Riverbottom Forest Assessment:

Forest Ecosystem Classification and Management Recommendations

FINAL REPORT

For

Canadian Forest Service
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1.0 Introduction

Over the past few years, the interest in local forest stands and the potential to manage them for forest resources as well as for a variety of other values has increased. This is particularly evident in agro-Manitoba where programs have been developed to assist interested landowners in managing their forest stands as woodlots. Forest stands remaining on private land in southern Manitoba are typically dominated by hardwood species. For those with land adjacent to rivers or streams, a portion of these remaining stands may include riverbottom forest communities.

Within Manitoba little information is available about the riverbottom forest communities of southern Manitoba. The recently completed *Forest Ecosystem Classification (FEC) for Manitoba - Field Guide (first approximation)* (Zoladeski et al. 1995) provides detailed information for forest stands typical of the boreal forest region within Manitoba, generally focusing on softwoods. The information it provides is less relevant to the hardwood forest stands in southern Manitoba. As a result, those landowners and woodlot program managers developing management plans for riverbottom forest stands do not have the benefit of information specific to the composition of these hardwood stands.

The objectives of this study were to examine riverbottom forest communities within the Aspen Parkland Forest Section of Southern Manitoba in order to:

- develop an appropriate forest ecosystem classification;
- evaluate regeneration on recently harvested or disturbed sites; and
- provide suitable management prescriptions.

This final report includes an ecosystem classification for riverbottom forests found in southern Manitoba, a review of recently harvested or disturbed sites, prescriptions for managing riverbottom forest ecosystems in southern Manitoba and a fact sheet for distribution to landowners describing the riverbottom forest ecosystems and recommended management regimes.

This report completes the contractual obligations under contract no. 4Y080 - 3 - 1429.

2.0 Overview of Riverbottom Forests and Manitoba's Forest Ecosystem Classification

The study area falls within the Prairie Ecozone (also referred to as the Grassland Ecoprovince by Mills et al. 1987) in southern Manitoba which extends from just east of the Red River valley to the Saskatchewan border to the west and from the U.S. border to the southern end of Lake Manitoba to the north (Map 1). Where native vegetation still remains, the majority of this ecozone is represented by groves of aspen, often with oak or balsam poplar, within a grassland matrix. Vegetation patterns are controlled by moisture gradients (Mills et al. 1987). Distinct vegetation communities occur in association with different surface water features. These include lakes, small wetlands, marsh complexes and forest communities found along intermittent water courses, creeks, streams and rivers.

Riverbottom forests are a characteristic element of the bottomland vegetation associated with fluvial landforms. The terrestrial landscape along rivers and streams can be subdivided into three components: the channel shelf, floodplain and terrace. The channel shelf, the gently sloping area adjacent to the edge of the water course, is dominated by pioneer species such as willow and cottonwood. Elevated above the channel shelf, the relatively flat floodplain is dominated by elm, ash, basswood and Manitoba maple. Farthest from the river lies the terrace, a higher area less prone to flooding, where the canopy includes bur oak along with the elm, ash and maple. Even though each of these landforms has its own characteristic elements, discrete boundaries are rarely discernible between them (Essenberg, 1991). A diagrammatic representation of these components is provided in Figure 1.

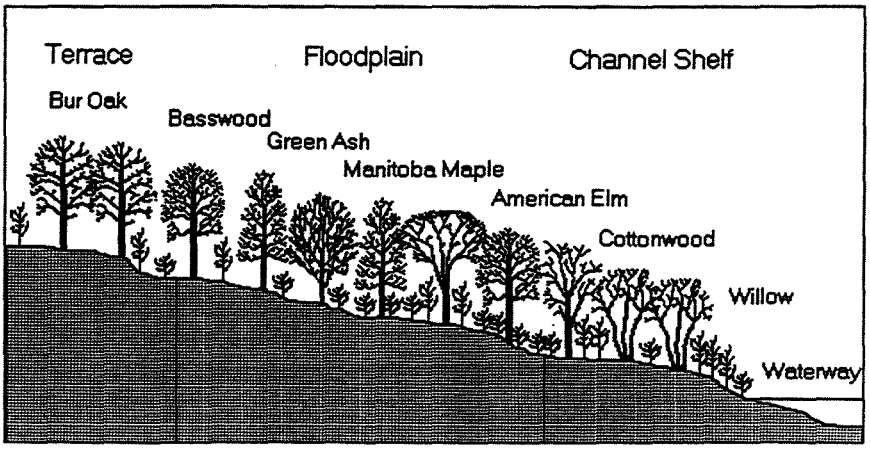
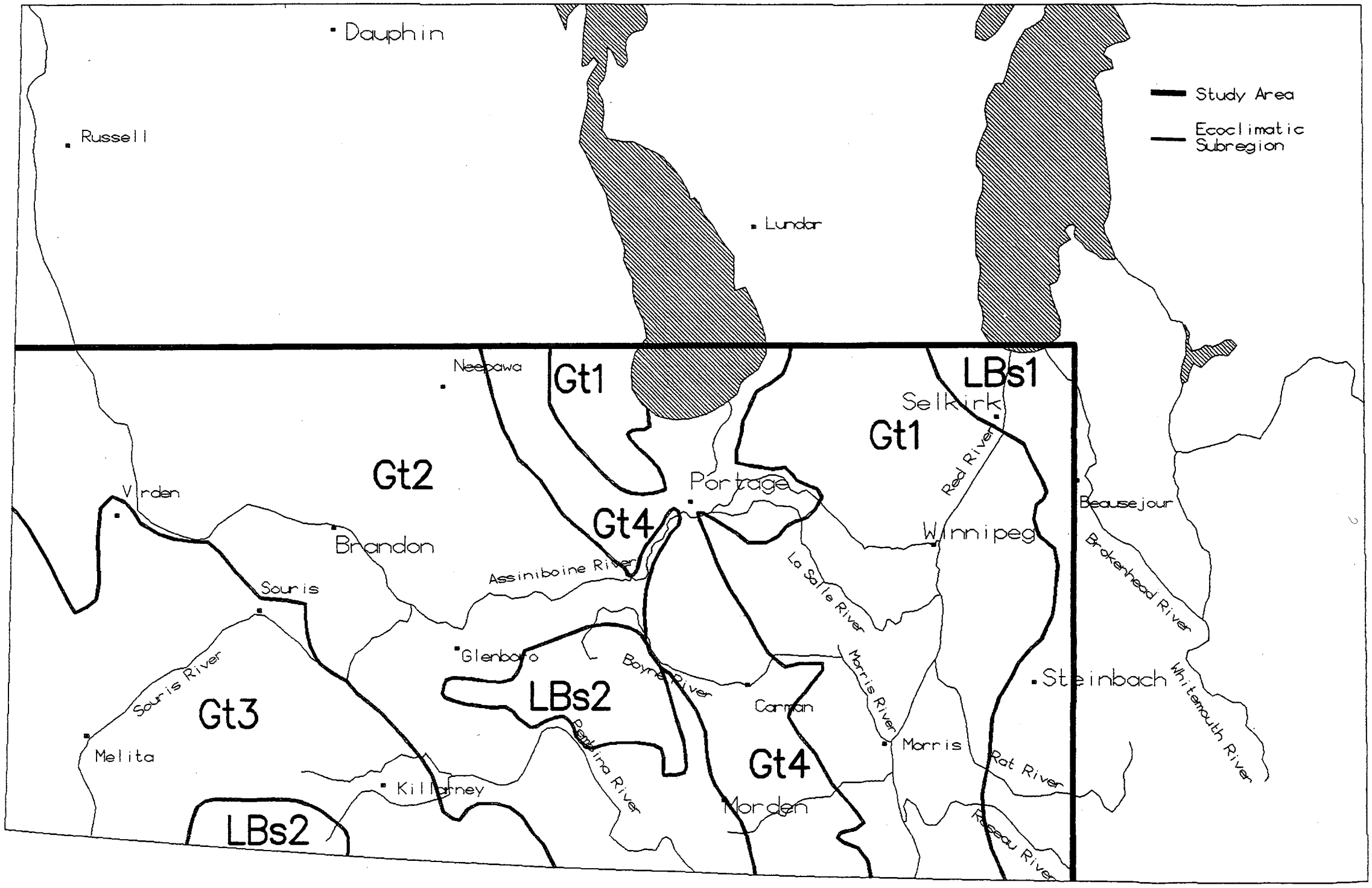


Figure 1
Profile of a representative riverbottom forest illustrating the three different zones that may be present.

Map 1. Riverbottom Forest Study Area



Riverbottom forest makes up only a small percentage of the total forest cover in the Aspen Parkland Forest Section. The Aspen Parkland Forest Section includes Forest Management Units (FMUs) 1, 2, 4, 5, 6 and 7. Historically a greater percentage of the land adjacent to flowing waters within southern Manitoba supported riverbottom forest. Land use changes associated with agriculture and the occurrence of Dutch elm disease (DED) have greatly affected the extent and general health of these riverbottom forest communities.
Within the *Forest Ecosystem Classification (FEC) for Manitoba - Field Guide (first approximation)*, two vegetation types (V-types) have been identified which may encompass the riverbottom forest found along Manitoba's rivers and streams (Zoladeski et al. 1995). Type V2, Black Ash (White Elm) Hardwood, is described as being the wetter of the two, occurring along periodically flooded creeks and small rivers in the central and northern portions of the province. As black ash is not common to the aspen parkland region of southwestern Manitoba, the occurrence of type V2 within the study area is considered unlikely.

Type V3, Miscellaneous Hardwoods, includes a range of site conditions from drier upland oak forest sites to moist, imperfectly drained sites of ash, elm, oak and maple in bottomlands. Type V3 is based on data from existing sources and suggestions from a forest ecosystem classification for Manitoba field guide workshop held in Winnipeg in November 1993. No FEC plots were located in southern Manitoba to collect data to confirm this vegetation type, as a more detailed examination of the range of sites within type V3 was beyond the scope of the work undertaken to develop the field guide (Zoladeski, pers. comm.). While the classification covers a broad range of conditions and species, it excludes several species often associated with riverbottom forest in southern Manitoba: cottonwood, willow and basswood.

It was the intention of this study to collect data from the riverbottom forests of southern Manitoba to further define the riverbottom vegetation communities encompassed within the type V3. This data then formed the basis for the development of FEC types which represent the variation found within these communities.

3.0 Methodology

This study focused on examining representative examples of the forest communities found along the intermittent and flowing water courses within the Prairie Ecozone. Through detailed examination of representative sites throughout the ecozone, any variations in riverbottom forest across this ecozone would be identified and addressed within the ecosystem classification and the recommended management prescriptions.

3.1 Site Selection

In order to conduct a systematic review of riverbottom forest sites across the Prairie ecozone in Manitoba, sample sites were chosen from each of the four ecoclimatic subregions located within the ecozone (See Map 1). An ecoclimatic region is defined as "*as area of the Earth's surface characterized by distinctive ecological responses to macroclimate as expressed by vegetation, soils, fauna and aquatic systems*" (Mills et al. 1987). The grassland transition (GT) ecoclimatic region is divided into four subregions, within the prairie ecozone of Manitoba. These subregions are based on variations across the GT ecoclimatic region in terms of climatic factors such as temperature, frost-free days, precipitation, etc. (Mills et al. 1987). Table 1 provides a comparison of selected climatic data for these four subregions.

It was assumed that local variations in riverbottom forest communities would likely occur within each of the four subregions, based on the subtle climatic differences between each subregion as well as their geographic locations. Therefore the species found in each subregion would be determined partially by the climatic factors and partially by their geographic range. By reviewing the forest resource inventory data and the climatic summaries for the subregions, an initial picture of these possible variations in riverbottom forest began to emerge. Examining Table 1 it was evident that the GT-4 subregion received the highest precipitation and had the longest frost-free period and the highest number of degree days (>5°C). As a result, this area was expected to have the moisture regime and frost free period to support the greatest species diversity. In the GT-3 subregion, which experienced the lowest precipitation, species diversity may be limited by available moisture.

In addition, some sites were chosen because they were known to have been harvested or impacted by other forms of land use management (e.g. grazing). The number of riverbottom sites currently under some form of forest management is very limited and most known locations were included within the study sample.

3.2 Field Survey Methods

The field work conducted during the summer of 1994 was designed to provide field identification of Forest Ecosystem Classification V-Types for riverbottom forests and to evaluate previously harvested or naturally disturbed riverbottom sites to assist in the development of management prescriptions on a species or site basis. Field work carried out to develop management prescriptions focused on the five riverbottom species that were perceived to be the most important from an economic perspective due to existing/potential markets or overall volume availability. These were bur oak, American elm, green ash, basswood and Manitoba maple. Markets currently exist on a limited basis for four of these species. Manitoba maple is a dominant component of the riverbottom forests throughout much of the study area, and overall its Net Merchantable Volume is second only to ash.

Table 1. Summary of Selected Climatic Data for the Grassland Transition Ecoclimatic Region and Subregions of Manitoba

Ecoclimatic Region and Subregion	No. of Stations	Mean Annual Temperature, °C			Mean January Temperature, °C			Mean July Temperature, °C			Average Frost-free Period (days)			Average No. of Degree Days >5 °C			Mean Annual Precipitation, mm			Mean Growing Season Precipitation, mm		
		Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.
GRASSLAND TRANSITION																						
Gt1	20	2.0	3.1	0.8	-19.5	-18.2	-20.9	19.3	20.1	18.2	116	130	95	1743.1	1908.3	1551.5	506.6	554.7	445.2	321.4	350.2	283.3
Gt2	23	1.6	2.4	0.6	-20.1	-18.4	-20.4	18.7	19.7	17.6	111	123	90	1640.5	1765.1	1466.1	487.7	540.7	426.0	313.6	360.7	268.3
Gt3	9	2.6	2.8	2.4	-17.9	-17.3	-18.6	19.4	19.6	19.1	114	121	110	1756.2	1769.1	1738.8	477.6	512.7	441.1	320.8	338.6	293.9
Gt4	11	2.8	3.3	2.1	-18.3	-17.3	-18.9	19.9	20.3	19.2	122	131	109	1838.6	1920.1	1711.2	508.1	531.1	463.7	327.6	345.3	299.5

From: Ecoclimatic Regions of Manitoba. 1987. Prepared by the Manitoba Ecoclimatic Region Working group. Available from the Manitoba Soil Survey, Winnipeg.

The remaining two riverbottom species (cottonwood and willow) were not considered in the development of management prescriptions at this time. Cottonwood and willow are usually found on the channel flats and islands, on the riverbottom sites most sensitive to disturbance. Additionally, the lack of an existing or perceived potential market for these species reduces their importance to landowners.

3.2.1 Identification of Riverbottom Forest Vegetation Types

Variations in species were expected to occur within riverbottom forest sites, with hardwood species such as elm, ash, Manitoba maple and basswood on the floodplain and oak dominated stands on the drier terraces. Variations were also expected between sites, reflecting differences in location and microclimates throughout the study area. Through the field program, data were collected from a number of sites to determine the nature of these variations and incorporate them where appropriate into the forest ecosystem classification.

Field work focused on a limited number of undisturbed sites within each of the four ecoclimatic subregions. Sampling sites were distributed on the basis of ecoclimatic subregions, as climatic variations, in large measure, have determined the distribution of species throughout the study area. Where possible, these sites were also located in proximity to harvested sites being evaluated for the development of management prescriptions. Similar methods were used to inventory both types of sites, to allow for some comparison between the undisturbed condition and regeneration on harvested sites.

A minimum of two undisturbed sites were chosen for sampling in each subregion with additional disturbed sites (e.g. cut, planted, grazed) being included where available. At each site chosen, 10x10 meter sampling plots were established and surveyed using methods similar to those used to develop the FEC types by Zoladeski et al. (1995). This provided a description of the site location, drainage characteristics, soil type and percent cover values for all vascular species present, subdivided into height strata. Percent ground cover (i.e.: deciduous litter, exposed humus, etc.) was also recorded where it was significant. The number of plots surveyed at each location varied depending on the size of the forest at the site and the ability to distinguish between the floodplain and the terrace areas. Comparison of these data from all the sample plots provided the basis for developing the riverbottom forest ecosystem classification.

3.2.2 Evaluation of Harvested or Disturbed Sites

The purpose of the field work was to better understand the nature of both undisturbed and harvested riverbottom forests in the Aspen Parkland, in order to develop prescriptions to ensure the long-term sustainability of riverbottom forests. The field program was designed to focus on identifying variations within the riverbottom forest community which were relevant to their management and to sustaining the health of these forest ecosystems.

The field work was designed to help verify whether or not suggested management techniques from other jurisdictions are appropriate for Manitoba conditions. In preparation for the field season, an attempt was made to identify riverbottom sites that had been selectively harvested or clearcut over the last several years. Several sources were contacted including the Manitoba Forestry Association, the Manitoba Habitat Heritage Corporation, the Canadian Forest Service and several local portable sawmill owners. Only four sites were identified that were harvested with the intention of managing them as woodlots. Several other sites were located, but these were primarily cleared for agriculture purposes with no regeneration allowed on these sites. These later sites were not included in this study.

Of the four sites located, one was a basswood cut, two were oak cuts, and the remaining site had more than one species removed. In addition, two of these sites had been planted. One additional uncut site was also planted. It was also sampled as the incidence of planting indicated a desire by the landowner to manage the area as a woodlot.

The same survey methods employed to sample undisturbed sites were used for harvested and disturbed sites. The amount of regeneration, by species and type (stump sprouts, root suckers or seed), was also noted on these sites, to allow for a comparison between the original stand composition and the composition of the developing stand. The amount of shrub and herbaceous cover by species provided some early indications of whether any of the grasses, herbaceous plants or shrubs have the potential to limit or impede regeneration on any of these sites.

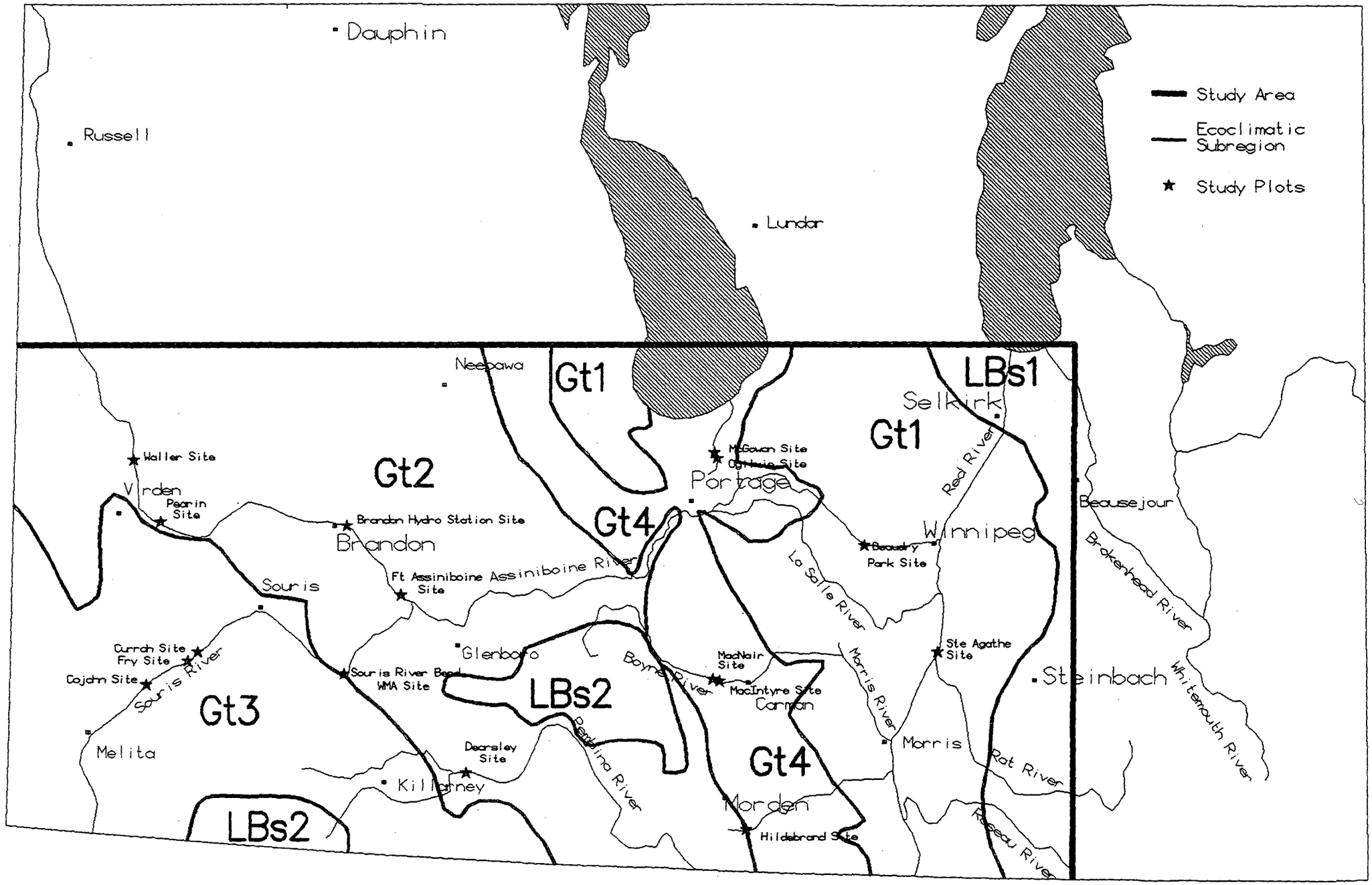
Each landowner was interviewed to determine the year of harvest, the season of harvest and the types of equipment used in the harvesting operation. For planted sites, landowners were asked when planting took place, the species planted and whether any treatments (e.g. herbicide applications) were applied to the site prior to planting or as part of their ongoing stand management.

The methodology used was not a statistically valid design. However, as the overall objective was to verify the suitability of the management prescriptions recommended in the literature, it was felt this approach was appropriate. The shortage of harvested sites also placed a limitation on the extent of field verification that could actually be accomplished.

4.0 Results of the Field Survey

A total of 24 sample plots were surveyed, encompassing 16 different sites across southern Manitoba (Map 2). Of these 16 locations, two were within the GT-1 subregion, five were within the GT-2 subregion, four were within the GT-3 subregion, one site was located on the boundary between GT-2 and GT-4, and four were within the GT-4 subregion. The number of plots varied at each site, however most had only one plot because variation within the forest stand at each sample location was limited. Table 2 provides a summary of the data

Map 2. Riverbottom Forest Study Plot Locations



obtained for each sample plot. Data summary sheets for each sample plot are provided in Appendix A. A list of all species identified in the plots is provided in Appendix B.

4.1 Overview of Vegetation in Riverbottom Forest Plots

Based on information from the sample plots, some general observations can be made about riverbottom forest vegetation across southern Manitoba. The diversity of both canopy and understorey species was greatest in the Gt-1 and GT-4 ecoclimatic subregions. The forest stands sampled as representative of these subregions had the greatest number of tree species present as well as the largest variety of shrubs. Vines, a particular vegetative component associated with riverbottom forests, also were most visible in these plots compared with those in other subregions. As vines are adapted for growth in areas with thick canopies, it is reasonable that they should reach their greatest diversity within the sites with the lushest growth and greatest canopy development.

As expected, the effects of Dutch Elm Disease (DED) were evident throughout the study area. In some locations the presence of elm regeneration was encouraging but the likelihood of its survival over the long term is unknown. The most surprising observation was the presence of a very large, apparently unaffected specimen along the banks of the Souris River on the Cojohn property. This towering giant alone may be the source of seed fuelling the elm regeneration evident in this riverbottom forest stand. In other locations, the presence of standing dead elm trees and the resulting opening of the forest canopy most often led to regeneration dominated by green ash. This was particularly true at sites where there had been no grazing.

Sites which had been disturbed through domestic grazing were the least likely to contain any significant regeneration of canopy species. Openings in the canopy, often as a result of DED, were dominated by graminoid species, typically introduced or invasive grass species such as brome grass (*Bromus* spp.), bluegrass (*Poa* spp.) and wheatgrass (*Agropyron* spp.) and broad-leaved weeds including Canada thistle (*Cirsium arvense*) and sweet clover (*Melilotus* spp.). Overall grazed sites had lower species diversity as well as little canopy regeneration.

While the study sites contained the three vegetation communities generally present within riverbottom forests (channel shelf, floodplain and terrace), the distinctions between these communities were not always clear. The channel shelf was often very limited in width. The floodplain species were often found across the entire range of the communities and terrace species were also found within the floodplain zone. However, enough distinctions do exist to require that these communities be treated as different forest ecosites within the forest ecosystem classification for riverbottom forests.

4.2 Forest Ecosystem Classification for Riverbottom Forests

The classification presented in this section builds on the data obtained from the study sites. It focuses on observed changes in the canopy species and overall species diversity. Five distinct subcategories have been identified to encompass the variations within riverbottom forests across the study area. These should be considered as falling within the V3 Miscellaneous Hardwoods vegetation category identified in the *Forest Ecosystem Classification for Manitoba - Field Guide (first approximation)* (Zoladeski et al. 1995).

Five FEC subcategories have been identified for classifying the vegetation communities present within the riverbottom forests of southern Manitoba. These represent the variations within each stand as well as the variations found between sample stands across the study area. These riverbottom forest (RBF) subcategories are defined as:

RBF-1: Cottonwood / Willow (channel shelf)
RBF-2: Green Ash (American Elm) / Basswood (floodplain)
RBF-3: Green Ash (American Elm) / Manitoba Maple / Shrub and Herb Rich (floodplain)
RBF-4: Green Ash (American Elm) / Manitoba Maple (floodplain)
RBF-5: Bur Oak / Green Ash / Manitoba Maple (terrace)

A graphic representation of each forest type, as well as a brief description of typical species and drainage conditions, are summarized in Appendix C.

4.2.1 Communities on the Channel Shelf

RBF-1: Cottonwood / Willow

Found directly on the channel shelf, this vegetation community is the most affected by annual flooding and deposition of silt. As a result of this regular disturbance regime, the understorey is often dominated by annuals, either introduced or native species, adapted to quickly revegetating disturbed areas. Historically, the dominant canopy species were cottonwood (*Populus deltoides*) and large willows, particularly the peach-leaved willow (*Salix amygdaloides*). However the number of large cottonwood and willow trees found within riverbottom forests has diminished as water regimes have been altered through man's activities. Other canopy species such as green ash, Manitoba maple and balsam poplar are also found along the channel shelf, while shrub species include various willow species as well as red-osier dogwood.

The RBF-1 subcategory has been developed, based on the historic canopy species, to capture this distinct subtype wherever it still occurs. In those locations where the species are more

Table 2: Summary of Riverbottom Forest Sites Surveyed June-July, 1994

Name	Location	Eco-climatic Region	Site Type	Canopy	Tall Shrub	Low Shrub	Ground Cover	Comments
Ste. Agathe (Red River)	NW-SW28-7-3E	GT-1	terrace	oak (85-100%)	grn. ash (70%) oak (5%)	grn. ash (15-20%) poison ivy (15%)	grasses (15%)	- clay = C horizon - only undisturbed site visited - good distinction of three levels, - greatest species diversity, (e.g. vines)
			floodplain	elm (40) grn ash (20) Mb. maple (10) oak (5-10)	elm (20) Mb maple (15)	poison ivy (40) chokecherry (20-25)	sweet cicely (50) stinging nettle (30-40) moonseed (30)	- silty loam = C horizon - note species regeneration
Beaudry Prov. Park (Assiniboine R.)	S25-10-1W	GT-1	terrace	oak (46-55) green ash (6-15)	None	rose (56-75) poison ivy (36-45)	grasses (56-75)	- deep mineral clay soil - limited regeneration of tree species
			floodplain	Mb. maple (30-40) cottonwood (10-20)	green ash (<10)	green ash (70-80)	ostrich fern (10)	- sandy loam/sand = C horizon - overmature with lots of blowdown - young ash/elm regeneration
			floodplain	green ash (30)	green ash (20) red-osier dogwood (20)	green ash (20) poison ivy (75)	wild grape (10)	- silty clay/clay = C horizon - in a draw about 30 m wide and 1 metre in depth
			floodplain	basswood (80) oak (5-10)	beaked hazel (10)	poison ivy (40-50)	ostrich fern (60-70) moonseed (25-30) Virginia creeper (15-20)	- fine sandy clay = C horizon
MacNair (Boyne River)	SE19-6-5W Graysville	GT-4	floodplain (cut)	basswood (20)	basswood (30) chokecherry (20) grn. ash (10)	snowberry (30) grn. ash (15-20) rose (10)	Virginia creeper (40) sedges (40) grasses (40) moonseed (30)	- silty sand = C horizon - selective basswood harvest winter '90
MacIntyre (Boyne River)	SW 20-6-5W Graysville	GT-4	terrace (cut)	None	grn ash (100) basswood (30) Mb maple (20)	snowberry (60) grn ash (50) Mb maple (30) oak (10)	brome grass (40) hog peanut (40)	- sandy clay = C horizon - small area of oak cut in winter '90, a few ash and basswood taken - little oak regeneration - basswood from seed
			terrace (control)	oak (80)	basswood (50) grn ash (35) elm (20)	grn ash (30) snowberry (10-15) basswood (10) oak (5)	leaf litter (50) sedges (10) grasses (10) meadow rue (10)	- sandy clay loam = C horizon - no cutting , some natural mortality - all regeneration from seed, no stump sprouts

Table 2 Cont. : Summary of Riverbottom Forest Sites Surveyed June-July, 1994

Name	Location	Eco-climatic Region	Site Type	Canopy	Tall Shrub	Low Shrub	Ground Cover	Comments
Hildebrand (intermittent creek)	NW 10-2-5W (near Morden)	boundary between GT-2 and GT-4	floodplain (cut and planted)	None	None	snowberry (20) green ash (5)	grasses (+85) leafy spurge (25)	-clearcut of oaks and ash but then planted to basswood - oak are stump sprouting; some from seed as well (ash also) - south exposure at bottom of floodplain beside creek
			terrace (cut)	None	elm (5)	chokecherry (30) Mb. maple (26-30) green ash (10)	sedges (50) Virginia creeper (30) wild buckwheat (20)	- sand = C horizon - well drained terrace; not grazed - clearcut oak in fall 1993 and some ash - some areas burnt at stumps - very weedy
			terrace (control)	oak (30) green ash (5)	oak (10) green ash (5)	snowberry (40) green ash (5)	grasses (+80) sedges (20) leafy spurge (10) meadow rue (10)	- on terrace above planted basswood site - large number of dead oak snags - silty sand to sandy loam = C horizon
Dearsley (Pembina River)	NE-NW 16-3-14W	GT-2	floodplain	elm (30) green ash (5)	green ash (75) Mb. maple (5)	green ash (70) snowberry (25)	grasses (50) sedges (20) fringed loosestrife (5)	- uncut but lots of DED opening the canopy - silty clay/clay = C horizon - heavy ash regeneration
Souris River Bend WMA (Souris River)	SW 9-6-18W off PTH 346	GT-3 (border)	floodplain	grn ash (55) Mb. maple (50) elm (5)	chokecherry (60)	chokecherry (30)	wood nettle (85-100) sedges (70-80)	- sandy clay loam = C horizon - various disturbed areas in stand - poor regeneration related to nettles ?
Fry (Souris River)	NW 7-6-23W Hartney	GT-3	floodplain	grn ash (70) Mb. maple (P)	grn ash (30)	grn ash (70)	sedges (30) grasses (10)	- sand = C horizon - relatively undisturbed site, grazing in past
			terrace	oak (60) grn ash (15)	chokecherry(40)	chokecherry(50-60) grn ash (35-40) oak (P)	leaf litter (80+) sedges (60)	- sand /loamy sand = C horizon
Currah (Souris River)	SW 17-6-23W Hartney	GT-3	floodplain (grazed but not this summer)	Mature Mb. maple, some young grn ash	grn ash	snowberry	grasses (100)	- sand = C horizon - >60% of original elm canopy is dead - heavy grass cover (evidence of grazing) and little regeneration

Table 2 Cont. : Summary of Riverbottom Forest Sites Surveyed June-July, 1994

Name	Location	Eco-climatic Region	Site Type	Canopy	Tall Shrub	Low Shrub	Ground Cover	Comments
Cojohn (Souris River)	SE 8-5-25W	GT-3	floodplain	green ash (60) elm (50)	green ash (25) elm (5)	green ash (65) elm (5)	leaf litter (+85) sedges (20) grasses (15)	- silty clay loam = C horizon - site about 200 m from river in wide forested area - may have been grazed up to 1981, not much evidence now - elm regeneration will eventually be hit by DED
Pearn (Assiniboine R.)	SE 15-10-25W	GT-2	floodplain (grazed)	Mb. maple (70) grn ash (40)	elm (5)	snowberry (10)	grasses (100)	- silty loam = B horizon - grazed 10 or more years ago - grass prevents regeneration by seed
			floodplain (not grazed)	grn ash (50) elm (25) Mb. maple (5)	chokecherry (10-15) grn ash (10)	snowberry (80) rose (15) chokecherry (10) elm (10)	grasses (5) sedges (5)	- silty loam = B horizon - thick, high snowberry may prevent regeneration, may have moved in from adjacent grazed area - a few trees were cut long ago
Waller (Assiniboine River Oxbow)	NE 31-11-25W	GT-2	floodplain	green ash (50) Mb. maple (50)	green ash (5)	green ash (5)	grasses (50) sedges (60) sowthistle (25-30) Canada thistle (15-20)	- silty clay loam = C horizon - may have been grazed long ago given heavy grass cover - opening up with dying of elm and ash
Brandon Thermal Generating Station (Assiniboine River)	E19-10-18W	GT-2	floodplain	grn ash (80) elm (5) Mb. maple (P)	buckthorn (85) grn ash (P) Mb. maple (P)	buckthorn (50) grn ash (P) Mb. maple (P) elm (P)	leaf litter (85+) sedges (5) grasses (5) sow thistle (50)	- silty clay loam = C horizon - buckthorn pervasive and high in stand - much less understory in south part of site, just dense ash
Fort Assiniboine Site (Assiniboine River)	SE 30-8-16W	GT-2	terrace	oak (70-75) elm (P)	Mb. maple (15) chokecherry (15)	snowberry (75) American hazel (60) chokecherry (45)	two-leaved Solomon's seal (70) sedges (50) western Canada violet (50)	- loamy sand / sand = C horizon - very productive site with dense understory vegetation - lots of elm and oak dying but Manitoba maple and some ash regeneration

Table 2 Cont. : Summary of Riverbottom Forest Sites Surveyed June-July, 1994

Name	Location	Eco-climatic Region	Site Type	Canopy	Tall Shrub	Low Shrub	Ground Cover	Comments
Ogilvie (Portage Creek)	NE 17-13-6W	GT-4	terrace (planted)	oak (70) Mb. maple (P)	chokecherry (40) Mb. maple (15) saskatoon (10)	snowberry (30) oak (5) chokecherry (5)	sedges (50) grasses (40) dewberry (35)	- silty clay loam = C horizon - not grazed in at least 40 years - very old, large oak - planted red oak, white spruce, Scot's pine and ash in sleeves
McGowan (Portage Creek)	SW18-13-6	GT-4	terrace	oak (60) green ash (25)	American hazel (15-20) saskatoon (5)	poison ivy (15) saskatoon (5) American hazel (5)	Sarsaparilla (50) grasses (15) sedges (15)	- clay loam to silty clay loam = C horizon - site about 200 m from creek - increased diversity in understory

typical of the floodplain, the location of this subtype directly along the channel shelf is its distinguishing feature. In these cases, the presence of willow species and red-osier dogwood within the shrub layer are also an identifying feature.

4.2.2 Communities on the Floodplain

Across the study area, the greatest variation in species was found within vegetation communities located on the floodplain. Typically, the floodplain zone is flooded irregularly and therefore experiences less disturbance than the vegetation community present on the channel shelf. Therefore the vegetation community on the floodplain is dominated by perennial species able to withstand occasional seasonal flooding.

A shift in the dominant canopy species on the floodplain from American elm to green ash is evident across the entire study area. This is occurring largely as a result of the impact of DED on mature elm trees and the species' natural regeneration. While mature elm were more common in some sample sites than others, it is generally assumed that all individuals eventually will be lost to DED. As a result, the vegetation subcategories identified for the floodplain are based on the presence or absence of two other canopy species within the community: basswood (*Tilia americana*) and Manitoba maple (*Acer negundo*), as well as the diversity of species within the shrub and herb layers.

RBF-2: Green Ash (American Elm) / Basswood

In the RBF-2 subcategory, while the canopy may include American elm, green ash and Manitoba maple, it also supports basswood. Within Manitoba, the range of the basswood is generally limited to riverbottom forests found east of Portage la Prairie. Farther west it disappears, perhaps due to reductions in precipitation or other microclimatic conditions. Basswood was found in sample sites at Beaudry Provincial Park along the Assiniboine River, in the two sites along the Boyne River and to a lesser degree in the site along the Red River near Ste. Agathe. General field observations indicate basswood can dominate the canopy layer, however this only occurred within one of the sites sampled (Beaudry Provincial Park).

RBF-3 Green Ash (American Elm) / Manitoba Maple / Shrub and Herb Rich

This subcategory is also situated on the floodplain within riverbottom forest stands. It is similar to the RBF-2 subcategory except for the absence of basswood and the increased domination of green ash, both in the canopy and shrub layers. The majority of sites sampled also had Manitoba maple as a component of the canopy and/or shrub layer.

The other distinguishing feature of these sites is the diversity of species found within the shrub and herb layers. These sites are found within the GT-1 and GT-4 ecoclimatic subregions where the growing conditions are most favourable.

RBF-4 Green Ash (American Elm) / Manitoba Maple

Sample Sites exhibiting these characteristics were generally found farther west within the study area, in the GT-2 and GT-3 ecoclimatic subregions. Below the canopy, the shrub and herb layers were also generally less diverse, probably a result of the decreased moisture available in these ecoclimatic regions. Changes in the historic flooding regimes along the Assiniboine and Souris rivers may also be partially responsible for the species composition within these stands.

4.2.3 Communities on the Terrace

RBF-5: Bur Oak / Green Ash / Manitoba Maple

This subcategory is found occupying the terrace level of the riverbottom forest throughout the study area. In sample sites which had not been disturbed, bur oak dominated the stands (cover values were >50%). The next most common woody species was generally green ash, followed by Manitoba maple. However minor variations in the canopy and tall shrub species did occur. Two sites (Fort Assiniboine on the Assiniboine River and the Ogilvie property along Portage Creek) had no green ash at all, with Manitoba maple being the most common woody species growing with the oak. On the terrace control site along the Boyne River on the MacIntyre property, the tall shrub layer also contained basswood (50%) and elm (20%), along with green ash (35%), but no Manitoba maple was present.

Within the small number of sample sites across the study area, less variation occurred within the canopy species found on the terrace, while the low shrub and herb layers varied in response to the ecoclimatic subregions. Sample sites within terrace communities located with the GT-1 and GT-4 ecoclimatic subregions were very similar and showed the most species diversity in the low shrub and herb layers, mirroring the pattern evident in the floodplain communities. The undisturbed GT-2 site at Fort Assiniboine also showed very similar shrub species and lush undergrowth, however the species diversity was not as great. As expected, the least diverse terrace sample site was located in the GT-3 ecoclimatic subregion at the Fry property along the Souris River.

Overall, the natural trends in vegetation within the riverbottom forest communities sampled throughout the study area were related to climatic factors, geographic location and the changes created by Dutch elm disease. The communities located on the floodplain are experiencing a shift in the dominant canopy species from American elm to green ash throughout the study area. With no chance for the long term survival of existing elm regeneration, green ash will likely come to dominate all the floodplain forests in southern Manitoba located beyond the range of the basswood. Even in stands now dominated by basswood, green ash is often an important component of the young regeneration in these stands. The potential changes in the understorey species associated with this shift in dominance are unknown.

4.3 Regeneration on Harvested or Disturbed Sites

A second primary objective of the field survey was to gather information on the natural regeneration capabilities of riverbottom sites that had been harvested in recent years. This information would be used to help verify the applicability of management prescriptions proposed for similar forests in other jurisdictions and in the development of prescriptions specific to the classifications proposed in the previous section. Early in the field work it was decided to expand this evaluation to also include sites with natural disturbances. This decision was a result of the small number of actual harvested sites in the study area and the fact that most sites had significant canopy openings due to the death of mature elms from DED. Even though the dead trees were often still standing, the canopy opening was usually sufficient to provide enough sunlight to promote natural regeneration. This situation would be very similar to a selective harvesting system. A discussion of the natural regeneration found on harvested or naturally disturbed sites for each FEC subcategory is provided below.

RBF-1: Cottonwood / Willow

There were no sample plots placed in this vegetation community for this study. Natural regeneration capability of the species typically found in these stands was not verified. However both species (willow and cottonwood) are typically aggressive invaders of disturbed sites, therefore it is anticipated that natural regeneration would be significant after harvesting.

RBF-2: Green Ash (American Elm) / Basswood

On those sites where basswood was the dominant canopy species, the previous land use also significantly impacted the degree and type of regeneration occurring after harvesting. Basswood which typically regenerates through a combination of stump sprouting and seed, was primarily limited to stump sprouting on those areas that were recently grazed (MacNair site). On the MacIntyre site, which had not been recently grazed and did not have significant grass competition, the basswood regeneration was primarily from seed. There were several large basswood stumps, but there were very few stump sprouts. The explanation for the lack of stump regeneration could be attributed to the maturity and condition of the trees when harvested. Most of the stumps showed signs of extensive rot, which could preclude their ability to develop and support sprouting. Both ash and maple regeneration from seed were beginning to fill in the openings on both sites. Initial numbers appear to indicate a gradual movement to more of a mixed (basswood/ash/maple) stand in the next rotation if left to regenerate on its own. On the one undisturbed basswood site included in the study (Beaudry Provincial Park, plot 4), there was very little natural regeneration occurring under the dense basswood canopy.

RBF-3: Green Ash (American Elm) / Manitoba Maple / Shrub and Herb Rich

Natural regeneration within this subcategory appeared to be significant after harvesting or when canopy openings were created through natural disturbance. On those sites where American elm, green ash and Manitoba maple dominated, the regeneration was primarily ash and maple, but elm was often present to some degree. Even where elm was the predominate canopy species, ash dominated both the low and tall shrub canopy layers. If left alone it is anticipated that the majority of these sites would develop into ash/maple stands for the next rotation.

The majority of the regeneration appeared to be from seed, but stump sprouting did occur if ash or maple were cut. On those sites where grazing was a recent land use, often the only regeneration present was from stump sprouting. The heavy grass competition appeared to restrict seed regeneration even in areas where canopy openings were plentiful.

RBF-4 Green Ash (American Elm) / Manitoba Maple

The regeneration capability of this subcategory appeared to be similar to RBF-3. The development of canopy openings through harvesting or natural mortality typically resulted in significant regeneration of the tree species found on the site if grazing had not occurred in recent years. Ash and maple regeneration were dominate with elm only occurring as a minor component at this point in time. Where grazing had occurred in previous years, the grass and sedge cover often ranged from 50 to 100%. Regeneration was typically poor on these grazed sites, but there was a small degree of ash stump sprouting on one or two sites.

On the Souris River Bend Wildlife Management Area site there appeared to be a second factor that potentially inhibited natural regeneration from occurring. Wood nettle dominated the site with cover percentage ranging from 85 to 100%. There was no regeneration occurring on this site even though there were numerous canopy openings from natural elm DED mortality. It is unknown if there is a causal relationship between the presence of the wood nettle and the lack of natural regeneration.

RBF-5 Bur Oak / Green Ash / Manitoba Maple

Undisturbed bur oak sites found on the river terraces tended to have very little natural regeneration occurring in the understorey. The opening of the canopy through natural factors (as in the Ogilvie site and the control site on the Hildebrand property) typically resulted in natural regeneration of the canopy species, but the numbers and densities were relatively low. It was anticipated that complete canopy opening such as in the case of clearcutting (Hildebrand cut site) would result in significant regeneration of oak, ash and maple through stump sprouting and seed. Regeneration by both methods did occur on the Hildebrand site,

but not to the extent anticipated. This could probably be attributed to the poor condition and quality of the trees at the time of harvest. Unfortunately there were no other oak cutovers available for comparison, to see if natural regeneration was improved if the stand was harvested at a younger and healthier age.

5.0 Management Prescriptions

A primary objective of this study was to recommend set of management prescriptions for riverbottom forests in southern Manitoba. These prescriptions focus on fibre production as the primary objective, but wildlife, conservation and aesthetic values have been considered throughout their development. These prescriptions were derived from management suggestions for the same or similar species in other jurisdictions and from information noted during the field survey work. A field trip sponsored by the Manitoba Section of the Canadian Institute of Forestry allowed these prescriptions to be reviewed with other forest professionals out at some of the riverbottom sites originally sampled. Prescriptions were recommended for each FEC subcategory overall, but also focused on species specific recommendations where so warranted.

RBF-1: Cottonwood / Willow Association

The removal of the overstorey vegetation from the channel shelf is not recommended. As indicated in the earlier discussion, this vegetation community is often affected by annual flooding and subsequently would be subject to significant erosion and bank instability if the vegetation were to be removed. This narrow belt is also extremely important as riparian habitat for nesting birds, small mammals and aquatic life. If any harvesting is to occur it should be selective harvesting only and it should take place in the winter to minimize disturbance to the fine textured soils found on most of these sites. Natural regeneration should be successful after harvest.

RBF-2: Green Ash (American Elm) / Basswood
and
RBF-3: Green Ash (American Elm) / Manitoba Maple / Shrub and Herb Rich

Due to the continuation of DED and the uncertainty of the success of the existing natural regeneration, it is recommended that these stands be managed for the remaining native species (green ash, basswood and Manitoba maple). The management prescriptions discussed in this section are based on this objective.

A second factor impacting the recommended prescriptions for these subcategories is the general age and condition of the majority of the stands found in this study. Many were

overmature decadent stands which were breaking up due to mortality from DED and other natural causes. Advanced regeneration was common on areas where grass did not dominate the site from previous grazing activities. Poor quality stands with heavy grass competition will have different recommendations than healthy stands with very little grass competition.

These stands are typically found on fine textured soils (silty clays, silty loams and sandy loams) that are subject to soil compaction from heavy equipment and have a high to moderate risk of erosion if significant vegetation is removed. The slope is typically less than 10%, but when higher these sites tend to be erodible due to the soil makeup. Harvesting should be restricted to the winter months only when the ground is frozen and snow covered. If harvesting must occur in other seasons, then light track equipment should be used to minimize soil disturbance and compaction.

Group selective or shelterwood silviculture systems are the preferred systems to be used in mixedwood stands that are healthy and vigorously growing. Group selective harvesting involves the removal of a few small groups of mature trees throughout the stand on a regular basis (areas less than one-half hectare in size), while shelterwood harvesting involves removal of individual trees selected throughout the stand, so that the entire stand is harvested in two or three cuts over a number of years. In both systems care should be taken to remove poorer as well as better quality trees in the first pass as this will leave the better trees to help regenerate the site. Typically these better quality trees will respond more favourably to this release.

Both systems will provide sufficient canopy opening to warm up the forest floor and promote natural regeneration from stump sprouting and seed germination. They will also provide the necessary shade required by these species during the establishment period as well maintaining wildlife habitat on the area. The next harvest should occur approximately 5 to 10 years later, once natural regeneration has become established. During these subsequent harvests care must be taken to protect this advanced regeneration. In harvesting these stands the stumps should be cut as low as possible to promote sprouting. In general sprouting ability decreases with age and is seldom a reliable method of regeneration when the trees are past 60 years of age.

If the stand has been previously grazed and grass is prevalent on the site, if the stand is overmature and badly deteriorating, or if the stand is comprised of primarily poor quality trees, a clearcut system could be an option. Cut blocks should be kept to a maximum size of two to three hectares and spread throughout the stand. Clearcutting is primarily an expansion of the group selection method, but the cut blocks are slightly larger, allowing for quicker removal of the stand and fewer age classes in the next rotation. By keeping the size of the cut blocks reduced, the impact of clearcutting on wildlife habitat, soil erosion and the aesthetics of the area will be minimized. As a common practice, several dead or dying trees should be left standing in each block for cavity nesting birds and mammals.

Group selective or shelterwood systems would typically result in sufficient regeneration through stump sprouting and seed germination on most of these sites. If care is taken during subsequent harvests to protect the advanced regeneration, then stem densities produced under this prescription should be sufficient to maintain the long term sustainability of the stand. Maintenance or enhancement of the stand and stem quality can be achieved through stand tending techniques such as brushing and weeding, precommercial thinning, commercial thinning and pruning. Some basic guidelines for tending of these stands include:

* Brushing and weeding of competing herbaceous and woody vegetation is typically not needed on these sites due to the rapid growth of the regenerating crop tree species.

* The first precommercial or juvenile thinning of the natural regeneration should occur approximately 4-5 years after harvest. Thinning should concentrate on the preferred species, thinning the best quality stems to about 2 meter by 2 meter spacing and removing all other woody stems that are directly competing with the crop trees. Stump sprouts should be thinned to two per stump before they are greater than 10 cm. in diameter. If possible the two closest to the base of the stump should be left as these will be the least impacted when the parent stump decays.

* Pruning can also occur during this first precommercial thinning. No more than one third of the canopy should be pruned at any one time.

* Light precommercial thinnings should occur every 5 to 10 years after the initial thinning. Pruning could also be done at the same time. Pruning to an approximate height of 5 meters is sufficient to produce quality sawlogs.

* Begin selective cutting or commercial thinning once the trees reach a marketable size. The optimum stand density and rotation age on these sites in Manitoba is not known, but it is anticipated that these sites when managed can produce sawlog size trees, in the 50 to 60 cm diameter range, in approximately 60 to 80 years.

Planting will typically not be required on these sites unless the landowner wishes to introduce other higher valued species to the site, create or improve wildlife habitat or add to the general aesthetics of the area. On those areas where clearcutting is the recommended option, planting will likely be required to regenerate the site. These planting techniques can be applied to either selective or clearcut stands. These may also be used when planting seedlings into a stand that has not been cut.

* Some form of site preparation will be required in most cases prior to planting. Since most of the cut blocks will be relatively small, the use of traditional forestry site preparation equipment will not usually be possible. Planting scalps (approximately 60 cm by 60 cm) can be made with manual tools such as a planting spade or motorized brush saw attachments. In heavy grass areas, herbicides registered for woodlands management can be used in combination with a manual treatment. Since application will always be near a river, special caution is required to prevent contamination of the water. Always follow label directions. In coarse textured sandy soils, never use a product that has the potential to move through the soil. The use of commercially available brush mats is another option open to the landowner for the control of grass and other herbaceous weeds.

* The desired species should be planted at approximately a 3 meter by 3 meter spacing which translates into roughly 1100 trees per hectare. Since many of these areas have significant wildlife populations, the saplings should be protected from browsing and girdling by using one of the protection tubes that are on the market. These should be removed within three to four years after planting or before they begin to restrict a seedling's diameter growth.

* The brushing and weeding, thinning and pruning recommendations presented above are also applicable on these sites.

RBF-4: Green Ash (American Elm) / Manitoba Maple

The management recommendations for this subcategory are very similar to those presented for RBF-3. Both climatic conditions and past land use practices appear to have had a more significant impact on the quality of the stands and the overall regeneration capability of these sites. In general the stem and stand quality was poorer on the majority of the sites. This could probably be attributed to the slightly drier moisture regimes and coarser textured soils typical throughout much of the GT-2 and GT-3 ecoclimatic regions (especially along the Souris and Pembina Rivers). Grazing also appeared to be more common on these areas, with the resulting high sedge and grass competition.

Within this forest type, natural regeneration will likely not be as high as found in RBF-3 forest stands. The poor quality stem form found on many of the sites and the high degree of herbaceous and grass competition will dictate the requirement to clearcut and/or plant many of these sites to achieve regeneration success. If the production of timber (primarily sawlogs) is the primary objective of the landowner then the planting of better quality stock combined with an intensive stand tending routine will be necessary on most sites. If the desired objective is maintenance of the stand for fuelwood, wildlife habitat or aesthetic purposes, then sufficient natural regeneration should occur on those areas that have not been previously grazed. On sites with heavy grass which have been previously grazed, planting without the follow-up stand tending should be sufficient.

RBF-5 Bur Oak / Green Ash/ Manitoba Maple

Generally these sites were relatively flat, with soils ranging from clay to clay loams in the GT-1 and GT-4 ecoclimatic regions and predominately sand to sandy loams in the GT-2 and GT-3 regions. Soil erosion potential was relatively low on the majority of these sites, while soil compaction potential was greater on the fine textured soils than the coarser sands. Fall harvesting can probably occur on many of these sites without degradation of the soil, but to be safe, harvesting should be limited to the winter months.

Clearcut harvesting is the preferred silviculture system for this type of stand. Bur oak, the dominant species in the subcategory and the species likely to be managed for, is generally shade intolerant and requires open sunlight conditions to achieve good natural regeneration. A minimum cut block size of one-half hectare is typically required to achieve this objective. While larger cut blocks will not impact the regeneration success, it is recommended that blocks be restricted to under 2 to 3 hectares, for reasons discussed previously. Remember that snags or dead trees should be left on these areas for cavity nesters. If there is sufficient advanced oak regeneration in the stand prior to harvest, a shelterwood system could be considered. None of the sample sites in this study fit this criteria and therefore this approach is not recommended unless the landowner is satisfied with the stand converting to the other shade tolerant species (ash and maple) that are found associated with this subcategory.

Natural regeneration of oak, ash and maple will occur from seed as well as stump sprouting on the clearcuts. Natural regeneration of oak from seed will be dependent on the previous years' acorn crop. Oak acorns are readily removed off the site by birds and rodents and those that remain on the ground are often attacked by acorn weevil. Since good acorn crops are only produced every 2 to 5 years, it is often worthwhile to delay harvesting until a good crop year. Stump sprouts are also a reliable source of natural regeneration, but it should be noted that the degree of sprouting generally decreases with the age of the trees. The harvesting of an oak stand prior to maturity (approximately 60 to 80 years of age) after a good acorn year will increase the chances of successful natural regeneration.

Areas that have been grazed and have heavy grass competition, areas that have poor acorn crops, or areas that are too old for adequate stump sprouting will likely have to be planted with oak saplings to retain the oak composition in the stand. Planting prescriptions and site preparation are similar to those presented in the previous section (See management prescriptions for RBF-2 and RBF-3 subcategories).

Since oak is not a prolific grower, it often has difficulty competing with the other tree and shrub species that are prevalent on these nutrient rich sites along river terraces. If the maintenance of the oak composition is an important objective then brushing and weeding will likely be required in the first year or two after harvesting or planting. Manual techniques will have to be used and care will be required to prevent damage to the seedlings that are often well hidden under the competition.

Juvenile spacing or precommercial thinning can begin at year 7 or 8 by removing competing hardwoods and other woody species. Clumps of oak regeneration should be spaced by removing those with poor form to a spacing of approximately 2 by 2 meters. Stump sprouts should be reduced to no more than 2 sprouts per stump, again selecting the sprouts closer to the ground with the most vigorous height and diameter growth. Pruning can begin at this age as well, remembering to remove no more than one third of the crown at any one entry. Subsequent precommercial and commercial thinnings should be implemented on a regular basis. Optimum stand densities and rotation ages are not known for these stands in Manitoba, but on a managed basis these good sites should be able to produce sawlog size trees in the 50 cm diameter range in 80 to 100 years.

6.0 Conclusions

In this study, site data were collected and used to develop a forest ecosystem classification which reflects the variation in composition found within riverbottom forest stands in southern Manitoba. The resulting five subcategories, RBF-1 through RBF-5, encompass the different zonations found within each site as well as the variations in canopy and understorey species present across the study area. These data, combined with additional observations regarding regeneration after harvest or disturbance, were used to develop general forest management prescriptions which can be used by landowners to ensure the long term sustainability of their riverbottom forests. It must be recognized that within both the subcategories and the prescriptions that have been developed there is a wide range of diversity and that individual sites may not fit the defined criteria. The landowner must recognize that these prescriptions are general in nature and that individual sites may require specific prescriptions to achieve their ultimate management objectives. It must also be kept in mind that the prescriptions have been developed with sustained fibre production as the primary objective and that management for other objectives may require different prescriptions.

7.0 Riverbottom Forest Management Fact Sheet

The enclosed fact sheet (See Appendix D) has been developed to serve as a guide to aid landowners in the management of their riverbottom forest stands. It provides a summary of four of the FEC subcategories developed for riverbottom forests in southern Manitoba: RBF-2 through RBF-5. For each of these subcategories, there is a brief description of the vegetation typical of stands within the classification as well as a summary of the recommended management prescriptions including information on harvesting, reforestation and stand tending. The RBF-1 subcategory has not been included in this fact sheet as harvesting of trees from RBF-1 stands is not recommended.

Landowners interested in actively managing their riverbottom forest stands are encouraged to refer to additional information available in the references noted at the end of this report as well as staff of the Manitoba Agro Woodlot Program located throughout southern Manitoba.

8.0 References

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APPENDIX A - SITE DATA SHEETS

Date: June 28, 1994

Plot No: 2, floodplain near channel shelf

Location: Beaudry Provincial Park
SE 25-10-1W
(GT-1)

Stand No: 9

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
cottonwood	10-20%		P	
Manitoba maple	30-40%			
green ash	10%	<10%	70-80%	
elm		P	5%	
oak			P	
poison ivy			P	
wild rose			P	
ostrich fern				10%
sweet-scented bedstraw				5%
veiny meadow rue				P
wild grape				5%
dandelion				P
slender wheatgrass				5%
feather moss spp.				P
basswood				P
Canada anemone				P
Canada thistle				P
late goldenrod				5%
small blue aster				P
bluegrass spp.				P
sedges				5%
sarsaparilla				P

Soil Horizon	Width	Description
LFH	2 cm	
A	6 cm	silty clay with fibrous roots
B	8 cm	sandy clay
C		sandy loam/sand

Note: Soil sampling done on maple ridge

General Comments: moist site, most of ground covered in leaf litter (80%); soil is well-drained; overmature forest with lots of blow down and mortality. Young ash/elm regeneration underneath. Huge cottonwoods just north of plot above fern draw. Plot edge is about 15-20 m. from river.

Plot located to include a ridge with maple and part of a draw full of ferns. South of plot there is a smaller draw then a large peach-leaved willow ledge on the river with an understory full of weeds (brome grass and Canada thistle).

Date: June 28, 1994 Plot No: 3, floodplain

Location: Beaudry Provincial Park
SE 25-10-1W
(GT-1) Stand No: 10

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
green ash	30%	20%	20%	
oak		P	P	
red-osier dogwood		20%	P	
elm		P		
Manitoba maple		P		
basswood			P	
poison ivy			75%	
wild raspberry			P	
virginia creeper				5%
wild grape				10%
carrionflower				P
veiny meadow rue				5%
Canada thistle				5%
ostrich fern				5%
slender wheatgrass				5%
hedge-nettle				P

Soil Horizon	Width	Description
LFH	2 cm	
A	6 cm	sandy clay
B	52 cm	silty clay; partially decomposed shrub roots; few brown, orange mottles at 40 cm down
C		silty clay to clay; lighter color with orange mottles

General Comments: Site is moderately drained; moisture regime is moist to wet; site 3 is in a bit of a depression north of the trail and east of site 2. Site is in a draw about 30 m wide, with a one metre drop into the draw; plot edge to south is along the edge of the draw.

Date: June 28, 1994 Plot No: 4, floodplain

Location: Beaudry Provincial Park
SE 25-10-1W
(GT-1)

Stand No: 10

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
basswood	80%	5%		
oak	5-10%		P	
beaked hazel		10%	5%	
green ash			P	
poison ivy			40-50%	
ostrich fern				60-70%
sarsaparilla				P
cream-coloured vetchling				5%
moonseed				25-30%
virginia creeper				15-20%
horsetail				5%
sedges				5-10%
veiny meadow rue				10%
sweet-scented bedstraw				5%
star-flowered Solomon's seal				P
carrionflower				P
wild rye				5%
bluegrass spp.				5%
hog peanut				P

Soil Horizon	Width	Description
LFH	3 cm	
A	20 cm	silty clay
B	67 cm	silty clay loam, with more silt; orange and blue mottles at 40 cm.
C		fine sandy clay

General Comments: Site is moderately drained; moisture regime is moist ; leaf litter is 80-90%.

Date: June 28, 1994 Plot No: 1, terrace

Location: Ste. Agathe Site, PR 200, NW-SW 28-7-3E (GT-1) Stand No: 35

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
oak	85-100%	5%	P	
green ash		70%	15-20%	
snowberry			P	
wild black currant			P	
wild rose			5-10%	
red-osier dogwood			P	
saskatoon			P	
poison ivy			15%	
downy arrowwood			P	
American hazel			P	
bluegrass spp.				5%
sedges				
star-flowered Solomon's seal				P
two-leaved Solomon's seal				P
unknown grasses				10%
late goldenrod				P
hedge-nettle				P
moss spp.				P
northern bedstraw				P
meadow rue				P
cream-coloured vetchling				P
aster spp.				P
marsh reed grass				P

Soil Horizon	Width	Description
LFH	7 cm	
AE	8 cm	black, well decomposed silty loam
B	12 cm	silty clay, light brown
C		clay

General Comments: Site is moderately to well-drained; moisture regime is moist; leaf litter is 80%.

Date: June 28, 1994 Plot No: 2, floodplain

Location: Ste. Agathe Site, PR 200, NW-SW 28-7-3E (GT-1) Stand No: 33

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
elm	40%	20%		
oak	5-10%		P	
green ash	20%	P		
Manitoba maple	10%	15%		
chokecherry		5%	20-25%	
basswood		P		
beaked hazel			P	
downy arrowwood			P	
snowberry			5%	
wild raspberry			P	
poison ivy			40%	
wild black currant			5%	
sweet cicely				50%
baneberry				P
moonseed				30%
hog peanut				5%
stinging nettle				30-40%
virginia creeper				5%
ostrich fern				P
sweet-scented bedstraw				P
sedges				P
grasses				P
star-flowered Solomon's seal				P
two-leaved Solomon's seal				P
hedge-nettle				P

Soil Horizon	Width	Description
LFH	2 cm	
AE	6 cm	silt, partly decomposed
B	12 cm	silty clay
C		silty loam, reddish mottles

General Comments: Site is well-drained; moisture regime is moist; plot about 25 to 30 m from Red River.

Date: June 29, 1994

Plot No: 1, floodplain, selective basswood harvest

Location: Graysville, MacNair homestead
SE 19-6-5W
(GT-4)

Stand No: 27

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
basswood	20%	30%	P	
Manitoba maple	P	5%	5%	
green ash		10%	15-20%	
chokecherry		20%	5%	
American hazel		5%	P	
hawthorn			P	
snowberry			30%	
oak			P	
poison ivy			P	
wild rose			10%	
elm			P	
virginia creeper				40%
moonseed				30%
wild grape				P
golden alexander				P
sedges				40%
tall meadow rue				5%
sweet-scented bedstraw				5%
Canada wild rye				P
late goldenrod				P
bluegrass spp.				P
spreading dogbane				P
red baneberry				P
other grasses				40%
showy milkweed				P
yellow wood-sorrel				P
northern bedstraw				P
Canada anemone				P
sarsaparilla				P

Soil Horizon	Width	Description
LFH	1 cm	well decomposed
AE	16 cm	silt, fair amount of woody/root material
B/C	70 cm	silty sand, fine sand with some silt

General Comments: Site is well to rapidly drained; fresh site; selective harvest of basswood in winter of 1990, using traditional methods (skidder took out tree lengths).
Second MacNair site - no plot - previously grazed, selective ash and basswood harvest, some basswood sprouting, heavy grass from grazing and plating of softwoods (spruce) - is very open.

Date:	July 4, 1994	Plot No:	2, terrace selective oak cut
Location:	Graysville, MacIntyre homestead (across from MacNair) SW20-6-5W (GT-4)	Stand No:	24

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
green ash		100%	50%	
Manitoba maple		20%	30%	
basswood		30%	10%	
oak		P	10%	
chokecherry		P		
elm			P	
snowberry			60%	
brome grass				40%
hog peanut				40%
Canada anemone				10%
sedges				10%
bluegrass spp.				5%
black snakeroot				P
Canada thistle				5%
showy milkweed				P
meadow rue				15%
virginia creeper				P
late goldenrod				P
stinging nettle				P
northern bedstraw				P

Soil Horizon	Width	Description
LFH	1 cm	fast decomposition
A	8 cm	silty loam
B	35 cm	clay loam
C		sandy clay

General Comments: Site is well to rapidly drained; fresh, moist site; no mature canopy; basswood is all from seed, no stump sprouts. Heavy ash regeneration on cut over - few oak are coming back.

Date: July 4, 1994 Plot No: 3, terrace

Location: Graysville, MacIntyre homestead SW20-6-5W (GT-4) Stand No: 24

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
oak	80%		5%	
basswood		50%	10%	
elm		20%	5%	
green ash		35%	30%	
snowberry			10-15%	
wild raspberry			P	
chokecherry			P	
leaf litter				50%
two-leaved Solomon's seal				5%
carrionflower				P
meadow rue				10%
sweet-scented bedstraw				P
sedges				10%
grass spp.				10%
northern bedstraw				P
hog peanut				P
American vetch				P
unidentified composite				P
star-flowered Solomon's seal				5%
virginia creeper				P
downy yellow violet				P

Soil Horizon	Width	Description
LFH	2 cm	
A	4 cm	silt
B	20 cm	silty clay
C		sandy clay loam

General Comments: All regeneration from seed, no stumps. Well to rapidly-drained fresh to moist site. No oak taken out but some natural loss - getting green ash regeneration.

Date: July 4, 1994 Plot No: 1, terrace, clear-cut oak

Location: Morden, Hildebrand homestead NW 10-2-5W (GT-2 to GT-4) Stand No: 14

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
elm		5%	P	
Manitoba maple		P	26-30%	
green ash			10%	
chokecherry			30%	
oak			P	
poison ivy			P	
saskatoon			P	
wild rose			P	
raspberry			P	
snowberry			P	
other grasses				P
brome grass				10%
virginia creeper				30%
sedges				50%
Canada anemone				P
meadow rue				P
two-leaved Solomon's seal				P
wild buckwheat				20%
yellow wood-sorrel				5%
lamb's-quarters				5%
maple-leaved goosefoot				P
burdock				P
plantain spp.				P
wavy-leaved sowthistle				P

Soil Horizon	Width	Description
LFH	5 cm	LF= 2 cm
A	12 cm	silty sand
B	14 cm	loamy sand, then just sand
C		sand

General Comments: Well-drained terrace; dry to fresh site; not grazed; mostly oak cut in fall 1993 and some ash; some areas burnt at stump including slash; very weedy, no canopy.

Date: July 4, 1994

Plot No: 2, floodplain clearcut planted to basswood

Location: Morden, Hildebrand homestead
NW 10-2-5W
(GT-2 to GT-4)

Stand No: 14

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
oak			P	
green ash			5%	
snowberry			20%	
hawthorn			P	
elm			P	
pincherry			P	
leafy spurge				25%
grasses				85%+
unknown violet				P
American vetch				P
northern bedstraw				P
American hazel				P
goldenrod spp.				P
wild peavine				P
meadow rue				P
downy yellow violet				P
yellow sweet clover				P
yellow wood-sorrel				P
slender wheatgrass				P

Soil Horizon	Width	Description
LFH	3 cm	
A	5 cm	silty loam
B	60 cm	sandy clay loam
C		sand with small stones

General Comments: Moderately well-drained; fresh site; site clear cut (only a few oaks and ash taken out) and planted to basswood on floodplain; no canopy and no high shrubs; oak are stump sprouting and a fair number from seed, same for ash; on a south exposure at bottom of floodplain right beside creek (about 5 m above creek); about 4-5 m off the terrace where dead oak are; lots more grass on this site and no bare ground.

Date: July 4, 1994 Plot No: 3, terrace

Location: Morden, Hildebrand homestead
NW 10-2-5W
(GT-2 to GT-4)

Stand No: 14

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
green ash	5%	5%	5%	
oak	30%	10%	P	
snowberry			40%	
elm			P	
American hazel			P	
veiny meadow rue				10%
brome grass				25%
other grasses				80%+
wild peavine				5%
unknown violet				P
sedges				20%
black snakeroot				P
northern bedstraw				5%
unknown composite				P
leafy spurge				10%

Soil Horizon	Width	Description
LFH	4 cm	
A	4 cm	silt
B	12 cm	sandy clay loam
C		silty sand to sandy loam, not as sandy as clear cut

General Comments: Well-drained; fresh site; site is above basswood planted site, at the top of the terrace; large number of dead oak snags.

Date: July 4, 1994 Plot No: 1, floodplain

Location: Dearsley property along west side of Pembina River NE-NW 16-3-14W (GT-2) Stand No: 82

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
elm	30%		P	
green ash	5%	75%	70%	
Manitoba maple		5%	P	
wild black currant			5%	
snowberry			25%	
red-osier dogwood			P	
giant hyssop				P
fringed loosestrife				5%
ostrich fern				P
grass spp				50%
sedges				20%
stinging nettle				P
carrionflower				P
meadow rue				5%
Canada anemone				P
sowthistle				P
unknown composite				P
virginia wild rye				10%
brome grass				P
sweet-scented bedstraw				5%
creeping charlie				P
bluebur				P

Soil Horizon	Width	Description
LFH	4 cm	
A	4 cm	silt
B	12 cm	silty clay
C		silty clay to clay brown-yellow mottles at 50 cm

General Comments: Moderately drained; fresh to wet site; uncut but lots of DED opening the canopy so great regeneration of green ash; across river is the same stand but ash has been cut and area mowed for a picnic site.

Date: July 5, 1994 Plot No: 1, floodplain

Location: Souris River Bend WMA
SW 9-6-18W
(GT-3)

Stand No: 119

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
Manitoba maple	50%	P	P	
green ash	55%	P	P	
elm	5%		P	
chokecherry		60%	30%	
snowberry			P	
wild black currant			P	
wood nettles				85-100%
sweet cicely				10%
sedges				70-80%
grasses				P to 5%
unknown vine				P
sarsaparilla				15%
sweet-scented bedstraw				P
carrionflower				P
meadow rue				P
nodding trillium				P
yellow wood-sorrel				P
northern bedstraw				P

Soil Horizon	Width	Description
LFH	3 cm	
A	10 cm	silt
B	17 cm	clay loam
C		sandy clay loam

General Comments: Well drained; fresh to moist site; very diverse sites within stand; on lower level nearer river, understory looks more disturbed-less shrubs, mostly grasses and nettles with mature Manitoba maple canopy; plot is on upper to mid slope of floodplain with about 25-30% slope; DED has claimed most of elm; plot is about 50 m from Souris River edge on south side of river.

Notes: Nettles are the densest we have ever seen in openings and under shrubs-could they prohibit regeneration of green ash by shading it out? Allelopathy? Pocket gopher mounds seem to add species diversity to the dense cover of creeping charlie in another vegetation cover area (no nettles) and little ash regeneration there also.

Date: July 5, 1994 Plot No: 1, floodplain

Location: Fry property on Souris River at NW 7-6-23W, near Hartney (GT-3) Stand No: 72

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
green ash	70%	30%	70%	
Manitoba maple	P			
snowberry			10%	
wild rose			P	
poison ivy			10%	
elm			P	
oak			P	
northern bedstraw				5%
sedges				30%
meadow rue				5%
hedge-nettle				P
American vetch				P
other grasses				10%
unknown composite				P

Soil Horizon	Width	Description
LFH	3 cm	
A	4 cm	silt
B	35 cm	sandy loam
C		sand

General Comments: Well-drained to rapidly drained; fresh to moist site; about 30 m from Souris River.

Currah property SE18-6-23W: Floodplain stand #62 on Souris River (GT-3)

- Lots of dead elm (>60% of original canopy dead)-must have been grazed in past due since ground cover almost all grass (brome, etc.), with young ash regeneration in places.

- Heavy grass competition seems to restrict or impede regeneration even under open canopy conditions. Remaining canopy is mature Manitoba maple with some ash. Understory, other than grass, is limited - more sedge and young ash under large ash out in the open. Ground cover consists of grass, a little snowberry, some meadow rue in shade of larger ash.

- Scared a faun out of its bed under a dead elm. Just scared an older deer in shade of Manitoba maple along fence.

- Nothing much coming in to replace elm that died. Greater canopy from young ash trees will kill off sun-tolerant grasses but will take a long time without planting.

Date: July 5, 1994 Plot No: 2, terrace

Location: Fry property on Souris River at NW 7-6-23W, near Hartney (GT-3) Stand No: 72

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
oak	60%		P	
green ash	15%		35-40%	
chokecherry		40%	50-60%	
snowberry			15%	
Manitoba maple			P	
elm			P	
poison ivy			5%	
sedges				60%
meadow rue				5%
grasses				P
sweet-scented bedstraw				P
two leaved Solomon's seal				5%
wild peavine				P
northern bedstraw				5%
leaf litter				80%+
star-flowered Solomon's seal				P
unknown violet				P

Soil Horizon	Width	Description
LFH	3 cm	
A	8 cm	silt
B	44 cm	sandy loam to silty sand
C		sand to loamy sand

General Comments: Well-drained to rapidly drained; relatively fresh site. Typical of forest in area.

Date: July 5, 1994 Plot No: 1, floodplain

Location: Cojohn site (island) on Souris River
SE 8-5-25W
(GT-3)

Stand No: 97

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
Manitoba maple	5%		P	
elm	50%	5%	5%	
green ash	60%	25%	65%	
wild rose			P	
wild black currant			P	
grasses				15%
sedges				20%
wood nettles				5%
meadow rue				5%
hedge-nettle				P
Canada anemone				P
sowthistle				P
carrionflower				P
northern bedstraw				P
leaf litter				85%+

Soil Horizon	Width	Description
LFH	3 cm	
AE	6 cm	silt
B	8 cm	loam
C		C varies-almost has 2 C horizons; silty clay loam; fair amount of fibrous woody material all through profile.

General Comments: Moderately-well drained; moist site; plot located at least 200 metres from river along forested edge of island- forested edge is quite wide here.

Notes: None of ash is root suckers in this stand now; never harvested but may have been grazed up to 1981 but not much evidence of that. Will get elm regeneration here but will eventually be hit with DED.

Date:	July 6, 1994	Plot No:	1, floodplain - grazed
Location:	Pearn property along Assiniboine River SE15-10-25W (GT-2)	Stand No:	43

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
Manitoba maple	70%			
green ash	40%	P		
elm		5%		
snowberry			10%	
chokecherry			P	
wild black currant			P	
brome grass - other grasses				100%
sweet-scented bedstraw				P
meadow rue				P
fringed loosestrife				P
hedge-nettle				P
sedges				P
wild lettece				P

Soil Horizon	Width	Description
LFH	4 cm	
A	8 cm	silty, very fibric, grass roots
B	70 cm+	silty loam

General Comments: Plot is 25 to 30 metres from Assiniboine River, on north side; grazed years ago - no recent signs of cow pies but grass cover and fenceline along river indicate grazing; could have been 10 or more years ago given the size of some regeneration- one ash looks about 15 years old. Well drained and fresh site.

Date: July 6, 1994 Plot No: 2, floodplain - not grazed

Location: Pearn property along Assiniboine River SE15-10-25W (GT-2) Stand No: 43

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
green ash	50%	10%	5%	
elm	25%	5%	10%	
Manitoba maple	5%	5%		
chokecherry		10-15%	10%	
saskatoon		P	P	
snowberry			80%	
wild rose			15%	
wild black currant			P	
wild raspberry			5%	
Brome and other grasses				5%
sedges				5%
sweet-scented bedstraw				P
meadow rue				P
feather moss spp.				P
fringed loosestrife				P
unknown composite				P
hedge-nettle				P
Canada thistle				5%
bluebur				P

Soil Horizon	Width	Description
LFH	3 cm	
A	6 cm	silt
B	60 cm +	silty loam; floury, same as plot 1 soil

General Comments: Well-drained site; level and fresh; plot is in an ungrazed area of stand with a large shrub layer. Snowberry was as high as the shoulders and thick. A few trees (3) have been cut long ago creating more of a man-made opening- one is an ash. No regeneration beneath thick snowberry. Why is snowberry so thick here? May be as in grazed pasture where get more snowberry once heavily grazed.

Date: July 6, 1994 Plot No: 1, floodplain

Location: Waller site along Assiniboine River oxbow Stand No: 139
NE 31-11-25W
(GT-2)

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
green ash	50%	5%	5%	
Manitoba maple	50%	P	P	
wild rose			P	
elm			P	
wild black currant			P	
snowberry			P	
sowthistle				25-30%
Canada thistle				15-20%
brome grass				20%
other grasses				25-30%
sedges				60%
carrionflower				P
hedge-nettle				10%
fringed loosestrife				P
small blue aster				5%
meadow rue				P
unknown vine				P
Canada anemone				P
Russian pigweed				P
star-flowered Solomon's seal				P

Soil Horizon	Width	Description
LFH	8 cm	
A	3 cm	silt
B	60 cm	silty loam
C		silty clay loam

General Comments: Well-drained site; fresh; distance from oxbow to plot is about 30 metres; supposedly ungrazed Manitoba maple, ash, elm forest but may have been grazed long ago or maybe due to influence of nearness of alfalfa field; also being opened up by elm and ash dying out (ash fungus?).

Date: July 6, 1994 Plot No: 1, floodplain

Location: Brandon Thermal Generating Stn. Forest south of Assiniboine River E19-10-18W (GT-2) Stand No: 72

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
Manitoba maple	P	P	P	
green ash	80%	P	P	
elm	5%		P	
buckthorn		85%	50%	
wild black currant			P	
wild rose			P	
snowberry			P	
sowthistle				5%
sedges				35%
meadow rue				P
yellow wood-sorrel				P
burdock				P
grasses				5%
sweet-scented bedstraw				P
bluebur				P
smooth-leaved buttercup				P
Canada anemone				P
carrionflower				P
northern bedstraw				P
fringed loosestrife				P
American vetch				P
leaf litter				85%+

Soil Horizon	Width	Description
LFH	2 cm	
A	8 cm	silt
B	10 cm	loam
C		silty clay loam w/ small pocket of sandy clay loam

General Comments: Mature ash/maple with odd elm trees- some dying- very dense canopy, very productive site, ash are tallest we've seen.

Notes: Well drained site; plot is at least 150 m from river- probably fresh to moist. Good floodplain forest. Along river get dense canopy of maple plus grass underneath. Has dense willow ring all around it that isn't seen around site farther to west of hydro crossing. Would buckthorn die back if canopy opened up and then ash could come back? Buckthorn is pervasive and high. We have seen a lot of it as walked through; area of stand farther south had much less understory and still dense straight ash canopy- very dark and lots of hog peanut in a few places.

Date: July 13, 1994 Plot No: 1, terrace

Location: Fort Assiniboine Site near Shilo
SE 30-8-16W
(Assiniboine River)
(GT-2)

Stand No: 203

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
oak	70-75%		P	
elm	P		P	
Manitoba maple		15%	25%	
green ash		5%	10%	
saskatoon		P	5%	
chokecherry		15%	45%	
American hazel			60%	
snowberry			75%	
poison ivy			P	
wild rose			P	
raspberry			P	
western Canada violet				50%
twinning honeysuckle				5%
sedges				50%
grasses				10%
two-leaved Solomon's seal				70%
meadow rue				5%
Solomon's seal				P
sarsaparilla				10%
cream-coloured vetchling				P
black snakeroot				P
Canada anemone				P
carrionflower				P
northern bedstraw				P
fringed loosestrife				P
spreading dogbane				P

Soil Horizon	Width	Description
LFH	3 cm	
AE	3 cm	sandy silt
A	6 cm	silty sand
B	23 cm	loamy sand
C		sand

General Comments: Well to rapidly well-drained fresh site; site probably never been grazed; very productive and dense vegetation on understory; lots of die back in oak and elm but getting ash and Manitoba maple; coming back in regeneration- maybe with oak under that.

Date:	July 7, 1994	Plot No:	1, terrace, planted
Location:	Portage Creek, Ogilvie property NE 17-13-6W (GT-4)	Stand No:	19

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
oak	70%	P	5%	
Manitoba maple	P	15%	P	
hawthorn		P	P	
saskatoon		10%	P	
chokecherry		40%	5%	
American hazel		P	P	
snowberry			30%	
wild black currant			P	
hawthorn			P	
wild rose			P	
wild strawberry				P
meadow rue				5%
carrionflower				P
sedges				50%
grasses				40%
sweet-scented bedstraw				P
northern bedstraw				P
nodding trillium				P
unknown violet				P
two-leaved Solomon's seal				5%
black snakeroot				P
golden alexander				P
unknown composite				P
dewberry				35%
wild peavine				P
Solomon's seal				P
baneberry				P
cream-coloured vetchling				P
sweet cicely				P

Soil Horizon	Width	Description
LFH	5 cm	
A	8 cm	silt
B	50 cm	silty loam
C		silty clay loam

General Comments: Well drained, fresh site; hasn't been grazed in at least 40 years; very old, large oak trees; has planted red oak, white spruce, Scot's pine and ash. Everything looks more unhealthy here- more leaves are curled and eaten than we have seen elsewhere;; more diversity of species, similar to other GT4 sites- have more moisture so are more productive. Plot located about 150 metres from Portage Creek.

Date: July 7, 1994 Plot No: 1, terrace

Location: Portage Creek, McGowan property
SW 18-13-6W
(GT-4)

Stand No: 23

Species: % Cover	Canopy	Tall Shrub	Low Shrub	Ground
oak	60%		P	
green ash	25%	P	P	
Manitoba maple	P		P	
saskatoon		5%	5%	
American hazel		15-20%	5%	
high bush cranberry		P	P	
downy arrowwood		P	P	
chokecherry		P		
elm		P		
poison ivy			15%	
wild black currant			P	
snowberry			P	
sarsaparilla				50%
golden alexander				P
hog peanut				P
black snakeroot				P
American vetch				P
sedges				15%
grasses				15%
dewberry				P
northern bedstraw				P
carrionflower				P
sweet-scented bedstraw				P

Soil Horizon	Width	Description
LFH	6 cm	
A	8 cm	silt
B	10 cm	loam
C		clay loam then silty clay loam; clay more like Red River gumbo

General Comments: Moderate to well drained, fresh site; plot located about 200 metres from Portage Creek; more species we haven't seen for a while.

APPENDIX B

Riverbottom Forest Sample Plots
Species List

Scientific Name	Common Name
Acer negundo L.	Manitoba maple
Actaea rubra (Ait.) Willd.	red baneberry
Agastache foeniculum (Pursh) Ktze.	giant hyssop
Agropyron trachycaulum (Link) Malte.	slender wheatgrass
Amelanchier alnifolia Nutt.	saskatoon
Amphicarpa bracteata (L.) Fern.	hog peanut
Anemone canadensis L.	Canada anemone
Apocynum androsaemifolium L. var. *incanum* DC.	spreading dogbane
Aralia nudicaulis L.	wild sarsaparilla
Arctium lappa L.	common burdock
Asclepias speciosa Torr.	showy milkweed
Aster simplex Willd.	small blue aster
Axyris amaranthoides L.	Russian pigweed
Calamagrostis canadensis (Michx.) Beauv.	marsh reed grass
Carex deweyana Schw.	Dewey's sedge
C. sprengelii Dewey	Sprengel's sedge
C. tenera Dewey	unknown
Chenopodium album L.	lamb's-quarters
C. hybridum L. var. *gigantospermum* (Aellen) Rouleau	maple-leaved goosefoot
Cirsium arvense (L.) Scop.	Canada thistle
Cornus alba L.	red-osier dogwood
Corylus americana Walt.	American hazel
C. cornuta Marsh.	beaked hazel
Crataegus chrysocarpa Ashe.	round-leaved hawthorn
Elymus canadensis L.	Canada wild rye
E. virginia L. var. *submuticus*	Virginia wild rye
Epilobium angustifolium L.	fireweed
Equisetum spp.	horsetail
Euphorbia esula L.	leafy spurge
Festuca obtusa Biehler	fescue grass
Fragaria virginiana Dcne.	wild strawberry
Fraxinus pennsylvanica Marsh.	green ash
Galium boreale L.	northern bedstraw
G. triflorum Michx.	sweet-scented bedstraw
Glechoma hederacea L.	creeping charlie
Hackelia deflexa (Wahl.)Garcke var. *americana* (Gray)Greene	nodding tickseed

Species List Continued

Lactuca pulchella (Pursh) DC.	blue lettece
Laportea canadensis (L.) Gaud.	wood nettle
Lappula echinata Gilib.	bluebur
Lathyrus ochroleucus Hook.	cream-coloured vetchling
Lathyrus venosus Muhl.	wild peavine
Lonicera dioica L. var. *glaucescens* (Rydb.) Butt.	twining honeysuckle
Lysimachia ciliata L.	fringed loosestrife
Maianthemum canadense Desf. var. *interius* Fern	two-leaved Solomon's seal
Matteuccia struthiopteris (L.) Tod.	ostrich fern
Melilotus officinalis (L.) Pall.	yellow sweet-clover
Menispermum canadense L.	moonseed
Osmorhiza longistylis (Torr.)	smooth sweet cicely
Oxalis stricta L.	yellow wood-sorrel
Parthenocissus quinquefolia (L.) Planch.	Virginia creeper
Phryma leptostachya L.	lopseed
Plantago spp.	plantain
Poa nemoralis L.	wood blue grass
Poa pratensis L.	Kentucky blue grass
Polygonatum commutatum (R.& S.)Dietr.	common Solomon's seal
Polygonum convolvulus L.	wild buckwheat
Populus deltoides Marsh.	cottonwood
Prunus pensylvanica L.f.	pincherry
P. virginiana L.	chokecherry
Quercus macrocarpa Michx.	bur oak
Ranunculus abortivus L.	smooth-leaved buttercup
Rhamnus cathartica L.	buckthorn
Rhus radicans L. var. *rydbergii* (Small) Rehder	poison ivy
Ribes americanum Mill.	wild black currant
Rosa spp.	wild rose
Rubus idaeus L.	wild red raspberry
R. pubescens Raf.	dewberry
Salix amygdaloides Anderss.	peach-leaved willow
Sanicula marilandica L.	black snakeroot
Smilacina stellata (L.) Desf.	star-flowered Solomon's seal
Smilax herbacea L. var. *lasioneura* (Hook.) DC.	carrionflower
Solidago gigantea Ait. var. *leiophylla*	late goldenrod
Sonchus spp.	sow-thistle
Spirea alba Du Roi	narrow-leaved meadowsweet
Stachys palustris L. var. *pilosa* (Nutt.) Fern.	marsh hedge-nettle
S. tenufolia var. *hispida*	hedge-nettle
Symphoricarpos occidentalis Hook.	western snowberry
Taraxacum officinale Weber	dandelion

Species List Continued

Thalictrum dasycarpum Fisch. & Lall.	tall meadow-rue
T. venulosum Trel.	veiny meadow-rue
Tilia americana L.	basswood
Trillium cernuum L. var. *macranthum* Eam. & Wieg.	nodding trillium
Ulmus americana L.	American elm
Urtica dioica L. var. *procera* (Muhl.) Wedd.	stinging nettle
Viburnum rafinesquianum Schultes	downy arrowwood
V. trilobum Marsh.	high bush cranberry
Vicia americana Muhl.	American vetch
Viola pubescens Ait.	downy yellow violet
V. rugulosa Greene	western Canada violet
Vitis riparia Michx.	riverbank grape
Zizia aurea (L.) Koch	golden alexander

APPENDIX C

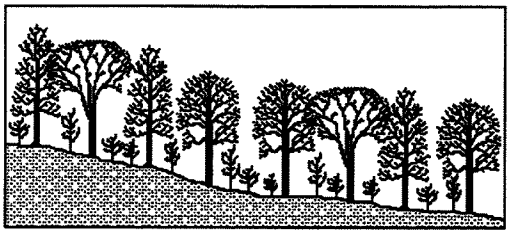
FOREST ECOSYSTEM CLASSIFICATION

for RIVERBOTTOM FORESTS

in SOUTHERN MANITOBA

Forest Ecosystem Classification for Riverbottom Forests in Southern Manitoba

RBF 2 - Green Ash (American Elm) / Basswood



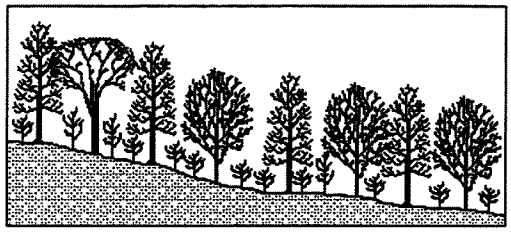
General Description (n=2)

This forest type is located on the floodplain. The canopy may include green ash, American elm and Manitoba maple but it also includes basswood. In some stands, basswood may dominate the canopy. These stands are only located east of the Manitoba Escarpment, as the range for basswood does not extend farther west. The shrub and herb layers are well developed. Sites are typically well-drained and site moisture is fresh to moist.

Common Understorey Plants

Shrubs: chokecherry, American and beaked hazel, snowberry, poison ivy and wild rose.
Herbs: moonseed, virginia creeper, meadow rue, sweet-scented bedstraw, cream-coloured vetchling, sarsaparilla, carrionflower.

RBF 3 - Green Ash (American Elm) / Manitoba Maple / Shrub and Herb Rich



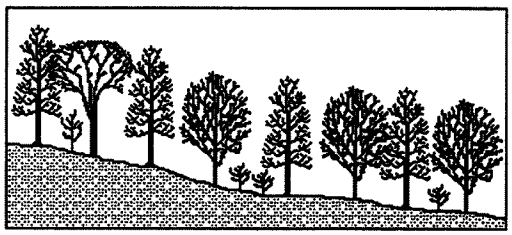
General Description (n=3)

Located on the floodplain, the canopy in this forest type includes green ash, American elm and Manitoba maple. It differs from other forest types on the floodplain due to the richness and diversity of species in the shrub and herb layers. These stands are found on the most productive riverbottom forest sites, in areas which typically have the best climatic conditions for growth. Sites are generally well-drained and moist.

Common Understorey Plants

Shrubs: poison ivy, wild raspberry, chokecherry, downy arrowwood, beaked hazel, snowberry, red-osier dogwood, wild rose, wild black currant.
Herbs: sweet-scented bedstraw, wild grape, sweet cicely, moonseed, hog peanut, stinging nettle, virginia creeper, late goldenrod, sarsaparilla, hedge-nettle, star-flowered Solomon's seal, two-leaved Solomon's seal.

RBF 4 - Green Ash (American Elm) / Manitoba Maple



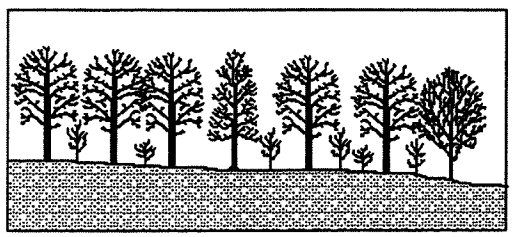
General Description (n=7)

This forest type is located on the floodplain within riverbottom forest stands. The main canopy species are the same as those found in the RBF - 3 forest type: green ash, American elm and Manitoba maple. However RBF - 4 stands generally are located in areas where climatic conditions are less favourable for growth and the shrub and herb layers are not as rich. Sites are well-drained with site moisture ranging from fresh to moist.

Common Understorey Plants

Shrubs: snowberry, wild black currant, chokecherry, poison ivy, wild rose, wild raspberry.
Herbs: meadow rue, northern bedstraw, sweet-scented bedstraw, carrionflower, wood nettle, fringed loosestrife, sarsaparilla, hedge-nettle.

RBF 5 - Bur Oak / Green Ash / Manitoba Maple



General Description (n=8)

This forest type is located on the terrace level farthest away from the water course. The tree canopy is generally dominated by bur oak, but green ash and Manitoba maple are often present. Some variation in species diversity exists across the stands, with those sites associated with RBF - 2 and RBF - 3 floodplain stands generally containing a greater variety of species. Sites are well to rapidly-drained and fresh.

Common Understorey Plants

Shrubs: hawthorn, American hazel, downy arrowwood, snowberry, poison ivy, wild rose, wild black currant, chokecherry, saskatoon.
Herbs: meadow rue, sarsaparilla, northern bedstraw, sweet-scented bedstraw, two-leaved Solomon's seal, star-flowered Solomon's seal, wild peavine, black snakeroot, western Canada violet.

APPENDIX D

RIVERBOTTOM FOREST MANAGEMENT RECOMMENDATIONS

FACT SHEET

Landowner's Guide to Managing Riverbottom Forests in Southern Manitoba

Introduction

Riverbottom forests are found growing along the edges of rivers and streams in southern Manitoba. Seasonal flooding enriches the soil, creating productive sites which support a variety of trees, shrubs and herbs.

Riverbottom forests are an important resource for landowners. They can provide a source of harvestable timber for fuel wood, sawlogs or speciality wood products as well as support wildlife, add aesthetic value and help maintain the health of the streams and rivers.

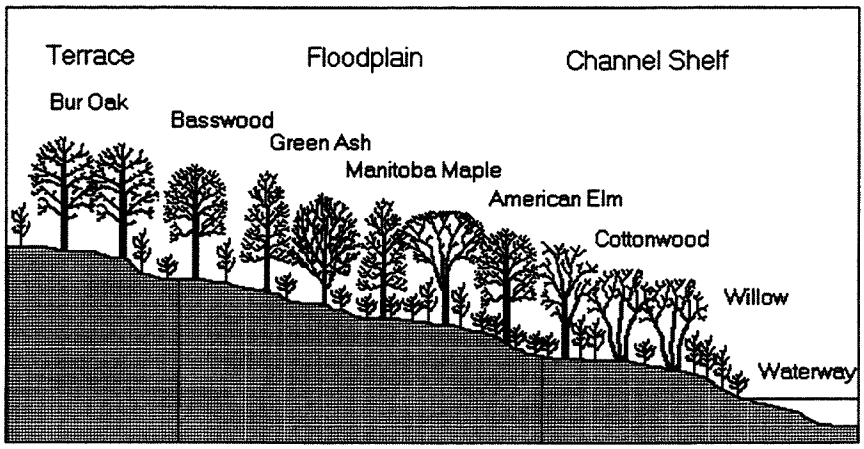
These management recommendations are provided for landowners in southern Manitoba with riverbottom forest on their property who wish to manage these forests for timber production. They have been developed to help landowners ensure the long term sustainability of their riverbottom forests. While the main purpose of these management recommendations is timber production, wildlife conservation and aesthetic values also have been considered.

Managing Different Types of Riverbottom Forest

Within a riverbottom forest, there are generally three locations which support slightly different forest types. In some cases, different management techniques are recommended for each type of riverbottom forest. Even in small forest stands these different types will be present but it may be very hard to tell where one stops and another starts. In such cases, the landowner should apply the management recommendations suited to the dominant tree species found in the stand.

The three locations within riverbottom forest stands and the different types of riverbottom forest they support are briefly described below.

Figure 1
Profile of a representative riverbottom forest illustrating the three different zones that may be present.



Terrace

Farthest away from the water, the terrace is a higher area less prone to flooding, where the forest is dominated by bur oak, along with some of the trees found on the floodplain.

Floodplain

Elevated above the channel shelf, the floodplain is a gently sloping or flat area with forest dominated by ash, elm, Manitoba maple and, in some areas, basswood.

Channel Shelf

Located next to the water, forest in this area is dominated by willow, cottonwood and other plants which are adapted to frequent flooding.

Applying the Recommendations

While these management recommendations are generally applicable to riverbottom forests in southern Manitoba, there are variations within each of these three forest types. Landowners should be aware that individual riverbottom forest stands may need specific management prescriptions to reach their management goals. Landowners should also keep in mind that these recommendations have been developed with the goal of sustained timber production. Managing riverbottom forests for other objectives such as wildlife conservation or aesthetics may require different management prescriptions.

Getting Additional Information

Landowners interested in managing their riverbottom forests are encouraged to refer to the publication *"Woodlot Management for the Prairie Provinces"* produced by the Farm Woodlot Association of Saskatchewan. Staff of the Manitoba Agro Woodlot Program, located throughout southern Manitoba, are also available to provide advice and assist landowners in developing management plans for their woodlots.

Canada

Canada - Manitoba
Partnership Agreement in Forestry

Manitoba

Management Recommendations
for Riverbottom Forests in Southern Manitoba

Harvesting

General

All harvesting should be limited to the winter months when the ground is frozen and snow covered. This will prevent soil compaction and damage from rutting.

All stumps should be cut as low to the ground as possible as this tends to promote stump sprouting.

Harvesting is not recommended along the channel shelf as this area is more vulnerable to erosion when trees are removed.

Selective Cutting

Selective cutting is preferred over clearcutting in most circumstances, except in oak stands. There are two selective cutting systems which can be used:

1) Removal of several small groups of mature trees (less than one half hectare in size) at one time.
2) Removal of individual trees throughout the stand.

In a selective cut, up to one third of the stand could be harvested at one time. Care should be taken to remove both poor and better quality trees during the initial harvest.

Subsequent selective cuts could be made in 5 to 10 years, once natural regeneration has become established. In these subsequent cuts care must be taken to protect these young trees.

Clearcutting

Clearcutting could be an option for floodplain stands where:

- the stand has been previously grazed and grass is prevalent;
- the stand is overmature and badly deteriorating; or
- the stand is made up of poor quality trees.

The area of each clearcut, called a cut block, should be no larger than 2 to 3 hectares. These should be spread throughout the stand.

Clearcutting is preferred for oak stands. Cut blocks should be at least one-half hectare in size to promote the ideal conditions needed for natural regeneration of oak. Maximum cut block size should also be 2 to 3 hectares.

One or two dead or dying trees should be left standing in any clearcut for cavity nesting birds or animals.

Reforestation

Both recommended harvesting techniques (selective cutting or clearcutting) will typically result in adequate natural regeneration through stump sprouting or seed germination.

Planting may be desirable, or even necessary, in some floodplain stands if:

- the area was previously grazed and there is significant grass competition;
- the quality of the existing stand is extremely poor and there is a desire to improve the future stand condition through the planting of better quality seedling stock; or
- the landowner wants to introduce higher value tree species to the stand, create or improve wildlife habitat or add to the aesthetics of the woodlot.

Planting in oak stands should only be necessary if there is a poor acorn crop the year prior to harvesting and/or if the stand is too old to generate sufficient stump sprouting. Sprouting typically declines as the trees reach maturity (80 to 100 years).

Planting Techniques

These techniques can be applied to stands harvested using either the selective or clearcut system. They may also be used when planting seedlings into a stand that has not been cut.

Site preparation will be needed on most areas prior to planting. For each seedling, a 60 cm by 60 cm area should be cleared of competing vegetation and the mineral soil exposed. Manual tools such as a planting spade or motorized brush saw scalping attachment can be used to create these planting sites.

In heavy grass areas, brush mats (covers made of synthetic or natural materials that can be placed on the ground around a seedling to help control competition) or herbicides registered for woodlands management can be used. If using herbicides, always follow label directions.

Trees should be planted at approx. a 3 m by 3 m spacing (approx. 1100 seedlings per hectare). Protection tubes can increase early seedling growth and protect them from wildlife browsing and girdling. These should be removed within 3 to 4 years after planting or before they begin to restrict a seedling's diameter growth.

Stand Tending

Due to the rapid growth of most riverbottom tree species, brushing or weeding will not typically be required during the first few years after harvest. Some oak stands could be the exception as heavy grass, herbaceous and woody competition could reduce oak seedling survival. These stands should be manually brushed. Care should be taken to prevent damage to the oak seedlings that are often well hidden under the competing vegetation.

Spacing or thinning treatments should begin approximately 4 to 5 years after harvest (7 to 8 years for oak). The preferred tree species should be thinned to leave a 2 m by 2 m spacing around the most vigorous seedlings. All woody stems competing with the desired crop trees should be removed. Stump sprouts should be thinned before they reach 10 cm in diameter, leaving only the best one or two sprouts per stump. The best sprouts to leave are those growing closest to the base of the stump as they will be the least affected when the parent stump decays.

Pruning of lateral branches should begin at the same time as thinning. Do not prune more than one third of the canopy at any one time.

Light thinning should occur every 5 to 10 years after the initial thinning, until the trees reach marketable size. Pruning could be done at the same time. Pruning of lateral branches to an approximate height of 5 m is sufficient to produce quality sawlogs.

Begin selective cutting once the trees reach a marketable size.