Aquatic vegetation assessment of Scatter Bar Pond and Collins Bay in relation to herbicide treatments

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Introduction

Excessive growth of non-native aquatic plants in lakes and rivers can degrade water quality, harm fish and wildlife habitat, and displace native aquatic plant communities. The Oregon Department of Agriculture (ODA) Class B Noxious Weeds *Ludwigia hexapetala* and *L. peploides* are particularly problematic along the Willamette River (Grewell et al. 2016). Very dense monocultures have been recorded in side channels, oxbow ponds, and gravel bars from Eugene to the Newburg Pool (Willamette Riverkeeper, unpublished data). Dissolved oxygen concentrations in these infested habitats often fail to support beneficial uses such as fish rearing and migration (Mosaic Ecology LLC 2017; US Geological Survey (USGS), unpublished data)

Due to these impacts, aquatic label glyphosate herbicide treatments have been, or will be applied, at several Willamette Valley sites including Collins Bay in Benton County and Scatter Bar Pond in Linn County (Figure 1). Collins Bay was treated once or twice per year from 2014 through 2017 (Figure 2). Scatter Bar Pond treatments are planned for 2018. While glyphosate has generally been effective at reducing *Ludwigia* spp. biomass (City of Eugene Parks and Open Space Division 2013; Mosaic Ecology LLC 2016, 2017), the longevity of effects on biomass, the aquatic plant community that replaces the *Ludwigia* spp. monoculture, and improvements to water quality are not well known.

Figure 1. Location of Scatter Bar Pond and Collins Bay study area within the Willamette River watershed.

During the summer and fall of 2017 Portland State University Center for Lakes and Reservoirs (CLR) collected aquatic plant community composition data at Collins Bay and Scatter Bar Pond. The survey data, along with water quality data collected by USGS at these same sites, can be used to monitor the impact of herbicide treatments on the aquatic plant community and water quality over time. This report provides an assessment of

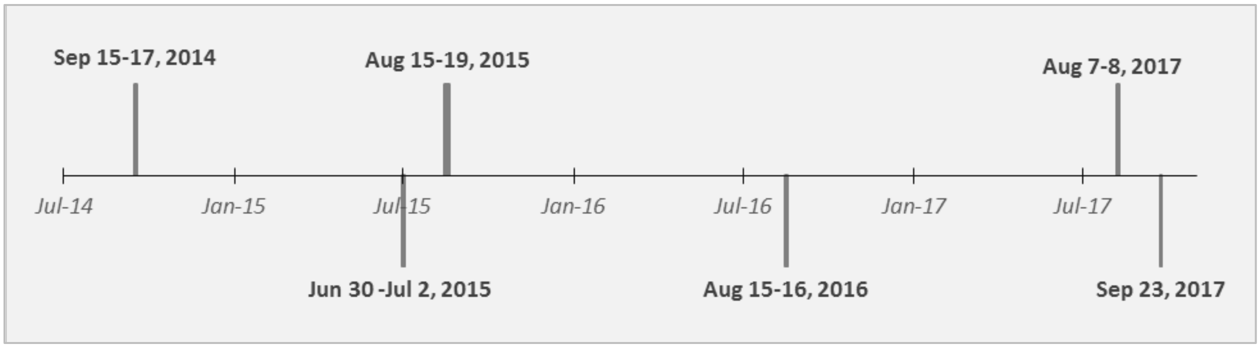

Figure 2. Timeline of Collins Bay herbicide treatments from 2014 through 2017.

baseline aquatic plant community conditions.

Methods

We assessed the status of the aquatic plant community in Collins Bay and Scatter Bar Pond on three occasions during 2017. Collins Bay assessments were conducted during mid-July, 25 days prior the first 2017 herbicide treatment; early September, 31 days after the first treatment, and late October, 38 days after the second treatment (Figure 3). Scatter Bar Pond assessments were conducted during late July, late September, and late October. Glyphosate herbicide treatments (Rodeo® with Agridex surfactant) were applied at Collins Bay by Integrated Resource Management during early August and late September.

During each sampling event aquatic plants were sampled at 60 pre-selected random points in each waterbody survey area (Figure 4, Figure 5). Collins Bay sample points were evenly divided between the east and west ponds. Random sample sites were selected so samples would be representative of each survey area. ArcGIS was used to define survey area boundaries from National Hydrography Dataset waterbody boundaries (US Geological Survey 2013) edited to match LiDAR elevation data (DOGAMI 2018). Random points located a minimum of 8 m apart within survey areas were selected using the ArcGIS Sampling toolset. Points were loaded onto a Trimble Juno 3b GPS unit with ArcPad 10.2 software prior to field sampling.

Field surveys were conducted by wading in shallow areas or by canoe in deeper areas. Submersed, emergent, and floating leaf plants were sampled at each of the pre-selected random points. Submersed plants were sampled using a double sided thatch rake attached to a graduated aluminum pole. The rake was lowered to the sediment surface (or as deep as possible), twisted one full turn, and retrieved to the

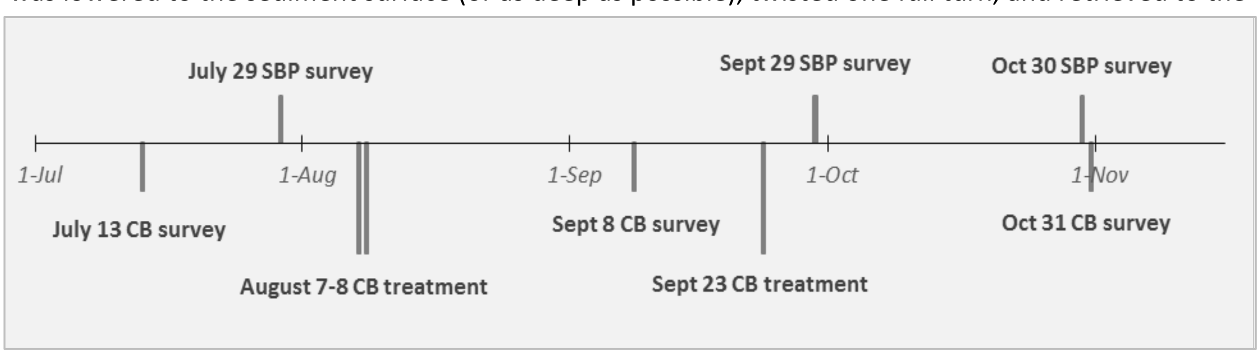

Figure 3 Timeline of surveys at SBP and CB and herbicide treatments at CB during 2017.

Figure 4. Points randomly selected for aquatic surveys within the Collins Bay survey area (white lines) during 2017.

surface. The percent composition by species was recorded along with the depth of the sample and a semi-quantitative assessment of sample density. Sample density categories were sparse (few rake tines covered), moderate (most rake tines covered), dense (all rake tines covered), and very dense (plants overflowing rake tines). Density of emergent and floating leaf species was assessed by placing a 0.5 m diameter hoop on the surface of the water or plant beds at each sample point. Percent of the hoop area covered by aquatic plants was noted along with the percent composition by species.

Plants were identified to species or genus using Hamel and Parsons (2001), Crow et al. (2006), Crow and Hellquist (2006), Jepson Flora Project (2017), Flora of North America (1993) and Jacono (2017). Voucher specimens were pressed and archived at the Center for Lakes and Reservoirs Laboratory. All data were recorded on waterproof field datasheets or logged on the field GPS unit and are stored in a Microsoft Access Database.

Percent frequency of occurrence coverage for each species by waterbody by species was estimated from the point sample data. Maps were produced using ESRI ArcGIS of measured depth, aquatic invasive species presence, important native species presence, and species richness for each waterbody and sampling event.

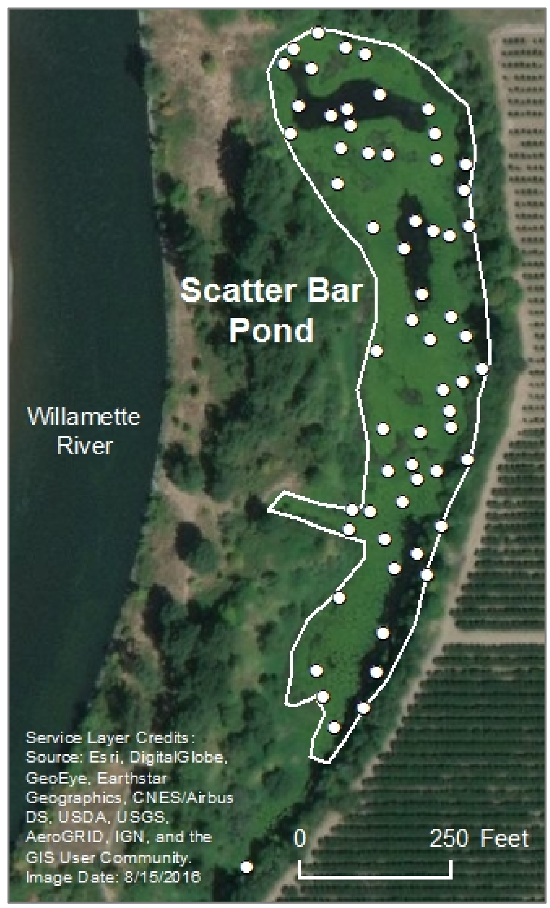

Figure 5. Points randomly selected for survey within the Scatter Bar Pond survey area (white lines) during 2017.

In addition, an index of *Ludwigia hexapetala* density was calculated and plotted from rake and hoop density estimates at each site as:

rake fullness * % *Ludwigia* in rake sample + hoop coverage * % *Ludwigia* in hoop sample

where rake fullness qualitative descriptions recorded in the field were converted to a scale of 25 for sparse, 50 for moderate, 75 for dense, and 100 for very dense fullness. The calculated *Ludwigia hexapetala* density index ranges from 0 to 100.

Results

Scatter Bar Pond

Fourteen aquatic plant species were recorded at Scatter Bar Pond, seven of which were aquatic invasive species (Table 1, Figure 6). *Ludwigia hexapetala* was present at approximately 80% of the sites and dominated the aquatic plant community. The wetland plants *Persicaria* spp. (including *P. hydropiperoides*) and the submersed plant *Ceratophyllum demersum*, both native species, were the only species other than *L. hexapetala* encountered at more than ten percent of the sites. Aquatic invasive species, other than *Ludwigia hexapetala*, were only present at a few sites (Figure 6). Submersed species and sites without aquatic plants were found in the three deeper basins located along the southeastern shore and in the northern half of the pond (Figure 7).

In addition to being commonly encountered throughout the pond, *Ludwigia hexapetala* were very dense. The *L. hexapetala* density index was greater than 75 (out of 100) at more than 58% of the sites and less than 25 at less than 10% of the sites during all sampling events (Figure 7).

Table 1. Percent of sample sites with aquatic plant species at Scatter Bar Pond.

Species	**Common name**	**Type[1]**	**Status[2]**	**Jul**	**Sep**	**Oct**
Ludwigia hexapetala	Uruguayan primrose willow	E	AIS	78	88	83
Ludwigia sp.	water primrose, uncertain sp.	E	AIS	2	-	2
Ceratophyllum demersum	coontail	S	N	13	12	12
Persicaria sp. (*P. hydropiperoides* and others)	smartweed	W	ND	30	22	13
Poaceae	grass	W	ND	3	8	2
Myriophyllum aquaticum	parrotsfeather	E	AIS	3	-	-
Sagittaria latifolia	wapato	E	N	3	-	-
Egeria densa	Brazilian elodea	S	AIS	7	5	2
Elodea nuttallii	Nuttall's waterweed	S	N	3	-	-
Potamogeton pusillus	thinleaf pondweed	S	N	5	3	-
Phalaris arundinaceae	reed canary grass	W	AIS	7	-	-
Potamogeton zosteriformis	flatstem pondweed	S	N	2	2	-
Potamogeton crispus	curlyleaf pondweed	S	AIS	-	2	-
Lythrum salicaria	purple loosestrife	W	AIS	2	-	-
Number of species present				13	8	6
Number of AIS species present				6	3	3
Percent of sites with no species present				4	3	7

[1]E = emergent, S = submersed, W = wetland, F = floating leaf.
[2]AIS = aquatic invasive species, N = native species, ND = did not determine species.

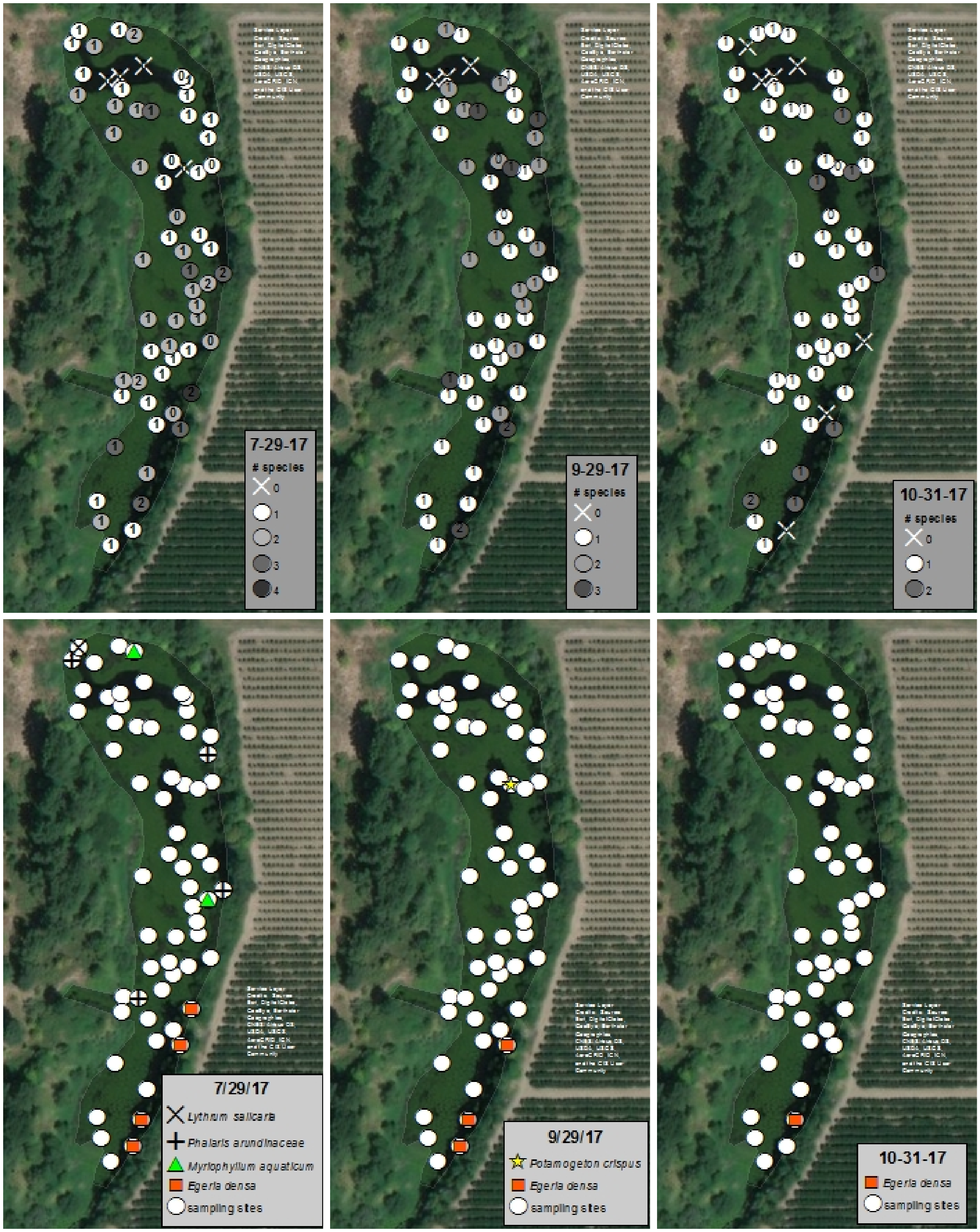

Figure 6. Total species richness (colors in top row) and aquatic invasive species richness (numbers on top of points) and aquatic invasive species other than *L. hexapetala* (bottom) observed at Scatter Bar Pond during 2017.

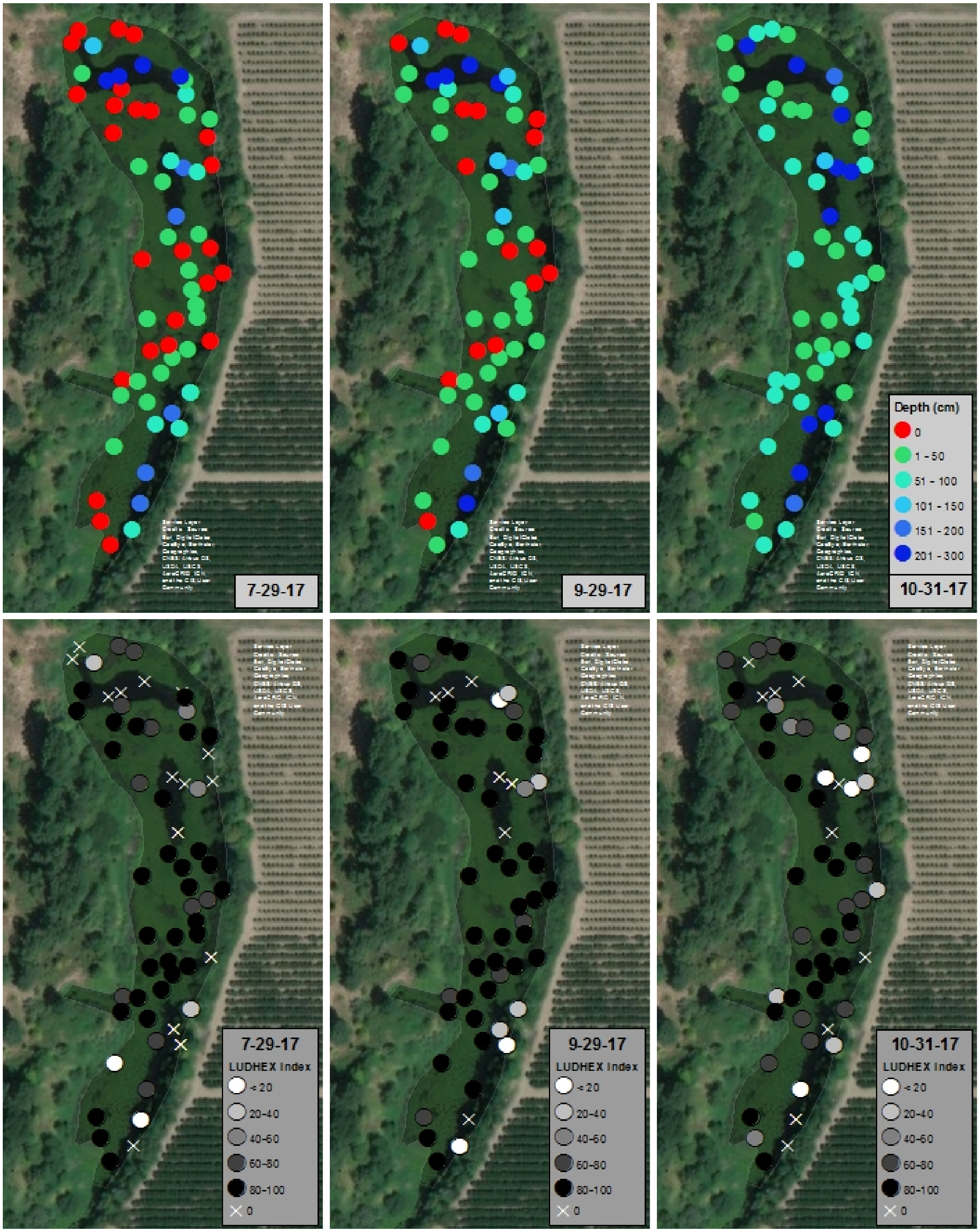

Figure 7. Depth (top) and *Ludwigia hexapetala* density index categories (bottom) at Scatter Bar Pond during 2017.

Collins Bay

Twenty-nine aquatic plant species were recorded at Collins Bay, seven of which were non-native species (Table 2). Up to six total and two non-native species were recorded at each site (Figure 8). *Ludwigia hexapetala* was present at between 42 and 58% of the sites during sampling events, although at low densities. The *L. hexapetala* density index was less than 25 at more than 51% of the sites and greater than 75 at less than 6% of the sites with *L. hexapetala* was present during all sampling events (Figure 9). Parrotsfeather (*Myriophyllum aquaticum*), the next most common non-native species encountered, was present at between 8 and 13% of the sites (Figure 10). Native aquatic plants were diverse and widespread and included wapato (*Sagittaria latifolia*), northern water plantain (*Alisma triviale*) and spatterdock (*Nuphar polysepala*) (Figure 11). Coontail (*Ceratophyllum demersum*) was the most commonly encountered native submersed species. The non-native submersed species Brazilian elodea (*Egeria densa*) and curlyleaf pondweed (*Potamogeton crispus*) were present, but rare, in the eastern pond. Depths ranged up to 3 m in the eastern pond during the October sampling event (Figure 12). Much of the center of the western pond was covered with a floating island comprised of dead *L. hexapetala* biomass.

Table 2. Percent of sample sites with aquatic plant species at Collins Bay.

Species	Common name	Type[1]	Status[2]	Jul	Sep	Oct
Ludwigia hexapetala	Uruguayan primrose willow	E	AIS	47	58	42
Ceratophyllum demersum	coontail	S	N	53	33	30
Persicaria sp. (*P. hydropiperoides* and others)	smartweed	W	ND	12	15	2
Lemna sp.	duckweed	F	N	13	43	20
Poaceae	grass	W	ND	20	25	18
Sparganium emersum	European bur-reed	E	N	18	23	12
Ludwigia palustris	water purslane	W	N	17	20	5
Myriophyllum aquaticum	parrotsfeather	E	AIS	8	10	13
Sagittaria latifolia	wapato	E	N	15	13	2
Cyperus erythrorhizos	redfoot flatsedge	W	N	2	22	3
Nuphar polysepala	spatterdock	E	N	12	7	5
Egeria densa	Brazilian elodea	S	AIS	2	3	3
Bidens cernua	nodding beggartick	W	N	8	8	2
Potamogeton natans	floatingleaf pondweed	F	N	8	5	5
Elodea nuttallii	Nuttall's waterweed	S	N	8	-	3
Potamogeton pusillus	thinleaf pondweed	S	N	7	-	-
Equisetum palustre	marsh horsetail	W	N	3	7	3
Phalaris arundinaceae	reed canary grass	W	AIS	2	3	-
Alisma triviale	northern water plantain	E	N	3	7	-
Potamogeton zosteriformis	flatstem pondweed	S	N	3	2	2
Eleocharis sp.	spikerush	E	ND	7	2	-
Potamogeton crispus	curlyleaf pondweed	S	AIS	2	3	2
Rumex sp.	dock	W	ND	8	-	-
Lysimachia nummularia	creeping jenny	W	AIS	-	3	-
Cicuta douglasii	Western water hemlock	W	N	3	-	-
Potamogeton richardsonii	Richardson's pondweed	S	N	2	2	-
Myriophyllum spicatum	Eurasian watermilfoil	S	AIS	-	-	2
Potamogeton epihydrus	ribbonleaf pondweed	S	N	-	-	2
Spirodela polyrhiza	common duckmeat	F	N	2	-	-
Number of species present				26	22	20
Number of AIS species present				5	6	4
Number of sites with no species present				3	0	2

[1]E = emergent, S = submersed, W = wetland, F = floating. [2]AIS = invasives, N = natives, ND = species not determined

Figure 8. Total species richness (colors) and aquatic invasive species richness (numbers on top of points) observed at Collins Bay during 2017.

Figure 9. *Ludwigia hexapetala* density index categories at Collins Bay observed during 2017 sampling events.

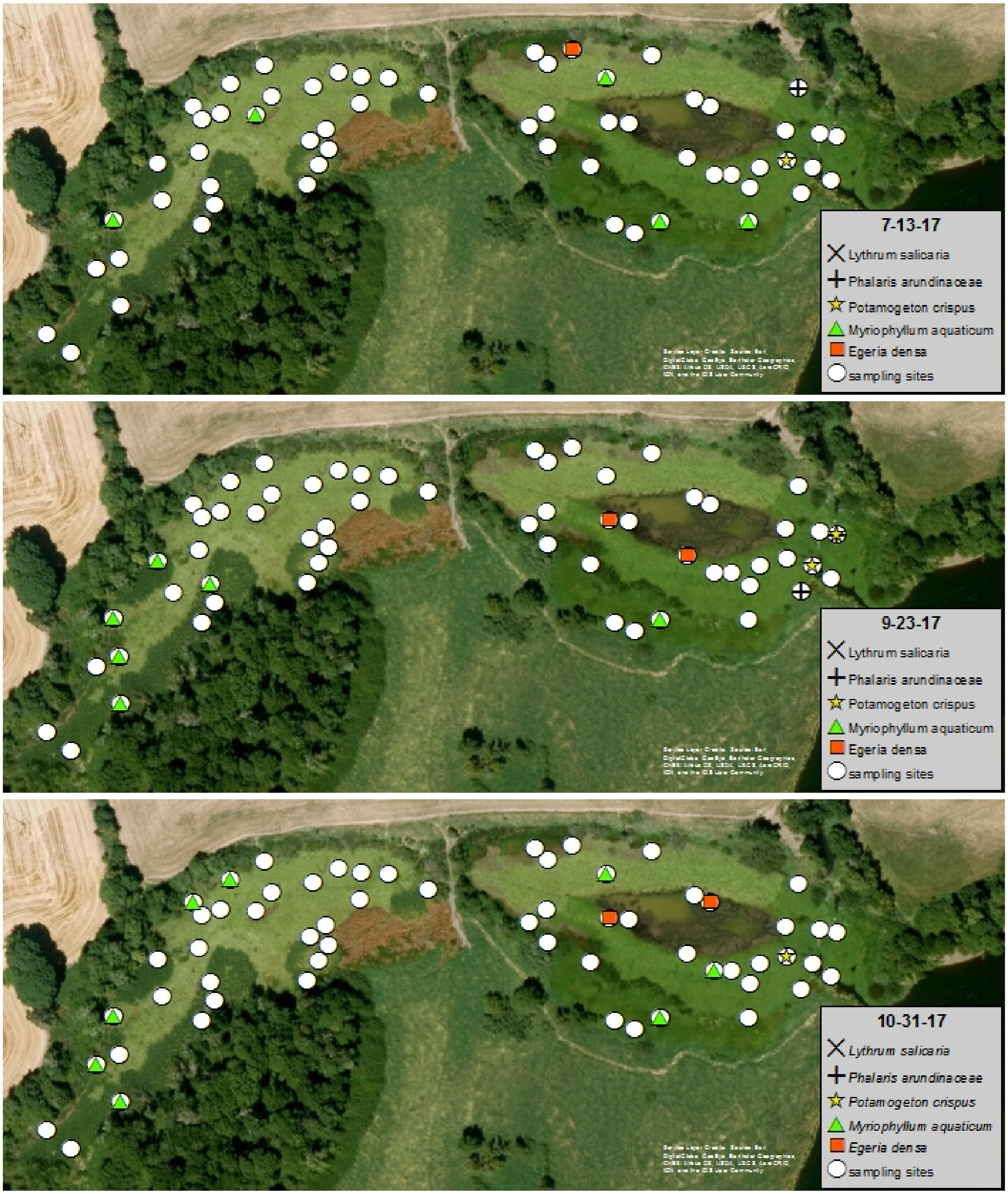

Figure 10. Other aquatic invasive species observed at Collins Bay during 2017.

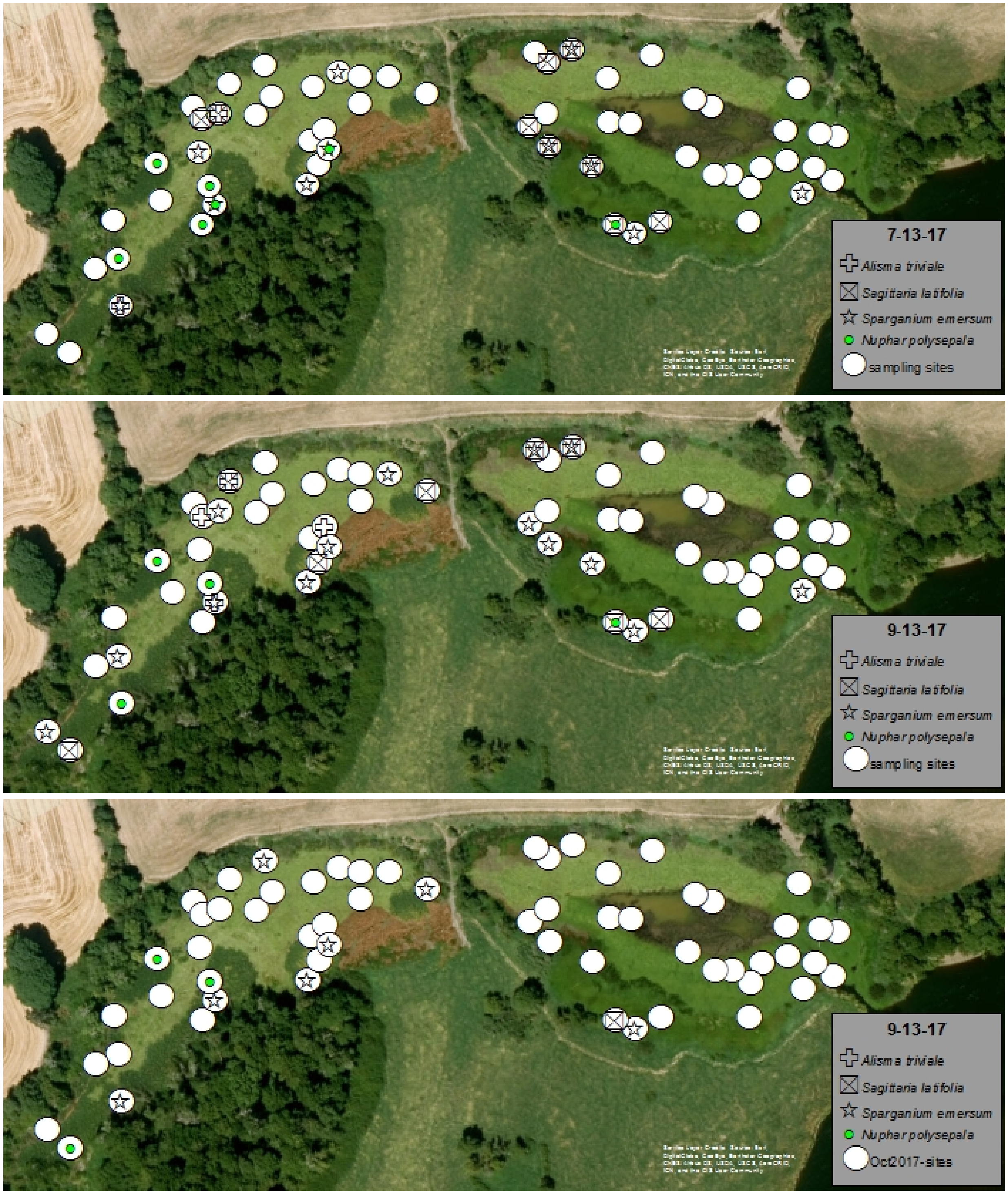

Figure 11. Location of selected native species observation at Collins Bay during 2017.

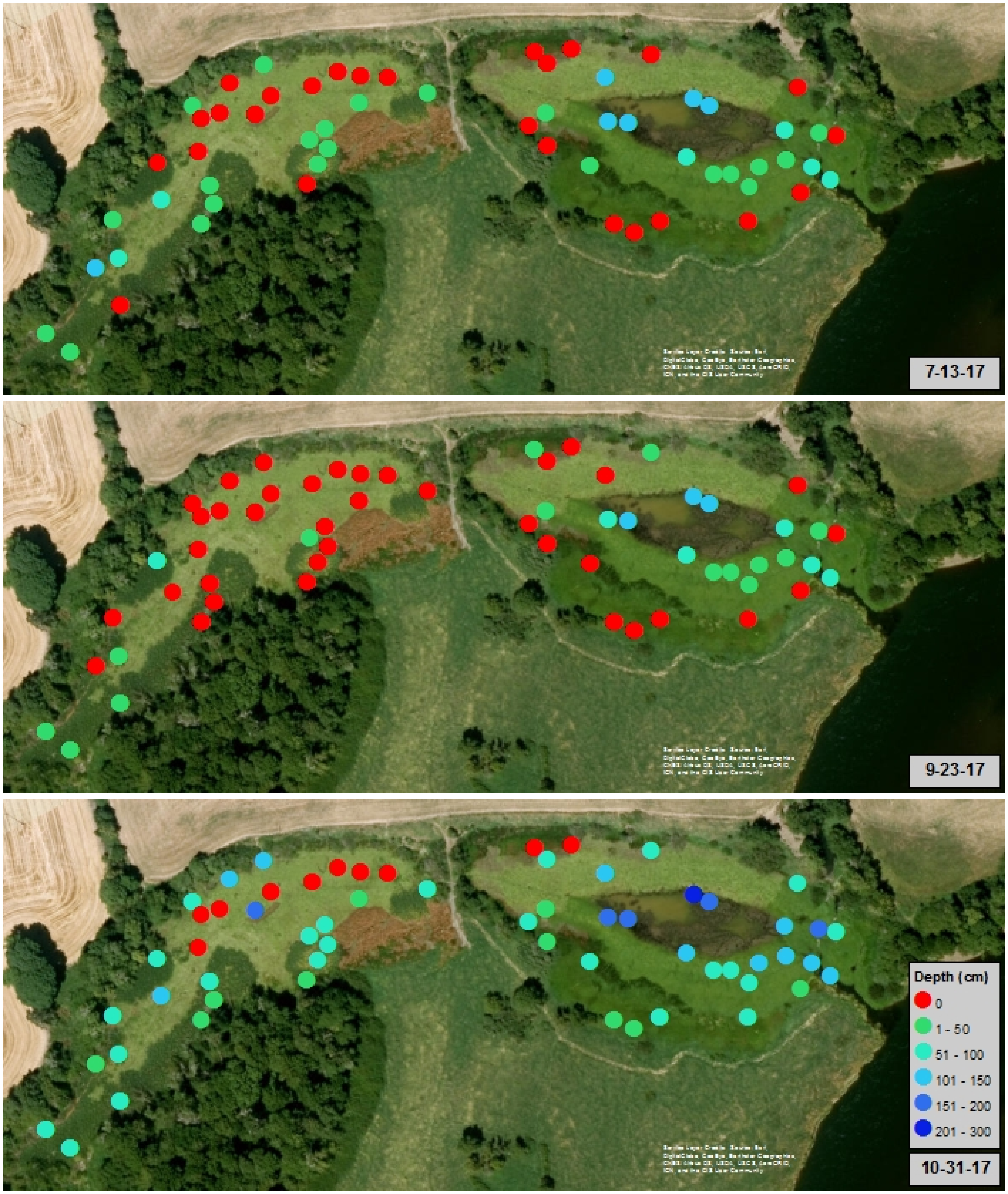

Figure 12. Depth of Collins Bay sampling sites during 2017 sampling events.

Discussion and Recommendations

The aquatic plant communities at Scatter Bar Pond and Collins Bay were strikingly different during the 2017 surveys. At Scatter Bar Pond *L. hexapetala* was the dominant species in terms of both frequency of occurrence and density. At Collins Bay *L. hexapetala* occurred less frequently, was less dense, and the aquatic plant community was more diverse. This difference, particularly the difference in density, is likely due to the three previous years of herbicide treatments. Although there was no pre-treatment aquatic plant community assessment, Benton SWCD's photo monitoring illustrates large declines in the Collins Bay *L. hexapetala* population since herbicide treatments began in 2014 (Figure 13).

Survey results at Collins Bay were encouraging in that removal of *L. hexapetala* did not result in a community dominated by other aquatic invasives such as *Egeria densa*, *Potamogeton crispus*, or *Myriophyllum aquaticum*. However, Benton Soil and Water Conservation District is concerned about the increase of *Myriophyllum aquaticum* in open water areas once dominated by *Ludwigia hexapetala*, and has applied for grant funding for targeted treatment of *Myriophyllum aquaticum* at Collins Bay in 2018.

The submersed native species *Ceratophyllum demersum* and emergent native species *Sagittaria latifolia*, *Nuphar polysepala*, and *Alisma triviale* were doing well in the post herbicide treatment habitat. Recovery of *S. latifolia* in Collins Bay is being assisted with plantings by the Benton Soil and Water Conservation District while other native species are recovering from the seed bank or transport from upstream. Benton Soil and Water Conservation District also hopes to be able to secure additional native plant material for species taking longer to recover (e.g., *Nuphar polysepela*).

Recovery of the deeper portions of the western Collins Bay pond was hampered by the presence of the extremely dense floating mats of dead *L. hexapetala* (Figure 14). This mat provides substrate for native wetland species growth, but also substrate for growth of *L. hexapetala* in areas that would be too deep for *Ludwigia hexapetala* without the floating mat. Removal of floating mats is recommended using a backhoe, grab dredge, weed cutter (e.g. www.aquarius-systems.com/pages/55/cutters.aspx), or manual cutting and removal (City of Eugene Parks and Open Space Division 2013).

Several questions about the effectiveness of herbicide treatments on the plant community remain. In particular:

- how quickly will *L. hexpetala* return to dominance if treatments are stopped?
- are annual treatments necessary for control?
- will other non-native species such as *Egeria densa* and *Myriophyllum aquaticum* increase in abundance with continued *L. hexapetala* treatment?

Continued aquatic plant community monitoring is essential to answering these questions. However, since differences in plant communities between waterbodies were much greater than changes across the summer, annual monitoring during the height of the growing season would be sufficient for answering these important questions.

Figure 13. East Collins Bay Pond from Benton SWCD Photo Point 4 looking east showing pre-treatment conditions with extensive *L. hexapetala* beds (left, July 7, 2014) and 2017 conditions with reduced beds (right, July 7, 2017).

Figure 14. Floating mats at West Collins Bay Pond on September 8, 2017. View towards the southwest with sparse growth of *Ludwigia hexapetala* and *Sparganium emersum* on floating mats.

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