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A Synthesis of the 2001-2004 Peace Native Grasslands Program

Alberta Conservation Association

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EXECUTIVE SUMMARY

This report summarizes activities performed as part of the Peace Native Grasslands Program between 2001 and 2004. Until this study was undertaken, very little was known about the current location, size, or condition of upland native grasslands in the Peace region. Historically, native grasslands were extensive and contiguous throughout the Peace region of northwest Alberta. Land development has heavily affected the landscape since the 1900s and the present study has shown that only 746 ha of upland native grassland remains; representing less than 0.5% of the original area. An additional 1,210 ha is yet to be fully evaluated. Current remnants of native prairie are distributed nearly equally between private and Crown ownership.

Interpretation of aerial photography identified 952 upland native grassland sites in the Peace region. Using field assessments, 395 of these sites were verified as being native grassland remnants and were subsequently described in terms of their plant communities. In addition, vegetation communities in valley native grasslands, moist native meadows and sphagnum peatlands were verified using aerial photographs. Based on field assessments, parcels of remnant upland native grasslands were very small in size with the vast majority (i.e., 97% of all sites assessed) sites being < 16.2 ha (i.e., 40 acres) and with 39% of all remnants being one hectare or less. The small size of remnant grasslands will affect the selection and application of potential management and conservation tools that can be used effectively and economically to conserve native grasslands.

Native upland grasslands are biologically diverse both within and among remnants and support both rare plant species and communities. Native grasslands in the Peace region also provide habitat for many animal species including several butterfly species that are dependent on specific grassland host plants. In fact, my data suggests that eight disjunct grassland dependent butterflies appear to have a strong affinity for native habitats. During this study, the known ranges for a number of plant, butterfly, and moth species were extended. Continued habitat disturbance and fragmentation represents an ongoing threat to the persistence of these and other species.

During the study period, baseline information was collected on upland native

grasslands, and related data used by other agencies to support conservation of native prairie habitat. The availability of these baseline data means that more projects can, and are, being developed to address specific questions related to native grasslands, their management and their conservation.

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All photographs in this report are taken by the author, unless otherwise noted.

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1.0 INTRODUCTION

Native grasslands of the Peace region in northwest Alberta are home to a diverse and interdependent mix of plants, insects, birds, and other animals; this assemblage of species is found nowhere else in Alberta. However, very little is known about these native grasslands, including how much remains, where it is located, its current condition and changes that it may undergo due to livestock and other human-induced pressures. In this report, native grasslands refer to graminoid (i.e., grass and sedge)-dominated areas of the Peace region, and do not include the tree or shrub dominated areas that are often associated with these open grassy sites.

1.1 Background

Native grasslands in the Peace Parkland ecosystem, which were once extensive and contiguous throughout the Peace region, are now confined to small, scattered remnants typically located in upland regions, and in larger areas along the south and west facing slopes of the Peace and Smoky Rivers and their tributaries (Alberta Environmental Protection 1997). Using Wilkinson's (1981) early land survey estimates of the Peace region parkland and the corresponding proportion that was classified as 'prairie' or 'open grassland', the areal extent of upland native grasslands covered can be estimated at 434,530 to 1,128,935 hectares in the Grande Prairie, Spirit River and Peace River areas. This estimate is likely conservative because it does not include other grassland areas that were scattered throughout the region including those in the Fort Vermilion, Manning, Keg River and High Prairie regions indicated by Moss (1952; Figure 1). Interestingly, the names of many towns in northwest Alberta include references to prairie ecosystems i.e., include Grande Prairie, High Prairie, Big Prairie, Salt Prairie, Paddle Prairie, John D'or Prairie, Buffalo Head Prairie, Wilson Prairie, Savage Prairie, Clear Prairie, Little Prairie, Prairie Echo, and Prairie Point.

Wide scale loss of open grasslands is generally attributed to the expansion of cultivation, urbanization and industry, inappropriate grazing practices, encroachment of forests and shrublands and competition with non-native species and invasive weeds from tame pastures (Alberta Environmental Protection 1997, Leonard 2000). Loss of the majority of

Figure 1. Map of the Peace River region from the 1950s. The shaded areas represent parkland vegetation and dark soils, and include the natural grasslands of the region. Taken from Moss (1952).

upland native grassland occurred in the early 1900s due to cultivation (Wilkinson 1981, Leonard 2000). Since that time, much of the remaining upland grasslands have also succumbed to cultivation, or more surreptitiously have been modified by overgrazing, shrub encroachment and the intentional introduction or accidental encroachment of agronomic species. These factors have and continue to affect all Parkland areas of Alberta. However, the Peace River Parkland has undergone perhaps the most extensive alteration and native habitat loss of all the regions (Alberta Environmental Protection 1997). Habitat loss, which has severely decreased the area of native grasslands in the Peace region; habitat fragmentation; and the invasion of non-native plant species into native remnants are considered the top three threats to biological diversity in the Peace River region (Alberta Environmental Protection 1997, Wolff et al. 1997).

1.2 Study rationale

Continued habitat loss and fragmentation of native grassland ecosystems reduce the biological diversity of plant communities and the animals that rely on those plants for their survival. The absence of basic information on the status of these native grassland ecosystems in the Peace region, greatly reduces our ability to conserve these important habitats and the plant and animal species that occupy them.

1.2.1 Conservation considerations

Native grasslands are home to a diverse assemblage of plants and animals and maintaining and conserving these grasslands has the potential to conserve multiple species, including those that directly or indirectly rely on these habitat types. The Alberta Conservation Association (ACA), Ducks Unlimited Canada (DUC) and the Nature Conservancy of Canada (NCC) have identified native grasslands as a priority for conservation. The use of GIS technology to map grasslands allows for comparisons with other spatial information to gain insights on what factors may affect grassland conservation. The information also provides benefits to other conservation-related projects such as rare plant inventories, butterfly monitoring and sharp-tailed grouse (Tympanuchus phasianellus) habitat conservation. When compared with identified conservation priority areas, the mapping products can be used as a planning tool for many conservation agencies.

1.2.2 Plant species

Five plant species that are often found in native grasslands and have been previously recorded in the study area are currently tracked by the Alberta Natural Heritage Information Centre (ANHIC), as they are considered of high priority because of their rarity or other attributes (Vujnovic and Gould 2002) (Table 2). Definitions of ANHIC status (S) ranks are provided in Table 1. The Provincial government has assessed the status of orchids and ferns in Alberta and has identified leather grape fern (Botrychium multifidum var intermedium) as being a species that 'may-be-at-risk' (Anonymous 2001). All other vascular species are still under review and status rankings are not currently available (Robin Gutsell, Alberta Sustainable Resource Development, Edmonton, pers. comm.). There are also at least 34 grassland species found in the Peace Parkland that appear to represent disjunct populations, which normally have a more southerly or westerly distribution (Achuff 1994, Lorna Allen, Alberta Sustainable Resource Development, Edmonton, pers. comm.).

Table 1. Definition of plant species assessment rankings by ANHIC (Alberta Natural Heritage Information Centre 2002).

Status Rank	Description
S1	5 or fewer occurrences or only a few remaining individuals, may be especially vulnerable to extirpation because of some factor of its biology.
S2	6-20 or fewer occurrences or with many individuals in fewer locations, may be especially vulnerable to extirpation because of some factor of its biology.
S3	21-100 occurrences, may be rare and local throughout its range, or in a restricted range (may be abundant in some locations), may be vulnerable to extirpation because of large-scale disturbance.
S4	Typically >100 occurrences, apparently secure.
S5	Typically >100 occurrences, demonstrably secure.

Table 2. Status and rank of select plant species found in the Peace region grasslands.

Common name	Scientific name	ANHIC rank
Canadian rice grass	Oryzopsis Canadensis	S1
Carolina wild geranium	Geranium carolinianum	S1
Herriot's sagewort	Artemisia tilesii	S2
Leather grape fern	Botrychium multifidum var intermedium	S2
Pale blue-eyed grass	Sisyrinchium septentrionale	S2S3

1.2.3 Plant communities

ANHIC tracks natural plant communities that have been described by vegetation experts as 'unusual', 'uncommon', 'of limited extent', 'encountered infrequently', 'in decline' or 'threatened' (Allen 2002). Six grassland communities found in the Peace region are present on this tracking list: slender wheatgrass (Elymus trachycaulus syn. Agropyron trachycaulum)-needle grass species (Stipa spp.) and June grass (Koeleria macrantha)-western wheat grass (Pascopyrum smithii syn. Agropyron smithii) communities are found on upland sites. Slender wheat grass-awned sedge (Carex atherodes) communities are found in moist areas. Western wheat grass-Herriot's sagewort-pasture sagewort (Artemisia frigida) and western porcupine grass (Stipa curtiseta)-green needle grass (Stipa viridula)-sedge species (Carex spp.) communities are found on steep river slopes.

1.2.4 Birds

Native grasslands also provide habitat for many wildlife species, including birds such as Le Conte's sparrow, which prefer native grasslands to tame pasture (Prescott and Murphy 1996). A study by Prescott and Arbuckle (1995) showed that native grasslands support some of the most diverse avian communities in the Peace Parkland Biome, along with sphagnum peatlands (referred to as perched sphagnum bogs by Prescott and Arbuckle (1995) and moist meadows (referred to as wet sedge meadows by Prescott and Arbuckle). Although sphagnum peatlands may be more widespread, Prescott and Arbuckle (1995) considered them one of two habitats unique to the Peace Parkland.

A number of priority North American Bird Conservation Initiative (NABCI) bird species

occur or nest within native Peace region grasslands (Reg Arbuckle, Ducks Unlimited Canada, Grande Prairie, pers. comm.). These include birds of prey, waterfowl and grassland songbirds (Table 3).

Table 3. Provincial and COSEWIC status of NABCI bird species found in the grasslands of the Peace region.

Common name	Scientific name	Provincial general species status	COSEWIC status
Peregrine falcon	Falco peregrinus	At risk	Threatened
Short-eared owl	Asio flammeus	May be at risk	Special concern
Trumpeter swan	Cygnus buccinator	At risk	Not at risk
Red-tailed hawk	Buteo jamaicensis	Secure	Not at risk
Northern harrier	Circus cyaneus	Secure	Not at risk
Upland sandpiper	Bartramia longicauda	Sensitive	Not assessed
Sharp-tailed grouse	Tympanuchus phasianellus	Sensitive	Not assessed
Le Conte's sparrow	Ammodramus leconteii	Secure	Not assessed
Lincoln's sparrow	Melospiza lincolnii	Secure	Not assessed
Vesper sparrow	Pooecetes gramineus	Secure	Not assessed
Say's phoebe	Sayornis saya	Secure	Not assessed
Clay colored sparrow	Spizella pallida	Secure	Not assessed
Western meadowlark	Sturnella neglecta	Secure	Not assessed
Eastern kingbird	Tyrannus tyrannus	Secure	Not assessed

1.2.5 Butterflies and moths

Butterflies, like birds, "are widely considered to be good indicators of the health of the environment" (Harding et al. 1995). Butterflies have been found to be the most prairie remnant-dependent of all insects (Panzer et al. 1995 cited in Debinski and Babbit 1997) and there is a close association between endemic butterflies of the Peace region and remnant

native grasslands. No other region of northern Alberta has as high a diversity of butterflies or as many species (23) with disjunct or edge-of-range populations (Kondla et al. 1994) as the Peace region. Grassland-dependent butterflies in the Peace region are physically separated from their main southern populations by a large area of boreal forest, which likely reduces marked exchanges between the two populations. As a result, nine species of disjunct populations occur in the Peace region grasslands (Table 4).

Butterfly species that are dependent on native grass species typically use non-agricultural sites; an association that is clearly influenced by larval host plant requirements (Fleishman et al. 1999). This degree of habitat affinity is particularly significant for four butterfly species found in the Peace region: plains skipper (Hesperia assiniboia), Alberta arctic (Oeneis Alberta) and Uhler's arctic (Oeneis uhleri varuna), which all feed on native grasses, and Pike's Old World swallowtail which is endemic to the Peace Region and listed as a 'Lower priority candidate' by the Committee of the Status of Endangered Wildlife in Canada (COSEWIC) (2004). Pike's Old World swallowtail (Papilio machaon pikei), which feeds exclusively on dragonwort (Artemisia dracunculus) in the Peace region is restricted to eroded native slopes of the Peace River and its tributaries (Bird et al. 1995, Hervieux 2002).

Moths and butterflies may also serve as biological indicators for a diversity of arthropods. Many elements of the biology of moths are shared with butterflies. For instance, many species of moths, like butterflies, are entirely dependent on a single plant species and hence, their occurrence is determined by the presence of a specific plant community. Some species are expected to be limited to native grasslands and therefore should be exceedingly vulnerable to habitat loss. There may be about 10 times as many moth species as there are butterfly species in Alberta; though very little is known about moth communities in the province.

Table 4. Peace region grassland butterfly species of interest and their provincial general species status and ANHIC rank.

Common name	Scientific name	ANHIC S rank	Provincial general species status
Gorgone checkerspot	Chlosyne gorgone carlota	S2	Sensitive
* Alberta arctic	Oeneis Alberta	S1S2	Sensitive
Pike's Old World swallowtail	Papilio machaon pikei	S1S2	Sensitive
* Northern checkerspot	Chlosyne palla	S1S2	Secure
* Plains (Assiniboine) skipper	Hesperia assiniboia	S1S2	Secure
Garita skipper	Oarisma garita	S4	Secure
Uhler's arctic	Oeneis uhleri varuna	S5	Secure
* Coral hairstreak	Satyrium titus	S1S2	Secure
* Striped hairstreak	Satyrium liparops fletcheri	S1S2	Undetermined

* The ANHIC ranks are for the Peace region populations only.

1.3 Study objectives

The objectives of this project were to: i) locate remnant patches of native grasslands, ii) complete field assessments to quantify plant communities, and iii) using GIS tools, map the location of remnant patches of native grasslands in the Peace region of northwest Alberta. We also addressed specific questions related to the first two objectives:

Goal 1. Location of remnant native grasslands:

a) Where are upland native grasslands, valley native grasslands, and moist native meadows located?
b) Based on current information, what is the areal extent of current patches of native grassland?
c) Who owns or manages the native upland grassland remnants?

Goal 2. Quantifying plant communities

a) Which plant species occur in upland native grasslands?
b) What is the condition of upland native grasslands?
c) Which rare plants are found in upland native grasslands?
d) What is the distribution and occurrence of butterflies associated with upland native grasslands?
e) What is the relationship between plants and butterflies that are disjunct, endemic or reliant on native grasslands of the Peace region?

2.0 STUDY AREA

2.1 Description

The study area encompasses a 43,203 km^2 area located in northwest Alberta (Figure 2). This region includes administrative areas of the Alberta Conservation Association (ACA) and Alberta Sustainable Resource Development (ASRD) in northwest Alberta and overlaps with the Alberta portion of the Peace Parkland Biome area identified by the North American Waterfowl Management Plan (NAWMP). Efforts were focused mainly within settled portions in this study area (i.e., white zone). The study extends from Valleyview in the south to High Level in the north, and Slave Lake in the east to the Alberta/British Columbia border in the west (Figure 2).

2.2 Natural region, climate and soils

Parkland areas that support grasslands in the Peace region are included in the Peace Parkland and Dry Mixedwood Natural Subregions, which are part of the Boreal Mixedwood ecological area (Achuff 1994, Alberta Environmental Protection, Beckingham and Archibald 1996). The Peace Parkland is a transition zone separated from the Central Parkland by 500 km of forest and is surrounded by boreal forest. The Dry Mixedwood component of the boreal forest includes the Debolt, Dunvegan, Falher, Smoky, Grimshaw, Manning, High Level, and Boyer plains ecodistricts (Willoughby 2000).

Figure 2. Location of the study area in the white zone (i.e. settled) in northwest Alberta. White zone = settled, green zone = non-settled.

Grasslands are generally located on the broad, gently rolling plains and steep sided river valleys (Achuff 1994, Alberta Environmental Protection 1997). The area is drained by the Mackenzie River via the Peace River and its tributaries. The climate is sub-humid (annual precipitation = 350-440 mm), with short cool summers and long cold winters (Achuff 1994, Alberta Environmental Protection 1997). Average summer temperature is 13.8 ^{o}C and the region experiences 1150 growing degree days (i.e., relative amount of energy available for plant growth, Strong and Leggat 1992). Soils of the grasslands are mostly Solonetzic (Wilkinson and Johnson 1983, Achuff 1994, Alberta Environmental Protection 1997).

2.3 Plant communities

Depending on moisture, the Parkland comprises a mosaic of aspen forest, upland and wetland scrub, grassland, marsh, and aquatic plant communities (Bird 1961). Grassland communities in the Peace River Parkland are closely related to the Northern Fescue communities, but rough fescue (Festuca scabrella) is absent (Achuff 1994, Moss 1952). The grasslands are dominated by native grasses, particularly wheat grasses (Agropyron spp.), western porcupine grass, June grass, sedge, intermediate oatgrass (Danthonia intermedia), and numerous forbs (Moss 1952, Wilkinson 1981, Wallis 1982, Kershaw et al. 2001). A listing of expected plant communities in the Peace region is shown in Appendix 1.

2.4 Animal communities

Large wildlife species found in the Peace River Parkland Natural Subregion are more closely related to the surrounding forested areas than the southern parkland. Some of the common large species are moose (Alces alces), whitetail deer (Odocoileus virginianus), black bear (Ursus americanus), and wolf (Canis lupus, Achuff 1994, Alberta Environmental Protection 1997).

3.0 MATERIALS AND METHODS

3.1 Site selection

Air photo interpretation was chosen as being the most effective and efficient initial method to locate potential remnants of native grasslands (Baker 2002) and recent black and white air photos taken in 1984, 1985, 1989, 1990, 1995, 1997, 1999, 2001 (primarily at a 1:30,000 scale) were used to identify upland native grassland, valley native grassland, moist native meadows, and sphagnum peatlands (Table 5) using definitions shown in Table 6.

Table 5. Definition of terms used to classify polygons through air photo interpretation.

Classification	Definition
Upland native grasslands	Upland; unbroken/uncultivated; rough or uneven texture, as opposed to smooth texture suggesting tame pasture; low cover of trees and shrubs.
Valley native grasslands	Generally south or west facing open slopes of major rivers and tributaries draining the Peace region and open areas down slope. Note: due to the complexity of valley vegetation communities, trees were included in the polygons where differentiating grassland from the tree portion would be too time consuming and costly.
Moist native meadows	Generally forest openings and open riparian areas suggesting primarily grass cover as opposed to depressional areas likely to be wetlands; no evidence of standing water.
Sphagnum peatlands	Perched sphagnum bogs typically small in area, in upland situations and ringed by a moat-like wetland. Bogs may be dominated by Labrador tea or by black spruce.

Table 6. Definition of terms used in data collection.

Term	Definition
Interpreted polygon	An area (separated by topography, vegetation or distance) determined by air photo interpretation which had high potential to contain either upland native grassland, valley native grassland, moist native meadow, or sphagnum peatland
Polygon portion	The polygon that was created when a large interpreted polygon that extended over more than one quarter section, was dissected by a quarter line
Site	Quarter section (65 hectares) that contained any interpreted polygon/s or portion/s thereof
Microplot	20 x 50 cm quadrat area that was sampled in a representative area of a site's upland native grassland polygon, to determine vegetation cover and species composition

Regardless of land ownership or quarter section boundaries, polygons were interpreted to 3-4 hectares in size, or as small as could be discerned by the experienced contractor who interpreted the aerial photographs. Polygons were outlined on a clear film 1:50,000 scale NTS mapsheet, which showed the most recently available (1997-2001) Indian Resources Satellite (IRS) image and Alberta Township System (ATS) information. Interpreted polygons were digitized and the spatial data set was created in an Arcview 3.2 shapefile format, which is stored at the ACA Peace River office. A segment of a map-sheet showing the interpretation product is shown in Figure 3.

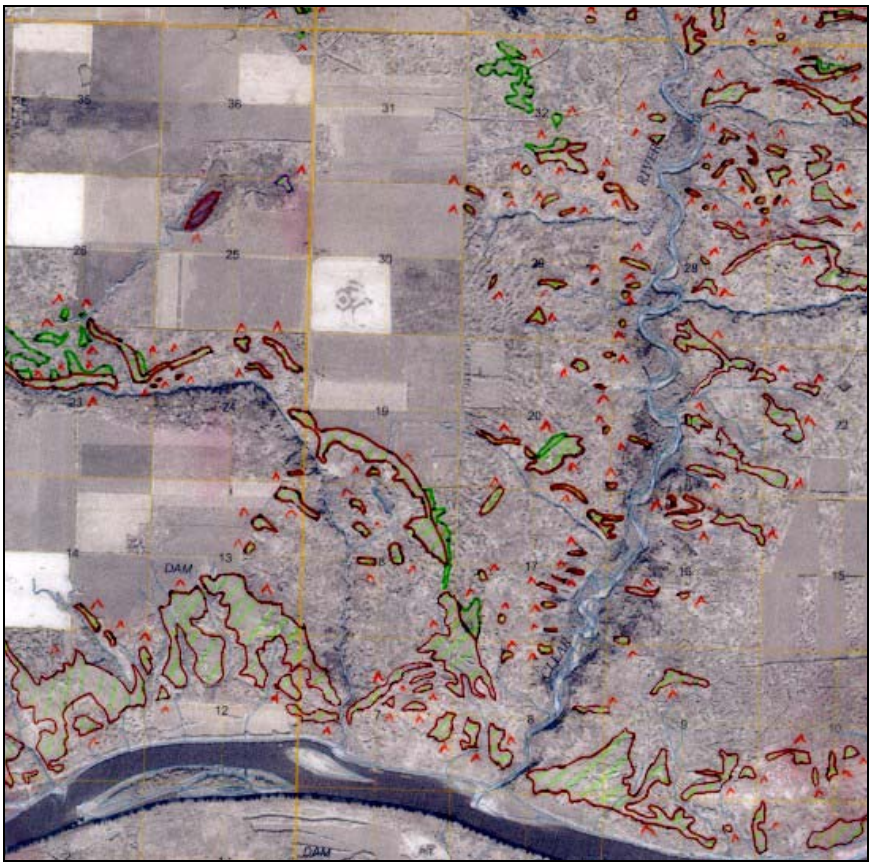

Figure 3. Portion of an NTS mapsheet which shows a satellite image with outlined areas of interpreted valley native grassland polygons (brown outline and green hatching) and interpreted upland native grassland polygons (green outline and green hatching).

This method follows the procedure used by the Native Vegetation Inventory and GIS Mapping-Central Parkland Natural Region project (R. Bjorge, ASRD, pers. comm.) to provide results comparable to other mapping initiatives. The main deviations in methods were: i) the smaller size of grassland remnants in the Peace region (3-4 hectares in size compared to 65 hectares patches elsewhere and ii) minor differences in the composition of plant communities.

Sites chosen for on-site verification were generally prioritized by land ownership (i.e., private land had higher priority than grazing lease, vacant crown land or protected areas), size (larger polygons had higher priority), location (upland sites away from river drainages had higher priority than those near valley slopes), and distribution (clusters or sites owned by same landowner had higher priority than isolated islands). This

prioritization was based on conservation focus of ACA, and includes many potential grassland prairie remnants located on private lands. Ungrazed sites are known to have higher plant, butterfly and bird diversity and are of greater conservation interest to project partners. Larger sites were more likely to be intact and may be the cost effective sites to conserve. Remnants that are clustered represent more effective habitat for butterflies, and time efficiencies were gained when dealing with a single landowner versus multiple landowners.

3.2 Data collection

While the interpretation of aerial photography provides a useful means to identify potential remnant patches of native grasslands, field assessments are required to verify their occurrence. Sites were visited to confirm their status as native remnants. If a spatial polygon was classified as being native upland grassland based on the field assessment, additional data were collected. If a polygon was found to be modified or composed primarily of native shrubland, no further work was done. To provide complementary data, polygon classification was based on criteria used by Alberta Sustainable Resource Development, Public Lands and Forest Division, using definitions shown in Table 7 (Willoughby 2000, Adams et al. 2003).

Table 7. Definitions of terms used to classify polygons.

Term	Definition
Native	Not cleared or broken, more than 30% native species
Modified	Cleared, broken, or more than 70% non-native species either through overgrazing which resulted in a Kentucky bluegrass (Poa pratensis) dominated community, or the domination of introduced species like awnless brome (Bromus inermis)
Grassland	No overstory tree canopy, dominated by grass or forb species
Shrubland	No overstory tree canopy, dominated by shrubs taller than 0.5 m

Plants were identified using Moss (1983) except for Ophioglossaceae syn. Botrychiaceae, which were identified using Williston (2001). Common names follow those defined by Alberta Environmental Protection (1993).

3.2.1 Vegetation relative abundance, flowering and inventory

During the traverse of a native grassland polygon, the relative abundance of each plant species was recorded by using the ACFOR scale which assigns relative abundance codes: of A = abundant, AL = locally abundant, C = common, CL = locally common, F = frequent, FL = locally frequent, O = occasional, OL = locally occasional, R = rare (Kent and Coker 1992).

Flowering forbs and shrubs were given an international phenology code related to the stage of flowering of the plant at the time (Dierschke 1972) (Table 8). Plant canopy cover and composition were recorded following Robertson and Adams (1990). Briefly, ten microplots were regularly spaced along a transect line which cut through the middle of a native upland grassland polygon. In each microplot, canopy cover was estimated and a cover class was given to each forb and graminoid species, exposed soil, litter, and moss and lichen. At every second microplot, litter was collected and later oven-dried and weighed to determine vegetation productivity. Woody species were described by estimating their density, height, and percent of the polygon area covered.

3.2.2 Range health assessment

The range health of a site was determined by comparing the plant community of the site with a reference plant community that showed the potential natural community structure for the site under light grazing. As reference sites for upland native grasslands of the Peace region had not been developed for use in the Range Health Assessment tool, the regional ASRD Public Lands Range Management Specialist, Mr. Colin Stone, provided descriptions and a number of 'best approximation' sites that could be used as reference sites. Site integrity and ecological status, community structure, hydrologic function and nutrient cycling, site stability and presence of noxious weeds were also evaluated (Adams et al. 2003). A site was classified as 'healthy' if it scored between 75-100%, 'healthy with

problems' with a score between 50-74% and 'unhealthy' if it scored less than 50%.

Table 8. Stage of flowering and corresponding phenology codes.

Stage of forb and shrub flowering	Phenology code
Without blossom	R0
Blossom buds recognizable	R1
Blossom buds strongly swollen	R2
Shortly before flowering	R3
Beginning bloom	R4
Up to 25% in blossom	R5
Up to 50 % in blossom	R6
Full bloom	R7
Fading	R8
Completely faded	R9
Bearing green fruit	R10
Bearing ripe fruit	R11
Bearing overripe fruit	R12
Fruit or seed dispersal	R13

3.2.3 Documentation of rare plants, butterflies and moths

3.2.3.1 Rare plants

ANHIC provided a list of plant element occurrences in or within 10 km of the Peace River Parkland Subregion as of June 6th 2001, plant tracking lists of plants with one or more occurrences mapped within 2.5 km of the Dry Mixedwood and Peace River Parkland Natural Subregions dated April 5th 2000 (ANHIC 2000), and plant communities of conservation concern within each Natural region as of 2001 (ANHIC 2001), which was subsequently updated in April 2002.

Element occurrence records from ANHIC existed for short-beaked rigid screw moss (Aloina brevirostris), Herriot's sagewort, leather grape fern, purple sedge (Carex mertensii), Carolina wild geranium, Melanelia subelegantula, Canadian rice grass, floating-leaf pondweed (Potamogeton natans), and pale blue-eyed grass (ANHIC 2001). Of these, Herriot's sagewort, leather grape fern, Carolina wild geranium, Canadian rice grass, and pale blue-eyed grass could be expected to be found in native grassland habitats, and were all expected to be flowering during the field period.

Tracked herbaceous and shrubland communities likely to be found in the grasslands of the Peace region included slender wheat grass-awned sedge, slender wheat grass-sweet grass (Hierochloe odorata), slender wheat grass-needle grass, western porcupine grass-green needle grass-sedges, saskatoon (Amelanchier alnifolia)-common bearberry (Arctostaphylos uva-ursi)-northern rice grass (Oryzopsis pungens), June grass-western wheat grass, western wheat grass-Herriot's sagewort-pasture sagewort (Artemisia frigida), and northern wheat grass (Elymus lanceolatus syn. Agropyron dasystachyum)-western wheat grass (Allen 2002).

Surveys for rare plants followed methods described by Alberta Native Plant Council (ANPC) (2000) and were conducted at the same time as the site visits throughout the growing season (17 May - 17 August, 2001; 5 June - 12 August, 2002; 3 June – 8 August, 2003). Surveys were completed by a single field crew that was able to complete assessments at one to four sites in a single day. Because sites were only visited once, it is possible that a number of particularly rare species may not have been encountered and that plant diversity may be underestimated. The time spent assessing sites varied from 0.5 to 7 hours depending on the site size and complexity. Plant identification, using specimens, was verified by a number of recognized experts including Lorna Allen, Ksenija Vujnovic and Patsy Cotterill (ANHIC) and Patrick Williston (Mnium Ecological Research). Photographs of the plants and surrounding habitats were taken and a single voucher specimen was collected where more than one plant was present.

3.2.3.2 Butterflies

Butterflies were surveyed at a total of 68 sites in 2001- 2003 (19 sites between 19 June and

17 August in 2001, 18 sites between 6 June and 24 July in 2002, and 31 sites between 3 June and 8 August 2003). Time spent catching, observing and identifying butterflies at a site ranged between five minutes and three hours, and averaged about 30 minutes. Approximately 40 hours were spent completing butterfly surveys during the three-year study period.

Individual surveys of butterflies were completed when weather conditions were suitable (warm, sunny, calm) and followed Hervieux (2002) to ensure compatibility between other surveys. Particular emphasis was placed on identifying disjunct or grassland dependent species including plains skipper, garita skipper, Pike's Old World swallowtail, coral hairstreak, striped hairstreak, gorgone checkerspot, northern checkerspot, Uhler's arctic, and Alberta arctic. Dr. Felix Sperling and Chris Schmidt Department of Biological Sciences (University of Alberta) verified voucher specimens.

3.2.3.3 Moths

Active netting for diurnal (day flying) moth species occurred concurrently with the butterfly survey between 3 June and 8 August in 2003. Light trapping for nocturnal (night active) moths followed methods described by Lawrie (2002) and included the use of ethyl acetate as a killing agent. Light traps were monitored regularly over 17 nights between 7 June and 4 October 2003 on a remnant of native grassland located on an upland slope northeast of the town of Peace River. Light traps were set up opportunistically at eight other sites near field camp locations between 5 June and 11 July in 2003. Specimens were submitted to Chris Schmidt at the University of Alberta for identification.

3.2.4 Mapping

For polygons that were verified as being native upland grassland, a hand-held GPS unit (Trimble Geo and Trimble GeoExplorer) was used to capture the native grassland perimeter and microplot locations. Where a polygon was bounded with shrubs, the grassland perimeter was defined as the boundary where shrubs were less than 0.5 m in height.

4.0 RESULTS

4.1 Site Identification

4.1.1 Air photo interpretation

Air photo interpretation enabled comprehensive identification of polygons over a very large area. To reduce the probability of not identifying remnants of grassland, the contractor included many sites (i.e., polygons) that represented a low probability of being remnant patches of grassland. Air photos ranged in age from one to 19 years, and changes to the landscape (management or natural growth) were expected to have occurred since the older photos were taken. By using the older photographic images, I gained an idea of how native grasslands disappear or change over relatively short periods of time, which adds impetus to conserving these areas while we still have the opportunity. The use of old photos increased the requirement for extensive ground verification.

Through air photo interpretation, 10,739 potential polygons and 290 questionable polygons were identified, and distributed amongst the classification codes summarized in Table 9. The size of interpreted upland native grassland polygons varied from 0.04 ha to 403.3 ha, with an overall average of 2.4 ha. Interpreted polygons were grouped into size categories to gain an idea of size distribution and these categories are defined in Table 10. Locations of these polygons are shown in Figure 4.

Table 9. Classification, number and area of interpreted polygons. Question marks define areas which were only likely to support remnant patches of grasslands.

Classification	Number of interpreted polygons	Area (ha)
Upland native grassland	1,002	2,431.8
Upland native grassland?	147	392.0
Valley native grassland	6,699	27,867.6
Valley native grassland?	30	140.3
Moist native meadow	984	1,073.4
Moist native meadow?	85	289.9
Sphagnum peatland	2,054	4,438.3
Sphagnum peatland?	28	105.0
TOTAL	11,029	36,738.3

Table 10. Size categories of interpreted polygons that potentially supported remnant patches of native grasslands in northwest Alberta.

Interpreted polygon size category	Definition
Minute	≤ 1.0 ha
Tiny	1.1 ha - 3.0 ha
Small	3.1 ha - 10.0 ha
Medium	10.1 ha - 30 ha
Large	30.1 ha - 65 ha
Extra-large	≥ 65.1 ha

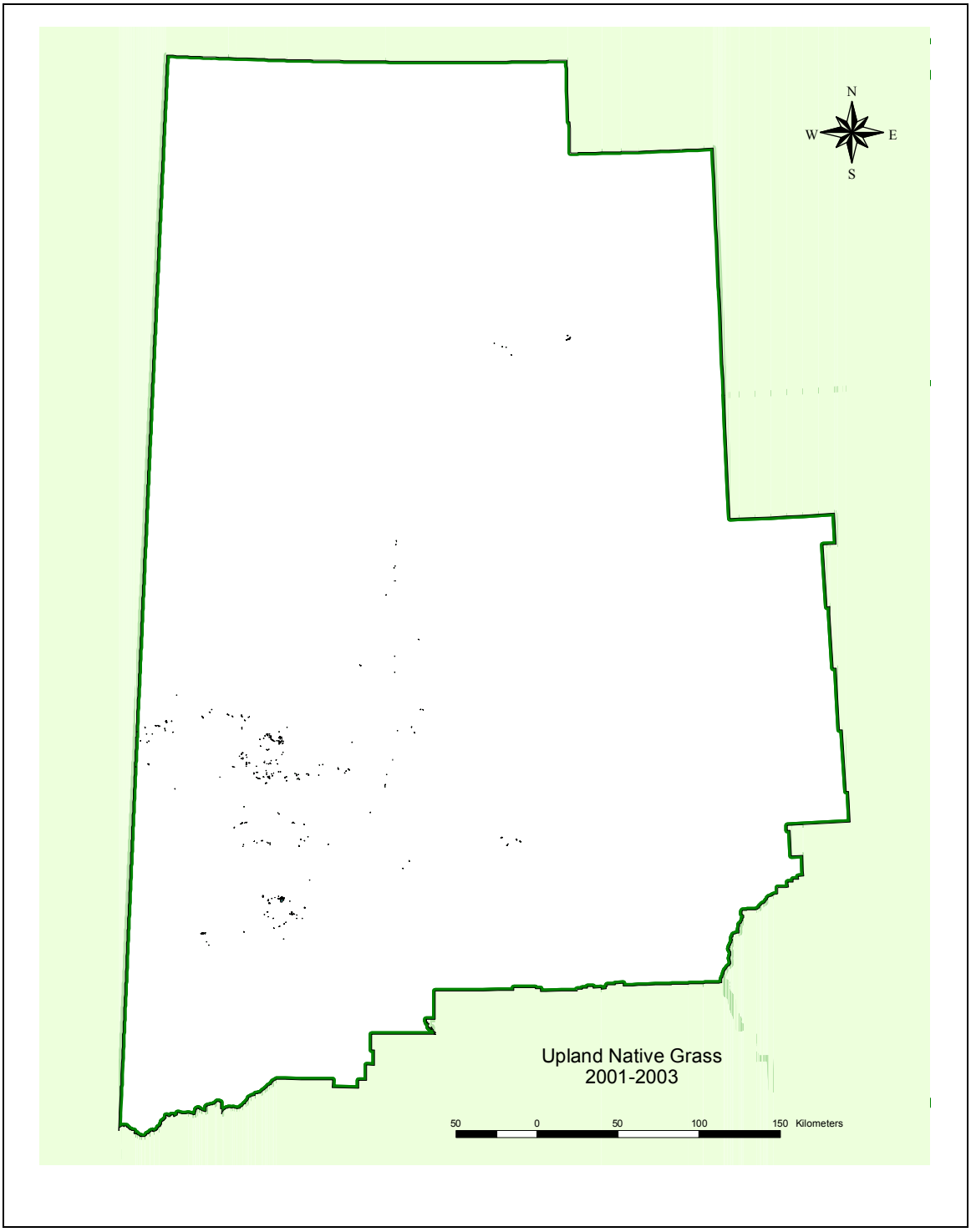

Figure 4. Location of interpreted upland native grassland polygons in northwest Alberta.

Figure 5 groups the interpreted upland native grassland polygons into size categories and shows how many polygons contribute to each group and to the total area of upland native grassland polygons in each size category. Most of the polygons were ≤ 10 ha and only a few exceeded 65 ha. Fifty five percent of all polygons were defined as minute in size, 31% were tiny, 12% were small, 2% were medium, 0.5% were large and only 0.1% were defined as extra-large. Of the area contributed by each size category, 13% of the area was made up of minute polygons, 22% were made up of tiny polygons, 25% were made up of small polygons, 13% were made up of medium-sized polygons, 10% were made up of large polygons, and 17% were made up of extra-large polygons.

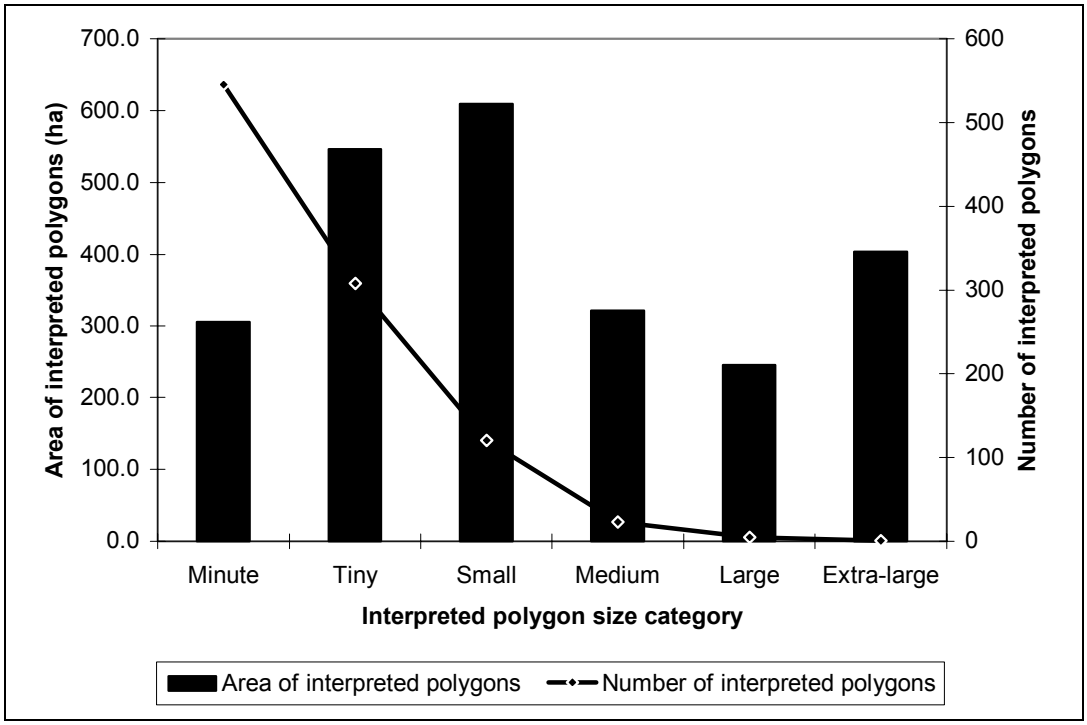

Figure 5. Area and number of interpreted upland native grassland polygons.

The size of interpreted native grassland polygons in valleys varied from 0.01 ha to 1296.8 ha, with an average of 4.16 ha. Figure 6 groups the interpreted valley native grassland polygons into size categories and shows how many polygons contribute to each group and the total area of polygons in each category. Most of the polygons were minute in size, but

nearly 60 polygons were large and more than 50 were extra-large. Fifty four percent of polygons were classified as minute, whereas 28% were identified as tiny, 13% were small, 3% were medium, 1% was large, and 1% were classified as extra-large. Of the area each size category contributed, 7% of the area was made up of minute polygons, 12% was made up polygons defined as tiny, 17% was made up polygons defined as small. Further, an additional 13% of polygons were defined as medium in size, 9% was made up polygons defined as large, and 42% was made up polygons defined as extra-large in size (Figure 6). Locations of these grassland remnants are shown in Figure 7.

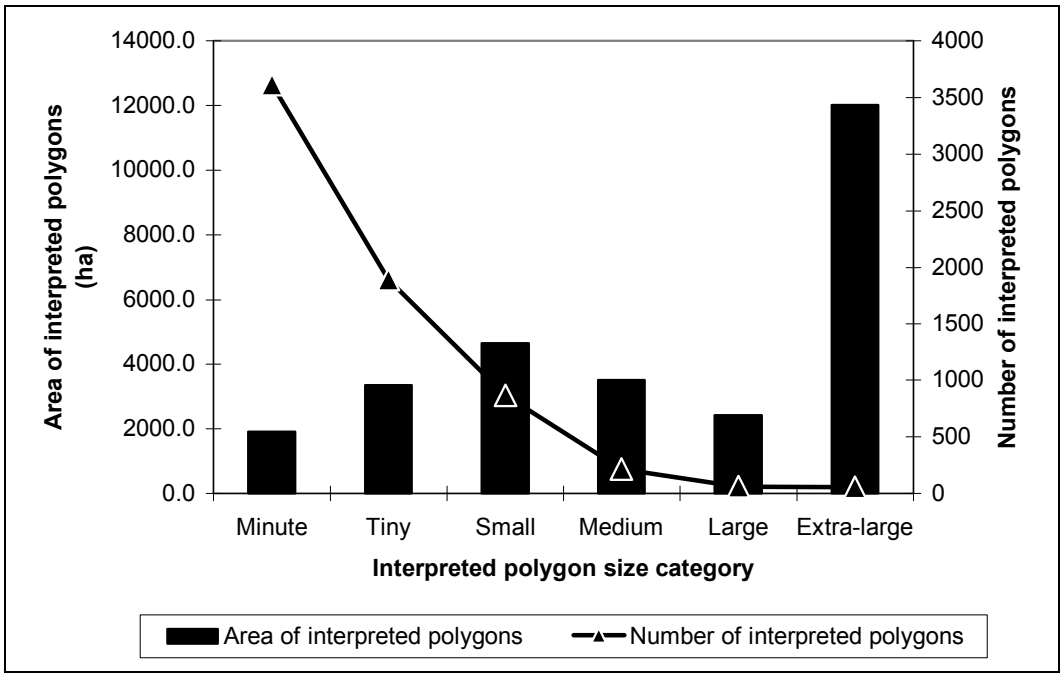

Figure 6. Area and number of interpreted valley native grassland polygons.

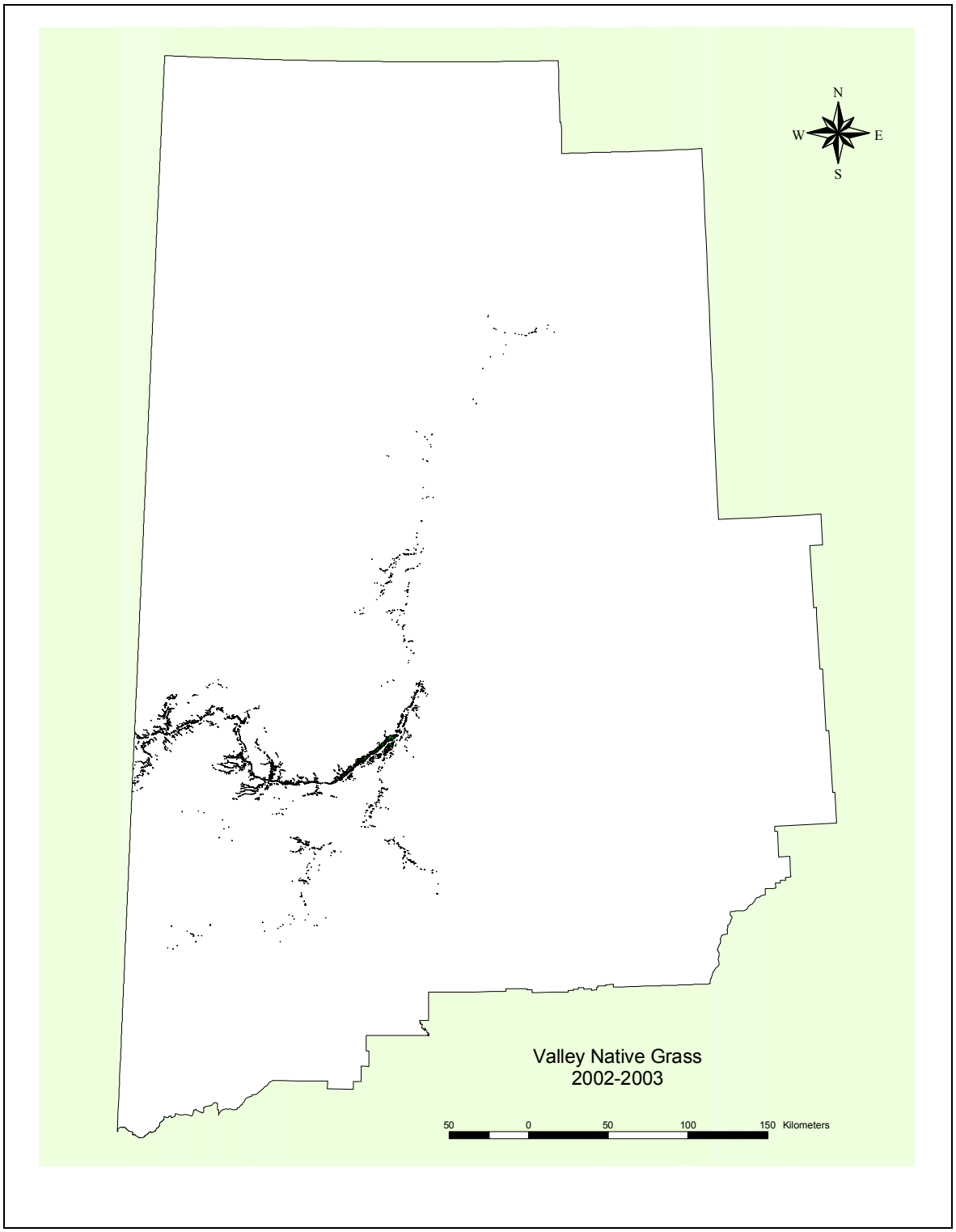

Figure 7. Map showing location of interpreted valley native grassland polygons in northwest Alberta.

The size of interpreted moist native meadow polygons varied from 0.04 ha to 22.14 ha, with an average of 1.09 ha. Figure 8 groups the interpreted moist native meadow polygons into size categories and shows how many polygons contribute to each group and the total area of polygons in each category. Most of the polygons were minute in size and none were identified as being large or extra-large. Sixty nine percent of polygons were defined as minute in size, 25% of polygons were defined as tiny in size, 5% of polygons were defined as small in size, and 1% of polygons were defined as medium in size (Figure 9). Of the area contributed by each size category, 33% of the area was made up of minute polygons, 38% was tiny, 21% was small, and 8% was medium. Locations of these polygons are shown in Figure 9.

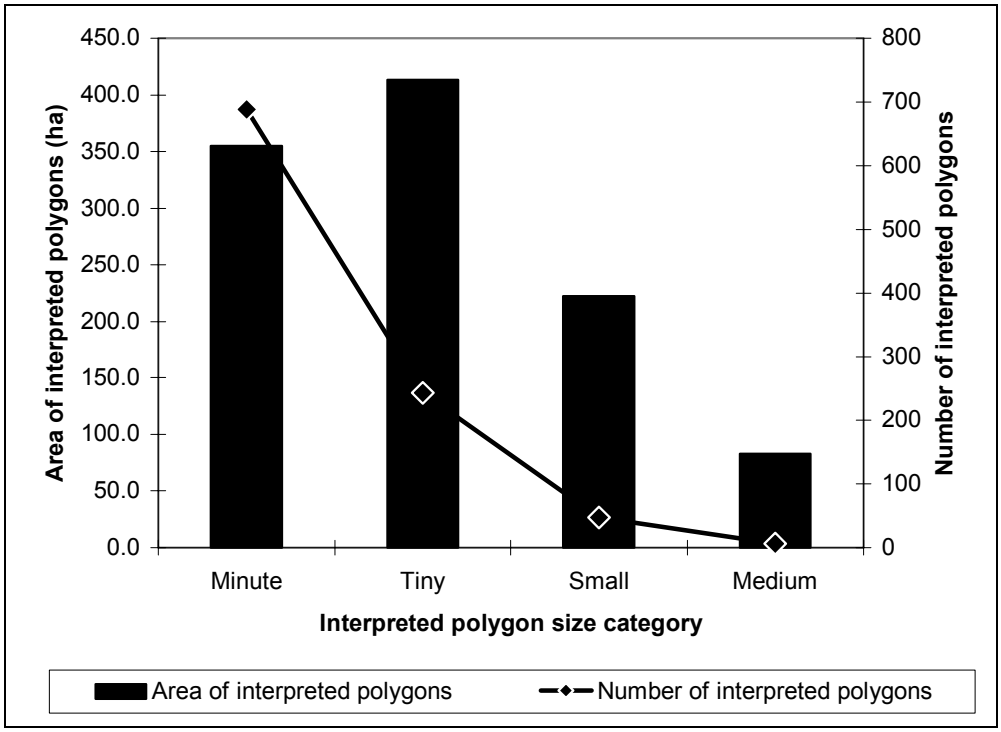

Figure 8. Area and number of interpreted moist native meadow polygons.

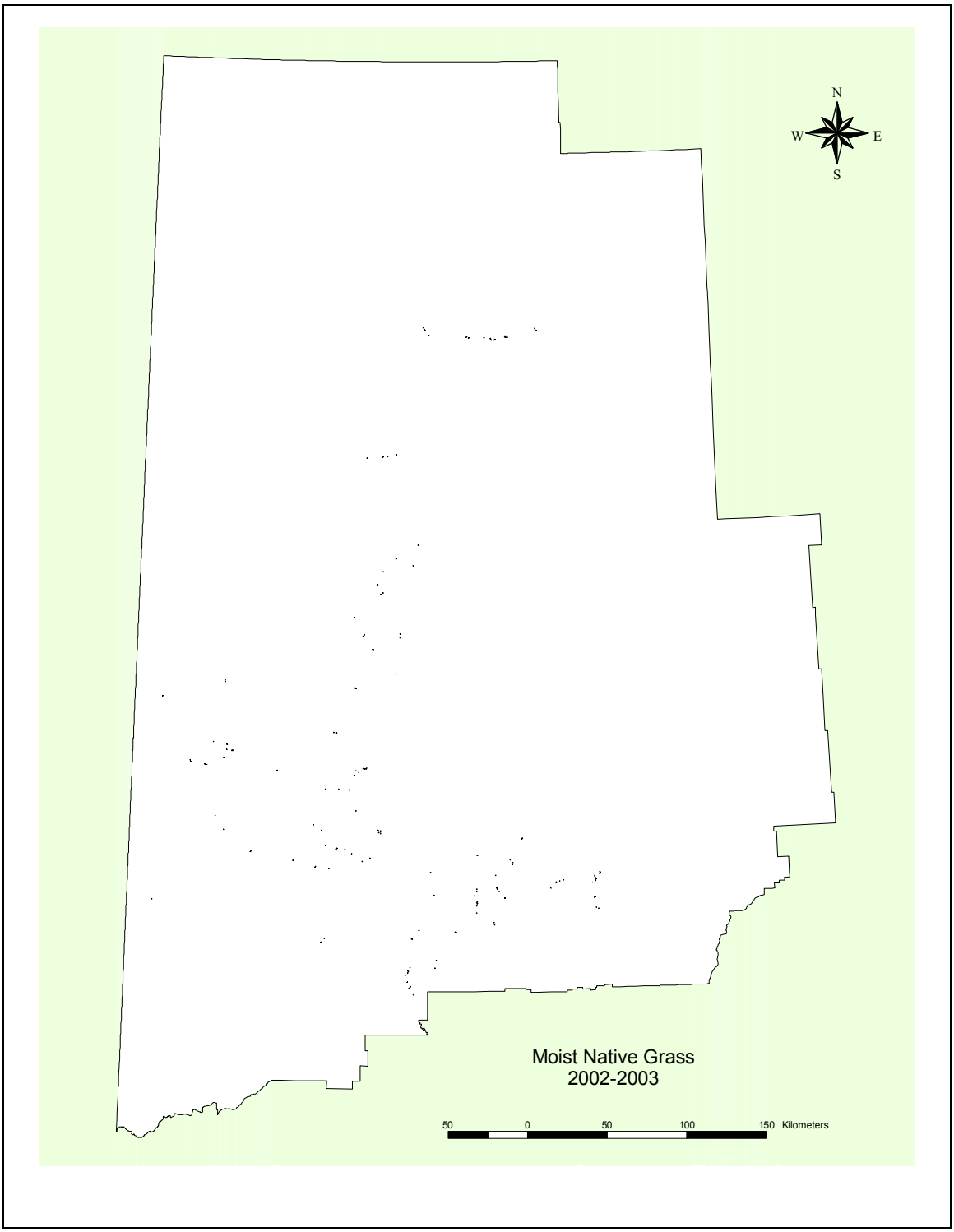

Figure 9. Map showing the location of interpreted moist native meadow polygons in northwest Alberta.

The size of interpreted sphagnum peatland polygons varied from 0.04 ha to 121.1 ha, with an average of 2.16 ha. Figure 10 groups the interpreted sphagnum peatland polygons into size categories and shows how many polygons contribute to each group and the total area of polygons in each category. Most of the polygons were minute in size and very few medium or larger in size. Fifty three percent of polygons were defined as minute in size, 32% of polygons were defined as tiny, 11% of polygons were defined as small in size, 3% of polygons were defined as medium in size, whereas 1% 0.05% of polygons were defined as large or extra large in size, respectively (Figure 10). Of the area each size category contributed, 14% of the area was made up of minute-sized polygons, 26% of the area was made up of tiny polygons, 25% of the area was made up of small polygons, 21% of the area was made up of medium-sized polygons, whereas 11% and 3% of the area were made up of large and extra large polygons, respectively (Figure 10). Locations of these polygons are shown in Figure 11.

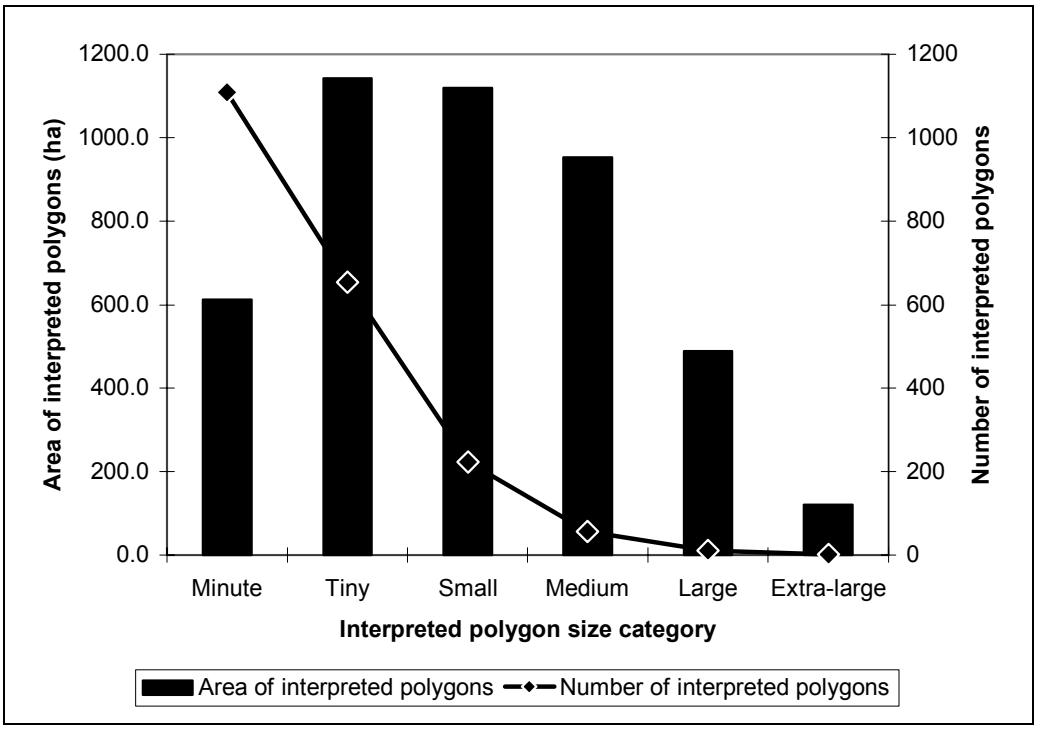

Figure 10. Area and number of interpreted sphagnum peatlands in the Peace region of Alberta.

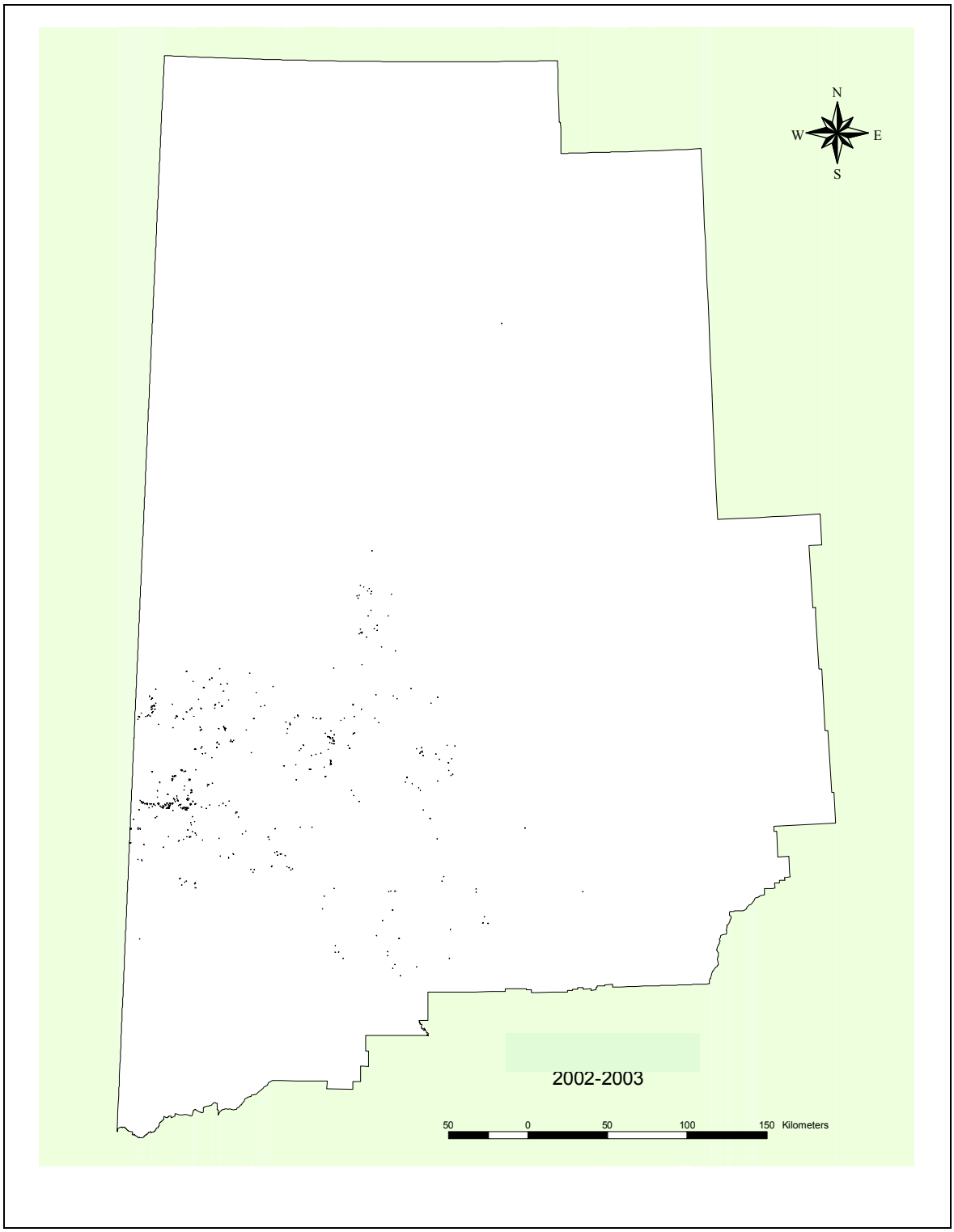

Figure 11. Map showing the location of interpreted sphagnum peatlands in northwest Alberta.

4.1.2 Land ownership

Sites for field verification were based on quarter section boundaries, as each quarter was viewed as a separate management unit, often with different owners and management practices. Large interpreted polygons that crossed quarter lines were divided digitally by the quarter boundary and this resulted in 'polygon portions', which is shown diagrammatically in Figure 12. How this affected the number of sites to be visited is given in Table 11. We only determined sites for interpreted upland native grasslands and questionable upland native grasslands, as these were our field focus. By separating the interpreted polygons into sites, the legal land locations could be used to gain permission from appropriate landowners for land access and can be used for subsequent management and stewardship activities.

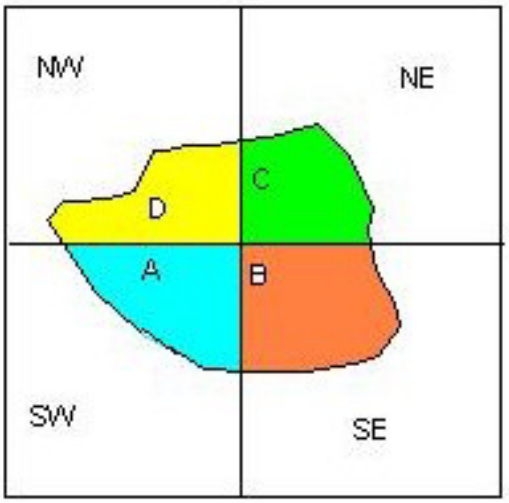

Figure 12. Graphical representation of how a large interpreted polygon that extends over four quarter sections can be divided into quarter boundaries representing four polygon portions (A, B, C, D). Each quarter is treated separately for field checking. The interpreted polygons or portions thereof on each site are referred to as potential upland native grassland until they are field checked.

Table 11. The number of sites and the number of interpreted polygons and how this number is affected by divided along quarter line boundaries.

Air-photo interpretation classification	Number of interpreted polygons	Number of polygons after being divided by quarter section boundaries	Number of sites
Upland native grassland	1,002	1,394	823
Questionable upland native grassland	147	205	129
TOTAL	1,149	1,599	952

In total, 929 sites were identified as either questionable or potential upland native grasslands and 23 had both questionable and potential upland native grassland polygons. Figure 13 shows the number and area of these sites as it relates to the portion of the quarter section that the potential native grassland covers. Most of the sites had small areas of potential native grassland. Nearly one half (45%) of the area of potential native grasslands was located on 8% of the sites. The coverage of potential upland native grasslands on a site was less than one legal subdivision (LSD) (1 LSD = 40 ac = 16.19 ha) for 97% of the sites, and this comprised 72% of the total area of upland native grasslands. Approximately 100 of the 374 sites (40%) that were one hectare or less were polygon slivers that were created in the digitizing process and when large polygons crossing a quarter line were divided. These sites were not viewed as potential upland native grasslands for field verification purposes.

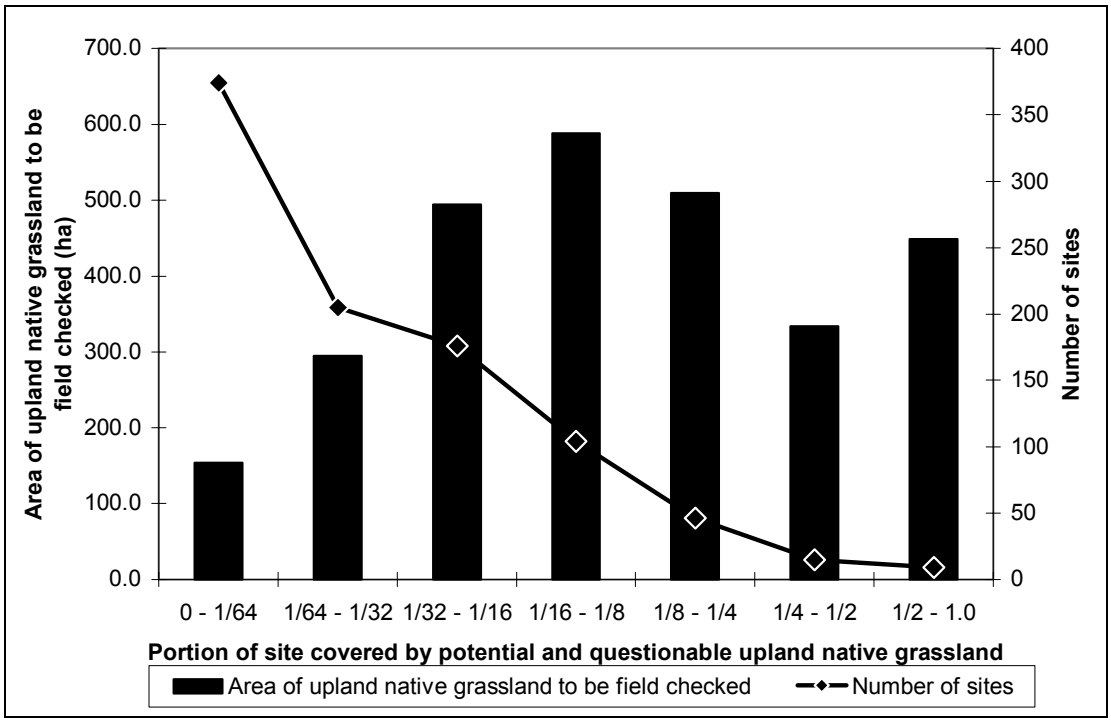

Figure 13. Area and number of sites with potential and questionable upland native grasslands in northwest Alberta.

The potential and questionable upland native grassland sites were mostly (91%) in the white (settled) management zone, with 9% in the green (forested) zone and 0.4% under Indian reservation management. Over half of the sites were located on Crown properties (56%), 43% were in private ownership, with the remainder being mixed ownership (1%) and Indian reserves (0.2%). Of the Crown sites, grazing dispositions (grazing lease, grazing reserve, grazing permit, forest grazing lease) were present on 42% of the sites, 3% of sites were a farm development lease, 8% of sites were in a forestry management area and 10% of sites were protected areas (natural area, ecological reserve) or had a recreational lease. The remaining 37% were under other Crown management.

4.2 Field Results

4.2.1 Vegetation relative abundance, flowering and inventory

Relative abundance estimations of plant species were completed on 307 polygons from 197 sites surveyed in 2002 and 2003. Estimates were completed on grasslands and shrublands with species diversity of each polygon averaging 31 plant species (range = 1 and 80 species). In total 305 species of plants were identified, including 167 native forbs, 29 introduced forbs, 56 native graminoids (e.g., grasses, sedges, rushes), 14 introduced grasses, 38 native shrubs, and one introduced shrub. A complete listing of species is shown in Appendix 2. This compares to 36 species of graminoids, 84 species of forbs, and 19 species of woody plants for a total of 139 species of vascular plants identified in the Peace region by Moss (1952).

Detailed vegetation inventories were conducted on 98 sites. Plant diversity at each native site ranged from 16 to 49 species with an average of 28. The occurrence of introduced grasses and forbs was generally low at each site. Forbs comprised the largest proportion of species with between 6 and 29 species and an average of 17 at each site. Native grasses accounted for between 3 and 17 species with an average of 9 at each site. Up to 12 shrub species were identified at an individual site. Figure 14 shows a field crew conducting a vegetation inventory. Estimations of flowering time of species were completed at a total of 124 sites between 5 June and 12 August in 2002 and 76 sites between 4 June and 8 August in 2003. These data have not been analyzed.

Figure 14. Estimating and recording vegetation cover and GPS location of a micro plot. Photo by Darcy Meyers.

Plant communities were diverse both within and between sites. Examples of the diversity of upland native grasslands are shown in Figures 15 to 22.

Figure 15. A Photograph of beardtongue (Penstemon spp.) and arnica (Arnica spp.)-dominated native grassland in northwest Alberta.

Figure 16. A photograph of intermediate oat grass (Danthonia intermedia)- dominated native grassland in northwest Alberta.

Figure 17. A photograph of three-flowered avens (Geum triflorum)-dominated native grassland in northwest Alberta.

Figure 18. A photograph of rough hair grass (Agrostis scabra)-dominated native grassland in northwest Alberta.

Figure 19. A photograph of harebell (Campanula rotundifolia) and northern bedstraw (Galium boreale)-dominated native grassland in northwest Alberta.

Figure 20. A photograph of sweet grass (Hierochloe odorata)-dominated native grassland in northwest Alberta.

Figure 21. A photograph of aster (Aster spp.) and intermediate oat grass-dominated native grassland in northwest Alberta.

Figure 22. A photograph of western porcupine grass (Stipa curtiseta)-dominated native grassland in northwest Alberta.

Previously, little vegetation data on upland native grasslands of the Peace had been available for incorporation into a guide to plant communities. A sample of the grassland plant communities that were described by us, including the change of a plant community under grazing, is included in Appendix 3. A plant community guide for Peace region grasslands is now under development and the plant communities described during this study will be included.

4.2.2 Range health assessment

Range health was assessed on 95 sites between 2001 and 2003, of which 73 were located in upland native grasslands, six in native shrublands, one in valley native grassland, one in moist native grassland, seven in shrublands modified by introduced species, four in pastures modified by overgrazing, two in grasslands modified with introduced species, and one modified by cultivation. Of these, three sites were defined as unhealthy, 34 sites as healthy with problems and 58 sites as healthy. The 22 sites that were not upland native grasslands were assessed to gain a comparison with upland grassland sites.

Of the upland native grasslands, 50 sites (68%) were deemed to be healthy, 22 (30%) healthy with problems and one site (1%) was defined as unhealthy. Twenty three sites were assessed as having the highest health possible with a rating of 100%. Factors that affected the rating of sites included significant alterations in the plant community due to grazing or other disturbances, missing life form layers, and reduced amounts of litter. Most sites were stable with little evidence of accelerated erosion, and none of the sites had a noxious weed problem. Generally, the number of native forbs increased as range health improved and the number of grass species stayed the same, though the species and their abundance often changed. Forage production varied between 16 and 3,939 kg/ha on the 42 sites where litter was collected during 2002 and 2003.

Range health varied based on ownership (Table 12). The sample size of farm development leases and general Crown owned sites was very small, which makes any conclusions speculative. On average, sites on grazing leases were rated as: 'healthy-with-problems', while privately owned land was generally rated 'healthy'. Despite higher sample sizes, further analysis is required before a conclusion can be made as to whether ownership affects range health.

Table 12. Range health of upland native grasslands under different ownership in northwest Alberta.

Ownership	Number of upland native grassland sites assessed	Minimum range health (%)	Maximum range health (%)	Average range health (%)
Private	58	53	100	85
Farm development lease	2	87	95	91
Grazing lease	10	45	98	72
Crown	3	100	100	100

4.2.3 Documentation of rare or significant plants, butterflies and moths

To obtain a comprehensive inventory of species (plant and wildlife) more time spent at a site, and multiple visits during a season and over a number of years would be required.

4.2.3.1 Plants

Three rare plant species were recorded: leather grape fern, low townsendia (Townsendia exscapa) and Carolina wild geranium. Rare plants were documented following the ANPCs guidelines (Alberta Native Plant Council 2000) and details were submitted to ANHIC for inclusion in their database. Voucher specimens are housed at the University of Alberta, Edmonton and ACA/Public Lands and Forests, Peace River herbaria. Locations of rare plants in northwest Alberta are shown in Figure 23, with photographs of these species shown in Figures 24-26.

Leather grape fern, shown in Figure 24 is ranked as S2 by ANHIC (Vujnovic and Gould 2002) as there are few element occurrences and a decline in population (ACD and ASRD 2000). It is unknown as to the effect of livestock grazing on populations of this plant and its habitat is threatened by conversion of natural habitats to monocultures (Alberta Natural Heritage Information Centre 2001). Leather grape fern was observed at ten sites during 2001 and 2003. Previous observation of this species in the Peace River Parkland subregion was at a single site during 1972 (Alberta Natural Heritage Information Centre 2001).

Low townsendia, shown in Figure 25, ranked as S2 (Vujnovic and Gould 2002), was observed at a single location during 2002, and while not shown as occurring in the Peace region in Kershaw et al. (2001), it was recorded in the Peace region by Moss (1983). Its habitat is threatened by the conversion of native grasslands to croplands (Alberta Natural Heritage Information Centre 2001).

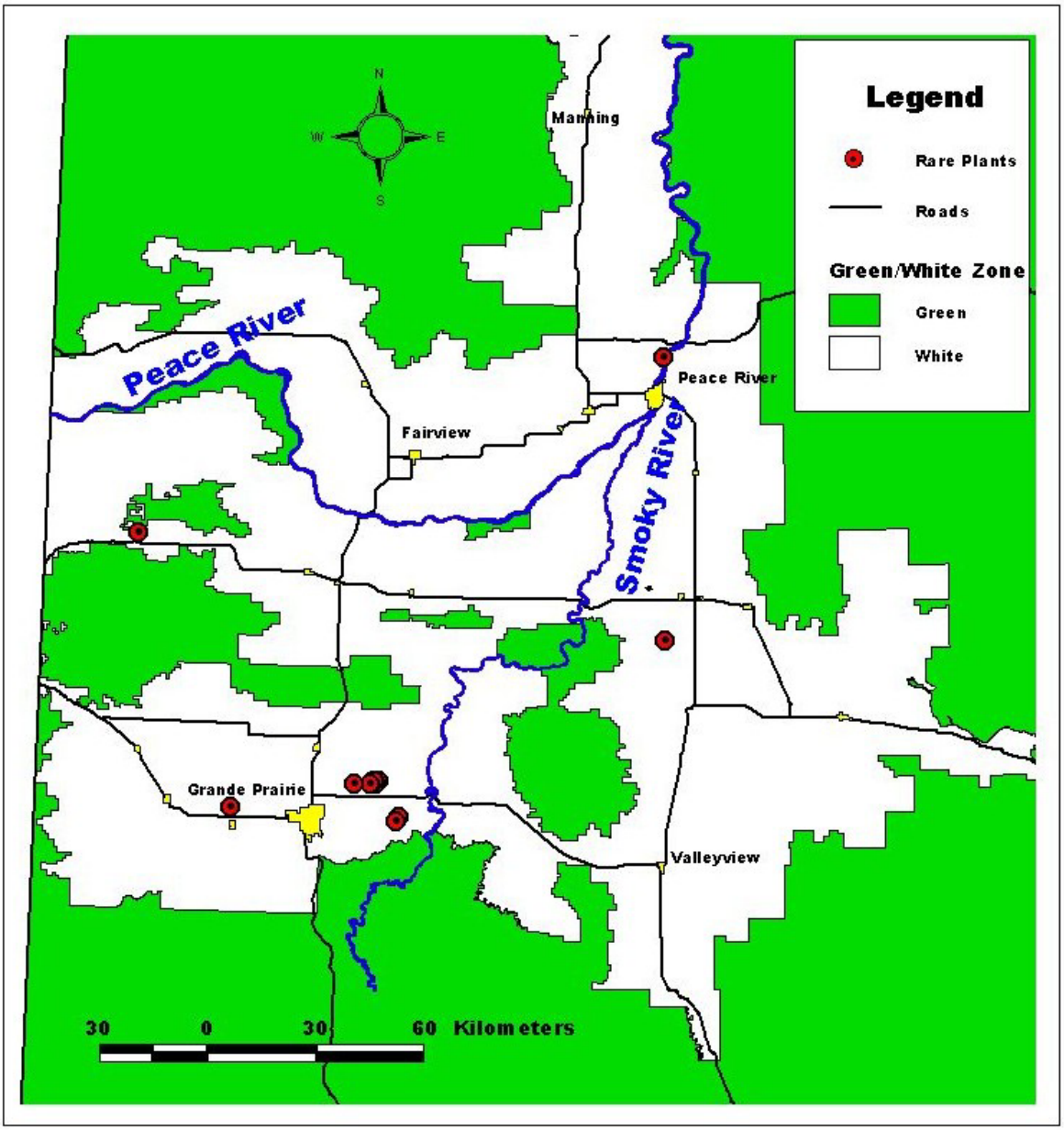

Figure 23. Map showing the location of rare plants that were observed during 2001-2003 in northwest Alberta.

Figure 24. Photo of leather grape fern (Botrychium multifidum).

Figure 25. A photograph of low townsendia (Townsendia exscapa). Photo by Tara Sample.

Carolina wild geranium, shown in Figure 26 is ranked as S1 (Vujnovic and Gould 2002). Its population status is unknown (ACD and ASRD 2000), as it is previously known from only seven locations in Alberta, all recorded about 50 years ago (K. Vujnovic pers. comm.). There are no known threats to Carolina wild geranium populations or the habitats it grows in (Alberta Natural Heritage Information Centre 2001). The Peace region has a disjunct Alberta population and a single observation in the Peace River Parkland subregion was recorded in 1948 (Alberta Natural Heritage Information Centre 2001). We

observed a single Carolina wild geranium plant during 2002.

Figure 26. A photograph of Carolina wild geranium (Geranium carolinianum).

Samples of plants with possible range extensions were collected, and details submitted to Joyce Gould at the University of Alberta/ANHIC who is working on an update to the book entitled: Flora of Alberta (Moss 1983). Voucher specimens are housed at the University of Alberta, Edmonton and Peace River ACA/Public Lands herbaria.

Due to environmental, climatic, and growth patterns, rare plants may not be visible within and between seasons, even when a thorough survey is done. Therefore, this survey can only be used to document the presence of species and not their absence (Cornish 2001). Combined with our single site visits and the short time devoted to conducting rare plant surveys, this suggests that the presence of rare plants is may to be much higher than documented here.

4.2.3.2 Butterflies

Butterflies were recorded at 68 sites, comprising at least 39 species (with an additional 12 only identified to genus) (Appendix 4). The number of species observed at each site ranged between one and 10, with an average of four. Species of swallowtail, blue,

common ringlet, sulphur, silvery blue, common wood nymph, and meadow fritillary were commonly encountered. Figures 27 and 28 illustrate field techniques to capture and process butterflies. The known Peace region flight time of butterflies was extended for the plains skipper which were seen four days earlier (i.e., on 31 July, 2001) than previously (i.e., 4 August). Dates for flight time comparisons were derived predominantly from Hervieux (2002), Kondla et al. (1994), Bird et al. (1995), and Schmidt et al. (2003). The locations where butterflies were recorded are shown in Figure 29.

Figure 27. A photograph showing the technique required to catch a flying butterfly.

Figure 28. A photograph of the process used to identify a captured butterfly.

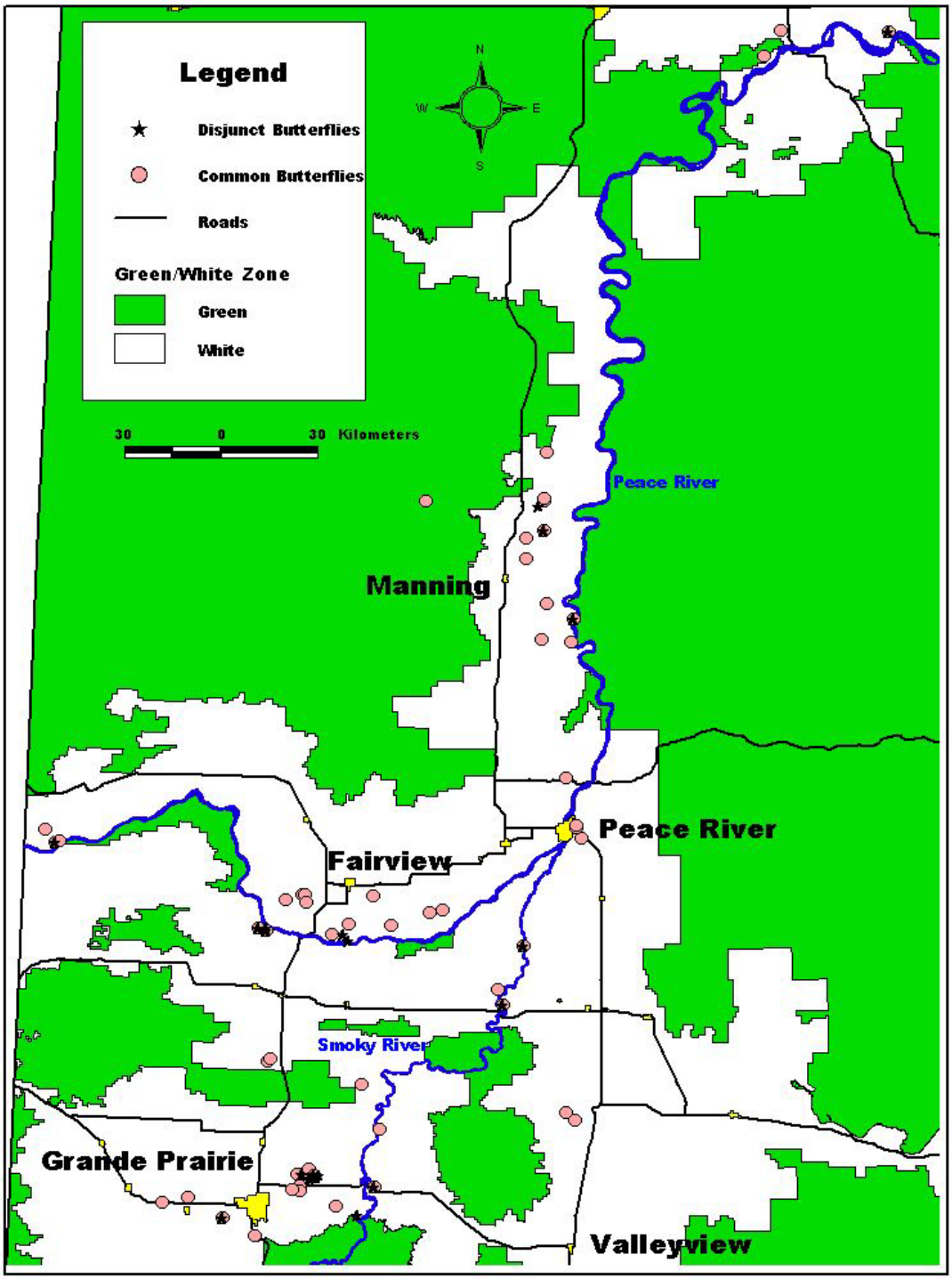

Figure 29. Location of study sites where butterflies were surveyed in northwest Alberta, 2001-2003.

The Grassland Natural Region supports the main populations for a number of species

with disjunct populations found in the Peace region. Seven of these species were observed at nearly one-third (22 of the 68 sites) of all sites (i.e., Alberta arctic, Uhler's arctic, Pike's Old World swallowtail, striped hairstreak, coral hairstreak, plains skipper, and garita skipper).

The Peace region population of the Alberta arctic is ranked as S1S2 due to few occurrence records (10 records in northwestern Alberta) and its distribution, which is restricted to the threatened native grasslands in the Peace region (ANHIC 2001a). Uhler's arctic is ranked as S5, however in British Columbia it is threatened due to habitat destruction in the Peace River valley (ANHIC 2001a). Pike's Old World swallowtail (Figure 30) is a subspecies ranked S1S2 because it is only found along the Peace River and displays a high degree of host plant specialization (ANHIC 2001a). Figure 31 shows a Canadian tiger swallowtail.

Figure 30. A photograph of Pike's Old World swallowtail (Papilio machaon pikei). Note the dark colour patch near the body and the black dot at the base of the red colour patch as compared with the more common Canadian tiger swallowtail shown in Figure 31. Photo by Adam James.

Figure 31. A photograph of Canadian tiger swallowtail (Papilio canadensis) taken through a plastic observation jar. Note the black 'swords', and two additional red patches on the wing edges, as compared with Pike's Old World swallowtail in Figure 30. Photo by Adam James.

The Peace region population of striped hairstreak is ranked as S1S2 because of threats to its habitat (ANHIC 2001a). Similarly, the Peace region population of coral hairstreak is ranked as S1S2 as there are few records, it is a phenotypically distinct population and its habitat (native grasslands and saskatoon) is also threatened (ANHIC 2001a). The Peace region population of plains skipper is ranked S1S2, however unclear taxonomy may result in the Peace River population being recognized as a separate subspecies. This may result in a higher threat ranking due to threatened habitat (native grassland) (ANHIC 2001a). Garita skipper is ranked S4, however in the Peace region its habitat (native grasslands) is threatened (ANHIC 2001a). Figure 32 shows the habitats where the observed species were observed and illustrates the affinity each of the tracked butterflies has to native habitat.

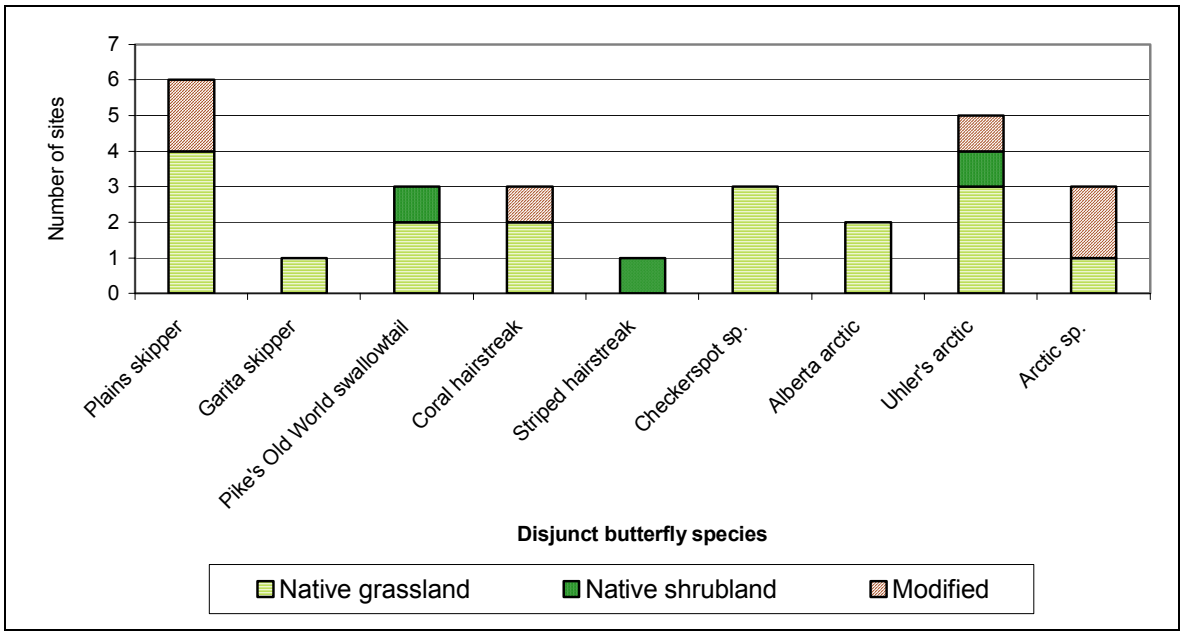

Figure 32. Disjunct grassland butterfly species and the habitats in which they were observed 2001-2003 in northwest Alberta.

It was hoped that we would collect sufficient information about flowering plants and butterflies at each site that we could determine a correlation between flowering plant and butterfly species. This was not achieved as we documented plants that were flowering (R5-R8) at only four sites that had corresponding disjunct butterflies present, and three of those butterflies are not known to use flowers as a food source.

4.2.3.3 Moths

Locations of sites surveyed for moths and where they were found are shown in Figure 33. Appendix 5 provides a list of the 56 moth species that were identified during 2003, mostly from the valley native grassland site near the town of Peace River. Of particular interest are the delicate beauty (Oncocnemis cibalis) and silver-banded gem (Schinia cumatilis), which has not been previously recorded in the Peace Region. Both species are characteristic of southern prairie grasslands and appear to occur as geographically isolated populations in the Peace region. Also noteworthy is the Doris tiger (Grammia doris), which, while widely distribted, has been recorded from only a few sites in western Canada. Samples of other Grammia species were also collected to assist with future taxonomic work on this group.

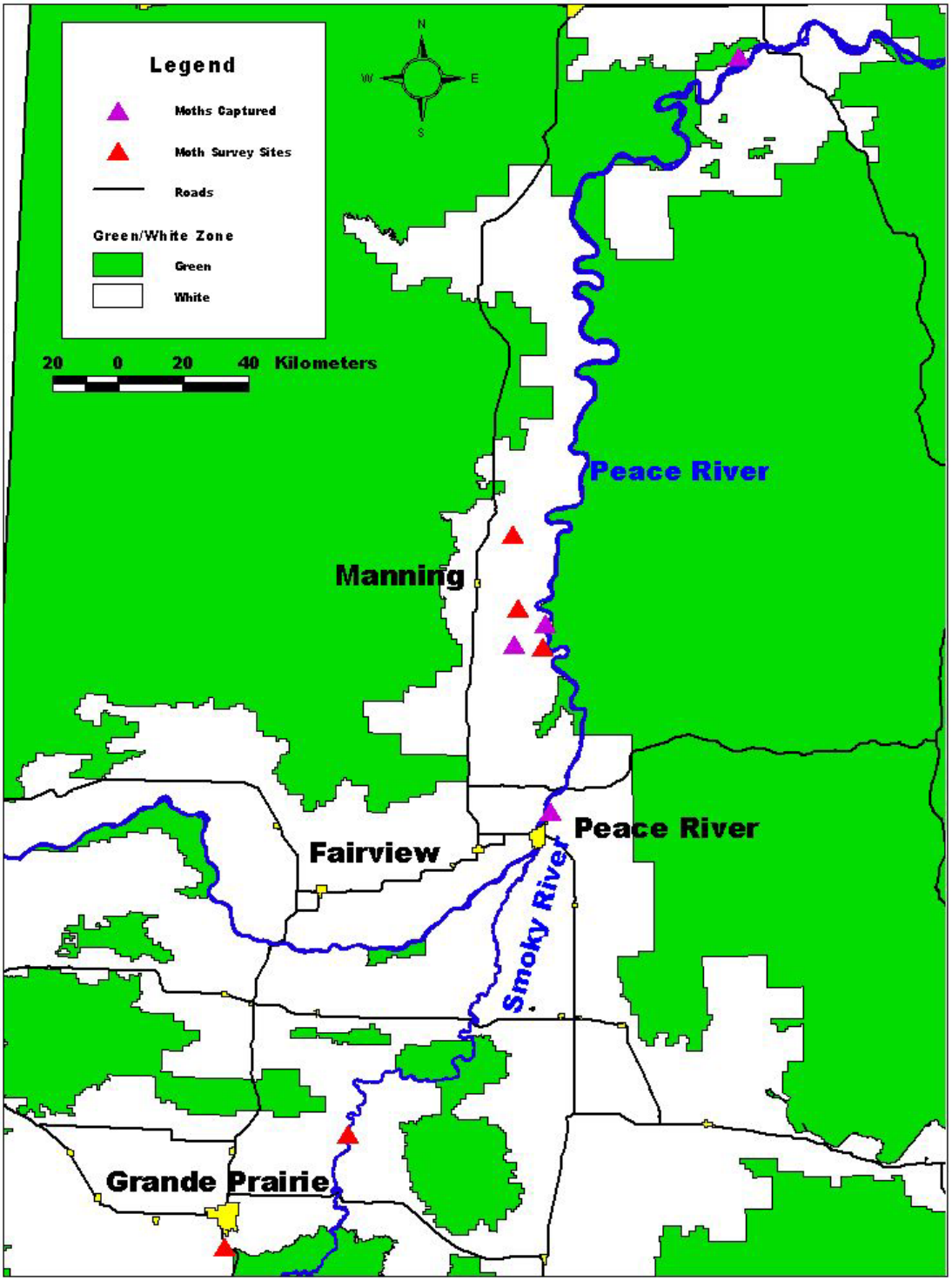

Figure 33. Locations of moth survey and capture sites for 2003 in northwest Alberta.

4.2.4 Mapping

Based on comparisons with pre-settlement levels (Wilkinson 1981), the results from this study suggest that only 0.2 to 0.4% (i.e., 1,956 ha) of the original upland native grassland remains. This estimate assumes that all the unverified sites are confirmed as upland native grasslands. The amount of remaining native grassland estimated may decrease further to 0.1% to 0.2% if none of the unverified sites represent native grassland.

Table 13 shows the number of potential upland native grassland sites and polygons that were verified with field assessments. This translates to 46% of sites, 47% of polygons divided by quarter section and resulted in verifications of 70% of the area. Verified upland native grassland sites are shown in Figure 34. As discussed previously (See section 3.2.2), potential and questionable upland native grasslands were compared with reference sites to provide consistent site classifications. Reference sites are shown in Figures 35-43.

Table 13. Number and area of verified upland native grassland and questionable upland native grassland polygons in northwest Alberta.

Air photo interpretation classification	Number of verified sites	Number of verified polygons after division with quarter section boundaries	Area verified (ha)
Upland native grassland	329	529	1,524.2
Questionable upland native grassland	66	114	302.7
TOTAL	395	643	1,826.9

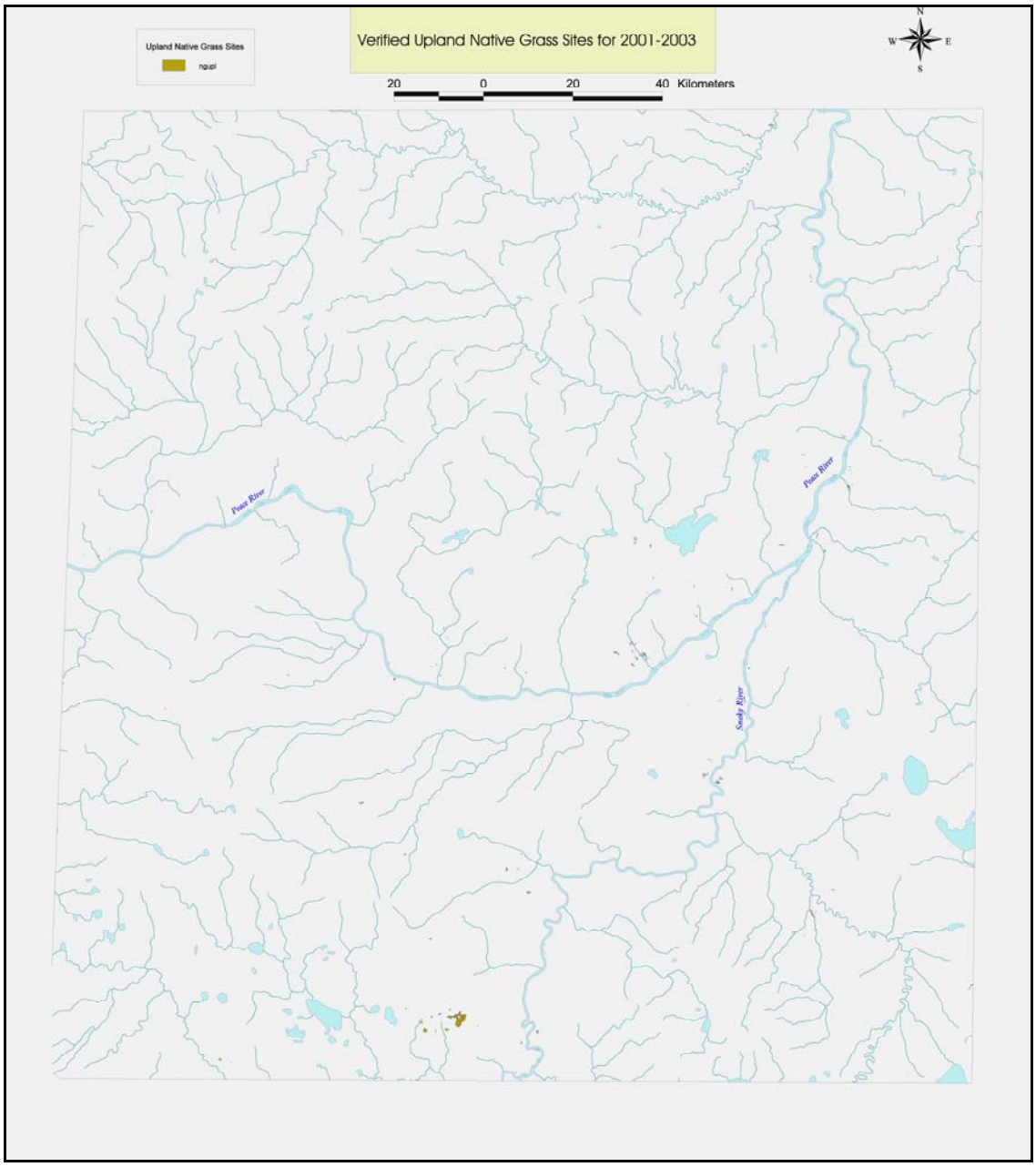

Figure 34. Map of upland native grassland sites in northwest Alberta that were verified with field assessments between 2001 and 2003.

Figure 35. A photograph of an upland native grassland used as a reference site in northwest Alberta.

Figure 36. A photograph of a valley of native grassland used as a reference site in northwest Alberta.

Figure 37. A photograph of a sand dune area used as a reference site in northwest Alberta.

Figure 38. A photograph of moist native grassland used as a reference site in northwest Alberta. Note the willow (Salix spp.).

Figure 39. A photograph of native shrubland used as a reference site in northwest Alberta. Photo by Tara Sample.

Figure 40. A photograph of a modified cultivated site used as a reference site in northwest Alberta.

Figure 41. A photograph of modified introduced site used as a reference in northwest Alberta. Note the nearly exclusive stand of awnless brome (Bromus inermis).

Figure 42. A photograph of modified shrubland used as a reference site in northwest Alberta. Note the domination of shrubs and introduced species including dandelion (Taraxacum officinale) and awnless brome.

Figure 43. A photograph of a modified overgrazed site used as a reference in northwest Alberta. Note the low height of the vegetation, lack of vegetation structure, cattle trailing, and plant community dominated by Kentucky blue grass (Poa pratensis).

Incidental verification of valley native grasslands, moist native meadows, and sphagnum peatlands occurred when these sites were located adjacent to an upland native grassland site that was being verified. Despite verifying 132 sites that contained potential valley native grasslands, this only represented 3% of the potential sites and 2% of the potential area. Only a few sphagnum peatlands and moist native grasslands were field checked.

Table 14 shows the classification of verified upland native grasslands. In total, verified upland native grasslands comprised only 746.1 hectares of the total area verified. Figure 44 shows the proportion of the total verified area for each of the classified polygons types. Of note is that 57% of verified polygons (divided by quarter section boundary), which covered 37% of the area, were modified (mostly through introduced species and shrub encroachment) and 43% of the polygons covering 63% of the area represented native cover. Only 14% of the polygons, which covered 43% of the area, were classified as

upland native grassland. Shrub encroachment was the second most predominant factor altering the status of patches. Of the potential questionable upland native grasslands that were verified, 74% of polygons, which covered 76% of the area, were modified. Only 6% of the questionable polygons, covering 19% of the area, were verified as upland native grasslands.

Table 14. Classification of verified upland native grasslands (polygons divided by quarter section boundary).

Classification	Number of verified polygons	Area of verified polygons (ha)
MODIFIED		
Cultivated	36	76.0
Introduced species	155	291.7
Overgrazed	64	156.7
Introduced species in shrubland	102	150.1
TOTAL	357	674.5
NATIVE		
Upland grassland	85	746.1
Moist meadow	11	36.8
Shrubland	140	290.5
Valley grassland	8	35.9
Sand dune (ricegrass community)	22	24.3
TOTAL	266	1,133.6
GRAND TOTAL	623	1,808.1

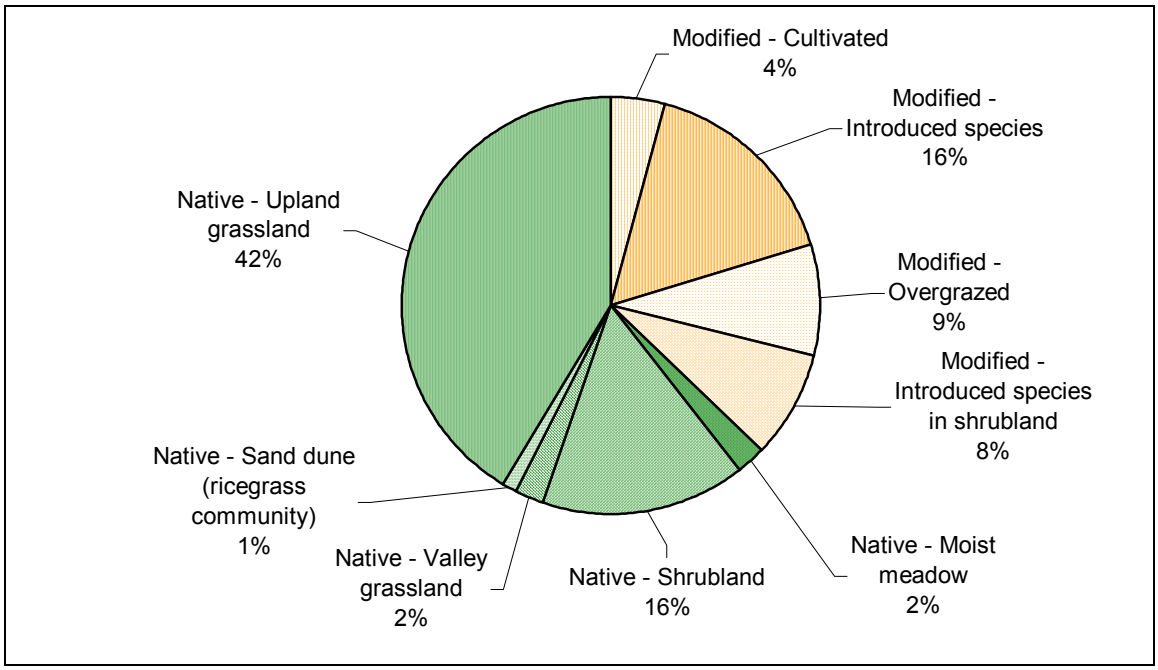

Figure 44. Chart showing the proportion of the verified area of polygons (divided by quarter section boundary) that each classification type of upland native grassland contributes.

5.0 DISCUSSION

5.1 Key findings and management considerations

Native upland grasslands are biologically diverse both within and between remnants and contain rare plants and a diversity of plant communities, some of which are likely unique to northwest Alberta. Native grasslands also provide important and often critical habitat for butterflies and other invertebrate assemblages.

Prior to this project, very little was known about the abundance, location and ecological characteristics of native grasslands in the Peace region. This project confirmed the occurrence of 746 ha of upland native grassland with an additional 1,210 ha that still requires field verification. My estimates also suggest that the loss of native grasslands since settlement by Europeans has been substantial and that existing remnants of native grassland represent <0.5% of that initially present. Additionally, existing remnants exist predominantly as small fragments, and apart from a few clusters, are widely distributed.

Continued encroachment of introduced species (particularly awnless brome), encroachment by shrubs and inappropriate livestock grazing practices represent the dominant challenges to the persistence of native grasslands. While I advocate efforts to identify additional remnants of native grassland, conservation efforts should focus primarily on conserving existing areas of native grasslands to ensure that they persist. Failure to do so will almost certainly result in the total loss of native grasslands in the Peace region.

Changes in current management practices, including restricting the use of remnants of existing grasslands for livestock feeding and reductions in the storage or cleaning of equipment, which serve as sources of non-native plant species introductions, would also reduce the inadvertent introduction of these species. Introductions of non-native species could also be reduced by developing vegetation buffers, comprised of native species, adjacent to known patches of native grasslands. If this option was exercised, it is preferable to collect native seed from adjacent sites to prevent possible genetic drifting that could be detrimental to the wild population. The ANPC and others have developed guidelines that address these concerns (ANPC 2002, Guinon 1993).

Through air photo interpretation and field verification, I developed a GIS layer that describes the location and spatial extent of existing patches of native grasslands. This tool is being used for conservation planning for the remaining native remnants and can be used to plan conservation and future research foci for other species.

The small size and scattered location of the majority of existing remnants of native grassland will pose challenges to managing them effectively and economically. Ecologically, all of these areas are important to butterflies, which can use a series of small remnants as 'stepping stones' from a large 'source' area (Launer and Murphy 1994) when little contiguous habitat is available for their use. Using limited observations of disjunct butterflies, there appears to be support for the affinity that these species have for native habitats. Conservation of these species, therefore, is dependent on the conservation of the habitats that they require.

From a cost effective viewpoint, the larger remnants should be targeted for conservation because they represent a substantial proportion of all existing native grasslands and they

appear to represent important habitats for butterflies. Smaller remnants should be considered as viable conservation targets if they are: i) located adjacent to larger remnants and ii) they are accompanied by landowners who are interested in their protection. When these areas have been addressed, efforts could shift to returning native shrublands to grassland areas through the use of prescribed burning, and increasing the size of these, and existing native grasslands through reclamation of adjacent areas.

With polygons being divided roughly equally between private and Crown ownership, effective conservation efforts will need to address both. Conservation efforts by ACA should focus on supporting private landowner stewardship actions in partnership with ASRD.

5.2 Further use of data

Cover class estimates for plant species, captured during transects have been provided to ASRD Public Lands and Forests Division-Range Management Branch to describe plant communities found in the upland native grasslands of the Peace region. ASRD staff will include this information on plant communities along with other range information in the development of a guide on range plant communities and carrying capacity for the grasslands of the Peace region. These plant communities will also be submitted to ANHIC to include in their plant community tracking database.

The underlying premise of range health assessments is to complete comparisons of reference plant communities to other sites. Prior to this study, little information on upland native grasslands of the Peace region existed, and the succession under grazing and other pressures is still not fully understood. Range health assessments, including litter weights, have been passed to ASRD Public Lands and Forests Division to incorporate into a rapid assessment tool.

Butterfly sightings and samples were provided to the 'Survey of Native Grassland Butterflies in the Peace Parkland Region of Northwestern Alberta – 2001' (Hervieux 2002) and 'Transect Monitoring and Habitat Assessment for Native Grassland Butterflies in the Peace Parkland Region of Northwestern Alberta - 2002' (Hervieux 2003), and to the University of Alberta's Entomology Department. All butterfly and moth samples will be

stored at the University to assist in confirming species distributions and taxonomy.

Plant flowering stage (phenology) information was provided to the Butterfly Program (Hervieux 2003) to try and correlate butterflies nectaring and plants flowering. Further analysis of the flowering time data is possible, and once completed, this data will be submitted to the University of Alberta and Devonian Botanic Garden's PlantWatch program, which records flowering times of Alberta plants. Plant specimens collected and mounted into herbarium samples are housed in the ASRD Public Lands and Forests Division herbarium at Peace River. The exceptions include samples of rare and disjunct species that extend the known range of these species and will be included in an updated Flora of Alberta. These samples are housed at the University of Alberta's herbarium. Records of rare and tracked plant species were submitted to ANHIC to be included in the plant portion of the ANHIC tracking database.

Digital coverage of verified native grasslands has been provided to project conservation partners (NAWMP, DUC) for use in their conservation efforts. ACA will also use this information to help determine habitat priority areas, and overlap it with sharp-tailed grouse dancing grounds (leks) to identify priority areas for landowner stewardship activities. These areas are also the foundation of the Peace Native Grasslands Conservation Program, which is reported on separately (Rosendal and Baker 2004).

The location of sphagnum peatlands was conducted simultaneously with the air photo interpretation that identified potential native grasslands. The digitized information was submitted to DUC and NAWMP and was not field checked in this study.

5.3 Future work

Improved management of remnant patches of native grasslands represents the highest conservation measure to ensure the persistence of native grasslands in the Peace region. Without these, upland native grasslands will disappear from the Peace region landscape. As the remnants are so small, and many conservation and management strategies have been developed for larger areas of native vegetation, trials to test the usefulness of these methods on small remnants will be required. These trials could evaluate the effectiveness of alternative land management practices such as prescribed burning, rotational or

deferred livestock grazing regimes, and increasing the size of the remnants through reclamation. Reclamation of sensitive remnant areas is required to maintain genetic stock diversity and to provide the opportunity for these patches to naturally increase in size.

Vegetation data collected through the inventory has been helpful to gain a broader understanding of the composition of plant communities that comprise remnants of native grasslands. Further inventories at more sites will increase this knowledge and can be used to make more accurate descriptions of reference plant communities. It will also give a better sense of the diversity of native grassland plant communities in the Peace region.

Range Management staff from the ASRD Public Lands and Forests Division implemented a grazing exclosure on a grazing lease west of Clear Prairie during 2001 to monitor the effects of grazing pressure on this unique native grassland site. They plan on adding more long term monitoring sites on grazed, ungrazed, crown and private upland native grassland sites during 2004 to describe successional plant communities under grazing, and determine production capabilities of the plant communities.

The preliminary analysis here, suggesting that sites under Crown grazing dispositions scored lower range health values than those under private ownership needs to be investigated further before definitive conclusions can be made. Important elements to this analysis include the size and use of the remnants, i.e. grazing is the primary use of grazing dispositions, whereas, under private ownership these sites may be idle or only periodically used for grazing.

This study has shown that rare plants occur in native grassland remnants and future work to describe the population and extent of rare plants within native grasslands of the Peace region can now be focussed on native grassland sites that have been identified through this study.

There is limited knowledge about the food and nectar sources required for individual butterfly species. Further work on plant community types that support particular butterfly species may bridge this gap, and potentially, could result in identifying indicator species that predict butterfly occurrences. This would be especially helpful as butterflies vary within a season (flight time and climatic conditions) and between seasons, so it is

difficult to observe all species on a single visit. Further butterfly work could be done to assess known distributions. By revisiting the same sites throughout a season and over multiple seasons, a more complete list of butterfly species frequenting the site can be identified and trends documented. This is also true of moth species and further work is required to fill in the many gaps that currently exist.

6.0 COMMUNICATIONS

6.1 Presentations at conferences, workshops and meetings

- Peace Parkland Naturalists meeting, (February 25, 2002) Grande Prairie, Alberta.
- Grande Prairie Science Festival – Become a Biologist (August 12, 2002) Grande Prairie, Alberta.
- Snack 'n Yak, (June 24, 2003) Peace River, Alberta.
- The Leading Edge – Conservation and Stewardship in Canada conference, (July 3 - 6, 2003) Victoria, British Columbia.
- Agricultural Service Board tour (July 16 - 17, 2003) Grande Prairie, Alberta.
- Alberta Institute of Agrologists meeting, (October 7, 2003) Peace River, Alberta.
- Public Lands Rangeland Management workshop, (November 13, 2003) Edmonton, Alberta.
- Prairie Conservation and Endangered Species Conference, (February 26 - 29, 2004) Calgary, Alberta.
- Kimiwan Naturalists meeting (May 6, 2004) McLennan, Alberta.

6.2 Posters displayed

- Grande Prairie Science Festival – Kleskun Hills Geological Picnic (August 10, 2002), Grande Prairie, Alberta.
- Saskatoon Island Swan Festival (April 24 - 25, 2003), Grande Prairie, Alberta.

6.3 Articles and Interviews

See Appendix 6 for copies of articles listed below.

- Alberta Outdoorsman (July 15 -August 15, 2002) "Peace project defines native grasslands"
- Record Gazette (August 13, 2002) "Butterflies grilled – rare?"
- Innovation Alberta – CKUA Radio (December 31, 2002) #71 "Native Grasslands: Remnants of the Grande Prairie" www.innovationalberta.com
- Biodiversity Makes it Work – NAWMP in Alberta (Volume 6, 2004) "An Inventory of Alberta's Northern Grasslands"

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8.0 APPENDICES

8.1 Appendix 1. Expected plant communities of the Peace Region

Vegetative community	Location	Literature source
Agropyron dasystachyum/A. smithii/Carex/Koeleria macrantha	Just below Agroyron smithii/ Artemisia tilesii/Artemisia frigida community on steep slopes of Peace River	Range Ecology and the impact of grazing on the Peace River Slopes, Alberta (Adams 1981)
Agropyron dasystachyum /Agropyron smithii/Herbaceous	Steep, unstable mid-slopes with south aspects in Peace River and Clear River Canyons	Adams (1981); Preliminary classification of Native wheat grass (Agropyron spp.) Community types in Alberta (Vujnovic and Bentz 2001)
Agropyron dasystachyum/Herbaceous	Dry steep southeast to southwest facing slopes near Kakwa Falls	(Vujnovic and Bentz 2001)
Agropyron dasystachyum/ Koeleria macrantha/Artemisia frigida	South and west facing slopes of Peace, Smoky and Wapiti Rivers; moderate to steep south and southwest facing slopes in Silver Valley	(Vujnovic and Bentz 2001)
Agropyron smithii/Artemisia tilesii/Artemisia frigida	Mid-slope position of steep slopes on Peace River	(Vujnovic and Bentz 2001)
Agropyron smithii/Stipa viridula/ Carex/Vicia americana	Upper, less steep slopes of Peace River	(Adams 1981)
Agropyron trachycaulum var. unilaterale/Stipa spartea/ Danthonia intermedia/Carex	Upland grasslands	An overview of the mixed grasslands of North America (Wallis 1982)
Agropyron trachycaulum/Carex atherodes	North of Ft. Vermilion and east of Caribou River, modified in Buffalo Prairie and Keg River	Grasslands of the Peace River region, western Canada (Moss 1952); Vujnovic and Bentz 2001
Agropyron trachycaulum/ Herbaceous vegetation	Steep to moderate southerly oriented slopes of Peace River Parkland	(Vujnovic and Bentz 2001)

8.1. Appendix 1. Continued

Vegetative community	Location	Literature source
Agropyron trachycaulum/ Hierochloe odorata/Herbaceous	Wettest, least saline areas of Hay River, High Level, Child Lake	(Vujnovic and Bentz, 2001)
Agropyron trachycaulum/ Stipa/Herbaceous	Moderately dry slopes, flat mesic grasslands of Peace River area	(Moss 1952, Vujnovic and Bentz 2001)
Amelanchier alnifolia/ Melilotus/Bromus inermis	saskatoon/snowberry/hairy wild rye community disturbed by livestock	Guide to range plant community types and carrying capacity for the Dry and Central Mixedwood Subregions in Alberta (Willoughby et al. 2000)
Amelanchier alnifolia-Symphoricarpos occidentalis/ Elymus innovatus	Small shrubby openings within aspen forests on southwest facing slopes and level areas	(Willoughby et al. 2000)
Artemisia campestris/Carex spp	Hilltops and south-facing slopes among jack pine on uplands and black spruce in lowlands	(Willoughby et al. 2000)
Artemisia campestris/Festuca saximontana-Carex spp	Hilltops and south facing slopes among jack pine on uplands and black spruce in lowlands of Central Mixedwood region	(Willoughby et al. 2000)
Calamagrostis canadensis	Edge of sedge meadows and moist draws	(Willoughby et al. 2000)
Carex aquatilis/Carex rostrata/ Carex atherodes	Wet sedge meadows	(Willoughby et al. 2000)
Carex stenophylla/Agropyron smithii/Herbaceous	Northwest of Fairview on steep southerly slopes (25-50% grade)	(Vujnovic and Bentz 2001)
Carex/Danthonia intermedia/ Stipa curtiseta	Flat, mesic grasslands and moderately dry slopes, upland grasslands	Remnant and early settlement prairies and solonetzic soils in the Peace River District (Wilkinson 1981)

8.1 Appendix 1. Continued.

Vegetative community	Location	Literature source
Carex/Thalictrum venulosum	Saddle Hills on fluvial deposits	Range plant community types and carrying capacity for the Lower Foothills Subregions of Alberta (Lane et al. 2000)
Carex-Poa pratensis/Thalictrum venulosum	Rested heavily grazed sedge/ veiny meadow rue community	(Lane et al. 2000)
Danthonia californica/ Arctostaphylos uva-ursi	Saddle Hills on gentle to level areas	(Lane et al. 2000)
Deschampsia cespitosa-Agropyron trachycaulum/ Thalictrum venulosum	Higher elevations on moist, level, valley flood plains and fluvial terraces	(Lane et al. 2000)
Elymus innovatus/Agropyron	Lower terraces of Peace River	(Adams 1981)
Hordeum jubatum/ Agropyron trachycaulum/ Distichlis stricta	Saline meadows Ft. Vermilion	(Vujnovic and Bentz 2001)
Koeleria macrantha/Agropyron albicans/Agropyron smithii	Drier upland and exposed slopes in Grande Prairie/Beaverlodge	(Vujnovic and Bentz 2001)
Koeleria-Agropyron-Artemisia	Soils with shallow layer of peat on grey wooded loam in Kleskun Hills area	(Vujnovic and Bentz 2001)
Picea mariana/ Calamagrostis inexpansa/ Sedge	Subhygric and hygric sites in Dry Mixedwood subregion	A Guide to Using Native Plants on Disturbed Lands (Gerling et al. 1996)
Pinus banksiana-Populus tremuloides/whortleberry/ grassy slopes	Sandy subxeric-submesic sites of Central Mixedwood subregion	(Gerling et al. 1996)
Pinus contorta-Populus tremuloides/Arctostaphylos uva-ursi/Oryzopsis asperifolia	Clear-cut lodgepole pine forest regenerating to both pine and aspen	(Lane et al. 2000)

8.1 Appendix 1. Continued.

Vegetative community	Location	Literature source
Poa interior/Agropyron trachycaulum/Herbaceous	Grande Prairie/Beaverlodge in parts of sand ridge	(Vujnovic and Bentz 2001)
Poa pratensis-Agrostis scabra	Marsh reed grass meadow under prolonged heavy grazing pressure	(Willoughby et al. 2000)
Poa pratensis-Phleum pratense/Thalictrum venulosum	Heavily grazed cow parsnip-veiny meadow rue community type	(Lane et al. 2000)
Populus tremuloides/Rosa	Deciduous mesic sites in Dry Mixedwood subregion; secondary shrub species determining the ecosite/community	(Gerling et al. 1996), (Willoughby et al. 2000)
Populus tremuloides/Rosa acicularis-Viburnum edule	Mesic sites in Central Mixedwood Subregion	(Gerling et al. 1996)
Populus tremuloides/Rosa-Alnus crispa/Oryzopsis asperifolia	Submesic sandy soils in Dry Mixedwood subregion	(Gerling et al. 1996)
Populus tremuloides/Rubus parviflorus	Rare in Lower Foothills subregion, along northeasterly banks of Smoky River	(Lane et al. 2000)
Populus tremuloides/ Spiraea betulifolia	Well drained northerly aspects throughout Saddle Hills	(Lane et al. 2000)
Rosa acicularis-Vaccinium caespitosum/Pleurozium schreberi	Small isolated openings in aspen dominated forests of Saddle Hills	(Lane et al. 2000)
Salix/Agropyron trachycaulum-Bromus ciliatus	Higher elevations on moist, level valley flood plains and fluvial terraces	(Lane et al. 2000)
Salix/Calamagrostis canadensis-Poa pratensis	Heavily grazed willow-marsh reed grass community	(Willoughby et al. 2000)
Salix-Alnus crispa/ Dryopteris carthusiana	North and east facing slopes in Saddle Hills	(Lane et al. 2000)

8.1 Appendix 1. Continued.

Vegetative community	Location	Literature source
Schizachne purpurascens/ Carex/Danthonia californica	Dry, grassy meadows on dark colored Solonetzic soils and gentle to level areas	(Willoughby et al. 2000)
Stipa curtiseta-Carex/Artemisia frigida	Steep, south facing slopes of Peace, Smoky and Wapiti rivers	(Willoughby et al. 2000)
Stipa viridula/Artemisia frigida	Xeric, well drained, SE facing steep slopes (40 degrees)	Silver Valley Biophysical Resource Analysis (Rintoul 1984)
Thalictrum venulosum/ Agropyron trachycaulum-Bromus ciliatus	Dry grassy meadows on dark colored Chernozemic soils	(Willoughby et al. 2000)

8.2 Appendix 2. Summary of plant species identified at verified sites in the Peace Region 2001-2003

Family	Name	Common name	Type
Adoxaceae	Adoxa moschatellina	moschatel	Forb
Apocynaceae	Apocynum androsaemifolium	spreading dogbane	Shrub
Araliaceae	Aralia nudicaulis	wild sarsaparilla	Forb
Asclepiadaceae	Asclepias speciosa	showy milkweed	Forb
Betulaceae	Alnus	alder	Shrub
Betulaceae	Alnus crispa	green alder	Shrub
Boraginaceae	Lappula squarrosa	bluebur	Forb Introduced
Boraginaceae	Mertensia paniculata	tall lungwort	Forb
Cactaceae	Opuntia fragilis	brittle prickly-pear	Forb
Campanulaceae	Campanula rotundifolia	harebell	Forb
Caprifoliaceae	Linnaea borealis	twinflower	Shrub
Caprifoliaceae	Lonicera	honeysuckle	Shrub
Caprifoliaceae	Lonicera dioica	twining honeysuckle	Shrub
Caprifoliaceae	Lonicera involucrata	bracted honeysuckle	Shrub
Caprifoliaceae	Lonicera tatarica	tatarian honeysuckle	Shrub Introduced
Caprifoliaceae	Symphoricarpos albus	snowberry	Shrub
Caprifoliaceae	Symphoricarpos occidentalis	buckbrush	Shrub
Caprifoliaceae	Viburnum edule	low-bush cranberry	Shrub
Caryophyllaceae	Arenaria	sandwort	Forb
Caryophyllaceae	Cerastium	chickweed	Forb
Caryophyllaceae	Cerastium arvense	field mouse-ear chickweed	Forb
Caryophyllaceae	Moehringia lateriflora	blunt-leaved sandwort	Forb
Caryophyllaceae	Silene	catchfly	Forb Introduced
Caryophyllaceae	Silene drummondii	Drummond's cockle	Forb
Caryophyllaceae	Silene pratensis	white cockle	Forb Introduced
Caryophyllaceae	Stellaria	chickweed	Forb
Caryophyllaceae	Stellaria longifolia	long-leaved chickweed	Forb
Caryophyllaceae	Stellaria longipes	long-stalked chickweed	Forb
Chenopodiaceae	Atriplex nuttallii	Nuttall's atriplex	Forb
Chenopodiaceae	Chenopodium	goosefoot	Forb Introduced
Chenopodiaceae	Chenopodium album	lamb's-quarters	Forb Introduced
Compositae	Achillea millefolium	common yarrow	Forb
Compositae	Achillea sibirica	many-flowered yarrow	Forb
Compositae	Agoseris glauca	yellow false dandelion	Forb
Compositae	Antennaria aprica	low everlasting	Forb
Compositae	Antennaria neglecta	broad-leaved everlasting	Forb
Compositae	Antennaria parvifolia	small-leaved everlasting	Forb
Compositae	Antennaria rosea	rosy everlasting	Forb
Compositae	Arnica	arnica	Forb
Compositae	Arnica chamissonis	leafy arnica	Forb
Compositae	Arnica cordifolia	heart-leaved arnica	Forb
Compositae	Arnica fulgens	shining arnica	Forb

8.2 Appendix 2. Continued.

Family	Name	Common name	Type
Compositae	Artemisia	artemisia	Forb
	Artemisia biennis	biennial sagewort	Forb
Compositae	Artemisia campestris		Forb
Compositae	Artemisia dracunculus		Forb
Compositae	Artemisia frigida	pasture sagewort	Forb
Compositae	Artemisia ludoviciana	prairie sagewort	Forb
Compositae		aster	Forb
Compositae	Aster conspicuus	showy aster	Forb
Compositae	Aster ericoides	tufted white prairie aster	Forb
Compositae	Aster laevis	smooth aster	Forb
Compositae	Cirsium	thistle	Forb
Compositae	Cirsium arvense		Forb Introduced
Compositae	Cirsium drummondii	Drummond's thistle	Forb
	Crepis tectorum	annual hawk's-beard	Forb Introduced
Compositae	Erigeron	fleabane	Forb
Compositae	Erigeron caespitosus	tufted fleabane	Forb
Compositae		smooth fleabane	Forb
Compositae	Erigeron philadelphicus	Philadelphia fleabane	Forb
Compositae	Grindelia squarrosa	gumweed	Forb
Compositae	Helenium autumnale	sneezeweed	Forb
Compositae	Helianthus	sunflower	Forb
Compositae	Helianthus annuus	common annual sunflower	Forb
Compositae	Helianthus subrhomboideus	rhombic-leaved sunflower	Forb
Compositae	Hieracium	narrow-leaved hawkweed	Forb
Compositae	Lactuca pulchella	common blue lettuce	Forb
Compositae	Matricaria matricarioides	pineappleweed	Forb Introduced
Compositae	Matricaria perforata	scentless chamomile	Forb Introduced
Compositae	Petasites palmatus	palmate-leaved coltsfoot	Forb
Compositae	Petasites sagittatus	arrow-leaved coltsfoot	Forb
Compositae	Senecio	ragwort	Forb
Compositae	Senecio eremophilus	cut-leaved ragwort	Forb
Compositae	Senecio pauperculus	balsam groundsel	Forb
Compositae	Senecio streptanthifolius	northern ragwort	Forb
Compositae	Solidago	goldenrod	Forb
Compositae	Solidago canadensis	Canada goldenrod	Forb
Compositae	Solidago missouriensis	low goldenrod	Forb
Compositae	Solidago spathulata	mountain goldenrod	Forb
Compositae	Sonchus	sow thistle	Forb Introduced
Compositae	Sonchus arvensis	perennial sow-thistle	Forb
Compositae	Tanacetum vulgare	common tansy	Forb Introduced
Compositae	Taraxacum officinale	common dandelion	Forb Introduced
Compositae	Townsendia exscapa	low townsendia	Forb
Compositae	Tragopogon dubius	common goat's-beard	Forb Introduced

8.2 Appendix 2. Continued.

Family	Name	Common name	Type
Cornaceae	Cornus canadensis	bunchberry	Forb
Cornaceae	Cornus stolonifera	red-osier dogwood	Shrub
Crassulaceae	Sedum lanceolatum	lance-leaved stonecrop	Forb
Cruciferae	Arabis	rock cress	Forb
Cruciferae	Arabis drummondii	Drummond's rock cress	Forb
Cruciferae	Arabis hirsuta	hairy rock cress	Forb
Cruciferae	Arabis holboellii	reflexed rock cress	Forb
Cruciferae	Brassica	mustard	Forb Introduced
Cruciferae	Capsella bursa-pastoris	shepherd's-purse	Forb Introduced
Cruciferae	Descurainia sophia	flixweed	Forb Introduced
Cruciferae	Erysimum cheiranthoides	wormseed mustard	Forb
Cruciferae	Erysimum inconspicuum	small-flowered rocket	Forb
Cruciferae	Lepidium	pepper-grass	Forb Introduced
Cruciferae	Thlaspi arvense	stinkweed	Forb Introduced
Cupressaceae	Juniperus	juniper	Shrub
Cupressaceae	Juniperus communis	ground juniper	Shrub
Cupressaceae	Juniperus horizontalis	creeping juniper	Shrub
Cyperaceae	Carex	sedge	Graminoid
Cyperaceae	Carex aurea	golden sedge	Graminoid
Cyperaceae	Carex concinna	beautiful sedge	Graminoid
Cyperaceae	Carex filifolia	thread-leaved sedge	Graminoid
Cyperaceae	Carex obtusa	blunt sedge	Graminoid
Cyperaceae	Carex pensylvanica	sun-loving sedge	Graminoid
Cyperaceae	Carex prairea	prairie sedge	Graminoid
Cyperaceae	Carex praticola	meadow sedge	Graminoid
Cyperaceae	Carex richardsonii	Richardson's sedge	Graminoid
Cyperaceae	Carex siccata	hay sedge	Graminoid
Cyperaceae	Scirpus	bulrush	Graminoid
Elaeagnaceae	Elaeagnus commutata	silverberry	Shrub
Elaeagnaceae	Shepherdia canadensis	Canada buffaloberry	Shrub
Equisetaceae	Equisetum	horsetail	Forb
Equisetaceae	Equisetum arvense	common horsetail	Forb
Equisetaceae	Equisetum hyemale	common scouring-rush	Forb
Equisetaceae	Equisetum sylvaticum	woodland horsetail	Forb
Ericaceae	Arctostaphylos uva-ursi	common bearberry	Shrub
Ericaceae	Vaccinium myrtilloides	common blueberry	Shrub
Ericaceae	Vaccinium vitis-idaea	bog cranberry	Shrub
Gentianaceae	Gentianella	gentian/felwort	Forb
Gentianaceae	Gentianella amarella	felwort	Forb
Geraniaceae	Geranium bicknellii	Bicknell's geranium	Forb
Geraniaceae	Geranium carolinianum	Carolina wild geranium	Forb
Gramineae	Agropyron	wheat grass	Graminoid
Gramineae	Agropyron dasystachyum	northern wheat grass	Graminoid

8.2 Appendix 2. Continued.

Family	Name	Common name	Type
Gramineae	Agropyron intermedium	intermediate wheat grass	Graminoid Introduced
Gramineae	Agropyron pectiniforme	crested wheat grass	Graminoid Introduced
Gramineae	Agropyron repens	quack grass	Graminoid Introduced
Gramineae	Agropyron smithii	western wheat grass	Graminoid
Gramineae	Agropyron trachycaulum	slender wheat grass	Graminoid
Gramineae	Agropyron trachycaulum var. unilaterale	awned wheat grass	Graminoid
Gramineae	Agrostis	bent grass	Graminoid
Gramineae	Agrostis scabra	rough hair grass	Graminoid
Gramineae	Agrostis stolonifera	redtop	Graminoid Introduced
Gramineae	Avena fatua	wild oat	Graminoid Introduced
Gramineae	Beckmannia syzigachne	slough grass	Graminoid
Gramineae	Bromus biebersteinii	meadow brome	Graminoid Introduced
Gramineae	Bromus ciliatus	fringed brome	Graminoid
Gramineae	Bromus inermis	awnless brome	Graminoid Introduced
Gramineae	Bromus pumpellianus	northern awnless brome	Graminoid
Gramineae	Calamagrostis	reed grass	Graminoid
Gramineae	Calamagrostis canadensis	bluejoint	Graminoid
Gramineae	Calamagrostis inexpansa	northern reed grass	Graminoid
Gramineae	Calamagrostis montanensis	plains reed grass	Graminoid
Gramineae	Calamagrostis neglecta	narrow reed grass	Graminoid
Gramineae	Calamagrostis purpurascens	purple reed grass	Graminoid
Gramineae	Dactylis glomerata	orchard grass	Graminoid Introduced
Gramineae	Danthonia californica	California oat grass	Graminoid
Gramineae	Danthonia intermedia	intermediate oat grass	Graminoid
Gramineae	Deschampsia cespitosa	tufted hair grass	Graminoid
Gramineae	Distichlis stricta	salt grass	Graminoid
Gramineae	Elymus innovatus	hairy wild rye	Graminoid
Gramineae	Festuca rubra	red fescue	Graminoid Introduced
Gramineae	Festuca saximontana	Rocky Mountain fescue	Graminoid
Gramineae	Glyceria borealis	northern manna grass	Graminoid
Gramineae	Helictotrichon hookeri	Hooker's oat grass	Graminoid
Gramineae	Hierochloe odorata	sweet grass	Graminoid
Gramineae	Hordeum jubatum	foxtail barley	Graminoid Introduced
Gramineae	Koeleria macrantha	June grass	Graminoid
Gramineae	Muhlenbergia richardsonis	mat muhly	Graminoid
Gramineae	Oryzopsis asperifolia	white-grained mountain rice grass	Graminoid
Gramineae	Oryzopsis pungens	northern rice grass	Graminoid
Gramineae	Phleum pratense	timothy	Graminoid Introduced
Gramineae	Poa	bluegrass	Graminoid
Gramineae	Poa compressa	Canada bluegrass	Graminoid

8.2 Appendix 2. Continued.

Family	Name	Common name	Type
Gramineae	Poa interior	inland bluegrass	Graminoid
Gramineae	Poa palustris	fowl bluegrass	Graminoid
Gramineae	Poa pratensis	Kentucky bluegrass	Graminoid Introduced
Gramineae	Poa sandbergii	Sandberg bluegrass	Graminoid
Gramineae	Schizachne purpurascens	purple oat grass	Graminoid
Gramineae	Secale cereale	rye	Graminoid Introduced
Gramineae	Stipa	needle grass	Graminoid
Gramineae	Stipa columbiana	Columbia needle grass	Graminoid
Gramineae	Stipa comata	needle-and-thread	Graminoid
Gramineae	Stipa curtiseta	western porcupine grass	Graminoid
Gramineae	Stipa richardsonii	Richardson needle grass	Graminoid
Gramineae	Stipa viridula	green needle grass	Graminoid
Gramineae	Triticum aestivum	common wheat	Graminoid Introduced
Grossulariaceae	Ribes	currant or gooseberry	Shrub
Grossulariaceae	Ribes oxyacanthoides	northern gooseberry	Shrub
Grossulariaceae	Ribes triste	wild red currant	Shrub
Iridaceae	Sisyrinchium montanum	common blue-eyed grass	Forb
Juncaceae	Juncus	rush	Graminoid
Juncaceae	Juncus balticus	wire rush	Graminoid
Juncaginaceae	Triglochin maritima	seaside arrow-grass	Graminoid
Labiatae	Agastache foeniculum	giant hyssop	Forb
Labiatae	Dracocephalum parviflorum	American dragonhead	Forb
Labiatae	Monarda fistulosa	wild bergamot	Forb
Labiatae	Stachys palustris	marsh hedge-nettle	Forb
Leguminosae	Astragalus	milk vetch	Forb
Leguminosae	Astragalus aboriginum	Indian milk vetch	Forb
Leguminosae	Astragalus bisulcatus	two-grooved milk vetch	Forb
Leguminosae	Astragalus dasyglottis	purple milk vetch	Forb
Leguminosae	Hedysarum alpinum	alpine hedysarum	Forb
Leguminosae	Lathyrus ochroleucus	cream-colored vetchling	Forb
Leguminosae	Lathyrus venosus	purple peavine	Forb
Leguminosae	Medicago sativa	alfalfa	Forb Introduced
Leguminosae	Melilotus officinalis	yellow sweet-clover	Forb Introduced
Leguminosae	Oxytropis	locoweed	Forb
Leguminosae	Oxytropis sericea	early yellow locoweed	Forb
Leguminosae	Oxytropis splendens	showy locoweed	Forb
Leguminosae	Trifolium	clover	Forb Introduced
Leguminosae	Trifolium hybridum	alsike clover	Forb Introduced
Leguminosae	Trifolium pratense	red clover	Forb Introduced
Leguminosae	Trifolium repens	white clover	Forb Introduced
Leguminosae	Vicia americana	wild vetch	Forb
Leguminosae	Vicia cracca	tufted vetch	Forb Introduced
Liliaceae	Allium	onion	Forb

8.2 Appendix 2. Continued.

Family	Name	Common name	Type
Liliaceae	Allium cernuum	nodding onion	Forb
Liliaceae	Allium schoenoprasum	wild chives	Forb
Liliaceae	Allium textile	prairie onion	Forb
Liliaceae	Lilium philadelphicum	western wood lily	Forb
Liliaceae	Maianthemum canadense	wild lily-of-the-valley	Forb
Liliaceae	Smilacina stellata	star-flowered Solomon's seal	Forb
Linaceae	Linum lewisii	wild blue flax	Forb
Onagraceae	Epilobium angustifolium	common fireweed	Forb
Onagraceae	Epilolobium ciliatum	northern willowherb	Forb
Onagraceae	Oenothera biennis	yellow evening-primrose	Forb
Ophioglossaceae	Botrychium lunaria	moonwort	Forb
Ophioglossaceae	Botrychium multifidum	leather grape fern	Forb
Orchidaceae	Habenaria	bog orchid	Forb
Orchidaceae	Habenaria viridis	bracted bog orchid	Forb
Orchidaceae	Spiranthes romanzoffiana	hooded ladies'-tresses	Forb
Pinaceae	Picea glauca	white spruce	Shrub
Pinaceae	Pinus contorta	lodgepole pine	Shrub
Plantaginaceae	Plantago major	common plantain	Forb Introduced
Polygalaceae	Polygala senega	seneca snakeroot	Forb
Polygonaceae	Polygonum arenastrum	common knotweed	Forb Introduced
Polygonaceae	Polygonum ramosissimum	bushy knotweed	Forb
Polygonaceae	Rumex	dock	Forb Introduced
Polygonaceae	Rumex occidentalis	western dock	Forb
Portulacaceae	Claytonia	spring beauty	Forb
Primulaceae	Androsace septentrionalis	northern fairy candelabra	Forb
Primulaceae	Glaux maritima	sea milkwort	Forb
Primulaceae	Primula incana	mealy primrose	Forb
Ranunculaceae	Actaea rubra	red and white baneberry	Forb
Ranunculaceae	Anemone	anemone	Forb
Ranunculaceae	Anemone canadensis	Canada anemone	Forb
Ranunculaceae	Anemone cylindrica	long-fruited anemone	Forb
Ranunculaceae	Anemone multifida	cut-leaved anemone	Forb
Ranunculaceae	Anemone patens	prairie crocus	Forb
Ranunculaceae	Aquilegia brevistyla	blue columbine	Forb
Ranunculaceae	Delphinium glaucum	tall larkspur	Forb
Ranunculaceae	Ranunculus	buttercup	Forb
Ranunculaceae	Ranunculus abortivus	small-flowered buttercup	Forb
Ranunculaceae	Ranunculus acris	tall buttercup	Forb
Ranunculaceae	Ranunculus cardiophyllus	heart-leaved buttercup	Forb
Ranunculaceae	Ranunculus macounii	Macoun's buttercup	Forb
Ranunculaceae	Ranunculus pensylvanicus	bristly buttercup	Forb
Ranunculaceae	Ranunculus rhomboideus	prairie buttercup	Forb
Ranunculaceae	Thalictrum venulosum	veiny meadow rue	Forb

8.2 Appendix 2. Continued.

Family	Name	Common name	Type
Rosaceae	Agrimonia striata	agrimony	Forb
Rosaceae	Amelanchier alnifolia	saskatoon	Shrub
Rosaceae	Crataegus rotundifolia	round-leaved hawthorn	Shrub
Rosaceae	Fragaria virginiana	wild strawberry	Forb
Rosaceae	Geum aleppicum	yellow avens	Forb
Rosaceae	Geum triflorum	three-flowered avens	Forb
Rosaceae	Potentilla	cinquefoil	Forb
Rosaceae	Potentilla anserina	silverweed	Forb
Rosaceae	Potentilla arguta	white cinquefoil	Forb
Rosaceae	Potentilla gracilis	graceful cinquefoil	Forb
Rosaceae	Potentilla hippiana	woolly cinquefoil	Forb
Rosaceae	Potentilla norvegica	rough cinquefoil	Forb
Rosaceae	Potentilla pensylvanica	prairie cinquefoil	Forb
Rosaceae	Prunus pensylvanica	pin cherry	Shrub
Rosaceae	Prunus virginiana	choke cherry	Shrub
Rosaceae	Rosa	rose	Shrub
Rosaceae	Rosa acicularis	prickly rose	Shrub
Rosaceae	Rosa woodsii	common wild rose	Shrub
Rosaceae	Rubus idaeus	wild red raspberry	Shrub
Rosaceae	Rubus pubescens	dewberry	Shrub
Rosaceae	Spiraea	meadowsweet	Forb
Rubiaceae	Galium boreale	northern bedstraw	Forb
Rubiaceae	Galium triflorum	sweet-scented bedstraw	Forb
Salicaceae	Populus balsamifera	balsam poplar	Shrub
Salicaceae	Populus tremuloides	aspen	Shrub
Salicaceae	Salix	willow	Shrub
Salicaceae	Salix bebbiana	beaked willow	Shrub
Salicaceae	Salix planifolia	flat-leaved willow	Shrub
Santalaceae	Comandra umbellata	bastard toadflax	Forb
Saxifragaceae	Heuchera	alumroot	Forb
Saxifragaceae	Heuchera richardsonii	Richardson's alumroot	Forb
Saxifragaceae	Mitella nuda	bishop's-cap	Forb
Scrophulariaceae	Castilleja miniata	common red paintbrush	Forb
Scrophulariaceae	Linaria vulgaris	butter-and-eggs	Forb Introduced
Scrophulariaceae	Orthocarpus luteus	owl-clover	Forb
Scrophulariaceae	Penstemon	beardtongue	Forb
Scrophulariaceae	Penstemon gracilis	lilac-flowered beardtongue	Forb
Scrophulariaceae	Penstemon procerus	slender blue beardtongue	Forb
Scrophulariaceae	Rhinanthus minor	yellow rattle	Forb
Selaginellaceae	Selaginella densa	prairie selaginella	Forb
Typhaceae	Typha latifolia	common cattail	Graminoid
Umbelliferae	Cicuta maculata	water-hemlock	Forb
Umbelliferae	Heracleum lanatum	cow parsnip	Forb

8.2 Appendix 2. Continued.

Family	Name	Common name	Type
Umbelliferae	Lomatium foeniculaceum	hairy-fruited wild parsley	Forb
Umbelliferae	Sanicula marilandica	snakeroot	Forb
Umbelliferae	Umbelliferae	umbellifer	Forb
Umbelliferae	Zizia aptera	heart-leaved Alexanders	Forb
Urticaceae	Urtica dioica	common nettle	Forb
Violaceae	Viola adunca	early blue violet	Forb
Violaceae	Viola canadensis	western Canada violet	Forb

8.3 Appendix 3. Examples of plant community descriptions to be used in a Plant Community Guide to Peace Region Grassland Communities

PPB1. Sedge-Slender wheat grass-Western porcupine grass

(Carex spp.-Agropyron trachycaulum-Stipa curtiseta)

n=33 This community type appears to represent a Sedge-Western porcupine grass-Intermediate oat grass community that has been grazed moderately for an extended period of time. As grazing pressure increases there appears to be a decline in the cover of Western porcupine grass and Intermediate oat grass. This allows sedge and slender wheat grass to increase in cover. Continued heavy grazing pressure will eventually cause all native species to decline and the site will become dominated by Kentucky bluegrass to form the Kentucky bluegrass-Sedge dominated community.

PLANT COMPOSITION CANOPY COVER (%)

	MEAN	RANGE	CONST.
SHRUBS			
ROSE (Rosa acicularis)	6	0-17	91
SASKATOON (Amelanchier alnifolia)	7	0-30	79
SNOWBERRY (Symphoricarpos occidentalis)	3	0-20	58
FORBS			
DANDELION (Taraxacum officinale)	4	0-15	67
OLD MAN'S WHISKERS (Geum triflorum)	9	0-24	88
PRAIRIE CROCUS (Anemone patens)	82	4	0-13
YARROW (Achillea millefolium)	10	0-21	97
FRINGED SAGE (Artemisia frigida)	52	1	0-8
GRASSES			
KENTUCKY BLUEGRASS (Poa pratensis)	2	0-7	76
SEDGE (Carex spp.)	30	1-58	100
SLENDER WHEAT GRASS (Agropyron trachycaulum)	5	0-10	85
WESTERN PORCUPINE GRASS (Stipa curtiseta)	5	0-15	91

ENVIRONMENTAL VARIABLES

MOISTURE REGIME (MEAN):
MESIC

NUTRIENT REGIME (MEAN):
MESOTROPHIC-PERMESOTROPHIC

ELEVATION:
697 M

SOIL DRAINAGE (MEAN):
WELL

FORAGE PRODUCTION (KG/HA)

TOTAL
2000 *ESTIMATE

SUGGESTED GRAZING CAPACITY
0.5 HA /AUM

PPB2. Sedge-Kentucky bluegrass-Intermediate oat grass

(Carex spp.-Poa pratensis-Danthonia intermedia)

n=22 This community type appears to represent a Sedge-Western porcupine grass-Intermediate oat grass community that has been grazed moderately to heavily for an extended period of time. As grazing pressure increases there appears to be a decline in the cover of Western porcupine grass and Intermediate oat grass. This allows sedge and slender wheatgrass to increase in cover. Continued moderate to heavy grazing pressure favours the growth of sedge and Kentucky bluegrass. Continued heavy grazing will eventually lead to the Kentucky bluegrass-Sedge dominated community.

PLANT COMPOSITION CANOPY COVER (%)

	MEAN	RANGE	CONST.
SHRUBS			
ROSE (Rosa acicularis)	9	0-35	100
SNOWBERRY (Symphoricarpos occidentalis)	4	0-17	59
SASKATOON (Amelanchier alnifolia)	9	0-50	86
FORBS			
YARROW (Achillea millefolium)	11	4-21	100
NORTHERN BEDSTRAW (Galium boreale)	10	0-20	91
OLD MAN'S WHISKERS (Geum triflorum)	10	0-24	82
DANDELION (Taraxacum officinale)	8	0-18	82
PRAIRIE CROCUS (Anemone patens)	2	0-18	59
GRASSES			
SEDGE (Carex spp.)	25	7-44	100
KENTUCKY BLUEGRASS (Poa pratensis)	12	1-29	100
SLENDER WHEAT GRASS (Agropyron trachycaulum)	6	0-14	96
INTERMEDIATE OAT GRASS (Danthonia intermedia)	5	0-12	77
WESTERN PORCUPINE GRASS (Stipa curtiseta)	4	0-19	64
PURPLE OATGRASS (Schizachne purpurascens)	3	0-10	27

ENVIRONMENTAL VARIABLES

MOISTURE REGIME (MEAN):
MESIC

NUTRIENT REGIME (MEAN):
MESOTROPHIC-PERMESOTROPHIC

ELEVATION:
576-606(588) M

SOIL DRAINAGE (MEAN):
WELL

FORAGE PRODUCTION (KG/HA)

TOTAL 2000 *ESTIMATE

SUGGESTED GRAZING CAPACITY
0.5 HA /AUM

PPB3 . Kentucky bluegrass-Sedge

(Poa pratensis-Carex spp.)

n=11 This community is formed when a Sedge-Western porcupine grass-Intermediate oat grass community is heavily grazed for a prolonged period of time. The heavy grazing pressure causes the native species to decline in cover and the site is invaded by grazing resistant species such as, dandelion, Kentucky bluegrass, timothy and smooth brome. It is not clear how this community type will respond to complete protection from grazing. It is likely that Kentucky bluegrass will dominate or co-dominate the site for many years.

PLANT COMPOSITION CANOPY COVER(%)

	MEAN	RANGE	CONST.
SHRUBS			
ROSE (Rosa acicularis)	4	0-22	82
SNOWBERRY (Symphoricarpos occidentalis)	3	0-10	55
SASKATOON (Amelanchier alnifolia)	5	0-17	73
FORBS			
YARROW (Achillea millefolium)	10	2-19	100
NORTHERN BEDSTRAW (Galium boreale)	6	0-12	91
OLD MAN'S WHISKERS (Geum triflorum)	6	0-38	55
DANDELION (Taraxacum officinale)	11	0-27	91
PRAIRIE CROCUS (Anemone patens)	3	0-17	55
GRASSES			
SEDGE (Carex spp.)	9	1-24	100
KENTUCKY BLUEGRASS (Poa pratensis)	38	10-57	100
SLENDER WHEAT GRASS (Agropyron trachycaulum)	3	1-6	100
INTERMEDIATE OAT GRASS (Danthonia intermedia)	3	0-8	55
WESTERN PORCUPINE GRASS (Stipa curtiseta)	3	0-20	55
SMOOTH BROME (Bromus inermis)	8	0-45	46

ENVIRONMENTAL VARIABLES

MOISTURE REGIME (MEAN):
MESIC

NUTRIENT REGIME (MEAN):
MESOTROPHIC-PERMESOTROPHIC

ELEVATION:
576-606(588) M

SOIL DRAINAGE (MEAN):
WELL

FORAGE PRODUCTION (KG/HA)

TOTAL 2000 *ESTIMATE

SUGGESTED GRAZING CAPACITY
0.5 HA /AUM

8.4 Appendix 4. Summary of butterflies observed in the Peace Region, during 2001-2003

Disjunct grassland species	Common name	Species name	Number of sites where observed
	SKIPPERS		
	Arctic Skipper	Carterocephalus palaemon	1
X	Plains Skipper	Hesperia assiniboia	6
X	Garita Skipper	Oarisma garita	1
	Long-dash Skipper	Polites mystic	1
	Skipper sp.		2
	SWALLOWTAILS		
	Canadian Swallowtail	Papilio canadensis	8
X	Pike's Old World Swallowtail	Papilio machaon pikei	3
	Anise Swallowtail	Papilio zelicaon	1
	Swallowtail sp		26
	SULPHERS AND WHITES		
	Christine Sulphur	Colias christina	2
	Pink Edged Sulphur	Colias interior	1
	Clouded Sulphur	Colias philodice	2
	Cabbage White	Pieris rapae	10
	Western White	Pontia occidentalis	2
	Sulphur sp.		14
	White sp.		5
	BLUES, COPPERS AND HAIRSTREAKS		
	Hoary Elfin	Callophrys polia	1
	Spring Azure	Celastrina ladon	2
	Western Tailed Blue	Everes amyntula	3
	Silvery Blue	Glaucopsyche lygdamus	9
	Melissa Blue	Lycaeides melissa	4
	Northern Blue	Lycaeides idas	1
	Gray Copper	Lycaena dione	1
	Bronze Copper	Lycaena hyllus	1
	Greenish Blue	Plebejus saepiolus	1
X	Striped Hairstreak	Satyrium liparops	1
X	Coral Hairstreak	Satyrium titus	3
	Blue sp.		21
	Copper sp.		3
	ADMIRALS AND ANGLEWINGS		
	White Admiral	Limenitis arthemis	9
	Red Admiral	Vanessa atalanta	2
	Anglewing sp.		1
	FRITILLARIES		
	Meadow Fritillary	Boloria bellona	9
	Variegated Fritillary	Euptoieta claudia	1
	Aphrodite Fritillary	Speyeria aphrodite	4
	Atlantis Fritillary	Speyeria atlantis	2
	Great Spangled Fritillary	Speyeria cybele	1
	Northwestern Fritillary	Speyeria hesperis	8
	Mormon Fritillary	Speyeria mormonia	3
	Greater Fritillary sp.		5
	Lesser Fritillary sp.		6

8.4 Appendix 4. Continued.

Disjunct grassland species	Common name	Species name	Number of sites where observed
	CRESCENTS AND CHECKERSPOTS		
	Tawny Crescent	Phyciodes batesii	1
	Northern Crescent	Phyciodes cocyta	6
	Crescent sp.		1
X	Checkerspot sp.		3
	SATYRS		
	Common Wood Nymph	Cercyonis pegala	11
	Common Ringlet	Coenonympha tullia	16
	Common Alpine	Erebia epipsodea	6
X	Alberta Arctic	Oeneis alberta	2
X	Uhler's Arctic	Oeneis uhleri	5
X	Arctic sp.		3

Note: Nomenclature follows Layberry et al. (1998)

8.5 Appendix 5. Summary of moth species observed during 2003

Species name	Author	Location	Dates captured (2003)				Collector
ARCTIIDAE							
Crambidia impure	(B. & McD.)	Peace River, 8km NNE (NE21-84-21-W5)	17-Aug	25-Aug			Walty, D.
Grammia doris	(Boisduval)	Deadwood area (SE33-89-22-W5)	10-Jun				Sample, T., Bone, S.
Grammia obliterata	(Stretch)	Peace River, 8km NNE (NE21-84-21-W5)	17-Aug				Walty, D.
Grammia parthenice	(Kirby)	Peace River, 8km NNE (NE21-84-21-W5)	5-Jul	21-Jul	28-Jul		Walty, D.
Grammia williamsii	(Dodge)	Peace River, 8km NNE (NE21-84-21-W5)	5-Jul	19-Jul	21-Jul	28-Jul	Walty, D.
Holomelina ferruginosa	(Wlk.)	Peace River, 8km NNE (NE21-84-21-W5)	5-Jul	21-Jul			Walty, D.
Hypoprepia miniata	(Kirby)	Peace River, 8km NNE (NE21-84-21-W5)	19-Jul				Walty, D.
Platarctia parthenos	(Harris)	Peace River, 8km NNE (NE21-84-21-W5)	26-Jun				Walty, D.
GEOMETRIDAE							
Dysstroma citrata	(L.)	Peace River, 8km NNE (NE21-84-21-W5)	25-Aug				Walty, D.
Erannis tiliaria	(Harr.)	Peace River, 8km NNE (NE21-84-21-W5)	26-Sep	4-Oct			Walty, D.
Hesperumia sulphuraria	(Pack.)	Peace River, 8km NNE (NE21-84-21-W5)	19-Jul				Walty, D.
Horisme incana	(Swett)	Peace River, 8km NNE (NE21-84-21-W5)	15-Jun				Walty, D.
Itame loricaria	(Evers.)	Peace River, 8km NNE (NE21-84-21-W5)	26-Jun				Walty, D.
Lomographa semiclarata	(Wlk.)	Peace River region (SE21-90-21-W5)	3-Jun				Bone, S.
Metarranthis duaria	(Gn.)	Peace River, 8km NNE (NE21-84-21-W5)	7-Jun				Walty, D.
Probole amicaria	(H.-S.)	Peace River, 8km NNE (NE21-84-21-W5)	26-Jun				Walty, D.
Scopula limboundata	(Haw.)	Peace River, 8km NNE (NE21-84-21-W5)	5-Jul				Walty, D.
Synaxis jubararia	(Hulst)	Peace River, 8km NNE (NE21-84-21-W5)	17-Aug				Walty, D.
HEPIALIDAE							
Gazoryctra noviganna		Peace River, 8km NNE (NE21-84-21-W5)	25-Jul				Walty, D.
Sthenopis purpurascens		Peace River, 8km NNE (NE21-84-21-W5)	21-Jul				Walty, D.
NOCTUIDAE							
Actebia fennica	(Tauscher)	Peace River, 8km NNE (NE21-84-21-W5)	25-Aug				Walty, D.

8.5 Appendix 5. Continued.

Species name	Author	Location	Dates captured (2003)	Collector
Agnorisma bugrai	(Kocak)	Peace River, 8km NNE (NE21-84-21-W5)	25-Aug	Walty, D.
Agrotis venerabilis	(Wlk.)	Peace River, 8km NNE (NE21-84-21-W5)	25-Aug	Walty, D.
Catocala relicta	(Wlk.)	Peace River, 8km NNE (NE21-84-21-W5)	25-Aug	Walty, D.
Catocala unijuga	(Wlk.)	Peace River, 8km NNE (NE21-84-21-W5)	25-Aug	Walty, D.
Chytonix palliatricula	(Gn.)	Peace River, 8km NNE (NE21-84-21-W5)	26-Jun 5-Jul	Walty, D.
Diachrysia aeroides	(Grote)	Peace River, 8km NNE (NE21-84-21-W5)	21-Jul 28-Jul	Walty, D.
Drasteria adumbrata	(Behr)	Peace River region (NW16-108-14-W5)	1-Jul	Sample, T., Bone, S.
Enargia decolor	(Wlk.)	Peace River, 8km NNE (NE21-84-21-W5)	25-Aug	Walty, D.
Enargia infumata	(Grote)	Peace River, 8km NNE (NE21-84-21-W5)	19-Jul	Walty, D.
Eurois astricta	(Morrison)	Peace River, 8km NNE (NE21-84-21-W5)	21-Jul	Walty, D.
Euxoa servita	(Smith)	Peace River, 8km NNE (NE21-84-21-W5)	19-Jul	Walty, D.
Feltia jaculifera	(Gn.)	Peace River, 8km NNE (NE21-84-21-W5)	28-Jul	Walty, D.
Hillia iris	(Zetterstedt)	Peace River, 8km NNE (NE21-84-21-W5)	25-Aug	Walty, D.
Homohadena stabilis	(Smith)	Peace River, 8km NNE (NE21-84-21-W5)	21-Jul	Walty, D.
Lacinipolia lorea	(Gn.)	Peace River, 8km NNE (NE21-84-21-W5)	26-Jun	Walty, D.
Lacinipolia lustralis	(Grote)	Peace River, 8km NNE (NE21-84-21-W5)	26-Jun	Walty, D.
Lacinipolia vicina	(Grote)	Peace River, 8km NNE (NE21-84-21-W5)	5-Jul	Walty, D.
Leucania insueta	(Gunee)	Peace River, 8km NNE (NE21-84-21-W5)	5-Jul	Walty, D.
Leucania multilinea	(Wlk.)	Peace River, 8km NNE (NE21-84-21-W5)	5-Jul	Walty, D.
Lithacodia albidula	(Gn.)	Peace River, 8km NNE (NE21-84-21-W5)	26-Jun	Walty, D.
Litholomia napaea	(Morrison)	Peace River, 8km NNE (NE21-84-21-W5)	26-Sep	Walty, D.
Oncocnemis cibalis	(Grote)	Peace River, 8km NNE (NE21-84-21-W5)	26-Sep	Walty, D.
Orthodes obscura	(Sm.)	Peace River, 8km NNE (NE21-84-21-W5)	7-Jun	Walty, D.
Parastichtis suspecta		Peace River, 8km NNE (NE21-84-21-W5)	19-Jul	Walty, D.
Phalaenophana pyramusalis	(Wlk.)	Peace River, 8km NNE (NE21-84-21-W5)	5-Jun	Walty, D.
Phalaenostola metonalis	(Wlk.)	Peace River, 8km NNE (NE21-84-21-W5)	21-Jul	Walty, D.
Schinia cumatilis	(Grote)	Peace River, 8km NNE (NE21-84-21-W5)	21-Jul	Walty, D.

8.5 Appendix 5. Continued.

Species name	Author	Location	Dates captured (2003)	Collector
Sideridis maryx	(Gn.)	Peace River, 8km NNE (NE21-84-21-W5)	7-Jun	Walty, D.
NOTODONTIDAE				
Clostera albosigma	(Fitch)	Peace River, 8km NNE (NE21-84-21-W5)	7-Jun	Walty, D.
Gluphisia septentrionis	(Wlk.)	Peace River, 8km NNE (NE21-84-21-W5)	7-Jun	Walty, D.
Nadata gibbosa	(J.E. Smith)	Peace River, 8km NNE (NE21-84-21-W5)	5-Jul	Walty, D.
Pheosia rimosa	(Pack.)	Peace River, 8km NNE (NE21-84-21-W5)	5-Jul	Walty, D.
Schizura unicornis	(Smith)	Peace River, 8km NNE (NE21-84-21-W5)	21-Jul	Walty, D.
SPHINGIDAE				
Smerinthus cerisyi	(Kirby)	Peace River, 8km NNE (NE21-84-21-W5)	15-Jun	Walty, D.
Smerinthus jamaicensis	(Drury)	Peace River, 8km NNE (NE21-84-21-W5)	5-Jul	Walty, D.

Note: All species identified by C. Schmidt, University of Alberta

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Alberta Conservation Association