



Northern Watermilfoil in Forest Lake on August 8, 2023

Aquatic Plant Point Intercept Survey for Forest Lake, Washington County, 2023

Point Intercept Aquatic Plant Survey: August 8, 2023

Prepared for:
Comfort Lake/Forest
Lake Watershed District
Forest Lake, Minnesota



Prepared by:
Steve McComas
Jo Stuckert
Connor McComas
Blue Water Science
St. Paul, MN 55116

December 22, 2023

Aquatic Plant Point Intercept Survey for Forest Lake, Washington County, 2023

Summary

An aquatic plant point intercept survey (250 meter spacing between points) was conducted on August 8, 2023 on Forest Lake (2,271 ac) by Blue Water Science to characterize conditions of aquatic plants.

The coverage of native plants is shown in Figure 1 and plants grow out to a water depth of about 15 feet. Plants covered approximately 1,386 acres (61% of the lake). The dominant plant in the August point intercept survey was coontail followed by water celery. In the survey, curlyleaf pondweed was found at 3 sample sites and was found to be growing at a low density. Eurasian watermilfoil (EWM) was first observed in Forest Lake in 2015. EWM was found at 1 site in the point intercept survey. Growth of EWM was been found in the first lake (northern basin). About 8.41 acres of EWM were treated in 2023.

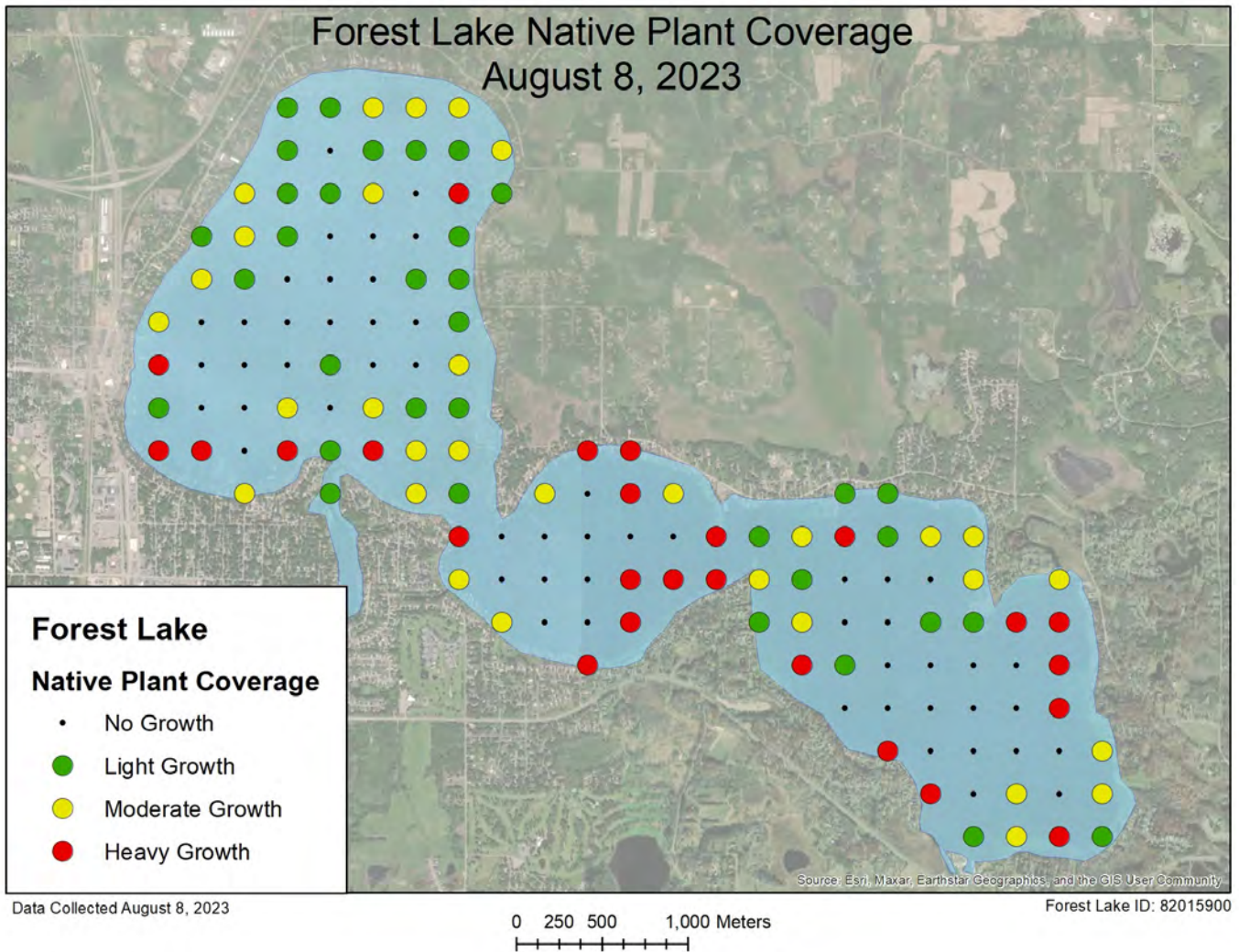


Figure 1. Native aquatic plant coverage of Forest Lake on August 8, 2023.

Key: Green shading = light growth, yellow shading = moderate growth, and red shading = heavy growth.

Forest Lake has a good diversity of aquatic plants, with 18 submerged species, 2 floatingleaf species, and 3 emergent species. Plant occurrence and relative densities are listed in Table 1. In 2023 the most common plant in the lake is coontail followed by water celery.

Table 1. Forest Lake aquatic plant occurrences and densities for the 2013, 2018, and 2023 surveys. Density ratings are 1-3 with 1 being low and 3 being most dense.

	2013 July 11-12 (n=97)(growth to 12 feet)		2018 August 15 (n=101)(growth to 15 feet)		2023 August 8 (102 sites)(growth to 15 feet)	
	% Occurrence	Density	% Occurrence	Density	% Occurrence	Density
Flowering rush (<i>Butomus umbellatus</i>)					1	1.0
Bulrush (<i>Scirpus sp</i>)	7	2.6	3	2.3	2	2.0
Cattails (<i>Typha sp</i>)	1	5.0			1	1.0
Spatterdock (<i>Nuphar variegatum</i>)	2	2.0			3	1.3
White waterlily (<i>Nymphaea sp</i>)	1	2.0	2	1.5	2	1.5
Marsh marigold (<i>Bidens Beckii</i>)	2	1.0	3	1.0		
Coontail (<i>Ceratophyllum demersum</i>)	30	1.5	46	1.1	52	1.4
Chara (<i>Chara sp</i>)	38	2.1	28	1.3	17	1.4
Elodea (<i>Elodea canadensis</i>)	1	1.0	3	1.0	4	1.5
Star duckweed (<i>Lemna trisulca</i>)	4	1.3	2	1.0	2	1.0
Northern watermilfoil (<i>Myriophyllum sibiricum</i>)	21	1.2	17	1.1	36	1.7
Eurasian watermilfoil (<i>M. spicatum</i>)			10	1.0	5	1.4
Naiads (<i>Najas flexilis</i>)	18	1.6	23	1.2	21	1.1
Nitella (<i>Nitella spp</i>)			2	1.0		
Cabbage (<i>Potamogeton amplifolius</i>)					2	1.0
Curlyleaf pondweed (<i>Potamogeton crispus</i>)	22	1.0	4	1.3	3	1.0
Fries pondweed (<i>P. friesii</i>)					1	1.0
Variable pondweed (<i>P. gramineus</i>)			1	1.0		
Illinois pondweed (<i>P. illinoensis</i>)			6	1.3	6	1.0
Whitestem pondweed (<i>P. praelongus</i>)	6	1.0	2	1.0	8	1.0
Claspingleaf pondweed (<i>P. Richardsonii</i>)	10	1.4	11	1.0	4	1.0
Stringy pondweed (<i>P. sp</i>)	8	1.6			13	1.0
Flatstem pondweed (<i>P. zosteriformis</i>)	4	1.3			27	1.2
Buttercup (<i>Ranunculus sp</i>)	1	1.0				
Sago pondweed (<i>Stuckenia pectinata</i>)	1	1.0	2	1.0	1	1.0
Water celery (<i>Vallisneria americana</i>)	21	1.3	41	1.8	42	1.8
Horned pondweed (<i>Zannichellia palustris</i>)	19	1.5				
Water stargrass (<i>Zosterella dubia</i>)	4	1.0	22	1.5	37	1.3
Number of submerged species	17		17		18	

2023 Aquatic Plant Maps for Selected Species

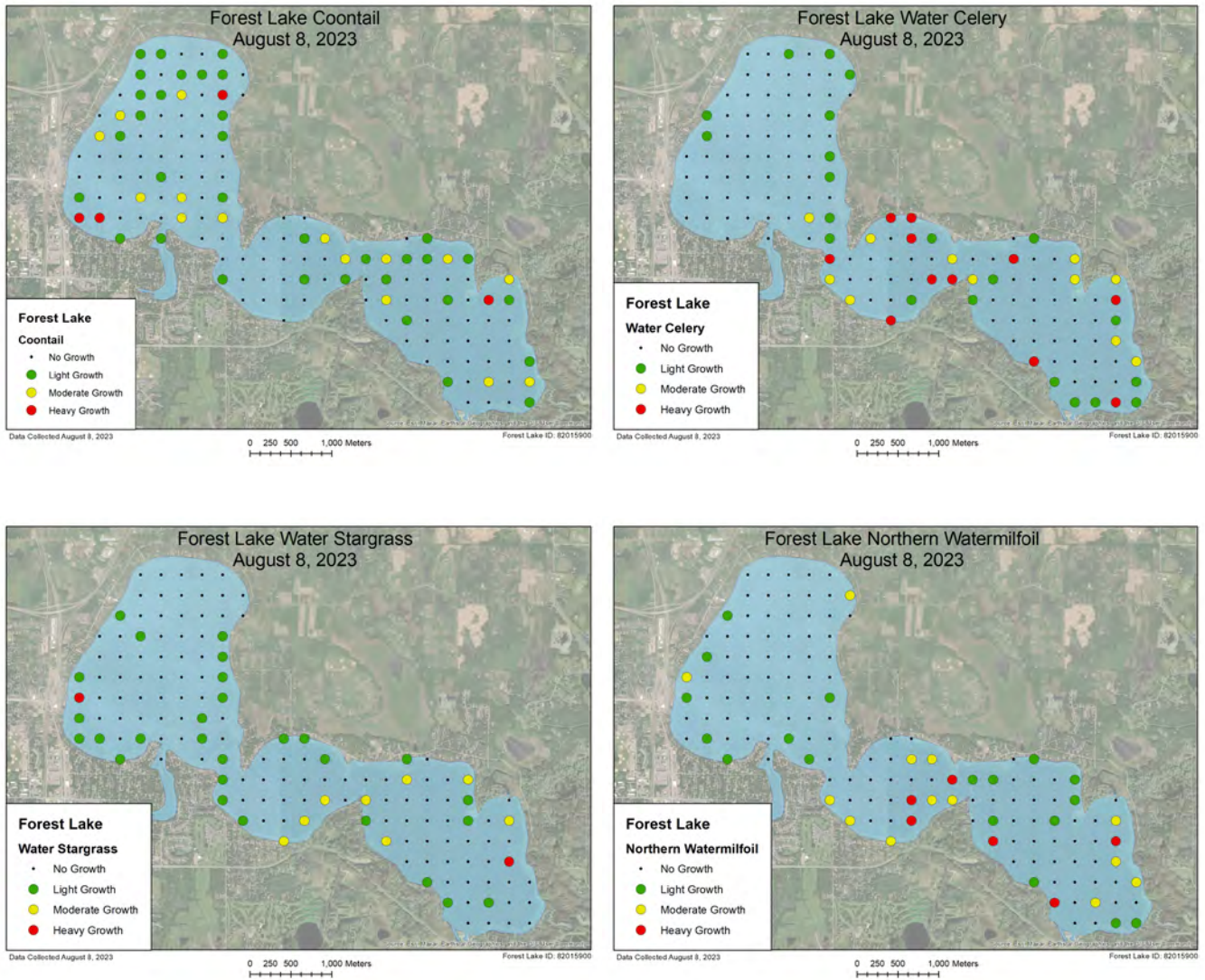


Figure 2. Coontail, water celery, water stargrass, and northern watermilfoil were the most common native submerged plants in 2023.

Aquatic Plant Point Intercept Survey for Forest Lake, Washington County, 2023

ID: 82015900

County: Washington

Area: 2270.94 acres

Littoral Area: 1,531 acres

Shore length: 15.71 miles

Maximum depth: 37 feet

Introduction

An aquatic plant point intercept survey was conducted on August 8, 2023 on Forest Lake. Results of this survey were also compared to a point intercept survey conducted by the MnDNR in 2009 and point intercept surveys conducted in 2013 and 2018 by Blue Water Science.



Figure 3. Contour map of Forest Lake (source: MnDNR).

Methods

A point intercept aquatic plant survey of Forest Lake was conducted by Blue Water Science on August 8, 2023, and 102 points were sampled out to 15 feet of water depth (Figure 4). The deepest depth of plant colonization in Forest Lake was out to 15 feet. Sample points were placed 250 meters apart on a grid that covered the lake. This is the same spacing used by the MnDNR in 2009 and by Blue Water Science in 2013 and 2018. Each sample point was equal to 15.4 acres of the lake area. At each sample point, a sampling rake was lowered into the water and a plant sample was taken. The plant species were recorded and the density of each species was assigned. Densities were based on the coverage on the teeth of the rake. Density ratings were from 1 to 3 with 1 being sparse and 3 being heavy growth. Based on these sample results, plant distribution maps were constructed.

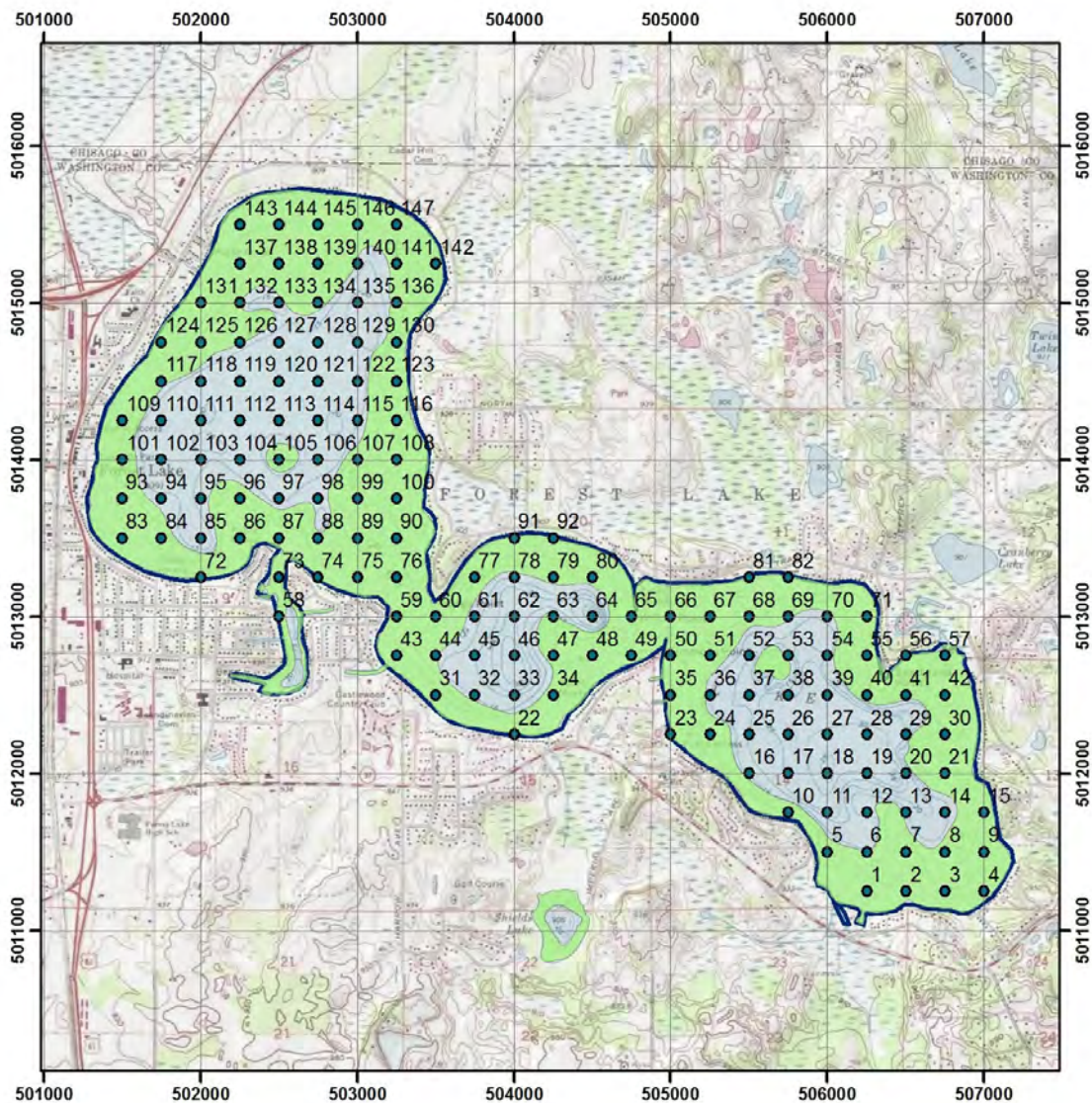


Figure 4. Sample location map for the aquatic plant surveys conducted on Forest Lake. Green shading represents the littoral zone of Forest Lake.

Forest Lake Point Intercept Survey Statistics

A summary of plant statistics from the August 8, 2023 point intercept survey is shown in Tables 2 and 3 and Figure 3. A total of 102 points were sampled in the growing zone, from 0 to 15 feet. Plants were common in depths up to 15 feet and no plants were observed growing deeper than 15 feet (Figure 5).

Table 2. Forest Lake plant survey statistics (using the MnDNR template).

Total # Points Sampled	120
Depth Range of Rooted Veg	0.5-15 feet
Maximum Depth of Growth (95%) in feet	11
# Points in Max Depth Range	87
# Points in Littoral Zone (0-15 feet)	102
% Points w/ Submersed Native Taxa	87
Mean Submersed Native Taxa/Point	2.7
# Submersed Native Taxa	16
# Submersed Invasive Taxa	2
Max Depth of *MYS in feet	12
% Frequency of *MYS	5
Mode Rake Abundance of *MYS	1
Max Depth of *PC in feet	10
% Frequency of *PC	3
Mode Rake Abundance of *PC	1

Table 3. Forest Lake aquatic plants sampled by depth.

Depth (feet)	Number of Points Sampled	Percent of Sampling Points with Submersed Species Observed
0	1	100%
1	0	0%
2	7	86%
3	9	100%
4	13	100%
5	12	100%
6	8	100%
7	6	100%
8	9	89%
9	5	100%
10	9	100%
11	8	100%
12	5	20%
13	1	100%
14	1	0%
15	8	25%
16	9	0%
17	4	0%
18	0	0%
19	1	0%
20	2	0%
All sites	118	

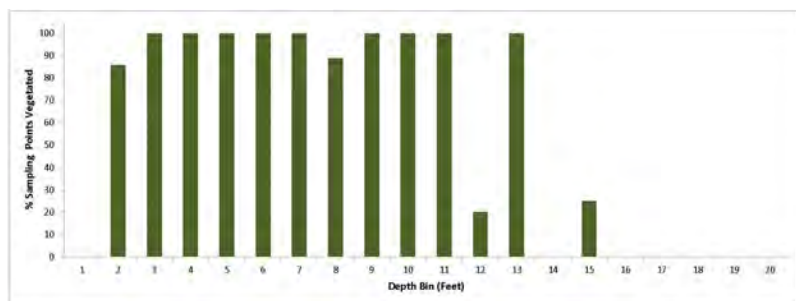


Figure 5. Depth of plant colonization (in feet).

Forest Lake has a good diversity of aquatic plants, with 18 submerged species (includes curlyleaf pondweed and Eurasian watermilfoil), 2 water lily species, and 3 emergent species. A summary of plant occurrence and relative densities is listed in Table 4. The most common plant in the lake was coontail followed by water celery. Northern watermilfoil and water stargrass were common. Aquatic plants covered about 1,386 acres or 61% of the 2,271 acre lake.

Table 4. Forest Lake aquatic plant occurrences and densities for the August 8, 2023 survey. Density ratings are 1-3 with 1 being low and 3 being most dense. Plants grew to a depth of 15 feet.

	2023 August 8 (102 sites)		
	Occur	% Occur	Density
Flowering rush (<i>Butomus umbellatus</i>)	1	1	1.0
Bulrush (<i>Scirpus sp</i>)	2	2	2.0
Cattails (<i>Typha sp</i>)	1	1	1.0
Spatterdock (<i>Nuphar variegatum</i>)	3	3	1.3
White waterlily (<i>Nymphaea sp</i>)	2	2	1.5
Coontail (<i>Ceratophyllum demersum</i>)	53	52	1.4
Chara (<i>Chara sp</i>)	17	17	1.4
Elodea (<i>Elodea canadensis</i>)	4	4	1.5
Star duckweed (<i>Lemna trisulca</i>)	2	2	1.0
Northern watermilfoil (<i>Myriophyllum sibiricum</i>)	37	36	1.7
Eurasian watermilfoil (<i>M. spicatum</i>)	5	5	1.4
Naiads (<i>Najas flexilis</i>)	21	21	1.1
Cabbage (<i>Potamogeton amplifolius</i>)	2	2	1.0
Curlyleaf pondweed (<i>Potamogeton crispus</i>)	3	3	1.0
Fries pondweed (<i>P. friesii</i>)	1	1	1.0
Illinois pondweed (<i>P. illinoensis</i>)	6	6	1.0
Whitestem pondweed (<i>P. praelongus</i>)	8	8	1.0
Claspingleaf pondweed (<i>P. Richardsonii</i>)	4	4	1.0
Stringy pondweed (<i>P. sp</i>)	13	13	1.0
Flatstem pondweed (<i>P. zosteriformis</i>)	28	27	1.2
Sago pondweed (<i>Stuckenia pectinata</i>)	1	1	1.0
Water celery (<i>Vallisneria americana</i>)	43	42	1.8
Water stargrass (<i>Zosterella dubia</i>)	38	37	1.3
Number of submerged species		18	

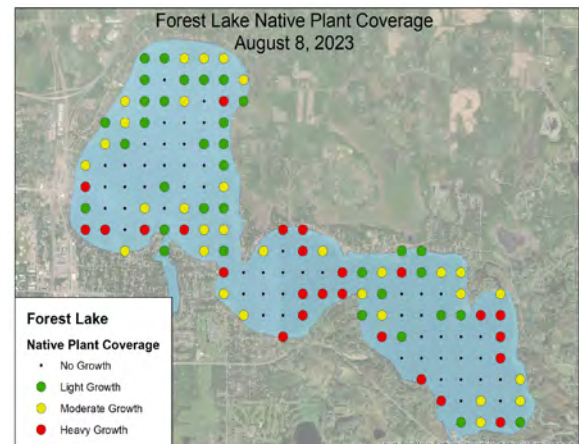
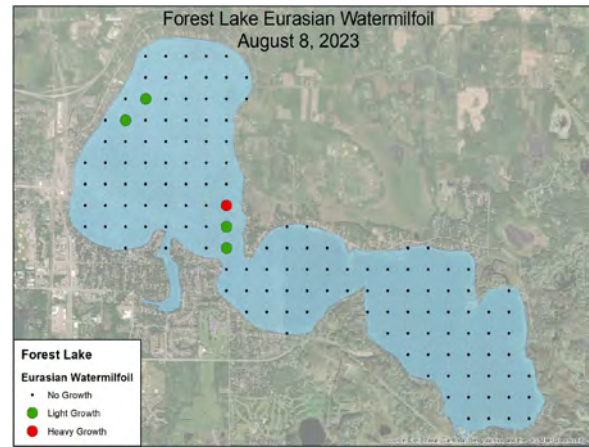
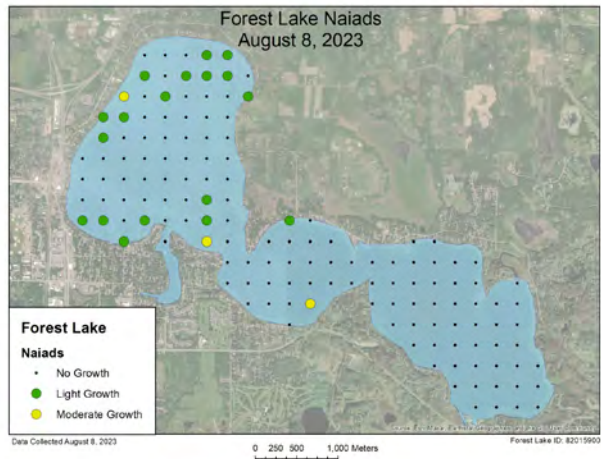
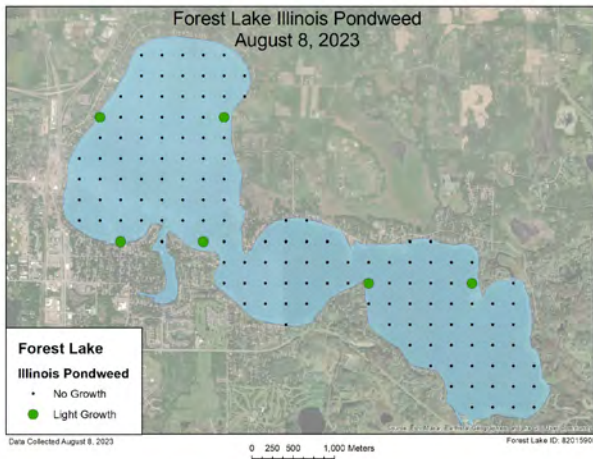
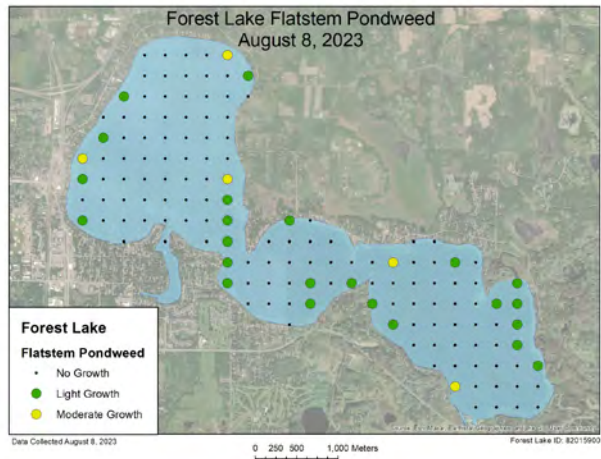
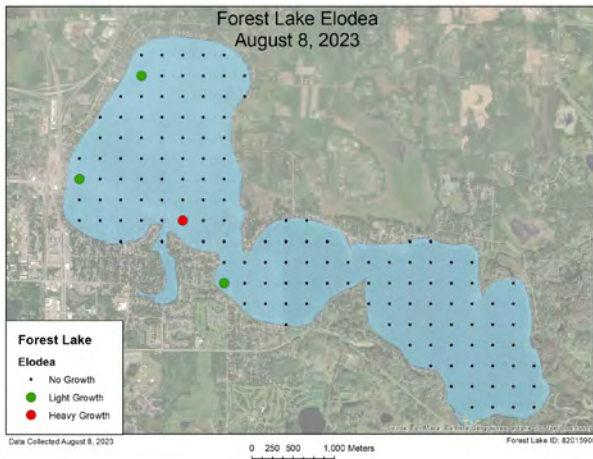
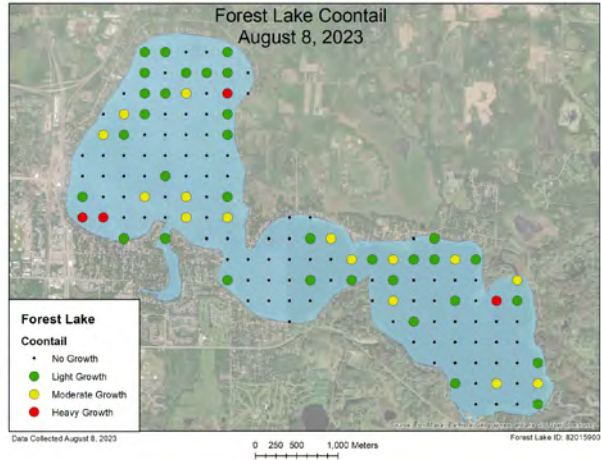
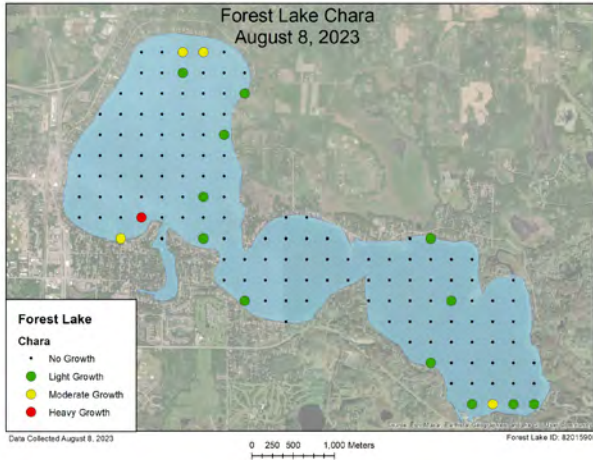
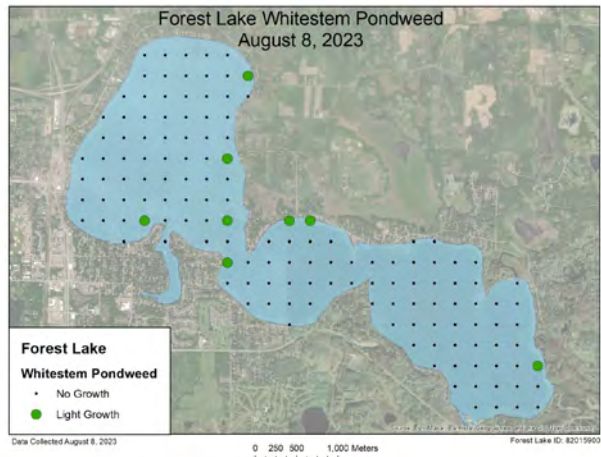
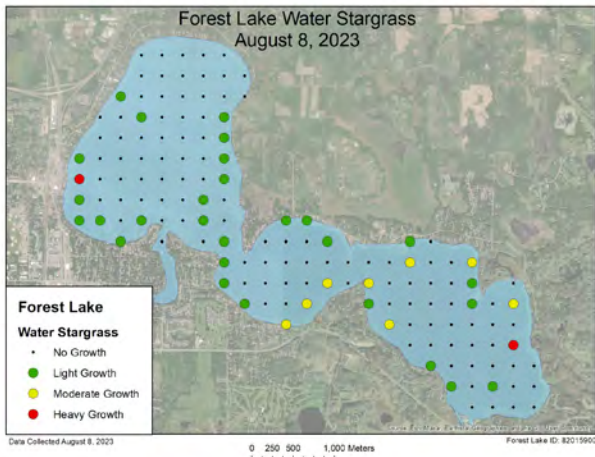
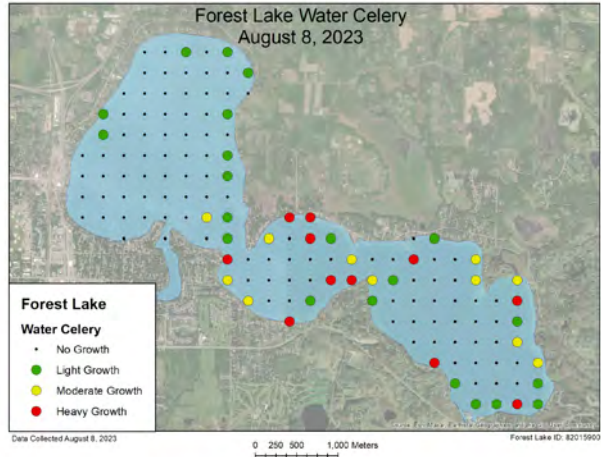
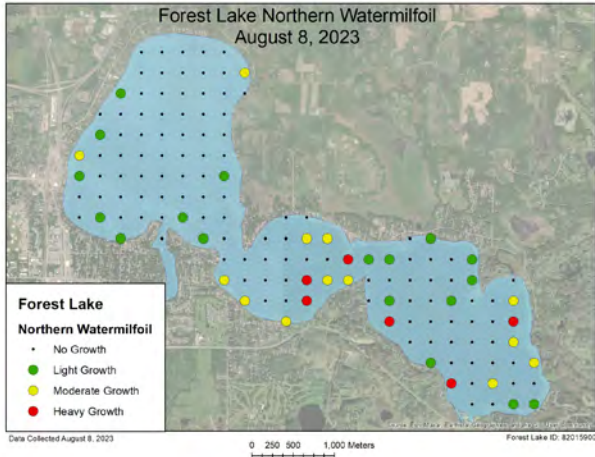


Figure 6. EWM (top) and native plants (bottom) density and distribution for the August 8, 2023 point-intercept survey. Key: green shading = light growth, yellow shading = moderate growth, and red shading = heavy growth.

Aquatic Plant Maps of Forest Lake from the August 8, 2023 Plant Survey





2009, 2013, 2018, and 2023 Point Intercept Surveys: Results of an aquatic plant point-intercept survey on June 22, 2009 by the MnDNR, along with point intercept surveys on July 11-12, 2013, on August 15, 2018, and on August 8, 2023 conducted by Blue Water Science are shown in Table 5.

A few changes may have occurred from 2009 to 2023. It appears coontail, naiads, water celery, and water stargrass increased in distribution from 2009 to 2023. On the other hand, it appears chara and horned pondweed may have decreased from 2009 to 2023. Several other species appear to have remained about the same.

Eurasian watermilfoil was first observed in Forest Lake in 2015 and has been treated since then in first and second lakes. Based on 2023 survey results, EWM does not appear to be rapidly spreading into third lake.

The aquatic plant community has changed over the last 15 years. Heavy growth seems to have increased for several plant species which may be due to lower lake levels and improved water clarity from filtering activities of zebra mussels.



Figure 7. Coontail has been the dominant plant in 2018 and 2023 point intercept surveys.

Table 5. Forest Lake aquatic plant occurrences for the 2013, 2018, and 2023 surveys.

	2009 June 22 (n=97) (MnDNR)	2013 July 11-12 (n=97) (growth to 12 feet) (Blue Water Science)	2018 August 15 (n=101) (growth to 15 feet) (Blue Water Science)	2023 August 8 (102 sites) (growth to 15 ft) (Blue Water Science)
	% Occurrence	% Occurrence	% Occurrence	% Occurrence
Flowering rush (<i>Butomus umbellatus</i>)				1
Bulrush (<i>Scirpus sp</i>)	present	7	3	2
Cattails (<i>Typha sp</i>)		1		1
Duckweed (<i>Lemna sp</i>)	1			
Spatterdock (<i>Nuphar variegatum</i>)	2	2		3
White waterlily (<i>Nymphaea sp</i>)	3	1	2	2
Marsh marigold (<i>Bidens Beckii</i>)	8	2	3	
Coontail (<i>Ceratophyllum demersum</i>)	13	30	46	52
Hornwort (<i>Ceratophyllum sp</i>)	4			
Chara (<i>Chara sp</i>)	36	38	28	17
Elodea (<i>Elodea canadensis</i>)	2	1	3	4
Star duckweed (<i>Lemna trisulca</i>)	3	4	2	2
Northern watermilfoil (<i>Myriophyllum sibiricum</i>)	27	21	17	36
Eurasian watermilfoil (<i>M. spicatum</i>)			10	5
Naiads (<i>Najas flexilis</i>)	5	18	23	21
Nitella (<i>Nitella spp</i>)	5		2	
Cabbage (<i>Potamogeton amplifolius</i>)	4			2
Curlyleaf pondweed (<i>Potamogeton crispus</i>)	54	22	4	3
Fries pondweed (<i>P. friesii</i>)				1
Variable pondweed (<i>P. diversifolius</i>)	2			
Variable pondweed (<i>P. gramineus</i>)			1	
Illinois pondweed (<i>P. illinoensis</i>)	5		6	6
Whitestem pondweed (<i>P. praelongus</i>)	4	6	2	8
Claspingleaf pondweed (<i>P. Richardsonii</i>)	8	10	11	4
Stringy pondweed (<i>P. sp</i>)	2	8		13
Flatstem pondweed (<i>P. zosteriformis</i>)	20	4		27
Buttercup (<i>Ranunculus sp</i>)	4	1		
Sago pondweed (<i>Stuckenia pectinata</i>)		1	2	1
Water celery (<i>Vallisneria americana</i>)	17	21	41	42
Horned pondweed (<i>Zannichellia palustris</i>)	38	19		
Water stargrass (<i>Zosterella dubia</i>) (<i>Heteranthera dubia</i>)	3	4	22	37
Number of submerged species	21	17	17	18

Flowering Rush: Flowering rush is a non-native aquatic plant with mostly emergent growth, but has a submerged form as well. Flowering rush is established in Forest Lake and is the only known lake that has viable flowering rush seeds. During the point intercept survey flowering rush showed up on one sample site location. The distribution of flowering rush on August 8, 2023 is shown in Figure 8.

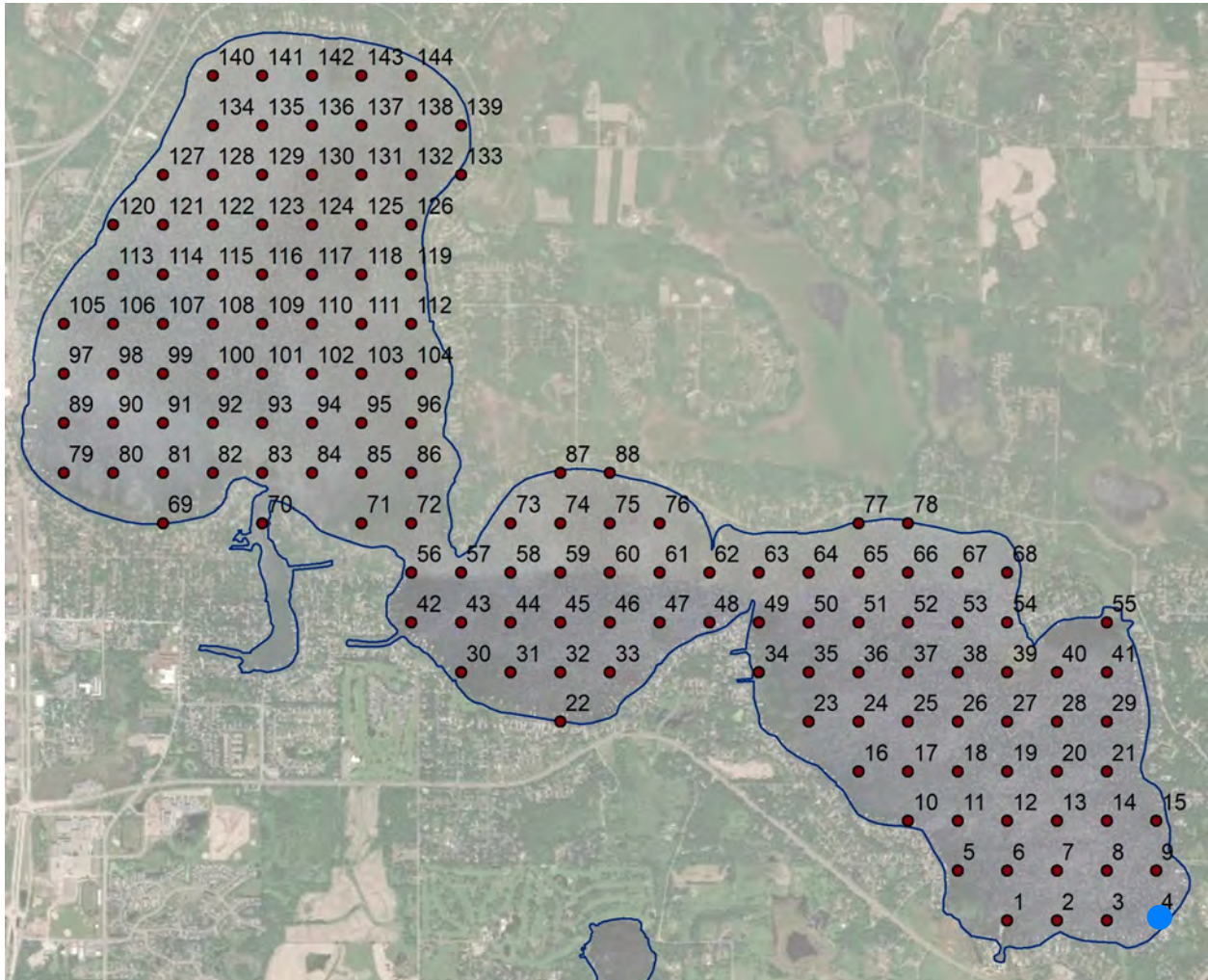


Figure 8. Location of flowering rush in Forest Lake sampled during the point intercept survey on August 8, 2023.

Zebra Mussels: Zebra mussels were first observed in Forest Lake in 2015. Because hard substrate needed for zebra mussel attachment is scarce in Forest Lake, zebra mussels will attach to aquatic plant surfaces. The occurrence of attached zebra mussels to aquatic plants was recorded during the point intercept survey. Zebra mussel distribution is shown in Figure 9. Zebra mussels are distributed throughout all three lakes basins. This map serves as a benchmark for future plant surveys to evaluate if zebra mussels are increasing or decreasing in Forest Lake.

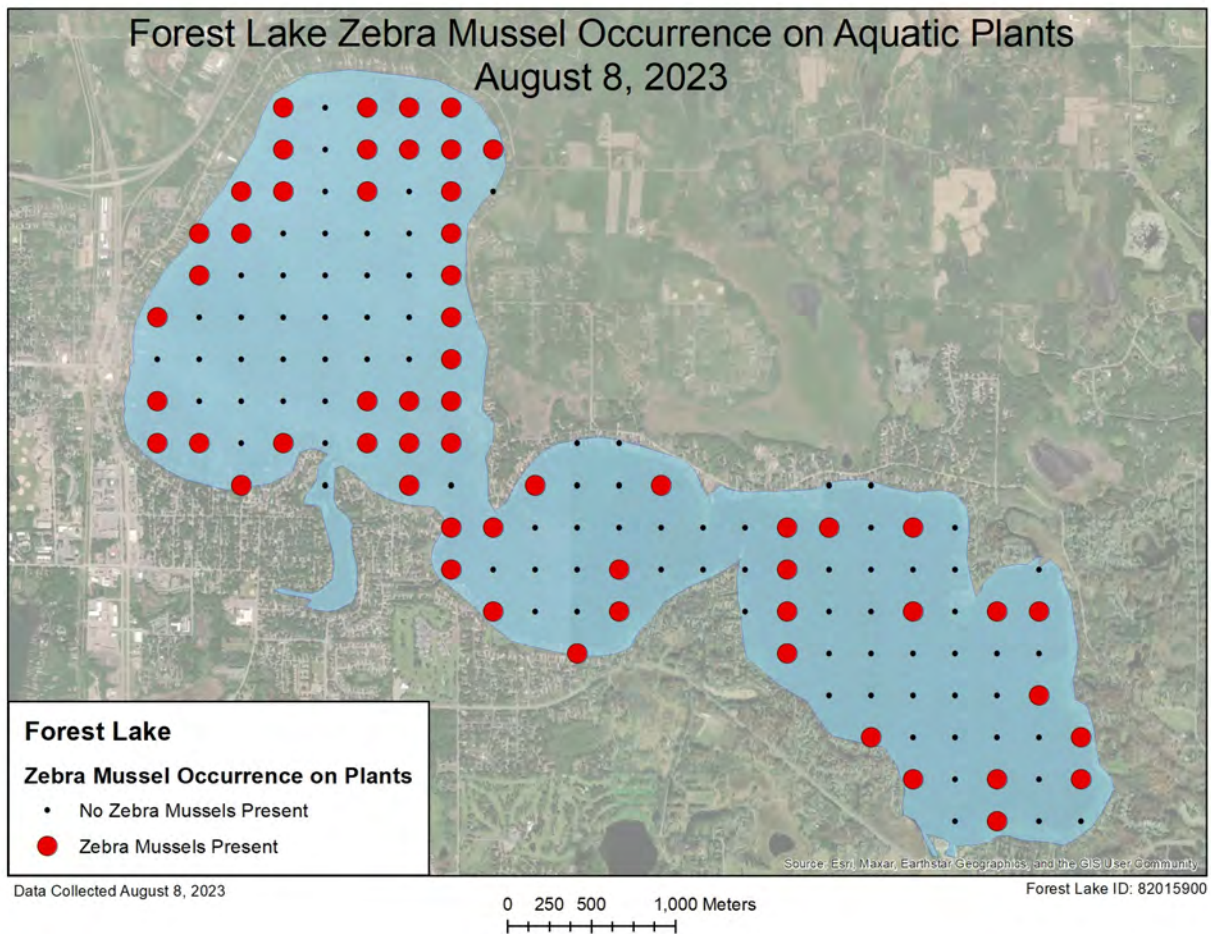


Figure 9. Location of zebra mussels on aquatic plants in Forest Lake sampled during the point intercept survey on August 8, 2023.

Aquatic plant occurrence and density for individual sample points in Forest Lake, August 8, 2023.

Site	Depth (ft)	Bul-rush	Cat-tails	Flower-ing rush	Spatter-dock	White-lilies	Cab-bage	Chara	Clasp-ingleaf	Coon-tail	CLP	Elodea	EWM	Flat-stem	Fries	Illinois	Naiad	NWM	Sago	Star-duck-weed	Stringy	Water-celery	Water-star-grass	White-stem	ZM on plants	
83	2	3				1																				
84	11									2		3						1								1
85	5																1					2	1			1
86	8									2			1	1								1			1	1
87	4													1			1					3	1	1		1
88	4																					3	1	1		
89	9									1													1			1
90	15																									
92	10									2																
93	17																									
94	10									2																1
95	4							1									1							1		1
96	8									1			3	1					1							1
97	7											1		1					1							
100	17													1									3			
101	15									1																
102	16																									
103	15																									
104	6																					1	1			1
105	5													2								1		1		1
106	16																									
112	6																						1	1	1	1
113	8								1	2				1			1	1			1	1				1
114	10									1																
115	16																									
118	15																				1					
119	5							1		1														1		1
120	2															1	1					1				1
121	11									2			1				1					1				1
122	11									1												1		1		
126	4									1						1						1	1		1	1
127	4													1			2	1					1			1
128	12									1			1													1
129	10									1							1									
130	10									2																1
131	16																									
132	11									3																1
133	3							1									1									
134	10									1		1					1									1
135	16																									
136	5							1		1							1									1
137	13									1							1					1				1
138	9									1	1						1					1				1
139	4						1							1					2				1		1	1
140	7								1	1	1											1			1	1
141	9									1																
142	4							2															1			1
143	3							2									1									1
144	6									1							1						1			1
Average		2.0	1.0	1.0	1.3	1.5	1.0	1.4	1.0	1.4	1.0	1.5	1.4	1.2	1.0	1.0	1.1	1.7	1.0	1.0	1.0	1.8	1.3	1.0		
Occur out to 15 ft (102 sites)		2	1	1	3	2	2	17	4	53	3	4	5	28	1	6	21	37	1	2	13	43	38	8		58
% occur		2	1	1	3	2	2	17	4	52	3	4	5	27	1	6	21	36	1	2	13	42	37	8		