AN EVALUATION OF THE ECONOMIC IMPACT OF WILDLIFE HABITAT ENHANCEMENT OPTIONS ON INDIVIDUAL LANDOWNERS IN WESTERN MANITOBA

BY

KENNETH WARD BELCHER

280 Paul Blvd.
St. Germain, Manitoba,
R0G 2A0
ph. 256-0045

A Practicum
Submitted in partial fulfillment
of the requirements for the degree,
Master of Natural Resources Management

Natural Resources Institute
University of Manitoba
Winnipeg, Manitoba

September 6, 1991

ISBN 0-315-76648-4

AN EVALUATION OF THE ECONOMIC IMPACT OF WILDLIFE HABITAT ENHANCEMENT OPTIONS ON INDIVIDUAL LANDOWNERS IN WESTERN MANITOBA

BY

KENNETH WARD BELCHER

A practicum submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

MASTER OF NATURAL RESOURCES MANAGEMENT

ABSTRACT

Increased agricultural production in the last 50 years has had a major impact on the prairie environment. Environmental factors have been degraded as an essentially un-priced cost of production of market commodities. In an attempt to assign an economic value to these environmental services the Habitat Enhancement Land use Program (HELP) has been delivering a series of land management incentive options to landowners to develop and maintain wildlife habitat on their land in the rural municipality of Shoal Lake, in western Manitoba. HELP options include 1) delayed cut tame forage, 2) delayed cut native hay, 3) salinity barrier, 4) rotational grazing and 5) land idling. The practicum seeks to identify the economic impact of adopting HELP options on the individual landowner, and the potential wildlife habitat improvements that may be provided by each option. The data employed are qualitative and quantitative, collected through a review of wildlife and economic literature and personal and telephone interviews conducted with HELP participant landowners. The HELP options impose a range of economic impacts on the participant landowners. The options also provide varying levels of benefits to the wildlife species utilizing these habitats. The economic and environmental implications of the options are examined at some length, with a discussion of how such incentive options can contribute to a more economically and environmentally sustainable agricultural production system. Recommendations for increasing the acceptability of the options for the landowner, and the wildlife productivity of the study options are developed from the study findings.

ACKNOWLEDGEMENTS

This study could not have been carried out without the assistance of a number of people. However, all of them could not be named in this short thank you. I would like to thank a few of the key people who provided me with their time and ideas.

First, I would like to thank my family and friends who put up with me throughout "the process". And particularly for performing beyond the call of duty when I spent many weeks unable to carry out the basic tasks.

I would also like to thank all the Shoal Lake landowners for tolerating my strange questions and being patient enough to provide me with values that were carefully thought out.

My excellent committee of Dr. Rick Baydack, Dr. Bob Jones, Rea Josephson and Wayne Digby, who always gave me sound advice, deserve much praise. I would also like to thank Roy Bullion for his insight during our many discussions throughout the last 2 summers.

The study was funded by the Manitoba Department of Natural Resources. I would like to thank Herb Goulden for his confidence in me.

Finally I would like to acknowledge Pam Maclean, who put up with more term papers and summer separations than should be expected.

TABLE OF CONTENTS:

INTRODUCTION 1
1.1 Background: 1
1.2 Problem: 3
1.3 Objectives: 4
1.4 Methods Summary: 4
1.5 Study Limitations: 5

LITERATURE REVIEW 7
2.1 Introduction: 7
2.2 Historical Overview: 7
2.3 Agricultural Impact On Prairie Wildlife Habitat: 9
2.31 Tillage: 9
2.32 Haying: 10
2.33 Grazing: 11
2.4 Conservation Farming Practices: 13
2.41 Conservation Tillage: 13
2.42 Delayed Haying: 14
2.43 Rotational Grazing: 15
2.44 Land Idling: 16
2.5 Potential Productivity of Management Options: 16
2.51 Conservation Tillage: 17
2.52 Delayed Haying: 22
2.53 Rotational Grazing: 24
2.54 Land Idling: 26
2.55 Summary: 28
2.6 Sustainable Agriculture Economics: 30
2.61 Conclusion: 35

METHODS 36
3.1 Study Area: 36
3.11 The Habitat Enhancement Land Use Program: 39
3.2 HELP Management Options: 40
3.3 Literature Review: 40
3.4 Landowner Survey: 41
3.41 Survey Procedure: 43
3.42 Data Analysis: 45
3.5 Recommendations: 46

RESULTS 47
4.1 Introduction: 47
4.2 Study Options: 47
4.3 Option Performance Characteristics: 47
4.31 Delayed Cut Tame Forage: 48
4.32 Salinity Barrier: 49
4.33 Rotational Grazing: 50
4.34 Delayed Cut Native Hay: 52

4.35 Land Idling: 53
4.36 Hypothetical Valuation: 55
4.37 General Comments: 56
4.4 Non-farming Landowners: 57
4.5 Sustainable Agriculture Perceptions: 58

DISCUSSION 64
5.1 Introduction: 64
5.2 Management Option Efficiency: 65
5.21 Delayed Cut Tame Forage: 66
5.22 Salinity Barrier: 69
5.23 Rotational Grazing: 71
5.24 Delayed Cut Native Hay: 73
5.25 Land Idling: 77
5.3 Conservation Tillage: 79
5.4 Landowners Versus Producers: 81
5.5 Hypothetical Valuation: 82
5.6 Sustainable Agricultural Development: 84

CONCLUSIONS AND RECOMMENDATIONS 90
6.1 Research Conclusions: 90
6.2 Recommendations: 92
6.21 Future Research: 97

REFERENCES CITED: 99

Appendix A 104

Appendix B 108

Appendix C 115

Appendix D 117

Figures:

1	HELP Project Area	37
2	Municipality of Shoal Lake	38
3	Idle Lease Land Characteristics	54
4	Why Idle Area Not Farmed	54
5	Idle Lease Land Characteristics	59
6	Primary Environmental Problems	59
7	Secondary Environmental Problems	61
8	Perceived Income Potential	61
9	Sustainable Agriculture Promotion	62
10	Responsible Bodies	62

Tables:

1	Waterfowl Nest Initiation and Completion.	23
2	Wildlife Literature Summary	29
3	Summary of Option Performance	91

CHAPTER 1

INTRODUCTION

1.1 Background:

Increased agricultural production in the last 50 years has had a large impact on the Canadian prairies:

> Excessive cultivation has been accumulating impacts on our natural resources. Fall tillage, "black" summerfallow, row-cropping, overgrazing, and cultivating low quality soils have increased soil erosion, degradation and salinization, decreased soil fertility and moisture retention capacity, driven down water tables and polluted wells. Off-site damages include higher frequencies of flooding, wind and water erosion, stream flow imbalances, sedimentation and pollution. (Cowan 1982)

Accompanying these effects is a widespread degradation and destruction of prairie wildlife habitat. The impact of conventional agricultural practices has been uniform across the prairies, with both wetland and upland habitats being affected. Approximately 40 percent of the wetland habitat, 80 percent of the native prairie and 75 percent of the aspen parkland habitats on the Canadian prairies have been degraded or destroyed, primarily as a result of agricultural development (World Wildlife Fund 1989). Conventional tillage, haying and grazing management practices are damaging to wildlife populations and habitat.

There are a number of cultural practices which can be incorporated into the present agricultural system to enhance the wildlife productivity of the land, and in many cases contribute to the environmental and economic sustainability of agriculture. These management strategies include various conservation tillage techniques and modified hay harvest and grazing regimes.

Market signals guide landowners toward economically sound decisions. In the case of many environmental services, including wildlife habitat, these signals often become distorted and ineffectual. The landowner cannot incorporate these values into the economic decision making process due to their apparent zero market value. Management options which are less damaging to the environmental services may be made more economically attractive by implementing various incentives. Incentives can include taxation policies, subsidization schemes and conversion or redefinition of property rights. The incentives provide the environmental resource with an economic value which can be included in the landowner's production equation.

Concern about the depletion of wildlife habitat has inspired the creation of a number of programs which offer incentive packages to landowners with the goal of preserving and developing wildlife habitat in harmony with agricultural

production. One such program is the Habitat Enhancement Land Use Program (HELP), operating in the rural municipality of Shoal Lake in western Manitoba.

Adoption of agricultural techniques which are less damaging to wildlife habitat is an integral part of the movement towards a more sustainable agricultural system. These techniques help to maintain the integrity of the basic resources necessary for agricultural production. The HELP incentives encourage the complementary development of commercial agriculture and wildlife habitat conservation. Formerly, these two activities were viewed as an either/or situation, primarily because of existing economic policies and institutional arrangements.

1.2 Problem:

Incentives have been offered to make the adoption of wildlife habitat-enhancing agricultural management strategies more economically attractive to farmers. The incentives provided are intended to approximately offset the extra costs to landowners associated with the adoption of these techniques. To facilitate the equitable and efficient implementation of these management strategies it is important to evaluate the economic impact of management strategy adoption on the individual landowner.

1.3 Objectives:

The purpose of the study is to evaluate the economic impact that selected land management options have on the participating landowner. The study seeks to address the following 5 objectives:

1) To select specific HELP land management options for analysis.

2) To evaluate the potential wildlife productivity of each option.

3) To determine the economic impact of each option on the individual landowner.

4) To identify the link between wildlife habitat enhancement management incentives and the economics of sustainable agricultural development.

5) To make recommendations based on findings from the previous objectives.

1.4 Methods Summary:

The study was carried out in the Rural Municipality of Shoal Lake in west central Manitoba. Agriculture is the primary land use in the region. Half of the farms are strictly grain producers with the other half being mixed grain and cattle producers (Morgan 1989). The area is dotted with wetlands, although less than 30 percent of the original wetlands remain.

The HELP options are identified in the HELP status report (Appendix A) (Manitoba Department of Natural Resources 1989). This study examined only those options with participant landowners (objective 1). A literature review and data from the HELP biological evaluation was used to appraise the potential wildlife productivity of the study options (objective 2). Individual landowners were interviewed to determine the perceived economic value of the benefits and costs attributable to the HELP incentives and restrictions. This data was evaluated using basic statistical analysis to determine the economic impact of the incentive option on the landowner (objective 3). Landowners were asked about their perceptions of sustainable agriculture. This information, with findings from the literature, was used to satisfy objective 4.

1.5 Study Limitations:

The literature used to determine the potential wildlife productivity values dealt primarily with waterfowl production and habitat needs. There was a lack of studies addressing the habitat needs of non-waterfowl wildlife species on the prairies. This study is therefore limited with respect to the potential productivity of study options for non-waterfowl prairie wildlife species.

Essentially, the entire population within the HELP program was used, however, this was a very small segment of the total farming population. The individuals surveyed were all HELP program participants and therefore may represent a segment of the population which are more receptive to preserving wildlife habitat than the general population. As a result the findings of this study should not be taken and applied to the general population.

The calculation of costs and perceived costs is based on commodity prices at the time of the study and does not account for the large price fluctuations common in agricultural commodities. As commodity prices increase the perceived value of agricultural lands will increase, thereby affecting the benefits and costs resulting from the various management options. The effect that yearly climatic variations have on producer income and wildlife productivity have not been effectively accounted for within this study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction:

The impact of agriculture on wildlife habitat and populations in North America in the last 50 to 75 years has received detailed attention. In addition, management strategies which can make agricultural lands more productive for wildlife have been assessed. This information may be used to estimate the potential increases in wildlife productivity resulting from the implementation of these management strategies. The adoption of these management strategies is greatly influenced by the economic principles associated with agricultural production and natural resource values.

2.2 Historical Overview:

As early as the 1940's several authors were calling attention to the conflicts between agricultural production techniques and wildlife habitat preservation. The land ethic and the problems that the application of industrial values are causing was discussed by Aldo Leopold.

> We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect. There is no other way for land to survive the impact of mechanized man (Leopold 1949).

Hochbaum discussed the damage to prairie wildlife habitat, and specifically to wetlands, caused by agricultural practices.

> Everywhere the breeding marshes border or overlap the realm of man's activities; and man is one of the most important factors limiting waterfowl success. His marsh fires when ducks are nesting, the grazing of his cattle, the early mowing of hay lands and many other activities destroy thousands of duck nests, or render marshes second-rate or worthless (Hochbaum 1944).

Milonski (1958) recorded more specific quantitative findings on the importance of farmland as waterfowl nesting habitat. He examined the species composition of waterfowl nesting on agricultural land, measured the loss of nests and nesting hens due to farming practices and specified modifications which could be incorporated to reduce these losses. Milonski ranked farming practices with respect to the destructiveness to waterfowl nests as follows; 1) cultivation, 2) discing, 3) mowing, 4) plowing and 5) harrowing.

This early literature was important in establishing the foundation for further investigation into the impact of agriculture on prairie wildlife habitat.

2.3 Agricultural Impact On Prairie Wildlife Habitat:

Conventional agricultural production techniques are damaging to wildlife habitat. There is a large literature discussing the impact of agriculture on waterfowl and upland nesting bird habitat. Within this literature conventional cultivation, haying and grazing practices receive the most attention.

2.31 Tillage:

Conventional tillage has an adverse affect on the vegetative ground cover which is essential to wildlife. Spring and fall tillage operations reduce the total crop residue levels in fields to less than 15 percent, which decreases those fields' wildlife productivity (Castrale 1986). Duebbert and Kantrud (1974) reported that cropland had the lowest duck nest density of all available habitats. This was primarily attributed to the poor cover available on these fields. The decrease in residual biomass diminishes the quality of the microhabitat in terms of environmental protection and concealment from predators (Castrale 1986).

Higgins (1977) reported that poor nesting cover, resulting from intensive land use practices, and nesting failures caused by farm machinery and predators are the

principal factors limiting wildlife production on annually tilled crop land. Higgins concluded that "upland nesting duck populations are not capable of maintaining themselves by reproduction during most years on areas that are 85 percent or more annually tilled". Rodgers and Wooley (1983) stated that nests located on tilled fields will seldom be successful because of tillage or harvesting operations. Ducks nesting in cropland had lower success rates than ducks using any other available nesting habitats in the prairie region. The major causes of nest failure on cropland are reported to be predation (54 percent) and machinery (37 percent) (Klett et al. 1988). However, conventional tillage was found to have no negative impact on local small mammal populations (Castrale 1986).

2.32 Haying:

Another important agricultural land use type is hay land. Management of these lands differs from crop land management in that the land is not cultivated annually, and in many cases the land is never disturbed with tillage equipment. However, conventional hay harvest operations do reduce the wildlife productivity of the haylands.

The negative impact that hay harvesting has on wildlife productivity largely results from the removal of vegetative cover. Cover management programs that remove all or part of the vegetation annually would be expected to have an adverse effect on upland nesting birds (Kirsch et al. 1978, Frawley and Best 1991). Duebbert and Kantrud (1974) attributed the relatively low wildlife productivity of haylands to the removal of cover and subsequent lack of residual cover in the spring, at the initiation of nesting activity.

A further consideration is that haying operations occur at a time when nesting birds are still present. Bollinger et al. (1990) reported a nest mortality rate of greater than 40 percent for eastern bobolinks (*Dolichonyx oryzivorus*) on hay fields. Klett et al. (1988) reported that duck nesting success was only 6 percent on hay fields compared to 21 percent on idle grassland. In both of these studies direct mechanical nest destruction from haying operations and elevated predation rates as a result of cover removal were cited as the principle causes of nest mortality.

2.33 Grazing:

In some areas of the prairies pasture is the dominant land use type. Pasture land can be very important local wildlife habitat due to the potential for residual cover,

the frequent interspersion with wetlands and the limited amount of disturbance by machinery. However, traditional grazing management can be damaging to the wildlife productivity of pasture land.

Grazing can be very effective at removing vegetative cover. Since most waterfowl nest before new growth is suitable for nesting, any activity which reduces residual cover from the previous year may adversely affect waterfowl production (Kirsch 1969; Kirsch et al 1978; Sedivec and Barker 1989). Kirsch (1969) found that nest success on ungrazed areas was twice as high as on grazed areas due to insufficient cover from predators on the grazed areas. Kantrud (1981) noted, in his research on passerine birds, the mean total bird density was highest on heavily grazed plots, intermediate on moderately grazed and lowest on lightly grazed plots. However, heavy grazing resulted in reduced species diversity with over 60 percent of the population being made up of 2 bird species.

Waterfowl breeding pairs were disturbed by cattle and tended to move from areas where cattle were present (Kirsch 1969; Gjersing 1975). As livestock densities increase, the effect of nest trampling becomes an increasingly important factor in ground nesting bird success (Jensen et al. 1990). However, Sedivec and Barker (1989) stated that the presence

of cattle will reduce the number of nests initiated, but ducks will continue to incubate a nest with cattle present.

2.4 Conservation Farming Practices:

The damaging effects of conventional agriculture on wildlife habitat may be alleviated, if not eliminated, by the implementation of management strategies which are less destructive to wildlife habitat. In addition, these conservation farming strategies are inherently beneficial to the environmental sustainability of the agricultural system. It should be noted that some of these techniques may be damaging to the economic sustainability of the agriculture system. Some of these strategies require relatively small changes to the existing conventional management, while others involve extensive modifications to production expectations and management. Within the literature the most frequently discussed management practices which address the above discussed problems are conservation tillage, delayed haying, rotational grazing and land idling.

2.41 Conservation Tillage:

Decreased tillage strategies have been shown to result in increased wildlife productivity, primarily resulting from increased levels of crop residues on the soil surface which

provide wildlife cover (Best 1986). "Reduced tillage practices in the spring and summer provided avian habitat superior to that provided by conventional tillage methods, but generally inferior to permanent undisturbed habitat" (Castrale 1986). Cowan (1986) described a number of tillage strategies which are considered less damaging to wildlife populations using cultivated fields as part of their habitat.

1) Zero tillage - Planting directly into the stubble, eliminating excessive tillage and providing safe nesting cover.

2) Stubble mulch fallow - This technique retains standing stubble until at least mid-June and thereafter buries only 10 percent of the surface cover by using an undercutting cultivator. This practice decreases soil erosion and in terms of wildlife, prevents wetland basins from filling with eroded topsoil.

3) Winter wheat - The crop is planted in the fall, eliminating spring seeding operations which are destructive to upland nests. This system provides more vegetative cover on the field, affording better protection for nesting birds.

4) Salinity barriers - Planting of saline tolerant, permanent vegetation, around cultivated low lying areas. This assists in retarding the spread of salinity into the surrounding field, and provides nesting cover.

2.42 Delayed Haying:

With respect to hay fields, the most destructive management process is the actual hay removal and resultant decrease in residual cover. In addition, haying or mowing these areas during the peak nesting season can create "death

traps" for relatively immobile nesting birds and flightless young (Carlson 1985). Obviously, the harvesting of hay is necessary to provide an important economic return to the landowner. Delaying the date of the first hay cut until the majority of the nesting birds have moved off of the field has been proposed as a change in management which could decrease the damage of hay harvesting (Burgess et al. 1965; Soutiere 1985; Bollinger et al. 1990).

2.43 Rotational Grazing:

Any management strategy on pasture lands which decreases the grazing intensity and increases the level of residual nesting cover in the spring will be beneficial to the wildlife productivity of these lands. Rotational grazing, which involves the frequent movement of cattle between separate paddocks over the grazing season, has been shown to provide these factors (Gjersing 1975; Sedivec and Barker 1989). Gjersing (1975) reported that waterfowl pair populations and brood numbers seemed to respond in a positive manner to increases in residual vegetation provided by the implementation of rotational grazing management. Gjersing recommended delaying the grazing of those pastures with good residual cover in the spring until after incubation is completed on most nests.

2.44 Land Idling:

A more intensive method of creating and enhancing wildlife habitat in an agricultural area involves the actual purchase or leasing of lands to be managed exclusively for wildlife. To maintain optimal habitat for most upland nesting birds it is desirable to preserve a large percentage of the total habitat in an undisturbed condition (Kirsch et al. 1978). Cowardin et al. (1984) discussed three management approaches to developing waterfowl habitat: purchase of waterfowl production areas and conversion of existing cropland within the wetland complex to permanent dense nesting cover; idling areas of pasture or hay land to facilitate an increase in residual cover; and, the application of intensive management, such as installing predator proof fencing around areas of permanent dense nesting cover within these idled areas. These management approaches were found to have distinct benefits for wildlife populations.

2.5 Potential Productivity of Management Options:

Within the context of this study, conservation tillage, delayed hay cut, rotational grazing and land idling will be evaluated with respect to potential increases in wildlife productivity over conventional management.

2.51 Conservation Tillage:

As discussed earlier, a number of conservation tillage strategies may be incorporated into the agricultural management system to make cropland more productive for wildlife. The three most frequently discussed procedures are stubble mulch fallow, winter wheat and zero tillage.

Stubble mulch fallow is a technique where the standing stubble is retained until at least mid-June and thereafter only 10 percent of the surface cover is buried as a result of using an undercutting cultivator. This technique increases the level of residual cover in the spring and provides an alternative to the habitat destructive, fallow weed control. The undercutter cultivator passes under the surface of the soil to cut and dislodge weed roots. This allows the stubble to remain erect, providing better cover.

Conventional tillage destroys virtually all established nests. However, following undercutting, 53 percent of the nests of 7 ground nesting bird species remained intact (Rodgers 1983). Of these intact nests, 89 percent continued to be incubated with a 64 percent success rate on the incubated nests. This translates to a 34 percent success rate on stubble mulch fields, compared to virtually zero percent success on conventionally tilled fields. Renesting

in undercut stubble is probably minimal due to the reduced concealment quality of the stubble. Cowan (1986) stated that stubble mulching would seem to provide for increases in duck production in western Canada. In contrast, Higgins (1977) found only a 9 percent success rate, with duck nest densities of .02 per hectare, on stubble mulched fields compared to an 8 percent success rate with .012 per hectare nest densities on summer fallow, and 15 percent success rate with .04 per hectare nest densities on standing stubble fields. In addition, Higgins stated that mulched stubble is only one fourth to one half as attractive for nesting as undisturbed standing stubble. The discrepancy between Rodgers and Higgins results may be explained by Higgins examining only duck nests whereas Rodgers examined all nests present. The smaller and tighter nests of the smaller passerine species may be less prone to damage by the undercutter operation than the larger waterfowl nests (Rodgers 1983). Stubble mulching may be more beneficial to some species than others, but it seems to provide more productive habitat than conventional fallow management.

Another modification to conventional management which could increase the wildlife productivity of the agricultural landscape is the production of winter wheat. Winter wheat is planted in the fall, eliminating spring seeding operations which are destructive to established nests. In

addition, winter wheat provides greater vegetative cover earlier in the season than conventional systems. There is little literature examining the potential productivity of winter wheat systems however.

Cowan (1986) stated that winter wheat will produce an estimated .08 nests per hectare at a 25 percent success rate, with 5 ducks fledged per brood. Cowan concluded that due to the tremendous area that could be converted to winter wheat production, the potential for increasing waterfowl populations is great. However, successful, disease resistant strains of winter wheat have not yet been developed for the Canadian prairies.

Winter wheat should provide a habitat similar in quality to established conventional grain fields. Higgins (1977) reported that growing grain was the most productive for ducks of the annually tilled cropland habitat types, with low nest density (.012 per hectare) but very high nest success (40 percent). This high nest success is attributed to very low predation levels as a result of the large areas of uniform habitat, making predator searches difficult. Klett et al. (1988) stated that although cropland is the least preferred of all available habitats on the prairies (except by pintails (*Anas acuta*)). The success rate for nests in cropland is slightly lower or comparable to most

other available habitats in the study. All of the other habitats in this study were untilled.

The most frequently discussed conservation tillage technique within the context of wildlife production is zero-tillage. Zero-tillage involves planting the crop directly into the previous years stubble. This eliminates tillage operations while maintaining constant levels of residual cover in the form of standing stubble.

Cowan (1982) reported that duck nest density on zero-till cropland was .13 nests per hectare, with a success rate of 60 percent. This compared to .018 nests per hectare, with a zero percent success rate on conventionally tilled cropland. Cowan proposed that the zero-tillage fields induced a dispersal of nests over all available habitats and thereby reduced predation and significantly increased duck production. It is important to note that potential duck production at this level can be realized on spring-planted zero-tillage croplands only if farmers avoid crushing the nests during seeding operations, a seemingly unreasonable request for producers with large areas to seed. Without this effort the increase in brood production over conventional till would be small.

Basore et al. (1986) stated that no-tillage corn and soybean fields are used by more avian species and at greater nesting densities than are tilled fields. Twelve bird species at an average density of .36 nests per hectare were found in no-till fields compared to 3 species at an average of .04 nests per hectare in tilled fields. In this study nest destruction by farming implements was reported to be infrequent with predation being the largest source of nest loss. The number of bird species detected in no-till fields was 32 percent greater than in conventionally tilled fields, and birds are 62 percent more likely to be detected on surveys in no-till fields (Castrale 1986). Zero-tillage will primarily benefit those grassland bird species that nest on the ground, therefore widespread adoption of zero-tillage may be significant to these species.

Some concern was expressed about the increased pesticide usage necessary with zero-till management, and the impact on nesting birds and mammals (Rodgers and Wooley 1983; Castrale 1986). Another concern was expressed by Best (1986) who suggested that conservation tillage fields may create "ecological traps" for nesting birds. These fields appear to provide more suitable nesting cover than more heavily tilled fields but nest disturbance may still be frequent enough to cause poor nesting success. The author states that conservation tillage may serve only to draw

birds away from other uncultivated habitats where there is less agricultural disturbance. This disturbance includes nest destruction by farm machinery and increased exposure to agricultural chemicals with the increased reliance on chemicals that conservation tillage dictates.

2.52 Delayed Haying:

Haylands, whether native or tame, provide an important wildlife habitat on the agricultural landscape. The removal or harvest of hay during the period of highest nesting intensity is damaging to resident wildlife. Delaying the first hay cut until after the balance of the nesting activity is complete has been recommended to minimize the impact of hay harvesting (Burgess et al. 1965; Soutiere 1985; Bollinger et al. 1990).

When the first hay cut is delayed there will be a decrease in the number of nests destroyed. Labisky (1957) found that 78 percent of mallard (*Anas platyrhynchos*) and blue-winged teal (*Anas discors*) nests in alfalfa fields were destroyed by haying operations in Wisconsin. Klett et al. (1988) reported a 6 percent success rate for duck nests in hay fields, with 27 percent of the nest losses attributed to haying machinery. This study concluded that delaying haying operations could increase nest success by as much as 550

percent. Based on nest initiation data from western Manitoba and a 25 day incubation period, July 1 hay harvest operations will mechanically destroy 37 percent of the initiated nests within hay fields. If harvesting is delayed 2 weeks to July 15, only 8 percent of the nests will be destroyed before hatch (Figure 1) (Jones 1991). A study examining bobolinks in eastern United States reported that mowing induced mortalities would decrease from 40 percent to 8 percent if haying operations were delayed by two weeks; ie. a 500 percent increase in nest success (Bollinger et al. 1990).

Table 1. Waterfowl nest initiation and completion (Jones 1991)

Date	% nests initiated	% nests complete
May 1	4	0
May 15	19	1
June 1	53	9
June 7	63	15
June 15	80	25
June 21	92	35
July 1	99	63
July 7	100	70
July 15	100	92
July 21	100	96
August 1	100	100

2.53 Rotational Grazing:

In certain areas of the prairies, pasture land makes up a substantial part of the land base. Intensive grazing has been shown to decrease the wildlife productivity of these lands (Kirsch 1969; Gjersing 1975; Kantrud 1981). One way to reduce grazing intensity is rotational grazing management.

Rotational grazing allows each paddock a rest period for vegetative re-growth between periods of grazing. Gjersing (1975) found that duck production was increased by 400 percent on rotational grazing systems compared to ranges which were grazed season long. Paddocks which were grazed only during the spring and early summer of the previous year had the greatest level of residual cover, and as a result, the greatest duck nesting density. Sedivec and Barker (1989) recorded that the level of residual vegetation was greater on rotational grazing than conventional grazing systems. In response, duck nest density was found to be 300 percent greater and success rate 400 percent greater on rotational grazing systems. Nest densities were .17 nests per hectare on conventional grazing systems and .53 nests per hectare on short duration rotational grazing systems. However success rate may have been artificially inflated by pasture location on the rotational grazing sites.

Kirsch (1969) found that duck nest density was approximately 150 percent greater on lightly grazed plots than on heavily grazed plots. Kantrud (1981) reported that mean total passerine bird density was highest on heavily grazed plots and lowest on lightly grazed plots. Heavy grazing resulted in reduced bird species diversity and increased dominance by a few species. Burgess et al. (1965) reported that grasslands grazed moderately between June 15 and October 1 provided better nesting habitat for blue-winged teal than ungrazed areas. However, grazing was shown to decrease the attractiveness of the area to other bird species. Heavily grazed pasture had duck nest densities of only .07 nests per hectare in the Shoal Lake area of Manitoba (Jones 1991).

There is disagreement in the literature with respect to the effect of the presence of cattle on nesting birds. Sedivec and Barker (1989) stated that the presence of cattle has a positive effect on the success rate of nests by decreasing predation levels. However, cattle stocking densities greater than 2.5 animal units per hectare could result in significant disturbances of ground nesting birds, with nest trampling increasing exponentially over time (Burgess et al. 1986; Jensen et al. 1990). Koerth et al. (1983) reported that ground nest losses averaged 9 percent for short duration grazing (rotational grazing) and 15

percent for continuous grazing, at a stocking rate of 1.2 head per hectare. When residual shoreline vegetation is present certain species of ducks, preferring to nest close to water, may be subjected to increased trampling loss due to the high level of livestock activity around water sources (Gjersing 1975). The author recommended that grazing be deferred until after nesting is completed to eliminate this trampling damage. The presence of cattle will reduce the number of nests initiated, although it was found that ducks will continue to incubate a nest with cattle present (Sedivec and Barker 1989). Delaying grazing on the paddocks with the greatest residual vegetation levels until after the majority of nest initiation is completed will result in increased wildlife productivity over conventional grazing systems.

2.54 Land Idling:

The termination of agricultural activity, whether it be cropland which is planted to permanent cover or hay land and pasture land allowed to go idle, has been shown to provide productive wildlife habitat.

Duebbert and Kantrud (1974) reported that idle prairie had the highest duck nest density (.31/hectare), aside from dry marsh habitat (.67/hectare), of all the major habitats

available in north-central South Dakota. Duck nest density, on idle prairie was 172 percent and 147 percent greater than active hay land (.18/hectare) and pasture (.21/hectare) respectively. Kirsch (1969) recorded that nest densities on idled grassland (.69/hectare) were 164 percent greater than on grazed grassland (.42/hectare). In addition, nest success on idle grassland was 200 percent greater than on grazed grassland. Higgins (1977) stated that idle grassland had nest densities (.16/hectare) 350 percent greater than on heavily grazed pasture (.045/hectare). Wooded areas had nest densities of .44 per hectare, greater than all other dominant habitats available (Higgins 1977). Idled prairie had duck nest densities (.35/hectare) 390 percent greater than on heavily grazed pasture (.09/hectare) and 318 percent greater than native and domestic hay land (.11/hectare). Woodlands had nest densities greater than idled prairie (.74/hectare) (Jones 1991).

Duebbert and Lokemoen (1976) stated that nesting waterfowl hens displayed a strong preference for undisturbed fields of cover by flying as far as 1.6 kilometres from wetlands across several other cover types to nest in undisturbed legume cover. Average nesting density was found to be 400 percent greater in idle grassland fields (1.14/hectare) than on nearby lands being farmed and grazed (.25/hectare). It was also noted that idled grassland

provided attractive habitat for a number of other bird species. Duebbert and Lokemoen recommended that established cover remain completely undisturbed for 5 to 10 years to provide optimum value as wildlife habitat. Kirsch et al. (1978) reported that dabbling duck and upland game bird nest densities were 250 percent greater in undisturbed vegetation than in adjacent habitats that were annually grazed or hayed. Klett et al. (1988) examined the relative preference for nesting habitat of 5 duck species if all habitats were equally available. Idle dense nesting cover was the most desirable, being the preference of 43 percent of the nesting ducks. This compared to only a 4.5 percent preference for idle grassland, and a 10.6 percent preference for hay land. This is the only study reviewed in which idle grassland was shown to be less preferred than hay land.

2.55 Summary:

The management techniques evaluated within this literature review provide varying levels of wildlife habitat improvement. The results from this review are briefly summarized in table 2.

Table 2. Summary of potential performance of wildlife habitat enhancing techniques.

Technique	Potential Habitat Improvement	Limitations	Comments
Stubble Mulch Fallow	-slight to moderate	-specialized equipment requirement	-potentially impact large area
Winter Wheat	-slight	-lack of successful strain	-potentially impact large area
Zero-tillage	-slight to moderate	-must manually move nests during seeding -specialized equipment requirement -increased pesticide use	-potentially impact large area
Delayed hay cut	-very strong	-not compliant with essential management	-never accepted on a wide scale
Rotational grazing	-strong	-wildlife targeted management important	-potentially impact large area
Land idling	-very strong	-not compliant with agricultural production	-can impact only a small area

2.6 Sustainable Agriculture Economics:

The World Commission on Environment and Development (WCED) (1987) in its report " Our Common Future", characterizes sustainable development as "patterns of social, economic and political progress that meet the needs of the present without compromising the ability of the future generations to meet their own needs." One of the 6 common challenges laid out by the WCED is food security, or, making agricultural production sustainable.

Gilson (1989) states that "a necessary, if not sufficient condition of sustainable agriculture involves the long-run economic viability of producers within the agricultural systems...economic viability, described in a broader social sense, involves an accounting for both on-site and off-site benefits and costs, as well as intergenerational benefits and costs." In other words, an agricultural production practice cannot be considered sustainable, even if the individual farmer realizes a net economic gain, if part of the production cost is shifted off site. The move should be towards sustainable land use, taking into account all competing uses for the land.

Market signals which can provide a mechanism to promote sustainable land use may not currently exist. Fox et al. (1990) stated that wetlands, for example, are not represented in the markets, making the allocation of the land to the "highest and best use" difficult. Danielson and Leitch (1986) stated that because landowners usually exclude the social values of wetlands from their decision making, such as waterfowl habitat, floodwater retention, groundwater recharge and nutrient filtration, from which they do not possess ownership rights, the quantity of wetlands drained may exceed the socially optimal level. This indicates a divergence between the private and social net benefits of wetland drainage.

The social demand for environmental services, which include the range of economic and social benefits provided by a healthy environment, is expected to increase by 300 percent over the next 40 years (Crosson 1991). This is based on an estimate that the public demand for these environmental services will increase 1.5 units for each unit of per capita income. Crosson stated that without market prices there is no measurement of scarcity and therefore no inducement to increase the development and supply of these environmental services. Hall (1990) states that "neo-classical economics argues implicitly for the destruction of the natural world, and as such assists in the destruction of

many existing non-market economies, since environmental services are rarely reflected in market prices." There appears to be short-comings inherent in the current economic thought which shows up as a failure to assess the total social costs and benefits of development. As a result there is a powerful institutional bias towards commodity services.

In response to this biased allocation of the land resource and the disregard for off-site costs, a number of systems have been developed to determine the value of these environmental services where no market exists. Adamowicz (1991) stated "the main objective of non-market valuation is to devise a money based measure of the impact of changes in the quality or quantity of a good or service which is not typically priced in a market." The two main techniques are the direct and indirect approaches. The direct approach tries to build representation of behaviour which can then be used to determine the value an individual will assign to a change in the existing conditions. The indirect approach, in contrast, ignores the individual's behaviour and attempts to structure a situation so that the individual understands the change in environmental conditions and is able to ascribe values for these goods as if they were in a market setting (Bishop and Heberlein 1979; Van Kooten and Schmitz 1990; Adamowicz 1991). This information can, to a degree, reflect the demand for these services by the target sector

of society. The valuation can then be used to shape policy such that these non-market environmental services are given appropriate importance.

Money and monetary incentives can play a significant role in efforts to transform present agriculture to practices which are environmentally sound (Soderbaum 1987). Van Kooten and Schmitz (1990) state that economic incentives are the most important factor in the adoption of wildlife habitat enhancing production techniques by farmers. Once the value of the environmental service has been determined, a number of techniques can assign that value to the service;

1) Taxation policies - can be used to encourage a certain desirable practice, or to discourage some practice which has adverse consequences for the environment.

2) Subsidies - use of public expenditures to preserve areas or withdraw tracts of marginal agricultural land from agricultural production for more productive use as wildlife habitat.

3) Modification of the conventional price system - tax levies or a specific form of production tax may be used to internalize the external or off-site costs.

4) Cross compliance - desirable environmental practices can be designated as a condition for eligibility in a certain government support program.

5) Purchase of property rights - an outright purchase of the land or of an easement to remove certain rights of the producer to facilitate a change in management strategies used.

6) Financial compensation - provide financial compensation to off set costs incurred by the producer when adopting a particular technique (Gilson 1989; Van Kooten 1991).

Economists argue for the use of incentive compatible instruments, rather than direct regulatory devices. Incentive policies tend to be more efficient, from society's perspective. Such policies align the goals of economic development and environmental protection while providing stimuli for innovation and technological change (Fox et al. 1990).

Changes in policy which can provide incentives for the implementation of more sustainable agricultural production techniques are an important step towards an economically and environmentally sustainable agriculture. These techniques will have environmental benefits which may include enhancement of the wildlife productivity of the agricultural region. The provision of incentives for management strategies which are more conducive to wildlife production is one important economic component of the movement towards sustainable agriculture. A careful systematic transition from conventional technologies and management practices in the agricultural food system to a more sustainable system is required if the system is not to end in disarray. "A sensible balance must be maintained between the economic viability of the system and the ultimate goal of sustainability" (Gilson 1989).

2.61 Conclusion:

The agricultural system currently in place in Canada does not seem to be environmentally sustainable. The failure of the economic system to assign a value to non-market environmental services is an important component of this unsustainability. The degradation of wildlife habitat is only one product of this disregard for non-market costs. The development of policy which can help to assign values to these services may be an important step in the movement of agriculture to a more environmentally sustainable level.

CHAPTER 3

METHODS

3.1 Study Area:

Research for this study was conducted in the rural municipality of Shoal Lake, in western Manitoba (Figure 1). The area is characterized by hummocky terrain dotted with many wetlands. The elevation of the area ranges from 549 to 594 metres above sea level, with the land sloping from the north to the south. The R.M. lies within the Assiniboine River drainage basin with intermittent streams passing through the western (Five Mile Creek) and eastern (Oak River) sides of the municipality. The Oak River widens to form 2 large water bodies, Shoal Lake and Raven Lake (Figure 2). Soils are primarily black chernozems with some gleysols in the poorly drained depressions and are clay-loam texture of the Newdale association (Morgan 1989). According to the Canada Land Inventory rating system for agricultural lands the soils are predominantly class 2 and 6.

The R.M. of Shoal Lake lies within the aspen parkland biome. The native vegetation historically included aspen clumps and wetlands within mixed grass and rough fescue prairie. Due to the pressures of agricultural development less than 30 percent of the original wetlands and 20 percent

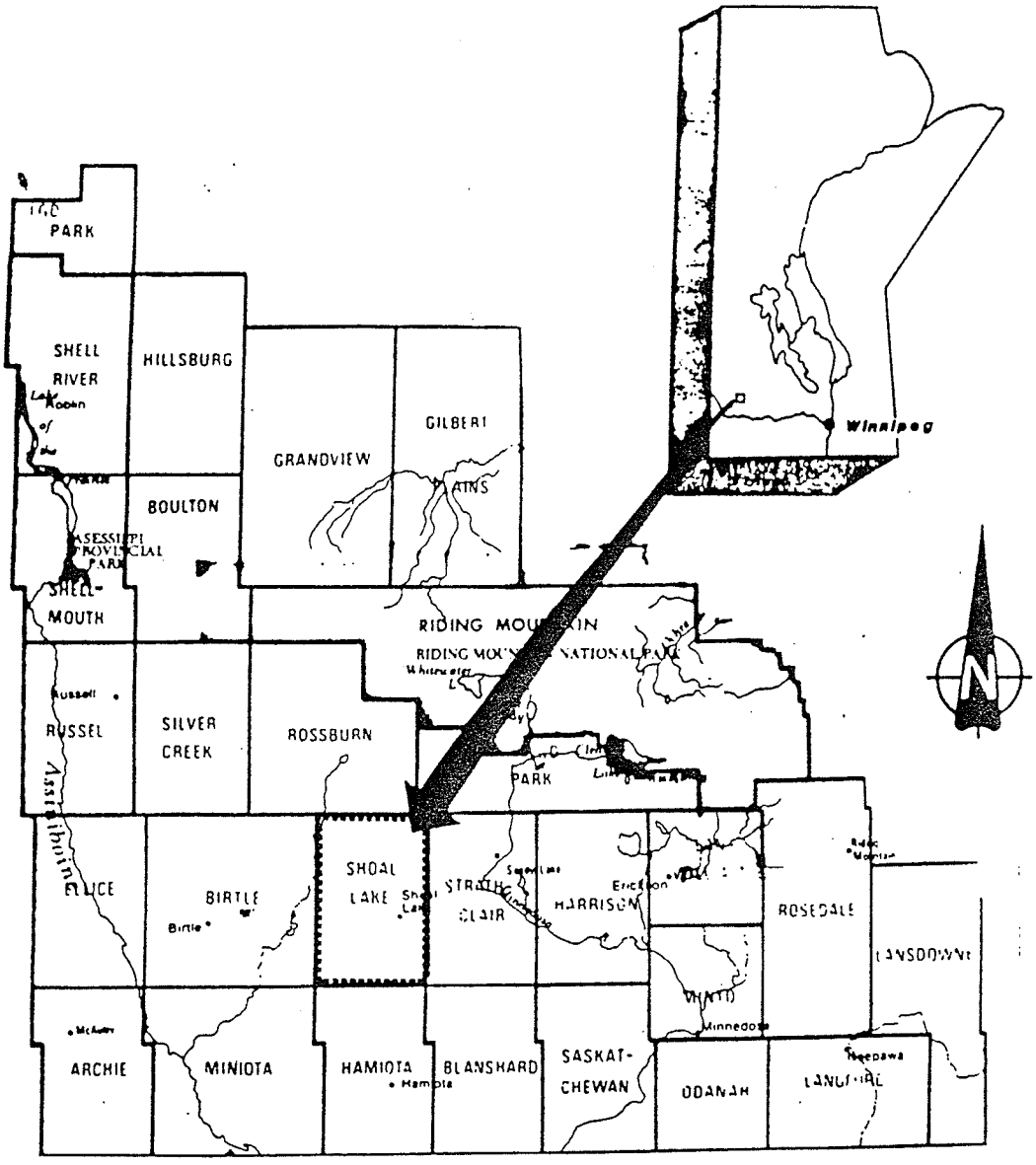


Figure 1. HELP project area (Morgan 1989)

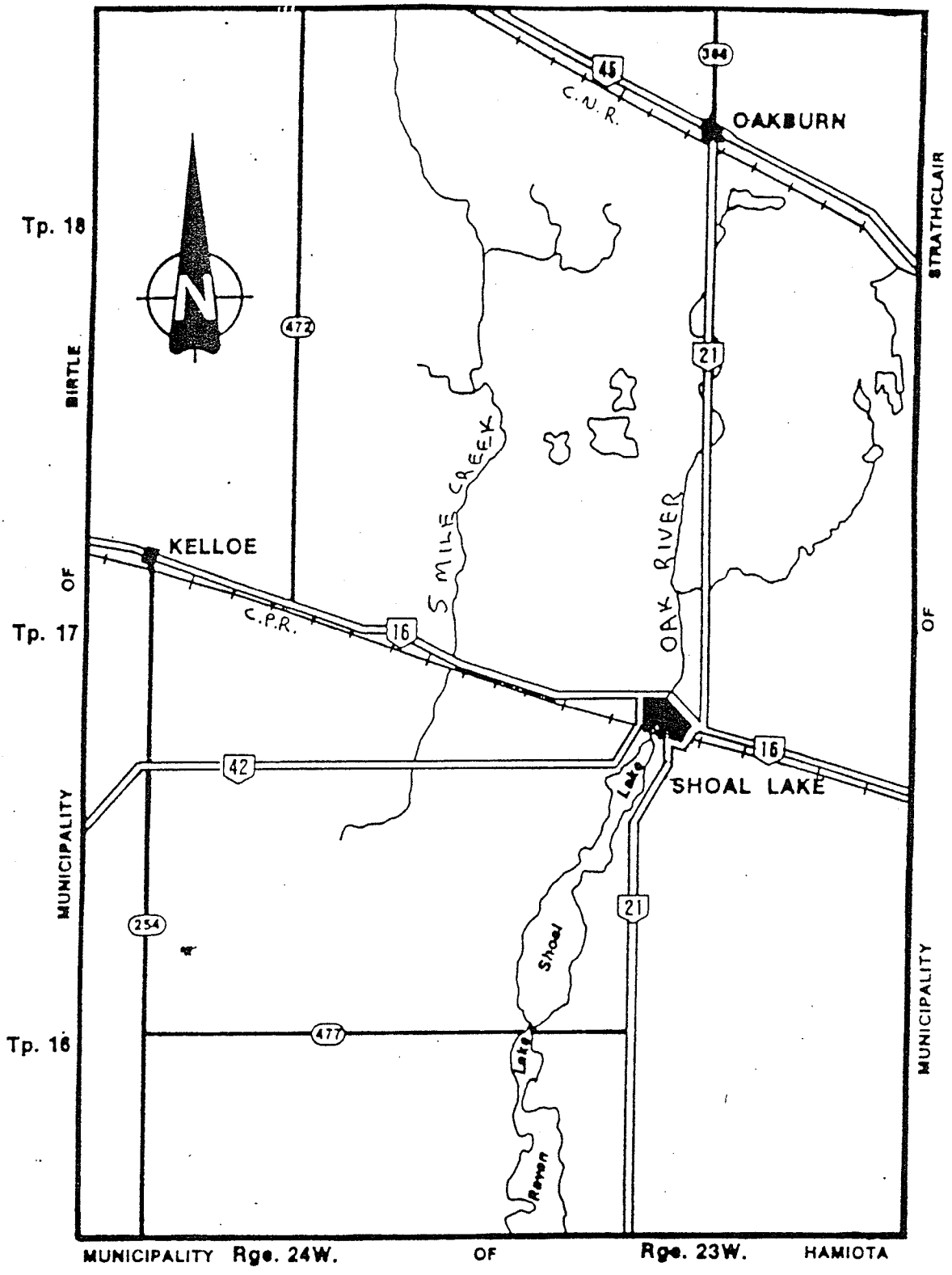


Figure 2. Municipality of Shoal Lake (Morgan 1989).

of the native prairie remain intact. Agriculture is the primary land use with 50 percent of the farms producing grain exclusively and 50 percent mixed grain and cattle operations (Morgan 1989).

The R.M. of Shoal Lake occupies townships 16, 17 and 18 in ranges 23 and 24 (west of the prime meridian). It has an area of 6 townships or 55,968 hectares. The population of the R.M. is 1,680, concentrated primarily in the towns of Oakburn and Shoal Lake (Morgan 1989).

3.11 The Habitat Enhancement Land Use Program:

The HELP program is targeted at promoting wildlife habitat retention and land stewardship in Manitoba's prairie pothole district. The objectives of the HELP program are:

- To lease and manage under long term agreements (5 to 7 years) 3600 hectares of adjacent uplands for nesting waterfowl and for soil and water conservation benefits.

- To encourage landowners to undertake conservation farming techniques beneficial to wildlife by means of incentives and on farm demonstrations.

- To evaluate this habitat maintenance, and develop initiatives in terms of waterfowl productivity and land owner acceptance (Morgan 1989).

The HELP program addresses these objectives by delivering a series of options; leasing and purchase of pothole complexes, seeding marginal cultivated lands to forages and

supplying innovative conservation farming equipment and materials to landowners.

3.2 HELP Management Options:

The habitat enhancement options delivered by the HELP program were detailed in the HELP status report for December 1989 (Manitoba Department of Natural Resources 1989) (Appendix A). Five of the options were targeted for this study. These were the only options with participant landowners.

3.3 Literature Review:

The literature examining wildlife habitat on agriculture lands was reviewed, and data collected in the ongoing HELP biological evaluation was evaluated. The conservation tillage techniques of stubble mulch fallow, winter wheat and zero-tillage were evaluated through the literature. The literature review was carried out primarily at the University of Manitoba libraries. Dr. B. Jones, Manitoba department of natural resources, was consulted for HELP biological evaluation data. This review provided an estimate, based on previous research, of the wildlife productivity that may be expected as a result of adopting the specific management changes.

The link between wildlife habitat enhancement management incentives and the economics of sustainable agricultural development was partially addressed through a literature review. An examination of sustainable resource economics literature was carried out at the University of Manitoba libraries, and at the International Development Research Centre library in Ottawa. This review provided a foundation of current thought with respect to the valuation and efficient provision of extramarket goods.

3.4 Landowner Survey:

A survey questionnaire was conducted with HELP participant producers. The survey sought economic information detailing the individuals' involvement with the HELP program.

The survey was used to determine the basic physical and economic structure of the individual agricultural operation, the rationale for the individual's involvement in the HELP program and the individual perceptions with respect to the acceptability of the HELP management incentives and restrictions. In addition, economic data were gathered to assess the net returns from option-targeted fields before and after HELP delivery.

The direct method of hypothetical evaluation (Bishop and Heberlein 1979) was used to determine the perceived willingness to accept (WTA) and willingness to pay (WTP) compensation value for certain types of land use restrictions by participant producers. These two values depend upon different allocation of property rights. If agricultural producers are not permitted to conduct certain practices on their land unless they provide some form of compensation to society, then WTP is the maximum amount that farmers are willing to pay in order to be able to employ the restricted practice (Van Kooten and Schmitz 1990). If the property rights are specified in such a way that a particular land use is allowed but society wishes to restrict the use, then WTA is the minimum amount that a farmer is willing to accept as compensation for restricting his use of the land (Van Kooten and Schmitz 1990). Appendix B presents the WTP and WTA questions used in this study. The actual compensation which needs to be provided is estimated to be approximately half way between the WTP and WTA values (Bishop and Heberlein 1979). This technique is used to capture non-measurable costs and estimate the incentive levels required to encourage farmers to participate in wildlife habitat programs.

3.41 Survey Procedure:

All landowners involved in the HELP program, and farming the land, were initially contacted by telephone between January 24 and February 12, 1991. During this initial contact landowners were given a brief background of the study and asked whether they would be willing to participate in the survey. If the landowner was willing to participate a meeting time was set. Approximately 7 percent (2) of the landowners contacted refused to participate. Interviews were conducted with 26 individuals. The number of individuals interviewed for each of the options is as follows; delayed cut tame forage - 6, salinity barrier - 2, rotational grazing - 2, delayed cut native hay - 22, land idling - 19. In most cases the interviews were carried out at the landowner's home. In two cases the interview was held at the HELP office, in Shoal Lake town.

In most situations the landowner was involved in more than one HELP option, however, in order to minimize interview duration a maximum of 2 options were targeted in each survey. The survey interviews were carried out in a very informal manner with any extra comments or information provided by the landowner being recorded.

Some of the landowners involved in the HELP program do not actively farm the land, but rent the land out to a third party. These landowners were contacted by telephone between April 21 and May 1, 1991. Landowners were given a brief background of the study and asked whether they would be willing to participate in the survey. Approximately 18 percent (2) of the landowners contacted were unwilling to participate. Those willing to participate were asked three brief questions pertaining to the sociological and economic impacts of their involvement in the HELP program (Appendix C). A total of 9 landowners who are involved in a HELP lease but rent the land out to other producers to actively farm were interviewed by telephone. The only HELP options represented in this group were 9 idle and 8 delayed native hay agreements.

The landowner survey was also used to help satisfy objective 4. General attitudes about sustainable agriculture were collected from all 26 survey participants. The landowners were presented the following brief definition for sustainable agriculture:

> Sustainable agricultural systems are those that are economically viable and meet society's needs for safe and nutritious food, while conserving or enhancing Canada's natural resources and the quality of the environment for future generations (Gilson 1989).

Each landowner was then queried about their general attitudes with respect to sustainable agriculture and

conservation farming techniques. The individual perceptions of how wildlife habitat programs tie in with sustainable agriculture were also gathered. This information was used to determine how wildlife habitat incentives contribute to the movement towards a sustainable agriculture system.

3.42 Data Analysis:

Means were calculated for each of the quantitative variables obtained from the survey. The qualitative responses were used to identify trends in program participant's perceptions. The delayed cut tame forage, salinity barrier and rotational grazing options were further evaluated by calculating economic returns before and after the implementation of HELP incentives and restrictions. Manitoba Department of Agriculture (1987,1989,1990,1991) standardized production cost and commodity price data were used in the calculation of benefits and costs. The above information was used to determine if HELP incentive levels are sufficient to offset economic costs imposed by HELP restrictions.

3.5 Recommendations:

Recommendations were generated based on the conclusions developed from the findings of the first 4 objectives. The recommendations were developed with a view toward achieving the most economically and socially efficient allocation of resources. The preferred management options were those which enhance the economic and environmental sustainability of the agriculture system while providing improved wildlife habitat.

CHAPTER 4

RESULTS

4.1 Introduction:

This chapter will present the results obtained by the research methods used in this study to satisfy the stated objectives. Included in this chapter is a listing of the study targeted options, and a summary of responses from the personal survey and the telephone survey.

4.2 Study Options:

The HELP options targeted for this study were; delayed cut tame forage, salinity barrier, rotational grazing, delayed cut native hay and land idling.

4.3 Option Performance Characteristics:

The average size of the participant farm was 639 hectares. Sixty-six percent of the land was under cultivation (including tame hay land) with 13 percent pasture land and 21 percent unproductive idle land including bush, permanent and temporary wetlands and alkali land. Participant producers derived 70 percent of their income from grain production and 30 percent from livestock.

4.31 Delayed Cut Tame Forage:

The average size of the delayed cut tame forage lease was 24 hectares. These producers derived 59 percent of their income from crop production and 41 percent from livestock production.

Within this agreement, the producer is restricted from cutting hay between July 15 and August 25. Sixty-six percent (4) of the participants felt that these restriction dates presented no conflict with traditional management. The other 33 percent (2) felt that there was a conflict and would have preferred a July 7 cut restriction date. The delayed cut date resulted in a perceived decrease in hay quality to 83 percent (5) of the participants. An increase in HELP lease incentives from $12.35 to $24.10 per hectare, to offset the economic loss associated with the decrease in hay quality, was desired by 66 percent (4) of the producers.

The average value of hay returns, previous to HELP program involvement, was a net loss of $32.75 per hectare. This is based on the returns of only 5 individuals due to one of the participants producing grain on the target field previous to 1990. One of the delayed cut tame forage option participants received 100 percent hail damage in 1990. The average 1990 hay return for the remaining 5 producers was

$74.80 per hectare. The average increase in returns over pre-HELP returns was $95.50 per hectare. These values are based on producer reported hay yields and Manitoba Department of Agriculture (1989) standardized hay values which include a factor for decreased hay value resulting from a delayed harvest.

Delaying of hay harvest results in a decrease in hay quality and an increase in hay yield. Therefore, estimated returns per hectare, given optimal yield, will be $175.00 in late June, $168.00 July 1, and $150.00 July 15. The delaying of the first cut of tame forage for three weeks results in an estimated $25.00 per hectare loss to the producer. See appendix D for a list of assumptions and values used in the above calculations.

4.32 Salinity Barrier:

The salinity barrier lease areas were 11 and 2 hectares in size. Previous to the 1989 establishment of salinity plantings these areas were used for cereal grain production. Barley was produced on the 11 hectare piece and wheat on the 2 hectare piece. The barley returned $24.96 per hectare, a net loss of $182.65 per hectare based on standardized crop production costs. The return for the wheat was $10.60 per hectare, a net loss of $209.00 per hectare. After these

areas were established to salinity barrier plantings the 11 hectare site provided a net benefit of $102.00 per hectare while the 2 hectare site imposed a net loss of $50.00 per hectare. However, the 2 hectare plot was established late in 1989 and the yield was only 1 tonne per hectare, compared to 2.5 tonnes per hectare on the other site. The above values were calculated using standardized hay values (Appendix D).

The July 15 cut restriction date was considered too late by both producers. The respondents felt that the delayed harvest resulted in greatly decreased hay quality. An increase in lease incentives from $12.35 to $29.65 per hectare was desired to offset the cost of decreased hay quality. As discussed with the tame forage option, given optimal yields, a 3 week delay in harvest will result in a $25.00 per hectare loss. This is the result of decreased hay quality, which is somewhat offset by an increase in hay yield.

4.33 Rotational Grazing:

Preceding the establishment of the rotational grazing systems one of the areas was permanent pasture (area A) and the other was cropland (Area B). Area A provided a net economic return of $16.00 per hectare in 1989 under

conventional pasture management. This is based on standardized pasture costs (Manitoba Department of Agriculture 1990). In 1990, after the establishment of the rotational grazing system this 130 hectare pasture provided a net return of $29.00 per hectare. Economic returns included the value of hay harvested on 12 hectares of the pasture. Excluding hay value, the net return was $21.00 per hectare.

Area B was 65 hectares in size. Because this area was cropped in previous years, a comparison with returns from the rotational grazing system are irrelevant. Hay was harvested on 46 hectares of the pasture, resulting in overall net returns from the rotational grazing system of $17.00 per hectare. Hay yields were very low, 1.1 tonnes per hectare, which resulted in the hay harvest imposing an estimated net loss. With hay value excluded, the returns were $27.00 per hectare.

In addition to these returns, the HELP program provided $4923.87 to pasture A, or $5.41 per hectare per year, and $5491.70 to pasture B, or $12.07 per hectare per year, in the form of materials for all internal fences, labour and 50 percent of the seed and fertilizer costs. These costs were budgeted over the 7 years of the pasture project. The portion of the seed and fertilizer costs which were the

responsibility of the individual were also budgeted over the 7 years of the project.

The producers did not perceive that there were any extra management costs associated with the rotational grazing system. Both producers stated that the rotational grazing system increased the accessibility of the cattle and decreased handling time compared to a conventional system. The individuals stated that having now had experience with rotational grazing they would be willing to establish such a system without external financial incentives. Both producers stressed the importance of technical support being provided by the HELP program.

4.34 Delayed Cut Native Hay:

The average delayed cut native hay lease area was 23 hectares. These producers gained 70 percent of their income from crop production and 30 percent from livestock. Within this option the native hay harvest is restricted until after July 20. Native hay was traditionally cut before July 20 by 45 percent of those surveyed. However, 86 percent of the producers stated that the July 20 cut restriction date presented no conflict with the regular management schedule. Only 18 percent of the producers perceived a decrease in native hay quality resulting from the delayed harvest date.

Many of the native hay areas are low spots, or sloughs within cultivated fields. The perceived cost of farming around these areas was $48.18 per hectare of slough. In other words, it would cost the producer $48.18 less to farm a field if a 1 hectare slough were removed. Therefore, if the producer would prefer to clear these areas but cannot due to the HELP lease, this cost is imposed on the individual. Producers stated that the cost per hectare of slough is partially dependent on the size, shape and location of the obstruction. One individual reported a perceived cost of $585.62 per hectare. This value was excluded from the calculation of the mean due to its distorting nature.

4.35 Land Idling:

The average idle lease area was 45 hectares, often made of many smaller segments throughout the land holding. The land type is predominantly bushland and wetland (Figure 3). Areas covered by type 3, 4 or 5 wetlands are protected under the lease agreement but do not qualify for payment, according to HELP regulations.

Only 16 percent of the producers reported any economic activity prior to signing the HELP lease on land within the idle leases. This economic activity was very minor and was

Figure 3:

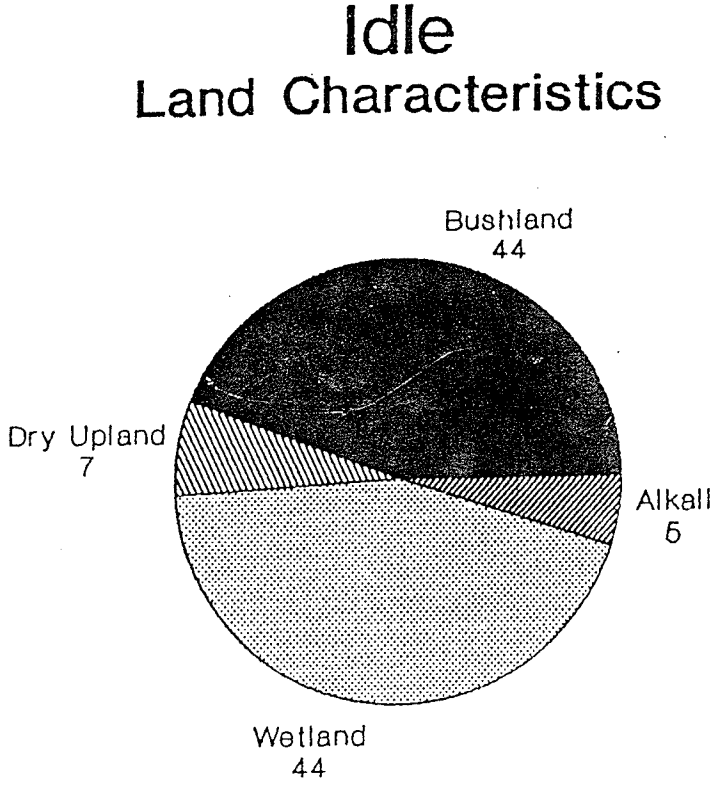
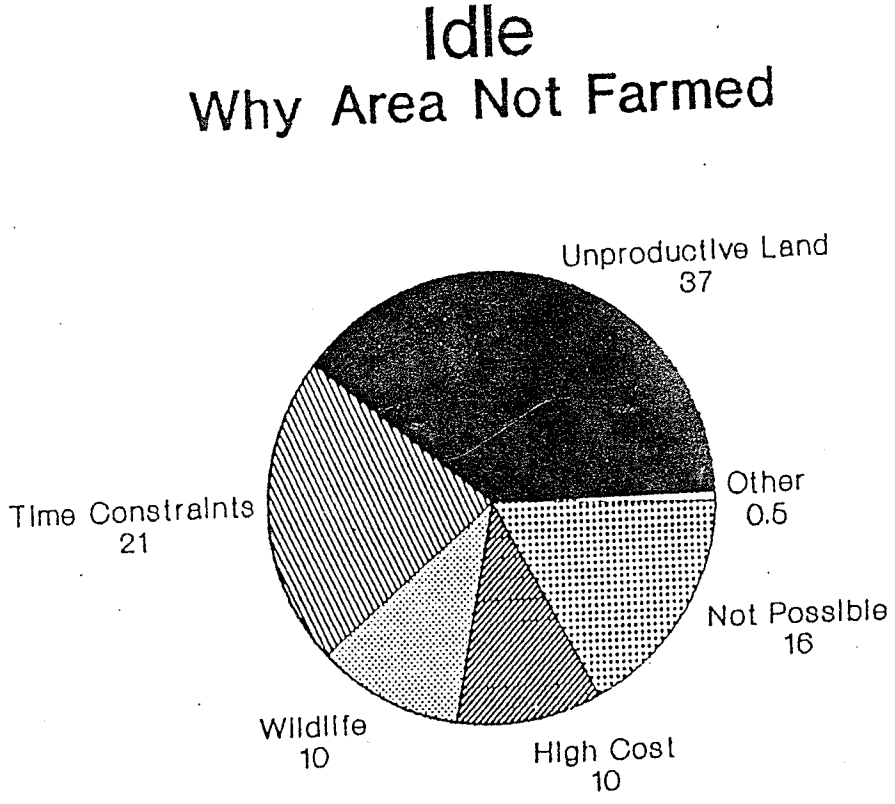


Figure 4:



carried out on small fractions of the lease area. Seventy-four percent of the respondents included the idle areas in the HELP program primarily for economic reasons. However, the other 26 percent cited interest in wildlife as the primary motivation in signing these areas to an idle agreement. The primary reason given for not farming this land previously was that the land was marginal agricultural land (Figure 4).

The average perceived cost of farming around idle areas within cultivated fields was $40.75 per hectare. The importance of the influence of size, shape and location of the area on the extra cost imposed was stressed. A perceived cost of $586.62 per hectare was reported by one participant. This value was excluded from the mean calculation due to its distorting nature.

4.36 Hypothetical Valuation:

The direct method of hypothetical valuation was used to determine the value of a 5 hectare slough within a cultivated field. Initially, the willingness to pay (WTP) compensation value was desired on a per hectare, per year basis. This value represented the amount an individual was willing to pay to gain the rights to drain and put into production a 4 hectare wetland which previously could not be

legally drained. However, producers were unwilling to pay on an annual basis and conceded to provide a single occasion value. The WTP valuation was $12.23 per hectare. The willingness to accept (WTA) compensation valuation was elicited on a per hectare, per year basis. This value represented the amount required to restrict a producer from farming a 4 hectare wetland. The WTA valuation was $105.43 per hectare per year. A WTA valuation of $494.20 was excluded from the calculation of the mean.

4.37 General Comments:

All personal survey participants were asked for general comments or concerns about the HELP program. Of the 26 individuals involved, 17 made comments pertaining to factors not discussed in other parts of the survey. The most frequently voiced concern was the need for flexibility in the lease agreement restrictions. More specifically, 27 percent of the respondents would like to be allowed to fall burn or graze native hay sloughs, particularly in years when it is too wet to harvest the hay. Related to this was a concern with Ducks Unlimited's increased involvement in the HELP program and a perceived resultant decrease in program flexibility. This view was expressed by 12 percent of the participants. Other concerns voiced included; the HELP program is competing for pasture with third party renters

and taking land out of production (12 percent), greater resources should be allocated to providing compensation for waterfowl crop depredation (8 percent), greater waterfowl predator control effort is needed (8 percent). In addition, producers recommended that the HELP program expand certain initiatives such as rotational grazing, tame hay development, zero-tillage and water conservation promotion.

4.4 Non-farming Landowners:

The average size of the delayed hay and idle leases held by these landowners were 8 and 25 hectares respectively. Interest in wildlife was the dominant (55 percent) reason given for signing the HELP lease agreement. Purely economic reasons were cited by only 11 percent of the landowners, while a combination of wildlife and economic reasons was cited by 34 percent of the landowners.

The delayed cut native hay option areas were 90 percent slough hay, with the remainder being dry upland. All of the landowners stated that the delayed hay harvest restrictions have no effect on the management of these areas. These areas are being hayed by renters, while the landowner receives the additional $9.88 per hectare HELP incentive.

Bushland was the dominant cover type of the idle land, making up 32 percent of the area (Figure 5). Only 2 of the 9 areas were providing an economic return previous to involvement with the HELP program. One of these areas earned $150.00 and the other earned $475.00 annually in rental fees. However, both of these landowners stated that the HELP program offered less inconvenience, and provided wildlife habitat.

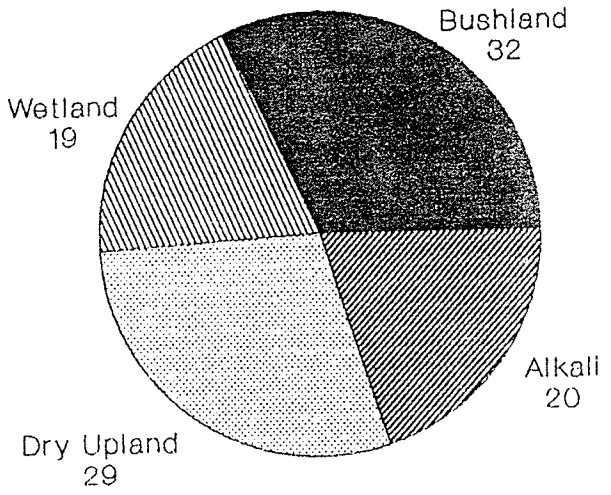
4.5 Sustainable Agriculture Perceptions:

A selection of environmental problems that are associated with agricultural production were ranked in order of primary and secondary perceived importance by the survey participants. Figure 6 and figure 7 show the percentage of producers that ranked the environmental problems listed as most important or of secondary importance respectively. Soil erosion was considered of primary or secondary importance by 76 percent of the respondents. In contrast, loss of wildlife habitat was considered of primary or secondary importance by only 15 percent of the respondents.

The sustainable agriculture techniques of zero-tillage, minimum tillage, winter wheat and rotational grazing were evaluated with respect to the income change that would be expected from adopting each of these techniques (Figure 8).

Figure 5:

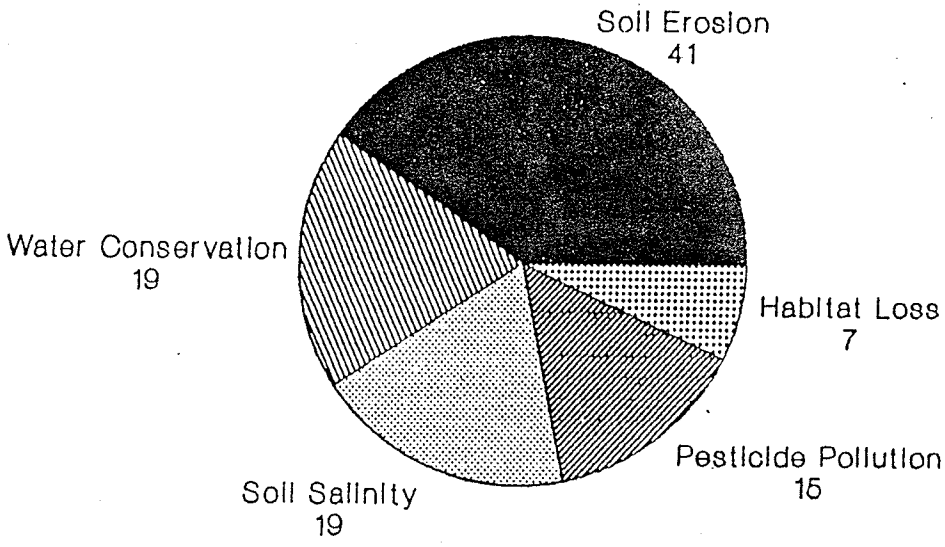
Idle
Land Characteristics



Non-farming Landowners

Figure 6:

Environmental Problems
Agricultural Related



Ranked As Most Important

The production of winter wheat would result in a decrease in income according to 80 percent of the respondents, reflecting the lack of successful winter wheat strains. In contrast, 68 percent of the producers considered rotational grazing to result in an increase in income over conventional management. No definition for minimum tillage was given to the survey respondents. Therefore producers may consider any form of reduced tillage a form of minimum tillage. As a result, 92 percent of the producers perceived minimum tillage as a technique which would maintain or increase their income over conventional management.

The primary reasons for not adopting sustainable production techniques were high equipment costs (54 percent) and unacceptability as a viable production technique (38 percent).

The formal promotion of sustainable agriculture techniques was viewed as unnecessary by only 16 percent of the participants (Figure 9). Forty-three percent of the participants felt that the promotion of sustainable agriculture should be carried out in a co-operative effort between government and private farm groups (Figure 10).

Figure 7: Environmental Problems
Agricultural Related

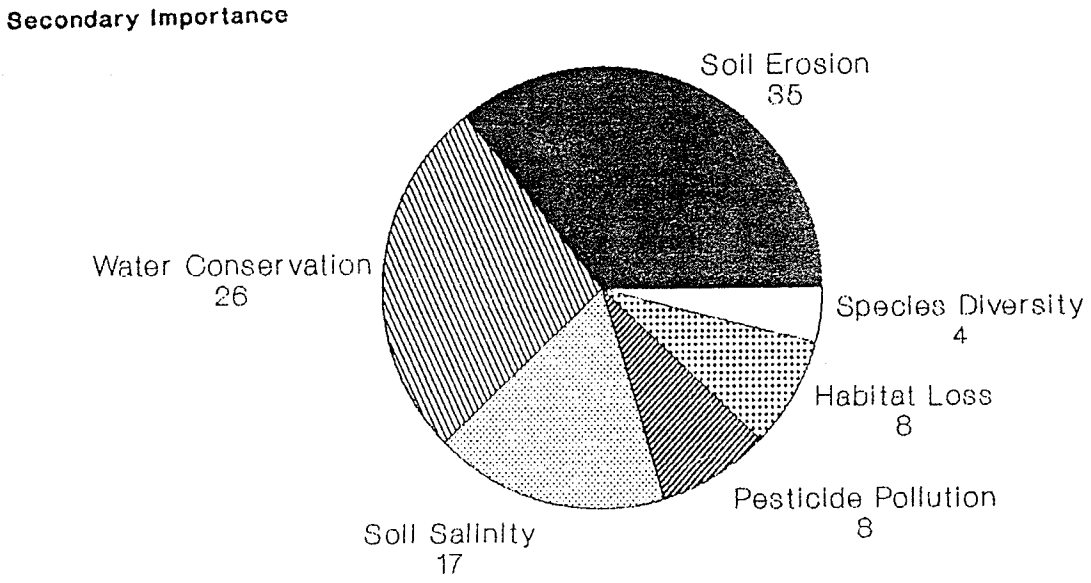


Figure 8:

Perceived Income Potential
Conservation Farming Techniques

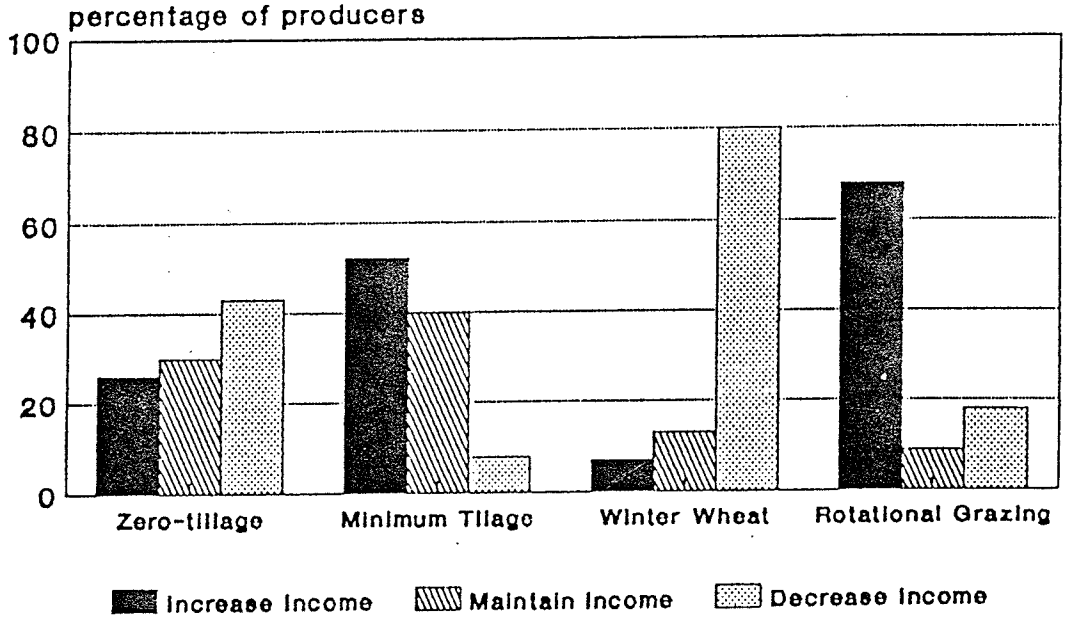


Figure 9: Sustainable Agriculture
Institutional Promotion

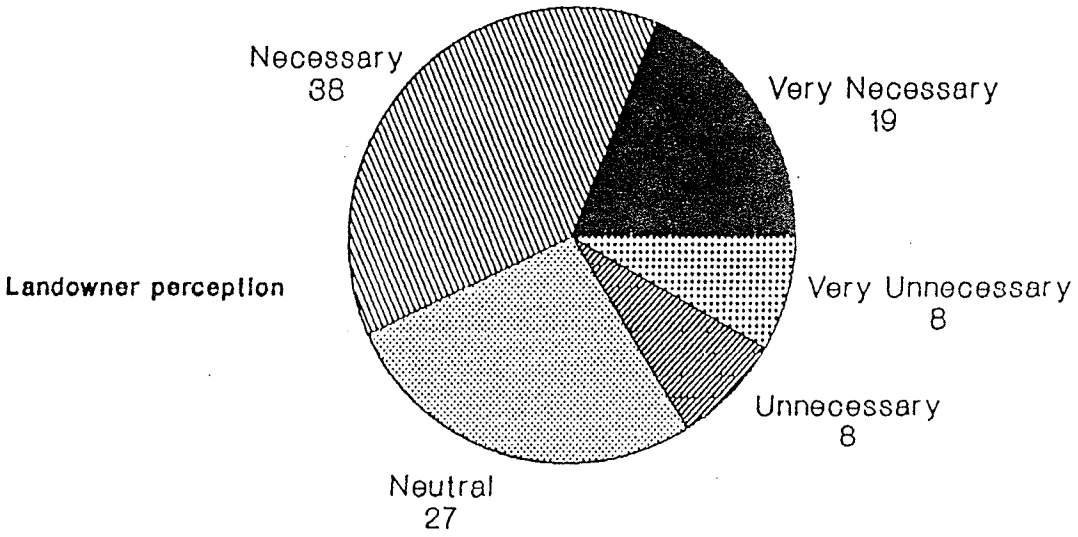
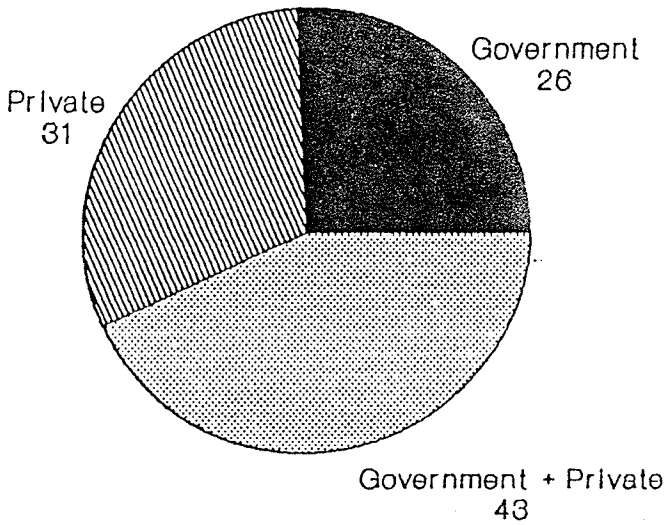


Figure 10:

Sustainable Agriculture Promotion
Responsible Bodies



The HELP program techniques were seen to be consistent with the development of a sustainable agricultural system by 85 percent of the respondents. Water conservation and the removal of marginal land from production were cited as the most important aspects of the HELP program.

CHAPTER 5

DISCUSSION

5.1 Introduction:

Economic incentives designed to encourage the adoption of agricultural management systems which are less damaging to wildlife populations than conventional management will have a number of impacts. The management change may impose a greater financial cost on the participant than equivalent conventional management would. The economic incentives provided to the producer need to be designed to cover these extra costs if the option is to be adopted. The incentives may be required to more than compensate the producer such that the adoption of the target management system provides a greater net economic return than the conventional system. The producer can then make an economic decision to adopt these wildlife habitat-enhancing management systems.

In order to efficiently allocate incentive money it is important to understand some particular characteristics of the individual management systems. It is necessary to assess the economic impact on the individual landowner of adopting these management systems. In addition, an evaluation of the potential benefits to wildlife that the change in management can provide is important. It would be

inefficient for a wildlife program to provide incentives to offset economic costs associated with a particular management strategy which provides little direct or indirect benefits to wildlife.

Another important component in the understanding of such incentive programs is the contribution made towards an economically and environmentally sustainable agriculture. Agricultural production has frequently ignored, or been unable to include as a cost, the environmental damage or externalities resulting from certain production techniques. Incentives are a very important tool in assigning value to these extra-market costs. Identifying the role of incentives for wildlife habitat enhancing management systems is a step towards the development of a sustainable agriculture system.

5.2 Management Option Efficiency:

The HELP management options were assessed within the following criteria; does the incentive money effectively cover the extra costs shouldered by the participant landowner, does the management option provide potential improvements in wildlife productivity relative to the magnitude of the economic incentive provided.

5.21 Delayed Cut Tame Forage:

The optimal cutting period for 50 percent alfalfa, 50 percent grass forage in Manitoba based on crude protein content, digestibility, voluntary intake and yield is around June 21, depending on yearly conditions (Manitoba Department of Agriculture 1987). Delaying the harvest date past this optimal period results in a decrease in forage quality and an increase in total yield. Assuming an optimal yield, the net economic loss of delaying harvest to July 15 would be $25.00 per hectare. Soutiere (1985) reported an extra cost of $127.50 - $159.50 per hectare resulting from delaying grass-legume forage harvest 4 weeks (June 15 to July 15) on a 4 hectare field in Maryland. This forage was fed to dairy cattle which required expensive supplements to elevate the protein levels of the feed intake. The 1 week less delay and the lower protein requirements of beef cattle (Manitoba Department of Agriculture 1987), helps to partially explain the cost discrepancy between this study and Soutiere's. In addition, the producer will always have a range in quality of feed which can be mixed to help compensate for low quality forage. Mixing of forages will impose an additional cost on the producer. Therefore, depending on the level of forage mixing required, the extra cost of delaying hay harvest could be somewhat greater than $25.00 per hectare.

It is very difficult to calculate a definite economic impact resulting from delaying the forage harvest date to July 15. The yearly variation in weather conditions may dictate that the optimal harvest date is dramatically earlier or later than June 21, resulting in a large range of forage quality on July 15. Harvest conditions may also vary dramatically. If weather conditions become very poor after July 15, harvest of the lease forage will be delayed even further resulting in very poor quality feed.

The delayed cut tame forage incentive offered by the HELP program ($12.35 per hectare) does not seem to be sufficient to offset the costs associated with delaying the harvest of large areas of tame forage. Although some low quality forage may be acceptable, the producer would not want large quantities of the poor forage. Since harvest operations can not begin until after July 15, if the lease area is very large some areas will not be harvested till much later than July 15, resulting in even greater decreases in feed quality.

In response to the above, producers suggested lease incentives be increased to $24.10 per hectare. This would almost compensate for the forage quality loss ($25.00 per hectare) resulting from the 3 week delay in harvest. It was also suggested that the harvest date be changed to July 7.

This was preferred to increasing compensation by some producers. This 2 week delay would impose a $15.00 per hectare cost, due to decreased forage quality. The existing incentive level seems to be sufficient only if relatively minor areas of the total tame forage area are involved.

The delay of tame forage harvest provide definite benefits to wildlife productivity. Bobolinks, which select alfalfa fields for nesting, realize great benefits from the delay of forage harvest. Waterfowl nest density will probably not increase, however delaying harvest operations will decrease mechanical nest destruction, the most common cause of nest failure in conventionally managed hay fields (Burgess et al. 1965; Soutiere 1985). Harvesting forage on July 1 will destroy 47 percent, July 7 will destroy 30 percent and July 15 will destroy 8 percent of the initiated duck nests (Jones 1991). Because tame forage provides attractive nesting habitat for all birds the delay of harvest should increase wildlife productivity.

If large areas of tame forage are targeted for enhanced wildlife habitat, specifying a July 7 harvest date should be considered. Forage quality losses ($15.00/hectare) would be almost covered by the present incentive level ($12.35/hectare). However, according to HELP data, harvesting forage on July 7 destroys 30 percent of the

waterfowl nests initiated on hay fields. Another possibility would be to offer a flexible harvest date based on seasonal conditions. Years with more advanced forage growth may also have a more advanced nesting season. Therefore, optimal or less drastically delayed harvest may have less of an impact on nesting. This was not discussed within the literature.

5.22 Salinity Barrier:

Approximately 4 percent of all Canadian prairie cropland and rangeland, or 2.2 million hectares, were affected by salinity by the mid 1970's. About 1.5 million hectares of this area was under cultivation (PFRA 1983). These saline areas impose a large economic cost on producers with high cost crop production inputs and very low yields. Income losses in 1982 due to salinity induced productivity reductions reached $257 million, with projected losses of $931 million by 1990 (PFRA 1983).

The two producers involved in the salinity barrier option realized net gains, above what was earned when cropped, of $284.65 and $159.00 per hectare. The salinity plantings provided a good return on areas that formerly imposed a substantial economic drain. It should be noted that 1990 was a particularly good year for hay resulting in

greater than average yields. The delayed harvest of these areas causes a decrease in forage quality, as discussed within the delayed tame forage option. In response, the producers suggested that lease incentives be increased from $12.35 to $29.65 per hectare. However, the salinity barrier areas will only make up a relatively small area resulting in a fairly small amount of poorer quality hay. In addition, establishment of salinity barriers seems to provide a net economic and conservation benefit compared to conventional cropping. These factors may prove to be sufficient incentive for the planting of salinity barriers. It appears that the present annual lease incentive and the $49.42 per hectare establishment and maintenance incentive in years 1 and 3 are adequate economic compensation.

There was no literature detailing the potential wildlife benefits of a salinity planting within crop land. However, these areas should provide wildlife habitat similar in value to delayed cut tame forage fields. Cropland nest densities are approximately .012 - .018 nest per hectare. A dramatic increase in waterfowl productivity on these areas could be possible with the establishment of salinity plantings, which provide much greater nesting cover than annual crop.

The net economic benefit to the producer, and the potential net increase in wildlife productivity that can be realized with salinity barriers make this an attractive option to both the farmer and the wildlife manager. Arnott (1988) stated that 87 percent of the farmers in the Shoal Lake area were either interested in or already utilizing some form of salinity control. In the present study, 36 percent of the program participants perceived soil salinity as the primary or secondary environmental problem associated with agriculture. There are long-run benefits of arresting the steadily advancing soil salinity problem. "The reclamation of such areas will provide potential nest cover for waterfowl and other wildlife. Many believe that improved wildlife habitat will be an inevitable by-product of any program directed at soil and water conservation projects such as salinity control" (Russell and Howland 1988). The widespread nature of the salinity problem makes this a very attractive option.

5.23 Rotational Grazing:

The producers involved in the HELP program earned 30 percent of their income from livestock production. Pasture land made up 13 percent of the land owned by the HELP participants. The enhancement of wildlife habitat on pasture land could impact large areas of the landscape.

One of the rotational grazing sites provided economic returns of $5.00 per hectare greater in 1990 ($21.00 per hectare) than when managed conventionally. The other area was cropped in 1989 and returned $27.00 per hectare in 1990. In addition, portions of both of these pastures were hayed in 1990. The grazing systems cost the HELP program $5.41 and $12.07 per hectare per year to establish over the 7 year life of the project. This was provided in the first year of the project.

Rotational grazing systems provide a positive economic return to the landowner. The returns are large enough to effectively cover the establishment costs. This was reflected by both operators stating that they would establish such a system without financial incentives. In addition, 77 percent of the HELP participants perceived rotational grazing as a technique which could maintain or increase their income over conventional management. Arnott (1988) reported that 75 percent of Shoal Lake area producers were interested in or already utilizing rotational grazing.

Rotational grazing is a system which can increase nesting density by 150 to 200 percent and increase nest success by 300 percent. However, in order to fully realize the wildlife benefits of rotational grazing some level of residual vegetation should be maintained. The harvest of

hay on rotational grazing sites reduces cover levels on the hayed paddocks and increases grazing pressure on the remaining paddocks.

Rotational grazing provides a net economic gain to producers, and if correctly managed can provide valuable wildlife habitat on pasture land. The widespread acceptance of this system by producers indicates that large incentives are not necessary to encourage the establishment of rotational grazing sites. Although some form of technical support may be necessary. A financial incentive may be needed to offset costs imposed on landowners when the management of pastures to optimize wildlife productivity is not the optimal management for livestock.

5.24 Delayed Cut Native Hay:

Temporary wetlands are an important part of the agricultural landscape in the Minnedosa pothole district. These areas serve as important islands of wildlife habitat. A large number of these wetlands have been drained, cleared and put into crop production in recent years. The delayed cut native hay option specifically targets these areas.

The delayed cut native hay lease option restricts hay harvest until after July 20. This represented no management

conflict to 86 percent of the producers. Fifty five percent of the participants stated that they did not traditionally cut these area until after July 20. Only 14 percent of the producers traditionally harvested before July 15. As a result, there would be little change in hay quality and little or no economic cost imposed on the producer by the delayed harvest date. It should be noted that yearly variations in temperature and precipitation cause wide variations in the optimal harvest date for native hay. However, July 20 seems to be a reasonable average harvest date.

An important cost associated with native hay areas is the cost of farming around them. There are two components to this cost:

> i) the increase in overlap or double coverage which results from farming around an obstruction.
>
> ii) the extra cost which is incurred because the obstruction reduces field efficiency, which includes (a) extra turning time, (b) loss of time in overtaking the field run, and (c) extra time and cost incurred in finishing out field portions. (Van Kooten and Schmitz 1990)

The survey participants were asked for their perceived valuation of these extra costs. The individual was asked for an estimation of the extra costs of farming around a 4 hectare slough. It is hypothetically assumed that the slough could be drained. The average perceived cost was $48.18 per hectare of slough. Van Kooten and Schmitz

obtained a somewhat smaller perceived value of $23.59 per hectare of slough. The discrepancy in cost could be attributed to Van Kooten and Schmitz's use of a hypothetical 16 hectare obstruction, while the present study proposed a much smaller 4 hectare obstruction. The effect of the size and shape of obstructions on the extra cost is significant, with larger more uniform obstructions having less of an impact on field efficiency.

An area that is included in a native hay lease is technically protected from being cleared. The participant landowner is then forced to shoulder the $48.18 per hectare cost of farming around the slough area. Therefore, the $9.88 per hectare delayed cut native hay lease incentive would not be sufficient compensation if the producer wanted to clear the area. However, many of these areas are not economic to drain, or are required by the producer as a source of livestock feed and water. An important economic return is provided by these areas in the form of hay. Although hay yields and values fluctuate according to vegetation types, weather and general hay supplies, net hay value is approximately $50.00 per hectare on these slough areas (Appendix D). The economic value of native hay appears to cover the perceived economic costs of preserving the slough areas.

The potential wildlife productivity of the native hay lease is difficult to quantify. Duebbert and Kantrud (1974) reported that dry marsh habitat had the highest waterfowl nest density (.67/hectare) of all available habitats on the prairies. Because most of these areas are not normally hayed till mid to late July the harvest restriction date will have little effect on the overall net wildlife productivity. A more important aspect of this lease option is the preservation of the native hay area. These areas have been identified as extremely important waterfowl breeding pair space and food sources when the larger wetlands are still cold and unproductive early in the spring (Bellrose 1980). In addition, these areas serve as important islands of habitat or as part of a corridor for many wildlife species. Therefore the preservation of these areas is very important for wildlife.

The $9.88 per hectare lease incentive appears to be a minor economic return to many of the producers for something they would be doing anyway. At least one of the participants stated that the incentive money is not enough to cause a change in management. A number of the participants stated that they would like permission to fall burn or fall graze some of these areas in years when hay harvest was not completed. These practices contribute to a better hay yield the next year. Some of the participants

stated that they would break the lease if they did not get prompt permission after a request to fall burn or fall graze. These practices would remove residual vegetation and have a negative impact on the attractiveness of these areas for wildlife in the spring. A decrease in lease payments could be imposed, as a penalty, on individuals wishing to fall burn or graze. This would provide landowners with the flexibility desired while providing an incentive to preserve these important areas.

5.25 Land Idling:

Areas that are not actively farmed provide important wildlife habitat across the prairies. Often these are areas of marginal agricultural land which are not economic to put into production.

The areas included in the idle lease are generally much larger than any of the other lease areas; an average of 45 hectares. The majority of these areas (84 percent) have provided no economic returns to the producer in recent years. Therefore, the $19.76 per hectare HELP program lease incentive was cited as the main reason for including land in an idle lease by 74 percent of the participants.

The average perceived cost of farming around these idle areas was $40.77 per hectare. This is a smaller value than the native hay area perceived cost. This may be explained by the larger size and the generally marginal nature of the idle lease areas. The HELP lease incentive compensates for only 50 percent of the perceived costs imposed by the lease area. However, most of these areas are marginal agricultural land or require a large economic input to convert to productive agricultural use. Almost 70 percent of the participants stated that these areas have not been converted to agricultural production due to the marginal nature of the land. Therefore, the HELP incentive seems to simply lessen an economic cost that would be imposed on the individual anyway.

The majority of these areas are productive wildlife habitat. Idle grassland can provide up to 1.14 waterfowl nests per hectare, while woodland has produced .74 nests per hectare. Woodland is important habitat to many wildlife species which are not provided for in most of the other HELP options.

The preservation of the idle areas could be very important to a wide range of local wildlife. The HELP incentive provided is not adequate to take an area out of production, or to convince an individual not to clear an

area which is targeted for conversion to cultivation. In other words, the idle incentive is insufficient to influence a major change in management by the producer. Only incentive levels equal to cash rent will preserve these areas (Van Kooten and Schmitz 1990). However, the incentive helps to maintain the areas for wildlife, which are not profitable to clear.

5.3 Conservation Tillage:

The conservation tillage techniques of stubble mulch fallow, winter wheat and zero-tillage could be included in the conservation tillage demonstration option offered by the HELP program. There were no producers participating in this option.

Fifty-seven percent of the participant landowners perceived the promotion of these conservation tillage techniques as necessary or very necessary. High equipment cost and unfamiliarity with the techniques were the most common reasons given for not adopting these techniques. Demonstration projects and availability of specialized equipment may encourage acceptance by making the transition to conservation tillage less risky for the producer.

The implementation of conservation tillage techniques result in an increase in wildlife productivity on formerly conventionally managed areas. Winter wheat holds the greatest promise, with zero-tillage and stubble mulching providing more modest wildlife productivity improvements. However, the wildlife productivity under conventional management is virtually zero. The wildlife productivity of these conservation techniques is very low compared to the potential resulting from the HELP options previously discussed. The true strength of these conservation techniques is in the large area that can be impacted. "The adoption of new agricultural practices...has the potential to affect millions of acres of farmland and could therefore have a significant affect on prairie waterfowl populations" (Russell and Howland 1988).

Promotion of conservation agriculture techniques through development of demonstration sites and provision of specialized equipment to producers would encourage the adoption of these techniques. Wildlife populations will be strongly benefitted only if the techniques are carried out on a wide scale. However, producers can not be expected to assume economic losses during the adoption of these unfamiliar techniques. It may be necessary to alter government policy to provide some form of benefits to producers who adopt these conservation tillage techniques.

5.4 Landowners Versus Producers:

The lease areas held by individuals who do not actively farm the land but rent the land out to a third party, were generally smaller than the producer held equivalents. Only delayed native hay and idle leases were utilized by this group. Eleven percent of the participant landowners cited purely economic reasons for signing a lease agreement. This compared to 74 percent of the producers citing purely economic reasons for signing a lease. The landowners received income from sources other than the land, therefore, the land base was not an important income source. Wildlife proved to be a far more important component in the decision to include land in the HELP program. Two of the landowners had been receiving rent for portions of the idle areas. Both stated that the HELP program provided wildlife habitat, economic returns, and less hassle than renting to a third party. Landowners rented the delayed cut native hay lease areas to a third party for harvesting. Since the HELP harvest restrictions represented no change to traditional management, the landowners could earn hay rent money as well as HELP incentive monies. The HELP program provides a positive economic return to these landowners; however this is perceived to be of secondary importance to the wildlife benefits gained.

5.5 Hypothetical Valuation:

The average WTP valuation was $12.23 per hectare. Van Kooten and Schmitz (1990) recorded a WTP of $9.64 per hectare per year in their study. The participants of this study were unwilling to pay on a per year basis, a one-time payment response was given. This may indicate that the HELP participants are more risk averse than the participants in the Van Kooten and Schmitz study. Some of the HELP participants stated that with the price of grain and high operating costs, only a "fool" would be willing to pay, even a very small amount, to drain a slough. The average WTA valuation was $105.44 per hectare per year. This value is much higher than the $66.22 valuation reported by Van Kooten and Schmitz. The authors state that their values may be biased downwards due to low starting values, exclusion of WTA values above $185.00 per hectare and WTP values above $123.55 per hectare were interpreted as zero. The mid-point value was $58.85 per hectare per year. This value would be lower if a per year WTP valuation could have been established.

Colpitts (1974) calculated the compensation necessary for a producer to idle an area, based on the opportunity cost of crop production on the land. A value of $49.00 - $62.00 per hectare per year was presented. Colpitts' study

used 1974 values and prices. This value was calculated to include some level of uncertainty. The WTA and WTP valuations also have an inherent inclusion of a level of uncertainty. The mid-point value of $58.85 per hectare per year generated by this study agrees with Colpitts' value.

The incentive provided by the HELP program to idle a slough or upland area is $19.77 per hectare per year. The survey responses indicate that this compensation level is far too low to prevent producers from draining and clearing these areas. The incentive provided would be attractive only to producers with permanent potholes or areas of marginal agricultural land which would not be economic to convert to productive agricultural land. Therefore, a greater level of compensation would be necessary for a producer to idle land for wildlife habitat exclusively.

Van Kooten and Schmitz (1990) attempted to explain WTP and WTA values using socioeconomic information. Within the present study, the sample population was too small to provide meaningful relationships. Van Kooten and Schmitz make the following conclusions:

> 1) It appears as if economic incentives are the most important factor determining the amount of compensation that will be required to induce participation in the wildlife program. Farmers with higher incomes need to be compensated more to participate in project agreements...

This study supports the above conclusion. Seventy-four percent of the participants included land in a HELP lease for purely economic reasons. The economic incentive gained by the producer is the most important component in the decision to involve land in the HELP program. The producer requires this incentive to off-set the extra costs associated with the change in management.

2) There is some evidence that other factors, primarily education, serve to reduce the amount of compensation needed and, thereby, contribute to the projects success.

3) It is clear from the positive relation between WTA compensation and the respondent's measure of risk that farmers do not become involved in the project as a means for spreading or reducing risk.

The reluctance of the producers in the present study to provide a per year WTP value indicates that the study participants are quite risk averse. The producers would require a large incentive to adopt a management scheme which involves some level of uncertainty with respect to economic returns.

5.6 Sustainable Agricultural Development:

As discussed earlier, the agricultural production systems operating on the Canadian prairies are not economically or environmentally sustainable. Agriculture policy has tended to ignore its impact on the environment, and created an economic framework for farmers that conflicts

with objectives for the environment and wildlife habitat (Girt 1990). Habitat incentives, such as those provided by the HELP program, may be an effective method of assigning a socially acceptable value to the non-market environmental services ignored by the present economic system.

The majority of the HELP participant producers identified soil erosion as the most important environmental problem associated with agricultural production. This was followed in order by water conservation, soil salinity and pesticide pollution. Only 7 percent of the participants identified loss of wildlife habitat, and none identified decreased species diversity as important problems. This may reflect the current economic system which ignores off-site costs. Soil erosion, water conservation, soil salinity and pesticide pollution impose long-run or short run economic costs on the individual producer. On the other hand, loss of wildlife habitat and decreased species diversity impose no economic costs on the producer.

In essence, this is a private cost versus social cost problem. When wildlife habitat is preserved on productive agricultural land, the costs, in terms of loss of field efficiency, the opportunity cost of unrealized production and the depredation of crops by increased wildlife populations, are borne by the producer alone. However, the

social benefits, the various environmental services provided by the preserved area, are enjoyed by all of society. If the area was converted to cropland the producer alone would realize the economic benefits while society would bear the cost of the lost habitat (Colpitts 1974). In general, the individual's economic decisions can not assess the total social costs and benefits of development. In addition, the present set of government agricultural policies alter the price regime under which farming operates such that certain types of production are favoured beyond the efficient level in an undistorted commodity market. These policies produce this effect in such a way as to increase unpriced off-farm costs, while priced on-farm costs are lowered (Girt 1990).

The importance of incentives as a means of assigning value to certain environmental services which otherwise are seen to have no private economic value was discussed earlier. Using WTP and WTA values from this study, the private value of idle wildlife habitat to the individual producer was calculated to be $58.83 per hectare per year. On limited use areas, where some economic returns are available to the producer through grazing or haying revenues, this value will be correspondingly smaller. The assignment of the private value to these environmental services should result in a change in accounting by the individual producer. The formerly ignored social costs can

now be included by the producer in the production equation. Girt (1990) stated that government agriculture policies have provided a massive input of public funds which have led to inflated land values and the need for inflated incentives for environmental and wildlife objectives. Girt calculated the annual payments for grain production in Saskatchewan as $106.00 per hectare.

The policy instruments which may be used to direct incentives toward minimizing the social cost of the environmental externalities include subsidization, tax mechanisms and redefinition of property rights. These are all incentive compatible instruments which are considered more effective than direct regulatory instruments. " The incentive compatible policies align the goals of economic development and environmental protection and they provide stimuli for innovation and technological change" (Fox et al. 1990). The HELP program uses economic subsidization to direct agricultural production. Wildlife programs may find it advantageous to incorporate other types of incentive instruments and encourage government to incorporate directed policies beyond the program's scope. It is important that the various policies do not conflict in their ultimate objectives. In other words, policy should not target the enhancement of wildlife habitat while ignoring the economic sustainability of the agricultural system.

The importance of a healthy livestock sector in the development of a sustainable agriculture, and the success of wildlife habitat programs, became evident during this study. The HELP participant producers earned approximately 30 percent of their total income from livestock. All of the options examined, except the idle agreement, rely on the presence of livestock. This dependence was direct, as in rotation grazing, or indirect, as a demand for forage in salinity barrier, delayed cut tame and native hay options. The inclusion of forage in crop rotations and the substitution of organic fertilizers for synthetic fertilizers, are techniques which could be important components of a sustainable agriculture system (Gilson 1989). These techniques decrease or eliminate the dependence on synthetic inputs. The above techniques absolutely depend on a healthy livestock industry. However, government agricultural policies generally discriminate against the production of livestock in western Canada (Girt 1990). Most agriculture policies give financial relief and develop infrastructures for the grain production sector alone. Decreased livestock numbers result in reduced pasture land which has a negative effect on wildlife. The decrease in livestock numbers can be partially attributed to government programs directed at grain farmers, to the detriment of the livestock industry (Van Kooten and Schmitz 1990). Therefore, policies need to be altered to be more

amenable to livestock production, and in this way facilitate the development of a more economically and environmentally sustainable agricultural system.

The movement of agricultural production towards sustainability requires an assignment of values to non-market environmental amenities and off-site costs. The assignment of these costs will make systems such as conservation tillage, which has incidental habitat enhancing characteristics, more economically attractive to the individual producer. The assignment of costs may be accomplished through a number of policy instruments. Assigning appropriate values to wildlife habitat is just one aspect of this accounting for costs. The most important step is to develop consistent policies aimed at making agriculture more sustainable and providing a socially and biologically optimal level of wildlife habitat.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Research Conclusions:

The HELP habitat management options of 1) delayed cut tame forage, 2) salinity barrier, 3) rotational grazing, 4) delayed cut native hay and 5) land idle were examined. The economic impact on the participant landowner, and the potential wildlife productivity resulting from the adoption of these options was considered in determining the overall efficiency of each option. Stubble mulch fallow, winter wheat and zero-tillage were evaluated to determine the benefits of a more environmentally sustainable production system.

The relative potential wildlife productivity and economic impact on the landowner of the study options is summarized in table 3. The rating of the options within this table is based on the relative performance of each option compared to the other option and compared to conventional management. The delayed cut native hay and land idle options involved virtually no change in management, the strength of these options lay in the preservation of these areas. The conservation tillage techniques provided better habitat than conventional

management, although wildlife productivity was less than that provided by the other options. These techniques could impact large areas of the prairies and as such can provide significant benefits to wildlife.

Table 3: Summary of HELP option performance.

Option	Wildlife Benefits	Economic Impact	Economic Impact (incl. HELP incentive)
Delay Cut Tame Hay	+ + + +	- - -	- -
Salinity Barrier	+ + + +	+	+ +
Delay Cut Native Hay	+ + +	=	+
Rotational Grazing	+ +	+	+ +
Land Idling	+ + + + +	- -	-

The size of the negative economic impact on delay cut tame forage option participants increases with larger lease areas. The economic incentive provided for the delayed cut native hay and land idle options were insufficient to induce any change in management by the landowner. These incentives simply provided an extra financial return for management which would be carried out anyway.

The study participant producers assigned a very low value to environmental services and the off-site costs of conventional agricultural production. This seemed to be caused by an inability of the market to give these factors a tangible value. Many government policies which are directed at the economic development of agriculture appear to ignore or aggravate the distortion of resource value. The assignment of value to these factors through policy instruments, such as incentives provided by the HELP program, help to furnish these factors with a value in the producer's production decision. This is a vital component in the establishment of an economically and environmentally sustainable agriculture system.

6.2 Recommendations:

1) A variable incentive level should be offered for a flexible tame forage harvest delay. The present $12.35 per hectare could be offered for forage cut July 7, with increasing levels of compensation offered, up to $20.00 per hectare, for forage harvested July 15. This would allow the producer to make a management decision based on how much of the lower quality forage he/she can afford to use. In addition, yearly weather variations could be adapted to by the producer such that forage could be harvested as close as possible to the optimal period.

2) The salinity barrier option should be maintained at $12.35 per hectare, and a harvest delayed until July 15. The net financial benefits accruing to the producer, resulting from replacing cereal crops with forage on saline areas were large. As a result, the adoption of this technique should require no extra financial incentive. However, in order to lessen the costs of decreased hay value and to maintain some control over the harvest date, a financial incentive should be provided.

3) The rotational grazing option provided a positive net economic impact compared to conventional pasture management. In addition, this was an accepted and desirable management system among producers. The HELP program provided substantial financial incentives in the form of fencing materials, forage seed and construction labour on the two existing systems. A more efficient package would be to provide extensive technical support with more modest financial contributions to the establishment costs. A per hectare incentive should be provided to help offset any management costs associated with the deferral of grazing on target paddocks in the late summer and fall and the following spring, to optimize the wildlife productivity of these areas.

4) The level of incentive ($9.88 per hectare) offered for delayed cut native hay was insufficient to influence any change in management, particularly with respect to clearing these areas. The level of incentive necessary to influence this management would need to be prohibitively high. However, there does need to be an increase in the flexibility of the restrictions due to the great importance of hay value to the preservation of these areas. In certain years, producers may wish to fall burn or graze the native hay areas. These activities should be allowed with a corresponding decrease in the incentive payment on the subject areas. This flexibility would allow producers to optimally manage these areas without breaking the lease, thereby maintaining the wildlife productivity of the areas in most years.

5) The present incentive level provided for idle land ($19.77 per hectare) was insufficient to compensate for the costs of maintaining potentially productive land idle. However, much of this land was marginal and would not be profitable to put into agricultural production. The potential agricultural and wildlife productivity of the idle areas should be assessed by the wildlife program, with per hectare lease payments reflecting this value. The HELP program does this to an extent by excluding permanent and semi-permanent wetlands from payment. The payment for

alkali areas and areas that require a large financial input to put into production, such as established woodland, should receive lower levels of payment. In contrast, dry upland and native grassland, which would be relatively inexpensive to break, should earn a correspondingly high payment.

6) Efforts should be increased in the area of promoting conservation tillage techniques, particularly systems which include forage in rotations. These systems could offer wildlife benefits as well as being more environmentally sustainable. Demonstration sites need to be established to educate producers, and to function as wildlife productivity evaluation sites. In addition, specialized conservation tillage equipment should be made available to individual producers.

7) There needs to be increased effort put into the education or deployment of information with respect to wildlife habitat. Only 7 percent of the study participants rated loss of wildlife habitat as an important agriculture related problem. If there was an elevated level of awareness of the loss of wildlife habitat, in the rural and urban public, the assignment of value to these areas would be perceived to have more relevance.

8) Government agriculture and wildlife agencies must develop policies which are more comprehensive with clearly defined objectives, to increase the economic and environmental sustainability of agricultural production while accounting for wildlife habitat priorities. The current policies reflect a lack of understanding among the various agencies of other's objectives, such that policies frequently have antagonistic and conflicting effects.

9) Wildlife habitat programs should not target waterfowl habitat exclusively. Many other prairie wildlife species are suffering from a loss of native habitat. Relatively minor changes or additions to program objectives could greatly benefit a wide range of prairie wildlife species. In addition, narrowly targeted waterfowl objectives may impose damaging effects on other prairie wildlife species.

10) There needs to be greater co-operation between various disciplines during the establishment, and evaluation of wildlife habitat initiatives. Biologists, agrologists and economists should be involved in developing programs which provide the most efficient and effective solutions to the problems facing the agriculture environment and the producer.

6.21 Future Research:

1) The impact that present agricultural and non-agricultural policies have on rural environmental factors needs to be more fully understood. The direct and indirect effect of these policies on the economic decisions of producers will give a better understanding of how to develop complementary rather than contradictory policies.

2) A study similar to the present study, but on a much wider scale, could provide more generally applicable results. The economic impact of the management changes incorporated in the HELP habitat options should be evaluated over many different biomes, over a range of possible climate changes to provide more valid findings.

3) There is a paucity of research examining the preservation of non-waterfowl species. This includes the potential negative and positive habitat impact of various agricultural management schemes, and the economic impact on landowners, of providing for non-waterfowl species. Non-waterfowl native species are an important component of a healthy ecosystem and the disregard for these species in research may contribute to their elimination.

4) There needs to be a greater understanding of the factors involved in developing an holistic agricultural system. In other words, all environmental and economic factors must be considered as the agricultural production system proceeds. Often, one of these factors is ignored in the planning and implementation of policy. With a better understanding of the processes involved there should emerge an economics which is consistent with environmental sustainability.

REFERENCES CITED:

Adamowicz, W.L. 1991. Valuation of environmental amenities. Paper presented at the Interdisciplinary Symposium on Agriculture and Water Quality. University of Guelph.

Arnott, G.A. 1988. Evaluation study of the Habitat Enhancement Land use Program in the R.M. of Shoal Lake. Glenco Agricultural Consultant Services. Portage la Prairie, Man.

Basore, N.S., L.B. Best and J.B. Wooley Jr. 1986. Bird nesting in Iowa no-tillage and tilled cropland. J. Wildl. Manage. 50(1):19-28.

Bellrose, F.C. 1980. Ducks Geese and Swans of North America. Wildlife Management Institute. Stackpole Books, Harrisburg, Pa.

Best, L.B. 1986. Conservation tillage: Ecological traps for nesting birds? Wildl. Soc. Bull. 14:308-317.

Bishop, R.C. 1981. Economic considerations affecting landowner behaviour. In R.T. Dumke, G.V. Burger and J.R. March eds. Wildlife Management on Private Lands. LaCrosse Printing Co., Inc, LaCrosse, WI. 576pp.

Bishop, R.C. and T.A. Heberlein. 1979. Measuring values of extra-market goods: Are indirect measures biased? Amer. J. Agric. Econ. 6:926-930.

Bollinger, E.K., P.B. Bollinger and T.A. Gavin. 1990. Effects of hay-cropping on eastern populations of the bobolink. Wildl. Soc. Bull. 18:142-150.

Burger, G.V. and J.G. Teer. 1981. Economic and socioeconomic issues influencing wildlife management on private land. In R.T. Dumke, G.V. Burger and J.R. March, eds. Wildlife Management on Private Lands. LaCrosse Printing Co., Inc, LaCrosse, WI. 576 pp.

Burgess, H.H., H.H. Prince and D.L. Trauger. 1965. Blue-winged teal nesting success as related to land use. J. Wildl. Manage. 29(1):89-95.

Carlson, C.A. 1985. Wildlife and agriculture: can they coexist. J. Soil and Water Conserv. 40(3):263-266.

Castrale, J.S. 1986. Responses of wildlife to various tillage conditions. Trans. N. Amer. Wildl. and Natur. Resour. Conf. 50:142-155.

Colpitts, L. 1974. The cost and feasibility of wildlife habitat maintenance on private lands. The Natural Resources Institute. University of Manitoba, Winnipeg.

Cowan, W.F. 1982. Waterfowl production on zero tillage farms. Wildl. Soc. Bull. 10:305-308.

Cowan, W.F. 1986. Duck's Unlimited agricultural extension program. Trans. N. Amer. Wildl. and Natur. Resour. Conf. 50:169-175.

Cowardin, L.M., D.H. Johnson, A.M. Frank and A.T. Klett. 1984. Simulating results of management actions on mallard production. Trans. N. Amer. Wildl. and Natur. Resour. Conf. 48:257-271.

Crosson, P. 1989. The long term adequacy of agricultural land: A different perspective, The J.S. MacLean Memorial Lecture, Publication AEB89/5, Department of Agricultural Economics and Business, University of Guelph.

Dabbert, S. and P. Madden. 1988. An economic model of a farm's transition to organic agriculture. In: Global Perspectives on Agroecology and Sustainable Agriculture Systems: Proceedings of the 6th International Conference of the International Federation of Organic Agriculture Movements. Eds. P. Allen and D. Van Dusen. Vol. 2:45-51.

Danielson, L.E. and J.A. Leitch. 1986. Private versus public economics of prairie wetland allocation. J. Env. Econ. and Manage. 13:81-92.

Duebbert, H.F. and H.A. Kantrud. 1974. Upland duck nesting related to land use and predator reduction. J. Wildl. Manage. 38(2):257-265.

Duebbert, H.F. and J.T. Lokemoen. 1976. Duck nesting in fields of undisturbed grass-legume cover. J. Wildl. Manage. 40(1):39-49.

Fox, G., V. Adamowicz, G. Debailleul and P. Thomassin. 1990. Agriculture and the environment: Economic dimensions of sustainable agriculture. CAEFMS Occasional Publication No. 1.

Frawley, B.J. and L.B. Best, 1991. Effects of mowing on breeding bird abundance and species composition in alfalfa fields. Wildl. Soc. Bull. 19:135-142.

Gilson, C. 1989. Sustainable agriculture: Implications for farmers, food consumers and the general environment. Department of Agricultural Economics. Univ. of Man.

Girt, J. 1990. Common Ground: Recommendations for policy reform to integrate wildlife habitat, environmental and agricultural objectives on the farm. Wildlife Habitat Canada Report.

Gjersing, F.M. 1975. Waterfowl production in relation to rest-rotation grazing. J. Range Manage. 28(1):47-42.

Hall, C.A.S. 1990. Sanctioning resource depletion: Economic development and neo-classical economics. The Ecologist. 20(3):99-104.

Higgins, K.F. 1977. Duck nesting in intensively farmed areas of North Dakota. J. Wildl. Manage. 41(2):232-242.

Hochbaum, H.A. 1944. The Canvasback on a Prairie Marsh. The American Wildlife Institute, Washington, D.C. 201 pp.

Jensen, H.P., D. Rollins, and R.L. Gillen. 1990. Effects of cattle stock density on trampling loss of simulated ground nests. Wildl. Soc. Bull. 18:71-74.

Jones, B. 1991. HELP biological evaluation report. Manitoba Department of Natural Resources. Winnipeg, Man.

Kantrud, H.A. 1981, Grazing intensity effects on the breeding avifauna on North Dakota native grasslands. Can. Field-Naturalist. 95(4):404-417.

Kirsch, L.M. 1969. Waterfowl production in relation to grazing. J. Wildl. Manage. 33(4):821-828.

Kirsch, L.M., H.F. Duebbert and A.D. Kruse. 1978. Grazing and haying effects on habitats of upland nesting birds. Trans. N. Amer. Wildl. and Natur. Resour. Conf. 43:486-497.

Klett, A.T., T.L. Shaffer and D.H. Johnson. 1988. Duck nest success in the prairie pothole region. J. Wildl. Manage. 52(3): 431-440.

Koerth , B.H., W.M Webb, F.C. Bryant and F.S. Guthery. 1983. Cattle trampling of simulated ground nests under short duration and continuous grazing. J. Range. Manage. 36:385-386.

Labisky, R.F. 1957. Relation of hay harvesting to duck nesting under a refuge-permit system. J. Wildl. Manage. 21(4):194-200.

Langner, L.L. 1985. An economic perspective on the effects of federal conservation policies on wildlife habitat. Trans. N. Amer. Wildl. and Natur. Resour. Conf. 50:200-209.

Leopold, A. 1949. A Sand County Almanac. Oxford University Press, New York, New York. 226 pp.

Lokemoen, J.T. 1985. Examining economic efficiency of management practices that enhance waterfowl production. Trans. N. Amer. Wildl. and Natur. Resour. Conf. 49:584-607

Manitoba Department of Agriculture. 1987. Feeding value of forage crops. In: Forages 87. Manitoba Department of Agriculture.

Manitoba Department of Agriculture. 1989. Guidelines for estimating the value of hay. Farm Business Management Information Update. June 1989.

Manitoba Department of Agriculture. 1990. Guidelines for estimating cow-calf production costs based on a 70 cow herd. Farm Business Management Information Update. Sept. 1990.

Manitoba Department of Agriculture. 1991. Farm planning guide, 1991 crop estimates. Farm Business Management Information Update. Jan. 1991.

Manitoba Department of Natural Resources. 1988. Habitat Enhancement Land Use Program. Manitoba Department of Natural Resources, Winnipeg.

Manitoba Department of Natural Resources. 1989. Manitoba Habitat Enhancement Land Use Program: Status report - December, 1989. Manitoba Department of Natural Resources, Winnipeg.

Milonski, M. 1958. The significance of farmland for waterfowl nesting and techniques for reducing losses due to agricultural practices. Trans. N. Amer. Wildl. Conf. 23:215-228.

Morgan, J.P. 1989. Habitat Enhancement Land Use Program: 1988 Biological Evaluation. Manitoba Department of Natural Resources, Winnipeg.

Prairie Farm Rehabilitation Administration. 1983. Land degradation and soil conservation issues on the Canadian prairies. Soil and Water Conservation Branch. Agriculture Canada.

Rodgers, R.D. 1983. Reducing wildlife losses to tillage in fallow wheat fields. Wildl. Soc. Bull. 1(1):31-38.

Rodgers, R.D. and J.B. Wooley. 1983. Conservation tillage impacts on wildlife. J. Soil Water Conserv. 38:212-213.

Russell, R.D. and R.M. Howland. 1988. Prairie Pothole Project: 1987 annual report. Saskatchewan Parks, Recreation and Culture - wildlife branch and Canadian Wildlife Service.

Sedivec, K. and W.T. Barker. 1989. Effects of grazing systems on ground nesting bird species in south central North Dakota. Masters Thesis.

Soderbaum, P. 1988. Agriculture, economics and eco-development. In: Global Perspectives on Agroecology and Sustainable Agriculture Systems. Proceedings of the 6th International Conference of the International Federation of Organic Agriculture Movements. Eds. P. Allen and D. Van Dusen. Vol 2:93-102.

Soutiere, E.C. 1985. Farm wildlife production: What does it cost? Trans. N. Amer. Wildl. and Natur. Resour. Conf. 49:159-163.

Van Kooten, G.C. 1991. Improving Policy Instruments. A paper presented at the Workshop on Sustainable Agriculture: Economic Perspectives and Challenges. Winnipeg, Manitoba. May 7, 1991.

Van Kooten, G.C. and A. Schmitz. 1990. Prairie Pothole Project - Phase II: Socioeconomic Evaluation 1990. Wildlife Habitat Canada.

World Commission on Environment and Development, 1987. Our Common Future. Oxford University Press, Oxford.

World Wildlife Fund, 1989. Prairie Conservation Action Plan: 1989. World Wildlife Fund Canada. Toronto.

Appendix A

HELP ASSISTANCE OPTIONS

HELP Assistance Options and Incentives:

1) Idle native-cover uplands - A fee of $8.00 per acre will be paid annually for the term of the lease on upland acreages (areas covered by type 3, 4 or 5 wetlands are protected under the agreement but do not qualify for payment).

2) Cultivated Land - On cultivated lands suitable for dense nesting cover or salinity barriers, a fee ranging from $16 to $22 per acre based upon the municipal assessment of the land is paid for the term of the agreement.

3) Tame Forage Option - In suitable locations around pothole complexes and large wetlands, farmers are offered incentives to establish tame forage crops for a period of 7 years to provide cover for waterfowl under the following conditions:

> 3:1 HELP will provide a $20 per acre establishment incentive in year one of the project (ie. seed purchase).
>
> 3:2 HELP will provide a $20 per acre stand maintenance incentive in year three of the project (ie. fertilization, re-seeding, etc.).
>
> 3:3 HELP will provide an annual $5 per acre lease payment provided that the landowner restricts forage harvest to one cut between July 15 and August 25.
>
> 3:4 On already established tame forage fields meeting the project criteria, HELP will pay a stand maintenance fee of $20 per acre (one payment only) and a $5 fee annually to restrict harvest to one cut between July 15 and August 25. No establishment fee is available for existing stands.

4) Native Forage Option: Farmers with native forage stands defined as areas dominated by "whitetop" (*scolochloa festucacea*) meeting the HELP project criteria are offered an annual fee of $4 per acre under a 7 year agreement to delay cut of this native hay until after July 20. This option is not and independent lease but is intended to compliment lease of idle upland habitat in the same lease area or adjacent to a lease of idle uplands.

5) Pasture Management Demonstrations: To address the problem of habitat deterioration on cattle pastures, incentives are available to establish two pasture management projects. The project sites must meet the HELP project criteria and in addition be beneficial to livestock production on that site.

The project must be established and managed in a manner which will allow for the evaluation of waterfowl and livestock benefits. The establishment and maintenance of a pasture management project will be implemented under a 7 year agreement with the following conditions:

5:1 The cooperating landowner must agree to the objective of the project and comply with Manitoba Agriculture and HELP management recommendations.

5:2 The site must have a water source for cattle, tame and native forage paddocks or potential for such, and suitable external fencing.

5:3 HELP will provide materials for permanent internal fences based upon project recommendations and design by Manitoba Agriculture staff. Materials will include: posts, high tensile wire, fencers, solar panels and miscellaneous hardware.

6) Conservation Tillage Demonstrations - Incentives are being offered to set up at least 8 conservation tillage demonstrations to promote land management practices that are beneficial to wildlife and that protect soil and water resources. Project sites must be between 40 acres and 100 acres in size on lands that are susceptible to erosion. Each project proposal will be screened using M.D.A., and P.F.R.A. recommendations and HELP criteria. Establishment and maintenance of conservation tillage projects using techniques such as minimum till, chem-fallow, winter wheat and green manure plough-down will be implemented under 5 year agreements with the following conditions:

6:1 Projects require a cropping system in which 50% of the land is covered by crop residue as surface cover with 10% of that crop residue in standing stubble. A minimum of 6" height is required for standing stubble. This and other crop residue criteria are to be met as of April 30 of each year.

6:2 Specifically designed equipment may be provided by HELP to enable tillage and seed establishment in existing crop residue.

6:3 Straw and chaff must be spread on the field evenly.

6:4 To maintain a suitable amount of crop residue and to control weeds, herbicides will take the place of tillage. As an incentive, herbicides will be cost-shared 50-50 between the farmer-cooperator and HELP. Application rates will be based upon Manitoba Agriculture recommendations.

7) Habitat Management - Landowners who wish to become involved in habitat enhancement projects without financial incentives will be provided with technical assistance, materials and in some cases, labour assistance. Projects of this type may involve nest structures, nesting islands and habitat that is protected without financial return ("habitat set aside"). Cooperating landowners will be recognized with suitable project signs and other tokens of appreciation.

8) Habitat Donation - Landowners who wish to make a long term commitment to wildlife conservation through a land donation will be provided with legal advice, and information on estate benefits. These landowners may name the area as they wish and will be honoured publicly through media coverage, signs and other tokens of appreciations.

9) Habitat Acquisition - Although the primary focus of HELP is to encourage habitat retention on private land through cooperative agreements with landowners, certain key wildlife habitats offered for sale will be purchased and managed in perpetuity for wildlife production.

10) Predator Proof Fencing - On selected parcels of dense nesting cover, predator proof electric fences will be erected to prevent predation on waterfowl and their nests. It is the objective of the HELP program to try two pilot projects of this nature on acquired land. One additional electric fence is planned for a peninsula on Shoal Lake to separate it from mainland predators.

Appendix B

PERSONAL SURVEY QUESTIONNAIRE

Survey Questions:

Name: _____

Address:

Lease Options:

i) What is the land use break down of your farm? (cultivated, pasture, bush etc.)

ii) Approximate percentage of your total income from livestock and crops.

1) Delayed Cut Tame Forage:

i) Indicate how the following have been affected by participation in the HELP program.

	Pre-HELP	HELP
a) Crop Insurance	_____	_____
b) Distance from field to storage (Miles)	_____	_____
c) Number of Acres	_____	_____
d) Yield of crop (tons/acre)	_____	_____
e) Expected price per ton	_____	_____
f) Weight per bale (pounds)	_____	_____
g) Fall grazed (#animals,#months)	_____	_____
h) Seed costs	_____	_____
i) Fertilizer applied (type and rate/acre)	_____	_____
j) List all operations over the field for the production year. (ie. baler, swather, bale wagon etc.)	_____	_____

ii) Farmers are cutting hay at a variety of times each year. Do the July 15 and August 25 cut restriction dates in the HELP lease represent any conflict with your regular management schedule?

iii) Do you feel that hay quality is equal, decreased or increased as a result of the HELP cut dates as compared to hay harvested under a regular management situation?

Concerning the above question, do you feel that HELP incentives are sufficient, less than sufficient or more than sufficient?

2) Salinity Barrier:

i) Indicate how the following have been affected by participation in the HELP program.

	Pre-HELP	HELP
a) Crop Insurance	_____	_____
b) Distance from field to storage (miles)	_____	_____
c) Number of Acres	_____	_____
d) Yield of crop (bushel/acre) (tons/acre).	_____	_____
e) Expected price (/ton,/bushel)	_____	_____
f) Fall grazed (#animals,#months)	_____	_____
g) Seed costs	_____	_____
h) Fertilizer applied (type, /acre)	_____	_____
i) Chemicals applied (type, /acre)	_____	_____
j) List all operations over the field for the production year.	_____	

3) Rotational Grazing:
i) Indicate how the following have been affected by participation in the HELP program.

	Pre-HELP	HELP
a) Distance from field to storage.	_____	_____
b) Number of acres.	_____	_____
c) Yield of hay crop.	_____	_____
d) Expected value of hay crop.	_____	_____
e) Total grazing capacity (#animals x #months)	_____	_____
f) Seed costs (portion provided by HELP)	_____	_____
g) Fertilizer applied (type /acre)	_____	_____
h) List all operations over the production year; specify implement used.	_____	

ii) How do the management costs associated with rotational grazing compare to those associated with a traditional grazing system?

iii) Based on your experience with rotational grazing, would you be interested in establishing a system without financial incentives? (Please explain).

4) Delayed Cut Native Hay:

i) Total number of acres leased under this option.

ii) Average cut date for native hay before HELP program restrictions.

iii) Harvesting operations used.

iv) Do you feel that there is an increase, decrease or no change in hay quality as a result of cutting according to the HELP specifications as opposed to traditional cut dates?

v) Farmers are cutting hay at a variety of times each year, do the July 15 and August 25 cut restriction dates in the HELP lease represent any conflict with your regular management schedule.

vi) If the native hay area lies within a cultivated area do you feel that there are any associated costs with farming around these areas? (please explain, magnitude of costs)

5) Idle:

i) Total number of acres leased under this option.

ii) Make up of these areas (acres of bush, hayland, permanent wetlands etc.)

iii) Was there any hay removed from these areas or were these areas grazed before the HELP program? If so, what was the hay yield and or grazing capacity?

iv) If the idle area lies within a cultivated area do feel there are any associated costs with farming around these idle areas? If so approximately how great are the costs?

v) For what reason have these areas been left unbroken to this point. (economic, moral, recreational).

6) General Attitudes:

i) Reason for becoming involved in each of the HELP options.

a) Option: _____

b) Option: _____

c) Option: _____

d) Option: _____

Hypothetical Valuation:

vi) Currently, the law prevents the draining of sloughs unless the body of water lies entirely on one's own property and the water is not drained off one's own land. Therefore, consolidation of sloughs is the only form of drainage permitted. Suppose the government has established heavy fines upon farmers who drain wetlands that do not lie entirely within their own land without permission. Suppose also that the government would be willing to sell you the right to drain your slough. In that case, how much would you be willing to pay the government for permission to drain a 15 - 20 acre slough? (per acre per year) (WTP)

ii) If the government were willing to pay to prevent you from draining and farming a slough and the surrounding area totalling 30 - 40 acres. How much would the government have to pay you to prevent you from farming the slough and surrounding area? (WTA)

Sustainable Agriculture: "Sustainable agricultural systems are those that are economically viable and meet society's needs for safe and nutritious food, while conserving or enhancing Canada's natural resources and the quality of the environment for future generations."

iii) The urban and rural public are concerned with a number of environmental problems associated with current agricultural techniques. Do you feel that these are reasonable concerns and if so, which do you consider the most important environmental problems associated with Canadian agriculture at this time?

Soil erosion _____
Water conservation _____
Soil salinity _____
Pesticide pollution _____
Species diversity _____
Loss of wildlife habitat _____
Other _____

iv) How do you view the promotion and implementation of more sustainable agriculture techniques?

_____ Very Necessary
_____ Necessary
_____ Neutral
_____ Unnecessary
_____ Very Unnecessary

v) Do you feel that the adoption of the following agriculture techniques would result in an increase, decrease or no change in net income compared to more traditional techniques?

a) Zero-tillage _____
b) Minimum-tillage _____
c) Winter wheat _____
d) Rotational grazing _____

vi) Do you feel that the HELP program's techniques are in keeping with sustainable agriculture as defined earlier?

vii) Who do you feel should be responsible for promotion of sustainable agriculture and providing technical information at the farm level? (Levels of Government or other agencies)

viii) Do you have any comments about the HELP project that you believe should be brought to the attention of decision makers?

Appendix C

TELEPHONE SURVEY

Telephone Survey:

1) What is the make up of the lease areas (acres of bush, wetlands, tame hay, slough hay etc.):

a) Idle areas

b) Delay cut native hay areas

2) a) Was there any income from areas that are now included in the idle or delay cut native hay lease, if so how much.

b) Do the harvest restriction dates within the delay cut native hay lease represent any conflict to the individual who harvests the hay.

3) What was the primary motivation for including the areas discussed above in a HELP habitat lease.

Appendix D

COST ASSUMPTIONS

Production Cost and Value Assumptions:
(Manitoba Department of Agriculture 87,89,90,91).

Forage Harvesting Cost: $88.39/hectare

Forage Fertilizer Cost: $29.55/hectare

Tame Forage Value:

Cutting Date	Price/tonne	Yield (t/ha)
June 21	$46.00	3.8
July 1	$41.00	4.1
July 7	$38.00	4.2
July 15	$35.00	4.3

Native Hay Value: $40.00/tonne
Native Hay Yield: 2.7 t/ha

Pasture Value: $.28/cow/day
$10.00/calf/season

Crop Production Variable Costs: Wheat - $219.60/ha
Barley - $207.61/ha