Bone Lake 2018 CLP Evaluation

There was a planned herbicide treatment for Bone Lake in spring 2018. The pretreatment survey was conducted and all beds were delineated and permitted. However, the late spring made timing difficult. There was never a day that occurred within the water temperature guidelines that met required conditions. As a result, it was decided to cease treatment.

In order to evaluate the results of no treatment, the planned beds were surveyed for CLP. The untreated areas of CLP were also mapped, which is done annually. This report summaries the evaluation of the CLP in Bone Lake with no herbicide application occurring. This will also provide data/information to help evaluate any treatment that may occur in the future.

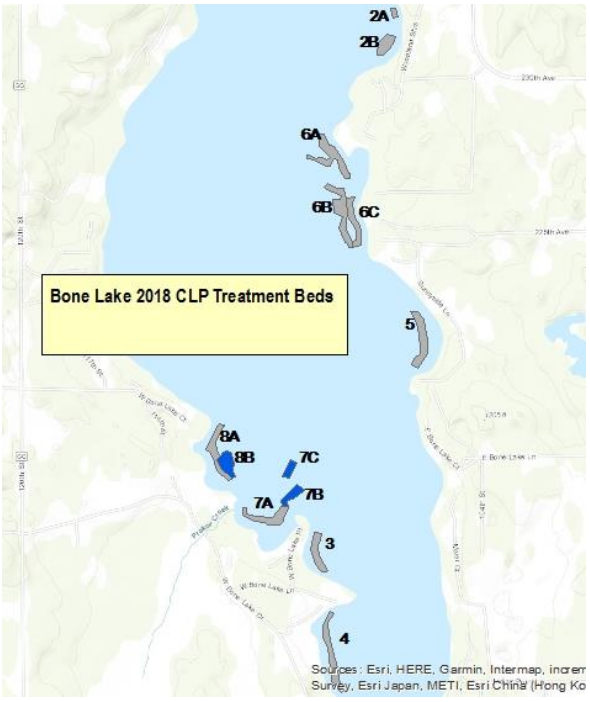


Figure 1: Planned treatment beds which are the same in years past.

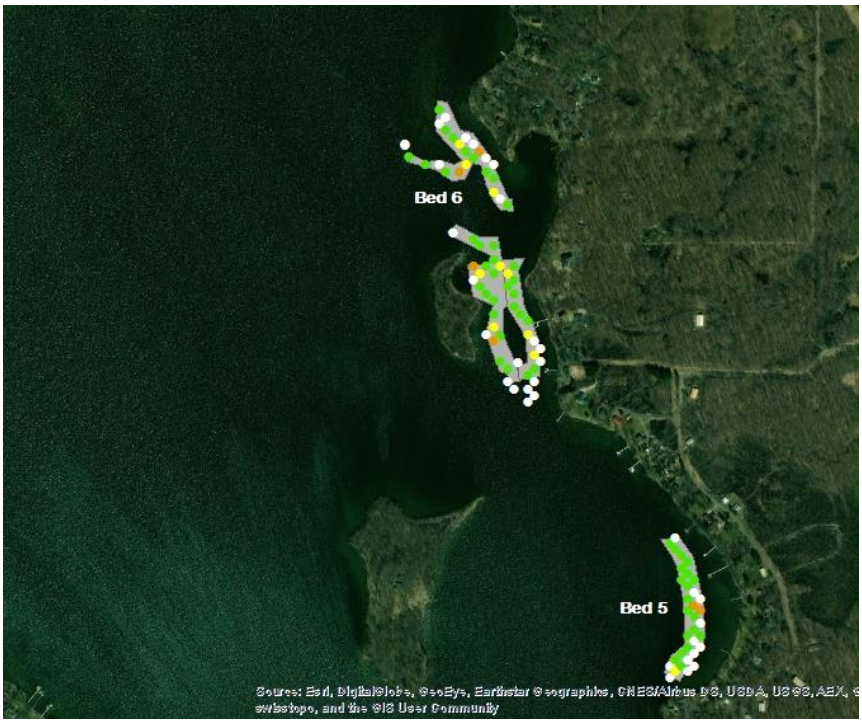
The pretreatment survey was conducted on May 12, 2018, to verify presence of CLP. The frequency of occurrence (FOO) is determined but density is not due to variability in plant size. This FOO can be compared to previous pretreatment surveys to help evaluate long term success in herbicide reduction.

After treatment, a post treatment survey is conducted. The frequency (FOO) is determined, as well as the density for annual comparisons. The native plant frequencies are also surveyed, however since the herbicide was not applied, the native plants were not evaluated.

Figure 2 shows the pretreatment maps from May 2018. Table one summarizes the pretreatment FOO and post treatment FOO density for 2017 and 2018 for comparison. Figures 3-4 show the post treatment density maps from June 2018.

Figure 2: Pretreatment maps from survey in April, 2018.

Green=present; white=absent; brown=viewed near sample point.



Bed	Pre-treat survey FOO 2017	Pre-treat survey FOO 2018	Post treat FOO 2017	June (*aka* post) FOO 2018
2	60.0%	52.4%	6.2%	52.4%
3	68.2%	57.9%	22.7%	36.8%
4	63.6%	31.9%	11.4%	21.3%
5	64.7%	60.6%	18.2%	42.4%
6	75%	66.7%	1.8%	50.0%
7	65.9%	52.5%	20.9%	50.0%
8	84.8%	81.6%	12.1%	78.9%
All Beds	**69.6%**	**57.8%**	**11.5%**	**47.3%**

Table 1: Frequency of occurrence (FOO) data from 2017 and 2018 surveys.

Chi-square significance	Change	P value	Significant?
2017 pre to 2018 pre	decrease	0.006	Yes
2017 post to 2018 "post"	increase	$2.1X10^{-19}$	Yes

Table 2: Chi square analysis comparing 2017 to 2018 surveys.

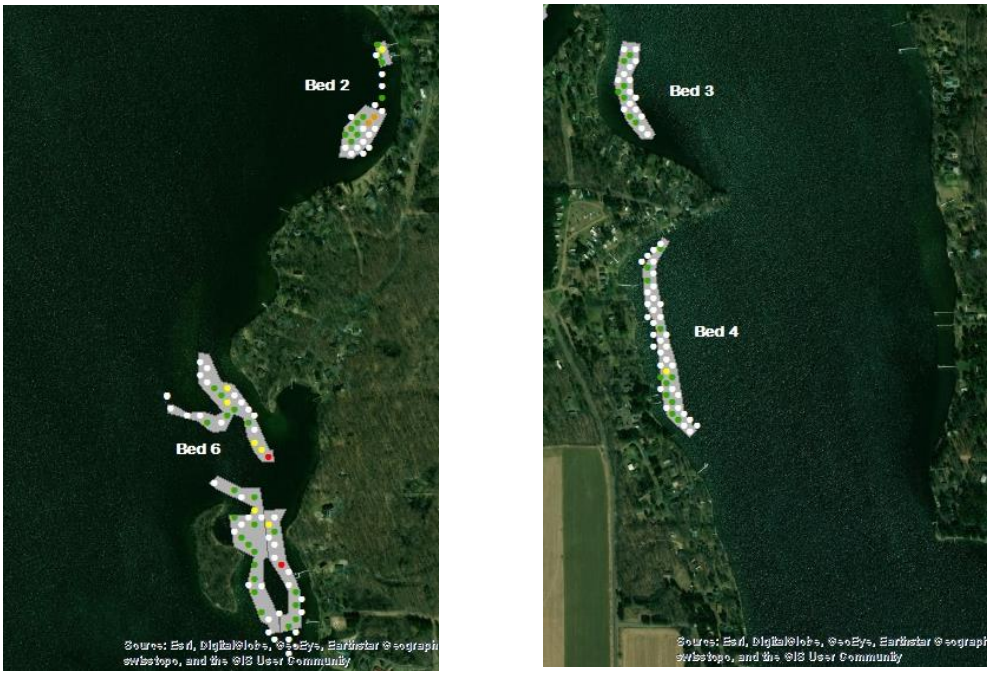


Figure 3: "Post" treatment maps for Beds 2,3,4 and 6.

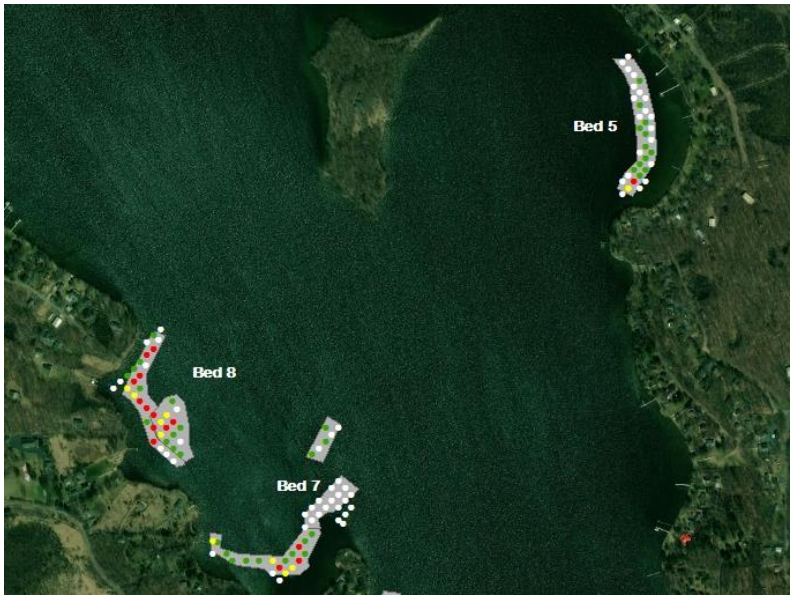


Figure 4: "Post treatment map for Beds 5,7 and 8.

As would be expected, the lack of treatment resulted in a significant increase in CLP frequency from 2017 to 2018. Comparing the pretreatment frequency from 2017 to 2018 resulted in a significant reduction. This demonstrates likely long term reduction from previous management. Interestingly, the "post" treatment frequency in 2018 was slightly lower than the pretreatment frequency. This could be sampling location variation, which would indicate the CLP is more sporadic in coverage in some areas, or the CLP naturally declined from May to June.

Turion analysis

In Oct. bottom samples are collected within each treatment bed to evaluate the turion (reproductive structures of CLP) density. A decline in turion density is the desired outcome of effective, long term CLP reduction from the herbicide treatment. Table 3 summarizes the 2018 data and compares to previous years. Figures 5-7 show the turion density within each treatment bed. Figures 8 and 9 are graphs that show long term trends with each bed and overall.

As would be expected, the turion density increased overall in 2018. This is due to the fact that CLP was not treated and the CLP plants grew and produced turions, which settled into the sediment. The overall trends shown in the line graph of all beds indicate that Beds 2-5, which have been treated for a longer period, have much lower turion density than beds 6-8. Beds 2-5 increased some in 2018, but remain relatively low compared to Beds 6-8.

Bed	2011	2012	2013	2014	2015	2016	2017	2018
2	75.00	27.00	34.70	10.90	0.00	16.30	0.00	10.75
3	269.00	65.00	79.40	48.80	0.00	119.60	54.25	107.50
4	512.00	47.00	29.80	36.20	28.70	18.10	14.50	43.00
5	274.00	161.00	64.50	76.00	75.25	65.20	16.25	96.75
All (2-5)	296.00	75.00	49.60	42.98	25.99	60.60	23.10	64.50
6			421.60	384.10	303.20	214.70	267.00	215.00
7			165.30	178.40	38.20	55.60	48.30	129.00
8			489.40	271.30	258.00	395.10	304.00	831.30
All(6-8)			358.77	277.93	199.80	205.50	218.55	391.78

Table 3: Turion density in all beds from 2011-2018.

Figure 5: Turion density map from Oct. 2018 for Beds 2 and 6.

Figure 6: Turion density map from Oct. 2018 for Beds 3 and 4.

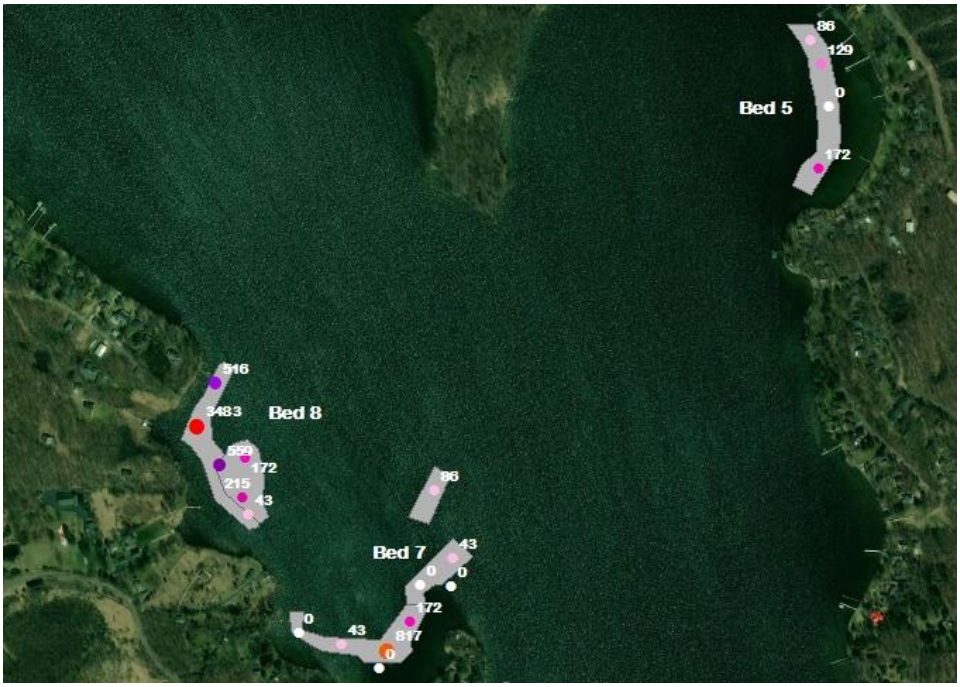


Figure 7: Turion density map from Oct. 2018 for Beds 5,7 and 8.

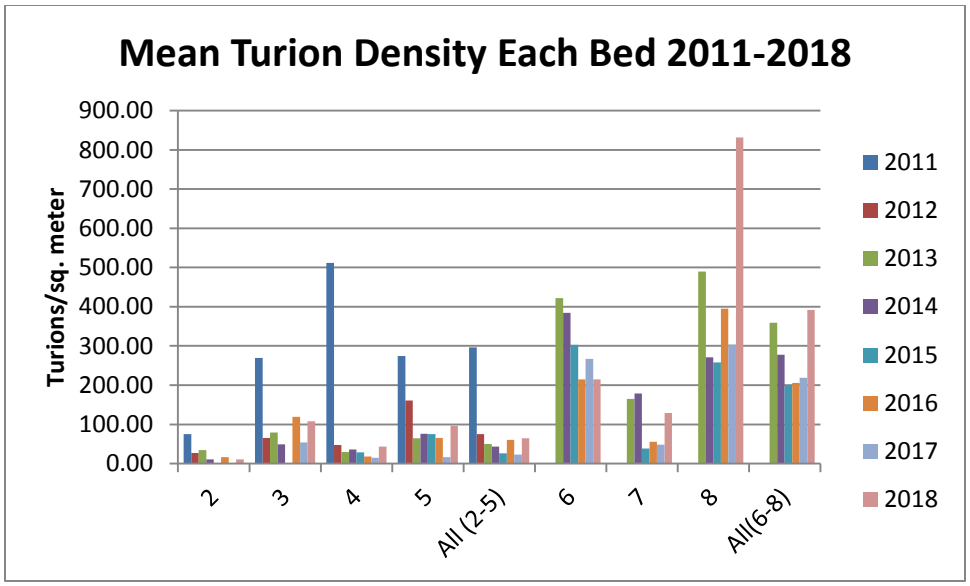


Figure 8: Graph of turion density for each bed from 2011 to 2018.

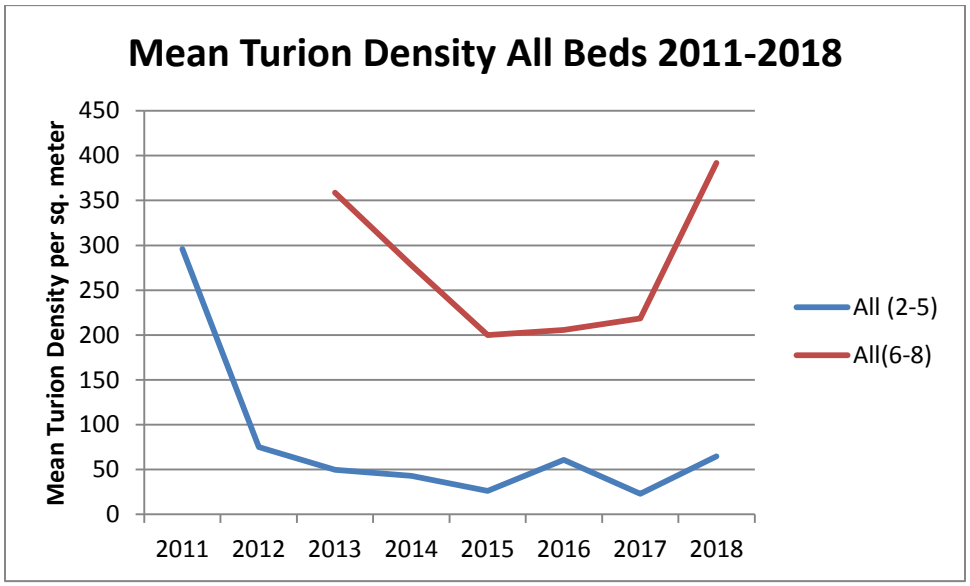


Figure 9: Graph showing turion density trends. Beds 2-5 are separated from 6-8 as these beds have been treated for different numbers of years.

In addition to evaluating the treatment sites, all beds of CLP that have dense enough to determine a boundary and has most plants at or near the surface were mapped. Figure 10 is a map of all of the CLP beds observed. These beds include areas within the treatment sites which had dense enough CLP that allowed delineation of the bed. The total area of CLP mapped was 41.3 acres.

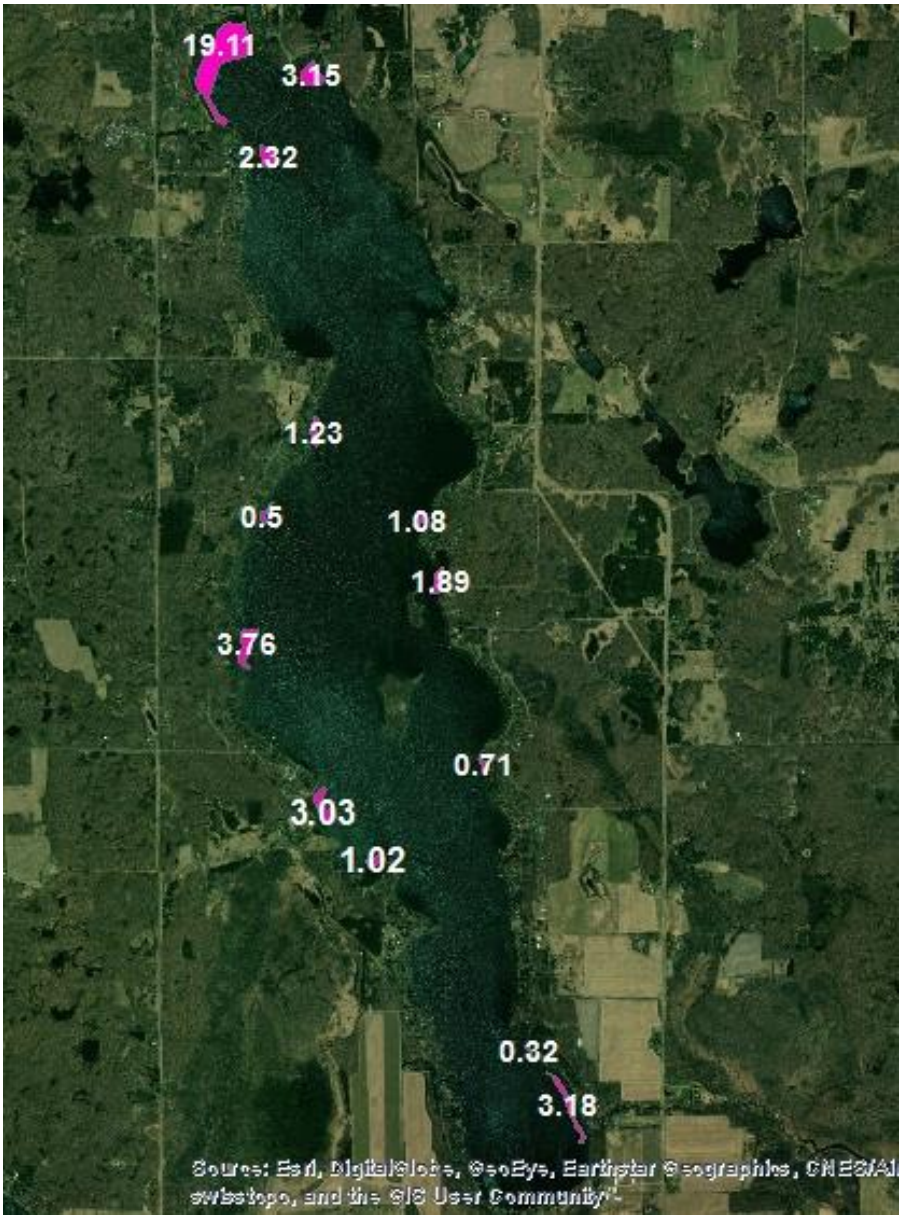


Figure 10: Map showing all delineated CLP beds June 2018. The numbers indicate the area in acres of each bed that was observed. The area of all beds is a total of 41.3 acres.