
PLANT COMMUNITIES

OBSERVATIONS OF HIGH QUALITY EASTERN DECIDUOUS RIPARIAN SITES IN SOUTHEAST MANITOBA'S WHITEMOUTH RIVER WATERSHED

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Introduction

The Superior Mixed Wood ecoregion contains mixedwood boreal, pine, and hardwood forests interspersed with forested and unforested peatlands.¹ The Whitemouth River Watershed lies within the northwestern-most extension of this ecoregion (Figure 1). Within the watershed, riparian gallery forests occur adjacent to the Whitemouth, Birch and Boggy Rivers and Whitemouth Lake. These forests are associated with rich floodplain soils, generally in the lower reaches of watershed. They are characterized by trees such as black ash (*Fraxinus nigra*), American elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*), box-elder (*Acer negundo*), willow spp., quaking aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*) and white spruce (*Picea glauca*).^{2, 3} These forests

support a vegetative assemblage thought to occur in no other ecological community type in the Prairie Provinces, as they support species that are commonly encountered in the deciduous forests of eastern North America but are rare or absent west of south-eastern Manitoba.

These forests are of conservation interest to organizations such as the Nature Conservancy of Canada (NCC) for their biodiversity value as well as their linkage to the maintenance of stream ecosystem health through erosion control, nutrient uptake, sediment capture and the contribution of woody debris.^{4, 5}

Based on forest resource inventories and aerial photography, approximately 7,150 acres (2,894 ha, 0.6% of the Whitemouth River Watershed) of eastern deciduous riparian forest persists

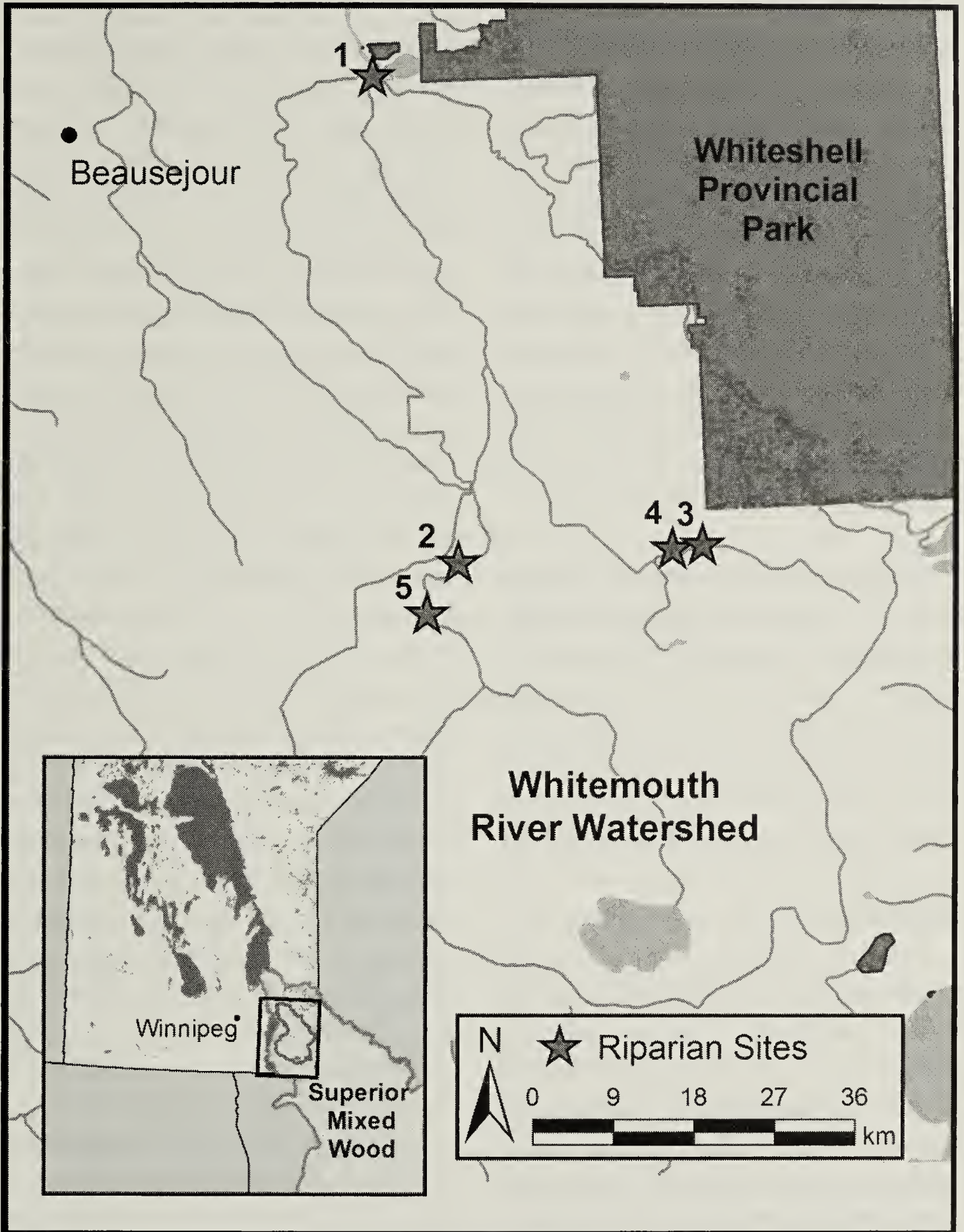


Figure 1- Context map and site locations

in the watershed (NCC internal calculation). A comparison of Dominion Land Survey township diagrams (circa 1890) with current aerial photography suggests that

riparian forest stands have been completely cleared in several locations and persist only as narrow bands in others.³ Larger stands occur on the inside bend of

oxbows, and in lower areas prone to flooding.³ Small riparian forest stands support less interior forest habitat, potentially increasing the chance of alien plant invasion and reducing the likelihood of supporting species dependent on interior forest.^{6, 7} Conversion of forest to annual or perennial cropland or, less often, to home and cottage development appear to represent the main historic causes of riparian forest loss in the Whitemouth River Watershed.³

The authors sought to identify and describe high quality eastern deciduous riparian forest sites in order to elucidate the potential 'benchmark' structure and composition. This information is needed to guide both restoration and habitat conservation activities.

Methods

Analytical tools in ArcGIS 10.1 were used to determine possible high quality riparian sites. Riparian forest polygons were created using aerial photos; polygons were drawn by tracing around forest patches adjacent to streams and rivers within the lower reaches of the Birch, Boggy and Whitemouth Rivers. The lower reaches coincide with a broad floodplain supporting rich soils – most of the watershed's agricultural development is

associated with this floodplain. Following Moffat (2002) and Richardson et al. (2007), we assumed that riparian patches with greater forest interior would be of higher quality.^{6, 8} Sites larger than 3 hectares and with an area:perimeter ratio larger than 50:1 were selected. We were interested in determining whether the number of rare species within a given stand could potentially be used as an indicator of riparian health. We further narrowed the list of potential survey sites by selecting patches within 500 metres of provincially rare or uncommon species occurrences, as recorded in the Manitoba Conservation Data Centre Biotics Database.⁹ Surveys focussed on forest patches that occurred on Crown land, as we were unable to obtain access to selected private lands. A reciprocal GIS analysis was conducted to find potentially degraded sites, but permission to access these properties could not be obtained.

Survey sites occurred along the Whitemouth River (Sites 1, 2, and 5) and on Boggy Creek near its confluence with the Birch River (Sites 3 and 4; Figure 1). Site visits were conducted on August 26 and 27th, 2013 with each visit taking two to three hours. While Manitoba's Forest Ecosystem Classification

Guide¹⁰ is an excellent resource for classifying most of Manitoba's forest types, it does not clearly resolve differences between stands dominated by green ash, American elm, box-elder and bur oak. These stand types are commonly encountered in riparian areas of the Superior Mixed Forest ecoregion. In this study, vegetation communities were classified using *Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province*, a guide developed for the Superior Mixed Forest region of Minnesota.¹¹

At each site a forest assessment was conducted. These assessments documented the dominant species within tree, shrub or non-woody categories at various height classes (Appendix A). All plant species observed were recorded, but resulting species lists are not considered complete as survey time was limited and multi-season visits were not made. Graminoids were generally not identified to species. The type and degree of forest disturbance was recorded and the amount of deadfall and standing dead trees was documented. A riparian assessment was conducted using *Managing the Water's Edge: Riparian Health Assessments for Streams and Small Rivers*.⁵ These assessments document

vegetation cover, invasive plant species, disturbance-increaser species, preferred tree and shrub establishment and regeneration, utilization of preferred trees and shrubs, standing decadent and dead woody material, stream bank root mass production, human-caused bare ground, streambank structurally altered by human activity, pugging and hummocking, and stream channel incisement. All measurements are based on visual estimations. Pugging and hummocking were not incorporated into our assessment as none of the sites visited supported livestock grazing. The assessment is designed to produce a score representing the relative health of the riparian area (for our study 54 points were possible). The riparian assessment, forest assessment, and other information were recorded for the reach of the floodplain only. Broad community and land-use information was recorded for the adjacent upland systems. Stream width and floodplain width were measured in GIS using aerial photos. Floodplain width was calculated as the mean length of the floodplain for the shortest and longest widths within the site. Stream depth was visually estimated.

We conducted exploratory

analyses to determine whether riparian health scores and other characteristics were correlated with rare species diversity. Species rarity was based on provincial status ranks classified by NatureServe.¹² These ranks range from S1 to S5, where S1 is critically imperilled and S5 is secure. In this study we defined rare species as those ranked S1 – S3.

Results

The dominant vegetation community at all riparian sites was Northern Terrace Forest. These communities were dominated by black ash in the upper canopy with black ash, green ash, American elm, and box-elder in the lower canopy/shrub layer. Within this matrix habitat, Northern Floodplain Forest occurred either in perched oxbows or on the inner side of river bends. The observed composition of both community types aligned well with the descriptions noted in the Minnesota community classification guide, except that silver maple was not observed. Silver maple has been reported in extreme southeastern Manitoba, but has not been confirmed as present.¹³

Table 1 describes each site based on the physical dimensions of the tributary, the adjacent land-use,

and the riparian assessment score. All riparian sites were deemed to be healthy based on the riparian assessment guide. No sites scored the maximum possible number of assessment points, losing points for a variety of reasons: invasive plants (all sites), maintenance of woody vegetation (Sites 2 and 5) preference of woody vegetation used (Sites 1, 3 and 5), dead and decadent wood (Site 5), and stream access to flood plain (Sites 4 and 5). No points were lost for vegetation cover, disturbance caused species, deep rooted banks, and human-caused bare-ground.

A list of common species observed is presented in Table 2. Only those species found at three or more of the riparian sites are listed. The following species were observed at all riparian reference sites: American elm, black ash, box-elder, broad-lobed dandelion, creeping thistle, downy arrowwood, green ash, hazelnut, highbush cranberry, nodding trillium, purple meadowrue, red-osier dogwood, spotted water-hemlock, and willow species. Black ash dominated the upper canopy in all riparian sites. Box-elder and American elm were found in all riparian sites in the lower canopy (0-5 m; see Appendix A for a complete list of dominant species). In the herb

Table 1 – Summary of site characteristics for five riparian sites in the Whitemouth River Watershed

	Site 1	Site 2	Site 3	Site 4	Site 5
Adjacent Land-use	Aspen and Balsam Poplar forest in uplands; cottages on the other side of river, ATV/Ski/Hiking trail in reach; campground at north end of reach; powerlines at south end of reach;	Mixed-wood forestry land and tame grassland in uplands; ATV and ski trails in uplands	Spruce and cedar forest	Mixed-wood forest bisected by wide gravel Road ; Cottages,	Balsam fir, aspen, white birch, white spruce forest; cottages to the south; surrounded by Provincial Forest
Stream depth (m)	8	6	2	3	5
Floodplain width (m)	48	64	56	16	23
Stream Width (m)	72	19	8	9	21
Riparian Health Score (/54)	49	48	50	49	47
Riparian Health Percentage (%)	91%	89%	93%	91%	87%
Photos	Figure 2	Figure 3	Figure 4	Figure 5	Figure 6



Figure 2 – Site 1 forest interior

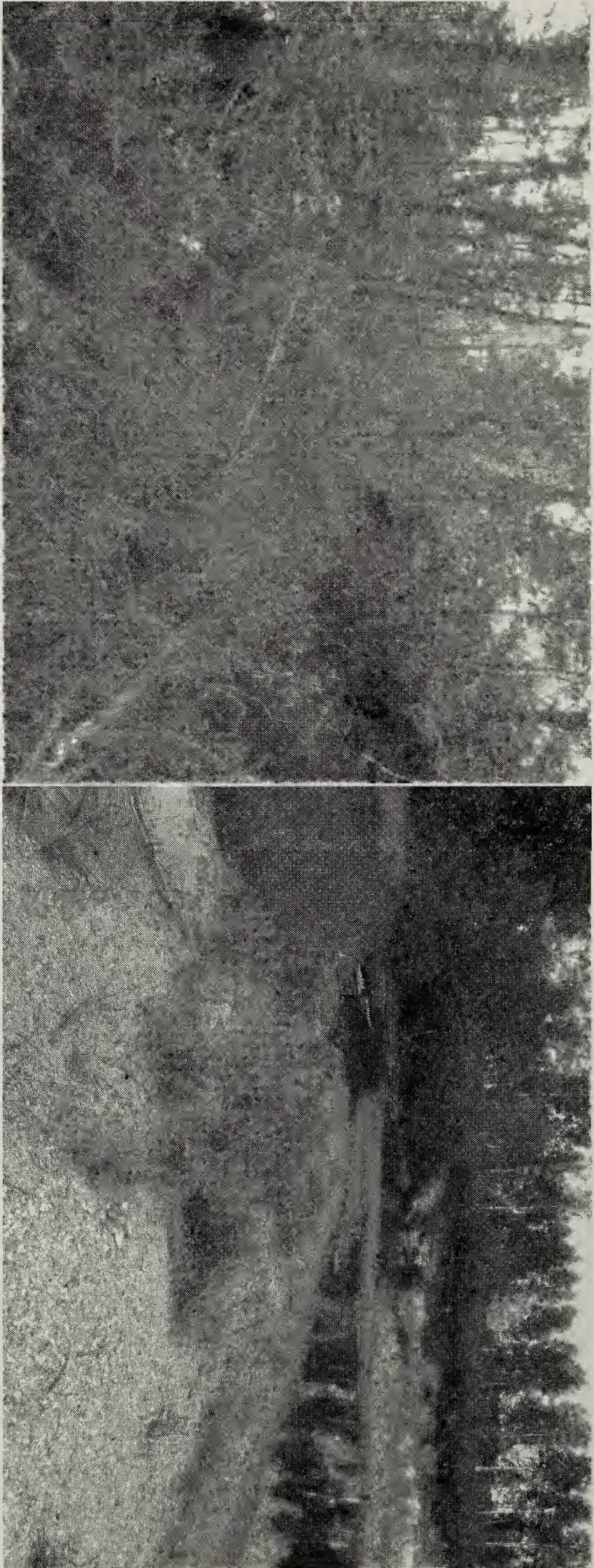


Figure 3 – Site 2 perched oxbow (left) and river bank (right)

Figure 4 – Site 3 interior (left), edge (centre) and river (right)

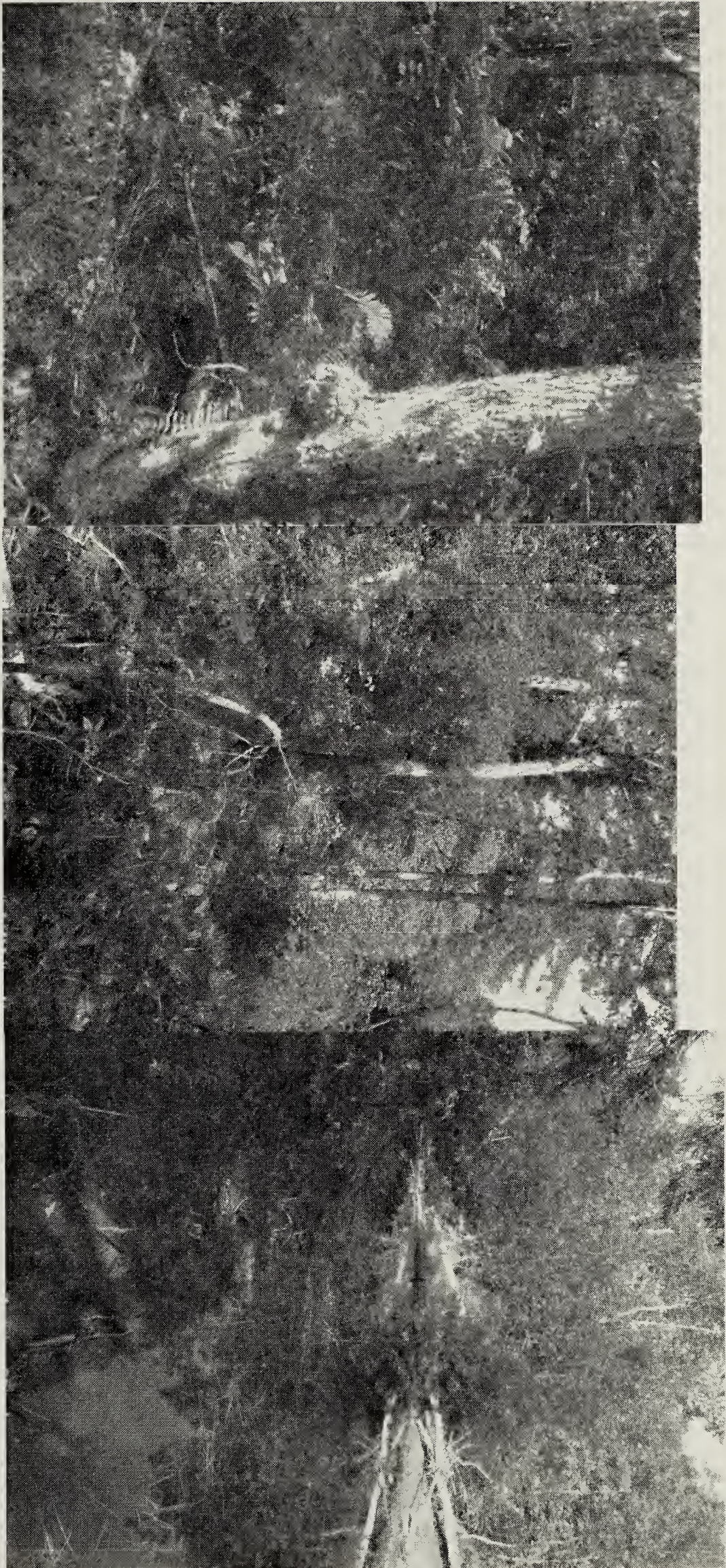


Figure 5 – Site 4 forest interior

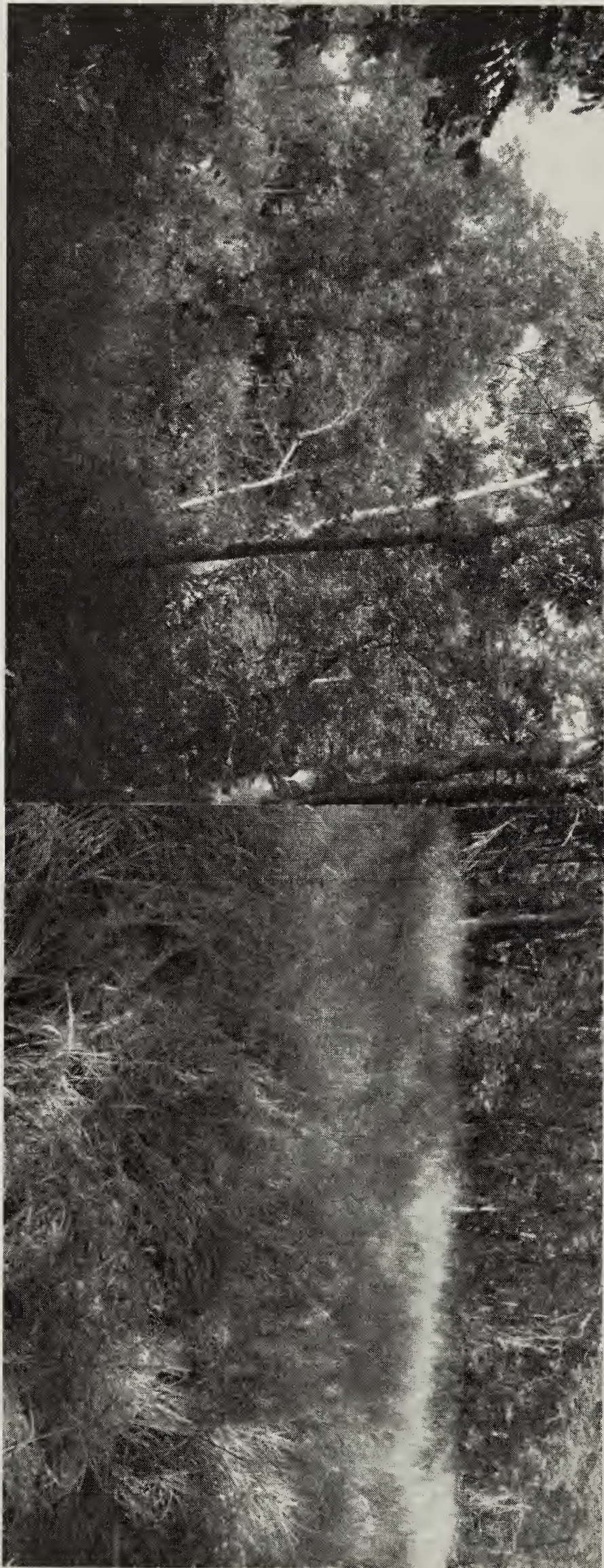


Figure 6 – Site 5 forest interior



Table 2 – Common species observed at five riparian forest sites in the Whitemouth River Watershed (species occurring in at least 3 sites). Species names after NatureServe¹⁴.

Common Name	Species Name	Number of Sites
American elm	<i>Ulmus americana</i>	5
Black ash	<i>Fraxinus nigra</i>	5
Box-elder	<i>Acer negundo</i>	5
Broad-lobed dandelion	<i>Taraxacum officinale ssp. vulgare</i>	5
Creeping thistle	<i>Cirsium arvense</i>	5
Downy arrowwood	<i>Viburnum rafinesquianum var. Rafinesquianum</i>	5
Green ash	<i>Fraxinus pennsylvanica</i>	5
Hazelnut	<i>Corylus sp</i>	5
Highbush cranberry	<i>Viburnum opulus var. americanum</i>	5
Nodding trillium	<i>Trillium cernuum</i>	5
Purple meadowrue	<i>Thalictrum dasycarpum</i>	5
Red-osier dogwood	<i>Cornus sericea</i>	5
Spotted water-hemlock	<i>Cicuta maculata</i>	5
Willow sp.	<i>Salix sp</i>	5
Alderleaf buckthorn	<i>Rhamnus alnifolia</i>	4
Canada anemone	<i>Anemone canadensis</i>	4
Canada goldenrod	<i>Solidago canadensis</i>	4
Canada wild ginger	<i>Asarum canadense</i>	4
Canada wild rye	<i>Elymus canadensis</i>	4
False lily-of-the-valley	<i>Maianthemum canadense</i>	4
Mannagrass sp.	<i>Glyceria sp</i>	4
Ostrich fern	<i>Matteuccia struthiopteris</i>	4
Rough Horsetail	<i>Equisetum hyemale</i>	4
Saskatoon serviceberry	<i>Amelanchier alnifolia</i>	4
Smooth herbaceous Greenbrier	<i>Smilax herbacea</i>	4
Awnless brome	<i>Bromus inermis</i>	3
Bur oak	<i>Quercus macrocarpa</i>	3
Chokecherry	<i>Prunus virginiana</i>	3
Fresh water cordgrass	<i>Spartina pectinata</i>	3
Horsetail sp.	<i>Equisetum sp</i>	3
Little green sedge	<i>Carex viridula</i>	3
Long-fruit anemone	<i>Anemone cylindrica</i>	3
Northern poison-oak	<i>Toxicodendron rydbergii</i>	3
Paper birch	<i>Betula papyrifera</i>	3
Reed canarygrass	<i>Phalaris arundinacea</i>	3
Rose sp.	<i>Rosa sp</i>	3
Spotted joe-pyeweed	<i>Eupatorium maculatum</i>	3
Violet sp.	<i>Viola sp</i>	3
White spruce	<i>Picea glauca</i>	3
White turtlehead	<i>Chelone glabra</i>	3
Wild mint	<i>Mentha arvensis</i>	3

layer, nodding trillium, a species with a more eastern distribution, was found in all riparian sites. A complete list of eastern-affiliated species observed is presented in Table 3.

Our exploratory analyses were unable to detect any possible correlations between rare species and riparian health scores. A possible relationship between rare species richness and floodplain width was observed: the three sites with the widest floodplain width (>45 m) supported three rare species each, while the two sites with the narrowest width (<25 m) supported two or fewer rare species.

Discussion

The results of this study represent a first attempt to describe high quality riparian forest sites in the Whitemouth River Watershed. These stands may represent ecological benchmark sites against which the quality of regional riparian areas and restoration efforts could be assessed. All assessed sites existed within larger forested blocks, and all sites received 'healthy' scores.

The species composition of the studied sites differs from that of most riparian sites in Manitoba, given the dominance of provincially rare black ash and the regular occurrence of other species of eastern North American affinity. Given the study area's location within the Superior Mixed Wood ecoregion the presence of these species is not unexpected. The species composition of the studied sites is consistent with previous observations by NCC staff and descriptions of eastern

deciduous riparian gallery forests in northeastern Minnesota.^{3, 11}

Invasive plants were present at all sites, but were most abundant at Site 1 and 2. Recreational trails (ATV/skiing/hiking) passed through or were adjacent to both sites. Regular soil disturbance and seed transfer from trail users and maintenance equipment may be linked to the higher degree of invasion of these sites.¹⁵

The three stands that were associated with floodplain widths of 45 m or greater supported the most rare species. It may be that rarer species have a greater affinity for interior forest conditions or that sites with greater flood plain width have a higher amount of habitat heterogeneity thus supporting a greater variety of species. However, sample size in our study was very small, and the potential link between riparian forest stand width and rare species diversity is presented only to highlight a possible relationship deserving of further study.

Future work should focus on describing and assessing riparian sites that are adjacent to the annual croplands and pasturelands that dominate the lower reaches of the Whitemouth River Watershed. This would contribute to a better understanding of the range of characteristics of riparian systems within the watershed and help gauge similarities with the putative high quality sites presented here. An expanded project would provide a better understanding of indicators of

riparian health, compatible land use, threats to riparian ecosystems and opportunities for future restoration projects.

Acknowledgements

The authors wish to thank Stephen Gietz and Julie Pelc of NCC for technical assistance and advice. J. Kornelsen was funded in part by the Shell Conservation Intern Program.

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Appendix A – Dominant plant species observed in Whitemouth River Watershed riparian forest sites, sorted by growth form and vertical strata. Invasive species are also noted.

Tree species >15 m					
Dominance	Site 1	Site 2	Site 3	Site 4	Site 5
1	Black ash			White spruce	Balsam fir
2	Bur oak			Jack pine	Black ash
3					White spruce
4					Paper birch
Tree Species 5-15 m					
	Site 1	Site 2	Site 3	Site 4	Site 5
1	Black ash	Black ash	Black ash	Black ash	Green ash
2	Bur oak	Box-elder	Box-elder	Green ash	Black ash
3	American elm	Bur oak	American elm	Box-elder	White spruce
4	Paper birch		Green ash	Paper birch	Balsam fir
5					American elm
Tree Species 2-5 m					
	Site 1	Site 2	Site 3	Site 4	Site 5
1	Black ash	Black ash	Black ash	Black ash	Green ash
2	American elm	American elm	Green ash	Green ash	Box-elder
3	Willow spp.	Green ash	Box-elder	Box-elder	Black ash
4	Box-elder	Box-elder		American elm	White spruce
5					Balsam fir
Tree Species <2 m					
	Site 1	Site 2	Site 3	Site 4	Site 5
1	Black ash	American elm	American elm	Black ash	Green ash
2	Box-elder	Black ash	Black ash	Green ash	Black ash
3	Bur oak	Box-elder	Box-elder	Box-elder	Box-elder
4		Green ash	Bur oak	White spruce	American elm
5				Balsam poplar	Willow spp.
6				American elm	
Shrub Species > 2 m					
	Site 1	Site 2	Site 3	Site 4	Site 5
1	Hazelnut spp.	Hazelnut spp.	Red-osier dogwood	Hazelnut spp.	Beaked hazelnut
2	Red-osier dogwood	Highbush cranberry	Highbush cranberry	Highbush cranberry	Highbush cranberry
3	Highbush cranberry	Red-osier dogwood	Hazelnut spp.	Downy arrow-wood	Downy arrow-wood
4		Choke cherry	Choke cherry	Red-osier dogwood	
5		Hawthorn spp.	Saskatoon serviceberry		

Shrub Species 30 cm - 2 m					
	Site 1	Site 2	Site 3	Site 4	Site 5
1	Hazelnut spp.	Hazelnut spp.	Red-osier dogwood	Saskatoon serviceberry	Beaked hazelnut
2	Red-osier dogwood	Rose spp.	Downy arrow-wood	Red-osier dogwood	American plum
3	Siberian peabush*	Snowberry	Saskatoon serviceberry	Alderleaf buckthorn	Highbush cranberry
4	Downy arrow-wood	Highbush cranberry	Alderleaf buckthorn		Downy arrow-wood
5	Highbush cranberry		Narrowleaf White Meadowsweet		Alderleaf buckthorn
6					Saskatoon serviceberry
Non-woody Species					
	Site 1	Site 2	Site 3	Site 4	Site 5
1	Ostrich fern	Ostrich fern	Grasses	Ostrich fern	Canada anemone
2	Rough horsetail	Sedge sp.	Canada anemone	Purple meadowrue	Canada wild rye
3	Meadowrue spp.	Rough horsetail	Aster (unknown)	Canada anemone	Canada wild ginger
4	Green sedge	Smooth herbaceous greenbrier	Purple meadowrue	Canada wild ginger	Purple meadowrue
5		Canada wild ginger	Sensitive fern	Wild sarsaparilla	Ostrich fern
Invasive/weedy Species					
	Site 1	Site 2	Site 3	Site 4	Site 5
1	Creeping thistle	Creeping thistle	Creeping thistle	Creeping thistle	Creeping thistle
2	Meadow timothy			Broad-lobe dandelion	
3	Common tansy			Smooth brome	

* A shrubby invasive species, not included in invasives since its growth form differed from the other invasives

