INTEGRATED RESOURCE MANAGEMENT PLANNING ON THE PEMBINA ESCARPMENT: THE DEERWOOD EXPERIENCE

BY

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A Practicum Submitted

in Partial Fulfillment of

the Requirements for the Degree

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ABSTRACT

The objective of this study was to examine the Deerwood Soil and Water Management Association members' on-farm experiences with soil and water conservation and to suggest means of improving these techniques, enhancing wildlife habitat, and extending these practices province wide. Forty-five active members were randomly selected from the Association and interviewed during the summer of 1989. Most members farmed on the escarpment, farmed full time and operated mixed grain and livestock operations. Most learned of the DSWMA through neighbours and joined out of personal interest in conservation. Surveyed members were very pleased with the project's operations. The DSWMA model was well received by farmer's because it encouraged local participation in identifying local resource issues and prospective management options; it coordinated agencies conservation programs with farmers' conservation activities; it fostered the exchange and accumulation of agricultural and wildlife habitat conservation information; and it facilitated the demonstration of site specific land management practices under local conditions. Several recommendations were provided to improve the operation of the DSWMA model and facilitate its extension throughout agro-Manitoba.

ACKNOWLEDGEMENTS

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Chapter I

INTRODUCTION

1.1 PREAMBLE

> "When the land does well for its owner, and the owner does well by his land - when both end up better by reason of their partnership - then we have conservation." (Leopold 1939)

This excerpt from "The Farmer as a Conservationist" is characteristic of Leopold's blend of idealism and practicality. Many of his presentations were based on the need for a state of "harmony between man and land" (Meine 1987). Hugh Bennett, who has been called "the father of soil conservation", held a similar ideology ...

> So direct, in fact, is the relationship between soil erosion and the productivity of the land and the prosperity of the people that the history of mankind, to a considerable degree at least may be interpreted in terms of the soil and what has happened to it as a result of human use (Paarlberg 1986).

Bennett realized the need for a "comprehensive farm conservation plan approach" that would extend the concept of land husbandry (Cohee 1987). Convinced of the need to incorporate all the aspects of good land use, Bennett and Leopold integrated measures to control soil erosion, improve flood control and wildlife management (ibid).

Many aspects of modern soil conservation and wildlife management practices on farmland have stemmed from these early beginnings. It is important to conservation development to expand traditional thinking and analysis for future conservation policy development (Paarlberg 1986) and ensure the resource base is protected, even enhanced, thereby guaranteeing agricultural productivity for future generations (Canadian Environmental Advisory Council 1984).

To manage natural resources so that the interests of all Canadians are represented, and to conserve soil, water and wildlife is a task which requires support from both the farm and non-farm communities (Sparrow 1984). However, the primary responsibility for good land management falls upon the private landowners.

> "Most of what needs doing must be done by the farmer himself. There is no conceivable way by which the general public can legislate crabapple trees, or grape tangles, or plum thickets to grow upon these barren fencerows, roadsides, and slopes" (Leopold in Miene 1987).

Farmers are individuals and like anyone else their ways of operating and conducting business differ considerably from one another. It is for this reason that farmers can be categorized as ... "innovators, early adoptors, early majority, late adoptors, and laggards" (Kraft et al 1986). Each of these groups requires a variety of types of information in different amounts and at different times.

> "Agencies must focus on what is called the critical 10 percent of the agricultural population.

> These farmers are not innovators or early adoptors; they are part of the large group labeled as the early-late majority. These are farmers who need a little prodding to induce them to accept conservation practices that have already been successfully demonstrated by the innovators and early adoptors. This 10 percent is important in pulling late adoptors along" (Kraft et al 1986).

The Deerwood Soil and Water Management Association (DSWMA) in southern Manitoba is a group of innovative farmers demonstrating conservation. The Association is located approximately 120 km (75 mi) south-west of Winnipeg on the Pembina escarpment (Fig. 1.1). Soil and water erosion problems in the area are of great concern to many local farmers. In response to these concerns, the DSWMA was formed to coordinate the implementation of a comprehensive soil and water management plan for the upper reaches of the Tobacco Creek watershed.

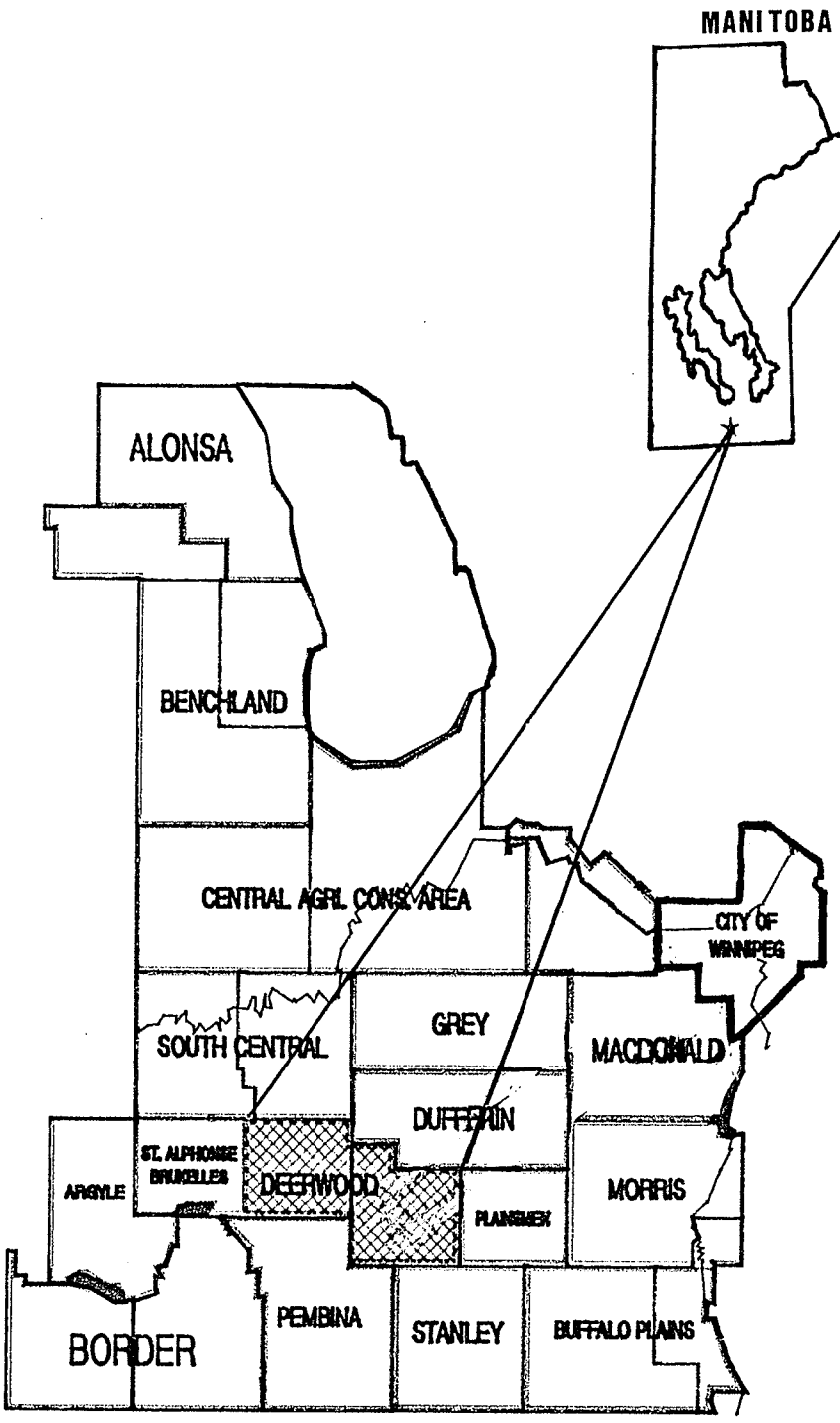

Figure 1.1

DSWMA PROJECT AREA

1.2 ISSUE STATEMENT

The DSWMA project is a prototype of progressive soil and water conservation activities. The activities are integrated into the individual farm management plans of the members to address soil and water management problems where they originate. In addition, the project exhibits alternate land uses generated from improved soil and water management and the effects of these practices on farm operations, soil, water and wildlife habitat.

The DSWMA project has the potential, as a prototype of soil and water conservation practices, to demonstrate to other interest groups the means to ensure the agricultural land base is sustained. The practical experience of the DSWMA members may be used to improve these techniques and extend their application to other farm groups.

This study examined DSWMA member's on-farm experiences with soil and water conservation practices, perceived effects on wildlife habitat, and potential off-farm effects.

1.3 OBJECTIVES

The intent of this study was to examine farmers' experiences with soil and water conservation practices on their farming operations, the perceived effects on wildlife habitat, and the potential off-farm effects. The objectives are:

1. to examine farmers' perceptions of the cost-effectiveness of the soil and water management techniques used by the DSWMA on their own farms,
2. to examine farmers' perceptions of the social and economic effects created through the adoption of these practices on their own land,
3. to solicit recommendations to enhance the delivery of the DSWMA and Agri-Food program, and
4. to assess the general effects of these soil and water management practices on wildlife habitat.

Based on farmers responses and the literature, this study recommended:

1. ways to enhance these soil and water management practices,
2. methods to further enhance wildlife habitat, and
3. how to extend the principles of the DSWMA model to other areas.

1.4 DEFINITION OF TERMS

1. Soil degradation is the "umbrella" term used to describe declining soil quality, as evidenced by erosion, organic matter breakdown, nutrient loss, and salinization (Hoechst 1984).
2. Wind erosion is the loss of dry unprotected soil by strong winds. Soils become more susceptible to wind erosion from excessive tillage, summerfallowing, and crop residues or cover crops not being in place (SCC 1986).
3. Water erosion occurs when the amount of water present is greater than the soil's capacity to absorb precipitation or runoff (SCC 1986).
4. Conservation Tillage is any of a variety of non-inversion types of tillage where a minimum of 30 percent of the soil surface remains covered with crop residue after planting.

1.5 ASSUMPTIONS

This study assumed that the interviewed farmers expressed their own opinions and attitudes. It also assumed the personal views and opinions of the interviewer did not bias the answers.

1.6 SUMMARY

The previous sections discussed the Deerwood Association's concern for soil and water degradation and interest in combating this problem. The remaining chapters include a literature review on soil and water conservation techniques and wildlife habitat enhancement on private lands, a detailed outline of the methods, an analysis and review of the results, and conclusions and recommendations based on the survey results. The questionnaire is presented in appendix A.

Chapter II

LITERATURE REVIEW

2.1 INTRODUCTION

Soil management for long term sustained production has received much less attention than soil management for short term economic gains. Soil is only as good a renewable resource as is its long term management practices. With short-term management, the soil inevitably suffers irreversible damage (SCC 1986). Unfortunately, these production based agricultural practices have received further encouragement through government policies and programs. Although there has been much research on the causes of soil degradation, there has been little effort until lately to implement soil and water conservation practices on Canadian farmland. On farm demonstrations of alternative technologies must place more emphasis on the short and long-term economic costs and benefits of the practices (TSRPC 1988). Farmers need to become more aware of the soil and water conservation practices that are to their benefit and the benefit of wildlife.

2.2 HISTORICAL BACKGROUND

2.2.1 Soil Conservation in Canada

The once common perception that Canada has an abundant agricultural land base - as depicted by posters placed in Europe in the late 1890's to entice people to take advantage of the ..."free farms for the million[s]" and "free farms of 160 acres" in the vast Canadian plains - has changed. Concern for the long term sustainability of the land base has lead to increased actions by provincial and federal governments.

The federal government has no authority to directly regulate the use of private land (with the exception of the Aeronautics Act) within provincial boundaries. However, they can influence private land use through financial vehicles, regulatory powers and investment activities. Federal programs and policies that affect private land use include:

* fiscal policies such as taxation, federal monetary and trade,

* sectoral support programs which include income support and economic assistance,

* regional development programs such as the Economic and Regional Development Agreement (ERDA),

* federal lands managed as national parks and community pastures,

* public works such as railroads and airports,

* regulatory powers which include transportation rates, marketing boards, chemical uses, and

* research and information activities in agriculture, forestry, energy, and technical information for the industrial sectors (Manning 1983).

Soil degradation occurs in all parts of the country at a cost to farmers of over $1.3 billion annually (Rennie 1985). Thirty eight percent of farm net income now is associated with soil degradation, which for many farmers represents the difference between profit and loss (ibid). The prairie provinces contain almost 80 percent of Canada's productive agricultural land. Thus, the agricultural industry is extremely important to the western economy. Primary and secondary agricultural sectors account for 8.4 percent of regional economic activity, and for 11.6 percent of total employment in this region.

Soil erosion by wind and water is the most common form of soil degradation in Canada. Erosion reduces the amount of organic matter, weakens soil structure, lowers water holding capacity, and lowers soil productivity (SCC 1986). Under natural conditions, soil erosion is off-set by a similar rate of soil formation. However, present conventional tillage practices have increased the rate of erosion while reducing the rate of soil formation (ibid).

The western provinces have lost 5.2 million hectares, or 14 percent of the farmland, due to topsoil erosion (Anderson and Knapic 1984). Wind erosion in the prairies has increased as the widespread practice of removing windbreaks to facilitate the use of larger machinery has occurred. The extremely dry conditions for most of this decade also accelerated these wind erosion problems. Water erosion is also increasing rapidly due to inappropriate cropping practices. It accounts for more than half of all topsoil lost in the prairie region (SCC 1985).

The Canadian constitution, under sections 92 and 92A, entrusts the provinces with the power to plan and manage the use of the private and public lands. The provinces, therefore, are responsible for the management of the land and the agencies governing land use planning.

The federal government influences land use in several ways. It is the planning agency for federal lands and lands in the territories. It influences various economic and social sectors through their policies and programs which, in turn, affect the use of the land by individuals. The management of the Canadian land resource base, therefore, very much involves both Federal and Provincial governments.

2.2.2 Soil and Water Conservation in Manitoba

The responsibility for soil and water conservation in Manitoba is divided mainly between the Department of Agriculture (MDA) and the Department of Natural Resources (MDNR). While the MDA does conduct some field work associated with soil conservation, the majority of conservation activities are conducted by the MDNR.

The Water Resources Branch of the MDNR promotes and develops conservation districts under The Conservation Districts Act (PFRA 1983). The objective of the conservation districts (CD) is to implement comprehensive soil and water conservation management activities on a watershed basis (ibid). They are active in soil management, water erosion control, agricultural land drainage and conservation education (Manitoba Cooperator 1986). Currently, there are six CD's, which encompass over 1.8 million hectares of farmland (pers. comm., P. McGary 1990).

The Planning Act has raised concerns over the jurisdiction of conservation. Under it, the Department of Municipal and Urban Affairs has authority to be involved in all aspects of land use planning. This has raised the concern that conservation planning may become the dual departmental responsibility of The Conservation Districts Act and The Planning Act (PFRA 1983).

2.2.3 Regional Resource Management

The regional agriculture land management concept involves the integration of agricultural production, environmental conservation and wildlife considerations through the development of "landscape mosaics" (Frank undated). The principle management feature involves the site specific allocation of appropriate land use activities. In effect, the highest quality farmland is used for intensive crop production, while the intensity of use gradually declines as the quality of the farmland decreases until there is a full transition to intensive wildlife management. This overall management concept is the basis of the landscape mosaic.

The landscape mosaic concept fosters the amalgamation of private and societal agricultural interests. Unlike private interests, which focus on present productive capabilities, societies interests are infinite because of the responsibility to future generations. Unfortunately, these different time horizons have often created tensions over production activities and management issues. However, the cooperative atmosphere required in the development of landscape mosaics bridges these time horizons and supports both groups objectives. Farmers benefit from public assistance by implementing conservation measures to sustain the productivity of the landbase and the development of more economically efficient and profitable production practices. Taxpayers benefit from the preservation of the farmlands productivity, the mainte-

nance of wildlife habitat and a healthy and diverse wildlife population.

Farm management plans are critical to the development of landscape mosaics. Typical conservation practices are fall zero till seeding, reduced tillage, grassed waterways, delayed or modified haying/grazing, impounding surface water runoff, permanent forage establishment on marginal croplands, and the enhancement of critical wildlife habitat on non-cropland (ibid). These conservation activities are presently being implemented variously in Manitoba through the existing CD's and conservation groups.

The implementation of a regional agricultural management plan requires detailed planning and landowner cooperation. Apart from direct and indirect economic benefits, farmers may also gain satisfaction by participating. By seeing how their own farm management plans complement the regional plan, landowners receive "justification" and "social motivation" to participate in the overall plan (ibid). The DSWMA is a model conservation organization actively pursuing the development of a comprehensive conservation project, which has implications for a regional agricultural plan for the entire Pembina escarpment.

2.2.4 Deerwood Soil and Water Management Association

The Deerwood area, which is characterized by moderate to severe slopes, experiences water management problems that include both excesses and deficits (Maddison 1983) (Fig. 2.1). Historically, considerable soil erosion and flooding on and below the Pembina Escarpment have been caused by spring runoff and flash rains, exacerbated by excessive land clearing, drainage and cultivation. The cumulative result has been the loss of top soil, growth of gullies, and many other related problems. There are frequent water shortages for livestock and other farm uses late in the summer.

Studies on the Tobacco Creek watershed began in the 1960's (Canada Department of Agriculture 1961). Several investigations and much discussion have focused on what could be done to improve the situation. In 1981, the R.M. of Thompson forwarded a request to the Provincial Minister of Agriculture for assistance to demonstrate a soil and water management project on Tobacco Creek. In association with the Prairie Farm Rehabilitation Administration (PFRA), a study of the water and land problems in the watershed was conducted (Maddison 1983).

Maddison concluded that surface water-runoff control, water-supply problems, and excessive land drainage were major issues of concern in the area. He suggested that conservation farming should be implemented, such as permanent

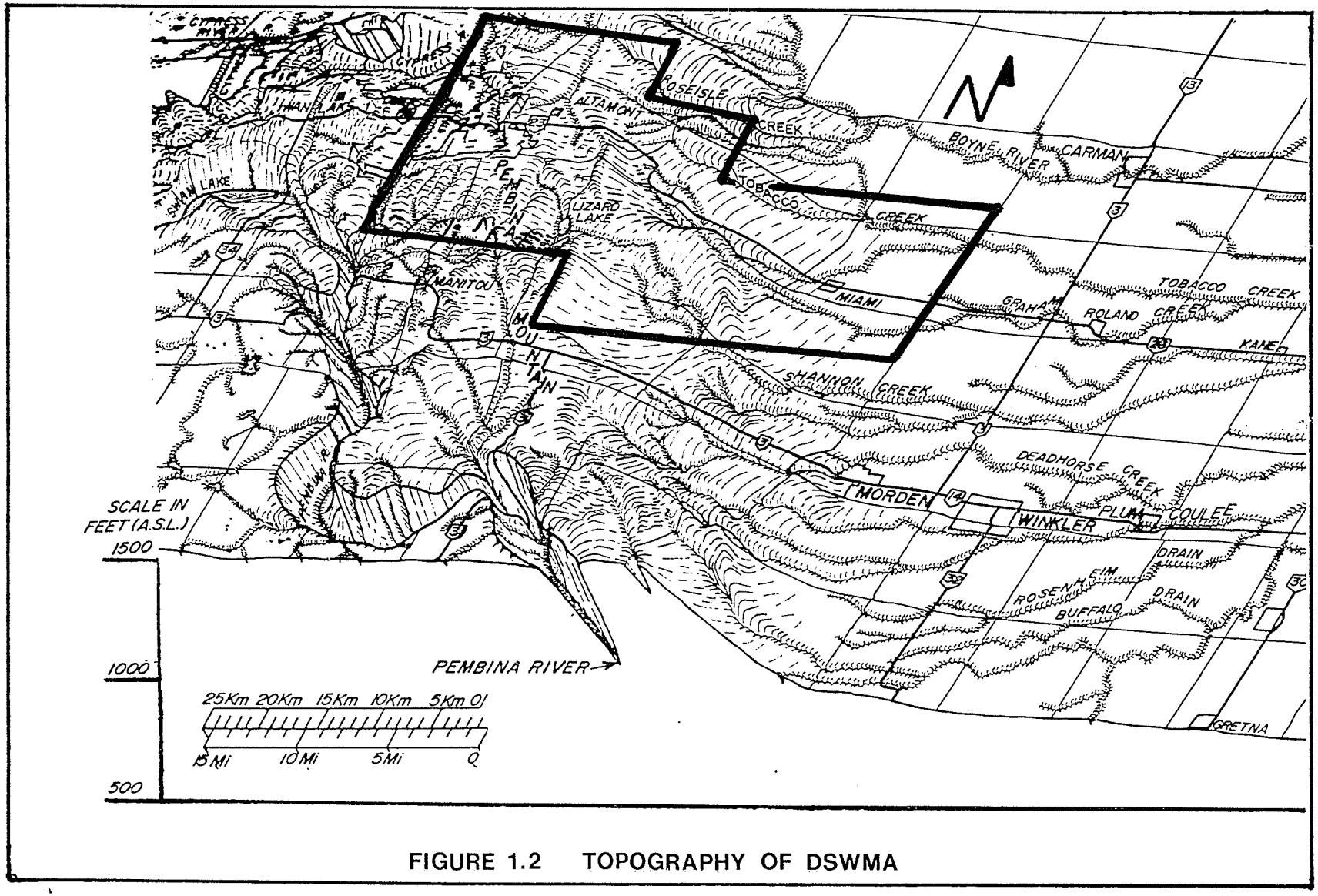

FIGURE 1.2 TOPOGRAPHY OF DSWMA

cover on poorer soil, field shelterbelts, conservation tillage, retention of crop residue stabilization of gully embankments, and forage crops in erosion-prone areas would reduce soil erosion and retard surface runoff. He recommended an evaluation of the feasibility of constructing small headwater retention structures for flood control and wildlife habitat enhancement.

In 1984, the federal and provincial governments initiated the Agri-Food program under the Economic and Regional Development Agreement (ERDA). Under this five year agreement, the federal government contributed $23 million and the province $15.3 million. The program consisted of research, evaluation, demonstration, and education projects designed to improve the present profitability and future viability of agriculture in Manitoba (Manitoba Cooperator 1986). All projects eligible for funding were cooperatively designed with producers and agri-business (researchers, government staff, processors and suppliers). The Deerwood Soil and Water Management Association (DSWMA) was formed under this Agreement.

The Deerwood Association was directed by a nine member board of directors and a project manager. In conjunction with the PFRA and MDA, the Association administered a five year $359,000 budget designed to implement programs based on the following targets set in 1985:

1. eliminate summerfallow and reduce tillage for erosion control,
2. increase contour farming and gully stabilization to reduce erosion problems,
3. enhance shelterbelts to reduce wind erosion and snow accumulation in drainage channels,
4. manage bush lots and native cover,
5. increase acreage of forage crops to reduce wind and water erosion and flood damage,
6. construct headwater-retention structures to reduce water erosion and flood damage in downstream areas (DSWMA,1986).

The DSWMA also works with Ducks Unlimited (Canada) which provides financial, technical and public relations assistance for water retention structures, grazing management, and conservation tillage demonstrations.

The focus has been on water erosion and flood prevention. A network of 34 small water control structures have been constructed to manage on-farm flooding and erosion, while enhancing ground water recharge, stock watering, backflood forage production, and thereby improving habitat for wildlife.

Various soil and water management practices have been initiated to complement the flood control dams. With such an integrated water management system, it is anticipated that

more moisture will remain at the point of origin - where it is needed most - and in the process reduce down stream flooding and bolster summer stream flows.

Examples of the techniques the Association uses in conjunction with water control structures to demonstrate comprehensive soil and water management are (Table 2.1):

1. Shelterbelts - members have planted 54.1 km (33.8 mi) of field shelterbelts mainly for wind erosion protection and snow retention.
2. Forage and pasture renovation - over 1120 ha (2800 ac) have been renovated, including critical areas (marginal land subject to severe water or wind erosion) and problem areas (less erodible areas with higher water tables leading to salinity problems).
3. Green manure crops - annual legumes versus summerfallow have been demonstrated on 48 ha (120 ac), showing the effects of legume fallow on nitrogen and residue, reduced nitrogen requirements, increased snow retention, reduced wind and water erosion, improved water infiltration and reduced soil crusting.
4. Conservation tillage - reduced and zero tillage projects demonstrate surface residue retention, using specialized equipment, chemicals, and yield improvements.
5. Grassed waterways - natural waterways are widened, gently sloped, flat-bottomed channels seeded to for-

age. They illustrate reduced erosion, forage production, and farm machinery access. Fifteen grassed waterways have been completed covering 14.4 km (9 mi).

6. Gully stabilization - concentrate on water courses with severe erosion problems. Gullies are sloped and grassed down to prevent further widening of the gully. Four sites have been constructed.

TABLE 2.1

DSWMA PROJECT ACTIVITIES (1985-89)

PROJECT	YEAR					
	1985	1986	1987	1988	1989	TOTAL
CONSERVATION TILLAGE ha(ac)	104 (260)	100 (250)	471 (1178)	249 (622)	407 (1017)	1331 (3327)
WATER RETENTION STRUCTURES (number)	3	8	4	13	6	34
SHELTERBELTS km(mi)	2.4 (1.5)	9.3 (5.8)	8.0 (5.0)	4.0 (2.5)	30.4 (19.0)	54.1 (33.8)
GULLY STAB & GRASSED WATERWAYS (number)	0	5	8	3	3	19
FORAGE & PASTURE IMPROVEMENTS ha(ac)	0 (0)	199 (497)	405 (1012)	224 (559)	341 (852)	1180 (2950)

The Deerwood project demonstrates three different types of water retention structures. They vary in height from 1.2 m (4 ft.) dykes to 7.0 m (23.2 ft.). Earth spillways are designed for each site to accommodate runoff for a one-in-ten year rainfall event.

Multi-purpose Dams

These structures hold water for various seasonal, domestic and irrigation uses. Each is designed with a 300mm (12 in.) drain pipe, gate and stand pipe. The stand pipe is used to regulate seasonal storage, to control spring flood water, to release the excess slowly, and store some for the summer. The dams are totally drained in the fall to prepare for full flood control potential in the spring. The average construction cost is $5827 (ranging from $3,000 to $9790 each), with an average capacity of 6.65 acre feet (8.1 million litres or 1.8 million gal.).

Dry Dam or Flood Control Structure

These structures decrease peak flows by retaining water for a short period of time, and reducing flow rate. The cost of these structures range from $2000 to $8000.

Backflood Dams

These structures retain water at a shallow depth over large acreages of cropped or pastured lands. Water is

retained for at least two weeks before being released, thereby greatly increasing soil moisture in the flooded area to the benefit of crops and wildlife. There are seven back-flood projects, which cost on average $4715 ($110 per acre ft.) and hold an average 43 acre feet (52.7 million litres or 11.7 million gal.).

2.3 SOIL AND WATER CONSERVATION TECHNIQUES

This section reviews literature related to the conservation techniques used in the Deerwood project.

2.3.1 Conservation Tillage

Tillage with the mold board plow originated in England in the late Eighteenth century (Hoechst 1984). Its use was believed to be beneficial in controlling weeds, managing crop residues, preparing seedbeds, and even improving the physical condition of the soil (Phillips and Young 1973). However, these benefits recently have been challenged due largely to soil degradation and the conservation alternatives now available which are of more sound and economic value.

Conservation tillage is any soil management system that leaves the soil more resistant to erosion and conserves more

moisture than does conventional tillage, by retaining crop residue on the surface. The U.S. Soil Conservation Service (SCS) defines conservation tillage as ..."any tillage method that leaves 30% of the soil surface covered with crop residue after planting" (SCS 1983). The amount of residue required for soil protection, however, depends directly on the erodibility of the soil.

Conservation tillage creates the best possible growing environment for crops while optimizing the conservation of the soil and water resources (Witmuss et al. 1973). Conservation of these resources centres on residue management systems. These systems range from reduced tillage using conventional tillage equipment to zero or no-till, which use specialized equipment that minimize soil disturbance.

The MDA produced soil management guidelines which recommend tillage operations based on soil erosion risk and residue cover. The MDA recommends continuous cropping on soils at slight, moderate and high risk of erosion, thereby eliminating summerfallow operations (MDA undated). Soils highly susceptible to erosion are not recommended for annual crop production, primarily perennial forage production. Recommended tillage operations for soils with a slight to moderate erosion risk are based on achievement of 50% ground cover at time of seeding. The number of tillage operations would, depending on the amount of residue produced, range

between 2 and 4 cultivations on heavy residue cereal crops, to 1 to 3 cultivations on heavy oil seed crops. On high erosion risk soils, tillage operations would range from 1 to 3 cultivations on heavy cereal crops to 1 to 2 cultivations on heavy oil seed crops. One cultivation is recommended on all soils and crop types when little residue exists (ibid).

Other techniques that complement conservation tillage activities are crop rotations and cover crops, contour farming and strip cropping. Grass or legume forages are beneficial to soils when used in rotation with cultivated crops, because the dense root and vegetative cover formed reduces soil erosion. When broken out, the residue improves soil structure, thereby improving moisture infiltration and resistance to erosion (Stewart et al. 1976). Corn following a sod rotation, using conventional tillage equipment, reduced soil loss from 14 to 68% of that without rotations (ibid). The residual effect of sod rotations in reducing soil loss may continue on a declining basis for 2 to 3 years under conventional tillage. Conservation tillage may extend this effect longer.

Cover crops, or green manure, are grasses, legumes or small grains which are grown mainly to protect or improve the soil. Soil losses can be reduced by up to 50% when following crops with little residue cover (Papendick & Elliott 1984). The most practical benefits are realized when cover

crops are planted in the fall for over-winter protection. They are also valuable for rest rotations which replace summerfallow practices and improve ground cover to protect against soil erosion, improve soil structure, and when legumes are used, additional short term sources of nitrogen for subsequent crops (Brach 1989).

Contour farming is another technique that can further reduce the risk of soil erosion while improving water infiltration. It is the practice of conducting tillage operations across, rather than with, the slope. It is very effective at controlling erosion especially on gently sloping terrain. Soil erosion rates can be reduced by up to 50% (NSCTF 1983).

Strip cropping is similar to contour farming in that crops are arranged in contoured strips to reduce wind and water erosion. The practice involves alternating sod or dense-growing crops, with less dense or row crops. On 2 to 7 % slopes, contour strip cropping can reduce soil erosion by up to 75% as compared to cropping with the slope (SCS 1983).

Aside from erosion control, conservation tillage provides benefits to individual farmers and society at large. Short-term benefits to the farmer include:

* reduced labour costs estimated to be eight to 20 percent of total costs of production (Crosson 1981, Zenter and Lindwall 1978, Lindwall and Anderson 1981),

* reduced fuel consumption has been estimated to be up to 40 percent depending on the type of conservation tillage used (Shipley and Osborn 1973, Doster and Phillips 1973),

* machinery costs can be reduced because equipment is used less, thereby lowering maintenance expenses and extending the life of the implements (Shipley and Osborn 1973).

2.3.2 Field Shelterbelts

Shelterbelt trees are supplied to farmers and other eligible applicants at no cost other than shipping by the PFRA tree nursery at Indian Head, Saskatchewan. In the Red River Valley/Pembina Escarpment area, PFRA has identified and approved the following species for use in shelterbelts:

Recommended species

* Lilac varieties
* Chokecherry
* Poplar varieties
* White Spruce
* Buffaloberry
* Green Ash
* Colorado Spruce
* Scots Pine

Satisfactory species

* Caragana
* Willow varieties
* Manitoba Maple

(PFRA 1981)

Single row field shelterbelts are generally recommended by PFRA because they require less acreage, although two and three row belts provide the best protection. The most desireable shelterbelts contain a mixture of tree species, which provide a measure of control for disease and pests, allow for variation in soil moisture levels (Sutton 1983), and provide wildlife habitat.

Field shelterbelts provide short and long-term benefits. In the short-term, greater crop yields have been realized due to a reductions in damage to young seedlings from blowing soil particles, newly seeded crop blowouts, and wind blown swaths (Sutton 1983). Shelterbelts create microclimates that protect crops, increase snow retention, and distribute snow, spreading moisture evenly over fields. They reduce snow blockage and siltation in drainage systems (Sutton 1983).

In the long-term, shelterbelts help sustain soil productivity by protecting the topsoil from wind erosion. Field shelterbelts are also beneficial to wildlife. They provide habitats for nesting, loafing, roosting, travelling and feeding as well as winter cover for various species of birds and small animals (Koechlmoos 1983).

2.3.3 Forage and Pasture Improvements

Incorporation of forages (especially legumes) into crop rotations improves the productivity of the soil while reducing erosion. Significant benefits to soil structure, increased organic matter levels, and reduced nitrogen applications can be realized using a one-third "farm in forage" - six year management plan (PFRA 1982). Forage rotations are more economically viable to farmers with readly available markets, such as livestock operations. Forage production, however, offers diversity, thereby reducing economic dependence on single commodity markets.

2.3.4 Gully and Drain Stabilization

Drainage systems with little vegetative protection become vulnerable to erosion when large volumes of water enter the systems. Gully erosion occurs when rill erosion (surface runoff accumulation in depressions which form well defined channels) becomes so large that tillage becomes impossible (PFRA 1982). Poor management practices such as summerfallowing and excessive incorporation of crop residue further aggravate the problem.

Gully restoration can stop soil loss and bring unproductive land back into production. Grassed waterways are broad, shallow channels that are seeded down to legumes or

grasses to carry runoff across crop-land while minimizing erosion (Bonnefoy 1983). Channel vegetation reduces stream flow velocity, traps solid materials, and reduces sediment loads 30 to 50% (NSCTF 1983). Sediment removal is much more effective if grassed waterways are wide and shallow to allow for "sheet flow" (Brach 1989). They are much less effective at removing very fine suspended particles and soluble nutrients.

Vegetated boarders are another erosion prevention technique which complement grassed waterways and drainage channels. Field boarders are strips of permanent vegetation on the edges of fields that help reduce soil movement off cultivated lands into drainage systems (ibid). They are most effective for reducing erosion from end rows which run with land contours. They also provide some sediment filtration from sheet flow (ibid).

2.3.5 Water Management

Winnipeg and the surrounding area receives an annual precipitation of 525 mm (21 inches) (MDA 1985). One half of this precipitation falls during the growing season, 36 percent in the late fall and early spring, and 24 percent as snow (ibid). In the Prairie region, crop yields may be increased markedly with efficient utilization of all available mois-

ture. Past tillage practices have deteriorated the soil structure, leading to less infiltration and greater redistribution of surface water during the growing season (Rennie 1977).

Nature often provides enough moisture for agricultural crops, but not always during the growing season. Efficient water management captures precipitation which falls outside the growing season. Management begins where precipitation falls in the field. Conservation tillage, crop residue, stubble, and continuous cropping all aid in retaining precipitation, thereby increasing moisture infiltration and reducing erosion.

Reduced tillage systems conserve soil moisture by maintaining surface residue while imbedding the crop seed into the moist soil beneath without severely disrupting trash cover (MDA 1985). Crop residues on the soil surface reduce evaporation, retain snow, reduce runoff and increase water infiltration (ibid). Continuous cropping is an important alternative to summerfallow. Fallow retains only six to thirteen percent of the precipitation. Continual cropping utilizes 85 percent of the seasonal precipitation (ibid).

Stubble management is an effective means of improving snow retention on fields, approximately 60 percent (Rennie 1977). At a very low cost to implement, such methods as tall stubble, alternate height stubble, unharvested strips,

or tall stubble strips have proven effective in capturing extra snow (Steppuhn Undated). Extra snow provides more moisture, insulation against low temperatures for over-wintering crops, and protection from soil erosion (ibid).

Effective on-farm water management involves development of a comprehensive soil and water management program. Conservation tillage, crop residue, continuous cropping and stubble management significantly reduce excess water runoff but do not eliminate it. Water retention in the upper reaches of tributaries - where water accumulation begins - further aids on-farm water management. Retention structures constructed in the area provide protection against downstream flooding, increases ground water recharge, and secures water for both agricultural and wildlife uses.

Many studies have illustrated the importance of water retention structures in reducing peak flow levels in watersheds. The U.S. Soil Conservation Service (SCS) installed floodwater retarding structures on Winter Creek in Oklahoma. The structures controlled 56 percent of the runoff from a 8550 ha (21375 ac) area. Peak flows were reduced an average of 61 percent (Schoof et al. undated). Further, severe bank erosion had been arrested and sediment yield was reduced 50 to 60 percent. Peak discharges that occurred on an average every two and ten years before treatment were reduced to every five and 100 years under post-treatement.

The U.S. SCS conducted another similar pilot project in North Dakota in the late 1950's on the Tongue River. The River, which originates in the Pembina escarpment and flows east to the Red River, has historically caused severe flood damage to farmland and urban property (USDA undated). The basic watershed management plan was to implement conservation measures that increased the water holding capacity in the upper reaches of the watershed and released runoff so as to prevent downstream flooding.

The project involved the placement of ten large water retention structures. The combined water retention capacity of the structures is near 20,000 acre feet, individually ranging from 250 to 6300 ac ft (ibid). Four of the structures are equiped with delayed release mechanisms that retain some spring runoff throughout the summer months. The added cost of this feature was paid by local wildlife agencies and municipalities. Recreational and domestic uses generated from the water have repayed these investments.

The watershed management plan incorporated on-farm conservation activities such as crop residue management, shelterbelt establishment, grassed waterway construction, special pasture management and farm pond construction. These practices are anticipated to double the 50 year life expectancy of the retention structures. Post construction flooding damages have been reduced approximately 73% (ibid). Each

dollar invested was expected to return $1.50 in measurable flood protection benefits.

2.3.6 Wildlife Habitat Enhancement on Private Lands

Agricultural activities and habitat management need not be mutually exclusive uses of the land resource. Agricultural practices which are generally good for the land are generally good for wildlife. Wildlife can be very responsive to the way land is used and managed, and when managed favourably, the response can be dramatic.

Wildlife habitat can be created in agricultural operations with little or no adverse effects. A study by Higgins (1976) on waterfowl nesting on intensely farmed areas indicated untilled uplands supported greater duck nest densities and production than annually tilled uplands. The five major habitat types, based on nest density, were untilled upland, standing grain stubble, mulched grain stubble, summerfallow and growing grain. Nesting densities were 12 times, and hatch-clutch densities 16 times greater on untilled cropland. The principle limiting factor to waterfowl production on intensely farmed lands were found to be poor quality nesting cover due to intensive tillage operations and nesting failures due to farm machinery and predators.

Waterfowl nesting densities and nesting success could be enhanced by reducing fall tillage operations to retain more

stubble residue, discontinuing the cultivation of road rights-of-way, and providing better quality vegetative cover on untilled uplands for waterfowl nesting and protection (ibid).

Development of habitat areas in areas uneconomical to crop or susceptible to erosion increases habitat for wildlife while preventing the possibility of serious soil erosion. The construction of earthen dams across natural waterways, for example, can be of considerable value to waterfowl. The Agricultural Experimental Station (1980) found that shoreline length is a more important determinant of brood success than pond area. However, emergent vegetation, idle grasslands and pastures also are important.

Conservation tillage generally is beneficial to wildlife as crop residue is left on the soil surface where it may provide cover and food. Wintering wildlife receive greater use from undisturbed harvested crop fields than fall tilled (Castrale 1983). Some forms of fall tillage are as detrimental to the availability of waste grain for wildlife food as the moldboard plow (Warner et al. 1984). Mulching residue after harvest may maintain surface coverage, but greatly decreases the value of the residue to wildlife as compared to standing stubble (Brady 1985).

Waterfowl production rates on intensely tilled prairie farmlands could be increased substantially with the adoption

of zero tillage seeding practices. Cowan (1982) found duck nesting success on zero till cropland was improved over annually tilled cropland. Larger areas of suitable nesting habitat produced lower nest densities, which effectively reduced predation rates. Fall zero till seeding operations provided the greatest benefit to waterfowl nesting productivity (ibid). The same study showed that spring zero till seeding operations were up to three times more beneficial than conventional spring seeding operations, when farmers took measures to avoid damaging and exposing nests to predators.

The undercutter plow (stubble mulcher or noble blade plow) is an effective conservation tillage implement that penetrates and loosens the soil root zone while causing little surface disturbance. This maintains soil moisture while providing adequate weed control and wildlife benefits. The undercutter may reduce bird nest mortality rates by 40 to 50 percent in wheat stubble, compared to 100 percent with surface tillage equipment (Rodgers 1984). In addition, waste grain and other foodstuff is maintained on the surface for wildlife.

The management of uplands for the primary use of generating wildlife habitat should concentrate on providing protective cover and food availability. Podoll (1978) suggested the following techniques be practiced to meet these objectives:

* select grain varieties with strong stems
* leave standing stubble 20cm (8in) in height or more
* avoid fall mulching to preserve stubble for cover and spilt grains for feed
* include legumes in rotations for soil tilth, fertility and nesting cover
* avoid fallow tillage operations

The management of forage areas for livestock feed and wildlife habitat can be incorporated into management plans easily with little or no ill effects to either interests. When the secondary goal of forage production is the maintenance of habitat, delaying the first cut in forage crops by one week is one method of increasing the nesting success of waterfowl and ground nesting birds. Although protein quality may be reduced about two percent, this loss is offset by an increase in the quantity of fibre (Heintz et al. 1980).

When the secondary goal is forage production for livestock, Podoll (1978) suggests that the first cutting be delayed until after July 15; machinery operating speeds be maintained at 3 mph or less to reduce bird mortality; 6 or more inches of stubble be maintained; and that cutting activities commence in the centre of the field, moving concentrically toward the outside. Light grazing may also be accommodated with proper management. Strips of grass cover

or old fence rows between crops provide sites for loafing, nesting, cover, and travel corridors. They also are valuable for soil erosion control (Heintz 1980).

Certain grazing systems, when managed properly, utilize vegetation resources more effectively and improve forage production, which in turn benefits both agriculture and wildlife. Rangeland habitat for birds and mammals is improved with increased stubble height which provides better thermal protection, refuge, nest cover, and foraging opportunities (PRISM 1988). The greatest benefits to wildlife are realized when grazing is limited between mid-May and mid-June, and when at least 80% of the annual growth is maintained (Podoll 1978).

PRISM (1988) categorized grazing systems as both unspecialized and specialized systems. Unspecialized systems incorporate continuous grazing and seasonally repeated grazing. These are medium to high intensity grazing systems which allow livestock unrestricted access to the whole pasture during the entire season. Residual forage cover is minimal, thereby leaving poor habitat for most species of birds and mammals.

Specialized systems include deferred-rotation grazing and rest rotation grazing. In deferred-rotation grazing systems, grazing on part of the total pasture area is delayed until the major plant species have reached the stage of seed pro-

duction. Rest rotation grazing was designed on the basis of plant responses with little consideration for the nutritional requirements of animals. Stock densities are increased on portions of the pasture for long grazing periods during the spring. Forced utilization of vegetation in this pasture may be detrimental to vegetation, but seed production or seedling establishment can occur in other parts of the pasture through deferment.

Specialized grazing systems involve more intensive management, however, they improve forage production for livestock fodder and residual habitat for wildlife. The quality of management in grazing systems is more important for wildlife habitat enhancement than the type of management system used. If unspecialized grazing systems maintained a 50 percent carry-over of crop residue, they would provide good habitat. The duration and intensity of the grazing system is more important than the type of system used. Ideally, any system that provides for a delay of the initial grazing time, deferal of grazing, or rest from grazing will enhance wildlife habitat.

Chapter III

METHODS

3.1 INTRODUCTION

The preceding reviewed various soil and water conservation techniques used by the DSWMA members. The next step is to examine the participants experiences and perceptions of these techniques. With input by individual farmers, a conservation philosophy can be instilled in the agricultural community. The methods outlined here provided the basis for this input. This chapter discusses the selection of the study area and sample size, the farmer survey, data processing and analysis.

3.2 THE STUDY AREA

The DSWMA project was selected because of the high level of conservation farming activities initiated by farmers in the area. It is one of the first attempts in Manitoba to demonstrate combined soil and water conservation techniques under the 1985 Agri-Food agreement, and it is the most advanced project demonstrating the incorporation of water retention structures into farm soil and water management systems.

The DSWMA is located in the south-central portion of the province 120 km (75 mi) south west of Winnipeg along provincial highway #23. It covers an area 160 km2 (100 mi.2) on the Pembina Escarpment in the Rural Municipalities of Thompson and Lorne, 8 km (5 mi) on both sides of highway #23 and 10 km (6 mi) from the lower to upper escarpment. Total number of farms in the DSWMA area is approximately 575; 125 of the farmers are DSWMA members. The major land use is agriculture, primarily mixed farming.

The area is characterized by moderate to severe slopes which necessitate intensive conservation practices or restricted crop production. Numerous tributaries of the Tobacco Creek and Boyne River originate within the Association boundaries. It is within this watershed that DSWMA members are implementing water management and soil conservation practices.

3.3 FARMER SURVEY

A personally administered attitudal questionnaire formed the basis of this descriptive survey. This technique was chosen for the advantages personal interviews have over other questionnaire designs. The reliability and validity of respondents identifications are not questionable; the response rates are higher than other forms of surveys; the interview-

er can describe and explain questions to respondents when necessary (Bruce 1983), and surveys administered by the researcher are more personal (Berdie and Anderson 1974).

The descriptive survey is a commonly used approach to assessing landowners attitudes. Zittlau (1979) used a personally administered questionnaire to assess landowners attitudes toward natural resources, Sutton (1983) to evaluate landowners attitudes toward field shelterbelts, Bruce (1983) to evaluate the environmental effectiveness, social acceptability and economic feasibility of soil and water management techniques in the Turtle River watershed, and Morgan (1985) to determine attitudes of farmers in the prairie pothole district of Manitoba towards wetland habitat conservation.

The questionnaire consisted of open ended and fixed response type questions. Many of the fixed type questions followed a format similar to the Likerk scale. Answers to specific questions were based on a numerical scale of 1 to 5, where 1 was the least and 5 the most favourable. The mean or "average" score to each question could be determined, providing a measure of strength of a specific attitude.

The questionnaire was developed in consultation with the faculty at the Natural Resources Institute, the Manitoba Department of Agriculture, Ducks Unlimited, and Wildlife

Habitat Canada. The questionnaire consisted of eight sections:

1. Landowner Information
2. General
3. Wildlife
4. Conservation Tillage
5. Water Retention Structures
6. Field Shelterbelts
7. Gully Stabilization and Grassed Waterways
8. Forage and Pasture Improvement

Data was collected on the first three sections from all interviewees and on selected sections thereafter, depending on the activities of the members.

A survey sample was identified in June, 1989 using current membership information. At the time, the DSWMA had 106 members - 82 of which were actively demonstrating one or more projects. Using a random number table, a sample of 45 was drawn from the active portion of the membership.

A pretest was conducted in mid June on four DSWMA members to identify ambiguous questions and minor clarifications were made. At the same time, all members were contacted by letter to introduce the researcher and inform members they may be contacted for an interview. Farmers were contacted by telephone to arrange dates and times most convenient for them to respond. Interviews were conducted between June 23 and July 24, 1989.

Two members from the original sample refused to be interviewed. Reasons for refusal included ... "the interview would take too long [and besides] I would get nothing out of it" and ... "I'm not involved in it, my son is". Two additional members were chosen using the process described above to make up the sample of 45. Two members were re-contacted by phone after the interviews were complete to clarify discrepancies relating to farm acreage values.

3.4 DATA ANALYSIS

The selection of the analytical techniques used in the analysis of the data was dependent on the nature of the data base. The majority of data was ordinal in nature. Analytical techniques using data recorded in this form are somewhat restricted (O'Grady 1986). Despite this limitation, frequency histograms and bar charts were derived from the data. Frequencies simply illustrate the distribution of the recurrence of each response either as the actual number of responses a variable receives or more usually as percentages (Weisberg and Bowen 1977).

The results were analyzed using the University of Manitoba main frame computer and Statistical Packages for Social Sciences (SPSSX) software. The responses were analyzed with reference to the literature. Based on the analysis, recom-

mendations were provided to aid in the improvement of the soil and water management practices employed by the DSWMA and facilitate their implementation throughout the escarpment region.

Chapter IV

SURVEY RESULTS AND DISCUSSION

4.1 INTRODUCTION

The survey of DSWMA members was carried out during June and July, 1989. Interviews were conducted with a random selection of 45 of the 82 active members. The active membership was grouped into three categories: those with one, two, or three or more projects, and fifteen interviewees were randomly chosen from each category. Overall, the results of this survey are based on the following representation from each project type: 50 percent of the members active in conservation tillage were interviewed along with 46 percent active in the water retention structures, 21 percent in field shelterbelts, 42 percent in grassed waterways and gully stabilization, and 35 percent in forage and pasture improvement activities. The most common project among surveyed members was the forage and pasture improvement demonstrations (Fig. 4.1).

4.2 MEMBER PROFILE

Thirty-four (76%) of the surveyed members farm on the escarpment while 11 (24%) farm below. The dominant type of operation is mixed grain and livestock (56%) followed by straight grain (33%), livestock (9%), and other (2%).

Individual farm sizes range from 80 to 5,000 acres with an average size of 946.8 acres (Fig. 4.2). However, 44% of farms are 640 acres or less in size. Most of the farmland (72%) is owned in whole or in part, which is similar to the provincial average (75%) but slightly higher than the national average (64%) (Statistics Canada 1987). Half the farmers (51%) do not rent land, 49% do.

Land distribution is shown in Fig. 4.3. Cultivated lands constitute 74 percent of the total, averaging 287 ha (719 ac) per farm unit. Sixty-two percent have less than 256 ha (640 ac) under cultivation. Hayland occupies 8 percent of the total farmland (7% improved hayland, 1% unimproved hayland). Almost three quarters (73%) have improved haylands, averaging 36 ha (89 ac). Only 36 percent have improved pastureland, averaging 36 ha (77 ac). Improved pastureland is 3 percent of the total farmland while unimproved pastureland is 6 percent. Almost half (48%) have unimproved pastureland, averaging 48 ha (120 ac).

Woodlands make up 7 percent of the total reporting landbase. Seventy-one percent of respondents have woodlands,

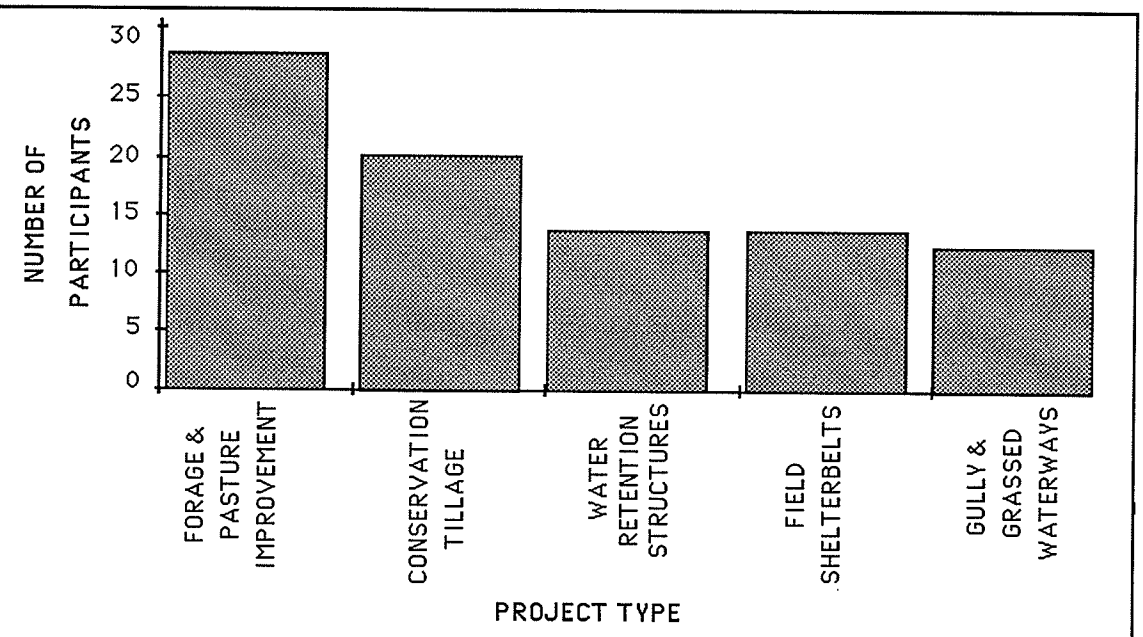

FIGURE 4.1
PROJECT PARTICIPATION

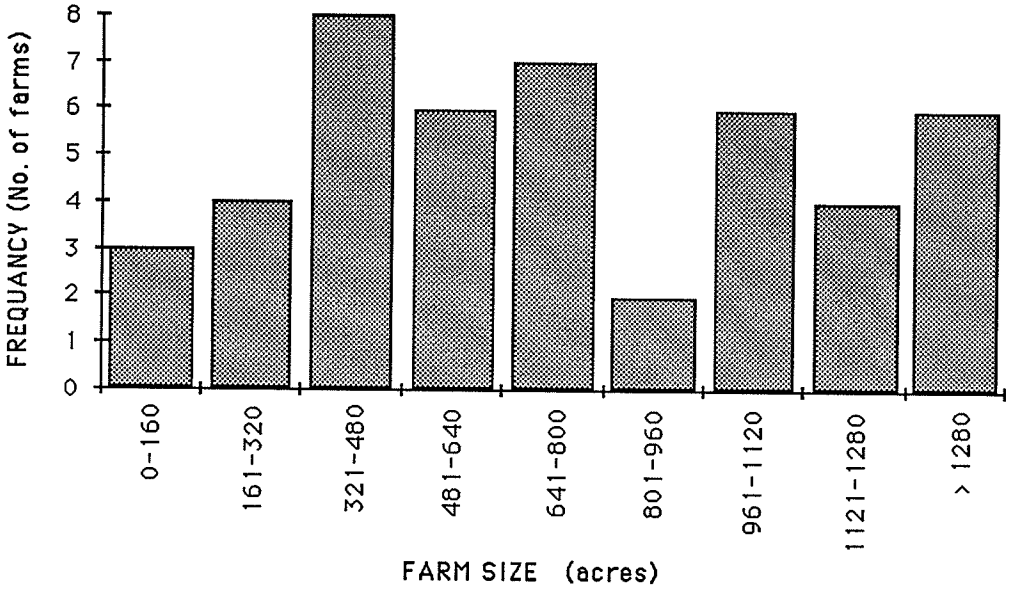

FIGURE 4.2
TOTAL ACREAGE FARMED

averaging 39 ha (97 ac) each. Fifty percent, however, have less than 20 ha (50 ac) of woodlands. Wetlands constitute 2 percent of the landbase. Forty percent of the respondents' have wetlands - averaging 13 ha (33 ac) per farm. However, over fifty percent (53%) have wetlands less than 6 ha (15 ac) in size. Other land types include yard sites and ravines, which make up 0.6 percent of the total farmland, averaging 8 ha (20 ac) per farm.

The majority of surveyed members (87%) farm on a full-time basis, and have done so for five to sixty years (Table 4.1). Thirteen percent farm on a part-time basis, and have done so for three to thirty-six years (Table 4.2). Two-thirds of respondents are under 50 years of age (Fig. 4.4) The average age is similar to the provincial and Canadian averages, however ages are less evenly distributed (Stats. Can. 1987).

The majority of respondents (60%) are between 31 and 50 years of age. Thirty one percent (31%) have had some form of post secondary education, including Agricultural College Diplomas and University Degrees.

TABLE 4.1

FULL-TIME FARMING EXPERIENCE

NUMBER OF YEARS	PERCENT	CUMULATIVE PERCENT
1-10	10	10
11-20	39	49
21-30	23	72
31-40	13	84
41-50	10	95
>50	5	100
n = 39		

TABLE 4.2

PART-TIME FARMING EXPERIENCE

NUMBER OF YEARS	PERCENT	CUMULATIVE PERCENT
1-10	50	50
11-20	33	83
21-30	0	83
31-40	17	100
41-50	0	100
>50	0	100
n = 6		

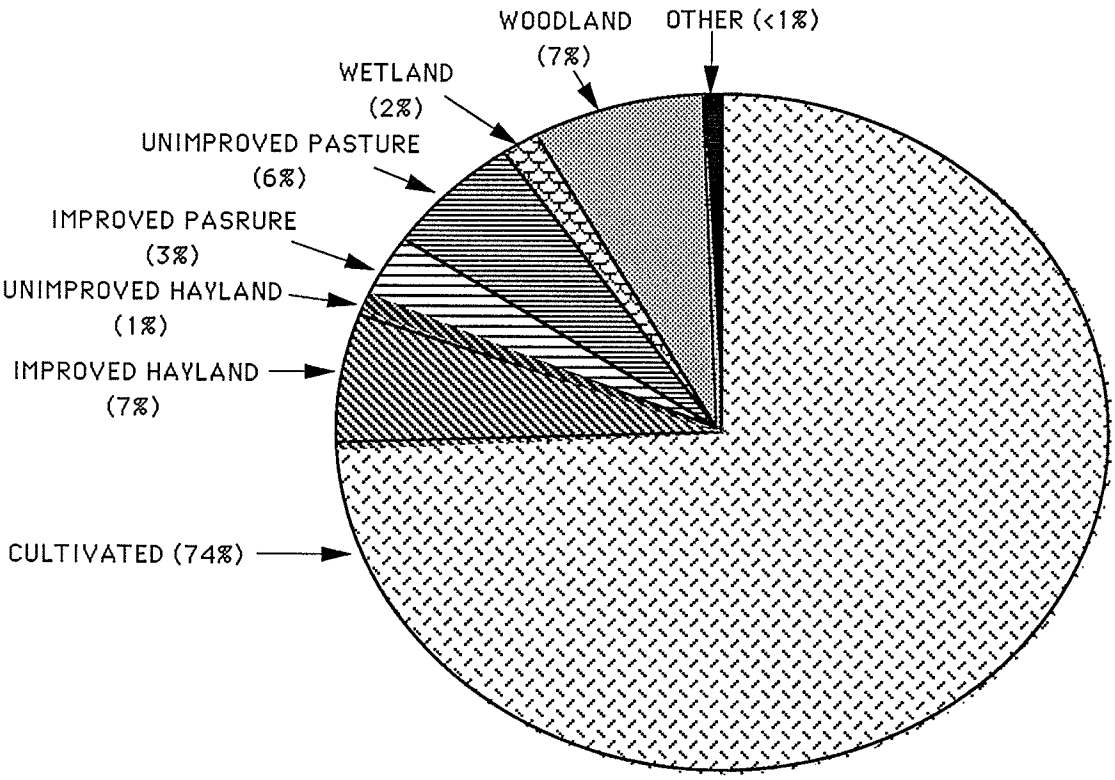

FIGURE 4.3
LAND DISTRIBUTION

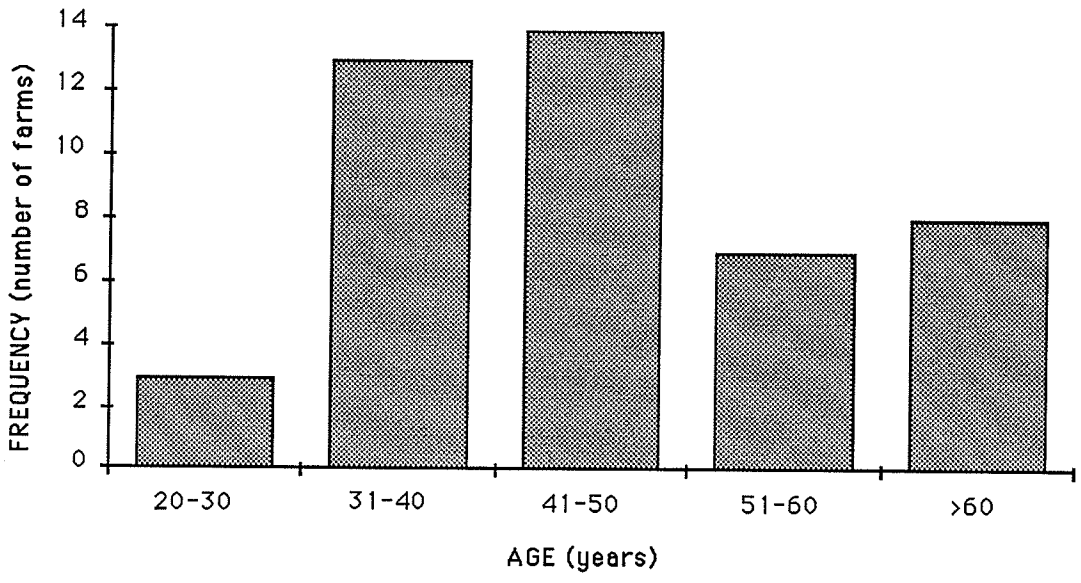

FIGURE 4.4
AGE DISTRIBUTION

4.3 GENERAL ATTITUDES

During 1984/85, half (51%) of the surveyed farmers became DSWMA members. A further 29 percent joined during the following year and a further 11 percent and 9 percent in 1987 and 1988 respectively. The majority (80%), therefore, have answered the survey on the basis of four or more years' experience as DSWMA members.

The most common method of finding out about the DSWMA was through their neighbours (Fig. 4.5). Personal interest in soil and water conservation and the conservation activities of the DSWMA were the main reasons why respondents joined. Other reasons included:

* to become eligible for enrollment in projects
* common interest in erosion control and DSWMA assistance in covering the costs of erosion control
* desire to expand knowledge of soil and water conservation practices
* exchange of information with other farmers
* concern about water conservation/management and land use practices
* desire for local input on local water activities (ie: escarpment studies)
* habitat preservation
* demonstration of accumulated information - advance a step further and show/share experiences locally

The most common reason given for joining when they did was that it was immediately after they were made aware of the DSWMA.

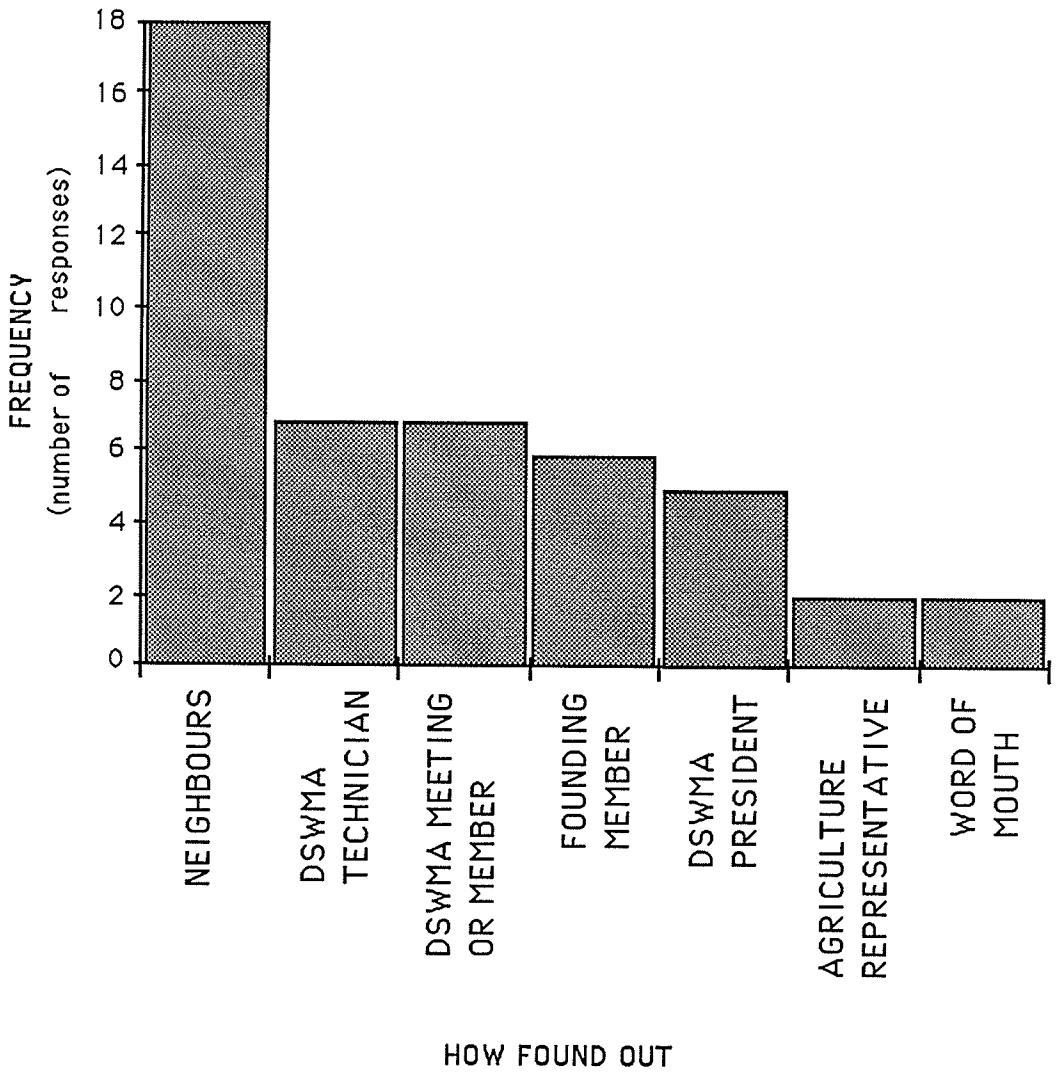

FIGURE 4.5

SOURCES OF FIRST EXPOSURE TO THE DSWMA

The extent to which financial and technical incentives provided through the DSWMA influenced the respondents to adopt soil and water conservation practices on their farms is illustrated in Table 4.3. Technical assistance influenced two-thirds of the members in a positive way. Financial incentives influenced a majority of members (65%), but generally only to a slight degree. Nearly one-third replied that the incentives had no influence on their joining the DSWMA. Financial and technical incentives are, therefore, both equally important in encouraging conservation activities. PFRA (1987) revealed similar findings (financial & technical assistance had mean score of 3.4).

Overall, the DSWMA project has had a positive effect on respondents' awareness, skills and activities relative to soil conservation (Table 4.4). The demonstrations have also had a positive influence on awareness of the potentials of improved moisture management. However, the significance of this influence is uncertain due to extremely dry weather during the late 1980's. The DSWMA's most profound effect has been on respondents' awareness of soil conservation and moisture management techniques. The majority (76%) acknowledge this: 30 percent say the project had a great positive effect on their awareness. Two-thirds acknowledge that the demonstrations have had a positive effect on their soil conservation skills and practices.

TABLE 4.3

INFLUENCE OF ASSISTANCE ON JOINING THE DSWMA

	INFLUENCE OF ASSISTANCE FREQUENCIES (%)					
	GREAT "-"	SLIGHT "-"	NEUTRAL	SLIGHT "+"	GREAT "+"	AVERAGE SCORE*
TECHNICAL	0	0	33	36	31	4.0
FINANCIAL	0	0	35	47	18	3.8

n = 45

* Average score on a scale of 1 to 5, where 5 = great positive influence, 4 = slight positive influence, 3 = neutral, 2 = slight negative influence, and 1 = great negative influence.

For example, 33% of respondents believed the technical assistance provided by the DSWMA had no influence on them becoming members, while 36% believed it had a slight positive influence and 31% believed it had a great positive influence. The average or "mean" response on the scale of 1 to 5 was 4, indicating the provision of technical assistance had a slight positive influence on the farmers decision to join the DSWMA.

The majority (80%) believe they have reduced both on-farm and off-farm soil erosion. They attribute their effectiveness to:

* being more conservation conscious (eg: managing stubble, crop residue, moisture infiltration)
* reducing tillage operations
* rotating crops (forage - cereal) to increase soil organic matter and decrease soil erosion
* being more aware/conscious of the environment

TABLE 4.4

THE EFFECTS OF THE DSWMA PROJECT ACTIVITIES ON MEMBERS

	EFFECTS OF ACTIVITIES FREQUENCY (%)					
	GREAT "-"	SLIGHT "-"	NEUTRAL	SLIGHT "+"	GREAT "+"	AVERAGE SCORE*
AWARENESS OF SOIL CONSERVATION	0	2	20	47	31	4.1
SKILLS IN SOIL CONSERVATION	0	0	31	49	20	3.9
SOIL CONSERVATION ACTIVITIES	0	2	31	56	11	3.8
AWARENESS OF MOISTURE MANAGEMENT	0	0	25	45	30	4.0

n = 45

* Average score on a scale of 1 to 5, where 5 = great positive effect, 4 = slight positive effect, 3 = neutral, 2 = slight negative effect, and 1 = great negative effect.

The observations advanced in respect to the perceived effectiveness in reducing off-farm erosion include:

* projects through DSWMA have both reduced and slowed down run-off
* the reduced tillage operations are maintaining more surface residue
* dams and reduced tillage hold back water upstream and reduce water downstream
* water courses aren't filling with dirt

One member strongly believed dams aid in controlling and slowing run-off. He stated ...

> "Each dam has a minor effect on the watershed. But a lot of minor effects will have a major effect".

All respondents believed that the DSWMA's demonstrations were important to their local area (Table 4.5). Two-thirds held them to be of great importance. Perceptions as to why the demonstrations are important include:

* groups like the DSWMA ..."help show leadership. It brings in a level of expertise that isn't usually there."
* The DSWMA demonstrations ..."get people thinking about what they are doing instead of just doing it out of routine. In other words, it gets farmers to look at what and why they are doing something in a particular way. Even if this is all Deerwood does, it is a big step in the right direction of getting soil and water conservation more widely adopted in farming."
* successful ideas catch on faster because members try a number of different experiments and those that work good get exposure "community wide" and spur on the adoption of that practice
* the demonstrations are an important source of information
* they stimulate and support "grass roots" thinking (eg: share ideas, solve local problems)

Respondents were also asked how important the DSWMA's demonstrations were to their own farm operation (Table 4.5). Overall, 90 percent held them to be important (40% very important). Conservation tillage was perceived as the most important of the demonstrations, closely followed by water retention, forage and pasture, gully stabilization and

TABLE 4.5

THE IMPORTANCE OF THE DSWMA DEMONSTRATIONS TO MEMBERS

	IMPORTANCE OF DEMONSTRATIONS FREQUENCY (%)					
	NOT AT ALL	NOT VERY	NEUTRAL	SLIGHTLY	VERY	AVERAGE SCORE*
TO THE AREA	0	0	0	33	67	4.7
TO THEIR FARMS	0	0	9	50	41	4.3
CONSERVATION TILLAGE	0	0	14	63	23	4.1
WATER RETENTION STRUCTURES	0	0	21	19	60	4.4
FIELD SHELTERBELTS	0	2	30	20	48	4.1
GULLY AND GRASSED WATERWAYS	0	0	28	30	42	4.1
FORAGE AND PASTURE IMPROVEMENTS	0	0	21	35	44	4.2

n = 45

* Average score on a scale of 1 to 5, where 5 = very important, 4 = slightly important, 3 = neutral, 2 = not very important, and 1 = not at all important.

grassed waterways, and shelterbelts respectively. An important observation to be made is that over 60 percent perceived the water retention structures to be a "very important" component in the DSWMA demonstrations. Reasons why the demonstrations were important to the members included:

* learning more about soil and water management

* encouraging the demonstration of new systems to solve local problems

* increasing local awareness and are also keeping local farmers informed

* making expensive conservation equipment more readily available

* experimenting with conservation techniques without assuming the full financial risk

* encouraging the retention and improvement of wildlife habitat

* Retaining more moisture in the local region

* Demonstrating the effectiveness of different techniques and their incorporation into existing farming operations

* establishing water retention structures for alternate uses

All but one respondent considered the DSWMA demonstrations to have been effectively administered (67% very effective). Characteristics identified to account for the success of the demonstrations included:

* DSWMA was effective in providing information and good public relations

* tours of demonstrations were informative

* dedicated leaders acted on their words

* DSWMA took the soil and water conservation initiative

* the demonstrations illustrate productivity - best value value for the conservation dollar

* only interested people became involved. Many farmers have yet to become involved

* the area farmers "..needed someone to point the way and that's what Deerwood has been doing"

Members commented and provided ideas on changes that would enhance the effectiveness of the DSWMA (Table 4.6). Over 80 percent supported the inclusion of incentives to retain marginal areas (bush, native pasture, wetlands). Some believe the provision of financial assistance from the "government" would encourage retention and practices best suited for marginal land. Although financial incentives would be provided by the government, they should be administered through the DSWMA. One member suggested that development pressure on marginal lands, especially bush, would be significantly eased if the provincial government redrafted the present municipal taxation system to remove the assessment of forested lands on farms. Two respondents stated that the DSWMA should not assume this responsibility.

Two-thirds considered the DSWMA to be doing a proper job of providing information to the members. The others believed they could improve the dissemination of information through a newsletter. More emphasis could be placed on providing non-members with soil and water conservation information.

Half (48%) of the respondents were satisfied with the current level of financial assistance. The others supported an increase in financial assistance for a variety of reasons, mainly to assure sufficient funding on a per-project basis to match membership growth (ie: more money-per-project is not the objective). One of the main objectives, the

TABLE 4.6

CHANGES THAT WOULD MAKE DSWMA MORE ATTRACTIVE TO MEMBERS

	ATTRACTIVENESS OF CHANGES FREQUENCY (%)					
	NOT AT ALL	NOT VERY	NEUTRAL	SLIGHTLY	VERY	AVERAGE SCORE*
INCENTIVES TO RETAIN MARGINAL LAND	2	2	14	46	36	4.1
PROVISION OF MORE/BETTER INFORMATION	0	2	61	34	2	3.4
MORE FINANCIAL ASSISTANCE	2	0	48	41	9	3.5
MORE TECHNICAL ASSISTANCE	0	0	67	27	6	3.4

n = 45

* Average score on a scale of 1 to 5, where 5 = very attractive, 4 = slightly attractive, 3 = neutral, 2 = not very attractive, and 1 = not at all attractive.

establishment of a network of small water retention structures on the Tobacco Creek watershed, required that sufficient financial support would be continued.

Most (80%) were satisfied with the technical assistance received. The remaining 20 percent held that more technical expertise on new conservation techniques needs to be made available to members. One-third thought the technician, although providing excellent service to the members,

required additional technical staff to assist in project operations. The consensus was that more government field staff would increase the efficiency of monitoring and measurement of field results. In general the government should be encouraged to initiate a more active "hands on" approach in project activities.

Several respondents offered suggestions as to how the DSWMA could become more responsive to their concerns. These were:

* to increase the variety of conservation equipment if more money became available
* to adopt greater flexibility in addressing its administrative mandate
* to accommodate greater project variety. DSWMA should consider linking up with other programs (eg: Western Diversification Fund)
* to have executive representation from all parts of the Association
* to be more supportive of wildlife habitat by providing information on creating/improving habitat
* to concentrate efforts on water retention projects
* to better coordinate the involvement of government departments (ie: reduce gov't infighting and increase inter-governmental cooperation)

Members were asked about financial and technical assistance and the distribution of funds. The majority (69%) were satisfied with the system. Those not satisfied (13%) explained that the different levels of government required excessive documentation regarding finances, the funds were

inflexible, and the existing projects were without maintenance funds.

The respondents were generally content as to the promptness of reimbursement for project related expenses. However, about ten percent held that the lag-time to receipt of financial assistance was excessive, and financing per project was inadequate.

Almost all respondents (96%) would recommend the DSWMA to others. The average score was 4.6, which indicates a majority (69%) would highly recommend the DSWMA to others. They indicated it was extremely important that the DSWMA's activities continue for a variety of reasons:

* to continue soil and water conservation in the area
* to continue financial and technical assistance
* to continue educating local farmers and general members of the public as to the importance of soil and water conservation
* to demonstrate that watershed planning will succeed through "grass roots" farm groups
* to acquire meaningful results from the projects. If the commitment to these projects ends, we will not see how effective public money was spent
* to provide a local forum for discussion of comparable concerns and interests
* to support societal interests. Conservation at a local level results in benefits on a global scale
* to ensure that institutional constraints are subjugated

Respondents overwhelmingly supported the continuation of the DSWMA management plan objectives as currently outlined. Some further recommendations advanced were:

* to put more effort into public relations
* to maintain project flexibility
* to keep focussed on objectives - maintaining the present membership size will aid this
* to implement plans for farmers to take marginal lands out of cereal production
* to broaden the scope of the management plan to include not just agricultural concerns, but all environmental concerns

The majority supported current soil conservation efforts. They held that further improvements could be made by promoting zero and minimum tillage as well as demonstrating and renting new equipment to members. Respondents recommended that the DSWMA maintain the present direction concerning water management. Many stressed the need to continue promoting the significance of the water retention structures, to raise the price ceiling on dams to accommodate larger structures, to licence the dams as "multi-purpose" not "dry" flood control dams, and to conduct more water flow monitoring.

Respondents were asked why they did not participate in certain projects, in order to identify shortcomings that could be corrected, and thereby improve member participation. Two-thirds did not practice conservation tillage for various reasons:

* they were attempting conservation tillage independently
* they saw no need for or had no interested in conservation tillage
* they preferred their present tillage systems until persuaded of something better
* their cropland is rented out
* they prefer to use their own cultivation equipment

Water retention structures were not built by 76 percent of respondents due primarily to a lack of suitable sites. Others expressed considerable interest, but maintained that funding under the existing program was inadequate. About ten percent held that there was no need for water retention on their farms.

Only 25 percent of respondents planted shelterbelts. The others had no interest or need for field shelterbelts, already had existing ones, or had enough existing cover/ bush. About 15 percent would establish trees in the future. One member said he didn't want to detract from the DSWMA's focus on water control/management.

Most respondents (80%) not participating in the gully stabilization and grassed waterway projects said they had already done, were doing this independently, or didn't require them. Forty percent were not involved in DSWMA sponsored forage or pasture improvements; they either had no use for their operations, or were making such improvements independently. Three members planned to seek assistance in the near future.

4.4 CONSERVATION TILLAGE

Minimum tillage was the most practiced conservation tillage system used by respondents (56%). Reduced tillage was next, while only one practiced zero tillage. Most respondents (75%) had used conservation tillage prior to membership in DSWMA. They were active in conservation tillage because they were interested in:

* increasing moisture availability
* improving soil quality (ie: increasing soil organic matter)
* reducing erosion
* experimenting with different techniques
* taking the next step (ie: trying 0-till)

When asked how important conservation was to their operations, 56 percent said "very important", 38 percent said "slightly important" and 6 percent said it was of no significant importance. Respondents who held conservation tillage to be important gave the reasons as:

* erosion control
* conservation of resources (ie: soil moisture)
* improving the soil (ie: increase the organic matter content)
* reducing input costs
* making their tillage system more flexible (ie: with reduced tillage, one is less likely to fall behind in work)

Surveyed members were asked what effects conservation tillage had on their operation (Table 4.7). There was generally no perceived effect on net farm income. Over 50 percent indicated there was no significant effect on crop production, while 40 percent said there was a slight improvement in yields. Nearly 90 percent indicated no change in fertilizer costs, and only a slight reduction in machinery costs through reduced maintenance. Over two-thirds indicated a slight to significant increase in weed control costs. A slight reduction in labour resulting from fewer tillage operations saved on costs and time. Fuel costs were reduced slightly due primarily to fewer trips around the field.

Most respondents (88%) believed there was a slight increase in soil moisture due to less tillage during seedbed preparation. None noticed any effect on spring tillage date, which indicates no apparent effect on surface soil temperature.

Overall, the implementation of conservation measures into their operations had no significant effect on production (overall average score 3.3). Input costs (machine maintenance, labour and fuel), with the exception of weed control costs, experienced a very slight reduction. The most pronounced effect was the prospect of long-term protection of

TABLE 4.7

VARIOUS EFFECTS OF CONSERVATION TILLAGE DEMONSTRATIONS

	EFFECTS OF CONSERVATION TILLAGE FREQUENCIES (%)					
	GREAT "-"	SLIGHT "-"	NEUTRAL	SLIGHT "+"	GREAT "+"	AVERAGE SCORE*
CROP YIELDS	0	7	53	33	7	3.4
FERTILIZER COSTS	0	6	88	6	0	3.0
MACHINERY COSTS	0	6	31	63	0	3.6
WEED CONTROL COSTS	19	50	25	6	0	2.2
LABOUR COSTS	0	0	31	56	13	3.8
FUEL COSTS	0	0	25	69	6	3.8
SOIL MOISTURE	0	6	6	75	13	3.9
TILLAGE DATE (SPRING)	0	0	100	0	0	3.0
NET FARM INCOME	0	13	60	20	7	3.2

n = 16

* Average score on a scale of 1 to 5, where 5 = great positive effect, 4 = slight positive effect, 3 = neutral, 2 = slight negative effect, and 1 = great negative effect.

the soil from erosion. All believed that conservation tillage reduced soil erosion - 65 percent held that it significantly reduces soil erosion.

Observations of the effects of conservation tillage include:

* there was less wind and water erosion
* the increased stubble cover effectively reduced erosion - "you can't imagine"
* the increased stubble cover reduced surface runoff
* the amount of snow retained on the fields was increased

Respondents were asked what other techniques they used which complemented their conservation activities (Table 4.8). All of these techniques were deemed effective in reducing soil erosion.

Crop residue management was considered very effective in controlling erosion, and could be easily incorporated into grain operations without significant changes. Input costs were reduced with the exception of chem-fallow. Cover crops were deemed very effective, fitting most readily into mixed or livestock operations. Physical changes in cropping practices such as strip cropping and contour farming were deemed to be slightly effective in reducing erosion.

Most respondents (87%) believed snow management is important for moisture conservation - 69 percent said it is very important. Reasons given were:

* with proper management snow is a good source of moisture - especially in the spring, when moisture is most important for germination
* moisture is held in the field (ie: in situ), which reduces runoff
* the snow protects the soil from erosion

TABLE 4.8

OTHER CONSERVATION TECHNIQUES

TECHNIQUE	NUMBER OF PARTICIPANTS	AVERAGE SCORE*
STUBBLE MANAGEMENT (VARIABLE HEIGHT)	3	5.0
WINTER COVER CROP	6	4.8
CHEM-FALLOW	3	4.0
SURFACE RESIDUE MANAGEMENT	15	4.9
GREEN MANURING	3	4.3
STRIP CROPPING	1	4.0
CONTOUR FARMING	4	4.3
FIELD SIZE/ ORIENTATION	7	4.4

* Average score on a scale of 1 to 5, where 5 = great positive influence, 4 = slight positive influence, 3 = neutral, 2 = slight negative influence, and 1 = great negative influence).

* in dry years, crop yields had been observed to increase ten percent where snowbanks had accumulated

Only two respondents included summerfallow in their crop rotations. Both agreed soil moisture loss is best controlled with trash cover. Members generally expressed indifference to the cost of pesticides used in their conservation activities (average score 3.1); 38 percent claimed cost had no influence. One quarter claimed it had either slightly or greatly inhibited their experimentation with conservation tillage. Comments include:

* the price of pesticides had inhibited use on a larger scale

* not just the cost involved but the timeliness (the window for spraying can be missed easily)

* could have started conservation tillage sooner if pesticide costs were lower

Most surveyed members (88%) believed the benefits gained by practicing conservation tillage outweighed the costs. Reasons included:

* the soil remains healthy for future generations

* sustained production would not be possible without conservation tillage

* conservation tillage helps maintain the market value of the farmland

The majority of respondents (81%) considered it advantageous for the DSWMA to purchase innovative machines for demonstration. Reflections on the question included:

* enables DSWMA to demonstrate the right equipment for local or specific field conditions

* consider renting/leasing or purchasing - whatever is the best deal for the DSWMA

* cost effective way of adopting conservation tillage

* consideration should be given to any equipment that promotes conservation (ie: yield wagons)

Respondents generally agreed they had easy access to sufficient information on conservation tillage (average score 3.8). The major sources were: DSWMA technician, DSWMA executive, agricultural representative and PFRA officials. One member pointed out that there was adequate information on

"conventional" conservation tillage but insufficient information on new techniques, such as terracing and sub-soiling.

All participants supported the continuation of conservation tillage demonstrations. Demonstrations could be improved by:

* continuing the demonstration of new techniques
* providing more detailed reports on individual trials (ie: monitoring of costs, yields, etc.)
* basing payments to participants on effective performance (ie: amount ground cover retained)
* increasing surveillance of demonstrations elsewhere

Most respondents thought their attitude towards conservation tillage had been changed slightly, but positively (average score 4.0). When asked how their attitudes had changed, they replied:

* "I have a greater awareness, and I recognize the need for soil and water conservation"
* "I'm gaining knowledge through the demonstrations"
* there was no change, it was strong before
* "now I think of what I'm doing and just don't do it out of routine
* "conservation tillage has been shown to be economically viable"

4.5 WATER RETENTION STRUCTURES

Twenty five percent of the respondents constructed water retention structures. There was a variety of interests in these structures, including:

* to ensure a supply of water for the farm
* to benefit the groundwater table (ie: create a groundwater recharge site)
* to reduce downstream flooding
* to promote water as a managable resource like other farm inputs - "water is the missing link in a total farm management plan"
* to compensate for previous drainage (ie: flood unproductive land in place of drained productive land
* to enhance wildlife

When asked what general impacts water retention structures had on their farms, 78 percent were neutral. This would appear to indicate uncertainty as to what effects the structures had on the land. This uncertainty may stem from drier than normal conditions during the last few years or a lack of experience due to the recent emplacement of the structure. When asked about the specific effects, they were uncertain about the impacts on farming practices on adjacent land, on property value, and on farm income. They thought there were some slight personal benefits in reduced flooding and erosion immediately downstream, in assured supplies for livestock watering, in aesthetics and in irrigation potentials (Table 4.9). There were some general benefits with

respect to flooding and erosion in the entire drainage system, and to wildlife.

TABLE 4.9

EFFECTS OF THE WATER RETENTION STRUCTURES

	EFFECTS OF THE STRUCTURES FREQUENCY (%)					
	GREAT "_"	SLIGHT "_"	NEUTRAL	SLIGHT "+"	GREAT "+"	AVERAGE SCORE*
IMMEDIATE DOWNSTREAM FLOODING	0	0	38	38	24	3.9
ENTIRE DRAINAGE SYSTEM FLOODING/EROSION	0	0	50	25	25	3.8
VALUE AS LIVESTOCK WATER	0	10	20	30	40	4.0
ADJACENT FARMING PRACTICES	0	0	80	0	20	3.4
WILDLIFE HABITAT	0	0	30	50	20	3.9
IRRIGATION	0	0	67	0	33	3.8
PROPERTY VALUE	0	0	70	20	10	3.4
AESTHETICS	0	0	36	55	9	3.7
FARM INCOME	0	0	82	18	0	3.2

n =11

* Average score on a scale of 1 to 5, where 5 = great positive effect, 4 = slight positive effect, 3 = neutral, 2 = slight negative effect, and 1 = great negative effect.

Respondents had not developed many alternative uses relative to their water retention structures. Two used them as a source of water for livestock and one used the retention pond for recreational swimming. The general attitude among respondents was that it is difficult to measure the effects of the structures because they are ... "nebulous and hard to measure." However, it is believed the structures will eventually provide benefits that will justify the initial financial investment. Most agreed that many benefits were as yet unknown and would be identified only after several years. Initial benefits expected were:

* reduced peak run-off levels, which lessen on-farm and downstream flooding and erosion damage
* recharge site for groundwater
* water source/habitat for wildlife
* reduced maintenance/repair costs on municipal roadways

Various other opinions were put forward as to what might be expected from the structures over their life-span. One member had costed out his structure at $80.00 per year - based on a 50 year life expectancy and a capital cost of $4,000. In addition, he estimated an annual value to waterfowl alone to be $60.00 - based on two pairs of ducks at $30.00 per pair. This excluded the perceived value to other wildlife. Other members said:

* "can't determine whether the benefits are greater than the costs yet"
* "the cost of construction should be recovered in five to eight years"

* "unsure if cost-effective, but structure is beneficial"

* "worth as a recharge site is difficult to measure"

* "the impact on drain maintenance by the Municipality may be significant (ie: one flash flood could pay for the structure(s))"

The majority (91%) think the implementation of a network of these structures on the Tobacco Creek would be very effective for erosion control (average score 4.6). Supportive reasons included:

* the structures control peak run-off levels

* in order to control water/erosion on the watershed, many structures are needed

* headwater management will reduce conflicts over who is responsible for erosion damage below the escarpment

* run-off and erosion are only effectively controlled in part of the watershed (ie: on class 1 drains where the dams are currently being built). Even with reduced peak flows, run-off is still directed into class 2 and 3 drains to flow freely down the drain system

When asked how the placement of dams should be determined, the responses were as follows:

* dam placement should be the farmers' choice (within reason)

* "dam construction should be maintained exclusively in South Tobacco Creek so we can measure if the structures do or don't work"

* dam placement should begin in the upper reaches and move down from there

* dam placement should be determined after consultations with farmer(s) and engineers

* the number of dams required on a watershed should be determined and then work backwards

* the number one priority is on-farm management so off-farm flows are reduced, which in turn benefits society

* universal dam "blue prints" should be designed so DSWMA members can build them independently

* there needs to be more complete coverage of the entire watershed (ie: build structures in upper reaches for on-farm water management and on class 2 drains for farm/societal benefit)

All respondents believed the dams should be retained as part of the DSWMA project. Most were satisfied with the structures but some believed better material could be used on the gates to control water leakage, and that dam size could be enlarged to allow for expanded uses such as irrigation. Others believe improvements could be made by:

* reducing the amount of engineering time per dam (ie: reduce costs)

* raising the support ceiling on construction costs

* changing the dam design by replacing the earth spillway with a steel or concrete spillway in the dam itself

Attitudes toward on-farm water management have generally been positively affected due in large part to members taking action upon their beliefs. In the broad context of water management, members have realized that on-farm management is both feasible and important in developing a farm management plan and that they now have the ability to manage the resource effectively.

Two trends in thinking appear to be developing from the management of the retention structures. Respondents indicated that DSWMA project activities and demonstrations were

effective in illustrating the cumulative impact of individual water management activities on the whole catchment basin. This realization may prompt the incorporation of more complementary production activities that further promote on-farm water management (ie: the retention of water in situ).

Respondents stated they do not think only of on-farm benefits, but also consider the value of these structures to society, whether it be as a recharge site for ground water recharge or as habitat for wildlife. In addition to thinking of complementary actions to satisfy their own farming interests, they are entertaining ideas which may benefit society at large. Interest in making the sites more hospitable to wildlife surfaced frequently.

4.6 SHELTERBELTS

Eleven (24%) members participated in shelterbelt projects. Three had existing shelterbelts before joining the DSWMA, that ranged in length from 1.5 to 2.0 miles. The established shelterbelts were performing well in respect to:

* reducing wind erosion
* increasing heat units on fields
* capturing and dispersing snow
* reducing snow related problems on municipal roadways

The respondents had planted an average of 1.3 miles of shelterbelts each through the DSWMA. Green Ash was the most popular species (50%), followed by Willow, Siberian Larch, Chock Cherry (11% each), Buffalo Berry, Villosa Lilac and Siberian Elm (6% each). Preferred tree spacings within rows was four to eight feet (64%); 27 percent preferred less than four feet. All respondents preferred single row shelterbelts because better snow distribution is achieved and acreage removed from production is minimized. Members were generally unfamiliar with mixed species shelterbelts and unwilling to speculate on their effectiveness at reducing wind erosion. Single species were deemed potentially most effective (average score 4.3), based more on conjecture than on experience.

Respondents believed the periodical inclusion of berry bushes would be beneficial for wildlife (average score 4.1). Only two had incorporated them, but seven (64%) would consider them in future plantings. One farmer had previously removed shelterbelts and intended to remove more in the future because they were dying.

Respondents were evenly split in preference to maintaining the shelterbelts themselves (55%) or having the DSWMA maintain them until they were well established (46%). They spent an average one-and-one-third days per year maintaining the trees.

Respondents found shelterbelts generally conveyed benefits, except for impediments to machinery operation (Table 4.10).

TABLE 4.10

EFFECTS OF THE FIELD SHELTERBELT PROJECTS

	EFFECTS OF SHELTERBELTS FREQUENCIES (%)					
	GREAT "-"	SLIGHT "-"	NEGATIVE	SLIGHT "+"	GREAT "+"	AVERAGE SCORE*
REDUCED WIND EROSION	0	0	8	46	46	4.4
SNOW TRAP FOR MOISTURE	0	0	8	64	28	4.2
WILDLIFE	0	0	8	74	18	4.1
AESTHETIC	0	0	18	55	27	4.1
PROPERTY VALUE	0	0	37	55	8	3.7
MACHINERY OPERATION	0	55	45	0	0	2.5

n = 11

* Average score on a scale of 1 to 5, where 5 = great positive effect, 4 = slight positive effect, 3 = neutral, 2 = slight negative effect, and 1 = great negative effect.

Nine (82%) considered them important in reducing soil erosion caused by wind. Shelterbelts were also important for:

* providing winter snow retention to enhance soil moisture

* improving farm operations; as the daily spraying time could be extended, windrow damage by wind could be reduced, and more intensive tillage could be permitted without the increased threat of erosion

* creating microclimates that lower evapotranspiration levels and increase heat units

The majority of respondents (82%) felt that shelterbelts were important in their farm operations (average score 4.5). However, their trees were not mature enough yet to have any significant impact. When mature, they are expected to more than compensate for their cost because:

* their maintenance costs are low when established

* this is the cheapest conservation program - it delivers "... the most bang for the buck"

* the benefits are greater than the costs of the trees because crop yields may increase due to more moisture (ie: 10 extra bushels per acre at $6.00/bushel is $60.00)

* "... if it stops the field from eroding just once, you have gained far more than the cost of the shelterbelts."

All respondents preferred that the shelterbelt project be retained. Many were satisfied with the present system, but a few thought more "positive" advertisement of the economic benefits to the farmer would encourage widespread incorporation into farm management plans. Others believed a maintenance program is needed (ie: hire a summer student). An improved maintenance program would ensure better results (improve tree survival and tree growth).

4.7 GULLY STABILIZATION AND GRASSED WATERWAYS

Gullies are a problem on nine (20%) of the respondents' farms. All of these members practiced some form of gully stabilization (22%) or grassing of waterways (78%) before joining the DSWMA. Involvement stemmed mainly from an interest in conserving soil. Particular motivaters included:

* reduction of water erosion on a field in which a gully was developing
* provision for total on-farm water management - "grassed waterways are an essential part of the farm management plan on this quarter section"
* qualification for financial and technical assistance
* improvement of wildlife habitat

Four interviewees had gully stabilization projects, five had grassed waterways. Both activities were considered equally important for conserving soil on their farms (average score 4.9) and in their area (average score 4.7).

One-half of the gully stabilization participants were unsure if there was a positive effect on wildlife or on machinery operation (Table 4.11). Most others considered that there had been a slight benefit to the immediate and general area in respect to a reduction in soil erosion, to the aesthetics of the sites and the expected property value.

Most grassed waterway participants (80%) believed there was no effect or a slight negative effect on wildlife, due to the removal of trees along the previous watercourse dur-

ing reshaping and grassing (Table 4.12). Grassed waterways were perceived very valuable to the immediate area as well as reducing soil erosion. A slight increase in property value was indicated as was a slight improvement in convenience of machinery operation. Grassed waterways were considered to have no effect on farm aesthetics.

TABLE 4.11

EFFECTS OF THE GULLY STABILIZATION PROJECTS

	EFFECT FREQUENCY(%)					
	GREAT "-"	SLIGHT "-"	NEUTRAL	SLIGHT "+"	GREAT "+"	AVERAGE SCORE*
IMMEDIATE VICINITY	0	0	25	25	50	4.3
GENERAL AREA	0	0	25	50	25	4.0
SOIL EROSION	0	0	25	25	50	4.3
WILDLIFE	0	0	50	50	0	3.5
AESTHETIC	0	0	0	75	25	4.3
PROPERTY VALUE	0	0	0	75	25	4.3
MACHINERY OPERATION	0	0	50	50	0	3.5

n = 4

* Average score on a scale of 1 to 5, where 5 = great positive effect, 4 = slight positive effect, 3 = neutral, 2 = slight negative effect, and 1 = great negative effect.

TABLE 4.12

EFFECTS OF THE GRASSED WATERWAY PROJECTS

	EFFECT FREQUENCY (%)					
	GREAT "-"	SLIGHT "-"	NEUTRAL	SLIGHT "+"	GREAT "+"	AVERAGE SCORE*
IMMEDIATE VICINITY	0	0	0	20	80	4.8
GENERAL AREA	0	0	0	40	60	4.6
SOIL EROSION	0	0	0	20	80	4.8
WILDLIFE	0	20	80	0	0	2.8
AESTHETIC	20	0	60	0	20	3.0
PROPERTY VALUE	0	0	0	60	40	4.4
MACHINERY OPERATION	0	0	20	40	40	4.2

n = 5

* Average score on a scale of 1 to 5, where 5 = great positive effect, 4 = slight positive effect 3 = neutral, 2 = slight negative effect, and 1 = great negative effect.

Sixty percent believed their gully erosion problems had been stabilized and were progressively improving, due to a combination of careful tillage, stubble management and grassed waterways. One member's gully problems were becoming more severe, due to the continued advancement of existing gullies. Respondents overwhelmingly believed the benefits

derived from these activities outweighed the initial cost of implementation. Supportive reasons included:

* they are one of the quickest returns on investment (ie: the hay gained from the waterways pays for the cost of construction in three years)
* the benefits are balanced between the farmer (increased hay) and society (reduced siltation in waterways)
* the cost of not acting is greater
* the grassed waterways increase the mobility of large machinery
* they are cheap investments that yield immediate returns

Fifty percent of respondents believed there had been a change in their attitude, stating that they were now more conscious and less skeptical of the effects these activities have. All believed they should be retained as part of the DSWMA project. Most were satisfied with the existing level and scope of activities. Two felt cooperation between the DSWMA and the local municipality could be improved in respect to the use of municipal equipment for waterway work, and that the placement of trees around gullies could reduce the negative effects of snow accumulation in the gullies.

4.8 FORAGE AND PASTURE IMPROVEMENTS

Sixty percent of respondents had forage and pasture improvement projects, and two-thirds of these had been actively involved in related activities before becoming members of the DSWMA. Most were interested in enhancing production from native areas and reducing soil erosion while retaining moisture in situ. Other reasons were:

* improved productivity of soil (ie: seed down saline areas)
* improved pasture
* experimentation with green manure crops as an alternative to summerfallow
* rehabilitation of a mine site
* benefit from livestock manure
* recouping costs of improvements
* work forage production into rotations
* increase soil quality while reducing input costs (ie: important aspect of crop rotations)

Since joining the DSWMA, 60 percent of respondents had expanded their forage and/or pasture area. Several practices had been tested by the participants, including:

* seeding down knolls to forages
* developing annual barriers on second cut, 15 feet apart, two feet wide
* establishing green manures for plowdown material to improve soil tilth
* upgrading forage areas in rotation with cereals
* rotational grazing
* seeding down saline patches to permanent cover

Participants were generally attempting to improve areas with rolling terrain or eroded knolls, saline intercepts below the escarpment and existing forage and pasture fields, employing zero-tillage. Most (60%) used all the forages they produced on their own farms for livestock feed. Those with surpluses sold them mostly to local markets.

Three respondents produced seed and believed the DSWMA had a positive effect on their production system (average score 4.7). Respondents identified positive results from forage and pasture improvement activities on erosion prone and saline areas (Table 4.13). Slightly less positive results were seen with crop yields, property values, water management, farm expenses and farm management/operation. Five respondents were engaged in rotational grazing and stated that the DSWMA had a positive effect (average score 4.4). None practised delayed cutting or delayed grazing.

Respondents were of the opinion that the benefits derived from forage and pasture improvements outweighed the costs of establishment. Some observations included:

* forages contribute to long-term soil improvement and the elimination of weeds
* is now possible to attain self sufficiency in forage production, and improve forage quality
* it is difficult to tell due to poor weather
* soil deterioration can be halted and yields greatly improved - for example, on a saline area a farmer is "... gaining a crop where didn't get one before"

TABLE 4.13

EFFECTS OF THE FORAGE & PASTURE IMPROVEMENT PROJECTS

	EFFECT OF FORAGE AND PASTURE PROJECTS FREQUENCY (%)					
	GREAT "-"	SLIGHT "-"	NEUTRAL	SLIGHT "+"	GREAT "+"	AVERAGE SCORE*
EROSION PRONE AREAS	0	0	18	6	76	4.6
SALINE/ ALKALINE AREA	0	0	14	43	43	4.3
PROPERTY VALUE	0	0	48	37	15	3.7
FARM OPERATION/ MANAGEMENT	0	11	45	33	11	3.4
WATER MANAGEMENT	0	4	39	46	11	3.7
CROP YIELDS	4	4	17	46	29	3.9
FARM EXPENSES	0	4	41	44	11	3.6

n = 27

* Average score on a scale of 1 to 5, where 5 = great positive effect, 4 = slight positive effect, 3 = neutral, 2 = slight negative effect, and 1 = great negative effect.

More than half of the respondents maintained their prior attitudes towards forage and pasture improvements, while others had modified their attitudes due to:

* a strengthened belief in, and increased awareness of accrued benefits

* a gain in knowledge

* the use of green manure as a replacement for summer-fallow

* recognition of the benefits of crop rotations (ie: cereal - forage - cereal)

* rotational grazing that extended grazing an extra two weeks - especially important during a drought

All respondents but one believed that forage and pasture improvement should remain part of the DSWMA's mandate. One member felt there should not be government financial assistance for these activities. Respondents indicated that forage and pasture improvement projects could be improved by:

* demonstrating plants suitable for green manures

* recording and publishing records on demonstrations

* demonstrating various forage varieties, fertilizers and herbicides

* increasing demonstrations based on rotational grazing

* providing financial assistance in modifying site-specific problem areas (ie: to lessen soil erosion on slope land, remove marginal land from cereal production)

4.9 WILDLIFE ATTITUDES

A national survey in 1981 by Filion (1983), indicated that 80 percent of Canadians considered it important to maintain abundant wildlife. DSWMA members held similarly

strong attitudes. Eighty-nine percent considered it important to harbour wildlife on their farms, overwhelmingly due to the conviction that the opportunity to view wildlife makes country living more enjoyable. Other reasons given were:

* " I have always enjoyed wildlife and I want to maintain wildlife for the children"
* it is important for the biological community to co-exist
* some wildlife is beneficial to the farm (ie: control insect populations)
* wildlife on the farm adds prestige
* the wildlife has to be conserved as much as the land
* the wildlife is valuable for recreation and hunting
* wildlife should be maintained just for the sake of having them around
* a diverse wildlife population is an indicator of a healthy ecosystem

Deer were the most preferred species, followed by song birds, upland game birds, geese, ducks, hawks and owls, foxes and coyotes, and moose (Table 4.14). Other preferred species included sea gulls, rabbits, and beavers. Rodents were generally not preferred.

All respondents thought wetlands, bush and native pastures provided important habitat for wildlife (average score 4.9). Over 90 percent (91%) held the view that draining, breaking or clearing land has a negative effect on wildlife (average score 1.4), due mostly to loss of habitat. Comments on how land development affects wildlife included:

TABLE 4.14

PREFERRED WILDLIFE SPECIES

	PREFERENCE FREQUENCIES (%)		
	PREFERRED	NOT PREFERRED	NO OPINION
DEER	100	0	0
MOOSE	80	7	13
HAWKS/OWLS	91	7	2
SONG BIRDS	98	2	0
GEESE	96	4	0
DUCKS	93	7	0
UPLAND GAME BIRDS	96	4	0
FOX/COYOTE	84	16	0
RODENTS	40	58	2
OTHER	22	0	78
n = 45			

* less habitat means less wildlife

* if some land is drained, water storage should be created somewhere else

* habitat destruction is worse than hunting pressure ("... cats are worse than guns")

* wildlife is not affected because bad areas are drained which provides more food

* "destroying the natural habitat is permanent destruction, so we have to save what is left"

* there is limited habitat left, therefore any changes on remaining habitat will have a major impact

Most (82%) respondents considered some crop damage by wildlife an inevitable part of farming and believed the advantages of having wildlife on the farm outweigh the costs. They claimed wildlife caused very little damage, and were generally willing to accept the costs. There was great enthusiasm for the enjoyment that wildlife provides and many found it difficult to place a dollar value on that enjoyment. Two respondents considered wildlife more costly than they were worth.

Attitudes towards wildlife were generally positive as far as aesthetic (average score 4.5) and recreation/hunting (average score 4.0) values were concerned (Table 4.15). Wildlife was perceived to have no effect on the value of the farm property (average score 3.3) and caused no appreciable crop depredation (average score 2.6). However, wildlife tended to create a slight problem with trespassers (average score 2.5). One farmer found that some species of wildlife are effective in controlling less desirable species; eg: sea gulls came onto his farm and ate grasshoppers one year.

Respondents were generally perceptive of the effects their conservation efforts have on wildlife and their habitat (Table 4.16). The water retention projects were perceived to have the greatest value for wildlife (average score 4.0) as they are an important source of water, especially during dry seasons, and provide waterfowl habitat.

TABLE 4.15

THE EFFECTS OF WILDLIFE ON FARMS

	EFFECTS FREQUENCIES (%)						
	NO OPINION	GREAT "-"	SLIGHT "-"	N	SLIGHT "+"	GREAT "+"	AVER. SCORE*
AESTHETIC	0	0	0	9	31	60	4.5
RECREATION/ HUNTING	2	0	0	40	22	36	4.0
CROP DEPREDATION	0	4	27	64	0	0	2.6
PROPERTY VALUE	0	0	2	67	31	0	3.3
TRESPASSER PROBLEMS	0	11	33	56	2	0	2.5
OTHER	98	0	0	0	0	2	-

n = 45
* Average score on a scale of 1 to 5, where 5 = great positive effect, 4 = slight positive effect, 3 = neutral, 2 = slight negative effect, and 1 = great negative effect.

Conservation tillage was considered to be valuable for wildlife (average score 3.9). Compared to conventional tillage, these practices provide additional sources of food as spilled grains remain on the soil surface, leave more cover, and cause less disruptions for ground nesting birds. Forage and pasture improvements were also beneficial (average score 3.8), providing additional sources of food, nesting cover, and protective habitat for smaller species. Field shelter-

TABLE 4.16

THE EFFECTS CONSERVATION ACTIVITIES HAVE ON WILDLIFE

	EFFECTS FREQUENCIES (%)						
	NO OPINION	GREAT "-"	SLIGHT "-"	N	SLIGHT "+"	GREAT "+"	AVER. SCORE*
CONSERVATION TILLAGE	64	0	0	8	22	4	3.9
WATER RETENTION STRUCTURES	78	0	0	7	8	7	4.0
FIELD SHELTERBELTS	76	0	0	11	11	2	3.6
GULLY AND GRASSED WATERWAYS	80	0	2	13	2	2	3.2
FORAGE AND PASTURE IMPROVEMENTS	42	0	0	20	20	18	3.8

n = 45

* Average score on a scale of 1 to 5, where 5 = great positive effects, 4 = slight positive effect, 3 = neutral, 2 = slight negative effect, and 1 = great negative effect.

belts were deemed beneficial to wildlife (average score 3.6). Many considered the newly established trees not mature enough yet, but speculated that they will eventually provide nesting cover, travel corridors, shelter, shade and food.

Gully stabilization and grassed waterways are generally perceived to have little value for wildlife (average score

3.3), especially for nesting cover. Although the clearing and reshaping of waterways destroyed existing habitat, it also created the potential for new nesting areas and cover.

Interviewees were asked what changes could be made to projects that could further enhance wildlife habitat. They generally believed they should begin working more closely with wildlife organizations to become more aware of supportive programs. Currently, there is insufficient information readily accessible to farmers on how they can improve their farming practices to better accommodate wildlife. Respondents also mentioned that reduced taxes on marginal lands could stimulate the establishment of more passive land use practices, such as forage or trees, which would also benefit wildlife.

Conservation tillage practices could be further improved if fall tillage was eliminated or reduced (ie: harrow once). This would leave more spilt grain on the surface for wildlife. In addition to a food source, standing stubble could enhance cover for many wildlife species, such as grouse, moles and associated predator species. Less tillage activity would reduce overall disturbance.

Improvement to water retention structures themselves is of limited value in the provision of wildlife habitat. However, dense nesting cover could be encouraged on adjacent areas if livestock were fenced out. The placement of wood duck nesting boxes would further diversify the habitat.

Field shelterbelts could better provide wildlife needs if berry bushes were more regularly integrated into shelterbelts and if grassed strips were maintained along shelterbelts. Habitat would be increased if more shelterbelts were established throughout the area. To encourage shelterbelt incorporation into the on-farm management plan, local farmers should be provided with financial and technical incentives to establish trees both on-farm and up-field, parallel to municipal road allowances.

Forage and pasture improvement projects were viewed as being most valuable as feed, cover and nesting habitat. Delayed and/or rotational grazing are perceived as practical measures that improve habitat. No comments were forthcoming regarding gully stabilization or grassed waterways.

Sixty percent of those interviewed were interested in making their farms more attractive to wildlife (average score 3.9). One half (51.1%) have previously taken specific action. The average total acreage set aside by such individuals is 40 ha (100 ac), with a range of 0.8 - 160 ha (2 - 400 ac). An average 11 ha (27 ac) of wetland, ranging from 0.4 - 35 ha (1 - 87 ac), and 16 ha (40 ac) of native pasture, ranging from 6 - 28 ha(15 - 70 ac), were set aside. The average size woodlot is 38 ha (95 ac), ranging from 2 - 160 ha (4 - 400 ac). Although the total habitat acreage represented three categories, the distribution can not be

accurately presented because of many indistinct habitat areas. Many respondents were unsure of the exact acreage of each. The attempt at categorization does, however, provide a general picture of the land base as currently set aside for wildlife habitat.

4.10 SUMMARY OF RESULTS

DSWMA members were surveyed to establish the effectiveness of a government sponsored, locally administered conservation initiative. All interviewed members farmed on or near the escarpment, and generally had several years farming experience. Most respondents learned of the DSWMA through their neighbours and joined because of their personal interest in soil and water conservation. Conservation projects were undertaken for the combined benefit of themselves, their community and society. The conservation mandate and structure of the DSWMA has provided members with the opportunity to pursue these interests that they otherwise may not have been financially or technically able to do.

The executive members and the field technician efficiently conducted the administrative affairs of the Association. The success of the Association was a result of their good public relations with members, their informative tours of the demonstration sites, and their provision of information

to members. Although effective, the administration of DSWMA's activities could be improved with the inclusion of incentives, with financial assistance from the government, to encourage more sustainable land use practices on marginal lands. The dissemination of project information to members, and perhaps non-members, could be improved with the publication of a newsletter. Executive representation from all parts of the Association could better reflect area concerns.

The DSWMA could encourage associated government agencies to better coordinate their involvement with the Associations activities. Linkages with other funding programs and agencies could enable greater project variety. The Association could become more supportive of wildlife habitat with the provision of information on creating/improving habitat. Securement of sufficient government financial support was considered essential to ensure that the Associations mandate was met.

Projects demonstrated through the DSWMA were perceived to be effective for dealing with various local soil and water management problems. The cost-effectiveness of many of these projects could not be determined until further monitoring and experience was obtained through their continued operation. The unusually dry conditions in recent years impeded the establishment and progress of many projects. None-the-less, a positive attitude has prevailed, and the

beneficial effects of the DSWMA's activities continue to unfold.

Farmers perceived the implementation of conservation practices into their agricultural operations to be economically viable. Although only a slight reduction in short term production costs were realized, the prospect of long term protection of the land base from erosion was perceived to be of greater value. Initial assessments of the intangible benefits of stubble and surface residue management centred on reduced wind and water erosion, improved snow capture and greater in situ moisture retention. Long term benefits were perceived to be greater erosion control, improved soil structure, reduced production input costs and more flexible tillage systems.

Water retention structures were constructed to attain a variety of personal and societal benefits, including on-farm water management and storage, reduced downstream flooding, ground water recharge sites and water/habitat for wildlife. General uncertainty prevailed with respect to the immediate effects of the structures. This uncertainty may be a result of the drier than normal conditions in recent years and/or a lack of experience with operational structures. Some direct benefits were realized in reduced immediate downstream flooding, livestock water supply, recreational swimming and aesthetic appeal. There was speculation that less flooding

and erosion in the entire drainage system might be induced and that they were beneficial to wildlife. The structures were expected to eventually provide measureable beneficial effects to justify the initial financial investment.

Field shelterbelts are important to the area, and were anticipated to provide a variety of benefits to individual farm operations. Although those established through the DSWMA have not yet made significant impacts, the members are confident that, over their lifetime, the shelterbelts will more than compensate for their establishment costs. Winter snow retention may increase moisture levels great enough to support increased yields of as much as 10 extra bushels per acre. Shelterbelts, through wind reduction, complement farm operations by extending daily spraying times, reducing windrow damage and protecting soil from erosion when more intensive tillage operations are necessary. Properly located shelterbelts can create micro-climates that reduce evapotranspiration levels and increase heat units.

Stabilized gullies and grassed waterways were considered beneficial in abating water course degradation. Both techniques were effective in reducing the amount of soil erosion in the immediate vicinity. These projects appear to also improve the market value of the farmland. Gully stabilization does not significantly affect wildlife or machinery operation, but does possess some aesthetic value. Grassed

waterways likewise appears to offer little habitat value, but does improve the convenience of machinery operation. The benefits were perceived to justify implementation costs.

Forage and pasture management trials attempted to improve areas with rolling terrain, eroded knolls, saline intercepts and existing forage sites. The most favourable results were realized on the erosion prone and saline areas. Establishment expenditures were justified since slight economic benefits were realized in crop yields, property values, in situ water management and reduced farm operating expenses.

The general attitude towards wildlife was very positive. Respondents were generally aware of the positive effects their conservation activities were having on wildlife and wildlife habitat. The water retention structures were perceived to have the greatest value for wildlife, as they provided a source of water for drinking and nesting habitat for waterfowl. Conservation tillage activities were also considered to be valuable, especially for an additional source of feed, cover and less disturbed habitat.

Forage and pasture improvements were considered beneficial for providing food, nesting cover and protective habitat. Shelterbelts, although not mature yet, will provide nesting cover, travel corridors, shelter, shade and food. Gully stabilization and grassed waterway projects were not considered to be either destructive or beneficial for wildlife.

One half of the respondents have taken specific action to enhance wildlife opportunities. Sixty percent are interested in making their farms more attractive to wildlife. However, insufficient information is readily accessible on how their farming practices could better accommodate wildlife. The general attitude was that significant progress could be made if the DSWMA became more closely associated with supportive programs of wildlife organizations. The DSWMA is in general support of "no net loss" of wildlife habitat in the local escarpment area.

Chapter V

CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The DSWMA model is a successful locally administered approach to resource management that coordinates multi-agency assistance with farmers' soil, water and habitat conservation activities. Farmers are made more aware of local resource problems and the management techniques available to address them while effectively and efficiently channelling agency assistance to practical conservation activities. The DSWMA projects are improving farmers' management of local resources, providing the opportunity to diversify their farms further, and ensuring their farms productivity is sustained. The continual development and implementation of better resource management practices is not limited to the farmers' willingness to adopt these practices. It is limited by agencies' outdated "reactive" mandates, inefficient program delivery systems and reluctance to collectively cooperate as a united resource management planning team.

Four primary conclusions were drawn from this study:

1. the locally administered DSWMA was an effective resource management planning delivery system,

2. resource management agencies need to develop better inter-agency administrative cooperation and coordination,
3. coordinated resource management planning is the best approach to integrating multiple land use objectives, and
4. education is important in improving the awareness and knowledge of resource management technologies and activities.

5.1.1 The Deerwood Soil and Water Management Association

Agricultural land management programs traditionally have been designed from the top down. The Deerwood Soil and Water Management Association (DSWMA) model has demonstrated a new approach. It involves the participation of local producers from the identification of objectives through to project demonstration and evaluation. The underlying philosophy of this approach to conservation is that local residents are best able to identify local resource issues and thereby apply effective conservation technologies to address them. Producers are receptive to this type of program because it encourages them to pursue conservation activities that benefit themselves, their community and the environment.

DSWMA members were concerned about local resource issues and shared a common interest in managing them more responsibly. Membership was sought for a number of reasons: First, members attributed their initial interest in the DSWMA to the fact that local input was encouraged in identifying local resource issues and prospective management options. It was important to members to be involved in the conservation and management planning for their lands. The DSWMA provided the leadership and encouragement to do this.

Second, members believed that there was a common public and private interest in responsible resource management planning. The DSWMA was perceived to be an efficient body through which the public's support for conservation activities could be administered. The success of the DSWMA is due largely to the technical and financial assistance from various public and private institutions. This was important in reducing the economic risk associated with experimental techniques.

Third, it was important to members that a system exist through which they could exchange information and expand their knowledge base through outside sources. The DSWMA created a central coordinating body that provided a single source that farmers could turn to for technical and financial assistance. The DSWMA has reduced confusion over different programs and information sources through informing

members about the different types of technical assistance from various sources and coordinating the delivery of public and private institutions conservation services.

Fourth, the DSWMA facilitated the demonstration of site specific land management practices. Through these activities, farmers have indicated greater awareness of the environment and the impact their land use practices have on it. Site specific demonstrations expose farmers to local resource issues and the technology available to address these issues. The implementation of the various conservation techniques on the farms has provided a natural laboratory for learning and developing effective techniques. The result is better informed farmers who are conservation conscious and receptive to alternative, more environmentally responsible farming practices.

In addition, these demonstrations stimulate and support more "grass roots" thinking on local resource issues. This local involvement is a critical factor in changing traditional land use practices. As one member explained ..."It gets people thinking about what they are doing instead of just doing it out of routine." Breaking these "routine" land-use practices is a critical first step towards widespread adoption of conservation farming practices.

The central theme of the DSWMA has been on-farm conservation planning, focusing on controlling water induced soil

erosion. To accomplish this, the DSWMA has promoted in situ moisture management through the establishment of permanent cover, conservation tillage and shelterbelts, and the management of excess surface water through stabilized gullies, grassed waterways and water retention structures.

Conservation tillage activities consisted of a variety of demonstrations that accomodated the use of conventional tillage equipment while encouraging experimentation with various new conservation equipment. The diversity of activities assisted farmers in selecting appropriate techniques for their particular operation. Farmers adjusted their tillage practices and changed their tillage and cropping systems at a rate they were comfortable with. They were also able to take that "next step" and experiment with, for example, zero tillage.

Conservation tillage improved the use of available moisture and protection and enhancement of the soil productivity, created more flexible tillage systems, promoted complimentary activities and increased the general awareness of the environment and economic values associated with these activities. Overall, these practices have aided these farms to become environmentally responsible, resource efficient and productively and economically sustainable. Members indicated they plan to progress further with these activities and work towards a more "holistic" approach to farm management.

Water retention structures were an intrigal part of a complete on-farm management plan and a regional watershed resource management plan. The multi-purpose dams were valued most. The structures enabled the efficient use of natural moisture supplies, the securement of water to maintain present farm requirements, and the diversification of farm operations. Collectively, these structures offer many benefits to society. They protect public property from floods and reduce public maintenance expenditures and flood damage repairs. They also are environmentaly valuable for maintaining rural water quality, recharging ground water reserves, and enhancing wildlife habitat.

Overall, the water retention structures have illustrated to farmers that on-farm water management is important, is feasible and individual farmers are capable of effectively managing the resource. The rural community witnessed the cumulative impact of the structures on the whole catchment basin. A positive atmosphere now exists and complimentary actions are serving to better provide for their rural community.

Forage and pasture activities consisted of permanent cover establishment on marginal lands, overseeding forages into existing stands and green manure cover crops in place of summerfallow. The benefits of these activities were reduced soil erosion, increased surface moisture infiltration, and

improved soil nutrient recycling, soil structure, weed control and wildlife habitat. Other noted benefits included increased crop diversity and extended crop rotation systems that reduced insect, disease and weed problems, more efficient and productive grazing systems and "emergency" fodder for livestock. Interest was expressed in experimenting with biological pest control strategies, rotational grazing systems and delayed forage harvesting and pasture grazing for the benefit of wildlife.

Forage and pasture improvements are good investments for livestock and mixed operations. Green manure crops provide a practical alternative to summerfallow while enhancing soil moisture and nutrients. These low-cost investments have made these farm operations more viable.

Field shelterbelts were another economical management practice that required little financial risk. Investments consisted largely of time and labour for tree maintenance. Returns on investment were considered to be slow but substantial. Few shelterbelts deviated from the standard single row, green ash design which limited exposure to the variety of economic and environmental benefits. A maintenance program was not an option, but was considered an important feature that could improve tree survival and growth rates. Although shelterbelts may not compliment every farm management plan, they do provide a valuable low-cost conservation option.

Stabilized gullies and grassed waterways facilitate the safe movement of excess surface water while minimizing soil degradation. Stabilized gullies prevented further loss of productive farmland through site specific activities such as silt catchments, terraces, erosion mats, and adjacent land use changes such as conservation tillage, permanent cover crops and shelterbelts. Waterways complemented farm management plans by providing a safe methods of transporting surface runoff across farmland that other conservation measures, such as conservation tillage, stubble management and permanent cover could not retain in situ. Stabilized gullies and grassed waterways are valuable conservation practices when surface runoff cannot be avoided.

5.1.2 Administrative Cooperation and Coordination

The maintenance and preservation of our natural resources is a task best shared by a number of responsible individuals and agencies. The DSWMA demonstrated a coordinating body through which multi-agency involvement could be facilitated. The model illustrated a framework through which farmers were willing and able to work in partnership with public and private sector agencies. Furthermore, the model represents an opportunity for integrated resource management planning that can occur in a fast, efficient and flexible manner. Unfortu-

nately, program delivery was impeded by the lack of inter-agency cooperation.

The primary agencies involved with the DSWMA were the Prairie Farm Rehabilitation Administration (PFRA), the Manitoba Department of Agriculture (MDA), and Ducks Unlimited Canada (DU). The principal source of technical and financial assistance was the Federal-Provincial Agri-Food program. DU provided technical and financial assistance to the DSWMA. The DSWMA coordinated the delivery of the agencies' assistance with the conservation activities of the members. Members were generally satisfied with the DSWMA's internal administration. However, executive members considered the two separate administrative systems used by the government agencies to be inefficient and unnecessary. These agencies' criteria for allocating funds were inflexible and required excessive documentation. This placed unreasonable administrative demands on board executives which greatly reduced the efficient allocation of public conservation expenditures.

Financial assistance from DU, although somewhat limited, was generally more efficiently allocated to the soil and habitat conservation activities. The most valuable attribute of DU's delivery system was flexibility. Annual financial contributions to the DSWMA were unrestricted and could be freely administered to various conservation and habitat

activities. This flexibility allowed the DSWMA to implement technologies locally accepted and support more creative and ambitious conservation activities. DSWMA members accredited much of the improved habitat and wildlife numbers, especially around retention structures, to DU's activities and considered their continued involvement important to the DSWMA's holistic resource management planning.

The DSWMA modelled a coordinating body to facilitate multi-agency involvement and encourage inter-agency cooperation to assist with local resource management planning. A locally administered coordinating body is an efficient mechanism for linking these agencies' technical and financial resources with farmers' operations in addressing specific resource concerns. Although the DSWMA has demonstrated an effective model, a larger decentralized "regional" coordinating body such as a conservation district could support the administrative facilities and increase the number of participating agencies. The DSWMA would take on a "subregional" or subdistrict coordinating role in this scenario. More extensive agency participation, combined with better inter-agency cooperation and coordination, and an efficient and flexible local delivery body would stimulate more creative, workable and locally accepted conservation activities.

5.1.3 Coordinated Resource Management Planning

The conservation techniques demonstrated by the DSWMA have proven to be effective activities for specific management problems. However, no one technology will solve all farm conservation concerns. Each conservation technique will provide the optimum value when incorporated into a holistic farm management plan. Most members unfortunately did not receive enough guidance and support to adequately develop such a plan for their farms.

Agricultural conservation technologies were the primary interest of farmers, but they were also interested in addressing all resource issues - especially those dealing with wildlife. Farmers, aware of the negative effects of their past land use practices on wildlife, were in general support of a "no net loss" of wildlife habitat. Farmers' actions to incorporate practices and develop areas complimentary to wildlife was limited due to a lack of knowledge and readly available assistance from wildlife agencies. Farmers urged wildlife and other resource agencies to assume more responsible roles and become more involved in developing farm resource management plans.

The DSWMA has assumed a leadership role in coordinating various interests in managing local farm resources. This has been an exceptionally important achievement in initiating local farmers' involvement with planning management tech-

niques for themselves. However, resource problems are seldom limited to an individual farm's resources or resource uses. When put in perspective, the DSWMA's activities are only one small step toward a responsible resource management ethic - an integration of resource management planning. Integrating agriculture, wildlife, forestry, recreation and other environmental interests is most efficiently achieved through local groups, such as conservation districts, that are best equiped to initiate the process and monitor progress. Coordinated resource management planning promotes coordination and cooperation between agencies, groups and individual resource users. It initiates, under the direction and consent of all users of the resources in the area, a plan that integrates regional resources and their uses into one unified land use management plan that minimizes conflicts and matches land uses with their ecological capabilities. The development of such a plan would facilitate the expansion and implementation of the DSWMA's initiative throughout the Pembina escarpment area.

5.1.4 Education

DSWMA members have shown great interest in resource technologies that aid them in making their farms more productive and environmentally sound. The DSWMA model has improved

access to, and increased the availability of conservation information through the coordination of various agencies' assistance programs with farmers' needs. More importantly, however, the DSWMA model exposed farmers to an array of conservation ideas through annual meetings, guest speakers and tours of local conservation demonstration sites. Farmers' awareness of available conservation technologies has been improved while simultaneously stimulating thought on possible solutions to their farm's resource management problems. Personal assessment of experimental technologies is of great importance to farmers as they decide for themselves what works best in their operation. Experimentation is limited only by farmers' innovativeness and agencies' knowledge and support of up-to-date conservation technologies.

Government agencies provided valuable assistance to the DSWMA members on "conventional" conservation technologies. This assistance, although important, has not fulfilled the information needs of farmers to maintain and enhance the development of more innovative conservation techniques. Technical field personnel require better knowledge of progressive resource management technologies while simultaneously assuming more responsibility over monitoring and assessing local demonstrations. Senior agency officials need to re-examine and develop more proactive mandates. The bottom line is that both public and private agencies must assume a partnership role in future program initiatives.

Farmer's need more responsible and flexible supporting agencies.

Public education is an essential component of any management planning effort involving natural resources. Agricultural production systems have been stereotyped as inefficient and environmentally degrading processes. It is, therefore, important to better inform the public that the farm community is equally concerned about the environment and with their assistance are pursuing better management practices. It is the responsibility of individuals, groups and agencies involved with resource management planning to inform the public. Most importantly, the next generation of resource users need to be made aware of the conservation ethic so that the land and the land users can " ... both end up better by reason of their partnership ..." (Leopold 1939).

5.2 RECOMMENDATIONS

The Deerwood Soil and Water Management Association model has great potential for employing integrated resource management planning in the agricultural regions of the province. Based on the experiences of the DSWMA members and a review of the related literature, the following recommenda-

tions are provided to improve the DSWMA model and facilitate the expansion of this conservation initiative.

5.2.1 Recommendations to Farmers

1. Farmers have the primary responsibility of operating a business that is both economically viable and environmentally responsible. Farmers should, therefore, take the conservation initiative and incorporate appropriate conservation technologies into their operations.
2. Farmers should take advantage of the technical and financial assistance available to them for resource management planning from various agencies such as the Manitoba Department of Agriculture, the Prairie Farm Rehabilitation Administration, the Manitoba Department of Natural Resources, Ducks Unlimited, and local fish and game clubs.
3. Farmers need to make these agencies aware of the shortcomings of their present extension programs and make them more responsive to farmers information needs regarding resource management.

5.2.2 Recommendations to the DSWMA

1. The DSWMA should continue to operate as a local producer group demonstrating conservation technologies appropriate for local resource management problems.
2. Executive representation from all parts of the Association should be considered so that all area concerns are represented.
3. A project advisory board for each project type should be established to monitor, evaluate and report to the executive board project activities.
4. Future conservation activities demonstrated through the DSWMA should be implemented as an intrigal part of a comprehensive on-farm management plan.
5. The high degree of interest by members in creating and enhancing wildlife habitat suggests that the DSWMA should incorporate wildlife habitat enhancement into its conservation objectives.
6. The DSWMA should develop a report outlining its wildlife objectives on area farmland. This report should outline an initial framework for the implementation of an integrated land management mosaic to complement a regional mosaic by the Pembina Valley Conservation District.
7. The DSWMA should establish a newsletter that covers DSWMA events, activities and demonstration high-

lights. The newsletter should be distributed to members and supporting agencies, and made available to other interested parties.

Specific recommendations for each project type are as follows:

1. Conservation tillage
   - improved monitoring of tillage activities
   - provide members with more/better information on new technologies
   - continue to purchase/lease/rent any equipment that promotes conservation

2. Water retention structures
   - the implementation and monitoring of these structures should remain the focus of the program.
   - the initial intention to establish a "network" of structures on the South Tobacco Creek watershed should remain a priority.
   - the support ceiling on construction costs should be increased to accommodate larger dams in the class 2 and 3 drains.
   - DSWMA should seek inter-agency support in designing, locating and constructing these structures.
   - consideration should be given to the demonstration of alternative structure designs.

3. Field shelterbelts
   - demonstrations should expand to encompass technical and financial assistance for shelterbelt planning, establishment, maintenance and renovation.
   - a shelterbelt maintenance program should be made available to interested members.
   - shelterbelt demonstrations should be initiated jointly with the local RM's on unused road rights-of-way and on private lands parallel to municipal roads.

4. Gully stabilization and grassed waterways
   - integrate shelterbelts to protect against snow accumulation in channels.
   - continue cooperative efforts on waterway works with local municipalities.

5. Forage and pasture improvements
   - focus assistance on site specific problem areas such as saline seeps, highly erodible

knolls and mine reclamations.
- increase assistance for demonstrating and implementing rotational grazing systems.
- continue to encourage the demonstration of various forage varieties, including those for green manure crops, native plant species, and those useful for enhancing wildlife habitat.

6. In addition to these improvements, the DSWMA should continue to demonstrate other conservation techniques such as vegetated field boarders, terracing, contour cropping and woodlot establishment and management.

7. To enhance the value of the present conservation activities for wildlife, it is recommended:
   - conservation practices should be used that reduce or eliminate fall tillage operations.
   - dense nesting cover should be established on uplands surrounding water retention structures.
   - field shelterbelts should contain a variety of tree species, including berry species.
   - field shelterbelt planning should take into account their value as travel corridors along waterways and between woodlots.
   - delayed forage harvesting and delayed grazing should be activities demonstrated as practical measures to improve habitat in key nesting areas.

5.2.3 Recomendations to the Pembina Valley Conservation District

1. The Pembina Valley Conservation District should assume the role of a decentralized regional body that provides coordination, education and lobbies for support from public and private institutions for groups, such as the DSWMA, interested in resource management.
2. To facilitate the development of a coordinated resource management plan, the PVCD should establish a

coordinating committee that consists of representatives from all levels of government, non-government organizations and other local groups with an interest in local resource planning and management.

3. A moderator should be appointed to conduct the planning sessions. In order to avoid perceived bias, an outside moderator would be more effective.

5.2.4 Recommendations to the Government of Manitoba

1. The Provincial Government must take the lead role in extending the principals of the DSWMA model throughout Agro-Manitoba. Coordinated resource management planning should be institutionalized in Manitoba with legislative designation that specifies the role of conservation districts in the program
2. The MDA should assume a more proactive mandate that is more responsive to farmers conservation needs.
3. Extension personnel in the MDA need to become better trained and knowledgable of new conservation technologies and become better equiped to monitor and evaluate conservation demonstrations.
4. Inter-agency cooperation should be given high priority for improving the effectiveness of program delivery and efficiency of public expenditures.

5. The Department of Natural Resources should establish regional field representatives to provide farmer's with easy access to wildlife information. These positions should be incorporated into regional agricultural offices.
6. The Department of Education should upgrade agriculture/ecological and natural resource management curriculum content for primary, secondary and post-secondary educational institutions.
7. The Province should establish courses in resource conservation and management that provide training to farmers, extension personnel and field technicians in current conservation and management practices.
8. A farm tax rebate program should be initiated by the Province in addition to the "conservation lands" tax adjustment with the objective of further encouraging conservation land use practices and less development pressure on marginal lands.
9. An economic evaluation of the cost-effectiveness of the DSWMA's conservation activities should be conducted by the Department of Agriculture with additional support from Water Resources and the Department of Natural Resources, Wildlife Branch.

5.2.5 Recommendations to the Government of Canada

10. The PFRA should develop a more proactive conservation mandate that provides the necessary leadership to the farm community on progressive resource management techniques.
11. PFRA extension personnel should receive better training on innovative conservation technologies and field demonstration monitoring.
12. The PFRA should assign inter-agency cooperation a high priority to ensure the delivery of future programs are more effectively and efficiently administered.

5.2.6 Recommendations to Wildlife Agencies

1. All wildlife agencies should place more emphasis on developing landowner programs that promote conservation farming practices which compliment wildlife.
2. Wildlife agencies should work more closely with agriculture agencies to develop policies and programs that complement each other's conservation goals.
3. Ducks Unlimited should become more active in designing and demonstrating resource management activities with agricultural agencies and increase the financial support to farmers initiating these conservation/habitat activities.

4. Wildlife Habitat Canada should actively support and promote joint agriculture-wildlife conservation programs.

5.2.7 Recommendations to all Resource Management Agencies

1. The development of future conservation programs, whether initiated by public or private agencies, or local groups, should seek to coordinate and integrate their conservation interests with one another so that all programs compliment each other's conservation goals.
2. All agencies should support and encourage multi-agency cooperation in coordinating resource management planning.
3. All agencies should recognize the importance of input by local resource users and encourage their involvement in developing, implementing and monitoring resource management plans on their land.
4. Information campaigns should be initiated by all resource agencies to increase awareness and demand for resource management programs such as the DSWMA model.
5. All agencies should support interest relief or subsidy programs on the purchase of conservation equipment.

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Appendix A

DSWMA MEMBER QUESTIONNAIRE

DEERWOOD SOIL AND WATER MANAGEMENT ASSOCIATION

LANDOWNER INFORMATION

Interview number: _____

Date: _____

Name: _____

Address: _____

Phone #: _____

Lot/legal description: _____

DSWMA project participation

		acres	miles
___	conservation tillage		
___	water retention structures (#)		
___	field shelterbelts		
___	gully & grassed waterways		
___	forage and pasture		

DEFINITION OF TERMS

1. CONVENTIONAL TILLAGE: a system where the soil surface is totally mixed or inverted by plowing, disking or other means to control weeds and to prepare a seed bed. Seeding is done into a seed bed with little or no residue cover.

2. CONSERVATION TILLAGE: any soil management system that leaves the soil more resistant to erosion and conserves more moisture than does conventional tillage by retaining crop residue on the soil surface.

3. REDUCED TILLAGE: a system in which the number of tillage operations are less than and not as intense as conventional tillage.

4. MINIMUM TILLAGE: a system which retains a portion of the previous crop's residue on the soil surface by using the least soil disturbance methods for crop production under existing soil and climatic conditions.

5. ZERO-TILLAGE (No-till): a system where a crop is seeded directly into undisturbed stubble from the previous crop, with less than 25 percent soil disturbance. Chemical weed control is a necessary part of the system. Other names are no-tillage, chemical tillage, direct seeding or direct drilling.

	INFLUENCE				
POSITIVE			NEGATIVE		
great	slight	neutral	slight	great	no opinion
5	4	3	2	1	0

GENERAL

1. The DSWMA was established in 1984. When did you become a member?

year _____

2. How did you find out about the DSWMA?

3.a) Why did you join the DSWMA?

b) Why did you become a member when you did?

4. To what extent did the financial and technical assistance provided through the DSWMA influence you to adopt soil and water conservation practices on your farm?

	INFLUENCE					NO
	+		N		-	OPINION
a) financial incentives	5	4	3	2	1	0
b) technical incentives	5	4	3	2	1	0
c) other _____	5	4	3	2	1	0

5. The following is a list of problems farmers face with their land. Thinking of the problems you may have had on your land before the DSWMA project started, on approximately how many acres was each a problem?

		COMMENT	ACRES
a) salinity/alkalinity	Y N	_____	( )
b) wind erosion	Y N	_____	( )
c) water erosion	Y N	_____	( )
d) organic matter decline	Y N	_____	( )
e) soil compaction	Y N	_____	( )
f) poor drainage (flooding)	Y N	_____	( )
g) lack of moisture retention	Y N	_____	( )
h) weeds/disease	Y N	_____	( )
i) other (specify)	Y N	_____	( )

6.How have these problems changed since the DSWMA started?

		CHANGE					NO
	ACRES	+		N		-	OPINION
a) salinity/alkalinity	( )	5	4	3	2	1	0
b) wind erosion	( )	5	4	3	2	1	0
c) water erosion	( )	5	4	3	2	1	0
d) organic matter decline	( )	5	4	3	2	1	0
e) soil compaction	( )	5	4	3	2	1	0
f) poor drainage (flooding)	( )	5	4	3	2	1	0
g) lack of moisture retention	( )	5	4	3	2	1	0
h) weeds/disease	( )	5	4	3	2	1	0
i) other (specify)	( )	5	4	3	2	1	0

7.a) Have you undertaken any drainage operations, broken any native pasture, or cleared bush on your farm in the 10 years prior to becoming a DSWMA member? Y N If no, go to #10.

b) How many acres?

_____ acres of drainage operations

_____ acres of native pasture broken

_____ acres of bush cleared

8.a) Have you undertaken any drainage operations, broken native pasture or cleared bush on your farm while a DSWMA member? Y___ N___

b) How many acres?

_____ acres of drainage operations

_____ acres of native pasture broken

_____ acres of bush cleared

9. What are the main reasons for these activities on your farm?

____ to bring more land into production

____ to make field work easier

____ to gain more wheat board quota

____ to reduce damage to crops by wildlife

____ other _____

10. a) Do you plan to undertake any drainage operations, break native pasture, or clear bush on your farm within the next 5 years? Y N If no, go to #11

b) How many acres?

____ acres of drainage operations

____ acres of native pasture broken

____ acres of bush cleared

11. What effect has the DSWMA soil and water management demonstration project had on your:

	EFFECT +		N		-	NO OPINION
a) awareness of soil conservation	5	4	3	2	1	0
b) skills in soil conservation	5	4	3	2	1	0
c) soil conservation activities	5	4	3	2	1	0
d) awareness of moisture management	5	4	3	2	1	0
d) other _____	5	4	3	2	1	0

12.a) How effective do you feel you have been at decreasing soil erosion on your farm?

EFFECTIVENESS +		N		-	NO OPINION
5	4	3	2	1	0

b) Comment:

13.a) Do you feel you have been effective at decreasing off-farm problems associated with soil erosion?

EFFECTIVENESS					
+		N		-	
5	4	3	2	1	0

b) Comment:

14.a) How important are the DSWMA conservation demonstrations to your farming operation?

	IMPORTANCE					NO
	+		N		-	OPINION
overall	5	4	3	2	1	0
conservation tillage	5	4	3	2	1	0
water retention structures	5	4	3	2	1	0
gullies and grassed waterways	5	4	3	2	1	0
forage and pasture	5	4	3	2	1	0
field shelterbelts	5	4	3	2	1	0

b) Why are they important/not important to you?

15.a) How important are the DSWMA conservation demonstrations to your area?

IMPORTANCE					NO
+		N		-	OPINION
5	4	3	2	1	0

b)Why are they important/not important to your area?

16.a) Do you, as a farmer, feel there is a need for an Association like the DSWMA in your area?

NEED					NO
+		N		-	OPINION
5	4	3	2	1	0

b) Why do you think it is needed in your area?

17.a) Overall, do you feel the DSWMA has been effective in developing and demonstrating a soil and water management project?

EFFECTIVENESS					NO
+		N		-	OPINION
5	4	3	2	1	0

b) Comment:

18.a) What changes (if any) would make the Association more attractive to you?

	ATTRACTIVENESS					NO
	+		N		-	OPINION
1. no changes needed	5	4	3	2	1	0
2. incentives to retain bush lots/marginal lands/sloughs	5	4	3	2	1	0
3. provide more/better information	5	4	3	2	1	0
4. increase financial assistance	5	4	3	2	1	0
5. increase technical assistance	5	4	3	2	1	0
6. other _____	5	4	3	2	1	0

b) Comments:

19.a) How satisfied are you with the various governments and DSWMA's system of:

	SATISFACTION					NO
	+		N		-	OPINION
1. financial assistance	5	4	3	2	1	0
2. technical assistance	5	4	3	2	1	0
3. time taken to receive funding	5	4	3	2	1	0
4. other _____	5	4	3	2	1	0

b) Comments:

20. From what you know about the DSWMA at this time, would you recommend it to other farmers in other municipalities?

RECOMMEND					NO
+		N		-	OPINION
5	4	3	2	1	0

21.a) How important is it to you that the activities of the DSWMA continue?

IMPORTANCE					NO
+		N		-	OPINION
5	4	3	2	1	0

b) Comments:

22.a) If DSWMA should continue, what should be the objectives of its management plan?

b)What direction should it take concerning soil conservation?

c) What direction should it take concerning water management?

23. If you have not tried conservation tillage on your farm, why not?

24. If you have not constructed any water retention structures as part of the DSWMA demonstration project, why not?

25. If you have not applied for assistance in establishing or maintaining field shelterbelts, why not?

26. If you did not practice any gully stabilization or construcy any grassed waterways as a DSWMA project demonstration, why not?

27. If you did not practice any forage or pasture improvements under the DSWMA demonstration project, why not?

CONSERVATION TILLAGE

1. What term best describes your present tillage system?

1 conventional tillage

2 conservation tillage

____ minimum tillage

____ reduced tillage

____ no tillage

2.a) How many tillage operations do you perform to prepare a seed bed?

CROP	FALL	SPRING

b) Comments:

3.a) DSWMA has provided various implements for its members to rent. Have you tried any of this equipment? Y N

b) How satisfied were you with it? Eg:

-advantages/disadvantages -costs (rent/purchase/operation)

-performance (soil type/conditions) - crop residue it was used on

-speed/convenience -crop residue it was used on

a) Haybuster hoe drill 5 4 3 2 1 0

b) Haybuster double disc drill 5 4 3 2 1 0

c) Lyleston double disc drill 5 4 3 2 1 0

d) Tye DD with colters drill 5 4 3 2 1 0

e) Amazon hoe drill 5 4 3 2 1 0

f) Conershay direct seeded 5 4 3 2 1 0

g) Blade plows 5 4 3 2 1 0

h) Sub soiler 5 4 3 2 1 0

i) Other _____ 5 4 3 2 1 0

j) Other _____ 5 4 3 2 1 0

4. What effect has using conservation tillage methods had on:

	COMMENT	EFFECT +	N	-	NO OPINION
a) crop yields	_____	5	4 3 2	1	0

b) fertilizer costs _____ 5 4 3 2 1 0

c) machinery costs _____ 5 4 3 2 1 0
(repairs etc)

d) weed control costs _____ 5 4 3 2 1 0

e) labour costs _____ 5 4 3 2 1 0

f) fuel costs _____ 5 4 3 2 1 0

g) soil moisture _____ 5 4 3 2 1 0

h) tillage date (spring) _____ 5 4 3 2 1 0

i) net farm income _____ 5 4 3 2 1 0

5.a) What effect has conservation tillage had on soil erosion on your farm? (ie: local environment?)

EFFECTIVENESS					NO
+		N		-	OPINION
5	4	3	2	1	0

b) Comment:

6 a) Conservation tillage is a soil management system. Aside from actual tillage practices, what other techniques do you use to retain crop residue on the soil surface and how effective are they? For example:

		EFFECTIVENESS					NO
		+		N		-	OPINION
a) stubble management (strips, variable height, etc)	Y N	5	4	3	2	1	0
b) winter cover crop (fall rye)	Y N	5	4	3	2	1	0

c) chem-fallow Y N 5 4 3 2 1 0

d) surface residue management Y N 5 4 3 2 1 0

e) green manuring Y N 5 4 3 2 1 0

f) strip cropping Y N 5 4 3 2 1 0

g) contour farming Y N 5 4 3 2 1 0

h) field size/orientation Y N 5 4 3 2 1 0

i) other _____ Y N 5 4 3 2 1 0

b) What type of cropping rotations do you follow?

7 a) How important do you think snow management is in increasing soil moisture availability?

IMPORTANCE					NO
+		N		-	OPINION
5	4	3	2	1	0

b) Comment.

8.a) Do you summer fallow? Y N

b) If yes,do you think soil moisture loss in summer fallow fields is most effectively controlled by:

____ trash cover on the soil surface

or

____ cultivation

c) Comment:

9. What type of pesticides do you use on your conservation tillage fields? How well do they perform?

CROP	TILLAGE PRACTICE	PESTICIDE	PERFORMANCE
			5 4 3 2 1 0
			5 4 3 2 1 0
			5 4 3 2 1 0
			5 4 3 2 1 0
			5 4 3 2 1 0

10.a) Has the high cost of pesticides inhibited your experimenting with conservation tillage techniques?

INHIBITED					NO
+		N		-	OPINION
5	4	3	2	1	0

b) Comment:

11.a) How important is conservation tillage in your farm operation?

IMPORTANCE					NO
+		N		-	OPINION
5	4	3	2	1	0

b) Comment:

12.a) What type of cropping practice are you demonstrating?

b) How is the demonstration acreage different from your normal cropping practices?

13. What is the predominant soil texture of the demonstration site?

____ Clay ____ Loam ____ Sand

____ Clay loam ____ Sandy loam ____ other

14.a) Were you practicing conservation tillage before becoming a DSWMA member? Y ____ N ____

b) If yes, how many years? _____ How many acres? _____ .

15.Why did you start before/after?

16. Do you think the benefits of conservation tillage outweigh the costs?

		BENEFITS			NO
+		N		-	OPINION
5	4	3	2	1	0

17. Why were you interested in this part of the project?

18.a) Is it advantageous for DSWMA to purchase machines for demonstration? ie: a machine co-op?

		ADVANTAGEOUS			NO
+		N		-	OPINION
5	4	3	2	1	0

b) Should DSWMA money be spent on conservation tillage equipment?

19.a) Do you feel there is sufficient information on conservation tillage available to you?

		SUFFICIENT			
		INFORMATION			NO
+		N		-	OPINION
5	4	3	2	1	0

b) Do you have easy access to information?

20.a) Should conservation tillage remain a part of the DSWMA demonstration project? Y___ N___

b) If yes, how can the demonstrations be improved?

21.a) Has your attitude towards conservation changed since you became a member?

CHANGE					NO
+		N		-	OPINION
5	4	3	2	1	0

b)How?

WATER RETENTION STRUCTURES

1. What type of structure(s) do you have on your farm?

a) multi-purpose dam

b) dry dam, flood control dam

c) backflood

2.a) When was it constructed?

b) What was the cost?

c) What is the storage capacity?

d) What is the predominant soil texture immediately surrounding the site?

____ Clay ____ Loam ____ Sand

____ Clay loam ____ Sandy loam ____ Other

3.a) What effects has the structure(s) had on your own land?

EFFECTS					NO
+		N		-	OPINION
5	4	3	2	1	0

b) Comment:

4. What effects has the stucture(s) had on:

	EFFECTS					NO
	+		N		-	OPINION
a) immediate downstream flooding/erosion	5	4	3	2	1	0
b) entire drainage system flooding/erosion	5	4	3	2	1	0
c) perceived value for livestock water	5	4	3	2	1	0
d) adjacent farming practices	5	4	3	2	1	0
e) wildlife habitat	5	4	3	2	1	0
f) irrigation (mechanical/natural)	5	4	3	2	1	0
g) property value	5	4	3	2	1	0
h) aesthetic	5	4	3	2	1	0
i) farm income	5	4	3	2	1	0
j) other _____	5	4	3	2	1	0

5.a) In your opinion, is the implementation of a network of small water control structures on Tobacco Creek effective in controlling water erosion?

EFFECTIVENESS					NO
+		N		-	OPINION
5	4	3	2	1	0

b) Comment:

6.a) What, if any, alternative uses have you developed from the dam(s) and how effective have you found them to be?

	EFFECTIVENESS					NO
	+		N		-	OPINION
a) _____	5	4	3	2	1	0
b) _____	5	4	3	2	1	0
c) _____	5	4	3	2	1	0

b) What, if any, alternate uses do you intend to develop from the dams within the next five years?

7. Why were you interested in the water retention part of the project?

8.a) Do you think the total benefits of the dams outweigh the total costs of construction?

b) Comments:

9. Has your attitude changed towards on-farm water management since becoming a member?

10.a) Should water retention structures remain a part of the DSWMA demonstration project? Y___ N___

b) If yes, how can the water structures be improved?

c) If yes, how should the placement of the dams be determined?

FIELD SHELTERBELTS

1.a) Did you have shelterbelts before joining the DSWMA? Y N

b)How many miles? _____ miles

2. Are these established shelterbelts doing what they were intended to do?

3. How many miles of shelterbelts have your planted since becoming a member? _____ miles

b)Do you prefer to maintain the field shelterbelts yourself or have DSWMA do it? self____ DSWMA____

4. What species of trees are included in your shelterbelts?

-Caragana
-Villosa lilac
-Buffaloberry
-Chokecherry
-Honeysuckle
-Manitoba maple
-Green ash
-Siberian elm
-Poplar varieties
-Willow varieties
-other

5. What is the spacing of the trees within the rows of your field shelterbelts?

1. <4 feet
2. 4 - 8 feet
3. >8 feet

6. What spacing within rows have you found to be most effective?

1. <4 feet
2. 4 - 8 feet
3. >8 feet

7.a) Do you prefer single row or multi row shelterbelts?

____ single row

____ multiple row

b) Why is this your preference?

8.a) How effective do you think the following types of shelterbelts are in reducing wind erosion?

	EFFECTIVENESS					NO
	+		N		-	OPINION
mixed species	5	4	3	2	1	0
single species	5	4	3	2	1	0

b) Comment:

9.a) What effect do you think the periodical inclusion of berry bushes in shelterbelts would have on wildlife?

	EFFECT					NO
	+		N		-	OPINION
	5	4	3	2	1	0

b) Have you done this in your shelterbelts before?

Y___ N___

c) Would you consider doing this in the future?

Y___ N___

10. How much time (days/year) do you spend maintaining your shelterbelts?

11a) Have you removed field shelterbelts? Y___ N___

b) If yes how many acres? _____ acres

c) Why were they removed?

12.a) Are you intending to remove any in the future? Y___ N___

b) If yes why?

13.a) Do you think field shelterbelts are necessary for the conservation of soils on your land? Y___ N___

b) Comment:

14. What is the predominant soil texture where you have established the field shelterbelts?

____ Clay ____ Loam ____ Sand

____ Clay loam ____ Sandy loam ____ Other

15.a) How important are field shelterbelts in your farm operation (ie: management plan)?

IMPORTANCE					NO
+		N		-	OPINION
5	4	3	2	1	0

b) Comment:

16. How important are they in your area?

17. What effects do shelterbelts have on:

	EFFECT					NO
	+		N		-	OPINION
a) reducing wind erosion	5	4	3	2	1	0
b) snow trap for moisture	5	4	3	2	1	0
c) wildlife	5	4	3	2	1	0
d) aesthetic	5	4	3	2	1	0
e) property value	5	4	3	2	1	0
f) machinery operation	5	4	3	2	1	0
g) other _____	5	4	3	2	1	0
h) other _____	5	4	3	2	1	0

18. Are the Shelterbelts doing what they were intended to do?

19. Do you think the benefits of having shelterbelts outweigh the costs?

20.a) Should field shelterbelts remain a part of the DSWMA demonstration project? Y___ N___

b) If yes, how can the demonstration be improved?

GULLY STABILIZATION AND GRASSED WATERWAYS

1.a) Do you have any gully problems on your farm? Y N

b) If yes, are they getting better or worse? explain

2.a) Did you practice either of these before becoming a member? GS ____ GW ____

b) Have you since becoming a member? GS___ GW___

3. What is the predominant soil texture at your gullies and grassed waterways?

____ Clay ____ Loam ____ Sand

____ Clay loam ____ Sandy loam ____ Other

4. Do you think (GS / GW) is important for the conservation of soils:

	IMPORTANCE					NO
	+		N		-	OPINION
a) on your farm	5	4	3	2	1	0
b) in your area	5	4	3	2	1	0

5. What effect has (GS / GW) had on:

	EFFECT					NO
	+		N		-	OPINION
a) immediate vacinity	5	4	3	2	1	0

b) general area	5	4	3	2	1	0
c) soil erosion	5	4	3	2	1	0
d) wildlife	5	4	3	2	1	0
e) aesthetic	5	4	3	2	1	0
f) property value	5	4	3	2	1	0
g) machinery operation	5	4	3	2	1	0
h) other _____	5	4	3	2	1	0

6. Do you think the benefits outweigh the costs?

7. Why were you interested in this part of the project?

8.a) Should these activities remain part of the DSWMA project? Y___ N___

b) If yes, how could these activities be improved?

9. Has your attitude towards (GS / GW) changed since you became a member?

FORAGE AND PASTURE IMPROVEMENT

1.a) Have you practiced forage &/or pasture improvement before becoming a member? Y___ N___

b) If yes, how many acres? _____ acres

2.a)Have you expanded your area in forage &/or pasture since you became a member? Y N _____ acres

b)Do you have more forages than you can use on your own operation? Y N

c) What are you doing with your forages?

3.a)What practices have you tried? eg:annual barriers, cover noles etc.

b)Why these specific ones? What have been the effects?

c) what areas have you tried to improve?

d)what varieties of grasses,techniques etc. have you tried?

4. What is the predominant soil texture of the areas you have improved?

____ Clay ____ Loam ____ Sand

____ Clay loam ____ Sandy loam ____ Other

5. What effect has forage and pasture improvement had on:

	EFFECT +		N		-	NO OPINION
a) erosion prone areas	5	4	3	2	1	0
b) saline/alkaline areas	5	4	3	2	1	0
c) property value	5	4	3	2	1	0
d) farm operation/mgnt (work load, time)	5	4	3	2	1	0
e) water mgnt (eg: soil infiltration)	5	4	3	2	1	0
f) crop yields	5	4	3	2	1	0
g) farm expenses (eg: fertilizer, fences	5	4	3	2	1	0
h) other _____	5	4	3	2	1	0
i) other _____	5	4	3	2	1	0

6.Are you practicing ... and if yes, what effect has DSWMA had on ...

	EFFECT +		N		-	NO OPINION
forage seed production _____	5	4	3	2	1	0
rotational grazing _____	5	4	3	2	1	0
delayed cut/rotational grazing _____	5	4	3	2	1	0

7. Do you think the benefits outweigh the costs?

8. Why were you interested in this part of the project?

9.a) Should it remain part of the DSWMA project? Y___ N___

b) If yes, how can the demonstrations be improved? eg: make seeding equipment more readily available when needed, develop a market for forages ... .

10.Has your attitude towards forage and pasture improvement changed since becoming a member?

WILDLIFE

Conservation practices such as those practiced by the DSWMA indirectly improve and provide new habitat for wildlife in the area. The next few questions will deal with your feelings about wildlife in relation to your activities through the DSWMA.

	IMPORTANCE					NO
	+		N		-	OPINION
1.a) In general, how important is it for you to have wildlife on your farm?	5	4	3	2	1	0

b) Comment:

c) What type of wildlife do you like to view on your farm?

____ Deer
____ Moose
____ Hawks/Owls
____ Song birds
____ Geese
____ Ducks
____ Upland birds
____ Foxes/Coyotes
____ Rodents
____ Other

						NO
	-		N		+	OPINION
2. Do you feel that the opportunity to view wildlife makes living in a rural area more enjoyable?	5	4	3	2	1	0
3. How interested are you in making your farm more attractive to wildlife?	5	4	3	2	1	0
4. Do you feel that some crop damage by wildlife is an inevidable part of farming?	5	4	3	2	1	0
5. Do you think that sloughs, bush, and native pastures provide important habitat for wildlife?	5	4	3	2	1	0
6.a) Do you think drainage, breaking or clearing land will affect wildlife on your farm?	5	4	3	2	1	0

b) How?

7.a) Have you set aside any land on your farm for wildlife?

Y___ N___

b) How many acres?

____ acres of slough

____ acres of native pasture

____ acres of bush

8. What effect does wildlife have on your farm:

	EFFECT +			N		-	NO OPINION
a) aesthetic	5	4	3	2	1		0
b) recreation/hunting	5	4	3	2	1		0
c) crop depredation	5	4	3	2	1		0
d) property value	5	4	3	2	1		0
e) tresspasser problems	5	4	3	2	1		0
f) other _____	5	4	3	2	1		0
g) other _____	5	4	3	2	1		0

9. Do you think the advantages of having wildlife on your farm outweigh the costs?

10.a) In your own opinion, what effect has your soil and water conservation activities had on wildlife?

a) Conservation tillage	5	4	3	2	1	0
b) Dams	5	4	3	2	1	0
c) Shelterbelts	5	4	3	2	1	0
d) Gully and waterways	5	4	3	2	1	0
e) Forages and pasture	5	4	3	2	1	0

b) How could they be improved?

LANDOWNER INFORMATION

Finally, I would like to ask you a few questions for statistical purposes only.

1. What type of farming operation do you have?

a) grains _____

_____

_____

_____

b) livestock _____

_____

_____

c) mixed _____/_____/_____

d) other _____

2. What is the total acreage of your farm? _____ acres.

owned _____ acres.

rented _____ acres.

3. How many years have you farmed full time? _____ years.

4. In which age group are you?

1. 20 - 30
2. 31 - 40
3. 41 - 50
4. 51 - 60
5. over 60

5. How many acres of your farm are:

1. cultivated
2. hayed _____ improved. _____ unimproved
3. pasture _____ improved. _____ unimproved
4. slough/wetland _____
5. woodland _____
6. other _____

6. What is your education level?

1. up to secondary
2. post secondary
3. other
4. degrees?

7. Have you any other ideas or comments you would like to express that have not been dealt with in this interview?

8. Location in relation to the escarpment on___ below___

Thank you very much for you cooperation. Your answers have been very useful.

Would you like a copy of the study results? Yes No

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