ADVERSARIES AND SCIENCE: ENVIRONMENTAL PLANNING AND THE SOCIAL CONSTRUCTION OF SCIENCE AND SPATIAL INFORMATION IN BRITISH COLUMBIA'S CENTRAL COAST

by

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THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

In the
Department of Geography

SIMON FRASER UNIVERSITY

Summer 2005

APPROVAL

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Degree: Masters of Arts

Title of Thesis: Adversaries and science: Environmental planning and the social construction of science and spatial information in British Columbia's central coast.

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ABSTRACT

Science and spatial information are essential to achieving sustainable land use plans, but adversarial science can increase conflict. This thesis combines environmental planning, GIS, and philosophy of science to investigate such situations.

B.C.'s Central Coast Land and Resource Management Planning process has taken place amidst market campaigns, scientific disputes, and conflicting social values relating to conservation of the world's largest remaining temperate rainforest. An analysis of policy debates over grizzly bear management and protected area network design reveal how adversarial science fashioned the terms of the debate, as well as the means for compromise.

The establishment of an independent information team played a key role in the emergence of consensus recommendations in 2004. While this team achieved only limited success in providing clear scientific direction, it served effectively as a dispute resolution strategy by establishing a separate process where the social construction of science could be acknowledged and engaged.

To Vance, my ballast and my best friend and my dear companion,

Thank you for everything.

To my friends whose support and laughter and endless supply of dark chocolate helped me through the roughest of times.

To my families, who helped me along this and every journey.

ACKNOWLEDGEMENTS

My warmest of thanks are extended to my advisor Dr. Alex Clapp who has provided me with countless hours of assistance, guidance, and friendship over the past few years. I would also like to thank Dr. Nadine Shuurman for her support, both academically and personally, and for the many times when I was able to refer to her work in key moments in an effort to help bring clarity to some of the theoretical questions that were challenging me. And next I would like to extend my thanks to Dr. Tom Gunton from REM for contributing to my thesis as my external advisor and for how he challenged me to think critically about the roles science and information maintain in collaborative planning.

To the many individuals who helped me along my research journey, from the kind Heiltsuk man who welcomed me into his home one rainy afternoon for coffee to those who shared their experience and time in more formal interviews and continued dialogue.

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LIST OF ABBREVIATIONS

AAC – Annual Allowable Cut
CAD – Conservation Area Design
CCLRMP - Central Coast Land and Resource Management Planning
CII – Conservation Investment Incentives
CIT – Coast Information Team
CITES – Committee on the Trade of Endangered Species
CORE – Commission on Resources and Environment
COSEWIC – Committee on the Status of Endangered Wildlife in Canada
EBM – Ecosystem Based Management
ENGO – Environmental Non-Governmental Organization
ESA - Ecosystem Spatial Analysis
FEMAT – Forest Ecosystem Management Assessment Team
GIS – Geographic Information System
GBMA – Grizzly Bear Management Areas (Formerly called Grizzly Bear Conservation Areas)
GBSC – Grizzly Bear Scientific Committee
LUCO – Land Use Coordination Office
LRMP - Land and Resource Management Planning
MoF – Ministry of Forestry
MoSRM – Ministry of Sustainable Resource Management
PAS – Protected Areas Strategy
SRI – Socially Responsible Investment
STS - Science and technology studies
TFL – Timber Forest Licence
THLB – Timber Harvesting Landbase
TSA – Timber Supply Area

1 INTRODUCTION

Land use decisions in forest resource management have frequently failed to achieve mandates for sustainability, conservation, or multiple use (Cassells 2001). This has resulted in increased conflict, direct action campaigns, and costly court injunctions. British Columbia (B.C.) follows many jurisdictions in experiencing conflict over land management. In the mid 1990's, the provincial government developed participatory land management throughout B.C. in an attempt to reduce conflict and achieve land use certainty by balancing environmental, economic and social values. Management of temperate rainforests in the area identified as the Great Bear Rainforest is challenged by adversarial science, market campaigns, and conflicting social values about the appropriate role of conservation in the region. The Central Coast Land and Resource Management Planning (CCLRMP) was intended to be the arena where disparate social values were negotiated in a collaborative process to arrive at consensus negotiations. Conflicting social values related to the central coast's pristine forest and remote watersheds demanded collaboration and innovative solutions in order to arrive at consensus land use recommendations. Among these was the development of an information team, the Coast Information Team (CIT), whose stated central mandate was to develop *independent information*. The CIT served as a conflict resolution tool precisely because it did engage the social construction of science and supported a process that increased collaboration and the building of greater trust in the way scientific (and other) information is developed and used to inform planning. Key innovations of the CCLRMP recommendations include commitments to silviculture based on ecosystem management, an expanded protected areas strategy, and evolution in negotiations between the provincial government and First Nations.

Science and information are contested through collaborative planning processes, which in turn affect resource management decision making and environmental conflict. Latour (1987) suggests that the proper place for Science and Technology Studies (STS) is to identify a controversial political issue which has captivated the attention of scientists. Such an opportunity is evident in the CCLRMP, where an independent information team was a critical component of the development of consensus recommendations. This thesis explores theories from philosophy of science, environmental planning theory, and critical GIS in order to better understand the evolution of the CCLRMP, to explain and situate outcomes of this planning process, and in doing so, to analyse ways that science has been constructed.

While many of the land use planning processes in the province have experienced high levels of controversy, the CCLRMP was particularly controversial because recommendations will not only impact the people living in the region and regional economies, but are also important to aboriginal and global conservation. For these reasons, the central coast has been described as "simultaneously a worked-over resource periphery and a wilderness with distinctive human faces" (Clapp 2004 p. 846). The central coast contains much of B.C.'s remaining high value coastal lumber (Ministry of Forest 1999), vital grizzly bear habitat (MacHutchon, Himmer et al. 1993), and large, interconnected, pristine areas (Moore 1991; Jeo, Sanjayan et al. 1999). Coastal First Nations have lived in the forest of the central coast for millennia, developing one of the world's most diverse and enduring human cultures (Suttles and Ames 1997). More recently, the region's marine and forest resources attracted non-native settlers whose pulp mills, sawmills, logging camps, canneries, and mines provided economic opportunities for native and non-native coastal communities (CFCI 2004). This dependence upon primary resource extraction left these communities vulnerable to market fluctuations (Hayter 2003), resource cycles (Clapp 1998), and more recently, changing social values that prioritise sustainable development over resource exploitation (Clapp 2004; CFCI 2004).

Science and information has played a pivotal role in the quest for social, economic, and ecological sustainability in the region conceptualized as the great bear rainforest. Science informed the ENGO characterization of the region as the world's largest remaining old growth temperate forests, it documents the region's species diversity and megafauna, and it demonstrated negative impacts of land use alteration. Science is also at the heart of the timber industry's quest to develop more sustainable forest practices, and underlies new silviculture strategies to regenerate forests, improve habitat quality of managed forests, and more effectively mimic natural disturbance regimes. In other words, science is essential to developing operational guidelines that will meet ecological, social, and economic values desired by stakeholders. Yet science alone was never intended to, nor would it be able to resolve value-based conflicts over *how* to achieve sustainability. This is where the applied practice and expertise of forest technicians, local experts, and traditional knowledge is essential. Science and information were drawn upon to better understand the implications of management decisions in the context of explicit goals. Often agreement could be achieved in a stated goal (e.g. maintaining viability of a salmon bearing stream) but it was setting the operational guidelines (e.g. the width of the riparian zone) where scientific and economic debates continued.

ENGOs initially emphasized the land use planning map in the CCLRMP because protected areas are seen as integral to ecosystem function and conservation in the region. Critical to this goal are scientific debates regarding how much is enough to ensure ecosystem function. However, debates over the management of the great bear rainforest soon expanded beyond protected areas and into the management of the entire land base. Conservation biologists argue that the management of the matrix is essential to maintaining ecosystem function (Noss 1996). Timber companies drew upon biophysical characterization of timber values in controversial watersheds and upon research supporting how new silviculture could support maintenance of ecosystem function. Local and regional communities look to economic benefits that might accrue from these watersheds, be they from tourism, non-timber forest products, or timber extraction. Many are interested in conservation, though not at the expense of human well-being. The First Nations, while concerned with many of the same issues as above, were also very interested in how land use decisions might affect their sovereignty over the management of the areas, as these allocations would affect the larger treaty process many were engaged in. Ecosystem management was the location where these diverse social values with regard to the appropriate role of conservation of nature versus human disturbance and resource extraction were negotiated.

As evident above, many of the key stakeholders in the CCLRMP actively engage in substantiating their assertions by science. The provincial government's New Era platform promotes science based management, the environmental coalition justifies its position via conservation biology, and the timber coalition strives for science-based silviculture strategies. Yet, each of these groups draws upon a different body of science to substantiate their assertions and each, to some degree, cloaks political strategies beneath the rubric of 'good science'. Often this can result in situations where one group's science is used to challenge another's, resulting in the intensification of environmental conflict. Larger research objective was to explore the relationship between science, advocacy, and policy. In pursuit of this, this thesis explored the following research questions:

1) What were key innovations and outcomes of the land use strategies developed in the central coast LRMP?

2) Have improvements in spatial information contributed to reduced conflict in this planning process?

3) Are social constructions of science and information being considered in collaborative planning processes?

Chapter 2 presents three theoretical lenses from which to explore how adversarial science informs collaborative planning. Collaborative planning processes are being used in B.C. to democratise land use decisions and achieve greater land use certainty by providing consensus recommendations to government. Politicians and decision-makers rely on the expertise of others to put technical information into clear recommendations in order to make political decisions. Contemporary environmental problems are frequently modelled using GIS because of their ability to encode, analyse, simulate processes, present spatially complex issues, and aide in decision making (Clarke, Parks et al. 2000). For example, maps depicting resource values, such as grizzly bear habitat, were a key component of negotiations over future land use in the CCLRMP. Critics argue, however, that GIS and spatial models fail to adequately depict features or ecosystem processes represented (Schuurman 2004). Limitations to the use of GIS are accentuated by the failure of users and political processes to recognize the human element in both the creation of the technology and its application. Philosophy of science explores, among other subjects, the roles that science and technology should and does play in the formulation of policies, and proposes improvements for how scientific inquiry can improve the democratic process.

Chapter 3 begins with a brief discussion of two other forest conflicts in the coastal temperate rainforests of North America that have influenced the central coast conflict: first, the conflict over spotted owl habitat in the federal forests of the Pacific Northwest and, second, the conflict over protection of un-logged old forests in Clayoquot Sound. This chapter then presents the provincial land use planning strategy, introduces the central coast planning region, and examines the history and key outcomes of Phase I: 1997-2001 and Phase II: 2001-2003 of the CCLRMP. Importantly, the roles that adversarial science and spatial information played in the forest conflict in the central coast will be highlighted. Among these were commitments to and the development of ecosystem based management and the CIT. The CIT also served as a conflict resolution tool precisely because it did engage the social construction of science, and supported a process that increased collaboration and built greater trust in the way scientific and other information is developed and used to inform planning.

Chapter 4 explores the circumstances, the innovations, and attempts at balancing ecological and social values that contributed to the consensus agreements achieved by stakeholders in the last days of 2003. Procedural changes, advances in science and technology, and building off high levels of commitment in Phase I clearly contributed to the arrival of consensus. However, the CCLRMP generated a series of institutional innovations that include First Nation protocol agreements, the formation of collaborative bilateral relationships between different sectors, and conservation financing. Also critical were elements that ensured economic opportunities. These included reduced impacts of protection on the timber harvesting landbase, the development of an Ecosystem Based Management (EBM) framework (which attempts to manage for ecological and social well-being), and provisions to allow economic opportunities in the parks. A critical ongoing process is the legislation and implementation of EBM.

Chapter 5 explores how adversarial science has informed two policy debates over grizzly bear management and protected areas in the central coast. Throughout the history of the CCLRMP scientific debates have been ongoing over what constitutes accurate information. This information was critical in understanding the impacts of protection, or conversely, how to develop resources in a watershed categorized as containing high environmental values. Further complicating the perception that better information was needed was that the cumulative impacts of environmental risks must be assessed at varying levels and intensity of resource extraction vs. conservation regionally. This is clearly demonstrated in the debates over the location, size, and scope of the protected areas design and grizzly bear management areas.

Adversarial science was caught up in the initial inability to resolve forest conflict in the great bear rainforest and addressing the antagonism of adversarial science was necessary to achieve consensus land use recommendations. Battles over science in the political arena can result in further entrenching interests. This was clearly the case in Phase I of the CCLRMP and directly related to the development of the concept and actualisation of the CIT. The CIT was tasked to develop EBM, and to provide information needed to resolve questions regarding the land use planning map. The CIT is an intermediary process, one created out of political disputes, but expected to operate in a quasi autonomous fashion. The CIT developed a broad suite of tools, analyses, and maps that provided information to Phase II of the CCLRMP and other planning tables. The independent information team served as a dispute resolution strategy and a separate process where the social construction of science and information could be acknowledged and engaged. Yet, problems inherent to the CIT resulted in it being less effective at transforming the conflict as there remained serious problems with trust, ongoing perceptions of bias, and problems with delivery. Nonetheless, the CIT played a key role in transforming elements of the larger conflict because it directly engaged debates about science and information, provided opportunities for building social capital, enabled a more dynamic human-nature relationship, and attempted to integrate multiple knowledge communities. As a result, a dynamic perspective on the human-nature dichotomy and adaptive management informed EBM. In a few cases, explicit spatial information assisted in developing solutions deemed critical to the arrival of consensus in that they were able to translate contested social values into operating guidelines or planning direction in a way that demanded the details of the data and the spatial configuration be addressed.

However, conflict remains regarding present and future management of the great bear rainforest. Importantly, a consensus set of recommendations was only achieved at the last meeting and until the very end, few of the participant believed this would be possible. Despite the participatory collaborative foundations of the provincial LRMP process, cabinet will make the ultimate decisions and these negotiations are occurring behind closed doors. Importantly, none of the CCLRMP recommendations have been legislated as of June, 2005, in spite of the fact that as of April 2005, many of the land use plans negotiated between First Nations and the provincial government (based on the CCLRMP recommendations) were submitted to cabinet for ratification (DSF 2005).

1.1 Methods

Conducting research for a political planning process as complex, controversial, and technical as the CCLRMP posed numerous challenges. Much of the first year was spend familiarizing myself with the regional LRMP process (this included taking a graduate course through SFUs Resource and Environmental Management School that investigated the provincial process), B.C. forest issues, the great bear rainforest environmental campaigns, and the grizzly bear hunting controversy. Previous academic experience with conservation biology and temperate forest management in the Pacific Northwest of the USA proved valuable in understanding much of the technical scientific prescriptions, research, and policy questions. However, the larger political context within which the great bear rainforest campaign is situated demanded familiarity with provincial and national politics, planning, and history of conservation activism.

There were numerous challenges arising from the controversial nature of the CCLRMP. People were quite concerned with revealing information that was confidential or might otherwise undermine the tenuous nature of the consensus recommendations. For this reason, there were numerous times when information was revealed but I was instructed not to divulge the sources or the nature of the discussion. This was particularly challenging. One, I did not want to escalate the conflict in any way by repeating certain statements, misinterpretation, or taking comments out of context. Secondly, while much of this information provided important contextual understanding, I did not always know how to reference or support conclusions that were informed by these meetings. In other cases, maintaining explicit confidentiality was difficult. For example, there are many times in the thesis where I use the passive voice instead of the active voice in an effort to ensure absolute confidentiality. Numerous times I have refrained from revealing which stakeholder has stated particular comments. Though the CCLRMP meetings were open to the public, much information was not transcribed in official meeting minutes and I have followed this protocol and have not linked individuals to particular comments. These comments are referenced to the meeting date, though some of their comments may not be located in the official meeting minutes. Similarly, conversations held at the CCLRMP meetings were not in the context of a formal interview process and I have titled these "personal communication" since no waiver of consent was signed. All of these conversations took place in the context of my role at the meetings as a researcher investigating the CCLRMP process.

My research questions and methodological approaches evolved throughout the course of the research. The original intent of the thesis had been to examine two threads of policy debate related to the grizzly bear management and the development of a protected area strategy. However, it became apparent that many larger social and scientific issues informed decisions in the CCLRMP. It was impossible to look at the construction of science and information and the impact of this particular spatial dataset without investigating the CIT, the history and politics leading up to its creation, and the impact that this institution had in leading to consensus. All of this needed to be placed in the context of political manoeuvrings, bilateral negotiations, and compromises that supported the work of the CCLRMP, but frequently operated outside of the participatory process, which meant that they were outside of the public domain. Looking in greater detail at the CIT demanded the theoretical foundation of philosophy of science in addition to familiarity with the sciences in question. Achieving a reflexive understanding of science and policy remains difficult and demands expertise in the scientific theories, technologies, and methodologies as well as the

Table 1: Methods used in thesis research

- Participant observation at the final two CCLRMP meetings of 2003. Observation at meetings (and in coffee breaks) provided invaluable insight into the personalities involved in collaboration (and antagonism), the structure of the negotiation process, the effectiveness of information dissemination to decision makers, and the building of social capital. Importantly, my presence at the meetings enabled me to observe the details, personalities, and intensity of emotions that is omitted from formal meeting minutes. Numerous conversations were held with other stakeholders and participants in the CCLRMP while attending meetings.
- Participant observation at two conferences that directly dealt with First Nations issues in the Province. One of which highlighted First Nation land use plans in the central coast. The first was the 2003 Indigenous Bar Association Conference Oct. 15-17th, 2003 in Vancouver, B.C. The second was the Aboriginal Mapping Network Conference Nov. 20-21st, 2003 in Duncon, B.C.
- Informal interviews with 10 stakeholders, CCLRMP process team members, and technical experts. These interviews were tape-recorded and transcribed. Refer to Appendix 2 for the interview schedule.
- Conversations and communication with biologists who work for the province, environmental activists, and individuals representing the resource sectors. For example, some of the most useful conversations were held at the climByng gym with an activist, who kept me up to date on the 'goings on' of the planning as they unfolded behind closed doors.
- A survey was sent out to each of the 29 stakeholders and their alternates participating in Phase II of the CCLRMP (See Appendix 3). Of these surveys, only four were returned. The responses from these surveys were used qualitatively to inform larger conclusions. Poor response to the survey has precluded its use for quantitative analysis. The Survey did help in providing qualitative and contextual information.
- Four visits to the central coast planning region. The first visit in June 2002 was a three-week trip to many of the coastal communities, including Bella Bella, Hagensburg, and Bella Coola. The second visit in August 2002 was to the mountainous regions of Tweedsmuir and Waddington. The third trip in September, 2003 was to the southern half of the planning region, namely the Broughton Archipelago, Northern Vancouver Island, and Alert Bay. The final visit in August 2004 was to the Broughton Archipelago to speak with community activists.
- Document and historical review of the CCLRMP, provincial grizzly bear strategy, and reports and campaign pieces related to the great bear rainforest campaign. This included searching local newspapers for media publications related to the CCLRMP and the great bear rainforest campaign.
- Detailed review of CCLRMP meeting minutes from Phase II. In total, there were 16 meetings and 40 working groups (Refer to Appendix 1 for a list of meetings). All of the meeting minutes were disseminated online at http://srmwww.gov.B.C.ca/cr/resource_mgmt/lrmp/cencoast/index.htm. While thorough, these meeting minutes refrained from linking individuals with comments and were not exact transcriptions but merely general documentation.
- GIS analysis of the 2001 and 2003 CCLRMP land use recommendations. Summary analysis was conducted for the 2001 proposed protected areas based on spatial data used to inform Phase I. Similar analysis was conducted for the 2003 proposed protected areas, though the boundaries of these new protected areas were approximated because boundary data was unavailable, as was spatial information from Phase II. Importantly, both these analyses examination of how much economically viable timber existed in proposed protected areas and omitted watersheds[i]. A summary of this aspect of the research is presented in Appendices 6, 7, and 8. Initially, GIS based research was intended to be much more comprehensive, and include an evaluation of the data emerging from the CIT, however this data was unavailable and precluded much of this analysis.

theoretical and practical realities of environmental planning, conflict resolution, and politics. Gross and Levitt (1994) argue that a "serious investigation of the interplay of cultural and social factors with the workings of social research ... requires an intimate appreciation of the science in question ... of its inner logic and of the store of data on which it relies." My background in environmental science and conservation biology helped me to analyse grizzly bear management and the protected area network. Nonetheless, it was ever a challenge to be informed with all elements of the research, including the political realities, the bureaucratic process, and the conflict resolution strategies, not only the scientific debates. As a result, there are likely important areas that have not received adequate attention.

I attempted to situate this research at the interface between science, policy, and philosophy in order to investigate challenges inherent in the flow of information from science and other information gathering teams to the political decision-makers. For these reasons, this thesis drew from environmental planning literature and emphasized discussions with policy makers and stakeholders, not just scientists and technicians. In order to understand the role that science generally, and spatial information, specifically, played in resource decisions (Kyem, 2004), an examination of the competitive forces that generate and then sustain a resource conflict and the social norms and values of key actors was necessary.

Weaknesses and problems encountered in this research are many. A few are described below and relate to the ambitious nature of the research project. 1) Because the CCLRMP process has been ongoing since 1996, my investigation of the last three years meant that I began research after Phase I had been concluded. As a result, many individuals involved in Phase I were no longer involved and my research emphasised Phase II, though much of this second Phase was built on Phase I. 2) Due to the complexity of the CCLRMP, it was hard to remain current with political decision making and information generation; provincial dissemination of information was not always forthcoming. For example, there was a brief period of time when the government changed its website and I kept returning to the old one, surprised at the lack of new information. 3). The spatial data related to the CCLRMP was not readily available, and this seriously limited the GIS component of the research methodology. This was particularly true for information developed by the Coast Information Team (CIT) because much of this information had proprietary elements. 4) Gaining access to participants and researchers remained a challenge. There are many graduate students, faculty, and media who are vying for the time and resources of overworked participants. Participant fatigue was a considerable obstacle until some form of personal relationship could be established. 5) First Nation perspectives and interests were hard to research and include. I lacked the contacts, expertise, and focus to appropriately address First Nation interests and territorial claims in the region, though they underlie the entirety of the CCLRMP.

2 THEORETICAL FOUNDATIONS

Philosophy of Science can provide insight into ways in which science and spatial information strategically inform resource management. Theorists from science studies investigate issues of objectivity, bias, democratisation of science, and the influence of science and technology on society. The environmental planning literature, with its emphasis on collaborative and participatory planning and innovative uses of technology to resolve environmental conflicts can shed light on resource management. A third lens with which to view these issues is from GIScience; a theoretical investigation of the politics of knowledge and the social impacts of using Geographic Information Systems (GIS). These literatures are related in a number of important ways. Theorists from both science studies and environmental planning propose increased participatory mechanisms and transparency. GIScience theorists call for increased recognition of the role of human agents and social forces when encoding information, drawing upon constructivism and science studies. Environmental planning utilizes sophisticated decision making models, tools, and spatial modelling that are built using GIS.

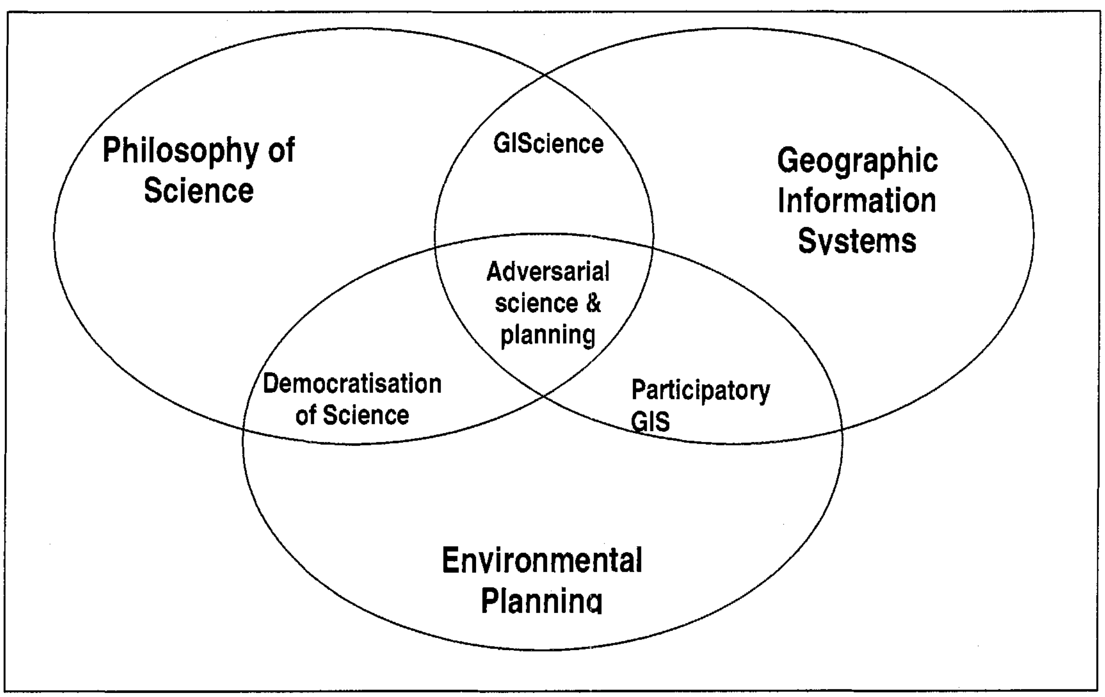


Figure 1: Venn diagram of theoretical foundations

Planning is challenged to both interface with science and these computer technologies and also to improve how science and policy interact, better integrate multiple knowledge domains (e.g. traditional or local), and meet societies demands for information that is perceived to be independent. Most planning relies heavily on representations of resources in the forms of maps. GIScience theorists draw attention to the encoding of spatial entities, the influence of funding, bias, limitations of models, cartographic assumptions, and how the above influence those using GIS. Despite these areas of overlap, gaps remain in the environmental planning and science studies literatures. In particular, these gaps relate to role of adversarial science in high conflict resource planning.

2.1 Philosophy of Science and Political Decision Making

The normative basis of all sciences is pressured from three sides: by awareness of the public, who claims more transparency and sensibility from the scientific institutions regarding factual or possible impacts of science-based industrial progress; by the industries, which try to speed up and intensify the industrialization of knowledge; and by the public policies, which want to see the sciences engaged in ways to mitigate unintended consequences of economic, ecological and social developments (Albrecht 2001 p 323).

Science is central to policy and political decisions made about resources and the environment (Sismondi 2004). Resource management decision making relies heavily on science to better understand resources cycles, harvesting thresholds, and biological diversity. As the above quote indicates, science encounters social, institutional, and methodological challenges when it interacts with politics and environmental policy. A growing body of literature calls for resource managers to broaden their understanding of the nature of science by engaging with science studies and the philosophy of science (e.g. Patterson and Williams 1998).

Government relies upon scientific studies for legitimacy such that virtually no action can be taken unless some claim can be made that it is supported by a study. Environmental organizations draw upon scientific inquiry, improvements in technology and access to information to further their political agendas, frequently producing analyses that contradict those sanctioned by government or industry. The centrality of science in land use planning results from foundational beliefs that scientific information is objective and independent of political bias or economic implications. To understand environmental conflict arising from risk, uncertainty, or bias, it is necessary to further investigate the interaction of science, technology, and philosophy.

Policy makers and politicians often legitimise decisions that are based on science, yet science and the scientific method can mean many things to many people. Let us pause briefly to explore the meaning of the term science as it is frequently used in policy debates. The common view holds *Science* (with a capital letter) as a formal activity which accumulates knowledge and enables progress because of a method that is based on observation, hypothesis building, experiment testing, reproducibility, and hypothesis refutation that enables different scientists to agree on 'truths' about that world (Sismondi 2004 p. 10). Constructivists challenge this view. For example, Latour (2004) argues that *Science* must be dissociated from *the sciences* and offers a constructivist definition positing that instead, Science is "the politicisation of the sciences through epistemology in order to render ordinary political life impotent through the threat of an incontestable nature". To bridge these perspectives, Patterson and Williams (1998 p. 284) offer a definition of Science as:

> 1) a systematic set of empirical activities for constructing, representing, and analysing knowledge about phenomena being studied which is guided by 2) a set of normative philosophical commitments shared by a community of scholars.

Normative commitments refer to philosophical assumptions that are accepted by scientists or research traditions without empirical foundations (Patterson and Williams 1998).

The reliance of policy processes on scientific information and expert advice is often based on positivist assumptions that scientifically derived information is objective and value free. Positivists emphasise that knowledge generation must be grounded in observed, verifiable facts about the world. Karl Popper (2000 originally published 1963) argued that the best theories are those that make the right predictions because they provide a demarcation criterion, or a clearly defined method of falsification. This empirical grounding was believed to be the major difference between science and the other theoretical and philosophical claims to knowledge. Epistemology refers to the "methods, limits, and nature of human knowledge" (Patterson and Williams 1998 p. 286) and seeks to investigate how knowledge of truths about the world are formed and how reliable this knowledge is (Sokal 2001). Positivists hold that science attains a privileged epistemological status because of its method and, as such, is justified as the dominant method by which modern societies understand and attain knowledge about the natural world. However, many contemporary environmental problems demand that decisions include, incorporate, and interface other knowledge communities (e.g. local or traditional), which are legitimised by different forms of verification than the scientific method. This situation demands broader discussions about the centrality of science as the dominant epistemology.

Theoretical discussions, collectively referred to as the science wars, occurred in the larger context of negotiations about the role of science and technology in society. While no actual combat occurred, the metaphor of war reflects the intensity of debate about the role science should play in modern societies as the epistemology by which knowledge about the world is made (Latour 2001). These discussions engage scientists, who frequently operate within the enlightenment model of science, and cultural constructivists, who claim that all science is partial, supports established nodes of power, and at times fails to represent truth (Kitcher 2001). These debates have been quite heated (See Levitt 1994; Sokal 2001) and are motivated by the interest in protecting the theoretical and methodological authority of scientists (Shank 2001

p. 67). Under investigation are underlying meanings of science and technology, particularly in the context of the culture within which they were formed (Schuurman 2002).

Cultural constructivism stands opposed to positivism and challenges science's privileged claim to truth as the "objective lens on reality" (Schuurman 2004 p. 40). Cultural constructivism emphasises three assumptions: science and technology are social, they are active, and they do not provide a direct route from nature to ideas about nature (Sismondi 2004). Cultural constructivists generally do not argue that science is an arbitrary construct, but that science must nonetheless be examined for the ways that science is a "situated and ongoing social practices" (Demeritt 2001 p. 309). Constructivists point to the influence of funding, gender, and ethics on science and the way science is practiced. Differentiation between science and pseudoscience[ii] (Machamer 2002) ethical questions, funding priorities, and the role of science in decision making are more accepted critiques offered by cultural constructivists that have gained some recognition.

Far less frequently engaged are critiques that relate to the "socio-cultural milieu" (Machamer 2002 p. 11) in which scientists are raised and trained. This view argues that the knowledge that science claims to produce are a complex set of conventions that are culturally and historically contextual. Central to this view is the notion that social, cultural, and economic influences interact with scientists, the scientific method, and by extensions, scientific knowledge. Cultural studies of science theorists maintain that there is a 'real world' upon which science informs, but that the way that this world is categorized, explained, and known is socially situated (Schuurman 2004). From this perspective, the opinion of a few scientists and technicians can influence the opinion of the majority on scientific and technical debates (Latour 1987). "Since information is power, much is not shared, and because information brings about implications with it, it is often filtered and edited as it moves between organizations" (Yaffee 1994 p. 347). The Actor Network Theory (Martin 2000) explores how scientific entities are created through social processes and the interaction between humans and their tools, computers, and other technologies. From this perspective, the tools that are used to inform knowledge are critical locations for further investigations, a point explored by GIScience theorists and presented in the third set of theoretical foundations.

Feminists within science studies deconstruct scientific claims to objectivity and the establishment of facts, pointing out the effects of social power and to who has access to constructing scientific truths (Harding and O'Barr 1987). Feminist analyses problematize claims of objectivity as rhetorical devices employed by scientists to persuade others of the value of their claims (Irwin 1995). Essentially, constructivists assert that to possess truly objective knowledge, one must "reach outside of a subjective world to a broader more true reality" (Cudd 2001 p. 81). In other words, the privileged epistemological status of the sciences as proposed by positivists is an unattainable ideal.

Constructivist accounts of science are subject to much criticism. While accepting that science is partially constructed, the call to recognize the influence of social bias on science has often been ignored by scientists and researchers. Science studies practitioners have much insight to offer science, yet to do so, analyses must identify "precisely how those social factors affected the outcome and how it might have been otherwise if the process were differently constructed" (Schneider 2001 p. 343). Thus, a scholar devoted to this kind of criticism must be a "scientist of professional competence, or nearly so" (Levitt 1994 p. 235). Gross and Levitt (1994) criticize the ignorance and misinformation that abounds when judgments and condemnation of science are laid, and argue that to investigate social and cultural factors in the workings of social research requires intimate understanding of that science. This is where some constructivists can fall into embarrassing errors, as the Sokal Hoax (see Sokal 2001) so effectively illustrates.

Many scientists, environmental planners, and stakeholders recognize how funding can influence research outcomes, how results can be suppressed, and how situated research clearly can support industry or interest groups. So much effort is focussed on the unveiling of social construction of science that inadequate attention is directed towards the relations between science and society (Demeritt 2001). Demeritt (2001 p. 311) argues that this oversight generates a rigid "*nature – society*, *objective – subjective*, and *science – politics*" rhetoric and reinforces these binaries. These binaries, and insufficient co-operation and communication between science studies theorists and scientists, inhibit critical examination of key environmental conflicts, such as what will be explored in a single thread of the global warming debate.

The global warming debate informs the theoretical foundation of this thesis because it demonstrates a controversial policy debate where the epistemic status of science is under investigation, where clear and science based decisions appear an impossible ideal, and where problems related to the flow of information from scientists to policy makers are paramount. All of these issues are evident in the case study explored in this thesis and will need to be addressed in most environmental conflicts if environmental planning hopes to develop mechanisms for engages a suite of environmental problems related to the sustainable management of resources such as old growth forests.

2.1.1 The adversarial science of global warming

There is a danger that the international debate over sustainability will be conducted without a critical account of science itself (Irwin 1995 pp. 6-7).

The climate is perhaps the most complicated system scientists have dared to tackle; it is reliant on expert opinion, global research projects, and sophisticated computer modelling. The economic and political implications of the anticipated outcomes and of even the mildest policies of mitigation set the stage for high conflict policy debates. There are considerable gaps in data and uncertainties in computer models that influence the accuracy of predictions. Institutional mechanisms have begun to address many constructivist critiques by increasing public participation and recognizing the effects of funding and power on researchers and their research. However, failures to engage other constructivist arguments is evident in the global warming debate, which must be understood as being about values as well as science, despite the forefront appearance of a rigorous scientific debate. Global warming scientists have been accused of making assumptions to fill gaps in scientific knowledge, assumptions that reflect the underlying values of scientists (Park 2001). The adversarial nature of global warming science has resulted in stalled political decisions due to claims of scientific uncertainty, conflicting scientific research, and lack of clear enough scientific direction. This is evident in a discussion that occurred between two leading academics Schneider and Demeritt in an issue of the *Annals of American Geographers* (2001). The former critiques the social construction of science while the latter asserts that despite persistent difficulties in modelling complex systems, the science remains valid and useful.

Political decisions claim to be based on objective scientific analysis. Demeritt (2001 p. 308) argues that a "distinction between fact and value and an associated division of labour between scientists and policy makers" facilitate the perception that science is independent of the political process into which it feeds information. One consequence of this rather conventional view of science is that the cultural politics of scientific practices and their consequential role in framing and constructing the notion of global warming are not investigated. Demeritt (2001 p. 309) suggests that rather then discrediting any particular knowledge or denying that scientific knowledge is socially situated and contingent, a proper response is to develop a more "reflexive understanding" of science and technology as a "situated and ongoing social practice."

Scientific uncertainty only heightens this conflict since estimating probabilities for complex systems like ecosystems or climate involves both subjectivity and objectivity (Schneider 2000). While scientific modelling has been fundamental in defining the issue of global warming, many sceptics challenge the usefulness of scientific modelling as being "socially constructed and politically biased" (Demeritt 2001 p. 308). The global warming debate reflects underlying conflict in values and ideology, however, it is often the science and the methodology that comes into question.

"All interesting science," namely complex systems science, is too "complex to fully falsify" (Schneider 2000 p. 340). This above quotation embodies a central dilemma: how to develop clear methods for modelling complex systems that allow for the falsification and reproducibility of experimental design. Global warming science faces difficulties both in observing the long-term global climate and in verifying theoretical explanations of observed climatic changes. Developing accurate and falsifiable models is challenged by the small number of research centres with the technological and scientific capacity to explore these issues. Further, model variability, global spatial scales, long temporal scales, and scientific uncertainty are central to controversy over integrating the science of global warming into policy. As a result, there is contradictory information fed into the public policy space such that the conclusions from scientists supporting current levels of consumption and growth counter the recommendations of scientists, major academic bodies, and conservationists (Schneider 2001). This situation raises important questions related to the social construction of science along normative commitments.

Critiques that science can be co-opted by economic interests or that political decisions can be cloaked under the rubric of good science have brought science under increased scrutiny (Yaffee 1994). As evident above, critiques of science are increasingly focussed on social assumptions or values that may influence results and interpretations (Irwin 1995). While the majority of climate scientists have achieved a statement of consensus (e.g. the International Panel of Climate Change reports), there remains controversy over the legitimacy of these conclusions, notably from a few PhDs, who receive funding from fossil fuel companies (Demeritt 2001). Problems arise when issues become complex, are characterized by uncertainty, or when different sides begin hiring their own experts who invariably produce alternative interpretations of a situation. As a result, the role of scientists who appear aligned with either industry or the environmental movement has captured the attention of science studies.

2.1.2 Environmentalism and science

Nearly all environmental policy debates draw upon scientific evidence to substantiate their claims that we need to alter current practices and/or take preventative action. Following groundbreaking documentation of causality between pesticides and ecological health in Rachel Carlson's *Silent Spring* (1962), the environmental movement continues to utilize scientific information and the scientific method to draw attention towards key issues such as global warming or deforestation. As such, environmental organizations fund science research, employ scientists, and disseminate information they produce. Nonetheless, the movement is also challenged by the same science that relies upon human control of nature and technological progress, in spite of externalities such as degradation of ecosystem services or loss of biodiversity that accompanies them. While technological progress and consumer spending are often held responsible for environmental degradation, other technologies such as satellite imagery and computer modelling are critical in defining and understanding these problems. This paradox results from the contradictory role of the sciences as being the cause of environmental problems as well as providing technological solutions to them (Albrecht 2001).

Just as company scientists hired to justify actions taken by industrial forest companies raise questions about the objectivity of science, many environmentalists' strong normative commitments fly in the face of objectivity sought after by an idealized science. Scientists' collective political response to the degradation of ecosystems and human communities has been termed scientist environmental activism (Frickel 2004). Scientists are increasingly being asked to communicate their research in Op-ed pieces, participate with independent scientific review, and engage with the societal implications of their research.

> The increasing use of scientists as coaches and advisors in developing and interpreting information creates additional concerns for both sides. The need for scientists to maintain integrity and credibility in the research community can create a tension between them and managers who need immediate answers and interpretations for day-to-day decisions. (USFS 2005 p. 19)

The scientist as activist, while considered an uncomfortable role for many scientists (Meine 1996), is becoming increasingly common as institutions involve scientists in decision making and nationally funded research informs policy.

Conservation biology, a scientific discipline striving towards the development of scientific methods to address issues of conservation, attempts to define clearly the relationship between science, technology, and normative values. Conservation biology is often referred to as a *crisis discipline* due to the perceived urgency of decisions, in spite of incomplete data and rudimentary theory (Meffe 2001 as cited in Diffendorfer and Doherty 2004). The term *conservation biology* itself embodies a tension inherent in the field it describes because it integrates objective methods and rigorous standards for gathering and interpreting information with diverse normative efforts to make the human-nature relationship sustainable (Meine 1996). Conservation biology is one of the leading scientific disciplines exploring human-nature relationships such as global climate change or loss of biodiversity. Conservation biology is "fraught with value and value judgements. ...The science may be as objective as ever, but the application is squarely in the realm of value" (Ostfeld, Pickett et al. 1997 p. 7). The explicit acknowledgement of conservation's value component and the need to motivate scientific and policy change was one reason why conservation biology coalesced (Meine 1996). The field of conservation biology advocates increased activism along normative commitments of conservation (Talbot 1997), leaving the research results vulnerable to criticism (e.g. Cooper 2002). However, Meine (1996) argues that all science is driven by value assumptions, either explicit or implicit, and that admitting the role of values does not discredit this science or compromise the reliability of its scientific knowledge. Thus, the opportunity for hybrid[iii] knowledge in conservation biology makes a powerful set of methods for viewing human and natural phenomenon. In tackling what can be termed natural-social problems, the social and political context of the sciences are highlighted and important questions are raised about the notion of the sciences as neutral providers of information and insights into decision making (Albrecht 2001).

2.2 Environmental Planning and Science

The 'science-centeredness' of decision making does not necessitate the reductionist form of scientific assessment....The question, therefore becomes not whether science should be applied to environmental (and of course, other) questions, but rather which form of science is most appropriate and in what relationship to other forms of knowledge and understanding (Irwin 1995 p. 170).

The second body of literature to be explored is that of environmental planning, particularly in relation to what can be termed adversarial science, independent scientific review, and democratisation of science in resource decisions. Environmental planning maintains a problematic relationship with science. Scientists are integral to resource management decision making due to the central role that scientific information and explanations play in these debates. Conventionally, scientists make *informed* and *unbiased* recommendations on the best course of action. Critiques of technocratic decision making focus on the role that experts and scientists should play in resource decision making, suggesting that democratically determined goals and values should drive participatory planning processes and technical experts and science should be regarded as a secondary status. Science, be it biological, physical, or social, should be used to inform problems that are driven by values, but science alone will be unable to make the ultimate choice (Clark, Stankey et al. 1997). Stakeholders should have equal access to information and the framework should ensure that decision making the weighing of social values in the process of social choice as a political rather than an administrative task (Cassells 2001). These objectives remain elusive. Many environmental problems demand that important questions be better engaged related to whose information is listened to, what constitutes good science, and how to integrate other knowledge domains with scientific.

Resource management traditionally claims science as the justification for decisions. Planning, like the scientific method, attains legitimacy to the degree that it can claim rationality and objectivity (Johannesen, Olaisen et al. 1998). Johannesen, Olaisen et al (1998 p. 157) continue:

> To gain status and cognitive authority, planning seeks to: a) acquire 'scientific' knowledge' b) formulate problems in a 'scientific' way; c) use 'scientific methodology; and d) use the logic of science to justify selected solutions and the professional status of the planner.

In rational comprehensive planning goals and objectives are the ideals against which the effects of alternatives approaches are tested. An alternative becomes the plan (just as a hypothesis is accepted) if its anticipated outcomes (or supporting analyses and facts) are consistent with planning goals (Johannesen, Olaisen et al. 1998). The model of rational comprehensive planning faces difficulty when a proposed alternative's affects are uncertain or risky, or when science yields multiple or ambiguous answers.

In contrast, collaborative planning, such as employed in B.C. does not expect scientific analyses or expert opinion to inform decisions, but to mediate discussion. Collaboration is supported through shared decision making, bringing together diverse interests to negotiate consensus agreements. In essence, those with authority to make a decision and those who will be affected by a decision jointly seek alternatives that accommodate rather than compromise important issues and values of all interested parties. These processes frequently utilize a round table format in an effort to represents all stakeholders and achieve effective public participation. In essence, stakeholders are empowered to make decisions. Collaborative planning emphasizes a discussion of social values, stakeholder representation, funding, and alternate epistemologies (such as traditional or local knowledge).

The role of science in such political decision making process is explained by a leading scientist involved in the central coast, Chuck Rumsey:

> Science is a critical bridge between raw stakeholder interest and stakeholder consensus. Science can help us understand the societal and ecological risks inherent in our decisions, providing transparent means for measuring the consequence of our choices around land use (Rumsey 2003 p. A 11).

In such processes, the role of expert knowledge is often viewed as limited in utility in terms of analysis, prediction, and management, particularly when these experts disagree (Clark, Stankey et al. 1997). Instead, effective incorporation of local knowledge and local validation is emphasized (Clark, Stankey et al. 1997). Theoretically, the development of trust, commitment and personal relationships mediates information (Kyem 2004). People with poor commitment to achieving consensus may construe the data to their own benefit in a way that can actually *increase* conflict (Interview #1). This interest-based negotiation theoretically operates within a new science – policy relationship where citizen and stakeholder values are central to negotiation and science and information are seen as vital, but still supplementary.

2.2.1 Uncertainty and adversarial science

The policy demand for scientific objectivity in resource management planning is particularly challenged by adversarial science precisely because in these situations claims of objectivity by one (or multiple stakeholders) are incompatible. If both sides claim to be scientific, yet their outcomes contradict along what appears to be normative foundations then constructivist critiques seem apt. As a result, it is often unclear what *science-based* means (Mills, Quigley et al. 2001) or whose scientific knowledge should drive policy when there are contradictory recommendations (Allen 2004). Decision making is negatively affected by conflicting information offered by scientists engaged in or contributing information to these debates, particularly when scientists do not speak with a unified voice (Mills and Clark 2001). Frickel (2004 p. 373) agrees: "environmental knowledge politics are mediated by scientific research and advocacy networks and professional scientific and science-orientated organizations".

Adversarial science emerges when there are questions related to methodology, reproducibility, and the proper framing of questions, but deeper problems arise due to the impact of funding, power, normative commitments, or assumptions. Adversarial science can characterize situations where stakeholders engaged in environmental conflict hire scientists and experts to defend or prove their positions. Not only does this approach present the image that science can be 'co-opted' or is somehow for sale, but it motivates dis-trust in both science and in the process of decision making. Concerns that scientific research can be co-opted by interest groups whose values do not reflect those all citizens (Meffe, Boersma et al. 1998) has led to increased calls for inclusion of the best available science and independent analysis (Schwarz and Thompson 1990 as cited in Clark and Meidinger 1998 p. 303). These situations require decisions made regarding how and when science and scientific information will be used to inform policy decisions with implications for future economic development.

Adversarial science can intensify conflict, particularly when scientific discourse is used strategically to achieve political aims (Satterfield 2002). This is evident in many forest conflicts experienced along the Pacific coast of North America. Legal challenges to timber sales (Selin 1995), the spotted owl forest controversy (Satterfield 2002), conservation area design (Jeo, Sanjayan et al 1999), and the numerous appeals to stop the export of B.C. grizzly bear trophies (Gilbert, Craighead et al. 2004) are all examples of situations where adversarial science has influenced coastal forest policies. Scientific information plays central roles in litigation, market campaigns, or protests launched by environmental organizations, aboriginal people, or other groups to achieve their interests. Frequently, these high conflict tactics are deployed because previous political decisions did not reflect environmental or aboriginal interests and perspectives.

Adversarial science also undermines scientific claims to objectivity. Environmental conflicts can be heightened by uncertainty and the absence of critical information and clear scientific direction (Yaffee 1994). Uncertainty can manifest in many ways, particularly in issues related to risk thresholds and systems analysis. Uncertainty can also "provide an out for decision-makers who do not want to make hard choices and take the heat for doing so" (Yaffee 1994 p. 170). In debates over science, uncertainty is made more problematic because of value differences underlying stakeholder interests. In this way, "science becomes advocate science as differing values are transformed into technical perspectives" (Yaffee 1994 p. 171). Furthermore, as previously excluded groups gain greater access to formal decision making via participatory processes, they bring to the planning table spatial, technical, and scientific information that may contradicts information previously available. Though perhaps less so than if the conflict were pursued through litigation or the markets, environmental conflicts can be escalated when advocate science contradicts information produced by government or industry.

The scientific identification of natural resources can be particularly problematic when policies, designed to mitigate the negative implications of resource use, would negatively impact resource extraction and industrial society (Allen and Gould 1986). Resource decision making is challenged by the need to make decisions if "complex, problematic, and ambiguous choices in which both causation and social objectives lack agreement" or when "experts disagree" (Clark, Stankey et al. 1997 p. 27). Allen and Gould (1986 p. 21) present a framework for differentiating complex problems from what they term "wicked problems". While complex problems can be solved with technical modelling and scientific information, wicked problems are symptomatic of deeper problems, concern incompatible demands upon natural resources, have no clear stopping rule, have *good* not *right* solutions, and involve systems characterized by scientific uncertainty (Allen and Gould 1986 p. 21). When faced with wicked problems, an enhanced commitment to democratic participation is necessary (Allen and Gould 1986; Ostfeld, Pickett et al. 1997; Cutcliffe 2000). It is within 'wicked' problems that scientific justification for resource management decisions frequently becomes adversarial. From this perspective, developing a policy for the management of a region's remaining old growth forests or determining sustainable harvest rates for grizzly bear hunting are wicked problems because each of these issues draws upon technical modelling and emergent scientific research, they are informed by strong social values about the role of conservation in society, will never produce a correct answer but an acceptable one, and are challenged by uncertainty.

Such wicked problems are influenced by intrinsic and instrumental values such that scientific questions can be viewed from both a scientific and an ethical perspective (Kitcher 2001). Controversy over science often involves disagreement over how data are interpreted and how data and theories are used to convince members of a community to agree with this meaning (Sismondi 2004). Independent scientific review or multi-disciplinary information panels have emerged as a response to 'adversarial science'. As well, recognition of a broader suite of social values related to resources entails recognizing diverse knowledge communities, whose perspectives, expertise, and experience informs the nature of the controversy and may hold key components of any attempted solution. To move beyond situations of adversarial science, a more reflexive science-policy debate and understanding is necessary. Increasing public trust in the science-policy relationship and better incorporating disparate knowledge communities is an essential starting point.

2.2.2 Independent scientific review

Policy responses to adversarial science can include calls for "common sense" (Irwin 1995 p. 65)[iv], for better science, or for mechanisms to develop new science institutions such as independent scientific review. One reason independent scientific review has become standard is that without independent scientific review any claim of "objectivity and scientific validity may be suspect" (Meine 1996 p. 268). Independent scientific review can be viewed as a response to both adversarial science and claims of constructivism. Yet, independent science review strives for the generation of better science, apparently in an engagement of the positivist ideal of science since they usually call for increased objectivity and independence. The irony of calls for 'independent science' is that they implicitly acknowledgement that science can be non-objective, that values can bias research and policy advice, and that policy processes can be influenced by this bias. Understanding how science can be objective and independent demands an examination of how normative commitments or dependence can taint these claims. Importantly, the emergence and reinforcement of independent scientific review need not be bounded by a positivistic or enlightenment ideal of science. There is often explicit recognition of the ways in which science can be socially constructed, biased, and support established power relationships. As a result, independent scientific review often emphasizes transparency, multi-disciplinary membership, qualifications for expertise, and institutional arrangements for both scientists and other applied experts to collaborate.

Objectivity is ever elusive. In recognition of this, science panels frequently develop clear guidelines for the development, evaluation, and presentation of information. Sismondi (2004 p. 114) differentiates between absolute objectivity, the unattainable ideal of perfect knowledge, and formal objectivity, the latter of which is the ideal of a "perfectly formal procedure for performing tasks" namely scientific tasks. Value neutrality or perfect objectivity demands the separation of theory and practice, the exclusion of ethics from science and also the "disenchantment of nature" (Sismondi 2004 p. 114). In contrast, independent scientific review operates within the organization of formalized objectivity. From this perspective, objectivity can only be achieved by the development of precise rules and procedures and must be viewed as a response to weakness and distrust of the scientific method (Sismondi 2004). These formalized procedures are also seen as protecting the scientific method from fallible scientists and serve to increase trust in the process of independent scientific review from both the scientific community and the public at large.

Natural resource management and planning have traditionally emphasized analysis, rationality, quantification, and objectivity. Rarely are deeper epistemic questions effectively addressed when policy issues demand and generate institutional structures for independent scientific panels. Constructivist critics have long revealed how funding and social cohesion can bias research, but more difficult to address are epistemic or ontological dependence such as which science is best suited to answer particular questions or which knowledge domains (local, traditional ecological, or scientific) will be used to inform policy. Increasingly, environmental planners recognize that "pluralism produces multiple perspectives; moreover, the views held from these various vantage points can lead to wholly different conceptions as to the nature of the problem as well as the appropriate solution" (Clark and Meidinger 1998 p. 303). Inclusion of a diverse range of scientific disciplines, traditional ecological knowledge practitioners, managers, stakeholders and local knowledge representatives can be a foundational mechanism for the development of relevant and suitable scientific information. When developing information teams, these issues are at times explicitly addressed so that information is not merely scientific in origin.

Independent scientific reviews not only address issues of social construction of science, but can also provide a working group format for building social capital, increasing trust, and opening channels of communication. Social capital "captures the idea that social bonds and norms are important for people and communities" (Pretty 2003 p. 1913). Pretty identifies four key components of social capital: "trust; reciprocity and exchanges; common rules, norms and sanctions; and connectedness in networks and groups" (Pretty 2003 p. 1913). This building of social capital can be instrumental in bridging the science-policy gap. In a related vein, Reid and Mace (2003 p. 944-5) recognize that good science does not necessarily preclude good policy; "we will not arrive at good decisions unless authoritative and useful scientific information is presented to decision-makers through a process they cannot ignore". Part of this process may include institutional arrangements that incorporate explicit provisions for adaptive management and long-term research, further shifting the power of decisions away from any one group of scientists or researchers, their assumptions, and potentially, their oversights.

One strategy to achieve these goals relates to a shift in the science-policy institutional arrangements such as "collaborative engagements of scientific inquiry" which emphasize relationships between managers, scientists, and the public (Beesley 2003 p. 1529). Collaboration requires long-term commitment, integration of theoretical and applied research, and restructuring of information flows so that scientists, managers, and local stakeholders have mechanisms for both the development of information and meaningful learning from each other. At the heart of an emerging science-policy relationship is re-structuring the direction in which information flows in the science-policy relationship and "a belief in the need for collaborative learning—a two-way learning process in which scientists would work with managers and local stakeholders to both share and gain information about natural processes and local values and uses" (USFS 2001 p. 90). The former view of an upstream science that feeds information into a downstream policy is being challenged, especially in situations where an environmental manager or technician exercises professional judgment on behalf of the public (Demeritt 2001). Such arrangements encourage greater buy-in from all participants, which is critical in reducing conflict and implementing the revised policy. Furthermore, institutional arrangements such as these can alleviate the need to choose between any two sciences in situations of adversarial science (Beesley 2003).

A challenge remains to create mechanisms through which independent scientific review can foster collaborative relationships while heightening legitimacy. The roles of scientists can be divided into two categories. A "complementary" role characterizes scientists who maintain a distinctly separate or arms-length relationship with the policy their science informs, while an "embedded" role characterizes those who establish collaborative and connected relationships (Evans 1996 p. 370). The complementary relationships can include 'science advisors' or 'technical expert' panels. In contrast, embedded scientist activism results from complex multi-disciplinary networks that span the academic-public-private divide and result from years of commitment and collaboration. In this role, scientists are not held to ideals of independence but instead clear statement of potential conflict of interest and expertise are central. Legitimacy can then be fostered by representation of all leading scientific opinion on a particular issue from all relevant disciplines and experts.

However, independent scientific information will not automatically reduce conflict resulting from ideological positions about the appropriate role of humans in a nature-society relationship. Instead independent science review should be developed in the context of greater and more meaningful public participation. How adversarial science operates within participatory frameworks is not well understood.

Independent science review aims to isolate information generated from politicised forces, thereby increasing the legitimacy of political decision making. Yet, this *science-centred* role of independent scientific review can be viewed as contradictory to mandates for greater participation and often emphasises science over other knowledge domains. Nonetheless, they can also provide opportunities to address the influences of bias, funding, and differential power.

2.2.3 Increased participation and collaboration

Forest resource management is growing increasingly technical and complex. Simultaneously, institutional processes demand increased democratisation and participation. These two forces can be incompatible and have generated conflict regarding the way that science, politics, and public participation inform policy. Democratisation of highly technical or scientific resource decisions involves a transfer of power and control over the decisions, technological and otherwise, to the people whose lives will be impacted by policy decisions (Levitt 1994; Irwin 1995). Nonetheless, scientific and technical information remain critical for decision-makers. Indeed, the US Environmental Protection Agency reported that credible data and information served an integral role in resolving conflict, and that outside confirmation of the data was fundamental in assessing their credibility (EPA 2001).

Since those who control scientific knowledge have considerable power over decisions, "calls for greater democracy will have only have limited impact if they do not consider the influence of technical experts within the decision making process" (Irwin 1995 p. 79). Sustainable development is a case in point. Principles and guidelines popularised from the 1987 Brundtland report (WCED 1987) argue that sustainability requires investigating knowledge and the status of science in policy decisions, as well as increasing participatory structures (Irwin 1995). In addition to reducing conflict, an inclusive process usually results in better decisions. Despite increased attention directed towards the role of heightened public participation in decision making, many policy processes still retain an expert model of science and scientists, reflect better-funded interests, and marginalize disparate voices. As a result, many public participation processes amount to tokenism (Halseth and Booth 2003).

Growing interest among managers and scholars in collaborative approaches to public involvement (Selin 1995) has led to consensus forms of decision making which engage a conflict resolution process to settle complex multi-party disputes. One such collaborative approach entails joint decision making in a shared power structure. A consensus mode of decision making involves multiple parties, identifies stakeholders, and strives for win-win, flexible, and collaborative methods of solutions (Pellow 1999). As such, consensus models offer adversaries a more sophisticated and cooperative vehicle for engaging conflict over resource management (Pellow 1999). Collaboration entails the "pooling of approaches or tangible resources by stakeholders to solve a set of problems that could not be solved individually (Grey

1985 as cited in Selin 1995 p. 190). Many environmental groups are pushing for collaborative decision–making because within it they are able to combine negotiation with confrontation, such as the coordination of efforts with more radical groups operating outside the process (Pellow 1999). While government usually retains ultimate authority in decision making, in collaborative planning there is a shift of power towards the stakeholders, one that can be even more influential when a consensus voice on previously contentious issues emerges.

Conflict resolution theory argues that at the root of forest conflict are social values, which must be addressed in a heightened commitment to participation and effective communication. Conflicting social values about the appropriate human-nature relationship can manifest as scientific controversy. When information about a conflict becomes available, actors will use it to confirm their predetermined positions and rational arguments may never serve to reconcile disparate interests (Kyem 2004). In these situations, collaborative frameworks can decide what role scientific inquiry and information will play in decision making (Irwin 1995). In essence, the development of trust, commitment, and personal relationships mediates information. While actors in a conflict are undeniably motivated by self-interest, social institutions (such as norms, sanctions and networks of social interaction) can also transform conflicts and communication can enable better mutual understanding and ultimately resolution (Irwin 1995).

At the heart of collaborative planning then, is the recognition of values and interests and an attempt to resolve conflict by linking scientific and technical knowledge to societal guidance and values (Cassells 2001). As an example, disagreements over specific harvesting techniques or conservation strategy are motivated by deeper conflicts over the role of forests and of the priority of alternative land uses (Clark and Meidinger 1998). Collaborative planning recognizes that reliance upon sophisticated technology and abundant information alone will fail to reduce forest conflict and mediate environmental debates. Science and spatial information remain critical to B.C. land use planning due to the need to identify background information and to develop a portfolio of maps descriByng land use capability (Day, Gunton et al. 2003).

These processes have been characterized as "aspects of environmental justice, in that they promote the concept of fairness in decision making process used for the management of Crown lands that had hitherto conformed to a technocratic stereotype" (Jackson and Curry 2004 p. 30). Building on a mandate of achieving "Peace in the Woods" upon gaining office in 1991, the B.C. New Democratic Party launched into a series of initiatives to promote greater public involvement and to reduce conflict related to the management of the provincial resource base (Jackson and Curry 2004). Two of these initiates were the Protected Areas Strategy, designed to double the province's protected areas to 12%[v] and Strategic Land Use Planning, which was intended to implement the former initiative using a collaborative framework[vi].

LRMPs are mandated to arrive at solutions using collaborative decision making, which is based on a higher level of shared decision making, greater involvement of stakeholders, and clear goals of consensus than conventional participatory planning (Day, Gunton et al. 2003; Gunton and Day 2003). A consensus solution is very influential, particularly when former antagonists have been able to agree upon future strategic direction. At the heart of the collaborative model is conflict resolution theory, where a conflict is re-positioned along a conflict resolution continuum (Refer to figure 1). Building on greater recognition that planning is a value laden process, public participation is used as part of an alternate dispute resolution strategy where planners act as mediators to help stakeholders resolve conflicts in a mutually beneficial way (Gunton and Day 2003). By transforming a high conflict situation into a negotiated interest-based conflict, it is theorized that sustainable solutions can be developed (CORE 1996).

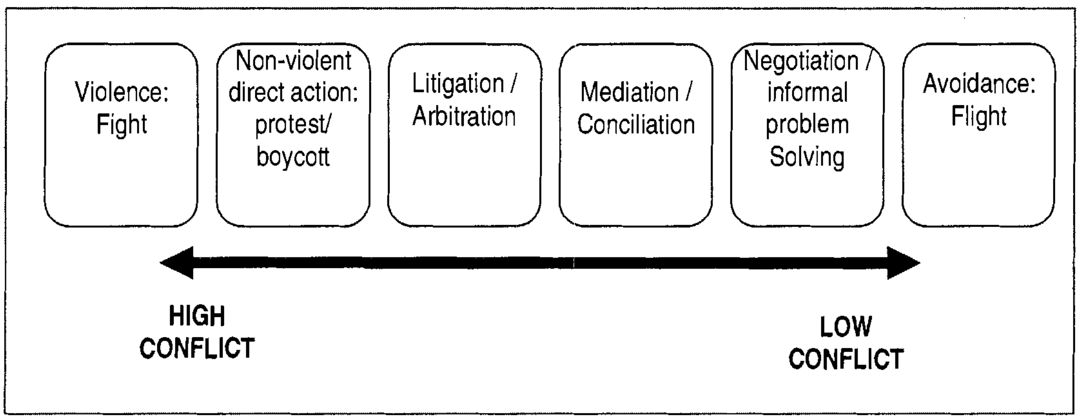


Figure 2: Conflict continuum (adapted from CORE 1996)

Although stakeholder recommendations ultimately have no binding authority, proposals advise the provincial government on provincial land use and have changed the provincial map in many important ways[vii]. The impact provincially of land use planning has been considerable; strategic planning has been completed in 73% of the province as of 2002, resulting in a significant change in provincial land use. Protected areas were increased from 6.1% in 1991 to 12.5%, special management zones[viii] were increased from 0.0% to 16.4%, and intensive resources extraction decreased from 91.6% to 67.6% (MoWLAP 2002; Day, Gunton et al. 2003). B.C.'s protection of 12.5% is comparable with Alberta and the Yukon, considerably more than other provinces such as Manitoba (8.5%), Newfoundland (4.5%) or New Brunswick (3.5%), and far higher than the national average (7.3%) (MoWLAP 2001; MoWLAP 2002).

Importantly, land use decisions were situated within a collaborative structure that emphasized the creation of land certainty and reduction of conflict in an effort to achieve sustainability. In a study investigating stakeholder's perceptions to the collaborative planning process in B.C., 64% expressed satisfaction with the process outcomes and 69% felt that collaborative planning was an effective method to develop land use plans (Frame, Gunton et al. 2003). Nonetheless, there are many critics. Criticisms of the collaborative model include the assumption that stakeholders are willing to negotiate, that stakeholder groups willing and able to participate do not adequately represent broader public interests, consensus rules motivate lowest common denominator solutions, problems remain regarding the resources and time needed, and that intractable conflicts may not be able to be resolved through this model (Gunton and Day 2003). There is further criticism about the effectiveness of the LRMP model at achieving public participation, particularly in response to a perceived shift of control to special interest groups (Halseth and Booth 2003). There also remain considerable problems related to the relationship between the provincial government and many First nations regarding unresolved land claims.

The B.C. planning model, while still looking to scientific information as the dominant epistemology, sought to be more inclusive of different stakeholder interests, values, and in essence, alternate epistemologies. Yet inclusions of local, traditional, and other forms of knowledge remained difficult as the discussion remained centred in many ways around a science-based solution. This was in part due to the goals of the environmental and timber stakeholders, who each sought a solution by engaging science. However, the sciences of the timber industry or environmentalists, maximum sustained yield or conservation biology respectively, were at odds. Furthermore, neither adequately reflected nor drew from local or traditional knowledge. For these reasons, development of alternate mechanisms for the generation, interpretation, and dissemination of information would be critical aspects of the conflict resolution strategy.

2.3 Geographic Information Systems and a Few Critiques

Latour (1987 p. 4) argues that the best locations to investigate social influence in science is to identify a controversial issue where scientists "are busy at work" informing controversial debates. This is quite apparent in the use of maps, spatial information, and GIS in land use planning. The third lens through which to investigate forest conflict is informed by the Geographic Information Systems (GISystems) and Geographic Information Science (GIScience) literatures. (Distinctions in the use of the acronym will be used in this thesis only where necessary). Technologies such as GIS play integral roles in the generation of knowledge about nature and beliefs about the way things are. GIS models are frequently used to encode spatial phenomenon, to predict the impact of a potential decision, and as essential tools for scientific research related to forest management. As a result, GIS is an important tool on which to focus investigation of the influence of science and information in participatory planning because GIS enables representation of space (Batty 2002). Environmental problems are frequently modelled using GIS for data analysis, spatial analysis, process simulation, and as a decision aide (Clarke, Parks et al. 2000). Participatory structures can be improved by the use of GIS, as explored in the participatory GIS literature. However, GIS is often referred to as an exclusionary technology that is expensive, hides many assumptions and technical decisions, and has a positivist foundation (e.g. GIS is better at representing quantitative and spatially explicit data). A final reason is that within the field of critical GIS there has been an engagement between social critics and practitioners of GIS in a way not actualised in other disciplines (Schuurman 1999).

By the 1990s the GIS industry had expanded tremendously[ix], was regarded as a "routine software application" (Batty 2002 p. 157), and "symbolize(d) a research method, a technology, an industry, and a way of doing work" (Chrisman 1999 p. 177). However, the arrival of this technology in academia, government, and the commercial sectors has not been without criticism, especially from human geographers. Critiques levied against GIS must also be situated within the context of the larger dialogue of the afore mentioned science wars, which targeted relationships of power and representation, such as GIS (Chrisman 2001).

Literatures related to GIS are evaluated from a number of perspectives: as an academic subject, a branch of technology, and a social institution. In this chapter GIS will firstly be examined for how is it being used in decision making, namely for representation and analysis of spatial complexity, to heighten communication via the mapping of values and development of options and scenarios, and in what is termed Participatory GIS. Secondly, this section reviews literature investigating GISystems analyses, focussing on issues of data quality and cartographic representation. Lastly, this section attempts to bring philosophy of science and GIScience literatures together.

2.3.1 Geographic Information Systems and decision making

As planning becomes more complex it becomes increasingly dependent on information and communication technologies such as GIS (Geertmen 2002). GIS and computer-based predictive modelling play important roles in participatory land use planning processes. Landscape ecology and conservation biology investigate large spatial and temporal scales; as a result, many methods exhibit poor replication and difficulty in controlling research parameters (Hilbern and Mangel 2000). Much of the methodology of conservation biology would not be possible without the spatial computation abilities of GIS (Schneider 2000). Essentially, GIS technology has transformed not only scientific methodology, but also the kinds of hypotheses that can be investigated.

In addition GIS and its methodological opportunities can be is also a powerful tool for facilitating ommunication in a conflict resolution model (Kyem 2004). GIS have been shown to improve communication of multiple stakeholders and to facilitate the integration of disparate data sets (Schuurman 2004). Using maps, decision makers can draw upon intuition and abilities to integrate complex spatial data utilizing map overlays to arrive at alternative scenarios. In essence a map unlocks the database and makes it useful to decision-makers and to the public. GIS provide powerful opportunities for articulating stakeholder interests, developing action alternatives, exploring potential forest management outcomes, and providing more transparent decision support systems to both land-management professionals and the broader stakeholder groups in society (Primm 1996; Cassells 2001). GIS can also be a mechanism for capacity building and the development of social capital by providing a forum for group collaboration on data collection, analyses, and ultimately problem solving (Kyem 2004).

Part of GIS' influence stems from its role in the generation of maps, long recognized as powerful conveyers of ideas and as representations of reality. If maps are power, then maps must be recognized for how they are used to challenge established power dynamics. The Participatory GIS literature explores how GIS represents and is a vehicle for perpetuating power relations. While GIS can facilitate participatory processes, technical exclusion, perpetuation of power dichotomies, and failure to highlight conflicts between social values also serve to inhibit participation. Despite the ubiquitous use of GIS in environmental planning and the generation of many user-friendly GIS interfaces, the complexity and cost of GIS technology has meant that a limited, though expanding, portion of society has access to both data and ability to interpret those data. Invariably, certain decisions, analyses, and spatial representations relevant to the creation of GIS have to be delegated to technical or scientific experts. Participatory GIS emerged in the mid-1990s to engage GIS technology in the context of the needs and capabilities of a community and to involve communities affected by planning or development programs in the decision making process (Abbott 1999). In essence, Participatory GIS is an attempt to democratise the technology; frequently this entails *counter-*mapping dominant discourse of land use. In this way collaborative planning substantiates counter mapping because disparate voices have been given opportunities to voice and present their maps. For example, to strengthen information claims and make data more useful, many groups (e.g. community, ENGOs, and aboriginal) have made the development of their own GIS and spatial database a priority. Participatory GIS facilitate understanding of stakeholders and expands abilities to include local and traditional ecological knowledge along with scientific knowledge (Clark, Brown et al. 1999). The potential for representing these alternate epistemologies can assist in giving previously marginalized voices more voice in decision making.

However, despite claims of GIS inherent neutrality, measured by its use in so many disciplines and thus a tool of objective analysis, GIS can also be used as "a tool of public persuasion" (Goodchild 1999 p 3). Citizen groups use GIS and more accessible spatial data to influence public opinion and decision making. The use of cartographic representation to empower excluded groups must be understood within the larger movement towards counter-mapping projects. Yet, GIS is a far better and more persuasive tool because of the kind of spatial representations, or maps, that can be made and spatial questions that can be investigated (Kyem 2004). GIS maps can be dynamic, quickly updated, modified, and altered. Also, GIS can support a host of other spatial information such as qualitative information like linked photographs, oral histories, and explanations than a conventional map.

Re-mapping frequently operates within state-sponsored processes (e.g. B.C. strategic land use planning), is enabled by changing social values, (e.g. with regard to resource falldown), and is realized by technological innovation (e.g. GIS). Re-mapping, therefore, must be understood as both a political and a technical process (Clapp 2004) and provides an ideal situation to reflect on the socio-political construction of science. Due to the re-structuring of power, interests and, in the case of the central coast, colonial boundaries, re-mapping is inevitably a conflictual process (Clapp 2004). Re-mapping enables previously ignored histories and voices to be heard, new social values to be acknowledged, and resource inventories to be improved and expanded upon. Yet, participatory GIS needs to be more than everyone getting their voice heard because nothing is achieved if all that is happening is that everyone is shouting at each other with their maps. Whenever spatial analyses and GIS derived maps inform land use planning, important questions must be asked regarding data quality, selection of model variables, and cartographic (mis) design. Additionally, epistemological questions related to the development of data models, encoding of spatial entities, and influence of society on science and technology should be, but rarely are, investigated.

2.3.2 Critiques of GISystems and GIScience

Critiques of GIS often fall into a couple of categories (see Schurman 2004 p 135), characterized loosely under headings of GISystems or GIScience, two different interpretations of the acronym GIS. By far the most common, GISystems critiques focus on the impact of spatial analysis, modelling, data quality, and cartography and visualization. GISystems theory investigates essential components of GIS and it is at this level that the majority of GIS users, technical training courses, and manuals/textbooks engage. From a systems perspective, "GIS is a set of computer-based systems for managing geographic data and using these data to solve spatial problems" (Yueng 2002). In contrast, GIScience critiques empasize issues related to the impacts of the technology on society and look to theoretical issues related to ontology and epistemology, cognitive and spatial reasoning, and the details of algorithms (Schuurman 2004). GISceince critiques flow from GISystems critiques and vice versa. For example, an evaluation of data quality demands documentation of origin, methods, and initial experience of data collectors. However, it also entails an examination of what the primary data were collected for, how primary data were manipulated to *give meaning* to their secondary use, how did bias inform assumptions made when developing algorithms, and what larger political agenda do output analyses speak to?

Cartographic visualization of spatial data (maps) are a critical component of resource planning in part due to the proliferation of GIS as a tool to encode, represent, and analyse resources. It is widely recognized that poorly designed or biased maps can mislead decision makers (McKendry 2000). Since maps are the level at which people frequently engage with GIS in decision making, broader critiques of cartographic representations are also relevant. Gross and Levitt (1994 p. 55) note that "map-makers are invariably selective...what counts as an omission or an inaccurate spatial representation depends on the conventions associated with a particular map, and in their turn, those conventions are in place because of the needs of the potential users." As such, maps are a mechanism for depicting and producing social relationships (Harley as cited in McKendry 2000). Maps remain the dominant way that decision makers engage with GIS analyses because maps are efficient ways of presenting patterns, data, and complex spatial information.

Those unfamiliar with GIS often overlook the role of the underlying data in cartographic representation. While end-users of GIS may focus on analysis, representation, visualization and mapping (Batty 2002), the most important component of any GIS is its data. In order for data to be useful, they must be high quality and compatible with their intended uses, and in agreement with the 'real world' they purport to represent (Yueng 2002). This notion that data is "an artefact that reflects people, policy, and agendas" often goes unacknowledged by users not familiar with GIS (Schuurman 2004 p. 54). In contrast with conventional cartography, the GIS map is transitory; it is the underlying database that is essential. If the data are low quality, the results will also be low quality no matter how skilled the technicians or powerful the technology. In essence, the popular notion of garbage in-garbage out remains ever a reminder of the fallibility of sophisticated analyses to poor initial data. This data may undergo many steps along the journey towards final cartographic output such that high quality data for one use may be used in another context inappropriately. As an example, conservation GIS analyses frequently rely on data originally generated by the timber industry, which may be incompatible or poor at representing other spatial phenomena, such as biodiversity or scenic value (Poiker 1994). The resultant maps may not reveal the underlying poor or inappropriate data used to create an attractive cartographic display, though rarely is this apparent to political decision makers or the public (McKendry 2000).

Focussing exclusively on data or cartographic output frequently overlooks larger epistemological questions that arise from human choices in both the creation of the technology and the execution of applications. The concept of GIScience developed in the early 1990's from the notion that the connection between tools and science is not clear and that the way society creates and applies GIS technology needs to be better understood (Chrisman 1999). In essence, GIScience specifically addresses the process by which models and GIS gain legitimacy in descriByng the world. Subjective decisions are made at every stage of GIS analyses. There are traces of the social in the most technical parts of GIS (Chrisman 2001). Human decisions are made in the development of a flowchart or cognitive model, selection of data sets, generation of data models, and choice of enabling software. So too are social decisions apparent in the process of spatial analysis, definition of variables, categorization, or methods of validation. Where a GISystems perspective might accept a model as accurate, a GIScience perspective would ask further questions related to who developed the model, what were the biases informing its development, has the model been effectively validated, how is uncertainty accounted for, and how applicable is the model forat addressing relevant policy questions (Schuurman 2004).

In essence, GIScience provides the "theoretical basis and justification" for the *ways* that GISystems processes (e.g. classification, spatial analyses, and output) are executed (Schuurman 2004 p. 12). The first serious dialogue between GIS and social theory occurred over the politics of knowledge and the social impacts of using GIS (Mark, Chrisman et al. 1996). Social theorists have challenged the notion that GIS could *produce* knowledge, as opposed to synthesize information (e.g. Turner 1991 as cited in Schuurman 2000). They investigate questions of equity, technological biases, privacy, origin, types of data manipulations employed, forms of data representation, and the economics, politics and ethics of using GIS. Many GIS practitioners assume that the technology is an accurate representation of reality and can be used to explain spatial processes and thus to predict future spatial changes. Latour (1987) suggests that science is constructed by a series of long-term processes that turn speculative and unproven work into firmly established facts that eventually disappear inside black boxes. Thus, within GISystems there exists a black box because systems are presumed to model reality. In contrast, GIScience explicitly engages with issues of knowledge construction, offering a theoretical framework for investigating the politics of knowledge creation and the use of technology. GIScience has been defined as "an organized activity by which people measure and represent geographical phenomena then transform these representations into other forms while interacting with social structures" (Chrisman 1999 p. 175).

Recall the way philosophy of science investigates the effects of technology on society and views science and technology as active processes that are socially constructed (Sismondi 2004). GIScience builds on this perspective to understand how results of GIS analyses are firmly tied to choices made in the selection of datasets and methodologies (Chrisman 1999). Tools emerge from social and historical contexts to respond to changing needs, but tools also alter their users and their surroundings (ibid). Science and technology studies (STS) provides a theoretical framework for understanding how social organization, political structure, economic interaction, and cultural foundations influenced the development of GIS (Chrisman 2001). Theoretical critiques developed by STS scholars and geographers investigate the role of GIS in society, ways knowledge is represented via GIS, and the implications of analyses or conclusions drawn from this encoded knowledge (Sheppard 1995). There are calls for continued dialogue between GIS theory and social theory, in an attempt to move the GIS community beyond technological justifications and give equal attention to the ethical use of the information technology (Sui 1994 as cited in Schuurman 1999).

From a GIScience perspective GISystems are a set of institutionalised systems and practices for data management that work within particular economic, political, cultural and legal structures (Curry 1993). Absolute scientific impartiality and lack of bias are impossible as science and technology are societal constructs and thus must be investigated as to epistemological, political, and ethical issues (Cutcliffe 2000).

Technology, applications, models and conventions influence the way that societies conceptualise natural phenomena. Inability to effectively model temporal complexity inhibits societal understanding of the way phenomena are temporally dynamic. Kitcher (2001 p. 55) notes, "our way of dividing up the world into things and kinds of things depends upon our capacities and our interests." Everything in our world is categorized and these categories shape the way in which we turn conceptualise our world (Bowker and Star 1999). For example, there is a discrepancy between the increasing sophistication of classification techniques used in land use and land cover analysis, with the lack of attention given to the origin and impact of land cover categories (Bowker and Star 1999; Robbins and Maddock 2000). This categorization facilitates analyses, data storage, analysis, and development of data models used in GIS. Like categories, a problem with models is that they are often confused with reality.

Scientific models are simplifications of reality that facilitate the understanding of complex relationships and potential consequences of management decisions on natural phenomena. As simplifications, the epistemological status of models is contentious (Plummer 2001). Creating subjective models to translate complex geographical problems incorporating multiple scales, knowledge domains, and political perspectives into mathematical formulations is extremely difficult (Xiao, Bennett et al. 2002). Models can reflect the degree of correspondence between models and geographic reality, the degree to which models correspond with our belief systems, or the utility of our empirical model specifications in solving problems (Plummer 2001). Models often rely upon metaphor and analogy or "manifestations of ways in which information can be expressed and, as some would argue, (are) processed in our mind" (Bailer-Jones 2002 p. 108). Geographers concerned with GIS are divided between those who "criticize its positivist claims and those who believe that it models reality, if only to a modest extent" (Schuurman 2002 p. 74). "The great irony that confounds STS researchers (and) that maintains the positions of science in western society is that models are capable of generating productive information that helps us to understand the world" (Schuurman 2002 p. 80).

Models are also susceptible to interpretation. As a result, models must be used carefully in policy-making due to the necessary tendency to frame problems and questions in narrow terms, utilize easily measured variables, and draw upon existing databases (Clark, Brown et al. 1999). For landscape models to be applied successfully, they must address appropriate questions, include relevant processes and interactions, be perceived as credible, and include people affected by decisions (Fall n.d.). GIS technicians, like scientists, develop models to answer specific questions posed to them by resource managements or scientists. For example, scientists and technicians in the case study of this thesis were tasked (among many others) to develop grizzly bear habitat assessments from which population estimates and to develop the best locations of protected areas. Many GIS models produced, and subsequently used to advise the decision making process, fail to produce outputs that are relevant to the economic or political context of the problem being modelled (Westmancott 2001). GIS is further challenged by difficulties in including more qualitative social parameters, temporal scales (Batty 2002), uncertainty, and heterogeneity.

Recognizing the influence that social objectives have in influencing the development of a GIS analysis is important because, once a model is encoded in GIS, it may initially be treated as hypothetical, but over time they become normalized and institutionalised (Schuurman 2002). Martin (2000) suggests that recommendations for implementation and evaluation of GIS can benefit from a broader theoretical foundation to support investigation, understanding, and improvement.

"The social construction metaphor in STS describes scientists and engineers utilizing models and theories to translate data into representations of natural phenomena. Yet there is no direct route from nature to accounts of nature" (Sismondi 2004 p. 56). Often scientific and technical controversy is underlain by alternate representations and theories of natural phenomena, constructed "on top of data" (Sismondi 2004 p. 57). As an example, policy decisions, public opinion, and academic research interested in assessing the quantity and distribution of old growth forests in the Pacific Northwest made decisions about which data sets to use. Many academics and research projects selected an ENGO data set because the dataset showed less old growth in the region than the government agencies data and was viewed as being more accurate. An analysis conducted by Norheim (draft) determined that the respective institutional cultures of a particular government agency and an ENGO analysing old growth significantly effected the way that the two remote sensing projects analysing old growth were conducted and on the data that emerged. Norheim further recognized that neither data set on old growth was inherently more correct within their institutional context, even though there was significant variation. This example is illustrative of the importance of investigating how GIS maps and spatial datasets can be subject to social construction and the difficulty decision-makers face when trying to decide which is the most accurate, un-baised, and useful for informing decisions.

2.4 Adversarial Science in Land Use Planning

Complex and pressing environmental problems tend to expose the gaps in our scientific knowledge, our technologies and our theories (Poore 2003 p. 62).

Despite explicit acknowledgement that science is socially constructed, incorporation of participatory mechanisms, and advances in both GIScience and GISystems, contested science remains the basis of much environmental conflict. In fact, certain stakeholder groups capitalize on increased space in participatory planning to inform the public and decision making. A consequence is that previously unacknowledged values and visions are included in decision making, restructuring power relationships and whose voices are heard. Furthermore, ecology and conservation biology, the sciences of ecosystem processes, conservation, and biodiversity emerged as a result of targeted efforts to understand the human-nature relationship. Important questions remain regarding uncertainty, the role of expert scientific knowledges versus local or traditional ecological knowledges, appropriate methodology, what constitutes 'good science' and what kinds of scientific information should be included in planning. Theoretically, improved science has the potential to result in better planning and resource management. However, adversarial science has exposed science to much criticism and requires innovation in planning models.

When scientists disagree with one another about technical and scientific issues, society is forced to engage with technical policy issues. Increased participation in decisions, multi-disciplinary science panels, or with explicit recognition of how social values inform forest management have been responses. Theorists argue that better decisions will result from this pluralist approach; however, it has not reduced the conflict over science (e.g. Meffe, Boersma et al. 1998; Cutcliffe 2000; Kitcher 2001). Problems related to the scientific uncertainly, objectivity, and difficulties with developing methodologies that can be transformed into policy decisions remain. Constructivist critiques are being addressed in public planning through institutional mechanisms such as formalized transparency, broader access to funding and technical support, participation, and independent scientific review. However, other critiques remain disregarded by scientists and planning processes, largely due to the lack of familiarity with the details of the sciences among constructivists and epistemological commitment scientists have to the scientific method.

GIS is unquestionably the technology used to represent and analyse space. This is evident in decision-support software programs, communication exercises, and the development of scientific models to answer specific management questions. In an expert model of science, these analyses purport to represent accurately the natural processes they model, and decisions are made accordingly. However, in cases of adversarial science, there are contradictory analyses produced, and political decision making needs to be more aware of how and where the social enters into a GIS. Within geography there have been heated debates about the epistemological status of GIS. As political decision making emphasise the need for improved methods of developing science and information, theoretical critiques of GIS and how social values inform the technology, the development of analyses, and the output maps will become more important. Local and traditional knowledge play important roles in ground truthing and bringing meaning to spatial information and analyses. These knowledge communities can play important roles in documenting or encoding spatial features in a map or database, in questioning models, and in grounding analyses in relevant social and political contexts.

Drawing upon the theoretical foundation presented in this chapter, this thesis will explore forest controversy in the so-called War in the Woods (Salazer and Alper 2000). The roles of adversarial science, institutional innovation leading towards a restructured science-policy relationship, and key outcomes of this process will be explored in the following chapters.

3 SCIENCE BASED POLICY AND CONFLICT

"Calls for change have been the most prevalent in forestry" (Patterson and Williams 1998 p. 281) where redefined roles for the use of science in land use planning have emerged. Amidst efforts to democratize science in decision making, science remains an integral part of developing and achieving sustainable forest management in the temperate rainforest biome of North America. The evolution of forest conflict in the central coast is linked to public perceptions that British Columbia crown land was not being managed to protect non-extractive forest values of its citizens, coupled with dissatisfaction over unsustainable cutting rates, tenure uncertainty, and the way land management decisions were being made (Hoberg 2000; 2001). Science has shaped the definition of problems (e.g. loss of biodiversity or declining water quality) and the solutions (e.g. variable retention forestry and riparian buffers), yet science alone is unable to resolve resource management dilemmas. In fact, science plays a role in exacerbating "wars in the woods" that affected the coastal forests of North America for nearly three decades. Mechanisms for increased collaboration and communication among stakeholders, scientists, and managers have been essential components of proposals for achieving peace in the woods.

The politics of conservation in western North American coastal forests are inseparable from industrial forestry. Science and spatial modeling play critical roles in the formulation of crisis, documentation of causality, and development of management guidelines or land use plans in forest conflicts. Because scientific and spatial information influence the larger conflict and often lead to the renegotiation of power structures, science itself can become the battlefield. Science is used to develop information about potential options and their consequences, but good science alone does not automatically result in good policy, and getting disparate stakeholders to agree upon what constitutes good science can be impossible. Many high profile resource conflicts incorporate independent scientific review as a way to increase public trust, achieve multi-disciplinary perspectives, and facilitate more objective science, or at least less biased science. In essence, however, forest conflicts are more than just scientific problems, and social values inform the construction of scientific information. As well, local and traditional knowledge, while increasingly recognized as integral to any solution, are frequently overlooked.

Many factors contribute to the intractability of forest conflicts, but a critical one is "failure to acknowledge its fundamentally socio-political and value-based character" (Clark, Stankey et al. 1997 p. 27). War in the woods represent "a perceived democratic deficit" due to the lack of public involvement in resource management as societies shift from a post-war technocratic regime towards more participatory management (Jackson and Curry 2004 p. 30). The "social and political context of natural resource management is characterized by *heightened complexity* caused by 1) expanding and conflicting public values, 2) ambiguous and conflicting norms of collective choice, and 3) inherently complicated future environmental choices" (Yaffee 1994 p. 294). Social values surrounding temperate forest conflicts could be described as shifting towards sustainability, maintenance of old growth and late seral conditions[x], and increased recognition of both anthropocentric and intrinsic value of forest ecosystems. This has led to a renegotiation of the role of industrial forestry and resource management, particularly on government-owned land. In these forest conflicts, conservation advocates speaking for nature are pitted against the interests of logging jobs, the timber industry, and regional economies. There are also community, indigenous, non-timber forest workers, and many other perspectives informing these conflicts, offering "the possibility of breaking open what is too often ... a polarized set of arguments" (Salazer and Alper 2000 p. 4).

In order to accommodate diverse social values for sustainable forest extraction, ecosystem management is increasingly viewed as a silvicultural model because of the potential for sustaining cultures, communities, and economies within the context of healthy ecosystems (CCLRMP 2004). Ecosystem management is described as "a philosophical approach to natural resource planning that theoretically places environmental issues on equal footing with the economic concerns of the dominant resource use" (Mabee 2003). The concept arose in the 1940s in an attempt to better defend other intrinsic value of ecosystems and to maintain social and economic benefits accruing from resource extraction. This shift in approach built on increased recognition that "conventional resource management threatens biodiversity", (Allen 2004 p. 8). However, ecosystem management is a contested term and difficult to formulate or implement (Rigg 2001). Conservation biologists emphasize the preservation of biological diversity while others see ecosystem management as a tool for conflict management (Salazer and Alper 2000), as a way to continue industrial forestry in sensitive zones, or as a location for the explicit negotiation of science and resource values. The details of ecosystem management are hashed out in the context of practical silvicultural questions about where, how, and which trees should be harvested. Silviculture guidelines are guided by the concept that an effective resource regime must allow for the maintenance of ecological and socio-economic well being, but that if a "conflict between them is unavoidable, ecosystem integrity comes first" (Allen 2004 p. 8). Yet, to facilitate successful application of ecosystem management, managers must also "1) build confidence and trust in the process, 2) acknowledge bias, 3) reconcile policy and funding constraints with long-term planning, 4) invest in scientific research, data collection, and monitoring capacity, and 5) explore the relationship between values and science" (Rigg 2001 p. 78). It is because of these diverse objectives that ecosystem management plays such critical roles in war in the woods conflicts on the coastal forests of North America and why in the case study, an independent information team was necessary to develop an ecosystem management framework.

3.1 War in the Woods: Examination of Two Conflicts

The difficult natural resource issues that command attention today took root over a century ago; today's headlines are merely the most recent manifestations of a continuing struggle to make decisions about things that matter to society (Clark, Stankey et al. 1997 p. 27).

The late 1980s and 1990s witnessed a series of environmental conflicts related to land use in the temperate rainforests of the Pacific Coast: in the federal forests of the Pacific Northwest, in Clayoquot Sound on Vancouver Island, and in the so-called Great Bear Rainforest. These conflicts share a few characteristics: 1) conflict over science informed the larger conflict and outcomes, 2) each of these situations resulted in the development of innovative roles for science and information (e.g. independent scientific review) and 3) ecosystem management was part of the solution. A brief analysis and presentation of key theoretical lessons learned from the spotted owl controversy and Clayoquot will presented to set the stage for this thesis' investigation of the central coast, situated in the heart of the Great Bear Rainforest.

3.1.1 Pacific Northwest forestry vs. the spotted owl

Few issues in the history of land management planning of public forests in the US have been as long lived and as intense as that over the fate of old forests in the West (Marcot and Thomas 1997 p. 1).

The 1991 listing of the spotted owl under the Endangered Species Act and a series of legal challenges forced the U.S. Forest Service to comply with regulations, which served to seriously undermine the Pacific Northwest timber industry (Marcot and Thomas 1997). By 1992 disputes were ongoing, characterized by court suits, timber harvest injunctions, and debates over a recovery plan (Yaffee, 1994). Conceptualised as a confrontation between protecting old growth habitat of the endangered spotted owl and logging jobs (Hoberg 2000), this conflict highlighted both social and ecological values that define forestry and led to a renegotiation of ecological science (Clark, Brown et al. 1999).

Scientific information on spotted owl biology and habitat was critical towards listing of the owl on the US Endangered Species Act, which would fundamentally alter forest management in the region. The adversarial use of science showed that science could not play a decisive technocratic role and served as a catalyst for intensifying conflict, particularly because scientific discourse was used strategically to achieve political aims (Satterfield, 2002). A key step towards resolution was achieved in 1993 when newly elected President Clinton held a forest conference and established the Forest Ecosystem Management Assessment Team (FEMAT), a multi-disciplinary team that included over 600 people to address human and ecological needs served by federal forests in the Pacific Northwest (FEMAT 1993). FEMAT provided a "scientifically credible, multi-agency, ecosystem based management plan" (Yaffee 1994 p. 144). Recognizing the intransigence of adversarial science, FEMAT sought to reconcile the role of scientists as advocates for a particular position or prescription:

> a clear demarcation (was) needed between the roles of policy makers and scientists to ensure that the inevitably controversial policy decisions are grounded in the best knowledge available, not on how persuasive or articulate the advocates on the various sides might be (Clark, Stankey et al. 1997 p. 24).

FEMAT was commissioned as a joint fact finding exercise to address spotted owl habitat in a collaborative response to complex pressures of the management of federal forests in the Pacific Northwest (Selin 1995).

While a single species problem triggered the elaborate government response, it soon became apparent that managing the region's old growth forests needed to be addressed at an ecosystem level. An earlier scientific report focusing solely on the spotted owl was ruled "inadequate" by judicial order at addressing larger ecosystem needs (Hoberg 2000 p. 41). As a result, FEMAT took an ecosystem approach, recognizing that effective ecosystem management requires addressing social values and investigating the role of a socially informed science in influencing resource management. Broad and integrated ecological perspectives (e.g. the shift from single species towards ecosystem management) developed by FEMAT are also seen as key catalysts for developing ecosystem management (USFS 2001). Ultimately, the Spotted Owl became an unintended catalyst for developing and implementing ecosystem management in an attempt to manage economic, social, and ecological interests simultaneously (Marcott, 1997).

FEMAT developed 10 detailed options, each with varying risk regarding the management of forests within the range of spotted owl; option 9 was chosen by the President amidst ongoing controversy and served as a blueprint for managing the federal forests of the Pacific Northwest (FEMAT, 1993). An internal US Forest Service assessment (USFS 2001) found that the roles of scientists changed in many ways. These include a shift towards policy-relevant research, of expanded scope and complexity, the development of integrated science teams, increased research into non-traditional forest uses, and a reaffirmed commitment to long-term projects. Furthermore, the report highlights a shift from the complementary to the collaborative role of scientists and an associated improvement in communication, commitment, and effectiveness. Questions regarding the appropriate role of experts versus citizen in setting policy were addressed and the notion of a "benevolent science and its inherent technical wisdom" was rejected (Yaffee 1994 p. 294). Key legacies of the spotted owl controversy include a new science-policy relationship, improved understanding of temperate rainforest ecology, articulation of social values of these forests, and advancing ecosystem and adaptive management.

It is also important to highlight that the forests of the Pacific Northwest are highly fragmented in comparison to many of the forests along B.C. coasts, where proactive attempts were being made by local, regional, and global actors to protect intact forests. Protection of high levels of regional ecosystem integrity was never possible, nor a goal per se. For this, many leading US conservationists and scientists looked to the wilderness and intact valleys to the north.

3.1.2 Clayoquot Sound

Nearly a decade of protests, First Nations litigation, and activism against industrial forestry came to a head with the 1993 blockades at Clayoquot Arm in response to proposals for additional logging in the region's intact watersheds. Clayoquot was eventually resolved through what Mabee (2003) views as a paradigm shift in environmental management and the science-policy relationship. Similar to the Pacific Northwest, in Clayoquot adversarial science informed the larger debate over what level of protection would ensure ecosystem function. An independent science team was critical to developing the solutions, and ecosystem management was a key part of the outcome of the science panel's recommendations as a space where disparate forest values could be encoded into silviculture and land use prescriptions. However, in Clayoquot, these decisions were made within a participatory decision making process that engaged aboriginal title. An expanded array of scientific, local, and traditional ecological information was central to the transformation of conflict and the development of an acceptable solution.

Clayoquot built on momentum gained from a larger war in the woods waged in B.C. since the 1980s between environmentalists, First Nations, the provincial government, woodworking unions, and commercial forestry interests (Jackson and Curry 2004). Rojas (2002) concludes in an analysis of the Clayoquot Sound conflict on Vancouver Island:

> There seems to be a deeper human drama involved which shapes and nurtures the 'flame' of environmental conflicts. As in religious conflicts, confrontations about the environment are clashes of worldviews: it is the confrontation about values which creates the flame (p. 2).

A cabinet-level decision to place 81% of Clayoquot Sound's forests under Integrated Resource Management, which would have resulted in many un-logged valleys being intensively logged, resulted in massive civil disobedience with over 800 people being arrested (Hatch, Berzman et al. 1994). Criticisms of the Clayoquot planning process focussed on whether the upper threshold of 12% protection was sufficient given the region's cultural and ecological significance or if it sufficiently adressed aboriginal interests. An international campaign led by Greenpeace, Friends of Clayoquot Sound, and other ENGOs helped to inform the world of the region's global significance, highlighting as well the cultural practices and the land claims of the Nuu Chah Nulth First Nation. In this way, social values at Clayoquot encompassed divergent local, regional, and global visions of sustainability.

The Nuu Chah Nulth led negotiations between Greenpeace, Friends of Clayoquot Sound, and Macmillan Bloedel (now Weyerhaeuser) helped to broker a path forward from the antagonism of the market campaigns and blockades (Cashore, Vertinsky et al. 2000). These talks resulted in the establishment in October, 1993 of a 19 member Scientific Panel for Sustainable Forest Practices in Clayoquot Sound, hereafter referred to as the Clayoquot Science Panel. The Clayoquot Science Panel recommended a commitment to ecosystem management and First Nation co-management of the forest operations in the region, which was actualised in 1997 through the establishment of Iisaak, owned 51% by the Nuu Chah Nulth and 49% by Macmillan Bloedel, now Weyerhaeuser, and soon to be Brascan (Isaak 2000). The B.C. government accepted nearly all of the panel's recommendations, significantly reducing logging in Clayoquot, increasing percentage of protection, and committing to implementing ecosystem management, and to the establishment of co-management with First Nations.

The Clayoquot Science Panel was a key innovation in land use planning in B.C because it was recognized that experts did not have sufficient information to make good planning decisions (Mabee 2003) and that social and economic information were critical for managing ecosystems.

> The disputes at Clayoquot were never simply about logging, or indeed about the environment, and could not be resolved by an agreement about logging or environmental preservation. Much else has always been at issue, including democratic process, local autonomy, dispute resolution, the nature and use of the law, the organization and purpose of economic activity, gender identity and gender equality, and relations between Natives and non-Natives (Shaw 2003).

While central to the transformation of the conflict, the establishment of this science panel in Clayoquot must also be understood for its success in engaging larger questions of aboriginal title, new silvicultural practices, Macmillan Bloedel's ability and willingness to enact sustainable forestry, and the role of conservation in society.

Part of the success of the Clayoquot Science Panel was the result of a "hybrid formation" rather then any expression of "pure science" (Lee 2002 p. 69). The panel integrated multiple ontologies and worked with numerous organizations "at the interface between Western Science-informed resource management and First Nations practices" (Lee 2002 p. 72). The V.P. for environmental affairs of Macmillan Bloedel stated that Clayoquot profoundly changed company practice:

> We have learned the hard way that technical, scientific, factual, and economic answers don't represent the full equation anymore. There are social, political, and even psychological dimensions to these issues (As cited in Cashore, Vertinsky et al. 2000 p. 103).

The Clayoquot Sound Panel recommendations avoided notions of either primitive wilderness or resource extraction on an industrial scale. Instead, they sought sustainability within a more socially situated nature (Braun 2002).

The Spotted Owl and Clayoquot controversies, despite different national contexts, have much in common (Salazer and Alper 2000). As in the spotted owl controversy, there were underlying values and ethical debates in Clayoquot Sound, yet policy-centered science remained critical to the development of a proposed solution. Both developed science panels, were challenged by adversarial science and disparate social, entailed resource re-mapping, and have resulted in profound changes in operational practices in land management. The science and information panels were quite different: the FEMAT team represented a "collaborative multi-party team approach" that involved scientific, technical and policy experts from various agencies while the Clayoquot Science Panel has been characterized as a "independent scientific team approach" where a groups of renowned experts are tasked to develop a series of management recommendations based on their collective expertise (Hadley 2004 p.1). However, local economies, stakeholders, ownership and legal structures varied, as did the ultimate road towards a compromise or solution of conflict. The spotted owl final planning map was drawn by FEMAT and edited by the USFS; entailed minimal roles for aboriginal interests; involved central roles for the President, individual judges, leading scientific experts, and top politicians; and had few participatory mechanisms. In contrast, civil disobedience, MacMillian Bloedel leadership, recognition of Nuu-Chah-Nulth title, and the influence of international market campaigns characterize Clayoquot Sound. Importantly, in Clayoquot, the local and global values of temperate forest conservation operated alongside, and at times became merged with the strong activism of the First Nation.

Clayoquot directly influenced both the general research agenda and policy debates on sustainable land use and particular forest practices first in Clayoquot and then in B.C. (Rojas 2002). In many ways, Clayoquot served as a catalyst for intensified international protests against logging in all of the coastal forests of B.C., notably in the regions characterized as the Great Bear Rainforest. However, Clayoquot also provided opportunity for actors to gain experience with mediation, participatory planning process, and the concept and practice of an interdisciplinary scientific committee. This experience would influence the strategies, solutions, and institutional structures employed by many stakeholders who would later be involved in the central coast (Interview #3). Clayoquot would soon emerge as a model for coastal planning, one that entailed full partnership between the provincial government and First Nations, strong roles for local and global stakeholders, and commitment to developing better scientific information as a basis for ongoing commitment to ecosystem management. Furthermore, ecosystem management demands a more dynamic science-policy relationship, often explicitly recognizing that information, scientific or other, can never be complete and that policies should rely upon adaptive management.

3.2 War Moves North to the Great Bear Rainforest

Clayoquot Sound ... marks the southern-most extent of any significant pristine rainforest valleys in North America ...But Clayoquot is only the tip of the iceberg. The largest areas of pristine ancient temperate rainforest in the world are on the central coast of B.C.& Alaska (Greenpeace 1997).

By 1995 the Greenpeace campaign to raise awareness of the ecological importance of B.C.'s coastal forests and to influence industry practices had clearly expanded beyond Clayoquot to include regions to the north (Cashore, Vertinsky et al. 2000). Recognizing the narrow scope afforded by "valley by valley confrontations" (Cooperman 1998 p. 3) and as controversy in Clayoquot subsided from high-conflict market campaigns and moved towards negotiations in 1994, regional and international conservation attention shifted to forestry issues and land use planning processes farther north on the central and north coasts of B.C. Science, spatial information, maps, and photos were pivotal in defining the emergent campaign (Interview # 7). Three land use planning forums address regions included in the Great Bear Rainforest: the central coast (4.8 million ha), north coast (1.7 million ha), and portions of the Kalum (1.2 million ha) LRMPs (Forest Action Network 2004). The CCLRMP was the largest and has required the most resources and time to complete of the three coastal LRMP regions. Four critical agreements have impacted the future of this area: 1) agreements between timber companies and environmentalists in 2000 to negotiate an end to the market campaigns and defer logging in 100 watersheds, 2) interim recommendations from the CCLRMP in 2001 to protect 20 watersheds and continue the moratoria in 68 more, 3) protocol agreements signed simultaneously between First Nations and government, 4) stakeholder recommendations from Phase II CCLRMP in 2003 (Save the Great Bear 2005). Refer to timeline in Appendix 5 or Table 3.

The scientific identification of the significance of the region, documentation of the impacts of industrial forestry, and the potential for a new form of ecosystem management were central to the emergence of the Great Bear Rainforest as a policy debate in B.C. The construction of scientific information related to the management of this region can not be divorced from the larger political and social questions related to aboriginal title, sustainability, and economic opportunity. As in the above two examples, forest conflict in the Great Bear Rainforest is situated within a larger conflict over sustainable resource development in B.C., one characterized as conflict between the economic exploitation of timber resources, which often have local and regional implications, and protection of globally significant environmental values (Hoberg 2000).

The collaborative foundation of the LRMPs is often emphasized as being critical to arrival at consensus-based recommendations. However, less has been written about the way that adversarial science develops due to increased opportunities and greater voice to formerly marginalized groups who were able to engage in processes of re-mapping. The Great Bear Rainforest conflict has forced the re-mapping of resource values, land use, and First Nation territories such that 2003 recommendations from Phase II of the Central Coast Land and Resource Planning Process (CCLRMP) recommend 33% of the land base be protected and First Nation management areas be established via a separate political process. While not unprecedented globally (e.g. Costa Rica has protected nearly 25% of its territory), this allocation is far higher than the provincial goal of 12% and earlier regional caps of 18%. Further, the CCLRMP established an independent scientific information team, the Coast Information Team (CIT), and developed operational guidelines for resource extraction based on principles of ecosystem management.

CentralCoast Proposed Resource Management Zones

3.2.1 The central coast LRMP planning region

Throughout the CCLRMP science and information remained central to the characterization of the conflict, to the development of potential solutions, and to the envisioned ecosystem management. To understand the conflict it is vital to map the biophysical and social values that informed the characterization of the region. The central coast area is 4.6 million hectares in size, extending from Princess Royal Island in the north to southern Johnstone Strait in the south (Refer to map). Descriptions of the region generally emphasize the outer coast bog forests, remote islands, and complex coastline while steep forested watersheds, deep fjords, and high alpine and rugged glaciers characterize the inland sections. Two major physiographic regions formally describe the region: the Coastal Trough[xi] and the Coast Mountains[xii]. Initially the central coast planning table was divided into a south and a north forum, though this strategy was abandoned in Phase II. The northern half of the planning region is more pristine, contains the majority of existing parks, undeveloped watersheds, and the region's major towns, including Bella Bella, Bella Coola, Hagensburg, Ocean Falls, Rivers Inlet, Namu, Shearwater, Firvale, Stuie, and Klemtu. In contrast, the southern portion of the planning area contains the forest industry's major operations, has few towns (but many small First Nation villages) and the parks are small, mostly marine, recreation areas.

Global conservation interests focus on the central coast's intactness, scenic beauty, potential for large conservation spaces, and traditional territorial claims of numerous First Nations. The conservation sector highlighted that the central coast possessed the last remaining intact temperate old growth forests. A report commissioned by the ENGOs in 1999 states "over half of the world's original temperate rainforests have already been destroyed; B.C. has one quarter of what is left, much of it in the Great Bear Rainforest" (Holmes and Larstone 2000 p. 1). From a global perspective, the region north of Knight Inlet stretching up the B.C. coast to Southeast Alaska contains the world's largest largely intact temperate rainforest ecosystem (Jeo, Sanjayan et al. 1999). The region's has well documented biological diversity, which includes red-listed species, anadromous fish, and numerous important mammals including the kermode bear, grizzly bear, and wolf[xiii] (MoSRM 2001b). Forests cover half of the central coast, with 50% of the forest land classified as old growth, a definition based on height and age class definitions (e.g. age class greater than 141 years). Most old forest is located in the northern region of the plan area (Jeo, Sanjayan et al. 1999; MoSRM 2001b). An analysis in 1991 identified 20 pristine and 25 slightly modified watersheds (Moore 1991). These pristine old growth valley bottoms and flood plains became central to the larger conflict due to overlapping habitat and timber values located there, both increasingly rare commodities.

The central coast is an important component of provincial timber supply[xiv] and forest employment, particularly the southern half. As a result, properly documenting the region's forest values and the impact of any potential land use decisions were deemed very important by numerous stakeholders in the CCLRMP.

7% of the provincial total Annual Allowable Cut (AAC) and 24% of the coastal AAC originates in the central coast (MoSRM 2001b). Timber interests emphasise that 26% of the forested land base is currently economically viable for timber harvesting (CCLRMP Dec. 8-9, 2003). From a different perspective, 12% of the total land base is currently considered economically viable for timber harvesting with 8% of the northern region and 20% of the southern region falling into this category (Enumark 1999; Holman and Eliot 2001). Accordingly, 60% of the THLB in the North plan area is indicated as older than 141 years, while only 30% of the south meets this classification, reflecting the accessibility and longer history of logging in the south (MoF 1999). Timber harvest from the plan area generated $155 million a year in gross provincial stumpage, personal, and corporate tax returns (Holman and Eliot 2001). Industrial forestry provides over 5000[xv] direct jobs provincially; however, virtually all[xvi] of the 3.6 million $m/^3yr$ of timber harvested are processed outside of the central coast and 96% of direct forest jobs accrue outside the region (Enumark 1999). As such, logging in central coast is significant for other communities' economic development, particularly communities on northern Vancouver Island.

Forest companies, mining companies, and other businesses with interests in the central coast, such as tourism, are key stakeholders in land use planning. Weyerhaeuser, International Forest Products, Norske International, and Western Forest Products are four of the largest forest companies with harvest rights in the area. As of 2004, there were no operating mines in the area, though the mining sector argues that no additional land should be excluded from potential exploration and exploitation. Mineral potential is not easy to plan at the strategic level since mines must be located wherever the richest ore deposits are found. As a result, companies argue against further allocation of parks in the region since parks exclude mineral extraction and are seen as "locking up" the land (BCCOC 2003 p. 132), a sentiment mirrored by many forest companies and local communities.

Amidst the above-characterized global and regional interests, the region remains local for the 5000 people living in the area, many of whom are directly dependent on the land base. Over half of this population is aboriginal. Both native and non-native communities look to the region's natural resources as sources of economic livelihood and community well-being, be they from fishing, forestry, or tourism. In 2001, there was a labour force of 2,456 people for whom forestry provided 13% of income and 15% of jobs, fishing provided 11% of income and 19% jobs, while tourism provided 6% of income and 13% of jobs (MoSRM 2001b). Tourism, envisioned as a vital part of a conservation economy, is one of the few growth industries (Holman and Eliot 2001). While average tourism incomes are lower than in the forest industry, many more of these jobs are in the central coast (4% of forestry and 60% of tourism jobs accrue within the central coast) (Holman and Eliot 2001). Tourism is dependent upon the central coast's pristine nature, wildlife viewing, sport fishing, and location along the Inside Passage as well as food and accommodation in main communities, saltwater charters, and lodges (Holman and Eliot 2001). As of 2004, Hagensborg contained the region's only forest manufacturer, Little Valley Forest Products, a sawmill, that focuses on value added products[xvii]. Community interests seek to gain greater control over the management and process of forestry in the region. Community forests have been pursued as one way to better achieve this goal.

While First Nations constitute less than 4% of the Province's total population, in the central coast First Nations represent a majority. There are over 19 First Nations residing in or claiming territory in the central coast and they do not speak with a unified voice. Among these are the Gitga'at, Kitasoo, Heiltsuk, Nuxalk, Oweekeeno, and Haisla. There are an additional 11 First Nations whose members live outside the planning region but have territorial claims in the area, notably the seven First Nations that make up the Kwakiutl District Council, the three members of the Musgamagw Tsawataineuk Tribal Council, and the Tlowitsis Nation (represented at the CCLRMP as KDC/MTT/TN). Many contemporary aboriginal villages remain and rely upon fishing and forestry resources for both formal employment and subsistence. Roughly half of the region's First Nation work force lives on reserves and are employed by the public sector (45%), fish and fish processing (19%), and forestry (9%) (Holman and Eliot 2001). Ultimately, however, unemployment on the region's reserves remains very high at nearly 40% (Holman and Eliot 2001). In addition to fish and forest resource jobs, non-timber resource harvesting represents an increasingly important component of the planning region. As an example, in 1999 there was an estimated $2 million harvest in pine mushrooms, most of this benefiting locals, particularly First Nation communities and often members of the population that were excluded from formal employment such as elderly women (CCLRMP 2004). First Nations have not reaped many benefits from the tourism economy and are trying to position themselves differently in the future.

Rojas (2002) developed a schema for examining social values in the Clayoquot conflict, which provides a good characterization of the social values motivating key actors in the central coast. Social values were envisioned as human centrism, social responsibility, individual responsibility, and eco-centrism. Rojas identified the unions and NDP as motivated by "human centrism" and "social responsibility", who sought public ownership and wealth redistribution, and adopted the goal of sharing forest resources. Their primary concerns were long-term access to resources and local economic sustainability. Industrial forest and mining companies, both motivated by an intersection of "individual freedom" and human-centered values, pursued tenure rights, free market allocation of resources, scientific and technological innovation, and competitive self-interest. The Liberal government would fall into this category. Mapped timber and mineral resources and tenure allocations were central to their attempt to protect their interests. Conservation sectors, motivated by an intersection of "community and social responsibility" and "eco-centrism", sought recognition of the intrinsic value of the natural world, communal ownership, and holistic forms of knowledge. This sector engaged with ecological science and spatial information to highlight conservation priorities (e.g. biodiversity, rare ecosystems, and habitat analyses) and to encode ecological values onto a region's map. Advocates of small-scale private ownership and consumer responsibility were located at the intersection of "individual freedom" and "eco-centrism". Local communities, the tourism sector, and the global consumer market represented this disparate quadrant. Lastly, First Nations were seen as being motivated by values of "community and social responsibility" and "eco-centrism" with their concerns focussing on land settlements and claims to historical sustainable resource use. As a result, Rojas (2002 p. 7) argues that many First Nations "position themselves politically and in terms of development options at the center, articulating elements of the ideological discourses of all the others, but within a complex discourse of their own".

An ecosystem-based approach towards management and planning was pursued to reconcile these disparate interests and social values. As evident in the above statistics, the region carries locally significant values for First Nations and for other non-native communities, many of whom are dependent upon the land base. The resource values of the region figure are important provincially in terms of government revenues, regional jobs, and wood processing. In addition to local and regional interests there are a suite of globally informed values that highlight the significance of the region's temperate forests, carnivore populations, and pristine wilderness. In essence, the central coast's global significance resulted from scientifically documented ecological values and well-marketed scenic beauty, while for the majority of the population living there, local and traditional knowledge informed their valuation of resources and land management. As one participant stated, at the land use planning table in the central coast, there were local, provincial, and international constituencies with different vested interests and prices they were willing to pay (Interview #1).

3.2.2 Phase I (1997-2001) of the central coast LRMP

B.C.'s provincial government initiated a regional planning process for the central coast region in 1996[xviii]. The provincial Land and Resource Management Process (LRMP) was intended to allow for "involvement at all levels of government, First Nations[xix], stakeholders, and the general public (to) ensure a balance among environmental, economic, and social objectives and (to) create land use certainty" (CCLRMP 2004 p. 16) (See Table 2). Conflict over land use in the central coast should have been resolved through the collaborative provincial LRMP process. Conflicting social values, boycotts of the process by ENGOs and various First Nations, and a dysfunctional process had bogged down the CCLRMP by 1999. As a result, it experienced great difficulty in achieving consensus recommendations to government over land use by the original 2000 deadline due in part to the antagonism of the market campaigns and the loss of legitimacy because key stakeholders were not at the table. Ultimately, the central coast planning table would need two phases (Phase 1: 1997-2001 and Phase II: 2001-2003) and to develop new institutions before arriving at consensus recommendations that reflected the region's local, provincial, and global significance. The radical change experienced in the central coast and the processes of re-mapping relate to the maneuvering of tools, the intensity of the conflict, and the global spotlight being directed by the great bear rainforest campaign towards forestry, land use planning, and ecological science in the central coast.

Table 2: Goals of Phase 1 CCLRMP.

• Balance all stakeholder interests (both local and global) • Provide people with certainty in employment, in their economic future and in the social and environmental stability of their communities • Ensure that we manage and protect the natural environment for today and in the future. • Provide resource management agencies with clear guidance on future land management (LUCO 1999)

In Phase I of the CCLRMP, both the timber and conservation sectors drew on science and spatial analysis to justify or challenge existing practices. Many participants felt that the extremely technical nature of the planning was counterproductive and maps, images, and analyses descriByng the region became embedded in conflict. As one interviewee explained "when we first started sitting down at the table there were maps galore and they were trying to bring to us every piece of information that they could and put it in front of the table to start reviewing" (Interview #2). Additionally, the conservation sector actively asserted ecological values via the Great Bear Rainforest Market campaign, since they felt the information being developed by the CCLRMP process team was biased (Interview # 9) and lacked technical capacity (Interview # 7). In the first few years of Phase I, the situation can be characterized by debates over science and information, market campaigns, and strategic manoeuvring to achieve political goals.

Initially, many environmental organizations refused to participate in the planning process initiated in 1997 for the central coast, calling it a "sham" and rejecting it as a *talk and log* scenario. An article in *Cascadia Times* by Paul Roberstein describes this moment in the conflict:

> Industry representatives didn't lose sleep over the environmentalists' departure. Hostility festered on both sides in the wake of a series of angry confrontations at Clayoquot Sound, Carmanah, and Haida Gwaii that took place in the 90s. 'There was a lot of animosity between them and us' Merran Smith (campaigner with Forest Action Network <SIC>) says. 'Some people did not want to be across the table talking with us' (Robertstein 2003 p. 8)

After walking out of the formal CCLRMP negotiations, ENGOs pursued their objectives through international market campaigns to raise international attention to the region's ecological significance, which drew heavily on scientific, local, and traditional knowledge of the region that was often quite different from the way that the government and industry presented the region.

This Great Bear Rainforest campaign used ecological science to substantiate its assertions, and targeted the forest companies operating in the coastal forests and their customers in Europe and in North America as well. Boycotts and publicity stunts were launched against retail, construction retail stores, and pulp and paper companies in Germany, the U.S. and the U.K. (Hoberg 2003; Clapp 2004). "Rising tensions on the west coast had global repercussions" states Lynn Brown of Norske Canada (CFCI 2004 p. 3). Home Depot, Ikea, Centex, and Kuaffman and Broad were among those who committed to phasing out timber from the central coast and other areas where old growth forests were being logged (Clapp 2004). From an environmental perspective, "the campaign was wildly successful" (Robertstein 2003 p. 8), in that foreign buyers were persuaded to cancel $15 million in sales contracts and certain companies, such as Home Depot, committed to phasing out timber purchased from areas that had been characterized as endangered. The central coast soon became a focus of international and domestic attention.

Table 3: Conflict in the central coast

1985	• Launch of sustained environmental battles in B.C. ENGO's pursue valley-by-valley protests against logging focused in the coastal region. FN blockades around the Province.
1991	• International orchestration of protests by ENGOs targeting B.C. pristine valleys. • New Democratic Party (NDP) elected on a mandate which included a peace in the woods
1993	• ENGOs focus on international markets to influence timber operations in Clayoquot Sound
1995	• Clayoquot Science Panel findings endorsed
1997	• CCLRMP Phase I initiated • ENGOs denounce the central coast planning table as a "talk and log" process. • Forest Ethics, Greenpeace, Rainforest Action Network, and the Sierra Club launch the Great Bear Rainforest market and publicity campaigns.
1999	• Beginning of bilateral talks between ENGOs and timber companies (JSP).
2000	• JSP talks agree to a temporary moratorium on logging in large, intact valleys in exchange for suspension of Great Bear Rainforest markets campaigns
2001	• JSP negotiated solution informs the substantive components of the CCLRMP plan. • CCLRMP Phase I interim agreement achieved. • Turning Point agreement signed between 8 First Nations and the provincial government. • Phase II initiated under newly elected Liberal government. • New sectoral model of LRMPs developed.
2002	• CIT starts work and informs the CCLRMP table with a series of analyses.
2003	• Intense negotiations in JSP result in the 2003 CCLRMP solution. • 2003 CCLRMP recommendations to government.
2004	• Government–to-government negotiations between the province and First Nations.
2005	• Completion of government-to-government negotiations. • Process delayed until after the provincial elections.

From another perspective, the campaign severely affected local economies and the forest companies' bottom lines. Central coast communities, which had been impacted by resource industry adjustments, market declines, softwood lumber disputes, and foreign currency fluctuations, were further impacted by land-use disputes and the market campaigns (e.g. by 2002 the labour force had declined 12% since 1996 when the CCLRMP was initiated) (MoSRM 2002). By 1999 the ENGO market campaign had achieved such international and regional influence that the ENGOs were able to engage the timber companies as equals in bilateral talks outside of the formal CCLRMP. To attempt to move through the impasse created by continued logging, adversarial science, and the market campaigns, in 1999, four forest companies (Canfor, Interfor, NorskeCanada, Western Forest Products and Weyerhaeuser) organized themselves into Coast Forest Conservation Initiative (CFCI) [xx] and initiated a mediation process with certain ENGOs (Forest Ethics, Greenpeace, Rainforest Action Network, Sierra Club of Canada – B.C. Chapter)[xxi], who organized themselves into the Rainforest Solutions Project (RSP). The CFCI and RSP together formed the JSP. JSP marked a fundamental difference in the way these former antagonists negotiated resource management and attempted to "move beyond the traditional conflict model and seek new and innovative solutions" (JSP n.d. p. 1). JSP outlined shared interests and values (See JSP n.d.), sponsored scientific, technical and socio-economic research, and provided information and ideas to the three coastal LRMP processes[xxii]. The purpose of bilateral negotiations within the JSP had been to develop a new collaborative model, outside of the formal LRMP process, to break through the polarized positions that had stalled the CCLRMP.

These bilateral negotiations and the resulting alliance would prove critical in brokering both the 2001 and 2003 consensus agreements. Early public statements of progress through the JSP forum appeared in March of 2000 in an agreement to suspend the market campaigns in return for not initiating logging in 30 un-logged watersheds that were considered critical for conservation interests. This "negotiated moratorium in the key areas under question made it possible to discuss future possibilities" (CFCI 2004 p. 3). Central to this early agreement was the development of a strategy for engaging problems arising from adversarial science. "The pathway for breaking through this situation lay in the creation of a broader array of information, options and ideas than was currently available to formal decision making processes" (JSP n.d. p. 2). This goal would ultimately result in the establishment of a multi-disciplinary independent scientific review panel, the CIT and also in commitments to development Ecosystem Based Management (EBM) for the coastal forests. The CIT and EBM would prove critical to the arrival of the CCLRMP to consensus and provide important lessons for land use planning elsewhere. The CIT, while based on the Clayoquot Science Panel, was widely acknowledged as an innovation (Interview #3, Interview #1). Key outcomes of CCLRMP 2001 interim agreement are summarized in Table 4.

Many of the ideas developed in the JSP were critical to the arrival at consensus at the CCLRMP because they engaged the issues of the two lead antagonists. However, these negotiations operated completely outside of the CCLRMP. So separate were these bilateral negotiations from the CCLRMP process that the JSP proposed solution was announced while the CCLRMP table was in session (Interview #1). Despite not having a seat at the CCLRMP table or including other sectors, this JSP proposal contributed most of the key elements of the 2001 interim consensus solution: CIT, EBM, and the 2001 interim land use planning map. The JSP proposal solution reflected compromise on the part of both the CFCI timber companies and the RSP environmental coalition. Other members of the CCLRMP table recognized that getting the two leading antagonistic stakeholder interests to arrive at a solution was notable, and the table adopted, by consensus, most of the JSP recommendations as part of the 2001 interim solution. Where previously disagreements between conservation and timber interests had stalled the CCLRMP, the two coalitions were able to work through substantive issues in JSP without dragging the entire table into polarized discussions.

While important to the arrival at the 2001 interim decisions, the way decisions are made is paramount to an effective collaborative planning process. Critics note that real democratic decision making was not achieved since many of the key outcomes of the central coast were developed in backroom negotiations outside the participatory structure of the LRMP. Many table members had been unaware that outside negotiations had been going on, and were disappointed and cynical of the fact that the foundation for the agreement the table would adopt was essentially generated in closed door negotiations (Interview #1). Unfortunately, the agreement that served as the basis for Phase II, was also responsible for many First Nations leaving because they felt that their views and interests had been excluded in this forum.

The CCLRMP was the only LRMP provincially to arrive an *interim* agreement that stated areas of consensus and clearly identified areas left unresolved. Perhaps the reason for the 2001 interim agreement lay in recognition that major political change was imminent given the likelihood of a Liberal government sweep of provincial elections in 2001. This resulted in the change of government from a more conservation friendly NDP government to the Liberal government, whose central mandate was B.C. is open for business. The creation of two phases of planning has been praised (Interview # 5) for the way it achieved a statement of progress. It has also been criticized (Interview # 9) for the way it resulted in a lack of continuity.

Initially, the provincial government and certain First Nations responded with indignation to the 2001 interim agreement of the CCLRMP. Indeed, the impact of the proposal was notable. The candidate protection areas included 41,200 ha of Timber Harvesting Landbase (THLB) (209,000 m^3 of AAC) and within the Option Areas 52,300 ha of THLB (241,000 m^3 of AAC) (CCLRMP 2003)[xxiii]. The impact of these new protected areas was expected to be a loss of 250-300 provincial forestry jobs (MoSRM 2001b). Yet the timber company coalition insisted that the province recognize the importance of the global markets upon which the market campaigns were operating and accept the CCLRMP table recommendations (Clapp 2004). Also, part of the interim agreement included attempts to mitigate this impact to the communities via the Coast Sustainability Strategy. Ultimately, the new Liberal government endorsed the intent of the Phase I agreements later in 2001 and committed to resolve un-addressed issues from Phase I such as final land-use designations in a second phase of the CCLRMP.

Table 4: Outcomes of Phase I CCLRMP

- Commitment to establishing the CIT and developing EBM.
- Expansion of the protected area network: 9.5% of the region as additional protected areas[xxiv], doubling the protected land base to nearly 21% and included the protection of 20 intact watersheds.
- 0.4% of the region was recommended as Goal II areas.
- 14% of the region was recommended for Special Management Zones[xxv], which were established to protect visual quality. These would develop into the Visual Quality Areas in Phase II.
- 11.7% (68 watersheds) were identified as Option Areas[xxvi], where logging was deferred.
- 1.4% of the region set aside for First Nation lead areas[xxvii] (As of 2005, their status is unknown. Many First Nations were interested in discussing larger title issues and not approaching these issues on a watershed-by-watershed basis. Likely these areas will be part of a package of First Nation Lead Areas.)
- Mechanisms to deal with unresolved issues with First Nations in government-to-government negotiations following Phase II.
- Creation of the Coast Sustainability Strategy, a $35 million transitional fund[xxviii] to mitigate job loss and promote the economic diversification of the coastal areas, with a particular emphasis on First Nations.

3.2.3 First Nations and unresolved land claims

"Unresolved claims of the province's First Nations to the exercise of traditional communal rights over Crown lands" constitute a second war in the woods in B.C.'s coastal forests, looming behind all provincial land use decisions and resource extractive policy (Jackson and Curry 2004 p. 38). Though LRMPs explicitly state that they do not infringe upon title[xxix], land use planning is often seen as de facto treaty negotiations and has been the subject of much controversy. While all proposed protected areas will allow for traditional aboriginal activity, they will limit the opportunities of First Nations to manage their traditional land for many forms of economic development. As a result of unresolved land claims, the issue of aboriginal title informed much of the decision making in the central coast. The issues of unresolved aboriginal rights and title remains "one of the most significant policy dynamics currently affecting forest management in B.C." (Clogg, Hoberg et al. 2004 p. 52). Many coastal First Nations[xxx] are pursuing land claims treaties in the B.C. Treaty Commission process (1992). Recent court decisions affirm the legal concept of aboriginal rights and Crown obligation to consult with First Nations; future treaty settlements will likely include greater access to and control over land and resources (see Table 5).

Table 5: Landmark cases regarding aboriginal title

- Nisga'a Treaty - (1996) The first modern day treaty, resulting in transfer of Crown land to a FN.
- Delgamuukw – (1997) Confirmed that aboriginal title and rights exist in B.C., established that governments have a fiduciary duty to consult, and that the government has an obligation to compensate for infringement of rights. However, FN rights had to be proven in court prior to making accommodations.
- Haida 1 - (2001) Confirmed that FN rights exist and expanded the government's duty to consult and accommodate First Nation's interests.
- Haida 2 - (2002) - Ruled that not only do governments need to consult, but that third parties also need to consult according to the nature of the proposal and the strength of aboriginal claim.
- Taku - (2000 & 2002) Court ruled that 'substantive accommodation' be required where 'significant' infringement can be proven.

Unlike much of the province, First Nations represent over half of the planning region's population. Like many other LRMPs in the province, initially the CCLRMP had poor First Nation involvement and great uncertainty remained surrounding how the provincial government would proceed with First Nation land title issues. In fact, this uncertainty remained quite unsettling to First Nations given the Province's poor legacy of engaging in these issues (Harris 2002). Despite formal statements that LRMPs do not undermine or address land title, many First Nation leaders emphasise that LRMPs implicitly discuss issues related to land tenure rights and access to land. The largest First Nation in the central coast, the Heiltsuk, abandoned the CCLRMP process in Phase I, but returned to the planning process in Phase II. The Heiltsuk Tribal Council stated on their website in regards to Phase I of the CCLRMP:

> The process is not what the Heiltsuk Tribal council wants. When we objected to this process we were told it would happen with or without our participation. The Council decided to participate in this process to safeguard Heiltsuk interests in Heiltsuk lands. We feel that we are in this process under duress (we have been forced to participate to look after our land). The LCRMP process is proceeding as if there were no Land Question in British Columbia (Heiltsuk Tribal Council 2001).

First Nations concerns, such as expressed above, were in part addressed in a series of protocol agreements (e.g. the Turning Point Solution[xxxi] and those signed with KDC/MTTC/TM) achieved at the end of Phase I. This resulted in First Nations participating at the CCLRMP as governments (not merely stakeholders), taking leading roles in the development of a solution, and ensuring that specific interests would be met in a parallel process.

The provincial approach towards First Nation land use claims is complex and beyond the scope of this thesis. However, it appears that it was motivated by changing social values, a series of landmark cases, attempts to gain global legitimacy, and recognition that in order for the CCLRMP solution to effectively reduce conflict or achieve land use certainty, aboriginal interests needed to be addressed. Interestingly, First Nations in other LRMPs along the coast would secure even larger roles: in the North Coast First Nations co-chaired the LRMP and at the Haida Gwaii LRMP the Haida have a formal government-to-government role at the table (O'Riordan 2005). As well, the Turning Point Agreement committed to reconciling aboriginal and crown title in the land use planning process. This and other protocols laid out the process by which central coast First Nations would enter into tripartite negotiations with the provincial and federal governments based on CCLRMP land use recommendations and resolve issues "either arising from, or not addressed by, those recommendations" (CCLRMP 2004 p 18). In sum, these protocol agreements ensured that the central coast's First Nations would have the opportunity to influence the final recommendations resulting from the Phase II of the CCLRMP.

3.3 Phase II of the Central Coast LRMP (2001-2003)

Phase II of the CCLRMP, initiated in 2001 under the Liberal government, provided both opportunities and new challenges to make peace in the woods. While Phase I resolved many issues regarding land use in the central coast, many issues remained unresolved including the status of Option Areas, the development of the CIT, and the definition of EBM (Hoberg and Paulsen 2004). The First Nations were divided within and among groups and certain First Nations chose to participate in Phase II of the CCLRMP process while others did not. For example, the Gitga'at, Kitasoo, Heiltsuk, Oweekeeno, KDC/MTTC/TN[xxxii] and Nuxalk regularly had representatives at Phase II of the CCLRMP meetings. Additionally, a sectoral model with a collaborative approach was established in order to have fewer people represented at the planning table. Despite being one the most contested forest regions in North America, the CCLRMP was able to reach consensus again in Phase II, resolving issues that had previously been too contentious. However, as in Phase I, the outline and details of the agreement were largely hashed out in negotiations behind closed doors with JSP and agreed upon in an 11th hour decision by the other members of CCLRMP planning table, who felt as though enough of their interests had been included in previous motions and in the proposal to sign off.

Table 6: Key outcomes of Phase II CCLRMP

- Commitment to EBM on 66.9% of the planning region.
- Expansion of the protected areas network to 33% of the land base. In addition to the 11.1% existing protected areas and 10.1% proposed areas from 2001, an additional 11.8% of the land base was proposed in what are termed Biodiversity areas (where mining is allowed by forestry is not).
- Identification of 2 grizzly bear management areas: Anuhati and Kitlope.
- Identification of visual quality areas within the EBM to guide visual management of key tourism areas.

In contrast to Phase I, Phase II of the CCLRMP was more streamlined in time and sector representation. In the two years given to complete the land use plan, the 17 stakeholders met 16 times as a group in addition to over 40 working groups (CCLRMP 2004). Refer to Appendix 1. A consensus agreement in principle was achieved in the last weeks of 2003 and formally signed early in 2004. This agreement built upon the 2001 interim agreements and expressed a balance between global, regional and local interests with regards to sustainability. General management directions were developed for 12 key topics[xxxiii], a final land use planning map was agreed upon, and a transitional EBM proposed. Key outcomes of the CCLRMP 2003 agreement are summarized in Table 6. After the completion of the CCLRMP, consistent with protocol agreements reached with First Nations in 2001, a series of government-to-government negotiations were completed in 2004-2005 with the region's First Nations. The outcomes of these negotiations are yet publicly available but anticipated areas of concern include "the recommended zoning map, the designation of certain protection areas and allowable uses within those areas, the implementation of EBM, and the management of First Nation culture and heritage resources" (CCLRMP 2004 p 18). In sum, all key areas of the stakeholder recommendations are subject to change and there is uncertainty as to what the final outcome look like.

3.3.1 Science and spatial information in the CCLRMP

Phase II continued to be influenced by adversarial science and competing visions of science and spatial information. The CIT emerged as a critical part of conflict transformation, providing technical guidance towards the development of a form of ecosystem management deemed essential to the balancing of social, ecological, and economic social values related to forest management and conservation. In the central coast adversarial science and processes of re-mapping have been apparent from early on in the CCLRMP due to disparate visions of how to characterize, document, and map the region. Adversarial science is situated within value conflicts over the appropriate management of forest resources, and shaped negotiations between timber companies and environmentalists. Manipulation of statistics, misleading cartographic representations, and premature reporting of scientific results characterized the most obvious examples of adversarial science. Perhaps more important, though, are the roles of scientific uncertainty, the social construction of science, and failure of political decision making to effectively bridge the science-policy gap. In Phase I of the land use planning process for the central coast (1997-2001), adversarial science and re-mapping informed the larger forest conflict and dominated the discussion (Hoberg 2002). Adversarial science remained important in Phase II of the CCLRMP, though it appears to have been not quite as debilitating as they had been in Phase I. Phase II (2001-2003) witnessed a shift in the dialogue from adversarial science out of the formal LRMP negotiating table and into working groups, bilateral negotiations between sector interests, and the Coast Information Team.

Conflict over science materialized in many ways and between many groups. There was conflict between scientists, as in disputes over the impacts of hunting on grizzly bear populations, or what regional level of conservation is needed to maintain biological diversity; there was also conflict between the scientists and the decision makers (Interview # 2). Conflict between scientists can paralyse a decision making process because decision makers struggle to determine which voice is more objective or methodologically robust. Conflict between scientists often occurred over questions of appropriate methodology, data gaps, poor models, or lack of ground truthing. Poor scientific methodology and lack of peer review or sufficient scrutiny exposed scientific direction to much criticism and encouraged decision-makers to question all scientific modelling exercises. How political decision-makers and scientists bridged the science-policy gap to legislate or implement recommendations is better understood as conflict between decision-makers and scientists. All kinds of conflict can be counter-productive in collaborative planning.

There was also tension between local knowledge and provincial (or expert) technicians, as evident in the following statement from one interviewee (Interview # 3):

> When provincial data technicians go into remote areas, the local take is different. One common mistake is to bring provincial data sets which don't demonstrate local needs. The central coast was bad for this, especially in Phase I. ... The government was always trying to bring an 'unbiased data set' but frequently there is mistrust. This (mistrust) is accentuated when the data that is viewed and presented at the provincial level appears irrelevant at the local level.

Adversarial science, bias, and inadequate local knowledge are among the issues the CIT addressed.

On a few occasions, solutions were achieved through technical means as exemplified by the tourism – forestry agreement on the development of Visual Quality zones. In this situation, opportunities for modelling different alternatives, enhancing communication, and collaboratively developing strategies were critical, particularly the "fly-through" 3-D modelling. This model represented generated images of the landscapes produced by different silvicultural strategies until a solution protecting the interests and values of both sectors was achieved. Without the modelling capability, the timber sector would never have been able to communicate their strategy with the tourism sector (Byng, Personal communication). Relationships and social capital built over the years of the land use planning process, and this particular negotiation was supported by a foundation of trust, collaboration, and communication. As one interviewee stated, "The best data and science can only support this foundation" (Interview # 5). Without social capital and commitment to consensus building, technological studies and models can serve to further entrench positions. However, with a strong foundation, technology can serve as a communication and problem-solving tool.

By the end of Phase II, there was increased recognition of social values and social choice in mediating scientific information. For example, Raincoast, a group actively seeking to improve scientific understanding of ecology in the region, recognizes the limitations of science, when what was being dealt with were social values:

> ...Tools such as micro satellite finger printing, stable isotopic analysis and GIS have revolutionalized conservation biology. They help us to understand how wolf families are related, give us insight into the diet of bears, and allow us to predict high-quality habitat for wildlife. As powerful as these tools may be, they are but one step in informing the decisions that would see a salmon stream protected or a rainforest left standing. In the end, it is people that make these decisions – people with entirely unique views on science, politics, economics and culture (Raincoast 2003 p. 1).

Science and information remained a focal point in the negotiations and were central to interest group positions. To develop a conservation strategy for this region, the environmental coalition still emphasised the development of a conservation strategy that was in essence "an ecological solution based on science" (Holmes and Larstone 2000 p. 1). Similarly, the timber coalition also pursued the notion of a science-based solution to sustainable forest operations. The government continued to justify its positions as being informed by the best available science. However, adversarial science was relegated to the CIT and working groups where scientists, managers, stakeholders, and other individuals could develop analyses to address critical information needs by the CCLRMP. In Phase II, the CIT and working groups provided opportunities for scientists and technicians to communicate, develop hypotheses and methods, and explain their outcomes. This took place within the collaborative LRMP model where values and interests, rather than scientific certainties, were recognized as the foundation for negotiation. In essence, this increased transparency regarding the normative commitments that influence the choice of method, analysis, and interpretation.

3.3.2 The quest for independence and the Coast Information Team

The CIT program was an ambitious undertaking of a size and complexity not previously attempted in B.C (Hadley 2004 p. 11).

Recall that the concept of the CIT arose as an early goal of the JSP and Phase I of the CCLRMP under the assumption that if one could establish a set of data that was agreed upon, antagonists would be able to move towards solutions [xxxiv](Interview # 1). A further stated goal of the CIT was independence and international credibility, testament to the internationalization of the conflict as well as the perceived partiality of science and information within central coast planning. The attainment of a single, shared, and authoritative data set speaks simultaneously to conflict resolution advocates, who seek to transform conflict by improving communication, as well as to scientists and technicians who argue that better data are needed in order to arrive at better decisions. "The intent was to create an independent body unconstrained by politics to provide advice and analysis (options and scenarios) to the planning processes, rather than make decisions" (Rumsey and Holmes, 2003). In pursuit of this, the CIT identified four "knowledge communities:" (Allen 2004 p.26) scientific, technical, traditional, and local.

Innovative aspects of the CIT were its tripartite funding structure, explicit statements of interest by participants, process of peer review, multi-disciplinary participation structure and management committee, and the diversity of spatial and technical information that it developed. Tripartite funding attempted to ensure that funding would not influence the prioritization of research or the practice of research by any one group. $3.3 million dollars funded the CIT with funding coming from the province (53%), the government of Canada (through Western Economic Diversification Canada) (6%), the RSP environmental NGOs (18%) and CFCI forest companies (18%) (Allen 2004).

Another way the CIT attempted to assure independence was in requesting all individuals to sign statements affirming that they would:

> a) contribute as independent individuals, unconstrained by the policies or positions of their employer, constituency, community, or interest group, and (b) disclose significant

influences (including values, assumptions, judgements, sources, and methodology) (Allen 2005 p 25).

However, Allen concludes that team members were "genuine in their commitment to (a) but erratic in their implementation of (b)" (ibid). In other words, people honestly tried and felt that they were participating as independent individuals but clear recognition and disclosure of how values, judgements, and sources influenced them as individuals was difficult, if not impossible. This is exemplified in the following:

> It was easier to recognize independence when participants liked the message. When they disliked the message, it was not difficult to find fault with the messenger (Allen 2004 p. 25).

There was sentiment that information was somehow open to scrutiny when it emerged from oppositional parties, and stakeholders continued to strive for ever more accurate, factual, and unbiased information without challenging the idea that all information is at least partially socially constructed.

CIT analyses and guides were also subject to a rigorous peer review which resulted in a higher level of quality and independence when compared to previous information presented to CCLRMP. (Compare Appendix 4 with Appendix 5). Nonetheless, problems remained. Though following guidelines[xxxv], the process of peer review nomination did not work well because this selection process resulted in unqualified or clearly situated reviewers being selected (Allen 2004). Also, many of the peer reviews were not completed prior to the 2003 CCLRMP completion deadline, nor were there clear guidelines for the incorporation of peer review recommendations that were complete. As a result, numerous CIT analyses were used prior to important changes, modifications, or validations, which only heightened the perception that CIT reports and conclusions were biased or incomplete. Some of the blame for this results from the institutional structure of the CCLRMP and the provincial government's insistence on a 2003 deadline. Many peer reviews were completed within 2 months of the time the CCLRMP had made their decision. One interviewee suggested that a month would have enabled many analyses to get to the point where they could have been viewed (Interview # 7). As a result, the CIT's effectiveness in informing land use decisions was reduced. What is particularly ironic is that as of June 2005, there appeared to be none of the earlier urgency with moving these issues forward towards legislation.

Another way the CIT attempted to ensure that no stakeholder group precluded, influenced, or censored information prior to its presentation at the planning table was the management team. The 5-member management team, made up of representatives of major interests, was critical in ensuring that "no one interest has an overbearing influence on the terms of reference or on signing off on final products" (Allen 2004 p. 25). In essence, for any of the CIT's six analyses to reach the CCLRMP table, the multi-disciplinary developers had to achieve consensus and the managerial team had to sign off on each. As a result, information emerging from the CIT was both collaboratively generated and legitimized. Presumably, no individual on the management team would sign off on an assessment unless they trusted that the scientists, experts, and technicians developing the information were qualified, had sound methodologies, and were sufficiently independent (or perhaps in some cases dependent to appropriate normative commitments). This was markedly different from the way that previous information reached the CCLRMP table, as shown in Chapter 5, in the different iterations of the protected area strategy.

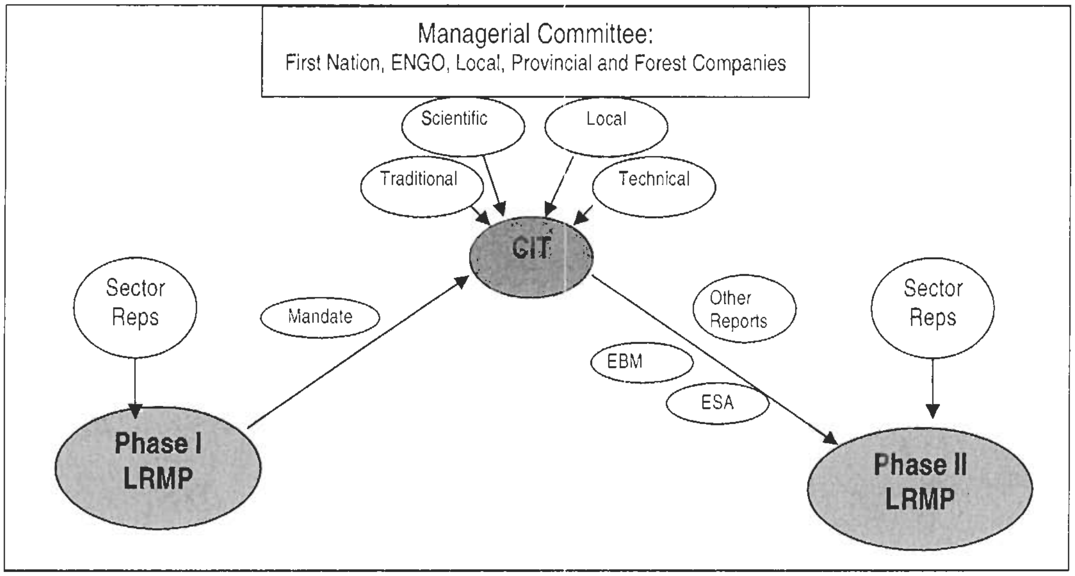


Figure 3: Relationship of the Coast Information Team to the CCLRMP

The CIT generated multi-disciplinary and diverse guides and analyses that would represent objectively the region's social, ecological, and economic values. For example, ecological data was intended to be purely ecological without any implicit adjustment to mitigate lost economic opportunity. The CIT produced four EBM guides and six regional and sub-regional analyses (See Appendix 5). The guides were designed to offer explicit policy recommendations and provide the theoretical foundation for their application. To resolve the protected area strategy, the CIT ecosystem spatial analysis (ESA) was intended to help characterize ecological values while other CIT analyses (e.g. the economic gains spatial analysis and the well-being assessment) were to develop and summarize socio-economic information. Many of CIT outputs attempted to bridge the gap between theory and application and to provide scientific information in ways that gave clear direction, while also emphasizing explicit statements of risk and uncertainty of outcomes as well as the theoretical assumptions underlying the conclusions.

In many ways, the CIT was successful in tackling issues of neutrality and value judgments in science, but several participants felt that it did not achieve this goal and it remained politically biased (Interview # 1). Despite the increased participatory mechanisms, innovative structure, access to information, and sophisticated analyses, there remained strong disagreements about the accuracy and completeness of the data emerging from the CIT. Local and traditional ecological knowledge, though intended to play large roles, remained difficult to develop, acquire, or integrate. Amidst much criticism of the data of the CIT, it still remains to be seen whether better data truly emerged, as much of the data has not yet been ground-truthed or verified. As one interview commented, In Phase II there was still "a lot of spin going on ... There was lots of ways to take information and twist it around to represent your interest" (Interview #2). For example, the ecosystem spatial analyses and economic gains spatial analysis while intended to provide clear direction to decision makers, were challenged by problems with delivery, methodology, and questions of objectivity. This limited their integration into decision making (Interview # 2, Interview # 3, Interview # 5). The peer review was designed to mitigate some of this, but many peer reviews only were completed after much of the initial information had been presented to the table and the table made their decision (Interview # 3). As a result of the pace of the scientific process and early problems with funding, the data did not significantly influence the decision, although they will affect the subsequent implementation (Interview # 3).

In many ways, Phase I can be characterized as conflict over information, which ultimately led to the creation of the CIT. In contrast, Phase II can be characterized as waiting for the science and information to arrive. Many of the CIT outputs were delayed due to late funding by the provincial government, the complexity of the analyses, and problems of limited capacity within the team. The CCLRMP attempted to wait for the key outputs of the CIT before making any of the substantive decisions (Interview # 5). In the end they were forced to make hasty decisions before completion of many critical analyses, prior to peer review, and before all stakeholders had the time to interpret what direction the analyses were indicating[xxxvi]. As a result, many of the final decisions were less about science and information than one might have anticipated, given the huge input of money, expertise and momentum into the CIT. For these reasons, while the CIT assisted the central coast planning process in getting beyond the adversarial science because former antagonists collaboratively generated science and information instead of using separately generated analyses to challenge policies or proposals, the direct impact of the science and spatial data on the final recommendations appear limited. Nonetheless, many of the recommendations of the CIT particularly related to EBM thresholds and implementation did influence the CCLRMP 2003 recommendations.

3.3.3 Commitments to ecosystem based management

EBM is an integrated set of principles, goals, objectives, and procedures that together seek to ensure the coexistence of healthy, fully functioning ecosystems and human communities (CCLRMP 2004 P3).

A second characteristic of war in the woods type conflicts is the development of ecosystem management that balances disparate interests. Similar to the concept of the CIT, EBM emerged as an early component of the compromise between the timber and conservation sectors, in Joint Solutions Project, and was a central concept emerging from the 2001 interim agreement at the conclusions of Phase I of the CCLRMP. EBM presents opportunities for "an ongoing process of design and redesign to achieve the twin goals of ecosystem and human well-being across an entire landscape or region" (CFCI 2004 p. 4). This is apparent in the guiding principles of EBM, as outlined in Table 7. As such, EBM represents a new planning model in B.C., with the only other previous similar model in B.C. being Clayoquot. EBM's objectives are to:

> Maintain ecological integrity, where ecological integrity is a quality or state of an ecosystem in which it is considered complete or unimpaired; including the natural diversity of species and biological communities, ecosystem processes and functions, and has the ability to absorb and recover from disturbance. Achieve high levels of human well-being, where human well-being is a condition in which all members of society are able to determine and meet their needs and have a large range of choices and opportunities to fulfil their potential (CCLRMP 2004 P3).

EBM was an essential component of the negotiations because it provided assurance that ecosystem function would be better maintained than in conventional forestry and conversely that social and economic well-being would be cultivated while promoting conservation.

Table 7: Guiding principles of Ecosystem Based Management (CCLRMP 2004)

- Aboriginal Rights and Title are recognized and accommodated
- Ecological Integrity is maintained
- Human well-being is promoted
- Cultures, communities and economies are sustained within the context of healthy ecosystems
- The precautionary principle is applied
- EBM is collaborative
- People have a fair share of the benefits from the ecosystems in which they live

A key goal of the CIT was to develop EBM guidelines, strategies, and scientific rationales. Translating complex social values and evolving ecological and silvicultural science into specific targets and thresholds was extremely difficult. As a result, the emerging operational framework and the scientific rational was extremely complex. Over 400 pages of text provide the supporting framework for this management strategy[xxxvii]. EBM is multi-scaled and sets goals and objectives for the sub regional/territory (500,000-5,000,000 ha), landscape (30,000,-100,000ha), watershed (1,000-50,000ha), and in a few cases, site levels (under 250 ha). Numerous First Nations articulated support for EBM and a few contributed to its development, including the Kitasoo / Xiaxais Pilot Project EBM operational trials, which were critical to estimating costs and feasibility of implementing EBM (Interview # 5)[xxxviii]. In the end, the CCLRMP was unable to make detailed commitments to EBM. However, at the last two meetings the CCLRMP formally agreed to the *intent* of EBM and was able to agree upon some critical thresholds for ecosystem representation and operational guidelines. As a sign of commitment in spite of no formal legislation and as first steps towards implementation, CFCI forest companies agreed to voluntarily implement seven key EBM elements for a 1-year transitional period, subject to government-to-government negotiations. These include commitments to conserve red-listed habitat, 15% retention of trees within cutblocks, conservation of high value fish habitat, and old seral stage ecosystem representation targets. As of June, 2005, there is great uncertainty as to how, or indeed if, EBM will be legislated and environmentalists claim that there "has been no substantial change on the ground" (Save the Great Bear 2005 p.2)[xxxix].

The targets developed for EBM are based on the notion of risk and a reliance on risk curves that translate the range of natural variability[xl] into benchmarks for developing operational guidelines. This explicit reliance on the notion of risk speaks to recognition that ecology is not an exact science, that many decisions related to resource management should operate under the precautionary principle, and that there are not necessarily *right* or *wrong* solutions but *higher* and *lower risk* choices to be made. Furthermore, the concept of risk is couched within a multiple scale analysis such that higher risk activities can still allow for ecological integrity as long as low risk is maintained at larger scales. As an example of this the old growth target at the landscape level is "50% of the natural proportion, *provided the average across all landscapes is 70%* (the sub regional target); and at the watershed level 30%, *provided the average across all watersheds is 50%* (the landscape level target) (Allen 2004 p. 11)(italics in original).

As evident in the example of targets for old growth forests, EBM as proposed by the CIT is complex and will require institutional and political innovation to implement (Clogg, Hoberg et al. 2004). Recognizing this, the CCLRMP explicitly recommended the continuation of both a science team and a decision making body to further develop EBM in an adaptive fashion. This proposed EBM council is envisioned to work with technical working groups and science teams to help develop guidelines and direct operational implementation of planning and silviculture. As such, EBM will likely undergo numerous changes as peer reviews get incorporated into the framework, adaptive management kicks in, and operational trials gain more site-specific implementation experience. As of 2004, the body's mandate and decision making authority was unclear (DSF 2004). The CCLRMP recommended that the EBM council be made up of representatives from both First Nations and government, establish the mechanisms to make EBM legally binding, and operate under adaptive management. Further, there is indication that this council will be informed by an independent science team (DSF 2004), in essence, an extension of the CIT.

There were major hurdles on the way to provincial legislation of EBM. Among these was completion of provincial and First Nation government deliberations. Implementation of EBM will be a lengthy process, requiring at least five years as various elements are introduced in a step-by-step fashion in order to reduce negative impacts (CFCI 2004). Implementation will allow for the adaptation of new practices and planning methods, collection of additional data, and establishment of mechanisms to oversee implementation.

3.3.4 Land use planning map

A key component of Phase II and a critical aspect of EBM was the final planning map, which details spatially explicit guidelines for conservation planning to "protect and sustain important, ecological, cultural, and social values" (Allen. 2004 p. 20). In pursuit of this, conservation planning identified protected areas; landscape, watershed, and site reserves; and site retention and management[xli]. Only the protected area (and biodiversity area) designations have been identified on the planning map, though these are subject to change as a result of government-to-government negotiations. Two other spatially defined management zones are grizzly bear management zones and visual quality zones. The former are linked to provincial grizzly bear management strategies and the latter resultant from bilateral negotiations between the timber and tourism sectors.

An early goal for the CCLRMP was identification of Goal I and Goal II parks, as part of the provincial protected area strategy. Goal I protected areas are large, relatively pristine watersheds selected to meet ecosystem representation goals[xlii]. Goal I areas appeal more to an international vision of conservation or a "concept of protection". (Refer to Appendix 7 and 8 for a more detailed summary of Goal I parks). At the culmination of Phase II a total of 33% of the central coast was protected under this category: 11.1% in existing parks, 10.1% from 2001 proposed parks, and 11.8% in 2003 biodiversity areas, where mining will be allowed. In contrast, Goal II protected areas, identified in Phase I, are smaller in scale and selected to capture special features[xliii], such as highly productive estuaries, culturally important sites, or boat moorages. Despite their small size, Goal II areas collectively make up approximately 27,000ha and are a vital component of the protected area strategy (See Apendix 8) because they capture many critical ecological and cultural areas. Goal II conservation areas also appear to reflect local community, cultural, and recreational interests, particularly those adjacent to settled areas such as Bella Coola, Bella Bella, or the Broughton Archipelago. Further analysis of the protected area strategy is presented in Chapter 4 and 5.

A second component of the land use planning map are grizzly bear management areas (GBMA). The social and ecological importance of grizzly bears ensured their centrality to land use negotiation in the central coast. Grizzly bears are a focal species in that they have critical habitat needs, an umbrella species due to their large home ranges, an indicator species due to their vulnerability to land use change and human impacts, and a keystone species due to their relationship with salmon (Noss 1996; Jeo, Sanjayan et al. 1999). Two GBMAs were identified in the central coast: one in the Anuhati Complex and the other in the Kimsquit region (Refer to map). The role that grizzly bears played in the central coast and the controversy surrounding their protection will be further explored in Chapter 5.

Visual management zones emerged as a third key component of the land use planning map emerging from Phase II. Clarifying the special management zones identified in Phase I, visual management zones were identified along important coastal travel corridors and around tourism sites. Special management zones were used in many LRMPs to designate areas where both non-timber values such as biodiversity or tourism could be protected while still allowing for timber extraction. However, "current management practices seldom meet these special management zones goals. Of most concern, timber extraction volume targets frequently override other land use objectives"' (Cooperman 1998 p . v). Nonetheless, these special management zones were "especially critical to bridging the differences between opposing viewpoints in sensitive areas. In many ways, these zones epitomize the spirit of innovation and cooperation which enabled land use processes to achieve consensus" (Cooperman 1998 p. 79).

The tourism sector worked with the timber sector in bilateral negotiations to ensure that a new planning category, one with more explicit objectives and silviculture guidelines was developed to meet the goals and interests of both timber and tourism. The tourism sector is concerned that visual quality would not be safeguarded by conventional forest practices, harming existing tourism operations and limiting the potential for growth in marine travel and the small "pocket" cruise ship industry. High priority regions for tourism were largely in Southern islands known as the Broughton group and the Northern cruise ship / ferry corridor[xliv] while the breadbasket of the timber industry was largely in the interior fjords of the south. A solution was achieved by focusing on areas of agreement, building on the philosophy that conflict could be addressed by finding compatible approaches to land use (CCLRMP Nov. 26-29, 2003). The solution entailed a three-zone categorization linked with spatially explicit zones as outlined in the following table.

Table 8: Visual Management Zones

• Wild: 2% of land base could be harvested in an effort to maintain the illusion of wilderness and the visual perception that unaltered landscape dominates. Cruise ship area. • Natural variability: 5% of the land base could be harvested in areas with slightly higher tolerance of visual alteration. • Landscape forestry zone: 8% maximum of the land base could be harvested (in cut blocks); for less visible areas, more forestry will be allowed.

While envisioned as being an integral component of EBM, the land use planning map was negotiated separately such that spatially explicit guidelines will be identified for each of the three land use designations if the CCLRMP plan is implemented. This is the most likely in the case of the protected areas strategy. GBMAs and visual quality zones will require additional planning to ensure the specific location of operational guidelines for silviculture operations in these zones. In this way, these more spatially explicit outcomes of the CCLRMP are likely to be those legislated even if EBM emerges in only a weakened form.

3.4 Interpreting Adversarial Science

Throughout the war in the woods in B.C. coastal forests, ENGOs have attempted to better control a "window of opportunity" by setting the forest policy agenda and formulating policy (Kingdom as cited in Hoberg, 2000, p. 5). Initially, ENGOs had refused to participate in the CCLRMP and rejected the process as a *talk and log* scenario, asserting that talks were occurring while environmental values were being compromised. They felt they could better achieve their goals via public market campaigns, such as the Great Bear Rainforest campaign[xlv] (McAllister and McAllister 1997). Bilateral negotiations between the timber companies and conservationists were critical to moving through conflict. A logging moratorium and commitments to the CIT and EBM ended the talk and log scenario, setting the stages for the collaborative partnerships that would result in the 2001 interim and 2003 final CCLRMP recommendations. The 2001 interim agreements clearly reflected how effectively the market campaigns had forced substantive change in the power balance in the province within a few years, ultimately motivating key timber companies to meet many of the ENGO's key interests in higher levels of protection, the development of ecosystem management, and an independent information team. In essence, the state sponsored land use planning process actualized re-mapping and power redistribution. EBM and CIT were important locations where the social values of these disparate groups could be reflected. In the CIT were opportunities for multiple knowledges to be developed, for engagement with social construction of science, and a location for building social capital. In EBM social values could be met with explicit silviculture guidelines.

Phase II built upon the clear guidelines from Phase I, a growing foundation of collaboration, and this reorganization of power between environmental and timber sectors. Via different avenues, First Nations in the central coast also gained increased power and recognition of their interests. A series of landmark decisions related to First Nation title and resource rights created a climate of uncertainty forcing the Province to engage more seriously with treaty negotiations. Though not as clearly, local communities have also exerted their influence over the Phase II outcomes, in commitments to the development of community forest operations, the exclusion of nearshore timber from a few biodiversity areas, and provisions to increase economic opportunities to local communities resulting from the recommendations. These will be analyzed in the following chapters.

4 INNOVATION IN THE CENTRAL COAST LRMP

Resource conflict and decision making inform and are informed by environmental planning and conflict resolution theory. Conflict resolution seeks to develop creative win/win solutions based upon articulation of shared values as a way to reconcile contradictory values and the competitive push to gain independent advantage (Kyem 2004). Formal conflict resolution strategies include interest-based negotiation, mechanisms for building social capital, and mediation to aid in communication. The central coast has for the past decade been one of the most contested forest regions in North America. Nonetheless, a consensus agreement on strategic land use planning recommendations was achieved through the British Columbian land use planning process. In an effort to understand the process of learning, innovation, and change in the CCLRMP, this chapter investigates Phase II in greater detail. Key outcomes of CCLRMP, such as the protected areas, GBMAs, visual management zones, and EBM, must be understood in the context of the planning process within which they were developed. Phase II of the CCLRMP process allowed evolution in the LRMP model and development of institutional structures, some of which can be characterized as innovative. This chapter argues that consensus emerged due to a unique combination of: 1) innovations in institutions, process, and science; 2) effectively balancing local with global and ecological with economic values; and 3) circumstantial factors.

The 2003 CCLRMP recommendations reflect compromise between local, regional, and global interests. For instance, the recommendation that nearly 33% of the planning region (1.5 million ha) should be off limits to logging, whereas only 21% (1 million ha) of this should also exclude mining, reflects the restricted footprint of mining while accommodating global conservation interests by achieving a higher proportion of conservation space. Additionally, careful selection of nearly all reserves to exclude high value timber land mitigated the loss of timber revenues, of great importance to local and provincial resource interests. The provision that EBM would guide future resource development and conservation in the operating land base reflects local and regional interests in achieving ecological, social, and economic sustainability. The recommendation for establishing visual management areas along critical tourism corridors reflects a compromise between the current economic driver of the region (timber extraction) and the potential new economic driver (tourism), both important provincial interests. Provincial re-allocation of the Annual Allowable Cut (AAC) enabled recommendations, normally outside the scope of provincial land use planning to be addressed, such as the Bella Coola Community Forest, First Nation Lead Areas, and aboriginal title. These outcomes will mean "significant changes for the companies who hold tenures in the central coast area" and are consistent with mandates for community well-being and ecological sustainability (CFCI 2004).

Within the central coast there have been formal processes of re-mapping and a focussed effort towards achieving sustainability. There remain many critics of the outcomes, the CCLRMP process, and especially of the independent information team developed for the coastal LRMPs, the Coast Information Team (CIT). These voices originate from the resource extractive industry, more radical conservation groups, and from locally based scientists. The publications from a coalition of the region's forest companies are among those most supportive of the outcomes while some of the environmental literature is the most critical. For example, the timber coalition calls the CCLRMP "arguably the most significant conservation initiative in the coastal temperate rainforest" (CFCI 2005 p. 1). Criticism includes claims that the recommendations do not protect valuable habitat or not enough of it, that they will further weaken single industry resource towns, or that they represent a decision by non-local interests (ENGOs and timber companies). Perhaps this is evidence of adequate compromise. However, continued conflict can also reflect the failure of the process to be truly representative of stakeholder interests or to have developed improved science. Ultimately, whether the CCLRMP recommendations will reduce conflict and result in sustainable land use hinges on how effectively disparate interests were satisfied in the consensus recommendations and how effective implementation is. Some compromise is inevitable; indeed if some parties were claiming definitive victory then certainly the agreement would not have reflected all interests.

An improved process for provincial and First Nation government negotiations was a key innovation. The provincial government accepted the CCLRMP recommendations in early 2004 and began government-to-government negotiations with First Nations. These negotiations occurred behind closed doors, and must be the subject of future research. Ultimately, however, failures to resolve issues regarding aboriginal title and resource tenure may slow, alter, or prevent implementation of the CCLRMP recommendations. Negotiations between the province and First Nations may serve to alter completely the table recommendations, particularly the land use zoning map (CCLRMP Dec. 8-9, 2003, personal communication). Furthermore, citizens, ENGOs, and academics have voiced doubts about the provincial government's and stakeholders' ability, capacity and commitment to implement these recommendations. The success of CCLRMP recommendations in reducing conflict and achieving a sustainable solution can therefore only be assessed with time and further research.

4.1 Achieving 2003 Consensus Recommendations

This section examines the combination of circumstances and local contingencies that facilitated the achievement of consensus. Three general categories have been identified to analyse how disparate interests that had been engaged in a high conflict situation were able to arrive at consensus. These categories include circumstantial elements, innovative elements, and what is termed an effective balance of ecological and socio-economic values. Circumstantial factors must be viewed as part of continuing advances in environmental modelling and processes of learning in provincial land use planning. The second category identified innovative elements that were exceptional, unprecedented, or experimental in nature. The final set of elements captures those deemed critical in helping to achieve a vital balance of ecological and socio-economic values.

4.1.1 The circumstances

As detailed in the following table, a series of influential circumstances collectively influenced the consensus recommendations of Phase II of the CCLRMP.

Table 9: Influential circumstances

Procedural Changes
• Completion of Phase I and initiation of Phase II under new Liberal government
• Adoption of sectoral model with fewer representatives
• Independent facilitator
Building off high levels of commitment in Phase I
• Achieving an interim solution that resolved many issues
• Developing a clear mandate for Phase II, including finalizing the planning map and developing EBM
• Maintaining high levels of commitment from all parties and strong social capital
• Exerting great pressure to achieve consensus solutions
Advances in Science and Technology
• Improvements in technology, data availability and environmental modeling
• Development of applied and theoretical tools for resource management

4.1.1.1 Procedural changes

Upon gaining power in 2001, the Liberal government made a series of procedural changes to the provincial planning model. The government's view on the process was that previous LRMPs were too long, too expensive, and did not allow for a large enough role for the private sector, reflecting central values of a fiscally conservative agenda. Initially the Liberal government considered scrapping multi-stakeholder planning because it was costly and time-consuming (Interview # 1). Indeed, consensus achieved through the CCLRMP required three years of information gathering, seven years of formal planning, and millions of dollars (CCLRMP Nov. 26-28, 2003). However, it appears that this time and money may have been essential investments in achieving a reduction in conflict. Consistent with this, an independent consultant hired by the province to assess the failures of the LRMP process later convinced the government to continue the process. After speaking to the participants from various LRMPs, the consultant concluded that the process was useful at achieving certainty and reducing conflict (Interview # 1). Instead of scrapping the LRMP model, the Liberal government reluctantly maintained commitment to it while changing many aspects of it. Sweeping changes promised to provide greater government leadership and improved certainty for resource communities (MoSRM 2001a) by providing quicker and more flexible processes that would incorporate more meaningful involvement with First Nations and the private sector. The Liberal government defined the changes to the LRMPs as helping to ensure economic prosperity, environmental quality, and social equity utilizing science-based environmental and resource management (MoSRM 2001a).

Changes to the LRMP model produced both successes and failures. As an example, changes such as firm deadlines and a streamlined collaborative process were both sources of frustration for many stakeholders excluded from the CCLRMP and a major reason why some LRMPs initiated under the Liberal government failed to achieve consensus. In contrast, this streamlined sector model where fewer representatives participated was also frequently cited by participants as one reason why consensus was achieved because having fewer stakeholders at the table led to easier negotiations (Interview # 3). It is clear why sectors participating in Phase II would have this perspective; it is less clear how those who no longer participated regarded this change. In Phase I, the CCLRMP utilized three forums; one listed 46 active members and consultants (Dorcy 1997). As one interviewee stated, having "too many representatives, while more democratic, simply did not work; everyone was obligated to put their own spin on whatever issue is being discussed" (Interview # 2). The previous '"come one come all model" of Phase I resulted in days of negotiations with few results (Interview #2, Interview #4). A streamlined model resulted in a negative impact on participation, however, in that the people with the resources were the ones who were left (Interview # 4). For example, the timber companies and internationally funded ENGOs remained, as did community leaders and First Nation representatives, though with varying levels of financial support.

Another procedural change in the CCLRMP was in the level of facilitation. In Phase I the provincial government representative fulfilled a dual role: facilitator and conveying the provincial position on motions and votes. In Phase II, the mayor of Campbell River, Jim Lornie, was the independent facilitator for the table negotiations. This approach to facilitation allowed for Wally Eamer to represent the provincial government representation at the table without compromising the facilitator's independence. This simultaneously clarified the provincial position while allowing for greater transparency in facilitation (Interview #3, Interview #4). Phase I illustrated how it is impossible for the chair to appear independent on decisions when the provincial representative had a clear position in one out of every ten motions (Interview # 1). While many commended the role played by Jim Lornie, one observer accused him of not effectively facilitating when situations grew antagonistic or stalled. Further, he was accused of having a political bias because he was the mayor of a timber dependent town on Vancouver Island (personal communication). As these comments suggest, even though many critics commended the facilitation process as legitimate, independence remained an elusive standard.

4.1.1.2 Building on Phase I

Momentum from Phase I contributed to achieving consensus. Phase I contributed clear mandates, process flexibility, pressure to achieve a solution, and ultimately, a balance of commitment, heightened social capital, and need to resolve the conflict. As a result of solutions agreed upon in Phase I, Phase II had a clear mandate outlining those issues open for negotiation (Terms of Reference, 2001). As mentioned, the key tasks to be addressed in Phase II included determining the fate of unresolved option areas and developing EBM. Importantly, this mandate retained the flexibility essential to a participatory process, nowhere more apparent than in the development of EBM (Interview #2). As well, process flexibility enabled an 11th hour decision to re-open discussion to consider other watersheds for protection based on the CIT analyses and negotiations in the Joint Solutions Project. Via the conservation and major forestry sectors, the Joint Solutions Project proposed a land use planning map that included a number of watersheds outside the Option Areas. A departure from the Terms of Reference was allowed due to how critical these new areas were argued to be for the 2003 consensus recommendations (CCLRMP Dec. 8-9, 2003).

The relative costs of success and failure in achieving consensus were apparent. Beyond the stated goals of the CCLRMP, there was great pressure on all stakeholders to achieve a consensus set of recommendations to the provincial government and to the First Nations, particularly given the amount of time and investment devoted. Not only would consensus garner greater legitimacy, but if no consensus were achieved, then the Chair of the table would have decided the ultimate outcome in areas of disagreement (CCLRMP Nov. 26-29, 2003). Furthermore, it likely could have resulted in a re-instatement of the market campaigns, which pose high costs for all involved. As the end of 2003 deadline approached, critical information from the CIT was still forthcoming. Final recommendations were largely negotiated in the absence of final data and analyses from the CIT. As late as the penultimate meeting, a consensus agreement had not appeared due to continued disagreements between sectors positions, notably the conservation and major forest sectors.

As a result, the mood of the table early in the last CCLRMP meeting (CCLRMP Dec. 8-9, 2003) can only be described as tense. Joint Solutions Project meetings had been ongoing since the previous meeting. When the two groups forming the Joint Solutions Project talks jointly presented their solution, there appeared to be mixed sense of relief, optimism, and curiosity as well as distrust. In fact, as soon as the proposal was announced, a "caucus" was called to provide the opportunity for all sectors *minus* the conservation and timber sector to discuss the proposal. Just as in 2001, there was great pressure on CCLRMP representatives to accept this proposal. While other stakeholders appeared frustrated that much of the solution was once again emerging from closed-door negotiations, there was also a sense that if the most antagonistic stakeholders, who had been at each others' throats for nearly a decade, had come to a solution, then it was worth considering. Indeed, the table had tasked the conservation and major forest sector to seek collaboration and compromise. The other sectors had formed trust in their mutual commitment and a sense that both sides had made real compromise to arrive at this proposal. Ultimately, as well, the Dec. 31, 2003 deadline was looming and all sectors wanted to achieve a solution, ideally by consensus before Christmas. In the end, the Joint Solutions Project document was adopted with only a few changes in wording.

However, focussing on the final days of the LRMP meetings does not give adequate emphasis to the commitment that sectors and their representatives had built to the CCLRMP process, particularly from the conservation and major forestry sectors where people had built careers on this process (Interview #1). Most stakeholders in Phase II had been involved directly from the early scoping phase, while at least five of the ten sector representatives in Phase II are also listed on the official 1997 participant list (Dorcy 1997). Not only does this involvement exemplify commitment and experience, but also there were high levels of social capital developed. Social capital "consists of the networks, norms, relationships, values and informal sanctions that shape the quantity and co-operative quality of a society's social interactions ... and may contribute to a range of beneficial economic and social outcomes including ... more effective institutions of government" (Aldridge, Halpern et al. 2000 p. 5). Further, because social capital "lowers the transaction cost of working together, it facilitates cooperation" (Pretty 2003 p. 1913). Social capital served as a foundation for building trust in Phase II. Stakeholders appeared quite familiar with each other, coffee break conversations would migrate to family news, and a deep level of understanding and at times trust was apparent. This was a pleasant surprise to the researcher. Further, at the start of Phase II, stakeholders already had a foundation of social capital; they knew each other's personal motivations and official sector positions and interests from Phase I (Interview #2). A few participants doubted they could have achieved consensus in the 2 years mandated by the new LRMP model (Personal Communication).

Commitment to arriving at a solution also arose from a general consensus that the status quo could not be allowed to continue. Awareness of the global and provincial interests hinging on consensus in the central coast was palpable. Sector representatives reflected this sentiment in the following statements during a series of particularly tense discussions at the final CCLRMP meeting:

> ...if we do this right, we can embrace positive change across the province. This is good for the land, for economies, and the communities.
>
> ... once the conflict line has been crossed, you can never come back. ... the work that has been done around the province can stand to be derailed if this meeting does not resolve itself (CCLRMP Dec. 8-9, 2003).

What is notable in the above quotations is the sentiment that successes or failures of the CCLRMP would have not just local, but also province wide implications. Numerous participants were engaged with other LRMPs or were aware of how failure in the central coast could destabilize efforts elsewhere through market campaigns or lost trust.

The formal provincial position in the central coast and the Great Bear Rainforest has been and remains somewhat ambiguous. Simultaneous to concessions to the conservation sector, the provincial government pursued sweeping reforms in the forest industry such as the Working Forest Initiative and the closure of Forest Renewal B.C., which can largely be categorized as pro-business and anti-environment. As an example of concessions to the ENGO lobby, the province extended the CCLRMP process into Phase II, which in turn required the extension of formal moratoriums in the Option Areas. Also, the province reluctantly committed millions of dollars to the CIT, enabling the coastal LRMPs to continue with the momentum gained in the late 1990s. This commitment was contrary to approaches adopted elsewhere in the province where the Liberal government pursued the twelve-point policy plan to promote economic development in sustainable forestry (See Hoberg and Paulsen 2004 for an overview).

So illogical does this seem that columnist Terry O'Neil (2002) in "No one beats big green" argues:

> The B.C. Liberals have in their first year of power angered an impressive array of B.C. voters. ... There is however, one possible opponent the business-friendly Liberal have not taken on. Indeed, as evidenced by a late May announcement, it is clear the Gordon Cambell government has decided to pacify, not confront, powerful and deep-pocketed US foundations responsible for bankrolling efforts to see vast tracts of B.C. forests turned into parks.

O'Neil goes on to explain the government's position as directly linked to continued pressure to reform and invent a new way of managing forests in coastal B.C. so that international buyers would continue to buy B.C. wood and pulp. The Premier's position on the central and north coast regions is undoubtedly linked to a threat of a re-initiation of the market campaign. As one stakeholder stated, the government agreed to continue with the process with their "arm twisted behind their back in a mercy hold" (personal communication). In sum, a clear mandate building on Phase I, coupled with process flexibility, intense commitment, and continuous pressure directed towards the Liberal government to resolving the Great Bear Rainforest conflict were elements built into the path towards consensus.

4.1.1.3 Improvements in science and technology

Improvements in science and technology contributed in a few ways towards the consensus recommendations. Technological innovation clearly shaped land use decisions in the CCLRMP, particularly in the context of the CIT, with the development of EBM, and in deciding the land use map. Computer spatial modelling, decision support, and GIS facilitated numerous analyses. The rugged and remote character of the planning area help explain why modelling was a crucial component of planning decisions. The CCLRMP was a lengthy process: early scoping began more than a decade prior to the 2003 stakeholder recommendations to government. Environmental, habitat supply, and timber supply modelling had improved considerably in the interim (Interview #4). GIS technology had revolutionized the kinds of analysis that could be completed and conservation biologists supported a series of workshops in the late 1990s that focussed on developing clear decision support tools, applied science methodologies, and clearer empirical foundations for conservation biology (Possingham, Ball et al. 2000). Data developed in early scoping were repeatedly deemed incomplete, insufficient or out dated; disputes over these data contributed to the conflict. At the start of Phase II, with the initiation of the CIT, there was the opportunity to develop new and improved baseline data as well as more complex and fine-grained maps and assessments.

The major timber and conservation sectors both supported the development of improved information because both were actively advancing their positions via science and spatial modelling and there were better bio-physical data and modelling techniques available. Such as the afore mentioned 3-D modelling, which was used only in the latter stages of negotiations, influenced decisions between the tourism and forestry sectors regarding visual buffers along marine corridors. The models simulated travelling through a modelled landscape cut with a range of silvicultural strategies and enabled the tourism sector to confirm what level of alteration was acceptable to them in a way that would have been impossible with statistics, reports or verbal description of retention levels (D.Byng, personal communication). So successful was this 3-D modelling at enhancing communication about silviculture strategies that Western Forest Products is planning to create these models for all their holdings (ibid).

In Phase II better data and more sophisticated analyses were available, but the biggest challenge remained providing data in a manner that was understandable and accessible to the entire range of participants (Interview #4). This was less a problem for the conservation and industry interests who were more comfortable with the science or the technology. For others, who were less familiar with ecological spatial modelling, CIT outputs were as much an obstacle as a beneficial tool (Interview #4). Conservation biology, particularly the explicit examination of risk and uncertainty, required that all involved participants think critically about issues of population viability, regional connectivity, and disturbance regimes (Interview #3). These are not simple concepts.

Surprisingly, considering the emphasis placed on data, information, and analysis, Phase II did not make use of available decision-support tools, despite early intentions to use them with the CIT data. This may be because much of the CIT data did not arrive on time. So weak was the use of technology that at one meeting, there was a discussion about which watershed contained a critical low-elevation pass and there was no available map (digital or otherwise) to confirm its location. Therefore, despite positive impacts of improved science and information, Phase II must also be criticised for not using available technology effectively, particularly since millions of dollars were spent on the development of an information team. Many of these criticisms would have been addressed had there been more flexibility from the government in setting deadlines for completion of Phase II to allow completion and peer review of CIT analyses.

Table 10: Innovative factors

First Nation Protocols • First Nations representation at the CCLRMP as governments not as representatives of sectors. • Protocol Agreements with KDC and Turning Point First Nations. • Co-management of the CIT and a central role in EBM and in EBM pilot projects. • Influential First Nation land use plans.
Process support of collaborative relationships • Process flexibility to support outcomes of bilateral negotiations between different sectors. Most notable are negotiations between the major timber sector and the conservation sector. Out of these negotiations emerged the CIT and commitments to developing EBM. Key outcomes also emerged from the major forest and tourism sector, particularly in the management of visuals quality zones.
Conservation Financing • Commitments to conservation financing and investment in people, industries, and communities who would be affected by the CCLRMP recommendations.
Coast Information Team

4.1.2 Innovations

In addition to what I have characterised as circumstantial elements leading to resolution of the CCLRMP, there were also innovative experiments in environmental planning that greatly influenced the outcome. As explored previously, Phase I consensus agreement contributed to the development of both the CIT and EBM. First Nation protocols and an engagement of negotiations over aboriginal title was essential for achieving consensus agreement. Conservation financing, a proposal aimed to fund the protection of wilderness, may emerge as an innovative outcome which will help provide financial backing to local communities in the uncertain transition to a new economy. Finally, the formation of collaborative relationships is paramount. Many of the most critical solutions and compromises were achieved outside of the formal CCLRMP meetings. These occurred in working groups, lunchtime discussions, and in formal facilitated meetings such as the Joint Solutions Project. Conflict over science and information contributed to the larger conflict between the forestry and conservation sectors. The CIT as a forum where scientists, managers, and other actors could collaborate was a key component of moving through conflcit. Within the CIT there was the opportunity to develop an Ecosystem Based Management (EBM) where social, ecological and environmental values with regard to managing the operating land base could be negotiated. The innovation that the CIT represents will be further discussed in subsequent chapters.

4.1.2.1 First Nation participation and agreements

Following the 2001 interim solution, protocols were signed between the Province and the Turning Point and KDC/MTTC/TN First Nations[xlvi]. These protocols were designated to facilitate First Nation involvement with the provincial land use planning process, promote First Nation participation in the regional economy, and guarantee bilateral or provincial government to First Nation government discussions on land use planning (CCLRMP 2004). These protocols laid the foundation for improved relationships between First Nations and the provincial government. While addressing the CCLRMP at the last meeting, First

Nation leader Dallas Smith acknowledged the "exceptional distance that the group has come in regards to recognizing First Nation title and interests" (CCLRMP Nov. 26-29, 2003). First Nation land use plans were central to the CCLRMP table discussions regarding the planning map and First Nation interests were central to discussions and informed final decisions. As a result of improved relationships Phase II had relatively strong First Nation representation.

Protocol agreements such as the Turning Point Agreement institutionalised the critical role that First Nations held during Phase II of the CCLRMP: they participated at the planning table as governments and not stakeholders. In addition, the Turning Point agreement solidified participation on the CCLRMP technical process support teams, ensured a separate First Nation information gathering team, provided a framework for land use agreements with the provincial government, and had specific mechanisms for fostering economic development of First Nation communities[xlvii]. These agreements and outcomes were viewed as being highly effective to those engaged in the CCLRMP (Interview # 3). Protocol agreements assisted in government-to-government negotiations between the province and First Nations, increased collaboration between native and non-native communities, and better reflected First Nation interests and needs. Furthermore, First Nations co-managed the CIT managerial committee and took a leading role in the development of EBM, both with the collection of independent information to support EBM, as well as in piloting two EBM studies.

The input, experience, and leadership of the First Nation leaders and representatives at the planning table were important. Specifically, First Nation land use plans were very influential in both Phase I and Phase II of the CCLRMP. Most notably, the Kitasoo First Nation developed a Land Use Plan in Phase I that greatly influenced the allocation of protected spaces in their territory, including Princess Royal Island[xlviii]. The Heiltsuk, the most populous First Nation in the Central Coast, strategically engaged with land use planning in Phase II (Heiltsuk Tribal Council 2001; CCLRMP Nov. 26-28, 2003). First Nation land use plans and statements of interest, which were informal statements indicating land use when formal land use plans were not feasible, provided guidance to Phase II (CCLRMP Nov. 26-28, 2003; Interview #5). Finally, leadership from First Nation individuals appeared critical at moving the table through conflict and impasse. Essentially, protocol agreements and First Nations participation at the table not only allowed for meaningful First Nation involvement and influence; it facilitated the arrival of a consensus solution to government.

4.1.2.2 Conservation financing

Conservation financing, which was developed outside of the CCLRMP (Interview #9), was a controversial proposal based on the assumption that there is economic as well as environmental value to conservation and wilderness and that the global community is willing to support the development of these values with its funds. In essence, the carrot in a carrot and stick analogy is apt; "the threat of market campaigns was the stick and conservation financing the carrot" (Interview # 7), Conservation financing refers to financial grants offered by philanthropists, foundations, and conservation investors seeking to promote conservation of biodiversity in the central coast by providing incentives for linking conservation with opportunities for local communities on the land base, particularly First Nations[xlix] (Ramsey 2004). These commitments reflected a shift away from an approach of demanding conservation spaces be allocated and government, if anyone, foot the bill. IWA representative Darol Smith elaborates:

> The Coast Investment and Incentives Initiative (CIII) is a precedent-setting strategy where forest companies and provincial taxpayers avoid funding costly support packages in a no-win mitigating strategy of compensating workers for forestry job losses. Under the CIII model, the opposite is the case (CFCI 2004 p. 8).

During the market campaigns of the late 1990s and subsequent negotiations, First Nations and local non-native communities challenged the conservation sector to:

> ...put their money where their mouth was...They said, 'if it's true that you can create a new economy based on conservation, we challenge you to actually work with us to do that' (Ramsey, 2004, p.2).

Current estimates suggest close to $200 million will be available for capital for business ventures, assistance for First Nations implementation of their land use plans, and for building a conservation economy (Ramsey 2004)[l]. As an example, Ivan Thomspon of Forest Ethics presented a report on Socially Responsible Investment at the Oct. 28-30, 2003 meeting outlining two community investment instruments being developed to focus on conservation in B.C.: the Coast Community Loan Fund & the Community and Conservation Venture Fund. Together they are targeted to amount to $25.5 for investment in economically viable opportunities aimed at environmentally sustainable local jobs (CCLRMP Oct. 28-30, 2003). A presentation made by Merran Smith of Forest Ethics further outlined conservation financing to the CCLRMP. The conservation financing funds are to be made available, contingent on achieving 35% of the region in protected status and 24% as First Nation areas (CCLRMP Nov. 26-28, 2003).

The stipulation that 35% of the land base would need to be placed in protected status for the conservation financing to be committed was controversial, as numerous stakeholders were critical of the Coast Sustainability Trust and generally mistrusting of what they perceived to be outside buyouts (CCLRMP Nov. 26-28, 2003). Critics are concerned that it is a mechanism for outside interests to exert control over local outcomes. This was apparent in one CCLRMP meeting where Dalles Smith expressed concerns about where the process was heading due to back room deals from which First Nation issues are excluded (CCLRMP July 22-24, 2003). Lloyd Juhala, representative for small business forestry sector, also expressed concern over the lack of transparency over the intentions of the CII in the CCLRMP area (CCLRMP July 22-24, 2003). Much of this mistrust at the CCLRMP stemmed from fears that conservation financing would be an involuntary program or attempt to purchase lands. In a presentation to the CCLRMP, a conservation activist rejected these assertions, insisting that the process would be transparent and could help generate a strong conservation economy if people choose to participate. The effectiveness of conservation financing in mitigating negative impacts as well as critiques of it may shift power and control from locals warrant further research.

4.1.2.3 Process support for collaborative relationships

The formation of collaborative relationships though caucuses, working groups, and bilateral negotiations such as the Joint Solutions Project enabled former antagonists to engage in negotiations in a manner which facilitated collaboration, and allowed for constructive communication. Two key bilateral relationships that directly influenced the CCLRMP outcomes were talks between the timber and conservation sectors in the Joint Solutions Project and talks between the tourism and timber sectors. Kyem (2004) differentiates between-system from within-systems conflicts. Between-system conflicts can occur when the actors' identities, belief systems, and values are different. In contrast, common identity, shared values, and dense networks of social interaction can characterize within-system conflicts. Thus, one innovation achieved within the CCLRMP process was precisely the exclusionary bilateral talks in Joint Solutions Project and the tourism / forestry collaboration, each of which enabled actors to move from a between-system conflict towards recognition of shared values, common identities, and the strengthened social networks characteristic of within-system conflict (Kyem 2004).

The Joint Solutions Project provided a forum in which the major timber companies and the conservation sector ENGOs could engage more freely on critical issues. Environmentalists and the timber companies recognize science and scientific opinion as the dominant discourse because each group is actively engaged and heavily invested in the process of utilizing science to substantiate their assertions, identities, and visions (Satterfield 2002). Conflict emerges, however, when environmentalists employ science in its abstract, or theoretical mode, while timber advocates draw upon an applied, more empirically grounded, agricultural model of science (ibid). It is within these two perspectives of abstract and applied, where most contemporary resource management decisions must be resolved. While maintenance of late seral stage or achieving connectivity have empirical grounding, translating objectives into explicit guidelines and then implementing them remain challenging tasks.

The Joint Solutions Project engaged conservation biology within which issues related to forest management and conservation in the central coast could be discussed. Conservation biology is the discipline where such issues as landscape heterogeneity, disturbance regimes, fragility, and 'ir-recoverability' are debated. Once the timber and conservation sectors were able to initiate dialogue because the "talk and log" scenario had been halted, a discussion about science could be engaged and a mechanism, such as the CIT, for resolving critical issues initiated. Interestingly, conservation biology as the shared science enables an engagement with the human element within natural processes, drawing upon ethical, philosophical, as well as scientific guidance to investigation environmental management (Meffe and Carroll 1994). What resulted from the engagement were early commitments to EBM and to the CIT.

Similar to the collaborative relationships between the forestry sector and the conservation sector in the Joint Solutions Project, negotiations that occurred outside the formal CCLRMP planning table between forestry and tourism sectors resulting in previously discussed visual quality areas, one of the most positive win-win outcomes of the central coast (CCLRMP Nov. 26-29, 2003). In addition to enabling otherwise disparate interests to conduct their own analyses, work together, and develop solutions, these collaborative partnerships will likely facilitate implementation and monitoring (Interview #3). As previously discussed, the 3-D visual modelling of visual management zones helped to achieve key solutions regarding visual quality for regions within the central coast.

4.1.3 Balancing ecological and socio-economic goals

This third set of elements promoting consensus comprises innovative strategies to balance ecological and economic goals. While collaborative planning theoretically strives for "win-win" solutions, resolving land use conflict frequently requires compromise and trade-offs. Within any process of re-mapping, there will be winners and losers. Indeed there was sentiment (though particular sources must be kept confidential) that First Nations would reduce the proportion of protected areas in subsequent government-to-government negotiations and secure provisions for enhanced economic opportunity. This sentiment enabled a few of the more critical stakeholders to sign on to what they believed was a 'conservation deal' (personal communication). These elements vary widely; I have selected three instances where the three legs of sustainability are balanced against each other. This section will investigate in turn processes for promoting community economic opportunities and development for First Nations and central coast communities more broadly, the debate over adopting EBM versus placing more of the land base in conservation areas, and finally, the decision to allow some economic activities (such as mining) within the 2003 proposed protected areas. Within each of these emerged critical discussions about the importance of balancing ecological with socio-economic goals. Furthermore, the central coast, perhaps more so than any other LRMP in B.C., was constantly mediating local, regional, and global values in a search for sustainability.

4.1.3.1 Ensuring economic opportunities

This research focused primarily on how ecological science and data are generated and used and the role played by this information in the CCLRMP negotiations and outcomes. There was equal, if not greater, attention focussed on the social and economic impacts of various decision options. For native and non-native communities, these socio-economic analyses were among the most important factors, as communities did not want to see boom-bust cycles repeated in their towns (Interview #3). The protected area strategy and EBM operating framework were always negotiated in the context of their economic impacts (CCLRMP Nov. 12-14, 2003). These were not always easy to forecast because economic models are invariably short-term, and susceptible to conflicting interpretations and lack of confidence (CCLRMP Nov. 12-14, 2003)[li]. To address uncertainty about the long-term local and regional impacts of the recommendations, key components of the CCLRMP table recommendations assured communities that their economic interests could be served. These include provisions for the Bella Coola Community Forest and the exclusion of high value timber harvesting land along shorelines from protected areas along the Dean Channel and Lake Oweekeno (CCLRMP Oct. 28-30, 2003). These exclusions kept easily accessible forest land outside of the parks so that tenure re-distribution could make them available for communities.

The First Nations are looking to both resource management and tourism as catalysts for economic development. Co-management agreements in Hakai Conservation Area between the Heiltsuk and the Province are but a few examples of the expanding role and opportunities for First Nations (CCLRMP Sept. 23-25, 2003). The 2001 proposed First Nation Lead Areas are perhaps an indication of the minimum amount of land to be turned over, in one form or another, to First Nations. First Nation land use plans assert the maximum influence they are seeking. While negotiations between the province and First Nation governments will help clarify this, forest companies and ENGOs each appear to be courting First Nations to influence the way resources will be managed. At least one forest company, Grizzly Holdings in Bella Coola, is owned and operated by an individual from the Nuxalk nation. Other First Nations are entering into relationships with forest companies in the area. The Gitga'at Forestry Agreement[lii] and Operational Forest Trials with the Kwakiutl District Council provided critical information for the implementation of EBM, as well as establishing collaborative partnerships between First Nations and forest companies. Many of the region's First Nations have clearly laid out their proposed direction towards management. As an example, the Heiltsuk plan focuses on sustainability, embracing economic and social as well as ecological pillars. This focus includes economic development based on resource use, in spite of what some Heiltsuk people perceive to be ENGO pressure to stop Heiltsuk people from developing their land (Brown 2003).

First Nation communities are themselves often divided on these issues, especially the degree to which resources should be exploited for rapid economic development or managed for long-term management or conservation. Nonetheless, there is some evidence that First Nation forest practices can be more sustainable (e.g. the Iisaak joint venture in Clayoquot). ENGO advocacy for First Nations is often motivated by the assumption is that First Nations should maintain a traditional relationship with their natural resources. Aboriginal societies developed over millennia and their cultures were implicitly sustainable (Suttles and Ames 1997); contemporary aboriginal people however, frequently develop by engaging with global economies and extracting resources. Nonetheless, First Nations have deeper and longer relationships with the land base than do industrial forest companies. Many of the ENGOs with clear interest in the region such as Ecotrust, the Raincoast Conservation Society, and ENGOs represented at the CCLRMP[liii], are working with First Nations to develop conservation economies. As an example, Ecotrust works with First Nations, including the Heiltsuk, as they develop their land use plans and has published a brochure specifically targeting sustainable resource extraction (Collier, Parfitt et al. 2002). Whether in regards to conservation, or sustainable resource extraction, First Nations have asserted, and other parties are learning to accommodate, political space for First Nations to develop their own vision and plans. As one First Nation leader stated, First Nations are "no longer going to bite at the first carrot dangling in front of them, they can handle the oppression a little bit longer, (but) ... they don't have the luxury of ignoring these carrots" (Dallas Smith at CCLRMP Nov. 24-26, 2003). There is pressure, capacity, and opportunity to develop sustainable practices in the central coast and First Nations will command a central role.

4.1.3.2 Reducing the impacts of protection on the THLB

With a few high profile exceptions (Koeye and Kitasoo each had over 8,000ha of THLB), high value timber was rarely placed in protection. (Refer to Appendix 8). In fact, the LRMP processes prioritised candidate areas by locating pristine watersheds that had low volumes of economically accessible timber in attempts to identify *win-win situations*. A problem with this approach is that often the most economically viable forests, which have already been logged, are also the most biologically productive. This critique is central to continued controversy over how effective the reserve design will be in conserving the region's biological diversity, explored further in the following chapter. Nonetheless, mitigating the impact of protected areas on potential timber harvests remained a central goal for most of the stakeholders in the CCLRMP.

One win-win solution can be found in the proposed protected area in the upper Klinaklini River, a valley whose timber stands are not currently operable due to transport costs, yet identified as having very high value ecological values. The upper Klinaklini protected area is unique in that, instead of conserving the entire watershed, boundaries were drawn placing all its potential harvestable timber in a protected area[liv]. That is, the park includes only low-elevation forest. While these forests were not economically operable in 2003, and thus fell outside currently operable timber, technological and economic development continually changes what is considered operable. The advantage of this dendrite shaped reserve for the conservation sectors is that fewer hectares of the total area allowed for protection are used. The alpine regions, it was argued, would be de facto wilderness because the high elevation areas of the Klinaklini would not be developed unless forest or mining roads[lv] were developed in the valley bottom.

Numerous other large pristine watersheds fall into this same category of being not *currently* viable for timber extraction: Hotsprings, SW King Island, Swallup-Dean Corridor, Nekite, and Tzeo are each over 20,000 ha but contain less than 1,500 ha of THLB). Appendix 7 & 8 contains detailed analysis of the percentage of land in protected areas that had economically viable timber. In contrast, the lower Klinaklini valley has long been recognized for having high ecological values (Dunsworth, personal communication (Jeo, Sanjayan et al. 1999; Kimmins 2004), but was never a high priority watershed for protection in the CCLRMP because of ongoing logging operations, high timber values, high levels of modification, and the ease of access to logging camps and transport down Knight Inlet.

Similarly, many biologists identified the lower Kimsquit as of higher conservation value than its more pristine upper reaches, yet the upper reaches were those proposed for protected areas. Local biologists considered the lower area to have extremely high wildlife value (Himmer, Personal communication and the CAD ranked the lower valley as an important riparian and salmon conservation area (Jeo, Sanjayan et al. 1999). The lower watershed has high timber values, an existing road network, forest tenures, and high levels of modification. As a result, this region was not identified as being a core intact area or core grizzly bear area and was not prioritised due to high levels of modification and strong timber interests. The strategy of prioritising the protection of watersheds with low THLB served the purpose of minimizing impacts upon the timber forest economy and contributed towards the effective balancing of ecological and economic goals.

4.1.3.3 Ecosystem based management vs. high levels of protection

There is great pressure on the conservation sector to promote a sustainable conservation economy in spite of declined resource extraction; EBM is the proposal whereby this can be achieved. Despite this departure from the conventional planning model, the complexity in formulation, and the difficulties with implementation, numerous sectors demanded that EBM be incorporated in the final agreement. The conservation sector views EBM as inextricably linked to the protected areas strategy, emphasizing the role that EBM will play in connectivity, riparian zones, salmon habitat, and large mammal population viability in the management of the operating landbase. The First Nations are a diverse group who presumably have negotiated EBM on a case-by-case basis in negotiations with the province held in 2005. A few First Nations, notably the Kitasoo and Gitga'at, were integral in the formation of EBM and many others have indicated support. Local communities see EBM as providing adequate conservation of ecosystem function while allowing for economic benefits to accrue from the land. The labour sector strongly recommended that there be no net job losses as a result of plan implementation. Darol Smith, labour sector representative and IWA member, states that this shift in thinking "has allowed conservation and other stakeholders to reach consensus on the principles which holds that people are as important as the environment" (CFCI 2004 p. 2).

EBM has great expectations to meet, as evident in these quotations:

> "if the quality of ecosystem improves and if community well-being and that of business which provide jobs and economic development for the coast region increases, then EBM has achieved its key objectives" (CFCI 2004 p. 4).

Mayor Gerry Furney of Port McNeil (CCLRMP south communities sector representative) re-iterated:

> (People who live on the coast) ... will accept EBM as long as they can assess and observe its benefits. If the effect of EBM is to further reduce jobs by making harvesting impractical or uneconomical, then a negative reaction is to be expected. (However,) if it provides positive, measurable results – for example, more jobs – and our resource industries are profitable, then people will be willing to work within it (CFCI 2004 p. 6)

These are tall orders. Under adaptive management, if EBM fails to sustain community well-being, then it appears likely that key thresholds and targets will be revisited, though this is not being discussed openly.

Until the last meeting, the percentage limits for protected areas was between 24%-33%, and leaning towards the minimum threshold. It appeared that the conservation sector would be unable to achieve both a high level of protection across the land base as well as a strong EBM framework. The trade-off between EBM and high levels of protection played out in the final meeting, informed by negotiations in Joint Solutions Project. At stake was whether the protection of more land would have fewer implications for the Annual Allowable Cut than more stringent regulations for EBM. In the end, 33% protection was adopted and EBM was weakened from proposals presented by the CIT. The decision to make new protected areas from outside the Option areas must be viewed as part of this discussion. Indeed, at the meeting, the timber sector suggested that they would accept a weaker EBM in exchange for a larger percentage of the region in protected status (CCLRMP Dec. 8-9, 2003).

A critical component of EBM as developed by the CIT proposal relates to the *ecosystem representation targets*, specifically the requirements to maintain 70% representation of old seral forests at the landscape level. Referred to as 70/50/30 Ecosystem Representation, this provision requires that 70% representation of old seral vegetation communities be maintained for all ecosections at the regional scale, 50% at the landscape level, and 30% at a watershed level. These targets stipulate that 70% of natural occurrence of old seral vegetation communities for any site series surrogate (an inferred category based upon analysis of available data) be maintained. These 70/50/30 targets emerged as one of the most contentious aspects of EBM because of the high costs to the timber industry of achieving these landscape representation goals. These costs were foreseen to be high because to meet the 70% retention targets for certain surrogates, across the central coast, an estimated 30% of timber would have to be reserved from the economically viable land base to meet regional representation targets, 4% more to meet landscape representation targets, and 1% to meet watershed representation targets (CCLRMP Dec. 8-9, 2003). Negotiations over the ecosystem representation component of EBM ran to the wire.

In the end, the conservation sector made a significant compromise in terms of landscape ecosystem representation by agreeing to a proposal presented by the major timber sector, but one which was considered necessary towards obtaining the entire package (Interview #10, Interview #6). The major timber sector developed a mechanism for 1-year transition period based on what they termed Variable Representation by Rarity (VR2) (CCLRMP Dec. 8-9, 2003). In contrast to the 30% anticipated impact to the operable timber land base, this approach was anticipated to have a 2% impact. For common ecosystems it was proposed that lower levels of representation could still ensure low risk thresholds of representation. VR2 is based on five categories[lvi] and stipulates that an ecosystem surrogate in the rare category would be at high risk if the 70% representation threshold were not met while very common ecosystems could absorb much higher levels of harvesting and did not need to be represented across the land base at such high levels. This would allow logging in a much higher proportion of the relatively common low-elevation ecosystems like coastal western hemlock forests.

A compromise solution, agreed upon in Joint Solutions Project negotiations and then approved by the CCLRMP, stipulated a 1-year transitional period where 30% representation was necessary for the most common ecosystem surrogates. The most stringent protection, 70% representation, was only necessary for those classified in the three (of five) least common categories. In other words, the compromise requires higher protection for scarce or rare types of forests (reserving approximately 35,000ha of the 44,500 ha within these categories), while allowing more lax standards for the more common forest types (reserving 1,056,700 of 1,797,700 ha within these categories). The latter constitute the majority of the forests that the timber companies operate on (CCLRMP O&S). This approach has been criticized, given that nearly 97% of the operating land base is categorized as low risk (Hoberg and Paulsen 2004) and this maintains the companies' access to most of their original THLB.

To reiterate, the overall impact of the VR2 approach was assessed at 2% of the THLB, in contrast to the 30% impacts associated with 70% landscape level ecosystem representation as presented by the EBM framework. Additionally, a requirement that all ecosections be maintained at least at 50% mid-seral was added. Beyond this 1-year transitional period there is uncertainty as to EBM in general, and the representation targets specifically. This will likely be decided, in part, in the management committee that was established by the 2003 LRMP recommendations to government. In sum, the increase in protected areas in the central coast was achieved in part because of last minute negotiations that weakened the EBM in order to reduce impacts on the region's timber base.

4.1.3.4 Economic opportunities within parks

The ENGO decision to accept some economic activity within the new proposed protection areas was critical to obtaining other sectors consent for an additional 11% protection in Phase II. It was recognized that the table wasn't going to allow more protection unless some economic activity was allowed, so the conservation sector was forced to allow some industrial activity in what are termed biodiversity zones

(Interview # 3; CCLRMP Oct. 28-30, 2003). This decision must be understood within the larger tension between goals of ecologic conservation and socio-economic well-being. The mining sectors argued that completion of studies of the socio-economic impacts of land use options were essential in order to reveal the true economic impacts of protection. This was a critical debate throughout both phases of the CCLRMP. The mining sector engaged their issues directly with the provincial government and appears to have secured a promise that no future protected areas would exclude mining. Thus, the 2003 CCLRMP recommendations to include some economic activities in the form of mineral exploration within proposed biodiversity areas can be viewed as political manoeuvring as well as a deliberate effort to appease local and regional interests for economic activity across the land base.

4.2 Re-mapping of the Central Coast

The central coast is simultaneously a local, a regional, and a global conflict. These values were recognized at the CCLRMP and the above examples were some of the many aspects of the 2003 CCLRMP recommendations that ensured that local interests would be secured within a globally influenced consensus. Certain sector representatives can be characterized as representing local interests (e.g. First Nations or the community representatives), others regional (e.g. tourism or labour), and others, while also reflecting local concerns, are global actors embedded in global markets and media (e.g. major timber and conservation). These values were mediated within the CCLRMP and can be understood within the constant tension between the pillars of sustainability: economic, ecologic, and social. Global interests, be they from the conservation community or the major timber companies, were most concerned with the map and the operating structure being developed in EBM.

Conservation financing is contingent on a high percentage of protected spaces. It was not linked tightly to a sustainable operating framework such as EBM. Even though the theory and science behind EBM suggests that forest harvesting under EBM guidelines would allow for some degree of ecosystem integrity in the managed zone, these concessions are not as easy to monitor as a clearly delineated park. Part of this results from the funding priorities of the conservation constituency, which prioritize the conservation of pristine nature over attempts to maintain ecological function in silviculture based on ecosystem management. In essence, parks are easier to understand as a conservation strategy than is EBM. In contrast, many local sector interests, who also frequently held conservation values, argued for EBM over a protected status. To be successful, EBM would have to rely on local knowledge and adaptive management, while parks can be clearly understood both from afar and on the local level. Furthermore, operational frameworks are far more vulnerable to social, economic, and political change. Perhaps then, the conservation sector's prioritization of the protected areas strategy will leave a more enduring legacy as long as the other pillars of sustainability can be achieved. This is not to suggest that the conservation sector is uninterested in the development of a more sustainable operating land base, rather that parks generate more philanthropic support than innovative silviculture strategies. Indeed, all conservation sector individuals reiterated endlessly the interconnectedness of both EBM and the expanded protected area network.

The Phase II consensus was achieved as a result of innovations, circumstantial factors, and balances or compromises between ecological and socio-economic values. Collectively, these factors transformed conflict into co-operations through collaborative engagement in a process of re-mapping. Phase I of the CCLRMP was informed by conflict over ideas and information. Phase II of the CCLRMP built upon procedural changes, the momentum of Phase I, and improvements in science and technology. Within collaborative experiments such as the First Nations participation as governments not stakeholders, the CIT and conservation financing emerged as new models for land use planning in high conflict situations. Specifically, First Nation protocols, the CIT, conservation financing, and bilateral relationships were critical in moving the CCLRMP towards consensus, though these were all pursued outside of the formal negotiating space of the CCLRMP. Ultimately, what emerged were ongoing attempts to balance ecological with socio-economic values, ones that required innovation and departure from the land use planning model of the province.

A conflict resolution expert would look at the science and spatial representation of the land base to understand how it became a mechanism for building social capital, creative solutions, greater understanding and higher levels of commitment to forging solutions. Waddock (1989) identifies 7 antecedents to collaboration: crisis, broker, mandate, common vision, existing networks, leadership and incentives. The central coast exhibits all of these. LRMPs were mandated for collaboration and had institutional structures designed to foster the development of the last 4. The Joint Solutions Project was initiated from the stagnation of Phase I and drew upon a broker to assist in developing the common vision and mandate fundamental to negotiating resolution. The Great Bear Rainforest campaigns represented the height of crisis for many involved. A broker was found in the formal LRMP negotiations, but more effectively, in the Joint Solutions Project talks for the participating antagonists. To the degree that conflict between timber and conservation sectors was resolved in the Joint Solutions Project, aspects of the larger conflict over land use in the LRMP were also resolved. Phase I of the LRMP gave Phase II a clear mandate as well as building upon common visions, existing networks, leaderships and incentives. Institutional structures established in the Joint Solutions Project and later the CIT provided the framework for a cooperative and then a collaborative relationship to develop between former antagonists. This was supported by, and fed into, the collaborative foundations of the provincial LRMP processes.

A critical question remains. Did the CCLRMP successfully resolve conflict? Most interviewees who were directly involved in the process seemed to agree that yes, the CCLRMP table was successful.

Many pointed to changes between Phase I and Phase II in the sector model, in process flexibility, and in the development of the CIT as contributing to the arrival at consensus (Interview #1, Interview # 5, Interview # 3). However, others were more critical (Interview # 9), cautioning it is still too early to tell as legislation on stakeholder recommendations are not forthcoming as of June 2005. Another contended that Phase II was not really a collaborative model (Interview # 10). Importantly as well, the CCLRMP did not have the authority or the mandate to address aboriginal title issues, which are crucial for re-mapping efforts in the central coast. As such, ongoing provincial and First Nation government negotiations might fundamentally alter the outcome of the formal land use plan[lvii], of EBM[lviii], or of the balance of redistributed power, and local and global interests. It is the map where the most controversy is likely to emerge, as there are competing visions between First Nations, which may be different than what the CCLRMP has proposed. Anticipated problems in implementation include the complexity of EBM, the ability of the government to address tenure issues with timber companies, and the effectiveness of conservation financing in mitigating the negative impacts and supporting a conservation economy. Fortunately, the plan outcome embraced tenets of adaptive management, prescriByng an iterative learning process.

Maps frequently play central roles in land use decisions and as a result are critiqued for being representations of power. The CCLRMP forced the revisiting of resource allocations, many of them spatial by nature and often informed by maps. By 1999, First Nations and ENGO were clearly influencing the planning model in the central coast of B.C. This included a situation where government and industry were no longer the sole suppliers of data and maps brought to the CCLRMP table (Interview # 7). The conservation sector needed credibility for their positions and the credibility was in the science (Interview # 9). In many ways this equalled the playing field. Re-mapping has been defined as the "contested re-definition, -zoning and –presentation of land use rights and values, including their ecosystem functions and intrinsic values, as well as their consumptive uses" (Clapp 2004 p. 6). As such, re-mapping was central to the high conflict situations in the region as sectors either attempted to strengthen their position (e.g. First Nations and the conservation sector) or affirm their position (e.g. the timber interest).

The conservation sector pursued re-mapping as a way to practice forest activism. Re-mapping occurs when economic models are in question, such as on the Pacific Coast of North America where regional development by resource extraction appears jeopardized by resource depletion and changing social values (Clapp 2004). The production of spatial models and maps of the central coast's ecological values, potential conservation networks, and pristine forests must be viewed as efforts to re-map the region, notably the Conservation Area Design (Jeo, Sanjayan et al. 1999). In effect, these maps highlighted a watershed's grizzly bear habitat value instead of focussing on forest tenure, or pristine valleys instead of potential mineral deposits. Conflict was heightened when conservation efforts at re-mapping presented these values differently than had the province or when high value regions on the conservation map coincided with high values on the timber harvesting map.

First Nations in the central coast also practiced re-mapping. Aboriginal people in North American and around the world are using maps to reverse actively the process of erasure (Warren 2003). Maps are used to claim and defend land, plan for sustainable economic development, protect natural resources, promote skills development in education, and transfer traditional knowledge about territory and resources (Gonzalez 2003). Within the central coast, many First Nations developed land use plans to achieve many of these goals. As one Heiltsuk leader observed, recent court decisions, an increasing awareness of First Nation rights, global attention on central coast, and joint nature proposals made it a critical time for the First Nations to create land use plans (Brown 2003). Dallas Smith, a First Nation leader at the CC LRMP, spoke eloquently about the importance of First Nations' control over the production and interpretations of their histories, stories, and maps (CCLRMP Dec. 8-9, 2003).

Ultimately, the CCLRMP will only be successful at reducing conflict to the degree that it is effective at including within re-mapping all interests engaged in the process. Spatial decisions such as the protected areas strategy, community forest areas, GBMAs, visual management zones, and First Nation Lead Areas are examples of formal re-mapping that directly met sector needs. The less spatially explicit outcomes of the CCLRMP such as EBM provided another forum for engaging many of the same interests and values within the re-mapped matrix. The 2003 consensus agreement suggests that re-mapping did indeed reconcile the interests of all key stakeholders. Yet, the process whereby spatial features are encoded and mapped remains an under investigated subject.

5 SCIENCE AND CONFLICT

Conflict over science and spatial information drove the larger conflict in the central coast, as demonstrated in Chapter 3. Science and information influenced the policy process at every stage: they helped set the agenda and structure the policy outcomes; they influenced the decisions, implementation and criteria for evaluation. When there is conflict over information, there will be conflict at every stage of the planning process. This was evident in the CCLRMP and explains the need for independent science review, both to transform the conflict and to produce science in which people have more confidence. Chapter 5 analyzes the evolution of two key policy issues throughout the course of decision making in the central coast: 1) provincial grizzly bear population estimates and location of grizzly bear management zones ,and 2) reserve area design in the central coast. These questions provide a context for examining the socio-natural construction of scientific information and the way adversarial science operates in resource conflicts.

Both protected area design and grizzly bear management rely heavily on GIS and spatial modeling, which in turn must grapple with risk thresholds, uncertainty, and poor data. In this context, it can be difficult to differentiate scientific from ethical arguments. Politicians, planners, and citizens involved in collaborative planning are challenged to make decisions about resources, nature and society based on insufficient and uncertain information about the consequences of various options. This chapter explores the sensitivity of spatial modeling exercises to poor data quality, decisions made at the data model level, problems with adequate field verification, and problems arising with the flow of information from scientists to decision-makers. To begin with, however, since both examples explored in this chapter are presented in part in the form of resource maps, this chapter begins by investigating resource mapping as used in the CCLRMP.

5.1 Resource Mapping

Certain sources of information, including baseline biophysical data and resource value maps, are critical to LRMP processes. The central coast's size (4.6 million ha), ruggedness, and inaccessibility made resource maps central to negotiations, so much so that people with less experience in cartography and in the region began cognitively to confuse the region with the maps (Interview #2). In land use planning, readily available data sources are used to develop resource value maps, which then serve as key negotiating tools (Day, Gunton et al. 2003). Using GIS or overlay exercises, complementary and conflicting values can then be identified spatially. For example, if there are 100 watersheds within a plan area and the majority of these have incompatible values (e.g. both high timber and ecological values) while a few appear to have complementary values (e.g. low timber and mining potential, coupled with high ecological and tourism values) then these watersheds will be prioritised for protection.

The effective use of value-based maps as a key element in land use negotiations requires making a few assumptions. These include: 1) societal values can be compared, 2) societal values can be isolated, encoded, and mapped; 3) intrinsic values can be derived from economic datasets; and 4) a stakeholder group can arrive at consensus over resource values. Achieving win-win solutions is challenging, particularly because it is difficult to compare respective values (e.g. high value timber versus high value conservation) or compromise solutions (Gunton and Day 2003). Watersheds with high ecological values are often those with important economic values (e.g. low elevation old growth valleys provide both good quality grizzly bear habitat and high timber values. Also, many of the economically unviable areas (high elevation or alpine regions) are already well represented in protected areas, and their ecological values, while important, pale in comparison with low elevation valleys (Jeo, Sanjayan et al. 1999). Therefore, if the decision set is limited to those that reflect compromise, then conservationists argue, the most ecologically important regions will not be conserved.

The second challenge to the use of resource mapping in land use planning lies in the process of encoding resource values into maps. This is evident even for a key economic value, the Timber Harvesting Land Base (THLB). THLB is derived from the Forest Inventory data based on criteria related to timber operability and economic viability, which are influenced by market trends, regulatory regimes, and technological change (Sorde, personal communication)[lix]. Ministry of Forest data were some of the most complete data in the CCLRMP. Forest inventory data were developed by air photo interpretation, ground truthed by foresters (Himmer, Personal communication), and audited (Sorde, personal communication). However, the 1999 THLB dataset for the central coast was still regarded as "rough" and "not really an accurate depiction of the THLB in the region" (Sorde, personal communication). The CIT improved upon the region's THLB data set by combining information from the region's Timber Supply Areas (TSA) and Timber Forest Licenses (TFL) lands, attempting to account for potential withdrawals (e.g. 20% is usually set aside for non-harvestable conditions such as wildlife habitat), and updating indicators of operability (e.g. increased use of helicopters). Nonetheless, key pockets of viable timber were not reflected in the data set (notably Class 3 cedar).

Representing intangible resource values proves even more difficult. Presenting the importance and worth that society assigns to forest resources is not an easy task given the shifting perceptions that many societies hold towards forests (Cassells 2001), particularly when values are in direct conflict. Intangible forest values are usually derived from existing or easily monitored biophysical spatial data. As a result, data on intrinsic values are often of poorer quality than those on economic resource values (Poiker 1994).

For example, data on THLB data are more accurate than the data representing culturally significant areas due to the subjective nature of the information, methodological challenges, and problems translating cultural information into a spatial database.

Regional data varied greatly: there were high-quality, adequately ground-truthed data; other data were derived solely from modelling or satellite imagery. Stefan Himmer, a Provincial biologist working in the central coast, suggested that quality of data is a serious issue (personal communication). A few examples illustrate this point. Aerial photos are frequently used to identify habitat quality, yet the scale and age of photos vary tremendously. Some of the photos are 1:10,000, which Himmer concludes is an appropriate scale, while others are 1:60,000. Similarly, ages of aerial photos range from 1950's to less than a decade ago. In order to get an accurate indication of which areas have been altered by human activity, datasets must be updated to reflect how logging activities and cutting patterns have altered certain regions. A related issue is the need to develop models that can project temporally dynamic seral stages in forests, and then to use these to model how habitat quality across a watershed will change as forests mature after logging (Dunsworth, personal communication). Mistrust of ecological and economic data only increased conflict. Many of the ecological maps (e.g. grizzly bear or mountain goat suitability) were developed using pre-existing spatial datasets, such as the bio-geoclimatic zones. While algorithms are substantiated by other field studies and the larger academic literature, rarely were these datasets adequately ground-truthed.

Thirdly, incompatible land-use visions have led to conflicts between and among conservation groups, First Nations, local communities, and resource extraction industries, among others. This is evident in situations where overlapping First Nation Land Use plans offered contradictory recommendations for the development of a watershed. For example, the Klekane Aaltanhash Option Area lies within the overlapping territories of the Haisla (who did not yet have a formal land use plan), the Giitga'at (who proposed protection), and the Kitasoo (who proposed operating). Also, the conservation coalition was frequently in disagreement over the prioritisation of regions, as reflected in critiques offered by ENGOs outside of the RSP coalition of the final land use map agreed upon by the RSP (e.g. Gilbert, Craighead et al. 2004).

Despite the limitations of resource maps in land use planning, they remain powerful tools for enhancing communication and representing spatial complexity. "Social values for which our ability to define and measure is the poorest are the very ones that appear to be of increasing importance on our society and around the globe" (FEMAT 1993 as cited in Clark, Brown et al. 1999 p. 308). For these reasons, they were central to decisions in both Phase I and II of the CCLRMP. One set of maps were developed in Phase I of the CCLRMP for economic and ecological values. Following the interim agreement, another set of maps was produced to show how the 2001 recommendations would meet the goals and objectives of the table. Among these maps were those relating to the grizzly bear habitat, which was used to develop provincial grizzly bear population estimates, and a series of analyses aimed towards developing a reserve network in the central coast. The grizzly bear habitat and proposed protected areas network maps illustrates how socially situated scientific decisions influence resource decision making.

5.2 Grizzly Bears and their Management in B.C.

Noss (1996 p. 950), perhaps the leading academic activist in conservation biology, suggests that "no group of organisms offers more challenges to conservation biology and conservation politics" than carnivores. Grizzly bears used to range over most of North America, but have been extirpated from much of their range. The national Committee on the Status of Endangered Wildlife in Canada lists grizzly bears as a "species of concern[lx]" (COSEWIC 2004) while the B.C. Conservation Data Centre places them on the "blue list" [lxi]. B.C. supports 25% of North American population and 50% of Canada's population (Banci 1991). Much of grizzly bear extirpation on the continent has resulted from widespread land alteration and hunting. In B.C. questions are focussed on hunting and also on the impact of logging on grizzly bear habitat. Recent provincial population estimates suggests that the grizzly bear population is 83% of what the entire provinces is capable of supporting and that 84% of the provinces grizzly bear population units support populations above 50% of what models suggest the habitat is capable of supporting (Austin 2004; Hamilton, Heard et al. 2004). Of the province's 11 grizzly bear population units, nine are classified as threatened, most of these in the more heavily populated regions and none of them in the central coast.

Provincial grizzly bear management is inextricably caught up in the campaign for the Great Bear Rainforest and the CCLRMP. Mapping of grizzly bear habitat provided essential information for provincial estimates of bear populations, determination of protected areas in the central coast, and the location of grizzly bear management areas (GBMA). Many different methods have been used to map grizzly bear habitat and then to estimate grizzly bear populations (Refer to Appendix 9). Successive iterations in both the habitat mapping and the model for estimating population numbers from mapped habitat have affected provincial policy decisions on the establishment of GBMAs, protected areas, provincial hunting levels, and even international regulation. Population estimates are controversial because these numbers are used to determine sustainable hunting levels, play a role in the prioritisation of watersheds for protection, and inform larger rationales for protection (Austin 2004). Management and conservation of bears depend on spatial modelling and expert opinion presented by scientists and managers; management actions could impact economic development.

Social perceptions further complicate the politics of grizzly bear hunting policy and forest conservation. Popular imagery presents bears in a myriad of forms. They are frequently presented as innately aggressive (Busch 2000) or as representative of pristine nature (Rossiter 2004).

> It is clear that bears have come to represent nature and wilderness - big wilderness - in the modern conservation movement and among conservation biologists as well, probably for the same complex reasons they play such key anthropological, religious, and literary roles (Simberloff 1999).

Contested methodologies for spatial modelling and problems linking human caused impacts to declines in carrying capacity interact with the social roles of bears. The negative impact of human activities on grizzly bear habitat has been well documented and includes: hunting, poaching (Primm 1996), land use alteration (MacHutchon, Himmer et al. 1993; Jeo, Sanjayan et al. 1999; Saxena and Gazey 1999), roads (MacLellan and Shackleton 1988), and acts of self-defence. Yet, how detrimental each of these impacts are remains contested.

Provincial grizzly bear management is further complicated by local, regional, and international perceptions and assessments of the sustainability of the harvest. B.C. announced a Grizzly Bear Conservation Strategy in June 1995 to maintain the genetic diversity and abundance of grizzly bears in B.C. The goals and objectives of the Grizzly Bear Conservation Strategy addressed loss and alienation of grizzly habitat, interactions with humans, and international concerns regarding the sustainability of grizzly bear hunting (Banci, Demarchi et al. 1995). As part of this strategy, an 11-member independent scientific review panel was convened provincially to evaluate implementation of B.C.'s Grizzly Bear Conservation Strategy and review strategies for grizzly bear management. Evaluation included a critical review of hunting management, habitat protection, and grizzly bear inventory and research. This first science panel provided the government with a "Three-Year Report Card" in 1998, which "contained sharp criticisms regarding the lack of implementation of the Grizzly Bear Conservation Strategy" (Peek 2002). Simultaneously, independent bear biologists published a critical review of B.C. bear management (Horejsi, Gilbert et al. 1998).

The first grizzly bear scientific review team was disbanded in 2000 after it was highly critical of the government's progress in implementing the conservation strategy for grizzly bears (Gilbert, Craighead et al. 2004). In 2001, under the New Democratic Party government, a three-year moratorium was placed on grizzly bear hunting in the province due to concern that the hunt was unsustainable, and a second 6 member independent scientific was convened to review grizzly bear management. The only constraint placed on this second grizzly bear science panel was that panellists could not be employed by government agencies in B.C. or financially linked to such agencies in an attempt to assure unbiased and independent analysis. Upon taking office in 2001, the Liberals reopened the hunt after only a season of the moratorium (Peek 2002). The provincial moratorium was lifted, in part, based on new population estimates (Austin and Hamilton 2002), but also motivated by the new Liberal government's agenda to promote economic development (Hoberg 2002). These science panels provided more transparency and documentation of uncertainty in B.C. population estimates and hunting strategy, and clarified the process and criteria for establishing GBMAs. In doing so, they legitimised the provincial grizzly bear management strategy, particularly in response to vocal opposition that the B.C. grizzly bear hunt was unsustainable.

5.2.1 Provincial management of grizzly bears

Hunting policies in B.C. have undergone much change in recent decades (Banci, Demarchi et al. 1995). Grizzly bears are still listed as a big game species under the provincial Wildlife Act, and all hunting is regulated through provincial guidelines for residents and non-residents (Banci, Demarchi et al. 1995). Austin, Heard, and Hamilton (2004) outline grizzly bear harvest management and determination of the annual allowable harvest in a provincial report. Peek (2003) provides a thorough summary of the provincial policy. The dominant hunting paradigm for decades has been maximum sustained yield, a utilitarian view of the management of vertebrate populations that presumes animals can be removed from populations at the same rate that populations are increasing. Principles of maximum sustained yield, in the context of hunting, are dominated by an understanding of nature that is stable in the absence of human alteration. Yet rarely do species follow the maximum sustained yield model because populations are not often as stable as the model suggests (Talbot 1997). Furthermore, deriving the maximum sustained yield necessitates a baseline population from which a percentage of the population is culled. The problem with any modelled estimate of grizzly bear populations is that they remain "estimates of an unknown true population" (Boulanger and McLellan 2001 p. 1).

There is great variability in estimated densities of grizzly bears in North America. Figures range from estimated 3.75-16 km^2 per grizzly bear in coastal regions of Alaska, and 18-44 km^2 per grizzly bear in the Columbia Mountains B.C., to upwards of 100 km^2 per grizzly bear in Southern B.C. interior mountains (Hating 1987 as cited in Fuhr and Demarchi 1990). Estimates in the central coast range from 22 km^2 per bear in the Kingcome – Wakeman Unit to 30 km^2 per bear in the Kwatna – Oweekeno and 90 km^2 per bear in the Kitlope – Fjordland Unit (Hamilton, Heard et al. 2004). The dominant methods for estimating grizzly bear populations in the absence of in-depth field studies is the Fuhr Demarchi / Stepdown, which uses habitat ranking to model carrying capacity, or the capability of the habitat to support populations of grizzly bears (Fuhr and Demarchi 1990). Capability mapping describes and prioritises types of habitat and important seasons of use. The Fuhr Demarchi method is "inherently subjective" because it relies upon "a thorough understanding of grizzly bear ecology and sensitivity to human impact as well as local knowledge of the area in question" (Austin and Hamilton 2002 p. 9). "The Fuhr DeMarchi estimates were not meant to drive allowable harvests, although, because of the lack of inventory data, they have been used for this purpose" (Banci, Demarchi et al. 1995 p. 54).

The Fuhr Demarchi / Stepdown method estimates the capability to support grizzly bear populations and then reduces these estimates to account for human impacts. Habitat units, characterized by factors such as vegetation, soils, aspect, moisture, and by terrain features such as floodplains and avalanche tracks, are ranked from nil to very high[lxii] and then combined with biogeoclimatic vegetation zones to produce detailed maps of habitat capability[lxiii]. Avalanche chutes, floodplains, and huckleberry fields are the most productive of forage. Current habitat potential is determined by assigning potential bear densities to habitat types scaled to benchmark densities derived from known research locations. The second part of the Fuhr Demarchi / Stepdown requires that habitat capability estimates be "stepped down" or reduced. At this stage, correlation between vegetation and population density must then be adjusted for factors that reduce carrying capacity such as land use alteration, disturbance, and human-related mortality (Fuhr and Demarchi 1990). Problematic questions remain regarding the degree to which food availability is a limiting factor in relation to other social factors such as concentration of feeding in specific areas high in energy or high protein (e.g. salmon streams) (Fuhr and Demarchi 1990).

Models can be verified by testing in an area that is well documented. Two examples are the Khutzeymateen Valley (MacHutchon, Himmer et al. 1993) and the Flathead Valley, where extensive habitat and telemetry research has been undertaken; provincial studies draw heavily from this research. As well, local and traditional ecological knowledge can be integrated into both data sets and interpretation. Confirmed sightings and hunting statistics are other important sources of information that can be introduced into the dataset or used to test the model, though they are difficult to integrate. Problems include the high degree of subjectivity inherent in this type of information as well as inconsistencies in methodology.

5.2.2 Grizzly bear management areas (GBMA)

Central to discussions on the sustainable management of grizzly bears is the creation of GBMAs where hunting is not allowed[lxiv] (Mattson, Herrero et al. 1996) and where populations would serve as source populations. Scientific debate remains over questions of size, location, and whether industrial resource activities can be allowed in these regions. The Grizzly Bear Conservation Strategy called for identification and establishment of what would later be referred to as GBMAs, to encompass benchmarks[lxv], core habitat[lxvi], and linkages[lxvii] crucial to maintaining viable populations.

Debate among government, industry, and environmental representatives over the creation of GBMAs has continued for years with no resolution (Davradou 2001). All actors agree on the need to sustain grizzly bear populations, but they disagree over how to realize this goal. Davradou (2001) applies a range of ethical theories to this controversial issue and concludes that they agree on the need for protection of habitat but disagree on whether the protection of the last surviving grizzly bears should outweigh the interests of cultural needs of humans. The divide centers on ideological differences but it is the science, and particularly the creation of habitat models and population estimates, that are politically open to scrutiny.

A key recommendation of the grizzly bear scientific panel was the establishment of one large "benchmark" grizzly bear management zone in each of the province's 6 ecoprovinces supporting grizzly bears (Peek 2002). It was argued that populations of grizzly bears require larger conservation areas than any individual proposed park within the planning region could provide. However, Gilbert (2004) doubts whether this approach would achieve goals of population stability, concluding that the two GBMAs identified in the central coast, the Khutze and the Ahnuhati, are considered "grossly undersized and likely too small to maintain grizzly bear populations" (Gilbert, Craighead et al. 2004 p. 10).

While hunting is to be excluded from these GBMAs, other extraction is allowed in the regions that are not also protected areas, and the total area of the land base closed to hunting is much lower than some biologists and conservationists advocate (Wielgus 2002; Gilbert, Craighead et al. 2004). An assessment conducted by a panel of independent scientists, two of whom were part of the first grizzly bear scientific advisory committee under the NDP government, criticise the location and size of the proposed GBMAs in the province and the central coast (Gilbert, Craighead et al. 2004). This report calls for 68-84% of the province's currently occupied grizzly bear habitat to be managed in either habitat security areas (a new concept) or GBMAs. Wielgus (2002) concluded that an effective system of six reserves would need to protect 5% of B.C. most densely populated watersheds to protect 11-15% of the province's population.

What is important with regard to the theoretical discussions of philosophy of science and environmental planning is scientific debate is conflated with social values about grizzly bear management and the role of hunting in society. Questioning of the scientific legitimacy of the policy in mid 90s led to the creation of a science panel, which was disbanded and subsequently recreated. The role of this panel was to advise decisions on grizzly bear management and to increase the transparency of decision making and scientific methodology.

5.2.3 Continued controversy

Great controversy remains over sustainability of the provincial grizzly bear hunt. In 2002, responding to claims by ENGOS that the hunt was unsustainable and while the second grizzly bear science panel was reviewing the grizzly bear management strategy, the European Union banned the import of grizzly bear trophies from B.C. to European Union member countries. At this time, Canadian grizzly bears were listed under Appendix II[lxviii] of Convention on International Trade in Endangered Species because their body parts resemble parts of Appendix I[lxix] bears from other countries (Austin 2004). Following the submission of additional information from the B.C. government, the European Union reversed its decision pending the results of this Panel's review (Peek 2002). In 2004 key B.C. Wildlife Federation biologists Demarchi, Halliday, and Munro concluded (2004 p. 3) that "hunting as it is currently practiced in B.C. does not threaten any grizzly bear population. It is our opinion that grizzly bear populations continue to thrive and are not endangered or threatened in any areas where hunting is allowed". The second science panel helped provide assurance to the international community that the management of grizzly bears in B.C. was sustainable.

Much of the continued controversy over the provincial hunting policy arises from lack of field verification and discrepancies between modelled estimates and local knowledge. Ground-truthing the entire province, or even the entire central coast, is an impossible goal. However, biologist Stephan Himmer regards the kind of analysis conducted in the Khutzeymateen (MacHutchon, Himmer et al. 1993) or on the southern coast as more accurate because the researchers treated each analysis of a watershed independently and helicopter ground truthed 10 –20% of the polygons. However, other verification methods are used.

In a regional effort to substantiate population estimates, the province has initiated a program of using the DNA / mark recapture in select areas and modifying population estimates to include more variables. The DNA / mark recapture is based on DNA analysis of grizzly bear hairs, repeatedly collected at specific baited locations in a sampling grid. Collected hairs are used to identify individual bears: the hairs are then analysed by statistical models to derive population estimates (Woods 1999). DNA / mark recapture techniques provide another method for estimating distribution and abundance of bears based on actual bear observations and not on habitat capability (Mowat and Strobeck 2000). As of 2004, DNA / mark recapture had been applied to 52,000km^2 to verify population estimates in portions of B.C. (Austin 2004). The DNA / mark recapture is more time consuming and resource intensive than the Fuhr Demarchi / Stepdown, so field models continue to supplement, rather than displace models (see Boulanger and McLellan 2001; Park 2001 for a complete comparison of the two methods and limitations associated with each).

Another source of controversy relates to the scale of the models. Regional staff are better able to able to integrate local knowledge of populations and stakeholder interests while headquarters staff may provide assurance that the best available science is incorporated (Austin and Hamilton 2002). The scale at which capability modelling is appropriate is far coarser than the scale of local knowledge, raising the question of regional accuracy in models. As an example, in the 1:50,000 Fuhr-Demarchi methodology, the smallest appropriate unit is 200 ha (Fuhr and Demarchi 1990). At smaller scales, more detailed field data are needed. For example, Ian McAllister, a scientist and activist living in the central coast criticises what he considers provincial grizzly population estimates that have been extrapolated from high population density areas (personal communication). McAllister further suggested that many regions of the central coast identified as high quality are largely devoid of ideal habitat and do not support high populations of bears.

It is well accepted that idealizations, simplifications, or analogies are frequently used to describe phenomena. This process requires that some aspects be highlighted while others be deliberately disregarded. Models must be understood therefore as partial descriptions that rely upon abstract ideas and concepts and mathematical formalisms in order to describe essential parts of the system being studied (Bailer-Jones 2002). To further illustrates uncertainty around grizzly bear habitat and population density estimates. Two often referred to examples will be explored that emphasise the importance of local knowledge, the necessity of field verification, and limitations of provincial grizzly bear modelling to estimate population. These are the Kwatna-Oweekeno and Kitilope GBPUs, both within the central coast.

In 1997 a Department of Fisheries and Oceans technician who had worked in the Lake Oweekeno area for decades contacted the Wildlife Branch to report dramatic declines in grizzly bear populations; hunting levels were reduced while an investigation ensued (Austin and Hamilton 2002). More recent estimates suggested that the current population size (113) was well below the 1990 estimate (285) (Austin and Hamilton 2002). The 1990 estimates had assumed that bears would migrate to the region due to the availability of salmon as a food source and population estimates were increased as a result (Austin and Hamilton 2002). Hunting levels remained high despite dramatic reduction of the region's carrying capacity resulting from collapsing salmon stocks until local experience challenged the model outcomes (Austin and Hamilton 2002). In another region of the central coast, an independent investigation (McCrory 1994) concluded that Fuhr Demarchi populations estimates for the Kitlope River valley were too high and had resulted in unsustainably high harvest levels (Austin and Hamilton 2002). It appears that the problem arose from mis-categorizing habitats in the Kitlope as being of higher value for habitat because of extrapolations from other richer areas (Austin and Hamilton 2002). Hunting was closed in the region, and the Kitilope has subsequently become a protected area. These two examples have brought into question the legitimacy of using the Fuhr Demarchi method to determine hunting levels in the absence of ground truthing and support claims calling for improvements in the scientific foundation supporting population estimates, the need for better validations, and increasing the transparency in the process.

The most tecent provincial grizzly bear estimates draw upon population methodology developed by the CIT for the ecological spatial analysis. This methodology relies less on the interpretation and ranking of habitat, and more on salmon catch estimates, road density, and other factors. The CIT's grizzly bear model is in essence a developmental extension of the Fuhr-Demarchi method. The model used the following data as indicators of habitat suitability: broad ecosystem units, TRIM 1:20,000 digital elevation model, salmon biomass estimates, and road density (Rumsey, Ardon et al. 2003). The data model increased the resolution of analysis[lxx] compared to previous population estimates and explicitly included salmon biomass estimates. In sum, the 2004 methodology used better salmon data, better road data set, a more refined modelling approach because it was verified against the Kingcome DNA / mark recapture and the Oweekeno grizzly bear monitoring projects (Tony Hamilton, personal communication 6/16/2003).

Nonetheless, though a considerable improvement, even this model was criticised because it relied upon an algorithm that emphasised the negative impact of all roads. The ground-truthing was completed in the USA, where such conclusions were warranted (See Rumsey, Ardon et al. 2003 for complete methodology). Roads are associated with negative impacts on populations because hunters frequent them; however it is not the roads that are bad *per se*, it is the people using road networks who kill bears that degrade the capability of habitat to support bears. Roads in the lower Kimsquit valley are largely deactivated and their only outlet is to the ocean; they are rarely used and not connected with the provincial road network. When this information was presented to the table, the data for the Kimsquit was ignored (Interview #1). Beyond the specific implications of methodology on grizzly bear population estimates, recognition of poor methodology for one element of the CIT ecosystem spatial analysis served (for some) to de-legitimise the entire analysis. The questioning of the data model for the Kimsquit Valley brought into question other focal species analysis used in the entire ecosystem spatial analysis, particularly for areas or species for which there was little or no local expert knowledge.

One reason tit was so apparent the limitations of methodology was because local and provincial biologists have long identified the Upper Kimsquit as critical habitat for Grizzly Bears. This is because bears travel through a low elevation pass to feed on salmon in the lower Kimsquit and to access other watersheds, especially those in Tweedsmuir Park, yet none of the coarse ecological analyses of the region captured this importance. The 1997 CCLRMP grizzly bear habitat assessment categorized this region of moderate importance to grizzly bears. An environmental analysis of conservation area design categorized this region as a core intact old growth region, not a core grizzly bear region (Jeo, Sanjayan et al. 1999). The CIT analysis for the Upper Kimsquit, indicated that this region was of medium quality (Rumsey, Ardon et al. 2003). Despite the relatively low priority that had been given to this region by coarse scale analyses, thus area was identified as a key region for the provincial network of GBMAs. As a result, there was initially much confusion at the CCLRMP until local expert knowledge could verify the selection of this region as ecologically important due to the role it would play in maintaining connectivity between regions of high ecological value, despite in not being highlighted as such on habitat maps.

Biologists involved with grizzly bear management in the province are well aware of problems inherent in managing such a charismatic species. Austin et al (2002) provide a critical summary of the 1999 grizzly bear harvest management procedure. They examine issues related to how "scientifically supportable information" and development of conservative hunting estimates in face of "uncertainty" are open to "considerable variations in interpretation" (Austin and Hamilton 2002 p. 2). They call for fully documented, formally peer-reviewed population estimates, suggesting that:

> There is a lack of formal documentation of the current potential or capability assignments to each of the unique combinations and their direct linkages to bear density. The rationale

> for these assignments, although logical and defendable, is not transparent. As a consequence, some believe that the approach is overly subjective and is not adequately based on appropriate scientific information. Some also suggest that it is simply not appropriate to extrapolate grizzly bear densities form known areas to other areas, or at least not to the degree that it has been done in B.C. Others believe that extrapolation based on an ecological stratification combined with an assessment of human impacts is a reasonable approach, provided that a conservative approach is taken and content that recent inventory supports this view (Austin and Hamilton 2002 p 7).

The technical manual guiding wildlife capability and suitability mapping for the CCLRMP also recognizes these points in a guideline document: "Each of the established models makes assumptions. Development of the mapping is an iterative process of rating, reviewing and fine tuning" (Wildlife Cap & Suit For CCLRMP). Another biologist is afraid that the provisional nature of grizzly bear data will not always be acknowledged, but instead will be treated as "more accurate or precise than it really is" (Stephan Himmer, personal communication). Instead, Himmer feels that those data provide information that can be used to focus further research and biological surveys – not as an end product.

Bear biology touches on issues at the cutting edge of new ecology and as such, is fiercely contested. Advances in grizzly bear biology and habitat modelling influence grizzly bear hunting policy in B.C. Fluctuations in mortalities and inadequate modelling of habitat to determine the baseline population from which a percent of the population can be culled have led to controversy over the sustainability of the B.C. grizzly bear hunting policy. One B.C. endangered species specialist addresses how scientific uncertainty operates when decisions are made on the grizzly bear harvest:

> Critics have suggested that grizzly bear harvest in B.C. should not occur in the absence of an "accurate" population count, however, given that the exact number of grizzly bears in B.C. will never be known, this is clearly impossible as well as impractical. This idea is also contrary to a fundamental principle of wildlife management in that the "perfect" information isn't required in order to manage harvests sustainably (Austin 2004 p. 3)

This is evident in Appendix 9, which describes grizzly bear population estimates that range from 5-8,000 in 1979 to a 17,000 in 2004. This suggests a rising trend, but in fact no trend is implicit. However, if population estimates serves as the basis for setting the sustainable hunting levels in a maximum sustained yield model, getting these numbers right is of paramount importance.

5.2.4 Social construction in data models and analyses

As evident above, many of the problems with habitat modelling in the central coast arose from limitations of the data model and its verification. Small differences in the construction of the models can lead to very different outputs that impact political decisions. Numerous iterations of the grizzly bear habitat data were used to decide the locations of proposed protected areas and GBMAs. As outlined in Appendix 9, there were analyses directly investigating the 'value' of various watersheds to support grizzly bears, including the early CCLRMP habitat suitability / capability map (1996), an ENGO-commissioned analysis

(Jeo, Sanjayan et al. 1999), and most recently, the CIT grizzly bear habitat ranking (Rumsey, Ardon et al. 2003). Each of these three assessments utilized different data models to develop ranking of habitat capability.

As evident in the Owekeeno GBMU, there was uncertainty about how habitat features, salmon as a food source, land use alteration, or hunting influences the carrying capacity of the land. In an attempt to highlight how the weighting of these factors influences the final decision set, an experimental grizzly bear habitat capability model was developed, different weighted analyses were performed, and the results compared. This exercise is not intended to improve upon grizzly bear modelling, merely to explore how slight variations in the weighting of beneficial factors (e.g. habitat quality) and negative factors (e.g. land use alteration or roads) would influence outcomes. There are numerous limitations in methodology, hence this model is not intended to predict grizzly bear capability in the selected watersheds of the central coast. However, this analysis does demonstrate that weighing factors differently produced significantly different results. (Refer to Appendix 10 and 11).

Habitat quality is best described in terms of a range of suitability, not in terms of crisp boundaries (e.g. old forest is more desirable than selectively logged forest, which is in turn more desirable than logged forest). In a rough approximation of the Fuhr-Demarchi / Step Down method, the experimental habitat model assigned habitat rankings and then stepped down or reduced these value rankings in recognition of their reduction in carrying capacity. Employing fuzzy logic, an algorithm was developed using weighted linear combination to vary the degree to which factors influenced the final habitat value. The final result was a theoretical capability map depicting a range of values where each cell was ranked according to its performance for each weighted factor. This differential weighting attempted to exaggerate how subjective decisions at the data model level can influence outcomes, particularly in the absence of verification.

Factors were identified as either detracting from (human settlement or land alteration) or enhancing (low elevation old growth valleys, avalanche chutes, estuaries, and sedge grass) the capability of habitat. Model parameters were based on literature documenting grizzly bear habitat needs and the negative impacts of various human influences. Old growth forest, with its structurally diverse and open canopy, was found to provide an abundance of food sources for grizzly bear (MacHutchon, Himmer et al. 1993; Jeo, Sanjayan et al. 1999; Saxena and Gazey 1999). Grizzly bears in the Khutzeymateen study consistently used valley bottoms, flood-plain old growth, wetlands and estuaries (MacHutchon, Himmer et al. 1993). The Bone Creek study (Saxena and Gazey 1999) reported that spring habitat (e.g. low-elevation wetlands and open forests) is the species' most limiting life requisite for modelling purposes. This study also emphasizes the importance of late summer and fall foraging habitats and the availability of high-energy forage like berries and glacier lily bulbs found in higher elevation study areas adjacent to the study site.

There are numerous studies documenting how bears avoid modified habitats (MacLellan and Shackleton 1988; Jeo, Sanjayan et al. 1999) and problems associated with increasing encroachment by humans into grizzly bear habitat such that that impact should be recognized to 500m (Hood, 2001). In contrast, Jeo et al (1999) suggests grizzly bears stay at least 400-2000m away from human sites and up to 5 km from areas known for high hunting mortality. What people need to kill grizzly bears is first and foremost access. Roads, camps, villages and other sites that bring people close to grizzly bears generally lead to contact, conflict and bear deaths (MacLellan and Shackleton 1988; Primm 1996; Wielgus 2002). Jeo et al (1999) estimates that between 55-75% of grizzly deaths are caused by humans. The number of human caused grizzly deaths is further broken down to include: hunting (89%), animal control (8%), illegal poaching (2%) and road kill(1%) (Austin 2002). In regions where there is human-bear contact there are even higher numbers of 'problem bears' killed (McLennon 1989). Following such studies, habitat quality was reduced adjacent to roads, settlements, and other areas where human and bears might interact.

The experimental habitat mapping analysis confirms that subjective decisions regarding the weighting of values affect overall outcomes. (Refer to Appendix 11 for outcome maps and analyses). The first analysis heavily weighted variables seen to increase grizzly bear mortality such as presence of roads and human settlement while not emphasising habitat quality. This analysis was intended to reflect a mindset suggesting that human caused mortalities were the most important variable in rating habitat quality; in essence anything that was remote and pristine would be good habitat. The first multi-criterion analysis, when reclassed to highlight regions with habitat quality of 200 or more, had an area of 2,161,499 ha, a figure two to three times that of the other analyses and one which did not exclude many regions that clearly did not contribute to habitat (e.g. high alpine / glaciers).. The second analysis attempted to weight both variables seen to positively improve habitat quality, such as low elevation old-growth forests, with variables known to decrease habitat quality. The mindset reflected by this weighting prioritized habitat quality above human mortality. This analysis produced an area of habitat quality above 200 of 639,791 ha, the lowest of the three analyses. The final analysis was constructed to consider both habitat quality and also human caused mortality. This analysis, when reclassed, produced 890,765 ha of high quality habitat. Without further qualifying the habitat rating scale in terms of what constitutes high quality habitat, the selection of 200 was arbitrary. The first analysis produced area of high quality habitat almost triple that of the neutral analysis reflecting that if the absence of human mortality was the sole criteria, then many remote regions of the coast would be mistakenly viewed as being higher habitat quality than they really were.

This analysis underscores the necessity of developing rigorous standards for the verification of models and attending carefully to the sensitivity of models to be influenced by human decisions. Greater awareness of these variables has led to heightened scrutiny of the way in which scientific information has been used to substantiate grizzly bear management in B.C. Two independent science teams, one focused on provincial grizzly bear management and the other mandated to address information needs for the provincial coastal plans use planning forums, have each highlighted the need for explicit statements of uncertainly, risk, and transparency. Local and provincial experts are increasingly integral to strategies to develop better management guidelines. Nonetheless, emphasis has remained on the pursuit of better science and modeling with insufficient attention directed towards the ways science is socially constructed. For example, difficult questions remain about model sensitivity to subjective decisions, how political priorities can be masked behind scientific rationales, and the difficulty in bridging the science-policy gap.

5.3 Reserve Design

In the case of reserve area design, questions of how much is enough or which areas will best complement a strategy are theoretically complex and not easily transferred into a political decision making framework. While ecological theories and concepts assist resource managers, "the relevance of these theories is often unclear since they are not couched within a decision making framework" (Maguire 1986 as cited in Possingham).

The second example of this chapter exploring how spatial modelling informs decision making is the determination of the protected areas network in the central coast, of which there were numerous iterations and proposals that were influenced by model design. Reserve design provides political decision-makers with the opportunity to create a protected area network to meet a variety of social values (Preesey 1994). In 1990, B.C. initiated a provincial policy of developing a protected areas strategy and in 1992, land use planning was developed as a mode of achieving this goal. Reserve design in the central coast is a coarse filter approach towards maintaining ecological integrity that provides 1) refuge for natural processes, 2) representative samples of ecosystems (or benchmarks), 3) core habitat for sensitive species, and 4) opportunities for recreation and tourism (Dorner, Holt et al. 2003). Because forests within the central coast are caught up in trans-national conservation values, the opportunity to expand the region's parks captured the imagination, attention, and funding of citizens, scientists, and philanthropists locally and globally.

Many protected areas are ad hoc (rather than systematic),de jure, or only capture less-economically (thus less biologically) viable land (Gonzales, Acerce et al. 2003). Poorly designed protected areas and reserve networks are often not immediately apparent. As a result, what constitutes best practice in defining reserve is the subject of much debate. Conservation biologists engage questions such as how much is enough to maintain ecosystem function, what size and configuration of reserves is necessary, or how effectively does the matrix (or operating land base) contribute to reserve design? There is a vast literature on reserve design and debate as to the best method to achieving a functional reserve design that maintains ecosystem function, given a set percentage of the land base in protection (Nott and Pimm 1987; Noss 1995; Possingham, Ball et al. 2000). Numerous explicit methodologies have been developed to maximize biodiversity protection such as gap analysis[lxxi], reserve selection algorithms (Possingham, Ball et al. 2000)[lxxii], or protection of special elements[lxxiii] (Dorner, Holt et al. 2003). Considerable evidence suggest that small reserves become islands of extinction and so large reserves (1,000-10,000km^2) should be created (Jeo, Sanjayan et al. 1999). On the other hand, maintenance of biological diversity, particularly in regions of high endemism or great topographic variability favours the establishment of numerous, well-placed reserves that capture effectively desired features. Yet, large reserves are vital for the maintenance of large carnivores such as the grizzly bear. Regardless, connectivity is essential for long-term ecosystem function, but particularly when reserves are small.

It has been argued that "reserve design is more a product than a process" (Barrett and Barrett 1987 p. 236), yet ultimately, it is the process that determines the outcome. In other words, if the process is flawed, then the output will reflect these weaknesses. Reserve design tools were intended to preserve ecosystem function, heterogeneity and biological diversity (Barrett and Barrett 1987), but a great difficulty facing conservation biology has been transforming pure science, theoretical or applied, into an effective decision making framework (Possingam 2001). This point was articulated well by one interviewee:

> The concept of a reserve design framework ... is a good one if you are dealing with a blank slate. However there are politics, personal interests, existing tenure and territorial rights that need to be dealt with. It really doesn't matter all of the time what the analysis says still people are going to be set on certain things, you know ' this is really important to me and I would like to see it this way' (Interview #2).

The process of determining a protected areas strategy for the central coast has involved the interplay of values, integration of scientific knowledge and mitigation of socio-economic factors. The process of developing a protected area strategy evolved greatly throughout the process. Early analyses were focussed on gap analysis, which appeared were intended to better incorporate tenets of conservation biology but were limited by political forces such as the 18% cap on protection (Interview # 7). This interviewee also suggested that there was notion of protecting favourite places: 'I love this valley and I want to protect it'.

Early scoping in the CCLRMP began in 1991 even though stakeholder meetings did not begin until 1996. At the time, 10.74% of the central coast was in protected status. There were a series of analyses that influenced the final recommendations of the CCLRMP. These include a list of pristine watersheds (Moore 1991), original study areas for the CCLRMP (1992), the protected areas strategy (Lewis 1997), an analysis commissioned by ENGOs entitled the *Conservation Area Design (CAD)*[lxxiv] *(Jeo, Sanjayan et al. 1999)*, various First Nation land use plans, and more recently, the ecological analyses created by the CIT (Rumsey, Ardon et al. 2003). The land use map recommended by the CCLRMP table reflects early land use process goals, a decade of reports, analyses and negotiations.

Moore (1991) identified two types of watersheds on the central coast: 1) pristine watersheds, which are those in which there is virtually no evidence of past human or industrial activities[lxxv] and 2) modified watersheds as those that have less than 2% of their area modified by industrial activity[lxxvi]. This early identification of watershed that had minimal impact left an enduring legacy. One interviewee confirmed this point (Interview #4); 'the issue of pristine watersheds was unquestionably a driving factor for debate". In fact, as will be discussed further in this chapter, many of the watersheds identified by Moore emerged on the final land use map. (Refer to Appendix 13). However, a series of further analyses were conducted to gain more knowledge about the ecological and economic impacts of decisions related to these regions' management. One reason this analysis was not deemed sufficient was because often areas not yet targeted by industrial logging are not the most biologically productive. Ironically, the prioritisation of intactness as a driving factor frequently favours regions that are the least ecologically productive. This was reinforced by the goal of achieving win-win solutions, particularly when the conservation sector identified intactness as a value (among others) that was compatible with other sector's values of not protecting operable timber.

The original study areas (1992) identified by the provincial Parks and Wilderness program were criticized as being excessively rock and ice, thus failing to capture ecological and conservation values associated with low-elevation forests (Lewis 1997). This list included 22% of the central coast, 11.3% above the 10.7% already in protection. An interagency technical team was established in 1996 to review and revise the original study areas for the CCLRMP and to conduct a gap analysis in to order to better conserve ecosystem representation and capture internationally significant values (Lewis 1997). A modified list of proposed protected areas were provided to the team in 1997, identifying goal 1 (representativeness) and 2 (special features).

This second list was mandated to remain within an 18% limitation of land, quite a constraint given the 10.7% protection already existing in the region at the time[lxxvii] (Hamilton, personal communication). Provincial process team members involved in the generation of this list expressed frustration at these caps. This 1997 list omitted many alpine regions (e.g. Kalone Peak and Mt. Waddington) and those which would be revisited (e.g. Ape Lake and Cascade Sustlem). A few areas were added, notably recreation sites (Hotsprings and Cape Caution) and intact valleys (e.g. Lockhart Gordon, Nekite, and Smokehouse). The proposed protected areas were compiled before the initiation of the CCLRMP in 1997, and as a result, direct expression of stakeholder values or perspectives did not inform them. Nonetheless, as evident in table 11, which is a section of Appendix 6, their identification as regions of high ecological value greatly influenced the 2003 recommendations.

The Conservation Areas Design (Jeo et al 1999)(CAD) was prepared by Round River Conservation Studies for the Sierra Club of B.C., Greenpeace, the Forest Action Network, Valhalla Wilderness Society, and the Raincoast Conservation Society to "delineate and prioritise areas for protection and restoration based on current scientific knowledge, the tenets of conservation biology, and the precautionary principle"

(Jeo, Sanjayan et al. 1999 p. 4). This analysis emphasized large carnivore populations (especially grizzly bears), viable populations of salmon stocks, representation of all native ecosystem types (especially old growth forests), and natural landscape connectivity along the assumption that maintaining these attributes would "help conserve biodiversity at natural levels of abundance and distribution" (Jeo, Sanjayan et al. 1999 p. 5). The CAD analysis combined a coarse-filter, ecosystem approach, a fine-filter species approach, and special elements. This analysis, unique in that it was developed outside of government, would ultimately serve as the platform from which the conservation sector advocated protection of watersheds (Interview # 7). It also constituted a shift in thinking for other stakeholders, especially First Nations, since this emergence of the CAD forced people to think about the implications of future forest policy (Interview # 7).

Another set of analyses that influenced the final land use map in the central coast were First Nation land use plans. The Kitasoo were the earliest First Nation to develop a land use plan and proposed 40% of their 530,000ha territorial land into protected areas (Kitasoo 2000). The Kitasoo have been involved in treaty negotiations with Canada and B.C. since 1982 and are pursuing many issues related to land and resource management at the Treaty Table. However, the Kitasoo developed this plan due to "the slow progress being made at the Treaty Table and the immediate need to protect the environment and valuable resources" (Kitasoo 2000). Kitasoo Band Manager Mr. Starr explains:

> We can't wait for the treaty talks or for the Central Coast Land and Resource Management Plan to be completed. We are moving forward now to assert how our rights and title will be respected. As we have in the past, we will work with any process or organization that will assist us to achieve our goals (Kitasoo 2000).

The Kitasoo land use plan indicates two categories of land: protected areas[lxxviii] and integrated use areas[lxxix]. The Heiltsuk, Gitga'at Haisla, Oweekeeno and Quatsino have all either initiated or completed their LUPs, athough many of these are not publicly available (CCLRMP Oct. 8-9, 2003; CCLRMP July 22-24, 2003).

The last reserve design analysis identified as having influenced the final outcomes of the CCLRMP is the CIT ecosystem spatial analysis (Rumsey, Ardon et al. 2003). While developed as a key CIT analysis, the ecosystem spatial analysis is in many ways an extension of the ENGO-commissioned CAD (Rumsey and Holmes 2003). The ecosystem spatial analysis identifies target land, freshwater, and marine special elements (rare or at-risk species and other features), ecosystem types (for ecosystem representation), and focal species (e.g., grizzly bear, black bear, marbled murrelet, northern goshawk, tailed frog, salmon). The ecosystem spatial analysis used as a basic unit a 500-hectare hexagon applied across the study area. The ecosystem spatial analysis used the SITES algorithm to minimize overall portfolio cost[lxxx]. This algorithm thus selects the smallest overall area needed to meet target goals, and selects planning units that are clustered or adjacent to existing reserves rather than dispersed (Rumsey and Holmes 2003). The ecosystem spatial analysis set protection goals for the targets, summarized human impacts, and then analyses different portfolios of sites in order to meet the protection goals.

The ecosystem spatial analysis was envisioned as a coarse-scale low resolution assessment, and not to address site specific issues. The ecosystem spatial analysis was developed by the CIT[lxxxi] in order to provide guidance to Phase II in their determination of whether the option areas were to become operating areas or protection areas. A key conclusion of the CIT ecosystem spatial analysis was that the needs of key focal species (e.g. grizzly bears, wolves, and salmon) and ecosystem function (e.g. connectivity) could be met if 40-60% of the region were in a form of protection. This conclusion from the CIT would be argued by the conservation sector as substantiating the need to have a stronger ecosystem based management framework applied across the landscape, since conserving so high a percentage of land was politically impossible.

5.3.1 Analysis of the protected areas strategy

Conflict over science and information was a central component of Phase I of the CCLRMP in regards to protected areas because there was insufficient and uncertain information regarding timber or conservation values of watersheds. It resulted in the unique interim solutions of 2001 when Option areas were identified and the CIT was commissioned to do further analysis and to develop an EBM framework. How influential were these various analyses in influencing the land use planning map in the central coast? As evident in table 11, despite numerous additional ecological analyses, many of the original areas identified by Moore's 1991 list ended up as proposed protection or biodiversity areas.

Moore (1991) identified 20 pristine and 25 modified watersheds. At the start of the CCLRMP, only 7 were protected or partially protected. Via the CCLRMP process, 7 more watersheds were recommended in 2001 and 21 more in 2003. Three more are likely to be managed in some form of First Nation forest operation. See table 6. Therefore, by the end of 2003, 35 of the 45 watersheds identified by Moore are in some form of protection. Either the early scoping analyses "got it right", as one stakeholder suggested (Interview #6), or there is a legacy towards the early identification of an area as being *high value.* This legacy may result, as it did with many watersheds due to moratoriums on logging, in greater local and international attention, and to heightened scientific analysis conducted upon these regions. As evident in Table 11, certain regions, such as the Anuhuati Complex and Cascade–Sutslem were identified in an analyses of intactness by Moore in 1991, they were identified as priority on both the 1992 and the 1997 Protected Area Strategy list, and became Candidate Protection Areas in either the 2001 or the 2003 CCLRMP Recommendations. These regions remained important due to the bias towards conservation of large, well connected, intact watersheds, all driving principles of conservation biology (personal communication).

The final decision regarding Option Areas remained the subject of much debate, analysis, and controversy to the very end of the CCLRMP. A vote regarding these option areas during the Oct. 28th-30th meeting resulted with stakeholders[lxxxii] voting nearly unanimously for either operating or protection[lxxxiii] depending on the direction given by available First Nation land use plans. The map resultant from the CCLRMP negotiations on Nov. 26-29, 2003 proposed 24% of the land base in protection, only slightly higher than the 2001 interim recommendations. As evident in the CCLRMP final recommendations, the outcome of this vote was not put forward as the final recommendations because meanwhile, JSP negotiations had continued. A few weeks later in the final CCLRMP meeting a different JSP proposal was proposed to the CCLRMP table and adopted, increasing total proposed protection to 33%.

Table 11: Tracing the influence of early analyses

	Moore 1991	Original Study Areas	PAS 1997	CAD 1999	2001 Agreement	2003 Agreement
Ahnuhati Complex	Ahnuhati, Kwalate & Ahta – Mod.	Yes 1 priority	Yes	High GB / core intact	CPA	Core GBMA in South
Ape Lake		Yes (276,028)	Deleted	Low value	CPA (20,965)	
Ashlu-Reeve / Upper Inziana				Core GB	Option (21,109)	Modified (16,993 ha)
Bald Peak/ Knight Inlet				Low value		New CPA
Bond Sound				Low value	Option (2,059)	Deleted (Visuals?)
Broughton Extension		Yes (4,384)	Yes Highly Signif.	Low value	CPA (4,281)	
Cape Caution			Area of interest	Low value	CPA (10,567)	
Cascade – Sutslem Inlet	Skowquiltz– Pristine Sutslem – Mod. Nascal – Mod.	Yes (138,888)	Deleted	Skowquiltz/ U. Cascade-GB / 2/3 intact	Option 136,333 ha	Modified CPA 126,500 ha

Interestingly, many new additions to the protected areas landscape were outside of the 2001 Option areas. It is unclear if and how the CIT science influenced their inclusion. The conservation and timber sectors clearly used available THLB and ESA data to guide their decisions, but because these negotiations were behind closed doors it is difficult to determine how strongly various analyses influenced decisions. A key shift in approach can be seen in the inclusion in the CCLRMP final map of proposed protected areas watersheds that were more modified (e.g. Tzeo & Washewash). Interestingly, many of these had not been previously identified by earlier analysis, with the exception of the ENGO commissioned analysis that had identified these regions as key restoration areas (Jeo, Sanjayan et al. 1999). It appears then that the CIT information was useful in informing the decision on which of the option areas would be proposed as biodiversity areas and which additional 'new areas' would also be included (Interview #3).

The CIT ecological spatial analysis and economic spatial gains analysis were supposed to provide the ability to rank watersheds by ecological and economic indices. While both conservation and major timber sectors worked with the same ecological data developed from the CIT, they interpreted it to mean very different things. Potential protected area maps presented by major forest sector and the conservation sector at the Nov. 28-28 meeting reflected this difference. The conservation map included all of the option areas as proposed protection areas in addition to numerous others. In contrast, the major forest map included only a couple of the option areas[lxxxiv]. At times like these, it did not appear that science was driving negotiations, at least not with regards to the maps. Instead, strength of argument and cartographic appeal were important. Further, it appeared that each side had become quite polarized in their positions. Indeed, during one vote regarding whether an option area was recommended to be protected or operating, the terrestrial conservation representative was out of the room and an individual from major forestry sat in his chair and perfectly articulated the position the conservation representative would have stated had he been in the room. Laughter abounded, as it was reiterated how well each sector knew the other sectors' interests, but also how established sector positions had become. Further analysis is needed in order to determine the role that scientific direction played in the determination of the protected areas network. This would require having access to the CIT ecosystem spatial assessment data.

5.3.2 Continued controversy

In spite of increased attention directed towards the development of scientific information, the commissioning of further analyses, and the establishment of a well-funded independent information team, there remains great debate over whether the CCLRMP process has chosen the right areas. Numerous criticisms of the proposed protection areas have emerged from academics (e.g. Gonzales, Acerce et al. 2003; Wells, Bunnell et al. 2003) and the environmental community, notably the David Suzuki Foundation and Raincoast Conservation Society, who are not part of the RSP environmental NGOs (e.g. Gilbert, Craighead et al. 2004; Moula 2004; Paquet, Darimont et al. 2004). An analysis was conducted by Gonzales (2003) using the SITES selection algorithm to optimise inferred goals of the RSP environmental coalition and the CFCI timber companies. Their results theoretically could reserve more wildlife habitat, more old-growth forest, and achieve better representation of rare ecosystem types in the central coast than did the 2001 interim solution. This kind of analysis reflects sentiment in the academic community that opportunities remain to revisit the process of reserve area design given the adaptive management of EBM.

The ENGOs outside of the RSP environmental coalition are not only among those most critical of the science of the CIT, they are also those advocating for a continued emphasis on developing science-based decisions. "We believe a science-based approach is the most effective way to conserve individual species, populations, communities, and ecosystems" (Paquet, Darimont et al. 2004 p. 16). Both Raincoast and the David Suzuki Foundation have also launched vehement attacks on the science and the interpretation of the science in the CCLRMP. An early assessment of the CCLRMP recommendations suggests that none of the protected areas are individually large enough to prevent net-loss (Gilbert 2004 as cited in DSF 2004). A report by Raincoast assessed protection of key wildlife habitat:

> Given the global significance of this region, a protected areas strategy was expected to transcend traditional approaches to resource management ... A paucity of scientific information, however, seriously compromised this effort. The most daunting obstacle was the lack of anything close to a full accounting of present day biodiversity (Paquet, Darimont et al. 2004 p. 5).

By this assessment, despite all efforts, the CIT ecological spatial analysis failed to produce a robust enough analysis. While the CIT did further develop the ecological datasets in the CCLRMP, only a few of the most charismatic species were identified as focal species in the ecological spatial analysis, largely due to lack of data, life history information, or region-specific research. A notable omissions was the grey wolf (*Canis lupis),* and as a result the majority of wolf reproductive habitat and their winter range of their dominant prey, white tailed deer (*Ococoileus virginianus)* remains unprotected (DSF 2004). A key conclusion from this assessment of habitat in proposed CCLRMP protected areas is that they remain inadequate in protecting key wildlife species on the B.C. coast.

Another report published by the David Suzuki Foundation (Dorner, Holt et al. 2003) analysed the outcome and concludes that not only has the total percentage of protection fallen short of the CIT recommendations (33% not 40-60% as identified in Dorner et al 2003) but that these protected areas may not have optimised habitat conservation. According to this analysis of focal species habitat 60% of prime grizzly habitat, 83% of best Northern Goshawk nesting sites, 74% of Marbled Murrelet nesting habitat, 71% of deer winter range, and 66% of salmon habitat remains unprotected. This report also criticizes the size of the parks, citing evidence that local extinction of large mammals was prevented only in parks of 1,000-10,000km^2 in size. By the stated criteria, only five of the proposed parks are large enough to assure no net-loss of grizzly bears.

Provincial biologists and others criticised the coarse filter approach towards conservation taken by the CCLRMP, due to its bias towards conservation of large pristine watersheds and subsequent exclusion of numerous ecologically rich regions that were modified or fragmented. A McLennan (2000) study ranked conservation value for the Mid Coast Forest District portion of the central coast using a series of environmental indicators to come up with a ranking of the most important site locations. The results emphasized extremely high values along riparian zones, in estuaries, and in low elevation forests, even if pockets of habitat existed in the watershed that had been altered extensively by logging or other human disturbances. If the value of intactness were dismissed, an alternative approach would allocate 2-5% of the land base in smaller, more strategically situated reserves within the operable harvesting land base. This approach could ensure regional ecosystem function and conservation of biological diversity because entire watersheds need not be protected, only those regions threatened with industrial impact (Dunsworth, Personal Communication). Often the most suitable locations and valleys for growing the trees are also the more biologically productive. The rationale behind this approach is that the areas most vulnerable to impact need to be preserved; the areas outside of timber harvesting landbase are unlikely to be disturbed.

For example, I was shown satellite imagery of a watershed, recognized as one of the most biologically productive regions in the Bella Coola area. Despite being heavily logged, there remain patches of intact forests providing connectivity corridors through an otherwise heavily logged landscape. Dunsworth's approach would have selected locations for reserves based on satellite imagery and local knowledge in an effort to maintain ecosystem function in what he believes is an extremely important ecological watershed. While this fine scale approach towards planning was never intended by the CCLRMP, it demonstrates a critical approach towards ensuring ecosystem function. It is precisely this kind of fine scale approach that EBM would seek to achieve. If implemented, EBM should maintain these corridors at the site and watershed level, via riparian goals and other silviculture strategies (Interview #10; EBM handbook). However, a multi-level approach to ecosystem management results in different scales of reserve networks, one that has highlighted the conservation of large, pristine reserves at the landscape level and relegated the reservation of smaller more strategically placed reserves to future site specific planning where they will not receive the same formalized protection.

By examining the process of reserve design, a few key factors emerge. First, this was a long and complex process that had strong theoretical and applied foundations. Nonetheless, it remains controversial and subject to change. Second, new studies continuously influenced the prioritization of regions, though certain areas consistently remained top priority. Thus the early identification of regions as being high conservation value can have lasting impact. Third, negotiations continued to the last minute and much of the foundation of the 2003 CCLRMP recommendations ultimately emerged from the Joint Solutions Project proposal as they had in the 2001 interim solution. Fourth, the final land use map is subject to change depending on ongoing provincial and First Nation government negotiations. Lastly, the protected areas strategy remains controversial, particularly with regards to maintaining healthy populations of the region's large mammals.

5.4 Adversarial Science as Social Construction

This chapter provides two specific examples of how spatial information operates within land use planning and resource decision making. Greater recognition of the social construction of science and the need for public participation in decision making has led to institutional mechanisms for utilizing science and technology in the context of participatory and multi-stakeholder based negotiation. A problem with the use of GIS in advising the decision making process is that its complexity makes it difficult to understand the process by which error, bias, and uncertainty are reflected in the maps and data. This coupled with the influence of maps and spatial data highlight the need to better express and document the ways in which bias does enter into the derivation of maps. Meta data standards are making great progress with documentation of the original data sources, as are efforts within the ministries highlighted here to standardize the assimilation of these data into databases. However, one recurrent problem with GIS modelling is that the mapped results of the model are presented without showing how they have been derived, information essential for their proper interpretation.

The mandates and objectives of different ministries and institutions enter into the modelling process. These influence the initial selection of criteria, the weight accorded to the criteria and the ultimate analysis leading to a decision set. A study conducted by Norheim (2002 (draft)) determined that the respective institutional cultures of a government agency and an ENGO had significant effects on the way that the two projects analyzing old growth in the Pacific Northwest were conducted and on the data that emerged. He further recognized that neither data set on old growth was inherently more correct within their institutional context. Martin (2000) suggests that recommendations for implementation and evaluation of GIS can benefit from a broader theoretical foundation to support investigation, understanding and improvement. He also states that there is much to be gained from understanding the important role that context plays in the configuring of GIS, especially when similar GIS implementations produce different outcomes. It may be unrealistic to expect that GIS can develop the absolute and unbiased answers that society often expects to questions that are in large part inherently subjective (Norheim 2002 (draft)).

As evident in these examples of adversarial science, political decision making must engage new science policy frameworks, ones that explicitly recognize how Participatory GIS utilizes spatial information technologies to articulate the needs and interests of disparate groups while also providing opportunities for collaborative information generation, communication, and transparency. This is particularly important when dealing with complex systems where modelled parameters can not be adequately verified with real world parameters, as explored in grizzly bear population estimates and in the generation of a reserve area network. Independent scientific review can play an important role in such situations by addressing constructivist critiques of the social construction of science and by heightening opportunities for communication and collaboration. In this way, even though the information generated was still controversial and may not have greatly improved despite numerous iterations, there was increased transparency and trust in the social institutions within which this information was generated. Importantly, adaptive management can both support and also be a response to understandings of science as socially constructed.

6 THE CIT AND THE SOCIAL CONSTRUCTION OF SCIENCE

I sit on the fulcrum between science and advocacy ... and am one of the few people who can shift back and forth between these two positions. I think the idea that science is objective ... is a false premise because it is always biased and laded with values and assumptions ... Once you accept that science is not objective and then try to set up an environment where assumptions are made explicit, then you can move forward with developing better science. If your pretext is that science is an ivory tower, you are setting yourself up for problems (Interview # 7).

Science and information are contested through collaborative planning processes, and contestation over environmental issues in the central coast of B.C. makes this abundantly clear. This influence affects resource management decision making and environmental conflict. This thesis bridged theoretical foundations of philosophy of science, environmental planning theory, and GIScience in order to better understand the evolution of the CCLRMP, and to explain and situate the outcomes of this planning process. In the process, I have analysed ways that critiques of the social construction of science were addressed. This concluding chapter summarizes key elements of the research and analyses of the role the Coast Information Team (CIT) played in the larger environmental conflict[lxxxv].

The CCLRMP experienced great difficulty in arriving at consensus recommendations: innovations in the planning model and high levels of commitment were necessary to achieve both the 2001 interim agreements and the 2003 consensus recommendations to government. A series of circumstances, innovations, and an effective balance of ecological and social values contributed to the consensus agreements achieved by CCLRMP stakeholders in the last days of 2003. Critical among these were bilateral negotiations between sector groups engaged outside of the CCLRMP process. Additionally, explicit provisions were needed to assure an acceptable balance of ecological and socio-economic values - as perceived by disparate stakeholder groups. Among these was the development of EBM and the CIT, whose stated central mandate was to provide independent information.

Spatial and scientific information informed the larger conflict and stakeholder recommendations. In a few cases, spatial information was critical in translating contested social values into operating guidelines or planning directions. This is evident in the variable representation proposal presented by the timber coalition as a first step towards implementing EBM, and with the visual quality areas proposed jointly by the timber and tourism sectors. Spatial information also played key roles in debates over the location, size, and scope of the protected areas and GBMAs. In these, and many other examples, spatial information was linked to adversarial science and attempts to remap the great bear rainforest (Clapp 2004). Surprisingly, despite the sophisticated nature of the information, analyses, guides, and reports developed by the CIT (visit www.citbc.org), much remains unused.

The CIT also served as a conflict resolution tool precisely because it did engage the social construction of science and supported a process that increased collaboration and the built greater trust in the way scientific (and other) information is developed and used to inform planning. Yet, much of the information developed by the CIT and their recommendations were never used, or as in the case of EBM, adopted in principal and implemented in a much weaker transitional form (DSF 2005). The CIT did, however play a key role in transforming elements of the larger conflict because it directly engaged debates about science and information, provided opportunities for building social capital, enabled a more dynamic relationship between human disturbances and preservation of intact natural landscapes, and attempted to integrate multiple knowledge communities. A key conclusion of this research is that the CIT played succeeded as a conflict resolution strategy and was critical in enabling the 2003 table recommendations. Interestingly, this conclusions lies outside the intended scope of this thesis, but nevertheless points to the value of social negotiation.

The CIT could have achieved far greater success had it better engaged values and interests to scientific and technical guidance, as explored by Cassells (2001). Despite the participatory collaborative foundations of the provincial LRMP process, the provincial cabinet will make the ultimate decisions and these negotiations are occurring behind closed doors. Significantly, none of the CCLRMP recommendations have been legislated as of May 2005, in spite of completion of negotiations between First Nations and the provincial government (based on the CCLRMP recommendations), which were submitted to cabinet for ratification (DSF 2005). There is concern that while the final land use planning map will be legislated in a form similar to the CCLRMP recommendations, the EBM framework will be considerably weakened as evident by the lack of real changes to silviculture currently in the central coast (Save the Great Bear Rainforest 2005). Indeed, according to a recent David Suzuki Foundation publication, the "current state of negotiated EBM standards falls far below the CIT EBM recommendations" (2005 p. 11). If a weakened EBM legislated, then it is less clear how the CCLRMP or the CIT will be evaluated since EBM was envisioned as the location where much innovative work regarding social values of forestry would have been actualised. Additionally, there is likelihood that conservation financing would be withdrawn as a result (Save the Great Bear Rainforest 2005) and even the possibility of a renewal of market campaigns, though no-one appears to be posturing this position, at least not yet. Limited success in the CIT's ability to develop information that would directly help transform or resolve conflict stem from continued challenges related to the construction of information and more importantly, how this information is used to develop policy.

6.1 Moving Beyond Adversarial Science

While many have focussed on the successes and failures of the CIT in developing better scientific information or integrating multiple knowledge domains (Allen 2004; Hadley 2004), less has been said regarding the CIT's role as a conflict transformation strategy (Interview #5). A key, yet unanticipated, conclusion of this research identifies conflict transformation as one area where the CIT has achieved limited success. When scientific and technical issues are a central part of the conflict then institutional mechanisms for conflict resolution in the context of this science may be useful (Meine 1996). In the case of the CIT, the development of science and information was used to foster dispute resolution and enable what one stakeholder group describes as "constructive dialogue" (RSP 2005 p. 2). Such dialogue seeks to avoid adversarial strategies such as the market campaigns in the earlier stages of the CCLRMP. From the environmental coalition's perspective, it was unacceptable to continue resource extraction while information and further scientific studies were ongoing. Thus, attaining the moratorium on logging and ending the market campaigns were essential prerequisites for initiating dialogue and developing a roadmap for developing the CIT and EBM, key components of shifting the conflict along the continuum identified in Figure 1. This strategy built upon the theory that in high conflict situations, independent scientific review can be a strategy to move beyond a "battle of the sciences". Accordingly, even if better science does not emerge, an independent science review can be a trigger for shifting the conflict if greater trust, participant buy-in, and increased social capital can be achieved (Beesley 2003, Meine 1996). One interviewee suggested that the work emerging from the CIT would have taken 10-20 years to develop and gain stakeholder support had it not been developed in a collaborative fashion (Interview # 6). In sum, the CIT's attention to science and information yielded both positive and negative impacts, summarized in the following table.

Table 12: Impacts of conflict over science and information

Positive impacts	Negative impacts
• Increased recognition of the way in which science is socially constructed. • Recognition of the need for incorporating alternate knowledge domains. • Innovative solutions such as ecosystem management emerge due to emphasis on technical aspects of resource extraction. • Forum for explicit discussion of uncertainty and risk. • Independent information generation can provide opportunities for identifying areas of overlap / agreement between stakeholder values. • Conflict attracts better scientific funding, technical support, and mediation.	• Distracts from important dialogue over values. • Polarizes discussion along my science versus your science. Emphasis on scientific details inhibits communication and collaboration. • Scientific information maintains epistemic dominance over other knowledge domains. • Uncertain and unconfirmed data are used to support and to dismiss entrenched positions. • Uncertainty or model inadequacy in one area raises legitimate concerns about entire data set. This can result in heightened mistrust of all science and information. • Media, non-scientists, and politicians can conflate conflict over science with conflicting social values.

Despite the development of the CIT conflict over the science and information remained. However, this conflict no longer paralysed the process as it had in Phase I. Forums such as JSP and the CIT provided opportunities for scientists and technicians to communicate, develop hypotheses and methods, and explain their outcomes. Importantly, this took place within the collaborative model of an LRMP where values and interests, rather than scientific certainties, were recognized as the foundation for negotiation. In essence, the collaborative model provided more transparency regarding the normative assumptions that influence choices of method, analysis, and interpretation. In Phase II of the CCLRMP, adversarial science was lessened by collaborative mechanisms for the generation, analysis, verification, and presentation of information. Importantly, the CCLRMP provided opportunities for the participation of technicians and scientists from multiple groups who would then jointly present results at CCLRMP meeting. The notion that the conservation sector was driven by normative values and the timber sector by material and economic interests was taken for granted by many involved and interested in the CCLRMP process. As a result, trust could be gained by the table if both sides agreed upon and presented their interpretation of any data.

Jackson suggests that the generation of better science may be less important than if fair, transparent, and inclusive process is developed.

> Procedural fairness (will have) a significant impact on attitudes and behaviours, and that people who believe they have been treated fairly are more likely to accept a decision, even where the outcome has gone against them. This implies that perceptions of fairness of planning *process* may be more significant in delivering environmental justice than those in respect of fair *outcomes*, because people are more likely to accept decisions when they acknowledge both moral basis of the judgement and the legitimacy of the decision making body (Jackson and Curry 2004 p. 30).

From this perspective, the specific outcomes of the science and the planning table recommendations pale in comparison to the acceptance and commitment to process demonstrated by stakeholders of the CCLRMP and the organizations, governments, and industries supporting the CIT.

Adversarial science can completely derail or stagnate a process, as appeared to occur early in Phase I of the CCLRMP. But, this same debate can also generate increased attention to the mechanisms by which scientific information is constructed and whether alternate forms of knowledge should be or are being included in decision making. This should ultimately result in more socially relevant scientific information. In the case of the central coast, this is most evident in commitments to the CIT, the development of EBM, and advances in conservation biology. Adversarial science and its negative impacts continued in Phase II. These were evident in prolonged debates about the science and its interpretation at the cost of discussions highlighting the social values related to the sustainable management of the region's forests. This is linked to the conflation of what Allen and Gould (1996) characterize as wicked and complex problems. Furthermore, both the timber and environmental sectors continued to analyse, interpret, and present conclusions from the same CIT data in different ways.

Demarcation of 'good science' from 'bad science' remains important in situations of adversarial science and a key goal of the CIT was to produce information that was regarded as legitimate by all parties. To achieve 'good science' in the CIT, scientific information was to be developed along strict criteria that focussed on independence, qualification, and peer review consistent with Sismondi's (2004) analysis of formalized procedures of review. Within the context of the two science questions addressed in Chapter 5, grizzly bears and conservation area design, it seems clear that perhaps 'better' science emerged. Multiple iterations facilitated the development of better science because later versions more effectively acknowledged risk, uncertainty, and transparency, and built upon previous assessments and model verification. While such assessments failed at times to adhere to strict hypothesis testing, such methods for model validation should fit Jackson's (2004) criteria for improving trust.

Tensions related to the validation of ecosystem science were apparent in the last two meetings of the CCLRMP in 2003. At this time, negotiations between the major timber and conservation sectors focussed on defining EBM guidelines and on the location of conservation areas. One representative from a third sector expressed great frustration that the CCLRMP table was still trying to find an answer by debating the science. This representative called for a common sense approach that sought a solution from the table members, not the science. He reiterated that ecology is not an exact science: if five ecologists received the same data set, each might come back with different interpretations. No amount of negotiation over the science nor the development of more sophisticated analysis would enable the team to arrive at a solution. He compared the table to a dysfunctional family where the major timber sector and the conservation sector were like two bickering children. Thus, conflict between scientists can result in decision makers rejecting all scientific analysis and information. This example highlights the need to further focus on the continued authority that scientists maintain in informing decisions, to question how scientific information should be disseminated, and to shift attention towards balancing social and economic values with scientific direction.

Furthermore, conflict over science can increase when non-scientists enter the battlefield (Levitt 1994). The role of the media is particularly important, and the local Vancouver media is not always recognized for its effective reporting of the issues, particularly the scientific issues. This remains a further area for inquiry as the media remains a primary way in which information about the CCLRMP has been disseminated. The role of the media, academics, and non-participants in influencing a foundation of collaboration is particularly important when sectors have been engaged in negotiations built upon trust slowly achieved over time. Poor reporting of facts, misinformation, or quoting out of context undermined trust achieved in the negotiations. The socio-economic and ecological analyses developed by the CIT were intended to, but never were, used in conjunction with each other despite the fact that neither was intended to provide a complete picture (Interview #5).

6.2 Towards an Evaluation of the CIT

Drawing upon the criteria laid out by Reid and Mace (2003) , the CIT can be evaluated for the degree to which it achieved scientific credibility, was politically legitimate, and responded to decision-makers needs. To achieve the first criterion, the CIT needed to demarcate good from bad science, ensure independence, and develop methodologies and information that satisfied the important questions regarding ecosystem management and risk thresholds. The CIT cultivated participation and commitment to the process from all stakeholders, in order to build political legitimacy. Initially, CIT legitimacy emerged from tripartite funding, a multi-disciplinary structure, the management team, buy in to the process from the CCLRMP stakeholders, and the intended centrality of the CIT outcomes and analyses to the envisioned solution. Maintaining legitimacy proved difficult as many stakeholders soon recognized limitations in the ability of the CIT to integrate local and traditional ecological knowledge with scientific assessments. Responsiveness to political decision making, as suggested by Reid and Mace, appears to have been more challenging to meet. While tasked to develop EBM and other analyses, the CIT soon ran into difficulties with timely delivery of clear recommendations, ensuring the independence of this information, and with the integration of disparate knowledge domains. Nonetheless, the CIT was successful in providing opportunities for collaboration and communication. It was also a location where challenges related to bias, independence, and integration of multiple knowledge communities could be engaged, while not sufficiently in many ways, still in an improved process than seen previously.

A few limitations reduced the effectiveness of the CIT in reducing conflict. The CIT struggled with integrating multiple knowledge communities in its mandate to provide "the best available scientific, technical, traditional, and local knowledge" (Allen 2004)[lxxxvi]. The difficulty with effectively integrating these knowledge domains is evident in the following statement in a summary document providing reflections of the CIT process by a CIT lead researcher, Robert Prescott Allen:

> Unexpectedly, the mandate to provide independent information conflicted with the mandate to use knowledge from a diversity of sources—technical and traditional, as well as scientific. Partly, this was because independence was loosely (and naively) equated with "scientific", although scientists are human and have their points of view and biases. Partly, it was because technical and practitioner knowledge seemed too close to the corporations and other interest groups from whence they came. To provide the most useful information possible for the social choices of planning processes and decision making, assessments should aim for neutrality and independence. At the same time—given that knowledge is value-rich rather than value-free—they should also try to accommodate multiple values(Allen 2004 p. 25-26).

This quotation suggests that the CIT directly confronted ways that science and information is socially constructed. In this summary document emerge some of the earliest formal acknowledgements in the context of the CIT that institutional mechanisms that address social construction of science can be used as

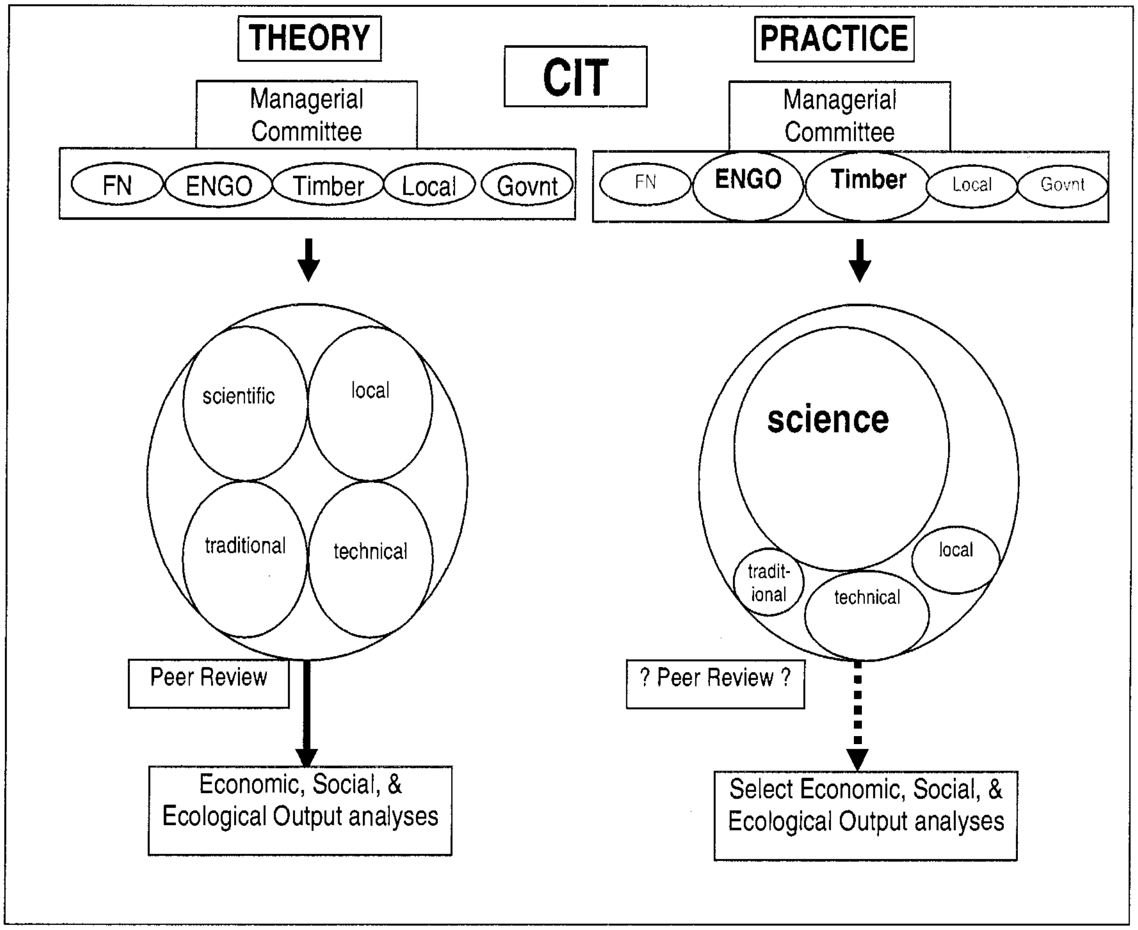


Figure 4: The Coast Information Team: Theory versus practice

dispute resolution. This lack of a strong theoretical foundation for this objective is surprising considering the great detail that has gone into providing the scientific rational for the development of the development of various ecological guides and analyses (e.g. Dorner, Holt et al. 2003). The CIT may have been more effective at transforming adversarial science had there been a clear rationale for instilling confidence in the inner workings of the black box. The black box is a concept popularised by Bruno Latour (1987) to describe how the inner workings of the construction of science and technical information are often sealed away such that only the inputs and outputs are recognized. The following section examines the challenges and evaluates the effectiveness of the CIT in integrating multiple knowledge domains and developing independent information about the great bear rainforest. In developing a critique of the CIT, each of these four knowledge communities and the information they produced will be taken in turn.

6.2.1 Scientific information and the quest for independence

Scientific information remained the most influential source of information for the CIT for a variety of reasons including: a tight timetable, availability of scientists, assessing their qualifications, and the societal perception that scientific information is independent (Allen 2004). Insufficient data and adversarial science had motivated the development of the CIT, yet achieving independence proved to be a more difficult challenge than originally anticipated.

> The CIT struggled with the same issues that the government struggled with. The government gave the CIT the base data, which they added to, improved and analysed using their own models. Yet, at the end of the day, it is unclear if they did much better: not all of the data ever emerged, there was fear it was biased, and there was fear it had been co-opted (Interview # 3).

As suggested above, the mandate to develop independent information required that a distinction be made between *independent* and *dependent*[lxxxvii] information (Allen 2004). This concept is easy to state, hard to deconstruct, and even harder to achieve. As presented in Chapter 3, the CIT attempted to ensure independence through a series of formalized rules, diverse management team, explicit statements of bias, and a peer review process. Importantly, the notion of a binary between dependence and independence is derived from the dominant position that scientific knowledge holds as the way by which knowledge of the world is constructed. Beyond these procedural guidelines, which clearly are a response to the recognition that science can be and is socially constructed, there needs to be greater critical engagement with these questions. In essence, the CIT was challenged then with two points: 1) the role of independence and dependence within the scientific paradigm and 2) integrating multiple knowledge sources from groups where this information often achieves legitimacy precisely because it is situated (e.g. local).

Recall the conservation area design commissioned by the ENGO coalition to prioritise ecological features in response to a perception maintain ecological information being presented to the CCLRMP was biased (Jeo, Sanjayan et al. 1999). While this report represents an early form of counter-mapping in the region and served as the conservation platform, other stakeholders dismissed much of this analysis because it was seen as representing a conservation perspective and did not investigate the economic and social impacts of removing these areas from the operating land base. In contrast, the CIT engaged in a process of re-mapping, whereby ecological and socio-economic information was developed in a process that enabled all groups to develop trust in the prioritisation of watersheds and the estimated costs and benefits of conservation because it had not been undertaken by one stakeholder group. The CIT separated ecological from economic analyses, not to prioritise one over the other, but to ensure that one view did not preclude the other and to further highlight the social decision in weighing the tradeoffs between goals[lxxxviii].

Multi-disciplinary representation, tripartite funding, and other institutional mechanisms to assure independence should have instilled high levels of trust and confidence in CIT reports and analyses.

However, concern was still voiced that certain CIT analyses, namely the Ecosystem Spatial Analysis, had been co-opted by conservation interests. This perception likely was influenced by the presence of individuals on the CIT who remained clearly aligned. A problem with the mission-oriented foundation of conservation biology: no matter how sound the science, the scientists appear to be clearly aligned with conservation, a compromising position in resource dependent communities. This may be unavoidable, however, since people who commit their academic lives to conservation area design will likely have complementary normative values. Similarly, individuals developing silviculture strategies for timber companies will likely have normative values that justify resource led development. While an obvious point to many, this challenges the notion of an *independent* science and speaks to the importance of having collaboration between what could be termed *dependent* scientists if both viewpoints are to inform their platform by emergent scientific recommendations. This reiterates the importance of including scientists from key stakeholder groups in an attempt to heighten trust in the development of scientific information.

As a result of continued problems with CIT data, an interviewee suggested that the CCLRMP was forced to incorporate information with a "jaundiced eye" because members feared that faulty assumptions had been built into the analysis (Interview #1). This interviewee further explains:

> It is tedious to get information from data. It is difficult, but relatively straightforward... Most technicians and scientists don't have the skill to manipulate the data and information at the data level. But at the analysis level it is difficult not to let worldviews influence.

This concern that analysis of data and information was vulnerable to normative beliefs and worldviews was reiterated in interviews, personal communications, and most notably, in the debates over the legitimacy of science that accompanied many of the presentations offered by the CIT. For many of the stakeholders, and especially for the timber and conservation coalitions, arriving at science-based solutions was paramount. For these groups, the CIT provided an opportunity to develop political answers because it integrated their interests, multiple sciences, and flexible solutions. Yet, the ontological status of science as the dominant form of knowledge appears to have limited the overall effectiveness of the CIT, in part because attention remained focussed on attaining the ideal of an independent science, but also because this dependence on science precluded effective inclusion of other knowledge domains.

6.2.2 The hidden (and not so hidden) power of technicians

The second knowledge domain identified by the CIT and investigated in this chapter is technical, identified as knowledge held by professionals, practitioners, and technicians. Often technicians are involved with analysing, interpreting, and presenting much of the scientific information in a form that could be then utilized by stakeholders and decision-makers. Technical experts frequently play integral roles in bridging the gap between theory and application, developing operational guidelines, running the models, and communicating output analyses (Yafee 1994). Achieving EBM goals (refer to Table 6) demands explicit operational guidelines. Not only has the multi-disciplinary and multi-knowledge focus of the CIT improved the development of operational guidelines, but it will also aid in implementation, because forest technicians were involved in the development of the guidelines[lxxxix]. However, technical practitioners were seen as prone to being influenced by normative commitments and their close association with their sectors (Allen 2004). Allen (2004) supports the conclusions of Chrisman (1999) and Latour (1987) that technicians play a critical role in the encoding of data, algorithms, and the operations in the black box. While the CCLRMP process team were intended to be apolitical, other technicians involved in the CIT, such as Jody Holmes (Forest Ethics) or David Byng (Western Forest Products), maintained strong commitments to a particular sector that ultimately pays them. Even the supposedly apolitical CCLRMP process team expressed viewpoints with regard to the appropriate role of conservation in the region, however these individuals' normative values were at times in contrast to the direction they receive as an employee.

From a critical GIS perspective, understanding the normative commitments of technicians is important due to their central role in the development and encoding of data (Schuurman 2004). Often environmental controversy results from mistrust in the way in which primary scientific research (in this case detailed habitat surveys) are combined with general data (such as regional habitat classifications) to inform provincial policy (in this case population estimates). This point was demonstrated in the development of grizzly bear population estimates, which remain highly controversial. Confirmation of the quality of the primary data, greater transparency in this process of extrapolation, clearer methods of validation, and a forum for independent scientific review (Meine 1996) can be understood as heightening trust in the process by which highly controversial grizzly bear habitat surveys and populations estimates are developed.

The technical analyst for Western Forest Products, David Byng, frequently offered presentations of the technical information. Byng observed:

> In terms of the science and the spatial data, there was a lot of debate about what the science was actually telling people. And I spent a lot of time at the table doing presentations trying to say, well we have one perspective, if you try to flip this around there is another perspective out there. The other thing was making sure that everyone understood the impacts if decisions were made based on just going with a preservationist kind of view or a precautionary approach. The presentations that I did were certainly geared towards, not necessarily a forestry perspective, but a pro development perspective.

What must be highlighted from a social constructivist perspective, and speaks to the power of technicians, is that while Byng's primary goal was to help explain the technical issues, his secondary motivations were to represent timber interests and resource extraction in general. It appeared that Byng commanded a great deal of respect from many of the other stakeholders at the table, particularly those who were interested in promoting resource development. In this way, his situated knowledge played a central role in his presentations and in the trust he achieved such that at a few meetings other stakeholders requested Byng to conduct parallel analysis using CIT data to ensure that the results were unbiased (CCLRMP Nov. 26-28, 2003). The ENGO coalition also had a leading technical analyst, Dr. Jody Holmes, who similarly commanded a great deal of respect from stakeholders with more of a conservation perspective. Unfortunately, she had been ill and did not attend the final meetings. Therefore it is impossible to draw any comparisons between these two key technicians. What is clear is that technicians from the two lead antagonists were influential, had strong normative commitments, and played key roles due to their ability to understand the details of the CIT data. Integration of multiple knowledge domains in planning and implementation will enhance opportunities for collaboration between technicians, decision-makers, and implementers (Selin 1995).

6.2.3 Integrating traditional knowledge

The third knowledge domain is traditional knowledge, or knowledge that is held by aboriginal communities. First Nation's traditional knowledge and their stated positions on land use planning clearly influenced the location of protected areas and operating areas. First Nations were also involved with developing EBM, particularly with regard to the EBM pilot project carried out with the Kitasoo and Gitga'at. However, traditional knowledge influenced the CIT far less than might have been anticipated given the centrality of First Nations to the region, both in population numbers and in the context of unresolved land claims. This is part due to the CIT not having access, expertise, or sufficient opportunity to integrate traditional knowledge. Information important to First Nations will be used to inform treaty negotiations, is highly sensitive, and is owned by clans or individuals. Furthermore, much of this information arises from worldviews or epistemic beliefs that may be impossible "to integrate with science" and require lengthy time and methodologies to develop (Allen 2004 p. 26).

Issues of epistemic authority remained controversial in the CCLRMP, particularly the integration of traditional knowledge with scientific information. Those First Nations that developed Land Use Plans exerted much influence on the land use map, though the rationale for the selection of areas was not explicitly stated. Further research would be needed to investigate if First Nations were guided by traditional knowledge or by different interpretations of the same scientific and technical information as the CCLRMP (e.g. data documenting timber harvesting landbase or ecologically sensitive watersheds). In other words, did the Kitasoo select a particular watershed within their territory based on traditional knowledge of the region or because the Kitasoo people evaluated available data on conservation and data on potential timber economic revenue and made a social decision based on the same information that was available to the CCLRMP? Or were First Nation land use plans guided by a combination of the above? Importantly, First Nation Land Use Plans were developed outside of the CCLRMP and the CIT and must be understood for the role that they play in the context of aboriginal title. For these reasons, the information behind the output maps, and in most cases, even the maps themselves are not publicly available. While warranting further research, and central to the outcomes, traditional knowledge remains proprietary and First Nations themselves must drive this kind of analysis.

6.2.4 Local knows best versus the expert knows all

The other type of information the CIT and all public planning processes are challenged to integrate effectively is local information, which is built on different epistemological foundations than scientific information. Local scientists fulfil multiple expectations because they can produce robust scientific methodologies and results that are situated within an established deep experience and local understanding of a region. A few locally based biologists who work for the province seem to fit this characterization, as do a few scientists living in the region who are heavily invested in environmental activism. Far harder to incorporate is the knowledge, information, and experiences of locals who are not also scientists or whose knowledge is not situated within the scientific method. Yet this knowledge is vital to the development of more sustainable planning and also better science (Clark 1998). Local knowledge is contextual to specific places and scales such that while impossible to extrapolate, it can validate or rebut generalization.

Mistrust of data often resulted from discrepancies between local and expert knowledge. One problem with information developed by both the CCLRMP process team and the CIT was that this information had to be developed at regional scales, while local citizens and experienced biologists in the areas scrutinize data at local scales since this is the level that the impacts of decisions are manifest (Interview #3). This is evident in an example of one stream, which was blocked to salmon by a small waterfall being given greater protection than an important salmon bearing stream. Local information could have been integrated into the regional analysis to correct this oversight.

However, if local knowledge were the dominant form of information, many remote areas would be overlooked or be swayed by whatever information might exist for these regions. Indeed, many central coast watersheds important to the conservation sector are so because they are rarely visited. As a result, little scientific or local knowledge is available about them. At the CCLRMP tables, frequently the individuals who knew the most about any watershed were individuals from the forest sector who were observing the meetings because they had hiked through or flown over the valleys while conducting timber analysis. It is in part for this reason that calls for more information and analyses were so common. Such calls reflect a desire to develop more and better bio-physical data about remote regions, as well as to improve data quality in locally known regions. As a result of this, Phase I of the CCLRMP invested much time, money, and resources in generating new studies, new models, and additional information. Phase II and the CIT continued this pattern. Much of this additional information does not appear to have influenced the arrival at consensus. This was evident in the protected areas overview. Many watersheds identified in early analysis (e.g. Moore's list) ended up being selected as top priority for protection while only a few new watersheds appear to be highlighted as a result of the CIT data. A few participants articulated that in the end political negotiations enabled the solutions, but the data had helped confirm people's understanding of an area and provide assurances that sustainability could be maintained.

In the case of the central coast, more effectively integrating local knowledge can provide opportunities for qualitative model verification, increase trust in the process of scientific knowledge generation, ensure that studies effectively address local needs and interests, and guide future scientific research. One of the CCLRMP representatives reiterated the importance of local knowledge and the limitations of science, particularly when the science uses GIS models that are insufficiently ground truthed (personal communication). This representative shared an anecdotal story of government biologists who visited the region with estimates of grizzly bears that were quite different than local knowledge. To convince the biologists, locals showed them locations of bear denning sites to confirm that areas marked as "low habitat value" on provincial analyses could support healthy populations of grizzlies. According to this source, as a result, the model was changed to integrate local experience. Unfortunately, the central coast's low population density, ruggedness, and remoteness preclude this kind of detailed information across the region.

There are many problems in developing and integrating local knowledge into decision making. This is particularly apparent in a region like the central coast where the population size is relatively small and global and regional values can easily dominate discussions. Tthe importance of balancing local with global values must be acknowledged, because a failure to reflect either may result in continued conflict, be it in the form of market campaigns, local challenges to implementation, or First Nation litigation.

6.3 Bridging the Gap Between Science and Policy

Environmental sustainability is fundamentally a question of reconciling diverse values and interests that expert-driven processes, based on science alone, can neither adequately identify, nor reflect. Although we believe that science is a crucial input into the management process, it must ultimately be integrated with the values of stakeholders if the process is to be successful in moving towards a more sustainable society. In effect, science is merely one critical component in a complex, rapidly-evolving decision system (Day, Gunton et al. 2003 p. 34)

In the quest for social, economic, and ecological sustainability in the region conceptualized as the great bear rainforest, science played a pivotal role. Yet science alone was never intended to, nor would it be able to resolve what were value-based conflicts over *how* to achieve sustainability. Despite the establishment of the CIT, problems with effectively bridging the science-policy gap continued to challenge the CCLRMP and CIT. Chapter 5 demonstrated some of the ways in which risk, uncertainty, model inadequacy, and ecological systems analysis can challenge the effective flow of information from scientists and technicians to policy makers. As one interviewee stated, "in terms of the science and the spatial data, there was a lot of debate about what the science was actually telling people" (Interview #2).

The CIT's engagement with risk and uncertainty, a more dynamic human-nature relationship that underlies EBM, and a multi-disciplinary adaptive framework attempted to develop information that was more relevant to stakeholders' interests and positions. As such, many interests, values, and concerns of various stakeholders could be addressed in the *process* of information generation and not merely in the final political negotiations. Such opportunities enhance communication and collaboration at the level of information development and research, but also should have served to improve the flow of information to the political decision making.

Much conservation theory is challenged with developing applied tools that can assist decision-makers (Possingham 1997 & 2001). The institutional mechanism of the CIT needed to better address the issue of how emergent information should inform the LRMP tables and how the CIT would work with the planning table. For example, numerous interviewees suggested that there needed to be a clearer relationship between the CIT and the CCLRMP. A few interviewees suggested that the CIT should have worked on hypotheses that were developed by the round table instead of generating their own research projects (Interview #2; Interview #3). The CIT technical team began conducting analyses and presenting information before stakeholders had been given the opportunity to define their issues and develop questions their sector needed addressed (Interview #2). Another interviewee confirmed this recommendation:

> I would bring people together first and then decide what data (was) needed. Include the input and information from local and First Nation groups and develop the data to their needs. This would be hugely costly, but would be worth it in the end (Interview #3).

One interview even suggested that this approach may actually have required less time and resources if the CCLRMP was adjourned while the CIT completed work (Interview #5). It must be pointed out that while there was a great sense of urgency to achieve the CCLRMP recommendations by the end of 2003 and begin First Nation to government negotiations, the plan's legislation was put on hold until after the May 2005 provincial elections. No movement towards legislation is evident as of July, 2005.

The complexity and accessibility of much of the CIT data were further barriers to the effective use of CIT data at the strategic planning level. Much of the spatial information developed by the CIT will likely be used for more detailed planning. "It was more or less ignored at the strategic level" (Interview #3). Data and CIT recommendations related to EBM guidelines (e.g. issues of rates of natural variability and seral stages) and reserve design are among the few areas where CIT data was used. Spatially explicit data were not well understood, though one technician who was interviewed considered it to be "awesome stuff".

Persistent problem remained regarding this complexity and better methods for presenting information to planning processes at the right level of complexity need to be developed (Interview #3).

There are methodological challenges in generating clear ecological data and then utilizing model outcomes in decision making. This is a location where technologies such as GIS can be used more effectively to present and demonstrate information. Numerous CIT analyses drew upon decision-support technologies (such as the ecosystem spatial analyses) and the flexibility that was envisioned by these tools could have been far more effectively used by the CCLRMP, had there been more time (Interview # 7). GIS could have been explicitly used as well to build capacity and collaboration (Kyem 2004). In the case of the CCLRMP, potential communication enhancing technologies were not actively used. The decision making meetings were noticeable 'low tech', much to the surprise of the researcher. Some maps were projected in presentations given to the table by CIT researchers and scientists, though it is questionable how effectively the information was communicated. From a critical GIS perspective, little attention was directed towards improving confidence in revealing the interior spaces of the black box and exploring the ways in which data and analyses were constructed. Further engagements with the way maps are power (McKendry 2000) and the power of mapmakers and technicians (Irwin 1995, Chrisman 1999) would have potentially helped in understanding the nature of adversarial science.

Concerns voiced regarding the interior operations of the black box, though never termed in this language, appear the strongest in the context of risk and uncertainty. The CIT articulated risk and uncertainty in a fashion that was intended to assist decision-makers in making informed tradeoffs between social values. From this view, scientific uncertainty and different normative approaches to conservation were documented and political decisions related to the appropriate trade-offs of ecological and socio-economic risks could be isolated. If there is clear causality or scientific direction, it is far easier for political decisions to incorporate scientific evidence when developing policy. When such clear causes or outcomes are impossible to quantify, decisions are frequently presented in the language of risk and uncertainty. Chuck Rumsey, scientist on the CIT, offers his advice on scientific uncertainty and how it should be addressed:

> Uncertainty raises another important point concerning the role of science in decision making - namely, that science alone cannot make the decisions for us, and decisions about acceptable ecological risk must be held in balance with the economic and societal uncertainties faced by communities (Rumsey 2003 p. A 11).

Though the CIT was intended to tackle issues such as uncertainty, objectivity, and transparency, nearly all participants in this research believed the CIT had failed to achieve these goals. Interview #3 continues:

> When people brought uncertainty up it was acknowledged, but never really investigated. As areas of poor data were revealed this led to questions about the data itself. People weren't up front and transparent about uncertainty, especially when much of the data was being used for reasons that it was not generated for without appropriately qualifying it.

6.4 Conclusions

Participatory structures for decision making, such as employed in B.C.'s LRMP planning process, conflict with a science-based approach in that stakeholders are supposed to make decisions based on information, but not be dictated by this information. The two leading antagonists in the CCLRMP, timber and conservation, used science to influence recommendations. As such, power redistribution, a new science-policy relationship, and improved capacity for inclusion of what has been termed 'alternative knowledge domains' was limited by the continued focus on science-based solutions. This radical change from conflict to collaboration did not occur because the conservation community convinced the timber company in a rational way that the science of conservation justified their assertions. On the contrary, it was through the market place that timber companies were motivated to revisit certain positions. Certainly, scientific analyses, spatial modelling, re-mapping and an international ethos of conservation may have influenced the understanding of consumers and retailers. However, science did not directly convince timber companies to seek a different approach; more it was economic pressure from the market campaigns coupled with scientific assertions that more sustainable silviculture was possible. Interestingly, it was within scientific analyses, spatial modelling, and maps that these two groups hashed out their different values in an attempt to collaboratively develop management strategies that effectively met their respective interests.

Bruno Latour argues that the "ecology movements have sought to position themselves on the political chessboard without redrawing its squares, without redefining the rules of the game and without redesigning the pawns" (2004 p. 4). In the central coast of British Columbia, however, the collaborative framework for deciding land use issues has fundamentally reconfigured the chess rules, the board, and the relative strength of weaker players such that certain stakeholders have achieved considerably more power than others. Science and information remain influential in environmental planning process, so evolution in the methods for the development of this information plays a role in shifting power. A key moment in this shift in power was the remapping of the coast as presented in the Conservation Area Design. This influenced the base map upon which decisions were made. Previously, negotiations were around a map highlighting high value timber, but later the emphasis shifted to which areas had high conservation value (Interview # 7).

There is great uncertainty regarding what final legislation based on the CCLRMP stakeholder recommendations will look like. Nonetheless, it is evident that power structures in the central coast were changed, perhaps most notably in remapping (Clapp 2004). The environmental coalition has solidified its seat at the negotiation table. First Nations have benefited from this power restructure in part due to a coalition between environmentalists and some First Nations, but more importantly, from changing values and a series of landmark decisions asserting aboriginal title and the province's duty to consult. This is demonstrated in the CCLRMP land use planning map and the government-to-government negotiations that will lead to co-management of many watersheds and a new model of engagement with First Nations.

The CIT's dual mandate is not often acknowledged. The CIT was presented as developing independent information, but one of the CIT's original intents was as a conflict resolution strategy to neutralize adversarial science (Interview # 5). The CIT was effective at this because it transferred the conflict over science out of the CCLRMP and into a separate institutional arrangement where scientists could engage in constructive dialogue over difficult questions related EBM, while simultaneously building capacity and collaboration (Interview #3). To cultivate a constructive dialogue, the science cannot be "a political hot potato" (Interview # 9). The CIT also directed attention towards power relations and which groups maintained influence over the methods by which science and information is socially constructed. While the CIT was critical to addressing key concerns of the key players in the central coast, notably the timber sector and the ENGOs, the funding and management committee structure of the CIT ensured that all interests would be represented. In this way, the CIT built social capital among numerous sectors and interests.

Perception that the CIT funders maintained power in the process compared to those not funding the CIT undermines the importance of better understanding the process by which scientific information is constructed. Slightly more time, process flexibility, and resources would have enabled considerable gains in trust and usefulness of the CIT outcomes. Some of the problems of peer review could have been prevented, had the government been more flexible in extending deadlines. Completion of and inclusion of the social and economic analyses would have likely improved trust in the CIT guides and analyses. Many of these issues could clearly be more effectively addressed in future information teams, such as the one proposed to guide the EBM.

With regard to goals of achieving objectivity and independence, the CIT could have also benefited from a more explicit theoretical foundation in philosophy of science and constructivist critiques and development of an institutional framework that more explicitly responded to such critiques. This point is clearly stated in a set of recommendations developed by Allen (2004) to better address and allocate for the development of independence required of the panel. Allen suggests that there needs to 1) be both a management committee and an independent and multi-disciplinary team[xc], 2) develop research methods and validation procedures that are appropriate for all four knowledge domains, and 3) emphasise social values and the way they influence the social construction of science and information. Following Allen's recommendations would necessitate a stronger engagement with questions relating to the epistemic status of science and information from other knowledge communities. It would also require reframing the binary that holds dependence and independence as opposites and to recognize the degree to which all information, including scientific, is socially situated.

The CCLRMP and the CIT made improvements in addressing power imbalances. However, significant power imbalances and technical capacity varied among stakeholder groups, notably in the context of paid participants versus volunteers (Interview # 7). The collaborative structure of the LRMP process gives veto power to any constituent as long as a consensus recommendation is mandated. In the case of the CCLRMP, this resulted in collaborations between sectors who were 'deadlocked' in attempts to arrive at compromise solutions such as achieved in JSP and between the timber coalition and tourism. Nonetheless, while tripartite funding did shift the relative balance of power, funders still maintained disproportionate power (Interview #3). Persistent power imbalances, argued one interviewee (# 7), meant that the concept of collaborative planning was less effective than well facilitated bilateral negotiations.

Better understanding how environmental conflict interacts with adversarial science would have helped in the generation of a more effective independent science review because it would have increased trust in the development of information. While the CIT and the larger process of the CCLRMP did attempt to address many of these issues, as reflected in Table 2, the effectiveness of the CIT at transforming conflict was reduced because these issues were not effectively engaged. For independent scientific review to help resolve conflict in situations influenced by adversarial science, it must directly engage the root causes of the contestation of information. This entails more than just the development of improved science, but also a critical engagement with reasons why previous scientific information has failed to provide easy solutions. This was demonstrated In the case of the grizzly bear habitat assessment, where conflict continued over the process by which the data was developed, extrapolated to produce grizzly bear population estimates, and then used to inform policy. The development of an independent information team, increased transparency, and clear guidelines for how estimates were generated and informed policy was necessary not only to appease local constituents, but also to appeal to international bodies such as the Convention on the International Trade of Endangered Species (CITES) regarding the grizzly bear hunt. In the other case, reserve network design, the iterative process of developing additional assessments of protected area strategy ultimately resulted in a confirmation of some of the earliest analyses. Yet, each new assessment increased trust in the ways in which watersheds were prioritised and what would be the social and economic implications of taking these areas out of the land base.

A few policy recommendations can be developed from the example of the CCLRMP and the institution of the CIT. The development of a science or multi-disciplinary information team needs to have clearly defined mandates, a process for ensuring that intended products will effectively address information needs of decision makers, and mechanisms for clearly disseminating this information to the decision making body. This communication of information from experts to decision makers may be met by the establishment of position (or positions) at the table whose responsibility it is to bridge the complexity of various analyses and recommendations to the information needs of the decision-makers. This person must be recognized as being legitimate and non-partisan. This may entail the presentation of information at appropriate levels of complexity such that uncertainty, risk, and detail is addressed but not at a level that is not useful for strategic planning. Information technologies should be used where necessary to heighten communication, such as those developed to perform on site calculations, develop iterations of maps, perform overlay, and conduct other visual / statistical tools. Part of ensuring an appropriate flow of information from the scientific experts to the decision makers is setting realistic objectives and deadlines. The best science or policy recommendations will mean little if they are just shy of being complete. In a related vein, developing methods for assessing the legitimacy of analyses and reports for multiple knowledge domains is paramount. For scientific research this may be peer review, but this may be an inappropriate strategy for local or traditional knowledge.

Table 13: Did the CIT address the social construction of scientific knowledge?

	YES	NO
Funding	• Tripartite funding Between ENGOs, Timber, and government.	• Power remained with funders.
Objectivity	• Rigorous credentials governing membership. • Peer review was built into the system. • Clear statements of 'dependence'.	• Peer reviews incomplete prior to decisions. • Ongoing perception of bias.
Equity in information	• Broad set of tools and analyses developed, with emphasis on under studied issues.	• Many qualitative socio-economic analyses were never completed.
Authority	• Ultimate decisions did not rely solely on the CIT recommendations, but involved political and social choice.	• Few local and provincial experts. • CIT outcomes continued to drive negotiations. • Big decisions postponed until CIT outputs ready.
Epistemology	• Traditional and local knowledge were utilized in decision making. • First Nation had strong representation on management committees in Phase II.	• Scientific information remained central; local and traditional information were poorly integrated • Perception remained that international interests, values, and worldviews drove information generation.
Power	• Progressive participatory process. • Power sharing of management team. • Broad representation of all interests in CIT management and committees.	• Interests of JSP dominated decision making • Management team determined prioritization of projects as opposed to the CCLRMP having more input.
Independence	• Adequate sector and multi-disciplinary representation.	• Perception conservation interests biased the one CIT analyses, the Ecological Spatial Analysis.
Critical STS	• The CIT engaged many constructivist critiques as a way of achieving collaboration on the development of science and information.	• Few formal institutional structures addressed the constructivist critiques of science. • Unclear process for how the CIT informed CCLRMP.

Achieving, and maintaining legitimacy can be cultivated by emphasizing mechanisms for building social capital and trust. Thus, when it comes to interpreting the results from scientific information and the way that research is unavoidably biased, there is a foundation of trust between sectors. Enhancing opportunities for communication can be built into the structure of the negotiations. Part of this trust may be gained by providing more explicit theoretical foundations for how science and information are socially constructed and how an information team has attempted to develop more transparent and exclusionary methods for addressing them. Ensure that there are legitimate ways in which local, traditional, and expert knowledge can be incorporated into spatial data sets and analyses specifically and information development generally. Incorporation of local knowledge is particularly important in regions where adequate ground truthing has not occurred. This will ensure that obvious errors have been addressed, and will heighten trust in the data. Importantly, having a strong path for developing adaptive management may help develop trust in a decision because all parties will recognize opportunities to refine, revisit, and learn from specific policies.

Table 14: Recommendations for better development of and use information

- Clearly state mandates and intended products of any information team
- Have clear, broadly accepted criteria for participation
- Have a scientific expert or panel of experts available at all meetings
- Ensure that reports, units of analysis, outcome products will support more detailed planning objectives
- Appropriately balance complexity with simplicity
- Emphasize the process of building social capital and opportunities to create 'safe solution spaces'
- Develop clear mechanisms for integration of local, traditional, technical, and scientific knowledge
- Incorporate appropriate technology into the collaborative decision making process
- Ensure that outstanding aboriginal title is addressed or that there are clearly defined guidelines for including First Nation direction.
- Support adaptive planning and management
- Utilize best technology to ensure that analyses can support temporally and spatially dynamic modelling

In sum, the path to consensus land use recommendations in the central coast has been a long and convoluted one. The consensus recommendations required over seven years of planning, the development of an ecosystem based management framework, the funding and work of an independent information team, two phases of planning, expert mediation, countless hours of commitment from participants, leadership, political negotiations, and compromise. Adversarial science played a central role in many of the controversial elements of the solution and in the ultimate consensus proposals, for EBM and the land use planning map. However, it remains unclear if any of this work will change forest practices and management on the ground as the current provincial government has delayed implementation of EBM or legislating any of the new protected or biodiversity areas. This has frustrated many involved in the process since, as the environmental coalition indicates:

> First Nations and all stakeholders have worked hard to meet the government imposed deadlines of Spring 2005. All parties were expecting a government decision on this package prior to the provincial election. But at the last moment, government declined to make the decision, thus raising uncertainty about the future of this region and continuing the lack of formal legislated decisions for change (Save the Great Bear 2005 p. 2).

This activist piece, continues, suggesting that "Internationally, B.C.'s reputation is at stake" and that continued stalling tactics will affect B.C.'s markets, from tourism to forestry. The criticise the government for failing to accept what are solutions handed to the government "on a silver platter: and that failure to implement may result in dissipation of the $180 million in investment for socially and ecologically responsible business, heightened conflict in the future, and jeopardize sustainability in the region (Save the Great Bear 2005 p. 2).

The situation may come to a point where the stakeholders who have developed this tenuous solution, one that balances social, ecological, and economic values sufficiently to reach consensus, will pressure the government to implement. Numerous ENGO documents and a few academic papers have criticised the size and location of protected areas and the failure to legislate and lack of on the ground silviculture change consistent with commitments made by timber companies to phase in EBM (Wells, Bunnell et al. 2003; Moola, Martin et al. 2004). Indeed, several environmental groups escalated their campaigns to bring the great bear rainforest into centre stage as issue in the 2005 election. For the time being, stakeholders, scientists, technicians, local residents, and First Nations all are waiting to see whether their hard work and collaboration will influence practices. Only if the plan is legislated and implemented can the real work begin to investigate if the CCLRMP stakeholder recommendations will achieve sustainability and community wellbeing.

APPENDICES

Appendix 1: CCLRMP Phase II Meeting Schedule

• December 6, 2001	• Port Hardy, B.C.
• February, 21, 2002	• Port Hardy, B.C.
• May 2, 2002	• Bella Coola, B.C.
• July 18-19, 2003	• Rivers Inlet, B.C.
• October 23-24, 2002	• Port Hardy, B.C.
• December 5, 2002	• Port Hardy, B.C.
• March 5th, 2003	• Port Hardy, B.C.
• May 29th, 2003	• Bella Coola, B.C.
• July 22-24, 2003	• UBC, Vancouver, B.C.
• September 10-12, 2003	• Bella Coola, B.C.
• September 10-12, 2003	• Richmond, B.C.
• October 8-9, 2003	• Nanaimo, B.C.
• October 28-30, 2003	• Nanaimo, B.C.
• November 12-14, 2003	• Richmond, B.C.
• November 26-28, 2003	• Nanaimo, B.C.
• December 8-9, 2003	• Nanaimo, B.C.

Appendix 2: Interview Schedule

Interviewee # 1	June 14th 2004	Interviewee # 6	September 10^{th}, 2004
Interviewee # 2	July 16th 2004	Interviewee # 7	September 22, 2004
Interviewee # 3	July 9th 2004	Interviewee # 8	June 16^{th}, 2004
Interviewee # 4	June 15th 2004.	Interviewee # 9	July 30th, 2004
Interviewee # 5	September 24th, 2004	Interviewee # 10	September 10^{th}, 2004

Appendix 3: Sector Representatives and Alternates

Sector	Representative	Alternate
• Energy and Mining	• Brian Welchman	• Dan Jepson
• Federal Government	• Midori Nicholson	•
• Heiltsuk Tribal Council	• Dean Wilson	• Chief Ross Wilson
• KDC / MTTC / TN	• Merv Child	•
• Labour	• Darol Smith	• Bob Freer
• Kwakuitl District Council	• Chief Tom Nelson	•
• Major Forest Companies	• Hans Granader	• Gerry Fraser
• North Local Communities	• Partricia McKim	• Phil Parr
• Nuxalk Nation	• Mark Moody	• Chief Anfinn Siwallace
• Oweekeno Nation	• Chief Alex Chartrand	• Clifford Hanuse
• Provincial Government	• Wally Eamer	•
• Recreation	• Ray Pilman	• Gary Ullstrom
• Recreation / Wildlife	• Tim Walters	•
• Small Business Forestry	• Lloyd Juhala	• Don Bendickson
• South Local Communities	• Larry Pepper	• Gerry Furney
• Terrestrial Conservation	• Dennis Crockford	• Amanda Carr
• Tourism	• Ric Careless	• Jeniffer Case

Appendix 4: Reports Produced for Phase I of the CCLRMP

• CCLRMP Phase 1 "Framework agreement" socio economic environmental assessment: Final report (Holman and Eliot 2001). This report was a multiple accounts assessment designed to "provide government with an impartial assessment of the implications and trade-offs likely to occur with implementation of the Framework Agreement.
• CCLRMP Socio-economic and environmental analysis maps (July 2001).
• Mid Coast Tourism Opportunities Study (July 2001).
• McKim Report – Northern Plan Area Economic Opportunities and Barriers Study (2000). This analysis investigated community economic development and resource employment dependency for the central coast.
• Pojar Report – Silvliculture Options in the Central Coast (December 1999). This report assessed the ecological suitability, sustainability, practicality, utility, and applicability of various silviculture systems in the central coast.
• Mt. Waddington Tourism Opportunities Study (Dec. 1997). This region was removed from the CCLRMP. Later Tourism Study reports were conducted for the Mid Coast (2001) and the Southern regions of the CCLRMP (2000).
The Central Coast Protected Area Strategy Report (Lewis 1997).

Appendix 5: Analyses Produced by the CIT for Phase II of the CCLRMP

Guide	Description	Developers
EBM framework	This guide defines EBM, states principles used to guide EBM, defines goals and objectives of EBM, and outlines key elements of EBM Planning and implementation. Drew upon practical applications of EBM at different scales (e.g. Gitga'at and Kitasoo/Xaixais pilot projects)	Prepared by a group of experts on terrestrial ecosystems, marine ecosystems, human systems, and adaptive management.
EBM planning handbook	Describes key concepts of conservation planning, socio-economic planning, and their integration, including management direction, risk management, human vulnerability mapping, monitoring, knowledge and information management, and collaboration. Sets out an EBM planning framework, covering planning scales, planning across scales, planning functions, and adaptive co-management.	Prepared by a team of experts on conservation planning, resource planning, and socio-economic planning.
Hydro-riparian planning guide	The guide supplements the *EBM Planning Handbook* by providing more detailed advice on how to maintain the functions of aquatic and riparian ecosystems, especially at the watershed level.	Prepared by a team of hydrologists, ecologists, and practitioners.
Scientific basis of EBM	This guide lays out the rationale behind ecosystem management in the CIT regions, emphasising three sets of concepts: 1) management at different scales, course and fine filter approaches, ecosystem representation, rare ecosystems, rare and focal species, and introduced species; 2) reserve and protected areas, benchmarks, range of natural variability and natural disturbance, and landscape pattern in order to guide decisions related to the amount, pattern, and location of reserves; 3) risk assessment, precautionary principle, and adaptive management; all essential tools for dealing with scientific uncertainty.	Prepared by a team of ecologists and other ecosystem scientists, and working closely with the EBM Planning Handbook and Hydroriparian Planning Guide teams.
Well-being assessment	Measures current environmental and human conditions in each of the eight subregions of north and central coast B.C. to provide a context for decision making, a test of options and scenarios, and a baseline for monitoring implementation of plans and progress toward EBM and sustainability. Shows whether ecological integrity is being maintained, the level of human wellbeing, the distance to sustainability, and the main strengths and weaknesses of each subregion. Ecosystem integrity is measured via indicators of land, water, air, and species and genes. Human wellbeing is measured via indicators of population and health, wealth, knowledge and culture, community, and equity.	Prepared by a small team led by a sustainability assessment expert. CCLRMP participants contributed to the choice of goals, objectives, components to be measured, indicators, and performance criteria.
Cultural spatial analysis	This analysis identifies important places for sustaining the cultural values of First Nations and other communities, including sustenance, heritage, spiritual, and recreational values. Analyzes densities of valued places, comparing their occurrence with protected areas and with areas with high timber value. Assesses rarity/abundance, threats, and condition of cultural features valued by other communities. Many First Nations chose not to participate in this assessment and as a result, lack of information prevented an equivalent assessment of First Nations sites. Major gaps in coverage of traditional territories make it likely that many places important to First Nations have not been recorded.	Prepared by a sociologist and anthropologist from data provided by First Nations or, in the case of other communities, gathered by individuals or small teams.

Economic gain spatial analysis	This analysis reports on timber and tourism and identifies areas with the highest potential for timber harvesting and tourism respectively, estimating the potential economic gain in terms of direct employment within and outside the region (jobs, full-time equivalents per year, and annual employment income), revenue to the Crown, and profit to enterprises (total revenues minus expenses). Working papers on nontimber forest products, fisheries and aquaculture, and minerals provide less detailed overviews of the potential for economic gain from those sectors.	Prepared by small teams led by an economist specializing in the sector concerned.
Ecosystem spatial analysis	This analysis identifies priority areas for biodiversity conservation and provides an information base and decision support for subsequent planning and management efforts designed to: (a) represent ecosystems across a range of environmental gradients; (b) maintain viable populations of native species; (c) sustain ecological and evolutionary processes within the natural range of variability; (d) build a conservation network that is resilient to environmental change.	Prepared by a team of conservation biologists and specialists in land, freshwater, and marine species and ecosystems.
Central coast coarse filter ecosystem trends risk assessment - Base case	This analysis uses the abundance and extent of old forest (older than 250 years), by ecosystem type, to indicate the probability of maintaining coarse filter biodiversity, ecosystem function, and ultimately ecological integrity in the Central Coast. Estimates the highest and lowest likely natural percentages of old forest in each ecosystem type based on estimates of stand-replacing natural disturbance rates. Compares the likely natural percentages with projected percentages of old forest based on forest harvesting trends to assess the risk of degradation and biodiversity loss in each ecosystem type.	Prepared by experts on ecosystem risk assessment.
Policy and institutional analysis	Identifies the main features of EBM that require institutional support. Discusses the design of institutions, institutional constraints and opportunities, and the design of policy instruments, drawing lessons from three case studies. Examines policy and institutional issues relating to aboriginal title and rights, adaptive co management, and local benefits from land use and resource extraction. Analyzes institutional opportunities and gaps with respect to five resource regimes: land use planning; forest resources and management; mineral resources; tourism and recreation; fisheries and fish habitat.	Prepared by a team of specialists in analysis and design of policies and institutions.

Appendix 6: Timeline of the Central Coast LRMP.

Date	Joint Solutions Project: RSP Environmentalists	Joint Solutions Project: CFCI Timber Companies	First Nation	Government	Economy
1992-1993	• Clayoquot Sound protests	• Proposal by Macmillan Bloedel to clearcut Clayoquot Sound	• BC Treaty Commission established	• CCLRMP Protected Areas Strategy released	• Global awareness about logging Canada's ancient temperate rainforests spreads
1994	• ENGOs focus on international markets to influence timber operations in Clayoquot sound	•	• Collaboration between Nuxalk FN and ENGO's • Section 35 of the Constitution affirms aboriginal self-government	•	• MacBlo customers cancel contracts due to Clayoquot
1995	•	• Forest Practices Code established, which protects some non-timber values	• *B.C. Treaty Commission Act*, joint act established	• Clayoquot Scientific Panel findings endorsed • Grizzly bear conservation strategy	•
1996	•	•	• Crown v. Van der Peet (Nisgaa Treatry) which resulted in a transfer of title from the Crown to a FN	• The LRMP process developed to complete provincial Land Use Planning begun under CORE	• Decline in global commodity prices reduces profits in timber industry
1997	• ENGOs denounce the Central Coast planning table as a "talk and log" process • ForestEthics, Greenpeace, Rainforest Action Network, & the Sierra Club launch the GBR campaign.	• Clayoquot controversy shifts from conflict to cooperation as Macmillan Blodel works with ENGOs & FN	• Delgamuukw v. British Columbia which confirmed FN title and obligation to compensate • 21-day blockade of Interfor logging site & 24 people arrested in protest by Greenpeace and the Nuxalk Nation	• CCLRMP initiated	• GBR campaign targets the trade & investment of the logging companies in the GBR • Customers in European countries condemn GBR logging & exert pressure
1998	• Beginning of talks that develop into JSP • Continuation of GBR market campaigns	• Macmillan Bloedel commits to phase out clear cutting	• Co-management of forest operations in Clayoquot Sound • Canada, BC,and FNs enter into a review of the treaty process	•	• Broad cancellation of contracts with the coastal logging companies
1999	JSP talks discuss temporary moratorium on logging in large, intact valleys in exchange for suspension of GBR markets campaigns		• Macmillan Bloedel support idea of swapping forest tenure for treaties	•	• Further cancellation of contracts. E.g. Home Depot
2000	• May: 'Peace Agreement' achieved in JSP resulting in moratoria on logging and suspension of markets campaigns • June: In response, RSP re-launch markets campaign targeting Interfor and West Fraser • July: JSP officially established and all parties commit to EBM	• June: Interfor and West Fraser leave the negotiations	• March: 8 coastal FNs endorse the principles of EBM • May: Nisga'a Final Agreement. The first modern Land Claims treaty	• Following the JSP negotiations, the CCLRMP, which had been stalled, resumes with all participants at the table	• Market campaigns suspended against participating CFCI companies. • Mitigation strategy

	• Fall: Canadian Forest Products and Norske Skog join JSP			
2001	• March: Interfor and West Fraser defer logging and rejoins JSP • JSP negotiated solution developed. Key aeras include: new protected areas, logging moratoria, an EBM framework for all future planning, funds for economic transition and the mitigation of impacts on workers and communities, and the establishment of the CIT	• Hadia case confirmed FN rights and government's duty to consult • April: The Turning Point Agreement signed • May: FNs on the B.C. coast engaging RSP to seek new economic opportunities	• Feb: NDP announces 3-year ban on grizzly bear hunting • March: CCLRMP consensus agreement & NDP endorsement • Nov. Liberals endorse the 2001 Agreement & commit to Phase II • Liberals lift ban on hunting • Dec. CCLRMP reconvenes	• Softwood lumber disputes resume • Nov: EU scientific review group bans grizzly bear hunt imports
2002	• Jan. CIT initiates work: developing options to help inform EBM and economic alternatives for the Central, North coast, and QCI LRMPS	• Haida case established third parties duty to consult • Direct award policy for FN for forest tenures initiated under Bill 41 • Operational trials for EBM initiated on Gitga'at and Kitassoo lands	• Talks between the BC government and FNs on economic measures and FNs land use planning • Nov: Forest Range and Practices Act passed establishing results based regulation	• Nov. Staples phases out paper purchases from GBR • $35-million sustainability trust est. • Conservation financing (CIII) proposed • Apr. International grizzly bear hunting ban reversed
2003	• Intense negotiations in JSP result in the negotiated solution, which is accepted by the CLLRMP and serves as the basis for the LRMP recommendations to government	• Concerns that the Forest Revitalization Plan will infringe upon aboriginal title and rights • Talks over Nuxalk and Bella Coola Community Forest	• March: International science panel confirms the BC grizzly hunt sustainable • June. OIC moratoriums on logging extended until 06/04 • Dec. CCLRMP reaches consensus	• March: Forest Revitalization Plan includes reallocation of tenure to be redistributed among First Nations, Woodlots & Community Forests
2004	• ENGOs outside of the JSP criticize the 2003 solution. • Threats of a new market campaign if process collapses • March: Timber companies begin voluntary implementation of the interim measures on cutting and ecosystem representation • Commitment between CFCI and ENGOs to the consensus agreement and interim measures of EBM	• June: FNs enter into government-to-government negotiations with the Provincial Government in the Central and North Coast	• Government negotiates only on the protected area network not on EBM until the economic analyses for EBM are complete	• .
2005	• ENGOs intensify criticism of government's failure to legislate & results of voluntary implementation of EBM • Threats of a new market campaign if process collapses • Timber companies continue their voluntary implementation of EBM •	• Government-to-government negotiations completed and submitted to cabinet	• May: Provincial election. The issue of the GBR is postponed until after the election	•

Appendix 7: Evolution of the Protected Areas Strategy in the Central Coast

	1991 Moore (M-Modified) (P-Pristine)	1992 Protected Area Strategy	1997 Protected Area Strategy [1]	1999 Conservation Area Design	2001 Agreement (CPA – Candidate Protection Area)	FN LUP[2] (When Available)	2003 Agreement
Ahnuhati Complex	Ahnuhati, Kwalate & Ahta – M	Yes - # 1 priority (19,537)	Yes	High GB / core intact	CPA		Core Southern GBMA
Ape Lake		Yes (276,028)[3]	Deleted	Low value	CPA (20,965)		
Ashlu-Reeve / Upper Inziana				Core GB	Option (21,109)		Modified (16,993 ha)
Bald Peak/ Knight Inlet				Low value			Biodiversity Area
Bond Sound				Low value	Option (2,059)		Deleted (Visuals?)
Broughton Extension		Yes [4] (4,384)	Yes Highly Significant	Low value	CPA (4,281)		
Cape Caution			Area of interest	Low value	CPA (10,567)		
Cascade – Sutslem Inlet	Skowquiltz– P Sutslem – M Nascal – M	Yes (138,888)	Deleted	1/3 Core GB / 2/3 core intact	Option 136,333 ha		Modified Biodiversity Area 126,500 ha
Catto Creek				Core GB	CPA (6,678)		
Chapple Cornwall				Core intact	CPA (22,854?)		
Chic Chic / Calvert	Chic-Chic - P			Core intact			Biodiversity Area (18,700)
Chuckwalla – Kibella				Low value			Biodiversity Area (72,000)
Clayton Falls				Low value	CPA 4,929		
Coast Mountains		Yes 7,831	Deleted	Low value			
Crag Creek / Tweedmuir				Low value			Biodiversity Area (24,500)
Deer Lake				Core intact	Option	Gitga'at:	West – Biodiversity

[1] The 1997 revised list was mandated to reduce the amount of official study areas from 22% to 7% in order to comply with the 18% protection cap for the Central Coast.
[2] The Kitasoo is the only First Nation land use plan that is publicly available. Information for the other First Nations was obtained from discussions that were held at the CCLRMP meetings.
[3] Included Monarch Glacier
[4] Originally with Cormorant Channel

					6157 ha	W–prot.; E- EBM	East – Deleted
Don Peninsula				Core GB			Biodiversity Area (6,000)
Elizabeth Lake				Core Intact	Option (6920)	Oweekeno – EBM	Biodiversity Area (6,920)
Green Sheep Passage	Green Lagoon-P Carter Lake–P Swanson Bay-M			2/3 Core GB 1/3 core intact	Option (50,741)	Kitasoo – EBM	Deleted GBMA?
Helmken				Low value	Option (5,264)	Kitasoo – EBM	Biodiversity Area
Hotsprings	Hotsprings - P		Area of interest	Core intact	X (22,714)		
Ickna				Core intact	Option (15,035)		Biodiversity Area
Jump Across	Swallup – P Jump Across- M			Core intact	Option (55,481)		Modified Biodiversity (50,500)
Kalone Peak/ Dean River		Yes (127,739)	Deleted	Low Value	CPA (5,070)		
Khutze	Khutze - M			Core GB	CPA	Kitasoo – Protected Area	Core GBMA
King Island				2/3 Core intact			Biodiversity Area (40,500)
Kitasoo				NE ½ core intact	CPA (90,402)	Kitasoo – Protected Area[5]	
Klekane Aaltannash	Klekane – P Aaltannash – M			Core intact E ½ core GB	Option (40,072)	Kitasoo – EBM Gitga'at – Protected	Deleted
KlinaKlini / Mt. Waddington	N. KlinaKlini – P	Yes[6] (397,930)	Deleted	Core GB	CPA (39,087)		
Koeye	Koeye – M	Yes 17,902 ha	High priority	Core GB	CPA (18,342)		
Kwatse Bay				Low value	Option (3,057)		Deleted
Lockart Gordon	Lockart – P		Area of interest	Core GB	CPA (33,621)		
Neekas				Core Intact	Option (1,562)		Biodiversity Area
Piper-Sandel / Neekite	Sandel – P Dallery – M		Area of interest	Piper-core GB Piper - intact Neekite- low	Option (77,991)	Oweekeno – EBM (except Dallery Creek as protected)	Modified Biodiversity (36,000)[7]
Pooley Island				Core Intact	CPA (6,587)	Kitasoo – EBM	

5 Indicated in the Kitasoo LUP as Canoona and Laredo Inlet Protected areas.
6 The Upper Klinaklini was originally associated with the Mt. Waddington Study area with a total size of 397, 390ha.
7 Reduced due to the removal of the Sandell

Price / Swindle				N. 2/3 Core intact	CPA (14,008)	Kitasoo – Protected area	
Racey Inlet				Low value	CPA (6,228)		
Roscoe	Ellerslie Lake - P			2/3 core GB	Option (25,690)		Biodiversity Area
Surf / Archie Lake	Archie Lake – P			Archie - Core intact	Option (32,298)	Kitasoo – EBM	Biodiversity Area (11,500)
Smokehouse	Smokehouse– P		Area of interest	Core GB	CPA (37,769)		
Tcal River							Biodiversity Area (15,000)
Takoosh	Takoosh – M			Core GB			Biodiversity Area (5,700)
Tolmie				Core intact	Option (22,506)	Kitasoo – EBM	Deleted
Tweedsmuir Additions		X 4,574 ha	Deleted				
Upper Kimsquit				Low value	CPA (10,575)		
Wahwash / Oweekeeno				Low value (?)			Biodiversity Area (32,800)
Western McPherson				W. ½ Intact E. ½ GB	Option Area (10,493)		
Whalen	Butedale – P			N ½ core intact	Option Area (26,815)	SE-Kitasoo – EBM	

FN Lead Areas	**Moore List 1991**	**1992 PAS**	**1997 PAS**[8]	**CAD - 1999**	**2001 Agreement**	**FN LUP**[9] **(When Available)**	**2003 Agreement**
Draney/Namu				N 1/3 core intact S 2/3 core GB	FN Lead area Heiltsuk		
Doos	Doos - M			Core GB	FN Lead area Oweekeeno		
Dalleck					FN Lead area Oweekeeno		
Ingram/Mooto/Polallie	Ingram – P			Core Intact	FN Lead area Heiltsuk		
Green and Fog (Ista)				½ Core intact	FN Lead area Nuxalk		
Clatse				¾ Core GB ¼ intact	FN Lead area Heiltsuk		

[8] The 1997 revised list was mandated to reduce the amount of official study areas from 22% to 7% in order to comply with the 18% protection cap for the Central Coast.
[9] The Kitasoo recommended Kynock Mussel Inlets, the area currently managed as Fjordland, as protected in their LUP.

Appendix 8: Area Description

	• Description	• Statistics
Ahnuhati Complex **(50,699)** **2001 CPA**	• Includes the Ahnuhati, Kwalate, Ahtna Rivers (3 of the last 4 undeveloped watersheds that are larger than 5,000 ha) and upper Kakweiken to the North of Central Knight Inlet. • Recognized for grizzly / salmon / bear interactions and overall high conservation value. • Provides public and commercial backcountry recreation and high elevation alpine ecosystems filling gaps in North Pacific Ecosection	• THLB: 3,711 • THLB >150: 3,055 • >150yrs: 3,055 • Alp/RI I: 14,797
Ape Lake (20,965) **2001 CPA**	• Located in the headwaters of the Ndeick River close to the Telchako Mountains and the Monarch ice fields. • Contains high recreational values for residents of the Bella Coola Valley as well as provincially significant Alpine Mountaineering. • Provides representation in North Pacific Range Ecosection	• THLB:338 • THLB >150: 247 • >150yrs:2,506 • Alp/RI I: 15,630
Archie Lake **(32,298 – 11,500)** **Formerly surf)**	• Located on Princess Royal Island within the North Coast TSA in the Hecate Lowland. • Located in an area of overlap between Gitga'at and Kitasoo territory. • High timber values, especially in the Class 3 cedar. • Interfor has existing tenures.	• Old stats • THLB: 348 • THLB >150: 335 • >150 years: 39,657 • Alp/RI: 538
Ashlum-Reeve-Upper Inziana **(16,000)** **2003 CPA (Opt)**	• North of Lake Oweekeno. Region was reduced from the original Option area proposal to exclude the Phiney watershed from protection. • Comprised of the Ashlum and Reeve watersheds on the north side of Oweekeno Lake and the Upper Inziana. • High sockeye salmon, moderate grizzly and mountain goat values. Contains the largest fjord lake on coastal B.C. • Fulfills representativeness for NPR. • Western Forest Products has existing tenures. • High biodiversity rank, moderate ecosystem diversity rank.	• OLD STATS! • THLB: 1,187 • THLB > 150: 907 • > 150 years: 5,442 • Alp/RI: 7,869
Bond Sound **(2,059)** **Deleted Option**	• Located just E of Lake Oweekeno. Important recreation and tourism. Especially around Kwatsie Bay • High fresh water values, including salmon. • Biodiversity rank – W. intermediate and E. high. • No forest tenures	• THLB: 770 • THLB > 150: 536 • >150: 2,059 • Alp/RI: 233
Broughton Extension **(4281)** **2001 CPA**	• Includes the islands of Swanson, Midsummer, W. Bonwi and Eden in the Western Broughton Archipelago. • First Nations Lead / Protection Area • Provides protection of an important marine destination for pleasure boaters and kayakers. • Fulfills representation for the outer Fjord land ecosection and priority biogeoclimactic variants characteristics of coastal forests. • Timber west and Interfor tenures	•
Cape Caution	• Provides recreational opportunities and protects special features such as beaches, tidal rapids and rock formations characteristic of the west coast. • Fulfils representation of the Hecate lowland ecosection and priority biogeoclimactic variants characteristic of coastal bog forests.	• THLB: 972 HA • THLB >150: 686 • >150 years: 12,041 • Alp/RI: 0
Cascade / Sutslem **(136,333 –126,500)** **2003 Modified CPA**	• Large region located to the North of Dean Channel, adjacent to Fjord land. Includes Cascade inlet, Skowquiltz River and Sutslem River. Skowquiltz has very high Grizzly Bear values and a low elevation pass leading into Ktilope. • High recreation values in Cascade inlet and to Skowquiltz waterfalls.	• THLB: 3664(old) • 2942(new) • THLB > 150: 3,295

(Opt.)	• Achieves moderate ecosection representation for KIT. • Domain Industries tenures and Nuxalk Community forest pilot project opportunities provided by nearshore exclusions. • Biodiversity rank – Intermediate. Ecosystem Rank - Moderate	• ____ (new) • >150: 36,304 (old) • 15,268 (new) • A/R/I: 88,271 • 85,267 (new)
Catto Creek	• This isolated unit is composed of the high elevation upper headwaters of Catto and Wakeman creek that flows into Wakeman Inlet. To the West of the Silverthorne Glacier. • Provides protection of the geomorphologic feature known as the 'paint pots' and tourism and alpine hiking.	• THLB: 91 HA • THLB_Old Forest: 86 • Old Forest: 952 • Alp/RI: 5,262
Chapple/ Cornwall (22,854) 2001 CPA	• Located on Princess Royal Island in NW Central Coast in the Hecate Lowland. • Provides protection of kermode bears and special and rare ecosystems. Also important are public recreation and commercial tourism opportunities.	•
Clayton Falls (4,929) 2001 CPA	• Close to Bella Coola at the junction between N and S Bentinck arms. The Clayton drainage is dammed for hydroelectricity generation. • Provides representation of the CWHvm3 biogeoclimactic subzone/variant. Yellow cedar in the variant is near the limit of its eastward distribution. • Provides recreation and commercial tourism opportunities.	• THLB: 4 • THLB >150: 4 • >150: 1,404 • Alp/RI: 1,514
Dean River estuary and corridor 2001 CPA	• The Dean Corridor, in the Kitimat Ranges, is composed of a series of smaller protected areas leading into Tweedsmuir Park. It is considered an important linkage area for grizzly bear and salmon ecosystem representation and represents the only Class 1 River on the Central Coast. • Protects wilderness recreation, internationally significant steelhead sport fishing, and the Chum Run.	• THLB: 2279 • THLB>150: 670 • >150yrs: 2047 • A/R/I: 0.7
Deer Lake (was 6,157) 2003 CPA (Opt.)	• Located on Princess Royal Island in the Hecate Lowland. This area is within Gitga'at territory. • Good salmon and Kermode Bear habitat. • Interfor Tenure • Gitga'at LUP proposes Western Deer Lake for protection and Eastern section for operating – final map reflects this.	• Old Stats • THLB: 456 • THLB>150: 440 • >150t: 4,684 • Alp/RI: 254
Elizabeth Lake (6920 ha)	• Adjacent to Koeye CPA and Fitz Hugh Sound • International Forest Products tenure. • High biodiversity rank, low ecosystem diversity rank. Important waterfowl habitat in estuaries, moderate GB values. • Proposed by Oweekeeno for operating.	• THLB: 491 • THLB> 150: 486 • > 150: 6,153 • Alp/RI: 0
Green Sheep Passage (50,741) Deleted Option	• Located in the NW region of the CC, south of the Khutze inlet. Includes Carter, David and Yule lakes). Region within the TFL 25 in the Kitimat ecosection. The Green inlet / lagoon / river is of important ecological value. Region home to Kermode Bear. • Region is within the proposed GBMA. • Kitasoo propose this area as operating and were firm in this position. Region is also within the Heiltsuk territory. • Existing tenures include Domain Industries Ltd. • Biodiversity rank – Intermediate. Ecosystem representation – moderate.	• THLB: 6,370 • THLB> 150: 6,003 • > 150: 31,954 • Alp/RI: 12.067
Helmken (5,264)	• Located on Princess Royal Island within the North Coast TSA and Hecate Lowland. • High Kermode Bear habitat. • No forest tenures. Intermediate biodiversity rank.	• THLB: 0 • THLB > 150: 0 • >150: 4,886

2003 CPA (Opt)		• Alp/RI: 0
Hotsprings (22,714) 2001 CPA	• Located on South Bennick Arm. Fore shore watersheds omitted to allow for timber extraction to benefit Bella Coola Valley. • Provides representation in NPR ecosection. Also captures excellent example of the high rugged mountains and large conifers normally found in this underrepresented ecosystem. • Protects the hotsprings and adjacent biological diversity; important for hiking, tourism, and cultural reasons.	• THLB: 1,467 • THLB >150: 1,197 • >150: 6,240 • Alp/RI: 12,978
Ickna	• South of Hotsprings and extending towards upper Bentick Arm excluding foreshore. • Former Option area, proposed by forestry as a protection area • International Forest Product tenures • Summary Biodiversity rank – Low. Ecosystem Diversity rank – High.	•
Jump Across (55,481 – 50,500) 2003 CPA (opt)	• Located to the SW of Dean Channel. The N. region has low forestry and conservation value while the S region is high in both. • Dean Channel Forest Products and International Forest Products have interests in the area. • High tourism. • Biodiversity Rank – Intermediate. Ecosystem Rank – Moderate.	• Old Stats: • THLB: 655 Ha - THLB_Old Forest: 486 Old Forest: 3,009 Alp/RI: 8,329
Khutze (34,479 ha) 2001 CPA	• Located in the NW corner of the planning region to the East of Princess Royal Island and Graham Reach. Protected in the Kitasoo LUP. • Protect and preserves significant features including salmon/grizzly ecosystem, the estuary ecosystem, low elevation Sitka spruce forests, and a diversity of habitat types. The area will also provides for scientific research, recreation activities, and is a major travel corridor. • 5 species of salmon • Contributes to the well represented Kitimat ecosection	• THLB: 1627 • THLB >150:1,572 • >150yrs: 14,241 • A/R/I: 15,725.
Kitasoo (90,402) 2001 CPA	• Larger protected area located on Princess Royal Island in NW Central Coast in the Hecate Lowland. The region consists of numerous small watersheds that flow into Laredo inlet and channel. Protected in the Kitasoo LUP. • Provides habitat for Kermode Bears and special and rare ecosystems. • The region also protects recreation and commercial tourism opportunities.	• THLB: 8,875 • THLB >150: 8,584 • >150: 76,301 • Alp/RI: 5,131.5
Klekane Aaltanhash (40,072 ha) Deleted Opt	• Region is located in the NW region, E of Fraser Reach. Includes the Klekane and Aaltanhash inlets and rivers • Located in along the Inside Passage Route and is thus an important travel corridor. High value marine tourism and scenery. TFL 25 Block 5. • Claimed as territory by the Haisla, Gitga'at (who want it in protection) and the Kitasoo First Nation (who want in operating). • High value Salmon streams	• THLB: 4,333 • THLB < 150: 4,092 • >150yrs: 26,865 • A/R/I: 9,507
Koeye (18,342) 2001 CPA	• Located East of Fitz Hugh Sound. The Koeye provides critical habitat for grizzly bear, salmon, and several red and blue-listed waterfowl, and contains unusually productive old growth, coastal temperate rainforest. • Protects forests, coastal feature and cultural heritage values filling major representative gaps (CWHvh2) within the HEL. • Provides connectivity from the Hakai conservation Area to higher alpine areas and has high recreation values.	• THLB: 8719 • THLB >150: 8,560 • >150: 16,579 • Alp/RI: 780.5
Kwatse Bay (3,057) Deleted Opt	•	• THLB: 422 • THLB > 150: 375 • > 150: 2,665 • Alp/RI: 106
Neekas (1,562)	• Located on the Don Peninsula in the Hecate Lowlands. • Summary biodiversity Rank: High, Ecosystem diversity rank: low • Western Forest Products tenures.	• THLB: 4,335 Ha • THLB> 150t: 4,092 • >150: 26,865

		• Alp/RI: 9,507
Pooley Island **(6,587)** **2001 CPA**	• The Protection Area on Northeast Pooley Island (James Bay, Windy Bay) is an addition to the Kitasoo LUP recommended by environmental groups and Western Forest Products and accepted by the Kitasoo. One of two islands which form the island portion of the Spirit Bear Wilderness Conservancy proposal. • Two key watersheds, with several additional salmon spawning streams. • Protects wolf/deer interactions and habitat values, Kermode bear habitat values, and provides commercial recreation and wildlife viewing.	• THLB: 970 • THLB > 150: 938 • >150: 6,361 • Alp/RI: 364
Piper/Sandal-Neekas **(75,991 – 36,000)** **2003 CPA (Opt)**	• Located S. of Oweekeeno Lake within the Oweekeeno Territory. and KDC. The Oweekeeno want the region as an operating area except Dallery Creek, which was proposed as protection. • Domain industries, Kyamua enterprises and Interfor tenures. • Biodiversity – High. Ecosystem Rep – High. • Fresh and salt-water estuaries, salmon and trout rearing system, small lakes, wetlands, bogs, very high rating for waterfowl nesting, rearing and resting areas, avalanche, flood plains, Mountain Goat and Black-Tailed Deer winter ranges.	• Old stats • THLB: 7,727 • THLB> 150: 6,222 • > 150: 37,301 • Alp/RI: 29,931
Price / Swindle **(14,008)** **2001 CPA**	• Protects representative forests, coastal features (muskegs, bogs, ferns) and cultural values characteristic of the Hecate Lowlands ecosectiion (CWHvh2). • Cconserves high fisheries values and protection of key recreation activities characteristic of the outer coast including kayaking, sheltered anchorages, and pocket beaches. Within Kitasoo LUP	• THLB: 150 • THLB> 150: 142 • >150: 13,112 • Alp/RI: 0
Racey Inlet **(6,228)** **2001 CPA**	• Located on Princess Royal Island in NW Central Coast in the Hecate Lowland. Includes the Cornwall inlet. • Protect cultural heritage values and traditional harvesting resources and to maintain wilderness recreation and tourism resource values surrounding the boat have anchorages in Racey, Evinrude, Commando & Helmecken inlets. • Also encompasses numerous small lakes and wetlands with high wildlife and bird values.	• THLB: 0 • THLB> 150: 0 • > 150: 4,496 • Alp/RI: 0
Roscoe **(25,690)** **2003 CPA**	• South of Fjord land within the Heiltsuk territory. • SWC tenures in the area. • Biodiversity Rank – intermediate. Ecosystem diversity – moderate. • Fresh and salt-water estuaries, salmon and trout rearing system, small lakes, wetlands, bogs, waterfowl nesting, rearing and resting areas, avalanche, flood plains, Mountain Goat and Black-Tailed Deer winter ranges.	• THLB: 2,767 • THLB < 150:2,498 • <150: 14,912 • Alp/RI: 9,157
Smokehouse **(37,769)**	• Protects a representative example of the North Pacific Ranges NPR ecosection, captures a range of ecosystems from estuary to alpine tundra, and protects Long Lake. • Also provides opportunities for remote backcountry and tourism. Recognized for high GB values due to productive diversity of GB habitats, high spring and fall GB use, extensive GB salmon fishing. Large run of sockeye salmon. Chinook salmon spawn in Large Lake.	• THLB: 2490 • THLB > 150: 2,055 • > 150t: 19,678 • Alp/RI: 13,160
Tolmie **(22,506)** **Deleted Option**	• Located on Princess Royal Island in the Hecate Lowland within the TFL 25 block 25. Located along the important travel corridor Inside Passage. High visual values and area of tourism / forestry visuals. Important Sockeye salmon values. • Kitasoo list this region as an operating area. • Biodiversity rank – high. Ecosystem rank – low.	• THLB: 3,385 H • THLB < 150:3,322 • > 150: 19,268 • Alp/RI: 1,251
Upper Kimsquit **(10,575)** **2001 CPA**	• Encompasses Kimsquit Lake in the upper headwaters of the Kimskuit River adjacent to Kitilope. • Protects unique grizzly/sockeye salmon features, an important wildlife linkage (a low elevation pass) to Kitilope drainage, very high seasonal bald eagle concentrations, and is one of the few coastal drainages supporting resident coastal moose populations. • Protects a portion of the historic FN grease Trail from the Dean to the Kitlope.	• THLB: 0 • THLB> 150t: 0 • >150t: 1,570 • Alp/RI: 5,706
Upper KlinaKlini	• Protects a significant geomorphologic trench system and an ecologically unique transmontaine valley which provides low elevation connectivity between moist continental ecosystems to dry interior ecosystem. Provides connection between Tweedsmuir and Upper	• THLB: 0 • THLB >150: 0

(39,087) **2001 CPA**	KlinaKlini Goal II. Major flyway fro migratory birds." Also has high backcountry recreation and eco-tourism opportunities. Recognized as a travel corridor for GB between interior and coastal habitat and salmon.	• >150yrs: 13,798 • A/R/I: 1,051.
Western / McPherson **(10,493)** **Deleted Option**	• Located on the Don Peninsula. • Existing forest tenures – Domain Industries Limited and SBFEP. • Biodiversity – high. Ecosystem representation – moderate.	
Whalen **(26,815)** **Deleted Option**	• Located on Princess Royal Island in the Hecate lowland. Within the Gitga'at territory. The Gitga'at (want the Northern region operating and Southern region protection), Kitasoo (in the south they want operating) and the Heiltsuk who have territorial claims in the south, all have claims to the region. • Located within the TFL 25 Block 5. A portion of this area is within the Inside Passage way and will be harvested under the tourism /. forestry visual agreement. • Biodiversity – intermediate.	
NEW Biodiversity areas for which little information is available.	• SW King Island – 40,500 ha • S Don Peninsula – 6,000 ha • Takoosh – 5,700 ha • Tcal River – 15,000 • Chic Chic Lake – 18,700 ha • Wahwash / Oweekeeno – 32,800 • Chuckwalla Kibella – 72,000 • Takoosh Extension – 3,000	

Appendix 9: Table of Protected Areas

2001 PROPOSED PROTECTED AREAS	HA	Web	THLB	Rock / Ice *	> 250 yrs	150-250yrs	< 150 yrs **
Ahnuhati Complex	52,336	50,669	3,711	29,152	7,168	13,476	1,931
Ape Lake	23,969	20,965	388	20,325	748	1,758	704
Broughton Extension		4,281	2,413	0		1,935	1,953
Cape Caution	14,366	10,567	973	5	10,140	1,901	334
Catto Creek	6,611	6,678	91	5,659	596	356	0
Chapple/Cornwall	25,506	22,854	1,438	2,777	21,376	-58	338
Clayton Falls	5,402	4,929	4	3,786	241	1,163	97
Cullen Harbour	231		69	0	131	1	52
Dean River Est./Corridor	5,168	5,070	2,279	4	324	1,723	3,026
Estero Basin	2,557		1,328	0	766	363	1,359
Hanson Island	1,455	1,431	899	0	134	206	1,114
Hot Springs/No Name	24,212	22,714	1,468	17,637	2,491	3,749	316
Khutze	34,411	34,479	1,627	19,667	4,764	9,478	91
Koeye	18,343	18,342	8,719	848	9,244	7,328	151
Laidlaw/Aitken Islands	0	0		0		674	0
Lockhart Gordon	34,026	33,621	3,972	6,838	23,880	939	2,021
Pooley Island	6,959	6,587	970	450	4,208	2,154	0
Price/Swindle	13,977	14,008	150	70	4,678	8,434	84
Racey Inlet	5,008	6,228		88	4,496	0	0
Smokehouse	38,283	37,769	2,490	15,185	16,914	2,734	1,161
Spirit Bear (kitasoo)	91,145	90,402	8,875	9,399	58,214	18,087	0
Upper Kimsquit	10,635	10,575		7,881	963	607	1,023
Upper Klinaklini	38,696	39,087		6,986	2,655	11,143	13,644
	453,295	441,256	41,864	146,757	174,131	88,151	29,400

2003 Biodiversity areas	HA by GIS	From Web	THLB	Rock/ Ice	Over 250 years	150-250 yrs	< 150 yrs
Ashlum / Reeve	12,657	16,000	619	8,839	2,666	770	340
Takush	11,936	8,700	1,383	0	7,210	3,723	0
Cascade/Sutslem	118,549	126,500	2,942	85,267	14,809	15,268	1,650
SW King Island	39,848	40,500	1,151	3,796	19,851	13,343	1,184
Swallop - Dean Corridor	22,741	24,500	3	8,726	202	10,732	2,945
Deer Lake	7,701	39,000	591	538	6,101	138	0
Elizabeth Lake	6,981	6,900	491	0	5,373	780	0
Chic - Chic Lake	18,719	18,700		0	7,648	10,600	0
Helmcken	5,267	5,200		0	4,800	71	0
Ickna	15,363	15,000	655	11,999	1,353	1,656	354
Inziana	2,422			2,103	298	3	0
Jump Across	51,222	50,500	3,185	35,221	8,343	6,812	709
Kibella_Chuckwalla	71,273	72,000	4,122	37,681	25,085	3,204	5,257
E. Knight Inlet	3,930		78	1,869	204	1,075	768
Near_Lady_Douglas_Oliver	5,909	6,000		0	5,393	36	0
Neekas	1,562	1,600		21	1,024	473	0
Nekite	20,124	21,000		8,880	7,744	215	1,954
Piper / Rhind	42,523	36,000	3,979	19,199	17,564	2,462	681
Roscoe	25,698	25,700	2,767	9,624	9,528	5,384	494
Surf	13,995	11,500	99	667	12,330	112	0
Tzeo_1	4,689	15,000	851	1,129	1,452	442	1,625
Tzeo_2	12,097			9,170	2,433	495	0
Washawash	13,273	32,800	441	8,112	3,672	933	404
	528,481	573,100	23,357	252,841	165,083	78,724	18,365

GOAL II PROTECTION AREAS	HA by GIS	Estu-aries	THLB	Rock/ Ice	Over 250 years	150-250 yrs	< 150 yrs
Summary of all Areas - Salt water - Land area only	12,657 27,004 35,613	1,801	2,773	517	16,255	2,766	3,293

** = Young forest, re. Burned, rec. logged

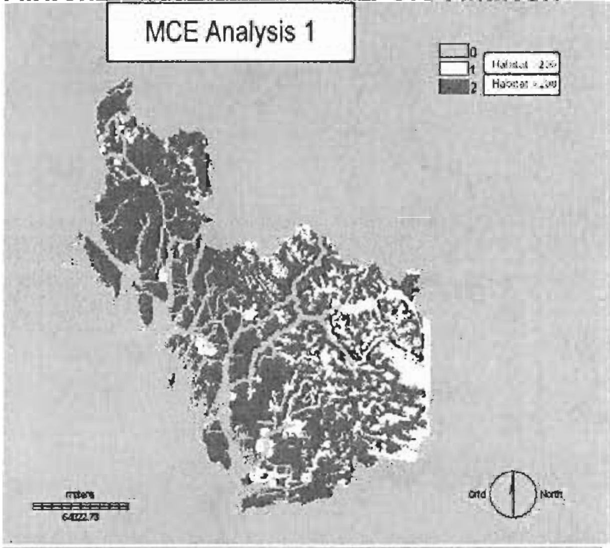
* = Alpine, Glaciers, Sub_alpine and Barren Surfaces

Data utilized from the Base Thematic Mapping and the MOF Forest Inventory Data

Appendix 10: Estimation of B.C. Grizzly Bear Populations

Date	Description	Provincial estimates
1972	The first official estimates of provincial grizzly bears. Based on a subjective assessment of bear density in physiographic areas. (MWLAP Management Plan, 1972).	5000-8000 bears
1977	Calculations determined by relative abundance categories that extrapolated density estimates based on habitat quality. E.g. few was classified as 1 bear per 195-1295km^2. Moderate was 1 bear per 65-194km^2. Plentiful was 1 bear per 65km^2. Mapped at very large scales1:2,000,000. (MoELP 1979).	6600 bears
1988	Advances in bear biology across the continent increased estimated densities (Peek, 2003). Mapped at medium map scales in the Flathead River, a region with long-term telemetry and biophysical data. Carrying capacities for this area are intended to be applicable in other areas. Developed value rating such that high (5 km2 per GB), moderate (14 km2 per GB), and low (45 km2 per GB).	13,170 bears
1995	Based on the Fuhr Demarchi / Stepdown method. By extrapolating conclusions from the above studies, potential GB populations were estimated for the province at small map scales (1:50,000). Each biogeoclimactic zone was ranked, field confirmations done in several areas of the province, and relative carrying capacity for small map scales applied. Estimates of GB numbers were calculated, as was current potential (capability). Regional Wildlife specialists then 'step downed', or reduced estimates to consider land-use activities, hunting, poaching, and habitat loss (Banci, Demarchi et al. 1995).	10,000-13,000
2002	Essentially used Fuhr Dmearhi Step down and DNA / mark recapture. Methods were developed at the Flathead River study site. A precursor to the following estimate (Boulanger and Hamilton, 2002).	13,834 – minimum 19,389 – medium
2004	Two methods were used to derive 2004 population estimates. The first technique involves the use of a multiple regression model. The second technique used to derive these new Grizzly Bear population estimates is the expert-based approach (Hamilton, Heard et al. 2004)	17,000

Appendix 11: Outcomes of GIS Analysis



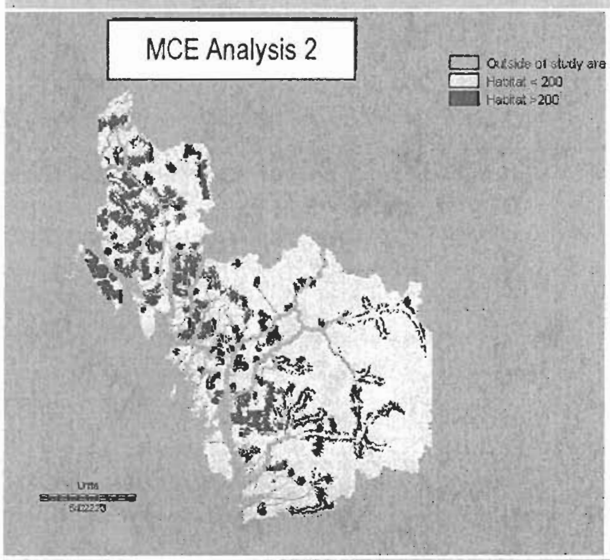
Analysis # 1: Human Influence Bias

	Btm Values	Hum Infl	Hum Settle	Old Forest	Roads	Salmon	Slopes
Btm Values	1						
Hum Infl	4	1					
Hum Settle	5	1	1				
Old Forest	1	1/5	1/3	1			
Roads	4	3	1/2	3	1		
Salmon	3	1/3	1/2	2	1/3	1	
Slopes	1/3	1/3	1/5	1/3	1/5	1/3	[illegible]

Area in Hectares of Habitat > 200

KHTZ: 310,293ha LRDO: 217,396 ha
KTSU: 87,263 ha NIEL: 282,092 ha
NASC: 338,684 ha NECL: 257,907 ha
BELA: 130,596 ha OWIK: 537,268 ha

Total: 2,161,499 ha



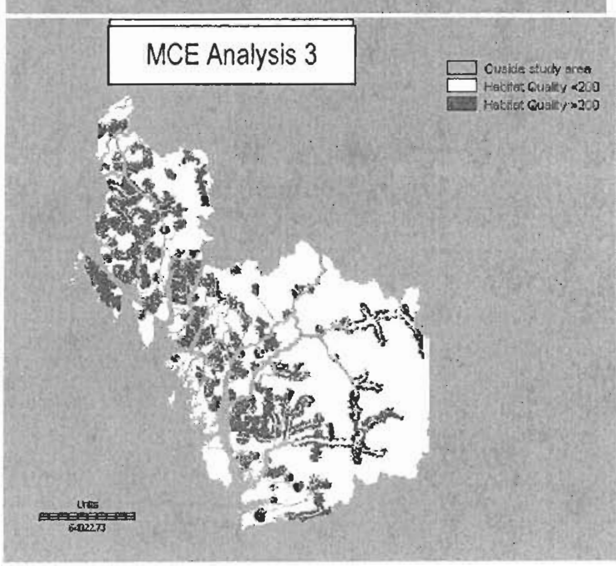
Analysis # 2: Neutral Position

	Btm Values	Hum Infl	Hum Settle	Old Forest	Roads	Salmon	Slopes
Btm Values	1						
Hum Infl	1/2	1					
Hum Settle	1	1	1				
Old Forest	[illegible]	2	[illegible]	1			
Roads	[illegible]	1	1	3	1		
Salmon	2	1/2	2	2	2	1	
Slopes	1	3	1/5	1	1	1/2	[illegible]

Area in Hectares of Habitat > 200

KHTZ: 88,053 ha LRDO: 115,722 ha
KTSU: 43,641 ha NIEL: 85,831 ha
NASC: 109,380 ha NECL: 48,900 ha
BELA: 23,206 ha OWIK: 123,058 ha

Total: 637,791 ha



Analysis # 3: Habitat Bias

	Btm Values	Hum Infl	Hum Settle	Old Forest	Roads	Salmon	Slopes
Btm Values	1						
Hum Infl	1/3	1					
Hum Settle	1/2	2	1				
Old Forest	1	3	1	1			
Roads	1/2	2	1	3	1		
Salmon	2	3	2	2	2	1	
Slopes	1/2	1/2	1/5	1	1	1/2	1

Area in Hectares of Habitat > 200

KHTZ: 105,590 ha LRDO: 142,070 ha
KTSU: 52,996 ha NIEL: 111,586 ha
NASC: 126,198 ha NECL: 68,137 ha
BELA: 72,870 ha OWIK: 163,813 ha

Total: 890,756 ha

Appendix 12: Factors Used in Provisional Grizzly Bear Habitat Model

Factor	Description	Data source
Land Use	19 land use classifications were ranked based on an estimation of how suitable a raster cell was in terms of habitat quality to grizzly bears. High Value (255): old forest, sub alpine avalanche, estuaries and wetlands Moderate value (150): alpine and young forest Low (100): selectively logged forest and barren surfaces Very low (50): recently burned, glaciers and snow, recently logged Nil (0): urban, residential, agriculture, mining, range and water	BTM data
Old Forest	Old growth forest, with its structurally diverse and open canopy, provides an abundance of food sources for grizzly bear (Jeo et al 1999, MacHutchon 1993, Saxena 1999).	BTM data
Human Settlement	This factor included data from two layers of the BTM data. Urban settlements greater than 15ha were combined with point locations of villages, towns and buildings. Distance and then Fuzzy logic was used to develop a sigmoidally increasing buffer where set where a=750m and b=5000m	BTM & CLUP data
Human Influence	Land use designations were used to indicate the location of all recreation, recently logged, selectively logged, and mining locations greater than 15ha. This data was combined with the TRNL line file listing trails and cart tracks in the region. This data was also combined with the TRNP point file that listed the location of all airstrips and sea anchorages. Distance and then Fuzzy logic was used to develop a sigmoidally increasing buffer where set where a=250m and b=1000m	BTM, TRNL, and TRNP data
Roads	In the absence of road density (available through the TRIM dataset), the less accurate TNRL data set was used. Distance and then Fuzzy logic was used to develop a sigmoidally increasing buffer where set where a=250m and b=1000m	TRNL data
Salmon	Salmon are a vital food source for grizzly bears (Hilderbrand et al, 1999), are a keystone species, (Jao, 1996). Evzl FISS layer was used to indicate salmonoid streams. Distance and then Fuzzy logic was used to develop a sigmoidally decreasing buffer where set where a=150m and b=10,000m	Evzl FISS
Slopes	Grizzly bear will use steeper slopes for denning sites. Slope was calculated from the DEM and areas less than 15 degrees were given highest values with a sigmoidally decreasing function up to 45 degrees.	DEM

Appendix 13: Multi-Criteria Analysis and Outcomes

Analysis # 1 Human influence bias:	The first analysis weighted heavily the factors that were seen to negatively influence grizzly bear habitat. The factors of human settlement, human influence and roads were therefore heavily weighted in the analysis. Land use values were not rated highly because they were interpreted to contribute to habitat quality.	KHTZ: 310,293 LRDO: 217,396 KTSU: 87,263 NIEL: 282,092 NASC: 338,684 NECL: 257,907 BELA: 130,596 OWIK: 537,268 Total high value habitat: 2,161,499 ha
Analysis # 2 Neutral position	This analysis attempted to adopt a more neutral position and to allow for selected factors to stand more evenly against one another. A few differences were highlighted, such as the relative importance of human settlements over human influence and the importance of salmon over all other factors.	KHTZ: 88,053 LRDO: 115,722 KTSU: 43,641 NIEL: 85,831 NASC: 109,380 NECL: 48,900 BELA: 23,206 OWIK: 123,058 Total high value habitat: 637,058 ha
Analysis # 3 Habitat bias	This analysis weighted heavily the factors that were seen to have a strong positive contribution to grizzly bear habitat.	KHTZ: 105,590 LRDO: 142,070 KTSU: 52,996 NIEL: 111,586 NASC: 126,198 NECL: 68,137 BELA: 72,870 OWIK: 163,813 Total high value habitat: 890,756 ha

Appendix 14: Moore (1991) List of Pristine and Modified Watersheds

Pristine Watersheds	Modified Watersheds
Existing protected • Kainet Creek • Poison Cove Creek	**Existing protected** • Iltasyuko River - Tweedsmiur • Lard Creek • Mussel River - Fjoird land • Takia River - Tweedsmiur • Tenas Lake • Turner Lake
Proposed protection - 2001 • Allard Lake - linked with Hotsprings (CPA) • Carter Lake – Green / Sheep Passage (CPA) • Green Lagoon – Green / Sheep Passage (CPA) • Klekane - Klekane Aaltannash (CPA) • Sandel River – Piper Sandel/Neekas (CPA)	**Proposed protection – 2001:** • Ahta - Ahnuhati Complex (CPA) • Ahnuhati River - Ahnuhati Complex (CPA) • Butedale Lake – Whalen (CPA) • Canoona Lake – Kitasoo (CPA) • Dallery Creek - Piper Sandel/Neekas (CPA) • Jump Across Creek – Jump Across (CPA) • Khutze River – Khutze (CPA) • Koeye – Koeye (CPA) • Kwalate – Ahnuhati Complex (CPA) • Nasal River – Cascade Sustem (CPA) • Smokehouse Creek – Smokehouse (CPA) • Sutslem Creek - Cascade Sutslem (CPA) • Takush River – Cape Caution extension (CPA)
Proposed protection - 2003 • Archie Lake (BDA) • Chic Chic Lake (BDA) • Hotsprings – Hotsprings (BDA) • Lockhart Gordon – Lockhart Gordon (BDA) • North KlinaKlini River* - N. KlinaKlini (BDA) • Nusash Creek – Confirm – Jump Across (BDA) • Skowquiltz – Cascade Sutslem (BDA) • Swallop – Jump Across (BDA)	**Proposed protection - 2003** • Aaltannash - Klekane Aaltannash (BDA) • Swanson Bay – Green Sheep Passage (BDA)
First Nation lead areas • Ellerslie Lake • Ingram-Mooto	**First Nation lead areas** • Doos Creek – FN Lead area – Doos Dallery
No form of protection • Kwakwa Creek • Four Lakes • Remote Creek – KlinaKlini??	**No form of protection** • Atway Kellesse River • Johnston Creek – High PAS by CCPAT • Waump Creek – High PAS by CCPAT

Appendix 15: Environmental NGOs Active in the Central Coast

ENGO	Mandate	Role in the central coast
Aboriginal mapping network (Vancouver, B.C.) Est. 1998	The AMN provides resources to First Nation engaged with GIS and mapping. The AMN supports a web page, informal round-table workshops, a publication series and an annual mapping conference.	The AMN and Ecostrust co-produced the following guide aimed to help aboriginal people manage forests: A Voice on the Land: An Indigenous Peoples' Guide to Forest Certification in Canada
Craig head Institute (Wyoming, USA)	Institute programs strive to increase our understanding of natural systems through basic, innovative scientific research incorporating GIS to develop Conservation Area Designs for analysis and education.	The Institute identified the Pacific coast (including the central coast) as one of 2 priority conservation spaces in terms of developing large conservation reserves and were involved with the CAD
David Suzuki Foundation (Vancouver, B.C.) Est. 1990	The DSF is a large NGO, focussing on four sectors: Forests and Wild Lands,. Oceans and Sustainable Fishing, Climate Change and Clean Energy & Web of Life and Sustainable Living.	The DSF has been vocal in the CCLRMP, were critical in negotiating the Turning Point Solution, have published numerous publications criticizing the protected areas networks and GBMAs, and contributed to the EBM handbook.
Ecotrust (Portland, WA and Vancouver, B.C.)	Ecotrust promotes the emergence of a conservation economy in the coastal temperate rainforests of B.C. and attempts to operate as a catalyst and broker to this end.	Ecotrust supports First Nation and non-native community participation in LUP with technical consultation. (E.g. a partnership with the Heiltsuk). Ecotrust and Raincoast collaborated in purchasing a privately owned fishing lodge in Koeye and transferring title to First Nation ownership.
Forest Ethics (California, USA) Est. 1994 / 1996	Forest Ethics emerged from the Clayoquot Rainforest Coalition with an expanded mission to prtoect all endangered forests by redirecting markets toward ecologically sound alternatives.	One of the four participating ENGOs in the Rainforest Solutions Project.
Rainforest Solutions Project (Vancouver, B.C.) Est. 1999	Mandate of this conglomerate is to find conservation and economic alternatives to industrial logging in B.C.'s Great Bear Rainforest and Haida Gwaii. \	Sponsored / made up of Forest Ethics, Greenpeace, Rainforest Action Network, and the Sierra Club of Canada, B.C. chapter.
Greenpeace (Vancouver, B.C.) Est. 1971	Greenpeace challenges government and industry to halt harmful practices by negotiating solutions, conducting scientific research, introducing clean alternatives, carrying out peaceful acts of civil disobedience and educating and engaging the public.	One of the four participating ENGOs in the Rainforest Solutions Project. Publishes many key pieces on the CC LRMP and GBR.
Raincoast Conservation Society (Vancouver & Bella Bella, B.C.) Est. 1990	Raincoast works in partnership with scientists, First Nations, local communities and Non-governmental Organizations to build support for decisions that protect marine and rainforest habitat on B.C.'s central and north coast.	Producing public educational materials including books, film documentaries, scientific reports, and other literature. Part of the Koeye lodge. A primary basis of Raincoast conservation is *applied conservation,* combining rigorous applied science with needs and traditions of coastal people.
Rainforest Action Network (California) Est. 1985	Established to protect the earth's rainforests and support the rights of rainforest inhabitants through education, grassroots organizing, and non-violent direct action.	For the past several years, RAN has focused on the home construction and home improvement retail industries in an attempt to foster the protection of endangered forests and the adoption of sustainable forestry practices.
Round River Conservation Studies (Utah) 1991	Round River advocates wildness and wild places as indicators of ecological health; work closely with traditional peoples, community, grassroots, and national and international conservation organizations; and employ conservation biology in analyses.	Commissioned to create the B.C.Conservation Areas Design n order to delineate and prioritise areas for protection and restoration based on current scientific knowledge, the tenets of conservation biology, and the precautionary principle.
Sierra Club of Canada, B.C. chapter (Victoria, B.C.) Est. 1969	Current campaigns are aimed at protecting critical wildlife habitat, protecting wild salmon and other marine resources, stopping clearcut logging, and saving remaining ancient temperate forests and other threatened ecosystems throughout British Columbia.	Produced a map showing forest coverage using 1991-1995 LandSat imagery. Part of the four ENGOs participating in the Rainforest Solutions Project.

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[i] Importantly, many of the jurisdictional boundaries of protected areas may change subsequent to government negotiations with First Nations.

[ii] Pseudo-sciences are those sciences that do not adhere to the demarcation criterion and thus are criticized as being open to incorporation anything in a theory precisely because a body of knowledge is not open to falsification.

[iii] See Bruno Latour (2001) for a further discussion of hybrid knowledge, including such examples as deforestation which implicitly engages questions related to how humans interface with the *natural* environment.

[iv] Attempts to take a non-ideological and pragmatic approach to decision making.

[v] The goal to double the provincial protected area to 12 percent built on goals popularized in the 1987 Brundtland Report.

[vi] The Commission on Resources and the Environment (CORE), established in 1992, attempted to bring together these initiatives and to outline future use of land resources, provide a predictable basis for land use allocation, and develop environmental management that reflects the needs and values of all interested parties. Building off the earlier CORE model of the early 1990s, the current provincial strategic planning model, Land and Resource Management Planning (LRMP) also aims for consensus recommendations on land use, which are then presented to government for the final decision and implementation.

[vii] Land and Resource Management Planning (LRMP) processes establish direction for land use and specify broad resource management objectives and strategies for Crown Land use for up to 10 years. Once accepted by cabinet, more detailed "higher level plans" will be developed for forestry related activities consistent with other legislation.

[viii] Special Resource Management zones will be further explored in subsequent chapters. In essence, these are integrated use zones where timber values are developed alongside the preservation of other values such as wildlife habitat or visual quality.

[ix] The size of the industry is estimated to be between $1-2 billio.

[x] The B.C Terrestrial Ecosystem Mapping standard (B.C. RIC 1997) defines seral association as the vegetation at the present time based on "identification and prediction of the sequences of seral plant associations and structural/development stages that occur over time on a site in a preclimax condition".

[xi] The Coastal Trough is defined by its complex coast line, low-lying elevation (<405m), matrix of islands, and vegetation dominated by poor growing forests and peatbogs (MoSRM 2001b).

[xii] The Coast Mountains consist of two ranges, the Pacific Ranges and the Kitimat Ranges and is defined by its rugged mountain (2500-3000m) rising from deep fjords and glacially carved valleys.

[xiii] Marbled Murrelet, Auklets, Northern Gosshawk, Keen's Long eared Myotis are red-listed vertebrates while grizzly bear, fisher, wolverine, tailed frog, great blue heron, short eared owl, peregrine owl and sandhill crane are all red-listed species in the area. Numerous ungulates (mountain goats, blacktail deer, moose and elK) live in the region. Five species of anadromous pacific salmon (sockeye, chinook, coho, chum & pink), anadromous cutthroat trout, steelhead and Dolly Varden char are all supported in the plan area. Resident trout and char populations are widely distributed throught the region. Salmonoid fish are found 540 rivers in the north and 150in the south, ranging form large rivers like the Bella Coola/Atnarko, Klinaklini River and the Kibella River as well as in numerous smaller tributaries. Eulachon are culturally significant anadromous fish found in the area as well as playing an important role in the riverine and oceanic food chains.

[xiv] The plan area includes all of the Mid-Coast Forest district and the mainland portions of the Port McNeil and Cambell River forest districts and the North Coast forest district.

[xv] The 2001 census data revealed a population of 5,076 a 7% decline from 1996. Estimates suggest this number is still declining due to declines in the resource industries. This is in contrast to the 22% population growth experienced from 1986-1996. (CCLRMP, 2004).

[xvi] 96% of the approximately 4500 person years of direct forestry and pulp and paper processing jobs resulting form the timber harvested in the central coast reside outside of the plan area. One third of them live in Campbell River and Northern Vancouver Island. Remote logging camps operated by licensees who transport the timber to processing facilities on Vancouver Island, the Lower Mainland, or to the Vancouver log market facilitate the majority of the timber harvesting.

[xvii] The Little Valley Forest Products sawmill has been open for 50 years and currently produces cedar plank and lattice paneling. 30 people are employed in the plant and 5 million board feet are processed.

[xviii] Initially the central coast LRMP included both coastal and terrestrial planning but the coastal planning was subsequently separated from the terrestrial component.

[xix] First Nations did not participate in many LRMPs, feeling that their interests would be better served at tripartite Treaty Negotiations. Uniquely, in Phase II of the central coast a series of agreements and protocols resulted in many First Nations participating as governments not stakeholders due to assurances of a separate government to government process for resolving specific questions related to First Nation interests.

[xx] Current members of CFCI are Weyerhaeuser (formerly Macmillian Bloedel), Canadian Forest Products, Western Forest Products, International Forest Products and Norske Skog Canada (formerly Fletcher Challenge Canada).

[xxi] Not all ENGOs participated with the LRMP or with Joint Solutions Project.

[xxii] These are the central coast, the north coast, and the Queen Charlotte Island LRMPs.

[xxiii] As a result of the exclusions from the operating land base, changes were required in the regulatory framework beyond the scope of the CCLRMP process, specifically regarding the A decision was made to reduce the AAC of the central coast until the final plan was produced.

[xxiv] Protected areas are defined as those preserving natural, cultural and/or recreation values. Resource harvesting are not permitted. Draft I: 20.6% of the region. 96, 458 ha of Princess Royal Island was protected to preserve habitat for the Kermode, or 'spirit bear'(a rare sub-species of black bear), and to acknowledge its cultural importanceto the Kitasoo/XaiXais and Gita'at First Nations. Adjacent Option areas will be determined at the Phase II negotiations. The Klinaklini will be protected for a period of 15 years in order to facilitate mineral exploration. If no development is feasible, then the region will be designated as a protected area.

[xxv] Special Management Zones (SMZ1 & SMZ2) were designed to maintain or enhance identified resource values; i.e. scenery, recreation, wildlife habitat and cultural features. Restrictions are region specific. A visual quality objective (VQO) of retention will apply in SMZ1 while a VQO of partial retention will apply in SMZ2. Draft I: 14.1% of the region.

[xxvi] Option Areas are those where the determination of future use was postponed pending development of the EBM and completion of the CCLRMP. Licensees were relieved of their cut control obligations in these areas. Draft I: 11.3% of the region.

[xxvii] First Nation Lead Areas: Forest licensees and environmental NGO's agreed that in these areas, final recommendations would be determined by First Nations. Draft I: 1.4% of region.

[xxviii] The Coast Sustainability Trust was created as part of the Coast Sustainability Strategy. This $35million dollar trust was established in April 2002 and is designed to address economic impacts of coastal land use planning on workers, contractors, communities, and companies.

[xxix] In 1992, the land use planning process of the time (CORE) explicitly stated that aboriginal title and inherent rights of aboriginal people to self-government will be recognized.

[xxx] The Haisla, Heiltsuk, Kwakuitl, Oweekeno, Tsimshian are all formally involved with the B.C.TC.

[xxxi] The 8 First Nations signing the agreement with territories within the central coast are the Gitga'at, Haisla, Heiltsuk, and the Kitasoo / Xaixais. Other First Nations outside the central coast include the Haida, Metlakatla, Old Masset Village Council and Skidegate Band Council. Turning point protocol agreements assured funding for participation, a government to government process to resolve First nation issues, completion, commitment to EBM, and commitment to the CIT.

[xxxii] At the CCLRMP, one First Nation leader represented the 11 First Nations with territorial claims in the southern portion of the central coast but who currently live outside the planning region. These groups include the seven members of the Kwakiutl District Council, the three members of the Musgamagw Tsawataineuk Tribal Council, and the Tlowitsis Nation.

[xxxiii] Terrestrial Biodiversity Conservation, Hydroriparian and Aquatic Systems, Fish and Wildlife habitat, Grizzly Bears, Water, Communities, Access and Facilities Management, Tourism and recreation, Non-timber forest products, Guide outfitting/ hunting/ and trapping, Subsurface resources and aggregates, Forestry /Timber, and Visuals management

[xxxiv] The CIT planning region includes all three of the coastal LRMPs: the North and Central Coasts and Queen Charlotte Islands LRMP regions. It appears however; that the role of the CIT was the greatest in the central coast and is was for this planning table that the CIT appears to have had the most direct influence.

[xxxv] The CIT followed recommendations for peer review that were developed by the Millennium Ecosystem Assessment.

[xxxvi] For example, the Economic Gains Spatial Analysis and the Ecosystem Spatial Analysis, were both used prior to completing peer review, and the Well-Being Assessment, which as of 2004 remains incomplete, was not used. Their use prior to peer review exposed the CIT and these analyses to much criticism and mistrust

[xxxvii] EBM is supported theoretically by the Scientific Compendium. Explicit technical concepts, thresholds and targets are provided in the EBM Framework. Finally, the Hydro-riparian guide is a (x) part manual for field practitioners for developing Forest Management Plans that implement the concepts of EBM.

[xxxviii] There is optimism that EBM on First Nation co-managed lands will fill a niche market for Forest Stewardship Council (FSC) lumber (Aboriginal Bar Association Conference, 2002).

[xxxix] The Save the Great Bear (2005) report card rates voluntary efforts by timber companies at implementing EBM with an F. They cite that only five of the seven voluntary elements are being incorporated into planning and that previous planning practices will be grandfathered in for four years.

[xl] The range of natural variability is defined as "the range of dynamic change in natural systems over historic time periods" (Allen 2004 p.10).

[xli] Protected areas will be formally legislated, reserves are areas where little or not resource extraction occurs but are not formally legislated, and retention refers to silvicultural practices aimed to retain desired features in a working landscape.

[xlii] Ecosystem representation was determined according to the ecoregional classification system and the biogeoclimatic classification system. These areas further highlighted the protection of "viable, representative examples of the natural diversity of the province, representative of the major terrestrial, marine and freshwater ecosystems, the characteristic habitats, hydrology and land, forms, and the characteristic backcountry recreational and cultural heritage values of each ecosection" (Lewis 1997).

[xliii] To protect the special natural, cultural heritage and recreational features of the province, including rare and endangered species and critical habitats, outstanding or unique botanical, zoological, geological and paleontological features, outstanding or fragile cultural heritage features, and outstanding outdoor recreational features such as trails (Lewis 1997)

[xliv] Areas of primary concern are the while areas of secondary concern are the corridors to Bella Coola, Knight Inlet, KlinaKlini and into Tweedsmuir.

[xlv] Initially the campaign was entitled the "Yosemite of the North" (Interview 6), though this was quickly abandoned for the more charismatic Great Bear Rainforest.

[xlvi] At the CCLRMP, one First Nation leader represented the 11 First Nations with territorial claims in the southern portion of the central coast but who currently live outside the planning region. These groups include the seven members of the Kwakiutl District Council, the three members of the Musgamagw Tsawataineuk Tribal Council, and the Tlowitsis Nation.

[xlvii] In the North Coast, First Nations co-chaired the process with the provincial government.

[xlviii] The Kitasoo Land Use Plan was a critical component of the Phase I conservation map and the 2001 map largely reflected their conservation and operating land interests. More problematic in Phase II were the absence of all First Nation Land Use Plan in the plan area. These are costly, time consuming and difficult to generate.

[xlix] Funds are to be spent in two main areas in order to support economic investment: a trust fund (this would support watchmen, progress, monitoring) and an economic development fund (to be spent in 7 years). First Nation interested in these funds will put forth draft land use plans and then use funds to help achieve these goals.

[l] The final amount of money available is unclear. 2003 estimates suggested that there should be 100 million in funds for Conservation Investment (Ramsey, 2004, p.2). The money made available by philanthropists and investors must be matched by provincial and federal government dollars. An additional 80 million in Socially Responsible Investment[l] may be made available for larger communities like Bella Coola for sound business projects.

[li] The Timber Supply Assessment at this meeting was contested. Concerns were raised about discrepancies between the model presented by the Process Team which shows little impact of EBM in the first 2 decades and then the impacts are staged down over the next 6 decades while the Timber West EBM impact analysis shows a 40% impact immediately.

[lii] This entailed a provincial roll out of $15, 30, 45 million with benefits for those First Nation who sign on in the first year

[liii] ENGOs representing the conservation sector are Forest Action Network, Greenpeace, Sierra Club of Canada B.C. chapter, and Forest Ethics.

[liv] There is currently no THLB in this candidate protection area due to difficulties with road building and economic viability due to remoteness.

[lv] The Klinaklini protected area is unique in that it remains open to mineral exploration for the next 15 years to determine if development is feasible. If no development is feasible, then the area will become fully protected.

[lvi] Representation targets were applied as per: Very Common (13%), Common (28%), Modal (60%), Uncommon (75%) Rare (97%).

[lvii] The Oweekeno may negotiate substantial changes the layout of the protected areas in particular because much of their land was proposed by the CCLRMP for protected status, precluding timber related economic opportunities.
[lviii] It is uncertain whether First Nations will attempt to alter EBM. Many timber / First Nation co-management agreements stand to benefit from opportunities for certified lumber.
[lix] As an example, the THLB insufficiently documents one classification of economically viable timber: Class 3 cedar.
[lx] Species of concern is a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats (Canadian Species at Risk 2004).
[lxi] Blue listed species are considered sensitive or vulnerable.
[lxii] Habitat extrapolation is based on Biogeoclimatic Ecosystem Classification at the variant level combined with the Ecoregion Classification system mapping at the ecosection level to produce 648 unique polygon combinations that are then rated according to their ability to support bears.
[lxiii] Capability is the potential carrying capacity if all conditions are ideal.
[lxiv] Grizzly bear management areas are not protected areas; they can include areas managed for resource development.
[lxv] Benchmark GBMA are the largest areas with one established in 6 ecoprovinces (Coast and Mountains, Southern Interior, Southern Interior Mountains, Central Interior, Sub-Boreal Interior and Northern Boreal Mountains). Benchmarks are intended to serve as "relatively un-impacted populations for comparative purposes over the long-term as well as a potential source population for the future" (2003). Central Coast Completion Table, Oct 28-30. Nanaimo, MSRM. p. 7.
[lxvi] Core GBMAs are smaller than Benchmark GBMAs and will represent refuge within BGPUs.
[lxvii] Linkage GBMAs are even smaller and designed to span current or potential human caused barriers to grizzly bear dispersal and movement.
lxviii CITES Appendix II lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. It also includes so-called "look-alike species", i.e. species of which the specimens in trade look like those of species listed for conservation reasons.
[lxix] CITES Appendix I lists species that are the most endangered among CITES-listed animals and plants. These are threatened with extinction and CITES generally prohibits commercial international trade in specimens of these species.
[lxx] The current application of the Fuhr-Demarchi model is at the Ecosection/Variant/Phase level of the B.C. biogeoclimatcc Ecosystem / Ecoregional classification system. The CIT ESA increases a level in resolution and accuracy from the BEU's by integrating the BEI. Individual unique combinations of Ecosection, Biogeoclimatic Zone, Subzone, Variant, Phase, BEU, Modifier, and Seral Stage were rated in the standard 6 class system for capability and suitability to support GB.
[lxxi] Gap analysis is a methodology for identifying ecosystems (or other elements) that are missing from an existing reserve design, often utilizing both a coarse and fine filter approach. The methodology for the 1997 Protected areas strategy is an example.
[lxxii] Reserve selection algorithms are the most useful if there are not existing reserves. In essence, desired ecological criteria are identified and then reserves selected from all available choices. The CITES analysis used in the CIT ecosystem spatial analyses was developed based on this methodology.
[lxxiii] Protection of special elements is a fine filter methodology for ensuring that reserve design effectively captures desired variables, such as species richness, critical habitats, or rare species.
[lxxiv] The Conservation Area Design (CAD) was envisioned as a "science-based framework for identifying and prioritizing areas for sustainable conservation, based upon biological values, threats, and opportunities for implementation. CADs present spatially explicit analyses that can inform decisions regarding conservation at a regional scale and over the long term."(Rumsey and Holmes 2003).This analysis employed conservation biology in the determination of a reserve network and highlighted high value grizzly bear, old forest and salmon areas.
[lxxv] Any past small scale removal of trees - including selective logging of individual trees, small patch cutting or land clearing - is limited to less than 5 ha.
[lxxvi] The amount of the watershed affected by past or recent logging with or without roads, powerlines, pipelines, mining, or settlements is less than two percent of its area; or, in the case of watersheds greater than 10, 000 ha, is less than 250 ha.
[lxxvii] A large percentage of this land was within Tweedsmuir Park.
[lxxviii] ...Whose primary objectives are the protection of fish, wildlife, cultural and bio-diversity values.
[lxxix] ...Whose primary objectives are to create jobs and economic development opportunities for the Kitasoo/Xaixais people with minimum impact on the environment and protect cultural and heritage values to sustain the Kitasoo/Xaixais people and communities.
[lxxx] The algorithm stated that cost (m) = area + species penalty / boundary length.
[lxxxi] The purpose of the ecosystem spatial analysis was to "identify priority areas for biodiversity conservation and, to provide an information base and decision support for subsequent planning and management efforts designed to address four well accepted goals of conservation: 1) represent ecosystems across a range of environmental gradients; 2) maintain viable populations of native species; 3) sustain ecological and evolutionary processes within a natural range of variability; and 4) build a conservation network that is resilient to environmental change (Rumsey, Ardon et al. 2003).
[lxxxii] Exceptions included conservation who (with the exception of one option area) voted conservation and major timber who nearly always voted operating.

[lxxxiii] This strategy was complicated in the few option areas where there were competing territorial claims and competing visions, as in the example of the Klekane / Aaltanhash where the Gitga'at LUP recommends protection and the Kitasso LUP recommends Operating area. The provincial view is that in areas of overlapping claims, it is the responsibility of the first Nations to achieve common ground. In the absence of an agreement the province would defer to its understanding of traditional territories and make decisions based upon the First Nations perspectives over the area in question.

[lxxxiv] From a cartographic perspective, the forest industry certainly took advantage of colour and context to persuade their audience. Parks outside the Central Coast planning area were included to give the appearance of more protected space and, the color scheme did not rely on green to represent all conservation spaces. In contrast, the conservation sector map had a key error: their color scheme failed to distinguish between 2001 CPAs and the new protected areas they were proposing. As a result, their map appeared to be a sea of parks and was quickly dismissed by the table, relegated behind the overhead screen, which consequently blocked its view. Negotiations used the major timber sector map as a base.

[lxxxv] This thesis has focussed on the CCLRMP recommendations, of which there remain many critics. Critics abound of the CIT's work, process, analyses, and the effectiveness of this institution in advising the CCLRMP. It appears the other two LRMPs the CIT was commissioned to inform (the north coast and the Haida Gwaii LRMPs) have been even more critical of the CIT analyses and integrated them even less than the central coast. A comparative approach investigating this would be highly useful, though it was beyond the scope of this thesis.

[lxxxvi] These communities were further defined such that *scientific* referred to knowledge held by biophysical and socio-economic scientists; *technical* referred to knowledge held by professionals, practitioners, and technicians; *traditional* referred to knowledge held by aboriginal communities; and *local* referred to knowledge held by non-aboriginal communities (Allen 2004).

[lxxxvii] The CIT identified dependence as "knowledge derived from or reflecting the perspective of a particular stakeholder, be it the provincial government, a First Nation, a forest products company, an environmental organization, or any other participant in the planning processes".

[lxxxviii] An interviewee from the conservation sector suggested that the CIT's Ecosystem Spatial Analysis represented the first time the CCLRMP had received ecological information that had not previously been adjusted to mitigate the negative impacts to the timber industry or other economic factors. This interviewee argued that all previous information produced by the CCLRMP provincial government process team had to be filtered through a forest impact assessment before it ever was given to the table and that few watersheds were identified for conservation because the government precluded economically viable areas from being identified Key watersheds such as Koyeye and Ahnuhati are notable exceptions. Each was identified by early provincial reports as being high priority for conservation, each has high timber values, and each has been recommended for protection.

[lxxxix] Also crucial in implementation of EBM is an EBM pilot project undertaken by the Kitasoo and Git Ga'at First Nations in a parallel process to the CITs work (DSF 2005).

[xc] This board should include scientists, local, and traditional knowledge practitioners.