3.3 Defining Resource Abundance and Scarcity

Many extant hunting and gathering subsistence systems occupy what anthropologists and ecologists call "marginal environments." These are regions where a combination of environmental factors or stresses reduce the carrying capacity of the land (Moran 1982). These stresses vary from one environmental zone to another. For example, prolonged dry season, cyclical drought and unpredictable herd size, composition, and location, challenge grassland occupations. While marginal environments are particularly prone to resource fluctuations, oscillating resources also are typical of such high biomass environments as temperate maritime regions and ecotones (Suttles 1968). In fact, fluctuating resources are undoubtedly typical of all types of environment (Suttles 1968; Kelly 1983). It is postulated here that environmental stresses, but equally as important, social stresses, alter food supply so that periods of abundance may be interspersed with periods of scarcity, irrespective of the type of environment. It is also acknowledged that structural features of marginal and benevolent environments are different and affect risk reduction strategies. The problem that must be solved by any primitive economic system is how to utilize the abundance that may be available in any given year as a defence against scarcity in poor years (O'Shea 1981).

Anthropologists have used the phrases, **resource stress** (Hayden 1986, 1987) and **ecological stress** (Laughlin and Brady 1978), to refer to periodic scarcity of productive resources. **Productive resources** are those portions of the nonhuman environment exploited to yield food and other materials (Richardson 1982). In the discussion which follows, it is alternating shortages and abundance of productive resources that is of concern.

There are, in fact, multiple dimensions to fluctuating food supply. Temporal variation may be seasonal, interannual or long-term. Seasonal variation occurs within a single year; interannual variation occurs between years; and, long-term variation may extend over a generation or more (Rowley-Conwy and Zvelebil 1989). Food supplies may be abundant, scarce or adequate to meet needs. Conditions of **abundance**, or perhaps even excess, occur when the available food outstrips the abilities or desires of human groups to use, process or store it. When hundreds of bison were killed in a single communal hunting event, there was more meat than could be consumed in the short-term or preserved for the long-term. In this situation massive waste of food occurred (Wheat 1972; Table 22).

There has been a tendency for anthropologists to ignore empirical evidence of waste in subsistence economies though they are fully cognizant of its presence in their own industrial societies. Resource management and mismanagement by hunting and gathering subsistence systems is an emerging issue in anthropology (Williams and Hunn 1982). Certainly abundance is the corollary to scarcity when resources fluctuate. The emphasis on scarcity or resource stress has dominated studies of resource fluctuation in the past. Since alternating abundance and scarcity is the reality of most ecosystems, this dissertation will examine both phenomena and their interrelationships. For as Millman and Kates (1990:3) so concisely said, "the history of hunger is interwoven with the history of plenty."

Conditions of **scarcity** occur when there are inadequate resources relative to demand and as indicated by hunger, discontent , and in market economies, rising prices. Scarcity may affect a region, a household or individuals. It may be short-term, inter-annual or long-term. Three types of scarcity can be recognized with respect to the levels at which it may manifest itself: food shortage, food poverty and food deprivation (Millman and Kates 1990).

Food shortages are marked by food insufficiency in a geographical region and occur when provisioning mechanisms fail. Harvest failure, hostilities between people and environmental hazards are cited as causes. The failure of migratory caribou or anadromous fish to return to expected locations produces food shortage for Nunamiut hunters in northern Alaska and Salish fishers in coastal and interior British Columbia. The failure of bison to move into the parkland in the winter caused starvation among the Assiniboine and others in the early historic northern plains.

Food poverty occurs when a household cannot obtain enough food to satisfy the requirements of all its members, given the customary pattern of allocation within the household. Entitlement to geographical locales, such as trapping areas in northern Quebec or fishing grounds on the Northwest Coast, allocated resources to Cree hunters and Kwakiutl fishers, respectively. Should these resources fail, food poverty resulted. Similarly, allegiance of Indian hunters to a fur trading company might mean that a competing company was unable to secure adequate provisions.

The inadequacy of individual intake for individual need is termed **food deprivation**. Food deprivation may, however, occur despite adequate household supplies. Diseases and differential access to food are mitigating factors. Speth (1990) drew attention to the inequities inherent in egalitarian hunting and gathering societies where age, sex, hunting ability and food taboos affect meat sharing. The meat rationing system used by the Hudson's Bay Company resulted in women receiving one-half the meat allocated to men and children one-quarter (Table 19). In the final analysis, "if there is no food deprivation, there is no hunger" (Millman and Kates 1990:11).

In anthropology shortages are synonymous with resource stress and as previously mentioned, anthropologists see resource stress as causal in human affairs. Shortages of food are responsible for a hierarchy of bodily conditions. **Hunger** is a weakened condition brought about by the prolonged lack of food (Webster's 1965:405). Continued hunger leads to **starvation**, a condition where deprivation of nourishment may ultimately lead to death. **Famine** is "a critical shortage of essential foodstuffs leading through hunger to starvation and a substantially increased mortality rate in a community or region" (Garnsey 1988:6). While starvation and famine can be perceived as points on a single continuum (Dirks 1980), with the former leading to the latter, there are important differences. The effects of starvation may vary from one individual to another depending on their physiological resistance and differing degress of access to remaining and increasingly scarce resources, whereas famine is a reduction in normally available food supply such that individuals, families, and eventually whole communities are forced to take up abnormal social and economic activities in order to secure food (D'Souza 1988). D'Souza (1988) and Shipton (1990) maintained that famine is the result of social rather than natural disasters, while Gibbons (1991) suggested that famines are due to a combination of circumstances. For example, events such as drought and subsequent political and social policies that progressively erode the capacity of the poor to deal with short-term shocks have precipitated extensive famine in the Sudan, Ethiopia and Somalia. Thus, it should be noted that starvation results from environmental disturbances and its successor, famine, has social causes. Physical and cultural anthropologists together have shown that true famines are far less regular or widespread than seasonal hunger or chronic malnutrition (Shipton 1990). Food deprivation, food poverty and food shortages will utimately have significant impact on sociocultural behavior particularly if they are temporally and spatially comprehensive.

The basis of food shortages and famines are many and varied: meteorological and hydrological, edaphic, biotic, economic, and political; they are also ethical, diplomatic, logistical and military (Shipton 1990). They may appear as external to a social system, such as environmental perturbations, or internal, deriving from individual and group interaction or systems of values and beliefs. Traditional habits and irrational beliefs may also prevent people using the resources at hand (Eidlitz 1969). Millman and Kates (1990) identify the following agents. Complex linkages in production, distribution and consumption of food have primacy as causal agents. Entitlement or access to food by a household by virtue of its socially recognized right to control certain resources is a second cause. Hazards, which are threats to humans and what they value, constitute a third agent. Lastly, factors relating to population size, the relations of production, and the ability of the environment to provide are seen as causes of food shortages.

One recurring, and perhaps even predictable, cause of food fluctuations is **seasonality** (Miracle 1961; Huss-Ashmore et al 1989; Speth 1990; Yesner 1990). Seasonality is found in all nutritional regimes, even equatorial ecosystems. The fluctuations may be a minor variance or major in that the resource is seasonally unavailable. Hunting and gathering activities are seasonal. Factors underlying seasonal harvests include local prey density, distribution, and visibility; physical condition of the landscape- soil moisture, relative humidity, vegetation cover; and social division of space and labour (Wilmsen and Durham 1988). The importance of seasonality has long been recognized by anthropologists. From a biological point of view, seasonality is part of the human evolutionary record. From an ecological point of view, as expressed by Liebig's Law of the Minimum, it is predicted that adaptive strategies should be concentrated on survival in the worst case scenario.

It may seem ironic that famine and waste can occur in the same environment; however, that is precisely the situation in the early historic northern plains. Depending on the year, one may read accounts of bison herds extending "as far as the eye can see" or accounts of people resorting to boiling hides for soup because the bison were nowhere to be found.

Alterations in resource abundance mean that "life is a risky and uncertain business" (Cashdan 1990:1). Resource risk and uncertainty have been studied by various disciplines (Bartow 1969; Slobodkin 1972; Burton and Hewitt 1974; Wiessner 1982; Huss-Ashmore et al 1989; Garnsey 1988; Halstead and O'Shea 1989; Cashdan 1990). Whereas risk relates directly to the natural and social environment, uncertainty is linked to lack of knowledge. **Risk** is unpredictable variation in some ecological or economic variable; for example, variation in rainfall, hunting returns, snow cover, prices (Cashdan 1990). As variation increases so does risk. Thus environments with considerable variation in rainfall or game animals from one season to another are high risk regions. Environmental variability can be characterized by its timing, frequency, duration, severity, spatial scale and regularity (predictability). **Uncertainty** means "lack of knowledge, lack of faith in reliability and sometimes the inability to make a decision regarding some phenomenon" (Webster's1965:964). If environmental variability is unpredictable in terms of timing and magnitude, this element of uncertainty significantly exacerbates the risk from perturbations. On the other hand, if variability is predictable, uncertainty is minimal and risk reduced. Food is needed very regularly yet tends to be both irregular in its availability and unstable once acquired; therefore, it has long been a basic limiting factor on human survival (Halstead and O'Shea 1989). Crucial aspects of food **variability** are the timing, frequency and severity of shortages. Temporal aspects of variability refer to how often risk occurs and how long the periods of scarcity last. Spatial dimensions of variability relate to the size of the affected area and must also consider the heterogeneity or homogeneity of resources in a given area. Intensity refers to the severity of shortages and to the degree of variation in severity that can occur. Another consideration of variability is its relative predictability (Colwell 1974). Some variations are seasonal and thus cyclic and predictable within certain limits, while others are the result of infrequent hazards and thus lack predictability. The structure of resources in a particular habitat provides challenges to which local inhabitants respond as they adapt.

Grasslands are variable environments. The climate of grasslands is characterized by extremes. Rainfall is seasonal and uncertain in both time and place. The rainfall pattern shifts are of variable duration and intensity; do not occur in regular succession; and, cannot to this day be accurately forecast (Moran 1982). Grasslands are characterized by high rates of evapotranspiration in summer, by periodic severe droughts, and by rolling to flat terrain. Dramatic fluctuations in the winter snowfall are also typical. Climatic factors affect vegetation, which in turn influences the animal biomass. An additional component in the ecosystem is fire. Many of the grasses are adapted to withstand fires and even to thrive on them. With fire and man's control of it, cultural behavior becomes causal in the variability of the Plains ecosystem and can be linked to the abundance and scarcity of food resources. Food supply uncertainty is a given in the northern plains.

Since resource fluctuations are typical of most, if not all, environments, individuals, communities and societies have developed strategies to cope with this problem. These buffering mechanisms are composed of belief and behavior in the realm of economic, social, political or ideological systems.

3.4 Buffering Resource Abundance and Scarcity

The means by which humans secure their food supply in the face of uncertainty are thus as central to society as the consequences of shortage are drastic and they have far-reaching ramifications throughout cultural behavior and social life (Halstead and O'Shea 1989). Over the long-term, humans have evolved a complex repertoire of technological and social practices, deeply embedded in biology and culture, to supply their basic food needs, to prevent hunger, and to cope with hunger when it occurs (Millman and Kates

1990:19). Den Hartog (1981) has argued that contemporary communities possess coping mechanisms at the individual, family and community level.

The following overview of different buffering strategies is preceeded by a discussion of the general characteristics of risk management.

3.4.1 Characteristics of Buffering Mechanisms

Every situation is unique: unique both in the nature and extent of uncertainty in the environment and unique in the form of the human response (de Garine and Harrison 1988:469). As a result, what works for one community may not work for another and what suffices in one set of circumstances may not in another. Environmental variability coupled with cultural ingenuity guarantee that buffering strategies will be diverse and flexible (Low 1990). As Halstead and O'Shea (1989) noted,

> Environmental variability is a fact of life and extreme variability may threaten life. The consequences of variability must be evaded or buffered and man employs a wide array of cultural mechanisms to this end. It must be stressed that not all cultural behavior serves to buffer risk, nor can any individual cultural form be understood solely in such terms. Nonetheless, some practices and institutions serve, literally, a vital role in mitigating the effects of variability and some of these buffering mechanisms occupy a central position in human behavior and in the articulation of human communities.

To be effective strategies must match in capacity and scale the variation with which they must cope. To use Binford's (1980) terminology, buffering strategies are "mapped on" to specific resource problems. For example, the resource problems of an arid environment are certainly different from those of a temperate area. Responses to seasonal and interannual variation are different from those to long-term fluctuations. Cashdan (1985) suggested that individuals must evaluate the costs and benefits of each risk reducing strategy. They must separate seasonal, interannual and long-term conditions; they must assess the magnitude of the problem; they must evaluate the ability of personnel to deal with the problem; they must consider the impact of the coping strategy on the cultural whole.

Responses to resource stress are ranked relative to each other and to the degree of existing or anticipated stress. Dirks (1980) identified a triphasic organizational response, including, in order of appearance, alarm, resistance and exhaustion. Alarm is generally a system-wide response typified by a broad spectrum of mechanisms to offset the stress. The spectrum of mechanisms narrows during resistance and conservation becomes the norm. Finally, during exhaustion the response expands to many channels in a final attempt to correct the situation; if these fail, the system collapses.

Six categories of response are recognized by Shipton (1990): (1) Precautionary strategies are ongoing cultural practices that act as insurance in the event of tragedy. Diversifying the subsistence base is an example. (2) Reversible measures are adjustments to shortages which occur as early responses but can be abandoned if not required. Intensifying production is a reversible measure. (3) Intermediate or semi-reversible responses occur as shortages persist; slaughtering domestic animals and temporarily moving to new geographical areas are examples. (4) Last or least reversible responses, such as infanticide, are self-explanatory. (5) After the period of stress has passed, societies embark on recovery techniques. (6) There are additional strategies used at all stages of resource stress, including prayer and migration.

The coping strategies selected must conform to other aspects of the culture since they may work in tandem with each other. Sedentary and non-sedentary societies may share some coping strategies, but others will be far different. Economic buffering mechanisms may have social implications and social strategies may influence political structures and economic structures. Cashdan (1985) found that mobile people will have geographically broader sharing networks than sedentary folk and that storage is far more prevalent among sedentary societies than mobile ones. Ives (1988) linked endogamy and exogamy to variability in local group size among the Beaver and Slavey Indians where the composition of the local group changed in response to resource fluctuations. Potential coping strategies may be rejected if they are not congruent with cultural patterns and beliefs. For example, Woodburn (1988) found that the Hadza rejected trading opportunities because they associated them with dependence on and domination by others.

Coping strategies are linked to resource structure as well as other cultural behavior. Schalk (1977) linked specialization to highly stable environments, with high productivity and low seasonality and in turn he noted that increased storage signals increased specialization. However, sometimes a buffering mechanism will not be what is expected under the environmental circumstances. For example, Cashdan (1983) noted that the most territorial of Bushmen groups are found where resources are sparsest and least predictable.

Proven strategies are retained; foreign strategies are slow to be adopted. People may be conservative with respect to technological innovations; this conservative behavior should be viewed as a rational response to risky circumstances and uncertain outcomes. We must regard coping strategies, that are embedded in a web of economic, social, political and ideological relations, to be the result of long-term adaptation.

Of course, not all strategies work. Long-evolved indigenous coping strategies do not always address current food problems; there are time lags (Shipton 1990). Sometimes strategies designed to avoid hunger operate to perpetuate it (Millman and Kates 1990; Shipton 1990). Farmers who kill off their livestock may solve the immediate problem but create a future one. Stockpiling food by one group may produce shortages for another.

3.4.2 Buffering Mechanisms in Economic, Social, Political and Ideological Perspective

To facilitate the discussion of coping strategies, the writer has organized them into four separate, though related categories (Table 1), which represent the major social institutions. As used here a social institution "is a stable cluster of values, norms, statuses, roles, and groups that develops around a basic social need" (Robertson 1987).

Coping strategies in the **economic domain** are those that relate to the means a population has for provisioning itself through the production, distribution and consumption of basic resources (Laughlin and Brady 1978). The economic domain deals with the process of survival and is the interface between society and the environment. Storage of food, mobility, communal hunting and diversified subsistence regimes are examples of economic coping strategies.

The **social domain** consists of the network of interpersonal relations, formal and informal, that operate through the mediation of a population's cognized environment (Laughlin and Brady 1978). The social domain provides channels through which basic resources are distributed for consumption or reallocation. It is the potential structure for amity, altruism, sociability, corporate action, "mass effect," alliance and cooperation in shared labor and defense (Laughlin and Brady 1978). Reciprocal access to different geographical territories, small settlement size, and kinship obligations are coping strategies found within the social realm.

The **political domain** is composed of the power relations that influence resource distribution and adaptive action (Laughlin and Brady 1978). Ranked, but more commonly egalitarian, systems exist within hunting and gathering subsistence systems. The political domain is closely linked to the regulation of the economic, social and ideological domains.

The **ideological domain** consists of all rationale formulae, affective states, symbols and meanings and behaviors that define, reify or otherwise reinforce the place actors perceive themselves to occupy in their universe of natural and supernatural forces (Laughlin and Brady 1978). It may include myth, sacred beings, totemism, magic, ritual, taboo, religious specialists, and religious movements (Pandian 1991). For example, oral literature in the form of myth or legends often tells of the success of the group in the face of adversity (Minc 1986).

An analysis of the four domains can provide information on the level of preparedness of a society's adaptive structure for particular forms of decrement in basic resources. As with all typologies there are problems with boundaries. Many coping mechanisms fall in more than one domain; consequently, the following typology is somewhat subjective. The writer placed specific strategies in one of the four main categories based upon a decision as to whether the strategy involved greater articulation with one area than another. For example, reciprocity is traditionally regarded as a method of exchange in the economic domain; however, the very essence of reciprocity is social interaction.

3.4.2.1 Buffering Mechanisms in the Economic Domain

Fluctuations in food supply directly affect subsistence activities; therefore, the greatest number of buffering mechanisms are found in the economic domain. These range from diversification of the economy to storage, information gathering, communal hunting, migration, seasonal nomadism, primitive valuables, use of famine foods and many more. Several of these overlap with the social domain including communal hunting, reciprocity, and redistribution.

Anthropologists have come to recognize as adaptive the diversity of subsistence activities that typify a hunting and gathering subsistence system (Bicchieri 1972; Colson 1979; Headland and Read 1989). **Flexibility** of behavior and **diversification** of food supply are synonymous with hunting and gathering subsistence systems, if not all subsistence systems under duress (Millman and Kates 1990; Shipton 1990). Colson (1979:22-23), in reviewing the food strategies of self-reliant societies, noted,

> Diversification of activities is probably the
> most effective device . . . for preventing weather
> vagaries or other adverse conditions from
> plunging them into famine. . .
> Specialization, in the light of human history,
> is a dangerous phenomenon, whether based on
> reliance on a single crop or a single craft
> If bad times are expected, then it is a mistake. . .
> to specialize. . . specialization increases immediate
> output at the expense of long-term support.

Bicchieri (1972) postulated that productive failure is halved by combining hunting and gathering. Headland and Reid (1989) suggested that hunting and gathering societies that embrace domesticated animals and/or plants and those that are involved in trade with non-hunting and gathering societies may be adapting to resource pressures. They believed that hunter- gatherers in food-scarce areas are more likely to diversify their subsistence regimes in these ways than are those in relatively rich areas who tend to specialize. Hayden (1981b) suggested that hunter-gatherers can be expected to place primary emphasis on exploiting the most reliable resources whenever possible. An important aspect of diversification is the knowledge of all plants, animals, locations of water and food, and seasonality of resources in one's territory, for this knowledge promotes survival (Strehlow 1965). While there is apparent flexibility in the organization of buffering responses, this is not true flexiblity because it is a product of a structured system of social relations operating according to certain principles (Wiessner 1982).

Diversification of subsistence activities is tied to the versatility of our species in the satisfaction of its food r equirements. As omnivores we consume leafy material, fruits and seeds and animal matter; furthermore, there are fluctuations, often seasonal, in the proportions of these classes of foods in the diet (Hamilton 1987). There are few potential food sources that have been neglected in the search for items to satisfy human hunger,

> Fish whose tissues yield deadly neurotoxins, acorns loaded with tannic acid, cheeses smelling like decaying flesh; and foot-long centipedes have all become part of the human gustatory repertoire at one time or another. Energy, amino acids, lipids, minerals, and vitamins can be obtained from the most unlikely sources . . . . (Stini 1988:34-35).

We are flexible in our diets; seasonal foods are a feature of these diets; and, we have developed a multitude of strategies to cope with seasonal and other fluctuations in our food supply.

Hunting and gathering subsistence systems have developed **cooperative strategies**, which reduce risk and uncertainty. Hunting and gathering is a risky endeavor because many resources, especially large game animals, may elude capture and when it is successful there may be a temporary glut of food; it is uncertain because the location, abundance, ripeness, or behavior of the resource may be unpredictable over the short or long term (Smith 1988). Preferring the routine and the reliable, hunter-gatherers in all but the highest latitudes acquire 60 to 80% of their diet through gathering (Lee 1968). Those in northern environments are hunters by virtue of the abundance of animals and scarcity of plants. Hayden (1981b) has suggested that communal hunting occurs predominantly in areas where meat is an absolute necessity for survival. This tactic is more reliable than individual hunting and probably yields more meat per day per group. Subsequently Driver (1990) argued that in regions where the condition, palatability and aggregation of large game animals varies seasonally, communal hunting, despite its high costs, is favored because it reduces the risk of hunting failure. Another strategy is to focus on less risky prey. Hunters in the boreal forest use fish seasonally and when caribou are scarce (Smith 1978). It is predicted that subsistence strategies will vary as resource productivity and predictability and associated risk and uncertainty vary. Reducing uncertainty through information exchange and risk through cooperation will be favored strategies. It is expected that communal strategies will be found where the uncertainty and risk inherent in a particular environment can be mitigated through cooperation of individuals who are partaking of clumped, seasonally available resources.

Resource monitoring and its corollary, **information sharing**, also reduce uncertainty and include communication about famine foods, seasonal and long-term availability of foods; and dispersal of information across generations. Kelly (1983) noted that resource monitoring is a critical factor in hunter-gatherer adaptation,

> Maintaining knowledge of current and potential
> future states of resources is critical if a group
> is to plan movements and activities around those

> resources. Members of hunting and fishing expeditions who fail to acquire their prey may turn their attention to checking the status of a waterhole, to seeing if there are signs of animals having recently visited an area, or to noting how close particular seeds or nuts are to being ripe (Kelly 1983:299).

Moore (1981:192) was of a similar mind when he said, "the ability of a population to deal with environmental variability is largely a function of its ability to collect, process and store information regarding this variability."

A key attribute of Binford's (1980) logistical foragers is their gathering of resource information of immediate utility and information of future utility. The former relates to resources to be taken imminently and the latter to future foraging expeditions. The gathering of information is linked to cooperative foraging and mobility of foragers as well as residential camps. Fowler (1982) has suggested that when Great Basin groups take their names from dominant food types present in their region, information about environmental and ecological differences and thus potential shareable resources is effectively conveyed over broad geographic areas. Ames (1985), in a study of complexity among hunters and gatherers on the Northwest Coast of America, argued that as they become increasingly logistically organized, more elaborate information processing strategies become necessary, leading to the emergence of social hierarchies.

Clearly, dissemination of information about resources is essential, which led Rowley-Conwy and Zvelebil (1989:45) to say, "Indeed, much of the movement entailed in the seasonal round of high-latitude hunter-gatherers may be intended primarily to monitor the availability of resources in parts of the landscape used only in bad years." It is suggested that there is a direct relationship between seasonality and resource monitoring. Information sharing will expand as seasonality becomes more pronounced.

Mobility involves the movement of people over the landscape in the process of acquiring critical resources. Halstead and O'Shea (1989) suggested that mobility is the simplest of cultural responses to both seasonal and long-term resource variability.

Mobility is tied to flexible territorial boundaries and extensive kin networks and operates at the individual, residential and territorial level in hunting and gathering subsistence systems (Kelly 1990).

Binford's (1980) separation of foragers and collectors is ultimately tied to mobility differences. Foragers, who gather foods daily and generally have no storage, make a number of residential moves among resource patches during the year. There is considerable variability among foragers in the size of the residential group as well as the number of residential moves in a particular year. It is suggested that the more abundant the resources, the larger the group and fewer residential moves will be made; conversely, the scarcer the resources, the smaller the group and the greater the number of residential shifts. However, this suggestion demands that the abundance be predictable. Should resource shortages or famine occur, group membership may drop to such low levels that some aspects of the lifeway, such as division of labor, cooperative subsistence activities, and social interation may be impacted. Foraging is more common in low latitude areas, where there are less pronounced differences in the availability of resources and more even distribution of critical resources. In contrast, collectors occupy environments where there are incongruent spatial and temporal distributions of critical resources. Logistically organized collectors supply themselves with specific resources through the formation of specially organized task groups (Binford 1980). Their residential groups are larger and storage may be practiced. Mobility of task groups rather than the entire community is a feature of collectors. As resources become more abundant, increasing sedentism would be expected. On the other hand, as resources become scarce, increased mobility of the task groups, and ultimately of the entire community, would be expected. Collectors face a situation absent amongst foragers. Their practice of storing food which extends the time utility of resources beyond their availability in the environment, may hinder movement so at some time they will have to evaluate the practicality of mobility against the desirability of storage. As food becomes increasingly scarce the problem will solve itself, as there will nothing to store.

Ultimately mobility is tied to the structural properties of the environment. Kelly (1983) linked hunter-gatherer mobility to two aspects of the environment: effective temperature and primary and secondary biomass as they relate to terrestrial resources. For example he found that in areas of high primary biomass, animals and plants are relatively inaccessible and hunter-gatherers living in these areas move frequently. Hunter-gatherers living in colder environments have an increased need to depend on fauna for subsistence, and in such environments the fauna use increasingly larger territories to support themselves, in turn forcing hunters to be more mobile.

The opposite of mobility is sedentism, a feature of complex hunting and gathering societies as well as horticultural and agricultural societies. Locally abundant food supplies are a prerequisite for settled living and are linked to subsistence specialization, storage, social stratification, ownership of resources, warfare, population increase, increased trade, competitive feasting, larger communities, and more complex political structures. Sedentary societies face a new set of challenges when food shortages occur, and the mechanisms used to buffer resource stress will be correspondingly different. One can expect that hunting and gathering subsistence systems that have adopted limited use of domestic plants and animals are restricted in their use of mobility as a coping mechanism.

Food storage is another common coping strategy that is linked to decreased mobility. It is used to buffer seasonal and interannual scales of resource fluctuation, but not the long-term (Rowley-Conwy and Zvelebil 1989). Food storage is not unique to humankind though among non-humans it is an instinctual behavior while in humans it is cultural (Vander Wall 1990). Food storage has been studied by anthropologists seeking to understand the differences between foraging and food producing societies (Ingold 1983; Testart 1982, 1988; Price and Brown 1985; Brenton 1989) and by those who view it as a response to seasonally available foods (Cashdan 1983, 1985; Wiessner 1982).

Storage permits human societies to extend the seasonal utility of clumped foods. Anthropologists believe that environments where one finds clumped, seasonally available resources, and where the appropriate technology for acquiring and preserving the food has been developed, are locales where social complexity may develop (Price and Brown 1985). Storage occurs when some natural food resources are bountiful but seasonal, can be gathered en masse and stored on a large scale, thus becoming the staple food year-round. This possibility lies at the intersection of four conditions, two ecological and two technical. These are abundance and seasonality of resources and efficient food-getting and food-storage techniques, respectively (Testart 1982). Food storage techniques are environmentally dependent. They are more common and more sophisticated in higher latitudes, with little or no storage occurring in equatorial regions where seasonality is less pronounced and stored food spoils easily (Hayden 1981b).

In addition to freezing, salting, drying, smoking and pulverizing, storage involves construction of cellars, cache pits, ceramic vessels, granaries, chests or hide containers for resource protection. For without preservation techniques and storage facilities, large catches of food would soon spoil or be pillaged by animals. Ingold (1983) and Rowley-Conwy and Zvelebil (1989) have viewed the construction and maintenance of facilities such as pounds, traps, nets, surrounds, and drive lanes as examples of stored labor. They require human activity and presence before the period of harvest and extend the occupation period of a site into the time after the harvest. Specialized, curated technology that increases technological efficiency is yet another example of stored labor and is designed to minimize failure (Bleed 1986).

Activity scheduling is a key feature of storage since the labor inputs necessitated by construction projects may have to be interrupted in order to acquire foods that have recently become available. Storage is a response to non-concurrence of production and consumption schedules (Ingold 1983). Economies dependent on storage are typically those where there are conspicuous seasonal variations in the intensity of food gathering activities; they also tend to lack the flexibility of non-storing subsistence systems.

Food may be stored for use within the community or for trade and ultimately consumption by other people. Storage is thus linked not only to features of the economic realm, but also to the social and political realms as well. Labor must be allocated during acquisition and preparation of the stored food and inter-community trade brings transporation considerations. Transportation may have to be seasonally adjusted. The introduction of new transportation methods, such as dogs and horses, may radically alter transportation efficiency and indirectly patterns of storage. Storage changes the length of time a site is occupied; furthermore, it requires that manpower be available to guard the stored supplies. Technology forms a necessary accompaniment to storage since without out effect technology to capture, preserve and storage food, there would be nothing to store (Rowley-Conwy and Zvelebil 1989). The availability of storage may change social relations, permitting individuals and corporate groups to consolidate power and prestige (Hayden 1990).

Testart (1988) has argued that storage among complex hunter-gatherers was not a means of coping with uncertainty in food supply but provided food during the next season of scarcity and these were perfectly predictable. Suttles (1968), however, noted that seasonal fisheries on the Northwest Coast were prone to fluctuations of a non-seasonal nature. It is posited here that storage is associated with clumped resources, with a surplus, and is also used to even out the food supply be it a predictable or unpredictable fluctuation which has occurred. But it also is conceded that storage may occur independently of seasonality and resource fluctuations as reported by Ellen (1988) for the Nuaulu of Seram who store food as necessary prerequisite to staging ceremonies. In the final analysis, storing food is a costly enterprise. It permits the growth of larger and more sedentary settlements but conversely it decreases mobility, which may formerly have been a risk reduction strategy.

Storage as discussed above is planned in advance of expected shortages. Another storage strategy occurs after shortages have begun; this is hoarding, where a hidden supply of food is accumulated. One indication of the transition from precautionary storage to hoarding is the graduation from visible storage facilities such as granaries and cache pits outside dwellings to hidden interior or underground facilities. It is postulated that a transition of this nature may indicate escalating resource stress.

Economists recognize three processes by which goods and services are distributed within and between communities: **trade, reciprocity**, and **redistribution** (Polanyi 1957); all may be used, either individually or collectively, as strategies to cope with fluctuating food supplies. These processes overlap the economic, the social, and the political domains. They are economic because they involve goods and/or resources; they are social because of the interaction among individuals, communities and regions; and they are political because control of goods and resources can be linked to power differentiation.

When people produce a surplus of foods or other goods and maintain this through storage, they facilitate **trade** and private ownership. Trade is the business of buying, selling or bartering commodities (Webster's 1965:938). The expansion of trade is a key feature of the evolution of human society from the paleolithic, through the mesolithic and neolithic and finally to the stage called civilization. Trade may occur under both stressful and non-stressful conditions. It may involve foods and non-food items. It may be related to shortages or to situations where people want to acquire food or other goods tjat they do not have. Spielmann (1986) refers to exchanges that alleviate periodic food shortages as buffering exchanges and those where complementary foods are exchanged on a regular basis as mutualism. Mutualistic relationships make new resources available; are regular; and the exchange is for distinctly different resources.

Shortages and abundance are thus features of trading activities. In order to have goods to trade one must generate a surplus, that is an excess beyond one's own needs. Trade that occurs under stressful conditions often involves the exchange of stored goods acquired when they were seasonally abundant, then traffic in these goods when shortages occur.

Trade may involve non-food items. Colson (1979) has suggested that the sale of valuables such as jewellery and an increase in craft production are associated with trade under conditions of resource stress. The production of these items involves the conversion of food surplus into items that can be stored and traded for food in an emergency. O'Shea (1981) recognized two types of storage systems, complementary and redundant. Complementary systems are those in which different varieties of goods move directionally through the exchange network; they allow goods from different ecological zones to move in respect to scarcity and abundance. Redundant systems involve traffic in goods that are more or less available to all participants and where goods do not cross major resource boundaries. In normal years, exchange is approximately symmetrical but with a greater emphasis on non-food items. In times of scarcity, exchange becomes asymmetrical, with foodstuffs moving in one direction and non-food items in the other. Redundant systems are typical of broad and undifferentiated environments and only function when failures are localized. In complementary systems, food is a regularly-moving commodity in most exchange transactions, whereas in redundant systems food in quantity only moves in times of scarcity. O'Shea (1981) suggests that trade is integrative, linking different productive units within the same community, and linking one community to another. Trade related to resource stress offers social units a chance to overcome to some degree the combined technological and environmental constraints that threaten general prosperity under a regime of social isolation (Torry 1979).

Trade may encompass a variety of activities and relationships. Comparing the etic description of trade as exchange or barter to the emic understanding of trade among Inuit societies in Northwest Alaska, Burch (1988) identified three different types of exchange that may be subsumed by the term 'trade', plus six other varieties of exchange including reciprocity or sharing, theft, gift-giving and inheritance. In Alaskan Inuit societies, as well as in hunting and gathering societies around the world, exchange systems are exceedingly complex.

Often the initial contact between hunting and gathering societies and European explorers during the Age of Discovery and subsequently, involved trade. Despite these initial contacts and the ongoing trade relationships that were forged, anthropologists have long considered hunting and gathering societies as closed social systems (Spielmann 1986). They have viewed hunter-gatherer trade with non hunter-gatherers as indicative of dependence in the one direction and not the other (Bailey and Peacock 1988). They have also consistently underestimated the impact on prehistoric and contemporary hunting and gathering societies of trade with other hunting and gathering societies as well as non-hunter-gatherers (Peterson 1978). Bird-David (1988) proposed that an alternative working paradigm, resting on the assumptions of contact, economic diversity and flexibility, is more congruent with hunter-gatherer subsistence activities in North America, Africa, India and Southeast Asia. Data indicate that hunter-gatherers there have maintained contact with adjacent societies for centuries, if not millenia. Bird-David (1988) has shown that hunter-gatherer social systems need not be fundamentally changed, but instead incorporate 'other people' as economic as well as social resources, to be used for maintaining the hunter-gatherer way of life.

It is posited that a more productive approach is to view the trade between different subsistence systems as a long-term means to acquire goods that one does not have and this is often, though not always, a risk reduction strategy for all parties. Not only are needed goods transferred, but social ties are forged, which may reap benefits in the future. Commenting on the redundant nature of Middle Missouri inter-band trade, Blakeslee (1975) suggested that by continuously exchanging food, band members encouraged production for the purpose of exchange; ensured that food would be seen as an appropriate item for exchange during time of need; and maintained social relationships within bands and villages. Similarly, O'Shea (1981:177) states "I would argue that the persistent and high value placed on inter-community exchange in good years reflects the importance of such trade links as a safeguard against shortage- the channels must continue to be used and reinforced in good years, so that obligations will be sufficiently strong to be honoured in times of shortage."

In those instances when trade is a risk reduction strategy, it is reasonable to assume that high levels of food exchange, production of crafts and increasing circulation of valuables, may be correlated with significant resource stress. Indeed, to trade is to cooperate. However, in the face of crushing shortages trading partners may resort to theft (Colson 1979).

Recently Hayden (1992) has suggested that complex hunter-gatherers are more likely to resort to trade for dealing with short and long term severe food shortages, than are generalized hunter-gatherers.

A second system of exchange and one which has received considerable attention by anthropologists is **reciprocity** or **sharing**. "A pattern of sharing out the collected food resources" was designated a characteristic of nomadic hunting and gathering societies at the first international conference on hunting and gathering societies (Lee and DeVore 1968b:11). Subsequently Isaac (1978) identified food sharing as occupying a critical role in the divergence of hominids from their ancestors. Though this stance has been subsequently modified, sharing is regarded as a hallmark of contemporary hunting and gathering societies (Dowling 1968; Hayden 1981b; Gould 1981, 1982; Cashdan 1983, 1985; Kaplan and Hill 1985; Wiessner 1982; Spielmann 1986; Winterhalder 1987; Testart 1988; Speth 1990). Reciprocal exchange also occurs in the distribution of wild animal products in societies where the subsistence technology is predominantly that of herding and gardening (Dowling 1968). The concepts of sharing and of reciprocity are virtually universal as social values .

Sharing or reciprocity is "a system of exchange where (1) there is no immediate return, (2) no systematic calculation of the value of the services and products exchanged, and (3) an overt denial that a balance is being calculated or that the balance must come out even" (Harris 1980:228). Reciprocity involves the sharing of actual foods as well as reciprocal access to potential food-providing territories (Wiessner 1982; Cashdan 1983; Spielmann 1986). Put another way, sharing of food involves moving food to the people, whereas reciprocal access moves people to the food. Futhermore, there is internal variation in both these phenomena such that the form, timing and intensity vary from group to group (Gould 1990). Reciprocity and reciprocal access are viewed as exchange mechanisms as well as examples of social storage (Halstead and O'Shea 1989).

The sharing or pooling of food has been documented for hunting and gathering subsistence systems in virtually all environmental zones, but especially those occupying marginal environments. Though commonly associated with the distribution of large bodied game animals, vegetable foods, small animals, fish and birds may likewise be shared. The pooling of resources acquired by individual endeavor is the opposite of communal hunting. Hayden (1981b) and Winterhalder 1987) have suggested that sharing is the most efficient way to acquire mobile prey; it yields the highest poundage per person per hour of work; it is a feature of groups who exploit big game; and it insures a fairly regular provision of meat to all or most community members. Complex rules governing sharing behavior are important norms in all societies where sharing is an important method of distributing food. Generosity is universally valued, inculcated in the young, and sanctioned by myth and tradition (Dowling 1968). Refusal to share can result in band fissioning (Lee 1972a), social ostracism, or even death for the individual.

A suite of ecological and cultural conditions seem to contribute to reciprocal exchanges of goods and reciprocal access to territories. Where there is low resource availability (Hayden 1981b) and environments are stochastic (Spielmann 1986), reciprocity or reciprocal access are important. Sharing also occurs more frequently in immediate return rather than delayed-return subsistence systems and there is a distinction between the two in terms of what goods are shared. In immediate return systems, shared goods are those that tend to be scarce or prone to acute seasonal fluctuations, and they are often critically important to the welfare of the sharing societies. In contrast, Richardson (1982) noted that in the delayed return economies of the Northwest Coast there is a high degree of sharing of abundant resources but restrictions on access to more limited resources. As a rule the regions where food and resource sharing occur are patchy so that shortages in one locale are offset by abundance in another. Resource fluctuations are not concordant across the entire region; otherwise sharing would cease to function. One expects that an individual would find it beneficial to maintain reciprocal networks with individuals whose economic fortunes are independent of his own (Cashdan 1985). The specifics of sharing vary according to the nature of the goods involved; whether they are manufactured items or food and whether they are meat from domestic versus wild animals. Sharing most often occurs where technologies for preserving and storing food are lacking.

A number of theories have been put forward to explain the phenomena of sharing and reciprocal access. Gould (1981, 1982), Wiessner (1982), Cashdan (1985), Spielmann (1986), Winterhalder (1987), Smith (1988) and Speth (1990) viewed reciprocal exchange of food and land rights as a mechanism to reduce risk in environments prone to resource stress. Reciprocal risk reduction strategies pool risk, enfolding as many productive units or territories as possible and extending over as wide an area as possible. One might say, "It is not who you know, but how many and how distant." Gould (1982:88) predicted that,

> the greater the risks imposed by limiting factors in a particular habitat, the wider and more coherent the 'envelope' of social networks will be, and the less one would expect to find any mechanism that would restrict the mobility of people, goods, or information from one subarea to another. Conversely, the more suitable a given habitat is for maximization of resources based upon strategies of individual family exploitation, the smaller and more restrictive this 'envelope' will be. . . .

Smith (1988) emphasized that obtaining permission to enter and use the territory of another social group, that is a feature of reciprocal access, serves two important functions. First, it is a mechanism used by the residents to keep tabs on the balance of reciprocity and hence on the ongoing stability or lack of stability of the partnerships involved. Second, reciprocal access requires communication between several groups and thus facilitates the exchange of strategic economic information. It can be expected that as risk increases, as is the case in marginal versus benevolent environments, so do reciprocity and reciprocal access. In looking at linkages between coping strategies, it is worthwhile to note the positive correlation between reciprocal access and increased mobility.

While reciprocity and reciprocal access are activated when there is seasonal and interannual resource stress, it is expected that they will decline with long-term stress or as shortages become so scarce as to cause starvation and famine. Smith (1988) also suggested that the costs and benefits of sharing must be weighed against each other. Costs relate to the expenses of maintaining and enforcing the system. Transportation of food or conversely, people is a maintenance consideration. It is expected that as distance to food sources increases, the costs of transportation will rapidly increase to such an extent that it becomes more economical to move people to the food supply rather than food to the people. Enforcement is required to prevent individuals and groups from reneging on their responsibilities. It may range from praise and enhanced prestige for the perennially successful hunter to gossip about, or even social exclusion of, the freeloader. Because of the high level of interdependence in hunting and gathering subsistence systems, the long-term implications of negative sanctions must be considered.

Redistribution is likely an extension of reciprocal relationships, though it is somewhat more coercive. As with reciprocity, redistribution is usually embedded in a complex set of kinship relations and rituals that may obscure the significance of the exchange behavior (Harris 1991). It is found in non-egalitarian societies where power differences permit an individual or his descent group to accumulate goods produced by others (Harris 1980). These goods will be sorted by type and some or all may be given away. Redistribution may be non-stratified or stratified. Non-stratified redistribution occurs when the personnel accumulating goods give most of them away, whereas in stratified distribution the bulk of the goods are kept by those in charge of collection. The potlatch of the Northwest Coast of America is perhaps one of the most famous redistributive systems found in hunting and gathering subsistence systems. Once viewed as an "absurdly wasteful epiphenomenon," a number of researchers have suggested that it is an adaptation to fluctuating resources in what is normally a benevolent environment (Vayda 1961; Piddocke 1965; Suttles 1968). Redistribution as found on the Northwest Coast is part of a suite of interrelated practices. It is found in an environment where resource fluctuation is largely predictable. These fluctuations result in the clumping of an enormous resource, anadromous fish. The technology for taking, preserving and storing the resource has been developed. Mechanisms are in place as well that organize the labor required for storing and redistributing food (Richardson 1982). Suttles(1968) suggested that these are criteria for coping with alternating periods of extreme abundance and scarcity. He identified prestige and power as the motivations underlying the system. Redistribution is not a feature of pristine hunting and gathering societies living in marginal habitats; however, it is found where these societies form alliances with settlements such as the fur trade posts of 18th and 19th century Canada. The aboriginal subsistence economy fed immense quantities of provisions into the posts, but when shortages befell them they turned to these same posts for assistance.

Redistribution implies predictably abundant resources; specialized subsistence strategies; technology to deal with the wealth of food; and organizational structures to gather and disperse the wealth. Storage of goods is a prerequisite for this mode of exchange. Collecting not foraging, hunting and gathering systems can be expected to practice redistribution. Redistribution is a mechanism for dealing with short-term disturbances in resource availability but it could break down if organization structures were altered, as for example through catastropic depopulation caused by epidemic diseases.

Trade, reciprocity and redistribution vary in terms of the commodities exchanged, the structure of relationships linking individuals, communities and regions, and the organizational complex into which the exchange system is embedded (O'Shea 1981). Environmental factors that have an influence are the physical geography of a region, environmental factors promoting scarcity, and the distribution of resources. The diversity of subsistence practices, existing technology and the levels of sociocultural integration are cultural factors affecting these strategies.

The former strategies, including diversification, information sharing, food storagetrade, reciprocity and redistribution, are largely precautionary and preventative and clearly are geared to anticipated fluctuations in resource productivity and predictability. Another set of strategies are employed after shortages commence. Called recursive responses by Dirks (1980), they emerge with the onset of stress and consist of strategies used to cope with escalating shortages. In the economic domain these strategies are diversified. The use of **alternate and famine foods**; the practice of **eating less food** and **bulky foods**; the husbandry of **foods that mature quickly** and that are **drought resistant**; the expenditure of **more time in the food quest** and **more time processing food**; and, the implementation of **conservative methods of food preparation** as well as **conservation of wild food sources** are all examples of strategies embarked upon after resource stress is felt (Colson 1979; Dirks 1980; Millman and Kates 1990).

These changes in eating patterns are ranked relative to each other. As people attempt to conserve food stores, it is not unusual for them to reduce the number of meals consumed per day and to broaden their diet. As conditions worsen they may dilute their food with waste or with other bulky substances not normally eaten, such as tree leaves and bark, wild greens, roots and seeds. The next stage might be to slaughter domestic animals, both breeding stock as well as those that would normally be eaten. Any available wild animals and plants might be consumed. Skins from tents, clothing and shoes, as well as earth, animal feces and ultimately corpses might be consumed. Overall conservative strategies will be the norm at all stages of food aquisition, preparation and consumption.

Despite the fact that humans are broadly omnivorous, all societies have a tendency towards selecting a small number of preferred foods. Shortages of preferred foods lead to enlargement of the variety of foods consumed. This practice of consuming famine or emergency foods is very old and can be regarded as an important strategy for coping with shortages, both minor and severe (Eidlitz 1969; Bhandari 1974; Golkin 1987). Famine foods are "such food as was usually eaten when there was a shortage of the normal diet, and which was considered not to have a full food value or to be inferior as human food, being eaten as a surrogate for the main diet" (Eidlitz 1969:129). It is not possible to make a clearcut distinction between emergency and normal food since the distinction is one of attitude, and attitudes towards food are notoriously fickle. Attitudes vary from individual to individual, group to group, and society to society; as well they change with time, economic conditions, influence from other groups and new developments. Whether a food was regarded as normal or famine-fare is to some extent a matter of tradition. For horticulturalists and agriculturalists, famine foods might well include the wild resources that formed the subsistence base in another time and place or for contemporary hunting and gathering systems (Bhandari 1974). For hunting and gathering societies, emergency foods may come in the form of domestic plants and animals acquired from pastoral or agricultural neighbors (Howell 1986).

As people broaden their diets in response to shortages of preferred foods, they resort to two categories of foodstuffs. The first type comprises food that is nutritionally inadequate if consumed alone. This would include bulky plant materials, such as leaves and bark or animal bone, or, perhaps, a cereal grain eaten to the exclusion of other foods. The second type comprises foods that are in fact nutritionally adequate but are not considered as proper food by the group in question. They are not part of the traditional fare as, for example, the consumption of fish by bison hunting Plains Indians (Lowie 1954). Famine foods often will be ranked relative to each other such that the more tolerable foods are eaten when shortages begin and the less tolerable are gradually added as shortages become more acute. Unfortunately, some emergency foods contain much woody tissue and substances which are neither digestible nor nutritive and may produce adverse effects on health and perhaps even death. The use of famine foods may be adaptable in the longterm since it may result in the addition of new foods to the diet, foods that may become more abundant during periods of environmental stress.

Hunting and gathering subsistence systems that also have domestic plants and animals and, of course, full-time pastoralists and agriculturalists may be forced to adopt other strategies. If living in areas prone to drought, they may adopt drought-resistant crops and animals; in areas prone to frost, quickly maturing food-stuffs. They also may reduce the food fed domestic animals and ultimately the number of animals, retaining only breeding stock. If shortages become progressively more stressful, all domestic animals may have to be sacrificed.

Food preparation techniques will become increasingly conservative as the impact of shortages increases. Pounding grain may give way to grinding, which produces a coarser, less desirable but bulkier product. It is expected that there will be less waste whether it be animal or plant foods that are being prepared. Food preparation time increases as famine foods are converted into more attractive foods by processing. Bones discarded during plenty may be retrieved and bone grease extracted (Eidlitz 1969). Binford (1978) noted that the discrete dumps around an Eskimo winter house are in fact emergency caches of usable but truly marginal foods, which could be reprocessed for grease and fat should conditions warrant.

When abundance rather than shortage is the norm, eating habits may accommodate the change through increased consumption. Many ethnologists represented in the Human

Relations Area Files have commented on the large quantity of food consumed by hunting and gathering peoples when food is abundant. On the other hand Howell (1986) suggested that the !Kung Bushmen deliberately eat small amounts at all times to avoid the peaks and valleys of resource availability. She also noted that peasants and industrial people in general eat a lot. Feasting is a significant feature of complex hunting and gathering subsistence systems, which, it will be remembered, occupy benevolent environments. Consumption patterns in these contexts involve great quantities of food.

Resource conservation can be considered both precautionary and recursive: precautionary because it may contain practices designed to minimize resource stress and recursive since increasing conservation may come after the onset of resource stress. Whether or not hunting and gathering societies in general and Native North Americans in particular conserved resources of the natural environment has been the subject of considerable debate (Macleod 1936; Ray 1975; Jacobs 1980; Baden et al 1981). If conservation means waste was absent, then many hunter-gatherers would be judged poor conservationists. For example, communal bison hunting might yield far more meat than available human-power could process, leading to considerable waste (Wheat 1972). If they are judged by "their burning practices, their patterns of subsistence (by growing for instance, beans and corn together to preserve the richness of the soil), by creating various hunting preserves for beaver and other animals, and by developing special religious attitudes" (Jacobs 1980: 49), then Indians were conservation minded.

In a comparative study of North American and Australian hunter-gatherers, it was found that hunter-gatherers actively manage their resources, whether through strategic ecological or economic courses of action via social controls and political maneuver or by virture of the power of symbol and ritual (Hunn and Williams 1982). Similarly, Kimber (1984) compared and contrasted resource management strategies of a number of central Australian aboriginal groups and found considerable variation in intensity and importance of these activities which he linked to degrees of resource stress. Macleod (1936) suggested that conservation has economic and spiritual dimensions; those resources which would diminish and tend to disappear if conservation were not applied are subject to conservation efforts. In addition, he suggested that animistic belief systems underly the conservation of many animals. Ray (1975), on the other hand, showed that the conservation issue is very complex when additional players such as European traders enter the scene. In contrast to Macleod, Ray (1975) reported that selected ideological beliefs may promote overuse of a resource such as beaver. As might be predicted, it is often those residents of the most resource stressed areas who put the greatest effort into all forms of resource management.

Baden et al (1981) argued that incentives are the most succinct explanation for the presence or absence of conservation measures. By incentives they mean that if the benefits of conservation outweigh the costs, then conservation tactics will be pursued. From this perspective it is posited that conservation measures are "mapped onto" resource structure such that the most diversified management strategies are expected in areas of greater stress. It is also suggested that conservation strategies will be implemented in the early stages of food stress but as times become increasingly stressful, should conservation measures increase time needed in the food quest or interfere with the acquisition of food, it is expected that these measures will be abandoned. Over-exploitation of a region caused by resource stress can lead to environmental damage, another empirical indicator of food supply problems.

Admonitions against **anthropophagy and necrophagy** are universal; however, under extreme privation the consumption of human flesh and carion is a last resort (Eidlitz 1969; Arnold 1988). Both have been historically documented for the multiple famines which have struck India and China in the past 500 years, as well as the Soviet famine of the 1930's. In addition the consumption of human flesh is documented for a variety of hunting and gathering, pastoral, horticultural and agricultural societies in the Human Relations Area Files. Three contemporary incidents of starvation-induced necrophagy, in the Northwest Territories, Idaho and Peru, revealed that this practice may be chosen when there are no other alternatives. The stark horror associated with anthropophagy and necrophagy and the conditions under which they occur indicate that the more protracted the crises the more the normal order of things collapses and gives way to all that is abnormal and horrific (Arnold 1988).

3.4.2.2 Buffering Mechanisms in the Social Domain

The social domain is defined by interactions among individuals and groups as they pursue socioeconomic and sociopolitical activities. Bifurcation and merging of personnel are important as individuals, communites and regions attempt to deal with resource fluctuations. As noted above, many economic coping strategies bridge several domains.

Mobility may involve movement of the entire community as discussed under economic coping strategies, or it may involve the movement of personnel among different settlements as resources fluctuate. As considered here, these residential shifts are coping mechanisms in the social realm. When personnel shift residential units, economic, social, political and ideological task groups change configuration. This process called "flux" has been the subject of debate among anthropologists studying hunting and gathering subsistence systems. Marshall (1960) maintained that the Nyae Nyae !Kung community consisted of individuals who were bilaterally organized and moved together for at least part of the year. In contrast, Lee (1972b) observed that the Dobe !Kung exhibit flexible local group composition, with individuals coming and going during the course of a year. Yellen and Harpending (1972) argued that the !Kung band or local group may be regarded as a temporary and unstable aggregation of individuals and nuclear families that , over the long run, may be viewed as moving randomly over the landscape. They noted that personnel changes of over 50% occur in the space of a few years. Yellen (1977) related these seemingly disparate observations to the flexibility required for adaptation in arid environments. The variation is explicable if one acknowledges that under certain cirumstances rigid composition is functional, while under other situations flux is preferred.

The Inuit had adaptable patterns of access to land and its resources. Nunamiut bands were flexible with some members taking up residence in other areas when required (Gubser 1965). Among the Netsilik, Iglulik and Copper Eskino, local groups were identified by name with a territory; however, the membership of a winter seal hunting camp might shift as much as 60 to 70 percent in a year (Damas 1969a). The foraging bands of Northern Paiute (Fowler 1982) and Australian Aborigines (Hiatt 1962; Myers 1982) had flexible membership as well,

> It seems sensible, then, to think of hypothetical bands moving through an optimal pattern of resource scheduling, with individuals affiliating themselves to these groups as they move from place to place, travelling with them for a while, and moving on. The size of this abstract band may remain relatively constant while the actual composition may vary greatly. Nonetheless, the important requirement is that individuals must affiliate with the residential group to use the land (Myers 1982:183).

Similar shifts are reported for the hunting and gathering Mbuti Pygmy by Pedersen and Woehl (1988), who suggested that the impetus derives from relations with neighboring agriculturalists and Europeans. Furthermore, they noted that pastoral and agricultural societies experience similar flux.

The composition of production units varies according to the task at hand (Binford 1980). If we assume that the division of labor in hunting and gathering subsistence systems assigns males responsiblity for hunting and females for gathering, and if we acknowledge that communal activities call for task specific work groups, we may conclude that personnel were moved about the landscape in order to complete the task at hand.

Borrowing from an earlier theme, it is postulated that it behooves people who reside in unpredictable environments to retain flexible social as well as economic arrangements in order that they may better cope with seasonal and environmental variations, exchange between nomadic and sedentary societies, long-distant trade and political conflict.

Mobility and **group size, population density and foraging area** are interrelated phenomena. A key characteristic of many hunting and gathering bands is that they "wax and wane" in numbers during the course of a year (Lee and DeVore 1968b; Binford 1980). Binford(1980) drew on the size of the mobile group as well as the number of residential moves in an annual cycle in distinguishing between foragers and collectors. Hayden (1981b) suggested that group size is linked to resource density, resource nucleation, resource reliability, the importance of hunting, techniques of hunting, the nature of the game hunted and food-sharing practices. Group size also may be related to intersocial stress; considerable strain occurs in large groups as contrasted to smaller groups (Myers 1982).

Group size in marginal environments is typically small while it increases substantially in benevolent environments. Similarly population density is low in marginal environments and increases as resources become more prolific. And, as resources become more scarce, the foraging area becomes larger. When resources are abundant, clumped, and/or reliable and when communal food procurement strategies are employed, one can expect aggregation of people, greater population density and smaller foraging areas. Conversely, when resources exhibit low density, patchiness, and unpredictability, dispersal of local foragers, lower population density and larger foraging areas are expected. For example, the Northern Paiute camp group varied from 3 or 4 to 10 families during an annual cycle (Fowler 1982). An early response of hunting and gathering systems, as well as horticulturalists, agriculturalists and pastoralists, is to split into smaller, more mobile communities or families as they turn to wild foods for sustenance (Shipton 1990). Decreasing group size, reducing population density and increasing foraging area are responses that one can expect in both marginal and benevolent environments.

Despite the myriad of causal factors shaping social organization, there are selected aspects of social organization which may be viewed as responses to resource stress. **Membership in unilineal descent groups such as clans, lineages, phratries**

and moieties, gender and age distinctions, marital arrangements, division of labour, and individual and group status create social relationships which in some cases can be viewed as precautionary coping strategies. Marriage and residential regulations preside over potential marriage relationships and thus guide the movement of individuals among communities. Exogamy promotes inter-group movement of both males and females. Under a rule of patrilocality, women leave their group of orientation and join that of their husbands'. Conversely, males join their wives' group in a matrilocal residence scheme. Bilocal residence rules permit married couples to alternate residence with their respective kinsmen as economic conditions permit. Low (1990) has linked sororal and non-sororal polygyny to pathogenic stressors, finding that the greater the pathogen stress, the greater the advantage to production of variable offspring. Polygyny because it permits a man to have multiple wives increases the variability of offspring.

Often kinship systems give clues to the type of intercommunity residential shifts that might occur. Among the Yolngu of Australia, membership in a patrilineal land-owning group confers rights, including the right to utilize certain tracts of land (Williams 1982). Descent systems may also be flexible and permit reciprocal access in the face of trying circumstances. Bilateral descent, which is common in hunting and gathering subsistence systems, ties individuals to kinsmen on both mother's and father's sides of the family, thereby facilitating movement between residential groups should such be required.

In a provocative article, Ives (1988) compared and contrasted the kinship and social organization of the Beaver and Slavey Indians of the boreal forest of northwestern Canada. He identified the Beaver as having a local-group growth system in which endogamy confers a significant potential for population growth. Because their affinal ties are inwardly focussed, external alliances receive less emphasis and personnel requirements for changing economic strategies are internally derived. In contrast, the Slavey have a local-group alliance system in which exogamy causes structural limitations over population growth. Ives views local group exogamy as promoting external ties, making the regional group the source of personnel for new economic strategies. Ives (1988) noted that these factors affected the average number of hunters in Beaver and Slavey trading parties. Among the Beaver the average number of hunters is significantly larger than for Slavey parties, and the variance in Beaver trading party sizes is significantly greater than for Slavey parties. The difference between the two groups was heightened since Slavey hunters had fewer dependents because of female infanticide. Ives (1988) suggested that these differences were linked to resource availability, seeing local-group alliances as advantageous in spreading affinal links widely as part of a strategy which ensured successful interception of migrating caribou herds. In contrast, local-group growth systems are advantageous where either communal game hunting or boreal forest foraging were viable strategies.

Retrenchment of social activity is a strategy enacted after resource stress begins as well as during the period of recovery. It involves the retrenchment, replacement, simplification or merging of social activities (Torry 1979). Marriages might be postponed; funeral rites scaled down; social and ritual activities suspended.

Extensive affinal and consanguineal ties and flexible residential rules underly the risk reduction strategy called **reciprocal access**. Through the extension of kinship ties, such resource alliances confer the right or privilege to use the resources of the land (Ingold 1983). Reciprocal access is practiced by the Australian Aborigines (Strehlow 1965; Yengoyan 1976; Myers 1982; Williams 1982) and the Kalahari Bushmen (Cashdan 1983) among others. Trade partnerships and the extension of kinship terminology are employed by the Nunamiut and Taremiut of North Alaska (Gubser 1965). A link may be established between a physical location and social appropriation through the use of symbols. These symbols may be found in band, lineage and family names or perhaps insignias on dwellings and containers. Reciprocal access and mobility are complementary risk reduction strategies. It is expected that reciprocal access and the associated sharing of resources may gradually decline and eventually cease as the impact of shortages becomes more acute or more geographically extensive, or alternatively longer distance connections may be established.

The status of individuals and groups may be a factor in subsistence activities and consumption as well. There is growing evidence that hunting and gathering subsistence systems are not as egalitarian as once thought (Speth 1990). It is acknowledged that complex hunting and gathering societies, horticultural, agricultural and pastoral societies are characterized by status differentials. Hunting and gathering are differentially valued. It is common to view the male activity of hunting as conferring more prestige than gathering by women. This is reinforced in that products of the hunt are highly valued. There is growing evidence to suggest that some hunters are more skilled, and hence more successful, than others (Speth 1990). Not only do these superior hunters have access to the nutritionally most valuable portions of an animal either through killsite snacking or subsequent game sharing, they also may be owners of the weapons or facilities used to capture game. Applying the logic of evolutionary ecology, Kaplan and Hill (1985) have argued that superior hunters are more attractive as mates and thus yield more numerous progeny. It is reasonable to expect that as availability of resources declines, the **better hunters** will be called upon to "save" the group and their **higher status will similarly be reinforced.**

The status of women and their activities are devalued not only in some hunting and gathering systems but other subsistence systems as well. Hayden et al (1986) have linked low status of women in some hunting and gathering societies to the persistence of resource stress. They suggested that in stressed environments, women are required to regulate population growth by lowering the birth rate. This is achieved through **infanticide, prolonged lactation and associated wide birth spacing.** It also may be achieved by **contraception.** Lowered status means that food taboos relating to consumption by women and children may be intensified in times of resource stress (Spielmann 1986). Women also have the primary responsibility of providing water and fuel. Should resource stress be drought-related, women have to travel farther and farther from camp to acquire these items. Research has shown that pregnant and lactating women, and children have the highest caloric and nutritional requirements and are most vulnerable when food supplies run short (Arnold 1988). In other societies, womens' work is specifically geared to short-term coping strategies. During seasonal shortages in Africa, the labour of women is more important than that of men, leading Moris (1989:222) to suggest that the qualities idealized by the Kikuyu in a wife, being "sober, hardworking and cautious," are attributes suited for conserving household resources and minimizing risks.

The participation of subadults in subsistence activities varies considerably from one type of society to the next. Among the !Kung Bushmen, which he identified as relatively affluent, Lee (1968) noted that the young and the elderly are essentially exempt from these activities with the burden falling on those of middle years. Hayden (1981b) suggested that subadults enter the food quest in regions of low resource density or where commerical hunting is practiced. One might add that this practice increases as pre-industrial societies enter economic relationships with industrial systems. There appears to be a positive correlation between increasing participation of subadults in the subsistence activities and increasing resource stress. When food shortages become acute, last or least reversible responses such as **selling children into slavery** (Todd 1991) **and infanticide** may be instituted.

The elderly are held in high esteem in hunting and gathering societies in contrast to industrial ones (Lee 1968). This elevated status is related to a previously discussed precautionary strategy, information sharing. Many shortages, be they seasonal, interannual or long-term, are recurring events. Those who have lived through them have the advantage of knowing which coping strategies worked and which did not; the context in which these strategies were used; and, the multifaceted costs associated with each. As Fagan (1992:294) noted,"the collective memories of successive generations prove to be of vital importance, for past experience is the basis upon which they modify their strategies in future years that prove to be the same as already experienced ones." This knowledge is so valuable it does not have a price. On the other hand, if resource stress becomes acute, the elderly may be forced into subsistence activities and as a last resort, communities may shed unproductive members through **senilicide.**

A final coping strategy in the social realm is to permanently remove oneself, that is, to commit **suicide**. Dodge (1884) reported that Indians of the western United States not infrequently committed suicide to escape the power of the Bad God, as manifested in hydrophobia, paralysis, or similar terrible and hopeless afflictions. Chardon reported suicides among the Mandan, Hidatsa and Arikara during the smallpox epidemic of the late 1830's (Abel 1932). These instances of suicide do not accompany food shortages caused by social and environmental factors, but seem to be a response to diseases associated with the arrival of Europeans and for which native belief systems had yet to develop alternate responses.

Irrespective of age, sex and status, an increase in work effort is related to environmental conditions (Hayden 1981b). People clearly work harder in areas of low resource density and in times of resource stress.

Precautionary approaches to anticipated resource fluctuations yield a flexible social organization that is persistent over a long time period; recursive responses that begin after severe stress is felt may result in alteration of existing social practices. Many of the aforementioned buffering mechanisms from the social realm are precautionary. Marriage and residential rules, descent and kinship systems, status recognition and reproductive strategies are on-going practices clearly related to the fluctuation of resources on a seasonal and interannual basis. When long-term resource shortages occur and when these become acute, recursive strategies are gradually adopted. Infanticide and senilicide are non-reversible strategies, that people use as a last resort. Recursive strategies may cripple social and thus political organization, temporarily or even permanently.

3.4.2.3 Buffering Mechanisms in the Political Domain

Buffering mechanisms in the political domain relate to power relations that influence resource distribution and adaptive action (Laughlin and Brady 1978). Power relations are based in part on actual or potential differences in access to basic resources. The political domain is closely integrated with the regulatory and adaptive functions of the economic, social and ideological domains. Coping strategies that derive from the political domain include land tenure-territorial rights, segmentary lineages, group fission, and raiding. Some aforementioned strategies, such as reciprocal access, overlap with the political domain.

Anthropologists have long been interested in **territoriality** among humans and nonhuman primates resulting in a "nature" versus "nurture" debate regarding its origins. In addition, it has been argued that some sort of territoriality is ubiquitous among hunter-gatherers (Peterson 1975). Territoriality is the maintenance of an area 'within which the resident(s) controls or restricts use of one or more environmental resources" (Cashdan 1983:47). Territorial divisions serve to apportion resources to all segments of a population (Wilmsen 1973). These controls may be repulsion through overt defense or some form of communication (Dyson-Hudson and Smith 1978). Raiding, murder, witchcraft and other forms of violence are overt defensive mechanisms while visual displays, vocalization, landscape alterations, identification marks (Wilmsen 1973) and food name designations of local groups (Fowler 1982) communicate territorial boundaries. Pitelka (1959 from Wilmsen 1973) has argued that the fundamental importance of territory lies not in the mechanisms (overt defense or any other action) by which the territory becomes identified with its occupant, but in the degree to which it is in fact used exclusively by its occupant. Territorial mechanisms become strategies for coping with resource fluctuations because they match people with resources. Those who control the territory are given first choice over resources before outsiders are allowed access.

Multiple theories have been formulated to explain territorial behavior among hunting and gathering subsistence systems. Etic analyses have linked territoriality to patrilineal descent groups (Steward 1955); bilateral kinship (Lee 1979); economic defendability (Dyson-Hudson and Smith 1978; Cashdan 1983); and, risk avoidance (Smith 1988). Myers' (1982) and Sutton and Rigsby's (1982) emic investigations suggested that the ideology of ownership plays a fundamental role in territorial arrangements in Australia.

Smith (1988) viewed territorial arrangements as lying along a continuum of increasing inflexibility progressing from commons to reciprocal access, territoriality and private property. When land is treated as a commons, there is no enforceable control over access or over unharvested resources, though there may be coordination of land use and resource harvests through consensus. Some western Shoshone, the Hadza and some Batek exhibit this approach (Smith 1988). As previously noted, reciprocal access overlaps the economic and social domains. It is widespread and particularly well described for the Australian Aborigines (Strehlow 1965; Yengoyan 1976; Myers 1982; Williams 1982) and the !Kung Bushmen (Wiessner 1977; Cashdan 1983). Reciprocal access is relatively easily negotiated. Myers (1982:184) reported that the first law of Pitjantjatjara morality was "Always ask." Territoriality involves local-group ownership of a defined area resulting in stronger controls on local group membership and a corresponding reduction in reciprocal access. Burch (1988) identified this form of territoriality among the Inupiat Eskimo of northwest Alaska. Lastly, private property may be held by clearly identified kin groups or by individuals. Four categories of individuals may hold private property on the Northwest Coast- individuals, restricted kin groups, multi-kin group village communities and larger geographically based ethnic units (Richardson 1982). Gould (1982) also identified individual ownership among a number of California Indian groups. Sutton and Rigsby (1982) noted that Western Desert Aboriginal people display a more flexible, individualistic and religion-cast approach to invoking attachment to land than do their more sedentary, clannish and secular counterparts on the coasts and in the uplands of Australia. The increased control inherent in private ownership reduces access to outsiders although reciprocal access may still be present. Community control is more common than individual regulation in hunting and gathering subsistence systems occupying marginal environments, whereas individual control is more typically found in benevolent environments. Particular societies may well exhibit several ownership systems, with different resources or sections of land falling at different points along the property-rights continuum (Smith 1988).

Territorial concepts vary in relation to their extent or inclusiveness. They may cover specific resources only, specific resources within a territory or all resources within a territory. Richardson (1982) noted that on the Northwest Coast the most important sites are those where fish are abundantly present and can be taken with specialized technology. Next in importance are gathering sites for plant foods such as acorn groves in northwest California. Beach salvage rights for dead sea mammals were also strictly controlled on the coast. General areas for hunting land mammals might also be owned on the Northwest Coast. Richardson (1982) also correlated the increasing resource control from south to north with declining variety of resources and greater local and seasonal variation. Among the Northern Paiute of the Great Basin, camp groups and families held rights to pinyon groves, small mammal trapping areas, fishing stations, and corrals and impounds for deer, antelope and mountain sheep (Fowler 1982).

All of the aforementioned theories (Steward 1955; Dyson-Hudson and Smith 1978; Lee 1979; Cashdan 1983; Layton 1986; Smith 1988), with the possible exception of Myers (1982) and Sutton and Rigsby (1982) relate territoriality to ecological circumstances. The abundance, predictability and density of resources are key ecological phenomena that affect territorial behavior. In general where resources are seasonally abundant, predictable and locally dense or evenly distributed one can expect notions of territoriality or private property. Commons, but particularly reciprocal access, occur when resources are widely scattered, patchy and unpredictable. Cashdan (1983) used these ecological criteria to distinguish between perimeter and social boundary defense of property. She suggested that where resources are dense and predictable, perimeter defense will prevail, whereas sparse, unpredictable resources lead to social boundary defense. Perimeter defense controls access to a region, social boundary defense and access to the group that occupies a region. In both cases, allocation of resources and information sharing are key concerns of both outsiders and those laying claim to a territory.

Territoriality is seen as a precautionary risk reduction strategy used in all environments. In marginal environments territorial behavior focuses on access to social groups affiliated with particular geographic areas. In benevolent environments access is more directly related to the resources of the region. In either case interpersonal contact between autonomous groups facilitates information sharing about productive resources and controls the balance of reciprocity (Smith 1988). Thus, territoriality in the political domain, residential flux and reciprocal access in the social domain and reciprocity in the economic domain overlap. According to Sutton and Rigsby (1982) and Myers (1982), ideological elements are involved as well in Australian aboriginal society. It is posited that the formal framework within which territoriality operates is a risk reduction strategy displaying flexibility in access to resources, lands and social groups. By institutionalizing access, information exchange and reciprocity, two key strategies for coping with fluctuating resources, are guaranteed. A second precautionary risk reduction strategy in the political realm is found in the type of **political organization** itself. Layton (1986) suggested that transactions in property shape the long-term processes of hunter-gatherer society and hence determine its political structure. The internal diversity of hunter-gatherer political systems is nowhere more evident than in territorial customs. Where territorial rights overlap and are non-exclusive and where rights over moveable property are generalized and not reserved by corporate groups within the community, egalitarian structures result; conversely, where exclusive rights in territory and their food resources, or geographical sites and sacred knowledge are vested in lineages, the opportunity for inegalitarian structures exists (Layton 1986:30).

Sahlins (1967) has shown that the segmentary lineage is an institution appearing at the tribal level of cultural evolution that functions in a variety of stressful situations.

Found among societies that form small, autonomous economic and political groups, the segmentary lineage attempts to ameliorate stress created by repetitive, long-term use of restricted resources, competition between tribal groups, and intrusion into already occupied habitats, by temporarily consolidating fragmented tribal groups.

Several regional studies have linked selected aspects of political structure to seasonal resource stress. On the west coast of North America, Schalk (1977) has suggested that as the period of resource availability of anadromous fish declines, organizational responses become more complex. Similarly, Richardson (1982) noted an increasing emphasis on descent-based kin groups from south to north and correlated this with decreasing resource diversity and increased local and seasonal variation. Moran (1991) suggested that occupants of nutrient-poor Amazonian blackwater ecosystems have evolved hierarchical forms of segmentary political organization to facilitate the flexible control of resources, their circulation, the maintenance of dispersed settlement, and the persistence of specialized knowledge and control. It is clear that most of the aforementioned risk reduction strategies impinge on the political arena.

Group fissioning and migration are activated after resource stress is felt (Colson 1979; Howell 1986). They are linked to increased mobility since they imply a change of residential locale. Both strategies are early and commonplace responses for mobile hunting and gathering societies; however, they are exceedingly disruptive for semi-sedentary and particularly sedentary communities (Colson 1979), so will be postponed until other strategies have failed. Group fissioning involves the splitting of a socio-political unit into smaller segments in order to spread over a broader geographic area. Migration is the movement of an entire group from one locale to another. The former may be a response to seasonal and inter-annual resource stress, while the latter is a common reaction to long-term stress such as that encompassed by climatic change and environmental desiccation. Group fission was used extensively by hunting and gathering societies in North America. For example, the nomadic Plains hunters joined together in the summer for communal hunting and ritual activities, then the group split into smaller units for fall, winter and spring subsistence activities. Similarly, on the Northwest Coast, the winter ceremonial season saw the community at its largest and living off stored resources provisioned by task groups, which spread beyond the permanent villages to fish, hunt and gather in the spring, summer and fall. Mobility, group fissioning and migration are interrelated phenomena, that in turn are affected by concepts of territory. Migration is a response that is difficult to document prehistorically; however, in recent years, this response has occurred in various parts of the Sahel and surrounding areas. It is very disruptive when it involves the movement of people into occupied territories.

As obtaining food from familiar sources becomes more and more difficult, efforts to procure nourishment expand and competition intensifies and raiding increases (Miracle 1961; Colson 1979; Dirks 1980). **Raiding** is a predatory incursion into the territory of another group for the purpose of resource expropriation. Increasing concern with perimeter defense of territories is often associated with these escalating incursions (Cashdan 1983). There are many examples of raiding of sedentary horticultural or agricultural communities by mobile hunter-gatherer or pastoral societies as they seek needed resources. For example the Mandan, Hidatsa and Arikara villages of the Middle Missouri were subjected to intermittent but continuous looting by the nomadic bison hunters, both in the prehistoric and early historic periods, with stored corn the plunder (Holder 1970). Vayda (1976) suggested that intertribal fighting intended to increase landholdings following local resource depletion is a common occurrence in horticultural societies. On the other hand, Torry (1979) indicated that it is only herding and mixed-herding populations such as the Nuer, Tuareg and Bedouin who resort to interethnic predation as an established method for recouping losses arising from environmental disturbance. In contrast Cannon (1992) proposed that raiding by complex hunter-gatherers in the Fraser Plateau of southern British Columbia correlated with the variability in salmon productivity. And Hayden (1992) has suggested that raiding is a common strategy among complex hunter-gatherers for dealing with short and long-term severe food shortages and serves to distinguish these groups from generalized hunter-gatherers.

It is suggested that raiding and the associated theft of food and other goods is normally counterindicated in societies where sharing and reciprocal access are carefully nurtured. Raiding destroys the trust relationship, that is a key element. Raiding should be considered an intermediate and semi-reversible response activated only after resource shortages become critical in societies dependent on reciprocity. However, where trade is a means to obtain needed goods, raiding may be a corollary activity when one runs short of items for trade. Rather than engaging in a mutually agreed transaction, forceful acquisition becomes the practice.

3.4.2.4 Buffering Mechanisms in the Ideological Domain

Dealing with uncertainty in food supply depends not only on technical devices but also on the non-material answers devised by traditional societies in coping with a situation perceived as highly dramatic (de Garine and Koppert 1988). Buffering mechanisms in the ideological realm consist of oral tradition, ritual, and, in selected cases, revitalization movements. These may be viewed as information sharing artifices designed to regulate, reduce or eliminate stress associated with provisioning problems and perhaps interethnic conflict; however, they may also contribute to stress. Laughlin and Brady (1978) suggested that the relative effectiveness of the ideological domain in risk reduction depends to a large extent on the psychological impact and general receptivity of ritual formulae and behaviors in the indigenous population, as well as on the source and degree of novelty of the ecological stress input. The body of belief comprising the ideological realm always operates in conjunction with the economic, social and political realms. In exploring the mechanisms used by societies to remember events of the past, such as periods of extreme deprivation, Connerton(1989) has stated that we link our experiences of the present largely to our knowledge of the past. Following this line of reasoning, it is reasonable to expect a rich body of coping strategies in the ideological realm. Examination of ideological phenomena and their role in reducing resource stress is a little studied subject though Aberle (1966), Rappaport (1979), Minc (1986) and Cohen (1990) have indicated the potential for understanding risk reduction through analysis of the content of oral tradition and ritual.

Oral tradition can be defined as "oral testimony transmitted verbally from one generation to the next or more" (Vansina 1971 from Minc 1986:44) through the media of folk tales, songs, histories, and mythologies, as well as prescribed ritual chants, activities, and performances. Oral tradition operates within a structured social context that prescribes the appropriate content and context of this body of knowledge. Secular oral tradition is comprised of folktales, songs and histories that depend on repetition for perpetuation. Repetitive telling of these traditions keeps them alive but individual error, elaboration and/or creativity can, in the long run, lead to a variation in the original storyline.

Societies vary in the way they incorporate fears of resource stress into oral tradition and ritual. In a study of 187 folktales from 19 different societies, Cohen (1990) determined that, while capricious aggression appeared fairly frequently, famines and natural disasters were avoided in folktales, even in societies prone to these disasters. He suggested that traumatic events are so frightening that people have to transform them in their projections. Their folktales served dual purposes. They provided a cosmology that explains a seemingly cruel and random environment and, through identification with the stories, people feel a psychic mastery over the capricious environment. Chapman's (1982) study of the Selk'nam of Tierra del Fuego encompassed analysis of oral tradition. She found a concern with food supply an ever present feature, "Do not be gluttonous because if you are you will become corpulent and lazy and not be a good hunter. . . do not throw food away because you may go hungry later. . . When you cut a piece of meat, divide it into about twenty pieces and give one to everyone, taking the last for yourself, then you will be treated the same way when you are old. . . ." Howell (1986) has stated that the !Kung Bushmen take the omnipresence of hunger for granted. No one is told to eat, or to clean up his or her plate or to try some of this nice food. Rather than maximizing seasonal weight gains and variations in consumption, their behavior minimizes seasonal weight gain; it is embedded in cultural standards that are adapted to the extreme seasonality of productive resources. Arguing for the zoonotic factor in Indian depopulation in the 19th century, Martin (1976) has reported that there is a widely held conviction among Native Americans that animals were disease-causing agents especially when their soul-spirits were outraged by a taboo infraction. In addition, Native Americans frequently incorporated their concern with past resource stress in month and year designations. For example, the Blackfoot winter counts preserve for all time that 1837-38 was "the year of smallpox" (Yellow Fly n.d.:1; Running Rabbit n.d.:1; Raczka 1979:45-46), while the January and February month names of the Mandan and Arikara, "the month of the seven cold days" and "the month which kills or carries off men" (Thwaites 1906:345, 393), serve a similar function.

Sanctified religious ritual is the prescribed performance of conventionalized acts manifestly directed toward the involvement of nonempirical or supernatural agencies in the affairs of the actors (Rappaport 1979:28). Ritual mediates the relations of people with their natural environment and the surrounding social milieu. To be effective, ritual must be performed and correct in its production; therefore, knowledge transmitted via ritual is more likely to be accurate than that transmitted by oral tradition (Minc 1986).

In some contexts magic rather than religion is used to mediate relations with an unpredictable and uncontrollable environment. Magic is a technique used to try to achieve empirical ends when empirical techniques provide inadequate prediction and control (Aberle 1966:228). Power, prediction and control are involved in both magic and religious ritual.

The impact of ritual as risk reduction strategy has been considered by a number of researchers. In an overview of hazardous environments, Torry (1979) noted the prevalence of magical devices and ritual used by people to mitigate disaster in a variety of societies from Sudan to the South Pacific. Rappaport (1979) examined the ritual cycles of the Tsembaga Maring of New Guinea, noting,

> . . . ritual cycles of the Tsembaga. . . play an important part in regulating the relationships of these groups with both the nonhuman components of their immediate environments and the human components of their less immediate environments. . . this regulation helps to maintain the biotic communities existing within their territories, redistributes land among people and people over land, and limits the frequency of fighting. . . provides a means for mobilizing allies when warfare may be undertaken. . . provides a mechanism for redistributing local pig surpluses. . . .

One can readily see that ideological elements reinforce coping strategies undertaken in other domains. Similarly most of the religious, magical and social life of the Massa and Mussey of arid regions of Chad and the Cameroons is directed towards obtaining from the supernatural powers, good crops, cattle, fish, as well as timely rains (de Garine and Koppert 1988). Food, eating, cheating over food, as well as lavish feasts are constant themes, as are plump figures, which are valued aesthetically and socially.

Paque (1980) has suggested that feeding and drinking habits of populations of Christians, Jews and Muslims residing in the Arabian and the Saharan deserts are adapted to an ecological circumstance where mild starvation has been the norm and abundance the exception for millenia. This model includes avoiding daily overeating even when food is available; avoiding drinking to excess even when water is available; strict religious fasting for a month; and breast-feeding of babies for two years and sexual taboos that help to prevent new pregnancies. These strategies are religious ritual prescribed by oral tradition that persist even when maladaptive.

Acute stress has in selected cases led to the emergence of religious movements designed to bring about change. Called "revitalization movements" or "nativistic movements", these transformations have had their roots in external factors such as the conflict between Western and non-Western societies, as well as in internal conditions including famine, epidemics, and other calamities that cause a group to lose faith in its sacred symbols (Pandian 1991).

In a different vein, belief may be the cause of food stress. In a study of food and emergency food in the circumpolar area, Eidlitz (1969) suggested that traditional habits and irrational beliefs sometimes prevented people from using the resources that were to hand and resulted in or contributed to starvation. Cited as examples were the Netsilik refusal to begin winter sealing until mid-January when the moon assumed a particular position, and avoidance of particular territories such as that of Lok's Land near Frobisher. In addition, lichens were overlooked as starvation fare despite their utility in this regard and fish were underutilized by the Nunamiut.

Recognizing that ritual and oral tradition work together, Minc (1986) evaluated the advantage of one over the other as a risk reduction strategy. First, the greater accuracy of sacred ritual as compared to oral tradition was acknowledged. Next it was noted that ritual action can be expensive and, when cyclical, may prove unresponsive to crises situations. Minc concluded that secular oral tradition provides the better avenue for dispersing information about short-term fluctuations of lesser magnitude. However, ritual is expected to increase with the greater periodicity and magnitude of fluctuations in the subsistence resources, as would be expected for long-term resource stress.

Hayden (1987; 1992) proposed that alliance formation is a common risk reduction strategy among generalized hunter-gatherers faced with short-term fluctuations of resources. Ritual plays an important role in the creation and maintenance of these alliances; therefore it is expected that it will covary with the formation of such associations.

3.5 Buffering Resource Stress in Crosscultural Perspective

3.5.1 The Sample

In order to explore the aforementioned buffering strategies in cross-cultural perspective, information on 38 predominantly but not exclusively hunting and gathering subsistence systems was drawn from references in the **Human Relations Area Files**.

Included are 26 social groups from North America, six from Asia, three from South America, two from Africa and one from Australia (Figure 3). To facilitate comparisons these social groups were placed in environmental zones, according to the Köppen climate system (Strahler and Strahler 1989). In constructing Tables 3-12 and Figure 4 the environmental zones and cultural groups are arranged according to their latitudinal vectors where possible. The sequence of environmental zones from north to south is E, Dfb, Dfc, Cfb, Cfc, Csa, Csb, BSh, Bsk, BWh, BWk and Af. Similarly the cultural groups range from the Copper Eskimo in the north to the Yahgan in the south. Table 3 provides a summary of the climatic zone, latitude and subsistence of the 38 groups. Information on resource stressors is summarized in Tables 5-7 and information on coping strategies is found in Tables 8-11. Tables 4 and 12 provide comparisons of the resource stressors and coping strategies and Figure 4 illustrates how they covary.

3.5.2 Sociocultural Groups and Environmental Zones

Table 3 provides information on subsistence, latitude and climatic zone for the 38 sociocultural groups. The Copper Eskimo at 69N and the Yahgan at 55S latitude are the furthest north and south groups, respectively. Thirty-two groups live in the northern hemisphere, 5 in the southern hemisphere and 1 straddles the equator. Seventy-four percent are located above 39 degrees N latitude. Twelve climatic regions are represented including polar, tropical rainforest and several variations on continental and desert regimes. Using the marginal-benevolent dichotomy of hunting and gathering environments, 28 (74%) groups occupy marginal environments (E, Dfb, Dfc, BSh, Bsk, BWh, BWk, Af) and 10 (26%) are located in benevolent regions (Cfb, Cfc, Csa, Csb). Hunting (H), fishing (F) and gathering (G) provide the subsistence base in all but 4 regimes. The latter include the Chukchee who engage in the herding (Hd) of domestic reindeer and the Pawnee, Dhegiha and Mandan who practice horticulture (Ht), growing corn, beans and squash. The available data did not permit reconstruction of the relative frequency of foods derived from the various subsistence activities; however, data was sufficient to permit the ranking of these activities relative to one another as undertaken by Lee (1968). Hunting is the foremost activity in 26 (68%), fishing in 7 (19%) and gathering in 5 (13%) societies. Hunting is the preeminent activity in high latitudes in the northern and southern hemispheres, where seasonal variations in temperature preclude reliance on plant foods. Conversely in low latitude tropical and subtropical climates where low temperatures do not impede plant growth, the gathering of plant foods is important. Similarly, domestic plants are found in regions with growing seasons of sufficient length. Shellfish collecting, subsumed under gathering, is important in mid-latitude coastal regions. Butzer's (1971) evaluation of the animal biomass of various climatic zones indicates that optimal conditions prevail in grassy, tropical deciduous woodlands and savannas and the mid-latitude grasslands (Bs) of the present, and the lower latitude Pleistocene tundras of the past. Areas of intermediate biomass are the temperate and subtropical deciduous and mixed woodlands (Cf,Cs) and the high latitude tundras (E). Tropical rainforest (Af), the boreal forest (Df) and semideserts (BS) and deserts (BW) contain marginal animal biomass. Many of the groups sampled have domestic dogs but these are generally not important sources of food, though as indicated in Table 5 they may be consumed as famine food should the need arise. The consumption of dog flesh is, however, not consistent across cultures, even during extreme privation.

3.5.3 Resource Stressors and Coping Strategies

The available information indicates that the variety of environmental stressors is somewhat greater than the variety of social stressors (58.3% versus 41.7%) (Table 7). However, environmental stressors are mentioned far more frequently than social stressors (77.1% versus 22.9%) (Tables 4,5). Among the more common environmental stressors are patchy resources, low diversity of resources, migratory game, adverse weather conditions, unpredictable resources, disease, wildlife cycles, environmental disasters such as volcanic eruption, and seasonal fluctuations. Stressors of social origin derive from the activities of humans and include hunting failure, waste, overhunting, lack of planning, shortage of stored food, preoccupation with ritual, and raiding.

The greatest variety of environmental stressors, ten, is present among the Ojibwa who occupy the Dfb environmental zone and the Ainu (Dfb), Chukchee (Dfc), Kamchadal (Dfc), Yahgan (Cfb), Pomo (Csb), Gros Ventre (Bsk), Arapaho (Bsk), Comanche (Bsk), Andaman Islanders (Af) and Semang (Af) are represented by the minimum of 1. The marginal environmental zones (E, Dfb, Dfc and BSh) clearly have a greater variety of environmental stressors than do the benevolent zones (Cfb, Cfc, Csa, Csb) (Tables 5, 7). While the most commonly mentioned environmental stressors, seasonality, unpredictability, patchiness, low diversity, animal movements and low density are structural features of particular environments, deteriorating weather conditions, longer than average winters, ice conditions, drought, vulcanism and earthquakes also had an impact. It would appear that such unpredictable variation is more common in marginal environments than benevolent ones.

While stressors with a social origin are mentioned only one-third as frequently as environmental stressors, it must be acknowledged that there is a paucity of social data among the references used. This shortage contrasts with observations by contemporary famine experts who have suggested that sociopolitical factors are paramount causes of food shortages and famine (Landurie 1971, Robson 1981, Arnold 1988). This writer suggests that as societies become more complex, social factors replace environmental ones as key causes of resource stress. Social complexity is tied to methods of acquiring and producing food. Hunting and gathering subsistence systems are very dependent on the vagaries of the natural environment. As subsistence systems embrace domesticated plants and animals and increasingly complex technology or where they occupy environmental zones with abundant, predictable resources, environmental factors become less pervasive as resource stressors, though they never disappear. Social complexity is synonymous with sedentism, population increase, increasingly rigid territorial concepts, and ever expanding mechanisms for exchanging information. The opportunity for social conflict increases as well and eventually outstrips natural environmental factors as the cause of resource stress. Following this line of reasoning, it would be reasonable to expect fewer social stressors in marginal habitats than in benevolent environments where indicators of social complexity are more common.

An evaluation of the frequency of shortages (Table 4) indicates that they were frequent in 30.8% of the groups, common in 12.8%, and seasonal in 10.3%. Shortages are infrequent in 15.4% and rare in 2.5% of groups. No information was available for 20.5% of the social groups. Of interest are those groups where it has been reported that shortages were common or frequent in the past but have decreased in severity since the arrival of Europeans (7.7%). Information in Tables 4 and 6 supports Suttles (1968) and others who have maintained that shortages do occur in benevolent environments. The benevolent environments rank 4th, 5th and 7th (out of 8) in terms of the mean number of stressors (Table 6). The impact is, however, reduced among the Ainu, Bella Coola and Nootka who rely on very productive and reasonably predictable resources such as anadromous fish.

Coping strategies in the economic domain (65.1%) are mentioned more frequently than those in the social (18.6%), political (7.8%) and ideological (8.5%) domains (Tables 4, 5 and 9). Of 72 different coping strategies, 30 occur in the economic domain, 24 in the social, 10 in the ideological and 8 in the political (Table 11). A maximum of 19 and a minimum of 1 coping strategie(s) are recorded for the 38 individual sociocultural groups. As with the resource stressors, groups resident in marginal environments have more coping strategies than do those in benevolent habitats. For example, of 12 ranked positions according to the mean number of coping strategies, groups resident in benevolent environments (Cfb, Cfc, Csa, Csb) occupy the 4th, 8th, 10th and 11th positions (Table 10) while groups in marginal environments occupy the 1st, 2nd, 3rd, 5th, 6th, 7th, 9th and 12th positions. Data from the 38 societies reinforces the information presented in Table 2 where it was noted that coping strategies of groups resident in marginal environments are qualitatively different from those of groups resident in benevolent environments (Tables 4, 11).

The ingenuity of cultural systems is nowhere more evident than in the selection of alternative or famine foods. As indicated in Tables 4 and 8, the use of famine foods is a short-term, recursive but reversible, coping strategy employed by the majority of societies sampled. Famine foods may include dietary items nominally or even strictly avoided. Many Plains Indians do not consider fish consumable, until famine strikes. Prescriptions against the consumption of human flesh are nearly universal, yet necrophagy and anthropophagy are responses to acute hunger. The existence of a category of consumables, considered eatable only under conditions of extreme shortage, testifies to the flexibility of human adaptive responses and in some respects may be viewed as a precautionary measure. That the tanned hides of animals consumed for their flesh may serve as clothing and shelter for hunter-gatherers is assumed, that these same hides may be roasted or boiled for human consumption is novel. Turning to alternate food sources during shortages of preferred foods undoubtedly broadened the dietary regime of humankind. Alternate foods might even become favorites. For instance, Le Clerq (1910:122) suggested that the use of sap from the maple tree, first recorded by Father Le Jeune in the Jesuit Relations of 1634, may have been a response to famine.

It is worthwhile noting that hunter-gatherers who are dependent on K-selected resources, that is, large bodied, long-lived, slow maturing species that produce few offspring at a time, often switch to r-selected resources when their preferred game is in short supply. The latter are small bodied, short-lived, have short maturation periods and many offspring. As for example, the Plains Indian reliance on rabbits in the absence of bison or the Nootka use of mussels when sea mammals are rare. R-selected species in general are more labor intensive or difficult to procure per calorie without specialized technology. In the absence of this technology, an increase in costs and a decrease in benefits occurs. Hayden (1981a) has suggested that the transition from k-selected to r-selected resources may lead to technological innovations that decrease the costs and increase benefits, leading to significant culture change such as that which occurred during the Upper Paleolithic-Mesolithic transition. Similarly, a number of researchers have linked resource stress to changes in subsistence systems that may ultimately have led to the domestication of plants and animals (Binford 1968, Flannery 1969, Cohen 1977, Redding 1988).

One of the assumptions underlying this research was the notion that tremendous variability existed not only in resource stressors, but also, in coping mechanisms. This is clearly demonstrated in Tables 7 and 11. And, one coping strategy where this is evident is that of attitude. As used here, attitude refers to the feeling or mental position with regard to some phenomenon. Many ethnographers have commented upon the attitude of individuals within particular sociocultural groups with respect to food shortages and famine. In speaking of the Ona, Gusinde (1931:301) says, "The Selk'nam practice continuous self-control, in order not to be regarded as 'gluttons' by others and to keep a thin body...." The Arunta, "... have to do quite a lot of buckling in, and for days together exercise the graces of patience and perserverance" (Chewings 1936:32-33). Burnet (1824-25:137) in describing the Comanche says,

> In times of scarcity the men hold it a matter of conscience and pride to sustain the severest portion of the general privations and to bear them without murmuring. And indeed they manifest a capacity for enduring abstinence, that would almost lead one to imagine nature had furnished their organic system with a peculiar adaptation to the various contingencies of their excistence.

All 3 ethnographers contrasted the coping strategies of their hunting and gathering subjects with industrial society to which they, themselves belonged. Whether there is variation amongst hunting and gathering societies in this regard is of interest. The data gathered for this study suggest that this is the case. An indepth comparison by R. Nelson (1973) of the adaptive skills of Kutchin and Eskimo cultures in terms of knowledge, practical resourcefulness, foresight, cooperation, industry, physical skills, supportive values and technical sophistication revealed that indeed there are significant differences. While he acknowledged the "greater adaptive challenge" of the Eskimo environment, R. Nelson (1973:319) went on to say,"In my opinion Eskimo culture has generated its own internal drive beyond a mere survival level. In short, Eskimos have made adaptation a cultural 'focus of interest', for reasons that defy explanation... Although culture responds creatively to its environmental surroundings, it is also powerfully directed by its own internal principles. . . ."

Another coping strategy that requires an explanation is gorging which is found in 8 of 12 environmental zones. Gorging is the consumption of large quantities of food to the point of satiation, that is far beyond the about amount needed to satisfy hunger. The conditions leading to this practice are typically those of abundance alternating with scarcity. Of the Comanche, Burnet (1824-25:137) notes, "When meat is abundant, they gorge and gormandize most voraciously without experiencing any subsequent inconveniencing and when it is scarce then endure hunger with singular patience . . . ."

Food taboos are relevant to the present discussion. Food avoidance norms are typical of 21 (55%) of the societies sampled. Carnivores such as wolves, lynx, dogs, coyotes, mountain lions, and wildcats plus song birds and fish are among the most frequently avoided items. It is tempting to link tabooed food sources to a conservation ethic designed to preserve select potential food sources for use during shortages of preferred foods; however, the data do not support this conclusion. In fact, those items that are taboo under normal circumstances are not consistently exploited during shortages, though in some cases they might be used. For example, the Blackfoot diligently avoided fish but would consume it under conditions of extreme privation. In conclusion it would appear that food taboos have multiple origins including religious belief; unacceptable texture, taste or smell; too little return for effort expended; unfamiliarity; and inadequate acquisition and storage facilities.

The range, mean and rank of resource stressors and coping strategies are compared in Table 12. It is shown that as the mean number of resource stressors increases, so does the mean number of coping strategies, for all 12 environmental zones. In Figure 4 the mean number of coping strategies is linked to climatic zone and it is shown that this number increases with latatitude in the northern hemisphere.

3.6 The Model

Models are part of the scientific approach and hypothesis testing advocated by processual archaeologists (Binford 1972; Clarke 1979; Bettinger 1980; Moore 1981; Winterhalder 1981; Greiser 1985). In a seminal work on the use of models in archaeology, Clarke (1979) viewed them as a vital element in archaeological theory and hypothesis building as well as in explanation, experiment, and classification. He stated "Models are pieces of machinery that relate observations to theoretical ideas, they may be used for many different purposes and they vary widely in the form of machinery they employ, the class of observations they focus upon and the manner in which they relate the observations to the theory or hypothesis" (Clarke 1979:21). He further noted "models serve as heuristic devices for manipulating observations and hypotheses; they may also act as visualizing devices, comparative devices, organizational devices, explanatory devices or devices for the construction and development of theory" (Clarke 1979:22 from Harvey 1969:141).

The model developed herein is primarily an organizational and explanatory model, and secondarily a predictive model. It uses ethnographic, ethnohistoric, and ecological information to organize, explain, and ultimately predict the response of hunter-gatherers to resource stress. Its status as an organizational and explanatory device rests on its descriptive and classificatory nature. The generation of this model began with an ethnographic survey of hunter-gatherer adaptative strategies whereby those deemed responses to resource fluctuations were assigned to four realms, the economic, social, political, and ideological. These realms represent the major institutions of human society. Multiple strategies in these realms were identified and their utility as coping strategies evaluated. For example, coping strategies identified for the economic domain included: diversification, cooperative subsistence strategies, information exchange, mobilization of subsistence groups, food storage, trade, reciprocity, redistribution, famine foods, increased food quest time, increased processing time and the conservation of wild resources. Coping strategies in the other domains were similarly identified and described. Information deriving from a cross-cultural sample of 38 societies provided numerous examples of these strategies. The above model is classificatory through the recognition of four realms in which adaptive responses occur and in the identification of a variety of strategies in each realm, and descriptive in the discussion of these strategies and analysis of examples from a variety of societies.

While descriptive and explanatory models are useful, contemporary archaeologists have emphasized the superiority of predictive models, referring explicity to the ability of those models to generate testable hypotheses (Binford 1972; Moore 1981; Winterhalder 1981; Bettinger 1982). The testing of hypotheses preceeds the formulation of empirical generalizations or universal statements describing human behavior. The predictive potential of the model developed herein exists on two levels: first as a device to describe and predict the responses of ethnographic hunter-gatherers to resource stress and second, as a device to predict the empirical indicators of these responses in the archaeological record. It is in the latter mode that the model functions as middle range research (Leone and Potter 1988; Thomas 1989). In the following discussion, the descriptive/explanatory and predictive aspects of the model as they relate to ethnographic and ethnohistorical peoples are outlined. The archaeological implications await discussion in Chapter 6.

This model clearly shows that what people do in the face of resource stress depends on multiple ecological, social and ideological factors.

First, ethnographic data clearly indicate that environmental zones vary in the frequency and intensity of shortages; therefore, it is reasonable to expect that there should be a wider variety of, and more coping strategies in marginal habitats than in benevolent environments. Furthermore, there should be a wider variety of, and more responses among generalized hunter-gatherers who normally occupy marginal habitats, and correspondingly fewer and less variable responses among complex hunter-gatherers who normally reside in benevolent environments.

Second, as resource stress escalates from food deprivation, to food poverty, to food shortages, these shortages become more than a problem of having enough to eat. There is "simultaneously a multiple crisis of subsistence, survival and order; the more protracted and intense the crisis the more the normal order of things collapses and gives way to all that is abnormal" (Arnold 1988:19). Evidence indicates that economic coping strategies are a first-line response to the onset of food shortages; that the number of coping strategies in the economic sphere increases as the temporal span of shortages grows; and that responses in the social and political realms are added as the temporal span of shortages expands. It therefore seems reasonable to expect that the greater the number of coping strategies in the individual domains and in all domains combined, the more frequent periods of resource stress. Furthermore, it is also reasonable to expect more strategies in the social, political and ideological domains in marginal environments and in generalized hunting and gathering societies, than in benevolent environments and among complex hunter-gatherers.

Third, coping strategies move through a hierarchy of responses; some are reversible, some are semi-reversible, and others are not reversible (Shipton 1990). Reversible measures are usually used early on and include intensifying production or trade; substituting bulkier foods or famine foods; movement to seek productive resources outside one's accustomed territory; and retrenchment of social activity. Semi-reversible measures include migration to new areas; slaughtering domestic animals; raiding food supplies of neighbors; and trading primitive valuables for foodstuffs. Infanticide, senilicide, and selling children into slavery are irreversible responses. At all stages of resource stress, individuals and groups must evaluate the mechanisms they have chosen against the pressures being experienced and within the framework of their cultural adaptation. It follows that irreversible responses to resource stress will be more frequent among societies residing in the most marginal of environments compared to those living in benevolent environments. Similarly, semi-reversible responses should be more frequent in societies in marginal environments versus those in benevolent environments. Since reversible coping strategies are the first line of defense and semi-reversible and ultimately, irreversible coping strategies are adopted as stress escalates, it is suggested that the relative number of each category of response is a measure of the relative impact of the resource stress.

Fourth, the nature of the stressed society will affect the specific coping strategies that are ultimately marshalled (Table 2). Nomadic or generalized hunting and gathering societies resort to different strategies than do sedentary or complex ones (O'Shea 1981; Hayden 1992). These differences are linked to multiple factors: the number of people, the complexity of social and political institutions, and the settlement pattern. The communities of generalized hunter-gatherers are smaller, more mobile, and less populous than those of complex hunter-gatherers. Hayden (1992) has shown that while sharing, alliances and mobility are responses of generalized hunter-gatherers to food shortages, storage, trading and raiding are strategies enacted by complex hunter-gatherers. This can be carried further. Generalized hunter-gatherers diversify their resource procurement activities, while complex hunter-gatherers have specialized. Furthermore, group mobility is a favored economic coping strategy for generalized hunter-gatherers in marginal environments, while sedentary complex hunter-gatherers will elect to mobilize their task groups. For generalized hunter-gatherers, it is reasonable to assume that increased mobility, increased diversity of foods procured, and the expenditure of more time in procuring and processing food are indicators of escalating resource stress. Similarly, an increase in the frequency with which task groups are mobilized, expansion of trade, and increased food storage are indicative of multiplying resource stress among complex hunter-gatherers. For both groups, a decrease in group size and population density coupled with increased foraging area are signs of escalating or significant resource stress.

Fifth, the temporality of shortages is an important factor influencing coping strategies. Long-term shortages are quite distinct from seasonal and interannual variability. Much short-term change is seasonal and is thus more or less predictable in terms of range, frequency, character and amplitude. Among generalized hunter-gatherers, intentional actions taken to mitigate short-term stress include diversifying the subsistence base, cooperative activities, group mobility, limited storage, and reciprocity while complex hunter-gatherers use mobile task groups, trade, and extensive storage. Laughlin and Brady (1978) suggest that if a society has been located in an environment marked by adaptively significant recursive change for a long period of time, one can expect that the population's anticipation of such change to be manifest in the flexibility of constraints placed on behavior and sociocultural alignments. According to Sahlins (1967) the segmentary lineage political organization of tribes, remarkable for its flexible structure, is in part a means of ameliorating stress created by repetitive, long-term use of restricted resources. Ongoing long-term shortages provoke unique responses. The destruction of subsistence base provokes major cultural change. Out-migration by significant numbers of people, a major change in subsistence, and dramatic population decline are symptomatic. It is reasonable to assume that if changes in these three factors occur, whether in generalized or complex hunting and gathering societies, they signal acute stress.,

Sixth, most responses to actual or potential food shortages are in fact extensions of practices conducted in some measure during a normal year (Watts 1988). In other words, they involve the intensification of existing patterns. It is logical that generalized hunter-gatherers will become more mobile; for example, where four moves is typical in a year when food is plentiful, eight moves becomes the norm when food is scarce. Sedentary complex hunter-gatherers may find the costs of moving settlements too high so they will intensify their specialized resource procurement activities, increase the number of task groups, and improve food storage.

Seventh, according to the tenets of optimal foraging theory consumers make choices concerning diet which will emphasize benefits and minimize costs (Winterhalder 1981). Optimal foraging models address a number of issues including diet choice and group size. As regards diet breadth, optimal foraging theory suggests that consumers rank resources based on search and handling times and that they will cease adding resources when a decrease in search time equals an increase in handling time. Under conditions of resource stress it is often the higher ranked resources which are affected; therefore, according to optimal foraging principles consumers will only add lower ranked resources when high ranked ones decline in availability. It is logical to expect that an increase in diet breadth is a response to resource stress and that the expansion of food items among both generalized and complex hunter-gatherers signals a disruption of preferred food sources. The group size model suggests that when resources are mobile, clumped and predictable, there will be large aggregates of consumers; when resources are mobile, clumped and unpredictable, there will be increased information sharing among consumer groups; and if resources are uniform and predictable, consumer groups will disperse. The group size model is useful in this study from several perspectives. When resource stress affects the clumping of resources so that they become increasingly dispersed and increasingly unpredictable, it is reasonable to expect that human consumers will respond by reducing group size, increasing search area, increasing task group mobility, and improving information sharing.

Eighth, as the social fabric in the economic, social, political and ideological domain changes, so do the coping strategies. The move towards modernization, that has impacted all contemporary hunting and gathering subsistence systems, has led to the disappearance of traditional rules and attitudes in relation to food production, distribution and consumption, and to the loosening of social ties that allowed cooperation at various levels. The net effect has been dramatic changes in mechanisms for coping with uncertainty in food supply. Individual endeavors are replacing collective action. In addition, external economic and political developments are having a significant impact on local conditions. As Thomas (1982 from de Garine and Harrison 1988: 473) noted, "External political, economic forces are increasingly introducing a set of factors which compete with local responses to seasonality, making them less effective." In relating these observations to the model, it seems likely that generalized and complex hunter-gatherers may react differently to modernization. With their simple social and political structures, it seems reasonable to expect that generalized hunting and gathering societies will be more profoundly impacted by contacts than will complex hunter-gatherers. For example, the reciprocal exchange of generalized hunter-gatherers proves maladaptive, while the redistribution and trade of complex hunter-gatherers are compatible with modern sociopolitical systems.

Bearing in mind that coping strategies likely begin in the economic sphere; that they may be ranked as reversible, semi-reversible, or irreversible; that they vary according to the complexity of socio-political organization; that they frequently involve the intensification of existing patterns; and that they likely follow optimal foraging principles, one is led to ask whether coping strategies can be rank-ordered relative to the onset of resource stress. Based on the aforementioned conditions, the answer is a cautious "yes." Cautious because the sequence of responses becomes increasingly speculative as the number of variables that must be considered increases and as the length of the stressed period grows. The following discussion proposes a tentative sequence of responses; its does not purport to incorporate all responses; and it attempts to show the stages at which the strategies of generalized versus complex hunter-gatherers likely differ. Since resourse stress interfaces most directly with activities in the economic domain, the majority of early responses are likely to be in that domain. For both generalized and complex hunting and gathering societies, it is suggested that the first group of responses will include: the consumption of less food, the practice of eating bulky foods, the implementation of more conservative methods of food preparation, and the expenditure of more time in food processing. These four practices are related in that they can begin immediately upon the awareness that the food supply is not assured; they apply to foods already in one's possession; and they operate within the already existing dietary regime; furthermore, it is suggested that they represent the earliest responses of both generalized and complex hunter-gatherers. Lastly, they are responses that can begin with individuals. Accompanying these early economic strategies is the retrenchment of social activity, although this likely extends only to activities involving familial groups, not lineages or communities. The second round of responses will likely include diversification of foods, increased mobility, cooperative strategies, increased time spent in the food quest, and more resource monitoring and information sharing. These responses involve groups of people and significant changes to extant provisioning strategies. It is at this stage of response that one can expect significant differences between generalized and complex hunter-gatherers to emerge. Whereas the former increase the mobility of entire settlements, the later will see an increase in the mobility of specific task groups. It is at this second level as well, that one will see the expansion of social and perhaps political responses. Generalized hunter-gatherers will form alliances and engage in reciprocal access, while complex hunter-gatherers will expand trade and engage in raiding. Other strategies such as marital arrangements, trading partnerships, segmentary lineages, reciprocal access and reciprocal exchange and intertribal aggregation for ritual purposes, complement and expand on these. A third level of responses includes a reduction in group size and decline in population density. The costs of these strategies will be far greater for complex hunter-gatherers and it is likely that they will explore other strategies before embarking on these. In all likelihood they may intensify their subsistence activities and notions of territoriality may similarly escalate. A final level of responses may well see the occupants of a region abandon the stressed area and migrate elsewhere. This response is, of course, tied to the presence or absence of other social groups and is not merely a decision that can be reached by a local group. As with the third level of responses, the costs of group fissioning are far higher for sedentary and complex hunter-gatherers, since this strategy is a pattern already typical of generalized hunter-gatherers during normal years. At some point on the continuum of escalating stress, people will become so desperate that they may resort to irreversible measures such as infanticide and senilicide and perhaps even, anthropophagy and necrophagy.

As is evident from the preceeding discussion the model developed herein is in the first instance a descriptive/explanatory device and in the second instance it has predictive capabilities. The model is a contruct for the study of resource stress and it also produced a number of hypotheses. In science the confirmation of hypotheses leads to the formulation of empirical generalizations regarding human behavior under specific circumstances. While there is no doubt that these generalizations are the end-product of the scientific method and they contribute to the understanding of human adaptation, one must also heed Dirks' caution that human social systems exposed to the same stressor do not always react in the same way (Dirks 1980).

In the following two chapters, the above model is examined in terms of its applicability to the ethnographic, historic and prehistoric cultures which occupied the northern plains. This process begins in Chapter 4 with an examination of the resource structure and resource stressors of that region.

Chapter 4

THE NORTHERN PLAINS: RESOURCE STRUCTURE AND RESOURCE STRESSORS

4.1 Introduction

> Human beings are components, beneficiaries, and modifiers of the biosphere, the film of life that coats this planet. Apart from humans and their domesticates, the biosphere is entirely wild. Accordingly, human economies, regardless of their stage of development, are utterly dependent on wildlife (Prescott-Allen and Prescott-Allen 1986:6).

> The prairies . . . have a climate of extremes, a climate . . . which features both 'normal' and 'abnormal' years or seasons with about equal frequency, and a climate which encompasses the pleasures of low humidity, Indian summer, plentiful sunshine and timely rains along with occasional disasters by drought, flood, hail, blizzard and windstorm (Paul 1984:205).

The northern plains is an ecological system occupied by humankind for over 10,000 years. Stretching 800 kilometers north-south and 1600 kilometers east-west, this grassland region is an area of 240,000 square kilometers in southern Alberta, Saskatchewan, Manitoba, and northern Montana and North Dakota. In Chapter 4 the resource structure of the northern plains will be described; resource stressors deriving from environmental factors will be analyzed; and the interrelationship among various environmental elements will be examined.

4.2 The Environment

4.2.1 Perspectives from the Past

The first descriptive comments about the northern plains were linked to evaluations of the agricultural potential of the region by Europeans who found the grassland vegetation, paucity of trees, herds of buffalo, limited precipitation, grasshoppers, winds, temperature extremes and above all the seemingly limitless, unoccupied, open spaces, a dramatic contrast to the profusion of trees, limited wild game, abundant precipitation, mild temperatures and dense settlement of their homelands (Webb 1931). There emerged a generally negative view of the plains environment, that was subsumed by such descriptors as "treeless", "barren", "semi-arid", and "sterile" (Warkentin 1964; Spry 1968). The term "*grassland* " did not appear until the early nineteenth century and did not come into wide currency until the mid-twentieth century (Pyne 1982).

In contrast American ranchers in the 1870s were attracted by the abundant grass, frequent chinooks and generally thin snow cover, the same environmental factors responsible for the profusion of wild herbivores. One can imagine that the aboriginal hunting and gathering peoples saw the herds of plains bison as an unparalleled resource as did the fur traders. To exploit this resource, aboriginals and Europeans alike had to deal with environmental perturbations and resource fluctuations.

The following description of the resource potential, resource stress and organizational responses to the exigencies of the northern plains environment adopts the ecological perspective proposed by Malin (1947), that examines the Plains as a holistic entity where environmental factors and human action are integrated and are seen to extend through time and space. These factors are considered to be in a constant state of flux rather than in a state of equilibrium and the grassland is viewed as an open ecological system in which vegetation continually changes, depending on climate, microorganisms in the soil, and the activity of plants and animals (Winterhalder 1980a).

4.2.2 Physical Features and Climate

Hydrography has always been important in the northern plains region because it is delimited by east-west trending river systems originating in the meltwaters of the Rocky Mountains (Figure 1). The North Saskatchewan River whose major tributaries are the Red Deer, Bow, Oldman and South Saskatchewan forms the northern boundary. To the south the Teton, Marias, Milk, Frenchman and ultimately the Yellowstone enter the Missouri River system in northern Montana. The Qu'Appelle and Assiniboine rise in Saskatchewan and drain into Lake Winnipeg.

The Europeans accessed the northern plains from the east via the Saskatchewan and from the south up the Missouri river systems. The mode of travel was boat during spring, summer and fall and dog sled during the winter. Prehistoric travel almost certainly followed similar routes.

Trees and shrubs providing fuel, horse fodder, berries, building materials and game cover were generally restricted to watercourses. During spring flooding thousands of game animals perished and their carcasses were washed downstream to waiting aboriginal hunters.

While year-round running water is currently scarce, interior drainage into sloughs captures some water. However, evaporation renders many of these water bodies alkaline. The distribution of prehistoric campsites and killsites, located many miles from current water bodies, suggests a different surface water regime for some periods in the past. For example, Buchner (1980) has suggested that the drought conditions of the Atlantic Climatic Episode (ca. 5500 to 3000 B.C.) restricted occupation to grassland near forest margins, areas of higher elevation and areas with perennial and assured supplies of water.

Most of the northern plains was impacted by the Laurentide continental glacier during the Wisconsin glaciation, that ended by 11,000 to 12,000 years ago. Subsequently wind and water erosion contributed to **topographic diversity** which is characterized by flat to gently rolling plains in parts of the southern Prairie Provinces and northern United States; deeply cut rugged valleys along parts of the Red Deer, South Saskatchewan, Milk and Missouri Rivers; hummocky disintegration moraine and extensive sandhills in southeastern Alberta and southwestern Saskatchewan; badlands along the Red Deer River; and, mountain range isolates such as the Cypress Hills, Sweetgrass Hills, Touchwood Hills, Bear Paw Mountains, and Little Rocky Mountains (Gilbert 1980). Land use patterns by prehistoric and early historic occupants have been linked to these geographic features, as for example on the Suffield Military Reserve where site density is positively correlated to increasing relief (Brumley and Milne Brumley 1977). The movement and size of grass fires also is dictated by topographic circumstances (Sauer 1950; Smoliak and Peters 1952; Daubenmire 1968).

Considerable local variation in seven soil forming factors, namely climate, organisms, parent material, relief, drainage, time and man (Robertson 1984) contributes to a diversity of chernozemic **soils**. The nomadic hunters and gatherers did not manipulate the soil to any extent, though their horticultural counterparts in the Middle Missouri region planted their crops in the rich, easily cultivated alluvial soils of the river floodplain.

The **climate** of the entire Great Plains is governed principally by precipitation regimes and secondarily by temperature, evaporation and wind (Coupland 1958). The northern plains is characterized by low precipitation, the relative effectiveness of which is increased by low temperatures and the short growing season and is further reduced by the high drying power of the wind (Coupland 1961). The area lies in the **Bsk** zone according to the Köppen-Geiger System of Climatic Classification (Strahler and Strahler 1989); the **Bs** indicates a dry climate and the **k** refers to a mean annual temperature under 18C.

In the northern plains, mean annual **precipitation** ranges from 31 cm. south of the Cypress Hills to 46 cm. in the aspen parkland (Coupland 1961). About half of this falls from April to July, one-quarter from August to October, and the remainder as a blanket of snow 75 to 100 cm. thick, that forms a continuous cover for 3 to 4 months (Coupland 1961). The relative variability of June-August rainfall is marked in the northern plains and failure of these summer rains is associated with drought (Borchert 1950). Precipitation is the single most important determinant of grassland vegetation and temporal and spatial fluctuations in this realm are the single most important environmental stressor in this region (Waines 1938; Quaife 1972; Chakravarti 1976; McNaughton et al 1982; Hildebrand and Scott 1987).

Mean annual **temperature** ranges between 6 degrees Celsius and 0 degrees Celsius (Coupland 1961); however, temperature extremes of 50 degrees Celsius in July and -46 degrees Celsius in January and February (Webb et al 1967) provide a clearer picture of temperature as stressor. Chinook winds ameliorate winter extremes and may cause temperatures to rise up to forty degress in less than three hours (Ives 1950). The vegetative period begins before April 15 and lasts for an average of 190 days in southeastern Alberta and northern Montana but only 170 days in the Parkland (Coupland 1961). Environmental stressors linked to the temperature regime include unreasonable cold in winter, excessive heat in summer, short growing seasons, early frosts, the evaporation of moisture from vegetation, soils and water bodies and massive short-term temperature shifts.

Prevailing westerly **winds** are linked to the rain shadow location of the Northwestern Plains, have their greatest impact in the regions close to the Rocky Mountains and decline as one moves eastward and northward. These winds are linked to subnormal precipitation; to higher temperatures; and to increased frequency of cyclones east of the Rockies (Borchert 1950). Average monthly wind velocity ranges from 19 to 26 kilometers per hour over the southern two-thirds of the region, usually reaching a maximum in the spring (Coupland 1961). Maximum daily speeds from 50 to 65 kilometers per hour in the open grasslands and infrequent tornados where wind speeds exceed 150 to 450 kilometers per hour are typical! Winter winds cause uneven distribution of snow and impact vegetation. Chinook winds expose forage; however if melt is incomplete herbivores may find it impossible to penetrate the ice and crusted snow.

In summary the regional distinctiveness of the northern plains grassland lies primarily in its precipitation regime: 1) low snowfall and low rainfall in winter; 2) greater risk of large rainfall deficit in summer than in bordering regions of forests; 3) markedly less rainfall in the xeric or shortgrass plains than in the tall grass prairie to the east; 4) fewer days with precipitation, less cloud, lower relative humidity in summer than areas to the west, north and east; and, 5) large positive departures from average temperature and by frequent winds during dry summers (Borchert 1950). A secondary feature of the environment is the variability of climatic factors over relatively short distances. Taken together, environmental features shape the resource structure.

4.2.3 Resource Structure

The cross-cultural analysis of resource stressors and coping strategies in Chapter 3 demonstrated that environmental stressors are largely linked to the resource structure of a particular environmental zone. As used in the present context, **resource structure** refers to the organizational relationships amongst those elements of the natural environment that are deemed valuable and are thus extracted by humankind. It follows that the greatest resource of the northern plains is the grassland, that supports herbivores upon which hunting and gathering economies were dependent. As Soper (1964:114) said, "all flesh is grass."

4.2.3.1 Vegetation

Natural grassland ecosystems are organized by three interactive processess: carbon flow, nitrogen flow and rainfall-evapotranspiration in the presence of stochastic temperatures, precipitation and winds (McNaughton et al 1982). There is a direct relationship between rainfall and grassland productivity. The Great Plains grassland coevolved with a variety of large herbivores whose semi-nomadic behavior was a direct response to the shifting availability of forage; fire also acted as an alternative nutrient recycling agent.

From north to south there are 4 arcuate vegetation belts in the northern plains according to the relative dominance of various species of grasses and sedges: (1) Aspen Parkland, (2) Fescue Prairie, and the Mixed Prairie made up of (3) Mesic Mixed Prairie and (4) Xeric Mixed Prairie (Coupland 1961; Rowe and Coupland 1984). In addition, patches of aspen parkland and fescue prairie are scattered throughout the northern plains where soils and microclimates favour their presence.

The **Aspen Parkland** is the ecotone between the boreal forest to the north and the grasslands to the south (Rowe and Coupland 1984). It is found along the western and northern boundary of the northern plains as well as atop the Cypress Hills, Bear Paw Mountains and Little Rocky Mountains. Scattered groves of aspen parkland merge into continuous forest as one moves north. Associated with the groves of aspen on well-drained sites are grasses and broadleaf herbs, tolerant of dappled shade, and a profusion of shrubs yielding edible fruit (Rowe and Coupland 1984). The Parkland was an integral location in the seasonal round of subsistence activities; historic accounts clearly indicate that hunter-gatherers followed bison that had moved into the Parkland in winter seeking forage and escape from the cold winds of the open plains (Roe 1972; Telfer and Scotter 1975). Trees provided fuel and building materials and fruit-bearing bushes yielded an important ingredient for pemmican and for the diet as a whole.

Fescue Prairie is the grassland community associated with the Aspen Parkland along the northern boundary of the Mixed Prairie, from central Saskatchewan westward to the foothills of the Rocky Mountains in Alberta and Montana (Coupland and Brayshaw 1953; Coupland 1961), as well as in the Cypress Hills and the Milk River Ridge. Coupland (1961) and Rowe and Coupland (1984) have suggested that more favorable moisture conditions produces grassland with a greater richness and abundance of grasses and forbs than that of the Mixed Prairie.,

The **Mixed Prairie** encompasses the southern part of the northern plains region. **Xeric Mixed Prairie** is found south of the Cypress Hills in Alberta and Saskatchewan and in northern Montana. **Mesic Mixed Prairie** lies north of the Cypress Hills and between the Fescue and Xeric Mixed Prairie.

Growing seasons of grasses vary from zone to zone and are related to early spring temperatures and available soil moisture during the growing season (Clarke et al 1943). Generally Xeric and Mesic Mixed Prairie vegetation commences growth during the first and second weeks of April, respectively, and the latter coeval with exposed aspen grove grassland; sheltered grassland begins growth in late April (Morgan 1979). Grass development in the aspen parkland occurs over a shorter period of time due to late spring onset; however, higher spring precipitation values do ameliorate this late start. Differences in the growth cycles of the Mixed Prairie and Fescue Prairie grasses mean that the nutritive value varies during the growing season (Clark et al 1943; Clark and Tisdale 1945).

Grassland communities show marked variations in forage yields. The carrying capacity of Fescue Prairie is far greater than that of the Xeric or Mesic Mixed Prairie (Clark et al 1942). Thus the carrying capacity of the study area increases to the west, in the foothills of the Rocky Mountains, in central Alberta and in southeastern Saskatchewan and southwestern Manitoba where Fescue Prairie prevails. Or as Gordon (1979) noted, the outer "sheltered" areas have higher forage capacities and the inner "unprotected" open plains, lower forage capacities. It has been suggested by Morgan (1979) and Gordon (1979) that developmental schedules, geographical distributions and forage yields of grasses affected the movement and density of bison in any particular area. In addition, variations in moisture and temperature and grass fires are environmental stressors, that can have a dramatic impact on grass and thus herbivores.

While grasslands provided forage for the large and small mammals consumed by hunter-gatherers, they also produced a variety of plants that aboriginal hunter-gatherers used in ceremonial and religious rites; for the treatment of sickness; in horse medicine; in crafts and folklore; and for consumption (Hellson and Gadd 1974). Among the most important plant foods consumed by Plains Indians and later Europeans were berries and the prairie turnip, *Psoralea esculenta* (Reid 1977). Berries were an ingredient in "fine" pemmican produced for the fur trade (Wright 1981). Over 20 varieties of berries are endemic to the Northwestern Plains, including saskatoons, chokecherries, wild raspberries, wild strawberries, black currants, red willow cherries, gooseberries, pin cherries, high bush cranberries, mooseberries, ground cedar berries, buffalo willow berries, blueberries, low bush cranberries, bear berries, rose berries, big thorn berries, dogfoot berries, dew berries, wolf berries, mountain ash berries and cactus fruit (Wright 1981).

4.2.3.2 Fauna

The distribution of wildlife is basically controlled by climate through its action on food resources and by prairie fires, disease and predators. And fauna in turn affects vegetation through consumption, fertilization and trampling. At present four life zones occur within or adjacent to the study area (Soper 1964). The Transition Parkland is an arcuate area straddling the North Saskatchewan River and extending southward along the eastern flanks of the Rocky Mountains and also occupies the drainages of the Red Deer, Bow, Oldman and South Saskatchewan River. The Transition Life Zone is more humid than the more southerly Upper Sonoran area, and campestrian species predominate. In extreme southeastern Alberta, southwestern Saskatchewan and extending to the Missouri River of northern Montana, one finds the arid Upper Sonoran Life Zone. Portions of the Cypress Hills and Rocky Mountain foothills are home to species of the Canadian Life Zone. This biologically rich area holds most of the major fur-bearers and many big-game animals. Lastly, resources of the Arctic-Alpine Life Zone also were exploited along the western periphery.

The Northwestern Plains was, however, a far different place in the late 1700s and 1800s as noted by Arthur (1975:11),

> It is doubtful that anyone today can conjure up the sight, smell, sound, and feel of the Great Plains prior to the coming of the white men. A partial requirement would be to envision an estimated 30 to 60 million bison wandering and feeding over this vast grassland along with four to eight million antelope, and extensive herds of deer, elk, big horn sheep, wolves, cougars, bears, and other wild animals.

Substantial dislocation of populations and species since the arrival of Europeans led to drastic reductions in the number and ranges of prong-horn, deer, elk moose, bighorn sheep and coyote, plus the extinction or near-extinction of the Plains grizzly, Great Plains Wolf, Prairie Kit Fox and Plains bison.

4.2.3.2.1 Ungulates

Seven varieties of herbivorous ungulates including prong-horn antelope, mule and white-tail deer, wapiti, moose, bighorn sheep, mountain goat and bison comprised the prehistoric and early historic period subsistence base.

Prong-horn antelope (*Antilocapra americana*) reside primarily in the Upper Sonoran Life Zone, though small numbers did invade the Transition Prairie Life Zone as well. Residential units range from solitary does about to fawn to large groupings, that prevail in the winter months when the animals join together to move about in favorite feeding grounds.

The diet of prong-horns is complementary to that of bison. While grasses are their main food, they also consume wild flowers, weeds, cacti, sagebrush and greasewood; shrubs and forbs are particularly important winter browse.

Prong-horn antelope were a distant second to bison as a source of meat as noted by Maximilian "The antelope became more and more common in this part of the country, and we saw several today, but the wishes of our hunters were disappointed. The Indians use the skin of these animals for clothing, but they are not very eager in the chase of the antelope except where the buffalo is scarce" (Thwaites 1905a:198). The small size of prong-horns relative to bison made the costs of pursuit and capture too high relative to the quantity of meat obtained (Winterhalder 1981). Furthermore, the meat of prong-horns was very lean in contrast to bison which was marbled with fat and where major deposits of fat were also to be found on the carcass.

Two prehistoric sites in the study area suggest communal prong-horn procurement. The Lost Terrace Site (24CH68), located on the Missouri River in central Montana, is a processing site where the carcasses of a minimum of 20 individual prong-horns and 7 foetal animals were butchered (Davis and Fisher 1988). The Laidlaw Site (DlOu-9), near the confluence of the Bow and Oldman rivers in southern Alberta, is a keyhole-shaped surface stone structure where five fragments of bone provisionally identified as prong-horn, have led Brumley (1984) to speculate that it functioned as a corral to impound prong-horns. The former is an Avonlea Phase site dating to between A.D. 700 and 1000 (Davis and Fisher 1988), while the latter dates to about 1500 B.C. (Brumley 1986).

In the past prong-horns were present in far greater numbers (McDermott 1951; Spry 1968; Hewitt 1970; Harper 1971) Grinnell (1972:277) even suggested that, ". . . that in old times the antelope in their range were probably more abundant than the buffalo. . . but because of their small size and inconspicuous coloring, they did not impress those who saw them as did the black herds of the larger animals." For a number of reasons this writer is inclined to believe this assessment may be exaggerated. First, the daily animal counts of those who visited the northern plains in the late 18th and 19th centuries never approached the numbers recorded for bison, nor do impressionistic assessments suggest a near-equivalent tally. Second, in less than 1% of northern plains archaeological sites, do prong-horns account for a significant proportion of the faunal remains. Third, while their hides were preferred for clothing over those of bison, the demand for clothing was far below that for meat, of any species. Fourth, prong-horn flesh is lean and therefore deficient as an energy source and it also lacks fat required for pemmican and the appealing taste of marbeled meat. Instead, this writer concurs with Davis and Fisher (1988) that hunting of prong-horn was an alternate subsistence strategy, activated by food provisioning problems that were probably most acute in mid to late winter. This position is corroborated by Maximilian (Thwaites 1905a) and Harris (McDermott 1951). It is further suggested that communal prong-horn kills, where large numbers of animals were dispatched, would affect local populations levels in such a way that some years would have to pass before populations would regain their former vigor. For this reason, prong-horn could be used to offset shortages one year, but not in subsequent years.

Perhaps less numerous than prong-horns, but certainly more widespread were **Mule Deer** (*Odocoileus hemionus*) and **White-tailed Deer** (*Odocoileus virginianus*). Preferring forested areas, mule or black-tailed deer, are typically found in the mountains and foothills regions of the Northwestern Plains (Soper 1964). White-tailed or Virginia deer favor the margins of brushy coulees and wooded areas along river systems.

Mule deer tend to band together while white-tail deer may generally be considered solitary, particularly in summer, when the basic social unit is the doe and her fawns. If the snow is deep in winter, loose aggregations of white-tail deer may gather on favorite feeding grounds.

Diet changes with the seasons. In winter deer prefer twigs from evergreens, deciduous saplings and shrubs, among them aspen, willow, red-osier dogwood, sagebrush, bitterbrush, serviceberry and mountain juniper; in spring, grasses; in summer, forbs and grasses; and, in fall, foliage.

Ethnohistorical and archaeological data indicate that deer were hunted by prehistoric and early historic inhabitants of the Northwestern Plains, particularly in the Parkland margin and when bison failed to apear. Captain John Palliser reported on August 14, 1858, "This is now nearly the time, too, when these Indians commence to arrive from the plains in the south-east, for the buffalo in winter approach the edge of the woods, and so also do the Indians, seeking fuel and thickwood animals, in case of the buffalo failing them during the winter" (Spry 1968:266). Grinnell (1972) reported that among the Cheyenne the whole camp of men, women, children and dogs would surround deer and drive them into snowdrifts, however, the hunting of deer was essentially an individual or small group effort during the historic period and may have been in prehistoric times as well since no archaeological sites indicative of the processing of large numbers of animals from a single kill event are known. Further south, Frison (1978) has suggested that a deer trap may have been used in the Absaroka Mountains of northwestern Wyoming as a means of procuring the 50 animals recovered at the Dead Indian Creek site (48PA551).

Wapiti (*Cervus elaphus*), otherwise known as biche, elk, red deer or waskesu, were present in the Parkland, Fescue Prairie and Mixed Prairie of the Northwestern Plains in early historic times. They are found most commonly in alpine pastures, marshy meadow, river flats, open prairies and aspen parkland although infrequently in coniferous forest as well (Banfield 1974). Group size fluctuates seasonally but may approach 100 individuals. Wapiti may move altitudinally seeking grasses and forbs in summer and browse and grass in winter. In the past they intermingled with bison on the open plains.

Wapiti were the main source of meat for fur traders accessing the northern plains via the North Saskatchewan River (Masson 1890; Morton 1929; Johnson 1967; Haig 1991) and they were also used prehistorically. A mound of elk antlers on the Missouri River above the mouth of the Yellowstone has been described by Denig (1930:398) as "covering an acre of ground and in height about 30 feet." Elk bones were found in the corral at Wahkpa Chu'gn (24HL101), a Late Prehistoric Period buffalo pound on the Milk River in northcentral Montana.

Moose (*Alces alces*) ranked behind bison, deer, antelope and elk as a subsistence item. They prefer a solitary lifestyle except when accompanied by young or when a feeding area is large enough to attract and sustain several animals at once (Banfield 1974). Seeking aquatic plants in summer and trees and shrubs in winter, moose prefer aspen-birch parkland where they can also access lakeshores and swamps.

Despite a relatively low population density, moose were of particular importance to Thickwood Indians (Spry 1968) and Europeans occupying parkland posts (Coues 1965; Harper 1971; Hind 1971a).

On the western periphery of the Northwestern Plains and extending into the eastern flanks of the Rocky Mountains, **bighorn sheep** (*Ovis canadensis*) were an important source of food and hides for aboriginal and European residents. Large numbers were reported from Jasper House and Lacs des Arcs. Bighorns also formerly occupied the Alberta-Montana Sweetgrass Hills (Soper 1964) and the badlands and breaks of the

Missouri River valley in central Montana (Banfield 1974; Thomas and Ronnefeldt 1982). Bighorn sheep are predominantly grazers, consuming grasses and sedges, forbs, and browse. Led by a matriach, the ewes, lambs, yearlings and two-year-old rams form bands that stay together throughout the year. Hector on August 29, 1859 from Kootanie Plain reported ". . . a band of several hundred . . ." (Spry 1968:443).

A number of procurement strategies were employed. Some European visitors simply rushed the flocks as they were feeding or moving from one locale to another (The Earl of Southesk 1969), while others used their knowledge of bighorn behavior to assist them in the hunt. They intercepted animals moving across valley floors or visiting salt-licks, walking along established paths or crowded together for protection (Spry 1968).

Amidst rocky outcroppings along the Bow, Wapiti and Athabasca Rivers in the eastern flanks of the Rocky Mountains **mountain goats** (*Oreamnos americanus*) live. Their diet consists of grasses, sedges, rushes, forbs, shrubs, and conifers. Mountain goats occupy the same ranges in summer and winter. During spring and summer singly or in small groups, they may trek to salt-licks in the valleys or cross valleys between mountains and it is under these conditions that they were most readily hunted. Otherwise they prefer rocky cliffs and narrow winding trails that are extremely difficult for a hunter to access and where communal hunting was impossible. The small numbers, inaccesibility, and meat variability made mountain goat a resource of limited utility for Indians and Europeans alike.

Despite the abundance of the foregoing ungulates, one herbivore stood out above all others as a preferred subsistence item for aboriginal and European hunters alike and that was **bison** (*Bison bison bison*). The largest terretrial mammal in North America, bison are gregarious and travel together in cohesive herds of four to 20 animals that may join with other herds to form concentrations of thousands of animals. They are primarily grazers, living on grasses, forbs and sedges, although they are known to consume aspen bark during severe winters (McHugh 1958). Bison were found in all vegetational zones in the northern plains and even in the mountain valleys of the eastern Rocky Mountains (Spry 1968).

Bison have been called the supermarket of the plains for aboriginal peoples because of the diversity of products that they provided. The meat was roasted, boiled and dried. It was a key constituent in pemmican. The internal organs were also used as food and for containers as well. Tongues were highly valued as a delicacy. Rattles used in ritual activities were manufactured from the scrotum; ornaments were made from the beard and hair; the skull had ceremonial significance; and the tail was used both for ornamentation and ceremonies. Though heavier and more intractable than prong-horn, elk, deer or moose skins, the hide was nevertheless made into clothing, containers, tipis, travois and the like. The sinew provided thread for sewing skin clothing and containers, as well as bow strings. Marrow for soup and food was removed from the bones that were in turn rendered to remove grease for pemmican production. Bone also was used for knives, ornaments and fuel. Horn cups, spoons, ornaments and powder horns were manufactured. The tanning of hides was undertaken using brains and other materials. Rattles and glue were derived from the hooves. And, in the absence of wood, a byproduct of bison, buffalo chips, could be used for fuel.

Henry Kelsey was reputedly the first European to see bison on the northern plains. In the August 20, 1691 entry in his journal written in west central Manitoba or east central Saskatchewan, Kelsey stated, "To day we pitcht to y outtermost Edge of y woods/this plain affords Nothing but short Round/sticky grass and Buffilo. . . ." (Dougherty and Martin 1929:12). Bison subsequently assumed tremendous importance in the North American fur trade. Pemmican was the provision base of the York boat brigades, the Red River cart and dog sled drivers and others travelling in Rupert's Land, and its production was a major activity at fur trade posts (Wright 1981). The advantages of pemmican were its high nutrition/weight ratio, long-term preservation properties, and the relative ease of transport.

Archaeologists and ethnologists, historians and prehistorians have viewed bison as the *raison d'etre* on the Northwestern Plains, emphasizing the pervasive influence of bison on aboriginal economic, social, political and ideological systems. The evidence was to be found in faunal assemblages from archaeological sites; in informants' statements; and in Plains Indian ceremonialism. Awareness of the tremendous numbers of bison led to the notion that bison exhibited regularity in their mobility, aggregation, and dispersion. Believing that bison herds aggregated in the fall and dispersed in the winter, Ewers (1955) argued for a fall bison hunting season. Flannery (1953) proposed that intensive hunts occurred in both spring and fall. Oliver (1962) recorded a pattern of summer aggregation and winter dispersion for the early historic equestrian nomads. Arthur (1975) proposed that kills occurred in all seasons, with an emphasis on winter aggregation and cooperative kills. In the past decade several researchers using new theoretical constructs have begun to explore this relationship on a deeper level and in the process have suggested that social, environmental and behavioral contraints acted upon bison populations and in turn influenced the resource base and subsistence strategies (Reher 1977, 1978; Bamforth 1986; Fawcett 1987). Reher (1977) has suggested that, when available, buffalo represented an option of high energy and protein potential that attracted agricultural and hunting-gathering groups from all points of the compass. By introducing the notion that bison were not always available, Reher departed from earlier ideas. In addition, he also predicted that climatic variation, through its influence on grassland productivity, could cause bison numbers to fluctuate significantly. Reher (1977, 1978) proposed that larger and more frequent bison kills occurred during periods with higher precipitation, better grazing and greater numbers of bison. Therefore, communal hunting, that requires large numbers of bison in a particular area, would not occur with the seasonal regularity proposed by many researchers. Taking this one step further, Bamforth (1986) examined the relationship between predictability, productivity and patchiness of bison and complexity of hunting and gathering societies. He suggested that human societies should be more complex when important subsistence resources are abundant and concentrated at predictable locations within a region. Setting environmental and subsistence variables aside, Fawcett (1987) has suggested that communal hunts served to mediate social and political tensions by providing food and exchangeable items for human groups. He saw feasting, ceremonies, and exchanges as instilling a sense of solidarity among participants and contributing to the mediation of tensions created by differences in power, wealth, gender, and age.

Whether or not bison herds of the Northwestern Plains exhibited regular seasonal movements or migrations has been the subject of an ongoing debate (Roe 1972; Arthur 1975; Moody and Ray 1976; Morgan 1979; Gordon 1979; Hanson 1984; Chisholm et al 1986; Bamforth 1987; Epp 1987). Roe (1972) rejected the notion of migration, as viewed by Hornaday and others who believed that bison moved north-south between Canada and Mexico. In addition he disavowed the north-south aligning buffalo trails as proof of such movements. On the other hand, Arthur (1975), Moody and Ray (1976), Gordon (1979), and Roe (1972) cited late 17th and 18th century ethnohistorical sources that reported patterned movements in the Northwest Plains. Bison were reputed to have sought shelter from winds, storms and snow by moving into the more protected parkland in winter and with the amelioration of weather in spring they moved back out onto the open plains. Morgan (1979), Gordon (1979) and Chisholm et al (1986) have proposed that bison moved seasonally between xeric mixed and fescue prairie. The components of movement identified include seasonal change in geographic range, return movement, geographical direction, periodicity and distance (Baker 1978). Hanson (1984) has postulated that the aforementioned pattern appears to be unique to Alberta, Saskatchewan and Montana and provided evidence that abundant forage permitted bison to remain on the North Dakota grasslands year-round. Epp (1987) has suggested that dual herding is a common foraging strategy among bovines, whereby some populations migrate seasonally and others remain in wooded ecologically varied locations. He feels that this maximizes ecological niche opportunities. This writer believes that the evidence supports seasonal movements but would suggest that many variables had the potential and, in fact, did impact regular manoeuvers. These variables can be considered resource stressors if bison failed to materialize in regions where they were expected and humans expecting that they would appear oriented their activities to this expectation.

4.2.3.2.2 Carnivores

The **Big Plains grizzly** (*Ursus arctoc horribilis*) and the **Rocky Mountain grizzly** (*Ursus arctos dusorgus*) were held in awe by Indians and Europeans alike, being the object of many anecdotes describing their strength, their cunning and their ferociousness (The Earl of Southesk 1969; Harper 1971).

Big Plains grizzly were the largest omnivore living in the study area. They were eclectic in their eating habits, consuming grass, berries, roots, tubers, fish, rodents and the carcasses of winter animal kills.

Their distribution may be reconstructed from ethnohistorical sources. In 1805, Lewis and Clark indicated that the Great Falls on the Missouri was infested with grizzlies, ". . . do not think it prudent to send one man alone on an errand of any kind" (DeVoto 1953:148). They also saw many at the confluence of the Yellowstone and Musselshell rivers. Maximilian reported that there were few grizzly among the Mandans in central North Dakota, but they became more common where the Little Missouri entered the Missouri and "The true country of these animals on the Missouri. . . is the tract about Milk River" (Thomas and Ronnefeldt 1982:38, 76, 251). Considerable numbers of grizzlies were seen along the North Saskatchewan, the South Saskatchewan and in the Cypress Hills. Hunting expeditions by Europeans and Indians alike involved a small group of hunters, for the activity was considered dangerous for a solitary individual. Their numbers declined rapidly and they were hunted into extinction by the turn of the century.

Ethnohistorical documents also mention the presence of **black and brown bears** in the Northwestern Plains. Two species appear to be represented, the **American Black Bear** (*Ursus americanus americanus*) and the **Rocky Mountain Black Bear** (*Ursus* *americanus cinnamomum*) (Soper 1964). Whereas the former favors the Canadian and Transition Life Zones of central Alberta and Saskatchewan, the latter occupies the Canadian and Hudsonian Life Zones of the mountains and foothills. Both varieties were observed in forested locales of the open plains in the early historic period; however, numbers appear to have been small.

Black and brown bears are smaller than grizzlies; solitary during much of the year; omnivorous; and spend considerable time consuming twigs, leaves, berries, grasses wedges and forbs and animal flesh.

Black bears were a minor resource, both in terms of pelts, meat and as trophies (Harper 1971); they simply could not compete with grizzly, either in size or reputation.

Wolves and foxes from the family Canidae were extensively exploited for their fur during the historic period and under conditions of privation were also consumed. The **Great Plains Wolf** (*Canis lupus nubilus*) was formerly common in the north-central Great Plains from Texas to southern Alberta and Saskatchewan where favored habitat included the game-rich Transition and Upper Sonoran Life Zones (Soper 1964). While the Great Plains wolf was hunted to extinction, small numbers of the **Montana Grey Wolf** (*Canis lupus irremotus*) remain in isolated parts of the Northwestern Plains (Soper 1964). They favor the Transition and Upper Sonoran Life Zones of the high western plains, and the adjacent Rocky Mountains.

Because they are dependent on big-game, wolves may assume the migratory patterns of the species on which they depend. For example, they move between the plains and parkland as they follow bison and altitudinally following elk. Wolves also feed on carcasses remaining after communal buffalo kills (DeVoto 1953, Spry 1968, Harper 1971, Thomas and Ronnefeldt 1982). Hunting in packs, they consumed huge numbers of wild animals as well as horses. Wolves were resident in the study area until the 19th century and figured prominently in ethnohistorical descriptions of the area (McDermott 1952, DeVoto 1953, Coues 1965, Spry 1968, Harper 1971, Hind 1971a, Quaife 1972, Thomas and Ronnefeldt 1982).

Four species of **fox** figured in the Northwestern Plains fur trade, **Northern Plains Red Fox** (*Vulpes fulva regalis*), the **British Columbia Red Fox** (*Vulpes fulva abietorum*), **Prairie Kit Fox** (*Vulpes velox hebes*) and the **Wisconsin Grey Fox** (*Urocyon cinereoargenteus ocythous*) (Soper 1964). While the red and grey foxes favour forested habitats, the kit fox thrived in arid shortgrass prairie. Foxes consume small mammals as well as vegetable foods. Foxes were run down; flushed from dens; trapped; and poisoned.

It is apparent that they were able to sustain small numbers even in territories the fur trading companies considered depleted. Thus in the 1815 report on the Edmonton District for the Hudson's Bay Company, James Bird stated ". . . an exhausted country but with an area so great it would long afford a few Beaver, Otters, Martins, Bears, and Musquashes and furnish Wolves, Red Foxes, Kitts and dry Provisions in great abundance" (from Nelson 1973: 52).

Another canid of the grassland and parkland of the Northwestern Plains was the **coyote** (*Canis latrans*), otherwise known as the case wolf, togony, prairie wolf of mischechogonis (Spry 1968). Coyotes are smaller than wolves and primarily consume small mammals such as rodents and hares as well as insects and some vegetation. They are important wildlife reservoirs of rabies and were likely avoided by Indians and Europeans.

Three members of the family Felidae figured in the historic period activities on the Northwestern Plains, the **cougar or mountain lion** (*Felis concolor missoulensis*), **Canada Lynx** (*Lynx canadensis canadensis*) and the **Pallid Barred Bobcat** (*Lynx rufus pallescens*). Ranked in order of relative size, the cougar is by far the largest. This species frequents the Canadian and Transition Life Zones, though it has been infrequently reported from forested areas of the dilute Upper Sonoran Life Zone of the Milk, Oldman, Bow and South Saskatchewan river valleys and the Cypress Hills (Soper 1964). Preying on ungulates, rodents and birds, cougars are solitary and wary, so few are sighted.

Canada Lynx are the most common felids and their long soft grey lustrous coats were actively traded in the fur trade. They occupy the same life zones as do cougar and are also solitary and wary. Lynx feed upon a variety of small mammals, most importantly the hare. Because their prey are subject to a cycle of abundance alternating with scarcity, lynx are similarly affected.

The smallest felid, the Pallid Barred Bobcat, exhibits a somewhat broader range than the cougar and lynx; consumes small mammals and vegetation; is solitary; and was rarely mentioned in the ethnohistorical journals. Its pelt is soft but not very durable so it was not a preferred trade item.

4.2.3.2.3 Small Mammals

At least four subspecies of hare and one of rabbit occupy and were important in the study area (Soper 1964). In the extreme north is found the **American Varying Hare** (*Lepus americanus americanus*) while the **White-Tailed Prairie Hare** (*Lepus townsendii campanius*) is found in adjacent regions of Alberta, Saskatchewan and Montana. The **British Columbia Varying Hare** (*Lepus americanus columbiensis*) occurs along the Rocky Mountains and the territory of the **Rocky Mountain Varying Hare** (*Lepus americanus bairdii*) extends from the Rockies into southwestern Alberta and northwestern Montana. The **Black Hills Cottontail Rabbit** (*Sylvilagus nuttallii grangeri*) is resident in the drier regions of Alberta, Saskatchewan, Montana, and North Dakota.

Both cottontails and hares are an important link in northern plains food chains between the plants and the carnivorous animals (Banfield 1974). They have many predators and exhibit tremendous oscillations in their population densities particularly in the northern parts of their range. Hares were more important as a food source because they are almost twice the size of rabbits at 1.5 kg. (Banfield 1974).

Banfield (1974) has suggested that the hare has been the most important small game mammal of Canada since the 17th century. Aboriginal and European occupants of the Northwestern Plains used these animals, particularly during those years when they were at the height of their cycle (Spry 1968, Harper 1971, Hind 1971a, 1971b). Under these conditions, search and capture time were low and large numbers could be obtained with a minimum of technology; however, at the bottom of the cycle, search time would increase dramatically and owing, to the relatively small size of the creatures, hunting would be counterindicated.

Two varieties of **porcupine**, the Dusky Porcupine (*Erethizon dorsatum nigrescens*) and the California Porcupine (*Erethizon dorsatum epixanthum*), were used as a source of food and quills by both the Indians and Europeans. The former occupied the Hudsonian, Canadian and Transition Life Zones of the Rocky Mountains and associated foothills, while the latter was found in brushy gulches, coulees, sagebrush flats and wooded bottonlands along streams in the Upper Sonoran, semiarid Transition Life Zones and the Canadian Zone of the Cypress Hills. Porcupines are generally solitary, slow-moving predominantly noctural rodents that were easy to kill when encountered. They are destructive to trees and shrubs in winter.

The desire for felt hats manufactured from **beaver** pelts was the impetus behind the North American fur trade. Canada Beaver (*Castor canadensis canadensis*) favored streams and lake shores in the Canadian and Transition Life Zones where there was ample supply of willows, aspen popular and birch, while Missouri River Beaver (*Castor canadensis)* occupied ponds, creeks and small rivers fringed with willows and populars in the Upper Sonoran and semiarid Transition Zone (Soper 1964).

Largely aquatic by habit, beaver are notable for their ability to modify the landscape through felling and consumption of trees and bushes and construction of dams, that may significantly alter drainage patterns. They must be considered a major modifier of the environment, particularly that of the Northwestern Plains where trees were localized and limited; where prairie fires frequently demolished trees; and where tremendous numbers of herbivores were ever-present consumers of most varieties of vegetation. Ethnohistorical sources indicate considerable spatial and temporal variation in the density of beaver that was likely due to their sedentariness, low rate of natural increase (compared to muskrat) and wide population fluctuations or cycles coupled with the aggressive acquisition of furs by Indians, Métis and Europeans (Wishart 1979).

Beaver were also highly ranked as a preferred food (The Earl of Southesk 1969). Castoreum was removed from the animals' scent glands and used to bait traps as well as for perfume (Wells 1972). Baiting traps in this way greatly accelerated the hunters' success and hastened the decline of beaver populations.

While beaver were important to the European fur traders, evidence strongly suggests that the Indians of the Northwestern Plains did not routinely hunt any fur-bearers until their economy was transformed by the fur trade. Anthony Henday in 1754-55 (Burpee 1907), Alexander Henry the Younger from 1799-1814 (Coues 1965), and Peter Fidler in 1792-93 (Haig 1991) reported that the Indians with whom they had contact demured trapping and Fidler even noted that the Piegan were superstitious and avoided touching the animals. Later on the acquisition of the horse "resulted in the flowering of a life style which worked against the Indian hunting of the beaver" (Nelson 1973:171). The benefits accruing from a beaver pelt fell far below the costs associated with its capture with the universal standard of comparison being the relatively low costs and considerable benefits gained from hunting bison.

Another fur-bearing animal, whose pelts were more numerous but less valuable in the fur trade, was the **muskrat** or musquash. Along the North Saskatchewan River, one finds the Northwestern Muskrat (*Ondatra zibethicus spatulatus*); in the Rocky Mountains and their foothills, the Rocky Mountain Muskrat (*Ondatra zibethicus osoyoosensis*); and, the most widespread is the Great Plains Muskrat (*Ondatra zibethicus cinnamominus*). Muskrats favor marshes, lakes, ponds, sloughs, and sluggish streams. They build above-water houses that are a prominent feature of the plains landscape and are prey to many different animals.

While muskrat fur was regarded as inferior by 17th and 18th century fur traders, tremendous numbers of these animals were acquired in trade for shipment to England in the 19th century (Spry 1968). Maximilian reported that as many or more muskrats than beaver were gathered in the Upper Missouri fur trade of 1833 (Thomas and Ronnefeldt 1982). Members of the Palliser Expedition reported large numbers in the vicinity of the Touchwood Hills, Carlton House, Lac Ste. Ann and Hay Lakes (Spry 1968). Muskrat meat was also eaten by Indians and Europeans alike. Hector's journal entry of March 14, 1858 from northwest of Carlton where he camped with a band of 200 Cree, noted, ". . . we had many feasts of the finest buffalo meat, but the great delicacy that was at this time in season was the musk rat. . . "(Spry 1968:222). Muskrats populations were subject to periodic oscillations as well.

In addition to the hides procurred from ungulates and pelts from coyotes, wolves, foxes, black and grizzly bears, beavers and muskrat, a number of other small animals were also taken for their furs and/or meat. This included **marten, fisher, weasel, mink, ferret, wolverine, badger, skunk, otter** and possibly also **raccoon**. It is probably safe to say that the interest in these animals post-dated the arrival of the Europeans and the development of the fur trade. Their small size, patchiness and low productivity would have precluded serious exploitation for food, especially in view of the productivity and large size of resident ungulates. Once their pelts were defined as valuable by the European market, and desirable trade goods were available in North America, interest in gathering them by Native Americans and Europeans, increased.

The ethnohistorical literature is remarkably silent about sightings of these animals in comparison with sightings of big-game. This is due to fewer numbers and probably also viewer bias. Small mammals are simply not as exciting as large carnivores and ungulates.

4.2.3.2.4 Game Birds

The abundance of upland game birds and migratory water fowl in the early historic period has been well documented particularly along the Red River, Pembina River, Qu'Appelle River, Touchwood Hills, the North Saskatchewan River, Eagle Hills, Egg Hills, Jackfish Lake, Athabasca River and Bow River (McDermott 1952, Spry 1968, The Earl of Southesk 1969, Hind 1971a, Thomas and Ronnefeldt 1982) . In addition to flesh, game birds provided eggs (Spry 1968), quills (Hind 1971a) and feathers (Grinnell 1972).

4.2.3.2.5 Fish

The ethnographic literature consistently reports that Plains Indians outside the Middle Missouri consumed little or no fish, preferring instead to hunt big-game (Lowie 1954). Early European descriptions of the Northwestern Plains do, however, refer to the plentitude of fish in the rivers, streams and lakes and to some Indian use of this resource (Spry 1968; Haig 1991). Nets, spears, basket traps, hooks and weirs were used to capture a variety of fish, including pike, sturgeon, cat-fish, gold-eye, whitefish, perch and trout (Spry 1968). Areas of abundance were in the Parklands, including Swan River, Jackfish Lakes, the Qu'Appelle Lakes, Lac Ste. Ann, Buffalo Lake, the Bow River, Waterton Lakes, Red River, Shell River and North Saskatchewan River. Whether this use was stimulated by shortages of big-game, by exposure to Europeans who fished or a long-standing practice is not known. It is known that fishing was practiced by aboriginal groups resident in regions to the west, north and east of the open grasslands (Smith 1991). The Narrows Site (DgPl-4) is a fishing station on the grassland-parkland interface in Waterton Lakes National Park with a 7000-year record of net fishing (Milne Brumley 1971). Shortages of big-game in the Swan River District led to exclusive use of fish to provision the fur trade in that area (Spry 1968). On the other hand, Palliser reported that the Qu'Appelle lakes abounded in fish but the Indians, being Plains hunters, did not know how to fish (Spry 1968). It is suggested that the areas of greatest productivity were localized; that they were located in the Parkland; that the aboriginal residents of these locales used the resource seasonally; and that the resource was available, though probably underutilized as long as preferred sources of meat were abundant.

4.2.4 Resource Stressors

Throughout the prehistoric and early historic periods, large-scale environmental modifications occurred on the northern plains. Glaciation during the Pleistocene Epoch and more recently neoglaciation in the Rockies in the 18th and 19th centuries, drought and fire, and, ultimately, the advent of western civilization, have each in their turn modified the resource structure. In addition, secondary stressors included predators, storms, disease among humans and animals alike, animal cycles, floods, overgrazing, intergroup conflict and failure of hunting technology. All factors that caused a decrease in productivity and predictability and increased patchiness of game animals, are considered stressors.

4.2.4.1 Drought

The key stressor in the Plains as a whole has been the periodic, severe, and widespread **droughts**, that impact flora, fauna and humankind. That these episodes are recurrent but unpredictable has been demonstrated by a 748 year tree-ring record for central Nebraska (Weakly 1962), an 8000 year-old pollen core from a slough in southeastern Alberta (Vance 1991; Vance et al 1992; Vance et al 1993), and a 9120 year-old pollen core from the Cypress Hills (Sauchyn and Sauchyn 1991). In the former, Weakly (1962) found that 269 or 36% of the years represented were sufficiently dry to have adversely affected vegetative growth. In the second Vance (1991) suggested that a variety of conditions prevailed over the course of time: extreme drought interrupted by short moist intervals; extended drought without abatement; and long intervals during which droughts were rare. He found that the intervals between 7300 and 6000 B.P. and 100 and

600 B.P. were two periods of heightened drought frequency (Vance et al 1993). In the latter, Sauchyn and Sauchyn (1991) report a major drought between 7700 and 5000 B.P. Northern plains prehistory has been written around the Altithermal (7500-5000 B.P.), a supposed dry interval when settlement patterns on the open plains underwent significant change (Reeves 1973; Benedict 1979; Buchner 1980; McKinnon and Stuart 1987). Historically, major droughts occurred in the region in the 1860s, 1880s to mid 1890s, 1930s, mid-1950s, mid-1970s and late 1980s (Wilhite 1980). Minor droughts have occurred in some portion of the Plains during almost every year of record. And even during the drought-stricken 1930s all areas of the northern plains were not affected equally (Chakravarti 1976). There are some subregions of this area that are subject to frequent severe periods of dry weather, while others are less vulnerable (Waines 1938). And drought periods may be interspersed with intervals of above-average precipitation. For example, the early 1880s, probably the wettest period in western Canada for over a century (Hope 1938), were followed by severe drought.

Drought differs from other natural hazards in several ways (Wilhite 1982). First, it is a 'creeping phenomenon', the effects of which accumulate slowly over a considerable period of time. Second, drought impacts are less obvious than are damages that result from other natural hazards such as floods and hurricanes. Third, the absence of a precise and universally accepted definition of drought adds to the confusion about whether or not a drought exists and, if it does, its severity. A definition of a drought incorporating the notion of impact is adopted herein. Drought is "a climatic excursion involving a shortage of precipitation sufficient to adversely affect grassland productivity" (Wilhite 1982:333; Wilhite and Glantz 1985:115). Droughts vary in intensity, duration, and spatial coverage. Intensity is often measured as the departure from normal precipitation (Waines 1938; Rosenberg 1980; Yevjevich et al 1983). Percentage of normal precipitation is an index that measures intensity of drought while duration usually examines below average precipitation on an annual basis. Tomanek and Hulwett (1970) noted that in the past 100 years on the

Great Plains, 48 have logged precipitation values below the mean, 44 above the mean and 8 near the mean. Waines (1938) found that more than 35% of the years in southeastern Alberta and southwestern Saskatchewan were drought years when precipitation dropped below an average of 20 cm. Chakravarti (1976) has suggested that the northern and southern parts of the northern plains are dialectical opposites; when drought persists in the southern region, the northern area received generally average to much above-average precipitation and the reverse was true as well.

The prehistoric droughts of concern in this study are caused by a lack of precipitation and an increase in evaporation. They are manifestations of climatic fluctuations associated with large-scale anomalies in atmospheric circulation, that essentially lead to absence of, or weak, precipitation, during a large period of time over a region (Peixoto 1983). Local and regional factors of climate also are important in producing droughts. Synoptic climatological studies of drought periods reveal that two types of circulation regimes are responsible for historic precipitation deficiencies in the northern plains (Vance 1987). Both are linked to the pattern of flow and strength of the mid-latitude westerlies. The Low Zonal Index is a meridional or north-south phenomena during which there is reduced westerly flow. High pressure ridges develop into quasi-stationary features that deflect to the south or north the eastward flow of moisture bearing low pressure systems. During periods of High Zonal Index, strong westerly flow brings warm dry Pacific air further east than normal, as well as extending its northern and southern limits. This prevents the incursion of moisture- bearing cool modified Pacific air from the north and Tropical air from the south. High surface winds, that hasten soil moisture loss and soil erosion, are associated with High Zonal Index drought. Borchert (1950) links the latter circumstance to the 1930s drought and the former to droughts in the 1910s and 1950s (Borchert 1970). Mitchell et al (1978) have analyzed tree ring data from the western United States extending back to A. D. 1600 and have found a statistical association between drought and the Hale sunspot cycle. Results are, however, far from conclusive (Chakravarti 1976).

Drought's impacts must be seen as dynamic, resulting from interactions between supply and demand (Wilhite and Glantz 1985). In the present context, supply is expressed as the availability of abundant, nutritional forage for herbivores and demand as the requirements of primarily, herbivores and secondarily, carnivores. Grassland responses include species removal, competitive release, thinning of the canopy and exposure of understory plants, invasion of fugitives, changes in the demographic and perhaps genetic structure of the populations and shifts in phenological events and fecundity of species (Bazzaz and Parrish 1982). Certain associations may disappear, expand or new ones may be formed. Changes in forage yield and density of plant cover are the most immediate and conspicuous responses of grassland to changes in weather. Ultimately changes in forage yield, density and floristic composition determine the presence or absence of herbivores.

The immediate response to decreased moisture is curtailment of height of growth (Coupland 1958), while forage yield continues to decline along with soil moisture (Smoliak and Peters 1952; Smoliak 1956; Coupland 1958). The reduced abundance of foliage accentuates drought by reducing shade and providing less debris to protect the soil against evaporation. Grasshoppers flourish during drought, consume enormous quantities of forage and thus add to the problem as well. Drought also affects the vigor of plants. Ellison and Woolfolk (1937) reported that the effect of a drought on plant vigor extends into the following season. According to Coupland (1958), grasslands recover rapidly from the effects of drought, providing grazing is moderate and in one to two years readjustment is complete. While prolonged drought causes loss of basal cover, response to increased availability of moisture is first expressed in increased height of grasses (Coupland 1958). On the other hand, if above-average moisture conditions prevail for an extended period of time, development towards a postclimax type of vegetation is possible and yields are above those of a climax zone (Coupland 1958; Johnston 1970).

A decline in vegetation density is a second response (Clarke et al 1943). Less xeric species of grasses and forbs are among those affected, as are the young, poorly rooted individuals and less vigorous older plants. Decrease in density is most rapid in early years of drought although intrusion by drought-resistant species may reverse this trend (Coupland 1958). Drought has a greater impact in fescue and mesic grasslands and less impact in xeric grasslands.

Another factor that affects the density of grassland vegetation is grazing. While moderate grazing has little impact, (Clarke et al 1943; Coupland 1958), heavy grazing is of as great or greater importance as climate in modifying plant cover. Under some conditions, grazing and/or drought may result in an increase in plant density as they promote the incursion of drought resistant species such as forbs. Drought and overgrazing, coupled with persistent winds, may accelerate soil erosion.

Lastly drought may affect floristic composition. Coupland (1958) has suggested that during drought mid-grass communities are replaced by mixed-grass communities; mixed-grass communities become dominated by short grasses; and the species composition of short-grass communities is modified. Conversely an extended period of above-average moisture conditions may result in the replacement of the usual mid-grass dominants of Mixed Prairie by more mesic mid-grass species. The rate of recovery from drought varies widely, depending on the kind of pre-drought cover, degree of depletion, kind of grass relicts surviving, amount of damage from burial by dust, intensity of grazing and trampling during recovery, and amount and distribution of location precipitation (Weaver and Albertson 1944).

Pollen analysis and the discontinuous distribution of trees and shrubs along stream and river valleys and in elevated areas have clearly shown northern plains grassland to be relatively recent. Axelrod (1985) suggested that these relict occurrences may be attributed to the Altithermal, a period of drought between 7500 and 5000 B.P., that he saw as furthering the spread of drought-resistant grassland vegetation and contributing to the concomittant decline in the forest and woodlands of earlier times. Palynological studies suggest that the establishment of grassland, based on faunal macrofossils, may be substantially earlier (Guthrie 1989). Climatic factors, particularly temperature, precipitation and wind regimes also are seen as contributing to the maintenance of grasslands (Hildebrand and Scott 1987), although woodland areas have increased in the northern plains in the past century (Archibold and Wilson 1980). It is the concensus of many researchers that this is due to a decline in prairie fires. (Sauer 1950; Stewart 1953; Raby 1966; Daubenmire 1968; Moore 1972; Lewis 1982; Barrett and Arno 1982; Pyne 1982).

4.2.4.2 Grassland Fires

The occurrence and the duration of climatic episodes, plus topographic features, lightning and human action are factors associated with another resource stressor, **grassland fires.** Fires with anthropogenic and lightning sources are conspicuous in early historic accounts of northern plains life and are assumed to have been in the prehistoric period as well. The ecological approach adopted herein views fire and grass as genetically and thus structurally, associated; man as the foremost source of fire and the primary vector for its distribution throughout the world; nomadism as intimately associated with fire; and knowledge of fire as a precondition to successful habitation on the plains (Raby 1966; Daubenmire 1968; Lewis 1977; Pyne 1982). That fire controlled the spread of trees and shrubs onto the Plains and is largely responsible for the maintenance of grassland vegetation is accepted (Sauer 1950; Stewart 1953). It is acknowledged that the causes, characteristics and effects of grass fires are variable. And they have enormous potential for influencing, negatively and positively, the availability of selected resources. It is when the effects of fires are negative that they are considered resource stressors.

Fire is both a mechanism of degradation and decomposition and is thus a profound biological event (Pyne 1982). A fire discharges energy through the release of heat and delivers organic and inorganic chemicals into the air, water and soil. Some organisms have adapted defensively to protect against the energy released by fire, while others have adapted so as to seize on the nutrients released by fire. Fire plays a profound role in ecosystem development through periodic disruption, that sets back succession. Succession is " the occupation of an area by organisms involved in an incessant process of action and reaction which in time results in changes in both the environment and the community, both undergoing continuous reciprocal influence and adjustment" (Margalef 1968:27). As decomposer and degrader, fire eliminates extant litter and standing vegetation cover. The subsequent youthful ecosystems contain fewer species and greater numbers of individuals with faster rates of production, leading to rapid rates of nutrient exchange (Odum 1971). Selective pressures in youthful stages are for quantity production characterized by conditions of instability and perturbation as more and more species attempt to colonize. As ecosystems mature or reach a climax, species diversity increases and equilibrium increases but the number of individuals is fewer and adaptations are more specialized. Periodic disruption enables fauna and people to exploit early stages of ecological succession when particular vegetational characteristics may prove attractive to them.

Vegetation fires have multiple causes including volcanism, spontaneous combustion, sparks released when boulders roll downslope or branches rub together, lightning, and the anthropogenic factor (Daubenmire 1968; Pyne 1982). Lightning fires have persisted through geologic time; occur in every terrestrial environment on the globe; and have contributed to a mosaic of vegetation types. Climatic and weather factors and fuel conditions are linked to temporal aspects of lightning fires. For example, Komarek (1969) associated lightning fires in the spring of 1965 with a North American cold front extending from South Dakota to Florida and summer monsoon in Arizona and New Mexico. Hubbard (1980) linked precipitation frequency and monthly temperature with fire occurrence in Great Basin rangelands. The most effective fire starters are "dry" lightning storms- thunderheads from which little precipitation reaches the ground and that commonly occur after droughts or dry seasons (Pyne 1982).

Hunting and gathering, swidden, agricultural and pastoral subsistence systems have used fire to aid hunting by encircling, rousing or stampeding game, drive animals from a region, improve pasture, improve visibility, collect insects, increase yield of seeds, increase yield of berries, increase other wild vegetable foods, make vegetable food available, remove or thin trees to allow other growth, clear land for planting, stimulate growth of wild tobacco, aid in warfare, facilitate travel, produce a spectacle, reduce danger from snakes, insects, etc., and sheer perversity or carelessness (Hough 1926; Stewart 1953).

Studies of the distribution and frequency of natural fires indicate that different regions and different historical periods tend to show characteristic fire regimes (Pyne 1982). Clusters of fires are linked to specific weather and fuel conditions. Lightning fires are more randomly distributed and are often remote from human settlements. Fires induced by human action are associated with human settlements and, because they most frequently have specific subsistence goals, differ from natural fires in terms of seasonality, frequency, intensity and selectivity (Lewis 1977).

Collectively, drought and fire have maintained the northern plains grassland (Borchert 1950; Sauer 1950; Stewart 1953; Pyne 1982). Conditions favoring lightning fires predominate in summer from June through September. Moore (1972) suggested that anthropogenic fires exhibit a pronounced summer burning season with late spring and fall as secondary, though winter burning of the area has also been recorded. In his journal entry of December 18, 1792 near present-day Calgary, Peter Fidler noted that "the lightning in the Spring and Fall frequently light the Grass, and in the winter it is done by Indians" (Haig 1991:36). The Saskatchewan District of the Hudson's Bay Company was particularly prone to fires in an autumn following an unusually hot, dry summer (Thomas 1977). Specific features of the northern plains landscape also render it vulnerable to alteration by fire: a dry season when surface water is scarce and localized; precipitation is minimal; electrical storms are prevalent; coupled with smooth to rolling topography where there are few elevated grades or escarpments; and dense grasses and forbs.

The frequency of conflagrations is recorded in surviving ethnohistorical documents, fire scars on old-growth trees and macrobotanical remains. Mehringer et al (1977 from Barrett and Arno 1982) reported inexplicably large concentrations of airborne charcoal occurring only in the last 2,000 years of sediments in a western Montana bog. In the same area, Barrett and Arno (1982) reconstructed fire chronologies based upon scars on old-growth trees, that indicate that fire intervals within similar forest types were shortest near Indian-use zones. J. P. Pruden, Chief Trader at Carlton House, reported that the frequency of fire appeared to be considerably higher there than in the Edmonton area (Thomas 1977). Using extant ethnohistorical sources to quantify incidences of fire in the northwestern North American grasslands between 1535 and 1890, Moore (1972) found that 86% of the fires occurred between June and September; 58% were attributed to Indians, 22% to Europeans; 31% of aboriginal fires could be attributed to either the Crow or Blackfoot; and half the fires attributed to Europeans were started by explorers.

Individual fires could assume vast proportions as Raby (1966) and Pyne (1982) reported plains fires that consumed 6000 square miles and 380,000 acres respectively. On June 27, 1858, Henry Youle Hind (1971a: 292) while in southwestern Manitoba, wrote, " . . . we traced the fire from the 49th parallel to the 53rd, and from the 98th to the 108th degree of longitude."

Grassland fires are characterized by a rather narrow zone of flames advancing across a finely divided and rather homogeneously dispersed fuel (Daubenmire 1968). Surface wind velocity, temperature and relative humidity determine the direction and rate of spread of fires in early and later stages. The typically gusting and/or high velocity winds, high temperatures and very low relative humidity during spring, summer and fall are ideal conditions for the growth of grass fires. These same conditions are accentuated during the frequent droughts and fires are correspondingly more prevalent and have greater impact. Though they lack the energy release of a brush or forest fire, grass fires can travel with incredible velocity. The spread of a grass fire accelerates quickly to a maximum rate (Daubenmire 1968), as Peter Fidler found when a campfire spread out of control so rapidly that he and his companions had to abandon their gear and flee on horseback (Thomas 1977). Fires moving at high speed could easily jump streams and even rivers as broad as the North Saskatchewan (Thomas 1977).

The amount and rate of heat released as vegetation burns depends on weather conditions, topography and fuel (Daubenmire 1968). The perennial winds, high temperatures and low moisture regimes of the northern plains were conducive to the release of great amounts of heat, particularly during summer and fall burns. In areas of heavier rainfall or surface moisture, such as bogs, bottoms, parkland, stream channels, sloughs and lakes, combustion was hindered, leaving a landscape that was a mosaic of burned and unburned regions (Pyne 1982).

Pyne (1982) has suggested that the knowledge of fire was a precondition to successful habitation on the plains and prairies by aboriginal peoples and that even nomadism was in part an adaptation to natural and anthropogenic fire. Aboriginal fire practices were largely a subsistence technology predicated on a migratory lifeway so that human groups and herds could roam among ranges alternately burned and greened. With the coming of permanent settlements, delimited territories, and domestic crops and animals, attitudes toward fire changed. John Macoun, as botanist on Sandford Flemming's Expedition across the prairies in 1872, spoke of prairie fires as "the evil that is so patent to every one" (Raby 1966:95).

In addition to naturally occurring fires, human occupants of the northern plains routinely fired the prairie grasses for a variety of reasons. Moore's (1972) study covering the interval between 1535 and 1890 identified 7 aboriginal groups (Blackfoot, Crow, Blood, Nez Perce, Sioux, Gros Ventre, Flathead) and 5 European groups (explorers, soldiers, immigrants, fur trappers, tourists) as responsible for intentional and unintentional burning of the area. Aboriginal fires were set for communication, warfare, hunting, to improve soil fertility, to improve berry patches and accidentally (Moore 1972; Arthur 1975). Fires started by accident, for communication, for pleasure and for warfare are attributed to Europeans (Moore 1972).

Of the 5 reasons given by Moore (1972) for fires attributed to Indians, warfare and communication accounted for nearly 70% of the cases. Setting grass fires to impede the advance of the enemy or to rouse the enemy were apparently common practices for the Blackfoot, Crow and Sioux (Quaife 1935; Moore 1972). Revenge, malice and harassment were seen by the Hudson's Bay Company traders as reasons underlying the firing of grass in the late 1820s outside Fort Edmonton and Carlton House by the Assiniboines and Stone Indians, respectively (Thomas 1977).

Signal fires also were used extensively by aboriginal peoples in the open plains where areas of high relief permitted one to see for many miles in any direction. Henry Youle Hind (1971a:336), in a journal entry for July 23, 1858, noted,

> This afternoon we saw three fires spring up between us and the Grand Coteau. They were Indian signs, but whether they referred to the presence of buffalo, or whether they were designed to intimate to distant bands the arrival of suspicious strangers, we could not tell. . . In a few days we ascertained that the fire had been put out* (a native expression meaning 'to set the prairie on fire) by Crees, to inform their friends that they had found buffalo.

Many instances of accidental fires also have been recorded. Journal entries for October 22 and 23, 1810 by Alexander Henry the Younger from Rocky Mountain House stated, "We perceived the plains afire on the S. side, and were told it proceeded from the carelessness of the Fall Indians when decamping. . . . " (Coues 1965: 656).

Fire was an integral element in the subsistence technology of the aboriginal inhabitants of the Northwestern Plains. It was used to control wildlife movements, particularly those of bison. Fire was used to direct bison away from designated territories; to attract them to other areas; and in the initial stages of bison drives. Henry

Youle Hind's July 23, 1858 journal entry indicates the great distances over which bison could be directed, " . . . by burning the prairie east of their course, they would be diverted to the south, and feed for a time on the Grand Coteau before they pursued their way to the Little Souris. . ."(Hind 1971a:336). Fur traders in the Saskatchewan District believed that the Indians deliberately fired the plains surrounding the posts, " . . . to frighten away the animals in order to enhance the value of their own provisions" (Morton 1929:33).

The Plains Indians also were well aware of ecological succession for they set the plains on fire to promote grass growth later in the season. An entry in the journals of Lewis and Clark for March 6, 1805 at Fort Mandan noted that "a cloudy morning and Smokey all Day from the burning of the plains, which was set on fire by the *Minetarries* for an early crop of Grass, as an enducement for the Buffalow to feed on. . . " (Thwaites 1959a:269).

While popular accounts report that fire was commonly used to drive bison towards pounds or jumps, ethnographic sources suggest that this has been exaggerated. Lowie (1954) reported that Upper Mississippi tribes hemmed bison in with fire and drove them to an opening where they were promptly slaughtered. Blackfoot informants, while acknowledging that firing was an ancient method used to drive bison, suggested that it was not a popular technique among their people (Kidd 1986). Simulated fire drives were, however, an element in religious ritual. In August 1833, while visiting Fort McKenzie, Maximilian (Thwaites1906:112-115) described the events of the last day of the Blackfoot medicine dance, "the buffalo park is imitated. . . several men represent buffalo bulls and are at first driven back by the women; but then, as is the practice in this kind of hunting, a fire is kindled to windward."

Using available ethnohistorical data, Arthur (1975) has suggested the northern plains Indians burned the short grass prairies in the fall, usually in September, whereas they fired the tall grass prairies of adjacent parklands in the spring. Fall burning was carried out as Indian bands left the plains to take up winter residence in the aspen parkland.

This forced bison out of the short grass plains and into the parkland in the fall and in the spring the animals were driven out of the parkland winter range by fire coupled with the promise of new growth forage on the shortgrass plains. Contrary to Barrett and Arno's (1982) statement that Indian burning was unsystematic, there is strong evidence that the economic, social and political motivations underlying the use of fire, its widespread occurrence, and its seasonality and timing were the result of careful planning and a long tradition.

Often Europeans were critical of aboriginal burning practices. For example, Henry Youle Hind (1971a:405-6), in his April 12, 1858 journal entry stated that:

> It appears to be beyond human power to arrest the annual conflagrations as long as the Indians hold the prairies and plains as their hunting grounds. Their pretexts for 'putting out fire' are so numerous, and their characteristic indifference to the results which may follow a conflagration in driving away or destroying the wild animals, so thoroughly a part of their nature, that the annual burning of the prairie may be looked for as a matter of course as long as wild Indians live in the country.

However the Europeans themselves caused grass fires in order to communicate, conduct warfare, for pleasure and accidentally (Moore 1972). Captain John Palliser had a near disaster in the upper Bow Valley on September 4, 1858 when, "a pine tree by which our tent was pitched caught, from a roaring fire we had lighted against its root. . . the roar of which luckily wakened me up, and, without waiting to see how much was burning of the forest, I caught our powder and my trowsers and bolted right into the swamp" (Spry 1968:315-6).

In 1832 a band of fur trappers in southern Alberta led by Finan MacDonald fired a woodlot in which the Piegan had taken refuge (Ross 1956). Hoping to locate a lost member of their party, the Yellowstone Expedition in 1870, " . . . ascended a high peak near camp and fired the woods in the hope of giving him a point of direction" (Doane 1871:23). In June 1863, Cheadle (1971:154) noted that one of the men in his expedition, "set fire to the country" in the valley of the McLeod River in southwestern Alberta for pleasure."

Fire had the potential for being a tool of extraction, destruction or production. As a tool of extraction it was part of a highly developed subsistence technology that controlled the movements of game animals out of some areas and into others. Fire destroyed thousands of acres of grassland on which herbivores were dependent; consumed structures and settlements constructed by humankind; and maimed and killed humans and wildlife alike. However, it must also be regarded as an agent of production when one considers its role in plant succession and maintenance of the grassland ecosystem.

It is fire's destructive dimensions that have led to its classification as a resource stressor. The enormous release of energy implied in grass fires that cover millions of acres; the rapid movement of a fire front that enables it to overtake all animate and inanimate objects in its path; and its consumption of all combustible materials in its path are the characteristics that render fire a tool on the one hand and an enemy on the other. The magnitude and power of the prairie fire as reconstructed by Paul Kane's artist eye are testimony to its potential as a resource stressor. In his journal entry of September 26, 1846 he noted:

> On the night of our arrival at Edmonton, the wind increased to a perfect hurricane, and we had reason to be thankful to Providence for our timely escape from the awful scene we now witnessed from our present place of safety, for, had we been one day later, we might have been involved in its fiery embrace. The scene on which our attention was now riveted, was the conflagration of the prairie through which we had passed but a few hours before. The scene was terrific in the extreme; the night being intensely dark gave increased effect to the brilliancy of the flames. We were apprehensive at one time of its crossing the river to the side on which the fort is situated. . . (Harper 1971:83).

Fire modifies grassland in many ways . First, the removal of litter allows more solar radiation to penetrate to the soil surface and causes an earlier warming of the soil surface in the spring (Bazzaz and Parrish 1982). In consequence, foliage usually appears earlier in the first post-burn season, and sometimes the onset of flowering is advanced (Daubenmire 1968). Ehrenreich and Aikman (1963) have shown that plants on recently burned areas began growing two to three weeks earlier than plants on unburned areas but those on unburned areas grow faster in the latter part of the growing season, so that there is no significant difference in herbage yield on burned and unburned areas.

Second, fire releases nutrients from accumulated litter, that may also enhance vegetation growth (Bazzaz and Parrish 1982). When the aboriginal inhabitants fired the short grass plains bordering parkland areas in the fall, they modifed the subsequent season's vegetation in two ways. First, the area greened earlier in spring than it would in the absence of burning and thus attracted bison to move out of the fescue grassland of the parkland. Second, early flowering leds to early maturation and curing relative to unburned areas. This promoted movement of herbivores and, correspondingly, of man among ranges alternately burned and greened, actively growing and cured.

Third, fire also creates open sites that may be invaded by other plants (Bazzaz and Parrish 1982). Sauer (1950), Stewart (1953), and Pyne (1982) have maintained that extensive grassland fires are responsible for the maintenance of the North American Plains, noting that suppression of fire results in gradual recolonization by woody species such as sagebrush, aspen, and ultimately pines. While passing through the Bow River Valley in 1800, David Thompson observed that "The soil appears good along its whole extent, but for the most part it is bare of woods, and those that remain are fast diminishing by fire" (Glover 1962:144). While wintering at Rocky Mountain House in 1811, Alexander Henry the Younger wrote, "Frequent fires have aided much in clearing away the wood and brush, so that we now have a grand view of the Rocky mountains" (Coues 1965: 701). The maintenance of extensive grasslands was a prerequisite to occupation by immense numbers of herbivores and their predators, humankind.

A fourth effect of fire on the organization of grassland communities is the general decrease in biomass production (Bazzaz and Parrish 1982) that stems from the interruption of plant succession. In southern Alberta and southwestern Saskatchewan, Clarke et al (1943) have shown that production decreased about 50% the first season following a spring fire, was still 15% below normal the second and recovery was completed by the third. Fall burning was less deleterious, reducing production by only 30% with recovery complete by the second post-burn season. From the standpoint of grazing, a detrimental effect of burning includes not only the reduction in forage yield, but the destruction of the cover of old grass. Clarke et al (1943) have pointed out that the carryover of cured vegetation is an important part of forage, especially early in the season when new growth is so watery and high in protein.

Fifth, burning also changes the composition of plant communities. Those actively growing will be more negatively affected than those that are dormant. Woody species that do not sprout from their roots can be eliminated or significantly reduced by repeated burning; forbs are commonly favored over grasses; in dry steppe annuals may gain an advantage at the expense of perennials; and, in some instances burning has little effect perhaps because of a long history of natural selection under repeated burning (Daubenmire 1968).

Intentional and natural fires differentially affect vegetation. On the Northwestern Plains, lightning fires have their highest frequency during the driest part of the year, while intentional burning often occurs during other seasons when its impact will maximize desirable results. For these reasons it is posited that the negative vegetational consequences of natural fires exceed those of intentional ones. Furthermore, intentional fires were frequently, though not always, kept under control.

With alterations in the density, diversity and patchiness of grassland vegetation came changes in the movements, productivity, predictability and patchiness of key faunal resources. In particularly dry years, such as 1812, 1828 and 1836, fire caused widespread starvation among the Plains Indians and considerably impeded the operations of the Hudson's Bay Company (Thomas 1977 Clearly all animals would abandon burning areas as well as those barren of vegetation. Smoke frightened bison and would cause whole herds to disperse, thereby complicating the process of acquiring food. Journal entries for December 20-22, 1809 by Alexander Henry the Younger while in a Blackfoot encampment at the confluence of the Vermillion and North Saskatchewan Rivers noted how "fog, wind and smoke from prairie fires confounded attempts to pound a herd of buffalo" (Coues 1965:577).

Fires also destroyed buffalo dung as reported by Henry Youle Hind (1971a:338), "Wood began to be a great treasure in the prairie . . . because we had neglected to take a supply at the last aspen grove we passed, thinking that the bois de vache(dried buffalo dung) would be found in abundance, but the fires had burnt it also, and not even a fragment was to be procured. . . ."

Roe (1972) has suggested that large numbers of bison were crippled or perished from prairie fires. In a journal entry on November 25, 1804, Alexander Henry the Younger noted that ". . . plains burned in every direction and blind buffalo seen every moment wandering about. The poor beasts have all the hair singed off, even the skin in many places is shriveled up and terribly burned. . . . " In one spot we found a whole herd lying dead and dying, blind, lame, singed and roasted buffalo" (Coues 1965: 253). On the other hand, the Reverend Robert T. Rundle indicated that animals killed by fire were also a source of food for aboriginal peoples, "These poor animals, probably under Divine Protection, were the means of saving the lives of some Indians who were driven from the woods by starvation. . . (Dempsey 1977:336).

Prairie fires also caused large stampedes. Sir Cecil Denny described a rampage caused by a prairie fire near Blackfoot Crossing on the Bow River in 1876, "A large number were driven in the blind rush away from the fire right over the cutbank west of our camp, and plunged in a bellowing mass down some hundreds of feet on to the rocky shores of the river. . ."(Denny n.d. from Roe 1972:130). Domestic animals also were threatened, suffered and even perished in the rapidly moving flames (Mullan 1854).

Humans perished too. In May of 1798 William Tomison, chief trader at Fort Edmonton, estimated that no less than eight Indians had burned to death within a period of ten days and, during the disastrous fires of 1812, eleven Blackfoot Indians perished in flames near Paint Creek House on the Vermilion River (Thomas 1977). The only escape from prairie fires for animals and humans alike was to reach a significant body of water or to outrun the fire. For people this meant transportation on horseback. One is led to believe that danger from fires in pre-horse days must have been magnified and to speculate that fire was probably treated with more care.

In addition to killing, prairie fires also destroyed property, were a hindrance to travel and provided inadvertent warnings to hostile Indians of the presence of Europeans (Moore 1972). The destruction of property was of utmost concern to the Europeans involved in the fur trade.

Smaller game animals also were affected. Prairie fires were devastating to ground-nesting birds since they destroyed nests, removed protective cover necessary for constructing new ones, eliminated insect and vegetal food sources, and killed young birds who were unable to flee (Daubenmire 1968). Spring and summer fires were a greater scourge than fall fires owing to the annual reproduction cycles. Fall and winter burning could be regarded as beneficial because it guarded against conflagrations during the following season of nest-building and reproduction. Areas devastated by fire sometimes stood in sharp contrast to surrounding regions where insects flushed by the advancing front of fire provided an unexpected bonus of food for carnivorous birds. Furthermore, optimal habitat for grasshoppers is provided by vegetation recovering from a burn, rather than by freshly burned or by long-unburned vegetation (Daubenmire 1968). Quantitative data on fire ecology in grasslands provided by recent studies, coupled with ethnohistorical observations, clearly shows the enormous impact of grassland fires on the organization of grassland communities. Changes in the plant community, in turn affect insects, birds, rodents, small mammals and ungulates, and ultimately humans.

4.2.4.3 Predators

Ongoing predation by wolves was responsible for the destruction of unknown numbers of big-game animals (Garretson 1938). Large packs of wolves were constant sentries outside fur trade posts such as Carlton House and Fort Edmonton (Harper 1971). When there was a shortage of bison, wolves would prey on horses (Harper 1971) or antelope (DeVoto 1953).

While there are no estimates on the total number of wolves, Roe (1972:157) said ". . . it is quite evident that wolves must have been numerous, for they furnished a living (on the northern range at least) to a tolerably large class of hunters, the 'wolfers'." To gain some idea of their impact, modern studies suggest that wolves kill between one and one and a half large animals each month (Banfield 1974). This means that 10,000 wolves would require between 120,000 and 180,000 animals to sustain them for a year! This is a significant number of animals, especially when one compares it to Ray's (1984) suggestion that the annual provision and robe slaughter consumed between 150,000 and 354,000 bison.

4.2.4.4 Weather

Frequent thunderstorms, snowstorms, windstorms and hailstorms are a feature of the northern plains (Spry 1968; Quaife 1972). Coues' (1965) suggestion that destruction by natural factors probably far outweighed human predation has been debated by Roe (1972) who noted that eyewitness accounts are not always in agreement about the behavior of game animals under these conditions. Some suggested that bison will stampede when surprised by thunder and lightning, others reported that they remain calm. Some observers suggested that huge numbers perished because of the extreme cold or the inability to paw through the frozen crust of snow to reach grass, while others reported that few animals were affected. Certainly there is good evidence that some bison sought shelter in river and stream valleys and the parkland periphery during fall and winter. On the other hand it is clear that others remained on the open plains. Spring snowstorms, though accompanied by mild temperatures, did bring excessive snowfall, that could be a problem for very young calves. In May 1843, Edward Harris reported from the Middle Missouri,"On the 5th of May snow fell here to the depth of two feet, and it is said that thousands of Buffalo calves were killed by it. We are also informed that they are so poor as not to be worth killing" (McDermott 1951:19).

Frison (1982) in drawing an analogy between the exigencies of winter weather for early European settlers in the high plains and Paleo-Indian hunters, has suggested that long periods of deep snow, high winds, and below-zero chill were factors that caused discomfort or even death to humans and in order to cope with these environmental stressors, food was stored. Weather perturbations as well as major climatic episodes have been cited as causal factors in the extinction of Pleistocene megafauna from North America (Butzer 1971).

Violent summer storms often brought high winds, hail and driving rain, that destroyed settlements and grassland and maimed or even killed animals. Isaac Cowie (1913:345) reported that a tornado partially destroyed Fort Qu'Appelle in July 1868 and that "hailstones, ranging in size from that of a trade bullet to that of a hen's egg. . . whitened the ground."

Heavy rainfall had a deleterious effect since it could render meat useless in an hour (Ross 1856). One can imagine that an inopportune storm could potentially destroy a significant portion, if not all, of the spoils of a communal kill. Heat could have the same effect. In September of 1800 near the Pembina River, Alexander Henry the Younger reported that, following several weeks of successful hunting, ". . . we were obliged to throw away great quantities of bear, biche, and buffalo meat, for in hot weather it soon spoils (Coues 1965:100). Henry Boller reported from the Upper Missouri in December 1858 that it was too cold for the Indians to butcher 40 cows killed in a surround (Quaife 1972). In all likelihood, communal kills would have been postponed in the event of storms because of their capacity to ruin meat, but also because they disturbed the bison. And they may have been scheduled to avoid the heat of summer. Judging from the bone beds excavated at communal kills, large numbers of animals went unused. Multiple factors could contribute to such waste, including hot weather, shortage of manpower to process the meat, and inability to control the number of animals killed. Forbis (1969) has suggested the northward facing escarpments where many communal jumps are located may have been intentionally selected to minimize spoilage caused by the sun's heating.

Ethnohistorical sources make frequent reference to the drowning of huge numbers of bison on the major rivers of the Northwestern Plains. Spring thaw of lakes and rivers producing treacherous ice and the buffalo proclivity to cross ice-covered water bodies were apparently contributing factors. On May 18, 1795, John McDonnell recorded ". . .I was taken up the whole day with counting them, and to my surprise, found I had numbered when we put up at night, 7360, drowned and mired along the river and in it. It is true, in one or two places, I went on shore and walked from one carcass to the other, where they lay from three to five files deep" (Masson 1889:294). George Simpson reported in the year 1829 that "I saw as many as ten thousand of their putrid carcases lying mired in a single ford of the Saskatchewan, and contaminating the air for many miles around"(Merk 1968:64). It is suggested that late thawing of ice, if it overlapped calving season, would lead to even greater fatalities.

4.2.4.5 Disease

While it is difficult to document the incidence of disease among humans in prehistoric times, one of the great tragedies in the history of the Americas was depopulation due to the introduction of European maladies (Dollar 1977; Decker 1989; Ray 1990). Epidemics of influenza, scarlet fever, smallpox and measles were destructive and disruptive in the Northwestern Plains. Smallpox was one of the most dreaded diseases and the one to have the greatest impact. The epidemic of 1837-38 first broke out in June 1837 at Fort Union, having been introduced by a traveller aboard an American Fur Company supply boat that originated in St. Louis. It was quickly transmitted to about a 1000 Indians in the vicinity of the post, of which only 150 survived (Denig 1930). The disease continued to spread up the Missouri to Fort McKenzie where 5000 Blackfoot and Piegan fell victim (Ray 1990). The equestrian Assiniboine, Cree, Blood, Blackfoot, Gros Ventre and Piegan Indians furthered the spread of the disease, so that by the fall of 1837 it had reached the Qu'Appelle Valley and Fort Edmonton and Carlton House on the North Saskatchewan. The impact was inconceivable,

> Before the disease burned out, the total death rate soared well into the tens of thousands . . . the balance of power among Indians tribes in the upper West shifted as entire sub-bands disappeared, social structures and customs altered to meet tribal survival needs, and the widespread Upper Missouri trade system was disrupted. In the aftermath many Indian groups whose hunter class had been too severely decimated to maintain food-obtaining capabilities increased their dependence on trade goods and government annuities. Others, more nomadic and less damaged by the disease, moved farther westard into areas where game could still be procured (Dollar 1977:15).

Subsequent epidemics continued throughout the 1800s. During the winter of 1864-65, scarlet fever and measles killed about 1200 natives in Alberta and Saskatchewan (MacGregor 1972). These diseases were significant stressors themselves and disrupted the mechanisms normally marshalled to deal with fluctuating food supplies.

Animal diseases may well have been another source of resource stress. Banfield (1974) has indicated that some preferred game animals are especially prone to recurrent outbreaks of disease. Beaver and muskrats fall victim to tularemia and the former to rabies as well. In his September 14, 1858 journal entry, Hector commented on the paucity of animals along the valley of the North Saskatchewan, " . . . a disease broke out among all the animals, so that they used to find wapiti, moose, and other deer, as well as buffalo, lying dead in numbers. . . " (Spry 1968:326). Martin (1976) has proposed that some wildlife diseases were a factor in the depopulation of the northern plains and subarctic regions. He cites fur trade records that reported the concurrence of epizootics and epidemics. For example, David Thompson noted that while the Indians were being decimated by the smallpox epidemic ". . . the numerous herds of Bison and Deer also disappeared both in the Woods and in the Plains. . ." (Glover 1962:237). In addition he linked epidemics of tularemia among beaver to the outbreak of fever among humans and the spread among humans to use of impure water sources. Sylvatic plague and tularemia have been implicated in wildlife cycles (Elton 1933) and Martin (1976) has pointed out that they are both highly contagious to man. As to whether large numbers of bison could be eliminated by the spread of disease, Roe (1972) has suggested that the evidence is at best contradictory, although why they should be immune when other animals were not is problematical.

4.2.4.6 Wildlife Cycles

Massive die-offs of unrelated species, that are often synchronous throughout the northern latitudes, have been noted for many fur-bearers and their predators (Elton 1933; Keith 1963; Nelson 1973; Martin 1976; Winterhalder 1980b). These population fluctuations are cyclical since populations appear to build up to considerable numbers and high density and then within the matter of months the population crashes. These fluctuations were first noted by 18th and 19th century Hudson's Bay Company employees. In December 1775 and again in February 1781, for example, Mathew Cocking reported that partridges, rabbits, and their predators, lynx, were scarce in the territories north and south of Cumberland House on the Saskatchewan River (Rich 1951, 1952). Members of the Palliser Expedition reported variation in abundance of hares, in the foothills of the

Rockies. Nelson (1973) has graphed Hudson's Bay Company returns of beaver, muskrat, marten and lynx for the Saskatchewan District between the years 1821 and 1891, clearly showing tremendous fluctuation in numbers. While fur returns provide an approximate picture, they are themselves influenced by vacillating prices, unstable socio-economic conditions, trapability of animals and interest and ability of trappers (Winterhalder 1980b). A comparative study by Keith (1963) of local, regional and continental wildlife cycles has gone far to characterize population oscillations among the animals so affected. Keith (1963) has found that snowshoe hares have generally peaked or declined after grouse; that lynx have at times remained common for two to three years after snowshoe hares have become scarce though they ultimately track hare behavior; that colored fox peaks slightly later than lynx, and coyotes and fisher are still later; that mink fluctuations are more closely associated with fluctuations of muskrats than with hares; that snowshoe hare have fluctuated more violently than grouse, and lynx more violently than other furbearers; that the most noticeable die-offs among hares have taken place in late winter or early spring; that cyclic species tend to persist in scattered nuclei of favorable habitat during periodic lows, and to disperse from these into less suitable habitat as populations increase; that mass emigrations associated with population highs have taken place among hares, grouse ptarmigan, lynx, colored fox and marten. These oscillations have been linked to climatic change, sunspot activity, overpopulation causing disease, starvation, physiological imbalance and emigrations and changes in the nutritive quality of certain key plant foods (Keith 1963).

Population oscillations created resource stress not only for animal predators but also for humans as well. If the high point of the cycle corresponded to abundance in big-game animals, it is likely that hunters would bypass the small species in favor of the larger ones because of differences in return for time invested. If, however, there is a shortage of big-game, hunters likely turned to smaller mammals such as hares. Should the scarcity of big-game coincide with abundance of small game, potential resource stress may be averted.

However, if the low point of a number of species, large and small, is contiguous, acute resource stress would result.

4.2.4.7 Ungulates

Because of the overwhelming reliance on bison, any discussion of ungulates as resource stressor must of necessity focus on these animals. The socioecological approach used herein recognizes the great variability of bison behavior and factors affecting bison. It is posited that the regularity of bison behavior across populations as suggested by Frison (1978) and others is unlikely. In a comparative study of feeding, social and reproductive behavior of nine extant buffalo herds, McHugh (1958) found significant differences in a number of factors, including feeding, wariness, and range. In his monumental study of bison, Roe (1972) also reported considerable variation as described by 19th century observers. This led him to state that "This variation must certainly be recognized and is, I believe, hopelessly irreconcilable with any process of facile and uniform generalization" (Roe 1972:153). And Mcdonald (1981) has proposed that behavioral differences underlay the evolutionary history of genus *Bison*..

Second, long-term climatic changes and short-term weather variability influences forage and bison behavior. It is suggested that increased rainfall and cooler temperatures associated with the Little Ice Age (A.D. 1550-1850) may have led to denser vegetation and a corresponding increase in the numbers of herbivores while the drought of the Altithermal (5000 - 2500 B.C.) had the opposite effect. Chinooks, lightning, hailstorms, blizzards, daily temperature shifts, wind and hour of the day may also have influenced bison behavior.

Third, prairie fires were a significant factor affecting the presence or absence of bison as well as premature death.

Fourth, over time hunting pressures reduced the number of animals available for procurement. The territorial distribution of Plains tribes also affected the distribution of animals (Nelson 1973). Bison, wapiti and other wildlife were less numerous in tribally defined localities than in buffer or neutral zones between them. These territorial distributions shifted frequently during the early historic era and affected resource procurement.

Fifth, it is posited that the variability created by climatic and weather perturbations, by animal behavior, by human social, political and ideological systems, and by disease among animals and humans, collectively created resource stress that impacted hunter-gatherer subsistence systems. The massive herds that Palliser (Spry 1968) and Hind (1971a, 1971b) saw in the western Canadian plains were aggregations of smaller herds upon which human predation had wrought significant behavioral and numerical change.

Lastly, the writer suggests that long-term residents of the Plains were familiar with variables in their sub-region to the extent that they were able to predict the likelihood of their occurrence, the impact that they might have, and to gear their subsistence activities to the reality of environmental and social stressors. When prediction failed, suffering ensued.

Despite estimates that some 30 to 60 million bison occupied the Great Plains (Roe 1972) in the early historic period, evidence clearly shows that the distribution of animals was discontinuous. Some areas of the country contained enormous herds, while others were reportedly barren. Areas rich in the resource one year were scarcely inhabited the next. Regions containing large herds in the summer had none the following winter. And ongoing predation led to a gradual decline in numbers during the 19th century, with near extinction by the 1880s. In August 1857 members of the Palliser Expedition had seen no bison on the Pembina River and travelling further west to Moose Mountain they reported, ". . . we were now some hundreds of miles into the buffalo country without having yet seen any" (Spry 1968:127). During that fall they reported from the elbow of the Saskatchewan River "The whole region as far as the eye could reach was covered with buffalo. . . the grass was eaten to the earth, as if the plain had been devastated by locusts" (Spry 1968:146).

4.2.4.8 Cultural Factors

Human activities that drastically reduced the productivity and predictability of game and/or increased patchiness enhanced resource stress. Territorial behavior and conflict among Indian tribes interfered with, or prevented the acquisition of food. Nelson (1973) described how the distribution of animals in the Cypress Hills and surrounding plains was influenced by the territorial distribution of the plains tribes. The game-rich Cypress Hills were a buffer zone between the Blackfoot on the north and the west, the Shoshone and Crow to the south, and the Assiniboine, Gros Ventres and Cree to the east. Palliser also reported a neutral ground of the Blackfeet and Cree near Mortlach, Saskatchewan (Spry 1968). George Dawson (1875:293) in describing the Sweetgrass Hills said, "The country surrounding the Buttes, is said to have been for a long time a neutral ground between various hostile tribes of Indians. That it has been so, is evidenced by the almost complete absence of buffalo bones in their neighborhood, and the rare occurrence of the circles of stones, marking camping places." Animals were profuse in the Cypress Hills until the late 19th century when severe tribal dislocation, the arrival of the Métis, wolfers and whiskey traders and the NWMP eliminated the neutral status of that area. That tribal territories fluctuated considerably in the 18th and 19th centuries is well known. Archaeological evidence also would seem to indicate that buffer zones shifted prehistorically. For example, the Cypress Hills has an unusual number of prehistoric archaeological sites spanning the past 8000 years, that clearly shows that the area did not function as a buffer throughout prehistory. It is suggested that these zones serve to maintain wildlife populations at a high level, that may provide insurance against severe localized resource stress. After disastrous provisioning seasons in 1868-1871, the Cypress Hills were accessed by the Métis who were not concrned with its neutral status. The Métis enjoyed substantial returns in provisions and furs through the rest of that decade. However, complicating the territorial access principle were the movements of bison, vegetational changes, and prairie fires.

The mere act of hunting drove herds of bison from vast geographic areas and led to the rapid decline of solitary ungulates such as moose. Hind (1971a, 1971b) and Palliser (Spry 1968) have suggested that the enormous herds of the 1850s and 1860s were aggregations formed by animals moving north and west to avoid predation by man.

While seldom mentioned in the HRAF sample discussed in Chapter 3, the fear of enemies and political conflict between tribal groups proved to be a concern of aboriginal peoples and fur traders in the northern plains. Matthew Cocking reported that the Assiniboine accompanying him through Saskatchewan country in August 1772 were afraid, having seen horses they suspected might "belong to the Snake Indians with whom they are always at variance" and later, having sighted smoke in the way they intended going, decided not to proceed since it might belong to foes (Burpee 1908:103-04). David Thompson had a similar concern as he and his companions crossed the great plain between the Souris and Missouri Rivers in December 1797 (Wood and Thiessen 1985). In August 1807 along the Souris River, Alexander Henry the Younger reported changes in settlement pattern to accommodate enemy presence: "The proximity to the Sioux country will for many years keep this place stocked with animals, as the Assiniboines and Crees dare not camp here during the summer and remain but a short time in winter" (Coues 1965:408). He also reported that in 1808 the upper reaches of the Battle River were dangerous due to the presence of Slave Indians and the lower part because of the Assiniboine Indians (Coues 1965); consequently these areas were avoided despite the need for the resources they contained. John Palliser commented in 1848, "As a general rule, the more dangerous the country the greater the probability of finding abundance of game. . . this part of the country is so evidently the line of direction between the three hostile tribes, that none of them dare venture into it for hunting purposes, except when driven to desperation by hunger" (Palliser 1969:265). Boller (Quaife 1972) and Palliser (Spry 1968) both observed situations where plains tribes in avoiding enemies and enemy territory opened themselves up to starvation. Territorial divisions affected fur trapping and provisioning activities at

Rocky Mountain House and Acton House because conflicts amongst the Piegan and Asiniboine and others led to repreated closures of the posts and they ultimately failed in their purpose (Dempsey 1973).

Another human activity that contributed to resource stress and the eventual demise of the bison was waste. Roe (1972) has noted that both Indians and Europeans were wasteful. Whereas the Indians prized buffalo tongues and unborn calves, the Europeans were interested in sport hunting, trophies, tongues, marrow bones, and hides. Many ethnohistorical references to aboriginal waste involved communal procurement technology. Peter Fidler on January 14, 1793 commented on the stench emanating from 250 rotting carcasses in a pound near Pekisko, Alberta (Haig 1991). Alexander Henry the Younger made a similar observation in December 1809 when the Blackfoot repeatedly drove buffalo herds into a pound: "the bulls were mostly entire, none but good cows having been cut up" (Coues 1965:577). In 1858, Henry Youle Hind (1971a) witnessed the Crees at Sandy Hills killing 480 buffalo in ten days, leaving enormous numbers to rot in the July sun. These instances of waste were tied to an ideological system that led people to believe that future hunts would be in jeopardy if any animals escaped from the pound, so that all driven in were dispatched (Moberly 1929). On the other hand Europeans removed only the tongues and sometimes the marrow bones when bison proved lean, as reported by Lewis and Clark (Thwaites 1959a, 1959b). Most European kills were solitary animals or at most small herds killed by running on horseback or from boats. Roe (1972) has suggested that the seemingly endless numbers of animals on the Plains precluded the development of a conservation philosophy. On the other hand, aboriginal people made use of many animals killed by drowning or in prairie fires, but which were still edible. No one can doubt that overhunting and waste on an enormous scale contributed to a steady decrease in the animal populations in the Northwestern Plains.

The European presence brought a trade item, alcohol, that caused a myriad of social problems and that interfered with provisioning activities. While wines and liquor were used by the Hudson's Bay Company in trade, it was not until competition between the various fur trading companies became intense that it wrecked havoc with the health, economic pursuits, and social and political alliances of the aboriginal peoples. With the arrival of the Missouri River whiskey traders the problem became even more acute. Alexander Henry the Younger's account from the Red, Pembina, Qu'Appelle, and North Saskatchewan Rivers of 1800-1811 (Coues 1965) and Chardon's journal covering his experiences as a fur trader among the Mandans, Gros Ventres and their neighbors on the Upper Missouri between 1834 and 1839 (Abel 1932) provide daily documentation. As the 19th century progressed and competition became more fierce the problem grew. Wishart (1979:69) has suggested that the use of alcohol may have damaged Indian societies and that in certain areas especially during times of competition, alcohol was the most important trade good, ". . . so violent is the attachment to it that he who gives most is sure to obtain the furs, while should any attempt be made to trade without it he is sure to lose ground to an antagonist."

4.2.4.9 Other Stressors

Other stressors that affected the distribution or hastened the demise of bison were quicksand and water shortages. Single animals usually were entrapped by quicksand and bogs though Roe (1972) reported half a herd of 4000 perished crossing the Platte River. It seems reasonable to expect resource stress when bison are out on the open plains far away from water bodies (Roe 1972) and humans are forced to remain in proximity to water. While on his Mandan tour of 1806, Alexander Henry the Younger reported that some people lost their lives for lack of water (Coues 1965).

Technological innovations introduced by the Europeans brought a new dimension to provisioning problems. Guns failed; ammunition ran out; horses were unable to run bison because of malnutrition; large watercraft were useless when water levels dropped or ice formed; and beaver could not be trapped when water levels were high. Entries in the Rocky Mountain House journal for late summer and fall 1868 mention a lack of ammunition as the cause of starvation among the nearby Stonies and as a contributing factor in a severe shortage of food that forced post residents to snare rabbits (HBCA B.184/a/5). Both trading establishments and Indian villages, that relied on horses for running buffalo, frequently found that the cold and malnourishment extending over the winter rendered their stock incapable of even overtaking buffalo who were similarly affected, a condition lasting well into the following spring (Quaife 1972). Since many horses were maintained on poplar bark and branches over the winter, the destruction of trees fostered by this practice and the need for firewood had a serious impact on settlements.

The usefulness of water routes varied seasonally. William Tomison was prevented from sending provisions and furs from Fort Edmonton to Buckingham House in April 1796 due to excessively low water levels on the North Saskatchewan River (Johnson 1967). Boat traffic was impossible between early November and early April due to ice (Hind 1971a) and dog sleds could only ply the river routes when ice was safe, usually in December through February. The Assiniboine and halfbreeds trading at Rocky Mountain House in the fall of 1830 brought few beaver to trade, owing to high water levels in the river, that prevented the setting of traps (HBCA B.184/a/3).

Another stressor that was linked to season, breeding cycle, and quality of forage was the extent of fat deposits on game animals. Virtually all individuals who recorded their experiences on the northern plains in the late 18th and 19th centuries exclaimed when they killed or otherwise acquired fat meat and demurred when it was lean (Burpee 1908; Abel 1932; Spry 1968; Hewitt 1970; Harper 1971; Haig 1991). Those animals yielding the best fat meat were bison, beaver, and Rocky Mountain sheep. Deer, moose and wapiti were lesser sources and subject to greater fluctuation in the amount of fat. Audubon (1960b) reported that it was rare to find a fat antelope. Fat was not only desired but essential in the production of pemmican, and for this reason, animals that were not fat were often left to the wolves.

4.3 Conclusions

The Northwestern Plains grassland and parkland habitats offered many resources attractive to hunting and gathering peoples. If there is one overriding characteristic of the resource structure of this area; however it is variability. There was variability in the climate, in the weather and in the vegetation and this in turn altered the productivity and predictability of the big-game animals, the carnivores, and the smaller mammals. Residents be they aboriginal people equipped with bows and arrows and a highly organized communal hunting strategy or Europeans outfitted with guns and horses had to face environmental vicissitudes. The major resource stressors included drought, grassland fires, predators, storms, floods, extreme cold, extreme heat, human and animal diseases, wildlife cycles, technology failure, and cultural behavior. This summary of resource structure and resource stressors provides a foundation for a number of observations.

First, the Northwestern Plains resource structure provides an instructive lesson about carrying capacity. This is an environment where millions of big game animals were to be found. Under similar conditions some prehistoric cultures developed burgeoning sedentism, dense populations and incipient social complexity as, for example, during the Upper Paleolithic of the Central Russian Plains (Soffer 1985). But on the northern plains it was difficult for either Indians or Europeans to maintain large numbers of people for extended periods of time in any one place. The resource structure of the Northwestern Plains clearly shows the inadequacy of carrying capacity models that use total biomass as currency. The timing of productivity, as well as patchiness and predictability, are fundamental to understanding settlement patterns and demographic variables.

Second, bison were the most highly valued of the game animals. They provided food, clothing, shelter, and tools to aboriginal peoples and food and valuable hides to the Europeans. For both, its size and behavioral features satisified the desire for a challenging hunting experience. Very simply, resource stress in the northern plains meant a shortage of bison.

Third, the Northwestern Plains was not an area of unlimited resources despite the number of big-game animals. One of the most important features of the environment was the rapidity with that geographical regions became devoid of game, whether through hunting pressures, prairie fires, localized drought, or disease and wildlife cycles.

Fourth, evidence suggests that the resource structure of the early historic period was similar to that in prehistoric times (Vance 1991); thus resource stressors of the historic period, also would have operated in the past. For example, fluctuation in effective precipitation and its effect on vegetation are presently correlated to variation in the total biomass of specific animal species and must be considered for prehistoric times as well.

Fifth, a number of individual stressors have been identified and it is likely that in combination they had an even greater impact on the Plains inhabitants. For example, prairie fires coupled with drought and overgrazing by bison led to severe shortages of vegetation, as noted by Charles MacKenzie near the Missouri River: "The first day we travelled until dark in hopes of falling in with a good spot of grass for our horses - but the Plains having been burnt in the fall and covered with Buffaloes all winter, the whole Country was as bare as the palm of the hand- Scarcely a Sprig of grass was to be Seen in any direction" (Wood and Thiessen 1985:266).

Sixth, these stressors led to a multiplicity of responses.

In the following chapter the subsistence pursuits, population changes, resource stress and coping strategies of aboriginal peoples and Eurocanadians and Euroamericans who resided in the Northwestern Plains in the late 18th and 19th centuries are summarized and evaluated.

CHAPTER 5

SUBSISTENCE AND RESOURCE STRESS IN THE EARLY HISTORIC PERIOD

5.1 Introduction

> Thus European travellers in North America followed the example of the Indians by making the flesh of the American bison the staple article of their diet (Merriman 1926:78).
>
> Christmas comes but once a year, and when it comes it brings good cheer. But not here! As everything seems the same, No New faces, No News, and worst of all **No Cattle**
> - François Auguste Chardon, December 25, 1834 (Abel 1932:18).
>
> The buffalo melted away like snow before a summer's sun (Dodge 1884:294).

The historic period in the northern plains began in the 17th century when the British-controlled Hudson's Bay Company, with North American headquarters on Hudson's Bay, first explored the economic potential and second, established trading posts in the interior of North America. It progressed in the 18th century as representatives of French Canadian and Scottish fur trading interests in Montreal entered the Great Plains via the Great Lakes. By the early 19th century American traders had penetrated the Upper Missouri River as well. These traders, plus the artists, missionaries, scientists, adventurers, big-game hunters and others who followed, shared the area with a dozen tribes of Indians. Intermarriage between European men and Indian women created another ethnic group, the Métis. Collectively the Indians, Métis and Europeans had in common a reliance on the buffalo. In addition, the Europeans complemented their diet with horticultural and agricultural products of their own as well as refined foods imported from Europe. They and other Indian tribes had access to native corn, beans and squash in the Middle and Upper Missouri regions. All residents experienced the challenges of securing a continuous food supply for themselves as well as their domestic animals. The traders had an additional burden, the need to redirect surplus food to the boreal forest fur trade, as well as for export to European markets.

This chapter examines early historic subsistence strategies and resource stressors in four regions of the northern plains- the North Saskatchewan, the South Saskatchewan, the Missouri and the Red/Assiniboine. Travellers' journals (eg. Palliser 1969) plus the post journals, district reports, correspondence and account books of the Hudson's Bay Company (Tables 13,14 and Figure 8) and ethnographies (eg. Lowie 1935; Mandelbaum 1979) provide the data base on subsistence pursuits (Tables 19-34 and Figure 9), resource stressors (Tables 35-49 and Figures 10-14), and coping strategies (Table 50).

5.2 Occupants of the Northern Plains

Four broad categories of people hunted in the early historic northern plains: the Eurocanadians, the Euroamericans, Métis and Indians. Within each of these categories were found multiple divisions distinguished by language and/or customs, country of origin, and ecological adaptation.

Until the early 1800s **Eurocanadians** were almost exclusively represented by men involved in the fur trade as employees of the Hudson's Bay Company, the North West Company, the XY Company or as free traders, and their numbers were small, probably only a few thousand. The establishment of the Red River Settlement in 1811 started a flow of European immigrants, that accelerated as time passed (Pritchett 1942; Murray 1967).

The **Euroamericans** entered the northern plains via the Missouri River beginning in the early 1800s and included members of government expeditions, fur traders, adventurers, artists and researchers. The efficiency of steamboat travel made this area more accessible than the Canadian plains; nevertheless, numbers of Euroamericans remained low until the second half of the 19th century.

The greatest diversity was found among the many **Indian** tribes residing in the northern plains as well as those who lived outside but made excursions into the region. Plains residents included the Blood, Piegan, Blackfoot, Gros Ventre, Assiniboin, Plains Cree, Plains Ojibwa, Crow, Mandan, Hidatsa, Arikara, Sarsi, and Sioux. Hunting and gathering prevailed among all groups and in addition, the Mandan, Hidatsa and Arikara practiced corn horticulture. Small groups of Pawnee (Coues 1965), Kootenay (Johnson 1967; Haig 1991), Flathead (Haig (1991), and Mohawk (Johnson 1967; Spry 1968) also entered the region for temporary economic pursuits.

The **Métis** emerged as a distinct and recognizable ethnic group initially from the union of native women and French Canadian men engaged in the fur trade and later as the mixed-blood offspring of English and Scottish traders (Olmsted 1983, Burley et al 1992). Cree, Saulteaux and other Indian tribes were among the maternal ancestries. The Métis were involved in a number of economic activities associated with the fur trade and the settlement of western Canada. Some were employed by the Hudson's Bay Company to transport water and freight overland; others were independent hunters who provisioned the fur trade with buffalo products; many engaged in farming using the long lot land tenure system of Quebec (Burley et al 1992).

Aboriginal population estimates from travellers' accounts and post journals are tabulated in Table 16. The numerical estimates by traders and others reveal a dramatic decline in native population fostered by the spread of contagious diseases, intertribal conflict, and, ultimately, destruction of the hunting and gathering subsistence system. In 1805 Alexander Henry the Younger estimated the population of the Forts des Prairies on the North Saskatchewan River at 64,361 (Coues 1965). By 1841-42 Governor George Simpson proposed the numbers in that region to be 16, 780 (Dempsey 1990). William McGillivray's 1809 estimate of 24,360 for the Blackfoot Confederacy and the Gros Ventres (Milloy 1988) was reduced to 7,600 in John Rowand's 1859 estimate (Hind 1971b). Alexander Henry the Younger estimated that 5,470 Indians occupied the Upper

Red River Department in 1805 (Coues 1965). In 1854 Edwin Denig (1930) suggested that smallpox and other diseases reduced the Arikara by 1/5, the Crows by 1/2, the Mandan by 3/4, and the Sioux by 1/3. If one assumes that these groups have not been counted twice, there were approximately 60,000 Indians in the four sub-regions of the northern plains in 1850. One hundred years earlier, before the recurrent epidemics, the population was likely substantially larger. Estimates of the total number of Métis are equally difficult to access. It is known that in the fall of 1820, 620 hunters, 650 women and 360 children trekked west from Red River for the buffalo hunt (Merriman 1926).

It is also difficult to estimate the total number of Europeans and their families who resided in the area. It is known that about 1798, the North West Company employed 1,276 men of whom 355 were employed in the work of transportation between Montreal and Fort William and the rest at trading posts in the North West (Merriman 1926). In 1837 the Hudson's Bay Company had a total staff of over 1,500 but the proportion stationed in the northern plains is not available (Merriman 1926). Table 17 furnishes a summary of the number of servants and estimates of the number of family members at selected settlements in the 4 sub-regions. Employee numbers have been derived largely from servant's lists in the account books of the Hudson's Bay Company posts. Seldom are the employee's dependants mentioned and, in order to estimate their numbers, a formula proposed by Wright (1981) was used. This equation suggested that 75% of the men employed fulltime at a post had wives and 50% of the women had 3 children. It is likely that the women and children at these posts were of Métis or Indian ancestry since prior to the establishment of the Red River settlement European women were virtually absent in the northern plains, and their numbers remained small for some time after (Van Kirk 1980)

Population estimates are provided for seven North Saskatchewan River settlements- Carlton House, Fort Edmonton, Jasper House, Fort des Prairies, New White Earth House, Rocky Mountain House and Fort Vermilion; two South Saskatchewan River settlements- Chesterfield House and Piegan Post; three Missouri River settlements-

Fort Clark, Fort MacKenzie and Fort Union; and, seven Red/Assiniboine River settlements- Fort Alexandria, Brandon House, Lower Red River, Pembina River Post, Fort Qu'Appelle, Red River Settlement and Upper Red River (Table 17). While the data are sparse, it is likely that company servants and their dependents plus the Red River Settlers may have numbered about 8,000 to 10,000 individuals in the 1850s.

5.3 Provisioning Activities

Faced with the need to provision themselves, the aforementioned groups were largely sustained by products of the hunt. Additional subsistence activities included horticulture, agriculture, fishing, birding, and the consumption of imported food. The following discussion focuses largely upon the subsistence activities of the European occupants since detailed quantitative data are not available for the other groups.

The Europeans who penetrated the country west of Lake Superior and Hudson's Bay were faced with the problem of provisioning their employees and their dependents at trading posts , as well as the brigades responsible for transporting goods between establishments. Traders who wintered at inland posts were expected to support themselves off the land. The brigades on the move had to take supplies with them and since space was at a premium, food needed to be concentrated and non-perishable. The provisioning problem was further exacerbated when they expanded into the Athabasca and, Mackenzie River drainage basins because the resource base of the boreal forest environment was inadequate for the task and the distances made importation of foodstuffs impractical. Furthermore, brigades simply could not take the time to hunt and gather food because of the short season for river transportation. These problems were solved by borrowing from the Indian way of life: the Indian canoe for transportation and the American bison for provisions.

5.3.1 Country Produce

Beginning in 1691 with Henry Kelsey and lasting to the early 1880s, the journals of almost every traveller to the northern plains, extolled the merits of buffalo products. A byproduct of the buffalo, pemmican, became the cornerstone of the victualling system of the fur trade.

The distribution of bison was coterminus with the North American grasslands and the European traders quickly realized that the area could serve as "the pantry for the western fur trade" (Ray 1984:263). Rich (1967) has reported that the North West Company was the first to realize the merits of buffalo meat and pemmican, with the Hudson's Bay Company following soon after.

Between 1779 and 1821 the Hudson's Bay Company and the North West Company constructed networks of "provision posts" on the North and South Saskatchewan Rivers and the Red, Assiniboine and Qu'Appelle Rivers, that were within proximity seasonally, if not year-round, to the great herds. Provision posts on the Red and Assiniboine Rivers existed almost exclusively to produce or trade pemmican for the sustenance of the canoe brigades, while the Saskatchewan posts collected furs in addition to producing pemmican. Table 18 provides a summary of the posts where provisioning was an integral activity. The key locations on the Saskatchewan River system were Fort Edmonton, Fort Pitt, Carlton House, Chesterfield House, Manchester House, South Branch House, and Fort à la Corne. Provisions gathered here were forwarded to Cumberland House for use by the Athabasca-bound brigades. Portage la Prairie, Brandon House, Fort Ellice, Fort Qu'Appelle, and Touchwood Hills Post were important provision posts on the Red/Assiniboine River system. North West company provisions gathered in southern Manitoba were shipped to Fort Bas de la Rivière on the lower Winnipeg River and were used by canoe brigades travelling between Cumberland and the Rainy Lakes-Fort William area. Hudson's Bay Company provisions from southern Manitoba were shipped to Norway House for use by brigades travelling to York Factory. Hudson's Bay Company account books also indicate that considerable quantities of provisions were transferred between posts as the need arose(eg. HBCA B.60/d/110). Evidence also shows that post functions changed through time. Prior to the 1820s, posts on the Saskatchewan had done a flourishing fur trade business, but as the furs became scarce, provisioning became the *raison d' être*. In contrast, the traders on the Upper Missouri were not interested in provisions beyond their immediate needs. It was furs in the early 19th century that drew them to the region and, when the furs declined, markets for bison robes served to maintain their presence in the area.

At provisioning posts great quantities of country produce were prepared, stored and ultimately transported to other posts, depots, and districts. Country produce listed in the account books of the Hudson's Bay Company included dried meat, beat meat, pounded meat, fresh meat, fat, backfats, tongues, but, most important, pemmican (eg. HBCA B.60/d/2a). Food supplies for post residents also included fresh buffalo meat, garden produce, game such as deer, moose, and rabbits, plus whitefish , ducks, partridges and geese. When food shortages occurred, the diet expanded to include such animals as muskrat, beaver, lynx, wolves and domestic species.

"Pemmican was to the fur trade what blood was to Dracula"(Wright 1981:12). It was used to feed the York boat brigades, the Red River Cart and dog sled drivers; residents of posts when fresh meat was in short supply; and others travelling not only in the plains but into the parklands, the boreal forest, and westward over the Rockies. The Red River Settlement, particularly in the early days, was very dependent on buffalo products as well. It was a highly nutritious food relative to weight; it had long lasting preservation properties; and it was easy to transport, being both light weight and compact.

The practice of making pemmican was borrowed from the aboriginal plains peoples who likely developed this stored food as a means of coping with a food supply that was seasonally productive but unpredictable. While buffalo meat was most commonly used, pemmican made from the flesh of goat, mountain sheep, wapiti, deer, antelope and fish also was produced (Spry 1968; The Earl of Southesk 1969; Mandelbaum 1979).

Pemmican and dried and beat meat were produced at hunting camps as well as at the posts. Once the hunters had killed the buffalo, women, who had accompanied the hunting parties, commenced slicing, drying, and pounding meat; melting fat; and mixing and packing the pemmican into bags. Considerable supplies of dried or beat meat acquired through trade accumulated at the post and the residents would melt fat, tallow and marrow to mix with the meat. Women and children played a considerable role in pemmican production, with women also spending considerable time manufacturing the rawhide bags in which the food was stored. Pemmican production did occur year-round, but especially large amounts were produced in the spring after the fur trade had declined and before the boats were to leave for the provisioning depots with provisions for the brigades.

The daily journals from provisioning posts indicate that country produce was acquired in at least four ways. First, in addition to furs, bladders filled with grease, dried meat, pounded meat, fresh meat and pemmican were obtained in trade with Indians. The 1834 account book for Piegan Post shows that the Blackfoot, Bloods and Sarcees traded four bags of pemmican, 2,576 pounds of grease, 28 bags of dried meat and 498 buffalo tongues (HBCA B.21/d/2). Indians also brought gifts of food. On November 2, 1804 Captain Meriwether Lewis returned from the Mandan villages with "a present of 11 bushels of Corn. . ." (Thwaites1959a:216).

Second, post servants, in addition to their other duties, often hunted, fished, trapped and made provisions. These activities occurred under the direction of the post factor as well as on their own. On July 30, 1795, at Fort Edmonton, William Tomison noted that "One man working a net, two men attending the nets, caught four sturgeon. . ." (Johnson 1967:3). Henry Fisher, clerk at Rocky Mountain House in February 1829, reported that on the 12th he sent two men to look for buffalo and on the 15th they returned with four animals (HBCA B.184/a/1). These men were not designated hunters. Post factors occasionally hunted for sport or when necessity demanded it. On May 4, 1831 François Auguste Chardon, accompanied by two men and four pack horses, killed four cows on the hills behind Fort Clark (Abel 1932). When food shortages threatened, more and more servants were expected to assist in procuring food for the post as well as for shipment elsewhere.

Third, servants' lists clearly show that some individuals were engaged explicity to hunt. The 1822/23 summary of 108 servants who formed the Bow River Trading Expedition to Chesterfield House lists three hunters, Michelle Bourassa, Amable Duplisis and Joseph La Framboise, in addition to Charles Hoole, who served as both a mid-man on the brigade and hunter (HBCA B.34/d/1). Hunting parties were sent onto the plains to procure meat and make provisions. Freemen who brought furs and provisions to posts for trade were often hired as hunters, especially when food shortages threatened (HBCA B.184/a/3). When the political situation was hostile, hunters would come together in temporary camps for protection. Hunters often were required to travel as far as 250 miles if the buffalo were "off on the plains." They established hunting camps and when sufficient quantities had been secured, sent word to the post where arrangements for transportation of the produce were made. The intermittent movement of food was particularly characteristic of posts like Rocky Mountain House that experienced chronic supply problems. As the game was depleted, the hunting camps shifted to new locales. At the Upper Missouri posts, Denig (1930) has estimated that one-half of the provisions consumed were supplied by post hunters.

Lastly, when supplies were running low, posts would rely on Indians from far away who were directed to hunt for a post. In July 1802, Daniel Harmon sent 7 men in different directions to find natives to hunt since animals were fat and this was the best time of year to make provisions (Lamb 1957). The provisioning situation at Rocky Mountain House was such that post hunters could not contribute all the provisions required by fort inhabitants, let alone provisions for the transportation system. Entries in the Rocky Mountain House journal for the winter of 1830-31 clearly show the dependence of that post on the Piegan. Daily entries for November, December, and January express concern that the Piegan have not yet arrived, a situation reversed on January 27th when they came in with furs and provisions (HBCA B.184/a/3). In January 1837, James Harriott reported that a band of Stone Indians was supplying Rocky Mountain House with large amounts of meat, placing 10,000 pounds in the ice-house on January 16th, and a further 4,300 pounds on January 21st. An equal amount was left behind because there were no horses to transport the meat and without snow, the dogs could not be used (HBCA B.184/a/4). The Indians of the Upper Missouri also helped to provision posts in their territory. Denig (1930) estimated that in 1831 half of the meat consumed at posts was supplied by Indians.

Throughout a post's history there was variation in the amount of country produce procured. For the fur trade era, it is clear that the amount of pemmican produced increased as the fur trade expanded(Wright 1981) and as the population increased. Based on population censuses from Red River, Ray (1984) has computed that buffalo meat consumption at this settlement grew from between 2,200,000 to 4,400,000 pounds per year in 1831 to between 7,500,000 and 15,000,000 pounds per year in 1870.

Provisioning demands were linked to prescribed daily rations and to the number of people who had to be supported. Because they are related to manpower, one can determine the years of growth and years of decline of the provision industry in different parts of the country. Table 19 summarizes ration formulae from several ethnohistorical sources. It is clear that the provisioning demands of the post servants and their dependents were considerable. In Table 20 the writer has taken the population details provided in Table 17 and the Moberly's rationing formula (from Table 19) and estimated the required daily and yearly poundage, as well as the number of buffalo that would be required to fulfill these requirements. While at Rocky Mountain House in 1854-55, Henry Moberly reported that rations were weighed out each evening to the postmasters and servants of the prairie posts. Each man received 8 pounds of fresh meat, each woman 4 pounds and children, regardless of age, 2 pounds (Moberly 1929). Pemmican, dried meat, whitefish, ducks, rabbits, and prairie chickens were similarly rationed (Table 19 and Cowie 1913). Examination of provisional requirements for Hudson's Bay Company employees and their dependants at

Fort Edmonton between 1856 and 1872 reveals that over 2000 head of buffalo would have been required annually to satisfy the fresh meat rations owed company employees. To assemble a surplus of pemmican for export to the brigades and for other markets required enormous numbers of animals since a single animal yielded an average of only about 55 pounds of pemmican and 45 pounds of dried meat (Merriman 1926).

A comparison of provision requirements at Brandon House, Carlton House and Fort Edmonton indicates that the former had its greatest growth in the first quarter of the 19th century while Carlton House experienced growth in the second quarter and Fort Edmonton in the third quarter (Table 20). These changes were due largely to the distribution and productivity of fur-bearing animals and bison. In 1836 and 1837 Carlton House was the principal point at which the food products of the bison were secured and prepared as indicated by the number of employees and their provisioning requirements. As the 19th century progressed, the geographic range of bison shrank, though their productivity within this range remained practically undiminished (Spry 1968; Hind 1971b). The peak of activity at Fort Edmonton from 1856 to 1872 marks the move westward and amalgamation of bison into very large herds. The plunge in fur trade employment in the late 1870s corresponds to the demise of this last great herd. In the Upper Missouri a similar pattern occurred. The fur trade expanded, so that by 1833 five hundred men were employed by the American Fur Company at trading posts on the Upper Missouri (Wishart 1979). However, the proliferation of posts and intensification of trapping and hunting placed stress on the resource base and the animals whose skins were valuable in the fur trade diminished greatly. When they were exhausted, the emphasis switched to the robe trade, that was flourishing by the 1830s. The resultant pressure on bison herds saw them disappear from the lands east of the Missouri River by the 1840s and the years of chronic food shortages, documented by Chardon (Abel 1932) and others, began. The American Fur Company responded by moving up river, establishing Fort McKenzie at the mouth of the Marias River. This area too was eventually trapped and hunted out.

In addition to the estimates presented in Table 20, several sources give the amounts of all foodstuffs expended in a particular year at a single post. These are summarized in Table 21. Alexander Henry the Younger reported that large quantities of fish, grease and potatoes plus small quantities of bird, deer and bear meat added to 63,000 pounds of buffalo meat were consumed by 27 persons and 45 dogs resident at the Pembina River Post from September 1, 1807 to June 1, 1808 (Coues 1965). From September 1822 to April 1823, the 143 members of the Bow River Trading Expedition consumed 650 animals or nearly 200, 000 pounds of buffalo meat at Chesterfield House in addition to 1200 pounds of flour and smaller quantities of other foods (HBCA B.34/d/1).

There are other indications that great quantities of game were killed. For the seasons 1800-08, inclusive, the North West Company procured about 61 tons of bison products from the Lower Red River Department and at least 200 tons from the Saskatchewan district (Merriman 1926). The Carlton House journal for January 16, 1833 mentioned that 2,650 fish, weighing 6,353 pounds, were brought to the fort (from Wright 1981). By the 1840s, more than 90,000 robes a year were shippped from the Upper Missouri (Wishart 1979).

Ray (1984) undertook the difficult task of attempting to quantify the number of bison killed in various decades by the Indians, the Métis, the Hudson's Bay Company, the North West Company, the Missouri traders and others. He has suggested that 100,000 to 300,000 cows would have been needed to provision the Hudson's Bay Company, the Red River Settlement and the Indians, taking into consideration food needs and the extensive waste. Ray is of the opinion that if Roe's (1972) estimate of an 18 percent/per year population increase for bison is correct then the destruction of animals for food would have had little impact on the overall population of bison. However, he further quantified the number required to sustain the expanding robe trade and found that the robe trade on the Missouri, and among the Indians, Métis and traders in Canada would have doubled the winter slaughter of buffalo from just under 56,000 to over 110,000 animals.

Combining the summer hunt, annual provision and robe slaughter, Ray (1984:276) has suggested that "the annual provision and robe slaughter probably ranged between 150,000 (assuming little wastage in the provision hunts) to as much as 354,000 (if two-thirds of the provision kill was wasted and no robes were obtained from the carcasses).

Attempts at reconstruction of annual bison kills must consider Indian and Métis requirements, waste, non-human predator kills, food for dogs, and resource stressors since human demands for meat and robes in all likelihood constituted less than 50% of animals slain and perhaps as little as 20%. Certainly the requirements of the thousands of Indian residents, and later the Métis, were considerably greater than the European needs since products of bison furnished not only food but also clothing, shelter, furnishings, and tools for these people. Denig (1930) has estimated that one-quarter of the total bison kill on the Missouri went to the fur trade and three-quarters to supply Indian needs. In addition, ethnohistorical sources clearly note the large numbers of domestic dogs resident in Indian villages and their importance for transportation by Indians and Europeans alike. These animals had to be fed meat. And, as noted in Chapter 4, carnivores such as wolves and grizzlies also were present in huge numbers and were a factor in bison depopulation.

A byproduct of provisioning activities, waste, must be considered when reviewing the impact of humans on fauna. Table 22 provides a summary of references to waste as it occurred between 1754 and 1867. This waste involved individual animals as well as herds; it was far more prevalent when bulls were killed than cows; it expanded during those seasons of the year when animals were lean; and it occurred independently of the motivation for hunting. That is, whether or not meat or robes were being sought, waste occurred. As Ray (1984) has suggested, the procurement of robes versus meat requires different strategies and it was unlikely that hunters intent on acquiring provisions for the fur trade had the manpower or the time to process robes. Later when the robes became economically important, it is likely that the motivation to make more than minimal use of the meat of animals taken for robes was lacking. Women were involved in the manufacture of pemmican and the processing of robes and their numbers were simply not large enough to handle both, if Denig (1930) is correct in his estimation that each woman produced only 18 to 25 dressed hides in a winter. A visitor to the central plains in the 1840s through the 1870s, Colonel Richard Irving Dodge (1884), suggested that for each hide traded, 4 to 5 buffalo died.

No one racial or ethnic group was more extravagant than another (Table 22). Observations by fur trade personnel and visitors mentioned that many Indian bands settled near a pound in winter and subsisted on those animals that they were able to corral and kill. These same sources report that large numbers of animals were either never used or processed minimally. For example, on January 14,1793 Peter Fidler reported that ". . . the Pound being quite full laying 5 or 6 deep one upon the other, all thro which in the whole was above 250 Buffalo. . . there was an intollerable stench of the great number of putrified carcasses. . ." (Haig 1991:58-59). In May 1805, the Lewis and Clark Expedition saw at least 100 mangled buffalo carcasses driven over a 120' bluff by the Indians on the Missouri River between the Yellowstone and the Musselshell (Thwaites 1959b). While on the South Branch of the Saskatchewan in 1857, Henry Youle Hind (1971) reported seeing 240 dead and rotting carcasses in a pound. Communal bison pounding and jumping are capable of providing great quantities of provisions, but they are also extravagant. This extravagance has provided us with archaeological sites such as Olsen Chubbock in Colorado (Wheat 1972) and Head-Smashed-In in Alberta (Brink and Dawe 1989). The organizational behavior and technological expertise that permitted communal hunting are considerable achievements but they were not developed to the extent that all the foods procured could be processed.

The waste by European visitors was also legend. The Earl of Southesk crossed the plains to the Rockies in 1859 in order to hunt big game to secure the requisite trophies. After killing a herd of bighorn sheep simply for their heads, he recorded in his journal: "too much slaughter and conscience rather reproached me" (The Earl of Southesk 1969:216);

nevertheless, he continued the wanton destruction. While visiting the Mandan Villages, Charles McKenzie reported that his party killed whole herds of buffalo but came back only with the tongues (Wood and Thiessen 1985). The trip up the Missouri River by the Lewis and Clark Expedition in 1804-06 led to massive waste of game animals on a daily basis (Thwaites 1959a, 1959b, 1959c). In June 1805 expedition members killed seven deer, just for their skins; in July, elk for skins and bighorns for skins and skeletons; and in August, many deer, elk, and buffalo for choice parts (Thwaites 1959b).

It is instructive to consider the context in which the waste occurred as it bears on the resource structure of the area, the organization of the resident groups, and their technological expertise. Waste was a byproduct of a number of interacting forces. First, the preferred game animal is large-bodied and, when coupled with the heat of a typical plains spring, summer or fall, a time-consuming preservation technology, and an inefficient transportation system, extensive processing of animals was out of the question. For those in transit, it was impossible to process the animals when under time constraints. Post hunters found it impractical to transport all of the animal back to the settlements for processing and consumption. Cowie (1913) reported that tongues, bosses, ribs and fore and hind quarters were retrieved while the head, neck, shanks and insides were discarded. For the Indians an ethos demanding that no animals who entered the pound escape, forced the killing of far more animals than were needed or could be processed (Moberly 1929).

Since this dissertation is concerned with resource procurement and processing, it is worthwhile examining the importance of subsistence-related activities in daily life. Daily journals provide a useful body of subsistence- related data, that can be extracted and quantified to give some understanding of its importance. Table 23 provides numerical and frequency distributions of days spent in subsistence related activities relative to the total number of days for which records were kept. Information also includes the identity of the observer; the dates when the observations commenced and when they were completed; the geographic location; the total number of days for which records were made; the number of days when subsistence-related activities were performed; the percentage of days with subsistence-related activities; and references. Activities described in daily journals that qualify as subsistence-related include: killing game animals; catching fish; collecting wild plant foods; construction and repairs to subsistence technology such as nets, garden plots, ice houses, victual sheds, pounds and jumps; butchering animals previously dispatched; extracting salt to preserve meat; feasting; gardening; haying; and trade in food. The observations were divided into three classes reflecting the mobility of the observer and his colleagues. The first set of observations are those made by individuals in transit between different locales, for example, Henry Kelsey who headed southwest from the mouth of the Saskatchewan River into the plains in 1691. The second category concerns individuals who were both sedentary and mobile. This included Fort Edmonton factors, William Tomison, George Sutherland, and James Bird, who travelled from Cumberland to Fort Edmonton, remained at the latter for a number of months, then travelled back to Cumberland. The final grouping consists of observations made while the journalist was wholly sedentary- Archibald McLeod at Fort Alexandria; Alexander Henry the Younger at Pembina River Post, and Peter Fidler at Chesterfield House. Days involving subsistence activities by travellers ranged from a low of 25.7% to a high of 82.6% (Mean 48.6%, N=12). Individuals combining sedentism and travelling saw 4.5% to 62.5% of the days involving subsistence related activities (Mean 33.6%, N=12). In sedentary communities, from 32.3% to 66.2% of days (Mean 45.5%, N=21) involved subsistence oriented work.

Several additional observations can be made from this information. First, there is far greater variability in travelling, and sedentism combined with travelling, than there is in completely sedentary communities. This may be due to several factors. The early travellers, Kelsey, Henday, Cocking, Fidler and Lewis and Clark, brought few provisions with them and expected to find food as they travelled. Lewis and Clark explicitly mentioned that their expedition spent considerable time hunting between Fort Union and the Musselshell River because they anticipated a shortage of wild resources as they ascended the Missouri River into the Mauvaises Terre (Thwaites 1959b). The time period when these people made their journeys predated the establishment of large numbers of trading posts; therefore, travellers were forced by circumstance to "live off the land." The entries for the British North American Exploring Expedition led by Captain John Palliser generally indicate far less time spent in provisioning. This was because the party left the Red River Settlement well supplied and purchased large quantities of provisions at Fort Edmonton (HBCA B.60/d/124,128b,133). James Hector's foray into the Rocky Mountains, which were game-poor, required more provisioning time (68.3%). The figures support the idea that once trading establishments appeared in the area, travellers were able to purchase food, rather than relying on their own expertise as they were forced to do before the inland trade was underway.

Second, examination of the days spent in provisioning in sedentary/travelling circumstances suggests that less time than for a pure travelling pattern is required and that provisioning requires less time in the Saskatchewan River region than the Red/Assiniboine River region. The very low figure of 4.5% for Alexander Henry the Younger's journey from New White Earth House to Rocky Mountain House may well be due to the lack of detail in his journal for that year, in contrast to the detail he provided for other years (Coues 1965).

Third, journal entries describing subsistence activities at sedentary communities show far less variation than the previous two categories and a mean close to that of a travelling adaptation. These activities are far more diversified than those of travellers because not only do they involve hunting and gathering but also gardening, fishing, and trade. Gardening activitiy is more capital and labor intensive than hunting and gathering, requiring cultivation of land; construction of fences about gardens and fields; construction of root cellars; and use of hoes, spades, plows, harrows and other equipment.

5.3.2 Imported Produce

No post in the northern plains was completely self-sufficient. Some regions had less productive resource bases than others, and it was posts in these areas, as well as brigades that were passing through, that were largely dependent on imported provisions. As time passed some posts decreased their dependence on imported foods while others maintained or increased theirs.

The volume of imported goods was limited by the transportation systems. During the early days of the fur trade, canoes and boats on the Red/Assiniboine and Saskatchewan River systems and dugouts, piroques, bull boats, keelboats, and mackinaws on the Missouri, proved expensive to operate (Alwin 1978; Wishart 1979). They required extensive manpower to portage; to pull the boats upstream; to load and unload; and to repair. Furthermore, the rivers were frozen during at least half of the year and the Missouri became so shallow in late summer that movement by river was interrupted. Imported goods coming from York Factory and Montreal came great distances and had to be portaged and reloaded many times. After the 1821 merger of the Hudson's Bay Company and the North West Company, the York boat became almost the main carrier in Rupert's Land, while 1831 marked the appearance of steamboats on the Missouri. The latter expedited river travel and the transport of goods but also had to be supplied with fuel which was no small task in a grassland environment.

From the advent of inland posts in 1774 until the 1860s, York Factory on Hudson's Bay was a key source of imported goods in the North West. In the early 1860s Red River Settlement replaced York Factory in inward supply since goods could be shippped more economically from Montreal by Grand Trunk Railroad to St. Paul and then by freighters up the Red River and by cart westward from the Red River Settlement (HBCA B.60/d/135). The Upper Missouri region received goods shipped by steamer from the Atlantic seaboard via St. Louis.

Because of the enormous expense in time and money, companies attempted to keep the ingoing provisions for their employees at a minimum and to maximize the space available for trade goods, which brought the favorable fur and robe returns (Smyth 1978). Considering these limitations the variety and quantity of goods shipped inland was nevertheless substantial. Table 24 provides a summary of goods shipped from England to Fort Edmonton in 1810-1811 and again in 1854-1855. Thirty different items were received in 1818-1811. Smyth (1978) has suggested that a similar selection would have been available at the North West Company posts. In later years the variety declined and only 17 different classes of goods were received in 1854-1855 in the Saskatchewan District. Imports consistently included flour, tea, seasonings, salt, spirits, and sugar.

Imported provisions broke the monotony of bison products but were available in limited quantities. Packages were shipped to the major post in a district, then opened and distributed to the various secondary establishments. For example in Table 25 the goods received at Fort Edmonton in 1854-1855 are listed alongside those sent on to Rocky Mountain House. Because of the small quantities and expense it is unlikely that most edibles were traded beyond the fur trading establishments themselves. The Eurocanadians and Euroamericans and Métis would have had greater access than the Indians.

Kegs of shrub, Madeira, port, rum and brandy constituted a significant part of the inland shipments of the Hudson's Bay Company and North West Company and were used as a bargaining agent in the fur trade. In 1833 when the United States government passed a law prohibiting the use of alcohol in the Upper Missouri fur trade, the American Fur Company found it increasingly difficult to compete with the Canadian traders who continued to use it (Wishart 1979). This law did not stop the liquor trade as couriers brought kegs overland to avoid the checkpoints on the river and a still was built at Fort Union to process Mandan corn. After John Jacob Astor sold his interest in the American Fur Company in the mid-1860s, the whiskey trade expanded. Between 1869 and 1873 a dozen whiskey posts were constructed north of the 49th parallel (Nelson 1973). The abundance of this imported beverage had a debilitating effect on native people and animals alike, for, in their frenzy to purchase more liquor, the Indians hunted more and more bison. When food shortages threatened, Indians sought and received limited quantities of provisions but it is clear that imported foods and even stored supplies of country produce at fur trade posts were largely denied to aboriginal consumers.

5.3.3 Horticultural and Agricultural Produce

While it is true that the fur trade was largely provisioned through hunting and gathering activities, cultivated vegetables and grains were used throughout the duration of the interior fur trade. Their importance varied from post to post. Wright (1981) has stated that garden produce was nothing but a supplement at Carlton House, whereas the abundance of produce from Lac St. Ann strongly suggests that garden vegetables were very important not only for the inhabitants of the settlement but travellers as well (The Earl of Southesk 1969). Differential production led to the transfer of produce between establishments (Tables 26, 27).

The horticulture/agriculture that supported the fur trade was of three types: Indian, company and colonial (Moodie 1980). Indian horticulture began long before the arrival of Europeans and the fur trade and provided a base on which European agriculture developed (Moodie and Kaye 1969). Cultivation at posts, developed exclusively in response to the needs of the fur trade, was confined to trading settlements; involved the husbandry of garden vegetables and grains; and accompanied the European expansion of the fur trade (Morton 1938; Roe 1952; Moodie 1978). Colonial agriculture came after the fur trade and was partially a response to the needs of that industry (Morton 1949; Podruckny 1990). The distinction is drawn between horticulture and agriculture. The former refers to cultivation using a hoe, the latter to cultivation using a plough. While Indian cultivation was exclusively horticultural, that at the posts included both horticulture and agriculture. Gardens were cultivated by hoe and grain fields by plough.

Aboriginal cultivation in the Middle Missouri River region by the Mandan, Hidatsa and Arikara produced corn, beans, squash, pumpkins, sunflowers, and tobacco and began in prehistoric times (Moodie and Kay 1969). Moodie and Kaye (1969) have suggested that the flint corn of the Mandan was so hardy that it may well have been grown further north than the Missouri River. They cite as supporting evidence Alexander Henry the Younger's reference to the cultivation of Indian corn and potatoes at Netley Creek, near the mouth of the Red River, beginning in 1805 and lasting until after the founding of the Red River Settlement in 1812. Recent archaeological evidence suggests that aboriginal corn was cultivated more than 200 miles north of the Missouri at Lockport, a site near present-day Winnipeg, Manitoba, and perhaps at the Lovstrom and Johnas archaeological sites in southwestern Manitoba (Nicholson 1990). The produce of the Indian villages on the Missouri was essential in provisioning Europeans and Indians alike. From the beginning of the Middle and Upper Missouri trade, the Mandan, Hidatsa, and Arikara supplied Fort Clark, Fort Union and Fort McKenzie with large amounts of corn, beans and squash. Fort Clark alone received 500 to 800 bushels annually (Wishart 1979). Not only was it a regular part of the diet, but also became one of the only foods remaining when bison were scarce. Indian corn was also cultivated at trading establishments. A 1796 journal entry for Brandon House mentions that fort employees cultivated Indian corn (HBCA B.22/a/3). Corn was traded widely throughout the network of posts. In 1814 Gabriel Franchère (1854) reported eating handfuls of corn when there was no meat at Rocky Mountain House.

The Hudson's Bay Company introduced cultigens to Rupert's Land soon after they commenced operations in North America. The first reference was a March 31, 1671 journal entry by Thomas Gorst who noted that "We sowd Peas and Mustardseed which came up well enough for ye time we stayd there and no doubt all sortes of rootes would have grown very well if we had been furnished with seed" (Gorst from Nute 1943:17). Since seed had not been brought for planting, it is likely that the peas and mustard seed were simply leftover imported provisions (Moodie 1972). In addition, Gorst reported that they had hens and hogs that also were probably sent as provisions rather than as breeding stock. This first attempt at cultivation on Hudson's Bay was an activity initiated by individual men, not the result of company policy. Moodie (1972) has suggested that entries in Gorst's journal provided an impetus for the London Office to make horticulture/'agriculture part of their policy; a May 16, 1674 directive ordered that there be provided for the establishments on the Bay "a bushell of wheate and of rye, barley and oates, or a burrell of each in caske" (Rich 1958:108). The Committee also ordered that the ships be furnished with "Such sorts of Garden Seeds as the Governour Shall Advise" (Rich 1958:108). From the very beginning the Company was concerned with the high costs of provisioning their servants, a concern that was repeatedly voiced in ingoing and outgoing correspondence between the London Committee and North American servants.

An agricultural policy evolved over time. In April 1683 outgoing supplies to Hudson' Bay included "hempe seed. . . also turnip, lettice, radish, spinage, colworts, and mustard seed, . . . together with 2 bushells of buck wheate. . . and a kilderkin of virginia wheate" (Morton 1972:149). A gardener was hired as well. Agricultural activities were promoted despite the unsympathetic environment; the Committee in London failed to realize that despite similar latitudes, Hudson's Bay and England had far different climates. The Committee continued to send out cereal seeds, implements and even skilled farm workers until the end of the 17th century; and they continued to regard gardening as an important enterprise (Moodie 1978) and some even saw agriculture as a way of supporting inland settlements (Moodie 1972). On the Bay garden produce was essential, for it became available in the summer when fishing was poor, caribou had moved north, and birds had dispersed, and its nutrients protected the people from scurvy and other deficiency diseases. So despite the low yields and frequent failures due to frosts and pests, gardening persisted. The Churchill packet of 1803 included 25 varieties of vegetable seeds and at least 9 varieties of flower seeds (Table 28). In addition, the first breeding stock was sent out in 1696 and included 4 sows, 1 boar, 7 goats, 10 sheep, 3 hogs, and 3 1/2 dozen fowl

(Moodie 1972). By 1701 a substantial herd of sheep and goats, mainly hardy Scottish breeds, had been established. And, despite low yields, there was often some garden produce given to those returning to England by boat. Potatoes were introduced to Bayside in 1768 or 1769 (Moodie 1972).

Meanwhile the French fur-traders from Montreal reached Lake Superior and found themselves in an environment somewhat milder than that of the Bayside establishments. They too brought cultivation to the area. La Vérendrye planted corn near Lake of the Woods and The Chevalier de la Corne left evidence of agricultural activities at Fort à la Corne which was established in 1753 (Coues 1965). Morton (1938) has reported that this is the first place beyond Bayside and in the North West cultivated by Europeans.

With the Hudson's Bay Company move inland in 1774, the era of continuous plant cultivation by Europeans in the Saskatchewan and Red/Assiniboine regions commenced. Table 29 provides a chronological summary of the ethnohistorical evidence for horticulture/ agriculture in the northern plains. Beginning in the late 1700s both North West Company and the Hudson's Bay Company personnel were involved. The earliest reference to cultivation at the American Fur Company posts on the Missouri was in 1836 (Abel 1932).

As time passed the cultivated area and yields increased (Tables 30, 31). In 1854 there were 109 acres cultivated in the entire Saskatchewan District (HBCA B.60/d/106) and by 1865 Fort Edmonton alone had 92 acres in potatoes, peas, wheat and barley (HBCA B.60/d/158). While information on yields is sparse, that mentioned in the ethnohistorical literature has been summarized in Table 31. From meagre beginnings the crops grew. The number of domestic animals also grew slowly. The difficulty of importing significant numbers from England via Hudson's Bay or Canada via Rainy Lake or overland from the United States prevented large-scale animal husbandry for many years. Table 32 is a summary of livestock in the Saskatchewan District and the Red River Settlement. Despite a steady increase in numbers, the human population also was growing so domestic animals did not constitute a secure economic base. Furthermore, half the animals were bred for use in the tranportation system rather than as designated food sources. Continuous demand resulted in domestic animals being transferred between posts.

The establishment of the Red River Settlement in 1811-12 marked the first attempt at systematic field cultivation, distinguished from the sporadic horticulture of the fur-trade posts (Morton 1949). Since 31 of the first 50 years ended in crop failures, dependence on country provisions continued during the 15 years that it took to establish agriculture; this dual economy persisted for the next 70 years. Colonial horticulture/agriculture suffered from a lack of experienced farmers, fall arrival of the colonists, a lack of agricultural technology, unsuitable strains of grain, and a multitude of environmental stressors, including early and late frost, drought, flooding, damp, mice, grasshoppers, blackbirds, wild pigeons, and mites (Sprenger 1972). Morton (1949) has submitted that the dominance of the buffalo hunt in the Red River economy set up an internal check on the development of the community towards a purely agricultural operation. By the 1820s the colonists were directing their attention towards raising staple crops, the surplus of which was directed to the fur trade. Eventually potatoes, dairy produce, wheat and fresh meat became available. Technological developments, such as mechanized machinery, furthered the productive success of the settlers (Murray 1967). At the beginning the Red River Settlement had 2 or 3 acres under cultivation (Pritchett 1942) and by 1859 there were 8,371 acres (Podruckny 1990). Domestic animals were a significant part of the colonial agriculture. Cattle, swine, sheep, horses and poultry were part of the mixed farming operations (Table 32).

Beginning in the 1820s the Hudson's Bay Company took an increasingly active interest in the agricultural endeavors. In the 1850s they established provisional farms at Lower Fort Garry, Lane's post and Georgetown as a way of encouraging state-of-the-art agriculture, to increase yields and to provide greater food supply security , that they felt was missing in the Red River settlement (Podruckny 1990).

The state of agriculture in the northern plains shifted in the late 1850s when the British government launched the British North American Expedition under Captain John Palliser and the Canadian Government sent Mr. S. E. Dawson and Professor Henry Youle Hind.

The provisioning system in the early historic northern plains was typified by a wedding of subsistence systems. Country produce secured by hunting, gathering and fishing provided the largest proportion of food consumed by aboriginal peoples and by the occupants of fur trading establishments. Horticultural and agricultural produce and imported provisions were ancillary. Even the agriculturally-oriented Red River Settlement flourished on this dual economy. Rev. John McDougall, writing of his experiences in the Fort Edmonton area in the 1860s said ". . . but one must remember that our diet in those days was for the most part of the time 'meat straight' or 'fish straight' with duck and rabbit for an occasional change" (McDougall 1898:170). Securing this food supply was fraught with difficulty.

5.4 Resource Stress

In Chapter 4 a general discussion of resource structure and stressors demonstrated that factors affecting the productivity, predictability and patchiness of bison can be considered the key resource stressors in the study area. The following is a quantitative analysis and summary of stressors affecting all human occupants of the northern plains in the early historic period. The body of literature consulted included the journals of all 54 individuals listed in Table 13, as well as a number of Blackfoot Winter Counts (Raczka 1979; Running Rabbit n.d.; Yellow Fly n.d.). Initially the researcher read and summarized relevant information from this literature, then a preliminary table explicitly identifying resource stressors and coping strategies was compiled; from this table, Tables 33 to 50 were generated. Beginning with Table 34, a number of the subsequent tables link stressors to the four seasons. Since some sources provide monthly but not daily records, the seasons used in this dissertation do not precisely follow the calendrical seasons.

Instead, winter encompasses January, February, and March; spring includes April, May, and June; summer covers July, August, and September; and fall comprises October, November, and December.

Table 33 is a chronological summary of recorded sightings of **immense herds of bison** from Henry Kelsey's visit to central Saskatchewan in 1691 to Isaac Cowie's reminiscences from Touchwood Hills Post in 1869. Several points bear review. First, only those observations for which a season could be assigned were included in this table. Second, immense herds were reported into the late 1870s, that is within a year or two of near extinction, but the records were not seasonally explicit. This table was constructed bearing in mind Roe's (1972) estimate that 30 to 60 million bison roamed the plains in the early historic period. As suggested by Merriman (1934) bounteous numbers of animals may well have precipitated the uncontrolled exploitation.

Table 34 and Figure 9 are seasonal and regional summaries of the data in Table 33. Overall there were 81 references to enormous herds in the references cited. The season with the largest number of sightings was summer (39.5%), followed by fall (24.7%), and spring (16.1%). For three regions, the season during which immense herds were most frequently sighted was summer, with the exception of the Missouri River region when it was spring. The season of the lowest frequency was winter in both the North and South Saskatchewan regions and in no region was winter the season with the greatest frequency of sightings. In one sense this corroborates Oliver (1962) and in another sense it does not. He stated that "buffalo only congregated into really large herds in the late summer and autumn. . ." (Oliver 1962:16-17). It is worth noting that not only is summer the season of rut (Banfield 1974), but it also is the season when bison move onto the open plains to forage (Gordon 1979; Morgan 1979). Our understanding of bison ecology suggests that winter weather leads the animals to separate into smaller groups as they move into the parkland and river valleys which provide more shelter from winds and storms. Thus deteriorating environmental conditions may be one factor precluding the aggregation of bison into vast herds. On the other hand, escalating hunting pressure in the 19th century (Spry 1968; Hind 1971b) forced animals west, where they aggregated into large herds even though their overall numbers were compromised. The inflexible aggregation-dispersion pattern of bison herds and correspondingly human groups, proposed by Oliver (1962) and adhered to by many Plains anthropologists and archaeologists, ignores the foremost attribute of the area: its interannual variability in a multiplicity of environmental factors.

One of the most frequently mentioned stressors is the **movement of bison out of geographic areas** occupied by sedentary or mobile human groups. Most observers in the North Saskatchewan region were present during a mild winter when bison were "off" or "on the plains" and they have commented on the food shortages, that prevailed among Indians, Eurocanadians and predators, alike. The unpredictability of bison movements was incorporated by Bamforth (1986) in his model of resource procurement/social complexity of hunter-gatherers. Other stressors such as drought, storms, prairie fires, and hunting had a direct effect on the mobility of bison. Tables 35 and 36 document 213 instances between 1738 and 1888 when animal movements affected provisioning success. In Table 35 they are organized by decade and region and in Table 36 and Figure 10 by season and region. For the northern plains overall, Table 35 shows that three decades have the greatest frequency of references: 1800- 1809 (14.6%), 1830-39 (18.8%) and 1850-59 (22.5%). In addition, by the far the greatest number of tabulations occur in the North Saskatchewan (36.2%) and Red/Assiniboine (38.5%) regions. A number of variables may produce these trends. First, they may simply reflect the years when observers were present. This may be the case with the decades of 1800-1809 and 1850-1859 but it is not for that of 1830-1839 (refer to Table 14 and Figure 8). Or, they may be related to the geographic location of the regions relative to prairie and parkland. The North Saskatchewan and Red/Assiniboine can be distinguished from the South Saskatchewan and Missouri regions. The former are located on the periphery of the northern plains grassland, whereas the latter two are on the open plains. If Gordon (1979) and Morgan (1979) are correct regarding the seasonal movement of bison in these two areas, then it is expected that they will remove themselves periodically. When animal movements are related to regions and seasons as in Table 36, for the northern plains overall and the North Saskatchewan region in particular, there are approximately equal numbers of references to bison being absent in each of the four seasons. However, when the South Saskatchewan, Missouri, and Red/Assiniboine are examined separately, specific patterns emerge. In the South Saskatchewan region animal movements create provisioning problems in spring, summer and fall. In the Missouri River region, winter and summer are the seasons of most provisioning problems while in the Red/Assiniboine region, winter, summer and fall are when movements occur.

There are ten references in the ethnohistorical literature to large scale buffalo deaths due to **drowning** (Table 37 and Figure 11). Fifty percent occurred in the Missouri River, 20% in the North Saskatchewan, and 10% each in the South Saskatchewan and Red/Assiniboine rivers. For the northern plains as a whole, massive drownings occurred in the months of May (30.0%) and August (30.0%). Drownings are restricted to the period from March to August or spring into summer. These are of course the times when decomposing ice, and later spring run-off, create hazardous conditions for animals attempting river crossings.

A second stressor that destroyed forage and killed bison outright was frequent, massive and rapidly moving **prairie fires**. These were documented 56 times in the years between 1754 and 1863 and all four regions were affected, though differentially (Tables 38 and 39). The decades with the greatest number of reported fires are 1800-1809 (N=20, 35.7%) and 1830-1839 (N=12, 21.4%). Between 1800 and 1809 fires were reported in all four regions while in 1830-1839 they were confined to the Missouri River area. By comparing the frequency of reported prairie fires in Table 38 with the frequency of ethnohistorical documentation in Table 14, it is evident that reports of prairie fires are not controlled by the number of ethnohistorical sources. The frequency of visitors and accounts increased through time, but the number of recorded instances of prairie fires decreased. The decade 1830-1839 contains only 5.6% of all sources while 21.4% of all prairie fires were reported from that decade. And 12.7% of all observations occurred between 1800-1809 but 35.7% of the fires were reported from that decade. Table 39 and Figure 12 provide a seasonal and monthly summary of prairie fires in each of the four regions. Prairie fires are reported 11 out of 12 months of the year. Taking the northern plains overall, the seasons of greatest frequency were fall (39.3%), followed by spring (25.0%), and summer and winter are behind at 17.9%. The month of greatest frequency is October (21.4%) followed by April (12.5%) and November (12.5%). There were no reports of prairie fires in February and few in June (0.2%). Examination of each region reveals some interesting patterns. First, the Missouri (35.7%) and North Saskatchewan (33.9%) regions experienced the greatest number of fires. Second, in the North Saskatchewan and Red/Assiniboine regions, first fall and secondly spring were the seasons of most fires; in the Missouri region and South Saskatchewan they were evenly distributed. The former two areas fit the pattern described by Arthur (1975) who suggested that the northern plains Indians burned the short grass prairies in the fall and the tall grass prairies of adjacent parklands in the spring. As discussed extensively in Chapter 4, prairie fires had multiple effects as stressors, modifying vegetation and killing large numbers of animals. Three reports of large herds being overcome by fire are summarized by region and month in Table 40. One report occurred in May in the South Saskatchewan region and one in each of October and November in the Red/Assiniboine region. The small sample precludes significant patterning. Suffice to say that people happening on "roasted" animals could and did make use of the flesh for food (Wood and Thiessen 1985).

Another environmental stressor, **drought**, when combined with prairie fires and overgrazing by herbivores, produced a synergistic effect. Table 41 summarizes 28 recorded drought episodes by decade and region, Table 42 by season and region and

Figure 13 summarizes drought episodes by season only. These cover the interval of 1730 to 1869. There are only three drought episodes recorded in the 18th century and 25 between 1800 and 1869. In addition these seem to be somewhat correlated to the frequency of ethnohistorical observations (see Table 14 and Figure 8). It is further suggested that records of drought are associated with specific perceptions of the environment and that the introduction of horticultural/agricultural pursuits changed perceptions of the adequacy of precipitation. Alexander Henry the Younger's gardening at Pembina River Post and elsewhere between 1799 and 1811 corresponds to intense competition between the Hudson's Bay Company and the North West Company and the corresponding increasing attempts to be self-sufficient in provisions. Cultigens proved far more sensitive to variations in precipitation than wild plants, leading to an increase in observations about the inadequacy of rainfall. This is reinforced by the data in Table 42. Drought was mentioned in historical documents from all four regions but the North Saskatchewan (32.1%) and Red/Assiniboine (46.4%) regions comprise over three-quarters of all episodes. It is posited that this is due to the longer history and greater use of cultigens in these areas. Overall, drought occurred with greatest frequency in spring (32.1%), though winter (21.4%), summer (25.0%) and fall (21.4%) are not that divergent. The North Saskatchewan region is most prone to drought in spring; the Missouri in summer; and the Red/Assiniboine in summer and fall. On the northern plains winter droughts correspond to those years when winters were mild and bison remained on the open plains.

Table 43 provides a chronological list of references to game and fur-bearing animals being **diseased and/or in poor condition**. It begins in 1754 with Anthony Henday's description of a buffalo bull that was too lean to eat and ends with Rev. John McDougall's comment of a similar nature during the winter of 1866-1867. Of 24 references, 18 deal with animals that were too lean; 5 were animals affected by disease; and 1 animal was old and tough. Buffalo, deer, moose, and elk were the species lacking fat and they represented all seasons, although spring and winter predominated. Spring found cows close to parturition and in poor condition although they were fat during the rest of the year. Bulls were described as lean and in poor condition in September, October, December, February, March and April. Diseases were identified among antelope (not specific), beaver (distemper), buffalo (not specified and mange) and fish (wormy). Communicable diseases obviously had a significant impact on animal populations considering that Blackfoot Winter Counts designate 1787 "the year of disease among the antelope" (Raczka 1979:28); 1803 "the year of disease among the buffalo" (Raczka 1979:34); and, 1826 "the year of mange amongst cattle" (Raczka 1979:41). It is likely that these were geographically extensive events since the Blackfoot ranged from south of the Missouri River to the North Saskatchewan and from the Rockies to eastern Saskatchewan.

Another stressor that influenced hunting success through its influence on activity by humans was the **threat of or action by enemies**. This stressor has several dimensions. Enemy threats involved aboriginal groups threatened by other aboriginal groups and European hunters threatened by aboriginal peoples. The former meant shortages for Indians and Europeans alike. The literature survey provided 25 documented instances between 1790 and 1879 where enemy threat or action was a resource stressor (Tables 44,45 and Figure 14). Overall the greatest frequency of this stressor occurred between 1830-1839 and 1850-1859. The latter decade is also when most ethnohistorical documentation occurred. Two-thirds (64.0%) of reports of enemy threat or action happened in the Missouri region and they also increased through time in that area. This may have been exacerbated by a number of factors. First was the rapidity with which large numbers of Euroamericans entered and impacted the region, facilitated by steamboat travel. Second, was the rapid depopulation caused by smallpox, cholera and other contagions. Third was the movement out of the prairies of Indian groups such as the Sioux who were avoiding the flood of settlers from the east. Fourth, the United States government fostered confrontation rather than cooperation. Enemy threats and action also are seasonally correlated, with 80% falling during spring and summer, traditional seasons for aggregation and warfare (Oliver 1962).

One of the great tragedies in North American history was the rapid, unforgiving depopulation of native groups caused by a variety of **disease** organisms (Decker 1989). Table 46 provides a summary of disease as resource stressor between 1765 and 1883. The cyclical nature of different epidemic diseases is clearly evident for every decade from 1760-1769 onwards. Not only did disease cause human suffering directly through death, but it also impacted the economic, social, political and ideological organization typical of times of plenty and the accommodations made in these realms in times of scarcity. Once again resource stressors acting in concert bolstered the impact of individual mechanisms. That the impact was profound is evident from various Blackfoot Winter Counts (Raczka 1979; Running Rabbit n.d.; Yellow Fly n.d.). Six years between 1764 and 1924 in one Blackfoot Winter Count were designated "The Year of. . .", a particular disease (Raczka 1979). The diary of François Auguste Chardon documents the day-to-day conditions among the Mandan, Arikara and Gros Ventre as they were assaulted by smallpox (Abel 1932). Epidemics of measles, mumps, cholera, and tuberculosis were similarly recorded. While it has long been assumed that rapid depopulation was due to a lack of immunity to foreign disease organisms, Chardon's journal clearly shows an additional stressor in the Middle Missouri in the year leading up to the smallpox epidemic, namely hunger and malnutrition. Initially disease among native people led to a decline in fur, robe and provision returns. Duncan McGillivray reported from Fort George in 1795 that "the Bel-homme and his family arrived. They have made no hunt this Spring, having enjoyed but a bad state of health for some time" (Morton 1929:76). In addition to economic collapse, aboriginal social and political breakdown as byproducts of disease were felt for years afterwords. Since the Europeans relied on Indian trade and hunters for food, they were indirectly impacted.

Much has been written about the influence of the horse on Plains Indian culture (Secoy 1953; Ewers 1955; Oliver 1962). Equestrian nomadism dramatically transformed northern plains cultures. Researchers often overlook the problems that accompanied the European introduction of the horse and other domestic animals. Table 47 provides a summary of 36 references to **domestic animals being impacted by resource stressors**. Perusal of these references clearly shows the attendant difficulty of provisioning domestic animals. As did humans, dogs fed on buffalo and other game animals, so that fluctuations in bison productivity, predictability and patchiness similarly affected them. Alexander Henry the Younger (Coues 1965), Rev. Robert T. Rundle (Dempsey 1977), Walter Cheadle (1971), and Rev. John McDougall (1898) reported starvation amongst their dogs in 1811, 1844, 1863, and 1866-67, respectively. Eurocanadian journals inevitably mention the dismal plight of Indian dogs, which they also reported numbered in the thousands. Dogs were essential for transporting goods between posts and communities and remained so long after horses were introduced. In April 1795, Duncan McGillivray reported that the Bloods and Blackfoot came into Fort George with all their commodities on their dogs as the shortage of food precluded travel by horse (Morton 1929). Generally speaking it was easier to provision dogs than horses and they withstood the rigors of winter better as well. They ate flour and even pack cords and, when hunger persisted, they could go one to two weeks without food (Table 50). The domestic animal held in highest esteem was the horse. Cold weather, lack of food, predators, and a predisposition to disease made rearing horses a risky business. The majority of references to resource stressors affecting domestic animals listed in Table 47 involve horses. They were described as starving, ill, lean, weak, and threatened by wolves, dogs, drowning and theft. Holder (1970) has provided detailed information on the challenges the Indian tribes of the Middle Missouri had in provisioning horses, particularly in winter when deep snow, a paucity of hay and cold operated together. Poplar branches were gathered by Indian women and, while the horses seemed to thrive on them, trees quickly disappeared in the areas about permanent villages, hastening the need to relocate. Osborn (1983) has linked the number of horses among Indian tribes to a Winter Severity Index that incorporates winter temperatures and snowfall. The milder the winter, the greater the number of horses and vice versa. Residents of trading establishments spent considerable time haying during the summer, as is revealed in the account books from Rocky Mountain House and Fort Edmonton. However, overgrazing by bison and prairie fires often destroyed ground cover over vast expanses of prairie and frequently in proximity to posts. Similarly, drought reduced the available forage. Winter and spring were the most difficult seasons for horses and often they became so weakened that they could not run buffalo, transport people or goods. To a large extent the traders suffered more than Indians when horses were in poor condition because they did most of their hunting on horseback. It is likely that the relatively small number of horses at trading establishments (Table 32) and among many northern plains Indian groups was due to these stressors (Ewers 1955); Osborn 1983). Other domestic animals such as cattle, sheep, oxen and pigs succumbed to the same stressors.

The last environmental stressor to be mentioned, and the one which signalled the end of the hunting and gathering subsistence system, was the **depletion of wildlife**. Table 48 presents a summary of 18 references to wildlife depletion beginning with Duncan McGillivray in 1795 (Morton 1929) and ending with D. McEachran (1881) in 1881. All four regions of the northern plains were affected and nearly 80% of these references occurred after 1850. Eurocanadian and Euroamerican observers in the 17th and 18th centuries frequently commented on the abundance of game animals in the regions through which they were passing and within proximity to the earlier trading estabishments. The observations of three individuals writing from different regions clearly show, however, the rapidity with which depletion occurred. On May 11, 1795, Duncan McGillivray wrote, "The country around Fort George is now entirely ruined. The Natives have already killed all beaver to such a distance that they lose too much time coming to the House during the hunting season" (Morton 1929:77). Fort George had been established but three years previously. Maximilian reported from Fort Union on the Upper Missouri in 1834 that wild fur-bearing animals had diminished greatly and predicted that within ten years the fur trade would cease (Thwaites 1905b). While there were sporadic visits by traders to the area, fur trading posts did not appear until 1829 when Fort Union was established, followed by Fort Clark and Fort Piegan in 1831 and Fort McKenzie in 1834. Hence, within five years after these permanent posts had appeared, the fur-bearers were in serious decline. The short periods of occupation of Chesterfield House (1800-02) and Piegan Post (1832-34) in the South Saskatchewan region are in part testimony to the erosion of fur-bearing stock. Whether this applied to game animals used to provision the fur trade is one question, whether it proceeded with the same speed in all parts of the northern plains is another. There is some information that in at least some parts of the country, reduction of game animals was as rapid as that of fur-bearers, there is also evidence to support the notion that reduction occurred at different speeds in different areas. For instance, John Tanner reported that, after a stay of three months, game became scarce and he and the Little Assiniboine band with whom he was living began to suffer from hunger (Morton 1949). John James Audubon reported that the size of the buffalo herds had declined by 1843 and he predicted their demise (Audubon 1960b) This was less than 15 years after the American Fur Company settlements were constructed on the Upper Missouri. On the other hand, the fur and provision returns recorded in the Saskatchewan District account books suggest that serious inroads took much longer in that region, although once they began the process quickly accelerated. During a trip across the plains in 1825, Sir George Simpson reported that "Altho' this River (Saskatchawaine) has been unremittingly hunted for nearly 100 years, it is still tolerably well stocked with Beaver and if it was possible to let it have 5 Years rest or respite would be as rich in Beaver as ever" (Merk 1969:151-52). While it was true that Simpson was arguing for a conservation policy for the Hudson's Bay Company and may have overstated the ability of the district to recover, district returns do confirm the ongoing productivity of the region. Further to the east in the Qu'Appelle Valley, Henry Youle Hind reported in 1857 that "So great had been the change during twenty years in the general aspect of this region that our old hunter. . . confessed that he did not 'know the country' when within ten miles of the Assinniboine. . ." (Hind 1971a:308).

The decline in bison and changes in their distribution seem to have progressed steadily across the decades of the 19th century, so that by the 1850s they had receded from the eastern to the western plains (Cowie 1913); they now were present only in large herds so that when one tribe of Indians were hunting them the others had to go without until the animals moved into their country (Spry 1968), and, as a consequence, they were completely absent over vast stretches of the northern plains (Dawson 1875; Scollen 1879; McEachran 1881; Butler 1968; Spry 1968; The Earl of Southesk 1969; Hind 1971b).

One way of documenting this gradual retreat westward is to examine the geographic location of first sightings of the animals by travellers accessing the northern plains from the east and the south. Table 49 summarizes this information. Where available, the month and year of the observation, the observer, the geographic location, the description of animals, and the reference are given. Two regions were distinguished: the Red/Assiniboine/Saskatchewan Route and the Missouri Route. While bison were highly mobile and may not have been encountered at certain times of the year, if there was recent evidence of their presence (eg. dung, recently butchered carcasses) these observations were included. These first sightings provide a clear picture of the gradual movement of buffalo herds west from Manitoba, into Saskatchewan and, ultimately, Alberta. For example, if the Red/Assiniboine route is examined, one finds that "multitudes of buffalo and deer" were present in Southern Manitoba in September 1738 when La Verendrye and his party were there (Burpee 1927: 303) and they were still present, though in reduced numbers, in September 1793 when John MacDonnell saw a few near the forks of the Red and Assiniboine (Gates 1965:110). In June 1846 when Paul Kane travelled up the Assiniboine he did not see any buffalo until he reached the Pembina River at Turtle Mountain (MacLaren 1989). The first buffalo that the Palliser Expedition encountered while traversing the same route in August 1857 were between Moose Mountain and the Souris River (Spry 1968). A year later, Henry Youle Hind had to travel to Fort Ellice on the Assiniboine River before encountering buffalo (Hind 1971b). And by fall of 1862, Walter Cheadle had ascended the Asiniboine River and crossed the plains to Carlton House on the Saskatchewan before encountering any (Cheadle 1971). In 1870 their eastern limit was Frenchmen's Creek (Dawson 1875). For the Métis from Red River who exploited these same herds, the distance between their homes and the herds increased: "In 1823, they did not go far beyond Pembina before meeting numerous herds; in 1840, the first herds were found two hundred and fifty miles beyond that place; and by 1870, the hunters had to travel some three hundred miles to secure the necessary quantity of meat" (Merriman 1926:92).

A similar decline in numbers and shifting of range occurred in the Missouri region. In June 1804 Lewis and Clark saw the first signs of buffalo near the Salt River in Missouri (Thwaites 1959a). By 1811 they had moved west and John Bradbury (1966) and H. M. Brackenridge (1966) did not encounter them until they were near the mouth of the Platte River in southeastern Nebraska. Twenty-two years later, Maximilian did not see buffalo until he reached the mouth of the White River in southeastern South Dakota. Subsequent observers, including John James Audubon (Audubon 1960a, 1960b) and Thaddeus Culbertson (McDermott 1952), first came across buffalo in the same area in the 1840s and early 1850s though Culbertson reported that it was unusual to see them down this low on the Missouri (McDermott 1952). In 1847 John Palliser had not encountered them until he reached Fort Pierre in central South Dakota (Palliser 1969). And by the late 1850s and early 1860s Henry Boller (Quaife 1972) and Lewis Henry Morgan (White 1959b) had to travel up to Fort Clark before coming across the first bison seen beyond St. Louis. The range of the animals shifted north and west as their numbers declined and as they sought to remove themselves from hunters. Rudolph Kurz reported that in the late 17th century they were still to be found in the State of Ohio (Hewitt 1970).

Several observations about the productivity, predictability and patchiness of key resources are necessary. First, there seems to be considerable difference between species in the rate of decline in the historic period. Fur bearers declined very rapidly about posts; perhaps in as little as three to five years their numbers were so reduced that trapping activities were forced to expand abroad. While some of these species were used for food as well as pelts in the early historic period, it is generally agreed that they were not exploited extensively in prehistoric times. It is also likely that the northern plains habitat harbored far fewer fur-bearers than the adjacent parkland and boreal forest and, as a result, their numbers declined much more rapidly on the plains. The picture is very different for game animals. The northern plains provided the environment in which herds of bison, pronghorn, and to a lesser extent, elk, deer, and bighorn sheep, flourished. Their numbers do not appear to have been threatened until many people entered the region to procure meat and robes. This included the Eurocanadians and Euroamericans directly employed in the fur and later robe trade; settlers involved in agricultural pursuits, and Indians abandoning their homelands under pressure from agricultural settlements, inter-tribal conflict or simply following the promise of an abundant food supply. In addition to an influx of people, the long-term sedentary settlements that they established caused a rapid decline in local plant and animal resources.

Second, the northern plains regions were not uniformly productive. Among the earliest visitors we find reports about the localized paucity of resources. Members of the Lewis and Clark Expedition were careful to lay in a supply of game prior to entering the Mauvaises Terre on the Upper Missouri (Thwaites 1959a). They subsequently also had difficulty finding game animals on the Marias River (Thwaites 1959b). Perhaps an additional indicator of game shortages was the fact that the expedition met no Indians as they ascended the Missouri River from the Yellowstone to the Great Falls. James Hector anticipated and in fact experienced considerable difficulty provisioning his party as they explored the Bow and Kootenay rivers in the easternmost Rocky Mountains in September 1858 (Spry 1968). Similarly, Hudson's Bay Company travellers between Fort Edmonton, Rocky Mountain House and Jasper House reported the insufficiency of game from their first penetration of these parklands in the late 18th century (Moberly 1929; HBCA B.21/a/1; HBCA B.184/a/1-5). It would seem that the parkland ecotone contained a variety of animals but the productivity of food-producing, large bodied ungulates was low. It was thus difficult to sustain sedentary communities and travellers. On the other hand, the diversity of resources meant that alternate food sources were available when selected species were in short supply. For instance, rabbits were eagerly sought when elk and deer were scarce (Spry 1968).

In contrast to unproductive regions, several areas were renowned for the abundance of game animals. In June 1742 the sons of La Verendrye set out to explore the country southwest of the Mandan Villages and "saw plenty of wild beasts" in a mountainous region presumed to be the Black Hills (Burpee 1927:408). Captain John Palliser found the Cypress Hills well stocked with a variety of wildlife in July 1859 (Spry 1968). In 1871, Isaac Cowie (1913) remarked on the richness of the wildlife in the Cypress Hills and suggested that, since the area was neutral ground between many warring tribes and thus undisturbed, game animals persisted in this area long after they had declined in numbers and shifted ranges on the open plains. Nelson (1973) has reported that this area was neutral ground from at least 1800 to 1870 and perhaps far longer. The maintenance of neutral zones may be viewed as a precautionary strategy to mitigate food supply fluctuations.

Lastly, a combination of factors may have hastened the demise of certain species in selected areas of the country. James Hector reported that the Indians identified fires and disease as factors that eliminated buffalo from the valley of the North Saskatchewan River in the eastern Rocky Mountains between 1847-48 and Hector's visit in 1858 (Spry 1968).

This suggestion reinforces the position taken in this dissertation that a multiplicity of factors were responsible for changes in game productivity.

5.5. Buffering Resource Stress: European and Aboriginal Strategies

Just as many stressors impacted the potential food supply, so too were numerous coping mechanisms employed by Europeans and aboriginal peoples. These included proven strategies, borrowed ones or those newly developed (Table 50).

5.5.1 Buffering Mechanisms in the Economic Domain

As was anticipated the greatest number of buffering mechanisms occurred in the economic domain. These included diversification; cooperative strategies; resource monitoring and information sharing; mobility; food storage; trade, reciprocity, redistribution, begging and theft; the use of famine foods; the practice of eating less food and bulky food; the husbandry of foods; expenditure of more time in the food quest and more time processing food; implementation of conservative methods of food preparation; and the conservation of wild food sources. Anthropophagy and necrophagy also were mentioned, though evidence is at best slim.

Diversification had several dimensions in the northern plains. First, as buffalo meat became scarce, all resident groups added non-bison wild foods to their diet. Cowie (1913) reported that the Métis at Qu'Appelle Lakes ate ducks, rabbits, beaver, deer and antelope when short of buffalo. Similarly, the Indians at Fort Clark dug roots and consumed rats (Abel 1932). The post employees at Rocky Mountain House turned to rabbits and other small game (Spry 1968; Harper 1971) and they ate imported corn as well (Franchère 1854). Fisheries at Lac St. Ann, Jack Fish Lake, and Pigeon Lake provided much needed food, particularly during the winter (The Earl of Southesk 1969; Dempsey 1977). A second means of diversifying the diet was to cultivate domestic plants and animals (Tables 26, 28-32). The belief that these resources would be more reliable than wild foods certainly underlay the agricultural/horticultural endeavors of the Hudson's Bay Company (Rich 1958). Horticultural produce of the Middle Missouri villages provisioned the Indians as well as the fur trade in that region (Thwaites 1906; Larocque 1910; Lamb 1957; Wood and Thiessen 1985). Clearly the dual economy of that region reduced risk and uncertainty for the Mandan, Hidatsa, and Arikara and those with whom they traded. A third means of diversification was the importation of processed foods such as flour, rice, and sugar (Table 24). It seems reasonable to expect the aboriginal occupants to have used a greater diversity of secondary wild foods and the Europeans to have had greater access to imported foods than Indians and many of the Métis.

Cooperative strategies helped reduce the risk and uncertainty inherent in subsistence pursuits. Communally operated buffalo pounds and jumps originated with and were exclusively used by aboriginal peoples, although the European residents were very dependent on meat procured by these means. In the northern plains the presence or absence of horses also affected hunting strategy. When aboriginal residents possessed buffalo runners and the ground was not covered in deep snow, buffalo running was favored. Buffalo pounding occurred more frequently in the Canadian plains bounding the North Saskatchewan River (Coues 1965; Burpee 1908; Morton 1929; Haig 1991), while chasing on horseback was more common on the Missouri (Thwaites 1905b, Abel 1932; McDermott 1951; Hewitt 1970). This was related to the greater availability of horses in the south (Ewers 1955). The organization and execution of a communal hunt required substantial manpower; similarly considerable womanpower was required to butcher and preserve the meat. In order to facilitate communal drives and to support the participants, the density of bison would have to reach a certain level. Even if all these factors were in conjunction, hunting failure was not uncommon (Johnson 1967; Haig 1991).

Resource monitoring and its corollary, **information sharing** were important mechanisms to reduce uncertainty with respect to resource availability and productivity. It was imperative that all groups using the northern plains monitor resources and share information because of the patchiness of resources. Information was disseminated within Indian villages, between villages, and between villages and trading posts.

During his 1811 trip up the Missouri to Fort Mandan, John Bradbury (1966:121) reported "As they were not *in the habit of printing newspapers* the news was carried through the village by heralds, who stood at the door of the council-lodge, and from time to time went through the village to give information." At every band encampment the Plains Cree engaged one or two criers or *oca kitostamakew* who went around the camp circle calling out the news of the day, the chief's orders, and other matters of public interest. (Mandelbaum 1979). Perhaps the most efficient information exchange between Indian tribes occurred during the Calumet Ceremony, which Blakeslee (1975) suggested forged and maintained intertribal and interband linkages in the trade system. He reported that 21 Plains Indian tribes were known to have used the calumet and, of those residing in the northern plains, only the Gros Ventre did not. Intertribal visiting during trading expeditions was an ideal venue for groups to exchange resource information and thus monitor resources over large territories.

Indian visitors to trading establishments and visitor's camps supplied information pertaining to subsistence pursuits. On October 2, 1864 Indians arriving at Fort Benton from different camps brought word that buffalo were aplenty at the Marias River (McDonnell 1940). It is reasonable to expect that a wide variety of information was disseminated by Indians coming to posts to trade; furthermore, the mobility of the Plains Indians guaranteed the rapid spread of information and it was this communication network that was of vital importance to the Europeans in the area. The Indians who came to the trading establishments brought not only provisions and furs but also news about human movements; the location of game and other potential foods; the activities of enemies and friends; the activities of competing trading establishments; and other information. It is likely that aboriginal information networks have considerable time depth as indicated by the widespread use of a complex sign language, that permitted tribes with mutually unintelligible languages to communicate (Hollow and Parks 1980).

Mobility as a response in the economic domain involved the movement of individuals, task specific groups and entire communities. The exclusively hunting and gathering peoples, semi-sedentary horticulturalists and many Métis were normally mobile in their seasonal round of subsistence activities. Resource stress simply augmented movement. In the early 19th century, Alexander Henry the Younger reported that the Indians left Lower Terre Blanche House seeking food (Coues 1965), while McDougall (1898) reported the same at Pigeon Lake mid-century. Maximilian observed that the Arikara abandoned their villages to search for food (Thwaites 1906). The European residents of trading posts also were forced by circumstance to be mobile. Their hunters pursued game in the immediate vicinity until it became depleted then they went farther and farther away; in the case of Fort Edmonton, these camps were as much as 250 miles distant in some seasons (Table 23). Hunting camps established to provision Rocky Mountain House were many miles east on the open plains and those close to the fort shifted very frequently because of the general paucity of game in the parkland habitat (HBCA B.21/a/1; B.184/a/1-5). In his district report from Carlton House for 1820/21, John Peter Pruden noted, "From the Buffalo not coming in as usual a very great fall off in the Provision Trade has been felt- much difficulty which has left the men travelling all winter so that no other work can be done. . ." (HBCA B.27/e/3). In addition, when there was difficulty securing meat, men were sent out to fish from Fort Edmonton (Johnson 1967), from Rocky Mountain House (HBCA B.184/a/5), and Carlton House (HBCA B.27//e/4). Mobility permitted hunters to access the resources of multiple ecological zones, although this strategy could also fail, as for example when mild winters detained bison on the plains or when population cycles of small mammals were at a low point. Mobility was precautionary since it minimized overexploitation of specific areas.

Separate technologies for preserving and **storing** meat extended the seasonal utility of clumped resources. Pemmican was a protein and energy-rich food first used by prehistoric inhabitants of the Plains. Its relatively light weight, compactness, nutrition, and excellent preservation qualities made it both movable and storable. It is believed that stored supplies of pemmican were used by all northern plains aboriginals and the numerous cairns that dot the plains appear in many cases to have been food caches (Brumley 1973). Furthermore, the Mandan, Hidatsa and Arikara stored great quantities of dried corn in underground cache pits. Just how important food storage was in the prehistoric period remains to be seen. Certainly the technology was in existence for a long time, perhaps going back to the Middle Prehistoric Period. As regards the "anthropology of storage," the northern plains may provide an important case where the aboriginal occupants were highly mobile despite the large quantities of food stored for future use (Forbis 1982). This runs contrary to Testart's (1982) view that significant storage was accompanied by sedentism, social stratification, and population density.

Stored food was fundamental to the fur trade enterprise because it permitted fur brigades to expand into the food-scarce boreal forest. The fur traders acquired large quantities of fresh meat and pemmican from Indians, or alternately, manufactured large amounts themselves. Pemmican was placed in 45 pound or 90 pound bags called "taureaux," which were cached in storehouses until needed. Post journals from Rocky Mountain House (HBCA B.184/a/1-5), Chesterfield House (Johnson 1967) and elsewhere acknowledge the construction of these buildings and the removal of blocks of ice from nearby rivers to aid in preservation. Duncan McGillivray reported that a "*Glaciere*" containing 500 thighs and shoulders was constructed at Fort George in January 1795 (Morton 1929). In December 1847 at Fort Edmonton, Paul Kane stated:

> The men had already commenced gathering their supply of fresh meat for the summer in the icepit. This is made by digging a square hole, capable of containing 700 or 800 buffalo carcases. As soon as the ice in the river is of sufficient thickness, it is cut into square blocks of uniform size with saws; with these blocks the floor of the pit is regularly paved, and the blocks cemented together by pouring water in between them, and allowing it to freeze solid. In like manner, the walls are solidly built up to the surface of the ground (Harper 1971:136).

In addition to meat products, imported foods, such as flour, sugar, biscuit and tea, as well as garden produce, were placed in stores until required. Ray (1984b) has suggested that this provisioning strategy of the Hudson's Bay Company served an additional purpose by making food available to natives in areas otherwise low in game.

In addition to storage facilities constructed at trading posts, the practice of **caching** food was highly developed among the European occupants of the northern plains and likely was adopted from the aboriginal people. It was designed to offset local shortages and to eliminate the need for extensive provisioning activities while moving between establishments. Caches were left in trading posts abandoned during the summer season as well as along overland trails. The Indians even assisted the traders and travellers by caching meat along the routes that they would take. In April 1848, Paul Kane mentioned arriving at Rocky Mountain House which had been abandoned for the summer (Harper 1971). His party expected to find dried meat in a cache but instead found that the Assiniboine had taken the meat and left a quantity of fine furs. The man who accompanied him back to Fort Edmonton had cached meat along the trail to provision them during their journey. On August 3, 1858, Captain John Palliser instructed his hunters "to kill, cut up, dry meat, and make 'cachés' for each party, who would find their shares buried for them as they arrived in succession from the mountain branch" (Spry 1968:260). Henry Youle Hind (1971b:89-90) also mentioned caching pemmican in river ice near Pembina,

> A hole was cut through the ice, then about fifteen inches thick, and a buffalo hide thong having been tied round the bag, and fastened to a stick, it was let down into the water, just below the ice, the stick being stretched across the orifice. Lumps of ice were then piled on the bag of pemmican, and water poured on them. . . the water froze the instant it touched the ice, and bound the masses together in one block. Fresh ice being added. . . the operation continued until a mound one foot above the frozen surface of the river was accumulated over the cache.

Occasionally food shortages at a fur trading post led to **hoarding**. During the winter of 1851-52, Rudolph Kurz reported from Fort Union that "sweet-toothed engagés have well supplied themselves. . .several barrels have been emptied without Mr. Denig's knowledge. . . ." (Hewitt 1970:247). Whether hoarding of food was practiced by aboriginal people is unclear. Certainly the mutual obligations inherent in reciprocal exchanges mitigated against hoarding, although the Plains Indian accumulation of horses can be considered hoarding (Ray 1984b).

The exchange of food via **trade, reciprocity,** and **redistribution** was of utmost importance among all groups on the northern plains. Exchanges among Indian tribes and between Indian tribes and European traders was an ongoing activity designed to ameliorate seasonal, geographic, and interannual food shortages. In addition, when food shortages among natives threatened the fur trade, the Hudson's Bay Company was called upon to sustain native populations (Ray 1984b). While the intertribal trade was symmetrical with food flowing both to and from particular tribes, that between natives and Europeans was asymmetrical since Indians supplied large quantities of food but generally received nonfood items in return.

The prehistoric and early historic trade of aboriginal peoples in the northern plains has been studied extensively by Jablow (1951), Ewers (1954), Wood (1972) and Blakeslee (1975). Wood (1972) suggested that Plains Indian trade was largely responsible for the Plains culture area through its promotion of cultural homogeneity and cultural stability, which, he proposed, are apparent in the archaeological record. That trading networks covered the plains in a reticulated or web-like pattern is clear (Blakeslee 1975). Trading partners met at the major trading centres in the Middle Missouri villages, while nomadic tribes kept regularly scheduled rendezvous both within and outside the Plains Culture Area. Among the items traded were foodstuffs. The nomadic hunting and gathering tribes provided fat, bison meat, berries and prairie turnip; the sedentary horticulturalists supplied corn, beans, squash, sunflower seeds, and tobacco. Medicinal plants, raw materials, manufactured goods, horses, slaves and ceremonial and craft knowledge also were exchanged. Will and Hyde (1917:174) reported that nonagricultural tribes from as far south as the Platte River and north to the Assiniboine and Lake of the Woods travelled to the Middle Missouri to acquire corn and that ". . . corn meant in times of plenty a welcome and needed change of diet; but in hard winters. . . it meant many times the salvation of whole camps, destitute of meat and perishing of starvation."

Jablow (1951), Ewers (1954) and Wood (1972) believed the trade to be complementary where especially strong trade ties existed between the nomadic bison hunters and the sedentary horticulturalists of the Middle Missouri, resulting in the exchange of meat and corn. In contrast, Blakeslee (1975) argued that the Middle Missouri trade was redundant. He proposed that this redundancy fostered social, economic, and political ties over the long-term, that would be useful under conditions of localized, recurrent and unpredictable food shortages.

The European-Indian trade which began in the late 17th century, profoundly affected aboriginal trade relations. Food items and furs flowed from Indian camps to the posts and trade goods such as whiskey, beads, metal goods, cloth, clothes, weapons and traps were received (Karklins 1992). While the Indians did not generally obtain food, when they experienced food shortages they did turn to the post occupants for help and the latter frequently assisted them (Abel 1932; Ray 1984b). This occurred from both a sense of duty and fear that the fur trade would suffer if the Indians were forced to increase food quest time. Trade between establishments in country produce, horticultural/agricultural produce and imported provisions was an important part of the fur trade enterprise.

Reciprocity or **sharing** is a second system of exchange and involves the sharing of foods as well as reciprocal access to food-producing territories. Generalized reciprocity and reciprocal access were organizing principles of aboriginal economic systems prior to the commercialization of these economies that occurred as the fur trade era progressed (Ray 1984b). The opening of lands and gifts of food that the aboriginal inhabitants extended to the incoming Europeans originated in intra and inter-tribal practices. The Indians permitted traders, travellers, missionaries and others to hunt on land which they had long occupied. This even extended to neutral territory such as the Cypress Hills. The Europeans were also the recipients of frequent gifts of food. William Francis Butler (1968:242), who traversed the plains from Red River to Carlton House, Fort Edmonton and Rocky Mountain House in 1870, described this generosity, "There is but a scrap of beaver, a thin rabbit, or a bit of sturgeon in the lodge; a stranger comes, and he is hungry; give him his share and let him be first served and best attended to." He reported that the Indians about Carlton House shared what they had with his party (Butler 1968). Likewise, the Rev. Robert T. Rundle (Dempsey 1977) accepted meat from the Assiniboine while he was at Pigeon Lake in the 1840s. The agricultural tribes of the Middle Missouri gave large presents of corn to visitors as repeatedly noted in the Lewis and Clark journals (Thwaites 1959a, 1959b, 1959c). Reciprocal exchange occurred within and between Indian tribes as well. Henry Boller who spent the years 1858 to 1862 on the Middle and Upper Missouri reported that the Yankton Sioux, long-time enemies of the Arikara, came proposing peace and seeking food (Quaife 1972). Reciprocal access to resource-producing land and reciprocity or sharing of food are common risk reduction strategies in unpredictable environments, such as the northern plains, where shortages are usually temporally and spatially localized rather than all encompassing.

Traders provided aboriginal peoples with food when they were in need through the process of **redistribution**. The storage facilities at fur trade establishments housed bison products, garden vegetables, and grains and imported foodstuffs designed to provision the employees and their dependents, as well as those at establishments in the north. These provisions were sufficient to permit their sale and trade to travellers such as Walter Butler Cheadle (1971), the British North American Exploring Expedition (HBCA B.60/d/124,128b, 133) and missionaries such as the Rev. Robert T. Rundle (Dempsey 1977) and the Rev. John McDougall (1895, 1896, 1898, 1983). Indians who ocupied areas that were initially marginal or became so through overhunting were sustained by the Hudson's Bay Company stores as well (Ray 1984b). François Auguste Chardon at Fort Clark (Abel 1932) and John Peter Pruden (HBCA B.27/e/4) at Carlton House handed out small quantities of food from fort stores to Indians. During the winter of 1862-63, Walter Butler Cheadle (1971) was forced to visit Carlton House repeatedly as an alternative to starving. European visitors and Indians alike came to the missions at Pigeon Lake (McDougall 1896) and Lac St. Ann (Spry 1968) to secure garden produce and fish. Following the demise of the buffalo in the early 1880s, the Northwest Mounted Police at Fort Walsh were supplying rations from time to time to 5,000 Indians (Morrow 1923).

As shortages escalated people resorted to **begging** and **theft**. On April 24, 1837, François Auguste Chardon reported that Indian women and children begged for food at Fort Clark (Abel 1932), while at Fort Edmonton Captain John Palliser stated that women and children came begging to accompany his party in order to search for food (Spry 1968). While the ethnohistorical sources are understandably silent regarding theft by Eurocanadians and Euroamericans they do mention, albeit infrequently, theft of food by aboriginal peoples. John Palliser (1969) reported that the Indians about Fort McKenzie, who were badly off owing to a dearth of buffalo, resorted to stealing meat from the post. As the herds of bison disappeared, theft of domestic cattle increased. Father Constantine Scollen (1979) wrote of the escalating problem near Fort Macleod in 1879: "many of those whose skeleton horses were able to plod through the deep snow hastened around the settlements in order to live. The consequence is, they have become a burden and a cause of anxiety to the settlers. They have begged and stolen all they would, and got into the way of helping themselves to white-men's cattle."

The use of **alternate** and **famine** foods is one of the most frequently mentioned coping strategies in the ethnohistorical literature (Table 50). It is likely that such a practice is extremely old and it occurs when food shortages are both minor and severe. Alternate foods could be lower ranked items as well as those from different ecological zones. Small mammals were a potential food source tapped when big game was scarce. Rabbits were consumed by the Palliser Expedition (Spry 1968) between Fort Edmonton and Rocky Mountain House; by Walter Butler Cheadle (1971) near Carlton House; by Rev. John McDougall (1898) in the Fort Edmonton area; by François Auguste Chardon at Fort Clark (Abel 1932); by Isaac Cowie (1913) at Qu'Appelle Lakes; by Paul Kane at Rocky Mountain House (Harper 1971); and by Archibald McLeod at Fort Alexandria (Gates 1965). But because of the cyclical fluctuations in their numbers, rabbits could not always be depended upon in times of meat scarcity. At the peak of their cycle they were, however, a dependable although lean, alternate food. Rats also were eaten at Fort Clark (Abel 1932) and at Fort Edmonton (Spry 1968).

Other animals consumed when buffalo meat was scarce included deer (McDougall 1896; Cowie 1913; Morton 1929; Bradbury 1966; The Earl of Southesk 1969), antelope (Cowie 1913; Spry 1968), beaver (Thwaites 1906; Cowie 1913), fox (Spry 1968), squirrel (Cheadle 1971), muskrat (Coues 1965), gopher (Cowie 1913), and turtle (Cowie 1913). Wild birds and eggs also were used extensively both as a famine food and to vary the nearly straight meat diet. Audubon (1960b), Cheadle (1971), Cocking (Burpee 1908), Cowie (1913), Franchère (1854), Lewis and Clark (Thwaites 1959b), Palliser (Spry 1968), McDougall (1898), and Robertson-Ross (1872) reported using ducks, geese, pheasants, prairie chickens, pigeons, owls, and swans.

Parts of the study area were especially suited to this broad-based economic strategy. The parkland as an ecotone contained species from converging ecozones plus species unique to the transition zone itself (Odum 1971). King and Graham (1981), Nicholson (1987), and Mirau (1990) noted that the greatest increase in diversity and density probably occurs when one type of vegetation has a sharp contact with another as a result of disturbance such as fire. While an ecotone may be characterized by greater species diversity, this diversity does not necessarily include a greater diversity of food resources. Furthermore, even if there is greater diversity of food sources this does not guarantee greater productivity than adjacent non-ecotonal areas. The ethnohistorical sources consulted for the present study suggest that the parkland played an important role in strategies for coping with fluctuating food supplies. Believing that bison would retreat to the sheltered parkland in winter, Plains Indians moved into the area in the fall and awaited their arrival. Upon the occasion of a mild winter, when bison did not seek shelter in the parkland, they and the residents of fur trading establishments in the Parkland hunted "touchwood" species, including deer, moose, elk, and rabbits (Spry 1968). Judging from the same ethnohistorical sources, these areas were rapidly overhunted, which verifies that the animal biomass was nowhere as large as that of the open plains. Three regions whose economic history supports this suggestion are the Rocky Mountain House area, the Cypress Hills and the area about Fort Alexandria. Daily journals from Rocky Mountain House covering the years 1828-31, 1836-37, and 1866-68 document the struggle to provision post inhabitants (HBCA B.184/a/1-5). Isaac Cowie (1913), who operated a fur trade post in the eastern Cypress Hills from 1869 to 1871, commented on the wealth of wildlife but a decade later the bison were gone and other species were severely diminished. Likewise Daniel Harmon's journal documents extreme suffering at Fort Alexandria between 1800 and 1805 from the lack of bison and parkland species (Lamb 1957). The variation between species diversity and productivity reinforces the notion that the myriad of relationships that characterize the resource structure of a region are integral to understanding resource stress.

Famine foods ranged from discarded bones to tanned hides, and animals used in transportation. They were used by Indians, Métis and Europeans alike. Alexander Henry the Elder reported making soup from bones left by wolves during a food shortage at Nipawin in 1775-76 (Bain 1969). During the winter of 1795 near Lac Verde, Duncan McGillivray's men were forced to retrieve fish bones discarded the previous fall (Morton 1929). Daniel Harmon consumed parchment skins, dogs, herbs and a few fish when buffalo meat was unavailable at Bird Mountain Post (Lamb 1957). Walter Butler Cheadle

(1971) had to eat boiled buffalo hide and a dog while camped at Egg Lake during the winter of 1862-63. The Rev. John McDougall (1898) and Henry Moberly (1929) consumed lynx in the Fort Edmonton area and at Jasper House, respectively. In 1772 when they were unable to procure meat, Matthew Cocking's party ate large quantities of berries in the Eagle Hills (Burpee 1908). Daniel Harmon reported eating rosebuds when a food shortage occurred at Qu'Appelle Lakes in the early 1800s (Lamb 1957).

In addition to the aforementioned famine foods, aboriginal and European peoples practiced **eating less food** and **more bulky foods**. A common response to food shortages was to reduce the rations allocated to post employees and their dependents (Table 19). Faced with extreme food shortages while travelling from Belle Prairie to Carlton House, Walter Butler Cheadle (1971) rationed the few remaining fish among the men and dogs. The Rev. John McDougall (1896) reported food rationing in the Fort Edmonton area during the winter of 1863-64. At Fort Union, Rudolph Kurz noted that dogs' rations were increased so they would steal less and men's rations were decreased (Hewitt 1970). Earlier while he was at Fort Berthold, a shortage of food reduced consumption to 2 meals per day (Hewitt 1970).

Bulky plant foods also were added to the diet as stores of meat disappeared. In the Upper Missouri, residents at Fort Mandan (Larocque 1910), Fort Clark (Thwaites 1906; Abel 1932), Fort Berthold (Hewitt 1970), Fort Union (Hewitt 1970), and Fort McKenzie (Thwaites 1906) reported consuming large quantities of corn obtained in trade from the Mandan, Hidatsa and Arikara. Prairie weeds and turnip were gathered in the Red/Assiniboine region when meat was in short supply (Pritchett 1942; Coues 1965). An exclusive maize diet was nutritionally inadequate, as indicated by an outbreak of scurvy at Fort Union in 1852 following a winter of maize consumption (Hewitt 1970).

Historic and prehistoric people had a history of raising **domestic plants and/or animals** as a means of increasing the security of the food supply (Tables 26, 28-32). Substantial quantities of corn and lesser amounts of beans, squash, pumpkins and sunflower seeds were raised by the Mandan, Hidatsa and Arikara in the Middle Missouri (Moodie and Kaye 1969; Blakeslee 1975; Wessel 1976). De Smet (1978) reported that in 1867, the Mandan, Hidatsa, and Arikara together cultivated 1200 acres and in 1878 the estimated yield was 15,000 bushels of corn (De Smet 1978). In the historic period these products offset shortages of meat among many Indian groups and Euroamericans alike. Wishart (1979) noted that Fort Clark alone received 500 to 800 bushels annually. Indian corn was consumed at Rocky Mountain House in 1814 according to Franchère (1854). Whether it originated in the Middle Missouri is unknown. Domestic crops offered security to some tribes but reduced mobility, and sedentary horticultural communities were targets for raiding by nomadic and sedentary groups.

For the European-derived horticulture and agriculture, crop security was a long time coming. Garden produce did nothing more than vary the diet until the mid-19th century. The strains of plants and domestic animals that were transplanted from the mild marine climate of the British Isles to the continental climate of central North America were ill-adapted to the recurrent drought, short growing season, and frost. It was not until the introduction of new agricultural machinery in the 1850s and new strains of wheat in the 1860s that crop yields improved and became more consistent (Morton 1949). At times domestic animals became a liability leading to the rationing of their food, their butchery, and, if stress persisted, all were slaughtered. Domestic livestock had to be slaughtered at Fort Pitt in 1859 (The Earl of Southesk 1969). In his account of a return journey from York Factory to Fort George in 1824-25, Governor Simpson commented on the versatility of horses, ". . . the object of bringing so many Horses is to carry our little Baggage, live on them if Game fails and make Skin Canoes of their Hides if we find it necessary. . ." (Merk 1968:155-56).

Conservative food preparation techniques are another response to food shortages. The reuse of discarded bones to make soup has been mentioned as response to food shortages. In January 1776 at Nipawin on the Saskatchewan, Alexander Henry the Elder described how he and his party found the bones of a moose left by wolves and gathered them and made soup (Bain 1969). Duncan McGillivray reported that a group of his men returned to Fort George on March 8, 1795 and that winter had been "forced to pick up the fish Bones which they threw out last Fall to prolong their miserable existance" (Morton 1929:60). Father Constantine Scollen (1879) reported in 1879 that the Indians about Fort McLeod also were gathering bones to extract the last bit of nourishment. After using the last of their meat at the Great Falls of the Missouri during the summer of 1805, members of the Lewis and Clark Expedition rendered grease from tainted meat (Thwaites 1959b). They also took all the available meat of animals killed before entering Mauvaises Terre, in anticipation of shortages of game in the region. Another strategy was to make use of game animals that had been killed by drowning, prairie fire, poison or other causes. On the Saskatchewan, downstream from the forks, Alexander Henry the Elder reported that on January 25, 1776 his party found a dead elk in the river ice and "laid bare his back and shoulders and so had meat enough for the journey" (Bain 1969:274). The Rev. John McDougall (1896) found a deer embedded in ice so chopped it out and ate it. He also reported that the Indians ate buffalo that had drowned in Jack Fish Lake. Maximilian reported that the Indians near Fort Clark ate decayed buffalo that they found on the plains during the winter of 1833-34 (Thwaites 1906). Father Constantine Scollen (1879) described how the Indians about Fort McLeod were forced to eat poisoned wolves because of the shortage of meat. At Park River Post in the Red/Assiniboine region, Alexander Henry the Younger observed Indian women gathering backfats and tongues of buffalo that had drowned in the river during spring runoff (Coues 1965). The Mandan, Hidatsa, and Arikara captured as many carcasses of dead buffalo as they could during the spring high water on the Missouri (Abel 1932). Alexander Henry the Younger and Charles McKenzie both document the use of singed and roasted buffalo that had perished in prairie fires (Coues 1965; Wood and Thiessen 1985). Conservative strategies extended to fuel as well. Buffalo dung and bone were used in the absence of wood by Peter Fidler (Haig

1991), William Tomison (Johnson 1967), Captain John Palliser (Spry 1968), Charles McKenzie (Wood and Thiessen 1985), and Matthew Cocking (Burpee 1908).

When food shortages threatened and become more acute, **time spent in the food quest increased**. The provisioning schedules at Rocky Mountain House as revealed in the daily journals of Henry Fisher (1828/29, 1829/30, 1830/31), John Harriott (1836/37), and Richard Hardisty (1866/68) are offered as support (HBCA B.184/a/1-5). The percentage of days during which provisioning activities were carried out during the September to April occupancy of the site ranged from 37.6% to 47.8% (Table 23); however, subsistence pursuits occurred every day when meat stores became threateningly low (HBCA B.184/a/1-5).

Resource conservation is another risk-reduction strategy in the economic realm. Whether hunting and gathering subsistence systems in general, and those resident in the northern plains in particular, conserved resources has been the subject of considerable debate (Macleod 1936; Ray 1975; Jacobs 1980; Baden et al 1981). On the one hand it is possible to cite examples where resources of a particular area were tended in order that anticipated game shortages could be offset; on the other hand there was enormous waste by all users of the area (Table 22). It is known that the Indians anticipated the demise of the buffalo as early as the 1850s but the tendency of the animals to aggregate in herds numbering thousands up to the late 1870s appears to have mislead many visitors and residents of the northern plains into believing bison would never become extinct (Dawson 1875; McEachran 1881) (Tables 33, 34, 48). Intensive exploitation of the animals continued until their near extinction in the early 1880s. Furthermore, as Ray (1975) has suggested, selected ideological beliefs may have promoted overuse of a resource. For example, Henry Moberly (1929:68) reported that the Indians would not permit a single buffalo driven into a pound to escape alive, fearing "that should one escape it would inform those outside and none could again be caught in the same way." One innovative example of conservation of a moose occurred at Jasper House: "This winter the hunters have only killed two, but they know where another has his feeding ground and do not intend to kill him till spring" (Spry 1968:371).

The last coping strategies in the economic realm, **anthropophagy** and **necrophagy**, were not reported in the ethnohistorical literature for the northern plains proper though Pritchett (1942) gave a vague reference to both among the Indians residing north of the North Saskatchewan River, although how far north was not specified. Anthropophagy involved consumption of human flesh from a victim killed for this purpose, while necrophagy was the consumption of the flesh of a person who had died from other causes.

Not only were coping strategies in the economic realm the most numerous in the northern plains, but also all strategies suggested in the model were used by both aboriginal and European occupants. Many economic strategies are precautionary, some are reversible and few are irreversible. Economic strategies were clearly linked to the resource structure. The prevalence of these strategies amongst all human groups in the northern plains is attributed to the fact that the economic domain is the interface between society and the natural environment.

5.5.2 Buffering Mechanisms in the Social Domain

The social scene on the northern plains was a complex intermingling of lifeways. Over a dozen tribes of Indians, the Hudson's Bay Company, the Northwest Company, the American Fur Company and the Métis occupied the area in the 18th and 19th centuries (Van Kirk 1980; Olmsted 1983). Distinctive patterns of work and family life contributed to enormous complexity in the social interaction that occurred among these groups. The merging and bifurcation of individuals, families, and communities occurred in response to a diversity of economic, social, political and ideological factors. Among those that can be viewed as coping strategies under conditions of resource stress are mobility; changes in group size, population density and foraging area; membership in unilineal descent groups such as clans, lineages, phratries and moieties; gender and age distinctions;

marital arrangements; division of labour; individual and group status, retrenchment of social activity, reciprocal access; status differentials for hunters; infanticide, prolonged lactation and associated wide birth spacing and contraception; sloughing off members; senilicide; and suicide.

Mobility as a coping mechanism overlaps domains. In the economic domain it involved the deployment of task specific groups to seek food. In the social domain, mobility entailed the bifurcation of communities, often directed by a central authority. Indian encampments and European posts responded in similar fashion. At European posts hunters and their families could be asked to leave the posts to forage for themselves. On January 4, 1801, Daniel Harmon dispatched the inhabitants of Fort Alexandria to the plains to winter because of a meat shortage (Lamb 1957). For the first few years after the establishment of the Red River Settlement, Miles Macdonell sent residents to Pembina River because of food shortages at the forks of the Red/Assiniboine (Pritchett 1942). In his journal entry for January 16, 1836 at Fort Clark, François Auguste Chardon stated: "Our prospect for the winter is now gloomy in the extreme. I have concluded to send off all my horses and Hunters to make a living on the Prairies or starve as fate May direct" (Abel 1932:54). A shortage of buffalo due to drought in the spring of 1834 led all but 50 people to abandon Fort Union according to Maximilian (Thwaites 1906). Rudolph Kurz reported that Edwin Denig, chief of American Fur Company operations at Fort Union, issued a similar order during the difficult winter of 1852 (Hewitt 1970).

The Mandan, Hidatsa, and Arikara pattern of leaving their earthlodge villages, where they had aggregated to plant and harvest corn and to trade, in order to pursue buffalo on the open plains (Lowie 1954; Quaife 1972) was linked to seasonal availability of foodstuffs and was also a pattern that could be activated in the event of unseasonal shortages. In 1833-34, Maximilian reported that drought and the absence of buffalo herds forced the Arikara to abandon their villages (Thwaites 1906). Mandelbaum noted that the Plains Cree abandoned their buffalo pounds in January and February when returns dropped and "scattered in small family units into the more densely wooded country" (Mandelbaum 1979:77).

Mobility and **group size**, **population density**, and **foraging area** are interrelated phenomena. At fur trade posts provisioning problems restricted the number of individuals who could be supported year-round. Judging from the servants' lists and area under cultivation recorded in the account books of various trading posts, Fort Edmonton would appear to be the most populous and agriculturally advanced centre in the northern plains (Tables 17, 30). The population did, however, wax and wane. The reconstructed population of Fort Edmonton for 1810/1811 was 191 and this decreased to 84 in 1814/1815 (HBCA B.60/d/2a). It increased to 250 persons in 1822/1823 (HBCA B.60/d/12). From 1840 to 1871 the population of Fort Edmonton was above 200, reaching a peak of 529 in 1871/1872 (HBCA B.60/d/65,177). Thereafter it declined rapidly to 38 persons in 1881 (HBCA B.60/f/1). Rocky Mountain House, with its ongoing provisioning problems, ranged between 36 persons in 1799 (Smyth 1978) and 69 in 1833/1834 (HBCA B.21/d/2). The population of Carlton House numbered 30 in 1811/1812 (HBCA B.27/d/2) and increased to 184 in 1824 (HBCA B.27/z/1), after which it dropped to 60 in 1870 (Butler 1968).

The resource structure impacted the population density, foraging areas, and territorial distributions of Indian tribes. The annual expeditions of the Métis from Red River penetrated further and further west with the retreat of the herds. Examination of the native population density of North American culture areas shows the Plains to have the second lowest density at 10 to 25 persons per 100 square kilometers (Driver 1969).

Selected social phenomena may be seen as precautionary strategies for coping with fluctuating food supplies. These included **marital arrangements**, **division of labour**, **gender and age distinctions**, **membership in unilineal descent groups**, **variations in individual and group status**, **reciprocal access**, and **wide birth spacing**. Before 1821, practically all officers of the Hudson's Bay

Company and Northwest Company and many of those affiliated with the American Fur Company had native wives. Marriage "after the custom of the country" was an indigenous marriage rite that evolved to meet the needs of fur-trade society (Van Kirk 1980). While Hudson's Bay Company policy initially discouraged these unions, they were ultimately accepted because of their inevitability and the positive contribution that they made to the success of fur trade endeavors. The expansion of these unions and their progeny transformed the social character of northern plains society (Brown 1980), creating "a distinctive and self-perpetuating community" (Van Kirk 1980:5). "Marital ties" between Eurocanadian and Euroamerican men and Indian women were initially encouraged by the Indians, who saw them as furthering both immediate and long-term social, economic, and political interests. First, they saw marital alliances as creating reciprocal social bonds since they drew the trader into the Indian's kinship circle. By giving sexual and domestic rights to traders, they would receive preferential treatment in trade. More to the point, there would be economic benefits accruing to the families of women who "married" traders. Of course, as a member of an Indian kinship circle, the trader could claim similar economic advantages. It is likely that gifts of food would be one manifestation of these reciprocal bonds. In addition, they secured reciprocal access to different tribal territories. Second, "marital" ties cemented trade ties because they enlarged the group of persons to whom one was tied economically. In the event of food shortages such a strategy was highly adaptive for both parties. Many of the Indians traded at posts where they had relatives among the Indian women and their families. Third, marital alliances were beneficial in the highly competitive fur trade because the knowledge of Indian women about food preparation and preservation, the tanning of furs and hides, and the hunting, trapping and survival knowledge of her male relatives were conferred on her fur trader husband, his post and ultimately his company. The transplanted Europeans learned how to survive in the variable plains environment, largely because of the knowledge that they acquired through their relationships with Indian women.

The creation of a new ethnic and racial group called the Métis, and the subsequent creation of new ecological niches (Olmsted 1983), reduced competition amongst them and guaranteed, at least for a short time, the productive success of each. Some Métis moved out onto the plains to pursue a hunting and gathering lifestyle similar to that of many Indian groups. Others affiliated themselves with trading posts where they secured employment and a place in a transplanted British class system. Those residing along the Red River broadened their subsistence strategy to include horticulture, agriculture, fishing, and seasonal buffalo hunting. These diversified economic strategies can be regarded as risk reducing.

Marriage arrangements among Indians were often governed by rules that expanded social ties and involved economic considerations. The 13 maternal clans of the Crow were exogamous (Lowie 1935), as were nine of the ten divisons of the Cheyenne (Grinnell 1972). The Blackfoot considered marriage within the band to not be good form, but it was not criminal (Wissler 1912). Industriousness was rewarded since mates who were good providers, either as hunters or collectors, were favored as spouses. Goods were exchanged at the time of betrothal and marriage, as a means of solidifying expanding kinship ties. The complementary division of labor enhanced the mutual dependence of individuals. In addition, kinship systems such as the Crow system, among the group of the same name, expanded reciprocal obligations.

Integration of people, fostered by the presence of lineages, clans, moieties, phratries, military societies, age grades and councils of leading men, existed at the community level (Sahlins 1968b). Matrilineages existed among the Crow, Hidatsa and Mandan and there is some evidence that the Blackfoot, Gros Ventre, Dakota Sioux and Assiniboin also had clans (Lowie 1954). The Council of 44 chiefs of the Cheyenne drew people together from throughout Cheyenne territory (Grinnell 1972). A key function of both the voluntary and kinship-based groups was mutual assistance. Military societies served a broader function which was the policing of the large-scale communal hunts and they were also active in warring exploits that secured large quantities of pillaged food. Women's societies, such as the Goose and the White Buffalo Cow society, performed ceremonies in order to make corn crops prosper or to attract buffalo herds (Lowie 1954). The presence of these groups in some ways prevented integration into larger groups for, "fellow-clansfolk recognized mutual obligations, that characteristically overrode their sense of duty to any larger group" (Lowie 1935).

While no one position or individual had a great deal of power, status differences did exist. The widespread honor accorded the elderly was an acknowledgement of their greater life experience. Social practices among the Plains Cree are a case in point (Mandelbaum 1979). Destitute elderly people were adopted; old men known to have powerful supernatural guardians were called upon to name children; old people played key roles in the pow wow; old men served as callers and a camp leaders during the summer when the entire band was together; old men consecrated the first berries of the season; and old women directed the puberty rights of young girls. Children spent far more time with their grandparents than their parents so that childhood socialization was largely in the hands of those with the longest life history. In recognizing the life knowledge of the elderly, Indian societies preserved access to an important information base, including the survival techniques used to cope with fluctuating resources.

Status differences were also based on differential abilities. Outstanding hunters and warriors and people with supernatural expertise experienced enhanced social position. Among the Plains Cree " a man became chief by virtue of his accomplishments in battle, his ability as a hunter, his liberality, his capacities as an orator and executive" (Mandelbaum 1979: 106). Religious specialists had diversified power bases. They participated in a variety of economic, social and political activities where their knowledge was seen to further the interests of the group as a whole. The Plains Cree shaman directed the construction and operation of a buffalo pound (Mandelbaum 1979). Plains Indian shamen were responsible for curing illness and for altering the outcome of future events such as raids and subsistence activities (Lowie 1954).

Reciprocal access to game producing territories as a risk reduction strategy overlaps the economic and social domains. While discussed extensively in regard to economics, it bears mentioning that reciprocal access was extended by the Indians to the Europeans who first entered the northern plains in the 17th century. The marital relationships between Indian women and European men fostered the obligatory environment in which this practice developed. In the inital stages of the fur trade when the traders were dependent on the Indians for survival, the Indian wife was an asset; and it is posited that Indian-European reciprocal access was initially established and flourished during this time. The emergence of a new racial and ethnic group, the Métis, resulted in the replacement of the Indian wife by the mixed-blood wife. This realignment of social relations likely affected the practice of reciprocal access. It is suggested that the generosity of reciprocal access declined during this time. The appearance of white European women in the second quarter of the 19th century led to another realignment of social relations and it is likely that reciprocal access was further eroded. Furthermore, the advent of the fur trade likely altered extant reciprocal access arrangements between bands and tribes as a communal lifeway gave way to an individual lifeway.

Comparisons of the number of births by Indian women living in Indian societies and those associated with the fur trade indicate a substantial difference. It was not uncommon for the wives of fur traders to give birth to from eight to twelve children, whereas the average Cree woman had four children (Van Kirk 1980). Prolonged lactation lasting from 2 to 4 years, coupled with a variety of sexual taboos restricting family size, prevailed in Indian societies. In addition, medicinal potions facilitated abortions and ceremonial bundles were believed to prevent conception (Hellson and Gadd 1974). Marital alliances with Europeans led to the abandonment of sexual taboos and discouragement of prolonged breastfeeding. Van Kirk (1980) also has suggested that the less fatiguing routine and more regular diet at trading establishments may have contributed to the increased fecundity. The bottom line is that aboriginal societies practiced population control but these measures were largely relaxed in fur trade society.

A variety of social mechanisms including **retrenchment of social activity, sloughing off of family members, infanticide, senilicide**, and **suicide** were instituted after resource stress began, although documentation would suggest that these desperate measures were not frequently enacted. Food shortages at trading posts such as Rocky Mountain House led to the cancellation of feasts put on for the benefit of employees and Indians who had come to trade (HBCA B.184/a/1-5). During the smallpox epidemic in the Middle Missouri in 1837-38, François Auguste Chardon's journal entries link a precipitous decline in ceremonial activity among the Mandan, Hidatsa and Arikara with the epidemic (Abel 1932).

Acute food shortages led some groups to slough off their dependent young, women and the elderly. Alexander Henry the Younger reported in his August 10, 1806 entry from Turtle Mountain Post: "There are a few freemen about this place, who have actually disposed of their women and clothing to the H. B. Co.'s people in barter for beat meat (Coues 1965:416). On March 9, 1837, François Auguste Chardon noted that the Gros Ventres abandoned their old men and women and went in pursuit of game (Abel 1932).

A variety of ethnohistorical sources allude to infanticide as a solution to excess population and scanty resources in Indian societies (Van Kirk 1980). Brown (1980:149-150) wrote: "Infanticide was not new in the Indian country; Indian groups had practiced it upon unwanted children and in multiple births, particularly in defence against privation and hunger." There is no way of knowing the extent of the practice in aboriginal societies. Noting an increase in infanticide in 1837 in the Red River Settlement, Brown (1980) suggested that this was due less to privation than to social pressures facing native women whose social position had been undermined by the arrival of European women.

A final coping strategy in the social realm is to permanently remove oneself, to commit **suicide**. Two individuals provided descriptions of the circumstances under which aboriginal people were led to commit suicide. Colonel Richard Irving Dodge (1884) reported that Indians of the western United States not infrequently committed suicide to escape the power of the Bad God, as manifested in hydrophobia, paralysis, or similar terrible and hopeless afflications. While Dodge's comments appear to be hearsay, François Auguste Chardon was eyewitness to suicides among the Mandan, Hidatsa, and Arikara as they suffered through the smallpox epidemic of 1837-38 (Abel 1932). No references to suicide as a response to hunger were uncovered. That a drastic measure such as suicide was the response to a stressor introduced by Euroamericans is noted.

5.5.3. Buffering Mechanisms in the Political Domain

Buffering mechanisms in the political domain relate to power relations that resulted in differential access to resources of the land. They included land tenure-territorial rights, segmentary lineages, group fissioning, and raiding.

Territoriality is a risk reducing strategy since territorial divisions function to apportion resources to all segments of a population (Wilmsen 1973). Those who control the territory are given first choice over resources after which outsiders may be allowed reciprocal access. While lands and resources were allocated according to territorial principles in the early historic northern plains, in no way was this a rigid system. The number of tribal groups who used the area increased through time while the number of people decreased due to epidemic diseases. Tribal groups whose homelands were in culture areas adjacent to the plains gravitated to the northern plains. In general there was a movement from east to west as tribe after tribe sought to escape the pressures of European incursions; to provision themselves with bison products; and to participate in the lucrative fur, robe and provision trade. While each of these groups was accommodated in this finite territory, continual shifting of territorial boundaries of individual bands and tribes occurred. In collaboration with a number of northern plains anthropologists and archaeologists, Magne (1987) produced maps showing the distribution of the various groups in A.D. 1700, 1750, 1800 and 1850. It is apparent that territories overlapped, shifted through time, and the geographic movement of particular tribes and bands was wide-ranging. The establishment of trading establishments on the South and North Saskatchewan and Missouri Rivers had a considerable impact not only on seasonal movements but also on territories as well (Smyth 1984). It is suggested that the fluidity of movement and overlapping territories were linked largely to the resource structure. The key subsistence item was bison. Though bison were enormously productive, they were a patchy resource and not entirely predictable in their movements. Rigid territories and notions of private property would hinder provisioning in this environment. It is postulated that fluid boundaries, reciprocal access and neutral territories were mechanisms developed to cope with fluctuations in the food supply.

A number of lines of evidence point towards the existence of the territorial principle in the northern plains. Band names are one indicator. Edwin Denig (1930) recognized six bands of Assiniboines, two whose names have a geographic affiliation, Gens du Nord and Gens des Roches. The Plains Cree were similarly organized (Mandelbaum 1979). Descriptions of territories or the means by which they were maintained are another indication. In passing abandoned Indian campsites, travellers frequently mentioned discarded artifacts, that permitted them to determine the tribal affiliation of the sites' occupants. These empirical indicators included moccasins, hearths, arrangements of tent poles, butchered animal remains, and the like (Dodge 1884; Thwaites 1905a, 1905b, 1906; Thwaites 1959a, 1959b, 1959c; Spry 1968).

Various European travellers and traders commented upon the fear of Indian bands should they be caught trespassing on the territory of another tribe. As early as 1738, La Verendrye described the Assiniboine fear of the Sioux (Burpee 1927), while Matthew Cocking commented on the Assiniboine fear of the Snake Indians (Burpee 1908). In 1807 Alexander Henry the Younger noted that the Cree and Assiniboine on the Souris River were terrified of the marauding Sioux (Coues 1965). According to the Rev. John McDougall (1896) the Blackfoot harassed the Woods Cree in Saskatchewan country. Furthermore, Palliser (Spry 1968), Bradbury (1966), Boller (Quaife 1972), and Kurz (Hewitt 1970) all reported that they themselves feared retaliation from the Indians through whose territory they travelled. This fear was such that at times Indians and Europeans went hungry rather than hunt for fear of drawing attention to themselves.

The movement of bison also interfered with territorial principles. In 1859 James Hector reported from the Highwood River, "I had a long talk with the chiefs. . . They said that every year they find it more difficult to keep from starving, and that even the buffalo cannot be depended upon as before, because being now only in large bands, when one tribe of Indians are hunting them the other tribes have to go without until the band migrates into their country" (Spry 1968:432). Isaac Cowie (1913:305) stated that ". . . the buffalo were ever receding from the eastern to the western plains, and for self-preservation the Crees and Saulteaux of the east were obliged to encroach every year further into the realms of the Blackfoot."

A question that remains to be answered concerns the nature of precontact territories. As noted in Chapter 3 territorial arrangements lie along a continuum of decreasing flexibility progressing from common to reciprocal access, to territoriality amd private property (Smith 1988). It is suggested that among the plains nomads the territorial principle was flexible owing to the unpredictable resource structure and to the difficulty of marking and maintaining boundaries in a grassland environment. On the aforementioned continuum it probably fell between reciprocal access and territoriality. In addition to fields, dry moats and palisades acted as defensive markers in the Middle Missouri villages in the Late Prehistoric Period as well as the early historic period (Wedel 1961). The territory of fur trading establishments also was marked as private property by palisades encircling the post proper and fences about the gardens and even fields (Cowie 1913; Wishart 1979).

Neutral zones serving as buffers between the territories of different tribal groups were present. The Cypress Hills were a buffer zone between the Blackfoot on the north and west, the Shoshone and Crow to the south, and the Assiniboine, Gros Ventres and Cree to the east (Nelson 1973). Isaac Cowie (1913:303) reported that: "in all Cree memory the Cypress Hills were neutral ground between different warring tribes." As neutral ground the area was not exploited; therefore, the populations of game animals were substantial. Captain John Palliser also noted that there was a neutral ground between the Blackfoot and Cree near Mortlach, Saskatchewan (Spry 1968). George Dawson (1875) identified the Sweet Grass Hills as neutral ground and observed that the area was lacking in buffalo bones and Indian campsites, that served to indicate its lack of exploitation. The location of neutral areas probably shifted through time as tribal territories fluctuated. But more important, the maintenance of wildlife populations at high levels may have provided insurance against severe localized resource stress. For as John Palliser (1969:265) stated in 1848 ". . . none of them dare venture into it for hunting purposes, except when driven to desperation by hunger." After disastrous provisioning seasons in 1868-71, the Métis accessed the Cypress Hills where they enjoyed substantial returns in furs, robes and meat for the rest of the decade (Cowie 1913). Since territorial behavior allocates resources, it is predicted that as resource stress escalated, territorial maintenance became more rigid.

Certain features of **political organization** were precautionary strategies. Political structure is linked to territorial concepts and formal organization, that are in turn related to resource structure. While the community organization at the trading establishments in many respects mimicked the European social system (Brown 1980; Hamilton 1990), that of the Indians was geared specifically to the realities of the Plains environment. The basic social unit beyond the family was the band, that was a local group that wandered over a specific territory in search of sustenance. Its size and composition varied seasonally. During the 18th century at least 8 bands of Plains Cree were recognized, many of which bore geographical place names that reinforced the notion of territoriality. Included were the Touchwood Hills People, the Calling River People, the House People, the Upstream People and the Downstream People (Mandelbaum 1979). The villages of the semisedentary Middle Missouri groups each corresponded to a band. Formal integration beyond the band was hampered by continuous economic instability (Sahlins 1968b), though bands did join seasonally to celebrate the Sun Dance and to hunt communally. Sahlins (1968b) has referred to loose associations of bands as segmentary lineages and noted that they rarely included more than a few hundred people; the segments were structurally, politically, and functionally equivalent; and true centralization of power was absent. He also suggested that lineality was a product of repetitive, long-term use of restricted resources and that segmentary lineages developed in a tribe that had intruded into an already occupied habitat rather than one that had expanded into an uncontested domain. The inherent flexibility of the segmental lineage as a form of political organization was, on the one hand, a result of the variable food supply, and on, the other, a mechanism for reducing the risk associated with resource stress.

The fur trading companies represented state-level political organization with the centralized control and social stratification that accompanied that genre; furthermore, their operations were directed from headquarters outside the northern plains. The head office of the Hudson's Bay Company was in London, England; Montreal was the location of the North West Company headquarters; and St. Louis was the administrative centre of the American Fur Company. Decisions affecting the northern plains fur trade were made outside the region itself although employees within the area were required to implement these directives. As regards risk reduction and resource stress, the Hudson's Bay Company directors felt from the beginning that subsistence self-sufficiency through horticultural/agricultural/pastoral pursuits was desirable and, to this end, they issued directives, provided seed, livestock and equipment to further this goal. The provisioning strategy of the Hudson's Bay Company with its emphasis on redistribution was a product of the state (Sahlins 1968b). As organizational components of state level societies, the fur trading companies possessed an infrastructure that permitted them to cooperate in the face of exterior stressors such as food shortages and threats of violence by aboriginal peoples.

Group fissioning and **migration** were strategies enacted after resource stress escalated and they were linked to increased mobility. They are early and commonplace for mobile hunting and gathering subsistence systems but could prove disruptive for semi-sedentary and sedentary communities, that had invested time, labour and resources in capital intensive subsistence technology (Gilman 1981). Both the fulltime hunting and gathering peoples and the semi-sedentary horticulturalists practiced group fissioning on a seasonal basis. This pattern saw amalgamation in the summer for communal hunting and ritual activities, and fissioning into small units in the fall, winter and spring (Lowie 1954). It is suggested that this annual cycle was likely modified to accommodate unpredictable resource stress. In other words, the circumstances and frequency of fissioning varied from a predictable pattern. Archaeological evidence at the Vore site led Reher (1978) and Reher and Frison (1980) to suggest that variability in grassland productivity affected the numbers and patchiness of bison herds so that annual communal hunting was precluded and such hunting strategies were only practiced when resources permitted.

Migration that featured the movement of entire tribal units from one geographical locale to another is best represented on the northern plains by the westward movement of the Cree, Ojibwa, and Sioux onto the Plains and the Crow-Hidatsa split. The migration of the Cree, Ojibwa and Sioux was a risk reduction strategy in their old territory but their incursion into occupied grasslands created stress in the new area. The Sioux in particular became feared for their equestrian skills, their numbers, and their reputation for terrorism.

As provisioning became more and more difficult, efforts to procure food expanded, competition intensified, and agonistic activities such as **raiding** intensified. Raiding was a common response to resource stress on the part of the aboriginal inhabitants of the northern plains. The Mandan, Hidatsa, and Arikara villages of the Middle Misouri were subjected to intermittent looting both in the prehistoric and historic periods (Holder 1970). Fortifications in the form of dry moats and pallisades and cache pits beneath earthlodges were designed to protect settlements and preserve food supplies. A single site, Crow Creek Village in present-day central South Dakota and dating to about A.D. 1325, has yielded at least 486 mutilated skeletons of villagers massacred by raiders (Willey 1982). Between 1799 and 1811 Alexander Henry the Younger reported having difficulty preventing the Indians from raiding his gardens at the various posts that he managed for the North West Company (Coues 1965). In order to ameliorate the threat to lives and property, common pallisades were constructed around the North West Company, Hudson's Bay Company, and XY Company posts as for example, at Chesterfield House in 1800 (Johnson 1967).

5.5.4 Buffering Mechanisms in the Ideological Domain

Buffering mechanisms in the ideological realm consisted of oral tradition, ritual, and revitalization movements, that can be viewed as information-sharing artifices designed to regulate, reduce, or eliminate stress associated with provisioning problems, illness, intergroup conflict and the like. Oral tradition includes folk tales, songs, histories, and mythologies, as well as prescribed ritual chants, activities, and performances. Buffering mechanisms in the ideological realm are largely although not exclusively, limited to aboriginal groups in the northern plains. It is suggested that this relates to a specific feature of primitive societies, where extensive integration of the economic, social, political and ideological spheres of life is the norm.

In order to keep the memory of past food shortages alive and to provide assurance as regards current and future provisioning problems, the Blackfoot winter counts named years after key resource stressors. For example the year 1837-38 was "the year of smallpox" (Yellow Fly n.d.:1; Running Rabbit n.d.:l, Raczka 1979:45-46). Among the Mandan and Arikara, January and February were "the month of the seven cold days" and "the month which kills or carries off men," respectively (Thwaites 1906:345, 393). The daily entries in fur trade journals served a similar purpose for the Europeans involved in the inland trade. The information in Table 50 derives from this source.

Ritual played an important role in coping with immediate problems. Lewis and Clark reported that the inhabitants of the Mandan Village where they wintered in 1804-5, performed "a Buffalow Dance (or Medeson) for 3 nights passed. . . all this is to cause the buffalow to Come near So that they may Kill them" (Thwaites 1905:245). Henry Boller (Quaife 1972:105) provided extensive descriptions of the Mandan making "their great Bull Medicine" when he lived among them between 1852 and 1861. He reported that they considered this their most important ceremony after the Calumet. The latter ceremony was viewed by Blakeslee (1975) as promoting fictional kinship ties, that symbolized social alliances between individuals of different social groups. These alliances involved the exchange of goods.

In evaluating the relative advantage of ritual and oral tradition, Minc (1986) suggested that secular oral tradition provided the better avenue for dispersing information about short-term fluctuations of lesser magnitude and that ritual is expected to increase with the greater periodicity and magnitude of fluctations in subsistence resources. Blakeslee (1975) correlated the beginnings of the plains interband trading system with the drought of Pacific I, that lasted from 750 B.P. to 500 B.P.

Ultimately, the conditions of acute stress experienced by Plains Indians in the late 19th century facilitated the spread from the Great Basin to the northern plains of the revitalization movement known as the Ghost Dance religion (Mooney 1965). Such movements appear to arise as a coping strategy under conditions of relative deprivation, meaning that there is a discrepancy between legitimate expectations and actual conditions (Pandian 1991). The interfacing of aboriginal and European cultures, an economic florescence followed by decline, and an awareness that conditions could be better, are all factors in the development of such movements.

5.6 Conclusions

Chapter 5 has furnished a summary of the provisioning strategies of the aboriginal and European occupants of the northern plains. It has presented a qualitative and quantitative analysis of the resource stressors that challenged these people and a review of their coping strategies as well. Both groups were largely dependent on the products of bison and other game animals and thus were victims of the same resource stressors. Their coping strategies in the economic domain were closely aligned and the longterm occupancy of the plains environment by hunting and gathering aboriginal groups can be clearly seen in the complex precautionary strategies in the social, political and ideological domains that they alone developed. What remains to be discussed is the impact that the fur trade had on these strategies.

The fur trade encouraged modes of economic specialization heretofore unknown to aboriginal plainsmen. Roles as commercial trappers, middlemen, and commercial hunters were quickly assumed, that rapidly led to commercialization of native economies and specialization of resource orientation (Ray 1984b). The latter undermined traditional attitudes of sharing, the foundation of reciprocity and reciprocal access. The most profound impact was the depletion of the subsistence base through overhunting. The seasonal round of subsistence activities, that had preserved game, was incompatible with the dependency that characterized the Indian relationship with trading establishments. As the number of big-game animals declined locally about trading establishments, Indian people turned to small mammals to provision themselves. The depopulation of this food source further exacerbated the provisioning problems, for labor inputs had to increase, but there was a corresponding decline in the time spent trapping furs. People who had gone from economic autonomy to dependence found themselves in a cycle of increasing powerlessness. In addition, trading competition led to escalating hostilities between Indian tribes. These hostilities eroded the trust relationship that underlay reciprocity; they became a major resource stressor in themselves; they transformed territorial principles and territorial boundaries; and they prevented conservation measures of individual tribes from working. The suggestion by Burton, Kates and White (1978:16) that societies in the process of rapid transition are exceptionally vulnerable to stress because "traditional social mechanisms for absorbing losses and sharing them among the community have been eroded away," is nowhere more evident than in the 18th and 19th century northern plains. Evidence presented in this chapter shows that resource stress may be causal in economic, social, political and ideological domains and changes in these domains may in turn create resource stress.

In the following chapter the model developed and applied herein is summarized and evaluated, and further discussion is directed towards the archaeological implications of the model in terms of middle range theory.

CHAPTER 6

SUMMARY AND CONCLUSIONS

6.1 Introduction

> American archaeology is anthropology or it is nothing (Willey and Phillips 1958:2).
>
> There are now signs that historical documentation may eventually be used . . . to build middle-range expectations (Thomas 1989:201).

This dissertation began with the statement that "the history of humankind is in large part the chronicle of our quest for food. Hunger, or the fear of it, has always played a major role in determining the actions and attitudes of humans." Acknowledging the profound effect of subsistence pursuits and the universality of fluctuating food supplies, the writer undertook a study on the impact of resource stress on organizational behavior in the economic, social, political and ideological realms of societies that provision themselves largely through the hunting and gathering of wild foods. The concept of adaptation and the socioecological perspective viewed from within the larger ecological anthropological paradigm provided the framework for examining the problem. From a survey of the literature on hunter-gatherer ecology, a descriptive model linking resource stress to coping strategies in the economic, social, political and ideological domains, was developed. Following the application of this model to a cross-cultural sample of 38 hunting and gathering societies, a series of predictions was made. Subsequently, an indepth examination of the aboriginal and European cultures that occupied the northern plains in the 18th and 19th centuries was undertaken using the descriptive model. In Chapter 6 this model and its predictions are summarized and evaluated and its implications in terms of archaeological visibility and middle range theory are considered in the context of northern plains prehistory.

6.2 Summary and Evaluation

The following summative statement will evaluate, in order, the theoretical perspective, the descriptive model, the predictions, and the application of the model.

6.2.1 Theoretical Perspective

Prior to formulating theories and testing hypotheses, social scientists adopt a paradigm and/or perspective for viewing the problem under consideration. Providing "a window on the world", such a perspective governs the questions that will be asked, the methods that will be employed, and the conclusions that will be reached. To facilitate this study of resource stress, the writer selected the socioecological perspective (Winterhalder and Smith 1981b), that is situated within the ecological anthropological paradigm (Vayda and McCay 1975; Hardesty 1977; Orlove 1980; Moran 1982), and a processual approach (Binford 1968) as providing the most theoretically satisfactory orientation. The commonalities of these approaches are their use of adaptation, variability, natural selection, and culture as key concepts and their recognition that interrelationships exist between human social and cultural systems and natural environments. The processual approach emphasizes mechanisms of change, the formation and consolidation of adaptive strategies, and the importance of variability in environments, in options, and in decision making. These approaches contributed in a number of ways to the robusticity of the current study. First, this model is about sources of variation in environments and in human responses to these environments. Variation provides the raw material of evolution by natural selection. It was shown that as resource stressors become more variable, so do coping strategies. In fact, adaptive success in variable environments is determined in part by the richness of coping strategies. Second, adaptation is an integrative concept that explicates the process whereby organism/environmental relationships are forged. Adaptation itself is a powerful concept since it is capable of integrating disparate methodological orientations and linking them to the central theme of culture (Kirch 1982). Third, the chosen paradigm permits an integration of synchronic and diachronic observations, since one can study adaptive responses at one point in time, as well as adaptive change through time. Furthermore, one can observe the accretion of coping strategies as the length of time that a society has occupied a region grows. Fourth, in focusing on behavioral adaptation it deals with strategies capable of responding to short-term, long-term and sudden resource perturbations. Fifth, with a central focus being culture, the paradigm is ideal for a study of behavioral adaptations. Sixth, the model perceives culture to be an open system whereby constant feedback occurs amongst cultural systems and the natural environment. This latter attribute is considered the greatest strength of these approaches since it leads one to view humans as members ot a finite global ecosystem whose existence is linked to the past, present, and future of that system. In addition, it views human societies as interacting with each other, be it cooperatively, competitively or in conflict. Resource fluctuations are universal, crosscutting all environments; therefore, a model grounded in ecological theory applies to all types of sociopolitical groups, and to ethnographical, historical, and archaeological cultures.

6.2.2 The Model

The model was developed with the knowledge that the availablity of resources, notably food supplies, fluctuates. They may be abundant, scarce or adequate to meet needs. While the condition of abundance is considered in this dissertation, it was scarcity that provoked specialized adaptative strategies and that is thus of central concern. It was proposed that variations in resource availability are typical of all environments; that fluctuations have multiple causes; that environmental and social factors are amongst these causes; that food shortages may be seasonal or seasonally independent; they may be predictable or unpredictable; they may be widespread or restricted; and they may occur frequently or infrequently. Resource stress is both a parsimonious and multicausal concept for it embraces a diversity of environmental and sociocultural factors.

While human adaptation has behavioral, physiological and genetic/demographic dimensions (Hardesty 1977), the present study focuses exclusively on behavioral adaptation. This embraces adjustments in technology, organization and ideology (Hardesty 1977). In generating a descriptive model, behavioral adaptation was separated into four domains or realms that constitute the main social institutions of human society. As used here institutions are clusters of values, norms, statuses, roles and groups that develop around a basic social need (Robertson 1987). The economic realm deals with the production, distribution, and consumption of goods and services and is the interface between society and the natural environment. The social domain includes ties that unite or bifurcate individuals and groups and that provide the channels through which resources are distributed. On a broader scale, the political arena deals with intercommunity organization and power differences amongst groups and individuals that also influence resource distribution. It is thus closely linked to the regulation of the economic, social and ideological domains. Ideology involves belief and ritual that define the relationships humans perceive themselves to have with the supernatural. The functions of strategies in the ideological domain are to regulate, reduce, or eliminate resource stress that individuals anticipate, imagine, or experience. A comprehensive overview of the literature on hunter-gatherer ecology led to the compilation of a list of coping mechanisms in each of these realms. The observations outlined below constitute the descriptive model.

Coping strategies in the **economic domain** include:

1. Diversification of subsistence activities
2. Cooperative subsistence strategies
3. Resource monitoring and information sharing
4. Mobility of subsistence groups
5. Food storage
6. Trade, reciprocity and redistribution
7. Famine foods, less food, bulky foods
8. More time spent in food quest
9. Conservative methods of food preparation
10. Increased food processing time
11. Conservation of wild food sources
12. Anthropophagy and necrophagy

Coping strategies in the **social domain** include:

1. Mobility of personnel between residential units
2. Fluctuating group size
3. Decreased population density
4. Increased foraging area
5. Marriage, descent and kinship systems that extend reciprocal relationships over broad geographical areas
6. Retrenchment of social activity
7. Reciprocal access
8. Enhanced status for productive hunters and gatherers
9. Prolonged lactation and wide birth spacing
10. Selling children into slavery, plus infanticide and senilicide

Coping strategies in the **political domain** include:

1. Territoriality
2. Adaptive forms of political organization (eg. segmentary lineages)
3. Group fissioning and migration
4. Raiding

Coping strategies in the **ideological domain** include:

1. Oral tradition with themes of resource stress
2. Ritual to cope with resource stress
3. Revitalization movements

This descriptive model was the framework for a cross-cultural analysis of 38 predominantly, but not exclusively hunting and gathering subsistence systems drawn from references in the **Human Relations Area Files** at the University of Calgary and Simon Fraser University. The 38 societies selected represent 11.4% of the individual societal listings at these institutions. Of the sampled societies, 26 are from North America, six from Asia, three from South America, two from Africa, and one from Australia (Figure 3). From north to south these are the Copper Eskimo, Hare, Koyukon, Kutchin, Chukchee, South Alaskan Eskimo, Koryak, Nahane, Tlingit, Aleuts, Kamchadel, Bella Coola, Montagnais-Naskapi, Ojibwa, Nootka, Gros Ventre, Blackfoot, Southeast Salish, Mandan, Micmac, Crow, Ainu, Klamath, Northern Paiute, Arapaho, Pawnee, Comanche, Dhegiha, Pomo, Utes, Andaman Islanders, Semang, Pygmies, Bushmen, Arunta, Tehuelche, Ona and Yahgan. These groups were placed in climatic zones according to the Köppen-Geiger system of climate classification (Strahler and Strahler 1989), that incorporates such environmental variables as temperature, precipitation, seasonality of temperature and precipitation, and vegetation. A series of tables (Tables 3-12) and Figure 4 related resource stressors and coping strategies to these climatic zones and to each other.

From the general overview of the literature on hunter-gatherer ecology and the examination of the coping strategies of the above sample of 38 societies, a series of predictions was generated. These are summarized:

1. Acknowledging that environmental zones vary in the frequency and intensity of shortages, it was predicted that:
   a) there should be a wider variety of and more coping strategies in marginal environments than in benevolent environments
   b) there should be a wider variety of and more coping strategies among generalized hunter-gatherers than complex hunter-gatherers.
2. Acknowledging that as resource stress escalates from food deprivation, to food poverty, to food shortages, it was predicted that:
   a) economic coping strategies would be a first-line response
   b) the number of economic coping strategies grows as stress escalates
   c) responses in the social and political realms are added after economic strategies begin and as the temporal span of shortages increases
   d) the greater the number of coping strategies in all domains, the greater the stress
3. Acknowledging that coping strategies move through a hierarchy from reversible, to semi-reversible, to irreversible, it was predicted that:
   a) early responses to resource stress are usually reversible
   b) as stress escalates, semi-reversible and finally, irreversible responses are added
   c) irreversible responses should be more common among peoples occupying the most marginal of environments
   d) the relative number of reversible, semi-reversible and irreversible responses may provide a measure of the severity of resource stress

4. Acknowledging that hunting and gathering societies may be generalized or complex and that their organizational structures vary, it was predicted that:
   a) generalized hunting and gathering societies will diversify their subsistence base while complex hunter-gatherers will intensify
   b) generalized hunting and gathering societies will increase group mobility while complex hunting and gathering societies will increase the mobility of task groups
   c) generalized hunting and gathering societies will increase reciprocity and form alliances while complex hunting and gathering societies will increase food storage and expand trade
5. When shortates are seasonal and thus predictable, it is suggested that precautionary strategies are developed and that those of
   a) generalized hunter-gatherers involve the expansion of reciprocal relationships and formation of alliances
   b) complex hunter-gatherers involve expansion of storage capabilities and trade
6. Acknowledging that intense long-term shortages provoke major cultural change, it was predicted that responses for both generalized and complex hunter-gatherers may include:
   a) a major change in subsistence strategies, dramatic population decline and out-migration
7. Acknowledging that many responses to food shortages are in fact extensions of extant practices, it was predicted that:
   a) generalized hunter-gathers will increase group mobility
   b) complex hunter-gatherers will increase task group mobility
   c) complex hunter-gatherers will intensify specialized subsistence activities
   d) complex hunter-gatherers will improve food storage
   e) generalized hunter-gatherers will broaden reciprocal ties

8. Acknowledging the consumer choices predicted by optiminal foraging theory, it is suggested that:

   a) as high ranked resources decline in availability, the resource base will be diversified

   b) as resources become increasingly patchy and unpredictable, human groups will reduce group size, increase search area, increase task group mobility, and improve information sharing

9. Acknowledging that modernization affects generalized and complex hunter-gatherers differently, and that the differences between generalized hunter-gatherers and the industrial world are greater it is predicted that:

   a) generalized hunter-gatherers will be more seriously affected by modernization and one of the first changes to occur will be abandonment of reciprocity and reciprocal access

10. Acknowledging that human groups rank responses to resource stress, it is predicted that:

    a) the first level of responses will be economic and essentially the same for generalized and complex hunter-gatherers and will include consumption of less food, eating bulky foods, implementation of more conservative methods of food preparation, and expenditure of more time in food processing

    b) the second level of responses will be more comprehensive, will include responses in the economic, social and political domains and will differ for generalized versus complex hunter-gatherers. For the former it will include diversification of foods, increased mobility, cooperative strategies, increased time spent in the food quest, resource monitoring and information sharing, reciprocal access and alliance formation, while the latter will increase mobility of task groups, expand trade and engage in raiding. Both may experience the retrenchment of social activity.

c) the third level of responses operate for both groups and may include reduction in group size and decline in population density

d) a final level of responses may see both generalized and complex hunter-gatherers abandon the stressed area and move elsewhere

6.2.3 Applying the Model: The Early Historic Northern Plains

The descriptive model was used to organize a study of the early historic inhabitants of the northern plains, a region occupied by European traders and travellers, the Métis and more than a dozen Indian tribes in the 18th and 19th centuries. The resource structure and resource stressors and associated coping strategies are reviewed and the predictions deriving from the model examined.

An understanding of the lifeway of early historic northern plains occupants is provided by the journals of 54 Europeans (Table 13), the account books and district reports from five Hudson's Bay Company posts, three aboriginal winter counts, and the ethnographies of the resident Indian tribes. In addition, modern environmental studies furnish information about naturally occurring environmental stressors of the region and pollen profiles provide information about climate during the prehistoric period.

The early historic northern plains was an arid temperate grassland populated by substantial herds of bison, pronghorn antelope, as well as elk, moose and deer. Limiting factors included a low and uncertain rainfall, high rates of evaporation, prolonged dry season, cyclical drought, low biological productivity, and fluctuating herd size and composition. It was found that the resource structure was largely defined by resource stressors; that these stressors exhibited tremendous variability; and that they had a profound effect on the flora and fauna. Primary stressors included drought and fire. Predators, storms, disease among humans and animals, animal cycles, floods, overgrazing, intergroup conflict and failure of hunting technology constituted secondary stressors. Some of these stressors were short-term and others long-term. While the former affected hunting activities on a day-to-day, week-to-week and perhaps month-to-month basis, the impact of long-term stressors lasted for extended periods of times, certainly seasons and perhaps years, decades, centuries and even millenia. Sauchyn and Sauchyn (1991) and Vance (1991) have identified drought as an important feature of the prehistoric environment, while Wedel (1941), Blakeslee (1975) and Reher (1978) have linked drought to changing adaptation of prehistoric inhabitants.

Changes in forage yield and density of plant cover are the most immediate responses to changes in moisture conditions. Ultimately floristic composition also is affected. Prairie fires have been linked to the maintenance of grassland vegetation (Sauer 1950; Stewart 1953) since they may enhance plant growth, create open sites, increase biomass, and change floristic composition. Taken together, drought and prairie fires have a synergistic effect and their impact on vegetation is responsible for a decrease in productivity and predictability and increased patchiness of game animals and it is from this perspective that they are viewed as the primary resource stressors in the region.

In addition to general observations regarding resource structure and stressors, quantitative data drawn from ethnographic and ethnohistorical sources provided temporal and spatial information on resource stress experienced by Europeans and Indians. Data on the sighting of immense herds, the movement of bison out of geographic areas, death of bison from drowning, drought episodes, bison in diseased or poor condition, enemy threats, domestic animals under duress, and the depletion of wildlife was summarized (Tables 33 through 50). Contrasts and comparisons were made for four subregions of the northern plains: the Missouri, the North Saskatchewan, the South Saskatchewan and the Red/Assiniboine, for the four seasons, and for specific years. Several patterns can be noted from the quantitative data. First, resource stress was a persistent problem on the northern plains and the area was not uniformly productive. Even the earliest Europeans to reach the Marias River and the Mauvaises Terre of the Missouri found these regions to be wanting. Similarly, Hudson's Bay Company travellers in the parkland between Fort Edmonton, Rocky Mountain House and Jasper House reported the insufficiency of game from their first settlement of these areas in the late 18th century. While the diversity of species was greater than on the plains, parkland animals were fewer in number, smaller, and provided substantially less food. In contrast, some regions such as the Cypress Hills and the Black Hills were noted for their abundance of game. Second, resource stressors varied seasonally and amongst the four subregions. For example, large-scale drowning of buffalo occurred predominantly in the spring. Prairie fires were most frequent in the fall. Two-thirds of all reports of threat of, or action by, enemies are from the Missouri subregion. Third, the decline of large ungulates began earlier in the eastern and southern plains and progressed from east to west and south to north. And fourth, there were differences among species in rates of decline. Fur bearers disappeared very quickly on the open plains, though less rapidly in the parkland. In contrast large ungulates declined much more slowly. The deterioration of both fur bearers and large ungulates was particularly rapid in close proximity to settlements.

When one studies the people who hunted and trapped on the northern plains in the early historic period, one is dealing with a number of very different lifeways. The lifeway of the Indian people was the product of over 10,000 years of adaptation, while the European traders did not appear in the region until the 18th century. Each pursued different subsistence activities though the use of wild foods was paramount for all 18th and 19th century inhabitants of the plains.

Beginning with the first establishment of posts on Hudson's Bay in the 1680's, employees of the Hudson's Bay Company were exhorted by London-based directors to provision themselves through the cultivation of domestic plants and animals. The move inland in 1774 saw post employees continue to respond to this directive but substantial harvests of homegrown vegetables, grains and animals eluded them until the mid 19th century; therefore, employees and dependents of the Hudson's Bay Company, North West Company and American Fur Company primarily lived off the hunt, the fisheries and Indian corn and secondarily on provisions imported from Europe. In contrast, the Indian tribes subsisted largely on wild foods, although native corn was of great importance in the Missouri River subregion. Whether long-term occupants or recent arrivals on the plains, all of the aboriginal peoples possessed proven subsistence techniques and coping strategies and the Europeans benefited from this knowledge.

As predicted by the descriptive model, strategies for coping with fluctuations in food supplies are to be found in the economic, social, political and ideological domains. A comparison of the strategies of the Europeans and aboriginal peoples reveals similarities, but equally important differences. The first pattern that can be noted is that the Europeans lacked the variety of coping strategies exhibited by the Indian peoples. In addition the majority of European coping strategies were in the economic domain, a situation due in part to the recency of their arrival, but also to the fact that they did not bring families, their tenure at individual posts was often limited, they relied on Indian peoples to provision them, and they were part of a larger economic unit that permitted them to rely on supplies from overseas. Of 11 different economic strategies, all were employed by the two groups. They diversified subsistence activities; engaged in cooperative subsistence strategies; monitored resources and shared information; mobilized subsistence groups; stored food; engaged in trade, reciprocity and redistribution; used famine foods when necessary; increased time spent in the food quest; increased food processing time; and conserved wild foods. Strategies in the economic domain were numerous and this may be attributed to the fact that the economic domain is the interface between society and the natural environment. While some economic strategies, such as trade, redistribution, and food storage were precautionary strategies, others such as the use of famine foods and increased time spent in searching for and processing game, were a response to extant shortages. While Europeans and aboriginal peoples employed the same strategies, there were nevertheless significant differences in specifics. The Europeans could tap into imported provisions such as flour, rice, and sugar and it was they who cultivated garden vegetables and raised livestock. And while they employed the same economic strategies as the natives, they hired or depended on native personnel to implement these strategies. The generosity of Indian people was measured in frequent gifts of food. Resource monitoring meant that traders gleaned resource information from visiting Indians. Mobilizing task groups involved hiring native hunters to provision a post. Cooperative subsistence activities meant that Indians constructed buffalo pounds near a post such as Fort Edmonton in order to acquire great quantities of buffalo meat, that post employees had asked them to obtain. Food storage involved the preparation of pemmican, a native invention. In fact, the Europeans borrowed the entire buffalo subsistence base from the Indians. Without wild foods and Indians to procure these foods, there is simply no way that fur company employees could have remained in the New World. Ultimately, their insurance against hunger was to abandon posts in unproductive districts and, if all else failed, they could simply pull up stakes and return to Europe. Aboriginal people did not have this option and one may view the multitude of their social, political and ideological coping mechanisms as precautionary strategies that they and their ancestors had developed over centuries of occupation in environments prone to resource fluctuations.

Coping strategies in the social domain derive from the complex intermingling of individuals and groups. Coping strategies suggested for the social domain included the mobility of personnel between residential units; fluctuating group size; decreased population density; increased foraging area; marriage, descent and kinship systems that extended reciprocal relationships over broad geographic areas; retrenchment of social activity; reciprocal access; enhanced social status for productive hunters and gatherers; prolonged lactation and wide birth spacing; sloughing off members; senilicide; and suicide. Distinctive patterns of work and family life characterized the social interaction that occurred among the Indian tribes, the European fur traders and the Métis. There were significant differences between aboriginal people and Europeans with regard to the nature of their communities and this in turn affected coping strategies. The Indian tribes existed as complete communities. Complete that is, in the sense that families formed residential and work units and the ties that bound the people together or bifurcated them were the result of a social tradition of considerable time depth. On the other hand, the European traders, notably the Hudson's Bay Company employees, were predominantly British nationals who had left their families of orientation and, in some cases, families of procreation in the British Isles. Until the 1820s company rules forbade them to bring their European wives to Rupert's Land and strongly discouraged them from taking Indian wives. Despite this, many entered into marriages with Indian women, "after the custom of the country", and from these unions evolved the racial and ethnic group known as the Métis. Some of these men maintained families in both Europe and Rupert's Land. Their committment to their native families also varied. But one fact is clear: these ties to native people furthered fur trade pursuits, for native women possessed essential skills and their ties to kinsmen assisted the Hudson's Bay Company in acquiring furs, robes and meat products and conversely Indian people gained economic advantages through these unions. But despite these bonds the Europeans were essentially strangers in the northern plains. While their coping strategies in the social domain did include the mobility of personnel between residential units, fluctuating group size, decreased population density, increased foraging area, retrenchment of social activity, and marriage to native women, they did not develop the marital residence, kinship and unilineal descent systems of the native people. The mutual helpfulness that characterized interactions among members of matrilineages, patrilineages, moieties and phratries, voluntary associations, and military societies was lacking. In other words, social networking never expanded beyond marital bonds. Their lack of social ties was a function of the recency of their northern plains occupation; their lack of committment to New World families; their ties to their European homelands; and the political control fostered by the Hudson's Bay Company. Furthermore, social bonds are shaped by economic requirements and with their ability to access imported foodstuffs and to abandon an area at will, the Europeans never saw their social arrangements adapt to the exigencies of the northern plains environment. Furthermore, European social norms were at odds with those of the resident groups. They did not reward productive hunters nor did they control the birth rate. In fact their birthing practices conflicted with native traditions. The weakening of sexual taboos, discouragement of prolonged breastfeeding, and sedentism contributed to a dramatic increase in family size (Van Kirk 1980). Based upon the objections of the Hudson's Bay Company to interracial marriages and the virtual absence of records of these families in post journals, the writer would venture to guess that employees deliberately concealed the size of their families. With these families numbering eight to twelve children contrasting to the Indian norm of four children, post populations expanded rapidly, further exacerbating provisioning difficulties. Another difference was the honor accorded the elderly found only in the aboriginal societies. Elderly people had experienced the cycles of abundance and scarcity for which the northern plains was noted and their knowledge was considered invaluable. In contrast, as European traders aged they were physically unable to continue their trading pursuits and many returned to Europe or settled at Red River after 1812. An additional contrast is to be found in an irreversible strategy, infanticide. This practice, marshalled by aboriginal people experiencing uncommon food shortages, was discouraged by Europeans because it conflicted with their religious doctrines. The inland fur trade by the Hudson's Bay Company began in 1774 so the duration of "fur trade society" was about a hundred years. This was simply too short a time for the evolution of complex social alignments that were key precautionary strategies of the aboriginal inhabitants.

Buffering strategies in the political domain relate to power relations and intercommunity contact. Only four strategies were proposed for the political realm: territoriality, political organization, group fissioning/migration, and raiding- and these were found to be largely limited to aboriginal groups. The fur trading world was conducted as a mercantile venture with a state level political structure combining elements from the world of business and European society. Hudson's Bay Company leadership was ultimately in the hands of a board of directors based in London, England, while headquarters for the North West Company were in Montreal and in St. Louis for the American Fur Company. The British class system was replicated in the sociopolitical organization at individual posts and district headquarters of the Hudson's Bay Company (Hamilton 1990). Leadership at a distance meant that the harsh realities of life in the northern plains were unappreciated and often ignored by those with power and coupled with the short duration of the fur trade era precluded the development of a political organization that embraced risk-reduction strategies. An additional factor was the lack of a firm social foundation from which political organization inevitably develops. It would have been most unusual for coping strategies to have developed in the political realm and, with the possible exception of a broad redistributive network, they did not. The strategies listed above were those of the aboriginal people and they bespeak adaptation to resource variability. Territoriality functions to apportion resources to all segments of the population (Wilmsen 1973) and exists along a continuum of increasing inflexibility from commons to reciprocal access, to territoriality and then private property (Smith 1988). On the northern plains territorial principles among native peoples remained flexible, falling between reciprocal access and territoriality. Band names, neutral zones, and tribal territories are empirical indicators of a territorial principle, albeit one where boundaries shifted through time. Flexibility was inherent in their political structure where bands united as conditions permitted, where the segments were structurally, politically, and functionally equivalent, and where true centralization of power was absent (Sahlins 1968b). These segmentary lineages were the result of a variable food supply on the one hand and a mechanism for reducing the risk associated with resource stress on the other. Segmentary lineages are believed to be a product of repetitive, longterm use of restricted resources and they develop among groups who had intruded into an already occupied habitat rather than one that had expanded into an uncontested domain (Sahlins 1968b). It is known that tribal dislocations accelerated in the 16th, 17th and 18th centuries bringing the Plains Cree, Plains Ojibwa, Sioux and others into the northern plains; consequently, it seems likely that the highly developed coping strategies in the social domain were developed elsewhere and adjustments in the political domain appear to be more recent and to reflect the harsh realities of the northern plains environment. As resource stress accelerated, raiding and theft increased among native people. The sedentary Mandan, Hidatsa, and Arikara villages of the Middle Missouri were repeated targets of raids by nomadic hunter-gatherers.

Buffering mechanisms proposed for the ideological realm include oral tradition, ritual, and even social movements designed to spread information about past catastrophes and to mediate future problems. In the northern plains it was found that they were largely, though not entirely confined to aboriginal societies. Oral tradition included folk tales, songs, histories and mythologies. In the extant winter counts of the Blackfeet, years are named after key resource stressors (Yellow Fly n.d.; Running Rabbit n.d., Raczka 1979). Indian tribes had well-developed rituals designed to ameliorate present and future food shortages. The Mandan performed the Buffalo Dance (Thwaites 1905) while many northern plains tribes partook in the Calumet ceremony, that Blakeslee (1975) suggested promoted fictional kinship ties and forged social alliances between individuals of different tribes and bands. The Ghost Dance, a revitalization movement, spread from the Great Basin into the northern plains in the 1890s. Engendered by acute stress, part of it consisting of food shortages, these movements developed out of contact between aboriginal and European cultures and when economic florescence was followed by decline. The study of coping mechanisms in the ideological sphere is not as well developed as it is in the economic, social, and political domains but the writer suggests that these mechanisms were of far greater importance to hunting and gathering societies than to state-level European society. An important characteristic of hunting and gathering societies is their holistic worldview. Ideological beliefs are intimately tied up with economic, social, and even political activities. Theological explanation prevails in these societies in contrast to 18th and 19th century European society where metaphysical and scientific explanation were blended together.

Having examined the coping strategies of northern plains inhabitants with regard to the descriptive model, an evaluation of the predictions deriving from this model remains. At the outset it is apparent that not all predictions can be confirmed within the current study. The entire northern plains is a marginal habitat and thus the region does not lend itself to comparisons of marginal versus benevolent environments. Furthermore, comparisons between generalized and complex hunter-gatherers is also not strictly possible. While the Indian tribes are clearly representative of generalized hunter-gatherers, the Europeans can not be considered complex hunter-gatherers, although specific features of their cultures, such as sedentary communities, overlap with those of complex hunter-gatherers. The Europeans came from, and were supported by, state level societies, but by virtue of their hunting and gathering subsistence activities, they were impacted by many of the same resource stressors as the aboriginal people. Their close associations with these people through intermarriage, economic alliances and proximity meant that they were able to "tap into" the coping system of the Indians. Bearing these conditions in mind, the predictions deriving from the model are evaluated.

One of the first predictions was that one could reasonably expect to find a wider variety of coping strategies in marginal environments versus benevolent environments and more strategies amongst marginal versus complex hunter-gatherers. Since all groups residing in the early historic northern plains experienced a marginal environment and the Indian peoples were marginal hunter-gatherers, nor can Europeans be considered complex hunter-gatherers, complete assessment of this prediction is not possible. The Indian tribes and the Europeans utilized a similar wide variety of coping strategies in the economic domain; however the latter possessed few strategies in the social domain and even fewer in the political and ideological domains. The ability of the latter group to access imported foods and their reliance on the Indians for provisions meant that they were not faced with the same strictures as the Indians. They thus developed far fewer precautionary and risk-reducing strategies.

A second series of predictions regarding responses to escalating resource stress suggested that economic coping strategies would be a first-line response, that the number of economic strategies would grow as stress expanded, that responses in the social and political domains would be added as the impact of stress expanded, and that the greater the number of coping strategies in all domains the greater the stress. There is good support for these predictions among the people and groups who occupied the northern plains. For example, fur trading establishments normally employed several individuals as hunters. When these individuals were unable to provision adequately because of food shortages, a series of additional economic strategies were adopted. These included: the hiring of additional hunters from among their own ranks, from the Métis people living at or near the post, or by encouraging the members of Indian tribes to increase the quantity of provisions that they brought for trade. When these strategies failed, the subsistence base was diversified to include smaller game and fish. One post where this expanding sequence of economic responses was frequent and cyclical was Rocky Mountain House (HBCA B.21/a/1). When one looks at many of the Indian tribes as long-term inhabitants of the area in contrast to the Europeans who were there for a far shorter period, one is able to link the accretion of their responses in the social, political and ideological domains to their longer occupancy of the region. Furthermore, the greater number and variety of responses in aboriginal cultures reflects their greater exposure to stressors. As noted, the Europeans were somewhat sheltered because of their overseas contacts and because of economic alliances with native peoples.

The prediction that coping strategies in early stages of resource stress tend to be reversible and that they become increasingly irreversible as stress escalates temporally and spatially is born out by specific cases as well. Early responses such as increased mobility of communities amongst Indian tribes and increased mobility of task groups for sedentary fur trading posts are easily altered as food supplies in the immediate area expand. However, the abandonment of a fur trade post because of localized food shortages, normally ruled out its reoccupation because the abandoned structures were often destroyed and the costs of rebuilding considered too high. Among aboriginal peoples, precautionary strategies designed to ameliorate seasonal shortages, such as reciprocity and trading partnerships, created obligations among people that had to be cultivated if they were expected to work. They were not as easy to reverse as was the diversification of the resource base.

Owing to differences in sociopolitical organization of generalized versus complex hunter-gatherers it was predicted that generalized hunter-gatherers will diversify their subsistence base while complex hunter-gatherers may specialize, that group mobility increases for the former while task group mobility increases for the latter, and that generalized hunting and gathering societies will increase reciprocity and form alliances while complex hunter-gatherers will increase food storage and expand trade. Specific examples from the northern plains are offered as support of these predictions. The nomadic Indian tribes of the northern plains, such as the Blackfoot, Gros Ventre and Sioux, increased the mobility of their communities as food shortages escalated. The sedentary Indian tribes, the Mandan, Hidatsa, and Arikara, temporally abandoned their permanent earthlodge villages, in order to procure meat on the open plains. The fur traders retained their permanent establishments but increased the number of hunters and the range over which they foraged. All groups were forced to diversify their subsistence base when shortages prevailed, because they were affected by the same resource structure, one of low productivity, patchiness and unpredictability. The thrust behind the horticultural and agricultural activities at fur trade posts was economic self-sufficiency. These activities, had they succeeded, would have led to specialization and ultimately, intensification of the subsistence base. However, early attempts at introducing these specialized techniques from the European homeland of the traders, were fraught with difficulty. So while the intent was to specialize and intensify, circumstances prevented this from happening. Because of the sedentary nature of their establishments, the European fur traders and the Middle Missouri earthlodge villagers, greatly expanded the storage capacity of their settlements. Ice houses capable of storing hundreds of bison carcasses were common at such posts as Fort Edmonton (Harper 1971) and cache pits for storing maize and meat were located beneath earthlodge floors or between lodges in the Mandan, Hidatsa, and Arikara villages of the Middle Missouri (Lowie 1954).

It was predicted that generalized hunter-gatherers would respond differently to seasonal shortages than would complex hunter-gatherers, in particular the former would improve the networks for reciprocal exchange and alliances while the latter would expand storage and trade. Data from the northern plains and the following discussion indicate that this simple dichotomy of strategies did not exist. The case has already been made for the magnitude of storage facilities at fur trade establishments (Harper 1971), and data from account books (eg. Tables 26, 27) provides a measure of the variety and quantity of trade in foods among the posts in the Saskatchewan District and beyond. This included imported items such as flour, sugar, biscuit, and tea, the transfer of locally grown horticultural and agricultural produce such as potatoes, and the transfer of bison products such as grease, pemmican, and beat meat. In addition, the Saskatchewan District posts were expected to assemble huge quantities of pemmican to provision the traders operating in the north. There is no doubt that trade in food was a major activity throughout the fur trade empire and this was necessitated by several factors: first, localized shortages at northern plains posts and second, very low productivity in the boreal forest where small fur-bearing mammals prevailed. While quantitative data on the magnitude of reciprocity among the Indian peoples is lacking, it is still possible to comment on their use of reciprocity and alliances as risk-reduction strategies. Reciprocity, reciprocal access and trade were all important risk reduction strategies among the aboriginal people. With the arrival of the Europeans, existing reciprocal arrangements became stressed as new ones were formed. A benefit of, and perhaps a contributing factor toward the formation of marital alliances between European traders and Indian women, was the promise of trading advantages to both groups. As reciprocal ties were established between Europeans and Indians, those between Indian bands and tribes were often weakened. As far as trade is concerned, archaeological and ethnographic information clearly supports the view that elaborate trading networks were established many centuries, if not millenia, before the arrival of the Europeans in the 18th century (Blakeslee 1975). These remained important in the early historic period and the Mandan villages on the Missouri River were the trade centre for inter-tribal trade and later European-Indian trade, as well. In evaluating reciprocity and alliances of generalized hunter-gatherers versus the increasing storage and trade of complex hunter-gatherers, the information from the northern plains is ambiguous and the reason for this ambiguity relates to features of the resource structure of the region. The writer suggests that sociopolitical differences between the resident groups and the effect of sociopolitical organization on coping strategies, was overshadowed by features of the environment. The patchiness of resources over this large area and the seasonal fluctuations in availability of large ungulates precluded a dichotomy of coping mechanisms between the European and Indian residents of the area. Therefore, the strategies that they embraced often overlapped. Reciprocity and reciprocal access had long been used as strategies by Indian peoples and they were coopted by the Europeans as a way of dealing with the fluctuations in food supply. Alliances whether through marriage or trading partnerships were mechanisms by which reciprocity was fostered. The advent of the fur trade era led to changing alliances among native groups and also to changes in the items traded, and even in resource stress itself.

Another response to seasonal shortages that was proposed was the development of flexible sociopolitical structures that would be preadapted to this insecurity. The segmentary lineage system of the northern plains Indian tribes is seen as an adaptation to repetitive, long-term use of restricted resources, competition between tribal groups, and intrusion into already occupied habitats (Sahlins 1967). Nowhere are the differences between the generalized hunting and gathering Indian tribes and the European traders more visible than in their sociopolitical organization. The latter were controlled by a state-level bureaucracy operating from London, England. In many respects this arrangement was maladaptive because of the distance and because in the northern plains it was supported by hunting and gathering, not intensive agriculture.

It was predicted that responses to intense long-term shortages might include changes in subsistence strategies, dramatic population decline, and out-migration and these responses would be found among both generalized and complex hunter-gatherers. Because of the short span of the early historic period in the northern plains, the evaluation of these predictions remains tentative. Changes in subsistence strategies did occur. With the demise of the ungulates, greater emphasis was placed on agricultural production by the Europeans, particularly in the region of the Red River. And the development of plant and animal varietals that were better adapted to the northern plains environment fostered the switch to an agricultural resource base in the late 19th century. While agriculture had been practiced since the first appearance of the Europeans on Hudson's Bay, there is little doubt that the transition was accelerated by the near-extinction of bison, by the development of new and hardier crops and animals and by new agricultural machinery. For the Indians, great suffering caused by disease and starvation dramatically reduced their population. Their dependence on a redistributive network established by the Europeans became a major coping strategy.

Out-migration from the northern plains did not occur because the new subsistence base and new subsistence technology provided an alternate strategy.

From the discussion above, comes support for the suggestion that many responses to food shortages are in fact extensions of extant practices. It was predicted that generalized hunter-gatherers should increase group mobility and expand their reciprocal networks and that complex hunter-gatherers would increase task group mobility and intensify specialized subsistence activities. There is ample evidence that the Plains Indians increased the number of camp moves per year as resources declined in availability, while the sedentary fur traders increased the number of hunters, the number of task groups, and the range of these individuals and groups. Unlike complex hunter-gatherers, the traders possessed horses and sleds that permitted them to exploit a much larger territory. It was not unusual for these task groups to travel 250 miles distant in search of food. In addition, they planted gardens and crops and raised domestic animals as supplementary food sources.

These latter activities intensified as the slow decline of game continued through the 19th century.

Several predictions deriving from optimal foraging theory find support in the activities of the northern plains inhabitants. Optimal foraging theory predicts that as high ranked resources decline in availability, the resource base will be diversified and that as resources become increasingly patchy and unpredictable, human groups will reduce group size, increase search area, increase task group mobility, and improve information sharing. There are numerous examples of the former as found in Table 50. When bison were scarce, fisheries at Lac St. Ann, Jack Fish Lake, and Pigeon Lake provided food for traders and Indians alike, (The Earl of Southesk 1969; Dempsey 1977). The Métis at Qu'Appelle Lakes ate ducks, rabbits, beaver, deer and antelope when short of bison (Abel 32). Rabbits were extensively used in the parkland when big-game was unavailable (Spry 1968; Harper 1971). The preceeding discussion offers support for the predictions that group size declines, and mobility and range increase as resources become increasingly patchy. Information sharing also expanded in the northern plains. Daily journals from posts such as Rocky Mountain House (HBCA B.184/a/1-5) and Chesterfield House (HBCA B.34/a/1-5) document reports of game availability brought to the posts by Indians coming to trade, by post hunters and by visitors. Information sharing was absolutely essential in the patchy environment.

The prediction that generalized hunter-gatherers experience greater social dislocation than complex hunter-gatherers as the process of modernization advances cannot be thoroughly tested in the study region because there were no complex hunter-gatherers and those who shared many of their attributes, the fur traders, were the architects of social change. However, if one compares the response of nomadic hunter-gatherers such as the Blackfoot, with that of the semi-sedentary horticulturalists in the Middle Missouri, one significant difference can be identified. The latter with their long tradition of maize cultivation adopted European crops much more readily than did the Blackfoot who, 100 years after the demise of the bison, could still not be considered agriculturai.

The final set of predictions is an attempt to temporally rank responses to resource stress. It was predicted that first line responses for generalized and complex hunter-gatherers should involve the consumption of less food, eating bulky food, implementation of conservative methods of food preparation and expenditure of more time in food processing. It was predicted that differences between these societies will appear in second-line responses when generalized hunter-gatherers increase their mobility, information sharing, and activite their reciprocal alignments, whereas complex hunter-gatherers increase the mobility of task groups, expand trade and engage in raiding. It was predicted that a third level response would see both groups reducing group size and population density. For both types of society, the final level of response would be abandonment of the territory. The northern plains case offers some support for the notion that a sequence of responses exists and that it varies from one social type to another. Because many of the Indian tribes were nomadic, the frequency of their movements simply increased. The fur traders increased the numbers of and mobility of their hunting parties. The Middle Missouri semi-sedentary horticulturalists abandoned the earthlodge villages after planting their crops, but with every intention of returning when the crops were mature. All groups were heavily reliant on information brought by visitors from afar. These first line responses reflected a feeling that while shortages were present, they were likely localized and should the community, in the case of the nomadic hunter-gatherers, or the task group, in the case of the sedentary fur traders, travel far enough food would be available. Upon securing information that shortages were not due to patchiness, but covered huge geographical areas, if not the entire northern plains, all hope that extant settlement patterns could be retained, disappeared. And in the level three responses one can expect to find changes in these very settlement patterns: groups bifurcate and move and population density declines. The final predicted response, near complete abandonment of an area, did not occur in the northern plains region, though it must be remembered that some regions of the plains were known to be game-poor and consequently, people avoided those areas. The Mauvaises Terre of the Upper Missouri is a case in point. Abandonment of a region becomes problematic if surrounding regions are occupied, especially if the residents are hostile.

In summary, the descriptive model provided a summary of the variety of coping strategies one can expect in societies that are reliant on hunted and gathered foods while at the same time it generated a number of predictions about how, when, where, and why these responses occur.

The study of resource structure and stressors provides a foundation for additional discussion of an anthropological nature. The notion of an optimal carrying capacity is frequently mentioned in ecological studies; however, the northern plains case corroborates Hayden's (1975) concern with this construct. Ethnohistorical sources repeatedly documented the enormous numbers of big-game animals. Under conditions of abundance, some cultures have become socially complex, exhibiting large, relatively stable, dense populations, sedentism, and social stratification. None of these phenomena developed amongst aboriginal peoples in the prehistoric northern plains, and while the rudiments of social stratification are alleged for the early historic period (Ewers 1955), this adaptation was of short duration, if it existed at all. Resource structure, technological change, and a new economic system are key to this discussion. The Europeans who first witnessed the massive herds of buffalo in the late 17th century believed that localized abundance transferred into large total biomass. They soon learned that bison constituted a patchy, unpredictable resource and, as time passed, one of declining productivity. The introduction of the fur trade economy and new appurtenances, the horse and gun, underwrote a brief cultural florescence for Indian peoples that was not to last. Increasing social strife and overhunting transformed the area in a century and a half. It is clear that hunting was the foundation of a viable economic system, but could only remain so if the numbers of people and their demands upon the subsistence base were controlled. It is estimated that at contact the aboriginal population was about 100,000 to 120,000 in an area encompassing 240,000 square kilometers, giving a population density of about 0.5 persons per square kilometer. Disease likely halved this number but the incursions of Europeans into North America, new technologies, expansion of the number of people dependent on bison, new uses for bison products, and wasteful practices more than offset this decline and added so much pressure that the subsistence base was effectively destroyed by 1880. Carrying capactiy is about far more than numbers of animals, and quantification of the variables involved is all but impossible.

Research on environmental stressors in the northern plains clearly shows the variety of stressors one finds in this typical marginal environment. While many of these stressors are inherent in the resource structure, having derived from the precipitation and temperature regimes, others are social in origin. And stressors are synergistic so that when they are combined they have a far greater impact than if occurring separately. In the northern plains one must appreciate the combined impact of drought, prairie fire, and the trampling of tens of thousands of hooved animals on grassland vegetation or alternatively the effect of abundant precipitation, unlimited food supply, and mild winters on ungulate numbers. When one looks at resource stress as a causal factor in culture change, one is not dealing with a single agent, but with multiple interacting phenomena. In light of this, monocausal explanations of cultural transitions, including those that ushered in the neolithic and civilization, are judged overly simplistic.

The model and the northern plains case study draw attention to weaknesses in extant typologies of hunter-gatherer societies, that deny their use of domestic plants and animals. The combining of subsistence strategies is an important coping mechanism for people whether predominantly hunting and gathering or agricultural (Bird-David 1992b). On the northern plains the fur traders with an agricultural origin were nevertheless heavily dependent on hunted game as were the Middle Missouri horticulturalists.

Some societies are more vulnerable to resource stress than others. Burton, Kates, and White (1978) have indicated that the most vulnerable are those in the process of rapid transition where traditional coping strategies have been eroded away and new strategies have not yet developed. In essence both the European settlements and the aboriginal peoples exhibited this problem. The Europeans had no experience of the vagaries of the plains environment, little knowledge of big game hunting, an agricultural heritage, and coping mechanisms congruent with this agricultural background. Their sojourn in the New World was a struggle. On the other hand, the economic changes brought by their presence were a new source of stress for the aboriginal peoples. Furthermore, the migration onto the plains by peripheral Indian tribes hastened cultural and environmental change. Fur trading posts could be occupied for decades, or at the very least several seasons, and the Indian tribes modified their nomadic patterns to increase their access to the economic opportunities afforded them at these posts, so that increased sedentism quickly led to game shortages about these posts, and, as time passed, shortages expanded over districts, regions, and ultimately the entire area. Intergroup conflict accelerated as territories shifted and peoples with divergent norms, values, beliefs and ideologies interacted. The profile of culture change in this region provides clear evidence that under conditions of extreme resource stress, cultural change is rapid.

Since a full suite of coping strategies is embedded in a web of economic, social, political and ideological relations, they can be considered the result of long-term adaptation. The complexity of responses in these different domains may ultimately be used to evaluate the relative adaptedness of different societies and following from that, the recency of their occupation of a region.

6.3 <u>Implications for Archaeology</u>

Having developed a descriptive model linking coping mechanisms to resource stress, the researcher will examine the predictions deriving from this model in the interpretation of select problems in northern plains prehistory. The *Doctrine of Uniformitarianism* facilitates this linkage because it assumes that the present provides observational data that may enable us to unlock the information in written and unwritten records of the past. Whereas ongoing geological processes furnish clues to climatic, erosional, and depositional events of the past, historical documentation and the study of living peoples provide valuable clues to prehistoric culture process. Bearing in mind that studies have shown that modern events are not always to be found in records of the past, nor are events of the past always represented by analogues in the present, the following discussion evaluates the utility of the resource stress model as middle range theory.

6.3.1 Middle Range Theory

Middle range theory was originally formulated by sociologist Robert Merton, who envisioned that it would provide a link between low-order empirical generalizations and comparatively high-order theories and that it would also vary in levels of abstraction, be flexible in seeking working hypotheses, and vary from one level of inquiry to another (Raab and Goodyear 1984). In middle range theory archaeologists initially saw a chance to isolate those factors that are the critical link between long-extinct dynamic human behavior of the past and the static material properties common in both the past and the present. However, middle range theory has come to mean different things. Some view middle range theory as synonyous with the study of archaeological site formation processes (Schiffer 1972), while others have sought to reconstruct settlement behavior using geographic and climatic variables (Binford 1978) or risk theory (Wiessner 1982). Middle range theory in archaeology has been generated by ethnoarchaeology, experimental archaeology, and recently, historical documentation (Thomas 1989). Leone and Potter (1988) suggested that a middle range framework can be achieved if archaeological and documentary records are viewed as independent, yet equally valid lines of evidence. Similarities between them provide corroborative evidence but differences are seen as equally valid because they continue to expand our knowledge. The present study uses ethnohistorical, ethnographical, and contemporary climatological, botanical, and zoological documentation to build middle range theory. It is based on the premise that this theory can be used not only to understand the processes responsible for the formation of the palaeoenvironmental and palaeocultural records, but as a theory of adaptation as well. In this later manifestation, it takes a holistic perspective attempting to understand how social institutions respond to external and internal stimulii that produce resource stress. As conceived here, middle range theory is the broad construct envisioned by Goodyear and Raab (1984). It is a basis for theorizing about the causes of human behavior. It bridges the gulf between the high-order theories and low-level empirical studies that Merton was attempting to address when he originally proposed the approach. In its present application middle range theory attempts to explain not only selected features of the northern plains archaeological record but the cultural dynamism responsible for that record as well.

The northern plains is one of the better known cultural regions in terms of ethnography, ethnohistory, archaeology and history. Members of the Boasian School and others produced multiple ethnographies describing the lifeways of the Indian tribes who occupied the region in the 18th, 19th, and 20th centuries (eg. Flannery 1953; Lowie 1935; Mandelbaum 1979; Wissler 1910, 1912). Extensive archaeological work commenced in the 1960s with the birth of salvage archaeology in the Missouri River Valley (Lehmer

1971) and this accelerated in the 1970s and 1980s with the advent of cultural resource management. And, invaluable historical documentation is to be found in records of the Hudson's Bay, North West and American Fur Companies. Despite these sources, archaeological and ethnographic interpretations have not kept pace with developments in the field of anthropology as a whole. This has been due to a reliance on the outdated cultural historical paradigm on the one hand, and faith in biased and impressionistic second-hand accounts, on the other. Consider that in 1991 a plains archaeologist asserted "About the only things which changed through time were projectile points and styles, and to a lesser extent certain items in tool assemblages" (Frison 1991:19). Or the respected historian who described the Plains Indian lifeway as one of "paleolithic bliss" where "There was no soul-destroying daily routine of drudgery. Securing food meant the exciting chase or buffalo drive, hunting other big game, wandering in the bush to pick berries or out on the prairie to dig roots. All of these diversified activities . . . were enjoyable" (Spry 1991:83). Historic data seriously challenges both assertions. Environmental data document significant climatic change in the historic period (Coupland 1958) and even more so during selected periods in prehistory (Sauchyn and Sauchyn 1991; Vance 1991). There is little doubt that significant resource fluctuations were a byproduct and there are strong suggestions that selected features of Plains Indian culture appear to be precautionary adaptive responses to these fluctuations. It is proposed that middle range theory built on historical documentation can offer at the very least new views on the static material record, and it may explicate the dynamic behavior of the past.

A major aim of middle range research is to link empirical observations from the archaeological record with observed contemporary behavior. In this study this means identifying evidence of resource stressors and coping mechanisms in the paleoenvironmental and paleocultural records. This activity is fraught with ambiguity. How are we to know if crushed and splintered bone deriving from bone grease production is linked to the use of grease as a famine food, an item of trade or for pemmican production. Are large ceremonial sites linked to increasing leisure time associated with food supply certainty, a strategy to foster reciprocal exchange in the face of food supply uncertainty, or territorial markers designed to ameliorate increasing social conflict? Are broad trading networks an indication of personal aggrandizement or a mechanism for maintaining reciprocal access in an unpredictable environment? Was communal hunting a response to clumped and declining or to clumped and abundant resources? It is not sufficient to simply find isolated empirical indicators of coping strategies in the archaeological record. It is essential that these indicators occur in contexts where they can be linked initially to resource stress and subsequently to changing adaptations by social institutions. Identification and delimitation of the temporal span of a known stressor must be followed by a contexual study of the social institutions of prehistoric cultures that lived in the stressed region before, during, and following a period of stress. Since the model predicted behavioral responses in the economic, social, political, and ideological domains, changes in these domains over time could be reliably associated with the stressor. It is assumed that when strategies are initiated at approximately the same time as resource stress is expanding, in all likelihood there is a causal relationship. Similarly, when stress declines and coping strategies associated with this stress disappear, a causal relationship is suspected. Judging from the nature of prehistoric human behavior, the relationship of this behavior to the archaeological record, the alteration of this record due to taphonomic processes, and the differences between historic and prehistoric behavior patterns, some areas of congruence will be established and others remain unresolved.

To begin a contexual analysis in the northern plains is to isolate temporal periods when significant resource stress was known to exist. Stressors can be subdivided into short-term versus long-term, and geographically restricted versus geographically extensive. The writer suggests that it is highly unlikely that most short-term environmental stressors will leave a record of coping strategies that scientists, with their current level of expertise, can recognize; therefore, any attempt to identify resource stress in the palaeoenvironmental record will have to focus on long-term stressors. It is also likely that we will only recognize stressors that had a widespread impact. In the northern plains drought is such a phenomenon. Since drought has an immediate impact on vegetation and declining food affects ungulates, in studying resource stress on the northern plains one is required to look at the changing economic and social configurations of resource procurement.

Once a period of significant resource stress has been delimited, the next step is to isolate the empirical indicators of coping strategies that one could expect to observe in the archaeological record. Some empirical indicators that might appear are: increased butchering and crushing of bone indicating a need to extract all nourishment; the use of all skeletal elements; diversification of the subsistence base by the incorporation of a greater variety of small bodied animals, fish and plant foods; an increase in the number of small sites at the expense of larger sites; a decline in the length of site occupancy; a decline in large scale communal hunting; a decline in the number of sites; and an increase in foraging area. Should a suite of indicators repeatedly occur in archaeological assemblages deposited during a stressful time period, the integrity of these indicators is enhanced and the relationship between resource stress and coping strategies more certain.

One way to identify empirical indicators of coping strategies is to compare assemblages from antecedent and subsequent temporal periods to those in a stressful period. Significant differences in subsistence pursuits, subsistence base, food processing and settlement patterns would help to confirm that innovations during the stressful period are related to resource stress. Bearing in mind the resource structure of the northern plains, it is highly likely that a move to exploiting small game is very likely associated with a decline in the availability of bison. Similarly, if faunal assemblages exhibit heavy utilization following a period of light utilization, the conservative food preparation is likely related to extant food shortages. And for a specific time period or cultural phase, a significant decline in the number of sites coupled with a decline in large sites and increase in small ones is likely related to a decline in the carrying capacity of the region. Since coping strategies are activated as stress intensifies, it is expected that they will be discarded as stress ameliorates. Returning to the foregoing example, if bison, after a period of decreased use, once again become the dominant animal in faunal assemblages, it is reasonable to conclude that their numbers have once again increased. Similarly, if the number of sites increases, as does their relative size, it seems likely that the impact of resource stress has declined.

As an additional consideration, it was predicted that some temporary coping strategies may be retained as precautionary strategies and thus become part of the long-term adaptation of the cultural groups in question. In the northern plains the extraction of bone grease indicated by large stone boiling pits and associated crushed bone seems to have initially appeared during the Mid-Holocene Climatic Optimum and persisted for thousands of years but in a different context. In other words, a strategy adaptive under conditions of stress might have adaptive value in a different situation. Bone grease may have initially served as a famine food and subsequently as a key ingredient in pemmican and later as a trade item.

Without a contextual approach one might find isolated examples of empirical indicators seemingly indicative of coping mechanisms but with no immediate evidence of resource stress. Isolated phenomena, such as evidence for bone grease extraction, are considered unreliable as empirical indicators of coping strategies and, in turn, as indicators of resource stress. Contextual analysis is required to improve the reliability of the observations and reliability increases as the number of assemblages undergoing analysis increases. The contextual analysis proposed herein will not be satisfied by the analysis of assemblages from single sites, but will involve assemblage comparisons from a number of widespread and roughly contemporaneous sites all in the same stressed region. Because long-term and spatially expansive resource stressors are requirements, the empirical indicators must derive from a similarly widespread area.

Since the model predicted coping strategies in the economic, social, political and ideological domains, far more empirical indicators than those mentioned above must be considered. The potential utility of indicators will have to be evaluated keeping in mind that the archaeological record is selective in terms of which human activities are preserved. Indicators of coping strategies in the economic realm are more frequently preserved in archaeological sites than are those from social, political, and ideological realms, or at least archaeologists find these signatures to be more visible or easily recognized. And for this reason, the application of the model should begin with the identification of these strategies, and move onto the others as data permits.

In the discussion that follows the utility of middle range theory is considered through: a) the identification of a specific time period when environmental dessication occurred in the northern plains, (b) a general discussion of the inferred resource stress deriving from environmental change, and c) empirical evidence of coping strategies deriving from archaeological assemblages of that time period. This discussion focuses on the conditions contributing to the stress, the delimitation of a period of known stress, the cultural innovations that appeared at this time, and their continuance in subsequent unstressed periods.

6.3.2 Resource Stress and the Mid-Holocene Climatic Optimum

6.3.2.1 Environmental Considerations

While the palaeoenvironmental record for central North America, in general, and the northern plains, in particular, is anything but complete, it has long been known that environmental conditions changed dramatically in the 10,000 or more years of human occupancy (Borchert 1950; Bryson and Wendland 1967; Christensen and Hills 1985; Driver et al 1985; McKinnon 1986; Bryson 1987; Vance 1987, 1991; Vance et al 1992; Vance et al 1993). The primary factor in environmental change seems to have been fluctuations in effective precipitation and the secondary factor, changes in seasonal temperature regimes. Until recently virtually all palynological data dealing with the mid-

Holocene came from sites outside the northern plains; however, two new studies provide evidence of changing environmental conditions in the study area (Vance 1991; Sauchyn and Sauchyn 1991; Vance et al 1992; Vance et al 1993).

Analyses of pollen, plant macrofossils, sediment mineralogy, geochemistry, and lithology of multiple cores permitted reconstruction of prehistoric lake level changes at Chappice Lake in southeastern Alberta and these fluctuations were in turn linked to regional climatic change (Vance 1991; Vance et al 1992; Vance et al 1993). Lake level changes are viewed as a reflection of water table fluctuations that are ultimately driven by climate; therefore, low water stands are considered representative of drought and high water stands indicative of elevated precipitation levels (Vance 1991). Evidence from the Chappice Lake cores suggests that droughts were not cyclical on the northern plains; that there were intervals of frequent, intense drought plus extended periods during which droughts were rare; that there were periodic high water intervals within periods identified as dry; that prehistoric droughts were often far more intense than those in recent history; and that the timing of paleohydrological events at Chappice Lake correspond closely with well documented Holocene climatic intervals, such as the Hypsithermal, Neoglaciation, Medieval Warm Period, and Little Ice Age (Vance 1991; Vance et al 1992; Vance et al 1993). Extreme water level changes recorded in sediments deposited between 7300 and 6000 B.P. were likely dictated by the prevailing climatic regime (Vance et al 1993). Vance et al (1993) noted that repeated desiccation at Chappice Lake during this interval indicates that droughts on the northern plains were relatively frequent and more severe than those of the historic period. The spatial extent of the affected area appears to have been considerable since low, but fluctuating water levels were also characteristic of lakes in Montana, the eastern slopes of the Canadian Rocky Mountains, central Alberta and southwestern Saskatchewan (Vance et al 1993). This has led to the suggestion that "a climatic regime warmer, drier, and more variable than present prevailed throughout the west-central interior of North America, possibly reflecting atmospheric circulation patterns driven by enhanced seasonal insolation variation" (Kutzbach and Guetter 1986 from Vance 1993:115). By 6000 B.P. climatic change led to elevated lake levels and it is likely that severe drought was not a feature of the northern plains at this time. Vance et al (1993) do, however, note that lake levels were lower between 6000 and 4400 B.P. than at present, which they interpret to mean that conditions were warmer and drier than at present. In the subsequent 4000 years Chappice Lake provides good evidence of several significant hydrological events, in contrast to paleoecological data from areas adjacent to the northern plains. A long high-water stand occurred between 2600 and 1000 B.P., while severe recurrent drought between 1000 and 600 B.P. is indicated by alternating high and low-water stands. The latter interval corresponds to the Medieval Warm Period. From 600 B.P. to the historic period, lake level remained high at Chappice Lake although several brief low-water stands did occur during this interval. The high-water interval corresponds to the Little Ice Age, a cool moist period when Rocky Mountain glaciers underwent their greatest expansion in the past 10,000 years.

A 9,120 year pollen profile from Harris Lake in the Cypress Hills documents a period of drought extending from 7,700 to 5,000 B.P.(Sauchyn and Sauchyn 1991). Sauchyn and Sauchyn (1991) suggested that a vegetation mosaic of forest and grassland existed prior to 7,700 B.P. and beginning about that time grassland and saline-tolerant vegetation increased at the expense of the forest. Following the interval of drought, forests spread and for the past 3200 years modern vegetation has predominated with little change throughout those years.

Chappice Lake and Harris Lake are within 200 km. of each other, and, while the former is located on the open plains, the latter is in a mountain outlier. Vance's interval lasting from 7,300 to 6,000 B.P. and the Sauchyn's 7,700 to 5,000 time period represent an era known variously as the Mid-Holocene Climatic Optimum, the Hypsithermal, the Altithermal or the Atlantic (Antevs 1955; Reeves 1973; Buchner 1980; McKinnon and Stuart 1984; Vance et al 1993). At this time decreased precipitation coupled with increased temperatures and evaporation contributed to recurring drought conditions. In the drought of the Mid-Holocene Climatic Optimum we have a temporally and spatially extensive stressor and the following discussion considers the utility of the resource stress model with respect to archaeological interpretation of that period.

Conceived by Antevs (1955), the Mid-Holocene Climatic Optimum was originally viewed as a gradual warming to a maximum, followed by gradual cooling to modern conditions. Subsequently, Bryson and Wendland (1967), using the Blytt-Sernander terminology, proposed an episodic model based on rapid transitions between quasi-steady state climatic episodes. An episodic model is supported by data from Chappice Lake where Vance (1991) reports some periods of extreme drought interrupted by short moist intervals and others of extended drought without abatement. It would appear that multiple factors influenced Holocene climates, including orbital variations, changes in upper atmospheric wind patterns, and the Laurentide ice mass (Vance 1987, 1991). These factors, in turn, produced changes in zonal circulation patterns, affecting the incursion of westerlies into the region. Vance (1991) has suggested that orbital variations resulted in amplification of high northern latitude seasonality between 15,000 and 6000 B.P. leading to increased summer temperatures. This seasonality is seen as a likely factor in the extreme drought events recorded at Chappice Lake prior to 6000 B.P. For the period between 6,000 and 4,000 B.P., Vance (1987) has suggested that the development of a high pressure ridge over the Rockies effectively blocked the movement east of moisure-bearing low pressure systems moving off the Pacific, thereby causing drought conditions in the northern plains.

It is posited that drought during the Mid-Holocene Climatic Optimum had an enormous impact on the resource structure of the northern plains. The immediate effect would be vegetational change and this in turn would affect herbivores and subsequently all of those species dependent upon them. While it is not possible to state with certainty the precise nature of the vegetational impact, evidence from the Chappice Lake cores and from contemporary studies of grassland vegetation provide some understanding of the dynamics of ecosystem response to drought. Changing frequencies of key taxa in the Chappice Lake pollen diagram clearly show that the lake basin dried completely on occasion between 7300 and 6000 B.P., although these desiccation events were interspersed with relatively high, freshwater stands (Vance et al 1993). These vegetative changes suggest that the magnitude of these prehistoric droughts was substantially greater than historic droughts in the northern plains (Vance et al 1992). Studies of the impact of contemporary droughts in the study region clearly document the variety and magnitude of vegetational changes (Clarke et al 1943; Smoliak and Peters 1952; Smoliak 1956; Coupland 1958; Bazzaz and Parrish 1982). This included species removal, competitive release, thinning of the canopy and exposure of understory plants, invasion of fugitives, changes in the demographic and perhaps genetic structure of the populations and shifts in phenological events and fecundity of species (Bazzaz and Parrish 1982). The most immediate response to decreased moisture is the curtailment of height of growth (Coupland 1958) that of course means a decline in forage yield. Reduced foliage in turn reduces shade that accelerates the evaporation of soil moisture. Grasshoppers flourish during drought and their consumption of vegetation exacerbates the decline in vegetation density. While grasslands can recover rapidly from the effects of drought as moisture regimes improve, should herbivores be present, their grazing has as great, or greater impact on plant cover, than drought (Coupland 1958). An additional factor that must be considered is the impact of prairie fires on vegetation. Historically, prairie fires were geographically extensive in the study area (Pyne 1982) and it is believed that they were largely responsible for the maintenance of grassland vegetation (Sauer 1950; Stewart 1953). Taken together, prairie fires and substantial herds of herbivores would have had their greatest impact on grassland habitats during periods of drought. Their impact during the early historic period was considerable (Spry 1968) and this interval fell during the Little Ice Age (A.D. 1430-1850) when cool, moist conditions are assumed to have increased the forage yield of northern plains grasslands (Reher 1978;Vance et al 1993). Their impact during the Mid-Holocene

Climatic Optimum must have been many times greater. The author concurs with Buchner (1980) that continuous low forage yields would typify periods of extensive drought and that in all likelihood this was the case during the severe desiccation episodes that occurred between 7300 and 6000 B.P. at Chappice Lake. However, Vance et al (1993) noted that periodic high-water stands also occurred during this interval; therefore, low forage yields would not have characterized the entire Mid-Holocene Climatic Optimum. In summary our current data base indicates that the Mid-Holocene Climatic Optimum in the northern plains witnessed periods of extreme drought interrupted by short moist intervals. Floral variety, height, density and yield would have declined precipitously during these periods of drought, and recovered during the short intervals of greater moisture. While plains grasses are adapted for rapid recovery as moisture regimes improve, this recovery is dependent on moderate grazing (Coupland 1958), and presumably a low incidence of prairie fires as well. Assuming a greater frequency of prairie fires during periods of drought combined with the impact of remaining herbivores and the greater intensity of drought, it is likely that grassland recovery was probably slower during the Mid-Holocene Climatic Optimum than in contemporary times. In the final analysis, it is likely that ungulate populations fluctuated dramatically as well. During periods of intense drought they would have experienced a substantial decline in numbers and during the episodes of increased precipitation, their numbers likely increased. If one were to make comparisons, it seems reasonable to assume that the carrying capacity of the northern plains fluctuated from a low during the drought intervals of the Mid-Holocene Climatic Optimum to a high during the improved moisture conditions of the Little Ice Age. Ethnohistorical observations are of course from the last half of the Little Ice Age. It, therefore, seems likely that the repeated observations about the enormous numbers of bison, antelope and other game animals (Table 33) record animal populations at one of their peak periods. Visualizing what the numbers might have been during a down cycle is more difficult.

Another issue that bears consideration is the geographical extent of drought cycles. At present a data base covering a wide geographic area is not available. The extant data, do however, indicate some correspondence from the foothills of western Alberta, to the plains of eastern Alberta, northern Montana and North Dakota between 7300 and 6000 B.P. and between central and southern Alberta and southern Saskatchewan between 6000 and 4400 B.P. (Vance et al 1992). If Chakravarti (1976) is correct, the northern and southern segments of the northern plains should exhibit differences, that is when one area experiences drought, the other does not, and vice versa. Certainly contemporary precipitation regimes from any one year show considerable variation across the region. However, as Vance et al (1993) have noted, droughts in prehistoric and historic times are not necessarily analogous. The former appear to have been far more intense. Resolution of this problem awaits additional paleoenvironmental studies of the magnitude of the Chappice Lake study (Vance 1991; Vance et al 1992; Vance et al 1993). Certainly, chronologies from various areas of North America clearly show that a Mid-Holocene thermal maximum on a continental level is not valid (Schweger 1984). And, in some areas the "Long Drought" may in reality have been two short droughts lasting from 7000-6500 B.P. and 6000-5500 B.P. (Benedict 1979).

Scattered pollen studies from across the plains and adjacent areas indicate that the areal extent of grassland increased at the expense of forested areas during the Mid-Holocene Climatic Optimum. Acknowledging this situation, Reeves (1973) suggested that the enlarged area would have maintained existing numbers of ungulates but the author regards this view as highly unlikely given the known impact of drought on forage yield (Smoliak 1956). It should also be noted that environments varied across the study area in the historic period and evidence suggests that this was so in prehistoric times as well. Sauchyn and Sauchyn's (1991) pollen core from the Cypress Hills clearly shows the presence of forest prior to 7700 B.P. and after 5000 B.P. and reduced amounts within that interval. This led them to suggest that the Cypress Hills has been an ecotone throughout the Holocene. What this means is that despite the fact that the entire region was impacted by the drought that defines the Mid-Holocene Climatic Optimum, different ecological zones continued to exist. The present diversity of resources found in this ecotonal area, relative to the open plains, may well have been a feature of drought periods in the past. The picture that emerges of the Mid-Holocene northern plains is one where the areal extent of grassland vegetation is greater than at present; this grassland extended further into areas that are today parkland; the forage yield per acre of grassland was substantially lower than at present; the distribution of surface water sources was more restricted; ecotones between grassland and forested zones existed in mountain outliers; the diversity and productivity of wildlife in these outliers was likely greater than that on the open plains; but overall, the resource structure of the northern plains was one of lower productivity, greater unpredictability and greater patchiness than that of early historic times.

6.3.2.2 Cultural Considerations

The impact on humans of these environmental changes remains to be evaluated. Vance (1991:154-55) has stated

> The Chappice Lake record suggests that the early postglacial period (prior to 6000 B.P.) presented a challenging environmental setting, with dynamic climatic conditions producing extremes in the availability of natural resources. Periods of intensive drought would have created chronic resource shortages, but these relatively short-term events would have been balanced by intervals of abundance. . . From 6000 B.P. to 4000 B.P. conditions on the northern interior plains changed considerably from the early Holocene. A period of continual resource shortage, maintained by lower-than-present precipitation, high winds and increased temperature compared to today, would have created a very difficult environment for nomadic hunters and gatherers.

No greater controversy exists in northern plains prehistory than the multitude of issues that relate to the impact of this climatic period upon humans and wildlife (Reeves 1973; Buchner 1980; Vickers 1986). Nearly forty years ago, Mulloy (1958) proposed that environmental dessication may have precluded human occupation of the Northern Plains during the Mid-Holocene Climatic Optimum. Subsequently, Wedel (1961) proposed that the northwestern plains outside the Saskatchewan Basin was reduced to a desert, resulting in the displacement of all native game animals. He further suggested that humans either abandoned the area or diversified their subsistence oase. Hurt (1966) modified this view, suggesting that the general habitat was probably unfavorable to man and grazing animals most of the time, but that it was doubtful that this region was ever abandoned completely. Instead, he suggested that human and animal populations moved to more favorable habitats on the northern, western, and eastern peripheries of the plains. While a cultural hiatus is no longer a tenable proposition, there remains a general belief that adverse climatic conditions significantly impacted human occupants (Benedict 1979; Buchner 1980; Vickers 1986; Reeves 1990). In addressing this issue through use of the resource stress model, it should be noted that the northern plains, then and now, is a marginal environment as regards resource structure and the aboriginal occupants, then as now, are generalized hunter-gatherers. Keeping in mind that resource stress during the Mid-Holocene Climatic Optimum appears to have been temporally and spatially extensive, a suite of predictions deriving from the model will be examined. Those predictions relating to complex hunter-gatherers and those which examine responses to short-term fluctuations are not considered. Coping strategies for which there should be evidence in the archaeological record are of particular interest. It was predicted that under conditions of resource stress generalized hunter-gatherers will diversify their subsistence base, employ conservative food preparation techniques, increase group mobility, increase reciprocity and form alliances, reduce group size, and increase search area. As stress intensifies, population density will decline and some areas will even be abandoned. While storage is seen as a common response among complex hunter-gatherers, the clumped nature of ungulate resources in the northern plains is the type of resource structure that lends itself to the seasonal storage of food; therefore, it is also predicted that the development of storage techniques may be a response to seasonal fluctuations in resource availability. It is also posited that owing to the low diversity of resources, bison will continue to be a key subsistence item whether or not other resources are taken. Because these animals are directly impacted by changes in forage, it seems reasonable to assume that changes in procurement strategies may be linked to resource stress. The aforementioned predictions focus upon changes from a pre-existing pattern and it is assumed that once the stressors diminish in intensity, further cultural changes will occur. In order to evaluate the model it is necessary to summarize specific features of preceeding and succeeding prehistoric cultural complexes. This discussion incorporates information from the High Plains south of the study area by virtue of the fact that this area appears to have been settled first and the northern plains appears to have been settled in part by the movement of people from the south to the north.

The chronological periods in the northern plains are the Early Prehistoric Period (11,500 to 7,500 B.P.), the Middle Prehistoric Period (7,500 to 1,800 B.P.), and the Late Prehistoric Period (1,800 to 250 B.P.) (Reeves 1990). The following discussion is organized around the first two of these periods.

Two cultural traditions are demarcated during the Early Prehistoric Period, the Fluted Point Tradition and the Plano Tradition. The Fluted Point Tradition involved two successive complexes, Clovis (11,500 to 11,000 B.P.) and Folsom (10,800 to 10,200 B.P. (Frison 1978). Whereas mammoth (*Mammuthus sp.*) and other extinct big game animals were hunted during the Clovis Complex, *Bison bison antiquus* and *Bison bison occidentalis* were pursued during the Folsom Complex. The Plano Complex (10,000 to 7,500 B.P.) also involved the hunting of extinct forms of bison and is distinguished by the diversification of lanceolate projectile point types. Based on excavated components and surface finds, it is clear that the northern plains were occupied by few people during Clovis and Folsom Complex times but this changed dramatically during the Plano Tradition (Figure 15). For the purpose of the present study, it is the latter complex that has a bearing on the cultures of the Mid-Holocene Climatic Optimum since it was the immediate precursor and it is from this temporal period that discussion begins, although discussion will of necessity refer to the Fluted Point Tradition.

In the northern plains deglaciation appears to have been complete by 11,000 to 12,000 B.P.in the northern plains, leading to the incursion of flora and fauna. Significant evolutionary changes in bison morphology and behavior occurred in the early to mid-Holocene, resulting in greater ecosystem productivity. Guthrie (1984) has suggested that increasing seasonality of resources typified the Early Holocene. Perhaps as early as 10,500 B.P. and certainly by 10,000 B.P. dramatic cultural changes were also under way. Population increase and the resultant increased circumscription led to the development of specialized tookits, local and regional artifact styles, declining workmanship, new procurement strategies, and new social arrangements (Kelly and Todd 1988). The number and size of archaeological sites increased which argues for the existence of a productive resource base and the development of a technology for exploiting these resources.

Collectively the cultural complexes of the Late Paleoindian Period are called the Plano Tradition and they persisted for about 3,000 years or until about 7,500 B.P. These complexes are largely identified on the basis of projectile point types; Agate Basin, Hell Gap, Alberta, Scottsbluff, and Frederick being major varieties. In southern Alberta the number of Late Paleoindian Period sites increases significantly over earlier times (Figure 15). While there were 15 sites where Clovis and related fluted points were found and 12 with Folsom and Plainview materials, 84 sites contained Plano Tradition materials. Hayden (1962) has provided statistics that quantify the reduction in territorial extent of Early Prehistoric Period complexes, noting that Clovis extended over 5,000,000 square kilometers, Folsom over 2,000,000 and Plano Tradition styles averaged about 400,000 square kilometers. One aspect of this increasing regionalization of cultures was the appearance of two concurrent yet separate adaptations. One in the Rocky Mountain foothills emphasized diverse resources, a true hunting and gathering lifeway, the other a hunting culture on the open plains pursued bison (Frison 1991). During the Plano Period, the now-extinct *Bison bison occidentalis* gave over to the historic *Bison bison bison* (Jennings 1983).

Subsistence specialization truly had its flourescence in the Late Paleoindian Period. Massive kill sites in the High Plains of Colorado and Wyoming including Jones-Miller, Horner, Carter/Kerr-McGee, Olsen-Chübbock, Casper, Agate Basin, Finley, and Hudson-Meng, provide clear evidence that the basic cultural elements of northern plains communal bison hunting were developed by 10,000 B.P. (Reeves 1990). Many of these sites are composed of the remains of between 50 and 200 now-extinct bison, such as those from the Casper site, and these animals demonstrate the traits of both *Bison bison antiquus* and *Bison bison occidentalis* (Frison 1991). Hunting strategies exploited expedient features of the natural topography, but they showed, as well, evolving ingenuity, increasingly complex social organization, and new technologies. At the Casper site a parabolic sand dune was used to trap the animals (Frison 1991), while an artificial corral or other constraint has been suggested for the Jones-Miller site (Stanford 1978). The Hudson-Meng site may have been a bison jump (Agenbroad 1978), while Olsen-Chubbock was an arroyo kill (Wheat 1972). Of particular note is the fact that evidence of multiple use episodes is to be found at a number of these sites. For example, Frison (1991:181) reported that "the Horner site was the scene of systematic bison procurement for at least a thousand years of Paleoindian time."

Driver (1990) has proposed that communal procurement reduced the risk where resources were clumped and somewhat predictable and where meat quality and hide condition varied seasonally. While many communal kills of this time took advantage of local topographic features, there is good reason to believe that intentionally constructed corrals were minimally in use (Frison 1991). This development further reduced the risk associated with bison procurement since you can move corrals to the herds but not the arroyos, sand dunes, and escarpments! Large-scale communal hunting was both a risk-reduction strategy, given the resource structure of the northern plains, but it also underwrote the costs of population increase. The increase in archaeological sites throughout the Early Prehistoric Period confirms the impression that population was increasing. And as population expanded, the need to guard against the failure of these undertakings likely led to increasingly complex social and political structures.

In all likelihood early plains occupants would have had to deal with periodic resource fluctuations. There are significant cultural differences between the Fluted Tradition and the Plano Tradition that in turn suggest different mechanisms for coping with periodic subsistence stresses. To review these differences is to provide a foundation for the discussion of Mid-Holocene adaptation to resource stress. A number of researchers have drawn attention to the remarkable homogeneity in Clovis and Folsom Complex assemblages as regards lithic types, tool types, site types, site size, tool reuse and lithic technology (Haynes 1980; Hayden 1982; Kelly and Todd 1988). Tools were frequently resharpened. Kill sites predominate and are locations where a few animals were taken; campsites were small and located immediately adjacent to the kills. Assemblages derive from short-term, single use episodes at sites. Fire hearths are shallow and small. Lithic types are high quality, selected for long use-lives, and were transported great distances (Hayden 1982). The picture that emerges is one of expediency as regards site location and subsistence pursuits, but the tool kit is highly portable, utilitarian, flexible, generalized and homogenous. Anthropologists interpret the lack of regional styles in artifacts as evidence of a lack of circumscription (Fagan 1991) or conversely, as evidence of very widespread interaction networks (Hayden 1982). Both of these features occur when population remains small and vast areas of land are unoccupied. Under these circumstances, the response to localized seasonal resource stress was either to switch to a different resource in the same territory or to switch territories (Kelly and Todd 1988). It is highly likely that the low diversity of animal species and seasonal nature of plant foods precluded the former, thereby leaving mobility as the only realistic option. When localized food supplies are scant, small groups of people simply move on. Among contemporary hunter-gatherers this option was not always available since all lands were occupied (Hayden 1982); they therefore, were forced to develop coping mechanisms that precluded movement into new territories. One such strategy was reciprocal access. However, in the early Holocene human population was small and scattered, which likely prevented reciprocal access from developing. Under these circumstances, Kelly and Todd (1988) have suggested that people relied on game rather than plant foods because of the lack of knowledge of the schedules of the latter in unknown territories. Rather they would continuously shift territories as large Pleistocene fauna changed their composition and distribution. It is assumed that this process led to the rapid peopling of the New World during early Holocene times. During the subsequent Plano Tradition there is clear evidence of increasing regionalization of artifact styles, increasing population and circumscription, and greater use of local lithics, all indicative of a major transformation of the cultural pattern. Continuous mobility into previously unoccupied territories appears to have been the case during the Fluted Point Tradition. Thereafter, all cultural groups operated with a limiting factor, human occupation of all territories, otherwise known as circumscription. In these circumstances mobility became restricted. Human groups could elect to (a) diversify or (b) specialize, both in a confined territory. The dual adaptations during Plano Tradition times involved diversified resource procurement in the foothills and specialized communal buffalo hunting on the open plains. Either way as territories filled up, the opportunity for reciprocal access and alliances presented themselves.

Much of what we know about the northern plains during the Early Prehistoric Period is inferred from assemblages from sites in the High Plains and even the American Southwest because of the paucity of materials in the northern plains region. This is perhaps unfortunate because it tends to mask the environmental differences that surely existed among these areas. A key difference is the fact that most of the northern plains region was covered by ice during the Wisconsin glaciation and though the area was free of ice by 11,000 to 12,000 years ago, the environment was nevertheless far different from the unglaciated High Plains and Southwest. While abundant vegetation and herds of animals were found in these latter regions, their appearance in the northern plains would have been a slow, gradual process throughout the early Holocene. This being the case, it seems reasonable to assume that resource stress would have been a particularly serious problem until grasslands and herds of herbivores were well established. From that follows the conclusion that this region would have been sparsely occupied by human groups prior to the development of this grassland environment. A review of the archaeological data from the Early Prehistoric Period sheds some light on this situation.

At present, the earliest archaeological evidence for the first human occupancy of the area comes from the Vermilion Lakes site (Fedje 1986) and the Sibbald Creek site (Gryba 1983), both located in the foothills/mountain region west of the extant plains biome. A number of radiocarbon dates falling between 9,500 to 10,500 B.P. at the former and in the 9,500 B.P. range at the latter may be inaccurate since they were based on small pieces of charcoal scattered through the lower zone of unstratified deposits . Small numbers of Clovis and Folsom fluted points are known from surface collections but these same collections indicate that the first major occupancy of the northern plains did not occur until the Plano Tradition. Artifact collections assembled in east-central Alberta during the dustbowl conditions of the 1930s show repeated association of Plano Tradition, Alberta, Scottsbluff and Eden points with Cody knives (Wormington and Forbis 1965). Pettipas (1980) has proposed that this is a regional subphase that he called the Little Gem Complex. Surface collections from southeastern Alberta (Brumley and Dau 1988) and the lower Red Deer River (Adams 1976) contain significant numbers of Plano Tradition projectile points as well. One of the first sites to be excavated was the Fletcher site in southern Alberta (Wormington and Forbis 1965). Though the hunting strategy is not clear, a bone bed likely representing many members of the extinct species, ***Bison bison occidentalis,*** rested on sands deposited in a periglacial lake. Scottsbluff and Alberta points were found in association. It appears that this deposit was laid down about 9,000 B.P. (Vickers and Beaudoin 1989). The earliest component at the Hawkwood site, a campsite located in Calgary, contained Plains/Mountain affiliated projectile points and yielded a date of 8,250 B.P. (Van Dyke and Stewart 1985). Local lithics predominate. Information from the living floor suggests that a small group utilized the site for a short period, during which time they butchered a single bison. Site location suggests that stalking of small herds of bison was the most likely strategy.

An areal pattern emerges that indicates that massive kills are concentrated on the High Plains, and as one moves north into the northern plains, smaller and fewer kills are to be found. In addition, an excess of campsites relative to kills plus small campsites with no association to major kills, seem to indicate a variety of procurement strategies. Van Dyke and Stewart (1985) suggested that the stalking of small herds in coulees and near sloughs was one of these methods. Seasonal changes in hunting strategies and settlement size are inferred. This flexibility indicated knowledge of the behavior patterns of local herds and people who may have been constrained by seasonal or interannual resource stress. The evidence from Charlie Lake Cave in northeastern British Columbia supports this view (Driver 1994: Personal Communication).

While specialization characterizes the open plains, diversification of the subsistence base appears in mountain/plains habitats. Driver (1982) documented the communal hunting of big-horn sheep in the Crowsnest Pass about 8,500 B.P. In a study of prehistoric hunting strategies from the same region and extending over the last 10,000 years, he was able to define two hunting strategies, the exclusive hunting of bison in the winter and a more varied resource base in summer (Driver 1985). Evidence of seasonal fishing extending back 7,000 years has been found at the Narrows site on Waterton Lakes (Milne Brumley 1971). Diversification of the subsistence base in the Early Prehistoric Period may have been a response to a variety of conditions but the most likely was seasonal shortages of bison. The development of suitable technology was essential. For the example the gill net was a prerequisite for the exploitation of the Waterton Lakes fishery.

The Early Prehistoric Period drew to a close about 7,500 B.P., coincident with the beginning of significant environmental change. As previously mentioned, the interval from about 7,300 to 6000 B.P. was a time when periods of exceptional drought were interspersed with short moist periods. Vegetational changes would likely have resulted in a lower overall carrying capacity for the region. The writer posited that carrying capacity of the region was lower than that of the High Plains and Southwest in the Early Prehistoric Period and it did not increase substantially until Middle Prehistoric Period II. Responses to resource stress at this time would include subsistence diversification, conservative food preparation, increased mobility, a decline in group size, an increase in the search area, population decline, increased storage, and changes in procurement strategies. Because of the low diversity of resources on the open plains, it is expected that bison would continue to be the focus of subsistence activities, but procurement strategies would have changed as the productivity and predictability of bison decreased and patchiness increased. In ecotonal regions such as the foothills, it seems reasonable to expect the diversification of resources to be maintained or even to broaden. An examination of the archaeological record of this era reveals that a number of these expectations were realized.

The cultural period falling between 7,500 to 1,800 B.P. is known as the Middle Prehistoric Period (Reeves 1983). This era is divided into three sequential intervals: Early Middle Prehistoric I (7,700 to 5,000 B.P.), Early Middle Prehistoric II (5,000 to 3,000 B.P.) and the Late Middle Prehistoric (3,000 to 1,800 B.P.). Early Middle Prehistoric I falls within the interval identified by Vance (1991) as a time of exceptional drought conditions. At this time in the High Plains of Wyoming, small-game hunting and generalized gathering replaced the big-game communal bison hunting (Frison 1991), while in the northern plains bison hunting prevailed, though strategies and technologies were modified (Buchner 1980) and in some instances, diet was diversified. It is likely that the diversified High Plains pattern had its roots in the mountain/plains adaptation of Late Paleoindian times and the bison hunting complexes were simply a continuation of the subsistence pattern established throughout Paleoindian times. The impact of the Mid-Holocene Climatic Optimum was greatest in the High Plains of Wyoming where communal hunting of bison was replaced by foraging. For example, at Mummy Cave (Husted 1969) in the Bighorn Canyon of northern Wyoming, the faunal assemblage included mountain sheep, rabbit, marmot, porcupine, wood rat, deer, grouse and waterfowl but bison were completely absent. In contrast, bison, though not the sole resource, were pre-eminent in faunal assemblages in southern and central Alberta at Head Smashed-In buffalo jump (Reeves 1978), the Hawkwood site (Van Dyke and Stewart 1985), the Stampede site (Gryba 1975), the Mona Lisa site (Wilson 1983), the Boss Hill site (Doll 1982), and the Anderson site (Quigg 1984). Some changes in procurement strategy are, however, indicated, in addition to other new patterns that include: fewer sites, more diverse faunal assemblages, new artifact types, new processing and storage strategies, different settlement patterns, new extra-areal relationships, and new types of sites. It is likely that the Middle Prehistoric Period I subsistence systems maintained a bison-focused economy because the latter remained productive enough to warrant this orientation but also because alternate resources were limited in the low diversity environment.

Northern plains archaeological sites from Early Middle Prehistoric Period I encompass a variety of types, including major buffalo jumps, campsites and other small bison procurement sites. The initial occupation at Head-Smashed-in buffalo jump occurred at this time. Campsites include the Stampede Campsite in the Cypress Hills (Gryba 1975) and Hawkwood (Van Dyke and Stewart 1985). These sites contain pre and post Mid-Holocene components, and show evidence not only of repeated site use, a pattern established in Late Paleoindian times, but also of a seasonal resource exploitation.

Radiocarbon dates extend from about 8,000 to 4,000 B.P. A diagnostic artifact of this time period was an early side-notched projectile point, that has been variously labelled Simonsen, Logan Creek, Bitterroot, amd Mummy Cave. In a study of their geographic and temporal distribution, Buchner (1980) noted that they are widespread in North America and their earliest occurrence is in the Eastern Woodlands. He and others (Vickers 1986; Husted 1969; Reeves 1983) have postulated that they are related to a movement of people from the east, possibly from the eastern grassland/forest ecotone. Buchner (1980) hypothesized that the richness of this ecotone, particularly in the fall when bison sought shelter, attracted forest-adapted peoples as well as those from the open grassland. The social interaction that followed permitted elements of the woodland weapon system to enter the plains. The co-occurrence of early side-notched points with lanceolate Late Paleoindian varieties at Boss Hill (Doll 1982) and Fletcher (Forbis 1968) has led Vickers (1986) to argue that their distribution represents the introduction of a new weapon system. Reeves (1983) has suggested that this new system was the atlatl and that prior to its introduction, the stabbing spear was in use (Reeves 1983); however, Lahren and Bonnichsen (1974) and Frison (1989) disagree, saying that the atlatl made its first appearance in the Early Prehistoric Period. Irrespective whether a new weapon system was introduced, the projectile points themselves bespeak significant cultural change.

Examination of artifact assemblages, features and debris from Early Middle Prehistoric I sites reveals additional patterning that is likely a response to resource stress. Vickers (1986) reported a reduction in the number of sites at this time and Buchner (1980) documented a settlement pattern whereby hunters exploited the resources of regions assumed to have been less heavily impactedby drought: grassland situations near forest margins, areas of higher elevation such as the Cypress Hills, and areas with assured supplies of water such as major river valleys and spring locations. In addition, there was a diminution in the size of stone artifacts such as projectile points. Small stone tools such as points, knives and scrapers were no longer as finely crafted as before; they were frequently made of local lithics; and, often recycled and curated. An increase in the number of classes of stone tools and types is likely related to the diversification of subsistence activities. The use of local lithics and recycling of tools suggests access was limited to nonlocal materials, or the corollary, a decline in trade through which non- local lithics were procured. It is tempting to speculate that this was due to the need to remain in refuge areas where subsistence was possible. For this period, Reeves (1990:179) has suggested

> . . . with less game available and only stored dried meat for backup, particularly in summer, more time had to be devoted to the hunt than previously. Less time would be available for aesthetic technological elaboration, tools would be used longer before discard, and long-distance travel and trade of large amounts of high-quality stone would sharply decrease . . . .

Driver (1994: Personal Communication) has indicated that his data from the Rocky Mountains suggests an increase in exotics through time and suggests that this may be the result of higher populations in the mountains.

An increase in food preparation is implied at the Gowen site near Saskatoon, where the fragmented nature of the faunal elements, extending even to the processing of bison phalanges, is likely evidence of acute food stress (Walker 1984). Frison (1983) has suggested that an additional innovation was the first appearance of stone-filled fire pits in both plains and mountain/plains habitats. He has implied that this technology may be linked to increased use of vegetable foods.

Early Middle Prehistoric Period II commenced about 5,000 B.P. and terminated about 3,000 B.P. It began with a period of improved environmental productivity and as it drew to a close modern climatic patterns and vegetation were being established (Vance 1991). The cultural dichotomy between the Plains and mountain areas continued, for on the northern plains two sequential complexes, Oxbow and McKean, were found, while the Mummy Cave Complex of earlier times persisted in the mountains. Multicomponent campsites and new site types such as medicine wheels, antelope kills, and burial sites are typical of this time period. Large communal bison kills are uncommon and even at Head

Smashed-In buffalo jump there is a gap in use between about 4,000 and 3,000 B.P. (Reeves 1978). At the Cactus Flower site in southeastern Alberta, seven and possibly eight cultural levels are representative of the McKean Complex (Brumley 1975). Two circular concentrations of debris with diameters of 4.0 and 4.8 meters appear to represent a living floor confined within a circular lodge. Five other sites with excellent campsite materials are the Harder site (Dyck 1970); the Moon Lake site (Dyck 1970); the Stampede site (Gryba 1975); the Southridge site (Brumley 1981); and, the Ross Glen site (Quigg 1986). A single stone circle is attributed to this period at the latter site. The Gray site in southwestern Saskatchewan is a massive Oxbow ossuary dating to between 5,000 and 3,000 B.P. and containing over 300 interments (Millar 1981). The initial use of the Majorville Cairn and medicine wheel appears to have been about 3,800 B.P. during the Oxbow Complex (Calder 1977). Fishing continued through Early Middle Prehistoric II at the Narrows site on Waterton Lakes (Milne Brumley 1971). The Laidlaw site in southeastern Alberta, that Brumley (1984) believes to be an antelope trap, yielded a date of about 3,300 B.P.

It is the writer's experience that diagnostic projectile points of the Oxbow and McKean Complexes comprise significant proportions of surface collections from southern Alberta and Saskatchewan. Furthermore, Vickers' statistics on phase-assigned sites in Alberta are further evidence that population increased substantially over Early Middle Prehistoric I; that a major population increase occurred during the McKean Complex; and, that populations of the McKean Complex were large relative to later cultural phases (Vickers 1986, Figure 3). Archaeological evidence shows the McKean Complex to be a specialized bison hunting adaptation with small local populations focused on redundant, carefully scheduled use of resource areas and who repeatedly reoccupied sites for periodic short-term subsistence activities (Spath 1984). A site distribution pattern along major waterways has been noted by Syms (1970) for the McKean Complex in the northern plains. Figure 15 illustrates the relative numerical frequency of sites of different complexes/phases/periods and clearly shows the decline of sites in Early Middle Prehistoric

I from the preceeding Plano Tradition, followed by a substantial increase of sites in Early Middle Prehistoric II. In fact, there is a six-fold increase in archaeological sites between Early Middle Prehistoric I and Early Middle Prehistoric II. Selected aspects of the cultural pattern of Early Middle Prehistoric II show both continuity and significant change from earlier times. There is the notable increase in the number of sites from Early Middle Prehistoric I to II and from the Oxbow Complex to the McKean Complex, that appears to be related to a population increase. The distinctive projectile point types and their similarity to point types in other cultural areas and cultural innovations such as the Gray site ossuary, have led several researchers to postulate that the Oxbow and McKean Complexes represent the migrations of people from the eastern Woodlands and Great Basin, respectively (Brumley 1975; Vickers 1986). The improvement in environmental conditions, together with the presumed increase in ungulate carrying capacity, may have been one of the factors promoting the widespread movement of human groups. But just how improved these conditions were remains to be seen. On the one hand, it is true that increased site numbers bespeak a population increase, but on the other hand the apparent absence of large scale communal bison hunting and the McKean Complex settlement pattern along major waterways may mean that bison populations were still not large enough, that they were not clumping or they were unpredictable in their movements, thereby precluding large scale communal hunting. In summary, the evidence would seem to indicate that the productivity of bison was not at the level required to sustain large scale communal hunts (Reher 1978), while the increase in small short-term occupied campsites (Brumley 1981) is evidence of a mobile, dispersed, but nevertheless growing human population.

Another cultural pattern that may be linked to resource stress is the diversification of food sources found at campsites such as Cactus Flower where a dependence on bison is noted, but antelope, deer, canid, fox, rabbit, birds, clams, fish and even dog were also used (Brumley 1975). The extensive butchery and processing evident in this faunal assemblage evokes conservative food preparation practices. Brumley (1975) noted that the skull was the most common antelope element and the second most common bison element in the faunal assemblage from Cactus Flower, and that extensive smashing of bone for grease and marrow extraction also occurred. He reported a similar pattern at the Oxbow Complex, Southridge site (Brumley 1981).

The use of stone-filled fire pits that may have first appeared in Early Middle Prehistoric I underwent a florescence (Frison 1983). Reeves (1990) regards the presence of fire-cracked rock, rock and bone-filled pits, and large amounts of macerated, sometimes burned bone and bone spill piles as providing evidence of stone boiling and grease extraction. These remains suggest new dietary strategies. First, stone boiling represents a new method of preparing food since a variety of eatables including meat, vegetables, berries and marrow could be incorported into a "stew". Second, bone grease could be rendered from bone and it became a key ingredient in pemmican, a storable food long associated with the buffalo hunting cultures of the Great Plains. The reduction of bone to scraps and their subsequent boiling to remove bone grease is mentioned as a famine food by several ethnohistorical observers (Morton 1929; Bain 1969). It is tempting to wonder if bone grease was first rendered from bones for use as a famine food and subsequently added to beaten pounded meat to produce the famed Plains Indian fare, pemmican. If one accepts crushed bone and stone boiling pits as evidence of bone grease extraction and if this grease was used in pemmican production, it follows that the production of this storable food likely began during Early Middle Prehistoric II.

Another change in Early Middle Prehistoric II was the diminution in the size of projectile points over time, as though lithic conservation were a concern. Tools were used longer; broken points were refashioned for continued use, and overall workmanship declined. Towards the end of this period there is evidence of expanding trade that may have been the forerunner of the reticulated and redundant trade networks of the Late Prehistoric and Early Historic Periods (Blakeslee 1975). Marine shell from the Gulf of Mexico and native copper from Wisconsin are among the grave goods from the Gray site

(Millar 1981). Two shell beads from the Cactus Flower site are marine, both from gastropods commonly occurring along the Pacific coast (Brumley 1975).

The first sites with an explicitly ritual function appear in the form of the giant ossuary that is the Gray site (Miller 1981), and the Majorville cairn and medicine wheel (Calder 1977). Whether most medicine wheels date from this time is unknown, as is their function(s), but their distribution is localized, the construction is accretional, and their existence appears to be linked to an increase in population, increasing complexity of social life, and establishment of a pattern that would prevail into the Historic Period. Calder (1977) reported that Majorville was used most during the Late Prehistoric Period, that is after 1800 B.P., followed by the Early Middle Prehistoric extending from 4200 to 3000 B.P., and that between 3,000 and 1,800 B.P. use dropped considerably. He is of course assuming that diagnostic artifacts were deposited by the cultural complexes who made and used them, and that curation by subsequent peoples was not a factor. Some medicine wheels such as the Big Horn medicine wheel in Wyoming may have functioned as "astronomical clocks." Eddy (1977) has proposed that this site and others were built and used as summer solstice markers, for calendar use, and probably for ritual, such as the Sun dance.

The Late Middle Prehistoric, that began about 3,000 B.P. and lasted until about 1800 B.P., witnessed a florescence of the bison hunting culture pattern (Reeves 1990) and a concomitant population expansion (Figure 15). An old subsistence pattern was re-established, in the form of large-scale communal bison hunting; and two major technological innovations, the bow and arrow and ceramics, were adopted towards the end. Medicine wheels such as Majorville continued to be used.

The interruption of large scale communal bison hunting, a decline in the number of sites, the introduction of stone boiling and bone grease extraction, the focus on local lithics, the conservation of lithic material and the diversification of stone tool types in Early Middle Prehistoric I and II form a suite of temporally contiguous cultural practices that characterize the period of ongoing resource stress. Innovations in the ritual world included the appearance of the only ossuary outside the Middle Missouri subregion and the beginnings of medicine wheel construction. These features are empirical indicators of a number of the coping strategies predicted by the model developed herein. It was predicted that a decline in bison carrying capacity fostered by drought would result in diversification of the subsistence base and changes in bison procurement strategies. This diversification is evident in the increasing variety of wild animals represented in faunal assemblages from selected sites and in the diversification of stone tool types. Conservative methods of food preparation were similarly forecast. Stone boiling produces a product that can incorporate a variety of wild plant and animals resources and in this way expands the food potential of these resources. Bone grease extraction yields a byproduct that was likely not used previously, judging from the great waste of carcass elements, lack of macerated bone and absence of stone boiling pits in Early Prehistoric Period sites. Furthermore, this byproduct when mixed with dried and beat meat produces pemmican, a new food item with excellent storage qualities. It is hard not to view the paucity of large communal kills during Early Middle Prehistoric I and II, relative to earlier and later times, as evidence of anything but increased patchiness of bison. Similarly, the decline in archaeological sites during Early Middle Prehistoric I testifies to changes in the carrying capacity of the region.

With one exception the above cultural patterns beginning in Early Middle Prehistoric I extend through Early Middle Prehistoric II. This exception is the six-fold increase in archaeological sites in the latter period over the former period. As illustrated in Figure 15 the numerical frequency of archaeological sites in Alberta declines from 84 Plano Tradition sites to 36 Early Middle Prehistoric I sites but increases to 228 sites in Early Middle Prehistoric II. The problem is how to reconcile the continuity of conservative food producing and lithic strategies, diversification of resource procurement, and limited external contacts with the tremendous increase in archaeological sites in Early Middle Prehistoric II. The writer would suggest that the carrying capacity of the northern plains was at its lowest during Early Middle Prehistoric I and would note that this encompasses Vance's interval of greatest drought that falls between 7300 and 6000 B.P. (Vance et al 1992; Vance et al 1993). Perhaps more telling than simple numbers of bison and other ungulates would be their behavior. In order to secure food in a desiccated environment, it is likely that herd animals would have to disperse. Since communal hunting is dependent on the clumping of animals and some predictability in their movements, the paucity of large communal kills and the presence of small kills strongly suggests resource patchiness, unpredictability and low productivity. The subsequent period falling from 6000 to 4400 B.P. was drier and warmer than present and also prone to fluctuating water level but drought conditions appear to have ameliorated somewhat (Vance et al 1992; Vance et al 1993). The great increase in archaeological sites in Early Middle Prehistoric II that encompasses this latter interval is likely a reflection of increased productivity and predictability and decreased patchiness of herd animals. It is further suggested that technological changes implemented in Early Middle Prehistoric I contributed to the population increase implied by the increase in site frequency in Early Middle Prehistoric II. These technological changes included the development of stone boiling that increased the efficiency of food preparation, but more important, it facilitated the extraction of bone grease. Bone grease mixed with dried and beat meat produced a new food with excellent storage qualities. The production of pemmican permitted prehistoric plains people to more fully utilize the expanding herds of bison. By preparing large quantities of grease, dried meat and pemmican, plains occupants in effect extended the availability of food from seasons when the productivity of the animals was high to those when it was low. Invoking Liebig's Law of the Minimum, one can view food storage as ameliorating the most important limiting factor for human occupants in the prehistoric northern plains, seasonal shortages of meat or fat. Furthermore, these three products provided new items for trade. That trade expanded is evident from the great increase in non-local lithics that is a hallmark of the sequent Late Middle Prehistoric Period, that lasted from about 3000

B.P. to 1800 B.P. Knife River flint from North Dakota was a preferred lithic during the Besant Phase; obsidian from Yellowstone became increasingly common in Pelican Lake Phase sites; and a variety of cherts, chalcedonies and agate from southern Montana were also used. As Reeves (1990) noted, quarries up to 1500 kilometers distant furnished significant quantities of lithics employed in chipped stone tool technology during the Late Middle Prehistoric.

In order to capture and process large numbers of bison and to cope with an environment that would always be patchy, yet one where population was expanding, organizational changes in society must also have taken place. These changes would demand the sort of flexible social arrangements which characterize segmentary lineage sociopolitical systems (Sahlins 1967).

The above discussion saw the application of the model of resource stress to an interval of drought documented in the paleoenvironmental record of the northern plains, namely the Mid-Holocene Climatic Optimum. It was shown that a number of cultural changes occurred during this time, some such as stone boiling and bone grease extraction represent technological innovations which enjoyed continued use in the subsequent prehistoric cultural complexes, while others such as a decline in population and the cessation of large scale communal bison hunting, reversed in subsequent paleoenvironmental and paleocultural periods. In evaluating the utility of the model, it should be noted that empirical indicators of some responses to resource stress are to be found in the archaeological record, while others leave no signatures. Economic strategies are far more evident that social, political or ideological responses. The suite of economic coping strategies which one can observe in Early Middle Prehistoric I, including a decline in site numbers and likely population, conservative food preparation and lithic procurement strategies, diversification of food supply, and cessation of large scale communal bison hunting appear together during a period of known stress and it therefore seems likely that they represent responses to that stress. Whether the initial use of medicine wheels was linked to social changes wrought by resource stress remains unknown. Future research needs to be directed towards quantification of the patterns discussed above. For example, radiocarbon dates can provide an effective overview of regional trends in non-complex societies when treated in a quantitative manner. Rick (1987:55) has shown that "dates are like self-dated artifacts; because each presumably represents human activity at a point in time, they can be directly compared to each other. . . it is possible to assess and compare, in a relative fashion, the occupation histories within and between regions." By comparing the frequency of radiocarbon dates along temporal and spatial vectors for the entire northern plains it should be possible to further clarify changes in occupational intensity of the region and how these relate to periods of known resource stress. Another approach would be to survey site reports from Plano Tradition and Early Middle Prehistoric I sites in order to clarify when and where stone boiling, bone grease extraction, and related technologies first appear. Future application of the model should also be directed towards the interval of drought between 1000 and 600 B.P. which Vance et al (1992, 1993) documented at Chappice Lake. This falls in the latter part of the Avonlea Phase and the early part of the Old Women's Phase. In Alberta it has long been known that there was a dramatic decline in the number of sites during the Avonlea Phase (N=50) compared to the antecedent Besant Phase (N=142) and succeeding Old Women's Phase (N=147) (Vickers 1986). Whether this was due to resource stress, needs to be evaluated.

A final issue remains and that is whether the model developed explicitly for hunting and gathering subsistence systems has any validity for other subsistence systems. The following section is a commentary on that and related issues.

6.4 The Modern World

The transition to food production was viewed as an improvement on the human condition by Pierre-Jean De Smet, a member of the Society of Jesus who wintered among the Assiniboine, Cree, and Blackfoot in 1845-46:

> Are these vast and innumerable fields of hay

> forever destined to be consumed by fire, or perish in the autumnal snows? How long shall these superb forests be the haunts of wild beasts? And these inexhaustible quarries, these abundant mines of coal, lead, sulphur, iron, copper, and saltpetre- can it be that they are doomed to remain for ever inactive? Not so- the day will come when some laboring hand will give them value; a strong, active, and enterprising people are destined to fill this spacious void.- The wild beasts will, ere long, give place to our domestic animals; flocks and herds will graze in the beautiful meadows that border the numberless mountains, hills, valleys, and plains of this extensive region (De Smet 1978:184).

De Smet's belief that an agricultural and industrial economy would replace the hunting and gathering one was realized by the late 19th century when an influx of Europeans, reduction of the native population, and demise of wildlife paved the way for sedentary ranching and farming communities and extractive industries. De Smet's intimation that these pursuits were superior to hunting and gathering, and that they would provide a more secure subsistence base, is an ongoing belief. This writer, however, finds a curious irony in two recent newspaper articles: a November 1, 1991 article appearing in the Calgary Herald entitled "Food banks finding deer answer to their prayers- Saskatchewan hunters donating their extra meat", and a July 6, 1992 article in The Globe and Mail, "Drought forces huge animal kill- Meat from 2,000 elephants to be given to starving Zimbabwean farmers" (Perlez 1992). Despite the transformation of the natural landscape that accompanied the introduction of agriculture and industry, and the corresponding decline in wildlife variety, density and populations, some species have endured. Social views such as those expressed by De Smet have persisted, but undergo some alteration when food shortages threaten. For example, agricultural products are preferred but the utility of wildlife as food source is rediscovered. Legislation to protect non-trophy deer and antelope was enacted to prolong sport hunting, but when food scarcity occurs, is reworked to permit broader use of this potentially useful resource. The behavior of deer is defined as destructive providing a rationale for increased slaughter,

> Saskatchewan hunters are helping to fill food bank freezers by shooting deer that have been destroying farmers' crops. . .
> 'The thing that excites me about this program is the protein potential', says Ed Bloos, director of the Regina Food Bank. . .
> **'Man, this wildlife thing is the answer to all our prayers'. . .**
> 'The root problem is that there's too many deer', says Ian McMurchy, program coordinator of the big-game damage prevention program.
> 'In better times, the farmers could handle it. But they're a little less tolerant now' (Calgary Herald Nov. 1, 1991).

Similarly, the rationale for the planned shooting and meat distribution of 2,000 elephants and 5,000 impalas in Zimbabwe is that the animals also are faced with food and water shortages so ". . . it is the right thing to do for conservation" (Perlez 1992:A1).

Some of the strategies pursued to offset food shortages in Saskatchewan in 1991 illustrate elements of the model proposed herein. First, faced with a decreasing supply of preferred foods, societies may respond by diversifying subsistence items and activities. In this case wild foods are added to domestic and manufactured foods. Second, faced with the threat of food shortages, cooperation amongst sociopolitical groups has increased. The Regina Food Bank, the Hunt for Hunger program, the Big-game Damage Prevention Program and the Saskatchewan Wildlife Federation have drawn together to implement policies that will permit the acquisition and distribution of wild foods. Third, the group providing game, Saskatchewan's big-game hunters, exhibit considerable mobility as they gather resources from a large geographical area. Fourth, the food bank serves as redistributor of the gathered foods. Fifth, extant legislation that normally limits hunting permits to trophy deer and antelope, has been modified to include non-trophy animals perceived to be "wrecking havoc" with farm crops. And, retrenchment of social activity through government cutbacks to social assistance programs has occurred.

In the southern hemisphere food shortages caused by drought have led to similar responses. The president of Namibia recently authorized the killing of wildlife to feed hungry people (Medicine Hat News March 30, 1992). The most likely targets will be antelope such as springbok and gemsbok, neither of which is an endangered species. As in Saskatchewan, members of the Endangered Wildlife Trust of South Africa have altered their position on wildlife conservation, noting that during droughts, large numbers of animals die anyway of thirst and starvation. This change in attitude paves the way for expanded use and destruction of wild animals. Other coping strategies that have been implemented include the slaughter of large numbers of beef and dairy cattle; the movement of people from rural to urban areas in search of food; the hoarding of sugar, cooking oil and maize; theft by private individuals and confiscation by government officials of food items; and foreign aid through redistribution programs (Manthorpe 1992).

This same drought has impacted Zimbabwe, that is facing its worst drought in history (McCullum 1992c). Water rationing has been instituted. Tales have been told of people eating river silt mixed with the bitter fruit of baobab trees to stave off the pangs of hunger. Others are grubbing through anthills for the bit of protein the insects provide. Many people are reduced to eating one-third of their normally sparse diet of ground corn and a few greens. Cattle and even rats are dying. The country has been forced to import food- corn, sugar, wheat, cotton, vegetable oils and fuel.

Further east Rudyard Kipling's "great, grey-green greasy Limpopo" is no more (McCullum 1992b:A8). Civil war coupled with drought have made Mozambique's plight the most extreme of all countries in the region. People have been reduced to boiling cacana leaves to make a bitter tea, that takes away the hunger but provides no nourishment. Starving peasants have lost their tools to raiders and have been forced to eat their seeds.

In the northern hemisphere the spring of 1992 found Muscovites expanding their elected foods to include domestic cats and dogs in the light of widespread food shortages caused by social and political dislocation following the breakup of the Union of Soviet Socialist Republics (Vancouver Sun March 9, 1992).

Long in the media as a typical hunger belt country, Ethiopia once again faces severe food shortages caused by a combination of drought, seasonal resource availability and tribal conflict (Stackhouse 1991). Entering the fourth consecutive year when sorghum and corn crops have failed, rural residents turned to tree roots, leaves and parched grass in order to survive. Other coping strategies include stealing, dependence on redistributed emergency food stocks controlled by the government and foreign food aid.

The recent war in Iraq has led hunters to use nets to catch thousands of wild geese in the southern marshlands, that they sell to hungry urban dwellers (The Globe and Mail May 12, 1992). These and other avian and animal species are threatened with extinction. While Iraq has issued laws to protect many species, there is little power to enforce legislation in the isolated, extensive marshlands.

In Mozambique, Zimbabwe, Namibia, Ethiopia and other similarly affected countries in Africa, and elsewhere, sociopolitical bodies that organize and effect foreign aid programs provide a coping strategy not available before the 20th century. Studies by four agencies: the World Bank, the World Food Program, the United Nations Food and Agriculture Organization and United States Aid, are paving the way for massive aid efforts (McCullum 1992a). Twentieth century geopolitics are such that "have" nations feel obligated to assist those less fortunate, particularly if the world power structure is affected.

One might ask what about the relevance of wild animals (and plants) to humans of the 20th, soon to be 21st century? Despite the diminution in numbers, contraction of range and even extinction, wild species of plants and animals share habitats with humans. And, human groups have in turn developed norms to regulate their interaction with these species. The hunting of animal species is governed by national and international legislation such as the Migratory Birds Convention Act signed by Canada, the United States and Mexico. As the foregoing discussion has shown, when our accustomed sources of food are in short supply, we may resort to the use of wild foods.

In the process of changing subsistence orientation, even if it is only supplementary, we are forced to modify our belief systems. The human-animal relationships of hunter-gatherers and agriculturalists are strikingly different. Whereas the former acknowledge wildlife's superior position to themselves in their ideological systems (Martin 1978; Tanner 1979), the latter exert control over both the animals they have domesticated and the predators of these animals (Genesis I:26). They do this by regulating the numbers and distribution of wild species through legislation, that, on the one hand, may prohibit hunting, and, on the other, expand hunting when shortages of preferred foods occur.

The relationship of humans to wildlife, be they hunter-gatherers or not, is a complex phenomenon. In a recent study of hunting in contemporary America, Marks (1991) proposed that extant hunting traditions reveal central values, symbols, and tensions in American life, "Scratch below the surface of any veteran raccoon, quail, fox, rabbit, or deer hunter and differences of caste, ethnicity, work, and life-style may be revealed. Individual choices of work, self, and community are anchored if not summarized in these recreational pursuits. . . Each species of game pursued is a marker, a visible bit of social differentiation" (Marks 1991:4).

The environmental movement has added its voice to thoughts on human-animal relationships. Professor Frank Popper of Rutgers University believes that the settlement of the west has been a failure. He has proposed that the American and Canadian West be allowed to revert to frontier where prairie grasslands and herds of bison would replace agriculture and cattle ranching; where subsidized agriculture would become subsidized nature; where the agrarian economy would become a Buffalo Commons (Cernetig 1992).

In conclusion we might be well advised to remember that "Coping with uncertainty in food supply may imply going back to the hunter-gatherer's knowledge" (de Garine and Harrison 1988:472). On the other hand, hunting and gathering subsistence systems that experience shortages may use domestic foods, acquired either through trade or limited cultivation. It is posited that dual economic systems, that combine hunting and gathering with horticulture/agriculture, provide flexibility. However, it is also true that the population expansion fostered by food-production may impact wild foods to such a degree that their existence is threatened. And these expanded populations will never be able to rely solely on wild foods.

Resource stress aside, "wildlife is the first resource" (Prescott-Allen and Prescott-Allen 1986:1). Prescott-Allen and Prescott-Allen (1986) in evaluating the contribution of wild species of plants and animals to the North American economy, expressed the viewpoint that North Americans with their industrialized economy have failed to appreciate the significant impact these resources have had and continue to have. They noted that the contributions of wildlife to the human economy occur in two spheres, the biological and psychological:

> Biological contributions comprise the provision of raw materials (food, medicines, and industrial materials such as timber) and services (such as the recycling of nutrients, watershed protection, and pollination). Psychological contributions include: recreational, both consumptive (hunting fishing, plant collecting) and nonconsumptive (watching, enjoying via film or print media); intellectual and scientific (including educational) aesthetic, artistic, and cultural; and religious and symbolic.

It behooves humans to cultivate knowledge about the resource structure of their particular environment; to recognize that we will never be master of our environment; to understand the ebb and flow of processes; and to compel these to our own advantage.

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B.27/d/11 Carlton House Account Book 1823/24
B.27/d/12 Carlton House Account Book, Servant's Advances 1836/37
B.27/d/14 Profit and Loss-Fort Pitt and Alberta Outfit 1874
B.27/d/16 Inventory of Merchandise on hand at Carlton 26 March 1885
B.27/d/18 Carlton Accounts 1876-1879
B.27/e/1 A Short Account of Carlton District 1815
B.27/e/2 Report from Carlton 1818-1819
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B.60/d/9 Fort Edmonton Account Book, General 1821/22
B.60/d/12 Fort Edmonton Account Book, General 1822/23
B.60/d/13 Fort Edmonton Account Book, Inventory 1823
B.60/d/15 Fort Edmonton Account Book, General 1823/24
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B.60/d/19 Fort Edmonton Account Book, Book Debts 1825/26

B.60/d/20 Fort Edmonton Account Book, Equipment Book, 1826
B.60/d/21 Fort Edmonton Account Book, Inventories andTransfers 1826/27
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B.60/d/25 Fort Edmonton Account Book, Saskatchewan Transfers 1827/28
B.60/d/27 Fort Edmonton Account Book, Statement of Servants' Accounts 1828/29
B.60/d/29 Fort Edmonton Account Book, Saskatchewan Transfer Book 1828/29
B.60/d/30 Fort Edmonton Account Book, Saskatchewan Inventories 1829
B.60/d/32 Fort Edmonton Account Book, Advances to Servants 1829/30
B.60/d/33 Saskatchewan Transfers Outfit 1829/30
B.60/d/36 Fort Edmonton Account Book, Servants' Debt Book 1830/31
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B.60/d/59 Fort Edmonton Account Book, Inventory of Articles in Use, Saskatchewan District 1839
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B.60/d/68 Fort Edmonton Account Book, Servants' Book Debts 1840/42
B.60/d/70 Fort Edmonton Account Book, Transfers, Saskatchewan District 1841
B.60/d/71 Fort Edmonton Account Book, Servants' Book Debts 1842/43
B.60/d/73 Fort Edmonton Account Book, Saskatchewan Inventories Outfit 1842/43
B.60/d/76 Fort Edmonton Account Book, Inventory Saskatchewan District 1843/44
B.60/d/78a Fort Edmonton Account Book, Book Debts 1843/45
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B.60/d/99 Fort Edmonton Account Book, Book Debts 1851/52
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B.60/d/106 Fort Edmonton Account Book, Saskatchewan General 18553/54
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B.60/d/121 Fort Edmonton Account Book, Saskatchewan District Transfers 1856/57
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B.60/d/124 Fort Edmonton Account Book, Saskatchewan District Transfers 1857/58
B.60/d/126 Fort Edmonton Account Book, Inventory of Saskatchewan District 1858
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B.60/d/129 Fort Edmonton Account Book, Saskatchewan District Inventory June 1859
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B.60/d/134 Fort Edmonton Account Book, Saskatchewan District Inventory 1860
B.60/d/135 Fort Edmonton Account Book, Saskatchewan Importation from London via St. Paul Outfit 1860
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B.60/d/140 Fort Edmonton Account Book, Servant's Book Debts 1861/62
B.60/d/141 Fort Edmonton Account Book, Saskatchewan Transfers 1861/62
B.60/d/144 Fort Edmonton Account Book, Servant's Book Debts 1862/63
B.60/d/146 Fort Edmonton Account Book, Saskatchewan District Transfers 1862/63
B.60/d/148 Fort Edmonton Account Book, Inventory 1863
B.60/d/152 Fort Edmonton Account Book, Edmonton Transfers 1863/64
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B.60/d/158 Fort Edmonton Account Book, Inventory 1864/65
B.60/d/160 Fort Edmonton Account Book, Servants' Book Debts 1865/66
B.60/d/161 Fort Edmonton Account Book, Saskatchewan District Transfers 1865/66
B.60/d/163 Fort Edmonton Account Book, Servants' Balances 1865/66
B.60/d/164Fort Edmonton Account Book, Inventory 1866
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B.60/d/169 Fort Edmonton Account Book, Servants' Balances 1866/67
B.60/d/170 Fort Edmonton Account Book, Saskatchewan District Inventory June 1867
B.60/d/173 Fort Edmonton Account Book, Servant's Expenditures 1868
B.60/d/174 Fort Edmonton Account Book, Servant's Equipment 1869
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B.63/z/fo.13 Fort Ellice Miscellaneous
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B.184/a/2 Rocky Mountain House Journal 1829-1830

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Table 1: **Economic, Social, Political and Ideological Mechanisms for Coping With Food Shortages in Hunting and Gathering Subsistence Systems.**

Domain	Activity	Strategy	P	R	ST	LT	Rb	NRb or SRb
Economic	Change subsistence base	–broaden use of resources	x	x	x	x	x	–
		–specialization	–	x	–	x	x	–
	Cooperation	–communal hunting	x	x	x	x	x	–
	Resource monitoring	–information sharing	x	x	x	–	x	–
	Mobility	–seasonal round	x	x	x	x	x	–
		–larger area	x	x	x	x	x	–
		–increase mobility	x	x	x	x	x	–
		–sedentism	x	–	–	x	–	x
	Food Storage	–storage	x	–	x	–	x	–
		–hoarding	–	x	x	–	x	–
	Exchange	–reciprocity	x	x	x	x	x	–
		–redistribution	x	x	–	x	x	–
		–trade	x	x	x	x	x	–
	Adjust food processing	–more time processing	–	x	x	–	x	–
		–reprocess garbage	–	x	x	–	x	–
	Conservation	–conserve food	x	x	x	–	x	–
		–conserve resources	x	x	x	x	x	–
	Change diet	–famine foods	–	x	x	x	x	–
		–less food	x	x	x	x	x	–
		–bulky food	x	x	x	x	x	–
		–quick maturing foods	x	x	x	x	x	–
		–eat seeds and domestics	–	x	x	–	–	x
		–anthropophagy necrophagy	–	x	x	–	–	x

Domain	Activity	Strategy	P	R	ST	LT	Rb	NRb or SRb
			Strategy Characteristics					
Social	Mobility	–move individuals	x	x	x	x	x	–
	Group size	–fissioning	x	x	x	x	x	–
	Population density	–decrease	x	x	x	x	x	–
	Reciprocal access	–enlarge resource base	x	x	x	x	x	–
	Marital arrangements Descent groups Kinship systems	}–move people } across land }–obligate } people	x	–	–	x	–	x
	Retrenchment of social activity	–conserve resources	–	x	x	–	x	–
	Division of labour	–reward good hunters –value elderly	x	–	–	x	x	–
	Population control	–infanticide	–	x	x	x	–	x
		–prolonged lactation	x	x	–	x	x	–
		–wide birth spacing	x	x	–	x	x	–
		–contraception	x			x	x	
		–senilicide	x	x	x	x	–	x

Domain	Activity	Strategy	Strategy Characteristics P	R	ST	LT	Rb	NRb or SRb
Political	Territoriality	–reduce access to own area by others	x	x	x	x	x	–
	Political Organization	–segmentary lineage	x	–	–	x	x	–
	Migration	–entire group relocates	–	x	x	x		x
	Raiding	–theft of food	–	x	x	–	–	x
Ideolog-ical	Ritual Oral tradition	–prayer, magic to cope with stress	x	x	x	x	x	–
		–content of myths etc.	x	–	–	x	x	–

N.B.

(1) abbreviations:

<u>P</u>- Precautionary
<u>R</u>- Recursive
<u>ST</u>- Short-term
<u>LT</u>- Long-term
<u>Rb</u>- Reversible
<u>NRb or SRb</u>- Not reversible or semi-reversible

Table 2: Coping Strategies Employed by Hunting and Gathering Subsistence Systems Resident in Marginal Versus Benevolent Environments.

		STRATEGY	
DOMAIN	**ACTIVITY**	**MARGINAL ENVIRONMENT**	**BENEVOLENT ENVIRONMENT**
Economic	Subsistence	Diversification	Specialization
	Mobility	Increased Mobility of Entire Community	Sedentism and/or Mobile Task Groups
	Food Storage	Minimal	Considerable
	Exchange	Reciprocity and Alliances	Redistribution Trade
Social	Group Size	Decreases	Increases
	Density	Low	High
Political	Territoriality	Social Boundary Defense	Perimeter Defense
	Political Organization	Band/Segmentary Lineage	Chiefdom

Sources: Bicchieri 1972; Binford 1978, 1980; Cashdan 1983, 1985; Colson 1979; Dyson-Hudson and Smith 1978; Hayden 1981b, 1992; Sahlins 1967; Service 1962; Speth 1990; Spielmann 1986; Wilmsen 1973)

Table 3: Subsistence Regimes, By Latitude (N to S).

Group	Climatic Zone	Latitude	Subsistence	References
Copper Eskimo	E	69N	H-F-g	Jenness 1922 Collinson 1889
Hare	Dfc	67N	H-F	Savishinsky 1974, 1976
Koyukon	Dfc	66N	H-F-g	Nelson, R. 1983
Kutchin	Dfc	66N	H-F	Nelson, R. 1973
Chukchee	Dfc	65N	H-Hd-F-g	Wrangell 1844 Priklonskii 1890 Bogoraz-Tan 1904-9
South Alaskan Eskimo	Cfc	60N	H-F-G	Birket-Smith 1953 Hrdlicka 1975
Koryak	Dfc	60N	H-F-g	Jochelson 1908
Nahane	Dfc	59N	H-F-g	Honigmann 1949 Teit 1956
Tlingit	Cfc	58N	F-H-G	Knapp and Child 1896 Jones 1914 Krause 1956
Aleuts	Cfc	55N	F-H-G	Veniaminov 1840 Shade 1949
Kamchadel	Dfc	55N	H-F	Antropova 1964
Bella Coola	Cfc	52N	F-H-G	McIlwraith 1948
Montagnais-Naskapi	Dfc	50N	H-F	Harper 1964 Henricksen 1973

Table 3: continued...

Group	Climatic Zone	Latitude	Subsistence	References
Ojibwa	Dfb	50N	H-F-G	Grant 1890 Densmore 1929 Jenness 1935 Landes 1938 Kinietz 1947
Nootka	Cfb	49N	F-H-G	Koppert 1930 Drucker 1951
Gros Ventre	Bsk	48N	H-g	Kroeber 1908 Flannery 1953
Blackfoot	Bsk	48N	H-g	Ewers 1955
SE Salish	Csb	48N	F-G-H	Ray 1932 Cline 1938
Mandan	Bsk	47N	H-Ht	Catlin 1851 Thwaites 1906 Will and Spinden 1906
Micmac	Dfb	46N	H-F-G	Le Clerq 1910 Wallis and Wallis 1955
Crow	Bsk	45N	H-g	Lowie 1935
Ainu	Dfb	44N	F-H-g	Watanabe 1972
Klamath	Csa	43N	F-H-G	Spier 1930 Voegelin 1942
N. Paiute	BWk	42N	G-H-F	Lowie 1924 Loud 1931 Riddell 1960
Arapaho	Bsk	42N	H-g	Hilger 1952

Table 3: continued...

Group	Climatic Zone	Latitude	Subsistence	References
Pawnee	Bsk	41N	H-Ht-g	Smith 1852 Wedel 1936 Dorsey 1940 Weltfish 1965
Comanche	Bsk	40N	H-g	Carlson and Jones 1939 Lee 1957
Dhegiha	Bsk	40N	H-Ht-G-F	Steffens 1965
Pomo	Csb	39N	G-F-H	Loeb 1926 Aginsky 1939 Kroeber 1953
Utes	BWk	37N	G-H	Powell 1971 Reid 1972
Andaman Islanders	Af	12N	H-G	Cipnani 1966
Semang	Af	6N	G-H-F	Schebesta 1954
Pygmies	Af	0	H-G-F	Turnbull 1965
Bushmen	BSh	20S	G-H	Story 1958 Marshall 1965 Lee 1966 Werner 1966
Arunta	BWh	25S	H-G	Spencer and Gillen 1927
Tehuelche	BSk, BWk	45S	H-G-F	Cooper 1946
Ona	Cfb	54S	H-F-G	Gusinde 1931 Cooper 1946
Yahgan	Cfb	55S	H-G	Gusinde 1937

Table 3: continued....

N.B.

(1) **Climatic Zone** according to Köppen-Geiger System of Climate Classification, after R. Geiger and W. Pohl 1953, from **Elements of Physical Geography.** by Arthur N. Strahler and Alan H. Strahler. New York: John Wiley and Sons, 1989. 4th edition.

(a) abbreviations:

- Cf – Mild humid climate with no dry season
- Bs – Dry climate
- E – Polar climate
- Df – Snowy-forest climate with moist winter
- Cs – Mild humid climate with dry summer
- BW – Desert climate
- BS – Steppe climate
- Af – Tropical rainforest climate

3rd letter

- a – hot summer:warmest month is over 22C
- b – warm summer: warmest month is below 22C
- c – cool, short summer: less than four months are over 10C
- h – dry-hot; mean annual temp. is over 18C
- k – dry-cold; mean annual temp. is under 18C

(2) **Latitude** from **Goode's World Atlas**. Edward B. Espenshade Jr. (ed.) Chicago: Rand-McNally, 1960. 12th edition.

(3) **Subsistence**

(a) abbreviations:

- H- Hunting
- Ht- Horticulture
- Hd- Herding, domestic animals
- G- Gathering, plants and shellfish
- F- Fishing

(b) these activities are in rank order. For example F-H-G indictates that fishing is the most important subsistence activity, followed by hunting then gathering. A capital letter, "H" , indicates an important activity; a small letter, "g", indicates an activity of minor importance.

(4) Information taken from references in the **Human Relations Area Files** at Simon Fraser University and the University of Calgary.

Table 4: Resource Stressors and Coping Strategies, By Climatic Zone.

Group	CZ	FS	Resource Stressors	Coping Strategies	References
Copper Eskimo	E	F	–patchy resources –low diversity of resources –migratory game –blowing snow –late breakup of ice	**E** –reciprocity –famine food –storage –necrophagy –anthropophagy –gorging –conceal food **S** –infanticide –senilicide –attitude **P** –theft of food from caches **I** –folktales of famine –ritual to bring back game	Collinson 1889 Stefansson 1914 Jenness 1922, 1959
Ojibwa	Dfb	F	–patchy resources –migratory game –seasonal plants –unpredictable game –wildlife cycles –fish runs fail –ice on waterways –predatory wolves –game too lean –health of hunter* –waste*	**E** –individual hunting –nomadism –famine foods –anthropophagy –necrophagy –storage –gorging –reciprocity –feed hunter first –fasting **S** –low density –infanticide –attitude –reciprocal access	Kohl 1860 Grant 1890 Densmore 1929 Jenness 1935 Landes 1938 Kinietz 1947 Hallowell 1955 Dunning 1959 Hickerson 1962

Table 4: continued...

Group	CZ	FS	Resource Stressors	Coping Strategies	References
Ojibwa				**P** –family territories –theft **I** –cannibal spirit myth –ritual to find game –belief that maleovolent spirits cause shortages	
Micmac	Dfb	C	–patchy game –rivers frozen –seasonal resources –no planning* –eat stored food too quickly*	**E** –storage –nomadism –famine foods –redistribution from forts –anthropo-phagy –gorging –fasting **S** –attitude	Le Clerq 1910 Wallis and Wallis 1955
Ainu	Dfb	I	–fluctuations in fish runs	**E** –cooperation –sedentism –storage –diversification	Watanabe 1972
Hare	Dfc	F	–patchy resources –wildlife cycles –migratory game –failure of fish runs –low density resources –extreme cold –severe ice conditions –unreliable resources	**E** –mobility of group –anthropo-phagy –reciprocity –some storage –famine food **S** –infanticide –senilicide	Hooper 1853 Keith 1890 Lefroy 1938 Hurlbert 1962 Savishinsky 1974, 1976 Hara 1976

Table 4: continued...

Group	CZ	FS	Resource Stressors		Coping Strategies	References
Hare			–disease* –waste* –forest fires		–mobility of individuals –attitude –postmarital residence changes –against freeloaders	
				P	–territorial –group fissioning –migration	
				I	–oral tradition-month names reflect concern with shortages	
Koyukon	Dfc	LFT	–Seasonal fluctuations in game and fish –long and cold winters –wildlife cycles –adverse water conditions for fishing –capriciousness in animal migrations –floods –fires* –patchy resources	E	–storage –nomadism –famine foods –diversification –women breast-feed husbands –rifles –avoid waste –sustained yield principle	Nelson, R. 1983
				S	–social control of violators of hunting rules –larger ranges	
				P	–territorial	
				I	–hunting taboos –folktales about starvation –supernatural explanations of fluctuations –conservation ethic	

Table 4: continued...

Group	CZ	FS	Resource Stressors	Coping Strategies	References
Kutchin	Dfc	LFT	–wildlife cycles –patchy resources –unpredictable resources –migratory game –overhunting* –snow crusting –sedentism*	**E** –famine foods –diversification, –anthropophagy, –nomadism **S** –sedentism during famine * –attitude **I** –conservation ethic	Nelson, R. 1973
Chukchee	Dfc	F	–cold winters –waste* –obligations of reciprocity*	**E** –nomadism –famine food –reciprocity –storage –fewer meals –gorging –trade	Wrangell 1844 Bogoraz-Tan 1904-09 Odulok 1934
Koryak	Dfc	R	–failure of fish –failure of sea mammals –disease in herds –lack of planning*	**E** –reciprocity –storage **S** –high status for good hunters	Jochelson 1908
Nahane	Dfc	F	–patchy resources –difficult to locate* –fish sources –spoilage of caches –caches taken by grizzlies –vitamin and fat deficiencies	**E** –storage –anthropo-phagy –gorging –fasting –redistribution –reciprocity **S** –small groups **I** –conservation ethic	Honigmann 1949, 1954 Teit 1956

Table 4: continued...

Group	CZ	FS	Resource Stressors	Coping Strategies	References
Kamchadal	Dfc	N	–fish runs fail –hunting difficulties*	**E** –Gorging	Lesseps 1790 Jochelson 1928 Antropova 1964
Montagnais-Naskapi	Dfc	F	–migratory game –wildlife cycles –weather conditions –forest fire* –disease –overhunting* –wolf predation –unpredictable game –only rabbit available (no fat) –hunters too hungry to hunt*	**E** –nomadism –information exchange –individualistic hunting –anthropo-phagy –famine foods –diversification –necrophagy **S** –senilicide –small groups –dispersed groups **P** –territorial **I** –myths about cannibal spirit	Turner 1894 Strong 1930 Speck 1935, 1936 Speck and Eiseley 1942 Lips 1947 Leacock 1954, 1968 McGee 1961 Harper 1964 Hind 1972 Fitzhugh 1972 Henricksen 1973
Nootka	Cfb	I	–stormy weather –patchy resources –seasonal resources –poor fish runs –poor hunters*	**E** –famine foods –storage –gorging –semi-sedentary **S** –large settlements **P** –alliances –raiding	Drucker 1951
Ona	Cfb	C	–low diversity –stormy weather –ignore plant foods* –disease	**E** –nomadism –gorging –storage –reciprocity **S** –reciprocal access	Gusinde 1931

Table 4: continued...

Group	CZ	FS	Resource Stressors	Coping Strategies	References
Ona				**S** –marriage contacts –attitude **P** –territorial –raiding	
Yahgan	Cfb	F	–stormy weather –canoe wrecks* –isolated from family*	**E** –nomadism –gorging –famine foods –reciprocity **P** –raiding	Gusinde 1937
South Alaskan Eskimo	Cfc	I	–winter storms –seasonal resources –red tide	**E** –diversification –famine foods –gorging –storage **I** –ritual and folktales about sea spirits	Birket-Smith 1953 Hrdlicka 1975
Tlingit	Cfc	S	–seasonal resources –shortage of stored food* –disease	**E** –famine food –gorging –redistribution –storage –semi-sedentary –reciprocity –necrophagy	Jones 1914 Oberg 1937 Krause 1956 Olson 1967
Aleuts	Cfc	F	–high tides –stormy seas –seasonal resources –patchy resources –low density resources –lack of fat	**E** –reciprocity –fasting –adults go without –storage –famine foods –gorging –diversification	Coxe 1803 Veniaminov 1840 Jochelson 1933 Bank 1953 Shade 1949 Berreman 1954

Table 4: continued...

Group	CZ	FS	Resource Stressors	Coping Strategies	References
Aleuts			–neglect food for furs* –disease	**I** –oral history of famine	
Bella Coola	Cfc	N	–mud slides –disease	**E** –sedentism –reciprocity –storage **I** –oral history of famine	McIlwraith 1948
Klamath	Csa	S	–stores run out* –unpredictable game –ice on lakes	**E** –famine foods –storage –nomadism **P** –raiding **I** –ritual to appease spirits	Voegelin 1942 Stern 1965
Southeast Salish	Csb	I	–long winters –fluctuating fish runs –volcanic dust –earthquake –insufficient storage* –disease –preoccupation with ritual* –carelessness* –late frosts	**E** –semi-nomadic –storage –anthropophagy –reciprocity –famine foods –necrophagy **S** –mobility of individuals –attitude **I** –ritual-pray for fish	Jewitt 1931 Ray 1932 Cline 1938
Pomo	Csb	LFT	–failure of acorn crop	**E** –sedentism, –diversification –famine foods –trade –conservation –fewer meals –storage	Loeb 1926 Barrett 1933 Aginsky 1939 Kroeber 1953

Table 4: continued...

Group	CZ	FS	Resource Stressors	Coping Strategies	References
Pomo				**S** –attitude –polyandry –reciprocal access –mobility of individuals **P** –territorial **I** –oral history about famine	
Bushmen	BSh	F	–shortage of water –patchy resources –unpredictable game –floods –unpredictable weather –disease	**E** –nomadic –reciprocity –famine foods –tobacco to reduce hunger –smaller meals –storage –diversification **S** –bilateral descent –reciprocal access –reward good hunters –senilicide –exogamy **P** –territorial **I** –magic(sling around waist)	Marshall 1958 Marshall 1959, 1965 Thomas 1959 Kaufmann 1910
Grosventre	Bsk	N	–Patchy resources	**E** –nomadic –famine foods –storage **P** –territorial	Kroeber 1908 Flannery 1953

Table 4: continued...

Group	CZ	FS	Resource Stressors	Coping Strategies	References
Blackfoot	Bsk	F	–overhunting* –heavy snows –intense cold –unpredictable game(bison) –waste* –difficulty in following herds* –drought –disease	**E** –semi-nomadic –famine foods –redistribution –reciprocity –fewer meals –gorging –fasting –medicine to curb hunger –storage **P** –territorial	Larocque 1910 Hanks and Hanks 1950 Ewers 1955 Grinnell 1962 Hellson and Gadd 1974
Mandan	Bsk	F	–capricious herds –disease –waste* –enemy territory*	**E** –semi-sedentary –redistribution –storage –gorging –hide stores –fasting –eat less **S** –unilineal descent **I** –ritual dances, buffalo mask	Catlin 1851 Thwaites 1906
Crow	Bsk	N	–low diversity resources –unpredictable game(bison)	**E** –famine foods –nomadism –trade **I** –ritual-prayers	Lowie 1935
Arapaho	Bsk	N	–seasonality of game and plants	**E** –famine foods –storage –redistribution –mobility of task groups **S** –exogamy **I** –folktales	Dorsey and Kroeber 1903 Elkin 1963

Table 4: continued...

Group	CZ	FS	Resource Stressors	Coping Strategies	References
Pawnee	Bsk	C	–failure of hunt* –raiding and warfare destroys crops* –drought –insect pests –disease	**E** –semi-sedentary –storage –redistribution –communal hunting –mobility of hunting task groups –gorging	Smith 1852 Wedel 1936 Dorsey and Murie 1940 Weltfish 1965
Comanche	Bsk	F	–seasonality of resources	**E** –nomadic –famine foods –reciprocity –gorging –limited storage **S** –attitude	Carlson and Jones 1939 Wallace and Hoebel 1952
Dhegiha	Bsk	N	–disease –declining no. of bison –improvidence*	**E** –semi-sedentary –storage –diversification –communal hunting –reciprocity –famine foods **S** –bilocal seasonally **P** –raiding –theft **I** –ritual	Dorsey 1884 Fletcher and La Flesche 1906 Steffens 1965 Graves 1949
Tehuelche	Bsk BWk	N	–unpredictable game –raiding* –storms	**E** –storage –nomadic –reciprocity **S** –small group size –attitude **P** –raiding –territorial	Cooper 1946

Table 4: continued...

Group	CZ	FS	Resource Stressors	Coping Strategies	References
Arunta	BWh	C S	–drought –patchy resources –low density resources –extermination of plants and animals* –lack of water	**E** –nomadic –gorging –fasting –famine foods –give children last good **S** –moieties –infanticide –breastfeed for 3-4 years –wide birth spacing –attitude **I** –ritual to increase food –folktales about food	Schulze 1891 Spencer and Gillen 1927 Chewings 1936 Roheim 1945
Utes	BWk	S	–unpredictable resources –patchy resources –seasonal shortages –drought	**E** –nomadic –famine foods –diversification –storage –reciprocity **S** –fluid social organization –small group size –generosity	Powell 1971 Reid 1980 Jorgenson 1980 Smith 1974
Northern Paiute	BWk	C	–Late winter –Failure of fish runs –Seasonal resources –failure to store* –early frost –lack of any dependable resource	**E** –diversification –storage –communal hunting –famine foods –reciprocity –conceal stored food **S** –large territory –small groups	Lowie 1924 Loud 1931 Kelly 1934 Wheeler-Voegelin 1955-56 Riddell 1960

Table 4: continued...

Group	CZ	FS	Resource Stressors	Coping Strategies	References
Andaman Islanders	Af	N	–seasonality of pigs	**E** –gorging **S** –attitude	Man 1932 Cipriani 1966
Semang	Af	I	–diseases	**E** –nomadic, –diversification. **P** –territorial.	Schebesta 1954
Pygmies	Af	I	–uncertainty of food supply –seasonal resources –area near villages depleted of game* –storms –improvidence*	**E** –trade –communal hunting –nomadic –storage –reciprocity **S** –small group size **P** –territorial –commons bet. territories	Turnbull 1965

N.B.

(1) abbreviations

(a) **CZ- Climatic Zone**

Cf –Mild humid climate with no dry season
Bs –Dry climate
E –Polar climate
Df –Snowy-forest climate with moist winter
Cs –Mild humid climate with dry summer
BW –Desert climate
BS –Steppe climate
Af –Tropical rainforest climate

Third letter:

a –hot summer: warmest month is over 22C
b –warm summer: warmest month is below 22C
c –cool summer: less than four months are over 10C
h –dry-hot: mean annual temp. is over 18C
k –dry-cold: mean annual temp. is under 18C

(b) **FS- Food Shortage**

F –Frequent
C –Common
I –Infrequent
S –Seasonal
N –No information
R –Rare
LFT –Less frequently today(than in the past

(c) **Coping Strategies**

E – in the environmental domain
S – in the social domain
P – in the political domain
I – in the ideological domain

(d) * The Kutchin "give up" when famine strikes and become sedentary, feeling that they should die together(Nelson 1973:304). This is regarded as a social response since it is not geared to finding food, ie. not in the economic domain.

(e) Climatic Zones according to Köppen-Geiger System of Climate Classification, after R. Geiger and W. Pohl 1953, from **Elements of Physical Geography,** by Arthur N. Strahler and Alan H. Strahler. New York: John Wiley and Sons, 1989. 4th edition.

(f) Information taken from references in the **Human Relations Area Files** at Simon Fraser University and the University of Calgary.

(g) Social stressors indicated by *

Table 5: Numerical Frequency of Resource Stressors, By Climatic Zone.

Group	Climatic Zone	Resource Stressor Environmental	Social	Total Per Group
Copper Eskimo	E	5	–	5
				Range 5
				Mean 5.0
Ojibwa	Dfb	10	1	11
Micmac	Dfb	3	2	5
Ainu	Dfb	1	–	1
				Range 1-11
				Mean 5.7
Hare	Dfc	9	2	11
Koyukon	Dfc	7	1	8
Kutchin	Dfc	5	2	7
Chukchee	Dfc	1	2	3
Koryak	Dfc	3	1	4
Nahane	Dfc	5	1	6
Kamchadal	Dfc	1	1	2
Montagnais-Naskapi	Dfc	7	3	10
				Range 2-11
				Mean 6.4
Nootka	Cfb	4	1	5
Ona	Cfb	3	1	4
Yahgan	Cfb	1	2	3
				Range 3-5
				Mean 4.0
South Alaskan Eskimo	Cfc	3	–	3
Tlingit	Cfc	2	1	3
Aleuts	Cfc	7	1	8
Bella Coola	Cfc	2	–	2
				Range 2-8
				Mean 4.0

Table 5: continued...

Group	Climatic Zone	Resource Environmental	Stressor Social	Total Per Group
Klamath	Csa	2	1	3
				Range 3
				Mean 3.0
Southeast Salish	Csb	6	3	9
Pomo	Csb	1	–	1
				Range 1-9
				Mean 5.0
Bushmen	BSh	6	–	6
				Range 6
				Mean 6.0
Gros Ventre	Bsk	1	–	1
Blackfoot	Bsk	5	3	8
Mandan	Bsk	2	2	4
Crow	Bsk	2	–	2
Arapaho	Bsk	1	–	1
Pawnee	Bsk	3	2	5
Comanche	Bsk	1	–	1
Dhegiha	Bsk	2	1	3
Tehuelche	Bsk	2	1	3
				Range 1-8
				Mean 3.1
Arunta	BWh	4	1	5
				Range 5
				Mean 5.0
Utes	BWk	4	–	4
Northern Paiute	BWk	5	1	6
				Range 4-6
				Mean 5.0

Table 5: continued...

Group	Climatic Zone	Resource Environmental	Stressor Social	Total Per Group
Andaman Islanders	Af	1	–	1
Semang	Af	1	–	1
Pygmies	Af	3	2	5
				Range 1-5
				Mean 2.3

N.B.

(1) numerical frequencies tabulated from references in the
Human Relations Area Files at Simon Fraser University and the University of Calgary.

(2) **Climatic Zones** according to Köppen Classification, R. Geiger and W. Pohl 1953, from **Elements of Physical Geography** by Arthur N. Strahler and Alan H. Strahler. New York: John Wiley and Sons, 1989. 4th edition.

Cf –Mild humid climate with no dry season
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Third Letter
a – hot summer: warmest month is over 22C
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h – dry-hot: mean annual temperature is over 18C
k – dry-cold: mean annual temperature is under 18C

(3) **Resource Stressors**
– see Table 4 for list of resource stressors in the environmental and social realms as reported for each cultural group.

Table 6: Mean Number of Resource Stressors Per Group, By Climatic Zone.

Climatic Zone	No. of Groups	Range	Mean	Rank
E	1	5	5.0	4
Dfb	3	1-11	5.7	3
Dfc	8	2-11	6.4	1
Cfb	3	3-5	4.0	5
Cfc	4	2-8	4.0	5
Csa	1	3	3.0	7
Csb	2	1-9	5.0	4
BSh	1	6	6.0	2
Bsk	9	1-8	3.1	6
BWh	1	5	5.0	4
BWk	2	4-6	5.0	4
Af	3	1-5	2.3	8

N.B.

(1) **Climatic Zones** according to Köppen Classification, R. Geiger and W. Pohl 1953, from **Elements of Physical Geography** by Arthur N. Strahler and Alan H. Strahler New York: John Wiley and Sons, 1989. 4th edition.

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(2) Information on 38 predominantly hunting and gathering societies taken from the **Human Relations Area Files** at Simon Fraser University and the University of Calgary.

(3) **Range** indicates the minimun and maximum number of resource stressors for the groups occupying each climatic zone.

(4) **Mean** is the average number of resource stressors facing groups occupying each climatic zone.

(5) **Rank** indicate the position of a particular climatic zone relative to all others as regards the mean number of resource stressors. 1 faces the greatest number of stressors and 7 the least. Where means are the same in different climatic zones, they are given the same rank.

(6) Climatic zones are arranged roughly from North to South

Table 7: Presence and Absence of All Resource Stressors, By Climatic Zone.

Resource Stressor	E	Dfb	Dfc	Cfb	Cfc	Csa	Csb	BSh	Bsk	BWh	BWk	Af
Environmental												
Adverse water conditions		x			x							
Blowing snow	x											
Crop failure(acorn)							x					
Disease in herds			x									
Drought								x	x	x	x	
Earthquake							x					
Extreme cold		x	x						x			
Failure of sea mammals			x									
Fish runs fail		x	x	x			x				x	
Floods		x										
Heavy snow									x			
Ice on waterways		x				x						
Insect pests									x			
Lack of dependable resources											x	
Late breakup	x											
Late frosts											x	
Lean game		x										
Long winters		x					x				x	
Low density resources		x				x				x		
Low diversity resources	x		x						x			
Migratory game	x	x	x									
Mud slides						x						
Patchy resources	x	x	x	x		x		x	x	x	x	
Predatory bears			x									
Predatory wolves		x	x									
Red tide					x							
Seasonal resources		x		x	x	x			x			x
Snow crusting			x									
Spoilage of caches			x									
Stormy weather			x	x	x			x	x			x

Table 7: continued

Resource Stressor	Climatic Zone										
	E	Dfb	Dfc	Cfb	Cfc	Csa	Csb	BSh	Bsk	BWh	BWk	Af
Environmental												
Unpredictable game		x	x			x		x	x			
Unreliable resources			x								x	x
Vitamin and fat deficiencies			x		x							
Volcanic dust							x					
Wildlife cycles		x	x									
Social												
Carelessness							x					
Canoe Wrecks				x								
Depletion of game			x			x			x	x		x
Difficulty following herds									x			
Disease		x	x	x	x		x	x	x		x	x
Enemy territory									x			
Exhaust stores		x			x		x					
Failure to store											x	
Floods												
Forest fires		x	x									
Hard to locate resources			x									
Health of hunter		x										
Hungry hunters			x									
Hunting difficulties			x						x			
Ignore foods				x								
Isolated from family				x								
Neglect food for furs					x							
No planning		x	x									
Obligations of reciprocity		x										
Overhunting			x					x				
Poor hunters				x								

Table 7: continued...

Resource Stressor	**Climatic Zone**											
	E	**Dfb**	**Dfc**	**Cfb**	**Cfc**	**Csa**	**Csb**	**BSh**	**Bsk**	**BWh**	**BWk**	**Af**
Social												
Preoccupied with ritual							x					
Raiding and warfare									x			
Sedentism			x						x			
Waste		x	x						x			x

N.B.

(1) **Climatic Zones** are according to the Köppen System of Climate Classification, R. Geiger and W. Pohl 1953, from **Elements of Physical Geography** by Arthur N. Strahler and Alan H. Strahler. New York: John Wiley and Sons, 1989. 4th edition.

(2) Information on 38 predominantly hunting and gathering societies taken from the **Human Relations Area Files** at Simon Fraser University and the University of Calgary.

(3) The sum of coping strategies in the economic, social, political and ideological domains for each of 38 predominantly hunting and gathering societies was calculated and the **Range** indicates the minimum and maximum number of coping strategies for the groups occupying each climatic zone.

(4) **Mean** is the average number of coping strategies per group occupying a particular climatic zone.

(5) **Rank** indicates the position of a particular climatic zone relative to all others as regards the mean number of coping strategies. 1 has the greatest number of strategies and 12, the fewest.

(6) Climatic Zones are arranged roughly from North (left) to South (right).

Table 8: Famine Foods, By Climatic Zone.

Group	Climatic Zone	Famine Foods	References
Copper Eskimo	E	–caribou dung –sealskin boots and bowcases –seal oil(lamp) –toadstools –sinew –human flesh	Collinson 1889 Stefansson 1914 Jenness 1922,1959
Ojibwa	Dfb	–sap of hemlock, bass-wood,black birch, black oak –moss growing on white pine –bulrush roots –milkweed flowers –brown lichens from rock surfaces –dung –pine fibers –fish –human flesh	Grant 1890 Jenness 1935 Hickerson 1962
Micmac	Dfb	–inner tree bark –curdled blood –scrapings of skin, old maccasins –use of maple sap may have begun as a famine food –human flesh	Le Clerq 1910
Ainu	Dfb	–no information	
Hare	Dfc	–otter –human flesh	Hooper 1853 Keith 1890 Lefroy 1938 Savishinsky 1974

Table 8: continued...

Group	Climatic Zone	Famine Foods	References
Koyukon	Dfc	–wolverine – songbirds which froze and fell from trees –blackfish –nettles –breatmilk for hunters	Nelson, R. 1983
Kutchin	Dfc	–many kinds of birds not normally eaten –human flesh	Nelson, R. 1973
Chukchee	Dfc	–fish –dried reindeer bones –roasted leather –bark worms –mice and contents of mice nests –berries –mushrooms –putrid meat –soft velvet from reindeer antlers –dogs, foxes, wolves –carrion of sea mammals	Wrangell 1844 Bogoraz-Tan 1904-1909 Odulok 1934
Koryak	Dfc	–no information	
Nahane	Dfc	–human flesh	Honigmann 1954
Kamchadal	Dfc	–no information	
Montagnais-Naskapi	Dfc	–mink –weasel –fish –tanned skins –inner bark of birch –caribou moss –human flesh	Strong 1930 Speck 1935 Lips 1947 Harper 1964 Hind 1972 Fitzhugh 1972 Henricksen 1973

Table 8: continued...

Group	Climatic Zone	Famine Foods	References
Nootka	Cfb	–venison –mussels –carrion(codfish heads abandoned by seals and sea lions	Drucker 1951
Ona	Cfb	–no information	
Yahgan	Cfb	–shags and shags blood –fungi –mussels –carrion(stranded seals or whales) –dandelion leaves –leather shoes, thongs	Gusinde 1937
South Alaskan Eskimo	Cfc	–mussels –bear excrement	Birket-Smith 1953 Hrdlicka 1975
Tlingit	Cfc	–inner bark of larch or fir –human flesh	Krause 1956
Aleuts	Cfc	–seaweed –shellfish –carrion(stranded whales or seals) –roots –marine cabbage –leather straps –sea urchins –fox meat	Coxe 1803 Veniaminov 1840 Jochelson 1933 Shade 1949
Bella Coola	Cfc	–no information	

Table 8: continued...

Group	Climatic Zone	Famine Foods	References
Klamath	Csa	–sugar pine pitch –boiled or roasted hides –overlooked roots –lichen –cambium of ponderosa lodgepole pines	Voegelin 1942 Stern 1965
Southeast Salish	Csb	–recover discarded salmon and game bones –rosehips –roasted hide clothing –salmon skins –prairie chicken droppings –mussels –black moss –cactus –sunflower roots –coyote –skunk –human flesh –locate shoals of trout depend on them if shortages	Ray 1932 Cline 1938
Pomo	Csb	–carrion(deer and elk)	Loeb 1926
Bushmen	BSh	–bitter bean –grass seeds	Kaufmann 1910 Thomas 1959
Gros Ventre	Bsk	–grown dogs –prairie dog –gophers –rabbit	Flannery 1953

Table 8: continued...

Group	Climatic Zone	Famine Foods	References
Blackfoot	Bsk	–mice –rats –gophers –badgers –skunks –rabbits –grease soaked bags –silverberries –inner bark of willow –bearberries –hooves –dogs –horses –discarded buffalo bones –grass –carrion	Hanks and Hanks 1950 Ewers 1955 Grinnell 1962 Hellson and Gadd 1974
Mandan	Bsk	–no information	
Crow	Bsk	–rabbits	Lowie 1935
Arapaho	Bsk	–wheat seed from gov't	Elkin 1963
Pawnee	Bsk	–government rations	Lesser 1933
Comanche	Bsk	–acorns –plant roots –fish	Carlson and Jones 1939
Dhegiha	Bsk	–acorns –roots	Graves 1949
Tehuelche	BSk BWk	–no information	

Table 8: continued

Group	Climatic Zone	Famine Foods	References
Arunta	BWh	–own blood –cow hides	Schulze 1891 Chewings 1936 Roheim 1945
Utes	BWk	–grasshoppers –ants –snakes –lizards –horned toads –boiled rawhide	Powell 1971 Smith 1974
Northern Paiute	BWk	–horses –magpies –wolves –coyotes –skunks	Lowie 1924
Andaman Islanders	Af	–no information	
Semang	Af	–no information	
Pygmies	Af	–no information	

N.B.

(1) abbreviations

(a) **Climatic Zone**

Cf – Mild humid climate with no dry season
Bs – Dry climate
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(according to the Köppen System of Climate Classification, R. Geiger and W. Pohl 1953, from **Elements of Physical Geography** by Arthur N. Strahler and Alan H. Strahler. New York: John Wiley and Sons, 1989. 4th edition)

Climatic Zones are organized from approximately North to South.

(2) Information taken from references in the **Human Relations Area Files** at Simon Fraser University and the University of Calgary.

Table 9: Numerical Frequency of Coping Strategies, By Climatic Zone.

Group	Climatic Zone	Coping Strategies (N) E	S	P	I	Total Per Group
Copper Eskimo	E	7	3	1	2	13
						Range 13
						Mean 13
Ojibwa	Dfb	10	4	2	3	19
Micmac	Dfb	7	1	–	–	8
Ainu	Dfb	4	–	–	–	4
						Range 4-19
						Mean 10.3
Hare	Dfc	5	6	3	1	15
Koyukon	Dfc	8	2	1	4	15
Kutchin	Dfc	4	2	–	1	7
Chukchee	Dfc	7	–	–	–	7
Koryak	Dfc	2	1	–	–	3
Nahane	Dfc	6	1	–	1	8
Kamchadal	Dfc	1	–	–	–	1
Montagnais-Naskapi	Dfc	7	3	1	1	12
						Range 3-15
						Mean 9.8
Nootka	Cfb	4	1	2	–	7
Ona	Cfb	4	3	2	–	9
Yahgan	Cfb	4	–	1	–	5
						Range 5-9
						Mean 7.0

Table 9: continued...

Group	Climatic Zone	Coping Strategies (N) E	S	P	I	Total Per Group
South Alaskan Eskimo	Cfc	4	–	–	1	5
Tlingit	Cfc	7	–	–	–	7
Aleuts	Cfc	7	–	–	1	8
Bella Coola	Cfc	3	–	–	1	4
						Range 4-8
						Mean 6.0
Klamath	Csa	3	–	1	1	5
						Range 5
						Mean 5.0
Southeast Salish	Csb	6	2	–	1	9
Pomo	Csb	7	4	1	1	13
						Range 9-13
						Mean 11.0
Bushmen	BSh	7	5	1	1	14
						Range 14
						Mean 14.0
Gros Ventre	Bsk	3	1	–	–	4
Blackfoot	Bsk	9	–	1	–	10
Mandan	Bsk	7	1	–	1	9
Crow	Bsk	3	–	–	1	4
Arapaho	Bsk	4	1	–	–	5
Pawnee	Bsk	6	–	–	–	6
Comanche	Bsk	5	1	–	–	6
Dhegiha	Bsk	6	1	1	1	9
Tehuelche	Bsk, BWk	3	2	2	–	7
						Range 4-10
						Mean 6.7

Table 9: continued...

Group	Climatic Zone	Coping Strategies (N) E	S	P	I	Total Per Group
Arunta	**BWh**	**5**	**5**	–	2	12
						Range 12
						Mean 12
Utes	BWk	5	3	–	–	8
Northern Paiute	BWk	6	1	–	–	7
						Range 7-8
						Mean 7.5
Andaman Islanders	Af	2	–	–	–	2
Semang	Af	2	–	1	–	3
Pygmies	Af	5	1	2	–	8
						Range 2-8
						Mean 3.3

N.B. (1) numerical frequencies tabulated from references in the **Human Relations Area Files** at Simon Fraser University and the University of Calgary.

(2) **Climatic Zones** according to Köppen Classification, R. Geiger and W. Pohl 1953, from **Elements of Physical Geography** by Arthur N. Strahler and Alan H. Strahler New York: John Wiley and Sons, 1989. 4th edition.

Cf – Mild humid climate with no dry season
Bs – Dry climate
E – Polar climate
Df – Snowy-forest climate with moist winter
Cs – Mild humid climate with dry summer

BW – Desert climate
BS – Steppe climate
Af – Tropical rainforest climate

Third Letter

a – hot summer: warmest month is over 22C
b – warm summer: warmest month is below 22C
c – cool, short summer: less than four months over 10C
h – dry-hot: mean annual temperature is over 18C
k – dry-cold: mean annual temperature is under 18C

Climatic Zones are organized from approximately North to South.

(3) **Coping Mechanisms**:
- see Table 4 for list of coping mechanisms in the economic, social, political and ideological domains as reported for each cultural group.

E – economic domain
S – social domain
P – political domain
I – ideological domain

Table 10: Mean Number of Coping Strategies Per Group, By Climatic Zone.

Climatic Zone	No. of Groups	Range (sum of E+S+P+I)	Mean	Rank
E	1	13	13.0	2
Dfb	3	4-19	10.3	5
Dfc	8	3-15	9.8	6
Cfb	3	5-9	7.0	8
Cfc	4	4-8	6.0	10
Csa	1	5	5.0	11
Csb	2	9-13	11.0	4
BSh	1	14	14.0	1
Bsk	9	4-10	6.7	9
BWh	1	12	12.0	3
BWk	2	7-8	7.5	7
Af	3	2-8	3.3	12

N.B.

(1) **Climatic Zones** are according to the Köppen System of Climate Classification, R. Geiger and W. Pohl 1953, from **Elements of Physical Geography** by Arthur N. Strahler and Alan H. Strahler. New York: John Wiley and Sons, 1989. 4th edition.

(2) Information on 38 predominantly hunting and gathering societies taken from the **Human Relations Area Files** at Simon Fraser University and the University of Calgary.

(3) **Range** indicates the minimum and maximum number of coping strategies for the groups occupying each climatic zone.

(4) **Mean** is the average number of coping strategies for the groups occupying a particular climatic zone.

(5) **Rank** indicates the position of a particular climatic zone relative to all others as regards the mean number of coping strategies. 1 has the greatest number of strategies and 12, the fewest.

(6) Climatic Zones are organized approximately North to South.

Table 11: Presence and Absence of All Coping Strategies, By Climatic Zone.

Coping Strategy	E	Dfb	Dfc	Cfb	Cfc	Csa	Csb	BSh	Bsk	BWh	BWk	Af
	Climatic Zone											
Economic Domain												
Adults go without					x							
Anthropophagy		x	x	x		x		x				
Avoid waste			x									
Communal hunting		x							x		x	x
Conceal food	x								x		x	
Conservation							x					
Diversification			x		x		x	x	x		x	x
Famine foods	x	x	x	x	x	x	x	x	x	x	x	
Fasting		x	x						x	x		
Feed hunter first		x										
Fewer meals			x				x		x			
Give children last food										x		
Gorging	x	x	x	x	x				x	x		x
Individualistic hunting		x	x									
Information exchange			x									
Medicine to reduce hunger								x	x			
Mobility of group		x										
Mobility of task group									x			
Necrophagy	x	x	x		x		x					
Nomadism		x	x	x		x		x	x	x	x	x
Reciprocity	x	x	x	x	x		x	x	x		x	x
Redistribution			x		x			x				
Redistribution from forts		x										
Sedentism			x		x		x					
Semi-sedentary				x	x		x		x			
Smaller meals								x	x			
Storage	x	x	x	x	x	x	x	x	x		x	x
Sustained yield principle			x									
Trade			x				x		x			x

Table 11: continued...

Coping Strategy	Climatic Zone E	Dfb	Dfc	Cfb	Cfc	Csa	Csb	BSh	Bsk	BWh	BWk	Af
Economic Domain												
Women breastfeed husbands			x									
Social Domain												
Attitude	x	x	x	x			x		x	x		
Bilateral Descent								x				
Bilocal by season			x									
Breastfeed long time										x		
Dispersed groups												
Exogamy								x	x			
Fluid social organization											x	
Generosity emphasized											x	
High status for good hunters			x					x				
Infanticide	x	x	x							x		
Larger ranges			x								x	
Large settlements				x								
Low density		x										
Marriage contacts				x								
Mobility of individuals			x				x					
Moieties										x		
Polyandry							x					
Reciprocal Access		x		x			x	x				
Sedentism during famine												
Senilicide	x		x					x				
Small groups			x						x		x	x
Social control of violators			x									
Unilineal descent									x			
Wide birth spacing										x		
Political Domain												
Alliances				x								
Commons between territories												x
Family territories		x										
Group Fissioning			x									
Migration			x									
Raiding				x		x			x			
Territorial (group)			x	x				x	x			x

Table 11: continued...

Coping Strategy	E	Dfb	Dfc	Cfb	Cfc	Csa	Csb	BSh	Bsk	BWh	BWk	Af
Political Domain												
Theft of food from caches	x	x										
Ideological												
Belief that male-evolent spirits cause shortages		x	x		x							
Cannibal spirit myth		x										
Conservation ethic			x									
Folktales of famine	x		x		x					x		
Hunting taboos			x									
Magic(sling around waist)								x				
Month names about food shortages			x									
Ritual to find food		x			x		x		x	x		
Ritual to appease spirits						x						
Ritual to bring back game	x											

N.B.

(1) **Climatic Zone** abbreviations:

Cf – Mild humid climate with no dry season
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Third Letter

a – hot summer: warmest month is over 22C
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(according to the Köppen System of Climate Classification, R. Geiger and W. Pohl 1953, from **Elements of Physical Geography** by Arthur N. Strahler and Alan H. Strahler. New York: John Wiley and Sons, 1989. 4th edition.

(2) Information on coping strategies taken from references in the **Human Relations Area Files** at Simon Fraser University and the University of Calgary.

(3) Climatic Zones are arranged approximately from North (left) to South (right).

Table 12: Comparison of Range, Mean and Rank of Resource Stressors and Coping Mechanisms, By Climatic Zone.

Climatic Zone	No.	Resource Stressors			Coping Strategies		
		Range	Mean	Rank	Range	Mean	Rank
E	1	5	5.0	4	13	13.0	2
Dfb	3	1-11	5.7	3	4-19	10.3	5
Dfc	8	2-11	6.4	1	3-15	9.8	6
Cfb	3	3-5	4.0	5	5-9	7.0	8
Cfc	4	2-8	4.0	4	4-8	6.0	10
Csa	1	3	3.0	4	5	5.0	11
Csb	2	1-9	5.0	2	9-13	11.0	4
BSh	1	6	6.0	6	14	14.0	1
BWh	1	5	5.0	4	12	12.0	3
BWk	2	4-6	5.0	4	7-8	7.5	7
Af	3	1-5	2.3	7	2-8	3.3	12

N.B.

(1) **Climatic Zone** according to Köppen-Geiger System of Climate Classification, after R. Geiger and W. Pohl 1953, from **Elements Physical Geography** by Arthur N. Strahler and Alan H. Strahler. New York: John Wiley and Sons, 1989. 4th edition.

(a) abbreviations:

Cf – Mild humid climate with no dry season
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(2) **No.** of groups in each climatic zone.

(3) **Range** is the minimum and maximum number of resource stressors per sociocultural group, in a particular climatic zone.

(4) **Mean** – is the average number of stressors in a particular climatic zone.

(5) **Rank** is the relative position of each climatic zone with reference to the mean number of stressors identified for that zone. Where mean values are the same, the zones are given the same rank.

(6) Climatic Zones are arranged approximately from North to South.

Table 13: Chronological Summary of Ethnohistorical Sources.

Name	Dates	Occupation	Locations	References
Henry Kelsey	1691	HBC Trader	Central Saskatchewan	Dougherty and Martin 1929
Pierre Gaultier de Verennes Sieur de la Verendrye	1738-43	Montreal Trader	Southern Manitoba, North Dakota	Burpee 1927
Anthony Henday	1754-55	HBC Trader	N. Sask. R. to Three Hills Ck.	Burpee 1907
Matthew Cocking	1772-73	HBC Trader	N. Sask. to S. Sask., Eagle Hills	Burpee 1908
Alexander Henry, the Elder	1775-76	Montreal Trader	N. Sask. R, to Fort des Prairies	Bain 1969
David Thompson	1786-88 1797-98 1800-01	HBC Trader	Assiniboine R, Souris R, Missouri R, N. Sask R. , Bow River, S. Sask. R.	Hopwood 1971
Peter Fidler	1792-93	HBC Trader	Buckingham House to Oldman R.	Haig 1991
	1800-02		Chesterfield House	Johnson 1967
John MacDonald of Garth	1792-98		Fort George, Fort Augustus	Masson 1890
John MacDonnell	1793-94	NWC Trader	Red River, Pine Fort, Fort Esperance, Fort Qu'Appelle	Masson 1889 Gates 1965 Wood 1984
Duncan McGillivray	1794-95	NWC Trader	Fort George	Morton 1929
William Tomison	1795-96, 1798-99	HBC Trader	Fort Edmonton	Johnson 1967
George Sutherland	1796-98	HBC Trader	Fort Edmonton	Johnson 1967
James Bird	1799-1800	HBC Trader	Edmonton House, Acton House	Johnson 1967

Alexander Henry, the Younger	1799-1811	NWC Trader	Riding Mountain, Qu'Appelle, Red R., Pembina Post, Missouri R., N. Sask. R., S. Sask. R., Fort Vermilion, White Earth House, Rocky Mountain House	Coues 1965
Archibald McLeod	1800-01	NWC Trader	Fort Alexandria	Gates 1965
Daniel Harmon	1800-07	NWC Trader	Fort Alexandria, South Branch Fort	Lamb 1957
Meriwether Lewis and William Clark	1804-06	Government Exploring Expedition	Fort Mandan to Three Forks	Thwaites 1959a, 1959b, 1959c
François-Antoine Larocque	1804-05	XY and NWC Trader	Fort Assiniboine to Missouri R.	Larocque 1910
Charles McKenzie	1804-07	NWC Trader	Fort Assiniboine to Missouri R.	Wood and Thiessen 1985
John Bradbury	1811	British Botanist	Up Missouri to Fort Mandan	Bradbury 1966
H. M. Brackenridge	1811	Botanist and Zoologist	Up Missouri to Fort Mandan	Brackenridge 1966
Miles Macdonell	1812-14	Leader of Red River Settlers	Red River	Pritchett 1942
Gabriel Franchère	1814	NWC Trader	Rocky Mountain House to N. Sask. R.	Franchère 1854
J. P. Pruden	1815 1818-19 1820-21 1826-27	HBC Trader	Carlton House	HBCA B.27/e/1-4

George Simpson	1825	HBC Trader	Rocky Mountain House, Fort Edmonton, Carlton House, Touchwood Hills, Qu'Appelle R.	Merk 1968
J. E. Harriott	1833-34	HBC Trader	Piegan Post	HBCA B.21/a/1
Maximilian, Prince of Wied-Neuwied	1833-34	German Naturalist	Up Missouri R. to Fort. McKenzie, Fort Clark	Thwaites 1905a, 1905b, 1906
Alexander Kennedy	1834	American Fur Co. Trader	Fort Clark	Abel 1932
François Auguste Chardon	1834-39	American Fur Co. Trader	Fort Clark	Abel 1932
Rev. Robert T. Rundle	1840-48	Wesleyan Missionary	Fort Edmonton, Rocky Mountain House, Bow R.	Dempsey 1977
Rev. John McDougall	1842-68	Wesleyan Missionary	N. Sask. R., Carlton House, Fort Pitt, Fort Edmonton, Victoria Post, Rocky Mountain House, Pigeon Lake, Qu'Appelle R., Red R.	McDougall 1895, 1896, 1898, 1983
John James Audubon	1843	Naturalist and Artist	Up Missouri to Fort Union	Audubon 1960a, 1960b
Edward Harris	1843	Painter	Up Missouri to Fort Union	McDermott 1951
Pierre-Jean De Smet	1845-46	Missionary for Society of Jesus	Rocky Mountain House, Fort Augustus, Jasper House	De Smet 1978

Paul Kane	1846-47	Painter	Red River to Assiniboine R. to Qu'Appelle to N. Sask. R. Fort Pitt, Carlton House, Fort Edmonton, Rocky Mountain House	MacLaren 1989 Harper 1971
John Palliser	1847-48	Irish Sportsmen	Up Missouri to Fort MacKenzie, Fort Berthold, Fort Union	Palliser 1969
	1857-59	Leader of British North America Trading Expedition	Red River to Qu'Appelle R. to S. Sask. R to Carlton House to Fort Edmonton to Red Deer R to Bow R to USA border to Crowsnest Pass and back	Spry 1968
Colonel Richard Irving Dodge	1840's-1870's	U.S. Military	Central Plains	Dodge 1884
Thaddeus Culbertson	1850	Naturalist for Smithsonian	Up Missouri to Fort Union, Fort Clark, Ft. Berthold	McDermott 1952
Rudolph F. Kurz	1851-52	Painter	Up Missouri to Fort Union, Fort Berthold	Hewitt 1970
Henry John Moberly	1854-55	HBC Trader	Carlton House, Rocky Mountain House, Fort Edmonton, Jasper House	Moberly 1929

Henry Youle Hind	1857-58	Leader of Canadian Exploring Expedition	Red River to Qu'Appelle to S. Sask. R. to N. Sask T. to Touchwood Hills to Red River	Hind 1971
James Hector	1857-59	Geologist on BNA Expedition	With Palliser to Edmonton then explored Rocky Mountains	Spry 1968
The Earl of Southesk	1859	Scottish Adventurer	Red River to Fort Qu'Appelle to S. Sask. R. to Carlton House to Eagle Hills to Fort Edmonton, to Lac St. Ann to Jasper House to Kootenay Plains to Bow R. to Rocky Mts. and back	The Earl of Southesk 1969
Henry Boller	1858-62	American Fur Company Trader	Up Missouri to Fort Atkinson,	Quaife 1972
Lewis Henry Morgan	1861	Lawyer / Anthroplogist	Red River to Pembina	White 1959b
	1862		Up Missouri to Fort Union	
Walter Butler Cheadle	1862-63	Doctor/ Adventurer	Fort Ellice to Carlton House to Fort Pitt to Fort Edmonton to Jasper House	Cheadle 1971
Isaac Cowie	1867-74	HBC Trader	Cypress Hills, Fort Qu'Appelle	Cowie 1913
William Francis Butler	1870-71	Military Officer of Gov't of Canada	Red River to Fort Ellice to Carlton House to Fort Pitt to Fort Edmonton to Rocky Mountain House	Butler 1968

Lt. Col. Robertson-Ross	1872	Military Officer of Gov't of Canada	Fort Edmonton to Rocky Mountain House to Bow R. to Porcupine Hills	Robertson-Ross 1872
L. Clarke	1874-75	HBC Trader	Carlton House	HBCA B.27/e/5,7
Father Constantine Scollen	1879	Roman Catholic Missionary	Fort MacLeod	Scollen 1879
George Dawson	1873-75	Dominion Gov't Geologist/ Surveyor	USA border from Red R. to Rocky Mountains	Dawson 1875
D. McEachran	1881	Adventurer	Fort Benton to Bow River	McEachran 1881
Archibald McDonald	1888	HBC Trader	Touchwood Hills Post	HBCA Search File: Touchwood Hills

Notes:

1. The dates given are those for which written documentation exists.

2. The locations include settlements at which the individuals resided as well as locations passed while intransit.

3. The occupations are those interests which brought the individuals to the study area or those in which they were employed while in this area.

Table 14: Frequency Distribution of Early Historic Accounts of the Northern Plains, 1691-1888, By Decade.

Decade	Numerical Frequency	Percentage Frequency
1690-99	1	1.4%
1700-09	-	-
1710-19	-	-
1720-29	-	
1730-39	1	1.4%
1740-49	1	1.4%
1750-59	1	1.4%
1760-69	-	-
1770-79	2	2.8%
1780-89	1	1.4%
1790-99	9	12.7%
1800-09	9	12.7%
1810-19	6	8.5%
1820-29	2	2.8%
1830-39	4	5.6%
1840-49	8	11.3%
1850-59	10	14.1%
1860-69	7	9.9%
1870-79	7	9.9%
1880-89	2	2.8%
Total	71	99.1%

Notes:

(a) An observer such as La Verendrye who wrote accounts spanning two decades (ie.1738-43) is represented twice on this table, once for each decade.

(b) References listed in Table 13 are the sources of the above information

Table 15: Time Line of Selected Events Pertaining to the Provisioning of the Fur Trade and Which Occurred in the 17th, 18th and 19th Centuries.

Year	Event
1670	**Hudson's Bay Company received Royal Charter permitting fur trade in Ruperts Land**
1691	Henry Kelsey visited Central Saskatchewan to convince Indians to bring their furs to HBC posts on Hudson's Bay
1713	Treaty of Utrecht gave control of Hudson Strait and Hudson's Bay to the HBC
1734	La Verendrye established Fort Maurepas on Winnipeg River
1738	La Verendrye established Fort La Reine
1741	La Verendrye established Fort Bourbon
1741	Fort Dauphin established by La Verendrye's son
1751	Fort Pasquia (The Pas) established by Canadian traders
1753	Fort à la Corne established by The Chevalier de la Corne
1754-55	Anthony Henday traveled to Central Alberta to ascertain the impact of the French on the fur trade
1763	Treaty of Paris ended British-French Conflict
c. 1767	Fort des Trembles established
1767	Portage La Prairie posts of HBC and NWC established
1768	Pine Fort established by Canadian traders
1772-73	Matthew Cocking travelled to Nipawin and Eagle Hills to attract Indians to trade at York Factory
1774	**Cumberland House, the first inland HBC post, established on the Saskatchewan River**
1775	J. B. Cadotte established Fort des Prairies near Fort à la Corne
1775-76	Alexander Henry, the Elder, travelled to Fort des Prairies to explore a new market for the Canadian fur trade
1783	Treaty of Versailles- American Revolutionary War and establishment of boundary between Canada and United States from Lake of the Woods east

1784	**McTavish, Frobisher and Co, agents of the NWC in competition with Gregory, McLeod and Co.**
1785	Fort de l'Isle of the NWC established
1786	Manchester House (HBC) established near Fort de l'Isle (NWC)
1786	South Branch House established by HBC
1786-88	David Thompson travelled to Manchester House and south to Piegan country for HBC
1787	Swan River Post established by NWC
1787	**McTavish, Frobisher and Co. and Gregory, McLeod and Co. plus other individuals unite to form the NWC**
c. 1787	Fort Esperance established by NWC
1790's	Montagne à Bosse established by NWC
1792	Buckingham House established by the HBC
1792	Fort George established by the NWC
1792-93	Peter Fidler travelled from Buckingham House to the Oldman River to attract the Blackfoot trade
1792-98	John MacDonald of Garth employed by NWC at Fort George and Fort Augustus
1793	Assiniboine House established by NWC
1793	Brandon House established by HBC
1793-94	John MacDonell employed by the NWC at Red River, Pine Fort, Fort Esperance, Fort Qu'Appelle
1794	Jay Treaty negotiated giving Montreal traders right to continue to operate in the Great Lakes area
1794	Rivière La Coquille established by the NWC and HBC
1794-95	Duncan McGillivray was clerk responsible for Fort George journals
1795	Fort Alexandria established by the NWC
1795	Fort Augustus (NWC) and Fort Edmonton (HBC) established
1795	Carlton House established by the HBC
1795-96	William Tomison was clerk at Fort Edmonton
1796-98	George Sutherland was clerk at Fort Edmonton

1797-98	David Thompson joined the NWC and travelled from Assiniboine House to the Mandan Villages on the Missouri
1798-99	William Tomison was clerk at Fort Edmonton
1799	White Mud House established by the NWC
1799	Island Post established by the XYC, NWC and HBC
1799	Rocky Mountain House (NWC) and Acton House (HBC) established
1799	Upper Terre Blanche House established by the NWC
1799-1800	James Bird was clerk at Fort Edmonton
1799-1811	Alexander Henry, the Younger, headed or visited NWC posts at Riding Mountain, Pembina Post, Fort Vermilion, White Earth House, Rocky Mountain House and the Mandan Villages
1800	Chesterfield House established by the HBC
c. 1800	Bird Mountain House established by the NWC
1800-01	David Thompson travelled from Fort George to Rocky Mountain House and then to the Row R.
1800-01	Archibald McLeod was NWC trader at Fort Alexandria
1800-02	Peter Fidler established and was clerk at Chesterfield House for the HBC
1800-07	Daniel Harmon was a NWC trader at Swan River Post, Fort Alexandria and South Branch Fort
1802	For Vermilion established by the NWC and HBC
1803	Louisiana Purchase from France doubled the territory of the United States
1804	**XYC and NWC merged**
1804-06	United States Government Exploring Expedition under Meriwether Lewis and William Clark sought to determine the suitability of the Trans-Missouri West for fur trade
1804-05	François-Antoine Larocque, of the NWC and XY Companies travelled from Fort Assiniboine to the Mandan Villages
1804-05	Charles McKenzie of the NWC travelled from Fort Assiniboine to the Mandan Villages
c. 1805	Establishment of NWC post, Rivière la Souris
1808	**Missouri Fur Company formed**

1808	**American Fur Company formed**
1810	Lower Terre Blanche House (NWC and HBC) established
1811	John Bradbury, British botanist, travelled up Missouri to Mandan Villages
1811	H. M. Brackenridge, botanist and zoologist, travelled up Missouri to Mandan Villages
1812	Selkirk Settlers arrived at Forks of Red River and Assiniboine River
1812	Pemmican Proclamation forbade export of any provisions (meat, grain or vegetables) by Red River Settlers
1812-14	Miles Macdonell was leader of the Red River Settlers
1814	Gabriel Franchère was a NWC trader who travelled from Rocky Mountain House to the N. Saskatchewan River
1814	Fort Qu'Appelle established by the HBC
1815	J. P. Pruden was clerk at Carlton House
1818-19	J. P. Pruden was clerk at Carlton House
1820	**French Fur Company (Berthold, Pratte Sr. and Choteau Jr.) established**
1820-21	J. P. Pruden was clerk at Carlton House
1821	**Columbia Fur Company established**
1821	**Union of the NWC and HBC with George Simpson as governor of the Northern Department**
1822	**Rocky Mountain Fur Company established**
1824	Fort Pelly established by the HBC
1825	George Simpson travelled to Rocky Mountain House, Fort Edmonton, Carlton House, Touchwood Hills and the Qu'Appelle River.
1826	George Simpson assumed control over all HBC operations in North America
1826	**American Fur Company absorbed by Columbia Fur Company and called Upper Missouri Outfit**
1826-27	J. P. Pruden was clerk at Carlton House
1829	Fort Pitt established by HBC
1829	Fort Union established by the American Fur Company

1831	Fort Clark established by the American Fur Company
1831	Fort Piegan established by the American Fur Company
1831	Fort Ellice established by the HBC
1831	Lower Fort Garry established by the HBC
1832	Piegan Post established by the HBC
1833	**William Sublette and Robert Campbell formed company to compete with the American Fur Company**
1833	J. E. Harriott was clerk at Piegan Post for the HBC
1833-34	Maximilian, Prince of Wied-Neuwied was a German naturalist who ascended the Missouri and wintered at Fort MacKenzie and Fort Clark
1834	Fort McKenzie established near former Fort Piegan by American Fur Company
1834	Alexander Kennedy was an American Fur Company trader at Fort Clark
1834-39	François Auguste Chardon was chief trader at Fort Clark
1835	Upper Fort Garry established by HBC
1839	Sir George Simpson appointed governor and chief of the HBC
1840-49	Rev. Robert T. Rundle served as missionary to the Indians residing at Fort Edmonton, Rocky Mountain House, near the Bow and Red Deer Rivers
1842	Rev. John McDougall served as missionary to the Indians at Carlton House, Fort Edmonton, Victoria Post, Pigeon Lake, and Rocky Mountain House
1843	John James Audubon was a naturalist who travelled up the Missouri to Fort Union
1843	Edward Harris was a painter who accompanied Audubon to Fort Union
1845-46	Pierre-Jean De Smet was a missionary at Rocky Mountain House, Jasper House and Fort Augustus
1840's to 1870's	Colonel Richard Irving Dodge visited the Great Plains
1846	Fort à la Corne established by the HBC
1846-47	Paul Kane, painter, travelled from Red River up the Assiniboine and Saskatchewan Rivers.. to Fort Pitt, Carlton House, Fort Edmonton and Rocky Mountain House

1847-48	John Palliser's first trip to North America was in the capacity of sportsmen and he travelled up the Missouri to Fort Berthold, Fort MacKenzie and Fort Union
1850	Thaddeus Culbertson travelled up the Missouri to Fort Union, Fort Clark, and Fort Berthold as a naturalist for the Smithsonian
c 1850	Touchwood Hills Post was established by the HBC
1851-52	Rudolph F. Kurz was a painter who wintered at Fort Berthold and Fort Union on the Missouri
1854-55	Henry John Moberly was a HBC trader at Carlton House, Rocky Mountain House, Fort Edmonton and Jasper House
1857-58	Henry Youle Hind led the Canadian Exploring Expedition from Red River to the North Saskatchewan River
1857-60	Capt. John Palliser led the British North America Trading Expedition from Red River to the Rocky Mountains
1857-59	James Hector was a geologist who accompanied the British North America Trading Expedition and explored the Rocky Mountains
1859	The Earl of Southesk was a Scottish adventurer who travelled from Red River to Jasper House, the Rocky Mountains, Fort Edmonton and Carlton House
1858-62	Henry Boller was an employee of Clark, Primeau and Co., competitors of the American Fur Company, who travelled up the Missouri to Fort Atkinson
1861	Lewis Henry Morgan was a New York lawyer and anthropologist who travelled up the Red River to Pembina
1862	Lewis Henry Morgan was a New York lawyer and anthropologist who travelled up the Missouri to Fort Union
1862-63	Walter Butler Cheadle was a doctor/adventurer who visited Fort Ellice, Carlton House, Fort Pitt, Fort Edmonton and Jasper House
1867-74	Isaac Cowie was a HBC trader who traded in the Cypress Hills and at Fort Qu'Appelle
1870	Rupert's Land was transferred to the Canadian Government by the HBC
1870-71	William Francis Butler a military officer of the Government of Canada travelled from Red River to Fort Ellice, Carlton House, Fort Pitt, Fort Edmonton and Rocky Mountain House
1872	Lt. Col Robertson-Ross was a military officer of the Government of Canada who traveled to Fort Edmonton, Rocky Mountain House, the Bow River and Porcupine Hills

1873-75	George Dawson was a Dominion government geologist/surveyor who was responsible for mapping the U.S./Canada border
1874-75	L. Clarke was a clerk of the HBC at Carlton House
1877	Treaty No. 7 Between the Government of Canada and the Sarsi, Stoney, and Blackfoot Confederacy
1879	Father Constantine Scollen was a missionary to the Blackfoot near Fort MacLeod
1881	D. McEachran was an adventurer who travelled overland from Fort Benton to the Bow River
1888	Archibald McDonald was a HBC trader at Touchwood Hills Post

Sources:
(a) Smythe, Terry. **Thematic Study of the Fur Trade in the Canadia West, 1670-1870.** Parks Canada, Historic Sites and Monuments Boards of Canada, 1968-29. Ottawa.

(b) Innes, H. A. The North West Company. in 'Notes and Documents' **The Canadian Historical Review** Vol. VIII No.l, 1927.

(c) References listed in Table 13.

(d) Chittenden, Hiram Martin. **The American Fur Trade of the Far West.** Stanford: Academic Reprints, 1902.

Table 16: Some Estimates of Aboriginal Population in the Northern Plains, 1730-1872.

Region	Year	Pop. Size	Description	Reference
North. Sask. River Region	1770	2,200 to 6,800	Estimated that 460 to 620 lodges for the Parkland/Grassland Cree	Ray 1974:111
	1805	64,361	Alexander Henry, the Younger estimated that there were 4,823 men, 13,632 women and 45,906 children in the vicinity of the Fort des Prairies.	Coues 1965:282
	1815	2,800	J.P. Pruden estimated that 100 tents of Crees and 300 tents of Stone Indians at Carlton House (used formula of 7 persons per tent)	HBCA B.27/e/1
	1841/ 1842	16,780	George Simpson estimated that 500 tents of Crees (3,500), 580 tents of Assiniboines (4,060), 300 tents of Blackfoot (2,100), 350 tents of Piegans (2,500), 250 tents of Bloods (1,750), 50 tents of Sarcees (350), 300 tents of Gros Ventres (2,100), 140 tents of Saulteaux (140), and 40 tents of Half Breeds (280) visited Carlton House, Fort Pitt, Fort Edmonton and Rocky Mountain House.	Dempsey 1990:12
	1863	425	John Palliser estimated the total Thickwood Cree population at 85 lodges (family sizes smaller in woodlands than plains)	Palliser 1863 from Ray 1974:192
South Sask. River Region	1754	2,254	Anthony Henday estimated there were 322 tents of Gros Ventres (used formula of 7 persons per tent)	Burpee 1907 from Wissler 1936:4
	1776	1,050	Alexander Henry, the Elder estimated there were 150 tents of Piegan (used formula of 7 persons per tent)	from Wissler 1936:4

1780	18,000	James Mooney estimated 3,000 Gros Ventres of the Plains (Atsina or Fall Indians) and 15,000 Blackfoot (Siksikas, Kainahs, Piegans).	Parks et al 1980:285-86
1789	595	Alexander Mackenzie estimated there were 50 tents of Bloods and 35 of Sarsi (used formula of 7 persons per tent)	from Wissler 1936:4
1799	1,120	David Thompson estimated there were 70 tents of Gros Ventres and 90 tents of Sarsi (used formula of 7 persons per tent)	from Wissler 1936:4
1805	1,820	Lewis and Clark estimated there were 260 tents of Gros Ventres (used formula of 7 persons per tent)	from Wissler 1936:4
1808	24,360	William McGillivray estimated 60 Sarsee families, 1000 Blackfoot families and 280 Gros Ventre families were involved in the Canadian fur trade on the plains (with 1.4 families=14 individuals), giving 840 Sarcees, 19,600 Blackfoot and 3,920 Gros Ventres.	from Milloy 1988:73
1809	5,740	Alexander Henry, the Younger estimated there were 200 tents of Blackfoot, 100 tents of Blood, 350 tents of Piegan, 80 tents of Gros Ventre and 90 tents of Sarsi (used formula of 7 persons per tent)	from Wissler 1936:4

1822/ 1823	15,400	Francis Heron estimated 400 tents of Bloods, 600 tents of Blackfoot, 600 tents of Muddy River and 600 tents of Fall Indians (used formula of 7 persons per tent), giving 2,800 Bloods, 4,200 Blackfoot, 4,200 Muddy River Indians and 4,200 Fall Indians.	HBCA B.34/e/1
1841/ 1842	8,800	George Simpson estimated 300 tents of Blackfoot (600 warriors, 1,500 women and children =2,100); 350 tents of Piegans (700 warriors, 1,800 women and children-2,500); 250 tents of Blood Indians (500 warriors, 1,250 women and children-1,750); 50 tents of Sarcees (100 warriors, 250 women and children-350); and, 300 tents of Gros Ventres (600 warriors, 1,500 women and children=2,100).	Dempsey 1990:12
1853	7,630	James Doty estimated there were 270 tents or 2,430 Bloods; 290 tents or 2,600 Blackfeet; and, 290 tents or 2,600 Piegan.	from Ewers 1958:212
1854	10,300	Edwin Denig suggested that the Blackfeet had been reduced by 1/3 through disease (2/3 of 15,400)	Denig 1930:625
1858	11,000	Capt. John Palliser estimated there were 8,900 Blackfoot, Blood, Piegan and Sarsi and 2,100 Gros Ventre.	Wissler 1936:6
1859	7,600	John Rowand estimated 250 tents of Blackfeet (1,750), 350 tents of Bloods (2,450), 350 tents of Piegans (2,450) and 360 tents of Gros Ventres (2,520).	Hind 1971b:157
1863	8,900	John Palliser estimated there were 600 Blackfeet, 2,800 Bloods, 4,400 Piegan and 1,100 Sarsi.	Palliser 1863 from Ray 1974:191

	1872	9,200	Indian Branch population estimates placed the Blackfoot at 4,000, the Blood at 2,000, the Piegan at 3,000 and the Sarsi at 200.	from Ray 1974:192
	1872	10,152	Jean L'Hereux's census of the Blackfeet Nation showed 3,068 Blackfoot (768 men, 1,800 women, 1,000 children); 4,134 Piegan (1,036 men, 1,388 women, 1,710 children); 2,508 Bloods (627 men, 1,836 women, 1,045 children), and 408 Sarsee (102 men, 136 women, 170 children).	Robertson-Ross 1872:7-11
Red/ Assiniboine River Region	1730	1,200 to 3,000	Estimate of population of Ojibwa at Fort Alexander and Fort Daughin.	Ray 1974:181
	1776	2,100	Alexander Henry, the Elder estimate the Plains Assiniboine at 300 tents in western Canada (used formula of 7 persons per tent)	Bain 1969:303
	1780	1,400	Alexander Mackenzie estimated the Assiniboine at 200 tents (used formula of 7 persons per tent)	from Wissler 1936:7
	1780	10,000	James Mooney's estimate of the total Assiniboine population.	Parks et al 1980:290
	1799	2,800	David Thompson estimated the Assiniboine at 400 tents (used formula of 7 persons per tent)	Wissler 1936:7
	1805	5,470	Alexander Henry, the Younger estimated that there were 1,170 Indian men, 1,200 Indian women and 2,500 Indian children in the Upper Red River Department and 160 Indian men, 190 Indian women and 250 Indian children in the Lower Red River Department.	Coues 1965:282

1809	9,844	William McGillivray estimated 24 Ojibwa familes, 350 Cree families and 322 Assiniboine families were involved in the Canadian fur trade on the plains (1.4 families=14 individuals) yielding 336 Ojibwa, 4,900 Cree and 4,508 Assiniboine.	from Milloy 1988:72-73
1809	6,000	Alexander Henry, the Younger estimated there were 847 Assiniboine tents (use formula of 7 persons per tent)	Coues 1965: 522-23
1815	5,900	J. P. Pruden estimated that 590 families of Indians in Brandon House area (use formula of 1.4 families= 14 individuals)	HBCA B.22/e/2
1815	200	Ojibwa (Chippewa) occupied Red River District	from Pybus 1984:35
1820	1,400 to 2,100	Estimated that 200 to 300 tents of Plains Cree	Ray 1974:187
1822/ 1823	778	Estimate of total Ojibwa population at Fort Alexander (136 tents), Brandon House (10 tents)	Ray 1974:181
1833	7,440	Maximilian estimated the Crees at 600 to 800 tents or 7,440.	Thwaites 1906:14; Milloy 1988:72
1838	8,400	Edwin Denig estimated the Plains Assiniboine population at 1,200 tents (used formula of 7 persons per tents)	Denig 1930:63
1842	2,660	Henry Youle Hind estimated the Assiniboine population at 380 tents (used formula of 7 persons per tent)	from Wissler 1936:7

	1854	~7,500	Edwin Denig divided the Crees into 8 bands, 100 tents of Eyes Open; 40 to 50 tents of Striped; 30 to 40 tents of Magpies; 30 to 40 families of Small Gulls; 130 to 140 tents of The Painted Lodge, He Who Shots the Bear With Arrows, The Little Eagle and The Standing Bear; 300 tents of Plusier des Aigles; 350 tents of La Lance ; and, several smaller groups. Denig suggested that these numbers were 7/8 of what they had been before diseases impacted the populations.	Denig 1930:109-111, 625
	1860	12,500	David Mandelbaum's estimate of Plains Cree population.	Mandelbaum 1979:52
	1863	11,500	John Palliser estimated there were 11,500 Plains Cree north of the border.	Palliser 1863 from Ray 1974:191
Missouri River Region	1780	28,100	James Mooney estimated there were 3,000 Arikara (Rees), 4,000 Crows, 2,500 Hidatsa (Minetarees), 3,600 Mandans, and 25,000 Sioux of all divisions.	Parks et al 1980:290-91
	1854	2,540	Edwin Denig recognized 6 bands of Assiniboines. Their numbers were 100 tents of Gens du Gauche, 60; 60 of Gens du Nord; 220 of Gens des Canot; 60 of Gens des Filles; 50 of Gens des Roches; 30 of Le Bas Rouge, for a total of 520 tents. He used a formula of 4.5 persons per tents.	Denig 1930:431
	1854	~24,000	By 1854 Edwin Denig suggested that the Arikara were reduced by 1/5, the Crows by 1/2, the Mandan by 3/4, the Sioux by 1/3 and by inference, the Hidatsa by ~1/3, resulting in 2,400 Arikara, 2,000 Crow, ~1,800 Hidatsa, 900 Mandan and ~17,000 Sioux.	Denig 1930:625

1863	4,000	John Palliser estimated that 4,000 Assiniboine lived south of the border.	Palliser 1863 from Ray 1974:191

Notes:

(a) Regional identification of a number of ethnic groups does not reflect rigid boundaries since they generally, but by no means exclusively, used the regions in which they have been placed.

(b) Wissler (1936:10) has estimated the combined population of Blackfoot, Blood, Piegan, Gros Ventre, Sarsi, Assiniboine and Western Cree at 28,700 in 1780; 16,360 in 1809; 25,620 in 1858; 24,291 in 1882; and 15,434 in 1899.

Table 17: Population of Selected Northern Plains Settlements, 1793-1882.

Location	Year	Pop. Size	Population Details	Reference
North Saskatchewan River Settlements				
Carlton House	1811/ 1812	30*	10 men, 8 women*, 12 children*	HBCA B.27/d/2
	1812/ 1813	53*	18 men, 14 women*, 21 children*	HBCA B.27/d/4
	1813/ 1814	74*	25 men, 19 women*, 30 children*	HBCA B.27/d/5
	1814/ 1815	46*	16 men, 12 women*, 18 children*	HBCA B.27/d/6
	1820/ 1821	35*	11 men, 9 women*, 15 children*	HBCA B.27/d/7
	1821/ 1822	122*	42 men, 32 women*, 48 children*	HBCA B.27/d/8
	1823/ 1824	128*	44 men, 33 women*, 51 children*	HBCA B.27/d/11
	1824	184*	64 men, 48 women*, 72 children*	HBCA B.27/z/1
	1836/ 1837	114*	39 men, 30 women*, 45 children*	HBCA B.27/d/12
	1862/ 1863	69	24 men, 18 women, 27 children, total 69 persons	Wright 1981 19
	1870	60	32 died of smallpox, leaving 28 persons	Butler 1968:228
Fort Edmonton	1809	279*	40 men(NWC) and 60 men(HBC), 75 women*, 104 children*	Coues 1965:569
	1810/ 1811	191*	66 men, 50 women*, 75 children*	HBCA B.60/d/2a
	1811/ 1812	138*	48 men, 36 women*, 54 children*	HBCA B.60/d/3
	1812/ 1813	143*	49 men, 37 women*, 57 children*	HBCA B.60/d/4

1813/ 1814	136*	47 men, 35 women*, 54 children*	HBCA B.60/d/5
1814/ 1815	84*	29 men, 22 women*, 33 children*	HBCA B.60/d/6
1815/ 1816	99*	34 men, 26 women*, 39 children*	HBCA B.60/d/8
1821/ 1822	174*	60 men, 45 women*, 69 children*	HBCA B.60/d/9
1822/ 1823	250*	86 men, 65 women*, 99 children*	HBCA B.60/d/12
1825	166*	57 men, 43 women*, 66 children*	HBCA B.60/d/19
1826	145*	50 men, 38 women*, 57 children*	HBCA B.60/d/20
1826/ 1827	199*	69 men, 52 women, 78 children*	HBCA B.60/d/21
1827/ 1828	206*	71 men, 54 women*, 81 children*	HBCA B.60/d/24
1828/ 1829	189*	65 men, 49 women*, 75 children*	HBCA B.60/d/27
1829/ 1830	204*	70 men, 53 women*, 81 children*	HBCA B 60/d/32
1830/ 1831	197*	73 men, 55 women*, 69 children*	HBCA B.60/d/36
1831/ 1832	199*	74 men, 56 women*, 69 children*	HBCA B.60/d/39
1840/ 1841	245*	85 men, 64 women*, 96 children*	HBCA B.60/d/65
1841/ 1842	258*	89 men, 67 women*, 102 children*	HBCA B.60/d/68
1842/ 1843	243*	84 men, 63 women*, 96 children*	HBCA B.60/d/71
1844/ 1845	242*	83 men, 63 women*, 96 children*	HBCA B.60/d/78a
1845/ 1846	237*	82 men, 62 women*, 93 children*	HBCA B.60/d/81a

1846/ 1847	253*	88 men, 66 women*, 99 children*	HBCA B.60/d/83
1847/ 1848	273*	94 men, 71 women*, 108 children*	HBCA B.60/d/86
1849/ 1850	296*	102 men, 77 women*, 117 children*	HBCA B.60/d/91
1850/ 1851	268*	93 men, 70 women*, 105 children*	HBCA B.60/d/93
1851/ 1852	276*	96 men, 72 women*, 108 children*	HBCA B.60/d/99
1852/ 1853	282*	94 men, 71 women*, 108 children*	HBCA B.60/d/103
1853/ 1854	296*	102 men, 77 women*, 117 children*	HBCA B.60/d/107
1856/ 1857	383*	133 men, 100 women*, 150 children*	HBCA B.60/d/119
1857/ 1858	381*	132 men, 99 women*, 150 children*	HBCA B.60/d/123b
1858/ 1859	423*	147 men, 111 women*, 165 children*	HBCA B.60/d/128b
1859/ 1860	379*	131 men, 99 women*, 149 children*	HBCA B.60.d.132
1860/ 1861	372*	129 men, 97 women*, 146 children*	HBCA B.60/d/136
1861/ 1862	383*	133 men, 100 women*, 150 children*	HBCA B.60/d/140
1862/ 1863	357*	124 men, 93 women*, 140 children*	HBCA B.60/d/144
1864	356*	123 men, 93 women*, 140 children*	HBCA B.60/d/154
1865	380*	132 men, 99 women*, 149 children*	HBCA B.60/d/160
1866	383*	133 men, 100 women*, 150 children*	HBCA B.60/d/163
1867	367*	127 men, 96 women*, 144 children*	HBCA B.60/d/169

	1868	283*	98 men, 74 women*, 111 children*	HBCA B.60/d/173
	1869	288*	100 men, 75 women*, 113 children*	HBCA B.60.d/174
	1871/ 1873	529*	184 men, 138 women*, 207 children*	HBCA B.60/d/177
	1876	73*	25 men, 19 women*, 29 children*	HBCA B.60/f/1
	1879/ 1880	30*	10 men, 8 women*, 12 children*	HBCA B.60/f/1
	1880/ 1881	45*	15 men, 12 women*, 18 children*	HBCA B.60/f/1
	1882	38*	13 men, 10 women*, 15 children*	HBCA B.60/f/1
Jasper House	1855/ 1856	9	Cook and wife, horsekeeper, 6 Iroquois	Moberly 1929:8
Fort des Prairies	1805	298	136 men, 59 women 103 children	Coues 1965:282
New White Earth House	1810	220	NWC- 28 men, 35 women, 72 children and HBC- 85 people	Coues 1965:603
Rocky Mtn. House	1799 to ~1850, except 1833/ 1834	36*	~12 men, 9 women*, 15 children*	Smyth 1978:2
	1833/ 1834	69	40 men, 8 women, 9 boys, 8 girls, 4 widows or orphans	HBCA B.21/d/2
	1850's and 1860's	53*	~18 men, 14 women*, 21 children*	Smyth 1978:2
Fort Vermilion	1809	130	36 men, 27 women, 67 children	Coues 1965:555

<u>South Saskatchewan River Settlements</u>

Chester-field House	1800/ 1801	58*	19 men, 15 women*, 24 children*	Johnson 1967:253

	1801/ 1802	58*	19 men, 15 women*, 24 children*	Johnson 1967:295
	1822/ 1823	143	108 men, 14 women, 21 children	HBCA B.34/d/1
Piegan Post	1832/ 1833	82*	28 men, 21 women*, 33 children*	HBCA B.21/d/1
	1833/ 1834	69	40 men, 8 women, 9 boys, 8 girls, 4 orphans or widows	HBCA B.21/d/2

Missouri River Settlements

Fort Clark	1836	30	"30 mouths to feed"	Abel 1932:122
Fort MacKenzie	1833	80+	"27 white men, several Indian women. . . to whom our arrival made an addition of fifty-three persons"	Thwaites 1905b:92
Fort Union	1833	50	"50 people"	Thwaites 1905a:377

Red/Assiniboine River Settlements

Fort Alexand-ria	1805	70	"70 souls"	Coues 1965:602
Brandon House	1793	58*	19 men, 15 women*, 24 children*	HBCA B.63/z/fo.13
	1794	15*	5 men in summer, 4 women*, 6 children*	HBCA Search Files-Brandon House
	1808	69	69 people	HBCA B.22/a/15
	1812/ 1813	76*	26 men, 20 women*, 30 children*	HBCA B.22/d/3
	1813/ 1814	128*	44 men, 33 women*, 51 children*	HBCA B.22/d/4
	1814/ 1815	89*	30 men, 23 women*, 36 children*	HBCA B.22/d/5
	1820/ 1821	191*	28 men plus 38 Canadians, 50 women8, 75 children*	HBCA B.22/d/6
	1821/ 1822	82*	28 men, 21 women*, 33 children*	HBCA B.22/d/7

	1823	171*	33 European, 27 Canadians, 45 women*, 66 children*	HBCA B.22/d/9
	1823/ 1824	170*	37 European, 5 Canadians, 32 women*, 96 children*	HBCA B.22/d/13
	1828/ 1829	43*	14 men, 11 women*, 18 children*	HBCA B.22/d/17
	1829/ 1830	43*	14 men, 11 women*, 18 children*	HBCA B.22/d/19
Lower Red River	1805	175	75 men, 40 women, 60 children	Coues 1965:282
Pembina R. Post	1807/ 1808	41	17 men, 10 women, 14 children	Coues 1965:441
Fort Qu' Appelle	1867	51+ *	15 men, 5 monthly employees, natives hired as temporary assistants, 11 wives, 20 children	Cowie 1913:214
Red River Settle-ment	1822	1,281	234 men, 161 women, 886 children	Morton 1938:22
	1857	6,523	6,523 people	Podruckny 1990:15
Upper Red River	1805	190	56 men, 52 women, 82 children	Coues 1965:282

Notes:

(a) Estimates of the number of employees at fur trading posts in a particular year have largely been taken from the account books kept by clerks at the various posts. Seldom are the employee's dependants mentioned. In order to provide an estimate of the total population at a given post, a formula proposed by Wright (1981) has been used. This formula suggests that 75% of the men employed fulltime at a post had wives and 50% of the women had 3 children. These population estimates are indicated by an asterisk (*) in the above table.

(b) The population estimates apply only to the HBC establishments unless otherwise mentioned.

Table 18: The Functions of Fur Trade Settlements in the Northern Plains.

Saskatchewan River Region

Post	Years	Function(s)
Chesterfield House	1800-02, 1822	Provision Post
Piegan Post	1832-34	Wintering Post
Acton House(Rocky Mtn. House I	1799-1834	Wintering Post
Rocky Mtn. House II	1835-61	Wintering Post
Rocky Mtn. House III	1865-75	Trading Post (hides and meat)
Upper Terre Blanche House	1799-1801, 1810-11	Wintering Post
Fort Edmonton I	1795-1801	Provision and Fur Trading Post
Fort Edmonton II	1801-1810	Provision and Trading Post
Fort Edmonton III	1812-1915	Provision and Trading Post
Lower Terre Blanche House	1810-1813	Provision and Fur Trading Post
Fort de L'Isle III (Island House)	1799-1801	Fur Trading and Provision Post
Buckingham House	1792-1802	Provision and Fur Trading Post
Fort Vermilion	c. 1802-1810, 1811- 1816	Pemmican Post and Fur Trading Post
Fort Pitt	1829-1885	Provision and Fur Trading Post
Manchester House	1786-1794	Fur Trade and Provision Post
Jackfish Lake House	1858	Wintering Post
Carlton House	1795-1885	Provision Post, Fur Trade and Depot
South Branch I	1786-1794	Pemmican Post
Fort à la Corne I	1753	Fur Trading Post

Fort à la Corne II	1846-1887	Provision Post

Red and Assiniboine River Region

Portage La Prairie	1767-1820	Pemmican, Portage and Trading Post
Brandon House I	1793-c. 1816 or 1818	Pemmican Post
Brandon House II	1818-21(?)	Pemmican Post
Brandon House III	1828-32	Wintering Post
Fort Ellice I	1831-1862	Pemmican Post
Fort Ellice II	1862-?	Provision Post
Fort Qu'Appelle I	1814-1816	Pemmican Post
Fort Qu'Appelle II	1857-1864 (?)	Trading Post
Fort Qu'Appelle III	1864- c. 1872	Provision Post
Touchwood Hills Post	c. 1850-1909	Provision Post

Missouri River Region

Fort Union	est. 1829	Depot for trade with Indians, collection of robes and furs, decision making
Fort Clark	est. 1831	Regional post to serve Indians and collect robes, animal byproducts and furs
Piegan Post, later called Fort Mackenzie	est. 1832	Regional post to serve Indians and collect robes, animal products and furs

Notes:

(a) Information in Table 18 was taken from Smythe (1968), Wishart (1979) and the Post Histories of Hudson's Bay Company establishments on file at the HBCA.

Table 19: Ethnohistorical Documentation of Fur Trade Rations in the Northern Plains.

Post	Year	Daily Rations	Observer/ Reference
Fort Edmonton	1833	Food Shortage led to food restrictions of 5 lbs. meat per man, 2 1/2 lbs. meat per woman, 1 1/4 lbs. meat per child plus small quantity of barley and as many potatoes as they think sufficient to make up for the scarcity of animal food.	HBCA B.60/a/27
Rocky Mountain House	1854-55	8 lbs. fresh meat, or 2 1/2 lbs. pemmican or 3 lbs. dried meat per man; 1 whitefish for each woman and 1/2 for each child(if available). Otherwise a woman received 1/2 a man's allowance and a child 1/4.	Henry Moberly 1929:83
Fort Qu'Appelle	late 1860's	Man's allowance- 12 lbs. fresh buffalo meat, or 3 lbs. pemmican or 6 lbs. dried buffalo meat or 6 rabbits or 6 prairie chickens or 3 large whitefish or 2 large (or 6 small) ducks. Women received 1/2 and children 1/4 the men's allowance. In addition, potatoes, some milk for children, dried berries tallow or fat and rough barley.	Isaac Cowie 1913:215-16
Fort Pitt	1870	10 lbs. of beef(domestic cattle) for men; 5 lbs. for women; 3 lbs. for children, no matter how small.	William Butler 1968:310-11

Table 20: Provision Requirements at Selected Northern Plains Trading Establishments, Based on Estimated Post Populations and Moberly's Ration Formula.

Post/Year.	Population Structure	Pounds Per Day	Pounds Per Yr.	No. of Animals Per Yr.	Reference
NORTH SASKATCHEWAN RIVER SETTLEMENTS					
Carlton House					
1811/1812	10 men, 8 women*, 12 children*	136	49, 640	175	HBCA B.27/d/2
1812/1813	18 men, 14 women*, 21 children*	194	70,810	249	HBCA B.27/d/4
1813/1814	25 men, 19 women*, 30 children*	336	122,640	431	HBCA B.27/d/5
1814/1815	16 men, 12 women*, 18 children*	212	77,380	272	HBCA B.27/d/6
1820/1821	11 men, 9 women*, 15 children*	154	56,210	198	HBCA B.27/d/7
1821/1822	42 men, 32 women*, 48 children*	560	204,400	718	HBCA B.27/d/8
1823/1824	44 men, 33 women*, 51 children*	586	213,890	751	HBCA B.27/d/11
1824	64men, 48 women*, 72 children*	848	309,520	1087	HBCA B.27/z/1
1836/1837	39 men, 30 women*, 45 children*	522	190,530	669	HBCA B.27/d/12
1862/1963	24 men, 18 women, 27 children	316	116,070	408	Wright 1981:19
Fort Edmonton					

1809	100 men, 75 women*, 104 children*	1308	477,420	1676	Coues 1965:569
1810/1811	66 men, 50 women*, 75 children*	878	320,470	1125	HBCA B.60/d/2a
1811/1812	48 men, 36 women*, 54 children*	636	232,140	815	HBCA B.60/d/3
1812/1813	49 men, 37 women*, 57 children*	654	238,710	838	HBCA B.60/d/4
1813/1814	47 men, 35 women*, 54 children*	624	227,760	800	HBCA B.60/d/5
1814/1815	29 men, 22 women*, 33 children*	386	140,890	495	HBCA B.60/d/6
1815/1816	34 men, 26 women*, 39 children*	454	165, 710	582	HBCA B.60/d/8
1821/1822	60 men, 45 women*, 69 children*	798	291,290	1022	HBCA B.60/d/9
1822/1823	86 men, 65 women*, 99 children*	802	292,730	1028	HBCA B.60/d/12
1825	57 men, 43 women*, 66 children*	760	277,400	974	HBCA B.60/d/19
1826	50 men, 38 women*, 57 children*	666	243,090	853	HBCA B.60/d/20
1826/1827	69 men, 52 women*, 78 children*	916	334,340	1174	HBCA B.60/d/21
1827/1828	71 men, 54 women*, 81 children*	946	345,290	1212	HBCA B.60/d/24

1828/1829	65 men, 49 women*, 75 children*	866	316,090	1110	HBCA B.60/d/27
1829/1830	70 men, 53 women*, 81 children*	934	340,910	1197	HBCA B.60/d/32
1830/1831	73 men, 55 women*, 69 children*	942	343,830	1207	HBCA B.60/d/36
1831/1832	74 men, 56 women*, 69 children*	954	348,210	1222	HBCA B. 60/d/39
1840/1841	85 men, 64 women*, 96 children*	1128	411,720	1445	HBCA B.60/d/65
1841/1842	89 men, 67 women*, 102 children*	1184	432,160	1517	HBCA B.60/d/68
1842/1843	84 men, 63 women*, 96 children*	1116	407,340	1430	HBCA B.60/d/71
1844/1845	83 men, 63 women*, 96 children*	1108	404,420	1420	HBCA B.60/d/78a
1845/1846	82 men, 62 women*, 93 children*	1090	397,850	1396	HBCA B.60/d/81a
1846/1847	88 men, 66 women*, 99 children*	1166	425,590	1494	HBCA B.60/d/83
1847/1848	94 men, 71 women*, 108 children*	1252	456,980	1604	HBCA B.60/d/86
1849/1850	102 men, 77 women*; 117 children*	1358	495,670	1740	HBCA B.60/d/91
1850/1851	93 men, 70 women*, 105 chidlren*	1234	450,410	1581	HBCA B.60/d/93

1851/1852	96 men, 72 women*, 108 children*	1272	464,280	1630	HBCA B.60/d/99
1852/1853	94 men, 71 women*, 108 children*	1252	456,980	1604	HBCA B.60/d/103
1853/1854	102 men, 77 women*, 117 children*	1358	495,670	1740	HBCA B.60/d/107
1856/1857	133 men, 100 women*, 150 children*	1764	643,860	2260	HBCA B.60/d/119
1857/1858	132 men, 99 women*, 150 children*	1752	639,480	2244	HBCA B.60/d/123b
1858/1859	147 men, 111 women*, 165 children*	1950	711,750	2498	HBCA B.60/d/128b
1859/1860	131 men, 99 women, 149 children*	1742	635,830	2231	HBCA B.60/d/132
1860/1861	129 men, 97 women*, 146 chidlren*	1712	624,880	2193	HBCA B.60/d/136
1861/1862	133 men, 100 women*, 150 children*	1764	643,860	2260	HBCA B.60/d/140
1862/1863	124 men, 93 women*, 140 children*	1644	600,060	2106	HBCA B.60/d/144
1864	123 men, 93 women*, 140 children*	1636	597,140	2096	HBCA B.60/d/154
1865	132 men, 99 women* 149 children*	1750	638,750	2242	HBCA B.60/d/160
1866	133 men, 100 women*, 150 children*	1764	643,860	2260	HBCA B.60/d/163

1867	127 women, 96 children*, 144 children*	1688	616,120	2162	HBCA B.60/d/169
1868	98 men, 74 women*, 111 children*	1302	475,230	1668	HBCA B.60/d/173
1869	100 men, 75 women*, 113 children*	1326	483,990	1699	HBCA B.60/d/174
1871/1872	184 men, 138 women*, 207 children*	2438	889,870	3123	HBCA B.60/d/177
1876	25 men, 19 women*, 29 children*	334	121,910	428	HBCA B.60/f/1
1879/1880	10 men, 8 women*, 12 children*	96	35,040	123	HBCA B.60/f/1
1880/1881	15 men, 12 women*, 18 children*	204	74,460	262	HBCA B.60/f/1
1882	13 men, 10 women*, 15 children*	174	63,510	223	HBCA B.60/f/1
<u>**Jasper House**</u>					
1855/1856	7 men, 1 woman	68	24,820	88	Moberly 1929:8
<u>**Fort des Prairies**</u>					
1805	136 men, 59 women, 103 children	1530	558,450	1960	Coues 1965:282
<u>**New White Earth House**</u>					
1810	28 men, 35 women, 72 children (NWC)	508	185,420	651	Coues 1965:603
<u>**Rocky Mountain House**</u>					
1799 to ~1850, except 1833/1834	~12 men, 9 women*, 15 children*	162	59,130	208	Smyth 1978:2

1833/1834	~40 men, 8 women, 9 boys and girsl, 4 widows	402	146,730	515	HBCA B.21/d/2
1850's and 1860's	~18 men, 14 women*, 21 children*	212	77,380	272	Smyth 1978:2
Fort Vermilion					
1809	36 men, 27 women, 67 children	530	193,450	679	Coues 1965:555
SOUTH SASKATCHEWAN RIVER SETTLEMENTS					
Chesterfield House					
1800/1801	19 men, 15 women*, 24 children*	260	94,900	333	Johnson 1967:253
1801/1802	19 men, 15 women*, 24 children*	260	94,900	333	Johnson 1967:295
1822/1823	108 men, 14 women, 21 children	962	351,130	1233	HBCA B.34/d/1
Piegan Post					
1832/1833	28 men, 21 women*, 33 children*	374	136,510	479	HBCA B.21/d/1
1833/1834	40 men, 8 women, 9 boys, 8 girls, 4 orphans or widows	402	146,730	515	HBCA B.21/d/2
RED/ASSINIBOINE RIVER SETTLEMENTS					
Brandon House					
1793	19 men, 15 women*, 24 children *	260	94,900	333	HBCA B.63/z/f.13
1794	5 men in summer, 4 women*, 6 children*	70	25,550	90	HBCA Search Files- Brandon House

1812/1813	26 men, 20 women*, 30 children*	348	127,020	446	HBCA B.22/d/3
1813/1814	44 men, 33 women*, 51 children*	586	213,890	751	HBCA B.22/d/4
1814/1815	30 men, 23 women*, 36 children*	404	147,460	518	HBCA B.22/d/5
1820/1821	66 men, 50 women*, 75 children*	878	320,470	1125	HBCA B.22/d/6
1821/1822	28 men, 21 women*, 33 children*	678	247,470	869	HBCA B.22/d/7
1823	33 Europeans, 27 Canadians, 45 women*, 66 children*	792	289,080	1015	HBCA B.22/a/9
1823/1824	37 Europeans, 5 Canadians, 32 women*, 96 children*	656	239,440	841	HBCAS B.22/d/13
1828/1829	14 men, 11 women*, 18 children*	192	70,080	246	HBCA B.22/d/17
1829/1830	14 men, 11 women*, 18 children*	192	70,080	246	HBCA B.22/d/19
Lower Red River					
1807/1808	75 men, 40 women, 60 children	880	321,200	1128	Coues 1965:282
Pembina River Post					
1807/1808	17 men, 10 women, 14 children	204	74,460	262	Coues 1965:441
Fort Qu'Appelle					
1867	15 men, 11 wives, 20 children	204	74,460	262	Cowie 1913:214
Upper Red River					

1805	56 men, 52 women, 82 children	820	299,300	1051	Coues 1965:282

Notes:

(a) The **population structure** consists of the relative number of men, women and children at a post. Estimates of the number of employees at fur trading posts in a particular year have largely been taken from the account books kept by clerks at the various posts. Seldom are the employee's dependants mentioned. In order to provide an estimate of the number of women and children at a post, a formula proposed by Wright (1981) has been used. This formula suggests that 75% of the men employed fulltime at a post had wives and 50% of these women had 3 children. Estimated numbers are indicated by an asterisk (*). Where there is no asterisk, the number of men, women and children was provided in the ethnohistorical source.

(b) The author has used a ration formula given by Moberly (1929:83) which sgives the daily poundage of fresh meat dispersed to each man, woman and child at a post. The sums are 8 pounds per man; 4 pounds per woman; 2 pounds per child, regardless of age. These rations coupled with details of population structure are used to determine the number of pounds of fresh meat required at a post per day. For example,

Carlton House 1811/1812

Population Structure= 10 men, 8 women*, 12 children*
Pounds per day = (10 X 8) + (8 X 4) + (12 X 2) = 136 pounds
Pounds per year = 136 X 365= 49,640 pounds

(c) Wright (1981), using figures from the number of animals killed and meat hauled at Fort Carlton in December 1814, has estimated that for each animal killed, an average of 285 pounds of meat is available for consumption. In order to calculate the number of animals needed to yield the annual poundage required, divide annual poundage by 285. For example,

Carlton House 1811/1812

$\frac{49,640}{285}$ = 174.175 animals (round up to the nearest whole number which is 175)

(d) The above calculations are based on year-round post occupancy though some posts, such as Chesterfield House, were abandoned during the summer.
Rations did, however, have to be provided during this time.

Table 21: **Consumption Patterns at Several Northern Plains Trading Establishments.**

Post	Year	Description	Reference
Pembina River Post	Sept. 1, 1807 to June 1, 1808	Alexander Henry, the Younger reported that 17 men, 10 women and 45 dogs consumed the following: -147 buffalo (63,000 pounds) -3 red deer(905 pounds) -5 large black bears(460 pounds) -4 beaver -3 swans -1 white crane -12 outards 36 ducks -1,150 fish of various kinds -775 sturgeon(50 to 150 pounds each)* -410 pounds of grease -140 pounds of meat -325 bushels of potatoes -assortment of kitchen vegetables	Coues 1965:444
Chesterfield House	Sept. 1822 to April 1823	Francis Heron, clerk with the Bow River Trading Expedition, estimated that the143 members consumed the following: -650 buffalo -1200 pounds of tallow - 80 pounds of dried buffalo meat, -12 bags of flour -1 keg of sugar -1 keg of wine - 30 pounds of tea	HBCA B.34/e/1

Notes:

(a) * a great part of these were given to the Indians.

Table 22: Documentation of Waste by Indians and Europeans in the Northern Plains, 1754-1867.

Date	Observer	Location	Circumstances	Reference
Oct. 1754	Anthony Henday	Muscuty Plains to Red Deer R.	Indians killed many buffalo took only tongues and left remains to wolves.	Burpee 307:336
Jan. 1793	Peter Fidler	S. Central Alberta	Over 250 buffalo lying 5 or 6 deep in a pound and an intolerable stench from putrified carcasses.	Haig 1991:58-59
March 1793	Peter Fidler	Minburn area of Central Alberta	The pound was full of dead buffalo.	Haig 1991:90
Sept 1794	Duncan McGillivray	Carlton House	His party killed buffalo and ate the "delicious parts".	Morton 1929:23
Dec. 1797	David Thompson	Souris R.	Killed a number of good young animals but too far away to go for meat. In winter many were killed but were poor so fed to dogs.	Wood and Thiessen 1985:106
Aug. 1800	Alexander Henry, the Younger	Scratching R.	Killed many bulls, but lots of meat in camp so only took tongues.	Coues 1965:64
Sept. 1800	Alexander Henry, the Younger	Park River Post	Killed many buffalo but only took tongues.	Coues 1965:99
Oct. 1800	Peter Fidler	Chesterfield House	Killed buffalo but too far off to bring back.	Johnson 1967:271
Oct. 1800	Alexander Henry, the Younger	Park River Post	Killed many buffalo but only took tongues.	Coues 1965:119
Jan. 1801	Alexander Henry, the Younger	Park River Post	Took fat and tongues as too cold to butcher meat.	Coues 1965:163
June 1801	David Thompson	Near Rocky Mtn. House	Killed 2 bulls and took as much of the meat as wanted and left the rest.	Thompson 1801

Feb. 1802	Alexander Henry, the Younger	Pembina River Post	Killed old bulls for diversion.	Coues 1965:193
Winter 1804	Charles McKenzie	Mandan Villages	Killed whole herds of buffalo but came back only with tongues.	Wood and Thiessen 1985:234
Dec. 1804	Lewis and Clark	Mandan Villages	Left meat out over night and wolves got it.	Thwaites 1959a:235
April 1805	Lewis and Clark	Mandan Villages to the Yellowstone	Killed fattest buffalo but so poor left it and took tongue and marrow bones (occurred many times during trip)	Thwaites 1959b:4
May 1805	Lewis and Clark	Missouri R. Between Yellowstone and Musselshell Rivers.	Saw a vast bunch of at least 100 mangled buffalo carcasses driven over a 120' bluff by the Indians.	Thwaites 1959b:93
June 1805	Lewis and Clark	Missouri R. Between Yellowstone and Musselshell Rivers	Shot many animals each day and took small amount of meat and if elk, took the skins for boats. Killed 7 deer for skins.	Thwaites 1959b:121
July 1805	Lewis and Clark	Missouri R. near Marias R.	Killed elk for skins and bighorns for skins and skeletons.	Thwaites 1959b:229
Aug. 1805	Lewis and Clark	Missouri R. near Milk R.	Killed many deer, elk, buffalo and took just what they wanted	Thwaites 1959b:231
Fall 1805	Charles McKenzie	Mandan Villages	Indians would kill whole droves in fields but only best meat taken home.	Wood and Thiessen 1985:265
June 1806	Charles McKenzie	Cheyenne Territory	Saw greater slaughter of buffalo than on the Missouri. Killed 250 fat cows near camp and only used tongues.	Wood the Thiessen 1985:281
July 1806	Alexander Henry, the Younger	Souris River	Killed fat buffalo and took choice parts.	Coues 1965:311

Dec. 1809	Alexander Henry, the Younger	Fort Vermilion	Saw mangled carcasses in a Blackfoot pound. The bulls were mostly entire but good cows had been cut up.	Coues 1965:577
May 1810	Alexander Henry, the Younger	Fort Vermilion	Abandoned fort leaving 400 limbs of buffalo still frozen.	Coues 1965:596
June 1811	John Bradbury	Missouri R. near Cannonball R.	Killed a buffalo and took what wanted, often only the marrow bones.	Bradbury 1966:130, 132
June 1833	Maximilian, Prince of Wied-Neuwied	Fort Union	Says agents of American Fur Company recklessly shoot buffalo then use only tongues.	Thwaites 1905a:382
July 1833	Maximilian, Prince of Wied-Neuwied	Fort Union to Musselshell R.	Killed a bear and only took claws, same with elk, buffalo and birds.	Thwaites 1905b:31, 34
Aug.1833	Maximilian, Prince of Wied-Neuwied	Missouri R. near Judith R.	Killed many animals and left meat or saved skeleton.	Thwaites 1905b:81
Aug. 1834	François Auguste Chardon	Fort Clark	Indians ran buffalo but ran into enemy so threw the meat away.	Abel 1932:5
Oct. 1838	François Auguste Chardon	Fort Pierre to Fort Clark	Killed buffalo, antelope and deer and,"fared sumptously on choice parts".	Abel 1932:171
Jan. 1839	François Auguste Chardon	Fort Clark	Bring home only tongues from lean animals	Abel 1932:183
Jan 1841	Rev. Robert T. Rundle	Beaver Lake	Pond was strewn with half-devoured carcasses of the animals, the spoils of previous captives and a fine feast for wolves.	Dempsey 1977:149
1842-1862	Rev. John McDougall	N. Sask. area	Killed 800 to 1000 animals in 1 kill.	McDougall 1895:208
June 1843	John James Audubon	Fort Clark to Fort Union	Killed buffalo and left it.	Audubon 1960b:26
July 1843	John James Audubon	Fort Union	Killed a bull but poor so left it.	Audubon 1960b:95

Aug. 1843	John James Audubon	Fort Union	Audubon complained to fort people about waste of animals killed.	Audubon 1960b:133
May 1845	Rev. Robert T. Rundle	Carlton House	Bull killed by guide and only took piece of inside.	Dempsey 1977:177
Oct. 1847	John Palliser	Fort Union	Killed 5 buffalo but only took the tongues.	Palliser 1969:118
June 1850	T. Culbertson	Fort Union	Killed whole herd of elk in river but most were swept away.	McDermott 1952:111
July 1851	Rudolph F. Kurz	On Missouri R. above Fort Pierre	Killed several buffalo but only retrieved one.	Hewitt 1970:22
Sept. 1851	Rudolph F. Kurz	Fort Berthold to Fort Union	Found a buffalo cow with only a bit removed.	Hewitt 1970:112
Sept. 1851	Rudolph F. Kurz	Fort Union	Killed buffalo and took tongue and choice bits.	Hewitt 1970:138
July 1857	Henry Youle HInd	S. Branch of Sask.	Mentions 240 dead and rotting carcasses in a pound.	Hind 1971:357
Winter 1858	Henry Boller	Fort Atkinson	Killed a bull and took tongue.	Quaife 1972:256
Feb. 1858	James Hector	Jasper House	Killed a ram but took only a small amount because expect to run into more.	Spry 1968:381
Aug. 1858	Capt. John Palliser	Cypress Hills	Threw away elk meat when got good buffalo meat.	Spry 1968:422
Sept. 1859	The Earl of Southesk	Rockies Foothills in S. Alberta	Killed many bighorn sheep for trophies and he noted that "too much slaughter and conscience rather reproached me".	The Earl of Southesk 1969:216
Oct. 1859	The Earl of Southesk	Red Deer. R.	Comments on waste in Indian pounds, "kill, kill, kill"!	The Earl of Southesk 1969:264

Oct. 1862	Walter Butler Cheadle	Carlton House	Slayed his first buffalo and took tongue and tail.	Cheadle 1971:63
Winter 1866-67	Rev. John McDougall	Battle R.	Shot bull but could only eat heart, tripe and tongue.	McDougall 1898:189
1870's	Colonel Richard Irving Dodge	Central Plains	For each hide traded, 4-5 buffalo died.	Dodge 1884:293
Spring 1872	Isaac Cowie	Cypress Hills	Left 40 fresh buffalo carcasses in store when post abandoned.	Cowie 1913:433

Table 23: The Importance of Food Procurement and Processing Activities in the Early Historic Northern Plains, 1691-1868
(As Measured by the Percentage of Days When Such Activities Were Mentioned in Ethnohistorical Journals)

During Travel

Observer	Dates	Location	I*	II**	**	Reference
Henry Kelsey	July 15, 1691 to Sept. 12, 1691	Central Sask.	60	28	46.7%	Dougherty and Martin 1929
Anthony Henday	July 21, 1754 to June 1, 1755	N. Sask. R. to Three Hills Ck. (Return)	259	178	68.7%	Burpee 1907
Matthew Cocking	July 15, 1772 to May 29, 1773	N. Sask. R. to S. Sask R. via Eagle Hills (Return)	281	169	60.1%	Burpee 1908
Peter Fidler	Nov. 8, 1792 to March 20, 1793	Buckingham House to Oldman R. (Return)	118	64	54.2%	Haig 1991
François - Antoine Larocque	Sept. 11, 1804 to Feb. 28, 1805	Fort Assiniboine to Missouri R.	101	26	25.7%	Larocque 1910
Lewis and Clark	Sept. 25, 1804 to Oct. 26, 1804	Teton R. to Mandans	33	17	51.5%	Thwaites 1959a
Lewis and Clark	March 22, 1805 to July 27, 1805	Mandan Villages to Three Forks	109	90	82.6%	Thwaites 1959a, 1959b
Capt. John Palliser (BNA Expedition)	July 21, 1857 to Oct. 11, 1857	Upper Fort Garry to Carlton House (Return)	86	23	26.7%	Spry 1968
James Hector (BNA Expedition)	Oct. 11, 1857 to June 4, 1858	Carlton House to Fort Edmonton and Rocky Mtn. House (Return)	88	25	28.4%	Spry 1968
Capt. John Palliser (BNA Expedition)	June 15, 1858 to Sept. 20, 1858	Carlton House to Rocky Mtns. to Fort Edmonton	81	32	39.5%	Spry 1968

James Hector (BNA Expedition)	Aug. 31, 1858 to Oct. 7, 1859	Crossfield Area to Kootenay R. and Elk R. and to Fort Edmonton	60	41	68.3%	Spry 1968
The Earl of Southesk	June 6, 1859 to Jan. 8, 1859	Fort Garry to Fort Edmonton to Bow Fort (Return)	199	61	30.7%	The Earl of Southesk 1969
Sedentary and Travelling						
William Tomison	July 28, 1795 to July 24, 1796	Cumberland House to Fort Edmonton (Return)	361	128	35.5%	Johnson 1967
George Sutherland	Sept. 26, 1796 to June 11, 1797	Buckingham House to Fort Edmonton (Return)	232	62	26.7%	Johnson 1967
William Tomison	Oct. 2, 1797 to June 5, 1798	Edmonton House to Cumberland House	247	81	32.8%	Johnson 1967
William Tomison	Aug. 3, 1798 to June 3, 1799	Cumberland House to Fort Edmonton (Return)	304	104	34.2%	Johnson 1967
James Bird	July 30, 1799 to May 31, 1800	Cumberland House to Fort Edmonton (Return)	306	63	20.6%	Johnson 1967
Peter Fidler	Aug. 15, 1800 to May 19, 1801	Carlton House to Chesterfield House (Return to Cumberland)	251	81	32.3%	Johnson 1967
Alexander Henry, the Younger	Sept. 20, 1803 to June 4, 1804	Forks of Red/ Assiniboine to Pembina R. Post (Return)	125	45	36.0%	Coues 1965
Alexander Henry, the Younger	Aug. 19, 1804 to May 25, 1805	Forks of Red/ Assiniboine to Pembina R. Post(Return)	43	14	32.6%	Coues 1965

Alexander Henry, the Younger	Aug. 1, 1805 to June 10, 1806	Forks of Red/ Assiniboine to Pembina R. Post (Return)	69	19	27.5%	Coues 1965
Alexander Henry, the Younger	July 7, 1806 to Sept. 15, 1807	Pembina R. Post to Mandan (Return)	40	23	57.5%	Coues 1965
Alexander Henry, the Younger	Aug. 8, 1808 to Sept. 17, 1808	Pembina R. Post to Fort Vermilion	40	25	62.5%	Coues 1965
Alexander Henry, the Younger	June 1, 1810 to Feb. 1, 1811	New White Earth House to Rocky Mtn. House	209	95	4.5.%	Coues 1965
Sedentary						
John McDonnell	Oct. 11, 1793 to June 7, 1795	Red River, Pine Fort, Fort Esperance, Fort Qu'Appelle	453	159	35.1%	Gates 1965
Alexander Henry, the Younger	Sept. 4, 1800 to May 22, 1801	Park River Post	148	98	66.2%	Coues 1965
Archibald McLeod	Nov. 15, 1800 to June 4, 1801	Fort Alexandria	205	111	54.2%	Gates 1965
Daniel Harmon	Oct. 10, 1800 to June 21, 1805	Swan River Fort, Bird Mtn. Fort, Fort Alexandria,	142	67	47.2%	Lamb 1957
Alexander Henry, the Younger	Aug. 22, 1801 to May 31, 1802	Pembina River Post	101	38	37.6%	Coues 1965
Peter Fidler	Sept. 27, 1801 to April 20, 1802	Chesterfield House	109	74	35.4%	Johnson 1967
Alexander Henry, the Younger	Sept. 4, 1802 to May 20, 1803	Pembina River Post and Portage La Prairie	66	28	42.4%	Coues 1965
Lewis and Clark	Oct. 27, 1804 to March 21, 1805	Mandan Villages	156	78	50.0%	Thwaites 1959a

Alexander Henry, the Younger	Sept. 13, 1809 to May 31, 1810	Fort Vermilion and Environs	182	79	43.4%	Coues 1965
Henry Fisher	Oct. 15, 1828 to May 4, 1829	Rocky Mtn. House	98	46	46.9%	HBCA B.184/a/1
Henry Fisher	Oct. 18, 1829 to April 12, 1830	Rocky Mtn. House	77	35	45.5%	HBCA B. 184/a/2
Henry Fisher	Sept. 30, 1830 to May 2, 1831	Rocky Mtn. House	157	75	47.8%	HBCA B.184/a/3
J. E. Harriott	Aug. 10, 1833 to Jan. 9, 1834	Piegan Post	125	47	37.6%	HBCA B.21/a/1
J. E. Harriott	Jan. 21, 1834 to April 14, 1835	Rocky Mtn. House	73	34	46.6%	HBCA B.21/a/1
François Auguste Chardon	June 18, 1834 to Aug. 11, 1835	Fort Clark	382	123	32.3%	Abel 1932
François Auguste Chardon	Sept. 12, 1835 to April 25, 1836	Fort Clark	153	72	47.1%	Abel 1932
François Auguste Chardon	June 18, 1836 to Feb. 28, 1837	Fort Clark	257	151	58.8%	Abel 1932
J. E. Harriott	Oct. 1, 1836 to May 4, 1837	Rocky Mtn. House	163	66	40.5%	HBCA B.184/a/4
François Auguste Chardon	March 1, 1837 to Feb. 28, 1838	Fort Clark	335	179	53.4%	Abel 1932
François Auguste Chardon	March 1, 1838 to May 6, 1839	Fort Clark	374	169	45.2%	Abel 1932
Richard Hardisty	May 1, 1866 to April 30, 1868	Rocky Mtn. House	520	216	41.5%	HBCA B.184/a/5

Notes:

(a) Activities described in daily journals which qualify as procurement or processing of food items, include- killing game animals, catching fish,collecting wild plant foods, construction and repairs to subsistence technology such as nets, garden plots, ice houses, victual sheds, pounds and jumps, butchering animals previously dispatched, extracting salt to preserve meat, feasting, trade etc.

(b) Observations are divided into three groupings to reflect the mobility of the observer and his colleagues- **During Travel, Sedentary and Travelling, and Sedentary.** Observations made during travel involve individuals moving over the landscape, such as the journey up the Missouri River by Lewis and Clark. Sedentary and travelling indicates that two mobility patterns are mixed; travelling from one locale to another and extended occupation of a particular locale. A sedentary pattern indicates that the observer spent an extended period of time at one locale.

(c) The total number of separate daily entries in a journal form **column I***.

(d) The number of days where subsistence activities are mentioned. form **column II****.

(e) **Column III***** is the percentage frequency of days devoted in whole or in part to food procurement and processing.

(f) In many fur trade journals, clerks would record "same as yesterday" but yesterday may have included many activities other than food acquisition; therefore, for the sake of accuracy, these entries were not tallied.

(g) The procurement of furs, even though the bodies of animals may have been consumed, was not included.

(h) It should be noted that some journals have gaps of a few days or perhaps even months, so that in the course of a 365 day year, entries may cover only 80 days. This table only covers those days explicitly mentioned in the journals.

(i) If the journal just says "traded", there is no way of knowing if this included furs, robes or provisions, so trade was included only if the goods received were clearly described as food items (ie. provisions, bladders of grease, pounded meat, dried meat, pemmican etc.).

Table 24: Provisions Imported by Saskatchewan District from York Factory, 1810-1811 and 1854-1855.

Quantity 1810-1811	Quantity 1854-1855	Item
109 lbs.		Bacon
5 gals.		Brandy
66 1/2 pieces		Salted Beef
47 pieces		Salted Pork
745 lbs.		Brown Biscuit
36 gal.		French Brandy
179 1/2 lbs.		Butter
62 lbs.		Cheshire Cheese
69 lbs.		Glouster Cheese
9 lbs.		Chocolate
10 lbs.		Coffee
2 lbs.		Currants
2819 lbs.		Flour
26		Hams
50 lbs.		Lard
275 lbs.	2 gal. keg	Molasses
3 lbs.	14 1/2 lbs.	Mustard
	7 1/4 lbs.	Pimento
80 gals.		Porter
10 lbs.		Prunes
56 lbs.	2 gal. keg	Raisins
52 1/2 gals.	19 2/3 casks, 191/3 kegs	Rum
41 1/2 gals.		Salt (Common)
7 1/2 lbs.	11 1/4 lbs.	Salt Petre
	3 gals.	Shrub
3 oz.		Spices, Cinnamon
1 1/2 oz.		Spices, Mace
5 oz.		Spices, Nutmeg
	28 lbs.	Spices, Pepper
4 lbs.		Suet
	520 lbs.	Sugar, Crash
538 lbs.		Sugar, Loaf
	1150 lbs.	Sugar, Mixed
550 lbs.		Sugar, Moist
25 1/2 lbs.	87 lbs.	Tea, Hyson
60 lbs.	46 lbs.	Tea, Souchong
	3. 3/4 gals.	Wine, Madeira
18 gals.	4 1/8 gals.	Wine, Port

Source: HBCA B.60/d/2a and B.60/d/112.

Table 25: Imported Provisions Received at Fort Edmonton and Those Shipped on to Rocky Mountain House, 1854-1855.

Received at Fort Edmonton	Shipped to Rocky Mountain House
5 gals. Brandy	1 gal. Brandy
2 lbs. Currants	
2 gal. keg Molasses	1 gal. Keg Molasses
14 1/2 lbs. Mustard	1 1/2 lbs. Mustard
7 1/4 lbs. Pimento	3/4 lbs. Pimento
2 gal keg Raisins	1 gal. keg Raisins
19 2/3 casks Rum	4 casks Rum
19 1/3 kegs Rum	4 kegs Rum
11 1/4 lbs. Salt Petre	3 lbs. Salt Petre
3 gals. Shrub	
28 lbs. Pepper	3 lbs. Pepper
520 lbs. Sugar, Crash	
1150 lbs. Sugar, Mixed	
87 lbs. Tea, Hyson	9 lbs. Tea, Hyson
46 lbs. Tea, Souchong	5 lbs. Tea, Souchong
3 3/4 gals. Wine, Madeira	1/2 gal. Wine, Madeira
4 1/8 gals. Wine, Port	

Source: HBCA B.60/d/112

Table 26: Saskatchewan District Transfers of Agricultural Produce, 1821/1822 to 1866/1867.

Year	Transferred to:	Goods	Reference
1821/1822	Cumberland	20 bu. barley	HBCA B.60/d/9
	Carlton House	1 bu. and 1 keg country salt	
		1 bu. potatoes	
	Lesser Slave Lake		
1822/1823	York Factory	6 bu. shelled barley	HBCA B.60/d/12
1824/1825	Carlton District	4 bu. barley	HBCA B.60/d/15
	Lesser Slave Lake	1 bu. wheat	
1825/1826	York Factory	14 kegs potatoes	HBCA B.60/d/18
1826/1827	York Factory	20 kegs barley 50 kegs potatoes	HBCA B.60/d/21
1827/1828	Columbia District	1 keg barley	HBCA B.60/d/25
	York Factory	9 kegs potatoes	
1832/1833	Columbia District	12 kegs potatoes	HBCA B.60/d/43
1836/1837	Columbia District	1/2 keg potatoes	HBCA B.60/d/51
1841/1842	Columbia District	2 kegs potatoes	HBCA B.60/d/70
1844/1845	Columbia District	20 lbs. plus 1 keg Red River Flour	HBCA B.60/d/78b
	Catholic Mission	3 milch cows	
	Mackenzie River		
		45 lbs. Red River Flour	
1845/1846	Catholic Mission	1 1/2 kegs barley 2 kegs potatoes	HBCA B.60/d/81b

1848/1849	Athabasca District	1 1/4 kegs barley	HBCA B.60/d/89
	Wesleyan Mission	2 kegs wheat	
1849/1850	Wesleyan Mission	1 1/2 kegs barley 1 keg wheat	HBCA B.60/d/92
	Columbia District	3 bags barley flour 2 bags wheat flour	
1850/1851	Columbia District	1 bag Red River flour	HBCA B.60/d/94
	Athabasca District	1 1/2 kegs rough barley	
1851/1852	Columbia District	18 kegs potatoes	HBCA B.60/d/100
	Athabasca District	1 bu. barley	
	Portage la Loche	3 kegs rough barley 1 1/2 kegs potatoes	
1852/1853	Columbia District	10 kegs potatoes	HBCA B.60/d/104
	Athabasca District	1/2 bu.plus 2 kegs barley 1/2 keg wheat 1/2 keg oats	
	Portage la Loche	2 kegs barley 2 kegs potatoes	
1854/1855	Western Department	25 lbs. Red River flour	HBCA B.60/d/113
	Cumberland District	2 full grown cows	
1855/1856	Athabasca District	2 milch cows 1 yr. old cow calf	HBCA B.60/d/116
	Wesleyan Missionary Society	2 milch cows	
1856/1857	Roman Catholic Mission- Lac St. Ann's	2 kegs wheat	HBCA B.60/d/121

1857/1858	Dunvegan Post	3 full grown cows 1 full grown bull	HBCA B.60/d/124
	Cumberland District	400 lbs. Red River flour	
	Roman Catholic Mission-Lac St. Ann's	1 bu. barley 5 bu. wheat	
1858/1859	Roman Catholic Mission- Lac St. Ann's	1 gal. wheat	HBCA B.60/d/128b
	British North American Expedition	3 kegs potatoes 2 1/2 bags Red River flour 1 qt. country salt	
1859/1860	Roman Catholic Mission- Lac la Biche	7 lbs. Red River flour	HBCA B.60/d/133
	British North American Expedition	3 bags Red River flour	
	D. Sheffield. Esq.	85 lbs. Red River flour	
	The Earl of Southesk	4 bu. potatoes	
1860/1861	English River	8 bags barley meal	HBCA B 60/d/137
	General Charges	1 keg potatoes	
	Wesleyan Missionary Society	80 lbs. barley meal 2 bu. rough barley 2 bu plus 1/2 keg potatoes 1 1/2 gal. country salt	

1861/1862	Northern Trading Expedition	1/4 ga. country salt 14 lbs. Red River flour	HBCA B.60/d/141
	Lower Red River	20 lbs. Red River flour	
	Swan River	10 lbs. Red River flour	
	Roman Catholic Mission- Lac St. Ann's	1 1/2 bu. wheat	
	Roman Catholic Mission- English River	8 lbs. Red River flour	
	Wesleyan Missionary Society	3 bu. potatoes 1/4 gal. country salt	
1862/1863	Cumberland District	22 1/2 lbs. Red River flour	HBCA B.60/d/146
	Lower Red River	55 lbs. Red River flour	
	General Charges	13 bags plus 20 lbs. Red River flour 1/2 keg potatoes	
	Wesleyan Missionary Society	2 bu. wheat 3 bu. barley 5 bu.plus 2 kegs potatoes 1/2 keg rough barley	
	Roman Catholic Mission- St. Albert	12 lbs. Red River flour 4 1/2 bu. wheat 5 1/2 bu. barley 56 lbs. Red River flour	
1863/1864	Robert Henry Hamilton	1 bu. potatoes 1 bu. barley	HBCA B.60/d/152
	Wesleyan Missionary Society	4 bu. barley 4 bu. wheat 2 milch cows 1 bull	

1864/1865	Western Department	4 bu. potatoes	HBCA B.60/d/157
	Telegraph Survey	1 keg potatoes	
1865/1866	MacKenzie's River Freight Establishment	2 bu. potatoes 4 bu. barley 50 lbs. Saskatchewan flour	HBCA B.60/d/161
	General Charges	1 bag American flour	
1866/1867	Lower Red River District	40 lbs. Red River flour	HBCA B.60/d/167
	Saskatchewan Surveying Expedition	1 1/2 kegs. plus 1 bu. potatoes	
	Wesleyan Mission- Victoria	2 bu. seed wheat 4 bu. barley 22 lbs. Red River flour	
	Roman Catholic Mission- St. Albert	20 lbs. Red River flour grinding 10 bu. wheat	

Table 27: Reproduction of the Saskatchewan Transfer Book, Outfit 1856/1857.

<u>**To Athabasca**</u>

3 strong dogs
1 dog sled
3 dog harnasses
1 pr. snowshoes

<u>**To English River**</u>

144 lbs. dried meat
20 lbs. grease
20 whole buffalo skins
2 whole parchment skins, dressed
10 lbs. pack cords
2 working horses
3 working oxen
50 lbs. fresh meat
70 lbs. dried meat
4 bags common pemmican
2 bags hard grease(100 lbs.)
50 lbs. hard grease
205 lbs. freshmeat
120 lbs. dried meat
35 lbs. hard grease
12 bags common pemmican
400 lbs. dried meat
40 lbs. grease
4 whole buffalo skins
270 lbs. fresh meat
4 bags hard grease(112 lbs.)
2 bags soft great (112 lbs.)
22 bags common pemmican (190 lbs.)
2 bags hard grease (112 lbs.)
412 lbs. dried meat
546 lbs. fresh meat
5 whole buffalo skins
90 bags common pemmican (90lbs.)
5 whole buffalo skins
90 bags common pemmican (90lbs.)
12 large dressed moose skins
3 small dressed moose skins
5 large dressed Red deer skins
10 whole dressed buffalo skins
1 small leather tent
2 lbs. crash sugar
15 large dressed moose skins
30 whole dressed buffalo skins
20 sinews
50 lbs. hard grease
40 lbs. pack cords
140 bags common pemmican
5 bags fine pemmican
14 bags grease
1 bale dried meat (100 lbs.)
60 half buffalo skins
12 buffalo parchment skins
5 leather tents

To Norway House

12 new inland boats
1 second inland boat
101 bags grease(112 lbs.)
1 keg soft grease(70 lbs.)
2 kegs bear grease(140 lbs.)
202 bags common pemmican(90 lbs.)
8 bags common pemmican (45 lbs.)
18 bags fine pemmican(90 lbs.)
19 bags fine pemmican(45 lbs.)
900 lbs. pack cord
2000 pr. tracking shoes
27 new leather tents
10 old leather tents
450 salted buffalo tongues
4 leather sacks
11 buffalo parchment skins
3 bags grease (100 lbs.)
1 inland boat
14 bags common pemmican

General Charges

180 lbs. dried meat
362 lbs. fresh meat
208 lbs. fresh meat
66 lbs. dried meat
70 lbs. dried meat
60 lbs. common pemmican
153 lbs. dried meat
208 lbs. fresh meat
15 lbs. dried meat
1 bag fine pemmican(90 lbs.)
5 lbs. hard grease
5 lbs. soft grease
102 lbs. dried meat
60 lbs. common pemmican

To Lower Red River

1 half buffalo skin
50 lbs. dried meat

To Roman Catholic Mission- Lake St. Ann's

1 horse saddle bag
1 lbs. black pepper
2 lbs. congou tea
5 lbs. crash sugar
1 keg wheat
1 keg wheat
2 lbs. crash sugar
1 keg wheat
57 lbs. salt butter

To Roman Catholic Mission- Lac La Biche

1 common buffalo robe
10 lbs. dried meat
90 lbs. hard grease
100 lbs. dried meat
30 olbs. dried meat
90 lbs. hard grease
4 lbs. hard grease
36 lbs. dried meat
4 large dressed moose skins
1 large dressed red deer skin

To Wesleyan Missionary Society

half dressed buffalo skin
1 dressed buffalo skin
1 buffalo robe
4 lbs. dried meat
30 lbs. dried meat
1 half buffalo skin
5 half buffalo skins
3 sinews
1 large dressed moose skin
37 lbs. dried meat
15 lbs. hard grease
1- 2 gal. keg vinegar
70 lbs. dried meat
1 half buffalo skin
1/2 gal. salt
17 lbs. common pemmican
17 lbs. dried meat
1 large red deer skin
25 lbs. dried meat
1 half buffalo skin
1 half dressed buffalo skin
1/2 gal. salt
3 1/2 large dressed mooseskins

Source: HBCA B.60/d/121

Table 28: Reproduction of List of Kitchen Garden Seeds - Churchill Factory, 1803.

4 Qts. Prussian Blue Peas
2 Qts. Miratha(sp.) Peas
2 Qts. Dwf. Marrowfatt Peas
4 Qts. Windsor Beans
1 Qt. Long Pod Beans
1 Qt. Speckled Dwf. Beans
1 Qt. White Dwf. Beans
1 lb. Prickled Spinach
1 lb. White R__ (sp.)Spinach
1 lb. Early Dutch Turnip
1 lb. White __ (sp.) Turnip
1 lb. __ (sp.) Carrot
1 lb. Parsnip
1/2 lb. Onion
1/2 lb. Short top Raddish
2 oz. Summer Raddish
1/4 lb. green Kale
1/4 lb. brown Kale
4 oz. Early York Cabbage
4 oz. Green Savoy
4 oz. Green __(sp.) Lettuce
4 oz. Mustard
4oz. Cress
1oz. White Celery

Flower Seeds
1/2 oz. Mignionette (sp.)
1/2 oz China asters
1/2 oz. Stocks
1/2 oz. Sweet Williams
1/2 oz. Wally flowers
1/2 oz. columbines
1/2 oz. Polyanthus
Bulbous Roots
1 doz. Jonquils

(from Moodie 1978:55)

Notes:

(a) (sp.) indicates that word is unreadable.

Table 29: **Evidence for Horticultural/Agricultural Pursuits in the Northern Plains, 1738-1885.**

Year	Location	Evidence	Reference
1738	**Mandan Villages**	**Grew corn and beans.**	**Smith 1980:98**
~1753	Fort à la Corne	Saw remains of agricultural equipment.	Coues 1965:482
1793	Fort Esperance	Harvested potatoes.	Wood 1984:84
1794	Fort Esperance	Planted and harvested potatoes. Sowed parsnip seed.	Wood 1984:104,111
1796	Brandon House	Planted Indian corn.	HBCA B.22/a/3
1796	Cumberland	Men working in garden.	Johnson 1967:44
1798	Fort Edmonton	Planted and harvested potatoes and other garden crops.	Johnson 1967:119, 145
1799	Fort Edmonton	Men planted potatoes.	Johnson 1967:165
1800	Swan River Fort	Tolerable kitchen garden.	Lamb 1957:34
1801	Pembina River Post	Harvested potatoes. Melons and cucumbers froze. Horses destroyed other vegetables.	Coues 1965:188, 189
1802	Pembina River Post	Sowed garden seeds. Cabbages above ground.	Coues 1965:19[illegible]
1803	Fort Alexandria	People making a garden.	Lamb 1957:67
1803	Pembina River Post	Planted potatoes, turnips, carrots, beets, parsnips, onions, cabbages.	Coues 1965:212
1804	Fort Alexandria	Preparing ground for garden seeds.	Lamb 1957:80
1804	Pembina River Post	Sowed potatoes, cabbage seed, garden seed. Prepared ground for corn, squash. and melons. Pickled cucumbers.	Coues 1965:242, 250, 252,

1804	**Mandan Villages**	**Gift of pumpkins from Indians and traded corn.**	**Thwaites 1959a:233**
1804	Brandon House	Sowed Indian corn, beans, pease, thyme, carrots, turnips, pumpkins, marigolds, cucumbers and cabbages.	HBCA B.22/a/12
1805	Fort Alexandria	Subsisted on little else than potatoes.	Lamb 1957:85
1805	**Mandan Villages**	**Bought corn from Mandan.**	**Larocque 1910**
1805	**Mandan Villages**	**Fine harvest. Saw kidney beans and pumpkins.**	**Wood and Thiessen 1985:251**
1806	**Mandan Villages**	**Fields of corn, beans, squash, sunflowers.**	**Coues 1965:321**
1806	Pembina River Post	Sowed potatoes and oats.	Coues 1965:275
1806	Portage La Prairie	Excellent garden- potatoes, carrots, corn, onions, parsnips, beets, turnips, cabbages and melons.	Coues 1965:291
1807	**Brandon House**	**Indians planting gardens.**	**HBCA B.22/a/15**
1807	Pembina River Post	Harvested little compared to other years.	Coues 1965:425
1808	Pembina R. Post	Grasshoppers destroyed the greater part of the vegetables- onions, cabbages, melons, cucumbers, parships, carrots, beets and also the corn and potatoes.	Coues 1965:428, 530
1808	Fort Vermilion	Found a small garden stocked with barley, potatoes, cabbage, turnips, carrots, parsnips and beets.	Coues 1965:507
1808	Brandon House	Garden near 1 1/2 acres.	HBCA Search File- Brandon House

1808	Cumberland	Barley grows to perfection and potatoes and all kinds of kitchen vegetables.	Coues 1965:476
1809	Fort Vermilion	Excellent crop of turnips and potatoes.	Coues 1965:549
1810	Brandon House	Melons, cucumbers, 458 kegs of potatoes.	Morton 1938:10
1810	New White Earth House	Frost hurt potatoes; turnips are all leaves; barley still green; everything stunted.	Coues 1965:605
1810	Rocky Mountain House	Gardens have already been made here but only potatoes come to maturity.	from Smyth 1978:6
1810	Carlton House	Used 1 package of garden seeds.	HBCA B.27/d/1
1811/1812	Carlton House	Used 1 spade plus cabbage, onion and carrot seed.	HBCA B.27/d/2,3
1811	Lower Terre Blanche House	No gardening this spring because of the incessant rain.	Coues 1965:746
1812	Red River Settlement	Planted potatoes, peas, turnips, winter wheat, English barley and summer wheat.	Pritchett 1942:83, 113
1812	Fort Alexandria	Growing wheat.	Bryce 1910
1812/1813	Carlton House	Used garden seeds.	HBCA B.27/d/4
1814	Red River Settlement	Planted potatoes, turnips, buckwheat, wheat, barley oats, Indian corn and green peas.	Morton 1972:548, 553
1814	Le Fort de la Montêé	Fields of barley and peas about post promise abundant harvest.	Franchère 1854:326
1815	Carlton House	The garden yields barley, oats, potatoes, pease, beans, cabbage, carrots, parsnips, raddishes, lettuce, in short all garden vegetables come to perfection.	HBCA B.27/e/1

1819	Carlton House	Ample returns of wheat, barley, oats and potatoes.	Franklin 1824: 106
		Drought during spring but got sufficient wheat and barley for seed plus some potatoes.	HBCA B.27/e/2
1820	Carlton House	Wheat and other crops looking well.	Franklin 1824:158
1820	Cumberland	A variety of vegetables plus wheat, barley and oats.	Rich1938:23
1820	Rocky Mountain House	A small garden was planted to potatoes and barley but was destroyed by severe frosts.	HBCA B.60/e/4
1821	Carlton House	Grew potatoes, wheat, barley, oats plus a kitchen garden. Two hoes and 4 scythes in use	HBCA B.27/e/3 HBCA B.27/d/8
1821	Upper Red River District	Articles in use - 15 hoes, 2 scythes, 1 shovel and 12 sickles.	HBCA B.22/d/6
1821/1822	Fort Edmonton	Shipped potatoes to Lesser Slave Lake and barley to Cumberland. Articles in use - 20 hoes, 6 sickles, 5 spades. Country produce, barley, on hand.	HBCA B.60/d/9
1822	Upper Red River District.	Articles in use - 13 hoes, 1 plough, 16 scythes, 12 spades, 2 shovels and 1 sickle.	HBCA B.22/d/7
1823	Fort Edmonton	Articles in use- 4 hoes and 1 old and nearly useless plough.	HBCA B.60/d/13
1823	Carlton House	11 hoes and 1 old plough in use.	HBCA B.60/d/13
		Garden seeds sent from Fort Edmonton.	HBCA B.60/d/15
1823/1824	Fort Edmonton	Article in use- 1 scythe.	HBCA B.60/d/15

1825	Fort Edmonton	Articles in use- 10 garden hoes, 3 ploughs, 2 husbandry ploughs, and 17 scythes.	HBCA B.60/d/18
1825	Rocky Mountain House	Planted a garden for food.	HBCA B.60/a/24
1826	Rocky Mountain House	Planted only potatoes.	HBCA B.60/a/24
1826	Carlton House	Harvested potatoes, barley, wheat and turnips.	HBCA B.27/e/4
1826	Fort Edmonton	Articles in use- 3 ploughs, 3 scythes	HBCA B.60/d/21
1827	Fort Edmonton	Articles in use- 15 garden hoes, 15 sickes, 15 scythes.	HBCA B.60/d/21
1827	Carlton House	Have sown wheat, barley, oats, potatoes, cabbage, onions, and Indian corn.	HBCA B.27/e/4
1827/1828	Fort Edmonton	Shipped barley to Columbia and potatoes to York Factory.	HBCA B.60/d/25
1828	Brandon House	Planted potatoes, barley, wheat, pease, Indian corn and smaller seeds.	HBCA B.22/e/2
1829	Fort Edmonton	Articles in use- 2 harrows, 10 old garden hoes, 1 plough, 4 old broken ploughs and 6 old garden spades.	HBCA B.60/d/30
1829	Brandon House	Planted crops and a large garden.	HBCA B.22/e/3
1832/1833	Fort Assiniboine	Supplied Columbia with potatoes.	HBCA B.60/d/43
1833	**Fort Union**	**Maize procured from neighboring Indians.**	**Thwaites 1905a:384**
1833/ 1834	**Fort Clark**	**Indians grow maize, beans, gourds, sunflowers and tobacco. Poor corn crop this year.**	**Thwaites 1905b:276 Abel 1932:10**

1836	Fort Clark	Grew green peas, potatoes, beans, corn and pumpkins but latter froze.	Abel 1932:79, 83, 136
1837	Fort Edmonton	Articles in use- 5 pitch forks, 3 hay forks, 10 sickles, 9 good garden spades and 8 worn garden spades.	HBCA B.60/d/53
1837	Rocky Mountain House	Planted turnips.	HBCA B.184/a/4
1839	Saskatchewan District	Articles in use- 5 hay carts, 5 pitch forks, 4 hay forks, 42 garden hoes, 6 harrows (wooden teeth), 1 harrow(iron teeth), 16 sickles, 21 grass scythes, 1 half worn grass scythe, 18 much worn grass scythes, 1 good scythe and 1 half worn scythe.	HBCA B.60/d/59
1840	Saskatchewan District	Articles in use- 30 much worn garden hoes, 9 good grass scythes, 11 half worn grass scythes, 18 much worn grass scythes, and 15 sickles.	HBCA B.60/d/62
1841	Carlton House	Large gardens and fields which produce abundance of vegetables and potatoes. Wheat usually destroyed by early frosts.	Simpson 1847:84
1841	Fort Edmonton	Barley usually a fair return but wheat frequently destroyed by frosts.	Simpson 1847:105
1841/1842	Saskatchewan District	Shipped potatoes to Columbia.	HBCA B.60/d/70
1843	Fort Union	Grew turnips, squash, vines, and peas in garden.	Audubon 1960b:109
1844	Fort Edmonton	Rev. Robert T. Rundle reported working in his garden.	Dempsey 1977:152

1845/1846	Saskatchewan District	Shipped potatoes and barley to Catholic Mission. Articles in use- 4 hay carts, 4 hay forks, 4 pitch forks, 35 garden hoes, and 13 garden spades.	HBCA B.60/d/81b
1845	Pigeon Lake	Harvesting and storing turnips.	Dempsey 1977:202
1846	Fort Edmonton	Paul Kane reported that great quantities of grain grew plus potatoes and turnips, but Indian corn did not succeed.	Harper 1971:136
		A large garden.	De Smet 1978:186-87
1846/1847	Saskatchewan District	Shipped wheat to Columbia	HBCA B.60/d/84
1847	Battle River	Gardening proved a failure- potatoes were very small; turnips and lettuce grew well; beets, carrots, raddishes were few; and, parsnips did not grow.	Dempsey 1977:276
1848	Pigeon Lake	Planted potatoes.	Dempsey 1977:136
1849/1850	Saskatchewan District	Shipped potatoes to Cumberland.	HBCA B.60/d/92
1850	Lac La Biche	Unfailing source of wheat at mission.	McDougall 1898:147
1850/1851	Saskatchewan District	Sent rough barley to Athabasca.	HBCA B.60/d/94
1851/1852	Saskatchewan District	Sent potatoes to Columbia, barley to Athabasca and rough barley and potatoes to Portage La Loche.	HBCA B.60/d/100
1852/1853	Saskatchewan District	Sent potatoes to Columbia; barley, barley meal, wheat and oats to Athabasca; barley and potatoes to Portage La Loche.	HBCA B.60/d/104

1854	Fort Pitt, Carlton House, Fort Edmonton	Few vegetables grown as discouraged by HBC.	Moberly 1929:48
1854	Lac La Biche, Lac St. Ann	Best gardens are at missions.	Moberly 1929:48
1854	Fort Assiniboine	Potatoes, turnips, cabbages, carrots, parsnips and beets in garden.	Moberly 1929:56
1854	Saskatchewan District	109 acres under cultivation. Articles in use- 10 ploughs, 9 garden spades and 5 shovels.	HBCA B.60/d/106
1855	Fort Benton	Made a garden.	McDonnell 1940:30
1856/1857	Saskatchewan District	Sent wheat, to Lac St. Ann's Mission.	HBCA B.60/d/121
1857	Lower Fort Garry	Lower Fort Garry Provisional Farm established to grow stores to offset years of scarcity.	Podruckny 1990:21, 27
1857	Red River Settlement	8371 acres of land cultivated.	Podruckny 1990:15
1857	Southern Manitoba	Many farms in area where wheat, barley, potatoes, pumpkins, turnips, carrots and oats grown.	Hind 1971a:145
1857	Fort Qu'Appelle	Garden of Indian corn, potatoes, turnips, beans and other vegetables.	Hind 1971a 321
		Garden of Indian corn, barley and potatoes.	Spry 1968:137
1857	Touchwood Hills	Garden produces every variety of vegetable grown in Canada.	Hind 1971a:414
1857	Fort Pitt	Grain and turnips grow well and famous for potatoes.	Spry 1968:195
1857/1858	Saskatchewan District	Sent wheat and barley to Dunvegan and Lac St. Ann.	HBCA B.60/d/124

1858	**Arikara Village**	**They grow corn, pumpkins and squashes.**	**Quaife 1972:27**
1858	Lower Fort Garry Provisional Farm	Harvested wheat, barley, oats, pease, potatoes, turnips.	Podruckny 1990:31
1858	Lac St. Ann	Grow barley, potatoes, turnips but no wheat.	Spry 1968:219
1858	Fort Edmonton	Barley, wheat and potatoes in storage.	HBCA B.60/d/126
1858/1859	Saskatchewan District	Shipped wheat to Lac St. Ann's Mission: Barley to Lac La Biche Mission: and sold potatoes, to Palliser Expedition, Brisco and Mitchell and the Earl of Southesk.	HBCA B.60/d/128b
1859	Fort Edmonton	Sowed barley, wheat, pease, potatoes and some garden seed.	HBCA B.60/d/128b
1859	Lac St. Ann	The Earl of Southesk obtained potatoes from the priests.	The Earl of Southesk 1969:169
1859	**Morley area**	**Assiniboines had a farm where they grew turnips.**	**The Earl of Southesk 1969.260**
1859	Fort Pitt	Vegetables thrive but barley does not ripen.	The Earl of Southesk 1969:286
1859	Lower Fort Garry Provisional Farm	Sowed 125 acres.	Podruckny 1990:31
1860	Fort Edmonton	Planted potatoes, barley, wheat, pease.	HBCA B.60/d/134
1860	Saskatchewan District	Articles in use- 1 harrow, 22 garden hoes, 4 ploughs, 17 grass scythes, 36 sickles and 9 garden spades.Shipped barley meal to English River and sold barley meal, rough barley and potatoes to Wesleyan Mission.	HBCA B.60/d/134

1860	Lower Fort Garry Provisional Farm	Wet year but good yields of wheat.	Podruckny 1990:33
1860's	Rocky Mountain House	Gardens did better now as fort occupied year round. Grew potatoes, barley, wheat, turnips.	HBCA B.60/a/34
1860-65	Fort Victoria	Garden has done well (potatoes and some barley).	McDougall 1896:80, 230
1861/1862	Saskatchewan District	Shipped wheat to Lac St. Ann and sold potatoes to Wesleyan Mission.Country produce on hand- wheat.	HBCA B.60/d/141
1861/1862	Lac St. Ann	Purchased 1 assortment of garden seed from HBC	HBCA B.60/d/141
1862	Carlton House	Cheadle obtained potatoes from post.	Cheadle 1969:69
		Shipped potatoes to North Trading Expedition.	HBCA B.60/d/146
1862	Lower Fort Garry Provisional Farm	Poor crops because of drought.	Podruckny 1990:34
1862/1863	Saskatchewan District	Shipped rough barley to Athabasca, and sold wheat, barley, potatoes, rough barley and garden equipment to Wesleyan Mission and St. Albert Mission.	HBCA B.60/d/146
1863	Saskatchewan District	77.5 acres cultivated and spring barley, wheat and potatoes planted.	HBCA B.60/d/148
1863	Carlton House	Cheadle obtained potatoes from post.	Cheadle 1969:129
1863	Lac St. Ann	Potatoes and turnips and also grain grow here.	Cheadle 1969:137
1863	Fort Edmonton	Wheat grows luxuriously and potatoes and other vegetables flourish.	Cheadle 1969:142, 179

1863/1864	Saskatchewan District	Shipped potatoes and barley to Montreal Department for Robert Henry Hamilton.	HBCA B.60/d/152
		Sold potatoes, barley, and wheat to Wesleyan Mission.	HBCA B.60/d/152
1863/64	St. Albert	Credit for produce including turnips, carrots, beet root, onions and turnips.	HBCA B.60/d/152
1964	Saskatchewan District	91.5 acres planted to barley, pease, potatoes and wheat.	HBCA B.60/d/153
1864/1865	Fort Edmonton	Sold potatoes to Messiers Alexander and Tebbitt for trip to New Caledonia.	HBCA B.60/d/157
1864/1865	Fort Pitt	Sold potatoes to Telegraph Survey Outfit and Edward Shelley.	HBCA B.60/d/157
1864-1868	Lower Fort Garry Provisional Farm	Crops severely damaged by grasshoppers.	Podruckny 1990:36
1865	Pigeon Lake	Gardens neglected but took potatoes to plant.	McDougall 1898:39
1865	Saskatchewan District	Country produce on hand-barley, potatoes and wheat. Ninety-two acres of land cultivated to barley, pease, potatoes, and wheat.	HBCA B.60/d/157 HBCA B.60/d/158
1865/1866	Saskatchewan District	Shipped potatoes and barley to Mackenzie River and potatoes in storage.	HBCA B.60/d/161
1866	Prince Albert	A mission and industrial farm where barley and potatoes are generally a success.	Roe 1952:118
1866	Saskatchewan District	68 acres under cultivation to barley, pease, potatoes and wheat.	HBCA B.60/d/164

1866/1867	Saskatchewan District	Sold potatoes to Saskatchewan Surveying Expedition; barley to the Wesleyan Mission at Victoria; and rough barley and wheat are in store.	HBCA B.60/d/167
1867	Fort Qu'Appelle	Kitchen garden same size as fort (150' by 150') plus a 10 acre field for potatoes and barley.	Cowie 1913:214
1871	Fort Qu'Appelle	Barley and potatoes were only food available.	Cowie 1913:425
1871	Pigeon Lake	Rev. John McDougall noted, "this was the autumn of my wonderful crop of potatoes and barley".	McDougall 1983:203
1872	Lower Fort Garry	Summer frosts are often injurious to wheat but all other crops thrive. Final garden 220' by 220'.	Butler 1968:381
1872	Touchwood Hills	Post does not have gardens but a missionary grows potatoes and barley.	HBCA Search File-Touchwood Hills
1873	Fort Qu'Appelle	Wheat, barley, Indian corn, potatoes, common kitchen vegetables are grown with varying success.	Cowie 1913:425
1873	Rocky Mountain House	Growing at the fort are potatoes, onions, carrots, turnips, cabbages but problem with barley being frozen.	from Smyth 1978:7
1874	St. Albert	Paid for ploughing and harrowing land.	HBCA B.27/d/14
1874	Fort à la Corne	Paid for weeding potatoes.	HBCA B.27/d/18
1874	Fort Pitt	Paid for weeding and taking up potatoes.	HBCA B.27/d/14
1875	Rocky Mountain House	Found fort abandoned but helped ourselves to potatoes and turnips.	from Smyth 1978:8

1879	Battleford	Fields of excellent oats, middling barley and first-class wheat.	Roe 1952:119
1885	Carlton House	Country produce on hand included flour, bran, oats and crushed feed.	HBCA B.27/d/16

Notes:

(a) The extant account books for Piegan Post, Rocky Mountain House, Fort Edmonton, Carlton House, Touchwood Hills Post, and Brandon House were perused for empirical indicators of agricultural and horticultural activities within the Saskatchewan and Red River Districts. Only equipment classified as **"Articles in Use"** was entered in the above table. "Equipment on hand", "Inventory" or "Equipment Tranfers" were not included since they are less accurate empirical indicators.

(b) Entries in **bold** indicate horticultural activities by Native Americans.

(c) The Fort Edmonton account books are largely Saskatchewan District summaries which lump activities and produce from the posts in that area. These are included in this table along with separate descriptions of the posts in that district.

Table 30: Area Under Cultivation at Early Historic Settlements in the Northern Plains, 1812-1867.

Location	Year	Area	Crops	Reference
Brandon House	1808	1 1/2 acre	Not mentioned.	HBCA Search File-Brandon House
Red. River Settlement	1812	2-3 acres		Pritchett 1942:113
Carlton House	1819	6 acres	Potatoes, wheat, barley and oats.	HBCA B.27/e/2
Carlton House	1821	approx. 7 acres (36,797 square yards)	Potatoes, wheat, barley, oats and kitchen garden.	HBCA B.27/e/2
Carlton House	1827	12.5 acres plus wheat	Potatoes, barley, oats, cabbage.	HBCA B.27/e/2
Brandon House	1828	10 acres	Potatoes, barley, wheat, pease, Indian corn and smaller seeds.	HBCA B.22/e/2
Saskatch-ewan District	1854	109 acres	Not mentioned.	HBCA B.60/d/106
Red River Settlement	1857	8371 acres	Wheat, hops, barley, oats, tobacco, root crops and garden vegetables.	Podruckny 1990:15, 23
Lower Fort Garry Provisional Farm	1859	125 acres	Wheat, barley, oats, pease, potatoes.	Podruckny 1990:31
		2 acres	Turnips.	
Fort Edmonton	1863	77.5 acres	Potatoes, wheat, barley	HBCA B.60/d/148
Fort Edmonton	1864	91.5 acres	Potatoes, pease, wheat, barley.	HBCA B.60/d/153
Fort Edmonton	1865	92 acres	Potatoes, pease, wheat, barley.	HBCA B.60/d/158
Fort Edmonton	1866	68 acres	Potatoes, pease, wheat, barley.	B.60/d/164

Fort Qu'Appelle	1867	10 acres, garden 150' by 150'	1/2 potatoes, 1/2 wheat	Cowie 1913:214
Rocky Mtn. House	1860's	220' by 220'	Potatoes, wheat, barley, garden vegetables.	HBCA B.60/a/34

Table 31: Productivity of Horticultural/Agricultural Crops in the Northern Plains, 1793-1866.

Year	Location	Productivity	Reference
1793	Fort Esperance	10 bu. potatoes	Wood 1984:84
1794	Fort Esperance	6 bu. potatoes	Wood 1984:111
1803	Pembina River Post	Garden produced 300 large heads of cabbage, 8 bu. carrots, 16 bu. onions, 10 bu. turnips, some beets and parsnips; and, 420 bu. potatoes grown from 7 bu of seed potatoes.	Coues 1965:228
1804	Pembina River Post	Harvested garden produce- 1000 bu. potatoes from 20 bu of seed; 10 bu. cucumbers, 2 bu. melons, 5 bu. squash, 10 bu. Indian corn, 200 large heads cabbage, 300 small heads savoy cabbage and much eaten and/or destroyed.	Coues 1965:252
1809	Fort Vermilion	Harvested 50 bu. of large and excellent turnips and 80 bu. of small watery potatoes.	Coues 1965:549
1812	Red River Settlement	Potatoes yield 45 to 50 kegs per keg sowed and turnips are very large.	Pritchett 1942:113
1812	Fort Alexander	Four quarts of wheat yielded 12 1/2 bu.	Bryce 1910:211
1819	Carlton House	Severe frost hurt potatoes so yield was only 40 bu.	HBCA B.27/e/2
1826	Carlton House	Produce of garden was 464 bu. potatoes, 93 bu. barley, 33 bu. wheat and 5 bu. turnips.	
1836	Fort Clark	Harvested 25 bu. beans	Abel 1932:83
1846	Fort Edmonton	Grow 20-25 bu. of potatoes per acre.	Harper 1971:136

1857	Southern Manitoba	Hind reported that one farmer sowed 63 bu. of wheat and harvested 700 bu; 36 bu. of barley gave 350 bu.; 24 bu. of oats gave 480 bu; and 101 bu. of potatoes gave 2100 bu.	Hind 1971a:152
1857	Red River Settlement	Wheat yield is 40 to 60 bu. per acre and each bushel weighs 64 to 70 lbs.	Podruckny 1990:16
1858	Lower Fort Garry Provisional Farm	Sowed 66 bu. wheat and thrashed 165 bu.; 17 bu. barley gave 102 bu.; ;6 bu. oats gave 36 bu.; 4 bu pease gave 33 bu.; 34 bu. potatoes gave 3050 bu.	Podruckny 1990:31
1858	Fort Edmonton	28 bu. wheat, 320 bu. potatoes	HBCA B.60/d/126
1859	Lower Fort Garry Provisional Farm	Crops gave 2000 bu. wheat.	Podruckny 1990:32
1860	Lower Fort Garry Provisional Farm and Lanis Post	Collectively produced 4000 bu. wheat.	Podruckny 1990:33
1864	Lower Fort Garry Provisional Farm	Potatoes yielded 3000 bu.	Podruckny 1990:38
1866	Prince Albert	First crop from mission and industrial farm yielded 600 bu. from 17 bu. sown.	Roe 1952:118

Table 32: Inventories of Domestic Animals at Selected Northern Plains Settlements, 1821-1867.

Year	Location	Inventory	Reference
1821	**Red River Settlement**	3 bulls 6 oxen 45 cows 39 calves 10 sheep 1 ram 12 pigs 78 horses	Morton 1938:21-22
1849	**Red River Settlement**	1,095 horses 990 mares 2,097 oxen 155 bulls 2,147 cows 1,615 calves 1,565 pigs 3,096 sheep	Morton 1938:22
1857	**Red River Settlement**	2,799 horses 2,726 oxen 290 bulls 3,593 cows 2,644 calves 4,674 pigs 2,429 sheep	Podruckny 1990:15
1865	**Red River Settlement**	2,799 horses 2,726 oxen 3,883 cattle 2,644 calves 4,674 pigs 2,429 sheep	Hind 1971a:228
1823/1824	**Fort Edmonton**	49 horses	HBCA B.60/d/15
1825/1826	**Fort Edmonton**	88 horses	HBCA B.60/d/18
1826/1827	**Fort Edmonton**	25 dogs 151 horses 9 pigs	HBCA B.60/d/21
1827/1828	**Fort Edmonton**	145 horses 13 dogs 25 pigs	HBCA B.60/d/21

1828/1829	**Fort Edmonton**	22 dogs 145 horses, 29 pigs	HBCA B.60/d/30
1856/1857	**Fort Edmonton**	70 horses	HBCA B.60/d/121
1857/1858	**Fort Edmonton**	62 horses 11 oxen 3 dogs	HBCA B.60/d/126
1836/1837	**Saskatchewan District**	18 oxen 20 cows 24 calves 286 horses 52 colts 3 sled dogs 1 buffalo	HBCA B.60/d/53
1938/1839	**Saskatchewan District**	27 oxen 31 cows 49 calves 327 horses 29 sled dogs 1 buffalo	HBCA B.60/d/59
1839/1840	**Saskatchewan District**	37 oxen 38 cows 41 calves 56 horses 14 colts 6 sled dogs	HBCA B.60/d/62
1842/1843	**Saskatchewan District**	69 oxen 64 cows 93 calves 387 horses 190 colts 45 sled dogs 8 buffalo	HBCA B.60/d/73
1843/1844	**Saskatchewan District**	122 horned cattle 7 buffalo	HBCA B.60/d/76
1853/1854	**Saskatchewan District**	37 bulls 110 cows 47 oxen 29 calves 851 horses 3 mules 54 dogs	HBCA B.60/d/106

1858/1859	**Saskatchewan District**	10 bulls 129 calves 61 cows 33 oxen 100 sled dogs	HBCA B.60/d/129
1859/1860	**Saskatchewan District**	21 bulls 23 calves 51 cows 21 oxen 348 horses 110 dogs	HBCA B.60/d/134
1862/1863	**Saskatchewan District**	12 bulls 16 calves 63 cows 89 oxen 405 horses 4 mules 126 dogs 5 pigs	HBCA B.60/d/148
1863/1864	**Saskatchewan District**	22 bulls 46 calves 87 cows 112 dogs 152 oxen 15 pigs 417 horses 4 mules	HBCA B.60/d/153
1864/1865	**Saskatchewan District**	21 bulls 35 calves 79 cows 123 oxen 408 horses 4 mules 121 dogs 33 + pigs	HBCA B.60/d/158
1865/1866	**Saskatchewan District**	28 bulls 62 calves 67 cows 144 oxen 621 horses 7 mules 111 dogs 63 pigs	HBCA B.60/d/164

1866/1867	**Saskatchewan District**	29 bulls 49 calves 85 cows 254 oxen 550 horses 7 mules 123 dogs 62 pigs	HBCA B.60/d/170
1854/1855	**Fort Pitt**	248 horses	HBCA B.60/d/114
1854/1855	**Carlton House**	10 bulls, 11 cows, 4 oxen 88 horses	HBCA B.60/d/114
1857/1858	**Carlton House**	1 sled dog 10 horses 4 oxen	HBCA B.60/d/126
1856/1857	**Rocky Mountain House**	53 horses	HBCA B.60/d/121

Notes:

(a) There are gaps in the information listed above. For example, the 1843/1844 entry for Saskatchewan District which lists 122 horned cattle and 7 bison as the only livestock should include horses, dogs and perhaps pigs, oxen etc.

(b) The first few entries were explicity for Fort Edmonton but subsequent entries lump together livestock from all the posts in the Saskatchewan district.

Table 33: Documentation of Immense Herds of Bison in the Northern Plains, 1691-1869.

Date	Location	Observer	Reference
Aug. 1691	Central Saskatchewan	Henry Kelsey	Dougherty and Martin 1929:13
Sept. 1691	Central Saskatchewan	Henry Kelsey	Dougherty and Martin 1929:14
Sept. 1738	S. Manitoba	La Verendrye	Burpee 1927:303
June 1742	Black Hills	La Verendrye	Burpee 1927:408
Sept. 1754	Sounding Creek	Anthony Henday	Burpee 1907:333
Oct. 1754	Muscuty Plains	Anthony Henday	Burpee 1907:336
Feb. 1776	Humboldt area and Fort des Prairies	Alexander Henry, the Elder	Bain 1969:318
Aug. 1788	Hudson House	David Thompson	Hopwood 1971:102
Dec. 1792	Pekisko Creek	Peter Fidler	Haig 1991:39
Feb. 1793	Red Deer River	Peter Fidler	Haig 1991:76
May 1793	Fort George	John MacDonald of Garth	Masson 1890:18
Oct. 1793	Qu'Appelle Valley	John MacDonald of Garth	Gates 1965:115
Sept. 1794	Fort George	Duncan McGillivray	Morton 1929:23
Sept. 1794	Qu'Appelle Valley	John MacDonald of Garth	Wood 1984:110
Jan 1795	Fort Esperance	John MacDonald of Garth	Wood 1984:119
Jan 1797	Fort Edmonton	George Sutherland	Johnson 1967:81
May 1799	Buckingham House	William Tomison	Johnson 1967:245
Feb. 1800	Fort Alexandria	Daniel Harmon	Lamb 1957:43
Aug. 1800	Lower S. Sask. R.	Peter Fidler	Johnson 1967:255
Sept. 1800	Park River Post	Alexander Henry, the Younger	Coues 1965:86-87
Sept. 1800	S. Sask. R.	Peter Fidler	Johnson 1967:261

Oct. 1800	S. Sask. R.	Peter Fidler	Johnson 1967:270
Dec. 1800	Park River Post	Alexander Henry, the Younger	Coues 1965:160
Jan 1801	Park River Post	Alexander Henry, the Younger	Coues 1965:163
Sept. 1801	S. Sask. R.	Peter Fidler	Johnson 1967:293
Oct. 1801	Chesterfield House	Peter Fidler	Johnson 1967:298
Nov. 1801	Chesterfield House	Peter Fidler	Johnson 1967:300
Dec. 1801	Chesterfield House	Peter Fidler	Johnson 1967:305
Feb. 1802	Chesterfield House	Peter Fidler	Johnson 1967:309
Nov. 1802	Pembina River Post	Alexander Henry, the Younger	Coues 1965:205
Dec. 1802	Pembina River Post	Alexander Henry, the Younger	Coues 1965:207
Feb. 1803	Pembina River Post	Alexander Henry, the Younger	Coues 1965:208
Sept. 1803	Pembina River Post	Alexander Henry, the Younger	Coues 1965:225
Winter 1804	Mandan Villages	Charles McKenzie	Wood and Thiessen 1985:231
Feb. 1804	Qu'Appelle Valley	Daniel Harmon	Lamb 1957:72
Nov. 1804	Souris R.	François Antoine Larocque	Larocque 1910
Dec. 1804	Mandan Villages	Lewis and Clark	Thwaites 1959a: 234
April 1805	Missouri R. from Mandan Villages to the Yellowstone	Lewis and Clark	Thwaites 1959a: 326
May 1805	Missouri R. from Yellowstone R. to Musselshell R.	Lewis and Clark	Thwaites 1959a: 362
May 1805	Missouri R. from Musselshell R. to Marias R.	Lewis and Clark	Thwaites 1959b: 10

June 1805	Missouri R. between Marias R. and Great Falls	Lewis and Clark	Thwaites 1959b: 144
July 1805	Missouri R. between Great Falls and Three Forks	Lewis and Clark	Thwaites 1959b: 234
July 1805	Upper reaches of Missouri R.	Lewis and Clark	Thwaites 1959b: 199
July 1805	Marias R.	Lewis and Clark	Thwaites 1959b: 208
Aug. 1805	Mandan Villages	Charles MacKenzie	Wood and Thiessen 1985:251
Nov. 1805	Pembina R. Post	Alexander Henry, the Younger	Coues 1965:273
March 1806	South Branch Fort	Daniel Harmon	Lamb 1957:99
July 1806	Souris River	Alexander Henry, the Younger	Coues 1965:308
Aug. 1806	Missouri River	Alexander Henry, the Younger	Coues 1965: 408
Aug. 1807	Pembina River Post	Alexander Henry, the Younger	Coues 1965:424
Oct. 1807	Pembina River Post	Alexander Henry, the Younger	Coues 1965:425
Sept. 1808	Carlton House	Alexander Henry, the Younger	Coues 1965: 491
July 1810	New White Earth House	Alexander Henry, the Younger	Coues 1965:614
June 1811	Middle Missouri R.	John Bradbury	Bradbury 1966:105
June 1811	Middle Missouri R.	H. M. Brackenridge	Brackenridge 1966:108
Sept 1833	Mauvaises Terre on Missouri R.	Maximilian	Thwaites 1905b:174
Jan 1834	Fort Clark	Maximilian	Thwaites 1905b:62
Aug. 1834	Fort Clark	François Auguste Chardon	Abel 1932:4
June 1835	Fort Clark	François Auguste Chardon	Abel 1932:32

Jan. 1836	Yellowstone R. to Little Missouri R., on Missouri R.	François Auguste Chardon	Abel 1932:54
Jan 1838	Fort Clark	François Auguste Chardon	Abel 1932:146
Feb. 1838	Fort Clark	François Auguste Chardon	Abel 1932: 148
Oct. 1838	Fort Clark	François Auguste Chardon	Abel 1932:172
Nov. 1838	Fort Clark	François Auguste Chardon	Abel 1932:175
Jan. 1839	Fort Clark	François Auguste Chardon	Abel 1932: 181
Oct. 1840	Between Carlton House and Fort Pitt	Rev. Robert T. Rundle	Dempsey 1977:41
April 1841	Bow R. to N. Sask. R.	Rev. Robert T. Rundle	Dempsey 1977:65
July 1843	Souris R.	John James Audubon	Audubon 1960b:122
Aug. 1845	Carlton House to Rocky Mountain House	Rev. Robert T. Rundle	Dempsey 1977:188
Sept 1846	Fort Pitt	Paul Kane	MacLaren 1989:81
Nov. 1846	Fort Edmonton	Paul Kane	Harper 1971:137
April 1856	Fort Benton		McDonnell 1940:71
Sept. 1857	S. Sask. R.	Capt. John Palliser	Spry 1968:150
Dec. 1857	Between Fort Pitt and Fort Edmonton	James Hector	Spry 1968:198
July 1858	Neutral Hills	Capt. John Palliser	Spry 1968:240
Summer 1858	Knife R.	Henry Boller	Quaife 1972:133
Fall 1858	Fort Atkinson	Henry Boller	Quaife 1972:187
July 1859	S. Sask. R.	The Earl of Southesk	The Earl of Southesk 1969:93
June 1862	Fort Union	Lewis Henry Morgan	White 1959b:173

Summer 1865	Pigeon L.	Rev. J. McDougall	McDougall 1898:93
Summer 1869	Touchwood Hills	Isaac Cowie	Cowie 1913:374

Note:
(a) Includes only those journal entries which specified day, month and/or season.

(b) Includes only those journal references which described bison herds as innumerable, immense, in the thousands, as far as the eye could see or some similar specification.

Table 34: Seasonal and Geographic Distribution of Immense Herds of Bison, Sighted Between 1691-1869.

Season	N. Sask. R	S. Sask. R.	Missouri R.	Red/ Assiniboine R.	Total
Winter	2(11.8%)	3(18.8%)	6(21.4%)	5(25.0%)	16 19.8%
Spring	2(11.8%)	1(6.3%)	10(35.7%)	—	13 16.1%
Summer	9(52.9%)	7(43.8%)	8(28.6%)	8(40.0%)	32 39.5%
Fall	4(23.5%)	5(31.3%)	4(14.3%)	7(35.0%)	20 24.7%
Total	17(100.0)	16(100.2%)	28(100.0%)	20(100.0%)	81 100.1%

Notes:

(a) **Months/Seasons**: January, February, March (**Winter**); April, May, June (**Spring**); July, August, September (**Summer**); October, November, December (**Fall**).

(b)**Sources:** Data derived from references in Table 33.

Table 35: Documentation of Animal Movements as Resource Stressor in the Northern Plains, 1738-1888 (By Decade).

Decade	N. Sask.R.	S. Sask. R.	Missouri R.	Red/ Assini-boine R.	Total
1730-1739	-	-	1	-	1(0.5%)
1740-1749	-	-	-	-	-
1750-1759	3	-	-	-	3(1.4%)
1760-1769	-	-	-	-	-
1770-1779	5	-	-	-	5(2.3%)
1780-1789	-	1	-	-	1(0.5%)
1790-1799	13	1	2	3	19(8.9%)
1800-1809	1	2	9	19	31(14.6%)
1810-1819	8	-	1	2	11(5.2%)
1820-1829	4	1	-	-	5(2.3%)
1830-1839	-	1	-	39	40(18.8%)
1840-1849	7	5	6	-	18(8.5%)
1850-1859	16	5	22	5	48(22.5%)
1860-1869	15	-	1	1	17(8.0%)
1870-1879	5	2	1	4	12(5.6%)
1880-1889	-	1	-	i	2(0.9%)
Total	77(36.2)%	19(8.9%)	35(16.4%)	82(38.5%)	213 (100.0%) (100.0%)

<u>Sources:</u> Abel 1932, Audubon 1960b, Bain 1969, Bradbury 1966, Burpee 1907, Burpee 1927, Cheadle 1971, Coues 1965, Cowie 1913, Dempsey 1977, Dodge 1884, Franchère 1854, Gates 1965, Haig 1991, Harper 1971, Hewitt 1870, Hind 1971, Hopwood 1971, HBCA B.21/a/1, B.27/e/2, B.27/e/3, B.27/e/4., B.27/e/5, and Search Files-Touchwood Hills Post, Johnson 1967, Lamb 1957, Larocque 1910, MacLaren 1989, Masson 1890, McDermott 1952, McDonnell 1940, McDougall 1896, 1898, 1983, McEachran 1881, Merk 1968, Moberly 1929, Morton 1929, Palliser 1969, Pritchett 1942, Quaife 1972, Robertson-Ross 1872, The Earl of Southesk 1969, Spry 1968, Thwaites 1906, Thwaites 1959a, 1959b, 1959c, White 1959b, Wood and Thiessen 1985.

Table 36: Seasonal Occurrence of Animal Movements as Resource Stressor in the Northern Plains, 1738-1888.

Season	N. Sask.R.	S. Sask. R.	Missouri R.	Red/ Assini-boine R.	Total
Winter	20	1	29	9	59(28.1%)
Spring	18	6	16	1	41(19.5%)
Summer	17	6	21	12	56(26.7%)
Fall	22	5	15	12	54(25.7%)
Total	77(36.7%)	18(8.6%)	81(38.6%)	34(16.2%)	213 (100.0%) (100.1%)

<u>Sources:</u> Abel 1932, Audubon 1960b, Bain 1969, Bradbury 1966, Burpee 1907, Burpee 1927, Cheadle 1971, Coues 1965, Cowie 1913, Dempsey 1977, Franchère 1854, Gates 1965, Haig 1991, Harper 1971, Hewitt 1870, Hind 1971, Hopwood 1971, HBCA B.21/a/1, B.27/e/2, /B.27/e/3, B.27/e/4. and B/27/e/5, Johnson 1967, Lamb 1857, Larocque 1910, MacLaren 1989, Masson 1890, McDermott 1952, McDonnell 1940, McDougall 1896, 1898, 1983, Merk 1968, Moberly 1929, Morton 1929, Palliser 1969, Pritchett 1942, Quaife 1972, Robertson-Ross 1872, The Earl of Southesk 1969, Spry 1968, Thwaites 1906, Thwaites 1959a, 1959b, 1959c, White 1959b, Wood and Thiessen 1965.

Table 37: Monthly Reports of Large-Scale Buffalo Deaths by Drowning in the Northern Plains, 1794-1857.

Month	N. Sask.R.	S. Sask. R.	Missouri R.	Red/ Assini-boine R.	Total
January					
February					
March			1		1(10.0%)
April			1	1	2(20.0%)
May	1		1	1	3(30.0%)
June			1		1(10.0%)
July					
August	1	1	1		3(30.0%)
September					
October					
November					
December					
Total	2(20.0%)	(10.0%)	5(50.0%)	2(10.0%)	10(100.0%) (100.0%)

Sources: Audubon 1960, Coues 1965, Harper 1971, Hind 1971, Masson 1889, MacLaren 1989, Thwaites 1959a, 1959b, 1959c.

Table 38: Documentation of Prairie Fires in the Northern Plains, 1750-1869 (By Decade).

Decade	N. Sask.R.	S. Sask. R.	Missouri R.	Red/ Assini-boine R.	Total
1750-1759	1	-	-	-	1(1.8%)
1760-1769	-	-	-	-	-
1770-1779	-	-	-	-	-
1780-1789	-	-	-	-	-
1790-1799	5	2	-	-	7(12.5%)
1800-1809	1	1	6	12	20(35.7%)
1810-1819	3	-	-	-	3(5.3%)
1820-1829	-	-	-	-	-
1830-1839	-	-	12	-	12(21.4%)
1840-1849	6	-	-	-	6(10.7%)
1850-1859	2	-	2	2	6(10.7%)
1860-1869	1	-	-	-	1(1.8%)
Total	19(33.9%)	3(5.4%)	20(35.7%)	14(25.0%)	56(99.9%) (100.0%)

Sources: Abel 1932, Burpee 1907, Cheadle 1971, Coues 1965, Dempsey 1977, The Earl of Southesk 1968, Haig 1991, Harper 1971, Hewitt 1970, Hind 1971, Johnson 1967, Lamb 1957, Larocque 1910, Morton 1929, Quaife 1972, Spry 1968, Thwaites 1959a, 1959b, 1959c, Wood and Thiessen 1985.

Table 39: Seasonal Occurrence of Prairie Fires in the Northern Plains, 1754-1863.

Season/ Month	N. Sask. R.	S. Sask. R.	Missouri R.	Red/ Assini-boine R.	Total
Winter					
January	2	1	1	-	4
February	-	-	-	-	-
March	1	-	4	1	6
Subtotal	3(15.8%)	1(33.3%)	5(25.0%)	1(7.2%)	10(17.9%)
Spring					
April	2	-	4	1	7
May	4	-	1	1	6
June	-	-	-	1	1
Subtotal	6(31.6%)	-(0%)	5(25.0%)	3(21.4%)	14(25.0%)
Summer					
July	1	-	2	1	4
August	-	1	2	-	3
September	2	-	1	-	3
Subtotal	3(15.8%)	1(33.3%)	5(25.0%)	1(7.2%)	10(17.9%)
Fall					
October	5	-	1	6	12
November	2	-	2	3	7
December	-	1	2	-	3
Subtotal	7(36.8%)	1(33.3%)	5(25.0%)	9(64.3%)	22(39.3%)
Total	19(100.0%) (33.9%)	3(99.9%) (5.4%)	20(100.0%) (35.7%)	14(100.1%) (25.0%)	56(100.1%)1 0100.0%)

<u>Sources:</u> Abel 1932, Burpee 1907, Cheadle 1971, Coues 1965, Dempsey 1977, The Earl of Southesk 1969, Haig 1991, Harper 1971, Hewitt 1970, Hind 1971, Johnson 1967, Lamb 1957, Larocque 1910, Morton 1929, Quaife 1972, Spry 1968, Thwaites 1959a, 1959b, 1959c, Wood and Thiessen 1985.

Table 40: Monthly Reports of Large-Scale Buffalo Deaths by Prairie Fire in the Northern Plains, 1794-1857.

Month	N.Sask R.	S. Sask. R.	Missouri R.	Red Assin-boine R.	Total
January					
February					
March					
April					
May		1			1(33.3%)
June					
July					
August					
September					
October				1	1(33.3%)
November				1	1(33.3%)
December					
Total		1(33.3%)		2(66.7%)	3(99.9%) (100.0%)

Sources: Coues 1965, Dempsey 1977, Wood and Thiessen 1985.

Table 41: Documentation of Drought Episodes in the Northern Plains, 1730 to 1869 (By Decade).

Decade	N. Sask. R.	S. Sask. R.	Missouri R.	Red/ Assini-boine R	Total
1730-1739	-	-	-	1	1(3.6%)
1740-1749	-	-	-	-	-
1750-1759	-	-	-	-	-
1760-1769	-	-	-	-	-
1770-1779	-	-	-	-	-
1780-1789	-	-	-	-	-
1790-1799	1	-	-	1	2(7.1%)
1800-1809	1	-	-	7	8(28.6%)
1810-1819	1	-	-	1	2(7.1%)
1810-1829	3	-	-	-	3(10.7%)
1830-1839	-	-	5	-	5(17.8%)
1840-1849	1	1	-	1	3(10.7%)
1850-1859	1	-	-	2	3(10.7%)
1860-1869	1	-	-	-	1(3.6%)
Total	9(32.1%)	1(3.6%)	5(17.9%)	13(46.4%)	28(99.9%((100.0%)

__Notes:__

(a) This table includes clearly specified periods of drought which occurred during Spring/Summer/Fall, as well as open winters when little precipitation fell.

(b) The greater frequency of reports of drought for the Red/Assiniboine R. area may be due to the earlier beginning of agriculture at trading posts and settlements in that area.

(c) __Sources__: Abel 1932, Burpee 1927, Coues 1965, Dempsey 1977, HBCA B.27/e/2 and B.27/e/4, Lamb 1957, MacLaren 1989, McDougall 1983, Merk 1968, Pritchett 1942, Spry 1968, Thwaites 1906, Wood and Thiessen 1985.

Table 42: Documentation of Drought Episodes in the Northern Plains, 1738-1869 (By Season).

Season	N. Sask R.	S. Sask. R.	Missouri R.	Red/ Assini- boine R.	Total
Winter	2	-	1	3	6 (21.4%)
Spring	5	1	1	2	9 (32.1%)
Summer	1	-	2	4	7 (25.0%)
Fall	1	-	1	4	6 (21.4%)
Total	9(32.1%)	1(3.6%)	5(17.9%)	13(46.4%)	28(99.9%) (100.0%)

Notes:

(a) The greater frequency of reports of drought for the Red/Assiniboine R. area may be due to the earlier beginning of agriculture at trading posts and settlements in that area.

(b) **Winter** (January, February, March), **Spring** (April, May, June), **Summer** (July, August, September), **Fall** (October, November, December)

(c) Sources: Abel 1932, Burpee 1927, Coues 1965, Dempsey 1977, HBCA B.27/e/2, B.27/e/4, Lamb 1957, MacLaren 1989, McDougall 1983, Merk 1968, Pritchett 1942, Spry 1968, Thwaites 1906, Wood and Thiessen 1985.

Table 43: References to Game/Fur-Bearing Animals in Poor Condition in the Northern Plains, 1754-1867.

Dates	Observer	Location	Description	Reference
Sept. 1754	Anthony Henday	Battleford	"I killed a Bull Buffalo, nothing but skin and bone; took out his tongue, and left his remains to the Wolves. . . ."	Burpee 1907:332
Oct. 9, 1772	Matthew Cocking	Eagle Hills	"Male Buffalo our food at present; very poor excepting in spring".	Burpee 1908:108
Year of 1787	Blackfoot Winter Count	Blackfoot Territory	"The year of disease among the antelope".	Raczka 1979:28
May 1797	George Sutherland	Fort Edmonton	". . . the Souther'd Indians. . . informed me that there has been a distemper among the beaver of which great numbers have died as they are daily seen floating on the water since the breakup of the ice".	Johnson 1967:92
Dec. 1802	Alexander Henry, the Younger	Hair Hills	"We have nothing but tough and lean bulls to eat."	Coues 1965: 232
Year of 1803	Blackfoot Winter Count	Blackfoot Territory	"The year of disease among the buffalo".	Raczka 1979:34
Feb. 4, 1805	Lewis and Clark	Mandan Villages	". . . killed two deer this evening, both very lean. . . ."	Thwaites 1959a:254
Feb. 12, 1805	Lewis and Clark	Mandan Villages	". . . arrived with hunting party. . . have killed forty Deer, three buffaloe bulls, and sixteen Elk, most of them were so meagre that they were unfit for uce particularly the Buffaloe and male Elk. . . ."	Thwaites 1959a: 259

Feb. 1, 1805	Lewis and Clark	Mandan Villages	". . . I killed 2 Deer the hunters killed an Elk, Buffalow Bull, and 5 Deer, all Meager".	Thwaites 1959a:260
Feb. 13, 1805	Lewis and Clark	Mandan Villages	"The Buffalow Seen last night provd to be Bulls. lean and unfit for to make use of as food. . . . "	Thwaites 1959a:260
April 2, 1805	Lewis and Clark	Mandan Villages	'The Mandans killed twenty one elk yesterday 15 miles below this, they were so Meager that they [were] scercely fit for use".	Thwaites 1959a: 279
April 13, 1805	Lewis and Clark	Missouri R. near mouth of Little Missouri R.	"We killed 2 antelopes today which we found swiming from the S. to the N. Side of the river; they were very poor".	Thwaites 1959a:303
April 14, 1805	Lewis and Clark	Missouri R. near mouth of Little Missouri R.	"Capt. Clark killed a buffaloe bull; it was meagre, and we therefore took the marrow bones and a small proportion of the meat only".	Thwaites 1959a:307
April 25, 1805	Lewis and Clark	Missouri R. between Little Missouri and Yellowstone R.	". . . killed three cows and a calf. two of the former wer but lean, we therefore took their tongues and a part of their marrow-bones only."	Thwaites 1959a:335
May 6, 1805	Lewis and Clark	Missouri R. between Yellowstone R.and Musselshell R.	". . . killed two Elk neither of which was fat, we saved the best of the meat. . . ."	Thwaites 1959b:6

April,18, 1810	Alexander Henry, the Younger	Fort Vermillion	"Mr. Rocque. . . saw upward of 60 dead buffalo; at this season many are so weak that if they lie down they cannot rise".	Coues 1965:594
July 3, 1810	Alexander Henry, the Younger	New White Earth House	'The doe moose and cows are wretchedly lean and will continue so until the latter end of the month".	Coues 1965:609
Oct. 17, 1810	Alexander Henry, the Younger	Lower Terre Blanche House	"My people prefer to purchase fat dogs from the Indians to eat rather than to live upon lean buffalo meat".	Coues 1965:654
Year of 1826	Blackfoot Winter Count	Blackfoot Territory	"The year of mange amongst cattle".	Raczka 1979:41
March 16, 1837	François Auguste Chardon	Fort Clark	"The Indians that arrived brought a little poor Bull Meat, having saw no Cows".	Abel 1932:103
March 1859	Henry Boller	Fort Atkinson	"The buffaloes were getting poor in flesh as it was near the time to calve".	Quaife 1972:278
July 1859	The Earl of Southesk	S. Sask. R.	"Like many of the males at that season this fine, well-grown bull was exceedingly scant of flesh, so we left his carcass, and merely brought in the tongue".	The Earl of Southesk 1969:86
Fall 1866	Rev. John McDougall	Pigeon Lake	"But while the fish were plentiful, they were of a very poor quality, both wormy and lean, so that out of hundreds a very small percentage was fit to eat".	McDougall 1898:178

Winter 1866-67	Rev. John McDougall	Fort Edmonton to Pigeon Lake	"An old bull was shot, but we could eat nothing of him except the heart and tripe and the tongue. Even our dogs declined the meat".	McDougall 1898:89-90

Table 44: Documentation of Enemy Threat or Action as Resource Stressor in the Northern Plains, 1790-1879 (By Decade).

Decade	N. Sask. R.	S. Sask. R.	Missouri R.	Red/ Assini-boine R.	Total
1790-1799	-	-	1	-	1(4.0%)
1800-1809	-	2	1	1	4(16.0%)
1810-1819	1	-	1	1	3(12.0%)
1820-1829	-	-	-	-	-
1830-1839	-	1	5	-	6(24.0%)
1840-1849	-	-	1	-	1(4.0%)
1850-1859	-	2	7	-	9(36.0%
1860-1869	-	-	-	-	-
1870-1879	1	-	-	-	1(4.0%)
Total	2(8.0%)	5(20.0%)	16(64.0%)	2(8.0%)	25(100.0%) (100.0%)

<u>Sources:</u> Abel 1932, Bradbury 1966, Butler 1968, Coues 1965, HBCA B.27/e/1 and B.21/a/1, Hewitt 1970, Johnson 1967, Lamb 1957, McDonnell 1940, Palliser 1969, Pritchett 1942, Quaife 1972, The Earl of Southesk 1969, Spry 1968, Thwaites 1906, 1959a, 1959b, 1959c, Wood and Thiessen 1985.

Table 45: Documentation of Enemy Threat or Action as Resource Stressor in the Northern Plains, 1790-1879 (By Season)

Season	N. Sask.R.	S. Sask. R.	Missouri R.	Red/ Assini-boine R.	Total
Winter	-	1	2	-	3(12.0%)
Spring	-	1	7	1	9(36.0%)
Summer	1	3	6	1	11(44.0%
Fall	1	-	1	-	2(8.0%)
Total	2(8.0%)	5(20.0%)	16(64.0%)	2(8.0%)	25(100.0%) (100.0%)

Sources: Abel 1932, Bradbury 1966, Butler 1968, Coues 1965, HBCA B.27/e/1 and B.21/a/1, Hewitt 1970, Johnson 1967, Lamb 1957, McDonnell 1940, Palliser 1969, Pritchett 1942, Quaife 1972, The Earl of Southesk 1969, Spry 1968, Thwaites 1906, 1959a, 1959b, 1959c, Wood and Thiessen 1985.

Table 46: Documentation of Human Disease in the Northern Plains, 1764-1883.

Date	Location	Description	Observer/ Recorder	Reference
Year of 1764	Blackfoot Territory	"The year of big smallpox scare".	Blackfoot Winter Count	Raczka 1979:21
May 1773	N. Sask. R.	"An Indian came from those down the river: Informs me that many are sickly. . . ."	Matthew Cocking	Burpee 1908:117
Year of 1780	Blackfoot Territory	"Year of cough disease or first appearance of consumption". (another name for measles)	Blackfoot Winter Count	Raczka 1979:25
1781-82	Fort Rouge	". . . in 1781-82; and at the time the smallpox made such havoc many hundreds of men, women, and children were buried here".	Alexander Henry, the Younger	Coues 1965:46
Sept. 1795	Buckingham House	". . . arrived at Buckingham House, found all well thank God, but sorry to hear of the death of so many useful Indians".	William Tomison	Johnson 1967:11-12
Jan. 1801	Southern Alberta	"Accounts of the smallpox being among the Blood Indians".	Archibald McLeod	Gates 1965:155
Sept. 1802	Pembina River Post	"This [pulmonary consumption] is the most common disease among them".	Alexander Henry, the Younger	Coues 1965:204
Oct. 1803	Pembina River Post	"Indians are sick with coughs and some at the point of death. . . ."	Alexander Henry, the Younger	Coues 1965:228
1806	Mandan Villages	"There was a violent Cough, or a Chincough among the Missurie Indians which carried away by their own calculation, 130 souls old and young in less than a months time".	Charles McKenzie	Wood and Thiessen 1985:270

Nov. 1810	Rocky Mtn. House	". . . Gros Blanc, chief of the Cold band, died a few days ago of the prevalent disease. All the Indians in the plains are affected with it".	Alexander Henry, the Younger	Coues 1965:660
Spring 1813	Red River Settlement	". . . a dangerous fever epidemic, a new disease in Hudson's Bay and attributed to the deficient subsistence during the preceding winter, and the abominably filthy habits. . . ."	Miles Macdonnell	Pritchett 1942:114
Winter 1819/ 1820	Brandon House	"Measles killed many Algonquins".	Vera Pybus	Pybus 1983:25
August 1835	Fort Clark	". . . The Diarrhoea . ., it is among the Mandans, some have died in 12 hours after its first appearance. . . ."	François Auguste Chardon	Abel 1932:45
Summer 1835	Saskatch-ewan District	". . . the epidemic (influenza) seems to have been spread to the Saskatchewan District by brigades from that area which arrived at Norway House . . . ."	Arthur J. Ray	Ray 1990:74
July 1837	Fort Clark	"A young Mandan died to day of the small pox- several others has caught it- the Indians all being out Makeing dried Meat has saved several of them __".	François Auguste Chardon	Abel 1932:126
Aug. 1837	Fort Clark	"News from the Gros Ventres. . . a great many of them have died of the small pox. . . I keep no a/c of the dead, as they die so fast that it is impossible__".	François Auguste Chardon	Abel 1932:126

Aug. 1837	Fort Clark	". . . the disease broke out at the Fort six days ago. . . the Number of Deaths up to the Present is very near five hundred. . . ."	François Auguste Chardon	Abel 1932:133
Sept. 1837	Fort Clark	". . . it has destroyed the seven eights of the Mandans and one half of the Rees Nations . . . ."	François Auguste Chardon	Abel 1932:138
Dec. 1837	Fort Clark	". . .Gros Ventre. . .in all probability they are all Dead, the last News that he had from them was that 117 had died, and the disease was still rageing".	François Auguste Chardon	Abel 1932:145
Jan. 1838	Fort Clark	"The small pox still ravegeing".	François Auguste Chardon	Abel 1932:147
Year of 1837	Blackfoot Territory	"The year of smallpox".	Blackfoot Winter Count	Raczka 1979:45-46
March 1838	Fort Clark	". . .The small Pox is still rageing with the Gros Ventres".	François Auguste Chardon	Abel 1932:153
May 1838	Fort Clark	"__. . .an Indian died at the Village of the Small Pox".	François Auguste Chardon	Abel 1932:161
Year of 1839	Blackfoot Territory	"The year of small pox".	Blackfoot Winter Count	Running Rabbit n.d.:1
Year of 1840	Blackfoot Territory	"The Big epidemic year".	Teddy Yellow Fly	Yellow Fly n.d.:1
Summer thru' fall 1843	Red R.	". . . the disease (scarlet fever) appeared first among the Red River colonists in mid-summer . . . and spread among the Indians . . . ."	Arthur J. Ray	Ray 1990:79
Sept. 1846	Fort Pitt to Fort Edmonton	". . . saw the boans of a partey of Creese that died of the small pox. . . ."	Paul Kane	MacLaren 1989:32

Nov. 1846	Rocky Mtn. House	"He died with the measles. Many deaths have occurred".	Rev. Robert T. Rundle	Dempsey 1977:246
Fall and Winter 1846	Saskatch-ewan District	". . . influenza did make its appearance once more. . . ."	Arthur J. Ray	Ray 1990:77
Summer 1846	Red R.	"The measles epidemic of 1846 first appeared in the Red River area. . . ."	Arthur J. Ray	Ray 1990:79
July 1851	Fort Berthold	"P. Gareau is back from Fort Clark. He declares that the Mandan have cholera. . . the epidemic grows constantly worse. Hardly an Indian seen outside their village. . . many Indians are sick afflected with dry cough and pains in the head".	Rudolph F. Kurz	Hewitt 1970
Aug. 1851	Fort Berthold	"This recent epidemic is getting the upper hand- not a day that somebody dies in the village . . . The entire blame for the cholera epidemic was cast upon me".	Rudolph F. Kurz	Hewitt 1970:98
Oct. 1851	Fort Berthold	"Arikara are still dying like flies under frost".	Rudolph F Kurz	Hewitt 1970:167
Year of 1864	Blackfoot Territory	The year of smallpox".(a scarlet fever epidemic called sikpixosin or black smallpox, in Blackfoot)".	Blackfoot Winter Count	Raczka 1979:56
Year of 1865	Blackfoot Territory	"Black pox year".	Houghton Running Rabbit	Running Rabbit n.d.:2
Year of 1865	Blackfoot Territory	"The year of the Black Epidemic".	Teddy Yellow Fly	Yellow Fly n.d.:1
Year of 1868	Blackfoot Territory	"Year of smallpox(little)".	Blackfoot Winter Count	Raczka 1979:60
Year of 1869	Blackfoot Territory	"Smallpox years (Three Sun died)".	Houghton Running Rabbit	Running Rabbit n.d.:2

Summer 1869	Canadian Prairies	"But as the season advanced rumors of the dread disease of smallpox, which had decimated these people about ten years before, being rife among the Assiniboines along the Missouri was confirmed".	Isaac Cowie	Cowie 1913:380-81
Summer 1870	Missouri R. Valley	"To add to this came rumors of some fell disease to the south of us. It was said that the Indians beyond the border were dying by the hundreds. Smallpox. . . ."	Rev. John McDougall	McDougall 1983:117
Oct. 1870	Saskatch-ewan District	"A terrible disease had swept for some months previous to the date of my journey, the Indian tribes of Sasakchewan__Smallpox in its most aggravated type, had passed from tribe to tribe, leaving in its track depopulated wigwams and vacant council lodges; thousands. . . had perished on the great sandy plains that lie between the Saskatchewan and the Missouri".	William Francis Butler	Butler 1968:202

Nov. 1870	Fort Carlton and Fort Pitt	"I cannot say that Carlton was at all a lively place of sojourn. Its natural gloom was considerably deepened by the events of the last few months, and the whole place seemed to have received the stamp of death upon it. . . Fort Pitt was free from smallpox, but it had gone through a fearful ordeal; more than one hundred Crees had perished close arounds its stochades".	William Francis Butler	Butler 1968:229, 250
Dec. 1870	Fort Victoria	"Smallpox had not been the only evil from which Victoria had suffered. . . To add to the misfortunes of the settlement, the buffalo were far out in the great plains; so between disease, war and famine, Victoria had had a hard time of it. . . ."	William Francis Butler	Butler 1968:303-04
Year of 1870	Blackfoot Territory	"Another epidemic year".	Teddy Yellow Fly	Yellow Fly n.d.:2
Fall of 1870-71	Pigeon Lake	". . . mumps this season. Several dead. . . ."	Rev. John McDougall	McDougall 198[illegible]
Year of 1883	Blackfoot Territory	"Year of disease".	Blackfoot Winter Count	Raczka 1979:70

Table 47: Documentation of Resource Stressors Affecting Domestic Animals in the Northern Plains, 1773-1781.

Date	Observer	Location	Description	Reference
Jan. 1773	Matthew Cocking	Bet. N. and S. Sask R.	"A Horse died for want and ourselves hard pinched for want of food".	Burpee 1908:113
Feb. 1773	Matthew Cocking	Bet. N. and S. Sask. R.	"An elderly man died; also several Horses for want of food; which they say is the case at this season of the year".	Burpee 1908:114
Nov. 1794	John Macdonell	Fort Qu'Appelle	". . . St. James found his mare dead and half eaten".	Wood 1984:117
April1795	Duncan McGillivray	Fort George	"This morning. . . 30 Blood Indians and 10 Blackfoot arrived; they have carried all their commodities on dogs, their horses being too much exhausted by hunger to undergo the fatigues of the Journey".	Morton 1929:69
Aug. 1798	William Tomison	Bucking-ham House	". . .they are poorly for provisions at both houses, and the horse stealers has stole all their horses and left them none to fetch meat upon".	Johnson 1967:142
Feb. 1802	Peter Fidler	Chester-field House	"Our hunter came to the house and tell us that two of our horses is killed by the cold and deep snow. . . ."	Johnson 1967:310
Feb. 1802	Alexander Henry, the Younger	Pembina R. Post	"One of our horses. . . fell. . .in the river, and perished. . . Buffalo have destroyed all the grass, and our horses are starving".. ".	Coues 1965:193

Aug. 1802	Daniel Harmon	Fort Alexandria	". . . I received a letter from Mr. McLeod, who is at Alexandria, informing me. . . the Assiniboines, who are noted thieves, ran away with twenty-two of his horses".	Haskel 1911:63
May 1802	Daniel Harmon	Fort Alexandria to Bird Mtn. Post	". . .in crossing this river, I drowned my horse. . . ."	Haskel 1911:64
Dec. 1804	François Antoine Larocque	Fort Mandan	"Sent the Co. horses down to the Lower village there being no food for them here, plains being all burnt. . . Heard that 16 horses had been stolen at the upper village by the Assiniboines".	Wood and Thiessen 1985:141
June 1810	Alexander Henry, the Younger	Near Fort George	"We made frequent stops to rest our lean, weak horses".	Coues 1965:602
Aug. 1810	Alexander Henry, the Younger	New White Earth House	"We learned that all our horses below have been stolen by the Assiniboines. . . ."	Coues 1965:620
Feb. 1811	Alexander Henry, the Younter	Kootenay Plains	". . .our dogs, which have been three days without eating".	Coues 1965:696
Spring 1813	Miles Macdonell	Red River Settlement	"They had been left at the point with a cow and a bull; and one ewe, two rams, and all the lambs but one had died. The summer did not seem to change their fortune, five more being killed by dogs".	Pritchett 1942:113
Oct. 1833	Maximilian, Prince of Wied-Neuwied	Fort Union	"The horses could now find no food, except the bark of the poplar trees, and appeared to be quite ravenous. . . they completely gnawed off the oil paint on the wooden palisades".	Thwaites 1906:205

May 1835	François Auguste Chardon	Fort Clark	"I fear for my Indian horses- as they are in a poor condition- and no grass for them to eat".	Abel 1932:31
Feb. 1838	François Auguste Chardon	Fort Clark	"An other of My Mules died last Night".	Abel 1932:150
Feb. 1838	François Auguste Chardon	Fort Clark	". . . the Indian Horses, being Poor, they kill but few".	Abel 1932:150
Feb. 1839	François Auguste Chardon	Fort Clark	"Run a band of Cows on the hill, our Horses being poor, could not catch them".	Abel 1932:186
April 1839	François Auguste Chardon	Fort Clark	". . . Sioux Made a rush on my horses and drove them all off. We have not a horse left at the Fort, bad prospects for fresh Meat".	Abel 1932:193
Year of 1842	Blackfoot Winter Count	Blackfoot Territory	"Year when many horses died from starvation".	Raczka 1979:48
April 1843	Rev. Robert T. Rundle	Fort Edmonton	"Great numbers of poor horses have been lost thro'cold and wolves. They are now generally very poor".	Dempsey 1977:125
Oct. 1844	Rev. Robert T. Rundle	Red Deer. R.	"Poor dogs, starving. What misery".	Dempsey 1977:162
Sept. 1846	Paul Kane	Carlton House	". . .it was the horsekeeper of Fort Carlton, who was swimming his horses across to an island in the middle of the river to save them from the wolves, which had killed several of them owing to the scarcity of buffaloes".	Harper 1971:78
Oct. 1847	Rev. Robert. T. Rundle	Pigeon L. to Fort Edmonton	"Horses lost in morning in consequence of smoke. . . ."	Dempsey 1977:283

March 1859	Henry Boller	Fort Atkinson	"The horses were also run down, and many which were prime runners in the fall were now hardly able to catch a cow, although the speed of the latter, as might naturally be supposed, was greatly reduced"!	Quaife 1972:278
May 1859	Capt. John Palliser	Fort Edmonton	"As the advancing winter had rendered each season no longer available for horses, we. . . extended our researches. . . accompanied by trains of dogs".	Spry 1968:394
July 1859	James Hector	Red Deer R.	"A wretched sort everywhere, the horses miserably off for grass".	Spry 1968:411
Nov. 1859	The Earl of Southesk	Forts in Saskat-chewan District	"The horses at all the Forts are also dying off rapidly, from a disease which I suppose to be pleura- there is the greatest scarcity".	The Earl of Southesk 1969:286
Dec. 1859	The Earl of Southesk	Touchwood Hills	"The poor things have no food but the dry grass they find after scraping away the snow".	The Earl of Southesk 1969:315
March 1863	Walter Cheadle	Belle Prairie to Touchwood Hils	"Short of provisions and have to feed the dogs on flour".	Cheadle 1971:120
Winter 1866-67	Rev. John McDougall	Fort Edmonton and Pigeon L.	"Meantime, we tried to fatten our dogs on fish, but even they would not thrive on these".	McDougall 1898:185
Winter 1866-67	Rev. John McDougall	Fort Edmonton and Pigeon L.	"Our dogs were so thin and weak they could not draw me on the sled".	McDougall 1898:196

Winter 1866-67	Rev. John McDougall	Fort Edmonton and Pigeon L..	". . . wolves had killed several of the horses and colts . .what really broke our hearts was an epidemic, a sort of distemper that took hold of the sleigh dogs and one after the other I had to shoot the poor brutes. They seemed to have a kind of hydrophobia:.	McDougall 1898:203, 243
Year of 1876	Blackfoot Winter Count	Blackfoot Territory	"The year when all the horses were frozen to death".	Raczka 1979:67
Year of 1881	Blackfoot Winter Count	Blackfoot Territory	"The year of mange among the horses".	Raczka 1979:67

Table 48: Documentation of Wildlife Depletion in the Northern Plains, 1795-1881.

Observer	Date	Location	Description	Reference
Duncan McGillivray	May 11, 1795	Fort George	"The country around Fort George is now entirely ruined. The Natives have already killed all beaver to such a distance that they lose too much time coming to the House, during the hunting season".	Morton 1929:77
George Simpson	1825	N. Sask. R.	"Altho' this River (Saskatchawaine) has been unremittingly hunted for nearly 100 years, it is still tolerably well stocked with Beaver and if it was possible to let it have 5 Years rest or respite would be as rich in Beaver as ever".	Merk 1968:151-52
Maximilian, Prince of Wied-Neuwied	1834	Fort Clark	"Wild beasts and other animals, whose skins are valuable in the fur trade, have already diminished greatly in number along this river, and it is said that, in another ten years, the fur trade will be inconsiderable. As the supplies along the banks of the Missouri decreased, the Company gradually extended the circle of their trading posts, as well as enterprises. . . ."	Thwaites 1905b
John James Audubon	1843	St. Louis to Fort Union on the Missouri R.	". . . even now there is a perceptive differ- ence in the size of the herds, and before many years the Buffalo, like the great Auk, will have disappeared. . .."	Audubon 1960b:131

Henry John Moberly	1854-55	Fort Edmonton	"During my short stay at Edmonton, I made another run after buffalo, and little did I know as I dismount- ed alongside a cow I had shot that on my next ride south of the Saskatchewan not one of these fine animals would be left, for though their numbers had greatly diminished since I first came to the country, hundreds still roamed the plains".	Moberly 1929:110
Capt. John Palliser	Aug. 5, 1857	Turtle Mtn.	"We have been disappointed by the entire absence of buffalo from the plains in this neighbourhood, where they are so frequently found. . . ."	Spry 1968:115
Henry Youle Hind	July 7, 1858	Qu'Appelle Valley	"So great had been the change during twenty years in the general aspect of this region that our old hunter, who had undertaken to guide us in a straight line across the prairie from Red Deer's Head River, confessed that he did not 'know the country' when within ten miles of the Assinniboine. . . ."	Hind 1971a:308
Henry Youle Hind	Aug. 5, 1858	Forks of the N. and S. Saskatch-ewan	"Throughout the entire length of our voyage we have been surprised at the extraordinary absence of animal life. . . no deer, or bear, or live buffalo. . . ."	Hind 1971a:393
Capt. John Palliser	Sept. 13, 1858	Qu'Appelle Lakes Fort	"Mr. Pratt. . . reports the Crees as beginning to apprehend scarcity of buffalo, and many are most anxious to try agriculture".	Spry 1968:137

James Hector	Sept. 14, 1858	Valley of N. Sask. R. within the Rocky Mtns.	"Near our camp we found some old buffalo dung, and the Indians told us that not many years ago there were many of these animals along the valley of the North Saskatchewan, within the mountains. Eleven years ago, they say, there were great fires all through the mountains, and in the woods along their eastern base; and after that a disease broke out among all the animals, so that they used to find wapiti, moose, and other deer, as well as buffalo, lying dead in numbers. Before that time(somewhere about 1847 or 1848) there was abundance of game in all parts of the country; but since then there has been great scarcity of animals . . . I have heard the same description of the sudden change that took place in the abundance of game from half-breed hunters in different parts of the country. . . . "	Spry 1968:325-26
James Hector	Aug. 10, 1859	Highwood River	"I had a long talk with the chiefs about what was likely to become of them and the other Indian tribes. They said that every year they find it more difficult to keep from starving, and that even the buffalo cannot be depended upon as before, because being now only in large bands, when one tribe of Indians are hunting them the other tribes have to go without until the band migrates into their country".	Spry 1968:432

The Earl of Southesk	July 8, 1859	Elbow of S. Sask R.	"I was much disappointed at seeing no buffalo, for we had fully expected to come upon them to-day".	The Earl of Southesk 1969:72
Isaac Cowie	1867-74	Fort Qu'Appelle and Cypress Hills	". . . the buffalo were ever receeding from th eastern to the western plains, and for self-preservation the Crees and Saulteux of the east were obliged to encroach every year further into the realms of the Blackfoot".	Cowie 1913:305
William Francis Butler	Nov. 18, 1870	Fort Pitt area	"Every where throughout this wild region lay the antlers and heads of moose and elk; with the exception of an occasional large jackass rabbit, nothing living moved through the silent hills".	Butler 1968:246
Frank Gilbert Roe	Writing of 1870	Northern Plains	"In the preceding fifty years, the annual expeditions of the Red River hunters had gradually 'pushed back' the buffalo frontier to the Cypress Hills. . . There was thus a 'frontal attack' on the buffalo territory from the eastward, along a line extending from latitude 49° to the Saskatchewan near Carlton or Battleford; and a turning movement along their flank extending for practically the entire'depth of their formation' from the Cypress Hills westward to the foothills of the Rockies	Roe 1934:12

George Dawson	1875	Northern Plains	"The White Mud R. or Frenchmen's Creek may at present be considered the easternmost limit of the buffalo, in this latitude. During the last sixteen years, their front has been driven back in the vicinity of the Line, over two hundred miles, and it is probable that their northern limit has been contracted to at least a like amount. . . At the present rate of extermination twelve to fourteen years will see the destruction of what now remains of the great northern bands of buffalo".	Dawson 1875:294, 296
Father Constantine Scollen	April 13,1879	Fort MacLeod	"Since the conclusion of the treaty, the decrease of the buffalo has been more apparent than ever before, and during the winter just past, the sufferings of the Indians from hunger have been something unparalleled heretofore in this section of the country".	Scollen 1879:5
D. McEachran	1881	Fort Benton to Bow R.	"The former abundance on the plains over which we travelled was amply testified by the countless remains of carcasses, especially heads, horns, ribs and by vertebrae, bleached almost to snow whiteness, to be seen in every direction. . . Hitherto game, especially buffalo, has been plentiful. . . but for three years back scarcely a buffalo has been seen there".	McEachran 1881:32-33

Table 49: Geographical Locations and Dates of First Sightings of Buffalo By Travellers in the Northern Plains, 1691-1881

Date	Observer	Location	Description	Reference
Red/Assiniboine/Saskatchewan Route				
Aug. 1691	Henry Kelsey	Central Sask.	". . .Indians having seen great store of buffillo. . . ."	Dougherty and Martin 1929:12
Sept. 1738	La Verendrye	S. Man.	". . . boundless stretch of prairie in which are multitudes of buffalo and deer".	Burpee 1927:303
Aug. 15, 1754	Anthony Henday	Muscuty Plains of S. Sask. R.	". . . saw several herds of Buffalo."	Burpee 1907:329
Aug. 16, 1772	Matthew Cocking	Birch Hills	"Indians tell me that in Winter buffalo are plenty here, which is confirmed by the quantity of Dung on the ground".	Burpee 1908:102
Aug. 23, 1772	Matthew Cocking	Lower reaches of S. Sask. R.	". . . Hunters killed 2 Buffalo. . . ."	Burpee 1908:103
Jan. 27, 1776	Alexander Henry, the Elder	Fort des Prairies, below forks of Sask.	". . . covered their table with tongues and marrow of wild bulls".	Bain 1969:275
Sept. 7, 1793	John MacDonnell	Near Forks of Red R. and Assin-iboine R.	"At the passage we found a Buffalo Bull which the men killed; Being the first I saw".	Gates 1965:110
Sept. 11, 1794	Duncan McGillivray	N. Sask. R. near Sturgeon R. or Setting R.	"The men having perceived some Buffaloes on the South Side, it was resolved that we should spend the next day in hunting as our provisions began to fail".	Morton 1929:21, 22

Sept. 15, 1795	William Tomison	N. Sask. R. below Eaglehill Ck.	"Sent three men a hunting, killed three buffalo but at so great a distance that could bring but little flesh".	Johnson 1967:10
Aug. 30, 1796	George Sutherland	Between Carlton House and Buckingham House on N. Sask. R.	". . . found plenty of buffalo all the way so that our men had plenty of fresh meat".	Johnson 1967:65
Aug. 22, 1798	William Tomison	N. Sask. R. above Sturgeon R.	"Killed one bull buffalo".	Johnson 1967:141
Aug. 17, 1799	James Bird	N. Sask. R, one day above Hudson's House	"Killed several buffalo".	Johnson 1967:203
Aug. 17, 1800	Peter Fidler	W. of Carlton House on South Branch	"Saw a bull buffalo the first we have seen as yet".	Coues 1965:56
Aug. 28, 1800	Daniel Harmon	Fort Alexandria (accessed from the N.)	"Two of our people. . have just returned with the news, that buffaloes are numerous, within two day's march from this. They say that the Natives. . . killed upwards of eighty into a park. . . ."	Haskel 1911:70
Sept. 1, 1805	Daniel Harmon	South Branch Fort	"Buffalo I am informed are plentiful within a half a Days march of this Establishment. . . ."	Lamb 1957:97
Aug. 3, 1808	Alexander Henry, the Younger	Near Fort à la Corne	"The plains on the S. approach the tops of the banks, but it cannot be called an open country, as spots of wood are frequent. Buffalo abound in winter when the cold obliges them to leave the plains for shelter among the hummocks. . . ."	Coues 1965:483

Sept. 5, 1808	Alexander Henry, the Younger	Fort du Milieu	". . . passed old Fort du Milieu. . . we saw. . . a herd of buffalo swim across the river".	Coues 1965:490
July 12,1825	George Simpson	Quill Lakes	"For three or four days the soil had been absolutely manured with the dung of the buffalo, so that myriads of these animals must recently have passed over the ground. . . ."	Simpson 1847:55
July 18, 1825	George Simpson	Carlton House overland to Fort Edmonton	". . . we had seen . . . two or three still warm buffaloes, from which only the tongues and a few other choice bits had been taken. . . It was not long before we saw. . . about five thousand in all".	Simpson 1847:62-63
Oct.2, 1840	Rev. Robert T. Rundle	Carlton House	"Mr. Small supplied me with fresh buffalo beef, pemmican, dried meat . . . ."	Dempsey 1977:41
June 24, 1846	Paul Kane	Pembina R./Turtle Mountain	"I ascended a small hill when I saw a band of about 40 cows and they hunters in full chase they ware they first Buffalow I had ever seene. . . ."	MacLaren 1989:24
Aug. 20, 1857	John Palliser(BNA Expedition)	Between Moose Mt. and Souris R.	"The only animals we have met since leaving Fort Ellice up to this point are bands of prairie antelopes, but we had not proceeded far after breakfast when we came in sight of two buffalo bulls, which I killed".	Spry 1968:127-28
July 2, 1858	Henry Youle Hind	Souris R. near 49th parallel and Red Deer's Head R.	"The first fresh buffalo tracks were seen today. . . ."	Hind 1971a:298

July 8, 1858	Henry Youle Hind	Assiniboine R. near Fort Ellice	"Here, however, we saw the first buffalo bull, and after a chase of half an hour's duration, succeeded in killing him".	Hind 1971a:309
June 26, 1859	The Earl of Southesk	Fort Ellice on the Assiniboine R.	". . . had the pleasure of sharing in some fresh buffalo-tongues . . . from the plains".	The Earl of Southesk 1969:51
June 27, 1859	The Earl of Southesk	Fort Ellice on the Assiniboine R.	"Two ox-carts came in . . . brought four calves. . . a two year old buffalo heifer was grazing about quite quietly in the neighboring prairie. . . ."	The Earl of Southesk 1969:52
July 7, 1859	The Earl of Southesk	Long Lake Creek, branch of Qu'Appelle R.	". . . I observed a single buffalo bull, about a half-a mile from us".	Southesk 1969:69
Sept. 30, 1862	Walter Cheadle	Carlton House	". . . find buffalo bull lying in the road, recently killed. . . ."	Cheadle 1971:62
Oct. 1, 1862	Walter Cheadle	Carlton House	". . . they saw 'les beufs' in the distance . ."	Cheadle 1971:62
1823 - 1870		Red River Settlement	"In 1823, they did not go far beyond Pembina before meeting numerous herds; in 1840, the first herds were found two hundred and fifty miles beyond that place; and by 1870, the hunters had to travel some three hundred miles to secure the necessary quantity of meat".	from Merriman 1926:92

Fall 1870	William Francis Butler	Travelled Fort Garry to Touchwood Hills to Carlton House to Fort Edmonton to Rocky Mountain House	"Upon whatever side the eye turns when crossing these great expanses, the same wrecks of the monarch of the prairie lie thickly strewn over the surface. Hundreds of thousands of skeletons dot the short scant grass. . . for the buffalo were 'far out' on the great prairie and that phrase 'far out' applied to buffalo, means starvation in the Northwest".	Butler 1968:229
Sept. 1872	Col. Robertson-Ross	Fort Edmonton to Crowsnest Pass	"We have seen no buffalo as yet. I fear they are at present all too far out in the Plain for us to see them at this time of the year".	Robertson-Ross 1872:6
Mid 1870's	George Dawson	USA/ Canada Boundary	"The White Mud River or Frenchmen's Creek, may at present be considered the eastern limit of the buffalo, in this latitude. During the last sixteen years their front has been driven back, in the vicinity of the line, over two hundred miles, and it is probable that their northern limit has been contracted to at least a like amount".	Dawson 1875:294
1878	Capt. W. J. Twining	Sweetgrass Hills	"The number of animals is beyond all estimation. Looking at the front of the herd from an elevation of 1800 feet above the plain, I was unable to see the end in either direction".	from McEachran 1881:32-33)
1881	D. McEachran	Fort Benton to Bow R.	". . . but for these years back scarcely a buffalo has been seen there".	McEachran 1881:33

Missouri Route

June 6, 1804	Lewis and Clark	Missouri R. near mouth of Salt R.	"Some buffalow Sign to day".	Thwaites 1959a:41
May 2, 1811	John Bradbury	Missouri R. near mouth of Platte R.	". . . our hunters killed Several Deer and Saw Buffalo. . . A little before noon we saw four large animals at a great distance, which we supposed to be elk, but on crossing their footsteps some time afterwards, we found to our great satisfaction that they were buffalo".	Bradbury 1966:53
May 24, 1811	H.M. Brackenridge	Bon Homme Island, Missouri	". . . a large buffalo bull made an appearance and was the first we had seen. . . ."	Brackenridge 1966:90
May 18, 1833	Maximilian	Missouri R. between Little Cedar Island and White R.	". . . we saw the first buffaloes that we had met with on this voyage".	Thwaites 1905a:298
April 21, 1834(last sighting as heading downriver)	Maximilian	Missouri R. near mouth of Cannonball R.	"We were equally unsuccessful with a herd of buffalo cows and some bulls".	Thwaites 1905c:86
May 14, 1843	John James Audubon	Missouri R. between Big Sioux R. and Vermilion R. which separate S. Dakota and Iowa	"A dead Buffalo floated by us".	Audubon 1960a:490
May 15, 1843	John James Audubon	Missouri R. (as above)	"Saw this evening another dead Buffalo floating down the river".	Audubon 1960a:493
May 20, 1843	Edward Harris(with Audubon)	Missouri R. near James R.	"Saw the first Buffaloes today at a great distance passing the crown of a hill".	McDermott 1951:68

May 20, 1843	John James Audubon	Missouri R. near James R.	". . . just before our dinner we saw, rather indistinctly, a number of Buffaloes, making their way across the hills about two miles distant".	Audubon 1960a:502
May 21, 1843	John James Audubon	Missouri R. near James R. and below Cedar Island	". . . saw 50 buffalo. . . ."	Audubon 1960a:503
May 22, 1843	Edward Harris	Missouri R. near Niobrara R.	"Have seen about 200 Buffaloes today, at least 100 were in view at one time".	McDermott 1951:69
Oct. 6, 1847	John Palliser	Prairie near Fort Pierre	". . . we were obliged to make our fire of dry buffalo dung, of which there was abundance".	Palliser 1969:107
Oct. 7, 1847	John Palliser	Prairie near Fort Pierre	". . . we actually did come in sight of the long wished for game. At first the dark grotesque outlines of two old out-straggling bulls loomed over the rising hill. . . ."	Palliser 1969:107
April 12, 1850	Thaddeus Culbertson	Vermilion Post on Vermilion R. or White Earth R.	". . . we had some fresh Buffalo tongue yesterday. . . we met on the prairie three Indians. . . laden with Buffalo meat".	McDermott 1952:37
April 18, 1850	Thaddeus Culbertson	White Earth Fork of Vermilion R.	". . . Indians discovered traces of a Buffalo and were after it. . . This is the first one we have seen and it is unusual to see them down this low on the Missouri".	McDermott 1952:42
July 7, 1851	Rudolph Friederich Kurz	Missouri R. below Fort Clark	"Today for the first time I saw buffaloes. One hundred and eighty years ago they were still to be found in the State of Ohio".	Hewitt 1970:72

June 1858	Henry Boller	Big Bend of Missouri	". . . up to this time we had only seen a few bulls".	Quaife 1972:35
June 1858	Henry Boller	Missouri R. below Fort William	". . . a band of buffaloes, the first we had seen on the trip, was discovered, barely distinguishable in the dim distance".	Quaife 1972:37
May 31, 1862	Lewis Henry Morgan	Missouri R. at mouth of Moreau R., above Fort Pierre	"This morning we saw the first herd of buffalo, about 70 of them, quietly grazing upon the prairie on the opposite side of the river".	White 1959b:158
June 3, 1862	Lewis Henry Morgan	Missouri R. just below Fort Clark	". . . we killed our first buffalo. . . . "	White 1959b:162

Note:

(a)The observers listed in Table 16 include those who produced daily diaries of their travels into and within the Northern Plains.

(b) Entries included in the Red/Assiniboine/ Saskatchewan group are those where the travellers accessed the region by moving westward from southern Manitoba to southeastern Saskatchewan and then north to the Saskatchewan River System.

(c) Entries included in the Missouri group are those where the travellers accessed the region by moving up the Missouri River from St. Louis.

Table 50: Seasonality, Resource Stressors and Coping Strategies in the Northern Plains, 1691-1888.

Location	Stressor	Strategy	Reference
WINTER			
North Saskatchewan River Region			
Between N. and S. Sask. R.	Buffalo scarce	Relocated to area where expect more buffalo	Burpee 1908
Nipawin on N. Sask. R.	No provisions	Ate dead elk trapped in river ice	Bain 1969
Nipawin on N. Sask. R.	No provisions	Went to Fort des Prairies for provisions	Bain 1969
Lac Verde, near N. Sask. R.	No food	Men forced to pick up fish bones discarded previous fall	Morton 1929
Fort George	Horses exhausted by hunger	Travelled by foot	Morton 1929
Between N. and S. Sask. R.	Buffalo scarce.	Relocated to area where expect more buffalo	Burpee 1908
Nipawin on N. Sask. R.	No provisions	Made soup from bones left by wolves	Bain 1969
Nipawin on N. Sask. R.	No provisions.	Went to Fort des Prairies for provisions.	Bain 1969
Fort George	Horses exhausted by hunger	Travelled by foot.	Morton 1929
Edmonton House to Chesterfield House	No wood	Used buffalo dung	Johnson 1967
Kootenay Plains	Dogs have not eaten	Cooked wolf and lynx for them	Coues 1965
North of N. Sask. R.	Indians experiencing starvation	They resorted to necrophagy and anthropophagy	Pritchett 1942
Carlton House	Buffalo off	Went to Eagle Hills where always elk	HBCA B.27/e/4

Carlton House	Indians come in starving	Gave them food from fort stores	HBCA B.27/e/4
Carlton House	Food shortages	Will need twine for nets and will look to lakes where can fish	HBCA B.27/e/4
Fort Edmonton to Rocky Mountain House	No big game	Ate rabbits	Spry 1968
Rocky Mountain House	Shortage of food	Got some provisions from Indians who came to trade	Spry 1968
Egg Lake	Came across starving Indian family	Gave them food	Spry 1968
Belle Prairie to Carlton House	Took meagre rations	Rationed fish among men and dogs	Cheadle 1971
Carlton House	Report that smallpox raging at Fort à la Corne	Vaccinated people at Carlton House	Cheadle 1971
Belle Prairie	Still experiencing shortages of food.	Snared rabbits.	Cheadle 1971
Belle Prairie	Shortages persist	Hunted birds	Cheadle 1971
Belle Prairie	Shortages persist	People of Carlton House went off hunting	Cheadle 1971
Egg Lake	No food	Boiled buffalo hide	Cheadle 1971
Egg Lake	No food	Ate dog	Cheadle 1971
Belle Prairie to Touchwood Hills	Very little buffalo meat	Traded with Indians for moose meat.	Cheadle 1971
Belle Prairie to Touchwood Hills	Cannot give moose meat to starving dogs because considered sacred by Indians	Gave dogs flour	Cheadle 1971
Fort Edmonton	Shortages of food	Found deer embedded in ice so chopped out and ate	McDougall 1896
Fort Edmonton to Plains	Short on provisons	Men and dogs on rations	McDougall 1896

Fort Edmonton to Plains	Short on provisions	Brought potatoes from Whitefish Lake	McDougall 1896
Fort Edmonton to Plains	Short on provisons	Indians ate buffalo drowned in Jack Fish Lake	McDougall 1896
Pigeon Lake	Shortage of food	Indians cached food for us to feed dogs	McDougall 1896
Fort Edmonton area	Shortage of food	Food rationed at fort	McDougall 1896
Fort Edmonton area	Shortage of food	When out of meat ate barley malt, turnips and rabbits	McDougall 1896
Fort Edmonton area	Horses being killed by wolves	Poisoned the wolves	McDougall 1896
Fort Edmonton area	Shortage of food	Used lynx and rabbits	McDougall 1898
Fort Edmonton area	Shortage of food	Indians went 250 miles to hunt buffalo	McDougall 1898

South Saskatchewan River Region

Red Deer R.	Buffalo disturbed by the Indians so scarce	Hunted moose instead	Burpee 1907
Bow R.	No success pounding buffalo	Ran buffalo	Haig 1991
Bow R.	Plains all burned, no fuel	Went to mountains where fuel	Haig 1991
Red Deer R.	No buffalo	Indians ate horses	Haig 1991
Chesterfield House	Buffalo leave because Indians running them	Sent hunters out to camp and hunt	Johnson 1967

Missouri River Region

Missouri R., N.D.	Cold stormy weather so cannot hunt	Bought corn from Indians	Wood and Thiessen 1985
Fort Mandan	State of alarm about horses	Fenced them in	Larocque 1910
Fort Mandan	No meat	Ate corn	Larocque 1910
Missouri R.	No buffalo	Indians purchased corn from Mandan	Larocque 1910

Mandan Villages	Buffalo off on plains	Indians performed buffalo dance	Thwaites 1959a
Missouri R.	Few provisions left	Ate ears of roasted corn	Lamb 1957
Missouri R.	Stock of meat nearly exhausted	Everyone went out hunting	Lamb 1957
Mandan Villages	Buffalo far off	Burned grass to initiate new growth to attract bison	Thwaites 1959a
Mandan Villages	Many buffalo drowned and floating by	Indians used those which they can reach	Thwaites 1959
Fort Pierre to Fort Clark	Drought and absence of buffalo herds	Arikara abandoned villages	Thwaites 1906
Fort Clark to Fort Union	Assiniboines suffer from lack of buffalo	Relocated to Missouri and Fort Union	Thwaites 1906
Fort Union	Decline of fur bearers and provisions	American Fur Company extended circle of trading posts and used winter posts among Indians	Thwaites 1906
Fort Clark	Shortage of food	Indians ate decayed buffalo found on Plains	Thwaites 1906
Fort Clark	Shortage of food	Ate a few chicken eggs	Thwaites 1906
Fort Clark	Shortage of food	Used cache of maize in fort	Thwaites 1906
Fort Clark	Food scarce near fort	Hunters arrived from afar with meat	Abel 1932
Fort Clark	Buffalo scarce all over country	Gros Ventres abandoned village except for old men and women and were off hunting	Abel 1932
Fort Clark	Sioux starving	Sent 3 dog teams to fort for corn	Abel 1932

Fort Clark	Small winter posts experience shortages	Sent to big post for supplies	Abel 1932
Fort Clark	Mandan short of food	Word of buffalo herds at Square Hills	Abel 1932
Fort Clark	Larder nearly empty and no prospects.	Sent off all horses and hunters to fend for themselves	Abel 1932
Fort Clark	Indians starving	They went off searching for buffalo	Abel 1932
Fort Clark	Absence of buffalo and robes	Started new trade item, rabbit	Abel 1932
Fort Clark	Indians without food	Women and children begged at fort	Abel 1932
Fort Clark	Older women left by Arikara who are starving	Fort provided a feast for older women	Abel 1932
Fort Clark	Smallpox and many deaths	A village was burned and several remaining amalgamated	Abel 1932
Fort McKenzie	Indians badly off owing to dearth of buffalo in area	They stole meat from the post	Palliser 1969
Fort McKenzie	Indians did not lay in supply of meat	Indians had to go off to hunt	Palliser 1969
Fort McKenzie	Have meat but all lean	Killed wolf and ate it	Palliser 1969
Fort Union	Shortages of food	Denig sent men and horses away to fend to themselves	Hewitt 1970
Fort Benton	Gros Ventres stole wagon with meat and tongues	Men went hunting again	McDonnell 1940
Fort Atkinson	Buffalo far off	Indians made "buffalo medicine" to get buffalo to come closer	Quaife 1972
Fort Atkinson	Buffalo getting more scarce	Indians talked about leaving fort to seek buffalo	Quaife 1972

Fort Atkinson	Horses suffer from food shortage	Indians hunt on foot more frequently	Quaife 1972
Arikara Village	Shortages of food	Arikara moved from winter village seeking buffalo	Quaife 1972
Arikara Village	Yankton Sioux short of food	Came to Arikara seeking food and willing to made peace	Quaife 1972

Red/Assiniboine River Region

Fort Alexandria	Winter mild, buffalo retreating back to plains.	Hunting camp moved further from fort.	Gates 1965
Fort Alexandria	Buffalo far out on plains	Sent fort inhabitants to plains to winter	Lamb 1957
Bird Mountain Post	Hunters unsuccessful	Sent to Fort Alexandria for provisions	Lamb 1957
Bird Mountain Post	Mild winter so game returns to plains	Live on chokecherries and hunt moose	Lamb 1951
Qu'Appelle Lakes	No buffalo and hunters unsuccessful killing moose or deer	Ate rosebuds	Lamb 1957
Qu'Appelle Lakes	Shortage of meat and no buffalo	Went far out on plains to trade with Indians for provisions	Lamb 195[illegible]
Fort Qu'Appelle to Fort Ellice	Short of food	Lived on flour and milk	McDougall 1896
Qu'Appelle Lakes	Poor fishing so Métis suffering	They ate ducks, rabbits, beaver, deer and antelope	Cowie 1913
Qu'Appelle Lakes	Poor fishing so Métis suffering	They went to HBC and exchanged furs for meat	Cowie 1913

SPRING

North Saskatchewan River Region

N. Sask. R.	No success pounding buffalo	Split into smaller groups to hunt	Burpee 1908
Fort Edmonton	Shortage of provisions and same expected next year	Left a cache of meat for winter	Johnson 1967
Lower Terre Blanche House	Indians starving	They left fort seeking food	Coues 1965
Rocky Mountain House	No meat, fresh or stored	Ate handfuls of corn instead	Franchère 1854
Rocky Mountain House	Insufficient game near post	Hunters sent away to hunt	Franchère 1854
Rocky Mountain House	Insufficient food at post	Killed horse for food	Franchère 1854
Pembina R.	Shortage of food	Got eggs, venison and tallow from a trader	Franchère 1854
Pembina R.	Shortage of food	Used cache of another hunter	Franchère 1854
Fort Vermilion	Shortage of food, tallow only provisions	Hunted geese and collected wild herbs	Franchère 1854
Fort Edmonton	Provison trade has failed	Simpson went to England to purchase grain	Franchère 1854
Fort Edmonton	Provison trade has failed	Can use horses for food or boats, if necessary	Franchère 1854
Rocky Mountain House	Caches robbed by Indians	Ate rabbits	Harper 1971
Carlton House	No provisions to spare	Palliser and Hector went to Eagle Hills to provide for themselves	Spry 1968
Carlton House	Very short of provisons	Indians killed their horses and hunted wolves and foxes for food	Spry 1968
Eagle Hills	No firewoood	Use dung and buffalo bones	Spry 1968

Fort Edmonton	Winter poor for provisions	Chief trader planning to expand agriculture	Spry 1968
Fort Edmonton	Scarcity very serious	Must all go to plains to seek provisions	Spry 1968
Fort Edmonton	Shortages of food	Women and children begged to accompany Palliser Expedition in order to search for food	Spry 1968
Fort Edmonton	Shortages of food	Ate eggs, rats, and killed domestic cow	Spry 1968
Fort Edmonton	Shortages of food	Dogs went without. Hunted pheasants, goose and ducks	Spry 1968
Fort Carlton	Shortages of food	Fort charged a per diem	Spry 1968
Fort Carlton to Belle River.	Shortage of food	Traded Indians fish and turnips for meat. Hunted birds	Spry 1968
Jasper House	Severe shortages of food	Hunt moose. Ate horses, squirrels and sheep	Cheadle 1971
Pigeon Lake to Lac La Biche	Limited provisions	Hunt ducks and rabbits along way	McDougall 1898
Pigeon Lake	Limited provisions	Indians off hunting	McDougall 1898
South Saskatchewan River Region			
Quill Lakes	Scanty provisions as hunters got lost	Rationed food.	Cowie 1913
Ghost River	Indians and dogs starving	Dogs ate pack cords	Dempsey 1977
South of Fort Edmonton	Shortage of buffalo	Relied on ducks	Spry 1968
South of Fort Edmonton	Season hard on horses	Used dogs instead	Spry 1968
South of Fort Edmonton	Shortages of food	Traded Indians for meat	Spry 1968
South of Fort Edmonton	Ran out of meat	Ate flour	Spry 1968

Sullivan Lake	Shortage of food	Opened flour which had been saving	Spry 1968
Sullivan Lake	Fear of Indians affected movement and hunting in enemy territory	Traded tobacco to Indians to facilitate movement in enemy territory	Spry 1968
Fort MacLeod	Indians starving	Ate poisoned wolves plus dogs and old bones	Scollen 1879
Fort MacLeod	Indians starving	Scattered into smaller groups	Scollen 1879
Fort MacLeod	Indians starving	Stole and begged at settlements	Scollen 1879
Fort MacLeod	Indians starving	Killed domestic cattle	Scollen 1879

Missouri River Region

Mandan Villages	Lack of wood	Women gather driftwood and village moved when wood ran out	Wood and Thiessen 1985
Mandan Villages to the Yellowstone R.	Antelope and buffalo very lean	Take only tongues and marrow bones	Wood and Thiessen 1985
Arikara Village	No buffalo in area	Herald ran through village sharing news about game	Bradbury 1966
Arikara Village	Food in short supply	Men killed and ate dog flesh	Bradbury 1966
Missouri R.	Fear Indians while moving so cannot run buffalo	Hunted deer instead	Bradbury 1966
Fort Clark	Low on provisions	Bought roots from Indian woman	Bradbury 1966
Arikara Village	Population declined from smallpox	Villages amalgamated	Brackenridge 1966
Fort Clark	Fort overrun by rats and short of food	Ate rats	Abel 1932
Fort Clark	Shortages of food	Cattle imported	Abel 1932

Fort Clark	Indians have no food	They hunted up and down river	Abel 1932
Fort Clark	Indians have no food	They dug roots in the woods below the fort	Abel 1932
Fort Clark	Afraid Indians will kill cattle	Sent cattle to Fort Pierre	Abel 1932
Fort Berthold	Shortage of food	Gathered waterfowl eggs and hunted antelope	Palliser 1969
Fort Union	Palliser's party dependent on fort but the latter is short of food	Denig sent them away to conserve on food	Palliser 1969
Fort Union	Area about fort hunted out	Went to Yellowstone which not yet hunted out	Palliser 1969
Fort Pierre	Blackfoot come to fort starving	Prepared a feast for them	McDermott 1952
Fort Union	Shortage of meat	Dogs' rations increased so they would steal less and men's rations decreased	Hewitt 1970
Fort Benton	Shortages of game	Planted garden	McDonnell 1940
Middle Missouri, N.D.	Shortages of provisions among the Gros Ventres	Shot elk instead of buffalo	Quaife 1972
Middle Misosuri, N.D.	Afraid to hunt in Indian territory	Chief trader planning to expand agriculture	Quaife 1972
Fort Atkinson	Provisons nearly exhausted	Rationed what was left	Quaife 1972
Red/Assiniboine River Region			
Fort Alexandria	Animals off on plains	Use stored meat and grease	Gates 1965
Park River Post	Entire herds of buffalo drowned in river	Indian women gathered backfats and tongues off dead animals	Coues 1965

Portage La Prairie	No food	Exist on prairie turnip	Coues 1965
Red River Settlement	Crops failed due to weeds, ash in fields, drought etc.	People ate prairie weeds, including turnip	Pritchett 1942
Red River Settlement	People suffering from malnutrition	Sent some people back to Pembina for winter	Pritchett 1942
White Horse Plains	Out of provisions	Sent to Lower Fort Garry for supplies	Cowie 1913
Red River Valley	Shortage of provisions	Got half a moose from the Indians	Spry 1968

SUMMER

North Saskatchewan River Region

Central Saskatchewan	Parkland devoid of game	Moved onto plains	Dougherty and Martin 1929
N. Sask. R.	Shortage of meat	Ate strawberries	Burpee 1907
N. Sask. R.	No birds or buffalo	Moved onto plains for buffalo	Burpee 1907
Battleford	No buffalo	Killed elk, moose and collected berries	Burpee 1907
Battleford	Buffalo very lean	Took tongue only	Burpee 1907
Eagle Hills	Moose and elk presently scarce	Gathered berries, hunted ducks, geese and beaver	Burpee 1908
Eagle Hills	Buffalo not numerous, perhaps frightened away by Indians	Hunted elk, moose and deer instead	Morton 1929
Eagle Hills	Buffalo numerous seasonally	Stored meat	Morton 1929
Carlton House	Buffalo kept off by Indians	Moose, elk, garden vegetables and wheat used instead	HBCA B.27/e/1

N. Sask. R.	Assiniboine frequently short of food	Ate roots, seeds, inner bark of cypress or rumored to have practiced anthropophagy	De Smet 1978
Pigeon L.	Out of provisions	Assiniboine gave us meat	Dempsey 1977
Carlton House	Wolves attacked horses	Man sent to guard them	Harper 1971
Battle River	Gardens failed	Ate raspberries, strawberries and made soup with scraps	Dempsey 1977
Fort Edmonton	Shortage of food	Killed domestic cattle	Spry 1968
Jasper House	No game	Moberly left place	Spry 1968
Lac St. Ann	No provisions	Stopped to get fish, potatoes and dried meat from priests	The Earl of Southesk 1969
Jasper House	Shuswap starving	They got meat from Moberly	Cheadle 1971
South Saskatchewan River Region			
Piegan Post	Nothing to eat	Sent hunters away to hunt	HBCA B.21/a/1
Blackfoot Territory	Threats from Indians	Trappers have abandoned area	Hewitt 1870
Chesterfield House	Expect shortage of provisions when reach mountains	Party split up to get provisions and laid in a supply of meat and cached it	Spry 1968
S. Sask. R.	Bulls very lean	Indian women drying large amounts of food	The Earl of Southesk 1969
Oldman R.	Low on provisions	Traded Kootenai Indians for a bullock	The Earl of Southesk 1969
Kootenay Plain to Bow R.	Short of provisions	Sent hunter to his people to get their help in hunting	The Earl of Southesk 1969

Old Bow Fort	Stoney had no buffalo meat	Hunting deer instead	The Earl of Southesk 1969
Canadian Prairies	Smallpox kills many people	Cowie vaccinated Indians	Cowie 1913
Rocky Mtn. House to Oldman R.	No buffalo as out on plains.	Used antelope, prairie chicken, wolves and trout	Robertson-Ross 1872
Missouri River Region			
Great Falls of Missouri to Three Forks	Immense herds have disappeared	Live on flour, parched meal, corn and cached meat	Thwaites 1959b
Great Falls of Missouri	No buffalo meat	Rendered grease from tainted meat	Thwaites 1959b
Great Falls of Missouri	No buffalo meat	Ate pigeons instead	Thwaites 1959b
Great Falls of Missouri	No buffalo meat	Hunted elk	Thwaites 1959b
Marias R. to Yellowstone R.	Lack of game on Marias R.	Relocated to Missouri R.	Thwaites 1959b
Missouri R. to Pembina R. Post	No firewood	Used buffalo dung	Wood and Thiessen 1985
Missouri R. to Pembina R. Post	Great scarcity of water	Altered course, found lake and dug a hole	Wood and Thiessen 1985
Mauvaises Terre(on Missouri R.)	Anticipated shortage of game	Took all available meat of animals killed before entering Mauvaises Terre	Thwaites 1906
Judith R.	Gros Ventres of Prairies suffered food shortages	Ate dogs and beaver	Thwaites 1906
Fort Mackenzie	Fort sometimes short of provisions	Indian hunters hired to go out hunting	Thwaites 1906
Fort Mackenzie	No fresh provisions for some time	Ate dried meat and maize	Thwaites 1906
Fort Union	Plains are naked and dry	Only 50 people remained at fort as rest went away to hunt	Thwaites 1906

Fort Clark	Buffalo scarce	Traded meat with Mandan	Abel 1932
Fort Clark	Drought	Mandan making rain medicine	Abel 1932
Fort Clark	Smallpox epidemic hits Indians	Arikara left in hopes of getting rid of smallpox	Abel 1932
Fort Union	Assiniboine come in and have had no meat for 3 days	The ate swans	Audubon 1960b
Fort Berthold	Shortage of food at fort	Took only 2 meals per day	Hewitt 1970
Fort Berthold	Cholera among the Indians and they believe Kurz the cause	Kurz sent to Fort Union and Indians left area	Hewitt 1970
Fort Berthold	Extreme shortage of meat	Eating crackers and drinking coffee and got some meat from an Indian	Hewitt 1970
Fort Benton	Game scarce about the fort	Hunters sent out	McDonnell 1940
Fort Benton	Game scarce about the fort	Kept domestic pigs and chickens	McDonnell 1940
Fort Benton	Hunters unsuccessful	Indians brought in provisions to trade	McDonnell 1940
Fort Benton	Out of fresh meat	Indians brought word that buffalo aplenty at Marias R.	McDonnell 1940
Fort Atkinson	Game scarce	Indians made bull medicine to attract buffalo	Quaife 1972
Fort Atkinson	Game scarce	Shot wild fowl and ate green corn acquired from Indians	Quaife 1972
Red/Assiniboine River Region			
Pine Fort	No buffalo or other food	Sent to Indians for provisions.	Gates 1965

S. Manitoba	Indians too alarmed to hunt	Fished in Red R.	Coues 1965
Bird Mountain Post	Horse drowned	Proceeded on foot	Lamb 1957
Bird Mountain Post	No provisions	Sent people to Lake to fish	Lamb 1957
Bird Mountain Post	No provisions	Ate parchment skins, dogs, herbs, and few fish from river	Lamb 1957
Bird Mountain Post	Indian hunters claim that evil spirit interfering with hunting	Gave them something to counteract it	Lamb 1957
Bird Mountain Post	Few provisions	Sent men out to find Indian hunters to hunt for us	Lamb 1957
Assiniboine R.	No meat so starvation	Used fowl eggs and muskrat	Coues 1965
Turtle Mountain Post	No buffalo, grease or fish so nothing to trade	Freemen dispose of women and clothing to HBC for beat meat	Coues 1965
Fort Ellice	Game scarce in woods	Indians went onto plains	Hind 1971a
Fort Ellice	Provisions scarce at fort	Hunters off 30 miles	Hind 1971a
Fort Qu'Appelle	Cree apprehended scarcity of buffalo	Said to be anxious to try agriculture	Spry 1968
FALL			
North Saskatchewan River Region			
Eagle Hills	Buffalo scarce	Indians sang buffalo pound songs	Burpee 1908
Eagle Hills	No success pounding	Hunted individual animals with gun	Burpee 1908
Eagle Hills	No meat.	Ate berries	Burpee 1908
Manchester House	Shortage of buffalo meat	Ate sturgeon	Hopwood 1971

Carlton House	Indians made no fall hunt and shortage of beaver	Waited for the bison to move north with cold weather	Johnson 1967
Fort Edmonton	Scarcity of meat	Men were put on half allowances	Johnson 1967
Fort Edmonton	Scarcity of meat	Relied on Indians for provisions	Johnson 1967
Fort Edmonton	Scarcity of meat	Grew vegetables in garden	Johnson 1967
Gull Lake	Buffalo very lean	Purchased fat dogs from Indians to eat	Johnson 1967
Athabasca River	No provisions	Ate dogs and horses	Coues 1965
Fort Assiniboine	Met a family who had been 18 days without food	They had eaten buffalo skins	Dempsey 1977
Fort Assiniboine	Starvation imminent	HBC fished at Fish Lake	Dempsey 1977
Rocky Mountain House.	Badly off for provisions	Indians left fort to go hunt	Dempsey 1977
Fort Edmonton to Fort Assiniboine	Brought no food along on journey	Hoped to hunt as travelled	MacLaren 1989
Rocky Mountain House	Anticipate shortages	Sent to Indian camp for provisions	Moberly 1929
Rocky Mountain House	Antipicate shortages	Killed many prairie chickens to conserve on buffalo meat	Moberly 1929
Fort Carlton	Prairie fires threatening fort and hay crop	Burned around hay ricks to prevent their destruction	Spry 1968
Fort Carlton to Jack Fish Lake	Buffalo stayed out on plains	Moved to Fort Pitt where buffalo always found	Spry 1968
Fort Pitt	Threatened shortages	Grew grain, vegetables and livestock to feed people	Spry 1968
Athabasca River	Assiniboine starving	Traded them ammunition for furs so they could hunt	Spry 1968

Fort Pitt	Shortage of provisions as buffalo off	Used domestic livestock instead	The Earl of Southesk 1969
Touchwood Hills	Shortage of meat	Ate flour and drank tea	The Earl of Southesk 1969
Belle Prairie	Fishery unproductive	Abandoned fishery and bought provisions at Carlton	Cheadle 1971
Belle Prairie	Only a few fish and a bit of flour left	Went to Carlton for suppplies instead of going to open plains to starve	Cheadle 1971
Pigeon Lake	Fish wormy and inedible	People scattered to seek food	McDougall 1898
Carlton House	Shortages of food	Indians shared what they have	Butler 1968
Battle River to Fort Pitt	Ran out of food	Purchased some meat at Fort Pitt	Butler 1968
Eagle Quills, near Carlton	Starvation	Ate buffalo sinews, wolves, gophers and suckers	Cowie 1913
South Saskatchewan River Region			
Near South Saskatchewan River	Wood scarce	Used buffalo dung	Burpee 1908
Between Manchester House and Bow River	Bison and deer scarce due to seasonal movements	Waited for cold weather when expected buffalo to arrive	Hopwood 1971
Central Alberta	No wood	Carried fuel or burned dung	Haig 1991
Highwood River	No success pounding buffalo	Ran buffalo instead	Haig 1991
Chesterfield House	Buffalo a good distance away	Traded with Indians for provisions	Johnson 1967
Chesterfield House	Buffalo a good distance away	Hired Indians to hunt for fort	Johnson 1967

Chesterfield House	Buffalo a good distance away	Set up a hunting camp some distance off	Johnson 1967

Missouri River Region

North Dakota	Seasonal food supply	Bought stored corn from Mandan	Burpee 1927
Assiniboine River to Mandan Villages	Prairie on fire	Took circuitous route to avoid	Wood and Thiessen 1985
Assiniboine River to Mandan Villages	Prairies on fire	Used singed and roasted buffalo for food	Wood and Thiessen 1985
Assiniboine River to Mandan Villages	Fear of Indians.	Took circuitous route	Wood and Thiessen 1985
Missouri River	No food since plains all burned	Sent horses to grassed area some distance away	Larocque 1910
Fort Mandan	Plains burned	Indians went off to find game	Larocque 1910
Fort Union	No firewood at hunting camp	Used dung and fat and marrow bones for fuel	Thwaites 1906
Fort Union	No grass for horses	Fed them poplar bark	Thwaites 1906
Fort William	Short of provisions and cannot get close enough to game to fire	Used stale bacon, ham, coffee, ship biscuit and sugar	Thwaites 1906
Fort Clark	Antelope away in Black Hills	Indians move to winter villages in forested areas	Thwaites 1906
Fort Clark	Buffalo far off	Lived on dried meat and boiled maize	Thwaites 1906
Fort Clark	Short on meat and tallow	Waited for Indians to bring meat in	Thwaites 1906
Fort Clark	Short on meat and tallow	Ate boiled maize without fat	Thwaites 1906
Fort Clark	Only beans and maize to eat	Sent to Indian camp for meat	Thwaites 1906

Fort Clark	Buffalo scarce	Hunter arrived with fresh meat	Abel 1932
Fort Union	Food shortage	Reduced to 2 meals per day	Hewitt 1970
Fort Union	Food shortage	Made bread of maize and nothing else to eat	Hewitt 1970
Fort Benton	Short of corn	Wagon sent to Fort Union for corn	McDonnell 1940
Fort Benton	Shortage of meat	Traded Indians for meat	McDonnell 1940
Red/Assiniboine River Region			
Souris River.	Enemy threat	Took a different route	Wood and Thiessen 1985
White Mud River	No buffalo or other animals	Hired hunters to procure provisions	Coues 1965
White Mud River	No buffalo or other animals	Ate moose's head	Coues 1965
White Mud River	No buffalo or other animals	Reduced food intake	Coues 1965
Fort Alexandria	Scarcity of food	Subsisted on rabbits	Gates 1965
Fort Alexandria	Piece meat gone	Used pounded meat from stores	Gates 1965
Fort Alexandria	Mildness of winter means buffalo staying on plains so none in vicinity	Relied on limited dried/stored provisions	Gates 1965
Fort Alexandria	Indians drove off game around fort	Relied on dried provisions	Gates 1965
Hair Hills	Only available meat is tough, lean bulls	Ate stored meat	Coues 1965
Pembina River Post	Whole herds of buffalo dead from fire	Took flesh and fat from dead animals	Coues 1965
Pembina River Post to Mandan Villages	Area barren of grass, no game and so state of starvation.	Abandoned horses and continued on journey	Wood and Thiessen 1985

Red River Settlement	Food shortages	Sent people to Pembina River	Pritchett 1942
Red River Settlement	Shortage of hooks	Hired Canadian to catch fish for settlers	Pritchett 1942
Red River Settlement	Shortage of stored food	Purchased meat, berries and prairie turnips from Indians and freemen	Pritchett 1942
Fort Carlton to Fort Garry	No big game	Lived on birds' eggs, turtles and beaver	Cowie 1913

Note:
(a) The entries in this table are derived from the ethnohistorical sources listed in Table 13 and the Piegan Post and Carlton House Journals.

(b) They include individually listed stressors accompanied by corresponding coping strategies.

(c) Many additional stressors (without mention of corresponding coping strategies) were also cited in the above sources. These included:

- too cold to butcher meat (winter)
- buffalo ate all grass and horses starved to death (winter)
- Indians at war so fur trade declined (winter)
- extreme cold so that people and animals froze to death (winter)
- thousands of bison die of starvation (winter)
- blizzard interferred with hunting or drove animals off (winter)
- no ammunition (winter)
- only bulls, no cows (winter)
- wild game famished (winter)
- expecting many drowned buffalo in spring but few passed (spring)
- plains covered in water which affected travel and herd movements (spring)
- hunters unsuccessful (spring)
- most beaver died from a distemper (spring)
- high water and frosts interfere with beaver trapping (spring)
- incessant rain so gardens not planted (spring)
- too cold to make pemmican as fat congeals (spring)

- hurricane force winds (summer)
- river very low (summer)
- grasshopppers ate garden crops (summer)
- horses all stolen so cannot fetch meat from hunting camp (summer)
- no trade goods so cannot trade for food (summer)
- gardens failed due to drought and frost (summer)
- Indians destroyed gardens (summer)
- low water levels so muskrat population declined (summer)

- plains flooded, so no hay for horses (summer)

- fresh water scarce (fall)
- wolves kill many horses (fall)
- resources in area completely exhausted (fall)
- area of destitute of small game and birds (fall)

- trees destroyed by beaver and grizzlies (no season given)
- hunger because no grease to go with meat (no season given)
- food shortages caused by NWC purchasing all wild rice and pemmican from Indians(no season given)

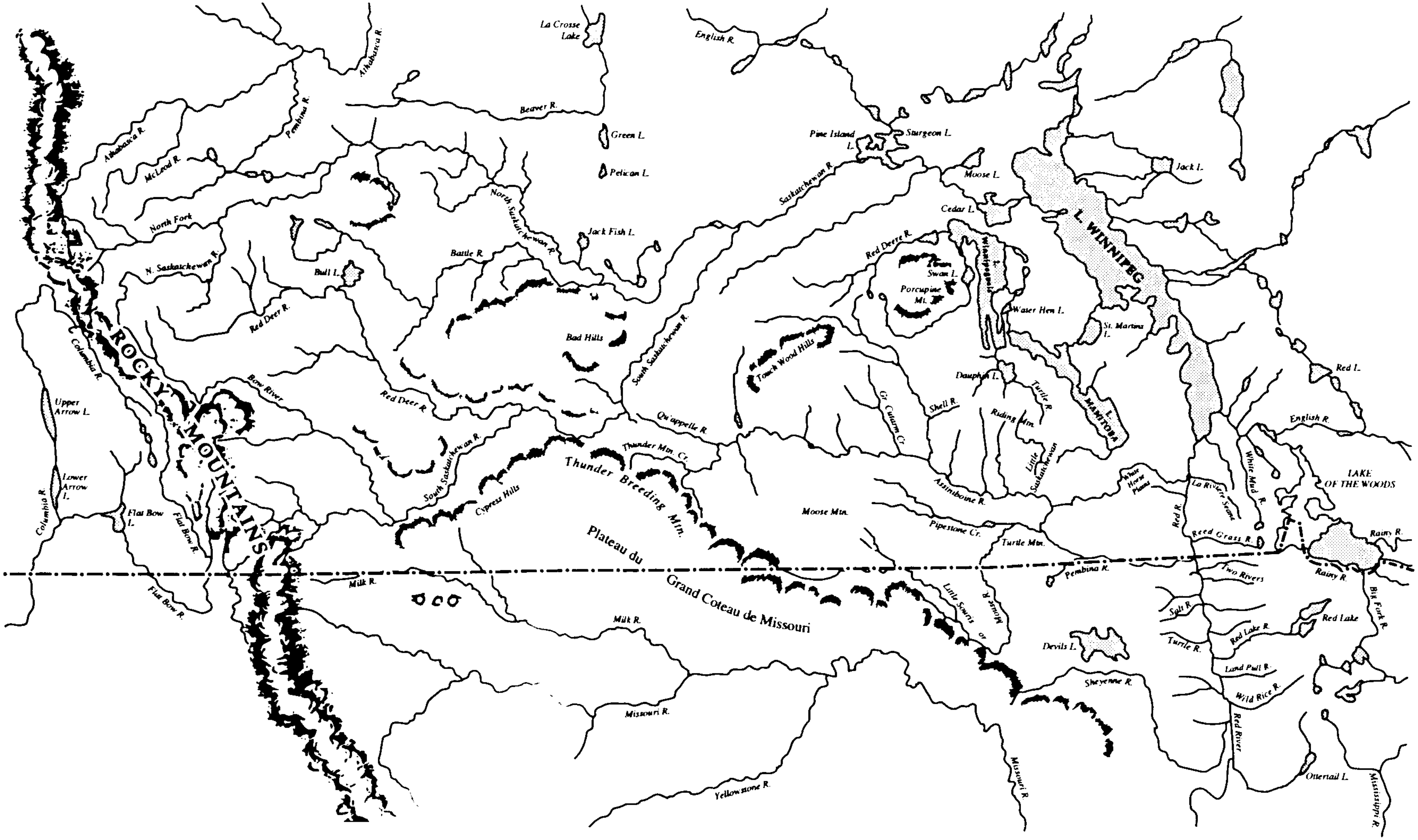

Figure 1: Map of the Study Area, Showing the Major Geographic Features

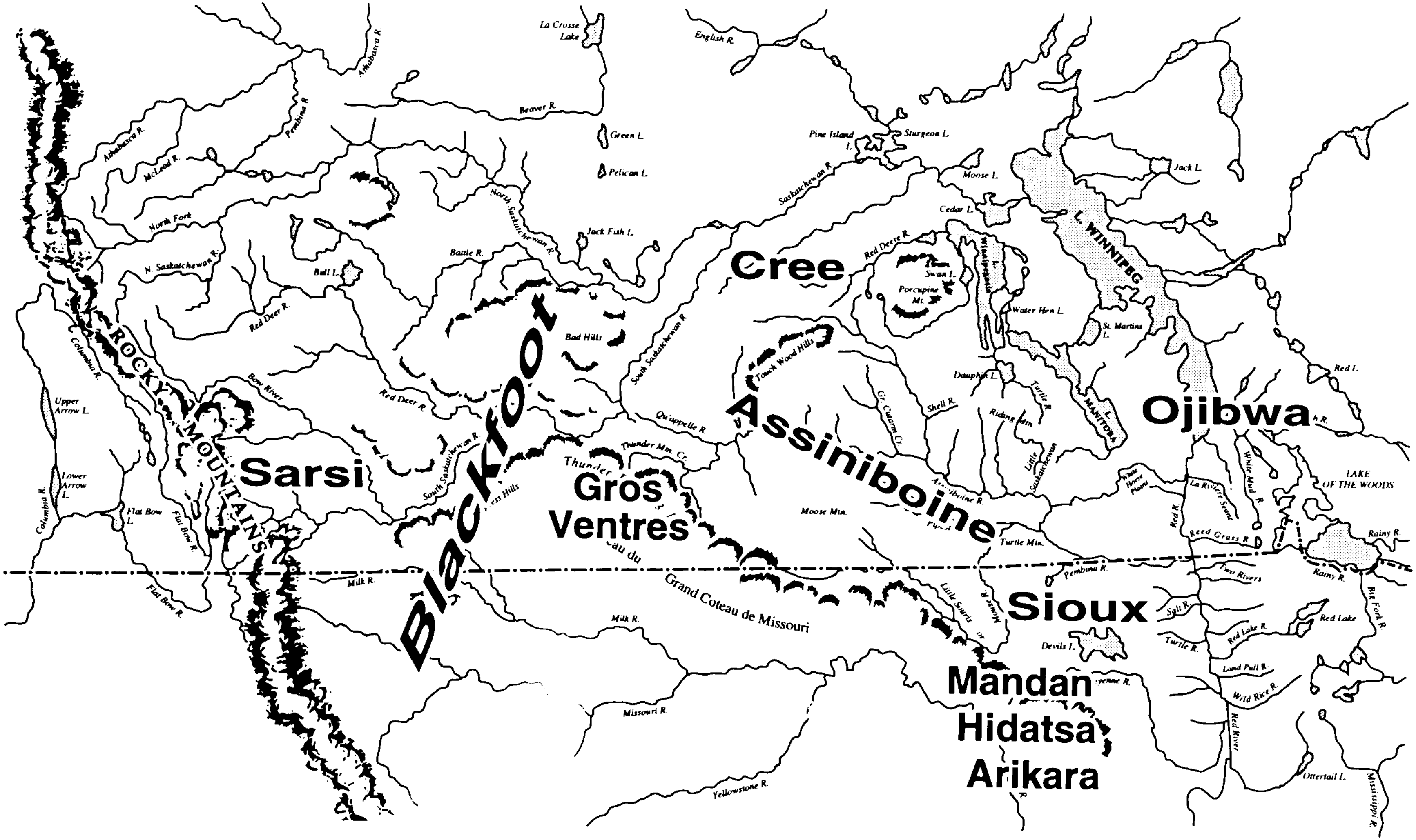

Figure 2: Map of the Study Area, Showing Tribal Locations (circa A.D. 1800)

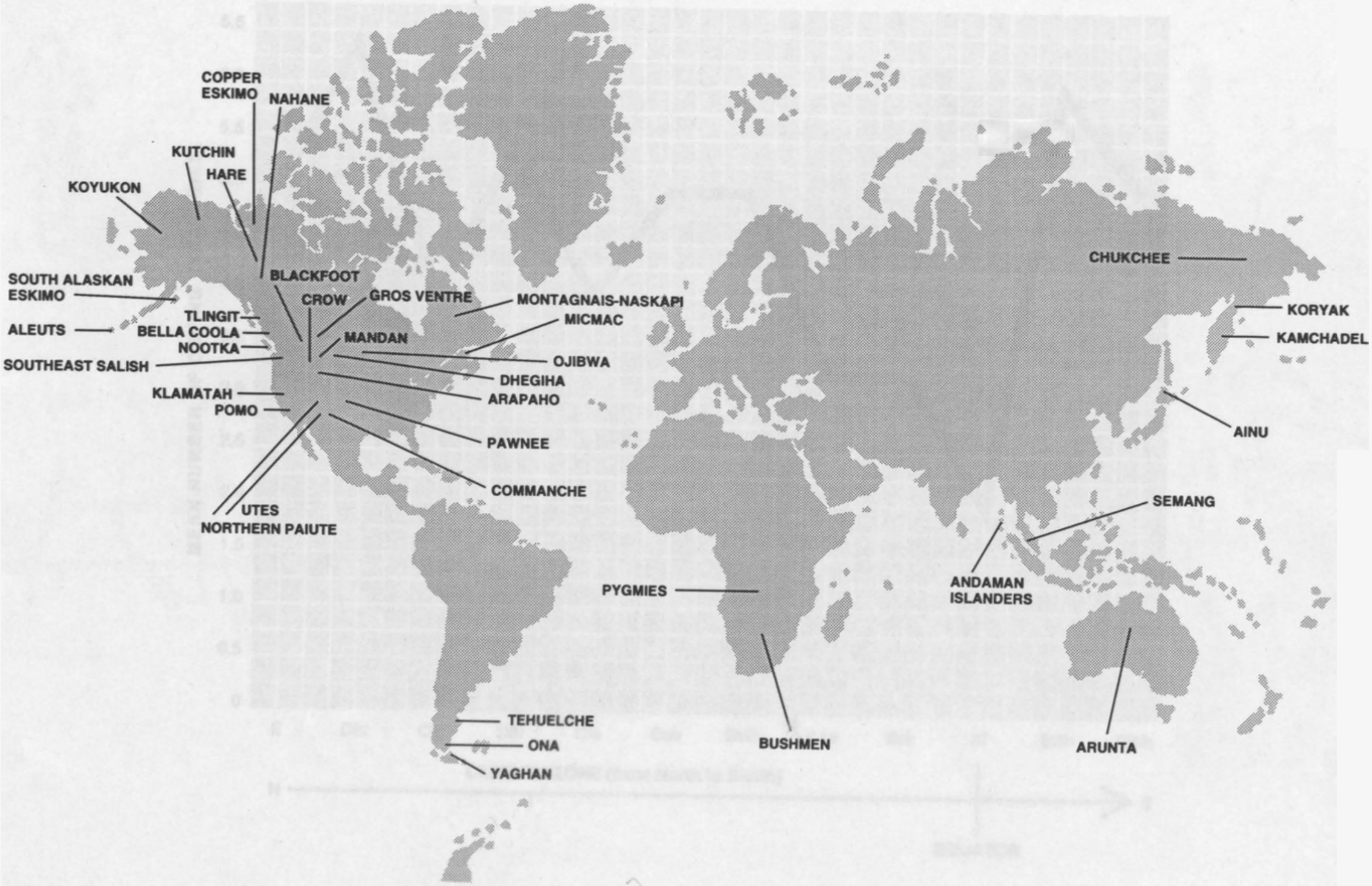

Figure 3: Map Showing the Location of 38 Societies which hunt & gather.

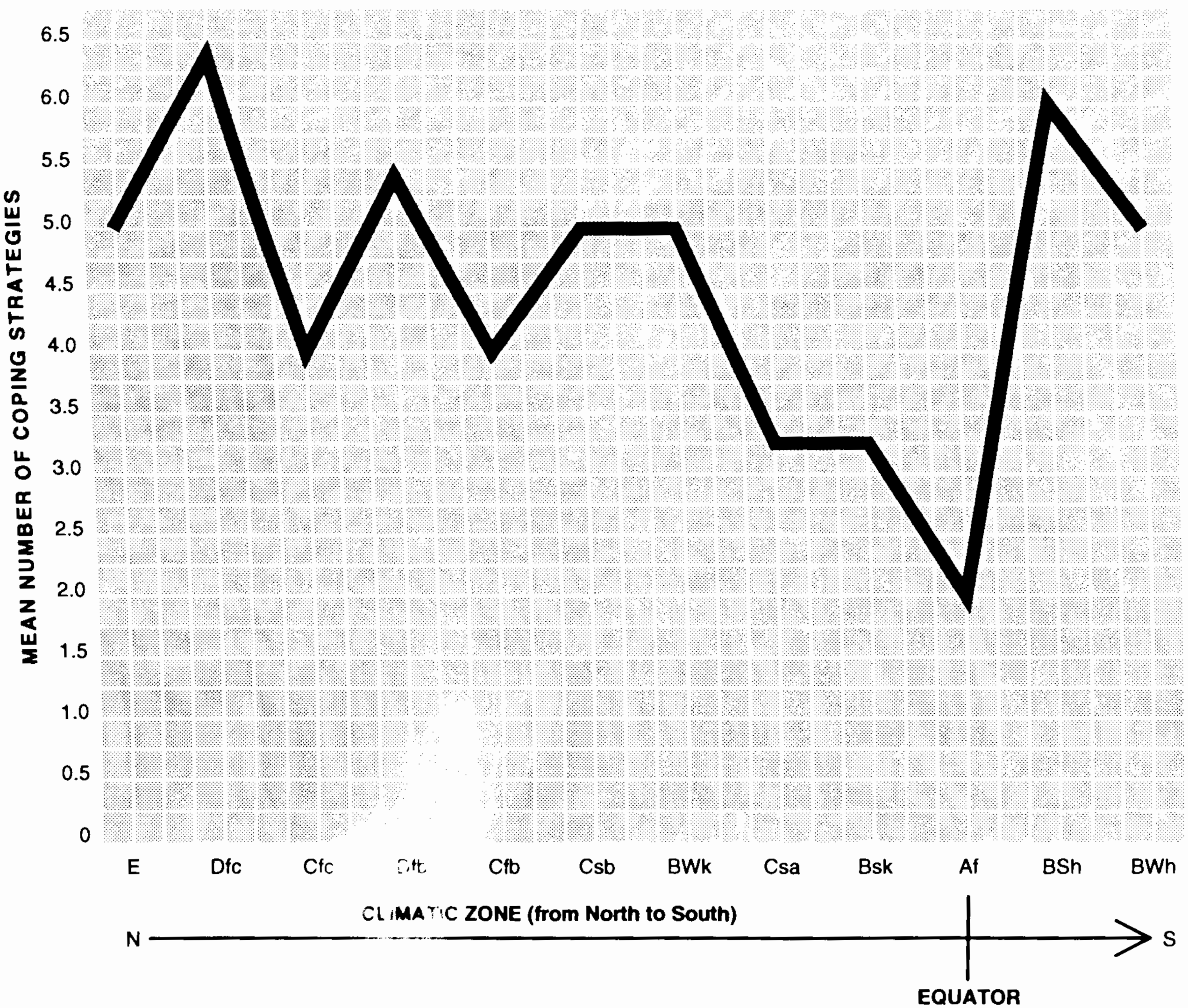

Figure 4: Comparison of Mean Number of Resource Stresses and Coping Strategies, by Climatic Zone

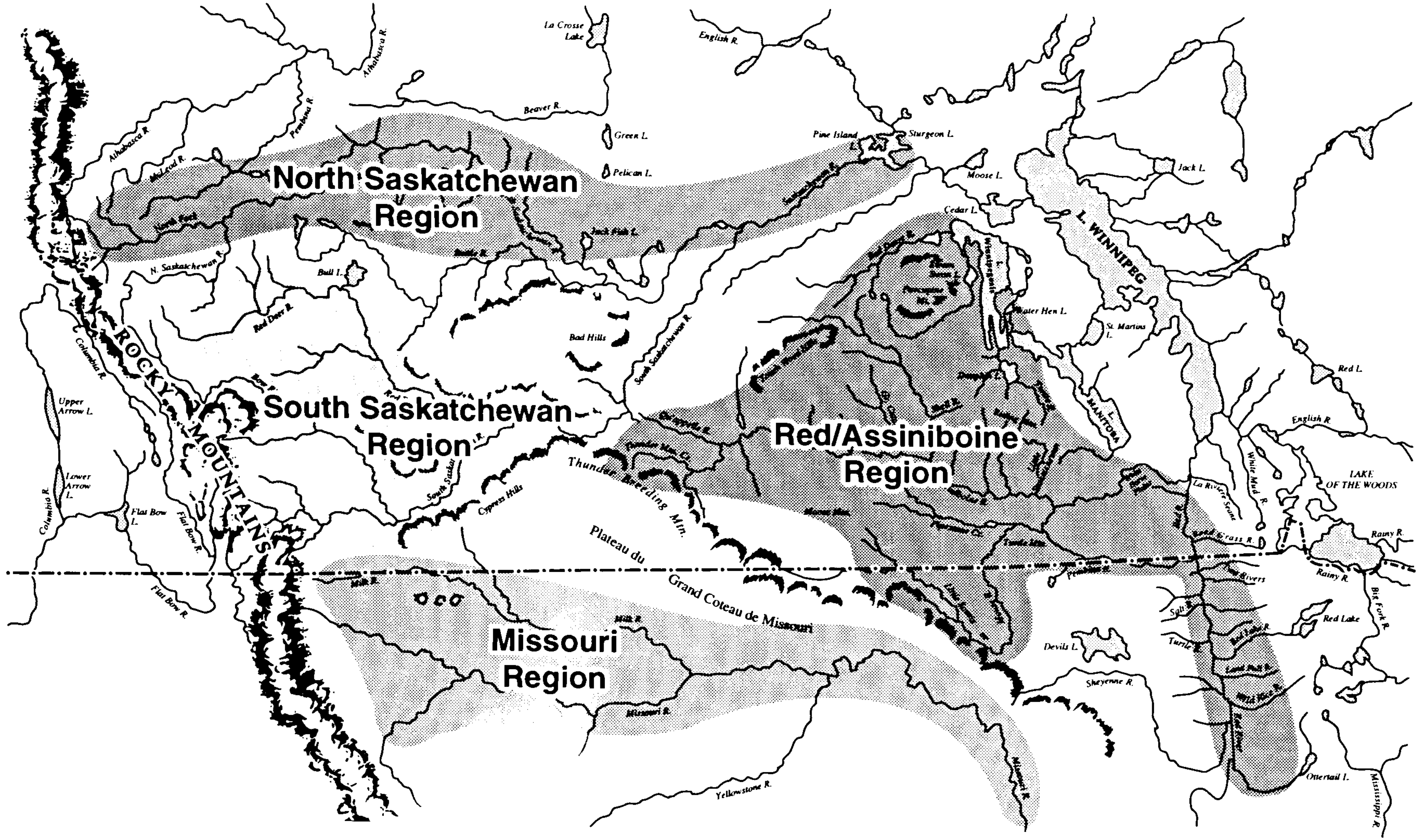

Figure 5: Map Showing Geographic Sub Regions in the Northern Plains

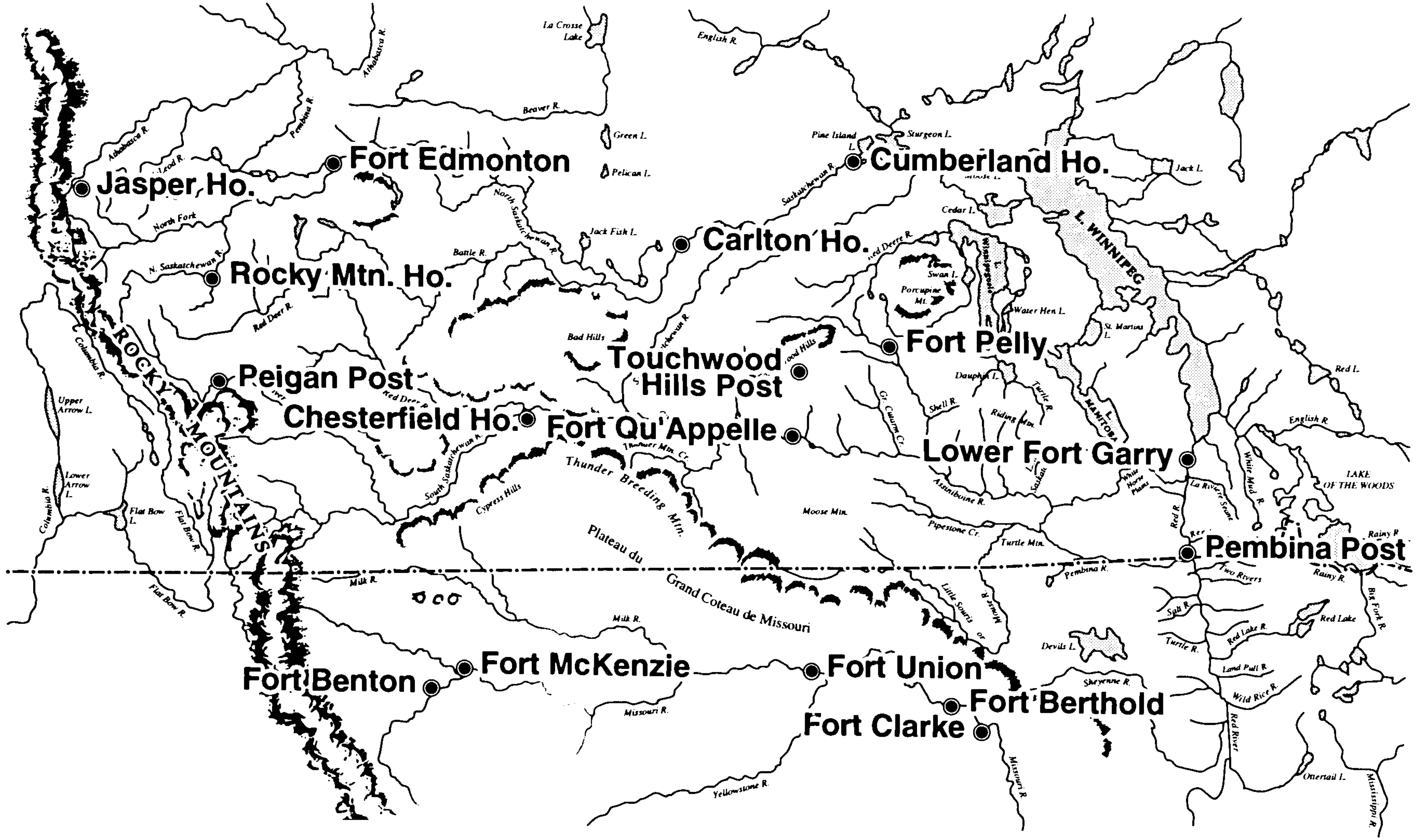

Figure 6: Map Showing Major Trading Establishments in the Northern Plains

Figure 7: Map Showing Direction of Movements of Fur Trade Settlements

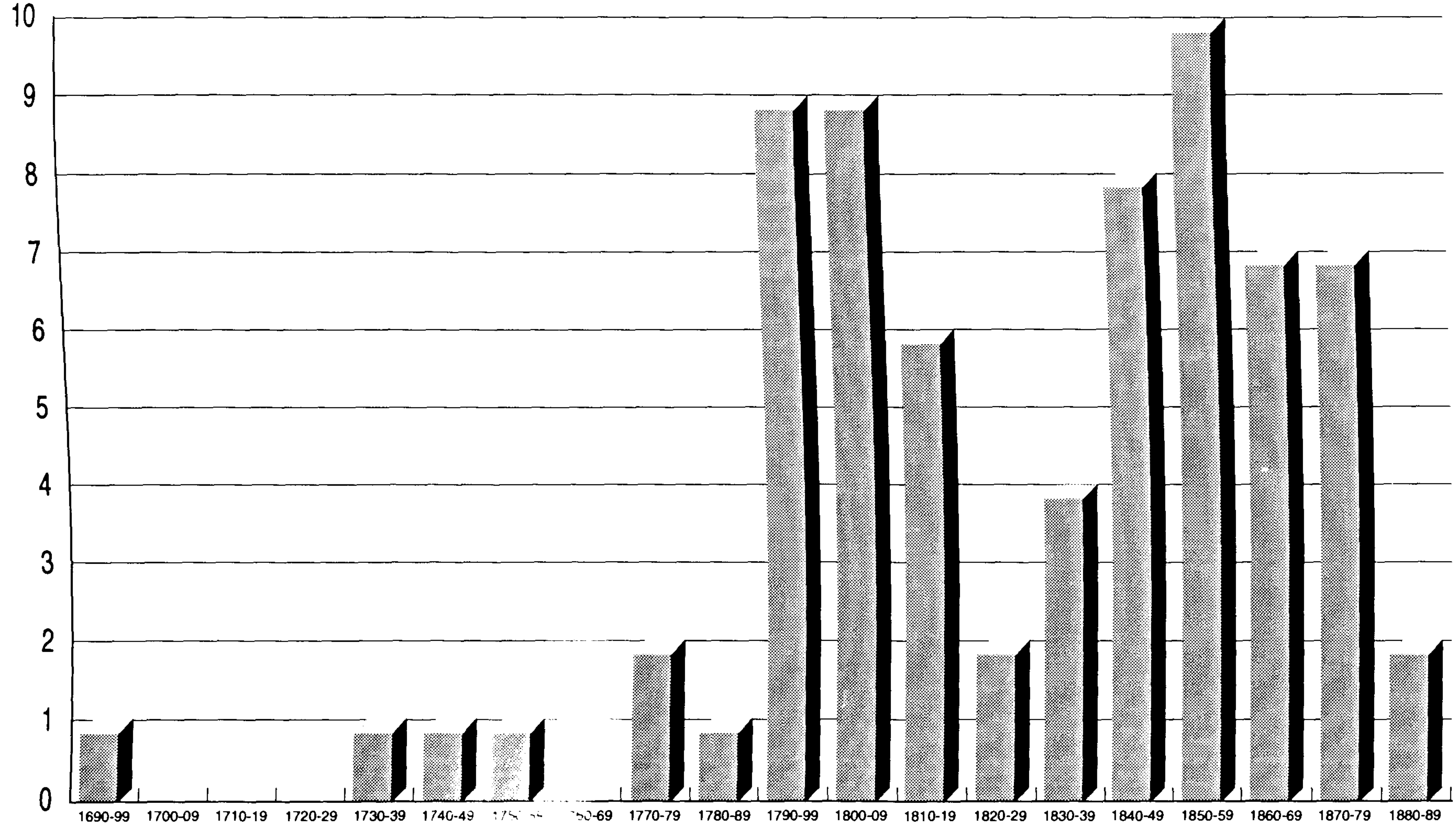

Figure 8: Numerical frequency of early historic accounts of the Northern Plains, 1691-1888, by Decade.
(see Table 14 also)

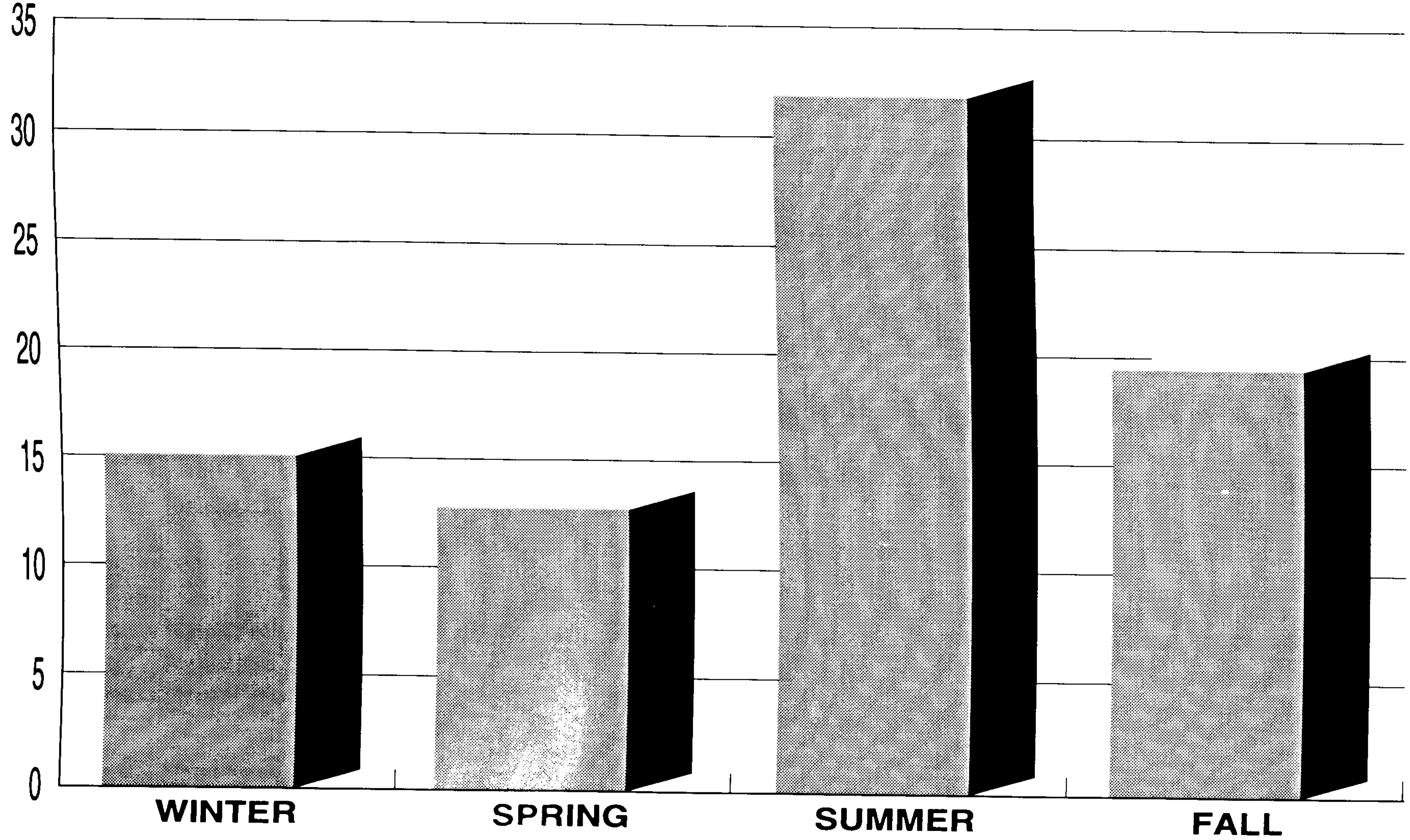

Figure 9: Seasonal distribution of immense herds of bison, sighted between 1691 and 1869.
(see Table 34 also)

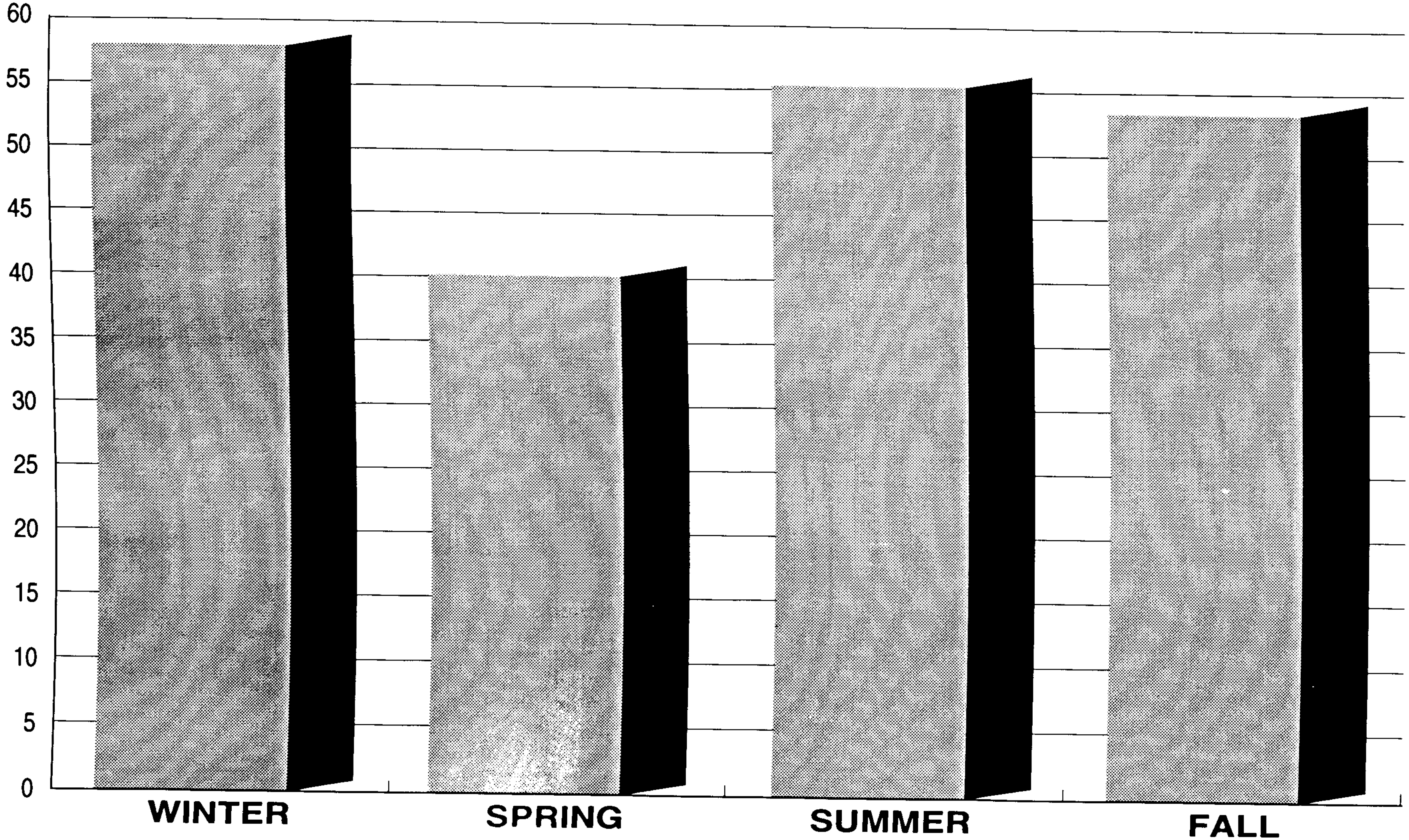

Figure 10: Seasonal occurence of animal movements as resource stressor in the Northern Plains, 1738-1888.
(see Table 36 also)

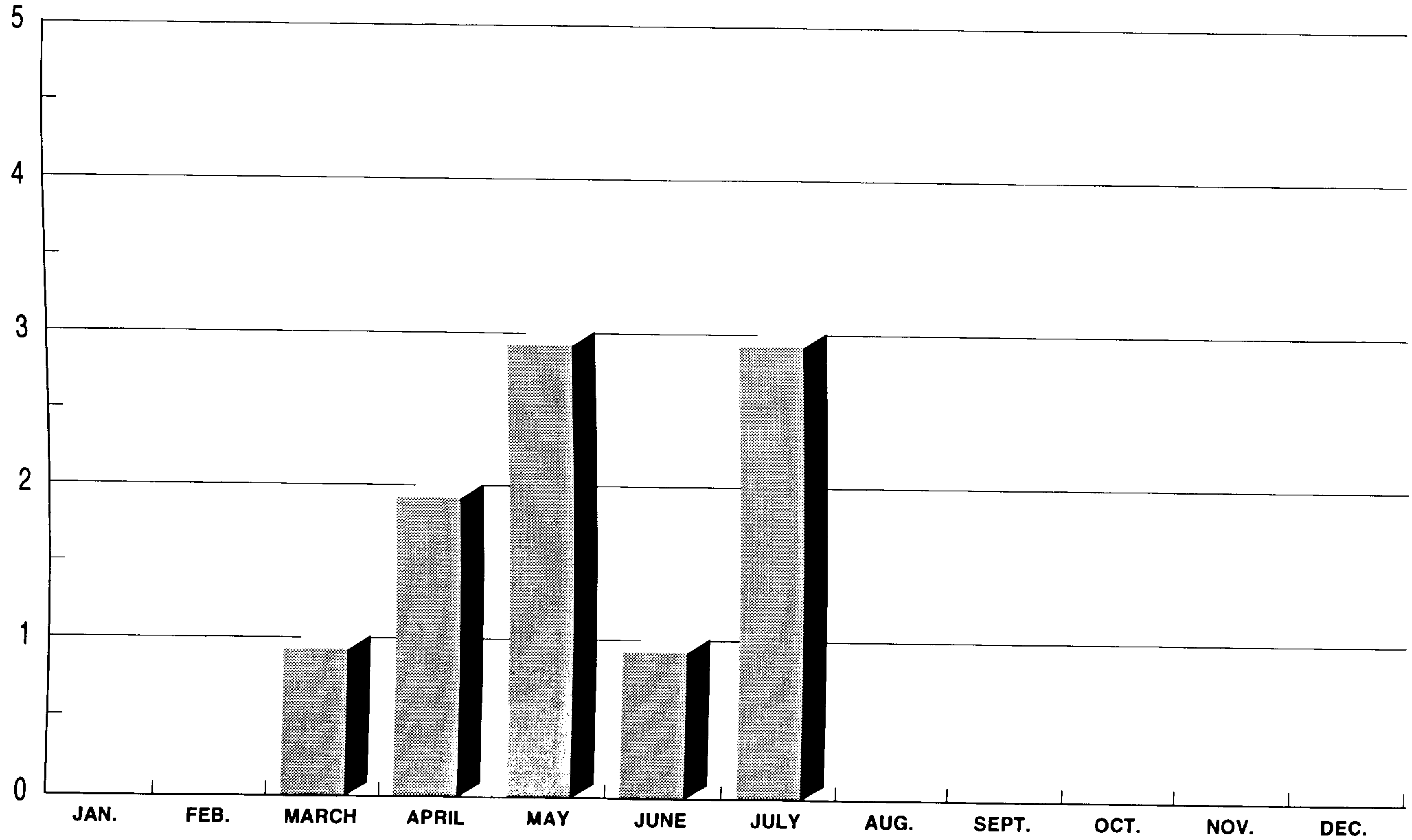

Figure 11: Monthly reports of large-scale buffalo deaths by drowning in the Northern Plains, 1794-1857.
(see Table 37 also)

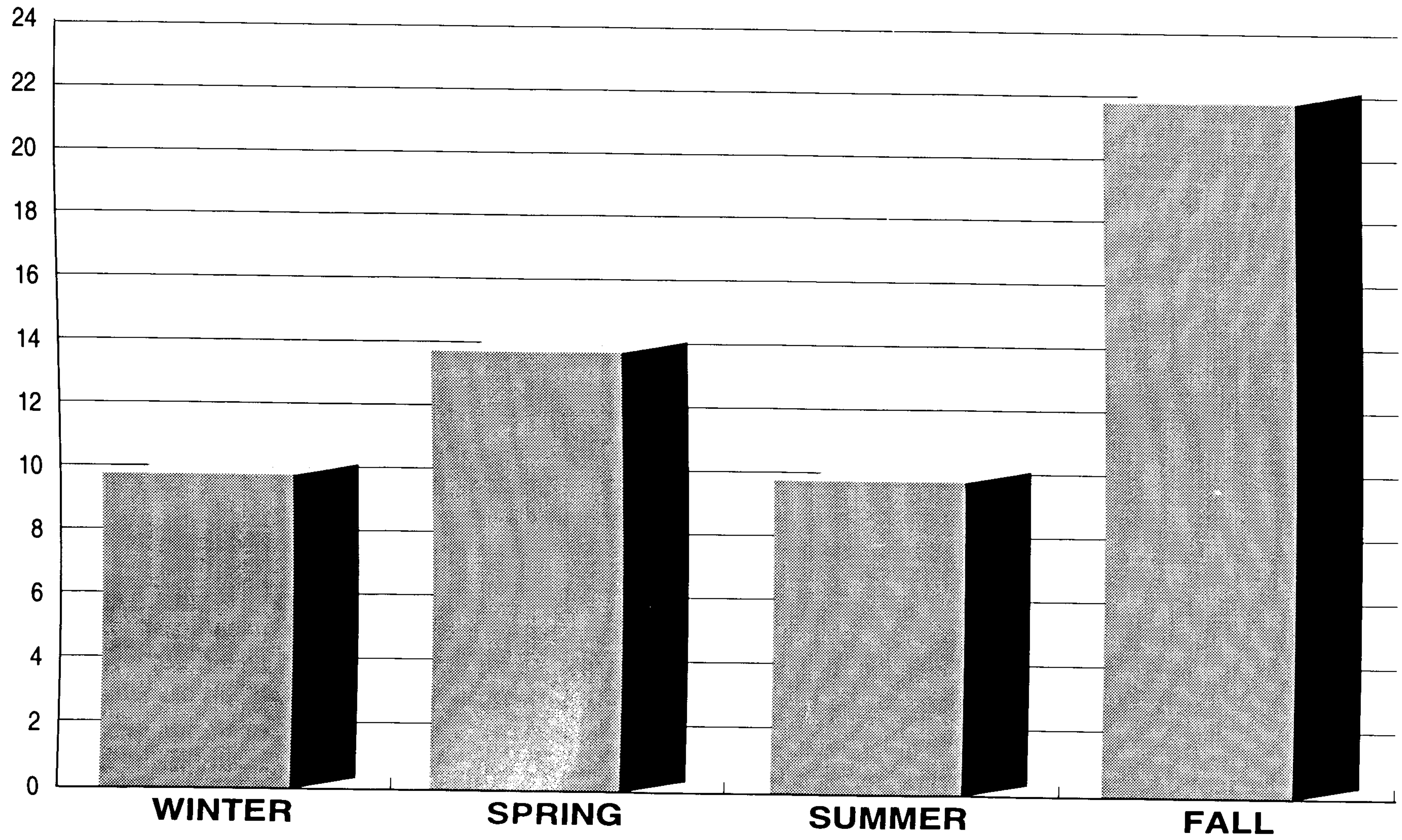

Figure 12: Seasonal occurrence of prairie fires in the Northern Plains, 1754-1863.
(see Table 39 also)

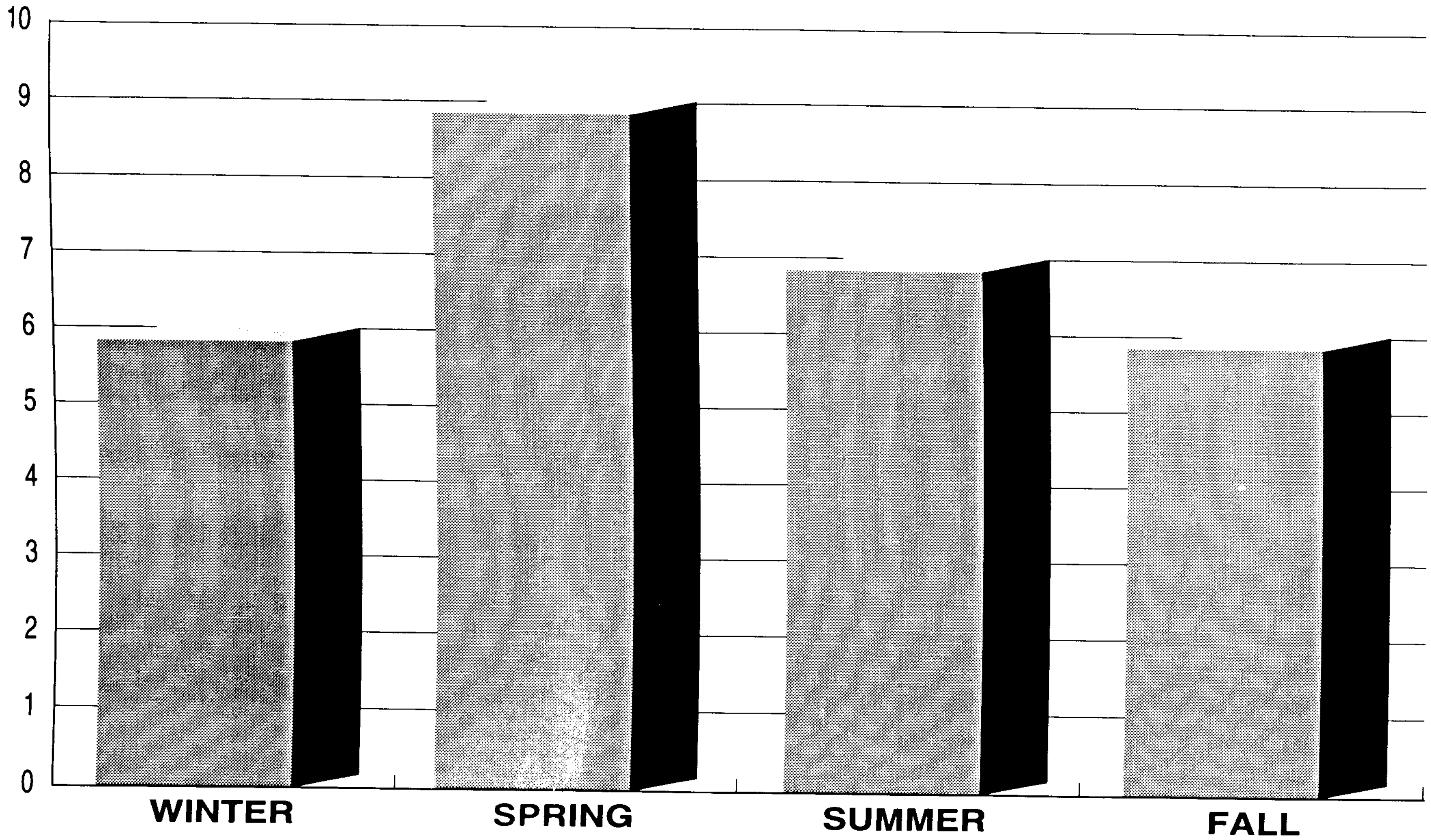

Figure 13: Documentation of drought episodes by season in the Northern Plains, 1738-1869.
(see Table 42 also)

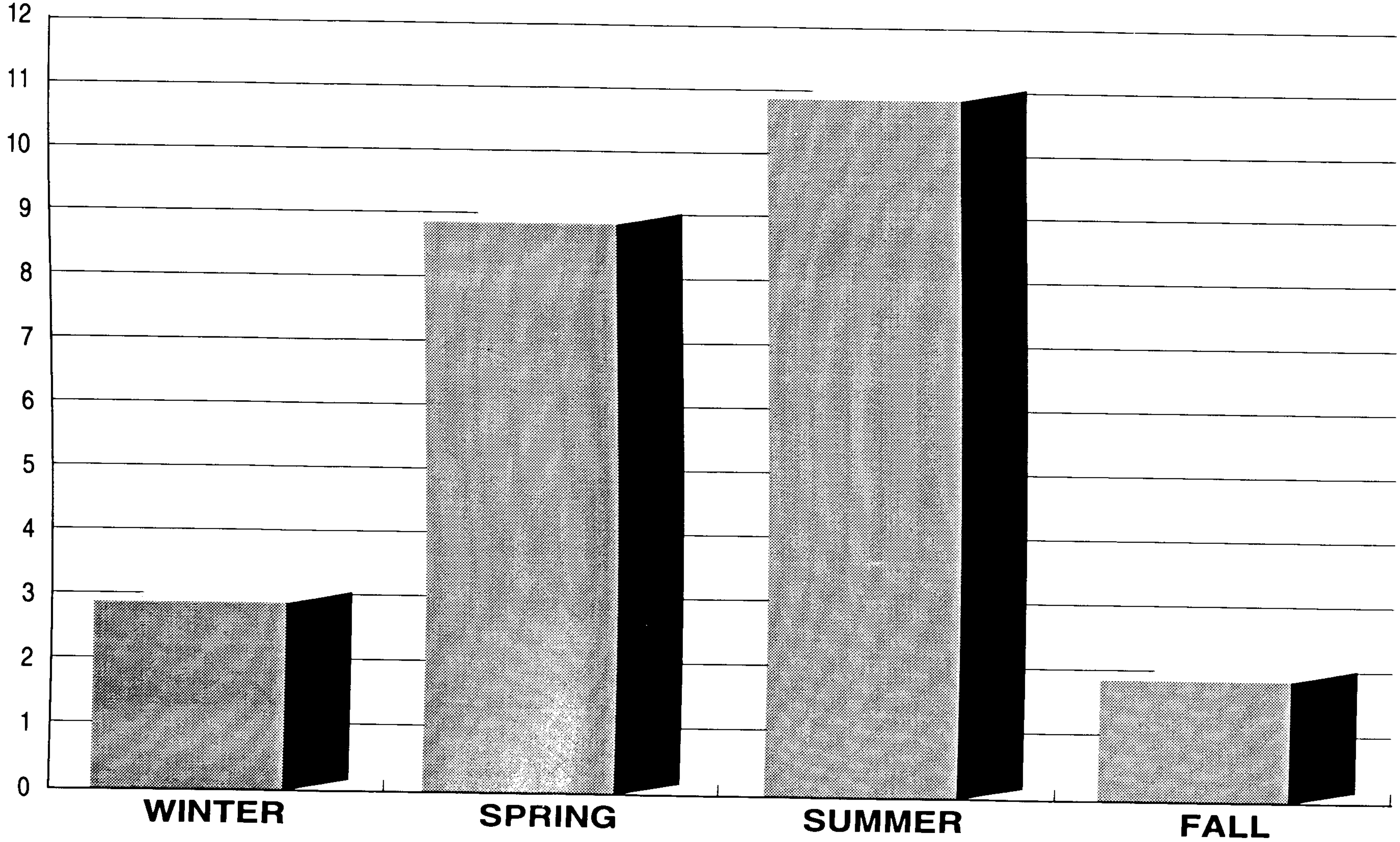

Figure 14: Documentation of enemy threat or action as resource stressor in the Northern Plains by Season, 1790-1870.
(see Table 45 also)

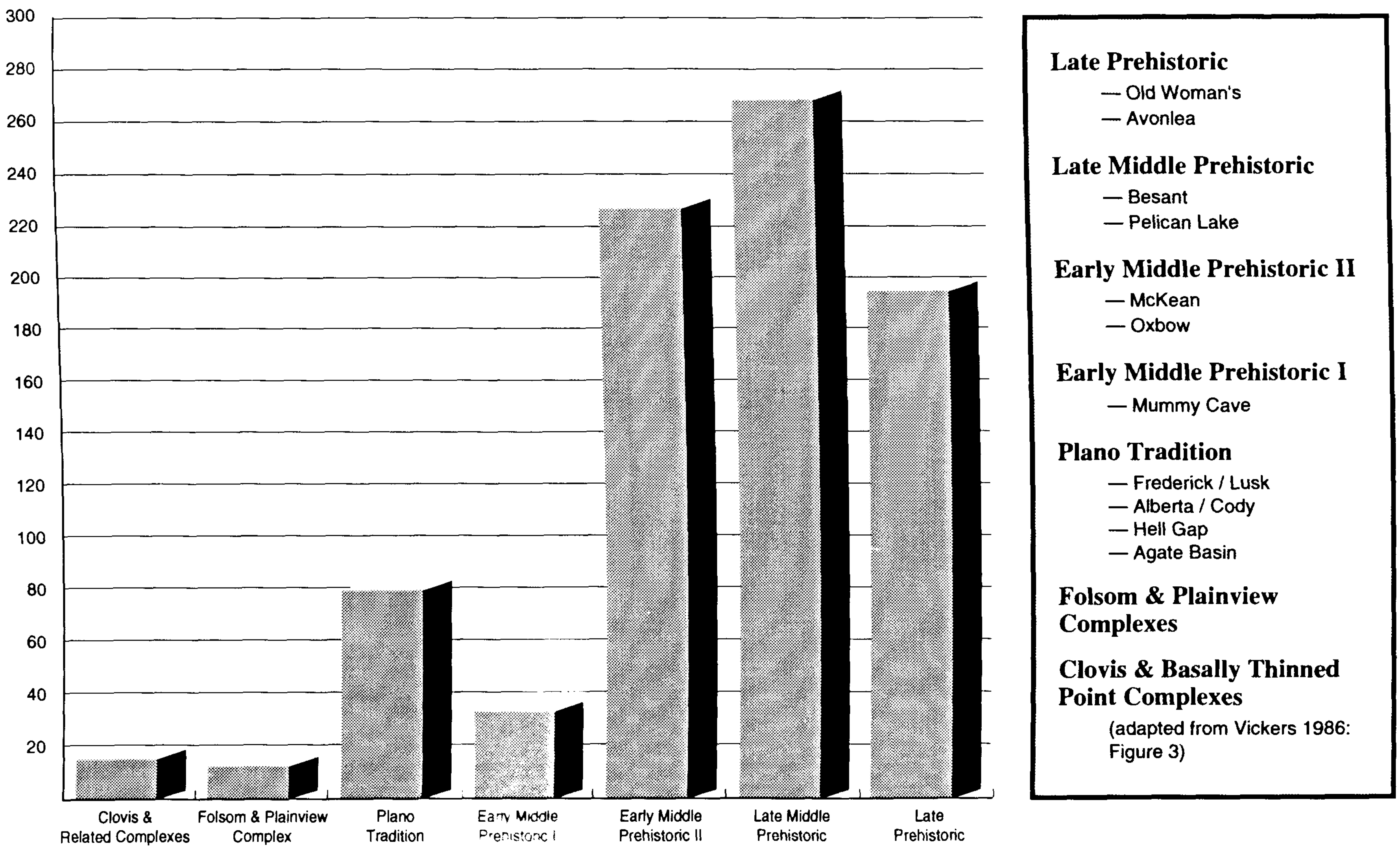

Figure 15: Numerical frequencies of Cultural Complex/Tradition/Period assigned sites in Alberta.