Aquatic Vegetation of

FREMONT LAKE

Sherburne County, MN
DOW #71001600

Surveyed: June 6, 12, 13, 2002 – Donna Perleberg
June 14, 2002 – Donna Perleberg and Ed Feiler
Minnesota Dept. of Natural Resources

Report by: Donna Perleberg
Aquatic Plant Ecologist
MNDNR Ecological Services
1601 Minnesota Dr.
Brainerd, MN 56401
Phone: 218.825.2052
Fax: 218.855.5072
Email: donna.perleberg@dnr.state.mn.us

Introduction

Fremont Lake is located north of the town of Zimmerman in Sherburn County, central Minnesota. The 11,100 acre watershed is primarily open land with about 50% described as cropland or grassland (Figure 1). Fremont Lake is the largest waterbody in the watershed, covering about 484 acres with a maximum depth of 8 feet (MN DNR 1993). The surrounding shoreline is heavily developed with the exception of the wetlands on the north shore (Figure 1). A public access exists on the southeast shore. Fremont Lake is described as having abundant growth of aquatic vegetation and low water clarity, with a Secchi Disc reading of 3.3 feet (MNDNR 1993).

Objectives

The 2002 vegetation survey of Fremont Lake was part of a larger evaluation by the Minnesota Department of Natural Resources (MNDNR) Ecological Services Division to evaluate different lake vegetation survey methods. Fremont Lake was selected because MNDNR Division of Fisheries is currently working with the lake association to develop a comprehensive lake management plan. Survey objectives included:

1) Estimate the maximum depth of rooted vegetation
2) Estimate the percent of the littoral zone occupied by rooted vegetation
3) Record the aquatic plant species that occur in the lake
4) Collect quantitative estimates of species abundance
5) Develop distribution maps for the common species

Data from the 2002 survey can be used to monitor annual changes in the native and exotic plant species composition.

Methods

A Point-Intercept vegetation survey of Fremont Lake was conducted on June 6, 12, 13, and 14, 2001 following the methodology described by Madsen (1999). Sample points were established using a 100 meter by 100 meter grid. This resulted in a total of 194 sample points throughout the lake (Figure 2).

A Trimble GeoExplorer 3 GPS unit was used to navigate the boat to each sample point. One side of the boat was designated as the sampling area. At each site, water depth was recorded using a measured stick. The surveyor recorded any plant taxa within a one meter squared sample site at the pre-designated side of the boat. A double-headed, weighted garden rake, attached to a rope was used to survey vegetation not visible from the surface. When possible, taxa were recorded to the species level. Nomenclature followed Crow and Hellquist (2000). Voucher specimens were collected for selected taxa.

Data were entered into an Excel database spreadsheet and frequency of occurrence was calculated for each species as the number of sites in which a species occurred divided by the total number of sample sites. Sampling points were grouped by water depth and separated into two depth zones for analysis: shore to six feet (102 points), and six to eight feet (92 points).

Results

Rooted vegetation was found to a maximum depth of eight feet and plants were found in 99% of the sample points. Eighteen native plant species were recorded including ten submerged species, two floating-leaved species and six emergent species (Table 1). The submerged exotic, curly-leaf pondweed (Potamogeton crispus) and the emergent exotic, reed canary grass (Phalaris arundinaceae) were also found.

Submerged vegetation occurred throughout the entire basin. Species richness, or the number of taxa, averaged 2.4 species per site and was greater in sites on the eastern and northern ends of the basin (Figure 3).

Curly leaf pondweed and Canada waterweed (Elodea Canadensis) dominated the submerged plant community, occurring in 87 and 82 percent of the sample points, respectively (Table 1). Whitestem pondweed (Potamogeton praelongus) (18% frequency), coontail (Ceratophyllum demersum) (13%), largeleaf pondweed (Potamogeton amplifolius) (11%) and flatstem pondweed (Potamogeton zosteriformis) (10%) were the next most common species (Table 1). All other species were found in less than 10 percent of the sample points (Table 1).

Most species were not restricted by water depth and had similar frequencies in both the shore to six foot zone and the six foot to eight foot zone (Figure 4). Curly leaf pondweed, Canada waterweed, coontail and flatstem reached their maximum abundance in water depths greater than six feet (Figure 4). Most other taxa reached maximum abundance in depths less than six feet.

Distribution maps for the most common taxa shown in Figures 5-8. Curly leaf pondweed (Figure 5) and Canada waterweed (Figure 6) were found throughout the lake. Pondweeds (includes whitestem, largeleaf, flatstem and Illinois) were primarily found in the north half of the lake (Figure 7) and coontail appeared restricted to the eastern part of the lake (Figure 8). Data have been entered into Arcview GIS program and individual species, or groups of species, may be mapped as needed.

Emergent and floating-leaved plant beds were not common in Fremont Lake. A bulrush (Scirpus sp.) stand occurred at the north end of the lake and a mixed stand of bulrush, spikerush (Eleocharis sp.) and sedges (Carex sp.) occurred at the southwest shore (Figure 9). White waterlily (Nymphaea odorata) and yellow waterlily (Nuphar variegata) occurred at several locations around the lake but did not form large stands (Figure 9

Discussion

Fremont Lake is a shallow lake where water clarity is sufficient to allow vegetation growth to the maximum depth. Most submerged aquatic plant species can grow in water depths of six to eight feet and depending on water clarity, many species can also grow to the water surface in these depths. Species such as curly-leaf pondweed and Canada waterweed have a broad tolerance to turbidity and often form dense mats in these depths.

Because curly leaf pondweed reaches its peak growth early in the summer and can tolerate more turbid conditions than many native species, it often dominates shallow lakes where it has invaded. In many Minnesota lakes where curly leaf dominates, few native species occur. However, Fremont Lake has a rather diverse native aquatic plant community, considering the large population of curly leaf. In particular, there are several beds of white-stem pondweed and large-leaf pondweed that are not typically found in curly-leaf dominated lakes. The abundant population of Canada waterweed may help maintain sufficient water clarity in Fremont Lake and may limit early summer algal blooms that compete with native vegetation.

Previous vegetation surveys of Fremont Lake were conducted in August, 1947 (MNDNR 1947), June 1957 (MNDNR 1957), and August 1993 (MNDNR 1993). Survey methods varied and results cannot be directly compared, particularly since much of the data collected during earlier survey are descriptive in nature. Species richness is similar in all surveys and many of the common species were found in all survey years. All surveys noted that emergent vegetation is sparse in Fremont Lake. Some differences in survey results may be due to the months in which surveys were conducted. Curly leaf pondweed was not recorded in 1947 and 1993 surveys and if it was present in those years it may have died back by the time of the August surveys. Bushy pondweed (Najas flexilis), which reaches it's peak growth in mid July to mid August was not recorded during the spring 1947 or spring 2002 surveys but was likely present later in the summer of those years. Other differences may indicate actual changes in the plant population. In 1947, surveyors noted that submerged vegetation covered the entire north end of the lake, whereas by 2002 vegetation was dense throughout the entire lake.

Recommendations

Develop realistic expectations

Fremont Lake residents and recreational lake users should realize that vegetation is naturally abundant in shallow lakes that are not dominated by algae. Efforts to control aquatic vegetation should be targeted at creating boat channels and swimming areas, rather than large-scale attempts to reduce the lakewide abundance of vegetation.

Maintain the existing native plant communities.

The existing native plant communities of Fremont Lake should be maintained and protected. In the absence of native vegetation stands, curly leaf pondweed populations can dominate the nutrient cycle of a lake. On curly-leaf pondweed dominated lakes with limited native plants, the natural mid-summer decline of curly leaf often results in a nutrient increase and subsequent algal

bloom. This cycle may be diminished on Fremont Lake because of the abundant population of Canada waterweed and other natives.

Despite the high abundance of curly leaf, the existing native species are present in sufficient amounts to provide a diversity of habitats. Particularly valuable are the native pondweed beds, the muskgrass beds and the bulrush stand at the northern end of the lake.

- Most Aquatic Plant Management activities require a permit with MNDNR Fisheries. MNDNR staff can provide information on the most appropriate plant control techniques to alleviate nuisance conditions while minimizing the impact to native plant communities.

- Exercise slow-no-wake motorized boat use near shore and avoid motorized boat use in waterlily and bulrush beds.

Improve / restore shoreline buffer zones

Much of Fremont Lake is developed and shorelines have been converted to lawn and/or rip-rapped. There are simple, yet effective steps that each lake resident can take to help increase the emergent shoreline buffer zone. Residential shorelines can include native vegetation areas while still allowing for recreational lake use. In the long-term, residents will find they spend less time managing their lawn and have more time to enjoy the lake. More information can be found in the book "Lakescaping for Wildlife" (Henderson et al. 1999) and in the companion CD-ROM "Restore Your Shore" (MNDNR 2001). Consult MNDNR Fisheries for more information about restoration projects.

- Encourage lake residents to restore a percentage of their shorelines to "natural conditions." Many shoreline areas of Fremont Lake lack vegetation buffer zones and would benefit from vegetation re-establishment.
- Refrain from mowing a one or two foot strip next to the lake. Often, native plants will re-establish in areas that are left un-mowed and will provide an excellent buffer strip to trap nutrients.
- Consult the MNDNR before planting anything below the ordinary high water mark. A MNDNR permit is required for planting aquatic vegetation along the lakeshore to help prevent the unwanted introduction of exotic species and to maintain existing quality native plant communities.

Monitor the lake

By learning more about the native plants in Fremont Lake, lake users can become more aware of the changes that occur in the plant community.

- Annually measure the maximum rooting depth at which plants grow in Fremont Lake. Along with standard Secchi disc readings, lake volunteers can measure the maximum rooting depth in mid to late summer each year. Dramatic changes in the maximum rooting depth can predict other changes that may be occurring in the lake water quality. Maximum rooting depth can be measured using a long-handled rake.

- Monitor for other non-native plants such as Eurasian watermilfoil and purple loosestrife. The MNDNR has information on how to identify common native plants as well as common exotics. Many lake associations have developed monitoring programs where each resident is responsible for monitoring the areas immediately in front of their home. Such activities can be combined with shoreline clean-up programs or similar group activities.

Literature Cited

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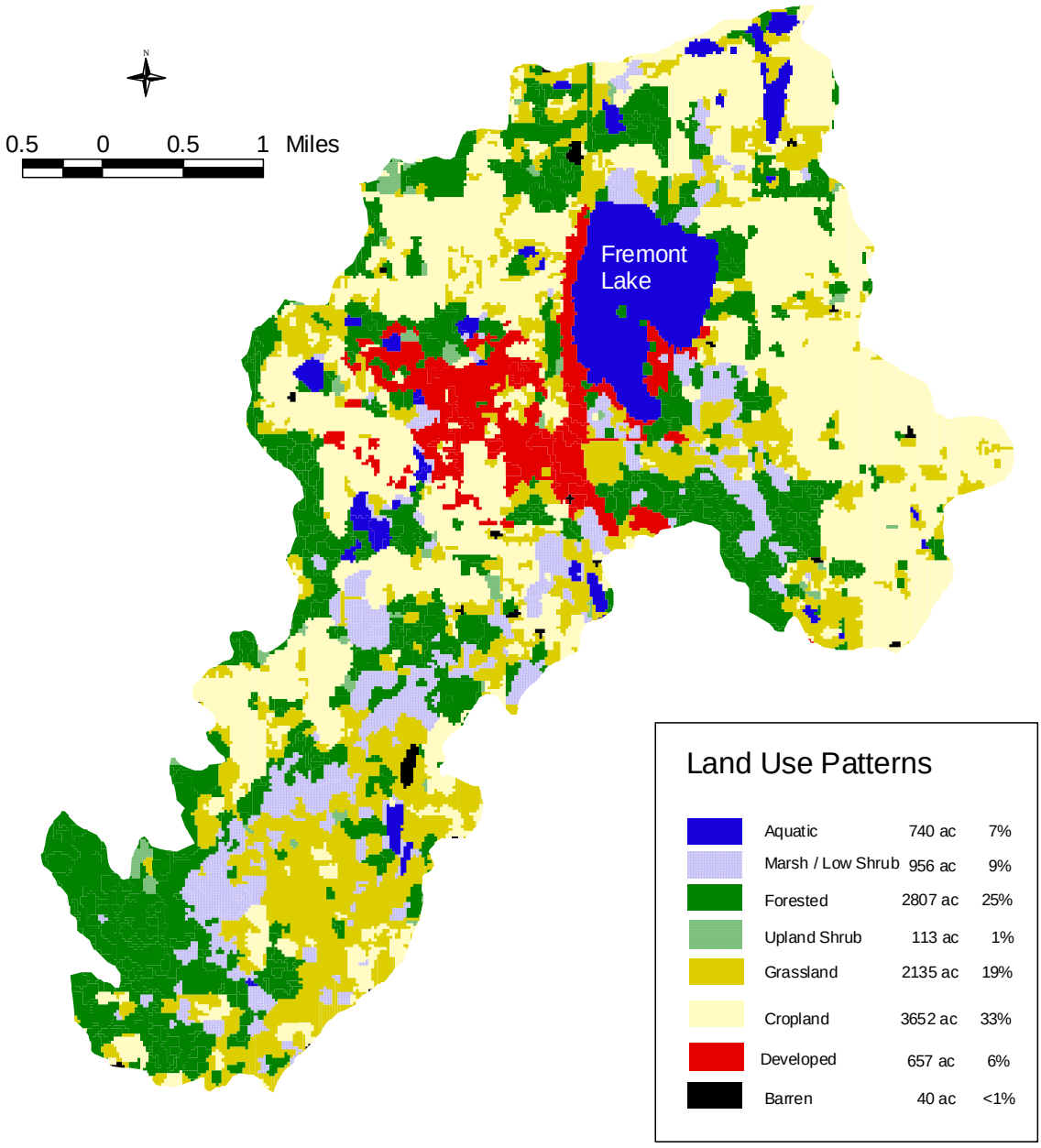
Table 1. Aquatic plant taxa recorded in Fremont Lake (Sherburne Co) 1947-2002
(cf. denotes tentative identification that requires verification from voucher specimens)
A=abundant, C=common, O=occasional, R = rare, P = present

	exotic	Common name	Scientific name	Aug 14 1947	June 21 1957	Aug 4,5 1993	June 6,12-14, 2002	
							FREQ	Depth range (ft)
Submerged	√	Curly leaf pondweed	Potamogeton crispus		A		87	2-8
		Canada waterweed	Elodea canadensis		C	R	82	2-8
		Whitestem pondweed	Potamogeton praelongus				18	3-8
		Coontail	Ceratophyllum demersum	C		R	13	2-8
		Large-leaf pondweed	Potamogeton amplifolius	A	O		11	3-8
		Flatstem pondweed	Potamogeton zosteriformis	A	C	R	10	4-8
		Muskgrass	Chara sp.	C	C	C	9	3-8
		Water stargrass	Zosterella dubia	C		R	6	3-8
		Northern watermilfoil	Myriophyllum sibiricum	A			4	3-8
		Sago pondweed	Stuckenia pectinata	O	C	R	3	1-7
		Illinois pondweed	Potamogeton illinoensis				1	3-4
		Variable pondweed	Potamogeton gramineus		C			
		Clasping-leaf pondweed	Potamogeton richardsonii			R		
		Narrow leaf pondweed	Potamogeton sp.	A		R		
		Bushy pondweed	Najas flexilis	C		R		
		Bladderwort	Utricularia vulgaris			R		
		Water moss		A				
Floating		Lesse duckweed	Lemna minor			R		
		White waterlily	Nymphaea odorata		P	R	1	3
		Yellow waterlily	Nuphar variegata	O	P	R	O	
		Floating-leaf pondweed	Potamogeton natans			R		
		Floating leaf smartweed	Polygonum amphibium	O		R		
Emergent		sedge	Carex sp.			R	O	
		Needlegrass	Eleocharis acicularis				O	
		Spikerush	Eleocharis sp.				O	
	√	Reed canary grass	Phalaris arundinaceae			R	O	
		Arrowhead	Sagittaria sp.			R		
		Three square bulrush	Scirpus cf. pungens				O	
		Hardstem Bulrush	Scirpus cf. acutus	O	P	R	2	2
		Woolgrass	Scirpus cyperinus			R		
		Soft-stem bulrush	Scirpus validus		C	R		
		Broad-leaf cattail	Typha latifolia		C			
		Narrow-leaf cattail	Typha angustifolia			R	O	

Figure 1. Land Use within the Mississippi River - St. Cloud Watershed



information derived from USGS Upper Midwest Gap Analysis Program. Early 1990's Landsat satellite imagery.

Figure 2. 2002 Vegetation sample points.
Fremont Lake, Sherburn Co.

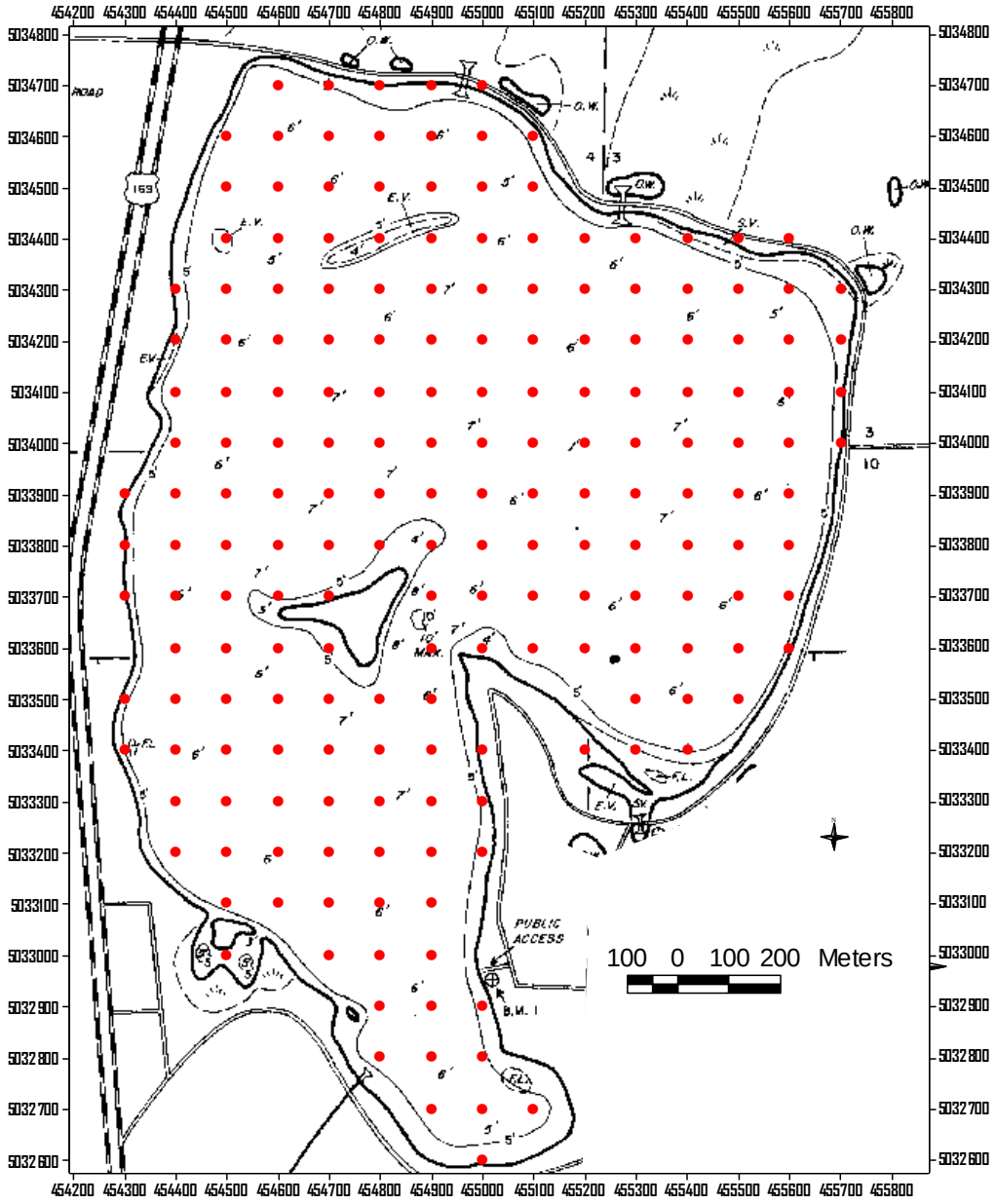


Figure 3. Aquatic plant species richness
Fremont Lake (Sherburne Co) 2002

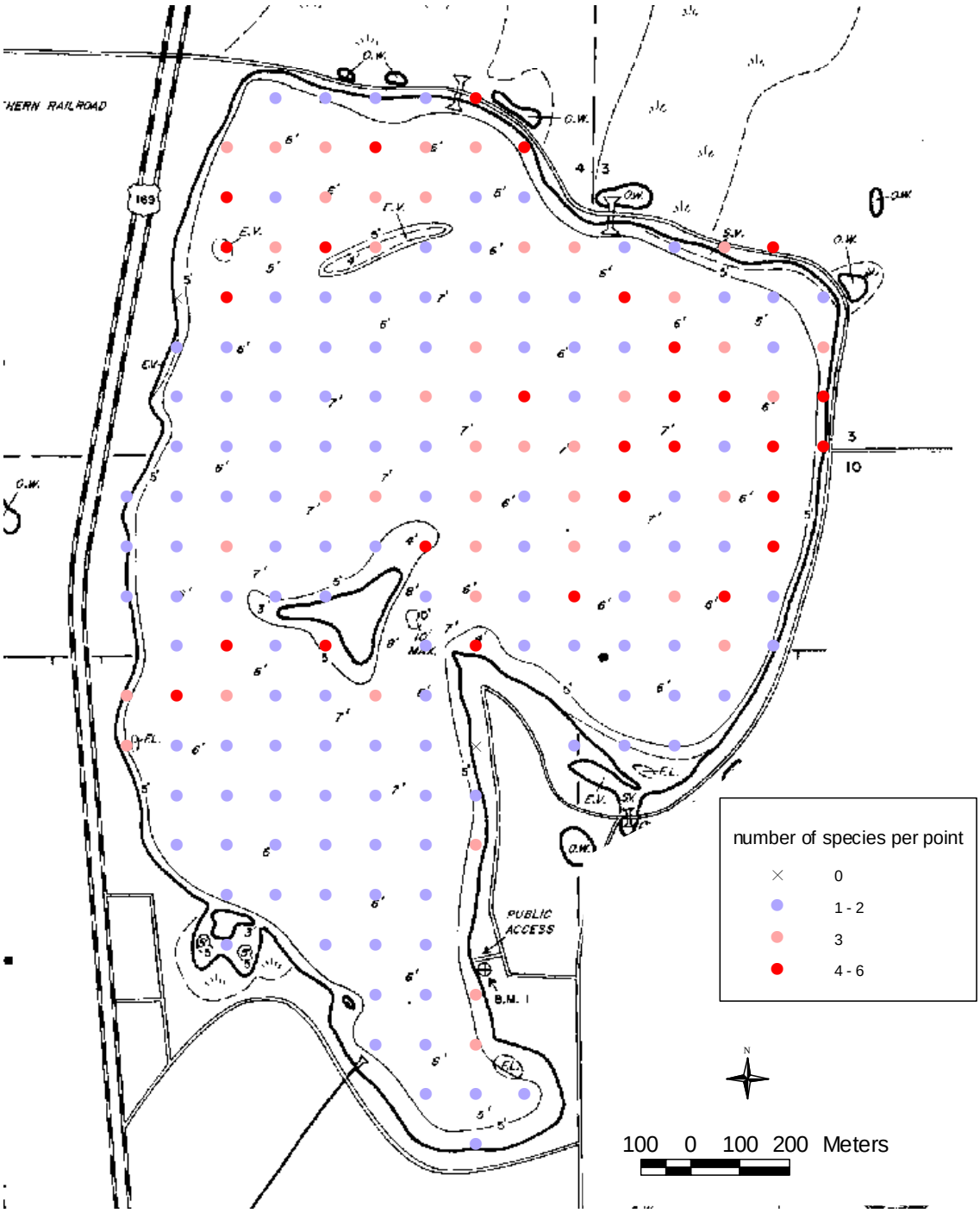


Figure 4. Submerged species composition vs. water depth
Fremont Lake (Sherburne Co) June 2002

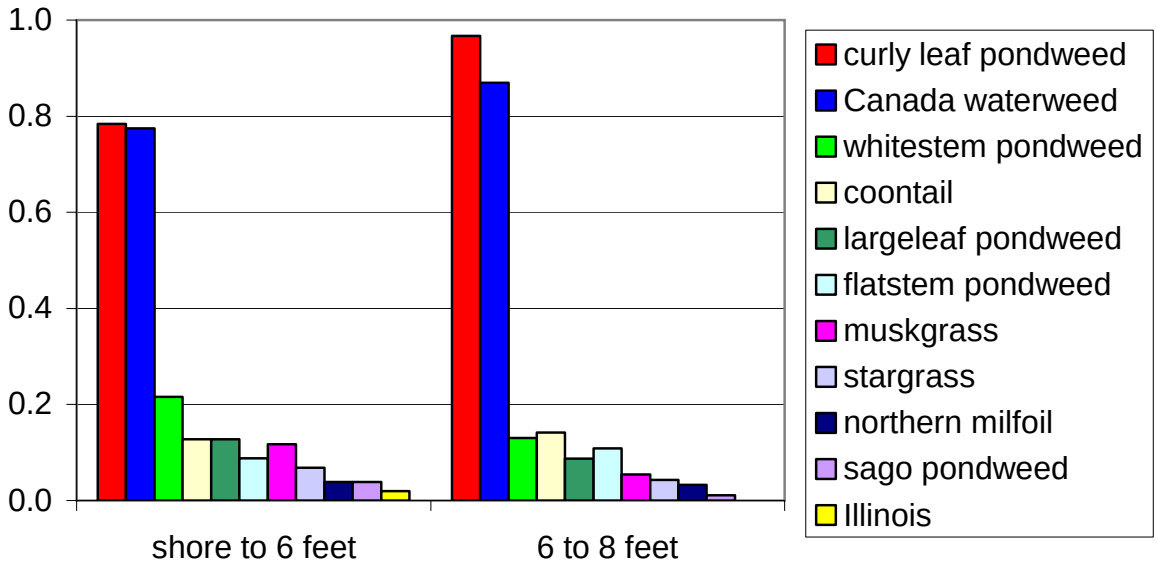
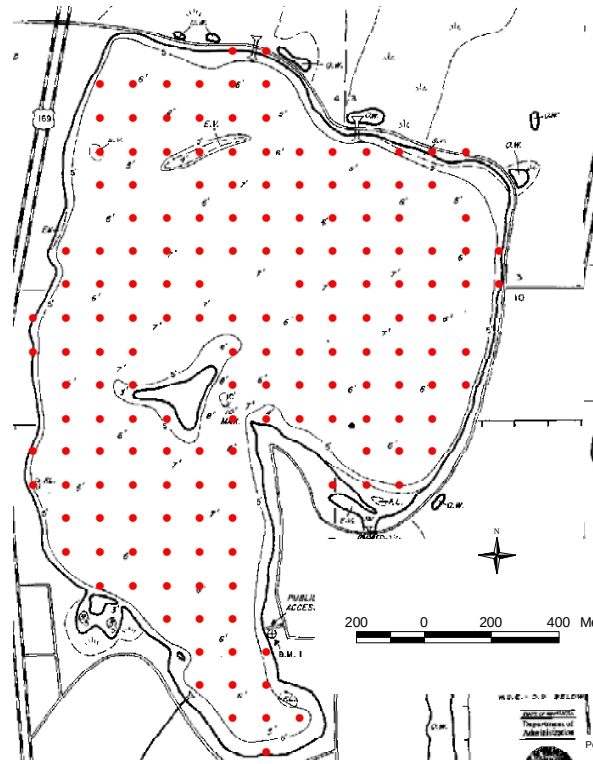


Figure 5. Distribution of Curly leaf pondweed in Fremont Lake, 2002



D. Perleberg, MNDNR Ecol. Services

Figure 6. Distribution of Candad waterweed in Fremont Lake, 2002

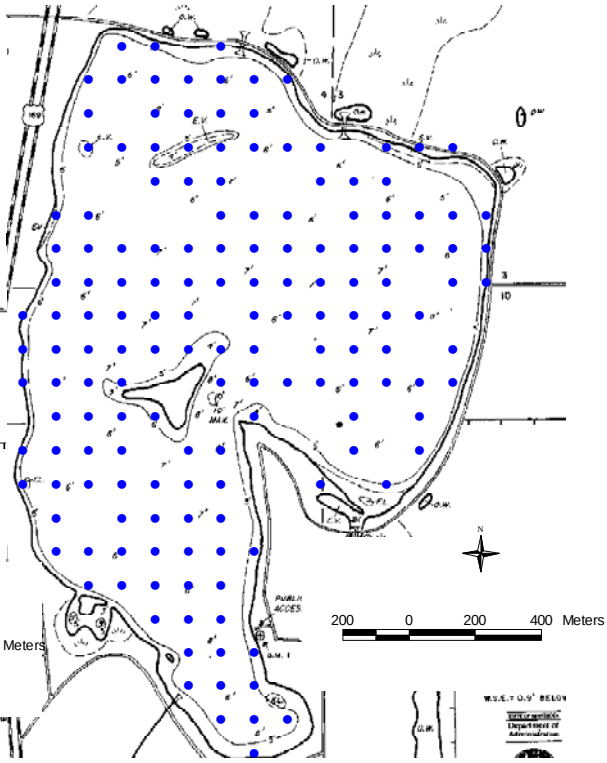


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Figure 7. Distribution of Coontail in Fremont Lake, 2002

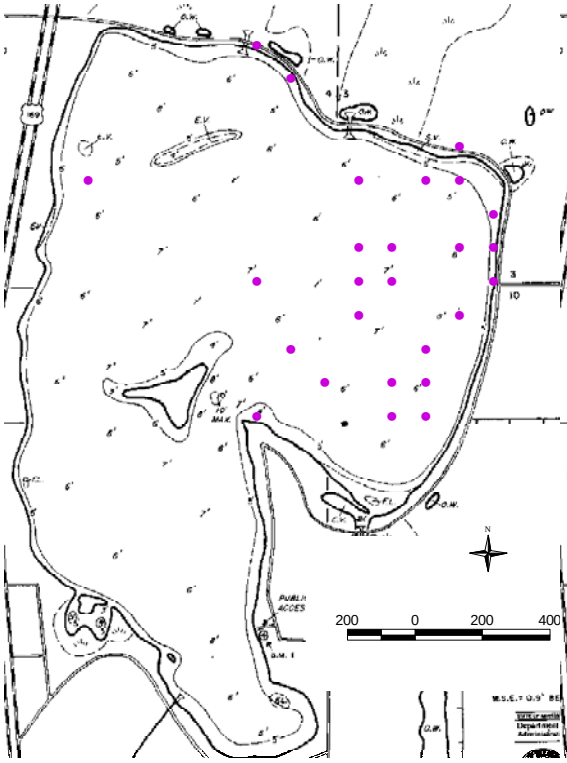

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Figure 8. Distribution of Pondweeds in Fremont Lake, 2002
(whitestem, largeleaf, flatstem, Illinois pondweeds)

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Figure 9. Locations of bulrush and waterlilies.
Fremont Lake (Sherburne Co) 2002