BASELINE (1985) HABITAT ESTIMATES FOR THE SETTLED PORTIONS OF THE PRAIRIE PROVINCES

Report #11: Manitoba Mixedgrass and Tallgrass Prairies

Prairie Habitat Monitoring Project

February 12, 1993

J.B. Millar

Contractor

Canadian Wildlife Service

115 Perimeter Road

Saskatoon, Saskatchewan S7N 0X4

Canada

ABSTRACT

This report presents data for two transects in the single physiographic unit in the Manitoba Mixedgrass Prairie and two transects in the single physiographic unit in the Manitoba Tallgrass Prairie. Each of the two units accounts for all (96.8 percent) of the total area of their respective ecoregions.

Attempts to analyse the habitat data with standard statistical methods have shown that the data are highly variable and frequently skewed to the point where these techniques cannot be legitimately used. As a result, caution must be used in interpreting apparent habitat differences and habitat values extrapolated from sample means for physiographic units.

For the ecoregion samples as a whole:

(a) Wetland area averages 3.5 percent of the total land area of the single physiographic unit in the Manitoba Mixedgrass Prairie and 2.4 percent of the area of the single unit in Manitoba Tallgrass Prairie.

(b) The two transects in Manitoba Mixedgrass Prairie are located on predominantly morainal terrain and the two in Tallgrass Prairie are on predominantly lacustrine material.

(c) An overwhelming proportion of wetland area (87.0 percent) and wetland numbers (90.1 percent) in the Mixedgrass Prairie are temporary or seasonal in nature. For Tallgrass Prairie these figures are 90.7 and 64.7 percent, respectively. The lower percent of wetland numbers in this cover group in Tallgrass Prairie is due to the high number of artificial open water wetlands in one

transect.

(d) Only 0.3 percent of the total wetland area and 0.4 percent of total wetland numbers are classed as permanent water (natural fresh open water) in the Mixedgrass Prairie. This cover class is totally absent from the Tallgrass Prairie sample.

(e) Just under one third (31.2 percent) of the wetland area in the Mixedgrass Prairie is not subject to any human use. In the Tallgrass Prairie this figure drops to 10.8 percent.

(f) Grazing occurs on 22.3 percent of the wetland area in the Mixedgrass Prairie but on only 0.2 percent of the wetland area in the Tallgrass Prairie.

(g) Over four fifths (85.2 percent) of the total upland area in Mixedgrass Prairie is in annual crops. In the Tallgrass Prairie this figure rises to 90.5 percent.

(h) Native cover occurs on 11.1 percent of the uplands in the Manitoba Mixedgrass Prairie and on only 4.5 percent of the uplands in the Tallgrass Prairie.

(i) Grazing occurs on only 4.1 percent of the uplands in the Mixedgrass Prairie and is almost completely absent (0.1 percent) from the Tallgrass Prairie.

(j) The single morainal physiographic unit, the Boissevain - Hartney Plain, in the Manitoba Mixedgrass Prairie is bottom-rated (level four) as waterfowl production habitat.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

BASELINE (1985) HABITAT ESTIMATES FOR THE SETTLED PORTIONS OF THE PRAIRIE PROVINCES

Report #11: Manitoba Mixedgrass and Tallgrass Prairies

Prairie Habitat Monitoring Project

Project Officer 1985-91: J.B. Millar

I. Objective

The objective of this portion of the Prairie Habitat Monitoring Project is to establish baseline habitat values for long-term monitoring sites and to generate estimates of the current distribution and quality of each of a variety of habitat (cover) and land use classes in individual physiographic units (habitat subregions) within each of the ecoregions in the settled portions of the three Prairie Provinces.

II. Introduction

The quality and quantity of prairie migratory bird habitat has progressively declined since the time of settlement. A variety of studies have documented this decline for specific locations and time periods (Millar 1989a) but the rate of loss (and hence the severity of the problem) across the prairies as a whole is largely unknown. There is a need to monitor trends in habitat loss in the various prairie ecoregions to ensure that habitat conservation programs address the areas of primary concern and that elected officials are equipped with current, factual information as a basis for directing land management policy. The initiation of the North

American Waterfowl Management Plan will most certainly increase the demand for habitat monitoring information.

Effective measurement of habitat change is dependent upon the availability of a baseline record of current conditions against which future observations can be compared. The establishment of such a baseline record is therefore an essential first step in the development of a habitat monitoring program and the determination of habitat trends. The data presented in this report represent one segment of a more comprehensive effort to establish this baseline record, expanding on the results of earlier pilot studies (Millar 1986).

III. Methods

Most of the methods employed in this project have already been described in detail in Report #1 of this series (Millar 1987). Changes in methodology developed since that time have been summarized in Report #4 (Millar 1992a). In this report only methodology relating specifically to the Manitoba Mixedgrass and Tallgrass Prairies will be discussed.

A. Delineation of Physiographic Units

Changes in unit boundaries from those delineated by Adams (1985) - Manitoba Mixedgrass and Tallgrass Prairies each contain only one physiographic unit. Both of these have been remapped and now have some significant boundary differences from those delineated by Adams.

B. Sampling Network

One of the two transects located in the Manitoba Mixedgrass

Prairie is the product of transect splitting. This has involved a split between parkland and mixedgrass prairie. Neither of the Manitoba Tallgrass Prairie transects have been involved in transect splitting.

C. Rating of Sampled Morainal Physiographic Units as Waterfowl Production Habitat

Minimum rating values for Manitoba Mixedgrass and Tallgrass Prairie - The establishment of minimum rating values for these two ecoregions cannot be done since there is only one physiographic unit in each ecoregion. In the case of the Tallgrass Prairie Ecoregion this concern is irrelevant since the single unit is not of morainal origin anyway. In the case of Manitoba Mixedgrass Prairie, however, the unit can only be rated against other relevant ecoregions, namely Manitoba Parkland as the adjacent ecoregion, Saskatchewan Mixedgrass Prairie as the nearest mixedgrass unit and Alberta Parkland as the benchmark ecoregion for the prairies. The same rating scale used in previous reports will be used in rating the Manitoba mixedgrass unit.

IV. Results and Discussion

A. General Information on Manitoba Mixedgrass and Tallgrass Prairies

1. Ecoregion Area and Distribution of Sampled Units

The total areas occupied by the Manitoba Mixedgrass Prairie and Tallgrass Prairie are calculated to be approximately 201,200 and 908,000 hectares (Tables 1A and 1B), respectively, based on the boundaries of the physiographic units lying wholly or predominantly within each of the ecoregions. The areas calculated in this manner will differ somewhat from the areas of the ecoregions when calculated on the basis of surveyed and redefined vegetation boundaries. A comparison of these values still needs to be made.

Each of the two ecoregions contains only one physiographic unit, each of which has been sampled with two habitat monitoring transects. In both ecoregions the sampled unit accounts for 96.8 percent of the total area of the ecoregion (Table 1). Major river and stream valleys as well as lakes and urban areas larger than 500 hectares have been excluded from the area of physiographic units and collectively comprise identical percentages (3.2) of the total area of each ecoregion.

2. Distribution of Landforms in the Ecoregion

The distributions of various landforms in both Mixedgrass Prairie and Tallgrass Prairie in Manitoba are summarized in Table 2. The Mixedgrass Prairie unit is on predominantly morainal terrain with a level surface form. The Tallgrass Prairie unit, on the other hand, is on predominantly level lacustrine material.

The distribution of habitat sampling between various soil parent material and landform categories is also shown in Table 2. Since only one such category is present in each ecoregion, 100 percent of our sampling is in that category.

3. Location and Landform Character of Individual Physiographic Units

Figure 1 shows the location of the single physiographic unit in each of the Manitoba Mixedgrass and Tallgrass Prairies.

This report presents baseline habitat data for two sample sites located in the single physiographic unit in Manitoba Mixedgrass Prairie and two sample sites in the single physiographic unit in the Manitoba Tallgrass Prairie.

The single unit in Manitoba Mixedgrass Prairie comprises an area of approximately 194,700 hectares or 96.8 percent of the ecoregion. The single unit in Manitoba Tallgrass Prairie involves an area of 878,800 hectares or 96.8 percent of the ecoregion, a figure which is identical to that obtained for the Mixedgrass Prairie. Individual units and the transects located in them are listed in Table 3.

Origin of soil parent material and surface form for each of the two units are also summarized in Table 3. The mixedgrass unit is predominantly of morainal origin while the tallgrass unit is predominantly on lacustrine material. Both units have a predominantly level surface form.

As has already been indicated, there are no unsampled units in either Manitoba Mixedgrass or Tallgrass Prairie Ecoregions so Table

4 is blank.

4. Size of Monitoring Samples in Relation to Physiographic Units

The relative sizes of monitoring samples covered in this report and the physiographic units in which they occur are presented in Table 5. The sample in the mixedgrass unit is 1.6 percent of the total area of the unit while the sample in the tallgrass unit is only 0.4 percent of the total area of the unit. Average sample sizes for the two ecoregions are, of course, identical to the unit values.

The mixedgrass unit has not been divided into sub-units but the tallgrass unit contains four sub-units. Ideally, transects should be related to the sub-units in which they occur rather than to the unit as a whole. However, if this were to be done there should be substantial additional sampling in other significant sub-units.

B. Sample Results

Discussion of baseline habitat conditions in the Manitoba Mixedgrass and Tallgrass Prairies is limited by the fact that each of these ecoregions contains only one physiographic unit. Consequently, there can be no discussion of the variability in baseline habitat conditions between units. However, since there are two transects in each of the single units, observations can be made about the variability between transects occurring within the same physiographic unit. Sample results for each ecoregion as a whole are, of course, identical to the physiographic unit figures.

1. Wetlands

a. Percent of Total Land Area Occupied by Wetlands

In the two transects located in the Manitoba Mixedgrass Prairie wetlands occupy 1.8 and 5.4 percent of the total land area (Table 6). This is a three-fold variation between transects. In the two transects located in the Manitoba Tallgrass Prairie wetlands occupy 0.9 and 3.8 percent of the total land area. This is just over a four-fold variation between transects.

i. Landform character and wetland area - The two transects in the Manitoba Mixedgrass Prairie are located on morainal terrain and their wetland area values are at or below the bottom end of the range observed for morainal samples in Manitoba Parkland (Millar 1993a).

The two transects in the Manitoba Tallgrass Prairie are on a lacustrine landform and their wetland area values (0.9 and 3.8 percent) are within or below the range recorded for lacustrine samples in Manitoba Parkland.

For the Manitoba Mixedgrass Prairie Ecoregion as a whole the percent of total land area occupied by wetlands averages 3.5. This is the third lowest wetland area value recorded for the ecoregions reported on to date. Only Saskatchewan Shortgrass Prairie and Manitoba Tallgrass Prairie have lower values. The 3.5 percent recorded for Manitoba Mixedgrass Prairie is slightly more than half that recorded for Saskatchewan Mixedgrass Prairie.

For the Manitoba Tallgrass Prairie Ecoregion as a whole the percent of total land area occupied by wetlands averages 2.4. This

is the second lowest value recorded for any of the ecoregions reported on to date.

ii. Variability in wetland area between samples within the same physiographic unit - The single physiographic unit in the Manitoba Mixedgrass Prairie contains two transects. The variability in wetland area between those transects is three-fold. The single unit in the Manitoba Tallgrass Prairie also contains two transects and in that situation there is over a four-fold difference in the percent of land area occupied by wetlands. The two mixedgrass transects are in an undivided physiographic unit while the two tallgrass transects are in different sub-units of a divided unit. The expectation in such situations is that transects within a relatively homogenous undivided unit should have more comparable habitat values than those located in different sub-units of a divided unit. This seems to hold true for Manitoba Mixedgrass and Tallgrass Prairies but the data are limited.

iii. Cultivated wetlands - The amount of land occupied by cultivated wetlands is of particular interest because this is a part of the landscape which, depending on surface water conditions at the time of surveys, cannot always be interpreted from air photos as being wetland. Classification may shift back and forth between wetland and cropland (upland) categories in terms of cover and land use.

The percent of total land area occupied by cultivated wetlands in the two transects in the Manitoba Mixedgrass Prairie is 0.8 and 1.5 and for the Tallgrass Prairie is 0.6 and 2.0 (Table 6).

Differences between transects in the same physiographic unit, in percent of total land area occupied by cultivated wetlands, are 0.7 percent for the mixedgrass unit and 1.4 percent for the tallgrass unit.

For the ecoregion as a whole total land area occupied by cultivated wetlands averages 1.1 for Manitoba Mixedgrass Prairie and 1.3 percent for Manitoba Tallgrass Prairie. These values are about the middle of the range of 0.5 to 3.2 percent recorded for all other ecoregions reported on to date.

b) Area of Wetlands in Various Cover Classes

The percent of total wetland area in various cover classes is summarized for all transects and physiographic units in Table 7. Cultivated, grassy and shrub or tree cover are considered collectively as the cover types most indicative of temporary or seasonal water conditions and this group dominates (85.8 and 87.5 percent of total wetland area) in the two transects in Manitoba Mixedgrass Prairie. They also dominate (89.1 and 91.7 percent of total wetland area) in the two transects in Manitoba Tallgrass Prairie. The level of dominance by the cultivated/grassy/wooded group in Manitoba Mixedgrass Prairie is higher than in either of the three parkland ecoregions or Alberta and Saskatchewan Mixedgrass Prairie but lower than the rest of the grassland ecoregions reported on to date. The level of dominance by this group in the Tallgrass Prairie is exceeded only by the levels recorded in the Alberta and Saskatchewan Shortgrass Prairies.

The percent of wetland area that is cultivated in the

mixedgrass samples varies from 26.9 at Melita West to 45.8 at Hartney where it is the dominant cover class. In the tallgrass sample the cultivated cover class dominates in both transects (53.2 percent at McTavish and 64.1 percent at Altona).

Grass (including sedges and forbs) is the dominant cover class only at Melita West in the Manitoba Mixedgrass Prairie. While both wet meadow and shallow marsh vegetation are included in this class, ground truthing surveys have confirmed that the great majority of the area involved is shallow marsh. Most wet meadow wetlands in both Manitoba Mixedgrass and Tallgrass Prairies have been cultivated.

The percentage of total wetland area covered by willows and trees in the two ecoregions ranges from zero at Altona in the tallgrass sample to 5.0 percent at Hartney in the mixedgrass sample. Only at Hartney does their presence exceed 0.8 percent. The values given in Table 7 for willows and trees include only cover which can be mapped as polygons and, as is to be expected, are of minor significance in grassland regions.

Bulrush and cattail (deep marsh vegetation) occupy 4.1 and 7.5 percent of total wetland area in the mixedgrass transects and zero and 2.8 percent in the tallgrass transects.

Transitional open water, which can only be identified from ground surveys, is absent from all transects in both ecoregions.

Natural fresh open water is present only at Melita West in the mixedgrass sample and there only as 0.3 percent of the total wetland area. It is totally absent from the tallgrass sample. The

only other ecoregions reported on to date which have equally low values for this cover class are the Alberta and Saskatchewan Shortgrass Prairies. In this report open running water in streams and rivers has not been grouped with natural fresh open water in ponds as in some previous reports but is recorded as "other".

Artificial open water occupies 0.6 and 4.2 percent of the wetland area in the two mixedgrass transects and 5.1 and 10.9 percent of the wetland area in the two tallgrass transects. At Hartney most of the artificial open water is in the form of gravel pit excavations. At both Altona and McTavish it is in the form of large dugouts and the larger than usual percentages of this category reflect the more limited presence of natural wetlands in the tallgrass sample.

Saline open water is not present in any of the transects in either of the ecoregions.

"Other" cover classes are recorded for both of the mixedgrass transects and account for 2.5 and 7.5 percent of the total wetland area. The 7.5 percent value at Melita West is due to the presence of a river in the sample. In the tallgrass sample "other" cover is absent from the Altona transects and occupies only 0.4 percent of the wetland area at McTavish.

In the two ecoregions the percent of total wetland area in various cover classes varies widely between transects within the same physiographic unit. Two of five (40 percent) of the data pairs (i.e., those cover classes which were represented in both transects in the single unit) in the mixedgrass sample have

differences greater than five percent of the total wetland area and running as high as 24.8 percent. In the tallgrass sample, on the other hand, all three data pairs have large differences but they only range from 5.8 to 12.7 percent, the lowest range and level of large differences recorded to date for any ecoregion. As anticipated, proportionally more of the large differences are associated with the transect pair in the tallgrass sample whose members are located in different sub-units. However, the actual sizes of the large differences are much smaller than expected in this situation.

For the Mixedgrass Prairie Ecoregion sample as a whole 92.1 percent of the total wetland area falls into four cover classes: grass - 53.2 percent, cultivated - 31.8 percent, bulrush/cattail - 5.1 percent and willows and trees - 2.0 percent. Natural fresh open water has virtually dropped out of the picture - 0.3 percent. An unusually large (6.3) percentage of the wetland area falls into the "other" class, primarily due to the presence of a river in one transect. The identity and order of importance of the top four cover classes are the same as that recorded for Manitoba Parkland.

For the Tallgrass Prairie Ecoregion sample as a whole 99.0 percent of the total wetland area falls into four classes: cultivated - 55.2 percent, grass - 34.9 percent, artificial open water - 6.4 percent and bulrush/cattail - 2.5 percent. This is the first ecoregion in which the cultivated cover class occupies over half of the total wetland area. The value for artificial open water is the second largest recorded to date, exceeded only by the

7.1 percent recorded for Alberta Shortgrass Prairie (Millar 1992d). Natural fresh open water is totally absent from the tallgrass sample.

c) Wetland Density

Wetland density figures can be used to a limited extent to draw certain inferences about the character of the wetlands under study but must be interpreted with caution. A high wetland density, for example, can be taken as a reliable indicator that most of the wetlands present are small and hence not likely to be very permanent in nature. A low density, on the other hand, may be indicative of a variety of conditions and hence is not a reliable indicator by itself of either wetland size or permanence. It may, for example, result from the presence of small numbers of either small temporary wetlands, a mixture of a variety of sizes of wetlands of variable permanence or a few very large permanent wetlands.

The mean wetland densities per quarter section for all transects covered in this report and for the two ecoregions samples as a whole are listed in Table 8. Densities in the two mixedgrass transects are 4.5 and 6.6 per quarter section. For the tallgrass transects they are 2.8 and 2.9 per quarter section.

The difference in wetland density between transects within the same physiographic unit is 2.1 on level morainal landform in the undivided Boissevain-Hartney Plain and 0.1 on level lacustrine terrain in different sub-units of the Red River Valley. This is the opposite to what was anticipated, i.e., that there would be

larger differences between transects in different sub-units.

For the entire Mixedgrass Prairie Ecoregion sample the average density is 5.5 wetlands per quarter section. This is the fourth lowest density recorded to date. Only Manitoba Tallgrass Prairie and Alberta and Saskatchewan Shortgrass Prairies have lower densities. The average wetland density of 2.8 per quarter section in the Manitoba Tallgrass Prairie is the lowest recorded for any ecoregion reported on to date.

d) Numbers of Wetlands in Various Cover Classes

In this report each wetland has been categorized according to the one cover class which dominates the central and deepest portion of the basin.

The three cover classes characteristic of temporary or seasonal wetlands, i.e., cultivation, grasses (including sedges) and woody vegetation collectively dominate (89.0 and 90.3 percent) the number of wetlands in the two transects in Manitoba Mixedgrass Prairie (Table 8). Cultivation and grass dominate both of the transects in the Manitoba Tallgrass Prairie but at a lower level (55.3 and 74.5 percent). The third cover class, woody vegetation, is totally absent from the tallgrass sample.

Artificial open water is the only other cover class of any significance in terms of wetland numbers. In the mixedgrass sample 3.5 and 8.4 percent of all wetlands fall into this category. In the tallgrass sample these figures rise to 25.5 and 39.1 percent. At McTavish artificial open water is the most common wetland type (39.1 percent).

Bulrush/cattail are present in almost equal percentages in both of the mixedgrass transects and one of the tallgrass transects (2.8 to 2.9 percent). They are absent from the Altona transect.

Natural fresh open water is present only in the Melita West transect and there constitutes only 0.7 percent of total wetland numbers.

"Other" cover types are present as 2.8 percent of wetland numbers in one transect in each of the ecoregions. Wetland area data showed the "other" cover class to be present in both of the mixedgrass transects but this category disappears from the Hartney wetland numbers data because only one large wetland is involved.

The variability in percent of total wetland numbers in various cover classes between different transects within the same physiographic unit in the mixedgrass sample is only slightly less (up to 20.3 percent of the total wetland numbers) than that recorded earlier for wetland area. The proportions of small and large differences are identical with two or 40 percent of the five data pairs having large differences. In the tallgrass sample all three of the data pairs have large differences and the variability is considerably greater (up to 29.1 percent) than that recorded for wetland area. When the small and large differences in percent of wetland numbers are matched against the corresponding values for wetland area those values coincide (i.e., small/small, large/large) in all cases in both ecoregions. As with wetland area, proportionally more large differences are associated with the transect pair whose members are located in different sub-units than

with the transect pair located in an undivided unit.

For the Mixedgrass Prairie Ecoregion sample as a whole 90.1 percent of the wetlands are dominated by grass (34.6 percent), cultivation (51.2 percent) and shrubs and trees (4.3 percent). Of the remaining wetlands, 2.7 percent are dominated by bulrush/cattail, 0.4 percent by natural fresh open water, 5.4 percent by artificial open water and 1.4 percent by all other categories together. For the Tallgrass Prairie Ecoregion sample as a whole 64.7 percent of the wetlands are dominated by grass (17.0 percent) and cultivation (47.7 percent). Almost one third (32.5 percent) of the wetlands are dominated by artificial open water. Of the remaining wetlands, 1.4 percent are dominated by bulrush/cattail and 1.4 percent by "other" cover classes. Manitoba Mixedgrass and Tallgrass Prairies have, respectively, the highest and second highest percentage of wetland numbers in the cultivated cover class of all ecoregions reported on to date. They also have the lowest and third lowest values for natural fresh open water wetlands. The percentage of artificial open water wetlands in the Tallgrass Prairie sample is not only the highest recorded to date but it is three times as large as the next highest value.

e) Area of Wetlands in Various Land Use Activity Classes

Utilization of wetlands in the four transects covered in this report falls into five major land use categories - no use, abandoned cultivation, annual crops, haying and grazing. Collectively these five activity classes occur on 93.3 and 98.3 percent of the total wetland area in the two mixedgrass transects

(Table 9) and 60.4 and 93.5 percent of the total wetland area in the two tallgrass transects (Table 9).

The percent of total wetland area that is not being subjected to any obvious or regular human activity ranges from 26.7 percent at Hartney to 33.1 percent at Melita West in the mixedgrass sample and from 7.5 percent at McTavish to 24.2 percent at Altona in the tallgrass sample. The minimum value at McTavish is associated with high values for both cropping and drainage activities.

The abandoned cultivation land use activity class is a transitory category that is assigned to wetlands which are in a state of flux between being used for annual crops and reverting to an unused condition. This category most frequently occurs when higher water levels flood out previously cultivated basins and persist long enough to permit the establishment of disturbed wetland vegetation. Since development of the abandoned cultivation class is related to local precipitation conditions, its presence can be expected to be erratic within and between transects. The percent of the total wetland area in this category ranges from 0.8 to 6.7 in the mixedgrass sample and is zero for both transects in the tallgrass sample.

The amount of wetland area being used for crop production ranges from 26.7 percent at Melita West to 45.8 percent at Hartney in the Manitoba Mixedgrass Prairie and from 52.5 at McTavish to 66.1 at Altona in the Tallgrass Prairie.

Haying of wetlands occurs in both of the transects and on 0.8 and 11.8 percent of the total wetland area in the Mixedgrass

Prairie. In the Tallgrass Prairie it occurs only at Altona and there on 3.2 percent of the total wetland area.

Grazing of wetlands occurs in both of the transects in the mixedgrass sample and on 13.3 to 25.9 percent of the wetland area in those transects. In the tallgrass sample grazing occurs only at McTavish and there on only 0.4 percent of the total wetland area.

Other land use activities on wetlands are recorded on both of the transects in each of the ecoregions but in only one case does those activities exceed 6.7 percent of the wetland area. The extremely large (39.6 percent) value at McTavish in the tallgrass sample is due entirely to drainage activities. This is the largest "other" activity level recorded in any of the ecoregions reported on to date and is well above the next highest value of 25.1 percent recorded at Patricia in the Alberta Mixedgrass Prairie (Millar 1992b). That value, incidently, was due primarily to irrigation activities.

The frequency of large differences in land use activities on wetlands between different transects within the same physiographic unit is substantially greater than that observed for both cover and wetland area data and cover and wetland numbers data (40 percent in each case) in the mixedgrass sample. Large differences (over five and up to 19.1 percent of total wetland area) occur in all of the six data pairs. In the tallgrass sample all three of the data pairs, as in previous data analyses, have large differences ranging up to 33.1 percent.

For the Mixedgrass Prairie Ecoregion sample as a whole,

virtually all of the total wetland area (96.5 percent) falls into the five identified land use categories, no use, abandoned cultivation, annual crops, haying and grazing. Just under one third (31.2 and 31.6 percent, respectively) of the total wetland area falls into each of the no use and annual crops categories. Slightly less than one quarter (22.3 percent) of the wetland area is used for grazing and 8.9 percent is hayed. The latter value is the second highest reported to date for that land use category.

In the Tallgrass Prairie Ecoregion sample as a whole only 66.8 percent of the total wetland area falls into the five named land use categories but 99.8 percent of the wetland area is in two named categories (crops - 55.2 percent and no use - 10.8 percent) plus the "other" category (33.2 percent). The value for cropped wetland area is the highest recorded to date, the "no use" value is the second lowest and the "other" value is the highest reported so far, being over six times larger than the next highest value.

f) Wetland Size Distribution

Variations in the size distribution of wetlands amongst transects and physiographic units will not be discussed in this report because the total areas of wetlands lying only partially within quarter section sample units cannot be easily generated and analysed within the program set up for the quarter section units. Any attempt to determine wetland size distribution within quarter sections would therefore lack a true representation of larger wetlands. Future manual digitizing of wetlands extending across two or more quarter sections would make it possible to calculate

accurate size distribution figures.

g) Wetlands Affected by One or More Permanent Impacts

Enough material has been generated on the nature and distribution of permanent, human-induced impacts on wetlands in the monitoring samples to provide the basis for a full-scale study on that subject alone. For the present, however, discussion of the effects of impacts on wetlands will be limited to an evaluation of the extent to which individual wetlands have been affected by one or more such impacts. It should be emphasized here that in this study cultivation is not considered a permanent impact.

The percent of wetlands affected by one or more permanent impacts in the Manitoba Mixedgrass Prairie is almost identical for the two transects (35.7 percent at Hartney and 34.2 percent at Melita West (Table 10). In the Tallgrass Prairie the level of impaction at McTavish is almost double (66.7 percent) that recorded at Altona (34.4 percent).

Differences in the rate of impaction between transects in the same physiographic unit are 1.5 percent in the mixedgrass sample and 32.3 percent in the tallgrass sample.

For the entire Mixedgrass Prairie Ecoregion sample the average impaction level is 34.8 percent and in the Tallgrass Prairie Ecoregion sample it is 50.9 percent, the highest level recorded to date in this project.

h) Distribution of Streams

The presence of stream segments in the data samples has been summarized (Table 11) to provide an indication of the relative

importance of this type of water body in the single physiographic units in each of the Manitoba Mixedgrass and Tallgrass Prairies.

Streams were recorded in 12.5 and 27.3 percent of the quarter sections in the two transects in the Mixedgrass Prairie sample and in 12.5 and 66.7 percent of the quarter sections in the Tallgrass Prairie sample. The maximum figure of 66.7 percent at McTavish in the tallgrass sample is due primarily to the widespread occurrence of artificial streams in the form of drainage ditches.

Each of the single physiographic units in the two ecoregions contains two transects and, since all the transects contain streams, there is a consistency in the presence of streams in transects within the same unit for these ecoregions.

In the total Mixedgrass Prairie Ecoregion sample 19.6 percent of all quarter sections contain stream segments. This is the second highest level recorded for any of the ecoregions reported on to date. The 39.6 percent stream presence in the Tallgrass Prairie Ecoregion is the highest recorded to date and is twice as large as the second highest value referred to above. The situation in the Manitoba Tallgrass Prairie is partially an artificial one since most of the wetlands identified as streams are drainage ditches.

3. Uplands

a) Distribution of Upland Cover Classes

Upland cover data have been analysed on the basis of seven classes, four native and three planted, plus a catch-all category for all other classes. In the two Manitoba Mixedgrass Prairie transects 98.4 and 98.7 percent of the upland cover falls into the

seven named classes (Table 12). In the two Tallgrass Prairie transects these figures are 98.8 and 99.1 percent.

Annual crops and summerfallow are the single most common upland cover class in all of the transects in both ecoregions, occupying 78.4 and 91.1 percent of the total upland area in the mixedgrass sample and 89.2 and 91.9 percent of the total upland area in the tallgrass sample.

Native grass occupies 5.9 and 13.6 percent of total upland area in the mixedgrass sample and 3.7 and 4.9 percent of the total upland area in the tallgrass sample.

Shrubs and trees are a very minor element in the landscape in all transects in both ecoregions. In the mixedgrass transects low shrubs (buckbrush) occupy 0.4 and 1.1 percent of the upland area, tall shrubs occupy 0.2 percent in both transects and native trees cover a trace to 1.6 percent of the uplands. Values for woody vegetation in the tallgrass transects are even lower, low shrubs - zero to a trace, both high shrubs and native trees - a trace to 0.2 percent.

Total native cover occupies 6.5 and 16.5 percent of total upland area in the mixedgrass transects and 3.7 and 5.3 percent of total upland area in the tallgrass transects.

Planted grasses and forbs are found on 0.7 and 3.1 percent of the uplands in the two mixedgrass transects and on 0.9 and 4.8 percent of the uplands in the two tallgrass transects.

Planted trees and shrubs are a minor but consistent part of the landscape, accounting for 0.4 percent of the upland area in

both mixedgrass transects and 0.7 and 1.4 percent of the uplands in the two tallgrass transects.

Variability in upland cover values between transects within the same physiographic unit is much lower than it is for wetland data and this is likely due in part to the extreme dominance of annual crops in all transects. Only two of the eight data pairs for individual cover classes in the mixedgrass transects have large differences (in excess of five percent of total upland area). One each of those are associated with annual crops and with native grass. The maximum difference is only 12.7 percent. None of the seven data pairs in the tallgrass sample have large differences, the maximum being 3.9 percent. These differences are well below those observed for wetland data from these two ecoregions.

For the Mixedgrass Prairie Ecoregion sample as a whole 85.2 percent of the total upland cover is annual crops and summerfallow. For the Tallgrass Prairie Ecoregion sample this value is 90.5 percent. This latter figure is the highest level of cropping recorded to date for any ecoregion. Total native cover accounts for 11.1 percent of the upland area in the Manitoba Mixedgrass Prairie sample and only 4.5 percent of the Tallgrass Prairie sample. This latter figure is the lowest level of native vegetation recorded to date. In both ecoregions most of the total native vegetation figures are generated by native grass. Planted grasses and forbs cover 1.8 percent of the uplands, planted trees and shrubs 0.4 percent and "other" cover classes 1.5 percent in the Mixedgrass Prairie. For the Tallgrass Prairie these values are, respectively, 2.9, 1.1 and 1.0 percent.

Hartney is the most intensively cultivated transect in the Manitoba Mixedgrass Prairie - 91.1 percent of the upland area and 45.8 percent of the wetland area. Altona is the most intensively cultivated transect in the Manitoba Tallgrass Prairie - 89.2 percent of the uplands and 64.1 percent of the wetland area.

b) Distribution of Upland Land Use Activity Classes

Upland land use data have been separated into seven classes plus an eighth catch-all category for all the other minor land uses (Table 13).

Annual crop production is the predominant land use activity in all of the transects in the two ecoregions covered in this report. The same values and comments given in the preceding section on upland cover for the cultivated cover class also apply here.

Idle (unused plus abandoned) land accounts for 2.2 and 5.9 percent of the upland area in the mixedgrass sample and 1.1 and 1.4 percent of the upland area in the tallgrass sample.

Forage production occurs on 0.6 and 4.9 percent of the upland area in the mixedgrass sample and 0.1 and 3.8 percent of the upland area in the tallgrass sample.

Grazing occurs in both of the transects in the mixedgrass sample on 1.6 and 6.8 percent of the uplands. In the tallgrass sample it is almost nonexistent (a trace and 0.2 percent).

Land use activities which are associated with native vegetation and/or planted grasses and forbs collectively account for 4.4 and 17.6 percent of the total upland area in the two mixedgrass transects and 1.7 and 4.9 percent of the uplands in the

tallgrass transects.

A minor but consistent part of the uplands is devoted to farmsteads - 0.5 and 1.2 percent in mixedgrass transects and 1.8 and 2.2 percent in tallgrass transects - and to roads and railways - 2.7 and 2.8 percent in mixedgrass transects and 3.0 and 3.1 percent in tallgrass transects.

Other land uses collectively occupy 0.4 and 0.8 percent of the mixedgrass uplands and 0.6 and 1.6 percent of the tallgrass uplands.

Variability in upland land use activity values between transects within the same physiographic unit is basically the same as that observed for upland cover with only two large differences recorded in the eight data pairs in mixedgrass transects. The maximum difference there is 12.8 percent and is associated with crop production. None of the eight data pairs in the tallgrass transects have large differences, the maximum being 3.7 percent.

For the Mixedgrass Prairie Ecoregion sample as a whole, upland land use activities in descending order of occurrence are as follows: annual crop production (85.1 percent), grazing (4.1 percent), idle - no use and abandoned - 4.0 percent), roads and railways (2.7 percent), forage production (2.6 percent), farmsteads (0.9 percent) and other uses (0.6 percent).

For the Tallgrass Prairie Ecoregion sample as a whole the descending order of upland land use activities is as follows: annual crop production (90.5 percent), roads and railways (3.1 percent), forage and farmsteads (2.0 percent each), idle land (1.2

percent), "other" (1.1 percent) and grazing (0.1 percent). The value for grazing is the lowest recorded to date for that land use and the value for idle land is the second lowest for that category. On the other hand, values for farmsteads and roads and railways are the highest recorded to date.

C. Extrapolation of Sampling Results

1. Data Variability

One of the objectives of this baseline habitat study has been to generate estimates of current habitat values for individual physiographic units by extrapolating the sample results obtained in this study to the entire unit. Application of standard statistical procedures to the sample data has, however, shown there to be such a high degree of variability in the data that the mean values generated cannot be considered to provide a consistently accurate estimate of conditions beyond the samples themselves for all habitat factors in all transects. Examples of the variability in the data are illustrated for some major wetland cover, upland cover and upland land use classes in Tables 14 to 16, respectively.

Comparison of the above data sets provides some indication of the degree of variability in the data. Results from the Manitoba Mixedgrass and Tallgrass Prairie samples show some deviation from the patterns shown in the data from other ecoregions and this is particularly evident in the Tallgrass Prairie data.

For the three wetland cover classes, i.e., cultivated, grass and willows (Table 14), the pattern in previously reported ecoregions has typically been for the number of transects in which

the standard error equals or exceeds the mean to be quite low. This same pattern exists in both Manitoba Mixedgrass and Tallgrass Prairies but the number of cover-transect combinations in which the standard error equals or exceeds the mean is even lower than usual - not a single one in the mixedgrass sample and only one (cultivation at McTavish) in the tallgrass sample.

For the three upland cover classes, i.e., cropland, native grasses and native trees (Table 15), the usual pattern has been for an intermediate number of cover-transect combinations to have standard errors which are equal to or higher than the mean. This pattern seems to hold for the mixedgrass sample where three of six such combinations have equal or higher standard errors. In the tallgrass sample, however, there is not a single higher standard error.

The three upland land use classes, i.e., unused, grazing and roads (Table 16), typically demonstrate the widest range of data variability with roads and railways showing a total absence of higher standard errors, the unused class exhibiting an intermediate situation and grazing having a very high frequency of higher standard errors. This pattern holds true for the Manitoba Mixedgrass and Tallgrass Prairie samples except for grazing in the tallgrass sample. There only one of two use-transect combinations has a high standard error and it equals but does not exceed the mean.

The low incidence of higher standard errors in upland cover and land use data for the tallgrass sample is interpreted as being

due to the uniformly high presence of cultivation throughout the sample which minimizes the possibility of large variations in other cover and land use categories.

A very common situation which contributes significantly to the variability in habitat data is the presence within a sample of one or more quarter sections operated by a landowner whose land use practices, e.g., grazing or forage production, are markedly different than those of his neighbours. When this happens the data are strongly skewed and cannot be analysed by standard methods.

Examination of standard error and coefficient of variation values obtained when data from two transects within the same physiographic unit are combined suggests a substantial reduction in the resultant variability in situations where the variability in the data varies markedly between members of a transect pair. However, the extent of this reduction appears to differ in the two ecoregions. In the two cases in the mixedgrass sample where the standard error equalled or exceeded the mean for one member of the transect pair but not the other combining the data did not bring the standard error below the mean for the physiographic unit in either case. However, in three similar situations in the tallgrass sample the standard error was brought below the mean in two cases by data combination.

Data for each of the entire ecoregion samples are the same as for the single physiographic unit in each ecoregion. When these data are analysed collectively the standard error is below the mean for five of the nine cover and land use categories in the

mixedgrass sample and for eight of nine categories in the tallgrass sample (Tables 14 to 16).

Although the shortcomings of using limited habitat data from this project to generate estimated habitat values for entire physiographic units have been identified, those extrapolated estimates are often the only data available for many localities. Certain broad conclusions can be drawn from the more obvious data extremes and the figures can be used to compare the results obtained from this study with those of other studies such as agricultural surveys and Ducks Unlimited's Habitat Inventory. The combination of accurate ground truth data from the Prairie Habitat Monitoring Project with a total habitat inventory from Thematic Mapper imagery in the Ducks Unlimited program still appears to offer the best possibility for obtaining the most accurate assessment of current habitat conditions.

2. Wetlands

Estimations of the area of wetland cover classes, the number of wetlands in each cover class and the area of each wetland land use activity class present in each physiographic unit in 1985 are presented in Tables 17 to 19, respectively, for Manitoba Mixedgrass and Tallgrass Prairies.

Since there is only one physiographic unit in each ecoregion there can be no determination of the top unit in each ecoregion in terms of total <u>quantity</u> of wetland habitat. It is possible, however, to compare each unit, and hence the ecoregion, with other ecoregion habitat averages recorded to date. When this is done the

Manitoba Mixedgrass Prairie comes out as the ecoregion with the smallest sampled area, the second smallest total wetland area, the third smallest area and second smallest number of semi-permanent and permanent wetlands for secure brood rearing habitat, the smallest area and numbers of grassy (seasonal) wetlands for additional breeding pair habitat and the second smallest area of undisturbed wetlands to ensure adequate escape cover. In short, it contributes the least to the total wetland habitat available in the Canadian prairies.

The Manitoba Tallgrass prairie presents a similar picture. It has the fourth smallest sampled area, the third smallest total wetland area, the fourth smallest area and second smallest number of semi-permanent and permanent wetlands, the third smallest area and second smallest number of grassy wetlands and the third smallest area of undisturbed wetlands.

In previous reports extrapolated wetland data for the entire sampled portion of an ecoregion have been summarized in two ways. First, extrapolated wetland values for individual physiographic units were added together to provide total values (physiographic unit analysis or summation) for the sampled portion of the ecoregion. Second, the entire ecoregion sample was analysed as a single unit and the resultant wetland values extrapolated to generate totals for the sampled portion of the ecoregion (ecoregion analysis). This dual analysis is not possible for the Manitoba Mixedgrass and Tallgrass Prairies since each contains only one physiographic unit.

3. Uplands

Estimated areas of upland cover and land use activity classes are presented in Tables 20 and 21. As with wetland data, ranking of units in terms of quantity of various upland habitats and the dual calculation of upland areas on a physiographic unit and ecoregion basis are not possible because the Manitoba Mixedgrass and Tallgrass prairies each only contain a single physiographic unit. However, the unit, and hence ecoregion, nesting cover values have been compared against other ecoregion habitat values recorded to date.

Manitoba Mixedgrass Prairie has the smallest area of sampled upland, the smallest area of upland nesting cover in the form of native vegetation plus planted grassy cover and the smallest area of land uses conducive to the perpetuation of nesting cover, i.e., idle land, forage production and grazing.

The Manitoba Tallgrass Prairie has the fourth smallest area of sampled upland but the second smallest area of native vegetation plus planted grassy cover and the second smallest area of land devoted to uses conducive to the perpetuation of upland nesting cover. It is therefore apparent that both these ecoregions contribute little to the total upland nesting cover available in the Prairie Provinces.

4. Rating of Sampled Morainal Physiographic Units as Waterfowl Production Habitat

Manitoba Mixedgrass Prairie has one physiographic unit and it is morainal in origin. Because only one unit is involved, minimum

waterfowl production rating values cannot be calculated for this ecoregion. Accordingly, minimum rating values from other ecoregions have been applied to the data in an effort to rate this single unit. The ecoregions used in this exercise are the Saskatchewan Mixedgrass Prairie as the nearest other mixedgrass ecoregion, the Manitoba Parkland as the adjacent ecoregion and the Alberta Parkland as the benchmark for rating prairie ecoregions. By all three sets of criteria the Boissevain-Hartney Plain is bottom-rated as a four (Table 22).

The single physiographic unit in the Manitoba Tallgrass Prairie is not of morainal origin so it is not considered for rating as waterfowl production habitat.

D. Cover/Land Use Changes Since May 1985

Cover/land use change is an ongoing process and formal efforts to measure this were originally scheduled to be conducted at five-year intervals as part of this project. It is possible, however, to obtain a very crude idea of the extent to which change is occurring in the interim by determining the number of quarter sections which have experienced some change in the interval between the taking of baseline aerial photography and the completion of the ground truthing surveys. The date of baseline aerial photography for all transects covered in this report was May 1985. The interval between that date and the completion of the ground truthing surveys for these transects is quite consistent for each ecoregion (40 and 41 months for the Manitoba Mixedgrass Prairie and 49 months for the Tallgrass Prairie, Table 23). Recorded changes

may be as small as the cultivation of a single wetland and as extreme as the cultivation of a large segment of a quarter section. Frequently the changes have been associated with road construction. Temporary interruptions of cultivation in wetlands or uplands are not counted as changes.

Cover/land use changes have occurred on all of the transects in both ecoregions. In Manitoba Mixedgrass Prairie the percent of quarter sections affected in individual transects ranges from 31.8 at Melita West to 37.5 at Hartney. In Manitoba Tallgrass Prairie the percent of quarter sections affected ranges from 16.7 at McTavish to 25.0 at Altona.

Differences in percent of affected quarters recorded for transects within the same physiographic unit are 5.3 percent in the mixedgrass sample and 8.3 percent in the tallgrass sample.

The average percent of quarter sections affected by cover/land use changes and the mean length of time in months between the taking of aerial photos and completion of ground truthing surveys for the ecoregions reported on to date are as follows:

Ecoregion	Average Percent of Quarter Sections Affected by Change	Mean Length of Time Between Photography and Ground Truthing (in months)
Saskatchewan Parkland	27.0	23.7
Alberta Parkland	47.1	40.1
Alberta Mixedgrass Prairie	34.6	55.3
Alberta Fescue Prairie	30.0	54.2
Alberta Shortgrass Prairie	8.3	63.0
Saskatchewan Mixedgrass Prairie	30.6	62.2
Saskatchewan Shortgrass Prairie	24.0	61.8
Manitoba Parkland	39.5	37.5
Manitoba Mixedgrass Prairie	34.8	40.1
Manitoba Tallgrass Prairie	20.8	49.0

According to the above data Manitoba Mixedgrass Prairie has the third highest percentage of quarter sections affected by change and is tied for second shortest mean time interval between date of baseline photography and ground truthing surveys. If one assumes that the percent of quarter sections affected by cover/land use changes can be expected to increase along with the length of time involved between the date of baseline photography and ground truthing surveys, then it appears that Manitoba Mixedgrass Prairie habitats are being subjected to one of the heavier rates of change in the prairie ecoregions reported on to date.

Manitoba Tallgrass Prairie has the second lowest percentage of quarter sections affected by change and the fifth shortest (or sixth longest) mean time interval between date of baseline photography and ground truthing surveys. This suggests a slower rate of habitat change than that occurring in Manitoba Mixedgrass Prairie and this is interpreted as being due to the fact that the Manitoba Tallgrass Prairie was so heavily impacted by agriculture prior to 1985 that there is limited potential for further habitat degradation in the ecoregion.

V. Literature Cited

Adams, G.D. 1985. A regional base map for a migratory bird habitat inventory - Prairie Provinces. Can. Wildl. Serv. Unpubl. Rep. 34 pp.

Millar, J.B. 1984. Classification of wetlands on air/ground comparison transects in the Prairie Provinces. Part III. Waterfowl Strata 26 to 29 - Saskatchewan. Can. Wildl. Serv. Unpubl. Rep. 77 pp.

Millar, J.B. 1986. Estimates of habitat distribution in the settled portions of the Prairie Provinces in 1982. Can. Wildl. Serv. Unpubl. Rep. 41 pp.

Millar, J.B. 1987. Baseline (1985) habitat estimates for the settled portions of the Prairie Provinces. Report #1: Methods and project status. Can. Wildl. Serv. Unpubl. Rep. 50 pp.

Millar, J.B. 1988. Baseline (1985) habitat estimates for the settled portions of the Prairie Provinces. Report #2: Saskatchewan Parkland - Part I. Can. Wildl. Serv. Unpubl. Rep. 44 pp.

Millar, J.B. 1989a. Perspectives on the status of Canadian prairie wetlands. Freshwater Wetlands and Wildlife, Proceedings of Symposium, Charleston, South Carolina. March 24-27, 1986, R.R. Sharitz and J.W. Gibbons (Eds.), DOE Symposium Series No. 61, U.S. Dept. of Energy, Oak Ridge, Tennessee, pp. 829-852.

Millar, J.B. 1989b. Baseline (1985) habitat estimates for the settled portions of the Prairie Provinces. Report #3: Saskatchewan Parkland - Part II. Can. Wildl. Serv. Unpubl. Rep. 65 pp.

Millar, J.B. 1992a. Baseline (1985) habitat estimates for the settled portions of the Prairie Provinces. Report #4: Alberta Parkland. Can. Wildl. Serv. Unpubl. Rep. 72 pp.

Millar, J.B. 1992b. Baseline (1985) habitat estimates for the settled portions of the Prairie Provinces. Report #5: Alberta Mixedgrass Prairie. Can. Wildl. Serv. Unpubl. Rep. 66 pp.

Millar, J.B. 1992c. Baseline (1985) habitat estimates for the settled portions of the Prairie Provinces. Report #6: Alberta Fescue Prairie. Can. Wildl. Serv. Unpubl. Rept. 58 pp.

Millar, J.B. 1992d. Baseline (1985) habitat estimates for the settled portions of the Prairie Provinces. Report #7: Alberta Shortgrass Prairie. Can. Wildl. Serv. Unpubl. Rept. 38 pp.

Millar, J.B. 1992e. Baseline (1985) habitat estimates for the settled portions of the Prairie Provinces. Report #8: Saskatchewan Mixedgrass Prairie. Can. Wildl. Serv. Unpubl. Rept. 86 pp.

Millar, J.B. 1992f. Baseline (1985) habitat estimates for the settled portions of the Prairie Provinces. Report #9: Saskatchewan Shortgrass Prairie. Can. Wildl. Serv. Unpubl. Rept. 52 pp.

Millar, J.B. 1993a. Baseline (1985) habitat estimates for the settled portions of the Prairie Provinces. Report #10: Manitoba Parkland. Can. Wildl. Serv. Unpubl. Rept. 84 pp.

North American Waterfowl Management Plan Saskatchewan Technical Committee. 1988. North American Waterfowl Management Plan Saskatchewan Implementation. Prairie Habitat Joint Venture. Draft Report. 52 pp.

Figure 1. Distribution of Habitat Sampling in Manitoba Mixedgrass and Tallgrass Prairies

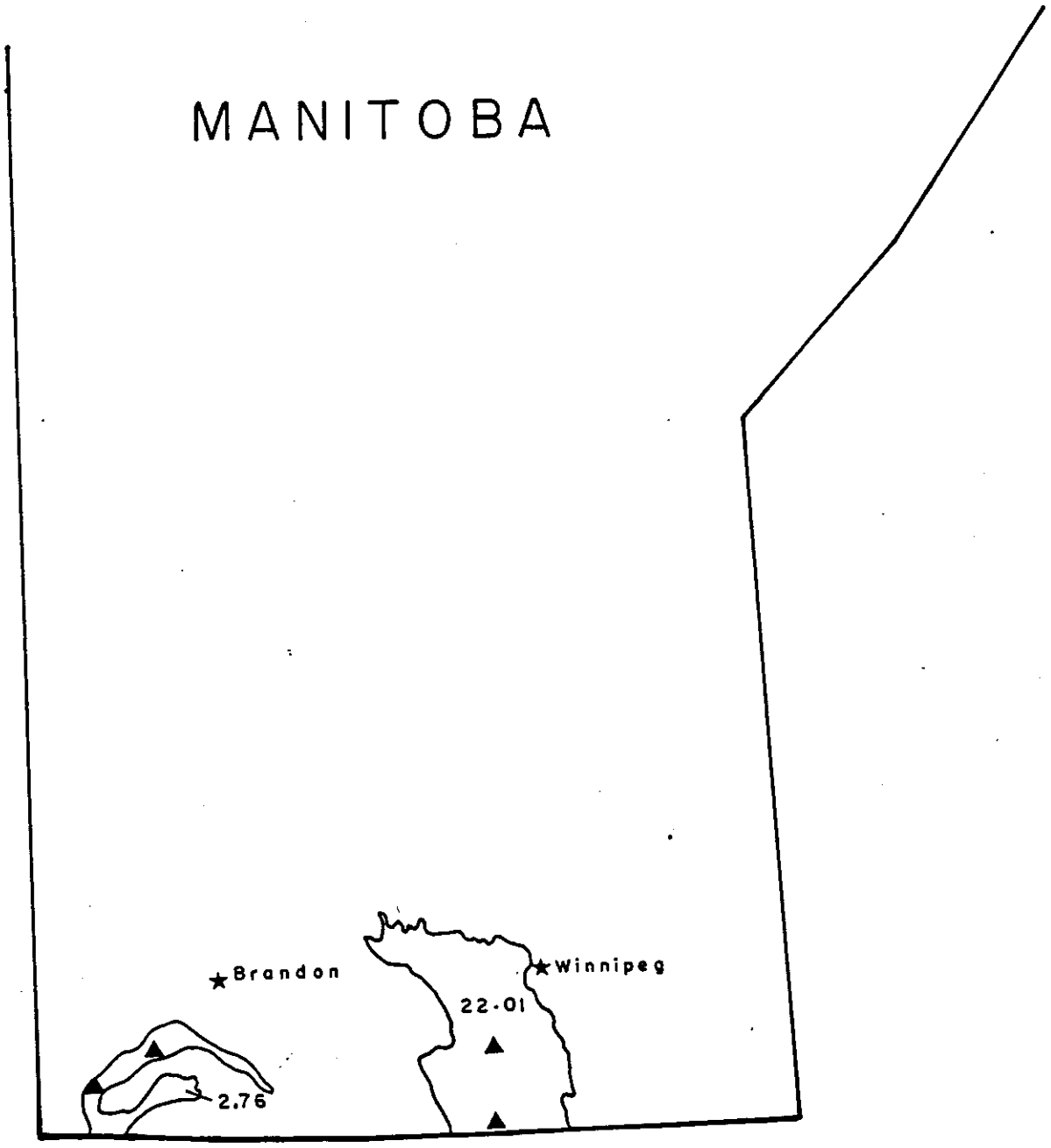

Table 1A. Distribution of Habitat Sampling Relative to the Entire Manitoba Mixedgrass Prairie

	No. of Units	Area	
		In Hectares[1]	As Percentage of Entire Ecoregion
Sampled Physiographic Units	1	194,700	96.8
Unsampled Physiographic Units	0	0	0.0
Areas Not Included in Physiographic Units			
- River and Stream Valleys	-	0	0.0
- Lakes[2]	-	6,500	3.2
- Urban Areas[2]	-	0	0.0
Total Manitoba Mixedgrass Prairie Ecoregion	1	201,200	100

1. To the nearest 100 hectares.

2. Larger than 500 hectares.

Table 1B. Distribution of Habitat Sampling Relative to the Entire Manitoba Tallgrass Prairie

	No. of Units	Area	
		In Hectares[1]	As Percentage of Entire Ecoregion
Sampled Physiographic Units	1	878,800	96.8
Unsampled Physiographic Units	0	0	0
Areas Not Included in Physiographic Units			
- River and Stream Valleys	-	26,100	2.9
- Lakes[2]	-	0	0
- Urban Areas	-	3,000	0.3
Total Manitoba Tallgrass Prairie Ecoregion	1	908,000	100

1. To the nearest 100 hectares.

2. Larger than 500 hectares.

Table 2. Distribution of Landforms in Manitoba Mixedgrass and Tallgrass Prairies

Origin of Parent Material[1]	Surface Form[1]	Area in Hectares[2] Sampled Units[3]	Unsampled Units[3]	Total[4]	Percent of Sampling Effort in Landform Category
MIXEDGRASS PRAIRIE					
Morainal	Level	194,700 (100)	0 (0)	194,700 (100)	100
Total Morainal		194,700 (100)	0 (0)	194,700 (100)	100
Total for Ecoregion		194,700 (100)	0 (0)	194,700 (100)	100
TALLGRASS PRAIRIE					
Lacustrine	Level	878,800 (100)	0 (0)	878,800 (100)	100
Total Lacustrine		878,800 (100)	0 (0)	878,800 (100)	100
Total for Ecoregion		878,800 (100)	0 (0)	878,800 (100)	100

1. Listed by primary category only.
2. To the nearst 100 hectares.
3. Figure in parentheses is the percent the indicated area is of the total area of that landform category.
4. Figure in parentheses is the percent each landform category is of the total area in physiographic units in the ecoregion.

Table 3. Physiographic Units Covered in This Report

Unit Number	Name	Landform Character[1]		Transect[2]
		Origin of Parent Material	Surface Form	
MIXEDGRASS PRAIRIE				
2.76	Boissevain-Hartney Plain	Morainal*Lacustrine* Recent Alluvium	Level (Undulating)	Hartney Melita West (22)
TALLGRASS PRAIRIE				
22.01	Red River Valley	Lacustrine*Fluvial	Level	Altona McTavish

1. Based primarily on data from "A Regional Map Base for a Migratory Bird Habitat Inventory Prairie Provinces" G.D. Adams, revised Oct 25, 1985.
   Secondary categories following * are a significant component while those in parentheses are of minor importance.
2. The sample size in most transects is 24 quarter sections. Where the sample size varies from 24 it is shown in parentheses.

Table 4. Physiographic Units in Manitoba Mixedgrass and Tallgrass Prairies Which Have Not Been Sampled

Unit Number	Name	Landform Character		Area in Hectares
		Origin of Parent Material	Surface Form	
MIXEDGRASS PRAIRIE				
	None			
TALLGRASS PRAIRIE				
	None			

Table 5. Size of Monitoring Samples in Relation to Physiographic Units

Unit Number	Name	No. of Quarter Sections In Sample	Area in Hectares		Percentage that Sample is of Unit Area
			Unit [1]	Sample	
MIXEDGRASS PRAIRIE					
2.76	Boissevain-Hartney Plain	46	194,700	3,067	1.6
Total for Ecoregion		46	194,700	3,067	1.6
TALLGRASS PRAIRIE					
22.01	Red River Valley	48	878,800	3,209	0.4
Total for Ecoregion		48	878,800	3,209	0.4

1. To the nearest 100 hectares.

Table 6. Land Area Occupied by Wetlands and Uplands

Physiographic Unit	Transect[1]	Sample Size (in ha)	Percent of Total Sample[2]			
			Wetlands			Uplands
			Total	Uncultivated	Cultivated	
MIXEDGRASS PRAIRIE						
(Morainal - L)						
2.76	Hartney	1,598	1.8	1.0	0.8	98.2
	Melita West	1,469	5.4	3.9	1.5	94.6
		(3,067)	(3.5)	(2.4)	(1.1)	(96.5)
Ecoregion Sample		3,067	3.5	2.4	1.1	96.5
**********						
TALLGRASS PRAIRIE						
(Lacustrine - L)						
22.01	Altona	1,607	0.9	0.3	0.6	99.1
	McTavish	1,601	3.8	1.8	2.0	96.2
		(3,209)	(2.4)	(1.1)	(1.3)	(97.6)
Ecoregion Sample		3,209	2.4	1.1	1.3	97.6

1. Transects are grouped by landform (soil parent material and surface form). Letters identifying surface forms in this and subsequent tables are as follows: L - Level.

2. Figures in parentheses are composite values for two or more transects occurring in the same physiographic unit.

Table 7. Distribution of Wetland Area in Various Cover Classes

Physiographic Unit	Transect[1]	Total Wetland Area in Sample (in ha)[2]	Percent of Total Wetland Area in Cover Class[2]								
			Cultivated	Willows and Trees	Grasses and Sedges	Bulrush/ Cattail	Transitional Open Water	Natural Open Water	Artificial Open Water	Saline Open Water	Other
MIXEDGRASS PRAIRIE											
(Morainal - L)											
2.76	Hartney	29	45.8	5.0	35.0	7.5	0.0	0.0	4.2	0.0	2.5
	Melita West	80	26.9	0.8	59.8	4.1	0.0	0.3	0.6	0.0	7.5
		(109)	(31.8)	(2.0)	(53.2)	(5.1)	(0.0)	(0.3)	(1.3)	(0.0)	(6.3)
Ecoregion Sample		109	31.8	2.0	53.2	5.1	0.0	0.3	1.3	0.0	6.3
TALLGRASS PRAIRIE											
(Lacustrine - L)											
22.01	Altona	15	64.1	0.0	25.0	0.0	0.0	0.0	10.9	0.0	0.0
	McTavish	61	53.2	0.8	37.7	2.8	0.0	0.0	5.1	0.0	0.4
		(76)	(55.2)	(0.6)	(34.9)	(2.5)	(0.0)	(0.0)	(6.4)	(0.0)	(0.4)
Ecoregion Sample		76	55.2	0.6	34.9	2.5	0.0	0.0	6.4	0.0	0.4

1. Grouped by landform (soil parent material and surface form).
2. Figures in parentheses are composite values for those transects occurring within one physiographic unit.

Table 8. Wetland Density/Distribution of Wetland Numbers in Various Cover Classes

Physiographic Unit	Transect[1]	Total Number[2] of Wetlands in Sample	Mean Density[2] Per Quarter Section	Percent of Total Wetland Numbers in Cover Class[2]								
				Cultivated	Willows and Trees	Grasses and Sedges	Bulrush Cattail	Transitional Open Water	Natural Open Water	Artificial Open Water	Saline Open Water	Other
MIXEDGRASS PRAIRIE												
(Morainal - L)												
2.76	Hartney	109	4.5	59.7	6.4	22.9	2.6	0.0	0.0	8.4	0.0	0.0
	Melita West	146	6.6	44.4	2.7	43.2	2.7	0.0	0.7	3.5	0.0	2.8
		(255)	(5.5)	(51.2)	(4.3)	(34.6)	(2.7)	(0.0)	(0.4)	(5.4)	(0.0)	(1.4)
Ecoregion Sample		255	5.5	51.2	4.3	34.6	2.7	0.0	0.4	5.4	0.0	1.4
TALLGRASS PRAIRIE												
(Lacustrine - L)												
22.01	Altona	67	2.8	62.7	0.0	11.8	0.0	0.0	0.0	25.5	0.0	0.0
	McTavish	69	2.9	33.6	0.0	21.7	2.8	0.0	0.0	39.1	0.0	2.8
		(136)	(2.8)	(47.7)	(0.0)	(17.0)	(1.4)	(0.0)	(0.0)	(32.5)	(0.0)	(1.4)
Ecoregion Sample		136	2.8	47.7	0.0	17.0	1.4	0.0	0.0	32.5	0.0	1.4

1. Grouped by landform (soil parent material and surface form).
2. Figures in parentheses are composite values for those transects occurring within one physiographic unit.

Table 9. Distribution of Wetland Area in Various Land Use Activity Classes

Physiographic Unit	Transect[1]	Total Wetland Area in Sample (in ha)[2]	Percent of Total Wetland Area in Land Use Activity Class[2]					
			No Use	Abandoned Cultivation	Annual Crop	Haying	Grazing	Other
MIXEDGRASS PRAIRIE								
(Morainal - L)								
2.76	Hartney	29	26.7	6.7	45.8	0.8	13.3	6.7
	Melita West	80	33.1	0.8	26.7	11.8	25.9	1.7
		(109)	(31.2)	(2.5)	(31.6)	(8.9)	(22.3)	(3.5)
Ecoregion Sample		109	31.2	2.5	31.6	8.9	22.3	3.5
TALLGRASS PRAIRIE								
(Lacustrine - L)								
22.01	Altona	15	24.2	0.0	66.1	3.2	0.0	6.5
	McTavish	61	7.5	0.0	52.5	0.0	0.4	39.6
		(76)	(10.8)	(0.0)	(55.2)	(0.6)	(0.2)	(33.2)
Ecoregion Sample		76	10.8	0.0	55.2	0.6	0.2	33.2

1. Grouped by landform (soil parent material and surface form).
2. Figures in parentheses are composite values for those transects occurring within one physiographic unit.

Table 10. Wetlands Affected by One or More Permanent Impacts

Physio-graphic Unit	Transect[1]	Mean Number of Wetlands/Quarter[2] Total	Affected by One or More Impacts	Percent of Wetlands Impacted
MIXEDGRASS PRAIRIE				
(Morainal - L)				
2.76	Hartney	4.5	1.6	35.7
	Melita West	6.6	2.3	34.2
		(5.5)	(1.9)	(34.8)
Ecoregion Sample		5.5	1.9	34.8
TALLGRASS PRAIRIE				
(Lacustrine - L)				
22.01	Altona	2.8	1.0	34.4
	McTavish	2.9	1.9	66.7
		(2.8)	(1.4)	(50.9)
Ecoregion Sample		2.8	1.4	50.9

1. Grouped by landform (soil parent material and surface form).
2. Figures in parentheses are composite values for those transects occurring within one physiographic unit.

Table 11. Occurrence of Streams in Data Samples

Physio-graphic Unit	Transect[1]	Number of Quarters In Sample[2]	Number of Quarters Containing Streams[2]	Percent of Quarters Containing Streams[2]
MIXEDGRASS PRAIRIE				
(Morainal - L)				
2.76	Hartney	24	3	12.5
	Melita West	22	6	27.3
		(46)	(9)	(19.6)
Ecoregion Sample		46	9	19.6
**********				
TALLGRASS PRAIRIE				
(Lacustrine - L)				
22.01	Altona	24	3	12.5
	McTavish	24	16	66.7
		(48)	(19)	(39.6)
Ecoregion Sample		48	19	39.6

1. Grouped by landform (soil parent material and surface form).
2. Figures in parentheses are composite values for those transects occurring within one physiographic unit.

Table 12. Distribution of Upland Cover Classes

Physiographic Unit	Transect[1]	Total Upland Area (in ha)	Percent of Total Upland in Cover[2]								
			Native					Planted			
			Grass	Low Shrub	Tall Shrub	Trees	Total	Annual Crops[3]	Perennial Grass & Forbs	Trees & Shrubs	Other
MIXEDGRASS PRAIRIE											
(Morainal - L)											
2.76	Hartney	1,569	5.9	0.4	0.2	T[4]	6.5	91.1	0.7	0.4	1.3
	Melita West	1,389	13.6	1.1	0.2	1.6	16.5	78.4	3.1	0.4	1.6
		(2,958)	(9.5)	(0.7)	(0.2)	(0.7)	(11.1)	(85.2)	(1.8)	(0.4)	(1.5)
Ecoregion Sample		2,958	9.5	0.7	0.2	0.7	11.1	85.2	1.8	0.4	1.5
TALLGRASS PRAIRIE											
(Lacustrine - L)											
22.01	Altona	1,592	3.7	0.0	T	T	3.7	89.2	4.8	1.4	0.9
	McTavish	1,541	4.9	T	0.2	0.2	5.3	91.9	0.9	0.7	1.2
		(3,133)	(4.3)	(T)	(0.1)	(0.1)	(4.5)	(90.5)	(2.9)	(1.1)	(1.0)
Ecoregion Sample		3,133	4.3	T	0.1	0.1	4.5	90.5	2.9	1.1	1.0

1. Grouped by landform (soil parent material and surface form).
2. Figures in parentheses are composite values for those transects occurring within one physiographic unit.
3. Includes summerfallow.
4. T = trace = less than 0.05 percent.

Table 13. Distribution of Upland Land Use Activity Classes

Physiographic Unit	Transect[1]	Total Upland Area (in ha)[2]	Percent of Total Upland Area in Land Use Activity[2]							
			Unused	Abandoned	Annual Crops[3]	Forage	Grazing	Farm-steads	Roads & Railways	Other
MIXEDGRASS PRAIRIE										
(Morainal - L)										
2.76	Hartney	1,569	1.2	1.0	91.2	0.6	1.6	1.2	2.8	0.4
	Melita West	1,389	4.8	1.1	78.4	4.9	6.8	0.5	2.7	0.8
		(2,958)	(2.9)	(1.1)	(85.1)	(2.6)	(4.1)	(0.9)	(2.7)	(0.6)
Ecoregion Sample		2,958)	(2.9)	(1.1)	(85.1)	(2.6)	(4.1)	(0.9)	(2.7)	(0.6)
TALLGRASS PRAIRIE										
(Lacustrine - L)										
22.01	Altona	1,592	0.7	0.4	89.2	3.8	T[4]	2.2	3.1	0.6
	McTavish	1,541	1.3	0.1	91.9	0.1	0.2	1.8	3.0	1.6
		(3,133)	(1.0)	(0.2)	(90.5)	(2.0)	(0.1)	(2.0)	(3.1)	(1.1)
Ecoregion Sample		3,133	1.0	0.2	90.5	2.0	0.1	2.0	3.1	1.1

1. Grouped by landform (soil parent material and surface form).
2. Figures in parentheses are composite values for those transects occurring within one physiographic unit.
3. Includes summerfallow.
4. T = trace = less than 0.05 percent.

Table 14. Examples of Variability in Wetland Cover Data

Physiographic Unit	Transect[1]	Area in Hectares Per Quarter Section								
		Cultivated[2]			Grass[2]			Willows[2]		
		Mean	S.E.[3]	C.V.[4]	Mean	S.E.	C.V.	Mean	S.E.	C.V.
MIXEDGRASS PRAIRIE										
(Morainal - L)										
2.76	Hartney	0.6	0.1	1.2	0.4	0.1	0.9	0.1	T[5]	0.6
	Melita West	1.0	0.3	1.4	2.2	1.7	3.7	T	0.0	0.3
		(0.8)	(0.2)	(1.3)	(1.3)	(0.7)	(3.8)	(T)	(T)	(0.5)
Ecoregion Sample		0.8	0.2	1.3	1.3	0.7	3.8	T	T	0.5
TALLGRASS PRAIRIE										
(Lacustrine - L)										
22.01	Altona	0.4	0.1	1.2	0.1	T	0.9	0.0	0.0	0.0
	McTavish	1.3	2.8	10.3	1.0	0.2	0.8	T	0.0	0.6
		(0.9)	(1.0)	(8.2)	(0.5)	(0.1)	(1.1)	(T)	(T)	(0.6)
Ecoregion Sample		0.9	1.0	8.2	0.5	0.1	1.1	T	T	0.6

1. Grouped by landform (soil parent material and surface form).
2. Figures in parentheses are composite values for those transects occurring within one physiographic unit.
3. S.E. = Standard Error
4. C.V. = Coefficient of Variation
5. T = trace = lessthan 0.05 percent.

Table 15. Examples of Variability in Upland Cover Data

Physiographic Unit	Transect[1]	Area in Hectares Per Quarter Section								
		Cropland[2]			Native Grass[2]			Native Trees[2]		
		Mean	S.E.[3]	C.V.[4]	Mean	S.E.	C.V.	Mean	S.E.	C.V.
MIXEDGRASS PRAIRIE										
(Morainal - L)										
2.76	Hartney	59.6	10.4	0.9	3.8	3.8	4.9	T[5]	0.0	0.1
	Melita West	49.5	38.9	3.7	8.6	19.5	10.7	1.0	2.0	9.6
		(54.8)	(20.3)	(2.5)	(6.1)	(8.5)	(9.5)	(0.5)	(0.7)	(9.9)
Ecoregion Sample		54.8	20.3	2.5	6.1	8.5	9.5	0.5	0.7	9.9
TALLGRASS PRAIRIE										
(Lacustrine - L)										
22.01	Altona	59.1	16.1	1.3	2.5	0.3	0.5	0.0	0.0	T
	McTavish	59.0	7.6	0.6	3.1	0.7	1.2	0.2	0.1	3.7
		(59.1)	(8.2)	(1.0)	(2.8)	(0.4)	(0.9)	(0.1)	(T)	3.6
Ecoregion Sample		59.1	8.2	1.0	2.8	0.4	0.9	0.1	T	3.6

1. Grouped by landform (soil parent material and surface form).
2. Figures in parentheses are composite values for those transects occurring within one physiographic unit.
3. S.E. = Standard Error
4. C.V. = Coefficient of Variation
5. T = trace = less than 0.05 percent.

Table 16. Examples of Variability in Upland Land Use Data

Physio-graphic Unit	Transect[1]	Area in Hectares Per Quarter Section								
		Unused[2]			Grazing[2]			Roads & Railways[2]		
		Mean	S.E.[3]	C.V.[4]	Mean	S.E.	C.V.	Mean	S.E.	C.V.
MIXEDGRASS PRAIRIE										
(Morainal - L)										
2.76	Hartney	0.8	0.6	3.4	1.1	2.8	12.8	1.9	0.3	0.7
	Melita West	3.0	6.3	9.8	4.3	16.8	18.4	1.7	0.3	0.7
		(1.9)	(2.4)	(8.8)	(2.6)	(6.9)	(17.8)	(1.8)	(0.2)	(0.7)
Ecoregion Sample		1.9	2.4	8.8	2.6	6.9	17.8	1.8	0.2	0.7
TALLGRASS PRAIRIE										
(Lacustrine - L)										
22.01	Altona	0.4	0.1	0.9	T[5]	0.0	0.5	2.1	0.1	0.2
	McTavish	0.9	1.7	9.7	0.1	0.1	2.9	1.9	0.2	0.4
		(0.7)	(0.6)	(6.7)	(0.1)	(T)	(2.5)	(2.0)	(0.1)	(0.3)
Ecoregion Sample		0.7	0.6	6.7	0.1	T	2.5	2.0	0.1	0.3

1. Grouped by landform (soil parent material and surface form).
2. Figures in parentheses are composite values for those transects occurring within one physiographic unit.
3. S.E. = Standard Error
4. C.V. = Coefficient of Variation
5. T = trace = less than 0.05 percent

Table 17. Estimated Area of Wetland Cover Classes in Physiographic Units

Physiographic Unit[1] Number	Name	Estimated Area in Thousands of Hectares: Total Wetland Area	Cultivated	Willows and Trees	Grasses and Sedges	Bulrush/ Cattail	Transitional Open Water	Natural Open Water	Artificial Open Water	Saline Open Water	Other
MIXEDGRASS PRAIRIE											
(Morainal - L)											
2.76	Boissevain - Hartney Plain	6.9	2.2	0.1	3.7	0.4	0.0	T[2]	0.1	0.0	0.4
Total for Entire Sampled Portion of the Ecoregion		6.9	2.2	0.1	3.7	0.4	0.0	T	0.1	0.0	0.4
**********											
TALLGRASS PRAIRIE											
(Lacustrine - L)											
22.01	Red River Valley	20.8	11.5	0.1	7.3	0.5	0.0	0.0	1.3	0.0	0.1
Total for Entire Sampled Portion of the Ecoregion		20.8	11.5	0.1	7.3	0.5	0.0	0.0	1.3	0.0	0.1

1. Grouped by landform (soil parent material and surface form).

2. T = trace = less than 0.05 percent.

Table 18. Estimated Numbers of Wetland Cover Classes in Physiographic Units

Physiographic Unit[1] Number	Name	Estimated Number of Wetlands (in Thousands) Total Number of Wetlands	Cultivated	Willows and Trees	Grasses and Sedges	Bulrush/ Cattail	Transitional Open Water	Natural Open Water	Artificial Open Water	Saline Open Water	Other
MIXEDGRASS PRAIRIE											
(Morainal - L)											
2.76	Boissevain - Hartney Plain	16.2	8.3	0.7	5.6	0.4	0.0	0.1	0.9	0.0	0.2
Total for Entire Sampled Portion of the Ecoregion		16.2	8.3	0.7	5.6	0.4	0.0	0.1	0.9	0.0	0.2
TALLGRASS PRAIRIE											
(Lacustrine - L)											
22.01	Red River Valley	37.2	17.8	0.0	6.3	0.5	0.0	0.0	12.1	0.0	0.5
Total for Entire Sampled Portion of the Ecoregion		37.2	17.8	0.0	6.3	0.5	0.0	0.0	12.1	0.0	0.5

1. Grouped by landform (soil parent material and surface form).

Table 19. Estimated Area of Wetland Use Activity Classes in Physiographic Units

Physiographic Unit[1] Number	Name	Estimated Area in Thousands of Hectares: Total Wetland Area	No Use	Abandoned Cultivation	Annual Crops	Haying	Grazing	Other
MIXEDGRASS PRAIRIE								
(Morainal - L)								
2.76	Boissevain - Hartney Plain	6.9	2.2	0.2	2.2	0.6	1.5	0.2
Total for Entire Sampled Portion of the Ecoregion		6.9	2.2	0.2	2.2	0.6	1.5	0.2
TALLGRASS PRAIRIE								
(Lacustrine - L)								
22.01	Red River Valley	20.8	2.3	0.0	11.5	0.1	T[2]	6.9
Total for Entire Sampled Portion of the Ecoregion		20.8	2.3	0.0	11.5	0.1	T	6.9

1. Grouped by landform (soil parent material and surface form).

2. T = trace = less than 50 hectares.

Table 20. Estimated Area of Upland Cover Classes in Physiographic Units

Physiographic Unit[1] Number	Name	Estimated Area in Thousands of Hectares									
			Native					Planted			
		Total Upland Area	Grass	Low Shrub	Tall Shrub	Trees	Total	Annual Crops	Perennial Grasses and Forbs	Trees and Shrubs	Other
MIXEDGRASS PRAIRIE											
(Morainal - L)											
2.76	Boissevain - Hartney Plain	187.8	17.8	1.3	0.4	1.3	20.8	160.0	3.4	0.8	2.8
Total for Entire Sampled Portion of the Ecoregion		187.8	17.8	1.3	0.4	1.3	20.8	160.0	3.4	0.8	2.8
**********											
TALLGRASS PRAIRIE											
(Lacustrine - L)											
22.01	Red River Valley	858.0	36.9	T[2]	0.9	0.9	38.7	776.5	24.9	9.4	8.5
Total for Entire Sampled Portion of the Ecoregion		858.0	36.9	T	0.9	0.9	38.7	776.5	24.9	9.4	8.5

1. Grouped by landform (soil parent material and surface form).

2. T = trace = less than 50 hectares.

Table 21. Estimated Area of Upland Land Use Activity Classes in Physiographic Units

Physiographic Unit[1] Number	Name	Estimated Area in Thousands of Hectares: Total Upland Area	Unused	Abandoned	Annual Crops	Forage	Grazing	Farm-steads	Roads and Railways	Other
MIXEDGRASS PRAIRIE										
(Morainal - L)										
2.76	Boissevain - Hartney Plain	187.8	5.4	2.1	159.8	4.9	7.7	1.7	5.1	1.1
Total for Entire Sampled Portion of the Ecoregion		187.8	5.4	2.1	159.8	4.9	7.7	1.7	5.1	1.1
TALLGRASS PRAIRIE										
(Lacustrine - L)										
22.01	Red River Valley	858.0	8.6	1.7	776.5	17.2	0.8	17.2	26.6	9.4
Total for Entire Sampled Portion of the Ecoregion		858.0	8.6	1.7	776.5	17.2	0.8	17.2	26.6	9.4

1. Grouped by landform (soil parent material and surface form).

Table 22. Rating of Sampled MORAINAL Physiographic Units in Manitoba Mixedgrass Prairie as Waterfowl Production Habitat

Physiographic Unit[1] Number	Name	Percent of Total Unit Area in Wetlands	Percent of Wetland Area In Cover Class				Percent of Upland Area		Area of Unit in 1000's of Hectares	Rating as Waterfowl Production Habitat[2]
			Grass	Bulrush/ Cattail	Natural Fresh Open Water	That is Unused	In Native and Seeded Grass and Shrub Cover	That is Unused		
2.76	Boissevain - Hartney Plain	3.5	53.2	5.1	0.3	31.2	12.2	2.9	194.7	4 /4*/4

1. Since there is only one unit in the Manitoba Mixedgrass Prairie minimum rating values cannot be calculated for the ecoregion itself but three waterfowl production ratings have been calculated for the single unit using the minimum rating values for, sequentially, Saskatchewan Mixedgrass Prairie, Manitoba Parkland and Alberta Parkland.
Asterisks indicate ratings which have been downgraded because of loss of points for both bulrush/cattail and natural fresh open water.

Table 23. Frequency of Land Use/ Cover Changes Between May 1985 and Time of Ground Truth Survey

Physiographic Unit	Transect[1]	Numbers of Quarters[2] In Sample	Numbers of Quarters[2] Affected by Land Use/ Cover Changes	Percent of Quarters Affected	Time Interval from May 1985 to Ground Truth Survey (in months)
MIXEDGRASS PRAIRIE					
(Morainal - L)					
2.76	Hartney	24	9	37.5	41
	Melita West	22	7	31.8	40
		(46)	(16)	(34.8)	
Ecoregion Sample		46	16	34.8	
TALLGRASS PRAIRIE					
(Lacustrine - L)					
22.01	Altona	24	6	25.0	49
	McTavish	24	4	16.7	49
		(48)	(10)	(20.8)	
Ecoregion Sample		48	10	20.8	

1. Grouped by landform (soil parent material and surface form).
2. Figures in parentheses are composite values for those transects occurring within one physiographic unit.