

WATERFOWL MANAGEMENT TECHNIQUE IN DELTA, BRITISH  
COLUMBIA: BALANCING THE PERSPECTIVES OF FARMERS  
AND WATERFOWL ADVOCATES

by

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## **Abstract**

In this study, I investigate methods of addressing the issue of migratory waterfowl damage to farms in Delta, BC. I examine the waterfowl management policies of British Columbia, namely the Delta Forage Compensation, Mitigation and Monitoring Project, and those of the prairie provinces. My analysis of the programs in the prairie provinces reveals that they share important characteristics related to compensation. Drawing on these findings, I propose four policy alternatives. After evaluating these alternatives, I recommend that British Columbia augment the current Delta Forage Compensation, Mitigation and Monitoring Project with enhanced mitigative schemes in the form of increased cost-shared lure and cover crop. Additionally, I recommend that BC adopts its own Canada-BC Waterfowl Damage Compensation Program modeled after Waterfowl Damage Compensation Programs in Alberta, Manitoba and Saskatchewan.

**Keywords:** compensation; mitigation; forage damage; Delta, BC; waterfowl damage management

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## Executive Summary

Waterfowl are often considered a valuable feature of North America's natural heritage. A common objective throughout North America has been the protection of waterfowl populations. Long-term measures have been sought to achieve population and habitat goals for waterfowl (Environment Canada 2009). While a healthy waterfowl population enhances biodiversity, some farmers are adversely affected by waterfowl depredation to their forage fields.<sup>1</sup>

Waterfowl depredation on Delta, BC's forage fields has reached significant levels. Following years of complaints by forage producers in the area, the Delta Forage Compensation, Mitigation and Monitoring Project was implemented with the mandate of examining mitigation, monitoring and compensation. Although substantial forage damage in the area, as a result of waterfowl grazing, has always been an issue, the region has experienced increasing waterfowl over the last several years. Currently partial compensation for forage damages is provided in Delta; however, forage producers are dissatisfied with the level of compensation and are concerned that economic losses will rise as waterfowl populations increase.

In researching the best ways to strengthen waterfowl damage management techniques, I have explored how other provinces with waterfowl damage issues similar to Delta have formulated and executed their policies. By examining the way that four of the western provinces' waterfowl compensation programs operate, this study highlights waterfowl management policies that the provincial government could apply to strengthen its current compensation/management programs. The four waterfowl damage compensation programs I have analyzed are those of British Columbia, Alberta, Manitoba, and Saskatchewan.

<sup>1</sup> According to US EPA Crop Glossary forage crop refers to annual or perennial crops grown primarily to provide feed for livestock. During harvesting operations, most of the above-ground portion of the plant is removed from the field and processed for later feeding (US Environmental Protection Agency, 2007).

My case study analysis reveals the following key findings. The level of compensation in BC is not adequate in relation to the financial losses incurred by forage producers. The prairie provinces incorporate wildlife compensation in their federal-provincial implementation agreements. In these provinces, producers that incur wildlife damage to crops or livestock are eligible for pre-defined levels of compensation, and governments cost-share claims on a 60-40 federal-provincial basis for crop losses. These findings inform the creation of policy alternatives that address weaknesses in the current Delta Forage Compensation, Mitigation and Monitoring Project. My study evaluates the following policy alternatives:

*Delta Forage Compensation, Mitigation and Monitoring Project:* This would involve maintaining the status quo by supporting the regional stakeholder model for agriculture-wildlife program management and supporting current initiative measures developed by Delta Farmland Wildlife Trust.

*Minimum Pay-Out/Full Compensation:* This option would add to the current agriculture-wildlife agreement in BC with the addition of minimum pay-outs that would evolve to full (100%) compensation measures.

*Mandatory Laser Levelling:* This option would be to broadly implement cost-shared mandatory laser levelling on forage producing farms in Delta. Laser levelling assists in removing low spots, thereby reducing the pooling of water. Reducing the pooling assists in reducing the amount of time waterfowl are in the fields and therefore reducing the crop damage.

*Lure Crops/Relay Cropping:* This would involve implementing mitigation measures to disperse wildlife concentrations through the use of lure crops and relay cropping.

The study assesses the policy alternatives by using a set of criteria that includes effectiveness, cost, acceptability among key stakeholders, and equity. This multi-criteria analysis reveals that the current policy within the framework of Delta Forage Compensation, Mitigation and Monitoring program is not adequate. The analysis reveals that *Minimum Pay-Out/ Full Compensation* is the best policy for the provincial

government to pursue. It would be the most effective at compensating forage producers while giving them an incentive to maintain farmlands for waterfowl habitat.

# 1. Introduction

When the Fraser River Delta was drained 100 years ago, use as farmland was compatible to use by migratory birds. In the past 50 years farming practices in the area have changed from mixed farming to monoculture and industrial agriculture. Vast acreages of farmland have been converted to residential and industrial uses. This has dramatically stressed the ability of the remaining farmland and wetlands to provide for migratory birds. At one time the municipality of Delta, British Columbia, had over 100 forage-producing and dairy farms; that number has now dwindled to a “handful” (Merkens 2008). Even with this decline, farmers plant thousands of acres of hay and corn annually for local and regional consumers. Forage producers in the south coastal area produce forage on their farms either to feed to their beef and dairy herds or to market locally, mostly to the horse industry. While forage production is not as extensive in BC as in the prairie provinces, it still generates income for many farmers in Delta.

The Fraser River delta, the largest estuary on the Pacific coast of Canada, supports the highest densities of wintering waterbirds, shorebirds and raptors in Canada. Due to a unique combination of climatic conditions and soil characteristics, the Fraser River delta is also one of Canada's most productive areas for agriculture (Baumbrough Consulting 2002). These Fraser River delta farmers provide critical habitat resources for more than 1.4 million migratory birds annually. It is estimated that between 200,000 and 300,000 of these are ducks, geese, and swans that feed on upland farm fields, particularly during the winter. Waterfowl typically use perennial forage fields during winter between October and April; the presence and severity of damage varies from year to year and from field to field (Zbeetnoff 2007). Having to share the delta with wildlife and a growing urban footprint has created challenges for farmers. Although much effort is being invested in providing and enhancing habitat to wintering waterfowl on the Fraser

River delta, duck and goose grazing causes significant damage to economically important forage crops.<sup>1</sup>

## 1.1. Policy Problem

The main policy problem concerns managing migratory waterfowl damage to forage crops. While maintaining a healthy waterfowl population is a public policy goal, it is essential that Delta forage farmers' fields remain viable. Addressing this issue involves an understanding of how compensation and mitigation should be undertaken by relevant government agencies and farmers, based on the social valuation of more waterfowl preservation. It also requires assessing whether and how waterfowl management costs should be borne by municipal, regional, provincial, or national levels. The policy problem at hand is to find a way to improve waterfowl protection at an acceptable cost, in terms of agricultural production and costs. Understanding the incentive effects and compliance issues of alternative mitigative and compensatory schemes will be a crucial part of the policy analysis.

The issue has always been a concern within the lower Fraser River Delta, which is situated on the outskirts of Vancouver (one of the largest cities in Canada).<sup>2</sup> Delta is essential to the functional integrity of the Pacific Flyway (an internationally significant stopover point for migrating birds). One million migrating and wintering waterfowl and 5 million shorebirds from Asia, Alaska, and Western Canada use the Fraser River delta for feeding and roosting. Delta also has some of the most fertile soil and one of the longest growing seasons in all of Canada. However, as wetland habitat diminishes within the lower mainland (for example the Vancouver Airport expansion on Sea Island displacing habitat areas), Delta and parts of Surrey around Mud Bay have experienced increasing waterfowl over several years. Forage producers would say the problem has always existed, but it would appear to be increasing (Butler 2005). In some cases, farmers have

<sup>1</sup> According to US EPA Crop Glossary, forage crop refers to annual or perennial crops grown primarily to provide feed for livestock. During harvesting operations, most of the above-ground portion of the plant is removed from the field and processed for later feeding (US Environmental Protection Agency, 2007).

<sup>2</sup> Refer to Figure 1.1

found several acres of grass fields completely grazed overnight. Uncontrolled grazing of forage results in a loss of bio-mass and a direct cost to forage producers. Producers that are also involved in dairy operations face additional costs in supplementing the loss of forage grasses by having to buy product elsewhere. Delta farmers are concerned about the cost associated with reduced forage yields, harvest quality, and reduced length of the production season caused by waterfowl grazing (Cheng 2007; Saddlemyer et al. 2001).

In this study, I investigate methods of addressing the issue of migratory waterfowl damage to forage crops in Delta. I assess waterfowl damage mitigation/compensation policies of British Columbia, namely the Delta Forage Compensation Project, and those of the Prairie Provinces (Alberta, Saskatchewan and Manitoba). Based on my findings, I formulate four policy alternatives. After evaluating these alternatives based on a specified set of criteria, I make a policy recommendation.

The study is organized as follows. Section two provides a background on waterfowl management technique; it also includes the rationale for waterfowl management and various viewpoints on the importance of such measures. Section three provides a summary of present wildlife management techniques in British Columbia and outlines current concerns over the status quo. Section four describes the methodology employed in the study. Section five summarizes successful waterfowl damage management techniques drawn from each case study. Section six formulates the policy alternatives and criteria to evaluate each alternative. Section seven provides a detailed outline of each of the policy alternatives and provides recommendations based on the results. The study offers conclusions in section eight.

## **2. Waterfowl Management**

### **2.1. North American Waterfowl Management Plan**

Responsibility for the management of migratory waterfowl is shared by the federal government, in part due to their participation in international agreements to protect and enhance internationally significant populations and habitats for these birds (Zbeetnoff and McTavish 2000). Canada signed the Migratory Birds Convention agreement with the US early in the 20<sup>th</sup> century. This agreement has been extended to include Mexico and Russia establishing regulations and protocol for the protection of migratory birds. In the past, the policy focus for migratory waterfowl management has been the rearing of birds in Canadian habitat areas for the large recreational hunting demand in the US. More recently, waterfowl agencies have articulated waterfowl management goals in relation to sustainable habitats and healthy continental populations (Zbeetnoff and McTavish 2000).

The 1986 North American Waterfowl Management Plan (NAWMP) is a more recent Canada-US agreement to secure, maintain, and enhance internationally significant waterfowl habitat. It is now an international action plan to conserve migratory birds throughout the continent (NAWMP 2008; Zbeetnoff and McTavish 2000). The plan was developed in response to concern for declining waterfowl populations and threats to waterfowl habitat considered internationally significant. The Plan's goal is to return waterfowl populations to their 1970s levels by conserving wetland and upland habitat. Canada and the United States signed the Plan in 1986 in reaction to significantly low numbers of waterfowl. Mexico joined in 1994 making it a continental effort. The original framers of the NAWMP recognized the inherent linkages among harvest, habitat, and hunters. The Plan set the stage for the next two decades of waterfowl conservation, during which managers demonstrated a capacity to deliver habitat initiatives through joint ventures, developed a technical framework for harvest management, and became

increasingly aware of the role of stakeholders, especially hunters (Joint Task Force 2007).

The NAWMP is a partnership of federal, provincial/state and municipal governments, non-governmental organizations, private companies and individuals, working to achieve better wetland habitat for the benefit of migratory birds, other wetland-associated species and people. Plan projects are international in scope but implemented at regional levels. These projects contribute to the protection of habitat and wildlife species across the North American landscape. The North American Waterfowl Management Plan is considered one of the world's most successful conservation initiatives (NAWMP 2008).

Throughout the continent, the NAWMP establishes regional partnerships called "joint ventures" to undertake conservation projects. Each joint venture includes the participation of individuals, corporations, conservation organizations, and government agencies. The joint ventures represent links in the Plan's national and international systems. Canada has four habitat joint ventures (Pacific Coast, Canadian Intermountain, Prairie Habitat, and Eastern Habitat) and three species joint ventures (Arctic Goose, Black Duck and Sea Duck). The Pacific Coast Joint Venture and each of the species joint ventures are international in scope. Joint ventures develop implementation plans focusing on areas of concern identified in the Plan. The joint ventures are integral to Plan implementation in Canada and the United States. In Mexico, regional partnerships have been formed to link with regional, national and international Plan activities (NAWMP 2008).

The Prairie Habitat Joint Venture (PHJV) covers one of the most productive areas for waterfowl and contains some of the best habitat in the world (NAWMP 2008). In the prairie provinces, agricultural policy is addressing the issue of agricultural damages created by waterfowl in reproduction and staging areas i.e. waterfowl damage compensation and waterfowl damage prevention programs. Over half of North America's mid-continent ducks breed within this region. The PHJV's broad-based partnerships and conservation activities are crucial to achieving the continental North American Waterfowl Management Plan (NAWMP) goal of restoring waterfowl populations to the average levels of the 1970s.

The PHJV is the top national priority because it provides breeding habitat for almost 40% of the continent's duck populations, including 50% of the mallards and more than 55% of pintail. Ducks Unlimited Canada is the primary delivery agent of PHJV programming. To address habitat losses, programs in the Prairies include: purchasing land outright at fair market price, leasing or set asides through conservation agreements; offering landowners financial incentives in exchange for modifying farming practices that accommodate waterfowl, and for returning suitable marginal land to conditions of improved nesting cover. Other programs that complement the prairie provinces' NAWMP initiatives include the Waterfowl Crop Damage prevention Program and Waterfowl Compensation Program (Ministry of Agriculture and Lands 2005).

## **2.2. Rationale for Waterfowl Management**

Migratory waterfowl commonly cause crop and soil damage to forage fields in Delta, BC. However in recent years the impacts of this grazing have escalated due to habitat loss (Group 1 Consulting Services Ltd. 2007). Waterfowl depredation results in loss of forage biomass for forage producers, forcing farmers to buy forage elsewhere at additional cost (Butler 2004). This loss, combined with reduced quality of perennial forage stand, can result in the need to reseed areas that are heavily grazed and damaged. Post et al. (1998) found that migratory birds redistribute large quantities of nitrogen and phosphorous across the landscape. In the case of excessive nutrient deposition by the birds, farmers must take precautions and may be required to install additional buffers or drainage systems to minimize the amount of leachate pollution from their nutrient-saturated soil (Post et al. 1998).

This problem is exacerbated by compaction problems caused by foraging waterfowl (Butler 2004). As soil becomes compacted due to trampling, water pools on the surface of the soil, which perpetuates the attractiveness of waterfowl to agricultural land. Such overgrazing of forage crops leaves agricultural soil vulnerable to erosion, resulting in loss of agricultural soils and the potential to pollute the surrounding watershed (Group 1 Consulting Ltd. 2007).

Because waterfowl habitat protection is a mandate of the federal government, the provision of conservation-friendly agricultural habitat in Delta is essential. At the same time, the retention of farmland productivity and the economic viability of the agricultural industry is a direct concern of farmers and local and provincial governments (Saddlemyer et al. 2001). Healthy and viable agricultural industries, populations of migrating waterfowl, and residential communities must be ensured for Delta while developing a strategy that addresses the issue of waterfowl impacts and meeting the needs of wildlife (Group 1 Consulting Ltd. 2007).

Agricultural land in Delta provides ecological goods and services beyond food production that are recognized by society, such as the provision of waterfowl habitat, air quality, and the conservation of biodiversity. The BC provincial government has indicated that it will begin to recognize the ecological goods and services provided by farmland and establish means of providing benefits to producers for these public goods. To help minimize conflicts between agriculture and wildlife, the Ministry of Agriculture and Lands and Ministry of Environment must commit to addressing wildlife-agriculture conflict issues, including waterfowl damage, as a priority. As part of The BC Agriculture Plan under 'Strategy 6: Implement approaches for farmers to receive benefits for ecological goods and services,' the Ministry of Agriculture and Lands developed and implemented a strategic wildlife damage reduction plan that aimed to include compensation funding for B.C. farmers (BC Agriculture Plan 2007). This program currently pays a maximum of 80% of the verified losses of the crop caused by wildlife. Such damages caused by wildlife are deducted from any production insurance claims so that damages are not double-compensated and minimum 10% crop loss must have occurred for an adjustment to be considered. However, the extent of this funding as it applies to Delta forage producers affected by significant waterfowl damage, beyond what is in place as per the pilot program, is not known.

### **2.3. Viewpoints on Waterfowl Management**

A study by Conover et al. (1997) examined various compensation programs in North America. This study used survey instruments to uncover information about the use of financial compensation programs for damages caused by wildlife, as opposed to

lethal wildlife damage management techniques. They reviewed compensation issues from a conceptual perspective to provide insight into local pilot program elements. The authors conducted surveys requesting information on wildlife species and type of damage covered by compensation programs, annual cost of programs, and the monitoring and assessment of program success to the wildlife agencies of all US states and Canadian provinces. They also requested information on programs providing producers with damage-abatement materials instead of or in addition to financial compensation. Often, compensation programs are motivated by problems that were recent in origin, exacerbated by governmental actions, or caused by highly valued species. Few states or provinces had formal evaluation procedures. Given the expense of and divided opinions about compensation programs, the authors recommend that all states and provinces implement a formal review system.

According to Zbeetnoff and McTavish's (2004) comprehensive evaluation of the Delta Forage Compensation, Mitigation, and Monitoring Project, the impact to forage by migratory waterfowl had been significant but was variable, changed location year by year, and was difficult to quantify. Zbeetnoff and McTavish found that a key challenge faced by the waterfowl pilot was the limited opportunity to reduce the risk of financial losses to forage producers short of changing the commodities produced.<sup>3</sup> Furthermore, they found that the real costs of compensating forage producers are likely to be significantly higher than the program's current payments.

Based on monitoring information, the Delta Forage Compensation evaluation project committee found that of all fields measured, laser levelling was a significant factor that had the largest effect on biomass loss due to waterfowl grazing (Delta Forage

<sup>3</sup> This project addresses the ongoing and serious impacts of waterfowl on agricultural crops. The approved support from the AEPI fund was \$41,781 to assist the Delta Farmer's Institute with the monitoring and mitigation components. The objective was to ensure that all reasonable mitigative measures were implemented in order to minimize the need for compensation. The BC Ministry of Agriculture and Lands, the Canadian Wildlife Service and Agriculture and Agri-Food Canada participated in this initiative.

Compensation 2003). Laser levelling evens out the topography of the land. This allows farmers to reduce ponding on their fields, improving the establishment and longevity of winter crops and grass fields that are subject to grazing by waterfowl. Laser-levelled fields tend to dry out more quickly in the spring. Earlier access gives farmers more options on what to plant in their fields and it also improves the likelihood that a cover crop can be planted on the field once the cash crop is harvested (Anderson 2007). Preliminary analysis for the 2001-2002 data has also found that fields that were not laser-levelled sustained higher damage (81-100% more damage than fields that were laser-levelled). Given the consistency of laser levelling as a variable associated with forage loss, the Delta Forage committee submitted a proposal to request funds to evaluate the impacts of laser levelling in the Delta and Surrey.

A study by Group 1 Consulting Services Ltd., evaluates current methods of measuring crop and soil damage due to waterfowl grazing, as well as methods of farmer compensation. According to this report, farmers are providing an environmental service by providing habitat for waterfowl and allowing them to graze farmland. The community at large benefits from this environmental service; however, currently the individual farmer is bearing the cost associated with waterfowl grazing. Compensation methods in Delta to date do not address the full financial impact of waterfowl grazing. Therefore, the researchers conclude that multi-stakeholder approach is necessary to ensure that both wildlife and human values are protected (Group 1 Consulting Service 2007).

## **2.4. Costs and Benefits of Waterfowl Management**

According to Hinterlands Who's Who (1995), the experience of wildlife enriches the lives of many Canadians. Additionally, Canadians are beginning to understand that the health and sustainability of wildlife is an excellent indication of the health of the environments on which we depend. Healthy wildlife populations are important to our social and economic well-being. The results of a 1991 Statistics Canada survey, conducted on behalf of the Canadian Wildlife Service and provincial wildlife agencies, showed that 86% of the population believe it is important to maintain abundant wildlife and 83% believed it to be crucial to protect a declining species. Wildlife recreation is also shown to be important to the Canadian economy.

The sheer scale of the benefits provided by wildlife to individuals and the economy is one more compelling reason for maintaining wildlife populations and habitats in a productive, healthy state. One strategy for maintaining abundant wildlife populations is to remind business executives and decision-makers that wildlife resources should be treated as assets to be conserved and managed for the benefit of all humanity. This notion is enshrined in the United Nations Convention on Biological Diversity, which Canada ratified in 1992. The objective of the Convention on Biological Diversity is "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits." Sustainable use is defined in the Convention as "the use of components of biodiversity in a way and at a rate that does not lead to long-term decline" but maintains the "potential to meet the needs and aspirations of present and future generations." From the perspective of sustainable use, wildlife is a renewable resource that provides many benefits and socioeconomic advantages.

Approximately 394,000 Canadians hunted waterfowl in 1991, and 5.8 million people enjoyed observing waterfowl (Hinterland's Who's Who 1995). About 30,000 jobs depended on waterfowl-related activities such as tourism, hunting, and waterfowl observation. Considerable social and economic values are therefore at risk when waterfowl populations shrink. Although wildlife has not traditionally been thought of as a major contributor to our well-being, we are becoming increasingly aware of its many important benefits.

The benefits of existing waterfowl habitat are thus shared among local users, other provincial users, other Canadian users, and finally United States users (Adamowicz, Philips, Pattison 1986). By analyzing the distribution of hunting benefits from production of ducks in Alberta, Adamowicz et al. (1986) identified the beneficiaries of habitat retention and enhancement projects so that this information would be available for policy development. They found that on a continental scale, the vast majority of benefits from Alberta-produced ducks accrue to United States hunters. If one views a situation of creating additional habitat for supporting ducks, 85% of the benefits will accrue to residents in the United States. However, as the prairie pothole area is the critical region in waterfowl production, Adamowicz et al. (1986) suggest that all groups benefit from maintaining the habitat in this region.

While this study shows that a large portion of the economic benefits of ducks produced in Alberta accrues to the United States, it fails to consider non-consumptive benefits. Furthermore, as noted by the authors, the distribution of benefits should not be the sole basis for cost sharing of habitat maintenance and enhancement since many incongruities exist between local, provincial, and federal governments in their power to tax and disburse funds. Even so, the benefit distribution information derived from this study can be an important element in policy development.

Economic evaluation of natural environments that provide pleasure without taking resource outputs, such as viewing wildlife, has been overlooked in customary analysis of cost and benefits (Shafer et al.1993). The economic value of non-consumptive use of natural resources has been labelled their 'amenity value.' The basic concept used by resource economists for expressing economic value of amenity resources is willingness to pay (WTP). WTP is the maximum amount individuals are willing to pay rather than go without a good or service.

Two prominent methods have been developed to estimate consumers' surplus for non-marketed amenities: the travel cost methods (TCM) and the contingent valuation method (CVM). TCM generally involves statistical modelling to relate quantities of use to total trip costs. Through personal interviews or surveys, CVM solicits marginal dollar values of the experience from respondents at a specific site, given the availability of alternative sites and activities. A study conducted by Shafer et al. (1993) aimed to use the TCM and CVM method to evaluate the economic value of six ecotourism activities involving observation of wildlife in Pennsylvania; waterfowl viewing was one of the activities that was studied.

According to Shafer et al. (1993) the amenity values for non-consumptive wildlife uses, including waterfowl viewing in Pennsylvania, compare favourably in some instances with values estimated for consumptive uses. Furthermore, the study states that economic values in the study represent only a partial estimate of the total economic values of the locations studied. Many people besides current users derive economic benefits from knowing that wildlife resources exist (i.e. existence values) or knowing they exist for future generations (i.e. bequest values). Additionally, many people who are not

currently using natural environments for recreational activities would be willing to pay to maintain the opportunity to use them in the future (i.e. option values).

Research indicates that waterfowl have an important economic value to British Columbia both in terms of hunting (consumptive use) and viewing of bird species (non-consumptive use). Surveys conducted since 1981 on the importance of nature to Canadians have tried to estimate and assess this economic value of nature, including waterfowl. In 1991, over \$174 million, or 17.8%, was spent on hunting birds and mammals, whereas almost \$572 million, or 58.6%, was spent on primary non-consumptive wildlife related trips or outings (Environment Canada 2005). This difference is attributable to the fact that the number of days of participation in primary non-consumptive trips or outings has been increasing since 1981, whereas the number of days spent hunting is in decline. Even though hunting has been declining since the late 70's, the economic importance of expenditures and benefits derived from wildlife-related activities in BC continues to be significant for the provincial economy.

In assessing which parties should bear the costs of compensation/mitigation in BC it is useful to examine effective programs operating in the prairie provinces, which are affected by similar waterfowl degradation issues. At the same time the current political and economic climate cannot be ignored. Given the present economic climate, provincial governments may be inclined to trim budgets with less funds allocated to environmental conservation programs. Therefore it is likely that many jurisdictions will require private interests and/or users of the resource base to help fund conservation projects. Thus, as predicted by Yen et al. (1997), funding for conservation will likely have to become more dependent on donations to environmental causes either through direct giving of funds or through memberships in organizations. Their study's empirical results suggested that changes in the economy will be important to donation behavior. Declines in participation and recruitment in hunting were also predicted to have impacts on donations to conservation causes, but these impacts, although significant, were not predicted to be as large. Yen et al. (1997) expected that consumptive and non-consumptive activities may be influenced by management agencies and used to bolster environmental donations.

Losses caused by waterfowl fall into the following main categories: forage yield loss, extra cost or more inefficient operations, deterioration of fixed assets such as land improvements, lost gross margin to reinvest, and cost of mitigation measures. According to research conducted by Zbeetnoff and McConnell (2007) none of the forage operations in the BC regions affected by waterfowl are receiving compensation anywhere close to the actual losses caused by waterfowl damage. The largest magnitudes of loss were associated with reseeded and over-seeded fields. These fields do not reach a mature stage of production in the year of seeding. Chronic waterfowl depredation can lead to fields that never reach mature production, although receiving the inputs associated with establishment of perennial forage production.

The notion of providing forage producers compensation for damages incurred by waterfowl grazing is contentious. Supporters of compensation believe that when government regulation is for the provision or protection of a public good, such as waterfowl, then landowners should be protected for options taken from them. Opponents of compensation say that there is no need to pay landowners to do what the government has determined is the right thing, and to pay compensation would be both costly and unjust (Stroup 1997). In this perspective, the rights of the community should give the government the power to limit the property rights of individuals. Those who argue against compensation point out that the goals of such regulation are often socially important. However, that begs the question: who should pay for an important public benefit such as waterfowl conservation? According to Stroup (1997) as long as government agencies act according to their budget constraints and according to changes in relative prices, compensation would not necessarily be costly to taxpayers. Instead it would simply be a shift in the identity of the payers of the public good cost. Rather than the cost being borne by individual land-owners, it would be shared by the public that is ostensibly receiving the public good. Stroup (1997) also found that removing the substantial costs of un-funded mandates for land-owners produces evidence that individuals will take actions on their own to protect species. Land-owners will be more likely to preserve a rare species if they face a reward rather than a punishment.

### **3. BC's Waterfowl Management Policies**

#### **3.1. Delta, British Columbia's Waterfowl Management Policies**

The extent of waterfowl damage on fields in Delta varies from year to year and represents a considerable economic burden to local farms. In some years, as much as 50% of the approximately 2,800 acres of forage fields on the Fraser delta can be damaged (Merkens 2008). In five years (2001/02-2005/06) of reports of the Delta Forage Compensation Mitigation Pilot project, between 16% and 40% of the forage acreage has been damaged by migratory waterfowl in any given year (Zbeetnoff and McConnell 2007). Although farmers receive some compensation for this damage, it does not cover the estimated hundreds of thousands of dollars of costs incurred because of the waterfowl grazing. Several management strategies and tactics have been identified as being partially effective in reducing waterfowl damage to forage fields.

For almost two decades, farmers have been planting winter cover crops on the delta. By the end of each winter as much as 80 % of the up to 4,800 acres planted with cover crops shows evidence of waterfowl grazing (Merkens 2008). Delta Farmland and Wildlife Trust shares in the cost of planting these important wildlife habitat amenities. This program is intended to benefit soil conservation by protecting delta soils from the heavy winter rains that typically occur in the area. While reducing significant erosion over the winter, the cover crops also provide organic matter to be ploughed into the soil prior to spring planting thereby improving soil structure and contributing to higher productivity. Benefits of this program for wildlife include an abundance of winter forage for the dense populations of waterfowl that congregate in the delta during winter months. Some of the more abundant waterfowl species that feed in cover crop fields include American Wigeon, Northern Pintail, Snow Geese, and Trumpeter Swans (DFWT 2006).

The availability of land to establish these un-harvested cover crops is declining as farmland is impacted by urban, industrial and transportation development as well as changes in crop composition. As farmland is converted to other uses, pressures on forage fields will likely increase. Conversion of fields to non-agricultural use, crops not attractive to waterfowl and greenhouses will limit the area able to absorb the large populations of waterfowl that use Delta annually.

The main concern in Delta is the problem of migratory waterfowl damage to forage crops. Ducks, geese and swans, are voracious eaters of young forage plants and target newly established forage grasses, as well as new season grasses each year, starting in the fall, and continuing through early to mid spring before they continue their migration (Butler 2005). While all ducks may cause some degree of damage, the American Widgeon is the species that has a voracious appetite for young forage grasses. Other species, such as mallards, because of size, can cause soil compaction on damp fields. Other forage eaters such as geese and swans also cause compaction, and all species tend to stay in fields where there has been water pooling as a result of uneven ground, foraging for grasses in and around those water pools.

Migratory waterfowl are generally a seasonal problem for Delta. However, some waterfowl may remain year-round once farmers provide sustainable food sources in areas such as protected wildlife or wetland refuges. Generally, the most severe problems occur from October/November (with the arrival of the Snow Geese and American Widgeon) and last through the winter until spring (usually March/April) causing significant damage to forage producing fields which are not harvested before annual migrations occur. Harsh winters may find the birds overwintering further south as they seek out climates that allow feeding. Milder winters tend to allow them to overwinter longer in one area or another. Generally, significant forage crop damage occurs annually; the extent of that damage may vary from year to year, depending on harshness of winter and the size of the flocks, which also varies for a host of reasons (Butler 2005).

Following many years of complaints by forage producers in the Delta area regarding waterfowl damage to local crops resulting in major losses, a project was

initiated through the Delta Farmers' Institute (DFI) with assistance from BC Ministry of Agriculture and Lands (BC MAL) staff in Abbotsford. The pilot project known as the Delta Forage Compensation Project was approved in 2001 with the mandate of examining mitigation, monitoring and compensation. The project is run by a local steering committee consisting of BCMAL, Crop Insurance, Ministry of Water, Land and Air Protection (WLAP), Delta Farmers Institute, Canadian Wildlife Service (CWS), Ducks Unlimited (Canada), Delta Farmland and Wildlife Trust, and the Corporation of Delta. The Delta Forage Compensation Program contains three primary components—monitoring, mitigation and compensation—in addition to the requisite administrative and delivery resources. The objectives of the Delta Project include: determining the extent and severity of waterfowl damage on forage fields; investigating mitigation options; providing compensation for crop losses; and forming the overall basis for province-wide application (Ministry of Agriculture and Lands 2004).

As part of the project each fall producers sign-up for the project. They must agree to field inspections and to allow enclosures or other devices to monitor the growth and damage caused by waterfowl depredation to their forage crops. Field inspections are done by agrologists who are trained to distinguish waterfowl depredation from damage caused by other wildlife. Farmers must also agree not to disturb their fields during the period of monitoring. All areas studied are on working farms; some are purely forage production and some are forage and dairy. Other farms are very diverse and can be involved in many types of farming, such as forage, dairy, blueberries, potatoes, etc. The only criterion is they must be full-time farming. Use of “enclosures” involves placing a small netted device (of variable sizes) on the grass in the fall, thus preventing the waterfowl from grazing within that area. This allows a monitoring team to determine and measure the growth rate within the enclosure versus the growth rate outside the enclosure. From this, biomass loss can be established. It should be noted that not every field will have enclosures. Some fields, due to factors such as location, type of crop, type of soil condition (laser levelled, drained, etc) will be more susceptible to damage than others, although research has not been concluded to date (Butler 2005).

The DFI is charged with looking at mitigation opportunities and has investigated lure crops (planting palatable grasses away from the forage fields), laser levelling, and

relay cropping. Relay cropping uses a corn field and allows a secondary crop of rye grass. Corn is first planted, and after the corn is about six inches tall, forage grass seed is planted between the rows of corn. The corn continues its growth, while the grass seed roots and remains dormant. Once the corn is harvested in the fall, the grass seed shoots up and provides a lure crop for waterfowl.

Laser levelling assists in removing low spots, which reduces the pooling of water. This works well in years where rainfall is not excessive, but it may not work as well in very wet years. Reducing the pooling of water assists in stopping the waterfowl from staying in the field for a longer period of time and resulting in less damage to the crop. The DFI also conducted research on laser beams as a means to distract the American widgeon from landing in the field during the night time hours, their preferred eating period.

Compensation to forage-producers began in 2001 based on a flat rate of \$45 per acre for a damaged field which required re-seeding; in subsequent years this was raised to \$100 where damage has been substantiated (Zbeetnoff and McConnel 2007). This was complemented with a reseeding compensation rate of \$305 per acre, which was initially intended to compensate for 80% of the cost of reseeding areas afflicted with severe loss of palatable forage plants due to waterfowl grazing (Group 1 Consulting Services Ltd. 2007). Despite this increased level of compensation, farmers in Delta still receive no compensation for lost forage production and the replacement cost of lost forage. Crop losses may be reflected in lower forage yields, reduced harvest quality, a reduction in the number of cuts and destroyed plantings. Damage from waterfowl may also result in soil problems such as compaction and puddling.<sup>4</sup> The flat rate was “known to be well below the actual economic loss to farmers since yield losses vary from slight to four tons per acre, and forage currently has a value of about \$300 per ton” (Zbeetnoff and McTavish, 2004).

<sup>4</sup> Forage damage refers to reduced yields in standing crops. The extent and intensity of damage is not severe enough to warrant over-seeding or re-seeding and the field is capable of recovering, thereby not considered to be a damaged field. The compensation rate per acre of a damaged field is not an actual field-specific-yield loss assessment but was arbitrarily set until more robust data on forage loss could be gathered (Zbeetnoff and McConnell 2007).

Funding for the compensation disbursed by the pilot project came from the BC Ministry of Agriculture and Lands' (BCMAL) Risk Management Branch. The DFI assisted with the compensation component of the project by acting as a field office, with the BCMAL covering the costs for administering and delivering the compensation. The Corporation of Delta contributes some funding for the monitoring portion within Delta only. The Canadian Wildlife Service and Ducks Unlimited provide additional funding for the monitoring of this project.

### **3.2. Concerns with the Status of Current Waterfowl Management Policies**

Partial compensation for forage damages caused by waterfowl is currently provided in Delta out of provincial contributions under the federal-provincial safety net program. However, forage producers are dissatisfied with the level of compensation provided by the current program and are concerned that economic losses will rise as waterfowl populations increase. The findings of Zbeetnoff and McConnell (2007) indicate that the current compensation program leaves an economic shortfall to the producer (based on the lost production value or LPV) that ranges between \$98 and \$630 per acre, depending on the severity of loss. This production value of the yield loss represents between 60% and 86% of the total economic impact on producers. Therefore, the current compensation program is estimated to compensate for 27% to 40% of the economic loss sustained by forage producers, depending on the severity of loss, or leaving a "gap" of 60% to 73% of total economic loss (Zbeetnoff and McConnell 2007).

Furthermore, when the replacement cost of the lost feed is factored into the analysis, the current compensation program leaves an economic shortfall to the producer (based on feed replacement value or FRV) that ranges between \$257 and \$1,113 per acre, depending on the severity of loss. The feed replacement value of the yield loss represents between 73% and 91% of the total economic impact on producers. Thus, the current compensation program, based on FRV, is estimated to compensate for 11% to 26% of the economic loss sustained by forage producers, depending on the severity of loss, leaving a "gap" of 74% to 89% of total economic loss. An increase in

compensation to account for LPV and FRV would not necessarily imply moral hazard problems as even complete compensation for forage damage would not include the cost of inefficient field operations, ineffective use of equipment, asset restoration, and time and effort to purchase replacement forage.

### **3.3. The Policy Problem and Waterfowl Management Stakeholders**

Crop damage caused by grazing waterfowl represents a significant cost to many Delta farmers (Baumbrough Consulting 2002). In a survey of 85 farmers conducted in 1992, four out of five farmers reported wildlife damage to their crops in the previous three years (Klohn and Leonoff et al. 1992). Of the 15 forage producers, in the Delta/Mud Bay area surveyed for this report, all had experienced significant damage to their forage crops from waterfowl and all but two felt that the damage had increased over the past ten years.

In the past 100 years, a substantial proportion (~70%) of the wetland habitat has been lost due to the diking and drainage of farmland (Baumbrough Consulting 2002). Since then, the upland farmland habitat adjacent to intertidal areas has become essential for waterfowl wintering in this region. Agricultural lands provide necessary alternate feeding and resting areas for ducks and geese. Farmlands also provide crucial habitat for shorebird populations wintering in the Fraser River Delta. Thus, a viable farming industry, able to operate in harmony with waterfowl populations, is critical to the maintenance of migratory bird populations in the Fraser River delta (Baumbrough Consulting 2002).

## **4. Methodology**

### **4.1. Case Study Selection**

This study's methodology includes two major components: case-study analysis and key informant interviews. In order to explore the best ways to strengthen waterfowl damage management techniques, I have examined how other provinces with waterfowl damage issues similar to Delta have formulated and executed their policies. The case study analysis aids in illuminating a decision or set of decisions.

I have selected case studies with sufficient similarities to warrant comparison, yet diverse enough to add new perspective on the current Delta Forage Compensation Program. The prairie province cases are all similar insofar as they aim to protect waterfowl, and all were initiated by provincial governments. The prairie provinces are the only principal jurisdictions in Canada with waterfowl compensation programs. These programs are based on the same model where the promotion of both waterfowl populations and local agriculture are vital. The migratory birds covered are ducks, geese, and sandhill cranes (Zbeetnoff and McTavish 2000).

Using academic literature and reports from government bodies and non-profit organizations, I have assessed both quantitative and qualitative information on the four case studies. The goal of the analysis is to highlight the strengths and weaknesses of various waterfowl management techniques. After examining each management structure, I have developed a set of criteria to evaluate the most effective and relevant management policies for the Delta region.

In addition to case-study analysis, key informant interviews have been used to collect primary data for this study. As case-study analysis is the primary methodology, I have followed up written material on cases by contacting key stakeholders. Interviewing

has usefully complemented secondary sources where the published information is incomplete. It has also complemented studies of elite decision-making by providing additional information about motives that help explain actions and constraints in policy-making and implementation.

A limitation of this approach is the varied perspectives on the challenges waterfowl populations face and likewise diverse viewpoints on what constitutes successful waterfowl damage management techniques. Given the nature of the issue, it is likely that key informants will have biases. Forage producers could potentially exaggerate the extent of damage to their crops; insurance-related perils such as moral hazard and adverse selection could affect the farmers' behavior in terms of management/mitigation strategies undertaken.

Moral hazard represents the inclination of an insured person to minimize their care of a crop once a loss situation has begun. Moral hazard is of limited concern in WDCPs if the full cost of the loss is not paid for in the compensation program (Zbeetnoff and McTavish 2007). With severe waterfowl losses by waterfowl in the forage crops, producers face significant costs for which they receive no compensation (e.g. inefficient field operations, asset restoration, ineffective use of equipment, and time and effort to purchase replacement forage). These additional costs could mean that producers who receive compensation are usually not as well off as they would be in the absence of compensation and therefore are inclined to mitigate or not directly engage in creating production losses by wildlife.

Adverse selection occurs when participants attracted to the insurance program feel they can predict program loss outcomes or that premium rates charged for the insurance program underestimate their own risks. However, according to Zbeetnoff and McTavish (2007), adverse selection is not typically a concern with compensation programs since they are freely available to all producers at no cost. In most programs insurance agencies that administer production insurance and wildlife damage compensation programs (WDCPs) work closely with their respective environment departments to provide advice and risk aversion strategies to the producer. If these

strategies are not followed, repetitive claims can result in higher losses and increased premium costs to all participants.

Waterfowl advocates and conservationists whose priority is to maintain waterfowl populations may not take an interest in highly efficient measures to reduce the damage to forage crops. Their priorities are likely to be different than that of farmers, and therefore their policy suggestions would be aligned more with conservationist agendas. In order to navigate through these opposing positions, I have attempted to interview key informants who represent both perspectives. I have gained access to such informants through contacts at the BCMAL and through online resources.

## **5. Case Study Analysis**

### **5.1. Waterfowl Damage Compensation Programs<sup>5</sup>**

Federal-provincial agreements for the purposes of implementing the Agricultural Policy Framework (APF) allow compensation for damage caused by wildlife, including waterfowl, with the production insurance (PI) portion of the framework agreement provided in any province without cost to the producer except for administration fees and without requiring the producers' enrolment in any other government programs (Zbeetnoff and McConnell 2007). Wildlife damage losses within defined tolerances are in the "no premium" category, not because they are infrequent, but rather because producers have limited ability to mitigate losses due to "property rights" since wildlife is "owned" and protected/managed by the Crown.

The prairie provinces incorporate wildlife compensation into their respective federal-provincial implementation agreement. In these provinces, producers that incur wildlife damage to crops or livestock are eligible for pre-defined levels of compensation. Eligible crops and livestock may vary to some degree, but the compensation programs in the three provinces follow similar principles and designs.

Wildlife compensation in the prairie provinces is administered by the respective provincial Crown Corporations that manage the wildlife resources and provide advice and assistance to producers sustaining wildlife damage. Farmers pay no premium for the wildlife damage compensation and do not have to be enrolled in the production (crop) insurance program to be eligible. Governments cost-share claims on a 60% federal/40% provincial basis for crop losses. In Manitoba and Saskatchewan compensation is equal to 80% of the value (yield and grade) of the crop damaged and

<sup>5</sup> All information in Section 5.1 is from Zbeetnoff and McConnell (2007) unless noted otherwise.

determined by 80% of the percent of loss times the estimated yield prior to damage times the acres damaged times the commercial value of the crop. In Alberta, compensation is paid at 100 % of the value (yield and grade) of the crop damage and the province pays the additional 20% of the claim on their own above what is cost-shared 60% federal/40% provincial as in Saskatchewan and Manitoba.

The crop value is determined by the high price option, which is the maximum price paid for the designated crop grade under the provincial production (crop) insurance program factored for the grade of crop lost at the time of harvest. This ensures the farmers get adequate compensation for the grade of crop that has been damaged. For example, a compensation payment in Alberta for 50 percent loss on 10 acres of spring wheat would be determined as in Table 1.

**Table 1: Compensation Payment Example for Wildlife Damage on Spring Wheat in Alberta**

Basic Information	Compensation Payment
<u>Yield prior to damage</u> 30 bus/acre	$\% \text{ damage} \times \text{crop value} \times \text{acres damaged}$ $= 50\% \times (30 \text{ bus/acre} \times 0.485 \times \$4.35) \times 10$ acres
<u>Grade of harvest crop</u> Canada Feed	
<u>Harvest grade factor</u> 0.485	$= 50\% \times \$63.29 \times 10$ $= \$316.45$
<u>Price of designated wheat grade</u> \$4.35	Producers in Manitoba and Saskatchewan would receive 80% of this example amount.

Source: Zbeetnoff and McConnell, 2007.

In this example the grade of harvested crop is Canada Feed, which is worth 0.485 of the value of the designated grade of wheat insured under the production (crop) insurance program. The annual price options and their respective grade values are determined on an annual basis.

Waterfowl and wildlife compensation claims are treated the same way with respect to federal and provincial funding. In each province, minimum claim amounts apply and producers are expected to manage their crops and livestock in a way to mitigate losses as far as practical. Repeat claims can be reduced or denied if the producer has not undertaken mitigation strategies recommended by qualified

environment personnel. Producers must file compensation claims within specified time limits and cannot harvest damaged acres until a qualified loss adjuster has made a damage assessment. The same appeal processes governing production (crop) insurance claim assessments apply to wildlife damage compensation for producers who are unsatisfied with a claims settlement. Payments for wildlife claims based on individual loss assessment are deducted from any forthcoming production (crop) insurance claims for the same crop to avoid double indemnification.

### **5.1.1. Alberta<sup>6</sup>**

Alberta Financial Services Corporation (AFSC) administers the Wildlife Damage Compensation Program (WDCP) for un-harvested crop that has been damaged by waterfowl. Eligible crops include commercially grown cereal, oilseed, special crops, and hay insurable under the AFSC Crop Insurance Program. The Alberta program does not include grazing land or native pasture, crops seeded on land considered unsuitable for production, crops seeded too late in the season to produce a normal yield, volunteer crops, or crops left exposed to wildlife damage due to management practices. No premiums or administration costs are charged, and crop/production insurance does not need to be purchased to file a claim. Crops cannot be harvested until they are inspected by an adjuster. Claims must be filed 72 hours prior to harvest. A non-refundable appraisal fee of \$25 is required for each section (640 acres) of land on which damage has occurred. WDCP claims are deducted from any production insurance payments.

Compensation is based on the percentage of damage multiplied by the commercial value of the crop. To qualify, at least 10% crop loss must be evident and a minimum of \$100 loss calculated before compensation is paid. Since 1990 there has been no limit on the payout amounts to individual farmers, due in part to the contributions by the NAWMP. The Government of Canada and the Government of Alberta provide equal support for the program.

<sup>6</sup> All information in Section 5.2 to Section 5.4 is from a Ministry of Agriculture and Lands (2005) resource unless noted otherwise

The Fish and Wildlife Division of Alberta Sustainable Resource Development offers programs to help minimize waterfowl damage. These include providing prevention advice and loaning scare cannons to farmers free of charge. In the past, in areas where historical damage was of such severity that operating a prevention program was more economical than paying compensation for waterfowl crop damage, the former Alberta Environmental Protection operated feeding stations and lure crops to attract waterfowl away from field crops to areas where they would not cause damage.

### **5.1.2. Saskatchewan**

The province of Saskatchewan and the federal government have signed a Waterfowl Crop Damage Prevention Agreement. Saskatchewan's Waterfowl Damage Compensation Program Regulations determine the program's funding, administration and eligibility requirements. Saskatchewan Crop Insurance Corporation delivers the Crop Damage Compensation Program. Farmers contact their Saskatchewan Crop Insurance office for compensation applications.

Compensation of up to 80% is available for all seeded commercial crops, including crops not currently covered by crop insurance. No payments are made for compensation claims of less than \$100. It is not necessary to hold crop insurance to receive compensation, but there is a \$200 premium on all paid claims. Compensation is based on the amount of crop lost in an area, compared to the projected yield for the rest of the field, and the forecast market price for the crop. The field must not be harvested before an adjuster inspects the crop. To qualify for compensation, producers are required to allow hunters reasonable access to farmland.

In the case of perennial crops, compensation is determined by the cost of replacing plants that are completely destroyed or a percentage amount based on the damage where the plants are not completely destroyed. Compensation is not available for volunteer crops, crops planted too late to produce a normal yield, or crops seeded on land considered unsuitable for crop production. Virtually all crop types are covered. To qualify, the producers must demonstrate that they have made a reasonable effort to

harvest their crop (e.g. a producer **may** be refused payment if they are the only one left with crop out in the area). This program has been well received although a number of landowners believe that coverage should be 100% of actual losses.

Saskatchewan Environment delivers the Waterfowl Crop Damage Prevention Program. The program offers advice on prevention measures including the use of scare cannons, scarecrows or scare permits (for firearms permits). Hunters may also be given permission to hunt in the damaged crop area once the migratory bird season is over. Scare cannons (i.e. propane cannons) are available on loan to farmers, along with recommendations for use.

In the Quill Lakes area, a key breeding ground for North American waterfowl, Saskatchewan Environment manages the Waterfowl Crop Damage Control Program. The program was instituted in the late 1960s to compensate landowners for grain crops lost to field feeding waterfowl. The program employs temporary lure crops (168 ha.) and four bait stations to reduce the incidence of crop depredation in the area.

### **5.1.3. Manitoba**

Manitoba Crop Insurance Corporation (MCIC) administers the Waterfowl Crop Damage Compensation Program. If, despite prevention measures, damage occurs, Manitoba farmers can apply for compensation at 80% of eligible agricultural products. Compensation is based on the quality of the crop and the current crop-year dollar value. The minimum claim is \$100. Eligible crops include tame grasses and forage crops during the growing season. Ineligible crops include: crops damaged after harvest, crops susceptible to damage because of poor farming practices, crops grown on land that is uninsurable for crop insurance; products planted or located on public lands; crops used for lure or intercept feeding; or crops cut for grazing. Losses must be reported to MCIC within three days of discovering the damage. Crops must not be harvested until MCIC completes its assessment.

MCIC also offers forage establishment insurance and tame hay insurance, with one of the eligible causes of loss being waterfowl damage. Manitoba Conservation, in cooperation with Environment Canada, operates the Waterfowl Crop Damage

Prevention Program, to assist farmers in preventing damage to crops by waterfowl. Farmers can borrow scare cannons, scarecrow materials and shell crackers from Manitoba Conservation offices. Additional information on scaring techniques (e.g. flags fashioned from lath and a 3-mil black garbage bag) and farming practices that can help reduce waterfowl crop damage (e.g. planting faster maturing varieties of grain) is also available.

#### **5.1.4. Summary:**

All three prairie provinces use the model of joint federal-provincial funding to offer waterfowl prevention programs (through their provincial environmental agency) and waterfowl compensation programs (through their provincial crop insurance agency). The federal Crop Insurance Regulations have a section devoted to the Waterfowl Crop Damage Compensation Program. The three provinces' programs, plus the provision of a compensation program within the federal regulations, appear to offer a potential role model for the future of the Delta program post-2008.

## **5.2. Comparative Success**

The Prairie Provinces have effective waterfowl damage compensation programs that recognize the vulnerability of farmers to migratory waterfowl. Alberta has an additional top-up to the federal-provincial program that eliminated the deductible and offers coverage to 100% of crop value (yield and quality). Even in Alberta, producers often experience financial losses in excess of compensation paid that can be attributed to inefficiency at harvest, administration costs associated with claims, the costs of mitigation strategies, and/or arranging for replacement feed (Zbeetnoff and McConnell 2007). According to Zbeetnoff and McTavish (2000) the four western provinces provide equipment and materials to scare off waterfowl, lure crops and feeding stations to intercept waterfowl. Alberta, Saskatchewan and Manitoba provide incentive payments for lure/cover crops and for laser land levelling.

### **5.3. Implications for British Columbia**

Waterfowl advocates and forage producers in Delta have to deal with the implications of waterfowl habitat overlapping with agricultural areas. Options to further increase the carrying capacity of agricultural land to sustain over-wintering waterfowl populations may be more expensive than outright full compensation of the impact currently experienced. A waterfowl program in BC ought to allow producers to protect their crops, in and outside of hunting season, in order to permit the continuation of economically viable agriculture. Full compensation funding and delivery of damage reduction measures should be set by federal-provincial agreements.

The prairie provincial governments are willing to pay compensation for waterfowl damages in a formalized manner with compensation based on the value of loss. In federal-provincial crop insurance schemes, program developers have rationalized the 80% compensation level to eliminate small nuisance claims, to reduce the potential for moral hazard and to lessen the potential for adverse selection. The 20% deductible under crop insurance acknowledges the principle that farmers have a responsibility to undertake mitigation measures to protect themselves from wildlife impacts. In some cases, if a crop is designated by wildlife officials as being important for habitat or as a lure crop to keep waterfowl from going into other crops, the losses are paid at 100% (Zbeetnoff and McConnell 2007). However, the waterfowl compensation programs in other provinces do not address losses beyond yield value. Recovery of damage costs incurred by perennial forage producers in field rehabilitation and preparation from a BC compensation program would entail looking beyond the scope of current approaches.

Alberta tops up its waterfowl damage compensation program coverage by 20% to 100% of crop value (yield and grade), beyond the terms of the federal-provincial agreement. Considering the magnitude of damages being sustained in the Delta area, a similar approach could be considered in BC. A rationale for making the 100% coverage argument is the restrictions on how producers can mitigate damage. If the producer is facing chronic damage exceeding 20% of the value of the crop on an annual basis, then there could be a case for higher compensation. This may be justified by the fact that waterfowl cannot be controlled by shooting or poisoning, while segments of society are

creating habitat and encouraging the increase in waterfowl populations. Full compensation for yield and grade of crop damaged does not cover the full cost to the forage-producer; however, it remains a cost-effective option to preserve critical habitat resources for over one million birds annually.

## **6. Policy Objectives, Alternatives and Criteria**

### **6.1. Policy Objectives**

From a careful review of information pertaining to waterfowl management policies in BC and the Prairie Provinces, it is apparent that farmers are providing an environmental service by supplying habitat for waterfowl and allowing them to graze farmland. Society benefits from this environmental service, yet it is the farmer who is individually bearing most the associated cost with waterfowl grazing. Policy formulation must recognize that the current compensation methods in BC do not address the full extent of waterfowl grazing. A farmer's main job is to produce food; crop damage by waterfowl reduces their output without decreasing their costs, thus threatening farmers' economic viability. The costs of full compensation for forage producers would be significantly higher than current program payments. Short of requiring a change in the crops produced opportunities to reduce the risk of financial losses to forage producers are limited (Zbeetnoff and McTavish 2004).

The primary policy objective is to find a resolution or integrated management plan to deal with the losses incurred by forage farmers in the lower Fraser River delta. Success of an expanded program will require support and participation of non-agricultural stakeholders in others areas (Zbeetnoff and McTavish 2004). Regardless of the precise policy adopted, a multi-stakeholder approach is needed to ensure that wildlife and human values remain protected.

Wildlife agencies should undertake strategic planning to determine whether it is more cost-effective to support existing farmers in areas used extensively by waterfowl or to risk losing some of that habitat in the event that the perennial forage producers find the damages to be unsustainable (Zbeetnoff and McConnell 2007). Provisional solutions can include a subset of potential management policy options. Some may be practical at

once, while others will require additional research to assess their effectiveness, and some may be simply too costly to consider.

## **6.2. Policy Alternatives**

In this sub-section I outline four policy alternatives that I have drawn from the key findings of my case study analysis. The policies suggested are underscored by relevant international/federal/provincial acts, legislation and regulations pertaining to waterfowl protection and agricultural issues. As prevention is not applicable with respect to migratory birds, only mitigation and compensation programs are feasible. The current management structure of the Delta Forage Compensation Programs is considered the status quo policy alternative in this analysis.

Policy Alternative 1: This would maintain the status quo by supporting the regional stakeholder model for agriculture-wildlife program management and supporting current initiative measures developed by DFWT. The challenge with status quo is that farmers in the Delta region are “running out steam”; they want to tend to their farms and not attend meetings. Also, there is a sense of lack of fairness in the compensation provided to forage producers in BC when compared to those in the prairie provinces, where the farmers have greater political clout (Interview #1 2009).

Policy Alternative 2: This option would add to the current agriculture-wildlife agreement in BC minimum pay-outs that would evolve to full compensation measures (100%). Delta presently has a 10 acre minimum for compensation; this should be kept and be part of an expanded program. Minimum payouts should be considered. Compensation needs to be based on a realistic measure of yield loss and a value for the loss. At the present time, “compensation levels” are at a base rate for affected areas or 80% of reseed/over-seeding costs (Zbeetnoff 2004). Any compensation program must be made meaningful by basing payments on yield loss.

Vegetative transect analysis should be used to monitor the impact of grazing and estimate economic loss of forages based on market rates for forage product. This method of damage assessment usually assesses the above-ground vegetation right

before the predicted arrival of migratory bird species. However, this procedure is labour intensive as a high number of replicates are required in order to generate statistically significant data (Group 1 Consulting 2007).

Compensation would be 100% of the economic value of the forage lost, and an additional 100% of the reseeding or over-seeding costs would be covered. The prairie provinces provide an example of how provinces have implemented compensation programs to deal with forage crop losses due to waterfowl damage. This requires that procedures for damage assessment be developed and that adjusters be trained to deliver a waterfowl damage compensation program.

The increased compensation model would operate differently in BC than it does in the prairies. The prairie provinces are more likely to have historical data about their annual forage production while farmers in BC are generally growing their forage on a smaller scale, mostly to feed their own animals; it is not as easy to figure out what farmers yield would have been or what the net market value would have been. Without yield data and market price data full compensation is an ideal policy option, when combined with mitigative strategies, but not a simple one. Farmers would need to provide their own yield data, perhaps based on a 5-year cumulate average. However, even comparing farmers' yield data to base data may prove to be "tough" (Interview #1 2009; Interview #2 2009).

Policy Alternative 3: This option would be to broadly implement mandatory cost-shared laser levelling on forage producing farms in Delta. Fields that have standing water within them during winter months are particularly attractive to waterfowl. Based on monitoring information gathered in 2000-2001, it was determined that laser levelling was a significant factor that had the largest effect on biomass loss due to waterfowl grazing (Delta Forage Compensation/ Mitigation/ Monitoring Project 2003). Preliminary analysis for the 2001-2002 data also found that fields that were not laser-levelled sustained higher damages (81-100% more damage than fields that were laser levelled). Laser leveling assists in removing low spots, thus reducing the pooling of water. This works well in years where rainfall is not excessive but may not work as well in very wet years.

Reducing the pooling assists in reducing the amount of time waterfowl are in the fields and therefore reducing the crop damage.

Given that laser levelling emerged consistently as a variable associated with forage loss, the Delta Forage committee submitted a proposal to request funds to evaluate the impacts of laser levelling in the municipalities of Delta and Surrey. While surveys of biomass loss have been collected on laser-level fields versus non-laser-level fields, post hoc analysis of observations surveys indicates a correlation but not necessarily causation. This management practice can result in considerable financial investment in the fields. Therefore, laser levelling should be compensated or at least cost-shared with farmers to lower the financial burden, in order to reduce the amount of water pooling on agricultural soils. This option may present a challenge in Delta as there is only one company in the region that carries out laser-levelling operations (Interview #1 2009). If the program was cost-shared and mandatory this may provide an incentive for other companies to invest in undertaking laser-levelling operations.

Policy Alternative 4: This policy would implement mitigation measures to disperse wildlife concentrations through the use of lure crops and/or relay cropping of palatable forage to attract waterfowl to land set-asides or annual cropped fields planted to winter cover crops. Since being adopted in 2002, relay cropping appears to have benefitted farmers (Delta Farmers Institute and the Project Steering Committee 2006). Relay cropping provides farmers with an opportunity to lure waterfowl with plantings of rye grass between rows of corn strategically planned to grow once the corn is harvested. It also provides a bonus harvest to those forage producers who utilize this method and find they have 'extra' forage not taken by the waterfowl. Also, farmers could plant less palatable forage crops in high-risk areas.

According to the 2006 study, producers themselves have, over several years, understood the lure of orchard grass for waterfowl grazing was greater than that of tall fescue (Delta Farmers Institute and the Project Steering Committee). Despite the large areas of diversionary forage planted specifically to lure waterfowl from perennial forage fields, damage to forage fields continues on an annual basis. Nonetheless, according to Zbeetnoff and McConnell (2007), where cover crops are intensively cropped by

waterfowl, the benefit of luring waterfowl from perennial forage crops may be of more value than the cost of lost cover crop silage at the end of winter.

In 2005-2006, DFWT funded a total of 2,470 acres of winter cover crops including approximately 100 acres of relay crops. Under their program, DFWT provides producers with \$45 per acre as a cost share. The direct cost of producing cover crops is estimated to be about \$224 per acres. Also, the opportunity cost associated with the foregone gross margin benefit could represent an additional \$2.25 to \$8.13 per acre, depending on the extent of waterfowl use (Zbeetnoff and McConnell 2007).

A challenge with any mitigative option in Delta is that it is not a panacea, since waterfowl damage cannot be fully eliminated (Interview #1 2009). Yet mitigation carries advantages including: the social benefit of getting society and agencies involved in working on problems together and an intrinsic value in trying to maintain as much farmland as possible. When local government is engaged, more people are likely to grapple with the issue and it does not get framed as just a problem for farmers or waterfowl advocates (Interview #3 2009).

### **6.3. Criteria for Analysis**

I use a set of four criteria to provide the framework for evaluating each policy alternative. The criteria are cost, effectiveness, acceptability, and equity. I establish benchmark measures for each criterion. I give these measures a performance rating of low, medium, or high. Policies that have a high performance rating receive three points, those with a medium performance rating receive two points, and those with a low performance rating receive one point. I have not weighted the criteria because each one plays a distinct and important role.

The measure of the cost criterion for wildlife management policies evaluates the annual cost to government for each of the policy options. Additionally, it would be ideal to include the social valuation of the net benefits of the provision of agricultural habitat for protected waterfowl species, but such information was not available. If there was sufficient information, the social valuation of net benefits would be measured through

benefit-cost analysis (BCA). BCA estimates the increase in value to society (measured in markets or by non-market methods) produced by some action, such as the preservation of agricultural habituated for waterfowl. This measurement weighs the social benefits and costs of an environmental action and determines whether the gains outweigh the losses (National Oceanic and Atmospheric Administration 2002). This data informs policy-makers of the social benefits of an initiative and offers insight beyond the budgetary cost to government.

Measures of the effectiveness criterion assess whether the option is feasible on a practical level and whether the program has developed a damage assessment protocol. If the option is theoretically viable but does not work well when applied in a realistic context, it may not be worth implementing. If the benefits do not arise in the immediate future, a policy could be deemed as less effective.

The criterion of acceptability among farmers, waterfowl advocates, conservationists, and relevant government agencies is evaluated. As the issue of waterfowl management is a contentious subject to interested parties, it will be important to determine the probable level of acceptability among those most affected by relevant policies.

Equity pertains to whether the policy provides equitability among farmers in BC whose crops are affected by waterfowl damage and whether the policy includes a sustainable stakeholder participation process in each region. Equitability in this study is defined as farmers having equal compensation levels and valuation for forage loss comparable to that of other farmers across BC and other provinces. The issue of equity to Delta farmers suffering crop losses is of concern even if they may have purchased their land at a value reflecting the restriction, with the knowledge of the mitigative constraints. Delta forage-producers are participating in the provision of a social good in an area of increased urbanization. Many observers would deem it fair for them to receive compensation comparable to that of other farmers in the country who are dealing with similar issues.

**Table 2: Criteria and Measures**

Criteria	Definition	Measure	Value
<i>Cost</i>	What is the annual cost to government for each policy alternative?	Assessment of annual expenditures, such as the cost to carry out the waterfowl management under the policy	1. High 2. Medium 3. Low
<i>Effectiveness</i>	Is the option is feasible on a practical level? Does the policy implement a significant compensation level based on yield loss and forage value? Does the policy meaningfully compensate farmers for economic losses due to waterfowl damage?	Assessment of whether policy has been successfully developed in previous studies/other jurisdictions	3. High 2. Medium 1. Low
<i>Acceptability</i>			
Acceptability among farmers	How much will the average total forage crop of Delta, BC farmers change under the policy?	Assessment of effect on forage crop yield (increase/neutral/loss?)	3. High 2. Medium 1. Low
Acceptability among waterfowl advocates	How much will waterfowl populations be affected under the policy?	Assessment of effect on waterfowl populations (increase/neutral/loss?)	3. High 2. Medium 1. Low
Acceptability among relevant government agencies	How simple is the design, implementation, and operation of this policy?	The policy entails: No changes to existing policies..... Moderate changes to existing policies.... Major changes to existing policies.....	3. High 2. Medium 1. Low
<i>Equity</i>	Does the policy provide equitability among farmers in BC whose crops are affected by waterfowl damage & does the policy include a sustainable stakeholder participation process in each region?	Farmers having equal compensation levels and similar valuation for forage loss comparable to that of other farmers across BC and other provinces	3. High 2. Medium 1. Low

## **7. Policy Analysis**

This section assesses each of the policy alternatives using the established set of criteria to gauge their merits in the context of Delta, BC. The analysis presented here informs the final policy recommendation.

### **7.1. Policy Alternative 1: Status Quo**

*Cost-A* study indicates that the current compensation program leaves an economic shortfall to the producer, based on the loss production value (LPV), which ranges between \$98 to \$630 per acre, depending on the severity of loss. The current compensation program, based on feed replacement value (FRV), is estimated to compensate 11% to 26% of the economic loss sustained by forage producers, depending on the severity of loss, or leaving a gap of 74% to 89% of total economic loss (Zbeetnoff and McTavish 2007). Generally the largest shortfalls in compensation are found in the over-seeding and re-seeding categories. Waterfowl-related economic losses in irrigated forage crops are higher than in dry-land crops. While program funding for the compensation was covered by the BC Ministry of Agriculture and Lands' (BCMAL) Risk Management Branch, as of March 20, 2007 continuation of funding beyond March 2008 had not been secured (Group 1 Consulting Services Ltd. 2007). Given the fact that pilot project has continued to operate it is likely that the budgetary cost to the government is low. The majority of the cost is carried by the individual forage-producer.

*Effectiveness*-The program has run since 2001 and has been running moderately well in terms of continuing to deliver the original needs and objectives. The Steering Committee have assisted in determining impacts on grazing perennial forage fields, subsequent cut impacts, reasonable methods of impact damage as well as reasonable

administrative procedures to deliver the program in a cost effective manner. Claims to waterfowl damage to forage fields have been paid to program producers. Of the 22 farms enrolled in the program, 18 received some level of payment for waterfowl damage (Delta Farmers Institute and the Project Steering Committee, 2006).

*Acceptability-* Acceptability of this program ranks low among Delta farmers. In 2006 it was estimated that the current compensation levels were approximately a third of the actual value (Delta Farmers Institute and the Project Steering Committee). Forage producers are dissatisfied with the level of compensation provided by the program and are concerned about economic loss as waterfowl populations increase.

Acceptability among waterfowl advocates would be moderate as the program does not adversely affect waterfowl populations. At the same time, more funding could go into supporting forage producers so that they have incentives to provide cover and lure crops annually. Acceptability among relevant government agencies is high as the program has been in place for a few years and is not costing the government as much as it would be if full compensation were being paid to the farmers.

*Equity-*The program does not provide comparable compensation levels to BC forage producers as to the levels provided in the Prairie Provinces. This puts Delta forage producers at a comparative economic disadvantage when they are competing with farmers in the other western provinces. Furthermore, the pilot project continues to provide nominal compensation, with minimal farmer involvement in the policy development process.

## **7.2. Policy Option 2: Minimum Pay-Out/Full Compensation**

*Cost-*A federal-provincial damage compensation program (WDCP) modeled on programs in the Prairie Province and utilizing the 60:40 federal-provincial cost sharing formula would provide a significant compensation level to Delta farmers. Ideally, the provincial government would treat waterfowl damages in the “no premium” category and top up the WDCP so as to provide forage producers with 100% compensation of loss production value. A funding arrangement would need to be arranged between the

federal and provincial governments. Compensation levels reflecting the market values of lost forage production would be significantly higher than indemnity level currently being paid (Zbeetnoff and McTavish 2004). This would cost the government more money in terms of the pay-out, however a more accurate understanding of the loss experienced by Delta forage producers may provide incentives for the government to fund more mitigative strategies as well.

*Effectiveness:* This program would be effectively modeled on the example of the Prairie Provinces. While existing yield information and damage information would be sufficient to get started, the program would be strengthened by the pursuit of more systematic and accurate waterfowl impact assessment techniques. As long as a number of information gaps are filled by targeted investigation, the program would be effective.

*Acceptability:* This program would be highly popular with farmers as it would fully compensate them for losses due to waterfowl damage. Waterfowl advocates would not be adversely affected by the program, and therefore the level of acceptability among this group would be moderate. Relevant government agencies would not be proponents of this policy. Initially it would be difficult to implement this policy, and the government would have to hire assessment experts in order to manage the program.

*Equity:* This policy would engage farmers in the participation process in each region. It would also put them in a similar situation to their counterparts in Alberta, Manitoba, and Saskatchewan. BC producers would no longer be at an unfair economic disadvantage.

### **7.3. Policy Option 3: Mandatory Laser-Levelling**

*Cost:* This option would cost the governmental a substantial amount at the onset of the program. However, as more forage producers implement this mitigative option there would be less need to invest in future laser-levelling operations and less compensation pay-outs would be required.

*Effectiveness:* Studies have shown that laser levelling is an effective mitigative tool, particularly when applied to fields that have standing water during winter months. However, surveys of biomass loss, which have been collected on laser-level fields versus non-laser-level fields, indicate a correlation but not necessarily causation. This management practice can result in considerable financial investment in the fields. Given the lack of decisive impacts as a result of laser-levelling, this policy option was assessed as being low in terms of effectiveness.

*Acceptability:* Acceptability among farmers would be moderate. This management practice could result in considerable financial investment in fields and some farmers may feel ambivalent about this. Incentives would have to be developed to cost share the investment with farmers to lower the financial burden to farmers wanting to implement laser-levelling on their fields. A mandatory laser-levelling program may not be supported by farmers, however, and expansion of the cost-sharing program administered by Delta Farmland and Wildlife Trust may be more readily accepted by farmers.

Waterfowl advocates may not accept this policy as it may be viewed as reducing the amount of fields with standing field water. Given the realities of an increasingly urbanized periphery around the Fraser delta, a new large wetland set-aside is not likely to be offered to waterfowl advocates. The loss of wet fields would not resonate well with waterfowl advocates. However, laser-levelling may actually provide more productive habitat for birds. Efforts should be made to increase awareness among waterfowl agencies that it serves their collective interests to “participate responsibly when wildlife management strategies create unsustainable impacts on forage producers, or risk having the land convert to crops that do not provide waterfowl food resources of habitat” (Zbeetnoff and McConnell 2007).

Relevant governments would also have a low acceptance level of the policy option of mandatory laser levelling. This policy would be logistically challenging to implement as it would require government officials providing incentives to farmers to participate. An expansion of the program that exists in Delta would be considerable and would take a great deal of governmental resources.

*Equity-* Incentive payments and compensation should be allocated to all forage producers affected by waterfowl damage in BC who participate in the mandatory laser-levelling process. These payments should be fair and equal in order to guarantee an equitable process for farmers.

## **7.4. Policy Option 4: Lure Crops/Relay Cropping**

*Cost:* Lure crops and relay cropping are mitigative measures that seek to limit commercial forage damage as a result of waterfowl grazing. This policy would not significantly increase farmers' compensation levels but could attract birds and prevent them from damaging forage crops. A waterfowl lure crop that is a set-aside in an area that has been selected by birds and where a feeding pattern has been established could prevent serious depredations to grain crops. Relay crops would offer another means of providing alternative habitat to waterfowl at the same time protecting the soil from erosion by heavy winter rains. Such cover crop may be able to provide an alternative feeding area for waterfowl (Bambrough Consulting 2002). This would involve growing two crops on the same piece of land for at least part of a growing season. The cost for such a program, compared to full compensation to forage producers, would be moderate.

*Effectiveness:* Theoretically this policy seems to provide an ideal solution to the issue of waterfowl grazing on forage fields. However a 3-year lure crop pilot study in North Dakota revealed that lure crops that had been pre-selected (i.e. before the damage occurred) failed because ducks could not be reliably induced into the field. Also fall rains caused flooding of the fields when the harvest had reached 50% completion (Bambrough Consulting 2002). Relay cropping also entails substantial difficulties including weed problems and inclement weather that may prevent relay crops from establishing properly or surviving the winter. For these reasons the effectiveness of this policy option is assessed to be low.

*Acceptability:* Farmers' acceptance of the lure cropping/relay cropping policy option would be moderate. It is not a challenging mitigative tool, and with the guidance of agency officials (i.e. from Delta Farmland and Wildlife Trust) farmers may feel more

inclined to participate in cost-sharing planting of cover crops. Hesitation on the part of the farmers may result if the rest of their fields become intensively grazed, and they will likely not engage in undertaking this policy measure in the future if this occurs.

Acceptance of this policy option among waterfowl advocates would be high, as this option promotes waterfowl conservation and habitat preservation. Government agencies would likely promote this option, provided that trial runs, with larger scale and replicated cover crop farmland trial to investigate various questions of plant palatability, preference, and selective defoliation, proved successful. This would enable a “better understanding of both the quantitative and qualitative aspects of managing cover crops for waterfowl conservation purposes” (Bambrough Consulting 2002)

## 7.5. Evaluation Summary

Table 3 summarizes my policy analysis results, using the four policy alternatives and the specified criteria and measures.

**Table 3: Evaluation of Policy Alternatives**

Criteria	Status Quo	Minimum Pay-Outs/Full Compensation	Mandatory Laser-Levelling	Lure Crops/Relay Cropping
<i>Cost</i> -annual cost to government for each of the alternative policy options	-Low (3) 3*	-High (1) 1*	-High (1) 1*	-Medium/High (1.5) 1.5*
<i>Effectiveness</i> -feasible on a practical level/include a damage assessment protocol/benefits reaped in the immediate future	-Medium (2)/ 2*	-Medium/High (2.5) 2.5*	-Low (1) 1*	-Low (1) 1*
<i>Acceptability</i>				
<i>Acceptability among farmers</i>	-Low (1)	-High (3)	-Medium (2)	-Medium (2)
<i>Acceptability among waterfowl advocates</i>	-Medium (2)	-Medium (2)	-Low (1)	-High (3)
<i>Acceptability among relevant government agencies</i>	-High (3)	-Low (1)	-Low (1)	-Medium (2)
<i>Average Acceptability Score</i>	2*	2*	1.3*	2.3*
<i>Equity</i> -Provides equitability among farmers in BC/includes a sustainable stakeholder participation process in each region	-Low (1) 1*	-High (3) 3*	-Medium (2) 2*	-Medium (2) 2*
<i>Total</i>	8	8.5	5.3	6.8

## 7.6. Policy Recommendation

Rather than eliminating the current Delta Forage Compensation Program, it should be modified to focus on key mitigative strategies. Any one method alone will not minimize crop losses in the Fraser Delta. A more effective approach may be to privately fundraise to expand the cost-sharing program into a broad program aimed at diminishing crop losses. This applies specifically to the suggested mitigative strategy of increasing

the amount of lure crops and relay cropping. A mandatory laser-levelling program would not be effective in terms of both cost and proven results.

Based on comparative analysis of the Delta Forage Compensation Program and the WDCPs in Alberta, Manitoba, and Saskatchewan I recommend that BC establish a BC-Canada Waterfowl Minimum Pay-out/Full Compensation Program (Zbeetnoff and McConnell 2007). This program would be based on a 60:40 federal-provincial sharing of costs. A process of dialogue with the federal government and provincial government could reveal their needs in order to participate in a waterfowl compensation program for forage in BC (Zbeetnoff and Mctavish 2007). In addition to the suggested policy options, research should be funded in areas such as damage reduction and “waterfowl-resistant” crop varieties. Solutions should not be seen as mutually exclusive management suggestions; an integrated management plan would include many or all of these options.

## **8. Conclusion**

The issue of waterfowl damage to forage crops has always been a concern within the lower Fraser River Delta, but as wetland habitat diminishes in the lower mainland, Delta and parts of Surrey around Mud Bay have experienced increasing waterfowl over several years. Delta farmers are concerned about the cost associated with the reduced forage yields, harvest quality, reduced length of the production season, and destruction of harvests caused by waterfowl grazing.

Agricultural lands provide necessary alternate feeding and resting areas for ducks and geese. Farmlands also provide crucial habitat for shorebird populations wintering in the Fraser River Delta. Thus, a viable farming industry, able to operate in harmony with waterfowl populations, is critical to the maintenance of migratory bird populations in the Fraser River delta.

In this study, I have explored ways to manage the issue of waterfowl damage to forage crops in Delta, BC. Through a case study analysis, I concluded that other successful waterfowl damage compensation programs in the prairie provinces have several main characteristics in common. All three prairie provinces use the model of joint federal-provincial funding to offer waterfowl prevention programs (through their provincial environmental agency) and waterfowl compensation programs (through their provincial crop insurance agency). The three provinces' programs, plus the provision of a compensation program within the federal regulations, offer a potential role model for the future of the Delta program.

After carefully considering the history and current context of waterfowl damage management practices in Delta, BC, I established a series of policy alternatives. These were: maintaining the status quo, minimum pay-out/full compensation to forage producers, mandatory laser-leveling, and lure crops/relay cropping implementation. Using a set of criteria and information from interviews with key stakeholders I analyzed

these policies and evaluated their comparative attractions and weaknesses. I conclude the best policy for British Columbia would be to develop its own Canada-BC Waterfowl Minimum Pay-out/Full Compensation Program modeled after the WDCPs in Alberta, Manitoba, and Saskatchewan.

# Bibliography

## Works Cited/Documents Reviewed

- Adamowicz, W.E., W.S. Phillips, W.S. Pattison. "The Distribution of Economic Benefits from Alberta Duck Production." *Wildlife Society Bulletin*. Winter 1985: 396-398.
- Anderson, Elaine. "Adaptation to Environmental Sustainability: The Story of the Delta Farmland and Wildlife Trust." 2007. Retrieved on October 25, 2008 from <<http://www.inter-disciplinary.net/ptb/ejgc/ejgc6/anderson%20paper.pdf>>.
- Baumbrough Consulting. "Mitigation of Waterfowl Grazing on Perennial Forage Fields: Final Report." April 2002.
- Bulte, Erwin and Daniel Rondeau. *Compensation for Wildlife Damage: Habitat Conversion, Species Preservation and Local Welfare*. Resource Economics and Policy Analysis (REPA) Research Group. Nov. 2003.
- Bulte, Erwin and Daniel Rondeau. "Why Compensating Wildlife Damages May Be Bad for Conservation." *The Journal of Wildlife Management*. Jan. 2005: 14-19.
- Butler, Robert. "Waterfowl Damage to Forage Crops." *Farmwest*. 2004. Retrieved on October 16, 2008 <<http://www.farmwest.com/index.cfm?method=pages.showPage&pageid=254>>.
- Conover, Michael, Robert H. Schmidt, and Kimberly K. Wagner. "Compensation Programs for Wildlife Damage in North America." *Wildlife Society Bulletin*. Summer 1997: 312- 319.
- Cheng, K. "A Bird in Hand: Achieving Reconciliation in Agroecology." *AGRO 461-Applied Agroecology*, 2007, 3.
- Delta Farmland and Wildlife Trust. "About the Trust." April 2006. Retrieved on January 8, 2006 from <<http://www.deltafarmland.ca/dfwt.html>>.
- Delta Farmers Institute and the Project Steering Committee. "Delta Forage Compensation Program." Year 5 Annual Report. August 31, 2006.

- Delta Forage Compensation/Mitigation/Monitoring Project. "Evaluation of Laser Levelling as a Mitigative Tool on Forage Fields in Fraser Delta." *Agriculture Environmental Partnership Initiative*. May 16, 2003.
- Ducks Unlimited Canada. "80,000 Snow Geese Carry the Message About Farmland Habitat in Delta." October 27, 2005. Retrieved on November 19, 2008 from <<http://www.ducks.ca/province/bc/news/2005/051027.html>>.
- Ducks Unlimited Canada. "Who We Are." 2008. Retrieved on January 16, 2009 from <<http://www.ducks.ca/aboutduc/index.html>>.
- Environment Canada. "Waterfowl Species Abundance: An Indicator of Wildlife Sustainability in British Columbia's Interior." 2005. Retrieved on February 20, 2009 from <[http://www.ecoinfo.gc.ca/env\\_ind/region/ducks/ducks\\_e.cfm](http://www.ecoinfo.gc.ca/env_ind/region/ducks/ducks_e.cfm)>.
- Environment Canada. "North America Waterfowl Management Plan." 2009. Retrieved on March 29, 2009 from <<http://www.qc.ec.gc.ca/Faune/sauvagine/html/nawmp.html>>.
- Extension. "Waterfowl Damage Management" 2008. Retrieved on February 2, 2009 from <[http://www.extension.org/pages/Waterfowl\\_Damage\\_Management](http://www.extension.org/pages/Waterfowl_Damage_Management)>.
- Gruner, Danny, Megan Halstead, Matt Ho, Erik Lauder, and Amy Sues. "An Assessment of Evaluation Methods for Quantifying Loss of Forage and Degradation of Soil Quality by Waterfowl in Delta and Surrey, British Columbia." Group 1 Consulting Services Ltd., UBC, March 30, 2007.
- Hinterland's Who's Who. "Issues and Topics: Benefits of Wildlife." *Canadian Wildlife Services*. 1995. Retrieved March 5, 2009 from <<http://www.hww.ca/hww2.asp?pid=0&id=221&cid=4>>.
- Joint Task Group. "Report from the Joint Task Group for Clarifying North American Waterfowl Management Plan Population Objectives and their Use in Harvest Management." 2007. Retrieved on January 25, 2009 from <<http://www.fws.gov/migratorybirds/reports/ahm07/Final%20Report%20of%20the%20Joint%20Task%20Group.pdf>>.
- Leonoff, Klohn, W.R. Holm and Associates and G.G. Runka Land Sense Ltd. 1992. Delta Agricultural Study. Funded under Agri-food Development Subsidiary Program, Ministry of Agriculture, Fisheries and Food; and Agriculture Canada
- Martin, Michael, Rebecca Johnson, and Raymond Rasker. "Theory versus Practice in Wildlife Management." *Conservation Biology*. Sep. 1992: 338-349.

- Merkens, Markus. "Protecting the Land." *South Delta Leader*. September 19, 2008. Retrieved on October 15, 2008 from <[http://www.bclocalnews.com/richmond\\_southdelta/southdeltaleader/business/28655504.html](http://www.bclocalnews.com/richmond_southdelta/southdeltaleader/business/28655504.html)>.
- Ministry of Agriculture and Lands. "BC Agriculture Plan: Growing a Healthy Future for BC Families." 2007. Retrieved on February 20, 2009 from <[http://www.al.gov.bc.ca/Agriculture\\_Plan/Agriculture\\_Plan.pdf](http://www.al.gov.bc.ca/Agriculture_Plan/Agriculture_Plan.pdf)>.
- Ministry of Agriculture and Lands. "Delta Forage Compensation Project." PowerPoint Presentation. March 31, 2004.
- Ministry of Agriculture and Lands. "Waterfowl Damage-Prevention and Compensation Programs." April 2005.
- North American Waterfowl Management Plan. "What is NAWMP?" 2008. Retrieved on February 18, 2009 from <[http://www.nawmp.ca/eng/index\\_e.html](http://www.nawmp.ca/eng/index_e.html)>.
- North America Wetlands Conservation Council. "Wetland Mitigation and Compensation- Proceedings of a National Workshop." April 22-24 1997.
- Ontario Soil and Crop Improvement Association. "Probing Problem Wildlife: An Update on the Wildlife Action Project." Wildlife Action Project. April 2004.
- Post, D.M., Taylor, J.P., Kitchell, J.F., Olson, M.H., Schindler, D.E., Herwig, B.R. 1998. "The Role of Migratory Waterfowl as Nutrient Vectors in a Managed Wetland." *Conservation Biology* 12: 910-920
- Saddlemeyer, Keith, Hobson Richard, and Suzanne Veit. "Report and Recommendation of the Delta Mediation Team." 2001. Retrieved on October 25, 2008 from <[http://www.agf.gov.bc.ca/publicat/delta\\_final\\_rept.doc](http://www.agf.gov.bc.ca/publicat/delta_final_rept.doc)>.
- Shafer, Elwood, Robert Carline, Richard Guldin, Ken Cordell. "Economic Amenity Values of Wildlife: Six Case Studies in Pennsylvania." *Environmental Management*. 1993.17:5, 669-682.
- Stroup, Richard. "The Economics of Compensating Property Owners." *Contemporary Economic Policy*. 1997. 15:4, 55-65.
- United States Environmental Protection Agency. "Crop Glossary." 2007. Retrieved on January 20, 2008 from <<http://www.epa.gov/oecaagct/ag101/cropglossary.html>>.
- Yen, Steven, Peter Boxall, Wiktor Adamowicz. "An Econometric Analysis of Donations For Environmental Conservation in Canada." *Journal of Agricultural and Resource Economics*. 1997. 22:2, 246-263.

Yoder, Jonathan. "Estimation of Wildlife-Inflicted Property Damage and Abatement Based on Compensation Program Claims." *Land Economics*. 2002: 45-59.

Yoder, Jonathan. "Damage Abatement and Compensation Programs as Incentives for Wildlife Management on Private Lands." *USDA National Wildlife Research Center Symposia*. 2000. Retrieved October 10, 2008 from <<http://digitalcommons.unl.edu/nwrchumanconflicts/2>>.

Zbeetnoff, Darrell and Bruce R. McTavish. *Strategies to Address Agriculture/Wildlife Challenges in BC*. White Rock, BC: Zbeetnoff Agro-Environmental Consulting, 2000.

Zbeetnoff, Darrell and Bruce R. McTavish. *BC Wildlife Damage Compensation Pilot Projects: Evaluation Report-Final Report Prepared for BC Agricultural Council Agriculture Environment Initiatives*. White Rock, BC: Zbeetnoff Agro-Environmental Consulting, 2004.

Zbeetnoff, Darrell and Richard McConnell. *Evaluation of the Economic Impacts from Waterfowl Damage: Final Report-Identification and Quantification of Economic Losses and Compensation Options*. White Rock, BC: Zbeetnoff Agro-Environmental Consulting, 2007.

## **Interviews**

Interview #1: MAL Participant. Interviewed on February 24, 2009.

Interview #2: DFWT Participant. Interviewed on February 25, 2009.

Interview #3: DUC Participant. Interviewed on February 26, 2009.

## Appendix:

## Figures



**Figure A1 Map of Delta, British Columbia**  
Source: Waite Air Photos Inc., 2009



**Figure A2 Wintering Snow Geese on the Fraser River Delta**  
Source: Delta Farmland and Wildlife Trust, 2006.