Purple Loosestrife Survey of the Bad River Watershed, 1994

by

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INTRODUCTION

Purple loosestrife (*Lythrum salicaria*) is an exotic perennial plant which was introduced into the United States from Europe in the early 1800s and became established along the eastern seaboard by the 1830s. Since its introduction this emergent aquatic plant has spread across mid-latitude North American wetlands (Thompson et al. 1987) subsequently invading Wisconsin in the early 1940's (Stuckey 1980). Several modes of introduction or escape into previously uninfested areas were probable including from ship's ballast, livestock bedding and forage, wool, and purposeful import as seeds or rootstocks for gardens, herb beds, and use by beekeepers (Thompson et al. 1987).

Early on loosestrife was observed to degrade the quality of waterfowl nesting sites (McKeon 1959). Loss of open water, loss of mud flats for foraging shore birds, and a reduction in the quantity of valuable wildlife food plants (Smith 1959) were observed ecological consequences of loosestrife invasion within a wetland system. For these reasons the Wisconsin Legislature designated all members of the genus *Lythrum* as nuisance weeds in 1987 (AB 141 1987).

Although purple loosestrife has invaded northern Wisconsin only to a small extent (Thompson et al. 1987) the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) recognized the threat purple loosestrife posed to ceded territory wetland communities and initiated a pilot project of loosestrife control in Fish Creek Sloughs during the summer of 1989. This site was chosen due to its high degree of loosestrife infestation and the likelihood that seeds from this area would promote the establishment of additional loosestrife populations in the Kakagon/Bad River Sloughs.

The Kakagon/Bad River Sloughs, the largest, healthiest, fully functioning estuarine system remaining in the upper Great Lakes Basin (Meeker 1992) and recognized as a National Natural Areas Landmark (National Registry 1983), are the ancestral home and cultural base of the Bad River Band of Lake Superior Chippewa. The vast and nearly pristine Sloughs contain ten natural communities in a complex mosaic that support an abundance of wild rice beds, crucial spawning grounds for Lake Superior fisheries, and provide critical nesting habitat for migratory waterfowl (Meeker 1992). The ecological health of the Sloughs is highly dependent upon the activities and events within the approximately 1,100 square mile watershed that provides the Sloughs with a continual supply of water, sediment and nutrients. In order to determine the current status and health of the Kakagon/Bad River Sloughs and to develop a long-term watershed protection plan, the Wisconsin Chapter of The Nature Conservancy and the Bad River

Band initiated a watershed conservation project.

In 1994 GLIFWC conducted a purple loosestrife survey of the Kakagon/Bad River Slough Watershed as a component of this larger project. The objective was to record baseline data on the location of purple loosestrife stands, stand acreage and plant density. These data were integrated into the Bad River Band's geographic information system (GIS) which will provide the basis for systematic monitoring of loosestrife infestation patterns and evaluation of control measures. Beginning in 1995 emphasis will be placed on containment, control, and eradication of loosestrife populations (Gilbert and Parisien 1989). The purpose of this report is to provide results of the loosestrife survey of the Kakagon/Bad River Slough Watershed.

METHODS

The Bad River Watershed covers approximately 1,100 square miles including much of Ashland, Iron, and Bayfield Counties in northern Wisconsin (Fig. 1). A set of 7.5 minute USGS topographical quadrangle maps were prepared covering the entire watershed (see Appendix 1, page 14 for Quadrangle names). Priority survey sites were identified as wet, disturbed areas along roads, train tracks and waterway corridors due to evidence that loosestrife seeds disperse along these routes. These areas included the: Marengo River, Bad River, White River, Silver Creek, Highways 2, 13, 77, 112, 169, and 118, Government Road, Bibon Swamp, and the Kakagon/Bad River Sloughs. Field work was performed during the summer flowering stage (i.e. late July and August). Surveys were conducted using various means of transportation including automobile, canoe, airplane, and on foot.

To further identify areas to search, we contacted individuals and organizations who may already have encountered purple loosestrife within the watershed (Appendix 2). These included personnel with the Bad River Natural Resource Department, county highway departments, Wisconsin Department of Natural Resources, county foresters, U.S. Forest Service and Soil Conservation Service. In most cases we simply explained the project and requested data for known stands of loosestrife. However, county highway departments were given a data form for recording information we were interested in (i.e. location, amount, and habitat) and a key to distinguish purple loosestrife from similar plants (Appendix 3).

The size and density of loosestrife stands were measured at each site. If the population was less than 10 meters long along its longest axis then all plants in the population were counted. If the population was greater than 10 meters along its longest axis then a transect was run parallel to this axis and density was measured based on a series of eleven sub-samples evenly spaced along this transect. Square meter quadrants were set one arms length from the surveyor at each sub-sample station. Randomness was determined by the "blind spinning" of a compass which produced a random bearing along which the quadrant was placed. If the coefficient of variation

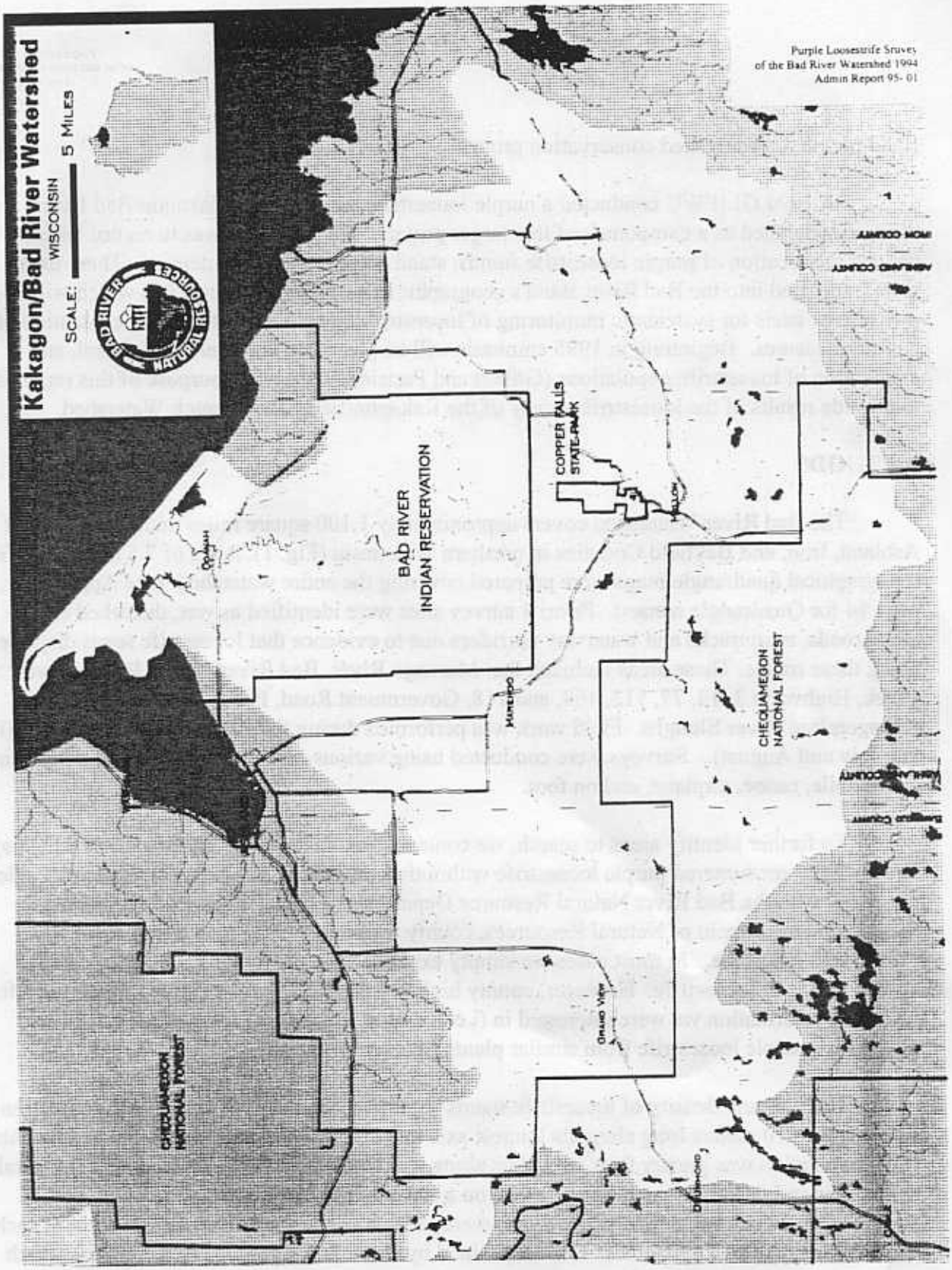

Figure 1. Location of the Bad River watershed, Wisconsin.

(CV) of the mean was above 20% for the first transect, then a more transects were run until the CV was less than 20%.

At each sub-sample quadrant the number of Class 1, Class 2, and Class 3 plants were counted and the number of stalks per Class 2 or Class 3 plants were tallied. Class determinations were based on methods following Thompson et al. (1982). Class 1 plants are small, single stalk plants, usually less than one year old, possessing a soft stem. Class 2 plants are medium size plants with 2-4 stalks coming from a single root system. Class 3 plants have 5 or more stalks, large root systems, woody stems, and possibly dead stems from the year before. The data for each stand were recorded on data sheets (Appendix 4) for later analysis and the infested areas were delineated on topographic maps. The results along the transect or transects were then averaged to yield a mean number of plants of each class and a mean number of plants per square meter for each stand (Appendix 5). Infestation areas were summed and weighted density means were averaged to obtain total area infested and average weighted density for each topographic quad map.

Additional environmental data were recorded during the surveys. Emphasis was placed on special features within the region that could threaten the watershed, and ultimately the Kakagon/Bad River Sloughs. Information recorded included tree species, presence of agriculture, bridge or utility line crossings, and bank and river corridor conditions. The areas traveled, the conditions along each route, and the special features encountered were noted (Appendix 6). A summary of conditions found along the Bad River, Marengo River and White River was preprared (Appendix 7).

After completing the field surveys, the data were organized in a spreadsheet. All information recorded on the field maps were transferred to a set of permanent maps and Universal Transverse Mercador (UTM) grid coordinates were determined for each population. These coordinates were used to import the purple loosestrife population data into Bad River's GIS, i.e. for each population, the number and percent of plants in each class, and overall plant density.

RESULTS

Distribution and Density

A total of 146.5 hectares of loosestrife was located in the Bad River watershed (Table 1). The majority (96 %) of the loosestrife was found in the Kakagon Sloughs, Long Island (including Chequamegon Point) and Highbridge. The Highbridge population had the highest total density (3.73 plants/m^2) of loosestrife, the highest density of Class 1 plants (3.16 plants/m^2) and because of it's large size, heavily influenced the average weighted density. The populations along the Bad River, Marengo River, Silver Creek and the northern half of Highway 13 did not cover a large area and could be easily controlled. The populations along the southern half of Highway 13 were distributed over a relatively long corridor and found in the roadside ditches. This population had relatively high densities of Class 1 loosestrife (1.3 plants/m^2) and relatively low densities of Classes 2 and 3 plants (0.02 plants/m^2 and 0.05 plants/m^2, respectively).

Table 1. Summary of area of infestation and density distribution of stage classes of purple loosestrife in the Bad River watershed, 1994.

Location	Area (ha.)	Density Class 1	Density Class 2	Density Class 3	Total Density
Long Island	12.8 (8.7%)	0.00	0.10	0.00	0.10
Kakagon Sloughs	38.6 (26.3%)	0.23	0.18	0.21	0.63
Highway 13 (n)	0.60 (<.01%)	1.19	0.18	0.07	1.44
Highway 2	0.002 (<.01%)	0.00	0.20	0.00	0.20
Bad River	0.28 (<.01%)	0.32	0.21	0.15	0.68
Highway 13 (s)	4.30 (2.9%)	1.30	0.02	0.05	1.51
Marengo R.	0.003 (<.01%)	0.00	0.69	0.31	1.00
Silver Cr.	0.06 (<.01%)	0.00	0.45	0.55	1.00
Highbridge	89.8 (61.4%)	3.16	0.34	0.23	3.73
Total Area Average Density (Weighted)	146.5	2.04	0.27	0.20	2.51

Population Estimates

An estimated 3.7 million purple loosestrife plants were found in nine locations or corridors within the Bad River watershed (Table 2). In all locations except Long Island, the number of Class 1 plants exceeded the numbers of Class 2 and Class 3 plants. Highbridge and the Kakagon Sloughs also had large numbers of both Class 2 and Class 3 plants which indicates a well established and mature stand. The large number of Class 1 plants in Highbridge, along Highway 13 (s) and in the Sloughs indicate the populations are expanding.

Table 2. Summary of population estimates (in thousands) of the 3 stage classes of purple loosestrife in the Bad River watershed, 1994.

Location	Area (ha.)	Pop. Est. Class 1	Pop. Est. Class 2	Pop. Est. Class 3	Total Pop. Est.
Long Island	12.80	0	12.8	tr.	12.8
Kakagon Sloughs	38.62	90.7	71.2	80.0	241.88
Highway 13 (n.)	0.60	7.1	1.1	0.4	8.6
Highway 2	0.002	0	tr.	0	tr.
Bad River	0.28	0.9	0.6	0.4	1.7
Highway 13 (s.)	4.33	56.1	6.9	2.2	65.2
Marengo R.	0.003	0	tr.	tr.	tr.
Silver Cr.	0.056	0	0.3	0.3	0.6
Highbridge	89.82	2,840.9	307.7	205.4	3,354.0
Total area and Population size	146.5	2,995.8	400.6	288.7	3,685.1

Typical plants that we found within 2 meters of purple loosestrife in Highbridge, Highway 13, and Kakagon Sloughs/Long Island were cattail (*Typha latifolia* and *Typha angustifolia*), sedge, broad-leaved arrowhead (*Sagittaria latifolia*), reed canarygrass (*Phalaris arundinacea*), bulrush, reed grass (*Phragmites australis*), and miscellaneous grasses. Purple loosestrife along the White R., Bad R., and Marengo R. was typically found within 2 meters of one or several of the following plants: blue vervain (*Verbena hastata*), willow (*Salix* spp.), stinging nettle (*Urtica dioica*), and miscellaneous grasses.

Survey Observations

The following is a summary of survey information by location noting areas where loosestrife was or was not found as well as other special features. Additional comments about special features are in Appendices 6 and 7.

Marengo River

Area surveyed: from County Road C (Sanborn Quadrangle section 31) to its junction with the Bad River (Highbridge Quadrangle section 25).

The upper section, from County Road C to immediately before its junction with Silver Creek (High Bridge Quadrangle Section 34), was free of purple loosestrife. The majority of this section did not contain suitable habitat; only small amounts of exposed sand points were present and the river corridor was covered with a full tree canopy.

However, beginning with its junction with the Brunsweiler River (T46N R3W S32 Marengo Quad) and continuing until it joined the Bad River, loosestrife habitat increased. Exposed sand bars and more gradually sloping banks gave way to a larger flood plain. Nonetheless, we did not find any loosestrife along the Marengo until its junction with Silver Creek. From this point to its junction with the Bad River we located 18 Class 2 and 8 Class 3 loosestrife plants; all were solitary plants. The plants found near the Silver Creek junction were rooted in rocky/sandy soil along the water's edge and along the banks. The remaining plants were rooted in moist clay soil along the banks.

White River

Area surveyed: from Pike River Road (Grand View NW Quadrangle border of sections 21 and 22) to the Mason picnic area (Mason Quadrangle section 25) and from Highway 13 (Ashland East Quadrangle section 26) to its junction with the Bad River (Odanah Quadrangle section 26).

No purple loosestrife was found in the entire area surveyed along the White River but suitable habitat for its possible establishment was abundant. Bibon Marsh was ideal habitat with its gradual, almost nonexistent banks, slow current, and high content of loosestrife associates such as broad-leaved cattail (*Typha latifolia*), bulrush (*Scripus* spp.), and sedge (*Carex* spp.).

Bad River

Area surveyed: from its junction with the Marengo River (High Bridge Quadrangle section 25) to its mouth at Lake Superior (Chequamegon Point Quadrangle section 17).

The entire stretch of the Bad River had scattered purple loosestrife plants. We counted 2 Class 1, 25 Class 2, and 3 Class 3 purple loosestrife plants. In addition, we measured three large stands totaling 2790 m^2 with a mean density of 0.68 purple loosestrife plants/m^2. This entire section contained ideal habitat for loosestrife establishment with a plethora of exposed sand points, gradual banks (although there were a few extremely steep sections), a large flood plain, and a slow current. All plants were rooted in moist clay soil along the banks of the river with the exception of those plants found in sections 36 and 25 of the Odanah Quadrangle being rooted in a sandy/rocky soil along the river banks and at the water's edge.

Highbridge

The town of Highbridge on Highway 13 eighteen miles south of Ashland had a serious infestation of purple loosestrife. We measured a total of 89.82 ha containing loosestrife plants of all three classes with a mean density of 3.73 plants/m^2. These numbers were calculated from twelve separate transects the results of which can be found in Appendix 5 (ID numbers 13-36 to 13-47). All plants of this area were found to be rooted in moist to dry clay soil.

Silver Creek

Area surveyed: from Highway 13 (High Bridge Quadrangle section 10) to its junction with the Marengo River (High Bridge Quadrangle section 34).

The entire area surveyed along Silver Creek was infested with purple loosestrife. The area totalled 0.056 ha with a mean density of 1.0 purple loosestrife plants/m^2. Loosestrife plants were found wherever there was an open canopy. Generally we found solitary plants or at most four to five distinct plants clustered together. We tallied a total of 557 plants consisting of 252 Class 2 and 305 Class 3 plants. The plants were rooted in rocky, moist soil on small islands, exposed banks, and within 10 meters from the creek along the flood plain.

Highway 13 (n and s)

Area surveyed: from Ashland (Ashland East Quadrangle section 4) to about two miles south of High Bridge (High Bridge Quadrangle section 14).

The ditches of this entire section were infested with purple loosestrife. Generally, there

were sporadic solitary plants or a lone Class 3 bush, but there were also a few continuous stands. The continuous stands covered a total of 4.92 ha with a mean density of 1.50 loosestrife plants/m^2. Additional sporadic and solitary loosestrife plants were found along Highway 13 all the way to Mellen. The majority of the plants were rooted in moist clay soil with a few rooted in one to six centimeters of water.

Kakagon Sloughs/Long Island

Area surveyed: the entire area covered by the Chequamegon Point Quadrangle as well as the following areas on the Long Island Quadrangle: T49N R4W section 13, T48N R3W sections 4,5,9,17,18,20,21,28, and T47N R3W sections 16- 21.

The entire area surveyed is highly susceptible to loosestrife colonization with an open canopy, slow moving water, and an abundance of loosestrife associates. We quantified a total of 51.44 ha with a mean density of 0.50 purple loosestrife plants/m^2. All plants were rooted in a floating bog mat submerged in seven to fifteen centimeters of water except for those plants found on Long Island which were on a sandy beach.

DISCUSSION

A major source of purple loosestrife for further dispersal and spread within the watershed is the Highbridge population (Figure 2). With 3.73 plants/m^2 covering 89.82 ha, it had the largest infested area and the highest mean density of purple loosestrife compared to all other areas. A rich seed bank maintained by the multitude of well established Class 2 and Class 3 plants gave rise to the highest density and number of Class 1 plants within the watershed. The population is healthy, expanding and is a seed source for the Highway 13, Silver Creek, Marengo River populations, and ultimately the Bad River below the Marengo River junction. A study of Figure 2 shows a direct path of purple loosestrife from Highbridge to Highway 13 down Silver Creek, into the Marengo River, and finally reaching the Bad River. Therefore, any efforts to control purple loosestrife within the watershed must begin in Highbridge.

Alternatively, the Kakagon Sloughs and Long Island areas, although infested, do not appear to be linked to the Highbridge colony. These areas have well established populations of purple loosestrife containing high percentages of Class 2 and Class 3 plants. On the other hand, both areas have a relatively small percentage of Class 1 plants. This may be due to the fact that these areas have been treated with herbicides since 1985 by the Bad River Band for the purpose of controlling purple loosestrife. (Their source of seeds in this area is believed to come from Fish Creek Sloughs and other populations surrounding Chequamegon Bay but outside of the Bad River watershed.) The location of Kakagon Sloughs and Long Island relative to these populations, the movement of the water within Chequamegon Bay, and the large amount of boat traffic between these areas would allow for a direct path of seed dispersal (Gilbert and Parisien 1989). Fish Creek Sloughs have been the target of a purple loosestrife control program since 1989 which has drastically reduced the number of purple loosestrife seeds released each year in this area. However, there are other loosestrife populations which could be acting as seed sources for the Kakagon Sloughs. For these reasons, the protection of Kakagon Sloughs and Long Island from purple loosestrife is highly dependent upon the continued control of loosestrife in Fish Creek Sloughs and the expansion of this control effort to other infected areas surrounding Chequamegon Bay.

The White River is a major waterway in the watershed that eventually drains into the Bad River just south of Odanah. We found no purple loosestrife along any section of the White River. However, since several areas along its path contained prime habitat for loosestrife it should be considered a high risk area. These areas include all of Bibon Marsh and the section of the river from Highway 13 to the its junction with the Bad River. Bibon Marsh consists of slow-moving water cutting through a large floodplain containing purple loosestrife associates such as cattail, bulrush, broad-leaved arrowhead, and sedge. The section from Highway 13 to the Bad River contains a large amount of exposed banks and a wide flood plain containing many swampy areas. The river section from Mason to Highway 13 was generally not conducive to loosestrife

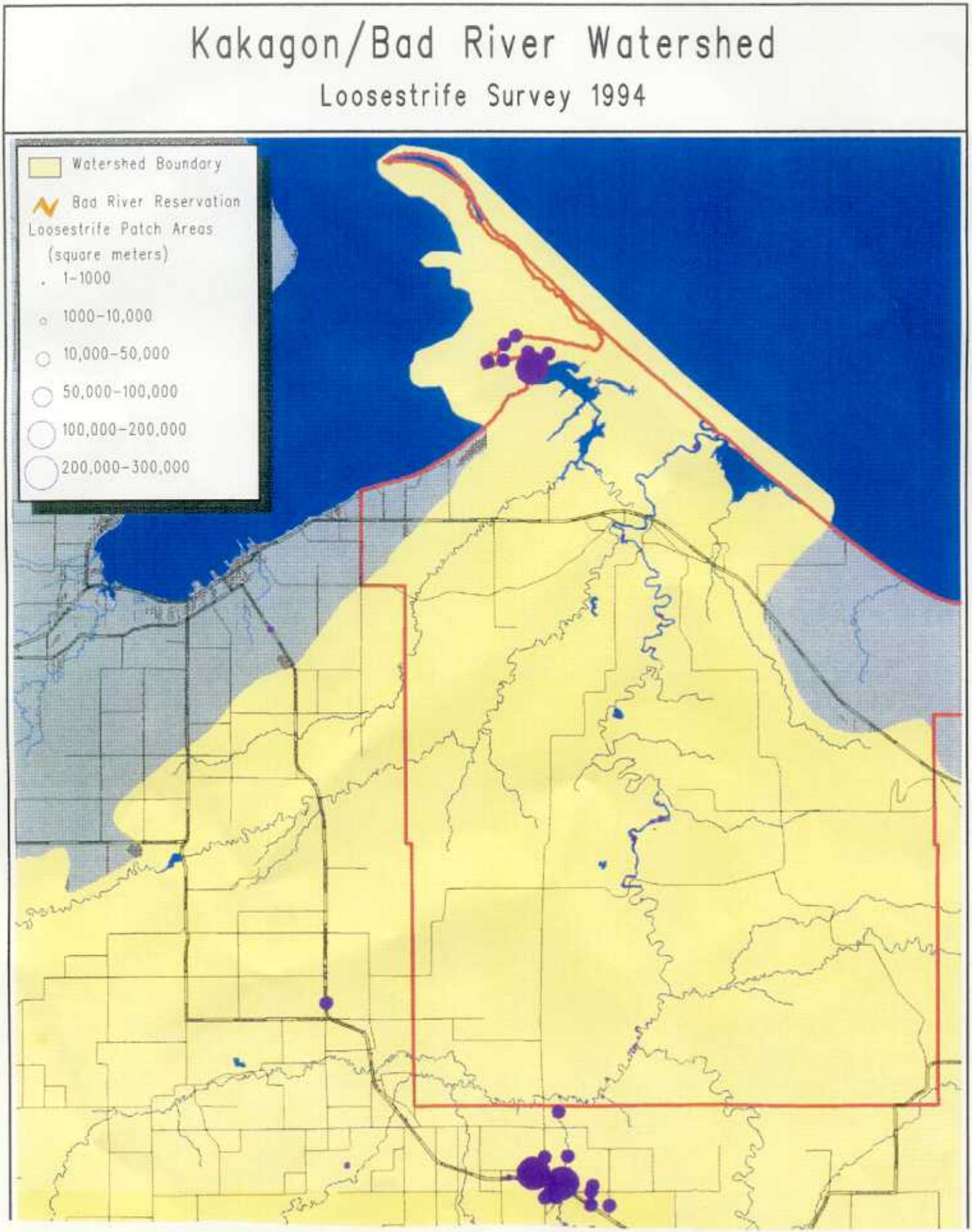

Figure 2. Locations of purple loosestrife populations within the Bad River watershed, Wisconsin.

growth due to the combination of very steep banks and a full canopy covering the more gradual banks. Nonetheless, this section should be monitored in the future. Although some sections of the White River are remote, they are still commonly traveled by hunters and anglers. This traffic is a potential source for introduction of loosestrife into the White River system. In addition, purple loosestrife was found along Highway 13 both north and south of the White River bridge and could easily disperse seeds into the river system. Future work in this area should include monitoring of the river and preventative measures such as posting warning signs and educating those using the river.

Some areas of prime purple loosestrife habitat were not surveyed. These locations should be monitored in the future and include the following: the upper Bad River upstream from its junction with the Marengo River, the Potato River, Trout Brook southeast of North York along Highway 13, the Brunsweiler River, Bear Trap and Little Bear Trap Creeks, the Kakagon River, Denomie Creek, Krause Creek northwest of Mellen, and Highway 169 from Mellen to Highway 2. No field surveys were conducted in the portion of the watershed within Iron County or eastern Ashland County. The elevated topography of this area protects it to some degree from seed dispersal from the established purple loosestrife populations within the watershed. However, if purple loosestrife were to enter this area there are plenty of moist, swampy areas in which purple loosestrife could flourish. The Iron County Highway Department reported no loosestrife populations along the roadways and our own surveys by car verified this report. Regardless, areas of suitable habitat do exist and this section of the watershed should be monitored.

Some areas of the watershed were not surveyed because they were on state or federal properties. These properties include the Chequamegon National Forest and Copper Falls State Park. Staff at the Chequamegon National Forest were confident that there was no purple loosestrife on their lands within the watershed and they agreed to relay any findings in the future. Copper Falls State Park had purple loosestrife within its boundaries but the staff was confident that they have killed all the plants found. A concern is that the Bad River, upstream from its junction with the Marengo River, runs through Copper Falls State Park and could very likely contain purple loosestrife. An attempt was made to survey this area by canoe but the river was not navigable for at least two miles down stream from Copper Falls State Park. Since this was the only access point between the Marengo River junction and Copper Falls, no other attempts were made to survey this area. Hiking was ruled out because the river was too deep to walk and the surrounding vegetation and topography would make it impossible to properly survey the river corridor. In the future this area should be surveyed when water levels are high, thus allowing canoe travel. Communication should be maintained with the Chequamegon National Forest and Copper Falls State Park staff in order to remain aware of purple loosestrife control efforts.

The majority of all the purple loosestrife located within the Bad River Watershed was found within one meter of broad-leaved cattail. In fact, broad-leaved cattail is the most common

associate of purple loosestrife throughout its North American range (Thompson et al. 1987). This means that it could be the most common plant displaced by a purple loosestrife invasion. This is of concern because broad-leaved cattail is preferred over purple loosestrife for food, bedding, and cover by many waterfowl and furbearers who contribute to the overall health of any wetland community. Additional plants that commonly associate with purple loosestrife within the Midwest United States are reed canarygrass, sedge, willow, narrow-leaved cattail, and reed grass (Thompson et al. 1987). All of the purple loosestrife found within the Bad River watershed was found within one meter of at least one of these associates. Any future purple loosestrife surveys of the Bad River Watershed should concentrate on areas that support these species.

An aerial survey of the watershed was conducted in mid-August to view areas not accessible by other modes of transportation. Large populations of purple loosestrife were quite easy to see from an altitude of 1,000 feet; we were able to clearly spot the major infestations at Highbridge, the Kakagon Sloughs and Long Island. However, solitary plants, the most common type of loosestrife distribution along riverways within the watershed, were impossible to spot.

CONCLUSION

The presence of purple loosestrife within the Bad River watershed poses a threat to the long-term health and integrity of the Kakagon/Bad River Sloughs. The displacement of native flora by purple loosestrife would upset the balance and use of this area by humans as well as the fish and wildlife species that depend on it. Although complete elimination of purple loosestrife may be impossible, it is a goal worth pursuing. Purple loosestrife control efforts should continue within the Bad River watershed to prevent further spread of this exotic plant and reduce the amount of habitat infested before it reaches the irreversible and uncontrollable levels found in many areas of southern Wisconsin. We believe that the Kakgon Sloughs are threatened by introductions from other loosestrife populations around Chequamegon Bay. Future surveys should identify these populations. By identifying priority areas for control and by proper implementation of control efforts the threat that purple loosestrife poses to the Kakagon/Bad River Sloughs can be greatly reduced. We hope that this report will assist in that effort.

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APPENDIX 1:

Quadrangle maps within the Bad River Watershed, with ID number.

1.	Long Island	2.	Chequamegon Point
3.	Ashland West	4.	Ashland East
5.	Odanah	6.	Cedar
7.	Drummond NW	8.	Delta
9.	Grand View NW	10.	Mason
11.	Sanborn	12.	Marengo
13.	High Bridge	14.	Gurney
15.	Saxon	16.	Iron Belt
17.	Upper Eau Claire Lake	18.	Marengo Lake
19.	Drummond	20.	Diamond
21.	Grand View	22.	Mineral Lake
23.	Mellen	24.	Mount Whittlesy
25.	Upson	26.	Turntable Creek
27.	Clam Lake	28.	Clam Lake NE
29.	Glidden NW	30.	Glidden NE

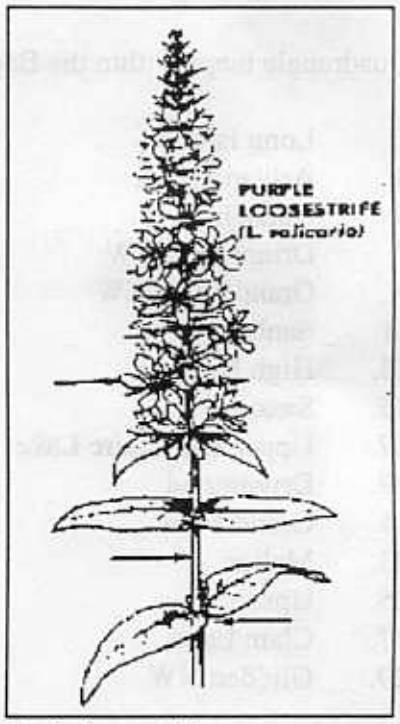
APPENDIX 2:

Contacts associated with the Exotic Plant Survey and their respective organization or affiliation.

Richard Spotts,	The Nature Conservancy
Jim Meeker,	Northland College
Joan Elias,	Private
Emmer Shields,	Ashland County Highway Department
Tom Salzman,	Iron County Forester
Steve Pruse,	Copper Fall State Park
Linda Parker,	US Forest Service
Tom Cogger,	Soil Conservation Service
Lawrence Young,	Bayfield County Highway Department
Robert Massoglia,	Iron County Highway Department
Russel Corbine,	Bad River Hatchery
Eugene Belanger,	Wisconsin Department of Natural Resources

APPENDIX 3

Purple Loosestrife:



Purple Loosestrife

These plants are found in wet, marshy or disturbed areas, such as along road sides and train tracks, or old fields and sloughs. They flower during early July through September. The plants grow to be 2-4 feet tall during flowering season, and have purple flowers with 6 petals. The stems are square and have stalkless, willow-like leaves with smooth edges, found in opposite pairs or threes, at intervals along the stem.


Fireweed

Similar Species: Fireweed and Wild Lupine.

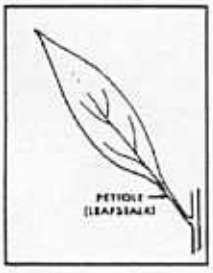
Fireweed:

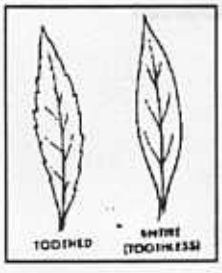
This can be distinguished from Purple loosestrife by noticing that the leaves have stalks, have toothed edges, and are positioned alternately along the stem. In addition, the flowers have only 4 petals. It also will be in bloom from July through September and it is very likely that you will see a lot more or this plant than Purple loosestrife.

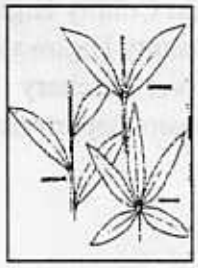
Wild Lupine:

This plant flowers from April through July and is often mistaken for Purple loosestrife. Notice that this plant has leaves that radiate outward from a central point while Purple loosestrife has leaves that extend directly form the stem.


Wild Lupine







Great Lakes Indian Fish and Wildlife Commission Purple Loosestrife Survey Form:

Location:_____

_____

Date:_____

Description: (Flowering, Approx. No. of Plants, Habitat etc.)

_____

_____

_____

****

Location:_____

_____

Date:_____

Description: (Flowering, Approx. No. of Plants, Habitat etc.)

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****

Location:_____

_____

Date:_____

Description: (Flowering, Approx. No. of Plants, Habitat etc.)

_____

_____

_____

****

Location:_____

_____

Date:_____

Description: (Flowering, Approx. No. of Plants, Habitat etc.)

_____

* All Diagrams taken from Petersons Field Guide to Wildflowers Northeastern/Northcentral North America, 1968.

APPENDIX 4

Exotic Plant Survey Data Sheet

Date:_____ Time:_____

County:_____

Quadrangle Map:_____

Location:_____

T:_____ R:_____ S:_____ 1/4:_____ C:_____

Plant Information:
Species:_____

Habitat:

Plant Community:_____

Canopy Type:_____

Notes:_____

Disturbances:_____

Cause:_____

Stage of Development:_____

Total Area Covered:_____

Source of Colonization:_____

Soil Type:_____

Water Depth:_____
Distance from Water:_____
Water Hydrology:_____

Transects:

****

#1:

Class: 1:_____ 2:_____ 3:_____

Population Density:_____/m^2

****

#2:

Class: 1:_____ 2:_____ 3:_____

Population Density:_____/m^2

****

#3:

Class: 1:_____ 2:_____ 3:_____

Population Density:_____/m^2

****

#4:

Class: 1:_____ 2:_____ 3:_____

Population Density:_____/m^2

****

#5:

Class: 1:_____ 2:_____ 3:_____

Population Density:_____/m^2

NOTES:

_____

APPENDIX 5

Purple Loosestrife Survey Results

Long Island Id Number:	Area: (sq.m.)	Density Class 1	Total # Class 1	Density Class 2	Total # Class 2	Density Class 3	Total # Class 3	Total Density	UTM Coordinates X	Y
01-01	1	0.00	0	0.00	0	1.00	1	**1.00**	671160	5167330
01-02	36,000	0.00	0	0.10	3,600	0.00	0	**0.10**	671800	5169880
01-03	50,000	0.00	0	0.10	5,000	0.00	0	**0.10**	671200	5169810
01-04	42,000	0.00	0	0.10	4,200	0.00	0	**0.10**	671820	5170470
01-05	1	0.00	0	0.00	0	1.00	1	**1.00**	671900	5174120
01-06	1	0.00	0	0.00	0	1.00	1	**1.00**	670860	5174990
01-07	1	0.00	0	0.00	0	1.00	1	**1.00**	670380	5175890
Totals	**128,004**	**0.00**	**0**	**0.10**	**12,800**	**0.00**	**4**	**0.10**		

Cheq. Pt. Id Number:	Area: (sq.m.)	Density Class 1	Total # Class 1	Density Class 2	Total # Class 2	Density Class 3	Total # Class 3	Total Density	UTM Coordinates X	Y
02-01	768	0.00	0	0.00	0	0.13	96	**0.13**	677720	5166400
02-02	750	0.00	0	0.00	0	0.17	125	**0.17**	677870	5166610
02-03	8,750	0.00	0	0.17	1,461	0.00	0	**0.17**	678880	5166890
02-04	300	0.00	0	0.00	0	0.25	75	**0.25**	679590	5167290
02-05	273,600	0.20	54,720	0.20	54,720	0.18	47,880	**0.58**	672870	5169620
02-06	42,000	0.40	16,800	0.10	4,200	0.30	12,600	**0.80**	672700	5170210
02-07	48,000	0.40	19,200	0.20	9,600	0.40	19,200	**1.00**	673440	5170180
02-08	12,000	0.00	0	0.10	1,200	0.00	0	**0.10**	672230	5170800
02-09	250	0.00	0	0.00	0	0.10	25	**0.10**	674480	5169700
02-10	1	0.00	0	0.00	0	1.00	1	**1.00**	674990	5169280
02-11	1	0.00	0	0.00	0	1.00	1	**1.00**	675320	5169320
02-12	1	0.00	0	0.00	0	1.00	1	**1.00**	675220	5169210
Totals	**386,421**	**0.23**	**90,720**	**0.18**	**71,181**	**0.21**	**80,004**	**0.63**		

Highway 13 Id Number:	Area: (sq.m.)	Density Class 1	Total # Class 1	Density Class 2	Total # Class 2	Density Class 3	Total # Class 3	Total Density	UTM Coordinates X	Y
04-01	1	0.00	0	1.00	1	0.00	0	**1.00**	663320	5159950
04-02	5,000	1.30	6,500	0.16	800	0.05	250	**1.51**	663510	5159710
04-03	1	0.00	0	0.00	0	1.00	1	**1.00**	663910	5159180
04-04	375	1.00	375	0.00	0	0.00	0	**1.00**	664330	5158430
04-05	1	0.00	0	1.00	1	0.00	0	**1.00**	664450	5158160
04-06	1	0.00	0	1.00	1	0.00	0	**1.00**	664460	5158120
04-07	1	0.00	0	1.00	1	0.00	0	**1.00**	664460	5158060
04-08	1	0.00	0	0.00	0	1.00	1	**1.00**	664530	5155870
04-09	400	0.40	160	0.40	160	0.25	100	**1.05**	665130	5154190
04-10	1	0.00	0	0.00	0	1.00	1	**1.00**	665220	5154020
04-11	1	0.00	0	1.00	1	0.00	0	**1.00**	665320	5154000
04-12	200	0.30	60	0.70	140	0.40	80	**1.40**	665570	5152930
04-13	1	0.00	0	1.00	1	0.00	0	**1.00**	665670	5152510
04-14	1	0.00	0	1.00	1	0.00	0	**1.00**	665700	5151910
Totals	**5,985**	**1.19**	**7,095**	**0.18**	**1,107**	**0.07**	**433**	**1.44**		

Highway 2 Id Number:	Area: (sq.m.)	Density Class 1	Total # Class 1	Density Class 2	Total # Class 2	Density Class 3	Total Class 3	Total # Density	UTM Coordinates X	Y
04-15	20	0.00	0	0.20	4	0.00	0	**0.20**	671510	5163970

APPENDIX 5 (Continued)
Purple Loosestrife Survey Results

Bad River Id Number:	Area: (sq.m.)	Density Class 1	Total # Class 1	Density Class 2	Total # Class 2	Density Class 3	Total # Class 3	Total Density	UTM Coordinates X	UTM Coordinates Y
05-01	1,400	0.62	868	0.25	350	0.00	0	**0.87**	677010	5152320
05-02	1	0.00	0	0.00	0	1.00	1	**1.00**	676980	5152370
05-03	1	0.00	0	1.00	1	0.00	0	**1.00**	676930	5152490
05-04	1	0.00	0	1.00	1	0.00	0	**1.00**	676990	5152670
05-05	2	2.00	4	0.00	0	0.00	0	**2.00**	677040	5152650
05-06	1	0.00	0	1.00	1	0.00	0	**1.00**	677230	5152630
05-07	1	0.00	0	1.00	1	0.00	0	**1.00**	677660	5152950
05-08	1	0.00	0	1.00	1	0.00	0	**1.00**	677670	5152930
05-09	1	0.00	0	1.00	1	0.00	0	**1.00**	677640	5152990
05-10	1	0.00	0	1.00	1	0.00	0	**1.00**	677720	5152950
05-11	1	0.00	0	1.00	1	0.00	0	**1.00**	677750	5152690
05-12	1	0.00	0	1.00	1	0.00	0	**1.00**	677920	5152970
05-13	1,250	0.00	0	0.17	209	0.33	413	**0.50**	677960	5153080
05-14	1	0.00	0	1.00	1	0.00	0	**1.00**	678270	5153200
05-15	1	0.00	0	1.00	1	0.00	0	**1.00**	677860	5153680
05-16	1	0.00	0	1.00	1	0.00	0	**1.00**	677820	5153980
05-17	1	0.00	0	1.00	1	0.00	0	**1.00**	676900	5155240
05-18	1	0.00	0	1.00	1	0.00	0	**1.00**	675550	5155370
05-19	1	0.00	0	1.00	1	0.00	0	**1.00**	677440	5158560
05-20	1	0.00	0	1.00	1	0.00	0	**1.00**	677590	5159360
05-21	1	0.00	0	1.00	1	0.00	0	**1.00**	677400	5159400
05-22	1	0.00	0	1.00	1	0.00	0	**1.00**	677770	5160270
05-23	1	0.00	0	1.00	1	0.00	0	**1.00**	677830	5160590
05-24	1	0.00	0	1.00	1	0.00	0	**1.00**	677740	5160650
05-25	1	0.00	0	1.00	1	0.00	0	**1.00**	677700	5160590
05-26	1	0.00	0	1.00	1	0.00	0	**1.00**	676980	1562970
05-27	1	0.00	0	1.00	1	0.00	0	**1.00**	676460	5163280
05-28	1	0.00	0	0.00	0	1.00	1	**1.00**	676330	5163300
05-29	1	0.00	0	1.00	1	0.00	0	**1.00**	676330	5163390
05-30	1	0.00	0	1.00	1	0.00	0	**1.00**	676330	5163460
05-31	1	0.00	0	1.00	1	0.00	0	**1.00**	676350	5163540
13-27	100	0.20	20	0.00	0	0.00	0	**0.20**	676670	5150560
13-28	1	0.00	0	1.00	1	0.00	0	**1.00**	676610	5150590
13-29	1	0.00	0	1.00	1	0.00	0	**1.00**	676880	5150920
13-30	1	0.00	0	1.00	1	0.00	0	**1.00**	676830	5150910
13-31	1	0.00	0	0.00	0	1.00	1	**1.00**	676980	5150910
13-32	1	0.00	0	1.00	1	0.00	0	**1.00**	677300	5150560
13-33	1	0.00	0	0.00	0	1.00	1	**1.00**	677350	5150060
Totals	**2,786**	**0.32**	**892**	**0.21**	**589**	**0.15**	417	**0.68**		

Highway 13 Id Number:	Area: (sq.m.)	Density Class 1	Total # Class 1	Density Class 2	Total # Class 2	Density Class 3	Total # Class 3	Total Density	UTM Coordinates X	UTM Coordinates Y
12-01	1	0.00	0	0.00	0	1.00	1	**1.00**	665700	5150890
12-02	1	0.00	0	0.00	0	1.00	1	**1.00**	665840	5148180
12-03	50	0.06	3	0.04	2	0.08	4	**0.18**	665810	5147590
12-04	9	0.00	0	0.00	0	0.22	2	**0.22**	665760	5147320
12-05	1	0.00	0	0.00	0	1.00	1	**1.00**	665810	5147270
12-06	1	0.00	0	0.00	0	1.00	1	**1.00**	665870	5147030
12-07	1	0.00	0	0.00	0	1.00	1	**1.00**	665820	5147010
12-08	1	0.00	0	0.00	0	1.00	1	**1.00**	665820	5146830
12-09	36,000	1.30	46,800	0.16	5,760	0.05	1,800	**1.51**	665880	5145920
12-10	1	0.00	0	1.00	1	0.00	0	**1.00**	666810	5145090
12-11	1	0.00	0	0.00	0	1.00	1	**1.00**	667290	5144890
12-12	1	0.00	0	1.00	1	0.00	0	**1.00**	667560	5144090
12-13	1	0.00	0	0.00	0	1.00	1	**1.00**	667810	5142890
12-14	1	0.00	0	1.00	1	0.00	0	**1.00**	668900	5141670
12-15	3,600	1.30	4,680	0.16	576	0.05	180	**1.51**	666780	5139930
12-16	3,600	1.30	4,680	0.16	576	0.05	180	**1.51**	672720	5139630
Totals	**43,270**	**1.30**	**56,163**	**0.16**	**6,917**	**0.05**	2,174	**1.51**		

APPENDIX 5 (Continued)
Purple Loosestrife Survey Results

Marengo River Id Number:	Area: (sq.m.)	Density Class 1	Total # Class 1	Density Class 2	Total # Class 2	Density Class 3	Total # Class 3	Total Density	UTM Coordinates X	UTM Coordinates Y
13-01	1	0.00	0	1.00	1	0.00	0	**1.00**	674510	5142670
13-02	1	0.00	0	1.00	1	0.00	0	**1.00**	674510	5142670
13-03	1	0.00	0	0.00	0	1.00	1	**1.00**	674560	5142680
13-04	1	0.00	0	1.00	1	0.00	0	**1.00**	675020	5142690
13-05	1	0.00	0	1.00	1	0.00	0	**1.00**	675260	5142590
13-06	1	0.00	0	1.00	1	0.00	0	**1.00**	675490	5142500
13-07	1	0.00	0	1.00	1	0.00	0	**1.00**	676080	5142700
13-08	1	0.00	0	0.00	0	1.00	1	**1.00**	676210	5143410
13-09	1	0.00	0	0.00	0	1.00	1	**1.00**	676240	5143410
13-10	1	0.00	0	1.00	1	0.00	0	**1.00**	677040	5144110
13-11	1	0.00	0	0.00	0	1.00	1	**1.00**	677020	5144380
13-12	1	0.00	0	1.00	1	0.00	0	**1.00**	677080	5144510
13-13	1	0.00	0	1.00	1	0.00	0	**1.00**	677210	5144410
13-14	1	0.00	0	1.00	1	0.00	0	**1.00**	677290	5144520
13-15	1	0.00	0	1.00	1	0.00	0	**1.00**	677220	5144560
13-16	1	0.00	0	0.00	0	1.00	1	**1.00**	677190	5144580
13-17	1	0.00	0	1.00	1	0.00	0	**1.00**	677240	5144660
13-18	1	0.00	0	1.00	1	0.00	0	**1.00**	677270	5144710
13-19	1	0.00	0	1.00	1	0.00	0	**1.00**	677360	5144940
13-20	1	0.00	0	1.00	1	0.00	0	**1.00**	677340	5144960
13-21	1	0.00	0	1.00	1	0.00	0	**1.00**	677350	5145180
13-22	1	0.00	0	0.00	0	1.00	1	**1.00**	677280	5145200
13-23	1	0.00	0	0.00	0	1.00	1	**1.00**	677250	5145260
13-24	1	0.00	0	0.00	0	1.00	1	**1.00**	677280	5145320
13-25	1	0.00	0	1.00	1	0.00	0	**1.00**	677310	5145350
13-26	1	0.00	0	1.00	1	0.00	0	**1.00**	677650	5145460
Totals	**26**	**0.00**	**0**	**0.69**	**18**	**0.31**	8	**1.00**		

Silver Creek Id Number:	Area: (sq.m.)	Density Class 1	Total # Class 1	Density Class 2	Total # Class 2	Density Class 3	Total # Class 3	Total Density	UTM Coordinates X	UTM Coordinates Y
13-34	159	0.00	0	0.43	69	0.57	90	**1.00**	674490	5142120
13-35	398	0.00	0	0.46	183	0.54	215	**1.00**	674870	5140490
	557	**0.00**	**0**	**0.45**	**252**	**0.55**	305	**1.00**		

High Bridge Id Number:	Area: (sq.m.)	Density Class 1	Total # Class 1	Density Class 2	Total # Class 2	Density Class 3	Total # Class 3	Total Density	UTM Coordinates X	UTM Coordinates Y
13-36	43,200	1.30	56,160	0.16	6,912	0.05	2,160	**1.51**	675810	5139410
13-37	28,800	1.30	37,440	0.16	4,608	0.05	1,440	**1.51**	676440	5138690
13-38	32,400	1.30	42,120	0.16	5,184	0.05	1,620	**1.51**	675760	5139190
13-39	41,400	1.30	53,820	0.16	6,624	0.05	2,070	**1.51**	675760	5138700
13-40	316,800	6.50	2,059,200	0.60	190,080	0.53	167,904	**7.63**	674700	5139480
13-41	43,200	1.30	56,160	0.16	6,912	0.05	2,160	**1.51**	674460	5138920
13-42	10,800	1.30	14,040	0.16	1,728	0.05	540	**1.51**	674250	5139150
13-43	46,800	1.30	60,840	0.16	7,488	0.05	2,340	**1.51**	674070	5138910
13-44	266,400	1.30	346,320	0.16	42,624	0.05	13,320	**1.51**	673630	5139810
13-45	7,200	1.30	9,360	0.16	1,152	0.05	360	**1.51**	673090	5139640
13-46	28,800	1.30	37,440	0.16	4,608	0.05	1,440	**1.51**	674020	5140420
13-47	32,400	2.10	68,040	0.92	29,808	0.31	10,044	**3.33**	674150	5139660
	898,200	**3.16**	**2,840,940**	**0.34**	**307,728**	**0.23**	205,398	**3.73**		

APPENDIX 6

MARENGO RIVER

Special Features:

(1) **Railroad bridge** (Marengo Quad: T46N, R4W, S36, 1/4NW, NW) with a strong smell of creosote this bridge could be the site of a creosote leeching. The foundation of the bridge looked strong and one of the supports was stamped 1905.

(2) **Wooden walk bridge** (Marengo Quad: T46N, R3W, S30, 1/4SE, SW) made out of two by fours reinforced with metal cables. The bridge is about 4-5 feet above the water so there is a possibility of it snagging trees that float down the river thus causing a jam. It did not look heavily used.

(3) **Wooden walk bridge** (Marengo Quad: T46N, R4W, S32, 1/4NW, SE) constructed in a similar fashion as the first bridge listed above but much newer and sturdier. The bridge is higher off the water than the first one and appeared more heavily used.

(4) The **junction of the Brunsweiler** and the Marengo R. (Marengo Quad: T46N, R4W, S32, 1/4NW, NW). The river was wider here and the substrate changed from sand to a mix of sand and small rock. There appeared to be no change in water quality. The Brunsweiler appeared stagnant at the point of juncture.

(5) The **junction of the Bad River** (High Bridge Quad: T46N, R3W, S25, 1/4SW, NW). The width increased to about 10 meters and there was a line of turbidity but no obvious concerns or threats were noted. There appeared to be no change in water quality.

Comments:

There were a lot of Belted Kingfishers in addition to cedar waxwings, a female hooded merganser, several solitary sandpipers, and a semipalmated sandpiper.

BAD RIVER

Special Features:

(1) The **Potato River junction** (High Bridge Quad: T46N, R3W, S24, 1/4NE, SW). The width increased to 40 - 50 meters after this. No concerns apparent.

(2) **Active train trestle** (High Bridge Quad: T46N, R3W, S25, 1/4NE, NE) could be the site of a derailment but seems sound and sturdy. This section of tracks is mostly straight so chance of derailment may not be great.

(3) **An Active Bridge** (High Bridge Quad: T46N, R3W, S2, 1/4SE, SE) that poses typical dangers such as pollution from the cars and possible contamination from wrecks. It seems sound and sturdy, and is made of stone and metal.

(4) The **Old Bridge Site** (High Bridge Quad: T46N, R3W, S2, 1/4SE, SE) no longer

spans the river and must be very old since it is mostly overgrown with years of vegetation. Poses no danger to the river system.

(5) **Power Lines** (Odanah Quad: T47N, R3W, S36, 1/4NE, NE) look sound and poses no obvious threat except for some disturbance during maintenance.

(6) The two sets of **Pipelines** (#1: Odanah Quad: T47N, R3W, S23, 1/4SE, SW #2: Odanah Quad: T47N, R3W, S23, 1/4NW, SE) pose the largest threat to the river system and the Sloughs. Rupture of the pipes would release a massive amount of gas which could impact the system for many years. The disturbance caused during normal maintenance poses no obvious threat to the river.

(7) **Power Lines** (Odanah Quad: T47N, R3W, S12, 1/4NW, SE) look sound and poses no obvious threat except for some disturbance during maintenance.

WHITE RIVER

Special Features:

(1) The **Pike River Road bridge** (Grandview NW Quad: T46N, R7W, S21, 1/4NE, NE) has a strong smell of creosote.

(2) **Old bridge supports** (Grandview NW Quad: T46N, R7W, S22, 1/4NW, SE), west of the creek coming in from the north. The bridge no longer spans the river. Could possibly cause a problem by jamming up logs.

(3) **Old bridge supports** (Grandview NW Quad: T46N, R7W, S22, 1/4NE, SW), west of the creek coming in from the north. Same concerns as special feature (2).

(4) **Telephone Wires** (Grandview NW Quad: T46N, R7W, S22/23) along the border of sections 22 and 23. Telephone wires crossing the river with a house in the immediate area.

(5) **Abandoned field and farm** (Grandview NW Quad: T46N, R7W, S25, 1/4SW, SW) The field is full of grass and appears to have not been used for many years. The farm house and buildings appear run- down. Seems to pose little danger to river.

(6) **Cow Pasture** (Grandview NW Quad: T46N, R7W, S25, 1/4SW, NE) from which cows have access to river and it appears that they use it often. There are potential threats from siltation and nutrient inflow from these pastures.

(7-12) **Beaver lodges** in the following areas:

1. Grandview NW Quad: T46N, R7W, S30, 1/4SE, SW
2. Grandview NW Quad: T46N, R7W, S31, 1/4NE, SW
3. Grandview NW Quad: T46N, R7W, S31, 1/4SE, SE)
4. Mason Quad: T46N, R6W, S34, 1/4SE, SW
5. Mason Quad: T46N, R6W, S34, 1/4SW, SE
6. Mason Quad: T46N, R6W, S2, 1/4SE, NE

(13) **Concrete bridge** (Mason Quad: T47N, R6W, S36, 1/4SW, SW) that poses the normal bridge dangers.

(14) **Train bridge** (Mason Quad: T47N, R6W, S36, 1/4SW, SW) that may pose a danger

to the river and thus the Sloughs since one small spill or other accident could impact the whole system.

(15) **Highway 13 bridge and the railroad culvert** (Ashland East Quad: T46N, R4W, S26, 1/4SW, SW). Both the bridge and the railroad culvert were structurally sound and appeared to pose no threat except for the possibility of accidents.

(16) **Old railroad bridge** (Ashland East Quad: T47N, R4W, S26, 1/4SW, SE) converted into a snowmobile and ATV trail. Creosote smell was strong. Structurally it appeared sound. Typical potential problems associated with bridges.

(17) **Large White Pines** (Ashland East Quad: T47N, R3W, S19, 1/4SE, NW) Healthy looking, and estimated to be about a foot in diameter and 80 feet tall.

(18) **Snowmobile Trail** (Ashland East Quad: T47N, R3W, S19, 1/4SE, NW) that crosses the river.

(19) **Power lines** (Ashland East Quad: T47N, R3W, S20, 1/4NE, SW) that appeared pretty new. There were no trees directly under the path of the wires and on 15 meters of either side.

(20) **Artificial rock river bank** (Ashland East Quad: T47N, R3W, S20, 1/4 NE, SE 1/4) used to prevent erosion from the pipeline. It is situated directly below the southern pipeline on the north shore of the corner turning directly west.

(21) **Pipe lines** (Ashland East Quad: T47N, R3W, S20, North half) go under the river. The southern one seems newer as there were no trees in the path of the pipeline. The path of the north pipeline contained many trees. Where the south pipeline crosses the river there were four large nets in place to catch debris for the purpose of slowing the water flow and accumulating silt. The pipelines pose a threat to the Bad River Watershed because they carry natural gas which could explode or leak. The pipelines are not visible at any point near the river.

(22) **Power lines** (Odanah Quad: T47N, R3W, S30, 1/4SE, SE) that seem to pose little danger other than disturbance from routine maintenance.

(23) **Great Blue Heron Rookery** (Odanah Quad: T47N, R3W, S3/20, 1/4NE/NW, SE/SW) that is beautiful and eerie. Definite location for protection. There were too many nests to count during our cursory exploration.

(24) **Unmarked power lines** (Odanah Quad: T48N, R3W, S35, 1/4NW, SE) pose little danger to the river system.

(25) **White River/Bad River junction** (Odanah Quad: T48N, R3W, S26, 1/4SE, NW) shows lots of sediment being dumped into the Bad by the White River Water color changes markedly from brownish to a glossy black. Depth increases a lot.

APPENDIX 7: River Conditions

Plant Species:	Bad River:	Marengo River:	White River:
White Pine:	x	x	x
Red Pine:	x		x
Jack Pine:			
Balsam Fir:	x	x	x
Hemlock:		x	
Black Spruce:	x	x	x
Tamarack:			
White Cedar:	x	x	x
Alder:.	x	x	x
Basswood:	x	x	x
Maple:	x	x	x
Oak:		x	x
Birch:	x	x	x
Aspen:	x	x	x
Upland Brush:			
Willow:	x	x	x
Ash:	x	x	x
Box Elder:	x	x	
General:			
Bog:			x
Field:		x	x
Northern Hardwood:	x	x	x
Swamp Conifer:		x	
Marsh:	x	x	x
Agriculture:			
Pasture Land:		x	x
Crop Land:		x	
Unused:		x	
Bank Conditions:			
Average Steepness:	Variable	Average	Variable
Average Erosion:	Variable	Average	Variable
River Corridor:			
Average Width:	15 meters	10 meters	10 meters
Average Depth:	1 meters	1 meter	1 meter
Canopy:	Open	Open	Open
Debris:	Light	Average	Average-Heavy
River Bottom:	Sandy/Clay	Sandy	Sandy
Corridor Conditions:			
Canopy:	Full	Sparse	Full
Understory:	Full	Full	Full