Wetland State-and-Transition Model Project Annual Report - 2015

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Executive Summary

Semi-permanently flooded wetland habitats throughout the Intermountain West and western Prairie Pothole regions provide important resources for migrating and breeding migratory birds and other wetland-dependent wildlife. Significant continental-scale loss and degredation of wetlands led to establishment of some of the regions' largest wetland complexes as National Wildlife Refuges (NWRs) (e.g., Benton Lake, Malheur, and Red Rock Lakes NWRs) and state Wildlife Management Areas (WMA) (e.g., Farmington Bay, Freezeout Lake, and Market Lake WMAs).

Wetland management actions often mimic natural disturbance processes in order to maintain ecological function. Objectives for semi-permanently flooded wetland habitats within these regions typically focus on one of the two following approaches to management: 1) managing for wetland function to provide a desired plant community or 2) managing to provide habitat for a specified population size and/or life-history requirement(s) of focal wildlife species. For example, sago pondweed (*Stuckenia pectinata*), a pioneering wetland plant species, is more nutritious and often more preferred by migratory birds than species more tolerant of anoxic conditions such as watermilfoil (*Myriophyllum sibiricum*). Hence, management objectives for semi-permanently flooded wetlands often include maintaining a relatively high abundance of sago pondweed for the benefit of migratory birds.

The primary disturbance process of management interest in semi-permanently flooded wetland habitats is the dynamic wet/dry hydrological cycle, which is a key driver of wetland productivity and vegetation community structure. Water level changes (either managed or natural) are perterbations that influence nutrient turnover rates, vegetation, aquatic invertebrates, and resource availability for wetland-dependent wildlife. Wetland systems can respond to perturbations in a non-linear fashion with multiple states and phases possible. The frequency, timing, and duration of drawdowns (natural or managed) are important factors in determining which vegetation community phases are expressed within a semi-permanently flooded wetland area. The ability to predict the biological outcome of water level changes varies depending on the knowldge of the wetland system being managed.

The first component of this project is to build a common management framework for semi-permanently flooded wetland habitats across the two regions. The framework will incorporate ecological processes, and site and management potentials, to define a range of states and vegetation community phases within states. This will be accomplished by:

- Developing a state-and-transition model (STM) for semi-permanently flooded wetlands to inform management actions.
  - Use existing published literature to identify the range of potential vegetation communities that could exist (100% complete).
  - Describe the ecological condition of states and phases (50% complete)
  - Describe the ecological processes (abiotic and biotic) that drive transitions and restoration pathways among phases and states (50% complete).

- Defining vegetation community phases within states using empirical data. Ecological site descriptions and NVCS associations do not exist for wetland communities, necessitating this step.
  - Identity indicator species for semi-permanently flooded emergent and submergent vegetation communities (67% complete).
  - Evaluate abiotic conditions of the emergent and submerged aquatic vegetation communities identified by indicator species analyses (50% complete).
  - Scale point-level data to the management unit to determine the state and phase (i.e., wetland condition) of a unit (10% complete)
- Designing an efficient monitoring scheme to inform management (15% complete)
  - Develop a rapid assessment method to identify the current state and phase (i.e., wetland condition) of a management unit based on the results from above.
  - Provide guidance on how to use the STM and assessment of the current wetland condition (i.e., phase and state) to identify potential management actions that: 1) perpetuate the current state and phase; 2) transition among phases of the reference state; 3) prevent transition to an altered state; or 4) undertake restoration from an altered state back to the reference state.
- Providing an analytical framework to estimate transition probabilities among states and phases at the local scale. This will reduce the uncertainty of predicted outcomes of water level manipulations and other management actions in achieveing desired outcomes (e.g., desired states and phases).
  - Install staff gauges and/or data loggers to assess hydroperiod characteristics of management units (100% complete).
  - Monitor water levels and track wetland management actions (25% complete).
  - Evaluate response of wetland vegetation to changes in water levels and management actions to estimate transition probabilities among states and phases in response to management actions.

Pilot field data collection to identify indicator species for emergent and submerged aquatic vegetation communites, examine abiotic characteristics of vegetation communities, and empirically define states and phases within the conceptual STM began at 21 management units across eight refuges during 2014. Stations participating in the project during 2014 and 2015 include Bear Lake, Camas, Grays Lake, and Malheur NWRs in USFWS Region 1 and Bowdoin, Fish Springs, Lee Metcalf, and Medicine Lake NWRs in Region 6.

Data were collected at a spatially-balanced random sample of points within each semi-permanently flooded wetland sampling frame. Ocular estimates of canopy cover of all wetland plant species, residual vegetation, and bare substrate were recorded at each plot. Abiotic variables measured included water depth, Secchi disk depth, pH, salinity, specific conductivity, temperature, and soil texture. Field methods were modified during 2015 to assess canopy cover of wetland vegetation present under filamentous algae. Data from 1651 sample points and 108 species were included in Cluster and Indicatory Species analyses to identify emergent and submergent vegetation community site groups and abiotic conditions of these vegetation assemblages. One more field season following these methods will be conducted during 2016 to increase the range of abiotic and biotic wetland conditions sampled. These data will be used to inform the design of a long-term monitoring scheme, sustainable with expected station capacity, for informing wetland management actions.

The second component of this project is to link regional migratory bird objectives to submerged aquatic vegetation communities within semi-permanently flooded wetland habitats in the two regions. Project participants identified diving ducks and swans as focal species for wetland management, and fall migration as the life-cycle period when wetland availability would be most limiting to these species. Through a partnership with Oregon State University, a graduate student will be collecting data on waterbird use at different submerged aquatic vegetation communities during the fall migration period.

Introduction

Wetlands in the Intermountain West occur across four geologic provinces where vegetation is strongly influenced by hydrology, which is inter-related to physiography, soils, and climate (Laubhan 2004). In addition, muskrat are an important biotic factor that directly influence vegetation in semi-permanently flooded wetland habitats. Because anthropogenic modifications of wetlands throughout the Intermountain West have altered these historical wetland processes and functions, management and/or restoration of ecological processes is required to produce desireable vegetation and optimize utilization of resources by waterbirds within the expected natural range of variability.

Wetland management actions largely center on mimicking disturbance processes necessary for maintaining ecological function. The primary process of management interest is the dynamic wet/dry hydrological cycle, a key driver of wetland productivity and vegetation community structure (see reviews in Murkin et al. 1997, Mitsch and Gosselink 2007). The ability to manipulate the timing and duration of flooding in managed semi-permanently flooded wetland habitats permits controlling, to some degree, the primary wetland disturbance regime.

Ecological systems commonly respond to perturbations in a non-linear fashion with multiple states possible (Drake 1990), and wetlands are no exception (van der Valk 1981, Zweig and Kitchens 2009, Smith 2012). Within wetlands, these non-linear dynamics are largely in response to water level manipulations and the resultant abiotic conditions. The ability to predict the outcome of such management actions varies dependent upon the knowledge of the wetland system being manipulated. These non-linear vegetation community responses can be contrasted with linear succession to a climax seral community as initially espoused by Clements (1936). Application of linear climax theory to management has proven largely unfruitful (Stringham et al. 2003), and led to the development of non-linear state-and-transition models (Westoby et al. 1989).

State-and-transition models (STMs) provide a framework to inform management and restoration actions. STMs depict the current knowledge of ecological dynamics and identify the range of potential vegetation communities (i.e., states and phases) that can exist for an ecological site. STMs also identify the ecological processes, disturbances, and management actions that may cause a site to transition among different states or community phases. Therefore, STMs can assist in making management decisions by identifying and quantifying actions that prevent degradation and/or promote desirable transitions (Bestelmeyer et al. 2010).

The applicability of state-and-transition models for management of semi-permanently flooded wetland habitats is being explored using data collected at eight national wildlife refuges within USFWS regions 1 and 6. The objectives are to 1) create a broad-scale, univerally-applicable STM that describes the current knowledge of semi-permanently flooded wetland systems that applies across wetlands in different geomorphic regions, 2) identify vegetation community phases using empirical data collected across a disparate suite of semi-permanent wetland habitats, 3) design a long-term monitoring scheme for identifying a wetland's current state and phase to inform application of management actions, and 4) quantify wetland response to water level manipulation and other management actions to reduce uncertainty of predicted outcomes.

State-and-Transition Models

When considering management actions and their influence on ecosystem attributes (e.g., vegetation), it is important to develop ecological conceptual models with drivers, stressors, & effects on measureable attributes (Busch and Trexler 2003) and to think through the possible ecological thresholds (Martin et al. 2009). Ecological thresholds are commonly defined as a point or zone along a continuum of a system variable (or suite of variables) that when crossed results in a change in the system state (Huggett 2005, Bennetts et al. 2007). State-and-transition models (STMs) are a type of conceptual ecological model that synthesizes the current knowledge of ecological processes and drivers, identifies the range of potential vegetation communities (i.e., states and phases), and hypothesizes thresholds that can exist for an ecological site.

The 'textbook' definition of an ecological site provided by NRCS is:

> An ecological site is defined as a distinctive kind of land with specific soil and physical characteristics that differ from other kinds of land in its ability to produce a distinctive kind and amount of vegetation and its ability to respond similarly to management actions and natural disturbances.

Using the above definition, ecological sites can be defined and then described (the latter aptly named 'ecological site descriptions', or ESDs). An ESD is the narrative that includes information about the vegetation, soils, hydrology, etc., of an ecological site. Given the historical development of this STM framework by the rangeland ecology and management community, most examples of existing ESDs come from western North American rangeland sites. By comparison, ESDs for wetland ecological sites are poorly developed. Many wetland ESDs lack description of soil and influencing water features. As part of the National Cooperative Soil Survey, soil types under flooded habitats are often not described, but instead mapped as water (i.e., NRCS SSURGO Database). In addition, very few wetland classification systems incorporate geomorphic setting and temporal climatic variability (see discussion in Euliss et al. 2004).

Components of the STM developed for this project follow definitions in Bestelmeyer et al. (2010), with the exception that hydrology instead of soils is the driving dynamic abiotic factor. These components, defined below (excerpted from Bestelmeyer et al. (2010)), include states, community phases, state transitions and restoration pathways, and community pathways:

- State: Plant community phases [sorted] according to the structures (e.g., dominant species, functional groups, and surface soil conditions) that control feedack mechanisms and ecological processes.

  - Reference State: Identified to represent the historical or natural state for the site including its range of variation. Often implicitly assumed that historically observed states are those that provide the maximum options for management and ecosystem services.
  - Alternative States: Feature a distinct set of feedbacks and processes compared to the reference state; technology and/or rare, extreme natural events (e.g., a once-in-a-century extreme wet year) would be needed to restore the reference state. Alternative states can be extremely persistent due to strong feedbacks, such as when exotic species invade and alter fire regimes and soil nutrient cycling.

- Community Phase: The distincitve plant communities and associated dynamic soil property values that can occcur over time within a state. Typically reflect management-relevant differences in plant communities and focus on differences in dominant species that govern the ecological processes and uses of a site.
  - Reference Community Phase: That [phase] which best exhibits the characteristics of the reference state, or that is considered to be the most resilient within the state (i.e., a healthy condition vs. an at-risk condition, see below).
  - At-risk Community Phase: The phase that is most vulnerable to a transition to an alternative state.

- Community Pathway: Mechanisms of change among community phases within the same state. Community pathways are best described using monitoring or inventory data coupled to information about climate, management, or other conditions.
- Transition: Mechanisms of change among states. Transitions are due to changing feedbacks and processes that subsequently limit the recovery of the former state.
  - Slow Variables and Triggers: Drivers and events that initiate a transition to an alternative state. Slow variables reflect more gradual processes such as shrub recruitment rates, rates of change in water table depth associated with land use, or long-term decreases in grass density. Triggers are discrete events that precipitate a transition, such as a drought period that stresses perennial grasses, an intense rainfall event that produces highly erosive overland flow, or a wildfire.
  - Thresholds: A set of conditions (and a point in time) beyond which altered ecosystem structures and functions do not recover by themselves.Thresholds are the consequences of the slow variables and triggers described above.

- Restoration Pathways: The technologies, events, and conditions within alternative states (including susceptible community phases) that can lead to recovery of the former state.

A simple schematic showing the relationships among the components of an STM is provided in figure 1.

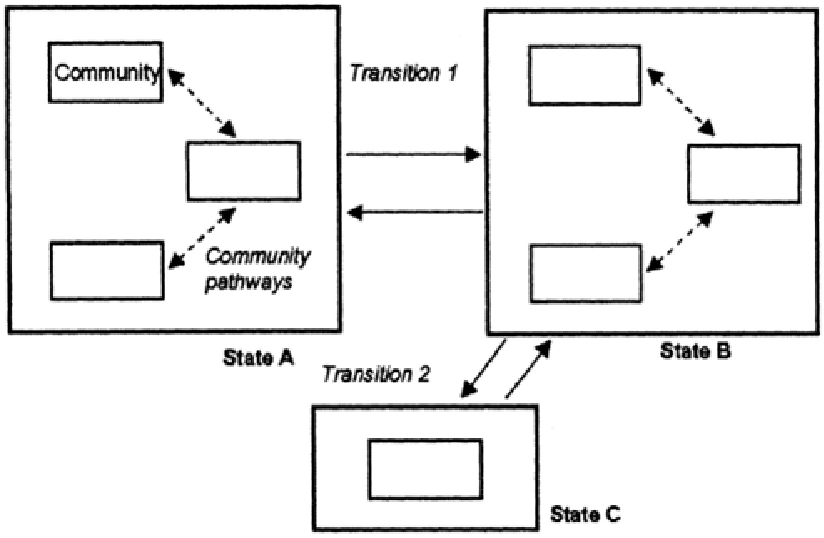

Figure 1

Figure 1. The general structure of a state-and-transition model, taken from Stringham et al. (2001).

A brief history of the development of STMs as a management tool will help clarify *what* an STM is, its component parts, and the impetus for their initial development.

Clementsian succession (1916) dominated early attempts by rangeland managers to predict the outcome of rangeland disturbance (primarily grazing and fire). In Clements's view vegetation communities responded to disturbance in a linear fashion, i.e., disturbance would push a climax community to an earlier seral stage that would, upon removal of the disturbance, progress in a predictable linear fashion through a series of communities back to the climax community for that site. This was the underlying paradigm of Dyksterhuis's (1949) seminal work that was the foundation for rangeland management for nearly 40 years. Failures of this paradigm to account for non-linear responses of systems to disturbance led to the initial development of STMs, introduced by Westoby et al.'s (1989) paper that acknowledged rangelands often had multiple 'equilibrial' states. STMs have since become a common tool used in rangeland management, with STM development for ESDs an ongoing effort by NRCS and others. For a good synthesis of the history of early efforts to use Clementsian successional theory to quantify rangeland health, and the switch to STMs with multi-state equilibrial theory, see Briske et al. 2005. The Society for Range Management published a special issue of *Rangelands* in 2010 to give practical guidance on developing ESDs and STMs (available online at: http://jornada.nmsu.edu/esd/literature#rangelands). A recent critical review of the application of ESDs and STMs is available in Twidwell et al.'s (2013) *Ecosphere* paper.

The application of ESDs and STMs for managers outside of rangeland ecology appears to be gaining traction. While most STM development still occurs within the realm of rangeland management, testing potential use of rangeland ESDs and STMs for wildlife habitat management (e.g., Doherty et al. 2011, Williams et al. 2011) is becoming more commonplace, as is development of STMs for other habitat types (e.g., wetlands, Zweig and

Kitchens 2009). This multi-region project exploring the applicability of STMs for management of semi-permanently flooded wetlands is another example of this.

STMs are largely qualitative, i.e., based on existing knowledge of an ecological site synthesized by experts. Therefore, most STMs lack a rigorous quantitative accounting of, for example, the likelihood of a particular management action moving the state or phase of a community to a different state (or phase). This is problematic for managers when they need to weigh multiple actions to achieve a habitat objective. For example, consider two possible management actions (e.g., treatments), each intended to push a wetland to a different state, with one twice as costly as the other. If the more costly treatment is three-times more likely to result in achieving the desired shift between states (or phases) it would be the logical choice. However, without knowing how likely each action would be in achieving the desired state a manager would likely decide based solely on treatment cost.

Few examples exist for using empirical data to 1) define vegetation community phases, 2) select indicator species for vegetation community phases, or 3) quantify transition probabilities between phases and/or states. This project is undertaking these tasks across a broad landscape to provide a management tool for assisting in wetland management for migratory birds and other wetland-dependent wildlife.

Study Area

Semi-permanently flooded wetland habitats were sampled at eight National Wildlife Refuges within USFWS Regions 1 and 6 (Fig. 2). These stations are located in the western Prairie Pothole region (Bowdoin and Medicine Lake NWRs) and Intermountain West (Bear Lake, Camas, Fish Springs, Grays Lake, Lee Metcalf, and Malheur NWRs).

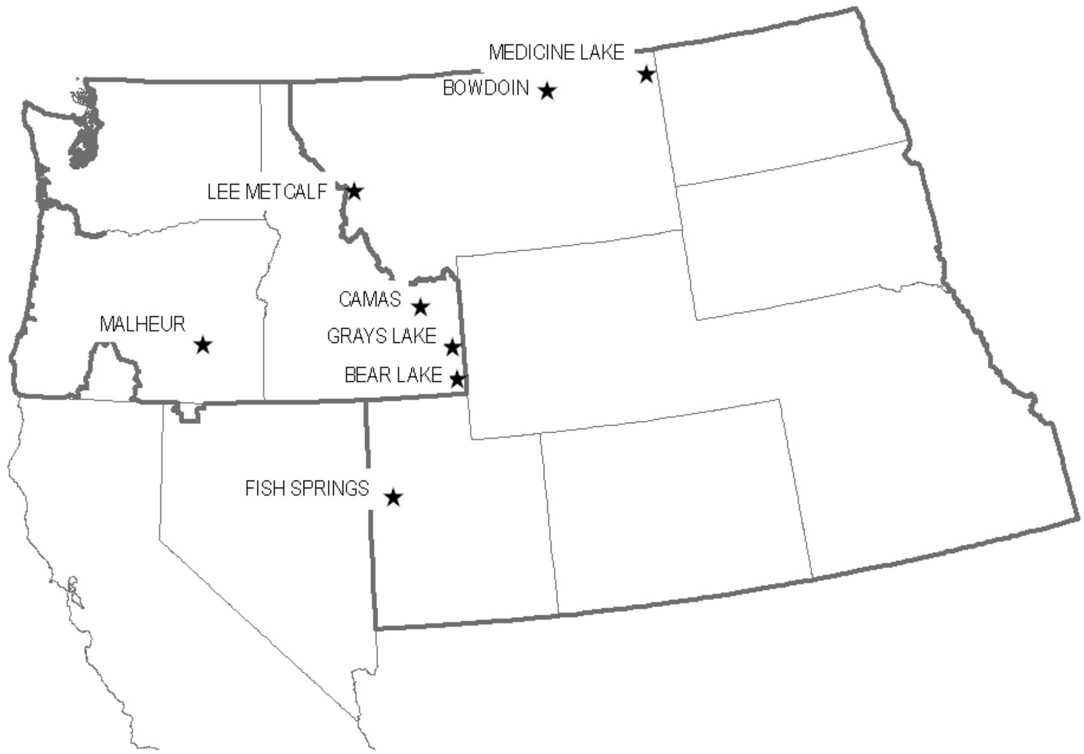

Figure 2. National Wildlife Refuges participating in the wetland state-and-transition model project. Regional USFWS boundaries (Regions 1 and 6) are dark gray.

Methods

Conceptual Wetland State-and-Transition Model

Ecological site descriptions were defined and described for 1) semi-permanently flooded palustrine wetland habitats specific to each participating station and 2) a general semi-permanently flooded palustrine wetland habitat based on hydrological modifiers as classified by Cowardin et al. (1972) with three additions to account for temporal variability among these flooding regimes with similar ecological processes. The STM was then developed for the general ESD in order to:

- Provide a universally-applicable ecological framework to apply across wetlands in different geomorphic regions; and
- Elucidate common ecological drivers and processes that influence the expression of wetland plants.

The STM framework was constructed using one or more community phases within a state. Community phases were defined by distinctive plant communities and associated hydrologic characteristics. States were distinguished according to vegetation structure, interactions with hydrology, and related ecological processes. The STM includes one reference state (e.g., historical range of variation prior to major anthropogenic changes) and three alternative states where the site has crossed a threshold, preventing a natural recovery to a desired phase or state (Fig. 3).

The reference state includes four reference vegetation communities characterized by diverse submerged aquatic and tall emergent vegetation communities. Two at-risk phases are also identified to indicate conditions when the site is likely to cross a threshold into a non-desirable, alternative state. A ruderal phase, characterized by annual vegetation and/or perennial emergent vegetation adapted to distubance, is also included as a vegetation phase within the reference becuase it may occur as a result of extreme drought, managed water-level drawdowns, or other management actions (e.g., mechanical disturbance) that are implemented to “re-set” succession in wetland impoundments. Non-desirable alternative states known to occur within the study area include turbid open water with no SAV, anoxic-tolerant SAV, and decadent tall emergent vegetation. One additional alternative state that occurs within the western United States, non-native, invasive vegetation, is also identified. Although non-native species are present at participating refuges, management units in this study are not dominated by non-native species and therefore this state and associated transitions are not described in detail. STMs for individual non-native species should be developed when they are of management concern because transitions and restoration pathways will vary depeding on the species and its life history strategies.

Narrative descriptions for each state include ecological indicators, feedback mechanisms, and abiotic/ecological processes (Bestelmeyer et al. 2010). Community phases are identified for each state based on structure and composition of wetland vegetation that result from natural processes or active management. Transitions and pathways between states are hypotheses based on historical accounts and literature reviews that will be tested through applied research and monitoring efforts completed at multiple refuges during this project. As empirical data are collected and analyzed, more detail can be added to further refine states, phases, transitions, and pathways within the current STM.

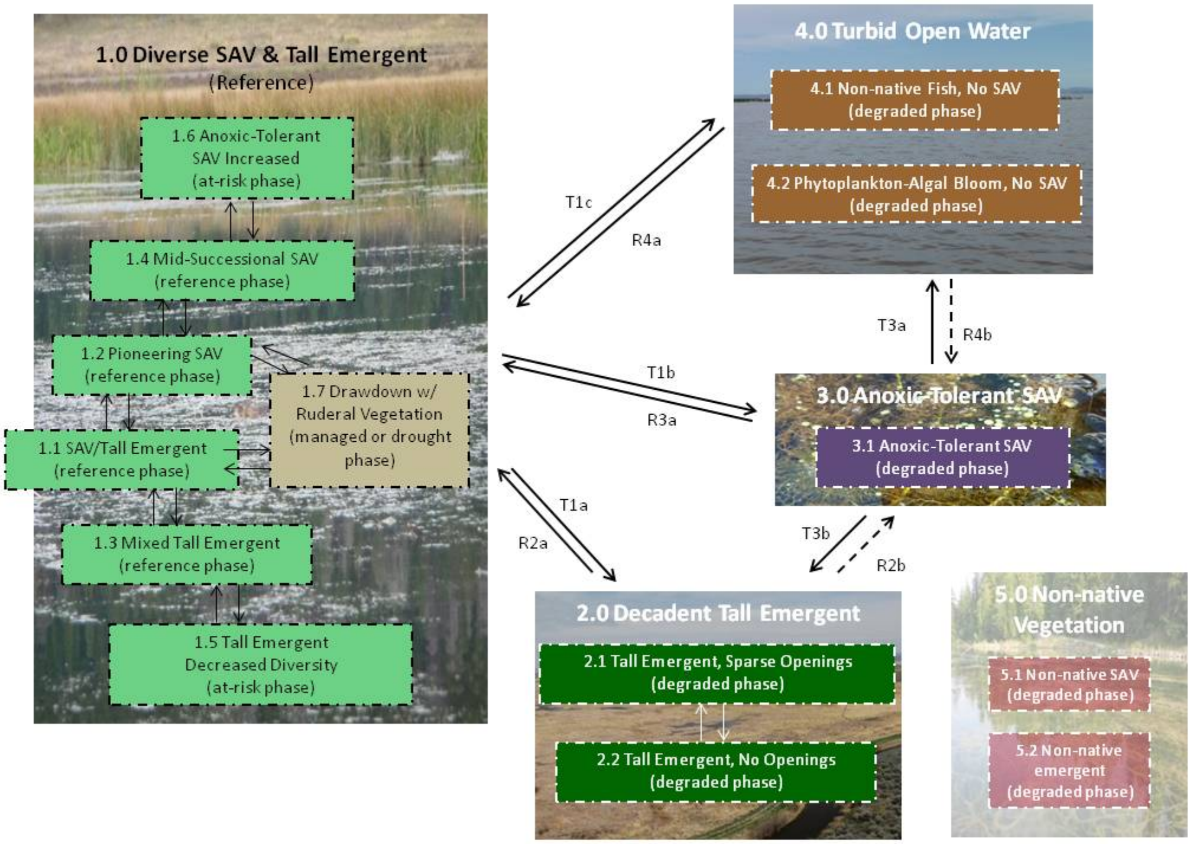

Figure 3. Draft state-and-transition model (STM) for semi-permanently flooded wetland habitats.

Field Data Collection

Sampling Design

Staff from each station non-randomly selected prioirty wetland management units to sample as part of this project. Within each management unit, semi-permanently flooded wetland areas were delineated based on available data (e.g., National Wetland Inventory, elevation data, vegetation maps, and staff knowledge of water levels). Hence, the primary sampling unit (i.e., sampling frame) consisted of semi-permanently flooded wetland habitats within each mangement unit. A generalized random tessellation stratified (GRTS) sample of points was created for each sampling frame to conduct wetland vegetation surveys. The GRTS algorithm provides a spatially-balanced random sample of ordered points to be visited for data collection. We used the grts() function within the spsurvey R package (Kincaid et al. 2012). Sampling intensity, defined as points per acre × 100% (e.g., 30 points/100 acres × 100% = 30% sampling intensity), was specified at 30% within most units (i.e., those 100-300 acres in area) with a minimum of exactly 30 points for smaller units (20-100 acres), exactly

90 points for units between 300 and 500 acres, and a maximum of exactly 120 points for larger units (>500 acres).

Vegetation Surveys

Vegetation surveys were conducted at each GRTS point with a 1 × 1 m quadrat; points were accessed via boat (e.g., canoe, airboat), amphibious vehicle (e.g., Marsh Master) or on foot. A point was identified as a target point based on the presence of vegetation species indicative of semi-permanently flooded wetland habitats (see IWWWG Procedures Manual). If a point was identified as non-target based on vegetation present, it was recorded as such and not evaluated. Non-target points were points located in: 1) upland habitats; 2) temporarily flooded habitats; 3) seasonally flooded habitats; 4) permanently flooded habitats; or 5) other (e.g., muskrat house, nesting platform, located on dike, etc). In addition, inaccessible points were recorded as such, with the reason, and not evaluated.

Canopy cover of each species, residual vegetation, and bare substrate was recorded to the nearest 1% at target points. Species that occurred as a single plant were recorded as having at least 1% canopy cover. Observers recorded aerial coverage of each species as viewed from above, even if a species (e.g., *Lemna* spp., *Potamogeton natans*, etc.) obscured submerged vegetation beneath it. Percent canopy cover for all species present, residual vegetation, and bare substrate was checked to ensure the sum equalled 100%. Floating plant parts of rooted plants were not recorded in the canopy cover estimate.

The exception to this included waterlily (*Nuphar* spp.) and smartweed (*Persicaria* spp.) that occurred at or above the surface of the water. If these species were present, ocular estimates were made for two vegetation strata or layers: 1) vegetation at or above the surface of the water; and 2) vegetation within the water column, including all species (e.g., SAV, waterlily stems, etc). The ocular estimate of waterlily and smartweed at or above the water column is not included in the sum for total cover. The percent cover of all species present within the water column summed to 100%.

In contrast to 2014, the canopy cover of filamentous algae was not included in the canopy cover of wetland plants. Observers recorded filamentous algae in one of two categories: 1) FILAL-FL (floating) or 2) FILAL-WC (water column, includes algae on the surface of SAV). After percent covers of FILAL-FL and FILAL-WC were recorded, filamentous algae was removed from the plot until they could see and estimate the canopy cover of wetland vegetation. Plant-like algae (e.g., *Nitella* spp. and *Chara* spp.) were treated as submerged aquatic vegetation and were not removed from the plot.

Abiotic Variables

Water depth (± 1 cm), Secchi disc depth (± 1 cm), temperature (± 0.1° C), pH (± 0.01 units), salinity (± 0.1 ppt), specific conductivity (± 1 μScm^{-1}), and soil texture (18 classes, see below) were measured at each GRTS point after canopy cover of vegetation were estimated and recorded. Water depth and Secchi disc depth were measured using a fiberglass tape attached to a Secchi disk. Water chemistry variables were measured with a YSI (model used varied by station).

Soil texture was determined for each plot using soil samples collected from the top 6 inches of the substrate using an auger, shovel, or Eckman dredge. Soil classes were determined for organic, mineral, and rocky soils. The NRCS *Soil Texture by Feel* flow chart was used to determine classes of mineral soil. Soil classes included:

- Organic (O)
  - Muck/Sapric (Oa)
  - Mucky Peat/Hemic (Oe)
  - Peat/Fibric (Oi)
- Rhizomes [dense mat of rhizomes > 2 ft deep with no other discernable substrate type present] (Rhiz)
- Mineral
  - Sand (Sa)
  - Loamy sand (LoSa)
  - Sandy loam (SaLo)
  - Silt loam (SiLo)
  - Loam (Lo)
  - Sandy clay loam (SaClLo)
  - Silty clay loam (SiClLo)
  - Clay loam (ClLo)
  - Sandy clay (SaCl)
  - Silty clay (SiCl)
  - Clay (Cl)
- Rocky
  - Gravel (Gvl)
  - Cobble (Cbl)
  - Boulder (Bldr)

Data Analysis

Species occurrence data from rake and ocular plots were used to define vegetation community site groups and explore abiotic variation among site groups. The following data were excluded from the species occurrence matrix: 1) data collected from wetland units undergoing a complete drawdown; and 2) residual vegetation, moss, unknown forbs, unknown grasses, and bare substrate. If a plot did not contain any other taxa after the above data were removed, that plot was excluded from analyses. Additionally, species occurence data were edited to combine certain species codes due to ecological and/or taxonomic considerations. Species that were lumped together included:

- ALISM + ALGR + ALTR7 = ALISMgr (*Alisma* spp. group)
- AZOLL + AZMI = AZOLLgr (*Azolla* spp. group)
- CALLI6, CAHE2 = CALLI6gr (*Callitriche* spp. group)
- CAUT, CARO6, CAREX = CAUTgr (Northwest Territory sedge group)
- CHARA + CHVU = CHARAgr (*Chara* spp. group)
- ELODEA + ELCA7 = ELODEAgr (*Elodea* spp. group)
- JUNCUS + JUBA = JUBAgr (Baltic rush group)
- LEMNA + LEMI3 = LEMNAgr (small duckweed group)
- MYRIO + MYSI + MYVE3 = MYRIOgr (*Myriophyllum* spp. group)
- NAJAS + NAFL + NAGU = NAJASgr (*Najas* spp. group)
- RUMEX + RUCR + RUMA4 = RUMEXgr (*Rumex* spp. group)
- SCAM6 + SCPU10 = SCAM6gr (Three-square bulrsh group)

Vegetation community site groups were defined by 1) calculating a Sørensen dissimilarity index using a plot by species occurrence matrix, 2) conducting a cluster analysis on the resulting dissimilarity matrix, and 3) selecting an optimal number of site groups using Indicator Species Analysis (Dufrêne and Legendre 1997). Once site groups were defined, we explored variation in abiotic variables among phases using Tukey's Honestly Significant Difference (HSD) test. All analyses were conducted in R version 3.3.2 (R Development Core Team 2016).

Cluster Analysis for Defining Vegetation Community Phases

Cluster analysis is a group of multivariate techniques commonly used in community ecology for grouping sites based on similarities. The goal of the analysis is to 'cluster' sites that are more similar within a site group than among site groups. A Sørensen dissimilarity index for the wetland vegetation data matrix of 1651 plots and 108 species and species groups was calculated after eliminating rare species, i.e., those that occurred in <0.5% of plots. The Sørensen dissimilarity index measures how different plots are from each other using presence/absence data, giving greater 'weight' to species common to both plots. The equation for calculating the Sørensen index is $2a/(2a+b+c)$, where a is the number of species common to both plots, b is the number of species unique to the first plot, and c is the number of species unique to the second plot.

Vegetation community site groups were created by conducting a hierarchical agglomerative cluster analysis with a flexible beta of -0.25. Hierarchical clustering has a number of benefits over other clustering algorithms, which has made it a commonly used technique in recent community ecology papers (e.g., Perrin et al. 2006, Little et al. 2010, Abella et al. 2012). In this method each plot starts out as an individual and the two least dissimilar plots are put together to form the first cluster. Remaining plots are fused one at a time in order of lowest dissimilarity until all plots are in a cluster.

Indicator Species Analysis

We used an indicator species analysis (ISA; Dufrêne and Legendre 1997) on output from hierarchical clustering to determine the optimal number of site groups. An ISA selects associated species for each site group identified in the cluster analysis above. It does this by calculating an indicator value, d, that combines measures of species *specificity* and *fidelity* to a site group. The former is the probability of a site being within a target site group (G) conditional on presence of species S, i.e., $A = P(G|S)$. This value is maximized when a species is *only* present in a site group. Conversely, B is the probability of finding a species within a given site group, $B = (S|G)$. This value maximizes when a species occurs in *all* sites within a site group. As defined by Dufrêne and Legendre (1997), an indicator species is:

> The most characteristic species of each group, found mostly in a single group of the typology and present in the majority of the sites belonging to that group.

An ISA provides a number of useful summary metrics based on d that can be used to objectively determine how many site groups are present in the data. These metrics include:

1. Number of significant indicator species ($P < 0.05$)
2. Mean indicator species value
3. Percent strong indicator species (>0.40 indicator value)
4. Mean P-value of all species

Criteria 1-3 should peak at the most informative level of clustering, while the lowest value of criterion 4 indicates the most signficant indicator species. The number of significant indicator species, mean indicator species value, and mean P-value of all species were used for selecting the optimal number of vegetation community site groups (McCune and Grace 2002).

Results and Discussion

Data from 1651 sample points and 108 species or species groups were included in analyses to identify vegetation community site groups.

Most species were relatively rare with 94 species occurring in $\leqslant$ 5% of points surveyed. Species occurring in >5% of points ($n = 13$) were: CAUT, CHARA, LEMI3, MYRIO, RINA, RUMA5, SCAC3, SCTA2, STFIF, STPE15, TYLA, TYPHA, UTRI. To reduce noise within the data set, species occurring in $\leqslant$ 0.5% of points ($n = 48$) were eliminated, leaving 59 species. This resulted in a cutoff of ca. 8 points a species needed to be present at to be included in analysis; the minimum number of points surveyed on any individual unit was 30.

The number of significant indicators and mean P value of all species were optimized at 24 site groups (Figs. 4 and 5). Therefore, we included 24 site groups in the following summaries and analyses.

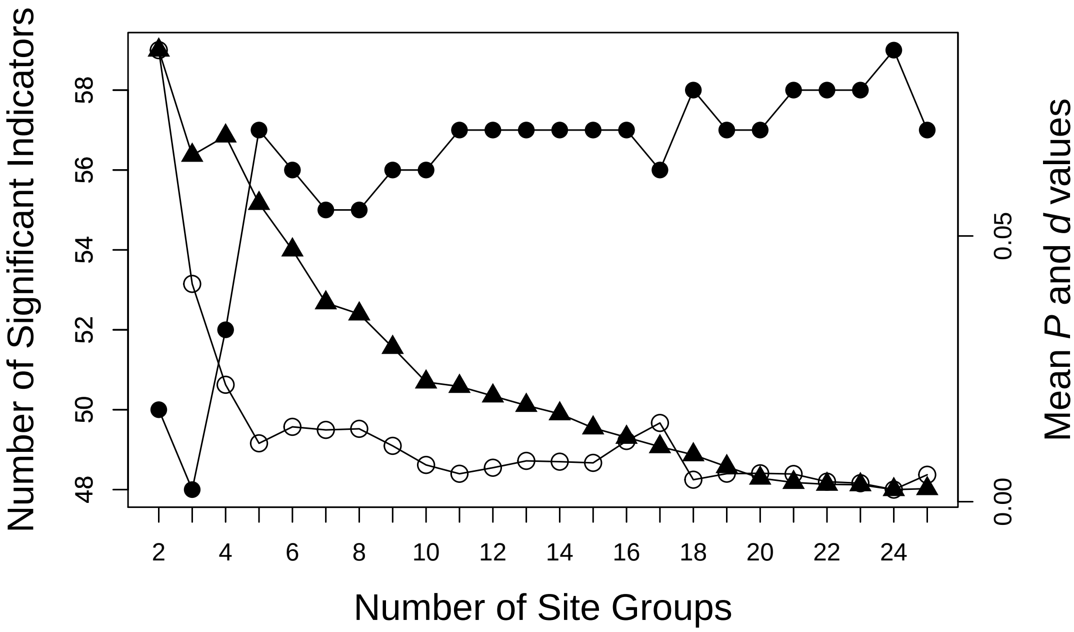

Figure 4. Criteria used to evaluate optimal number of vegetation community site groups based on Indicator Species Analysis (Dufrêne and Legendre 1997). Site groups were identified with a hierarchical agglomerative cluster analysis. Number of significant indicators ($P <$ 0.05; solid circles), mean P-value of all species (open circles), and mean indicator value (solid triangles) identified by ISA for 2-25 site groups.

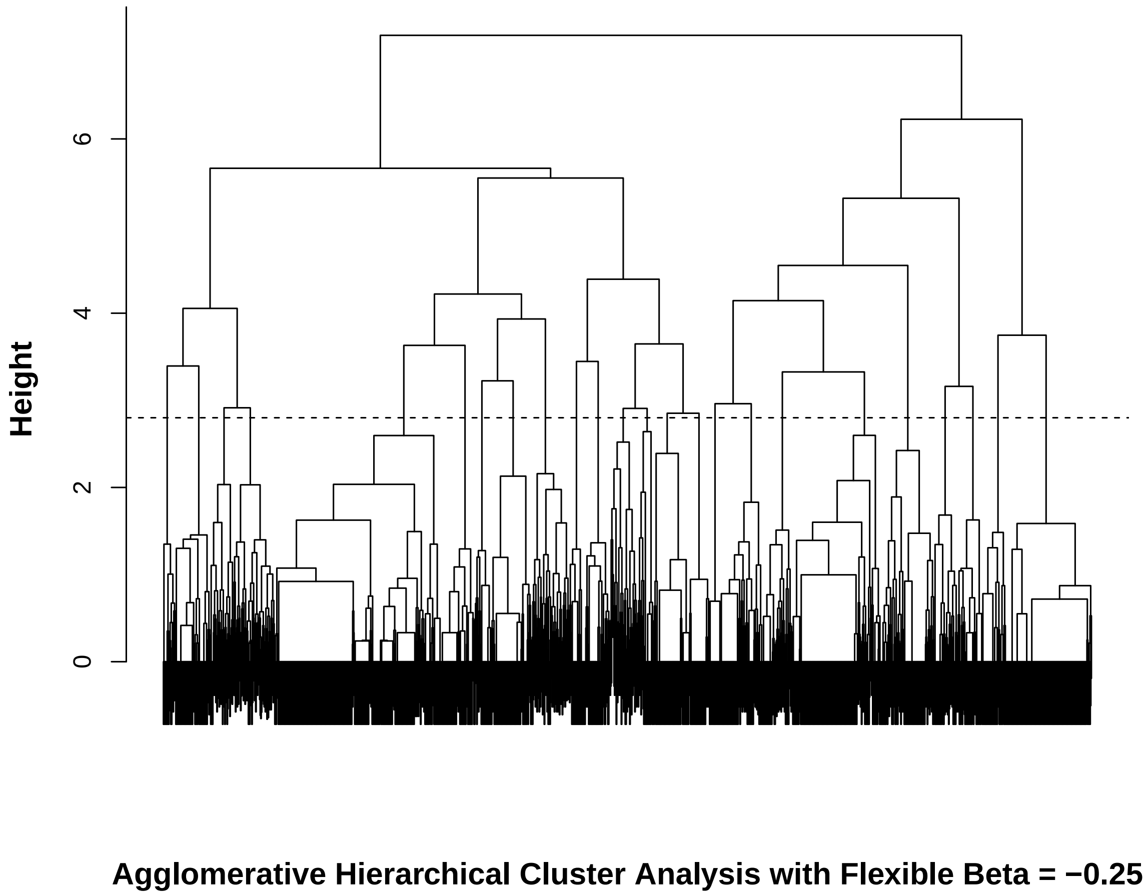

Figure 5. Cluster dendrogram for 1651 wetland vegetation survey points across 23 wetland management units at 8 National Wildlife Refuges during 2015. A hierarchical, agglomerative cluster analysis with a flexible beta = -0.25 was used to cluster plots. The optimal number of vegetation community site groups based on Indicator Species Analysis (Dufrêne and Legendre 1997) was 24 and is indicated by the horizontal line.

Of the 24 site groups, 2 were characterized by ruderal species, 10 by submergent species, and 12 by emergent species. The hybrid cattail, *Typha x glauca*, had the highest indicator value of the emergent site group indicator species (Indicator value = 0.82). Widgeongrass (*Ruppia maritima*) had the highest indicator value among the submergent site group indicator species (Indicator value = 0.87). The following six submergent site groups contained at least one species with a reasonably high indicator value (>0.40): sago pondweed (STPE15), slender pondweed (STFIF), widgeongrass (RUMA5), horned pondweed (ZAPA), Florida mudmidget (WOGL2), and Rocky Mountain waterlily (NUPO). The following eight emergent site groups contained at least one species with a reasonably high indicator value: hybrid cattail (TYGL), narrowleaf cattail (TYAN), unidentified cattail (TYPHA), three-square bulrush complex (SCAM6), softstem bulrush (SCTA2), Northwest Territory sedge complex (CAUT), purple-fringed riccia (RINA), and reed canary grass (PHAR3). For each site group, the statistically significant species with the three highest indicator values are provided in Table 1.

Hardstem bulrush (SCAC3) was the most common emergent site group (297 points) and muskgrass (CHARA) was the most common submergent site group (160 points). Hardstem bulrush site groups occurred in all sampled units except four: Boca at Malheur NWR; Pond 4 at Lee Metcalf NWR; and Curlew and Ibis at Fish Springs NWR. The muskgrass site group was not observed at Malheur, Bowdoin, or Medicin Lake NWRs. The widgeongrass (RUMA5) site group was the third most common site group (143 points), but was only observed at Fish Springs NWR. The water milfoil complex (MYRIO) site group was the fourth most abundant site group (92 points) observed at all stations except Malheur and Fish Springs NWRs. The sago pondweed (STPE15) site group was the fifth most common site group and was observed at all stations. Vegetation community site groups by wetland unit are listed in Table 2.

Table 1: Top three indicator species (ordered left to right) and their values (d) for each site group identified using agglomerative hierarchical clustering and Indicator Species Analysis (Dufrêne and Legendre 1997) for semi-permanently flooded wetland areas sampled across 23 wetland management units at eight National Wildlife Refuges in 2015. Common and scientific names for each species code are provided in Appendix C.

Site Group	Species	d	Species	d	Species	d	Life History
1	TYGL	0.82	TYLA	0.11	LEMI3	0.05	Emergent
2	TYAN	0.72	STPE15	0.01			Emergent
3	STPE15	0.55	STFIF	0.02	CHARA	0.02	Submergent
4	SCAC3	0.19	UTRI	0.03	LEMI3	0.01	Emergent
5	TYLA	0.38	SCAC3	0.08	CAUT	0.03	Emergent
6	HOJU	0.62	LASE	0.22	CIAR4	0.02	Annual/ruderal
7	SCAM6	0.81	DISP	0.05	CHARA	0.03	Emergent
8	MYRIO	0.30	CEDE4	0.14	STPE15	0.12	Submergent
9	PORI3	0.33	PEMA24	0.29	ELAC	0.15	Emergent
10	CAUT	0.46	SCAC3	0.07	TYPHA	0.03	Emergent
11	PHAR3	0.78	LASE	0.10	URDI	0.08	Emergent
12	SCTA2	0.78	SCAC3	0.11	LEMI3	0.02	Emergent
13	STFIF	0.67	CHARA	0.15	POPU7	0.10	Submergent
14	UTRI	0.34	MYRIO	0.09	CHARA	0.07	Submergent
15	JUBA	0.39	MEAR4	0.26	CIAR4	0.21	Emergent
16	NUPO	0.82	UTRI	0.19	LETR	0.05	Submergent
17	CHARA	0.23	RAAQ	0.05	PHAU7	0.04	Submergent
18	SPPO	0.32	AZOLL	0.28	LEMI3	0.20	Submergent
19	WOGL2	0.72	PEAM	0.03	ZAPA	0.02	Submergent
20	RINA	0.58	SPEU	0.23	RIFL4	0.18	Emergent
21	ZAPA	0.60	ALISM	0.03	RAAQ	0.01	Submergent
22	TYPHA	0.59	SCAC3	0.11	FOAN2	0.03	Emergent
23	KOSC	0.26	CHENO	0.24	ALAE	0.20	Annual/ruderal
24	RUMA5	0.87	CHARA	0.19	DISP	0.04	Submergent

Table 2: Occurrence of 24 clusters identified using Indicator Species Analysis (Dufrêne and Legendre 1997) across 23 wetland management units sampled at eight National Wildlife Refuges in 2015. Vegetation community clusters are labeled with the top indicator species code for each cluster. Note that the top indicator species may not occur in all plots within that cluster. Common and scientific names for each species code are provided in Appendix C.

Unit	CAUT	CHARA	HOJU	JUBA	KOSC	MYRIO	NUPO	PHAR3	PORI3	RINA	RUMA5	SCAC3
BDW_GIPO	N/A	N/A	3	N/A	N/A	1	N/A	N/A	N/A	N/A	N/A	1
BDW_LAUN	6	N/A	2	N/A	N/A	32	N/A	1	3	N/A	N/A	12
BRL_BLOO	N/A	N/A	N/A	5	N/A	2	1	N/A	N/A	N/A	N/A	57
BRL_BUNN	N/A	11	N/A	4	N/A	4	2	N/A	2	1	N/A	55
BRL_RAIN	N/A	8	N/A	4	1	2	N/A	N/A	N/A	1	N/A	67
CMS_BIGP	N/A	1	N/A	7	2	N/A	N/A	N/A	N/A	N/A	N/A	2
CMS_REDH	N/A	2	N/A	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5
CMS_SANL	N/A	1	6	16	7	1	N/A	1	2	N/A	N/A	19
FHS_CURL	N/A	14	N/A	3	1	N/A	N/A	N/A	N/A	N/A	37	N/A
FHS_IBIS	N/A	13	N/A	1	1	N/A	N/A	N/A	N/A	N/A	47	N/A
FHS_MALU	N/A	27	N/A	N/A	5	N/A	N/A	N/A	1	N/A	32	3
FHS_SHOV	N/A	32	N/A	1	7	N/A	N/A	N/A	N/A	N/A	27	1
GYL_BEAV	12	36	N/A	2	N/A	7	N/A	N/A	1	N/A	N/A	10
GYL_BIBE	2	N/A	N/A	5	N/A	21	N/A	N/A	2	59	N/A	1
GYL_LAKE	6	5	N/A	4	N/A	1	N/A	N/A	N/A	2	N/A	26
GYL_OUTE	2	N/A	N/A	2	N/A	2	41	N/A	4	7	N/A	9
LMC_PO02	N/A	10	N/A	1	N/A	N/A	N/A	N/A	N/A	2	N/A	1
LMC_PO04	N/A	N/A	N/A	2	N/A	1	N/A	N/A	N/A	1	N/A	N/A
MDL_SAYE	N/A	N/A	N/A	N/A	N/A	3	N/A	N/A	N/A	N/A	N/A	6
MDL_SAYW	N/A	N/A	N/A	N/A	N/A	15	N/A	N/A	N/A	N/A	N/A	13
MLH_BENN	1	N/A	N/A	2	1	N/A	N/A	1	10	N/A	N/A	8
MLH_BOCA	1	N/A	18	3	3	N/A	N/A	34	7	N/A	N/A	N/A
MLH_WKNR	1	N/A	N/A	N/A	N/A	N/A	N/A	6	17	N/A	N/A	1
Total	31	160	29	67	28	92	44	43	49	73	143	297

Table 2. Continued.

Unit	SCAM6	SCTA2	SPPO	STFIF	STPE15	TYAN	TYGL	TYLA	TYPHA	UTRI	WOGL2	ZAPA
BDW_GIPO	6	N/A	N/A	N/A	8	7	1	2	N/A	N/A	N/A	N/A
BDW_LAUN	N/A	N/A	N/A	N/A	N/A	6	7	1	N/A	N/A	N/A	N/A
BRL_BLOO	N/A	41	N/A	4	N/A	N/A	N/A	N/A	N/A	5	N/A	N/A
BRL_BUNN	N/A	4	2	5	N/A	N/A	1	2	N/A	9	3	1
BRL_RAIN	N/A	7	2	9	3	1	1	1	5	6	N/A	N/A
CMS_BIGP	N/A	N/A	N/A	7	4	N/A	N/A	6	4	N/A	N/A	4
CMS_REDH	N/A	3	N/A	6	7	N/A	N/A	N/A	N/A	N/A	N/A	3
CMS_SANL	N/A	N/A	N/A	1	16	N/A	N/A	N/A	N/A	N/A	N/A	7
FHS_CURL	18	N/A	N/A	N/A	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FHS_IBIS	N/A	N/A	N/A	N/A	3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FHS_MALU	18	N/A	N/A	N/A	N/A	1	N/A	N/A	1	N/A	N/A	N/A
FHS_SHOV	10	N/A	N/A	N/A	1	N/A	N/A	1	1	N/A	N/A	N/A
GYL_BEAV	N/A	2	N/A	11	2	N/A	8	19	11	N/A	2	N/A
GYL_BIBE	N/A	N/A	4	3	5	N/A	N/A	5	9	1	3	N/A
GYL_LAKE	N/A	N/A	3	2	2	N/A	4	13	19	4	N/A	N/A
GYL_OUTE	N/A	N/A	1	1	1	N/A	N/A	1	5	16	N/A	N/A
LMC_PO02	N/A	N/A	2	2	2	N/A	N/A	3	N/A	N/A	N/A	4
LMC_PO04	N/A	N/A	21	N/A	N/A	N/A	N/A	5	N/A	N/A	N/A	N/A
MDL_SAYE	N/A	N/A	N/A	N/A	N/A	3	N/A	3	17	N/A	N/A	N/A
MDL_SAYW	N/A	N/A	N/A	N/A	15	2	N/A	N/A	N/A	N/A	N/A	N/A
MLH_BENN	N/A	N/A	3	N/A	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MLH_BOCA	N/A	N/A	3	2	N/A	N/A	N/A	N/A	N/A	N/A	24	16
MLH_WKNR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	33	N/A
Total	52	57	41	53	75	20	22	62	72	41	65	35

Abiotic attributes of vegetation community site groups varied considerably (Tables 3 and 4, Figure 6). Variation within a vegetation community site group may in part be due to timing of sampling (July, August, September), differences in water management cycles among units, and time (years) since disturbance. For example, water depths during July are likely higher than water depths during September within the same vegetation site group. Because water conditions at time of plant germination and water depths during previous years can influence SAV, other water and hydroperiod variables, in addition to water depth at time of sampling, will be examined in future analyses. Two vegetation community site groups, reed canary grass (PHAR3) and foxtail barley (HOJU) had mean water depths of 0 and no associated water quality variables.

Water depths at all SAV community site groups, excluding mud midget (WOGL2), were significantly deeper than water depths at all tall emergent site groups (Table 5). The highest mean water depth occurred in the waterlily (NUPO; 51.4 cm) and sago pondweed (STPE15; 55.9 cm) site groups. However, water depth in waterlily site groups was only significantly different than three other SAV site groups: widgeongrass (RUMA5; 36.6 cm), greater duckweed (SPPO; 35.2 cm), and mud midget (WOGL2; 25.7 cm). Although *T. angustifolia* is usually found in deeper water than *T. latifolia* (Snyder 1993), water depths did not significantly vary among cattail vegetation site groups (TYAN, TYGL, TYLA, and TYPHA) in this study. Water depths also did not vary among the tall bulrush community site groups (SCAC3, SCAM6, and SCTA2). Water depths in the softstem bulrush site group (SCTA2; 20.8) were significantly higher than water depths in the *Typha* spp. site group (TYPHA; 7.6 cm); other pairwise comparisons between bulrush and cattail site groups were not significantly different. Mean water depths in ruderal site groups and site groups with top indicator species characteristic of seasonally flooded wetland habitats ranged from 0 to 5 cm (Table 3).

All site groups had basic mean pH values (i.e., >7), except for narrow-leaf cattail (TYAN), which had a mean pH of 6.3 (Table 3). Muskgrass (CHARA), widgeongrass (RUMA5), and horned pondweed (ZAPA) site groups had mean pH values > 9. Other SAV site groups had mean pH values 7.3–8.7. Mean pH values of tall emergent site groups ranged from 6.3–7.8.

Mean specific conductivity of the widgeongrass site group (RUMA5; 6138.9 μ S cm^{-1}) was significantly higher than all other SAV and tall emergent community site groups (Table 7). The next highest mean conductivity values were for tall emergent vegetation site groups: three-square bulrush complex (SCAM6; 4482.5), and narrowleaf cattail (TYAN; 3955.2 μ S cm^{-1}). Other SAV site groups with relatively high specific conductivity included muskgrass (CHARA; 2878.3 μ S cm^{-1}), sago pondweed (STPE15; 1856.8 μ S cm^{-1}), and water milfoil (MYRIO; 1102 μ S cm^{-1}).

Based on mean salinity values, six vegetation community site groups were fresh (0–0.3 ppt), 11 slightly brackish (>0.3–1.3 ppt), four moderately brackish (>1.3–3.2 ppt), and one brackish (>3.2–9.6 ppt) (Table 3). Freshwater vegetation community site groups included broadlead cattail (TYLA), northwest territory sedge complex (CAUT), waterlily (NUPO), greater duckweed (SPPO), mud midget (WOGL2), and horned pondweed (ZAPA). Moderately brackish vegetation community site groups included narrowleaf cattail (TYAN), three-square bulrush complex (SCAM6), muskgrass (CHARA), and kochia (KOSC). Widgeongrass (RUMA5) was the brackish vegetation community site group. Note that individual points ranged up to 10.61 ppt (Figure 6).

Organic soil was the most commonly observed soil category, followed by silty clay and silty clay loam (Table 4). Hard-stem bulrush (SCAC3), soft-stem bulrush (SCTA2), broadleaf cattail (TYLA), and unidentified cattail (TYPHA) site groups were dominated (>62% of plots) by organic soils. Organic soils occurred at <30% of plots within all SAV site groups. SAV site groups were dominated by mineral soils with a broad range of soil textures.

Table 3. Abiotic variable summary (means and standard deviations [SD]) for 24 vegetation community site groups identified using Indicator Species Analysis (Dufrêne and Legendre 1997). Vegetation community site groups are labeled with the top indicator species code for each site group. Data are from 23 wetland management units sampled at eight National Wildlife Refuges in 2015. Common and scientific names for each species code are provided in Appendix C.

Species Code	Depth	SD	pH	SD	Sp. Cond.	SD	Salinity	SD	Temp	SD
TYGL	12.6	13	7.5	0.4	621.6	810.9	0.33	0.41	17.1	3.4
TYAN	6.5	8.8	6.3	1.2	3955.2	1690.1	1.81	1	21.9	3.5
STPE15	55.9	39.4	8.5	1.2	1856.8	2368.3	0.96	1.23	21.1	4.3
SCAC3	14.1	13	7.6	0.4	1207.1	842.6	0.61	0.44	19.9	4.4
TYLA	11.7	9.8	7.4	0.6	549.3	723.4	0.28	0.39	15.8	3.1
HOJU	0	0								
SCAM6	9.2	8.7	7.8	0.6	4482.5	1548	2.55	1.29	19.6	3
MYRIO	46.8	19.8	8.3	0.9	1102	885.8	0.55	0.47	23.2	5.7
PORI3	4.8	9.6	7.7	0.7	1953.3	3311.3	1.07	1.91	15.6	5.3
CAUT	4.4	6.2	7.3	0.2	509	213.9	0.26	0.11	14	2.2
PHAR3	0	0								
SCTA2	20.8	11.2	7.8	0.4	1072	628.9	0.53	0.33	21.8	4.6
STFIF	46	22.9	8.7	0.7	786.2	1740.5	0.4	0.99	20.5	2.8
UTRI	44	15	7.9	0.5	759.6	390.5	0.39	0.2	19.2	4
JUBA	3.6	10.7	8.5	0.6	2129	2022.7	1.12	1.08	23	4.2
NUPO	51.4	17.1	7.3	0.2	546	230.5	0.28	0.12	15.2	1.6
CHARA	46.2	23.9	9.2	0.8	2878.3	2718.5	1.58	1.55	21	2.9
SPPO	35.2	24.1	7.6	0.4	343.9	274.9	0.19	0.13	11.6	5.6
WOGL2	25.7	13.8	8.4	0.5	410.3	126.8	0.2	0.06	22.5	5.2
RINA	12.8	10.7	7.4	0.4	621.1	262.9	0.31	0.13	15.3	3.3
ZAPA	43.4	29.2	9.2	0.8	330.9	167.4	0.16	0.08	19.7	3.4
TYPHA	7.6	7.2	7.3	0.4	657.2	697.3	0.33	0.36	15.7	2.9
KOSC	2.8	5.3	8.4	0.7	5104.4	1407.1	2.81	0.84	18.1	2.8
RUMA5	36.6	22.6	9.4	0.7	6138.9	2994.7	3.38	1.76	22.3	3.5

Table 4. Soil type summary for 24 vegetation community site groups identified using Indicator Species Analysis (Dufrêne and Legendre 1997). Vegetation community site groups are labeled with the top indicator species code for each site group. Data are from 23 wetland management units sampled at eight National Wildlife Refuges in 2015. Soil type codes are listed in Methods; common and scientific names for each species code are provided in Appendix C.

Species Code	Cl	ClLo	Gr	Lo	LoSa	Org	Sa	SaCl	SaClLo	SaLo	SiCl	SiClLo	SiLo
TYGL		1				10				1	2	6	2
TYAN		1						1	1		11	5	
STPE15		2		11	12	2			2	7	27	10	2
SCAC3	3	4		9	23	183	1	5	5	3	32	17	11
TYLA			1	1	2	43		2		1	3	2	
HOJU		9		7	4						3	5	1
SCAM6	2	9			1	15		2	4	2	8	7	2
MYRIO	4	8		3	1	5			3	5	24	30	9
PORI3	3	5		3	1	3			2		7	19	4
CAUT		1		1	1	19					3	4	2
PHAR3	2	14		5	4	1		1	1		2	9	4
SCTA2	1	2		1	3	46			1		1	1	1
STFIF		5		10	8	2				6	4	8	9
UTRI		2		6	1	10			1		1	2	14
JUBA		3	1	4	19	19		2	3	2	3	6	3
NUPO				8		4						7	25
CHARA	8	26		14	9	9		4	10	11	24	22	23
SPPO		1			3	7			3	2	4	3	7
WOGL2	1			1	2	6			2	4	10	19	20
RINA	5	5	1	3		21					18	9	10
ZAPA				6	2	1		1	1	2	3	10	8
TYPHA		1		1	2	44			2		16	3	2
KOSC	1	1			5	2		1	1	1	7	3	6
RUMA5	14	19	1	2	4	2		4	19	8	32	35	3

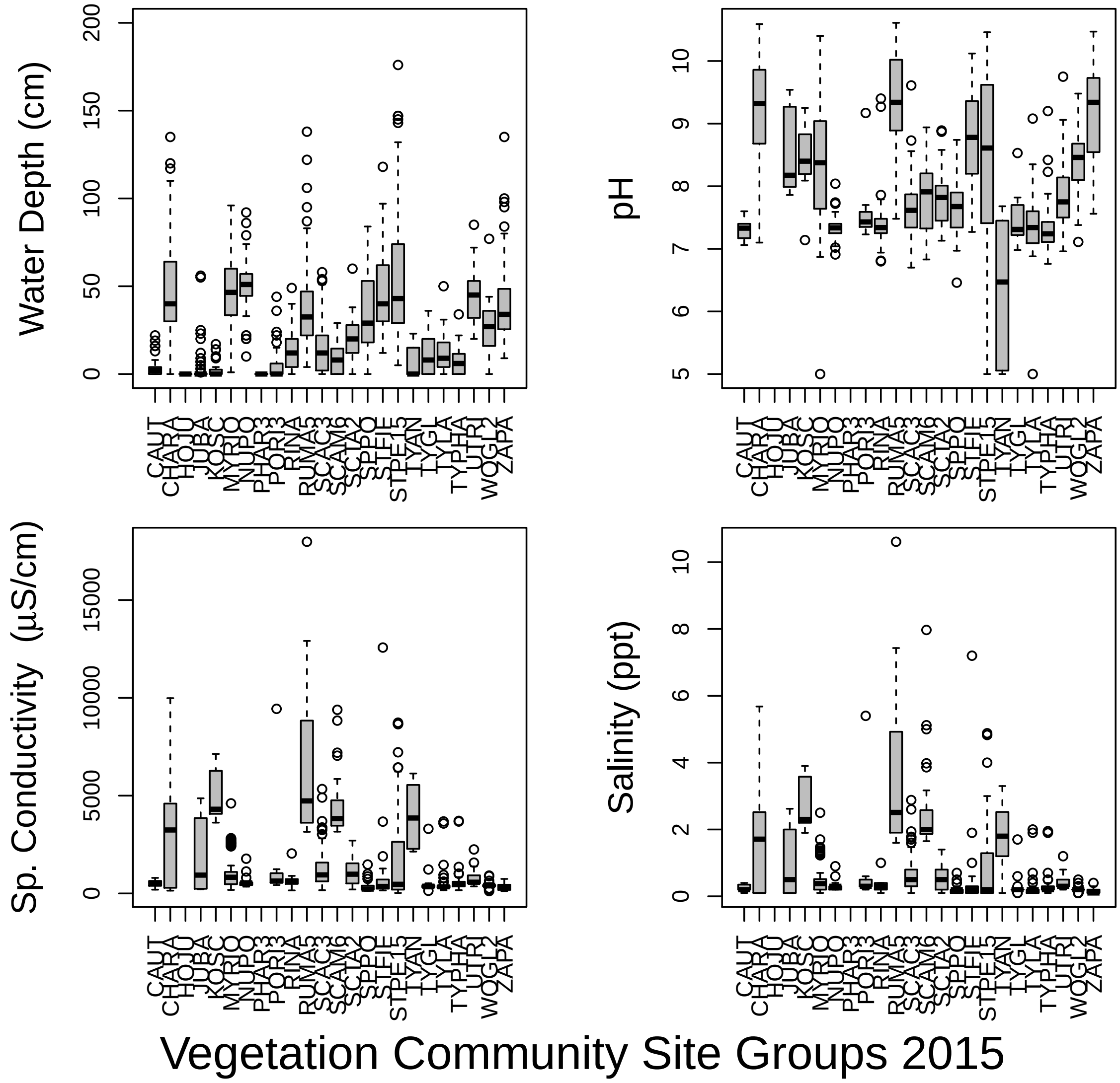

Figure 6. Abiotic variable boxplot summaries for 24 vegetation community site groups identified using Indicator Species Analysis (Dufrêne and Legendre 1997). Vegetation community site groups are labeled with the top indicator species code for each site group. Data are from 23 wetland management units sampled at eight National Wildlife Refuges in 2015. Common and scientific names for each species code are provided in Appendix C.

Table 5. Significant ($P = 0.10$) differences in water depth (cm) among site groups based on Tukey's Honestly Significant Difference test. Ruderal or emergent site groups with top indicator species indicative of seasonally or temporarily flooded wetland habitats are excluded. Indicator species codes associated with each site group are provided in Table 1.

	Difference	Lower CI	Upper CI	Adjusted P-value
RINA-CHARA	-33.47	-42.15	-24.79	0.00
RUMA5-CHARA	-9.66	-16.75	-2.58	0.00
SCAC3-CHARA	-32.08	-38.11	-26.04	0.00
SCAM6-CHARA	-37.03	-46.84	-27.22	0.00
SCTA2-CHARA	-25.44	-34.92	-15.95	0.00
SPPO-CHARA	-10.98	-21.74	-0.22	0.08
STPE15-CHARA	9.69	1.05	18.33	0.03
TYAN-CHARA	-39.67	-54.25	-25.10	0.00
TYGL-CHARA	-33.65	-47.92	-19.39	0.00
TYLA-CHARA	-34.53	-43.73	-25.34	0.00
TYPHA-CHARA	-38.66	-47.43	-29.90	0.00
WOGL2-CHARA	-20.53	-29.57	-11.49	0.00
RINA-MYRIO	-34.06	-43.70	-24.43	0.00
RUMA5-MYRIO	-10.25	-18.48	-2.03	0.00
SCAC3-MYRIO	-32.67	-40.01	-25.33	0.00
SCAM6-MYRIO	-37.62	-48.29	-26.96	0.00
SCTA2-MYRIO	-26.03	-36.39	-15.67	0.00
SPPO-MYRIO	-11.57	-23.11	-0.03	0.10
TYAN-MYRIO	-40.27	-55.43	-25.10	0.00
TYGL-MYRIO	-34.24	-49.11	-19.38	0.00
TYLA-MYRIO	-35.12	-45.22	-25.02	0.00
TYPHA-MYRIO	-39.25	-48.96	-29.54	0.00
WOGL2-MYRIO	-21.12	-31.08	-11.16	0.00
RINA-NUPO	-38.68	-50.41	-26.95	0.00
RUMA5-NUPO	-14.87	-25.47	-4.26	0.00
SCAC3-NUPO	-37.28	-47.22	-27.35	0.00
SCAM6-NUPO	-42.24	-54.83	-29.65	0.00
SCTA2-NUPO	-30.64	-42.98	-18.31	0.00
SPPO-NUPO	-16.19	-29.53	-2.85	0.01
TYAN-NUPO	-44.88	-61.46	-28.31	0.00
TYGL-NUPO	-38.86	-55.16	-22.56	0.00
TYLA-NUPO	-39.74	-51.85	-27.62	0.00
TYPHA-NUPO	-43.87	-55.66	-32.08	0.00
WOGL2-NUPO	-25.74	-37.74	-13.74	0.00
RUMA5-RINA	23.81	14.96	32.66	0.00
SPPO-RINA	22.49	10.49	34.49	0.00
STFIF-RINA	33.27	22.17	44.36	0.00
STPE15-RINA	43.17	33.03	53.30	0.00
UTRI-RINA	31.30	19.30	43.29	0.00
WOGL2-RINA	12.94	2.46	23.42	0.01
ZAPA-RINA	30.68	18.04	43.31	0.00
SCAC3-RUMA5	-22.41	-28.69	-16.14	0.00

Table 5. Continued.

	Difference	Lower CI	Upper CI	Adjusted P-value
SCAM6-RUMA5	-27.37	-37.33	-17.41	0.00
SCTA2-RUMA5	-15.77	-25.41	-6.14	0.00
STPE15-RUMA5	19.36	10.54	28.17	0.00
TYAN-RUMA5	-30.01	-44.69	-15.33	0.00
TYGL-RUMA5	-23.99	-38.36	-9.62	0.00
TYLA-RUMA5	-24.87	-34.23	-15.51	0.00
TYPHA-RUMA5	-29.00	-37.93	-20.07	0.00
WOGL2-RUMA5	-10.87	-20.08	-1.67	0.01
SPPO-SCAC3	21.09	10.85	31.34	0.00
STFIF-SCAC3	31.87	22.70	41.04	0.00
STPE15-SCAC3	41.77	33.78	49.76	0.00
UTRI-SCAC3	29.90	19.66	40.14	0.00
WOGL2-SCAC3	11.54	3.12	19.97	0.00
ZAPA-SCAC3	29.28	18.29	40.27	0.00
SPPO-SCAM6	26.05	13.21	38.89	0.00
STFIF-SCAM6	36.83	24.83	48.82	0.00
STPE15-SCAM6	46.73	35.60	57.85	0.00
UTRI-SCAM6	34.86	22.02	47.69	0.00
WOGL2-SCAM6	16.50	5.06	27.94	0.00
ZAPA-SCAM6	34.24	20.80	47.67	0.00
SPPO-SCTA2	14.45	1.87	27.04	0.02
STFIF-SCTA2	25.23	13.50	36.96	0.00
STPE15-SCTA2	35.13	24.30	45.96	0.00
TYPHA-SCTA2	-13.23	-24.16	-2.29	0.01
UTRI-SCTA2	23.26	10.67	35.85	0.00
ZAPA-SCTA2	22.64	9.44	35.84	0.00
STPE15-SPPO	20.68	8.71	32.64	0.00
TYAN-SPPO	-28.69	-45.46	-11.93	0.00
TYGL-SPPO	-22.67	-39.17	-6.18	0.00
TYLA-SPPO	-23.55	-35.92	-11.18	0.00
TYPHA-SPPO	-27.68	-39.74	-15.62	0.00
TYAN-STFIF	-39.47	-55.60	-23.34	0.00
TYGL-STFIF	-33.45	-49.30	-17.60	0.00
TYLA-STFIF	-34.33	-45.82	-22.83	0.00
TYPHA-STFIF	-38.46	-49.61	-27.30	0.00
WOGL2-STFIF	-20.33	-31.70	-8.95	0.00
TYAN-STPE15	-49.37	-64.86	-33.88	0.00
TYGL-STPE15	-43.35	-58.54	-28.15	0.00
TYLA-STPE15	-44.23	-54.81	-33.64	0.00
TYPHA-STPE15	-48.36	-58.57	-38.14	0.00
WOGL2-STPE15	-30.23	-40.68	-19.78	0.00
UTRI-TYAN	37.50	20.73	54.26	0.00
WOGL2-TYAN	19.14	3.43	34.86	0.01
ZAPA-TYAN	36.88	19.65	54.11	0.00
UTRI-TYGL	31.48	14.98	47.97	0.00

Table 5. Continued.

	Difference	Lower CI	Upper CI	Adjusted P-value
ZAPA-TYGL	30.86	13.89	47.82	0.00
UTRI-TYLA	32.36	19.98	44.73	0.00
WOGL2-TYLA	14.00	3.09	24.91	0.00
ZAPA-TYLA	31.74	18.74	44.73	0.00
UTRI-TYPHA	36.49	24.43	48.54	0.00
WOGL2-TYPHA	18.13	7.58	28.68	0.00
ZAPA-TYPHA	35.87	23.17	48.56	0.00
WOGL2-UTRI	-18.36	-30.61	-6.10	0.00
ZAPA-WOGL2	17.74	4.85	30.62	0.00

Table 6. Significant ($P = 0.10$) differences in pH among site groups based on Tukey's Honestly Significant Difference test. Ruderal or emergent site groups with top indicator species indicative of seasonally or temporarily flooded wetland habitats are excluded. Indicator species associated with each site group are provided in Table 1.

	Difference	Lower CI	Upper CI	Adjusted P-value
MYRIO-CHARA	-0.89	-1.19	-0.59	0.00
NUPO-CHARA	-1.90	-2.29	-1.51	0.00
RINA-CHARA	-1.82	-2.18	-1.46	0.00
SCAC3-CHARA	-1.61	-1.85	-1.37	0.00
SCAM6-CHARA	-1.41	-1.83	-0.98	0.00
SCTA2-CHARA	-1.44	-1.80	-1.08	0.00
SPPO-CHARA	-1.59	-2.00	-1.18	0.00
STFIF-CHARA	-0.52	-0.88	-0.16	0.00
STPE15-CHARA	-0.69	-1.01	-0.36	0.00
TYAN-CHARA	-2.91	-3.73	-2.08	0.00
TYGL-CHARA	-1.77	-2.41	-1.14	0.00
TYLA-CHARA	-1.85	-2.25	-1.46	0.00
TYPHA-CHARA	-1.89	-2.28	-1.51	0.00
UTRI-CHARA	-1.37	-1.77	-0.97	0.00
WOGL2-CHARA	-0.85	-1.19	-0.51	0.00
NUPO-MYRIO	-1.01	-1.43	-0.60	0.00
RINA-MYRIO	-0.93	-1.32	-0.54	0.00
RUMA5-MYRIO	1.06	0.75	1.36	0.00
SCAC3-MYRIO	-0.72	-1.01	-0.44	0.00
SCAM6-MYRIO	-0.52	-0.97	-0.07	0.02
SCTA2-MYRIO	-0.55	-0.95	-0.16	0.00
SPPO-MYRIO	-0.70	-1.14	-0.26	0.00
TYAN-MYRIO	-2.02	-2.85	-1.18	0.00
TYGL-MYRIO	-0.89	-1.54	-0.23	0.00
TYLA-MYRIO	-0.97	-1.39	-0.55	0.00
TYPHA-MYRIO	-1.01	-1.42	-0.59	0.00
UTRI-MYRIO	-0.48	-0.91	-0.05	0.02
ZAPA-MYRIO	0.82	0.36	1.27	0.00
RUMA5-NUPO	2.07	1.68	2.46	0.00
STFIF-NUPO	1.38	0.91	1.84	0.00
STPE15-NUPO	1.22	0.78	1.65	0.00
TYAN-NUPO	-1.00	-1.88	-0.13	0.02
UTRI-NUPO	0.53	0.04	1.02	0.04
WOGL2-NUPO	1.05	0.60	1.50	0.00
ZAPA-NUPO	1.83	1.31	2.34	0.00
RUMA5-RINA	1.98	1.62	2.35	0.00
STFIF-RINA	1.29	0.85	1.74	0.00
STPE15-RINA	1.13	0.72	1.54	0.00
TYAN-RINA	-1.09	-1.95	-0.23	0.00
WOGL2-RINA	0.97	0.54	1.39	0.00
ZAPA-RINA	1.74	1.25	2.24	0.00
SCAC3-RUMA5	-1.78	-2.02	-1.53	0.00

Table 6. Continued.

	Difference	Lower CI	Upper CI	Adjusted P-value
SCAM6-RUMA5	-1.58	-2.00	-1.15	0.00
SCTA2-RUMA5	-1.61	-1.97	-1.24	0.00
SPPO-RUMA5	-1.76	-2.17	-1.34	0.00
STFIF-RUMA5	-0.69	-1.06	-0.33	0.00
STPE15-RUMA5	-0.85	-1.18	-0.52	0.00
TYAN-RUMA5	-3.07	-3.90	-2.25	0.00
TYGL-RUMA5	-1.94	-2.58	-1.31	0.00
TYLA-RUMA5	-2.02	-2.42	-1.63	0.00
TYPHA-RUMA5	-2.06	-2.45	-1.67	0.00
UTRI-RUMA5	-1.54	-1.94	-1.13	0.00
WOGL2-RUMA5	-1.02	-1.36	-0.67	0.00
STFIF-SCAC3	1.09	0.74	1.44	0.00
STPE15-SCAC3	0.92	0.61	1.24	0.00
TYAN-SCAC3	-1.30	-2.11	-0.48	0.00
WOGL2-SCAC3	0.76	0.43	1.09	0.00
ZAPA-SCAC3	1.54	1.12	1.95	0.00
STFIF-SCAM6	0.89	0.39	1.38	0.00
STPE15-SCAM6	0.72	0.25	1.19	0.00
TYAN-SCAM6	-1.50	-2.39	-0.61	0.00
WOGL2-SCAM6	0.56	0.08	1.04	0.02
ZAPA-SCAM6	1.34	0.79	1.88	0.00
STFIF-SCTA2	0.92	0.48	1.36	0.00
STPE15-SCTA2	0.76	0.34	1.17	0.00
TYAN-SCTA2	-1.46	-2.33	-0.60	0.00
WOGL2-SCTA2	0.59	0.17	1.02	0.00
ZAPA-SCTA2	1.37	0.87	1.86	0.00
STFIF-SPPO	1.07	0.58	1.55	0.00
STPE15-SPPO	0.90	0.45	1.36	0.00
TYAN-SPPO	-1.32	-2.20	-0.43	0.00
WOGL2-SPPO	0.74	0.27	1.21	0.00
ZAPA-SPPO	1.52	0.98	2.05	0.00
TYAN-STFIF	-2.38	-3.24	-1.52	0.00
TYGL-STFIF	-1.25	-1.93	-0.57	0.00
TYLA-STFIF	-1.33	-1.80	-0.86	0.00
TYPHA-STFIF	-1.37	-1.83	-0.91	0.00
UTRI-STFIF	-0.85	-1.32	-0.37	0.00
TYAN-STPE15	-2.22	-3.07	-1.37	0.00
TYGL-STPE15	-1.09	-1.75	-0.42	0.00
TYLA-STPE15	-1.17	-1.61	-0.73	0.00
TYPHA-STPE15	-1.21	-1.64	-0.78	0.00
UTRI-STPE15	-0.68	-1.13	-0.24	0.00
ZAPA-STPE15	0.61	0.14	1.08	0.00
TYGL-TYAN	1.13	0.13	2.14	0.03
TYLA-TYAN	1.05	0.18	1.93	0.01
TYPHA-TYAN	1.01	0.14	1.88	0.02

Table 6. Continued.

	Difference	Lower CI	Upper CI	Adjusted P-value
UTRI-TYAN	1.54	0.66	2.41	0.00
WOGL2-TYAN	2.06	1.20	2.91	0.00
ZAPA-TYAN	2.83	1.94	3.72	0.00
WOGL2-TYGL	0.92	0.25	1.60	0.00
ZAPA-TYGL	1.70	0.98	2.42	0.00
WOGL2-TYLA	1.01	0.55	1.46	0.00
ZAPA-TYLA	1.78	1.26	2.30	0.00
UTRI-TYPHA	0.52	0.03	1.02	0.05
WOGL2-TYPHA	1.05	0.60	1.49	0.00
ZAPA-TYPHA	1.82	1.31	2.33	0.00
WOGL2-UTRI	0.52	0.06	0.98	0.02
ZAPA-UTRI	1.30	0.77	1.82	0.00
ZAPA-WOGL2	0.78	0.30	1.26	0.00

Table 7. Significant ($P = 0.10$) differences in specific conductivity (μ S cm^{-1}) among site groups based on Tukey's Honestly Significant Difference test. Ruderal or emergent site groups with top indicator species indicative of seasonally or temporarily flooded wetland habitats are excluded. Indicator species associated with each site group are provided in Table 1.

	Difference	Lower CI	Upper CI	Adjusted P-value
MYRIO-CHARA	-1776.29	-2532.64	-1019.93	0.00
NUPO-CHARA	-2332.30	-3314.93	-1349.66	0.00
RINA-CHARA	-2257.18	-3172.32	-1342.03	0.00
RUMA5-CHARA	3260.61	2594.70	3926.51	0.00
SCAC3-CHARA	-1671.17	-2281.47	-1060.88	0.00
SCAM6-CHARA	1604.26	527.46	2681.06	0.00
SCTA2-CHARA	-1806.33	-2721.48	-891.18	0.00
SPPO-CHARA	-2534.41	-3575.88	-1492.95	0.00
STFIF-CHARA	-2092.08	-3007.23	-1176.94	0.00
STPE15-CHARA	-1021.48	-1845.34	-197.61	0.01
TYGL-CHARA	-2256.69	-3863.46	-649.92	0.00
TYLA-CHARA	-2328.97	-3320.48	-1337.45	0.00
TYPHA-CHARA	-2221.05	-3195.11	-1246.98	0.00
UTRI-CHARA	-2118.64	-3128.96	-1108.32	0.00
WOGL2-CHARA	-2467.97	-3332.03	-1603.91	0.00
ZAPA-CHARA	-2547.40	-3624.20	-1470.60	0.00
RUMA5-MYRIO	5036.89	4266.98	5806.81	0.00
SCAM6-MYRIO	3380.55	2236.50	4524.59	0.00
TYAN-MYRIO	2853.26	729.86	4976.65	0.00
RUMA5-NUPO	5592.90	4599.80	6586.01	0.00
SCAM6-NUPO	3936.56	2631.82	5241.29	0.00
STPE15-NUPO	1310.82	205.57	2416.07	0.01
TYAN-NUPO	3409.26	1195.15	5623.37	0.00
RUMA5-RINA	5517.78	4591.40	6444.17	0.00
SCAM6-RINA	3861.44	2606.74	5116.13	0.00
STPE15-RINA	1235.70	189.99	2281.42	0.01
TYAN-RINA	3334.15	1149.15	5519.14	0.00
SCAC3-RUMA5	-4931.78	-5558.80	-4304.76	0.00
SCAM6-RUMA5	-1656.35	-2742.71	-569.98	0.00
SCTA2-RUMA5	-5066.94	-5993.32	-4140.55	0.00
SPPO-RUMA5	-5795.02	-6846.37	-4743.67	0.00
STFIF-RUMA5	-5352.69	-6279.07	-4426.31	0.00
STPE15-RUMA5	-4282.08	-5118.41	-3445.75	0.00
TYAN-RUMA5	-2183.64	-4276.52	-90.76	0.06
TYGL-RUMA5	-5517.30	-7130.49	-3904.10	0.00
TYLA-RUMA5	-5589.57	-6591.47	-4587.68	0.00
TYPHA-RUMA5	-5481.65	-6466.28	-4497.02	0.00
UTRI-RUMA5	-5379.25	-6399.76	-4358.74	0.00
WOGL2-RUMA5	-5728.58	-6604.53	-4852.62	0.00
ZAPA-RUMA5	-5808.01	-6894.38	-4721.64	0.00
SCAM6-SCAC3	3275.44	2222.24	4328.63	0.00

Table 7. Continued.

	Difference	Lower CI	Upper CI	Adjusted P-value
TYAN-SCAC3	2748.14	672.29	4824.00	0.00
SCTA2-SCAM6	-3410.59	-4665.29	-2155.89	0.00
SPPO-SCAM6	-4138.67	-5488.27	-2789.08	0.00
STFIF-SCAM6	-3696.34	-4951.04	-2441.65	0.00
STPE15-SCAM6	-2625.74	-3815.49	-1435.98	0.00
TYGL-SCAM6	-3860.95	-5682.62	-2039.28	0.00
TYLA-SCAM6	-3933.23	-5244.67	-2621.79	0.00
TYPHA-SCAM6	-3825.31	-5123.60	-2527.01	0.00
UTRI-SCAM6	-3722.90	-5048.62	-2397.19	0.00
WOGL2-SCAM6	-4072.23	-5290.17	-2854.30	0.00
ZAPA-SCAM6	-4151.66	-5528.71	-2774.61	0.00
TYAN-SCTA2	2883.30	698.30	5068.29	0.00
STPE15-SPPO	1512.94	355.06	2670.81	0.00
TYAN-SPPO	3611.38	1370.54	5852.22	0.00
STPE15-STFIF	1070.61	24.89	2116.32	0.08
TYAN-STFIF	3169.05	984.05	5354.05	0.00
TYLA-STPE15	-1307.49	-2420.65	-194.33	0.01
TYPHA-STPE15	-1199.57	-2297.22	-101.92	0.04
WOGL2-STPE15	-1446.50	-2447.81	-445.18	0.00
ZAPA-STPE15	-1525.93	-2715.68	-336.17	0.00
TYGL-TYAN	-3333.66	-5886.78	-780.54	0.00
TYLA-TYAN	-3405.94	-5624.00	-1187.87	0.00
TYPHA-TYAN	-3298.01	-5508.34	-1087.69	0.00
UTRI-TYAN	-3195.61	-5422.15	-969.07	0.00
WOGL2-TYAN	-3544.94	-5709.04	-1380.84	0.00
ZAPA-TYAN	-3624.37	-5881.85	-1366.89	0.00

Table 8. Significant ($P = 0.10$) differences in salinity (ppt) among site groups based on Tukey's Honestly Significant Difference test. Ruderal or emergent site groups with top indicator species indicative of seasonally or temporarily flooded wetland habitats are excluded. Indicator species associated with each site group are provided in Table 1.

	Difference	Lower CI	Upper CI	Adjusted P-value
MYRIO-CHARA	-1.03	-1.47	-0.60	0.00
NUPO-CHARA	-1.31	-1.87	-0.74	0.00
RINA-CHARA	-1.27	-1.80	-0.75	0.00
RUMA5-CHARA	1.79	1.41	2.17	0.00
SCAC3-CHARA	-0.97	-1.32	-0.62	0.00
SCAM6-CHARA	0.97	0.35	1.59	0.00
SCTA2-CHARA	-1.05	-1.58	-0.53	0.00
SPPO-CHARA	-1.39	-1.99	-0.79	0.00
STFIF-CHARA	-1.18	-1.71	-0.65	0.00
STPE15-CHARA	-0.62	-1.10	-0.15	0.00
TYGL-CHARA	-1.26	-2.18	-0.33	0.00
TYLA-CHARA	-1.30	-1.87	-0.73	0.00
TYPHA-CHARA	-1.25	-1.81	-0.69	0.00
UTRI-CHARA	-1.20	-1.78	-0.62	0.00
WOGL2-CHARA	-1.38	-1.88	-0.89	0.00
ZAPA-CHARA	-1.42	-2.04	-0.81	0.00
RUMA5-MYRIO	2.83	2.38	3.27	0.00
SCAM6-MYRIO	2.00	1.35	2.66	0.00
TYAN-MYRIO	1.26	0.04	2.48	0.07
RUMA5-NUPO	3.10	2.53	3.67	0.00
SCAM6-NUPO	2.28	1.53	3.03	0.00
STPE15-NUPO	0.68	0.05	1.32	0.04
TYAN-NUPO	1.53	0.26	2.80	0.01
RUMA5-RINA	3.06	2.53	3.60	0.00
SCAM6-RINA	2.24	1.52	2.96	0.00
STPE15-RINA	0.65	0.05	1.25	0.04
TYAN-RINA	1.49	0.24	2.75	0.01
SCAC3-RUMA5	-2.77	-3.13	-2.40	0.00
SCAM6-RUMA5	-0.82	-1.45	-0.20	0.00
SCTA2-RUMA5	-2.85	-3.38	-2.31	0.00
SPPO-RUMA5	-3.18	-3.79	-2.58	0.00
STFIF-RUMA5	-2.97	-3.50	-2.44	0.00
STPE15-RUMA5	-2.41	-2.90	-1.93	0.00
TYAN-RUMA5	-1.57	-2.77	-0.37	0.00
TYGL-RUMA5	-3.05	-3.98	-2.12	0.00
TYLA-RUMA5	-3.09	-3.67	-2.52	0.00
TYPHA-RUMA5	-3.04	-3.61	-2.48	0.00
UTRI-RUMA5	-2.99	-3.58	-2.40	0.00
WOGL2-RUMA5	-3.17	-3.68	-2.67	0.00
ZAPA-RUMA5	-3.22	-3.84	-2.59	0.00
SCAM6-SCAC3	1.94	1.34	2.55	0.00

Table 8. Continued.

	Difference	Lower CI	Upper CI	Adjusted P-value
TYAN-SCAC3	1.20	0.00	2.39	0.10
SCTA2-SCAM6	-2.02	-2.74	-1.30	0.00
SPPO-SCAM6	-2.36	-3.13	-1.58	0.00
STFIF-SCAM6	-2.15	-2.87	-1.43	0.00
STPE15-SCAM6	-1.59	-2.28	-0.91	0.00
TYGL-SCAM6	-2.22	-3.27	-1.18	0.00
TYLA-SCAM6	-2.27	-3.02	-1.52	0.00
TYPHA-SCAM6	-2.22	-2.97	-1.47	0.00
UTRI-SCAM6	-2.17	-2.93	-1.40	0.00
WOGL2-SCAM6	-2.35	-3.05	-1.65	0.00
ZAPA-SCAM6	-2.39	-3.19	-1.60	0.00
TYAN-SCTA2	1.28	0.02	2.53	0.09
STPE15-SPPO	0.77	0.10	1.43	0.02
TYAN-SPPO	1.61	0.32	2.90	0.00
TYAN-STFIF	1.40	0.15	2.66	0.03
TYLA-STPE15	-0.68	-1.32	-0.04	0.05
WOGL2-STPE15	-0.76	-1.34	-0.18	0.00
ZAPA-STPE15	-0.80	-1.49	-0.12	0.01
TYGL-TYAN	-1.48	-2.95	-0.01	0.09
TYLA-TYAN	-1.52	-2.80	-0.25	0.01
TYPHA-TYAN	-1.47	-2.74	-0.20	0.02
UTRI-TYAN	-1.42	-2.70	-0.14	0.03
WOGL2-TYAN	-1.60	-2.85	-0.36	0.00
ZAPA-TYAN	-1.65	-2.94	-0.35	0.00

Field work in 2016 will continue to explore wetland vegetation communities across diverse gradients of abiotic attributes. This will allow use of empirical data and repeatable methods for defining vegetation community phases within wetland states, and a better understanding of abiotic attributes phases are associated with. Long-term monitoring of states and phases, and management actions, will permit future estimation of the likelihood of state or phase shifts in response to management actions. Lastly, the ability to assess the state and phase of wetlands will provide an improved understanding of the habitat resources provided to migratory birds and other wetland-dependent wildlife, facilitating more coordinated wetland management to meet regional and flyway objectives.

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1 Appendix A: Assessment of Total Survey Error Using 2015 Data

For the survey design used in 2015, refer to the section in the main report titled "Field Data Collection." In this Appendix, we explore the potential sources of error within the proposed survey design. Core concepts considered here are presented in "Lohr, S. (2010) *Sampling: Design and Analysis.*"

Total survey error can be broken down into the following components: coverage error, non-response error, measurement error, processing error, and sampling error. Ideally, a survey design is constructed to minimize all of these sources of error, particularly the sources related to non-sampling error. Non-sampling errors are any errors or variability in the data that can not be attributed to the process of observing a portion of the area contained within semi-permanently flooded wetlands. In our case, we observe and record data on a set of plots (1 m^2) for percent cover by species or points for abiotic measurements within a delineated sampling unit or polygon (sampling frame). We do not exhaustively measure or collect wall-to-wall data throughout the entire polygon or sampling unit (census). Sampling error is just the inherent variability that happens from sample-to-sample. In other words, we have selected a probabilistic sample of points within the sampling frame. Therefore, the data collected from one set of GRTS points would vary from a different set of GRTS points. This sampling error or variation is accounted for within the statistical design-based estimators. Specifically, we report our uncertainty regarding the mean percent cover of a species (e.g., sago pondweed) by way of a confidence interval.

The harder to estimate and account for errors are non-sampling errors. Here, we discuss potential sources of non-sampling errors for this project related to coverage (Section 1.1), non-response and measurement errors (Section 1.2). Our assessment is informed by the 2015 field surveys that occurred on semi-permanently flooded wetland areas at 28 wetland management units across eight stations. Processing errors can occur during data entry into the database, coding errors when data are retrieved from the database, and/or data editing can introduce errors. Many of these processing errors are being corrected and adjusted for as the database is being developed and used for this project.

1.1 Coverage Errors

Coverage is the percentage of semi-permanently flooded wetland habitat within a given sampled wetland management unit that is covered by the sampling frame. In our case, the sampling frame was a delineated polygon within a geographic information system (GIS). The GRTS design is a dynamic sampling design in that points can be added and/or deleted based on whether a selected point is deemed within the target population and data were collected (TS) or determined non-target (NT) and no measurements were taken. If a point was deemed NT, an additional point could be surveyed starting with the first point on the over-sample list, assuming that all the points were evaluated from the panel one GRTS ordered list. The benefit of the GRTS design is that the target sample size can still be achieved and the realized sample of locations or points should still be spatially balanced within the sampling frame. Also, we are able to obtain a (likely) unbiased estimate of coverage within each sampling frame by way of the NT and TS recorded information (Table 9, Table 10, Table 11).

Table 9. For the combined 2014 and 2015 data, the total number of GRTS points evaluated as TS (target and sampled) or NT (non-target) by year.

	2014	2015
TS	1432	2232
NT	303	251

There were a total of 28 management units sampled within the 8 refuges surveyed in 2015. The percentage of each sampling frame that was deemed non-target (NT) versus target and sampled (TS) (Figure 7, Table 11) provides a representation of potential over-coverage and under-coverage errors for each sampling unit, or an indication of change in hydrology over time. For example, those units that have a high proportion of points deemed non-target (e.g., CMS - Redhead) should re-assess the polygon used for the sampling frame. As an example, at CMS-Redhead the sampling frame contained 2 points that were deemed seasonally flooded (SF) and 11 points evaluated as temporarily flooded (TF) (Table 12) among its 44 sites evaluated. This suggests that a large portion of the area within the sampling frame contained wetland areas not within semi-permanent flooding regimes. The main drawback with over-coverage errors is wasted time in the field and, potentially, reduced sample sizes (resulting in larger confidence intervals then desired) within semi-permanently flooded wetland areas within a management unit of interest. On the other hand, units that had 100% of points deemed target may consider whether their sampling frames may be subject to under-coverage. Under-coverage occurs when a portion of semi-permanently flooded wetland is outside of the delineated polygon. These areas have 0 probability of ever being surveyed. This might happen if the delineated polygon boundary for the sampling frame was restricted to areas within open water only but excluded tall emergent vegetation within semi-permanently flooded wetland habitats. Both of these patterns should be discussed and considered further.

The evaluation criteria used to deem a point non-target is informative to consider when reassessing the sampling frames for certain management units. Another consideration is whether using observed species to classify a point as non-target is an unbiased and repeatable criteria. We assume that designation of NT based on vegetation is unbiased because vegetation responds to abiotic conditions (e.g., hydrology), keeping in mind that the statistical target population of interest is "semi-permanently flooded wetland area" and the sampling frame is the "bridge" to access this target population. Ideally, the sampling frame would not change over time nor as the result of management actions. However, changes in climate (*e.g.*, drought) or management (*e.g.*, reduced water availability) could change the extent of the semi-permanently flooded wetland area within a management unit.

Table 11. For the 2015 data, the number of GRTS points by evaluation status (TS=target and sampled, NT=non-target) and the proportion of target points (TS/(NT+TS)), which provides an estimate of coverage for management units surveyed. For refuge codes, see Appendix D.

V1	NT	TS	V4	NT	TS
BDW - Goose Island Pond	16	30	GYL - Big Bend	59	149
BDW - Lakeside	9	78	GYL - Lakefront	4	130
BRL - Bloomington	30	149	GYL - Outlet East	2	115
BRL - Bunn Lake	24	155	LMC - Pond 2	5	30
BRL - Rainbow	29	156	LMC - Pond 4	1	33
CMS - Big Pond	7	44	MDL - Sayer E	0	35
CMS - Redhead	13	44	MDL - Sayer W	4	54
CMS - Sandhole Lake	14	113	MLH - 4WO2	0	124
FHS - Avocet	7	108	MLH - 5CBR	0	121
FHS - Curlew	10	75	MLH - 5CMI	0	120
FHS - Ibis	8	65	MLH - Benson N	0	33
FHS - Mallard	2	89	MLH - Boca	0	117
FHS - Shoveler	4	81	MLH - W Knox	0	58
GYL - Beavertail	2	157			

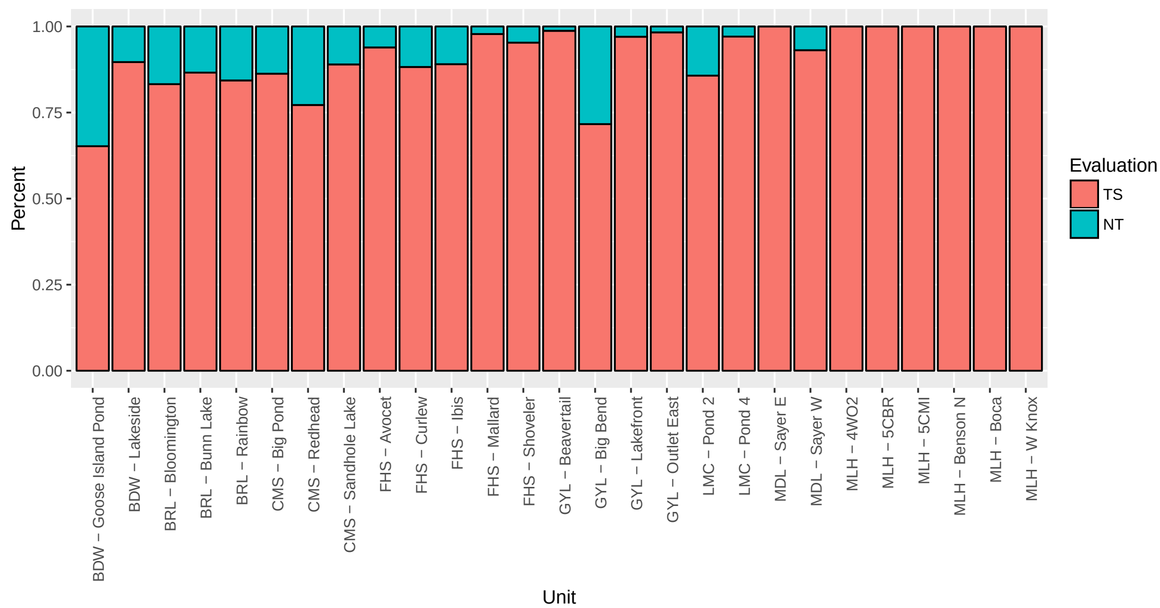


Figure 7. Percentage of GRTS points target and sampled (TS) versus non-target (NT) in each management unit for 2015. For refuge codes, see Appendix D.

Table 12. Non-target sample point evaluation reasons for 2015. IN=inaccessible, SF=seasonally flooded, TF=temporarily flooded, UPL=upland, OTHER=any other reason. For refuge codes, see Appendix D.

	OTHER	SF	TF	UPL
BDW - Goose Island Pond	0	0	0	16
BDW - Lakeside	0	0	0	9
BRL - Bloomington	11	11	7	1
BRL - Bunn Lake	1	5	10	8
BRL - Rainbow	6	14	7	1
CMS - Big Pond	0	2	4	1
CMS - Redhead	0	2	11	0
CMS - Sandhole Lake	0	7	7	0
FHS - Avocet	4	3	0	0
FHS - Curlew	7	0	3	0
FHS - Ibis	2	0	6	0
FHS - Mallard	0	1	1	0
FHS - Shoveler	2	0	2	0
GYL - Beavertail	1	1	0	0
GYL - Big Bend	0	40	19	0
GYL - Lakefront	0	2	1	1
GYL - Outlet East	0	1	1	0
LMC - Pond 2	0	0	0	5
LMC - Pond 4	0	0	0	1
MDL - Lake10	0	0	0	1
MDL - Sayer W	0	0	0	3

1.2 Non-response, Measurement, and Detection Errors

Non-response refers to the situation when data are not available or collectible from a point. The point is still located within a semi-permanently flooded wetland area, but no data were recorded or available. In environmental and ecological surveys, this usually happens due to accessibility issues. On the other hand, *measurement errors* occur when the recorded value is not the true value. For example, with visually assessed cover, the true cover may be 80%, but an observer recorded 75%. A common type of measurement error that occurs with wildlife studies is *detection errors*. Detection errors are false zeros, a species is not recorded because an observer didn't see or "detect" it within a plot. A zero is recorded for % cover, but really the species was present and not detected. The double-observer data will be examined thoroughly in a separate analysis to explore the potential sources of variation in visual estimates of canopy cover (e.g., measurement errors and detections errors).

A complication that was anticipated for this project, and did occur, was that some locations were too turbid for ocular surveys or unbiased data collection of vegetation. If a point had a value for water depth larger than the value for Secchi depth, a rake sample of vegetation was collected to reduce detection errors due to turbidity. Species occurrence data from both rake and ocular surveys were used to inform the Indicator Species Analysis for 2015. Water quality data from both rake and ocular surveys are summarized in Section 2.1.a of Appendix B (Among-Unit Comparisons of Abiotic Data). Percent cover comparisons in Section 2.1.b. and-unit level summaries in Section 2.2 only include data from ocular points. Further investigation into the differences between points with vegetation data collected by ocular estimates and rake samples within a management unit will be conducted in a separate report.

Table 13. Number of points by management unit with ocular canopy cover estimates used for unit-level summaries (Used), turbid due to water depth deeper than Secchi disc depth (Turbid), missing water depth or Secch disk depth (Missing), and target and surveyed (Total TS; Total TS = Turbid + Missing + Used). The proportion of points excluded (Proportion Excluded) from percent cover comparisons in Section 2.1.b. and unit-level summaries in Section 2.2 in Appendix B is calculated by (Turbid + Missing)/(Total TS). The total number of points with a water depth of zero (Dry) are also noted. Ocular canopy cover summaries were calculated for all points that were not turbid or missing data, including points that were dry. Rake density summaries were calculated for all turbid points. Vegetation data from both methods are presented in Section 2.2 Appendix B.

	Turbid	Missing	Used	Total TS	Proportion Excluded	Dry
BDW - Goose Island Pond	4	1	25	30	0.17	12
BDW - Lakeside	8	0	70	78	0.10	46
BRL - Bloomington	2	1	118	121	0.02	3
BRL - Bunn Lake	0	1	119	120	0.01	4
BRL - Rainbow	2	1	116	119	0.03	9
CMS - Big Pond	1	0	36	37	0.03	17
CMS - Redhead	3	0	28	31	0.10	5
CMS - Sandhole Lake	5	1	75	81	0.07	50
FHS - Avocet	0	2	106	108	0.02	107
FHS - Curlew	0	1	74	75	0.01	2
FHS - Ibis	2	0	63	65	0.03	3
FHS - Mallard	0	0	89	89	0.00	9
FHS - Shoveler	2	0	79	81	0.02	8
GYL - Beavertail	1	0	122	123	0.01	6
GYL - Big Bend	12	0	108	120	0.10	19
GYL - Lakefront	0	2	89	91	0.02	2
GYL - Outlet East	12	2	80	94	0.15	2
LMC - Pond 2	3	0	27	30	0.10	1
LMC - Pond 4	6	6	18	30	0.40	1
MDL - Lake10	19	0	29	48	0.40	12
MDL - Sayer E	2	2	31	35	0.11	27
MDL - Sayer W	26	0	26	52	0.50	4
MLH - 4WO2	0	0	124	124	0.00	124
MLH - 5CBR	4	0	1	5	0.80	0
MLH - 5CMI	1	0	0	1	1.00	0
MLH - Benson N	0	0	30	30	0.00	18
MLH - Boca	43	0	72	115	0.37	66
MLH - West Knox Reservoir	30	0	28	58	0.52	25

2 Appendix B: 2015 Data Summaries

In the following data summaries, non-target points (NT) were not included. Because rake vegetation data are ordinal (i.e., ranked categories) and ocular vegetation data are numerical, separate summaries are provided for vegetation data collected using the different sampling methods. Among-unit comparisons of abitoic data include data from rake and ocular plots.

2.1a Among-Unit Comparisons of Abiotic Data

The following set of figures compares average abiotic measurements from rake and ocular plots among management units (Water level in Figure 8; pH in Figure 9; Specific Conductivity in Figure 10; Salinity in Figure 11; Temperature in Figure 12). The units are presented in ascending order based on average values. Units without abiotic information recorded are located on the far right within each figure. Refer to Section 2.2 for more in-depth, by-unit vegetation and abiotic summaries.

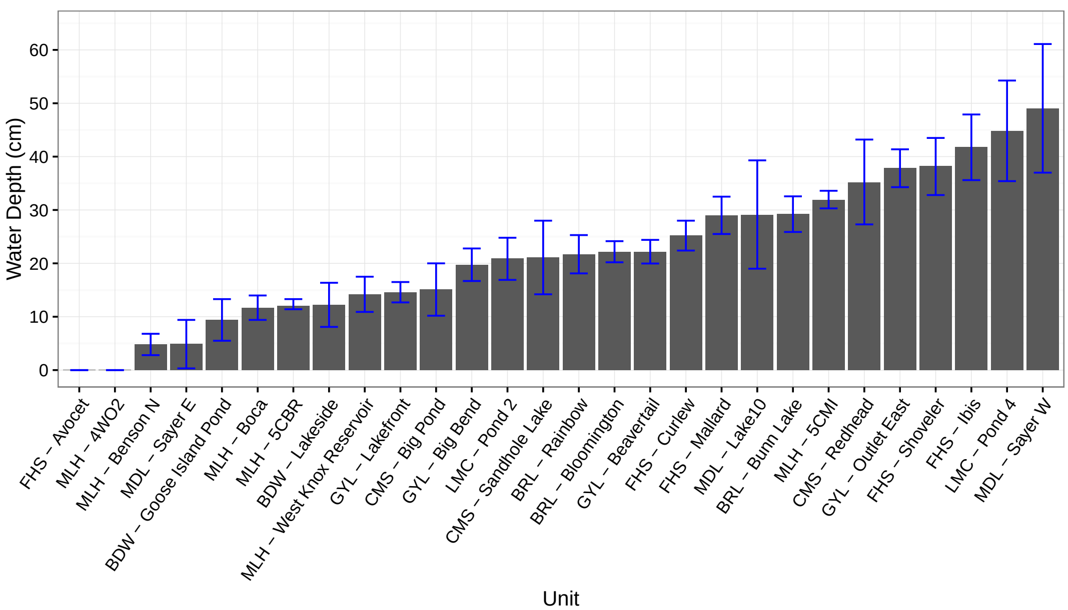


Figure 8. Average water depth for management units in ascending order, with 90% confidence intervals. FHS-Avocet and MLH-4WO2 have a mean estimated water depth of 0.

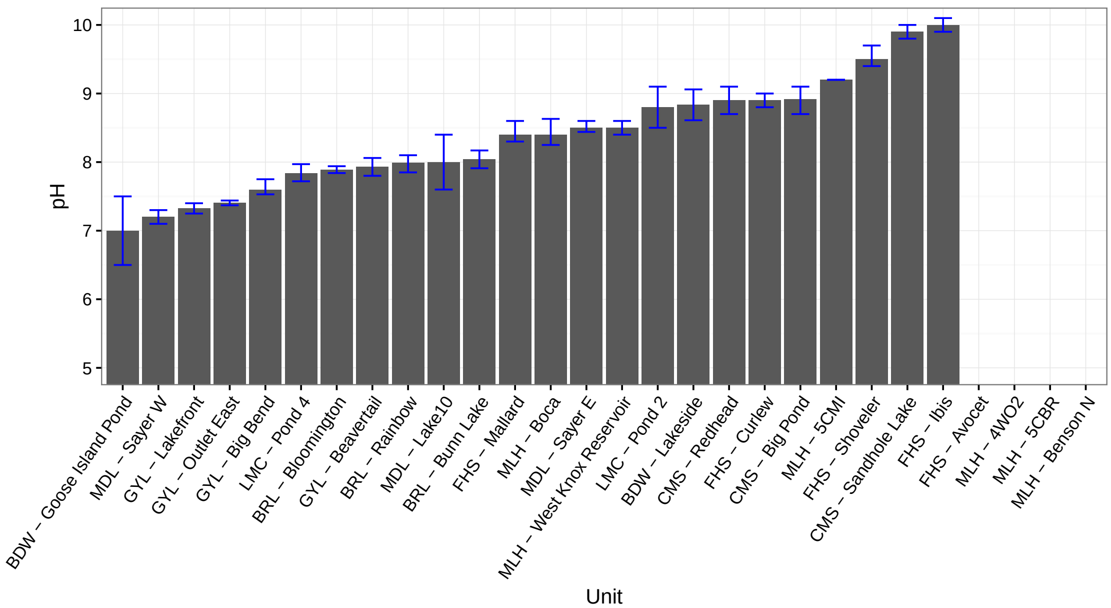


Figure 9. Average pH for management units in ascending order, with 90% confidence intervals. Note that FHS-Avocet and MLH-4WO2 were dry, while MLH-5CBR and MLH-Benson N had no pH data recorded.

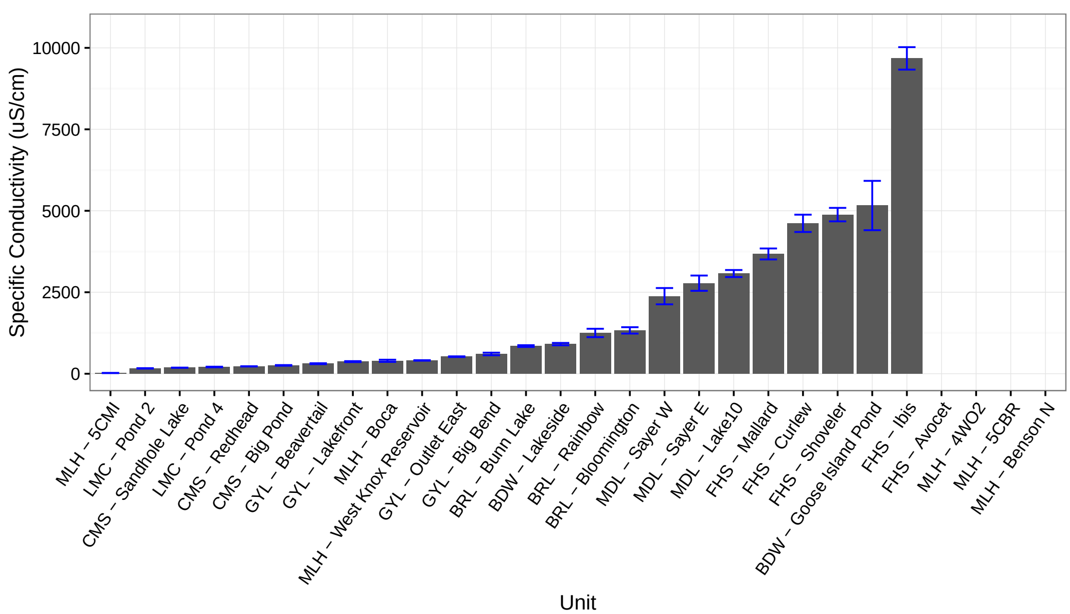


Figure 10. Average specific conductivity for management units in ascending order, with 90% confidence intervals. Note that FHS-Avocet and MLH-4WO2 were dry, while MLH-5CBR and MLH-Benson N had no specific conductivity data recorded.

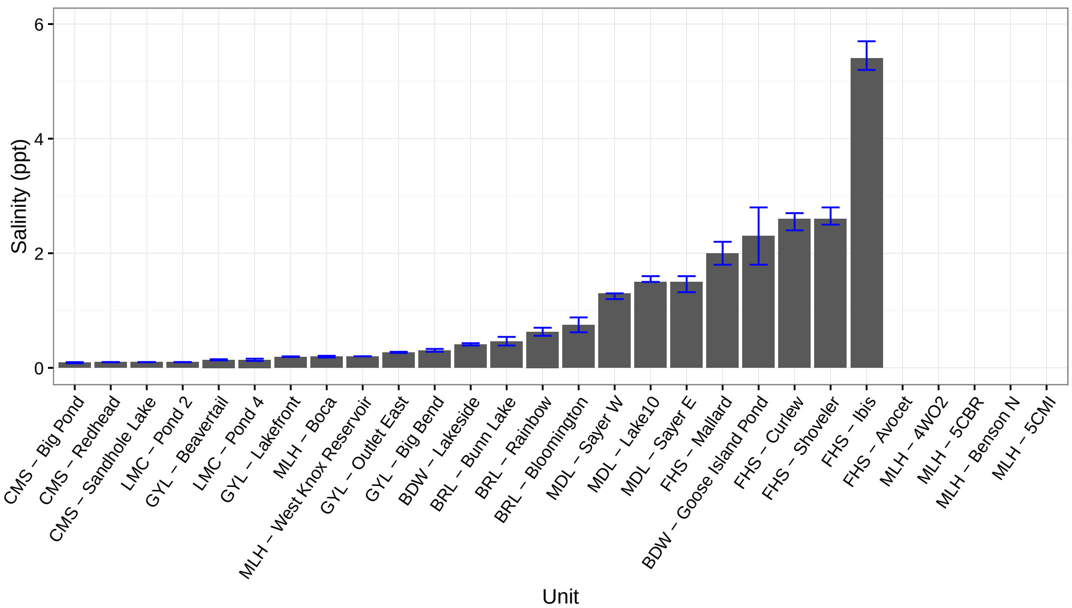


Figure 11. Average salinity for management units in ascending order, with 90% confidence intervals. Note that FHS-Avocet and MLH-4WO2 were dry, while MLH-5CBR, MLH-Benson N, and MLH-5CMI had no salinity data recorded.

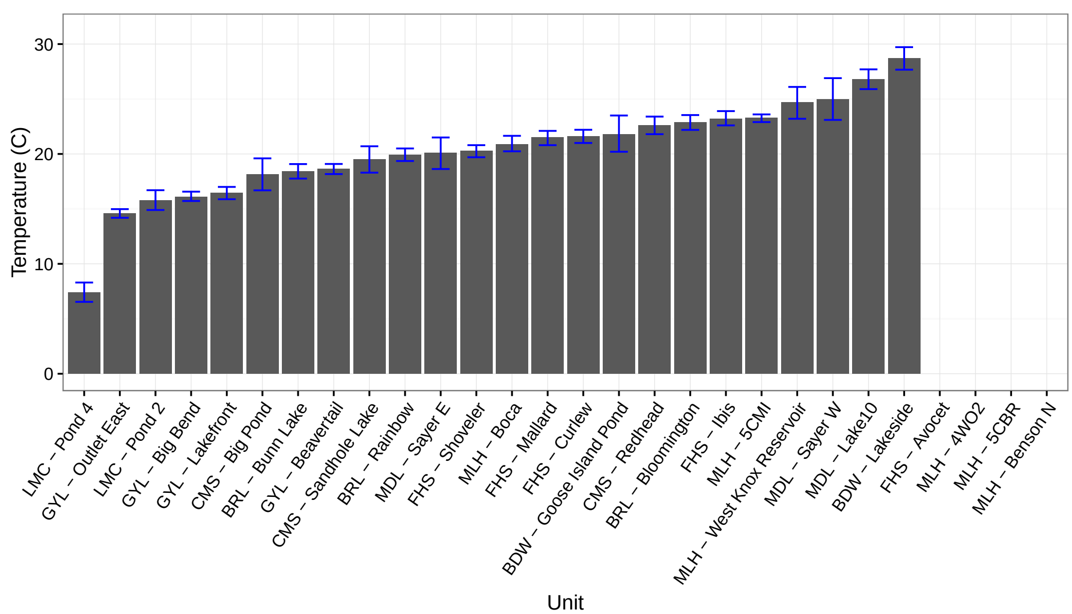


Figure 12. Average temperature ($^{\circ}C$) for management units in ascending order, with 90% confidence intervals. Note that FHS-Avocet and MLH-4WO2 were dry, while MLH-5CBR and MLH-Benson N had no temperature data recorded.

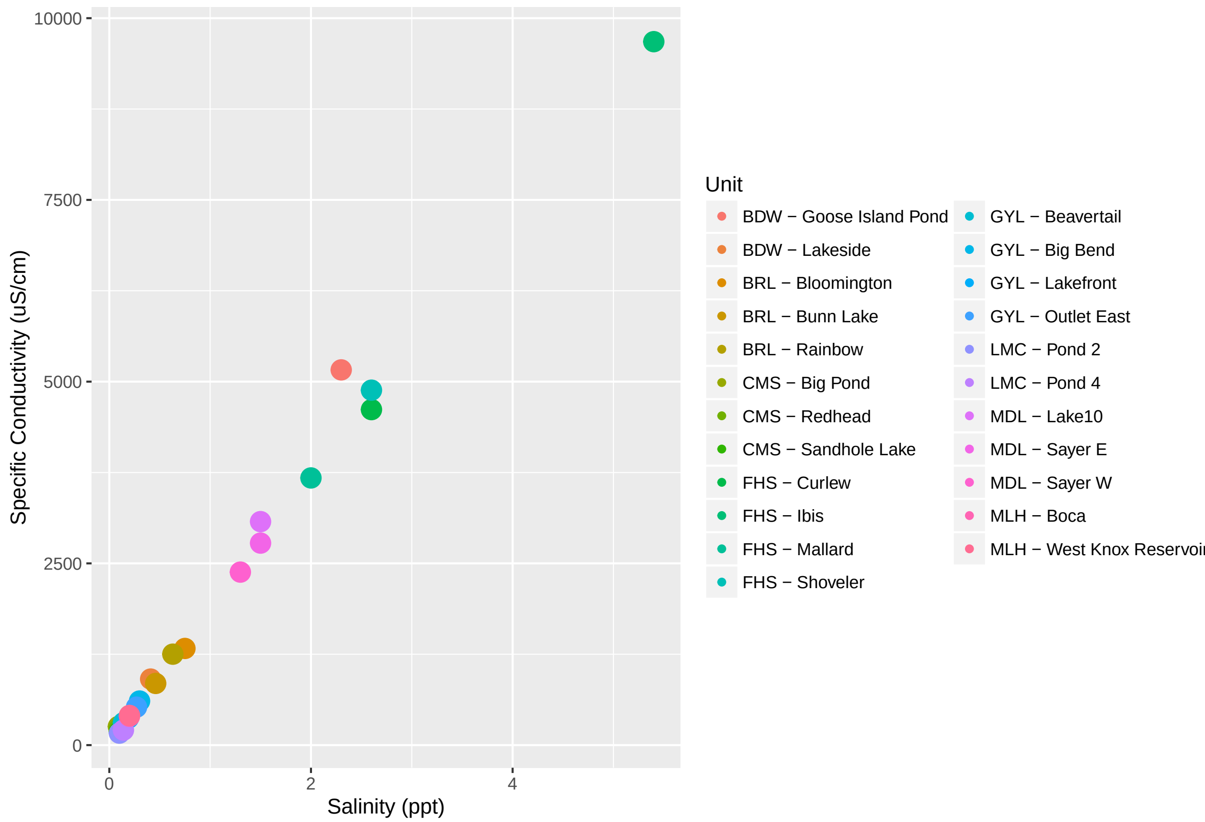


Figure 13. Average salinity and specific conductivity plotted by unit. FHS-Avocet, MLH-4WO2, MLH-5CBR, and MLH-Benson N are not plotted due to missing salinity and specific conductivity data. The highest value for each was observed at Fish Springs in the Ibis unit.

2.1b Among-Unit Comparisons of Vegetation Data

We compared percent ocular canopy cover among common genera of tall emergent wetland plant species (TY; includes broadleaf, narrowleaf, hybrid, and unidentified cattail), and tall bulrush (SC; includes hardstem and softstem bulrush) in order to draw comparisons with watermilfoil (MYSI, MYRIO, MYVE3) and sago pondweed (STPE15) by unit (Figure 14). These species are of specific management interest and/or inform vegetation community phase descriptions for the conceptual STM.

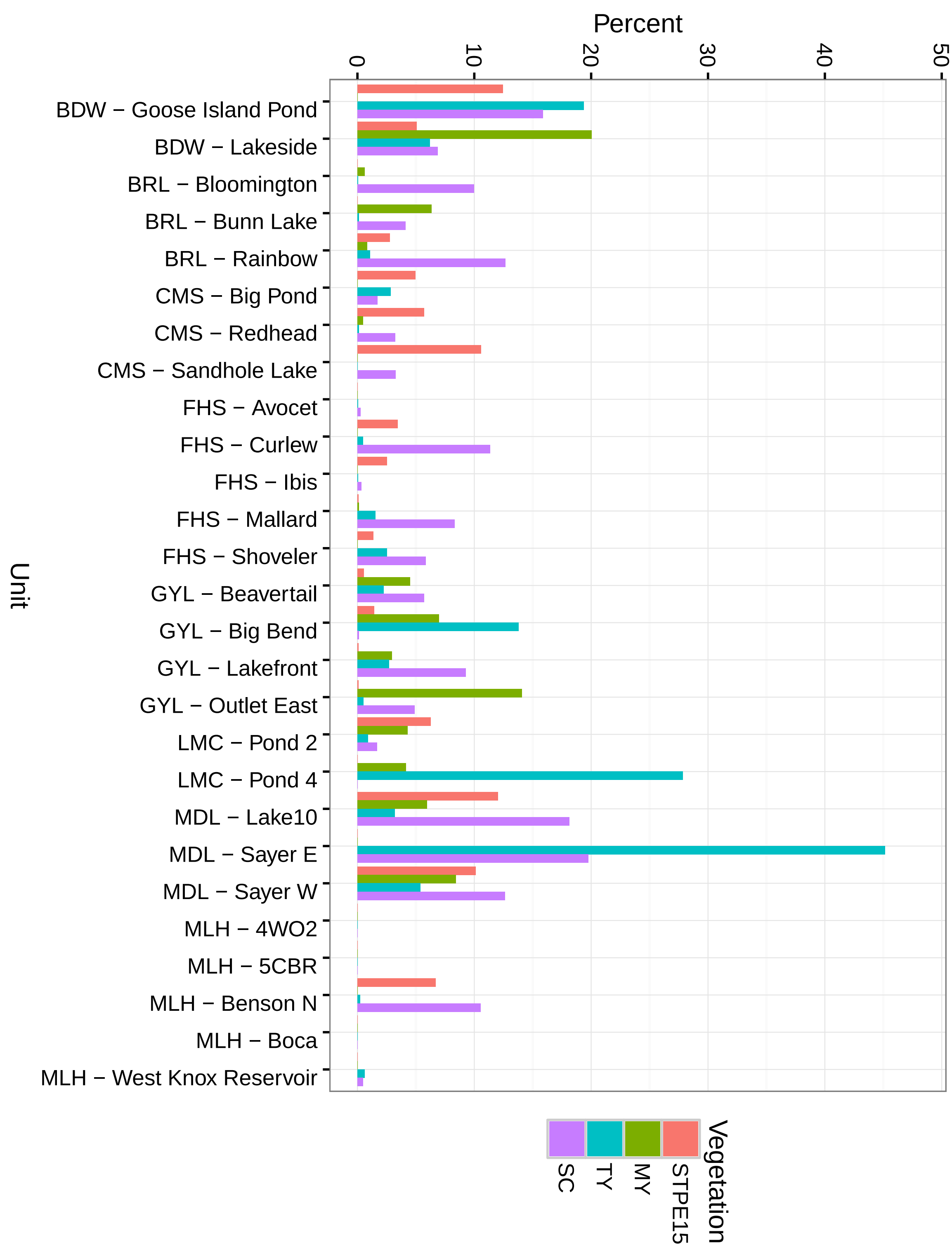


Figure 14. Estimated mean percent cover of sago pondweed (STPE15), watermilfoil (MY), cattail (TY), and bulrush (SC) at ocular plots for each unit. Dry wetland units (FHS-Avocet

and MLH-4WO2) and units with more than 50% of vegetation samples collected by rake (MLH-5CBR and MLH-5CMI) are excluded. Note that MLH - 4WO2, MLH - 5CBR, MLH - Boca had no observed cover for these common genera at any ocular plots.

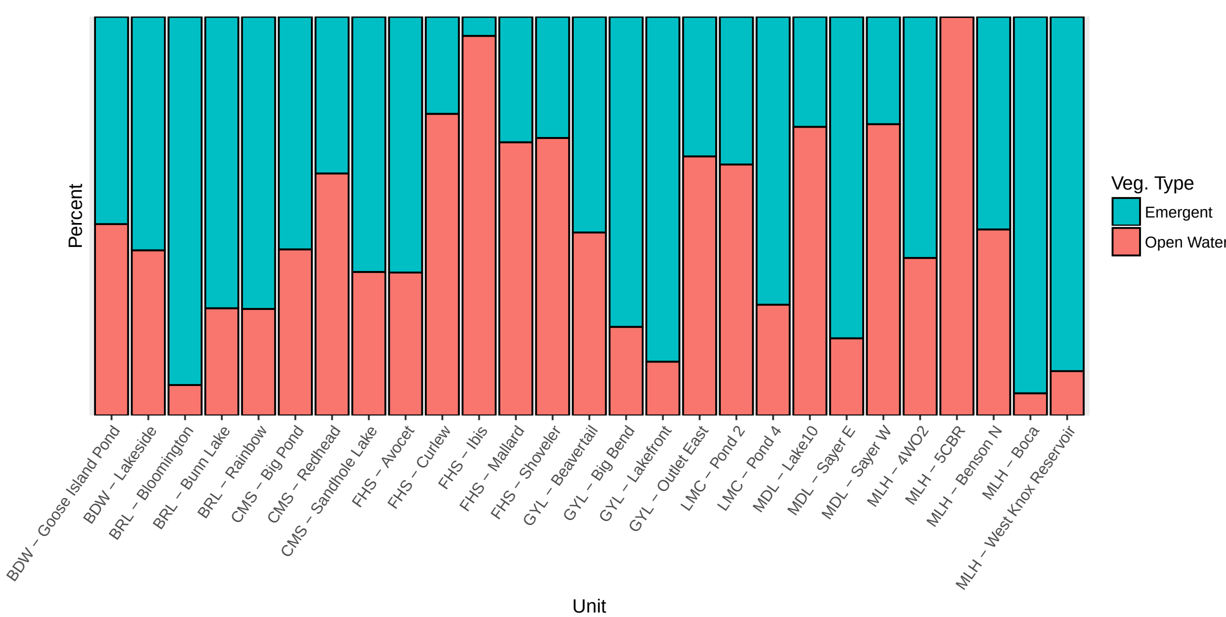


Figure 15. Percentage of points dominated (i.e., $\geqslant$ 50% canopy cover) by open water/submerged aquatic vegetation (SAV) by unit. SAV species include submergent, floating, and floating-leaved species that have all or most of their leaves, stems, and roots underwater or at the water surface. The open water/SAV species groups inlcude the following: bare substrate (BARESU), water starworts (CAHE2, CALLI6, CAST), hornworts (CEDE4), plant-like algae (CHARA, CHVU, NITELL), waterweeds (ELCA7, ELNU2, ELODEA), aquatic mosses (FOAN2), mare's tail (HIVU2), quillworts (ISOETES), mudworts (LIAQ), bladderworts (UTGI, UTMI, UTMA), duckweeds (LEMI3, LEMNA, LETR, SPPO), watermilfoils (MYRIO, MYSI, MYVE3), water nymphs (NAFL, NAGU, NAJAS, NAMA), pondweeds (POFO3, POFR3, POGR8, PONA4, POPR5, POPU7, PORI2, POTAM, POZO, STFIF, STPE15, STUCK, STVA8), pondlilys (NUPO-FL, NUPO-SU), aquatic buttercups (RAAQ, RAFL), riccias (RIFL4, RINA), mosquitoferns (AZMI, AZOLL), Widgeongrass (RUMA5), watercress (NAOF), watermeals (WOLFF), and horned pondweeds (ZAPA). Points with <50% open Water/SAV species were classified as emergent.

During survey development for 2014, one concern was the potential for significant time invested collecting data from areas with homogeneous stands of tall emergent species. Based on the 2015 data, 17 different units contained $\geqslant$ 50% of surveyed plots dominated ($\geqslant$ 50% canopy cover) by emergent species (Figure 15, BDW - Goose Island Pond, BDW - Lakeside, BRL - Bloomington, BRL - Bunn Lake, BRL - Rainbow, CMS - Big Pond, CMS - Sandhole Lake, FHS - Avocet, GYL - Beavertail, GYL - Big Bend, GYL - Lakefront, LMC - Pond

4, MDL - Sayer E, MLH - 4WO2, MLH - Benson N, MLH - Boca, and MLH - West Knox Reservoir).

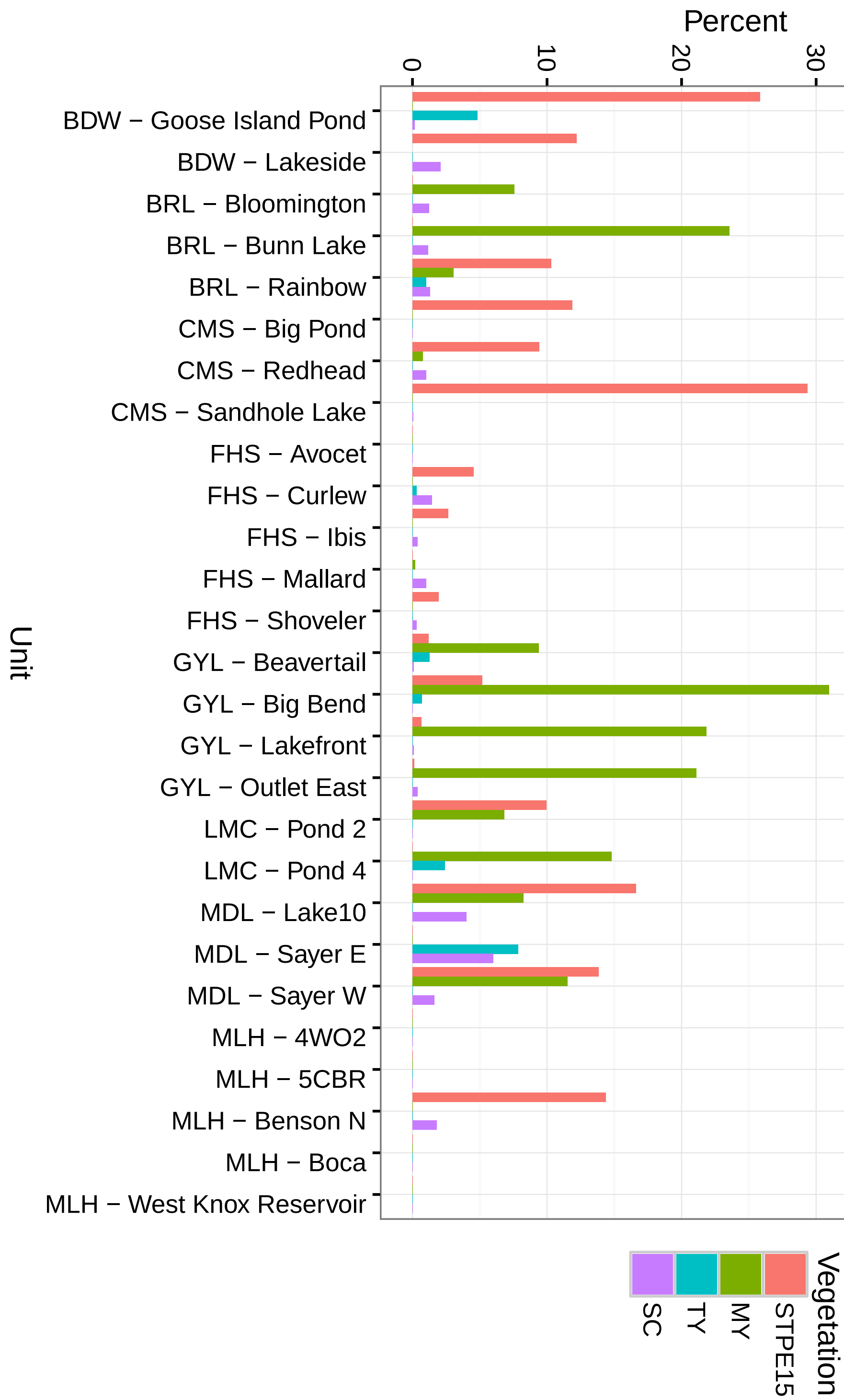


Figure 16. At sites with $\geqslant$ 50% open water/submerged aquatic vegetation (SAV) cover (see Figure 15 for list of open water/SAV species), the estimated mean percent cover of sago pondweed (STPE15), watermilfoil (MY), cattail (TY), and bulrush (SC) for each unit. Dry wetland units (FHS-Avocet and MLH-4WO2) and units with more than 50% of vegetation samples collected by rake (MLH-5CBR and MLH-5CMI) are excluded. Note that MLH - 4WO2, MLH - 5CBR, MLH - Boca, MLH - West Knox Reservoir had no observed cover for these genera at open water/SAV-dominated sites.

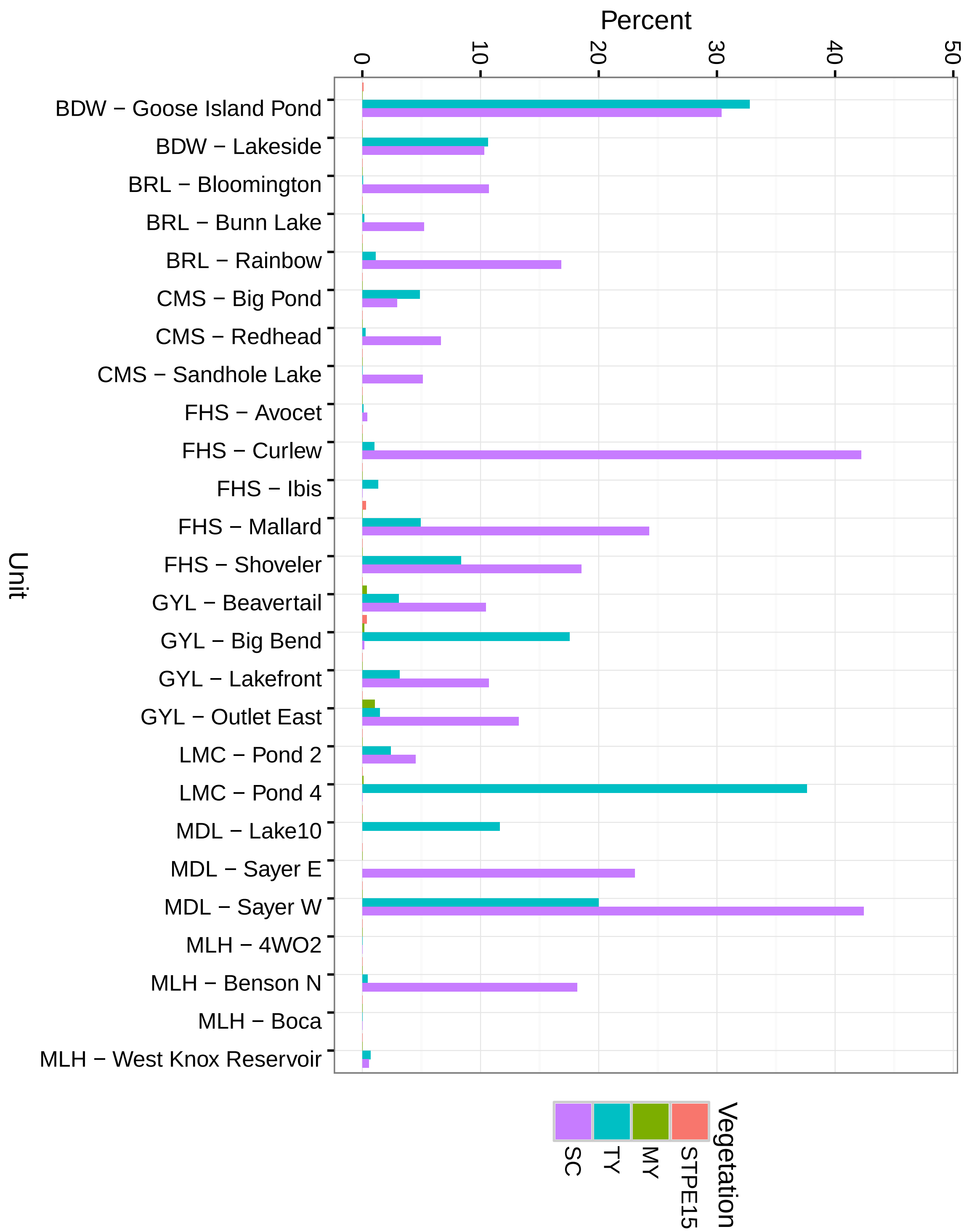


Figure 17. At sites with <50% open water/submerged aquatic vegetation (SAV) cover (*i.e.*, emergent sites; see Figure 15 for list of open water/SAV species), the estimated mean percent cover of sago pondweed (STPE15), watermilfoil (MY), cattail (TY), and bulrush (SC) for each unit. Dry wetland units (MLH-4W02 and FHS-AVOC) and units with more than 50% of

vegetation samples collected by rake (MLH-5CBR and MLH-5CMI) are excluded. Note that MLH - 4WO2, MLH - Boca had no observed cover for these genera at emergent-dominated sites.

2.2 Summaries by Unit

Each unit surveyed in 2015 has a table reporting design-based estimates for mean percent cover by species (Species codes in Appendix C), water quality variables, and a frequency histogram of soil texture. Mean percent canopy cover estimates by unit are provided for 1) all ocular plots, and 2) post-stratified open water/SAV and emergent strata. Strata are defined as 1) SAV $\geqslant$ 50% canopy cover dominated by SAV species and bare substrate, and 2) emergent, <50% canopy cover dominated by SAV species and bare substrate (see Figure 15, Appendix B, for a list of SAV species). Each species in the table has been characterized by growth form as:

- perennial emergent, 'E': typically perennial emergent species that germinate on exposed mudflats and tolerate varying periods of inundation by water; includes tall emergent, short emergent, and residual emergent vegetation;
- ruderal emergent, 'R': ruderal emergent species which are usually annuals that typically germinate during a drought or drawdown; also includes perennial species characteristic of drier areas in playas, upland/wetland edges, and disturbed areas; or
- submerged aquatic vegetation, 'SAV': submerged aquatic vegetation that has all or most of its leaves, stems, and roots underwater or at the water surface; includes submersed, floating, floating-leaved vegetation, plant-like algae, and residual SAV.

We assume that the visually estimated percent cover is a continuous variable. For the 2015 field data, ocular canopy cover was estimated to the nearest 1 %, though for the 2014 field data it was estimated to the nearest 5%. We assume no detection errors - if a species was present within a plot it was recorded. Also, we assume the designated "primary observer" data were accurate (no measurement errors). The presented 90% confidence intervals can be used as a guide to determine whether 2015 levels of survey effort (sample size) were/are sufficient to inform station level objectives. Are the confidence intervals narrow enough to inform management decisions? Conversely, perhaps slightly wider intervals would still inform management?

For a summary of the abiotic water quality information by unit, we present the mean for all plots (ocular and rake) as well as the mean for open water sites (ocular plots only) and emergent sites (ocular plots only). Similarly, we present the soil texture plot separately for open water/SAV (ocular plots only) and emergent (ocular plots only) sites.

2.2.1 MDL - Lake 10

Table 3: Design-based estimate of mean percent canopy coverage for vegetation present at MDL - LAKE10. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 29), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 21; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 8). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	42.7	(29.9, 55.5)	18	58.7	(44.9, 72.5)	17	0.6	(0, 1.7)	1
SAV	CEDE4	1.3	(0, 3.1)	3	1.8	(0, 4.3)	3			
SAV	FILAL.FL	7.5	(1.2, 13.9)	8	10.4	(1.9, 19)	8			
SAV	MYSI	6	(0, 12.7)	4	8.2	(0, 17.4)	4			
SAV	RESID.SU	0.7	(0, 1.8)	1	1	(0, 2.5)	1			
SAV	RUMA5	3.5	(0, 9.1)	1	4.8	(0, 12.6)	1			
SAV	STPE15	12	(3.4, 20.7)	11	16.6	(5, 28.2)	11			
E	RESID.SE	0.3	(0, 0.9)	1	0.5	(0, 1.3)	1			
E	RESID.TE	11.8	(5.8, 17.9)	15	4	(1, 6.9)	7	32.5	(17, 48)	8
E	SCHOE6	18.1	(9.3, 27)	15	4	(1.6, 6.4)	7	55.2	(36.5, 74)	8
E	TYAN	3.2	(0, 8.5)	1				11.6	(0, 30.7)	1

Table 4: Summary of water quality information for all ocular survey point locations at MDL - LAKE10.

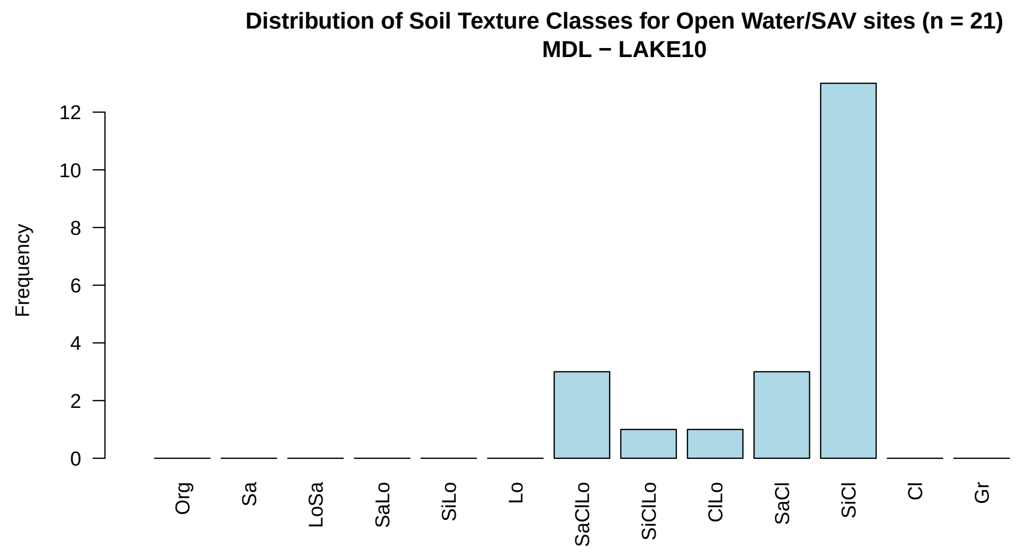
	n	Min	Mean	SE	Max
Water depth	29	0	29.1	6.19	93
Secchi Depth	29	0	29.1	6.19	93
pH level	17	7.1	8	0.24	10.1
Specific Conductivity	17	2473	3074.5	65.81	3345
Salinity	17	1.2	1.5	0.02	1.6
Temperature	17	22.4	26.8	0.55	29.6

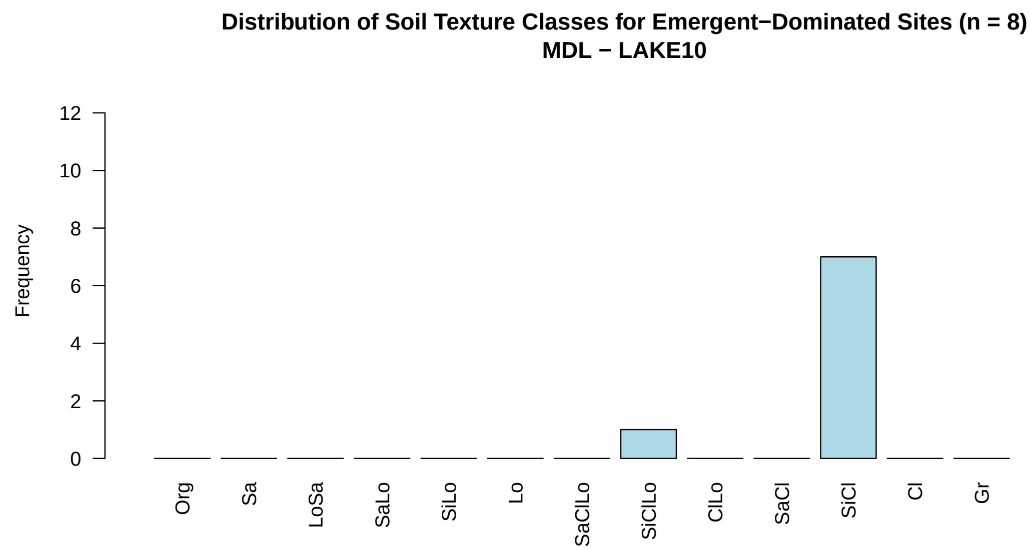
Table 5: Summary of water quality information for ocular survey, SAV point locations at MDL - LAKE10.

	n	Min	Mean	SE	Max
Water depth	21	0	40.2	7.2	93
Secchi Depth	21	0	40.2	7.2	93
pH level	17	7.1	8	0.24	10.1
Specific Conductivity	17	2473	3074.5	65.81	3345
Salinity	17	1.2	1.5	0.02	1.6
Temperature	17	22.4	26.8	0.55	29.6

Table 6: Summary of water quality information for ocular survey, Non-SAV point locations at MDL - LAKE10.

	n	Min	Mean	SE	Max
Water depth	8	0	0	0	0
Secchi Depth	8	0	0	0	0
pH level	NA				
Specific Conductivity	NA				
Salinity	NA				
Temperature	NA				


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 21)
MDL − LAKE10
Frequency
0
2
4
6
8
10
12
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 8)
MDL − LAKE10
Frequency
0
2
4
6
8
10
12
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr

2.2.2 MDL - Sayer Bay East

Table 7: Design-based estimate of mean percent canopy coverage for vegetation present at MDL - SAYER E. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 31), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 6; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 25). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	16.3	(7.1, 25.5)	10	70.5	(50.6, 90.4)	6	3.3	(0, 7)	4
SAV	CEDE4	2.6	(0, 6.9)	2	13.5	(0, 35.4)	2			
SAV	FILAL.WC	2.4	(0, 6.4)	1	12.5	(0, 33.1)	1			
SAV	LEMNA	0.2	(0, 0.5)	3	0.2	(0, 0.4)	1	0.2	(0, 0.6)	2
SAV	RESID.SU	Trace	(0, 0.1)	1	0.2	(0, 0.4)	1			
E	RESID.TE	15	(8.8, 21.3)	28	2.2	(0.1, 4.3)	3	18.1	(10.7, 25.6)	25
E	SCHOE6	18.6	(10, 27.2)	22	6	(0, 12.5)	3	21.6	(11.2, 32)	19
E	SCTA2	1.2	(0, 3.1)	1				1.4	(0, 3.8)	1
E	TYAN	10.2	(2.3, 18.2)	5				12.7	(2.9, 22.4)	5
E	TYLA	3.6	(0, 8.9)	3				4.5	(0, 11)	3
E	TYPHA	31.3	(19.6, 43)	16	7.8	(0, 16.8)	2	36.9	(23.2, 50.6)	14
R	CACA	0.7	(0, 1.5)	2				0.8	(0, 1.8)	2
R	UNFOR	0.3	(0, 0.6)	3				0.4	(0, 0.7)	3

Table 8: Summary of water quality information for all ocular survey point locations at MDL - SAYER E.

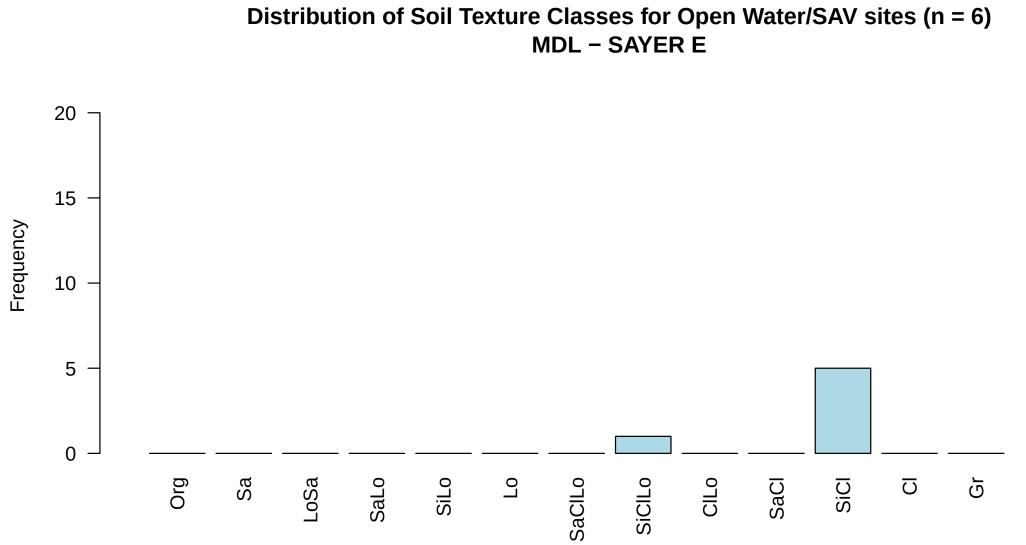
	n	Min	Mean	SE	Max
Water depth	31	0	4.9	2.77	76
Secchi Depth	31	0	4.9	2.77	76
pH level	3	8.5	8.5	0.04	8.6
Specific Conductivity	4	2462	2778.8	142.51	3155
Salinity	4	1.3	1.5	0.09	1.7
Temperature	4	18.8	20.1	0.86	22.6

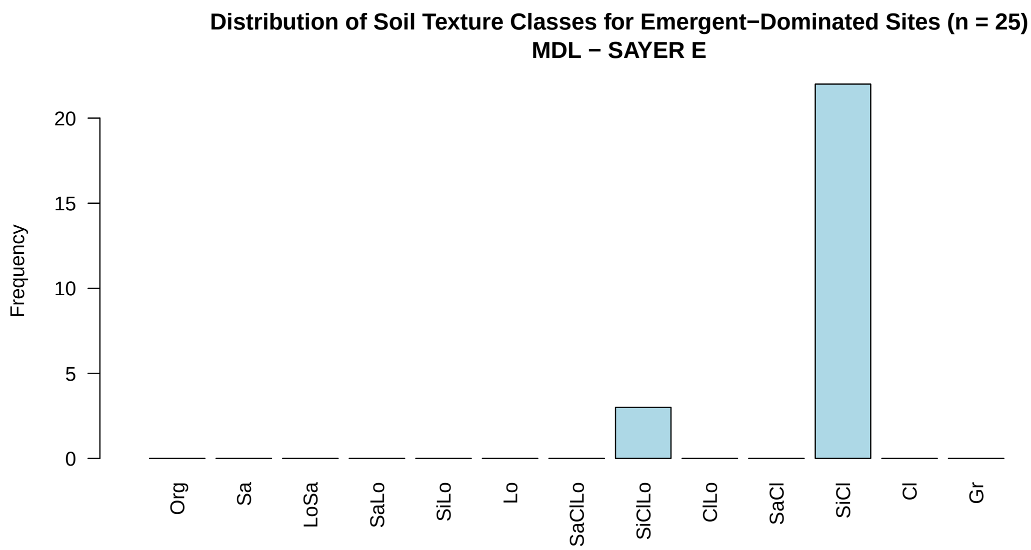
Table 9: Summary of water quality information for ocular survey, SAV point locations at MDL - SAYER E.

	n	Min	Mean	SE	Max
Water depth	6	0	25.2	11.65	76
Secchi Depth	6	0	25.2	11.65	76
pH level	3	8.5	8.5	0.04	8.6
Specific Conductivity	4	2462	2778.8	142.51	3155
Salinity	4	1.3	1.5	0.09	1.7
Temperature	4	18.8	20.1	0.86	22.6

Table 10: Summary of water quality information for ocular survey, Non-SAV point locations at MDL - SAYER E.

	n	Min	Mean	SE	Max
Water depth	25	0	0	0	0
Secchi Depth	25	0	0	0	0
pH level	NA				
Specific Conductivity	NA				
Salinity	NA				
Temperature	NA				


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 6)
MDL − SAYER E
Frequency
0
5
10
15
20
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 25)
MDL − SAYER E
Frequency
0
5
10
15
20
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr

2.2.3 MDL - Sayer Bay West

Table 11: Design-based estimate of mean percent canopy coverage for vegetation present at MDL - SAYER W. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 26), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 19; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 7). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	53.5	(39.2, 67.8)	19	72.6	(59.1, 86.2)	18	1.6	(0, 4.2)	1
SAV	CEDE4	Trace	(0, 0.1)	1	0.1	(0, 0.1)	1			
SAV	FILAL.FL	0.6	(0, 1.6)	2	0.1	(0, 0.1)	1	2.1	(0, 5.7)	1
SAV	LEMI3	Trace	(0, 0.1)	1				0.1	(0, 0.4)	1
SAV	MYSI	8.4	(0.4, 16.4)	6	11.5	(0.8, 22.3)	6			
SAV	RESID.SU	Trace	(0, 0.1)	1	0.1	(0, 0.1)	1			
SAV	STPE15	10.1	(2.6, 17.6)	12	13.8	(3.8, 23.9)	12			
E	RESID.TE	7.2	(0.8, 13.6)	11	0.3	(0.1, 0.4)	5	26	(5.4, 46.6)	6
E	SCHOE6	12.6	(3.3, 21.9)	8	1.6	(0, 3.8)	3	42.4	(15, 69.9)	5
E	TYAN	5.4	(0, 12.1)	2				20	(0, 43.8)	2
R	CACA	2.7	(0, 7)	1				9.9	(0, 26.1)	1

Table 12: Summary of water quality information for all ocular survey point locations at MDL - SAYER W.

	n	Min	Mean	SE	Max
Water depth	26	0	47.3	7.38	143
Secchi Depth	26	0	47.3	7.38	143
pH level	22	6.2	7.2	0.08	8
Specific Conductivity	23	0	2378.6	158.71	2817
Salinity	23	0	1.3	0.06	1.5
Temperature	23	0	25	1.21	30

Table 13: Summary of water quality information for ocular survey, SAV point locations at MDL - SAYER W.

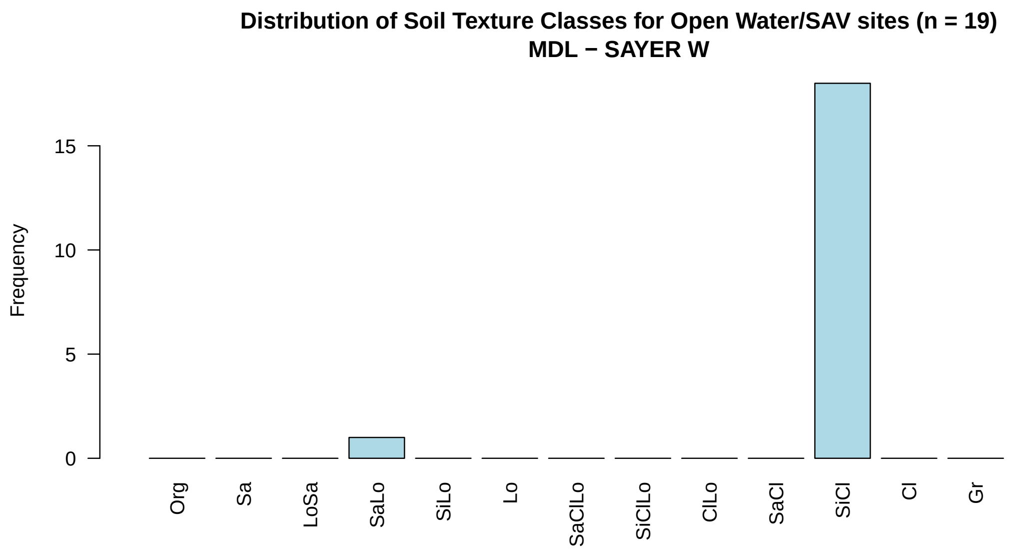
	n	Min	Mean	SE	Max
Water depth	19	33	63.6	6.93	143
Secchi Depth	19	33	63.6	6.93	143
pH level	19	6.8	7.3	0.07	8
Specific Conductivity	19	24.1	2477.3	139.99	2817
Salinity	19	1.2	1.3	0.01	1.4
Temperature	19	23.8	26.6	0.41	30

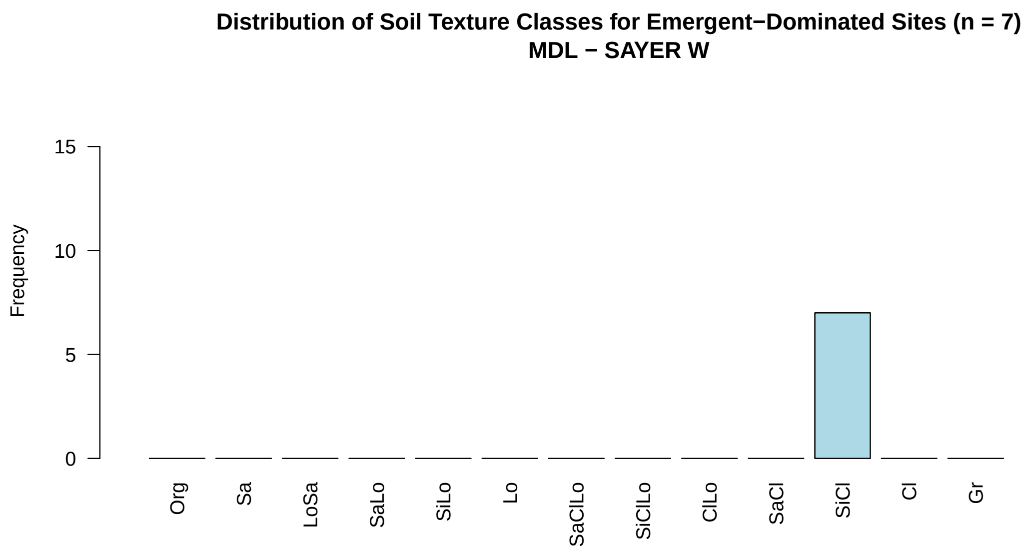
Table 14: Summary of water quality information for ocular survey, Non-SAV point locations at MDL - SAYER W.

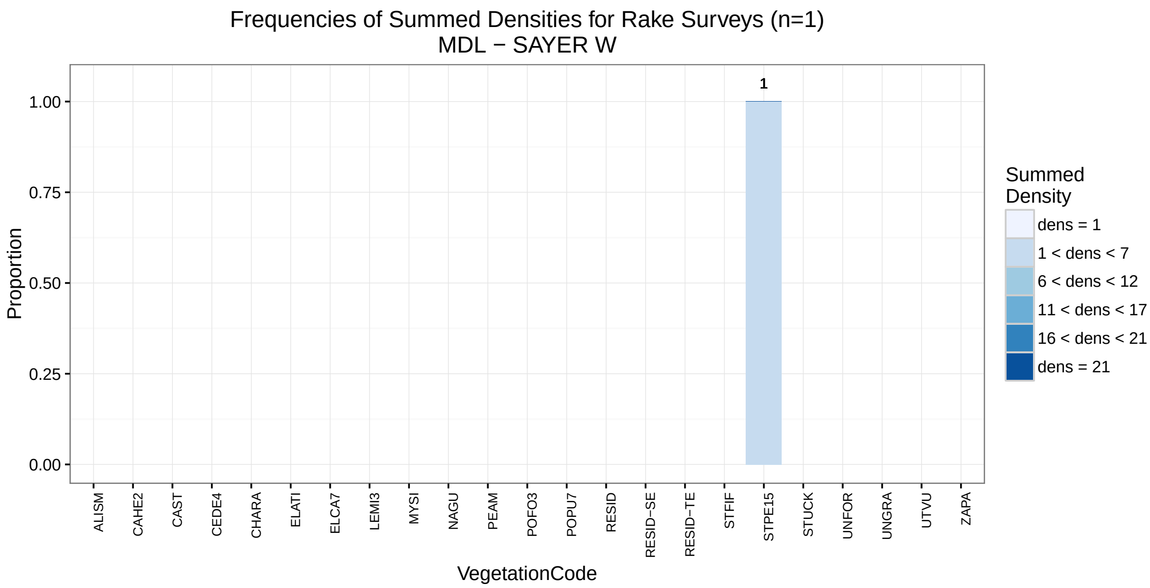
	n	Min	Mean	SE	Max
Water depth	7	0	3	2.12	15
Secchi Depth	7	0	3	2.12	15
pH level	3	6.2	6.8	0.28	7.1
Specific Conductivity	4	0	1909.8	644.14	2796
Salinity	4	0	1	0.34	1.5
Temperature	4	0	17.6	5.95	25.1

Table 15: Summary of water quality information for rake survey point locations at MDL - SAYER W.

	n	Min	Mean	SE	Max
Water depth	1		94		
Secchi Depth	1		80		
pH level	1		7.04		
Specific Conductivity	1		2410		
Salinity	1		1.26		
Temperature	1		24.26		


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 19)
MDL − SAYER W
Frequency
0
5
10
15
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 7)
MDL − SAYER W
Frequency
0
5
10
15
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr



Frequencies of Summed Densities for Rake Surveys (n=1)
MDL − SAYER W
Proportion
1.00
0.75
0.50
0.25
0.00
1
VegetationCode
ALISM
CAHE2
CAST
CEDE4
CHARA
ELATI
ELCA7
LEMI3
MYSI
NAGU
PEAM
POFO3
POPU7
RESID
RESID−SE
RESID−TE
STFIF
STPE15
STUCK
UNFOR
UNGRA
UTVU
ZAPA
Summed Density
dens = 1
1 < dens < 7
6 < dens < 12
11 < dens < 17
16 < dens < 21
dens = 21

2.2.4 BDW - Goose Island Pond

Table 16: Design-based estimate of mean percent canopy coverage for vegetation present at BDW - GOOSE ISLAND POND. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 25), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 12; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 13). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	34.5	(21.3, 47.7)	16	65.8	(48.3, 83.4)	10	5.6	(1.6, 9.7)	6
SAV	FILAL.FL	0.1	(0, 0.3)	2	0.2	(0, 0.6)	2			
SAV	FILAL.WC	0.2	(0, 0.5)	2	0.4	(0, 1)	2			
SAV	LEMNA	0.5	(0.2, 0.9)	8	0.3	(0.1, 0.6)	4	0.7	(0, 1.4)	4
SAV	LETR	Trace	(0, 0.1)	1	0.1	(0, 0.2)	1			
SAV	STPE15	12.4	(2.7, 22.2)	8	25.8	(7.1, 44.5)	7	0.1	(0, 0.2)	1
E	CAREX	2.4	(0, 5.8)	3				4.5	(0, 11.2)	3
E	MUAS	1.6	(0, 4.3)	1				3.2	(0, 8.3)	1
E	RESID.TE	8.2	(4, 12.4)	19	2.9	(0.9, 5)	8	13.1	(5.7, 20.4)	11
E	SCAC3	0.3	(0, 0.8)	2				0.6	(0, 1.5)	2
E	SCPU10	15.6	(4, 27.1)	8	0.2	(0, 0.4)	1	29.8	(9.4, 50.1)	7
E	TYAN	14.4	(5.4, 23.3)	11	4.8	(0, 10.2)	5	23.2	(7.5, 38.8)	6
E	TYGL	3	(0, 7.9)	1				5.8	(0, 15.3)	1
E	TYLA	2	(0, 5.3)	1				3.8	(0, 10.2)	1
R	CHAL7	0.1	(0, 0.3)	2				0.2	(0, 0.5)	2
R	HOJU	1.3	(0, 3)	3				2.5	(0, 5.7)	3
R	PHPR3	Trace	(0, 0.1)	1				0.1	(0, 0.2)	1
R	UNFOR	3.4	(0, 7.6)	2				6.5	(0, 14.5)	2
R	UNGRA	0.1	(0, 0.3)	1				0.2	(0, 0.6)	1
	POLSP.	Trace	(0, 0.1)	1				0.1	(0, 0.2)	1

Table 17: Summary of water quality information for all ocular survey point locations at BDW - GOOSE ISLAND POND.

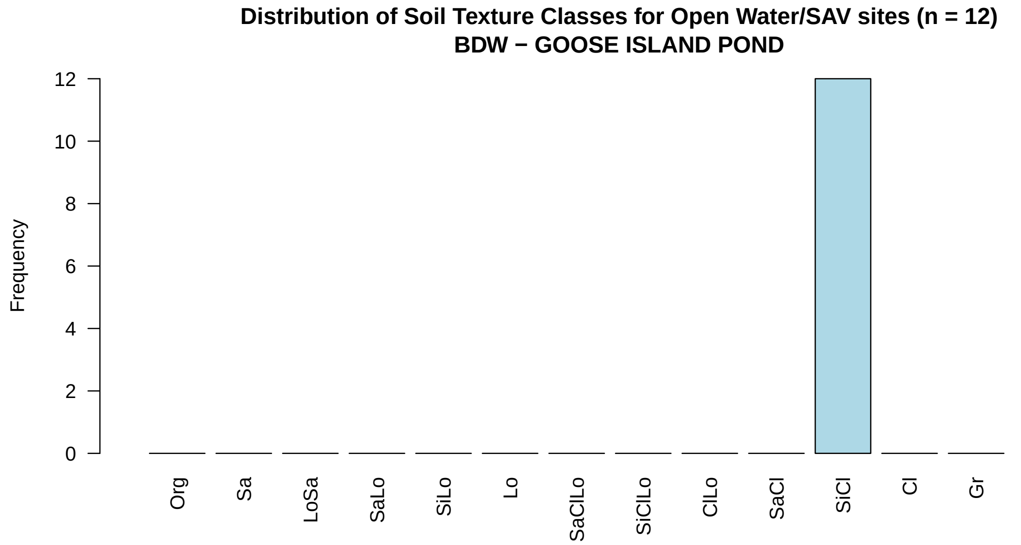
	n	Min	Mean	SE	Max
Water depth	25	0	9.4	2.35	34
Secchi Depth	25	0	9.4	2.35	34
pH level	13	5	7	0.32	8.3
Specific Conductivity	13	2140	5161.6	460.17	7217
Salinity	13	0.1	2.3	0.29	4
Temperature	13	15.1	21.8	1.02	27

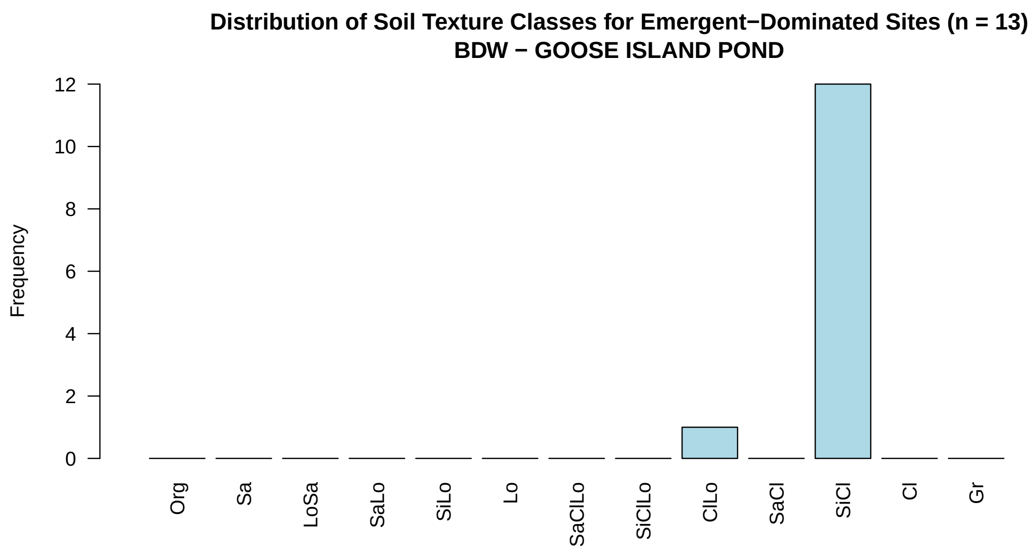
Table 18: Summary of water quality information for ocular survey, SAV point locations at BDW - GOOSE ISLAND POND.

	n	Min	Mean	SE	Max
Water depth	12	0	16.4	3.58	34
Secchi Depth	12	0	16.4	3.58	34
pH level	10	5	6.8	0.4	8.3
Specific Conductivity	10	2140	5270.4	567.45	7217
Salinity	10	0.1	2.4	0.38	4
Temperature	10	15.1	21.9	1.32	27

Table 19: Summary of water quality information for ocular survey, Non-SAV point locations at BDW - GOOSE ISLAND POND.

	n	Min	Mean	SE	Max
Water depth	13	0	2.9	1.75	21
Secchi Depth	13	0	2.9	1.75	21
pH level	3	7.3	7.5	0.1	7.7
Specific Conductivity	3	3303	4799	768.18	5850
Salinity	3	1.7	2.1	0.27	2.6
Temperature	3	20.9	21.7	0.75	23.2


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 12)
BDW − GOOSE ISLAND POND
Frequency
0
2
4
6
8
10
12
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 13)
BDW − GOOSE ISLAND POND
Frequency
0
2
4
6
8
10
12
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr

2.2.5 BDW - Lakeside Unit

Table 20: Design-based estimate of mean percent canopy coverage for vegetation present at BDW - LAKESIDE. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 70), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 29; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 41). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	11.3	(6.6, 16.1)	24	18.3	(8, 28.6)	8	6.4	(3.3, 9.5)	16
SAV	CEDE4	7	(2, 11.9)	8	16.8	(5.5, 28.2)	8			
SAV	FILAL.FL	0.4	(0, 0.9)	1	0.9	(0, 2.3)	1			
SAV	FILAL.WC	0.4	(0, 1.1)	2	1	(0, 2.6)	2			
SAV	LEMNA	Trace	(0, 0)	1				Trace	(0, 0.1)	1
SAV	MYSI	20	(12.8, 27.2)	21	48.4	(35.1, 61.6)	21			
SAV	RESID.SU	4.4	(0.7, 8.1)	6	0.1	(0, 0.2)	2	7.4	(1.2, 13.6)	4
SAV	STPE15	5.1	(2, 8.2)	13	12.2	(5.2, 19.2)	13			
E	CAREX	0.6	(0, 1.1)	6	Trace	(0, 0.1)	1	1	(0, 1.9)	5
E	PHAR3	0.2	(0, 0.6)	1				0.4	(0, 1)	1
E	RESID.SE	1.3	(0, 3)	2	0.7	(0, 1.8)	1	1.7	(0, 4.5)	1
E	RESID.TE	27.4	(20.6, 34.2)	41	1.3	(0, 2.8)	5	45.9	(36.9, 54.8)	36
E	SCAC3	6.9	(3.7, 10)	19	2.1	(0.2, 3.9)	4	10.3	(5.2, 15.3)	15
E	TYAN	3.5	(0.8, 6.2)	8				6	(1.5, 10.5)	8
E	TYGL	2.7	(0.5, 4.8)	7				4.6	(0.9, 8.2)	7
E	TYLA	Trace	(0, 0)	1				Trace	(0, 0.1)	1
R	HOJU	Trace	(0, 0.1)	2				Trace	(0, 0.1)	2
R	RUMA4	4.6	(1.3, 8)	6				7.9	(2.3, 13.5)	6
R	UNFOR	3.3	(0.7, 5.8)	20	Trace	(0, 0.1)	1	5.5	(1.2, 9.8)	19
	POLSP.	1.7	(0, 3.5)	5				3	(0, 6)	5

Table 21: Summary of water quality information for all ocular survey point locations at BDW - LAKESIDE.

	n	Min	Mean	SE	Max
Water depth	70	0	12.23	2.51	73
Secchi Depth	70	0	12.23	2.51	73
pH level	24	7.14	8.84	0.14	9.94
Specific Conductivity	24	770	908.67	22.16	1161
Salinity	24	0.37	0.41	0.01	0.57
Temperature	24	23.49	28.69	0.62	35

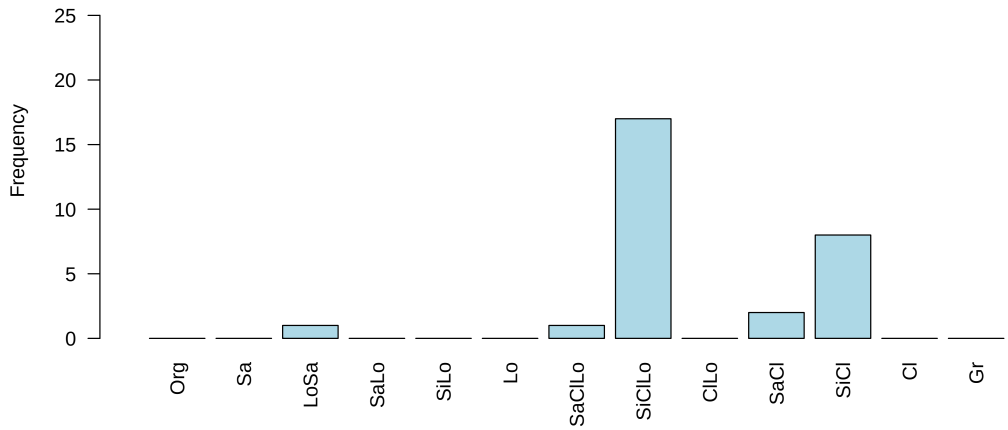
Table 22: Summary of water quality information for ocular survey, SAV point locations at BDW - LAKESIDE.

	n	Min	Mean	SE	Max
Water depth	29	0	29.52	4.4	73
Secchi Depth	29	0	29.52	4.4	73
pH level	24	7.14	8.84	0.14	9.94
Specific Conductivity	24	770	908.67	22.16	1161
Salinity	24	0.37	0.41	0.01	0.57
Temperature	24	23.49	28.69	0.62	35

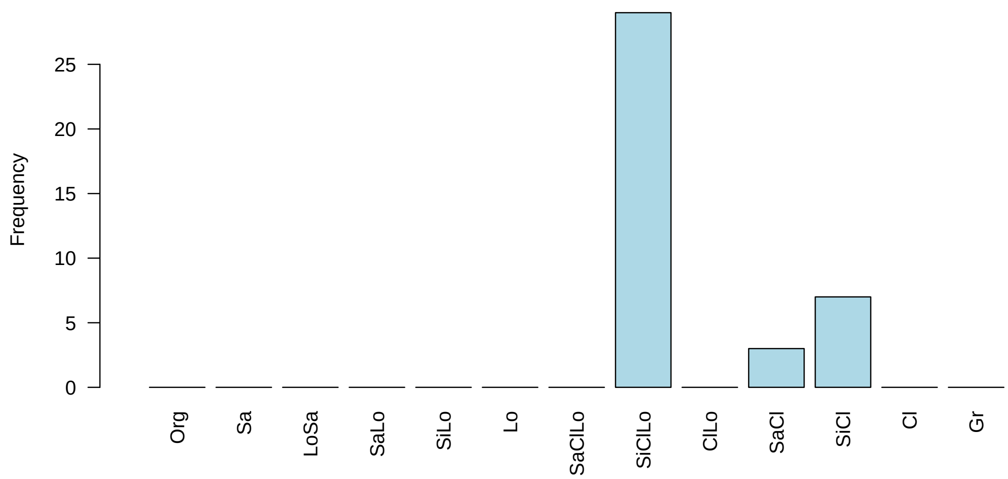
Table 23: Summary of water quality information for ocular survey, Non-SAV point locations at BDW - LAKESIDE.

	n	Min	Mean	SE	Max
Water depth	41	0	0	0	0
Secchi Depth	41	0	0	0	0
pH level	NA				
Specific Conductivity	NA				
Salinity	NA				
Temperature	NA				

Distribution of Soil Texture Classes for Open Water/SAV sites (n = 29)
BDW − LAKESIDE



Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 41)
BDW − LAKESIDE



2.2.6 LMC - Pond 2

Table 24: Design-based estimate of mean percent canopy coverage for vegetation present at LMC - POND 2. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 27), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 17; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 10). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	14.1	(8.1, 20.2)	16	17.1	(8.4, 25.9)	9	9	(2.5, 15.5)	7
SAV	CALLI6	0.3	(0, 0.7)	3	0.1	(0, 0.2)	2	0.6	(0, 1.6)	1
SAV	CHVU	31.3	(19.5, 43.1)	13	49.7	(35.5, 63.9)	13			
SAV	FILAL	24.6	(12.5, 36.6)	10	4.3	(0, 9.4)	3	59	(37.1, 81)	7
SAV	FILAL.FL	0.4	(0, 0.9)	3	0.3	(0, 0.8)	1	0.7	(0, 1.6)	2
SAV	FILAL.WC	1	(0, 2.4)	3	1.5	(0, 3.8)	3			
SAV	ISOETES	0.1	(0, 0.2)	1				0.2	(0, 0.5)	1
SAV	LEMI3	1.6	(0.6, 2.5)	13	1.6	(0.5, 2.7)	10	1.5	(0, 3.5)	3
SAV	MOSS	0.1	(0, 0.2)	2				0.2	(0, 0.4)	2
SAV	MYSI	4.3	(1.3, 7.3)	7	6.8	(2.4, 11.3)	7			
SAV	NAJAS	1	(0, 2.6)	2	1.5	(0, 3.9)	1	0.3	(0, 0.8)	1
SAV	POPU7	0.2	(0, 0.5)	2	0.4	(0, 0.8)	2			
SAV	RINA	0.3	(0.1, 0.4)	8	0.3	(0.1, 0.5)	5	0.3	(0, 0.6)	3
SAV	SPPO	Trace	(0, 0.1)	1	0.1	(0, 0.2)	1			
SAV	STFIF	Trace	(0, 0.1)	1	0.1	(0, 0.2)	1			
SAV	STPE15	6.3	(1, 11.5)	6	9.9	(1.8, 18.1)	6			
SAV	ZAPA	3.3	(0, 6.6)	6	4.3	(0, 9.5)	2	1.7	(0.2, 3.2)	4
E	CAREX	6.2	(0, 13.3)	2				16.8	(0, 35.2)	2
E	ELEOC	0.1	(0, 0.2)	1	0.1	(0, 0.3)	1			
E	GLGR	Trace	(0, 0.1)	1				0.1	(0, 0.3)	1
E	JUNCUS	0.2	(0, 0.6)	1				0.6	(0, 1.6)	1
E	MENTH	Trace	(0, 0.1)	1				0.1	(0, 0.3)	1
E	RESID	0.8	(0.4, 1.2)	10	0.8	(0.2, 1.3)	6	0.8	(0.2, 1.4)	4
E	SACU	0.2	(0, 0.6)	1				0.6	(0, 1.6)	1
E	SCHOE6	1.7	(0, 4.3)	2				4.5	(0, 11.7)	2
E	TYLA	0.9	(0, 1.9)	3				2.4	(0, 4.9)	3
R	CIAR4	Trace	(0, 0.1)	1	0.1	(0, 0.2)	1			
R	UNFOR	1.2	(0.2, 2.3)	5	1.4	(0, 3)	2	0.9	(0, 1.9)	3
R	UNGRA	0.1	(0, 0.4)	1	0.2	(0, 0.6)	1			

POLSP.	1	(0, 2.5)	2	1.5	(0, 3.9)	1	0.2	(0, 0.5)	1

Table 25: Summary of water quality information for all ocular survey point locations at LMC - POND 2.

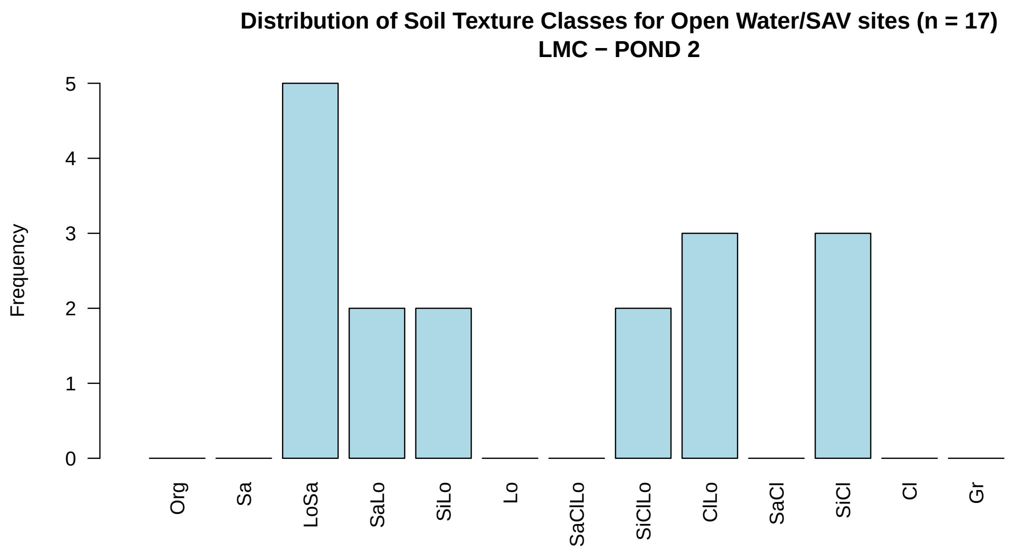
	n	Min	Mean	SE	Max
Water depth	27	0	20.9	2.41	49
Secchi Depth	27	0	20.9	2.41	49
pH level	24	7.1	8.8	0.2	10.5
Specific Conductivity	24	143	164.6	4.07	227.2
Salinity	24	0.1	0.1	0	0.1
Temperature	24	9	15.8	0.55	19.5

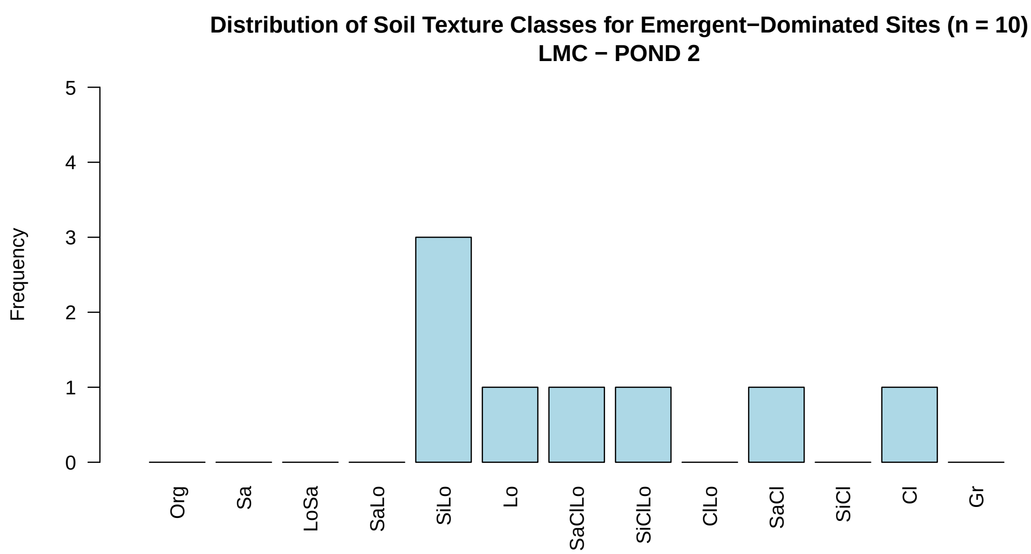
Table 26: Summary of water quality information for ocular survey, SAV point locations at LMC - POND 2.

	n	Min	Mean	SE	Max
Water depth	17	4	25.7	2.72	49
Secchi Depth	17	4	25.7	2.72	49
pH level	17	7.1	9	0.19	9.8
Specific Conductivity	17	143.3	164.2	5.19	227.2
Salinity	17	0.1	0.1	0	0.1
Temperature	17	9	15.9	0.61	19.2

Table 27: Summary of water quality information for ocular survey, Non-SAV point locations at LMC - POND 2.

	n	Min	Mean	SE	Max
Water depth	10	0	12.7	3.32	28
Secchi Depth	10	0	12.7	3.32	28
pH level	7	7.1	8.3	0.47	10.5
Specific Conductivity	7	143	165.6	6.56	186.7
Salinity	7	0.1	0.1	0	0.1
Temperature	7	9.2	15.5	1.24	19.5


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 17)
LMC − POND 2
Frequency
0
1
2
3
4
5
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 10)
LMC − POND 2
Frequency
0
1
2
3
4
5
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr

2.2.7 LMC - Pond 4

Table 28: Design-based estimate of mean percent canopy coverage for vegetation present at LMC - POND 4. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 18), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 5; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 13). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	AZOLL	3.4	(0.3, 6.5)	7	10.2	(0.3, 20.1)	3	0.8	(0, 1.5)	4
SAV	BARESU	12.4	(3.6, 21.3)	8	31.6	(4.4, 58.8)	3	5.1	(1.1, 9.1)	5
SAV	CEDE4	0.8	(0, 2.2)	1	3	(0, 7.9)	1			
SAV	ELCA7	2.1	(0, 5.4)	1	7.4	(0, 19.6)	1			
SAV	FILAL	10.9	(0.9, 20.9)	5	0.8	(0, 1.6)	2	14.8	(1.2, 28.4)	3
SAV	FILAL.FL	5.2	(1, 9.5)	6	10.4	(0, 22.8)	3	3.2	(0, 6.8)	3
SAV	FILAL.WC	2.2	(0, 5.9)	1				3.1	(0, 8.1)	1
SAV	LEMI3	5.6	(2, 9.2)	13	8	(0.9, 15.1)	5	4.7	(0.4, 8.9)	8
SAV	MYSI	4.2	(0, 10.9)	2	14.8	(0, 39.1)	1	0.1	(0, 0.2)	1
SAV	RANUN	0.8	(0, 1.9)	4	2.8	(0, 6.6)	3	0.1	(0, 0.2)	1
SAV	RIFL4	1.3	(0.3, 2.4)	7	0.2	(0, 0.5)	1	1.8	(0.4, 3.1)	6
SAV	RINA	0.3	(0.1, 0.6)	4				0.5	(0.1, 0.8)	4
SAV	SPPO	3.1	(0, 6.2)	9	7.4	(0, 18.8)	3	1.4	(0.3, 2.5)	6
SAV	STFIF	3.5	(0.7, 6.3)	4	7	(0, 15.1)	2	2.2	(0, 4.6)	2
SAV	ZAPA	0.7	(0, 1.5)	2				0.9	(0, 2)	2
E	CAREX	13.4	(0, 28.4)	5				18.6	(0, 39)	5
E	GATR2	0.4	(0, 1.2)	1				0.6	(0, 1.6)	1
E	PHAR3	0.6	(0, 1.5)	1	2	(0, 5.3)	1			
E	RESID	15.7	(5.7, 25.7)	12	1.8	(0.6, 3)	4	21.1	(7.9, 34.2)	8
E	TYLA	27.8	(16.1, 39.6)	13	2.4	(0, 5.6)	2	37.6	(23.8, 51.4)	11
R	SODU	4.5	(0, 10.4)	6	0.2	(0, 0.5)	1	6.2	(0, 14.3)	5
R	UNFOR	0.2	(0, 0.3)	3	0.4	(0, 0.8)	2	0.1	(0, 0.2)	1

Table 29: Summary of water quality information for all ocular survey point locations at LMC - POND 4.

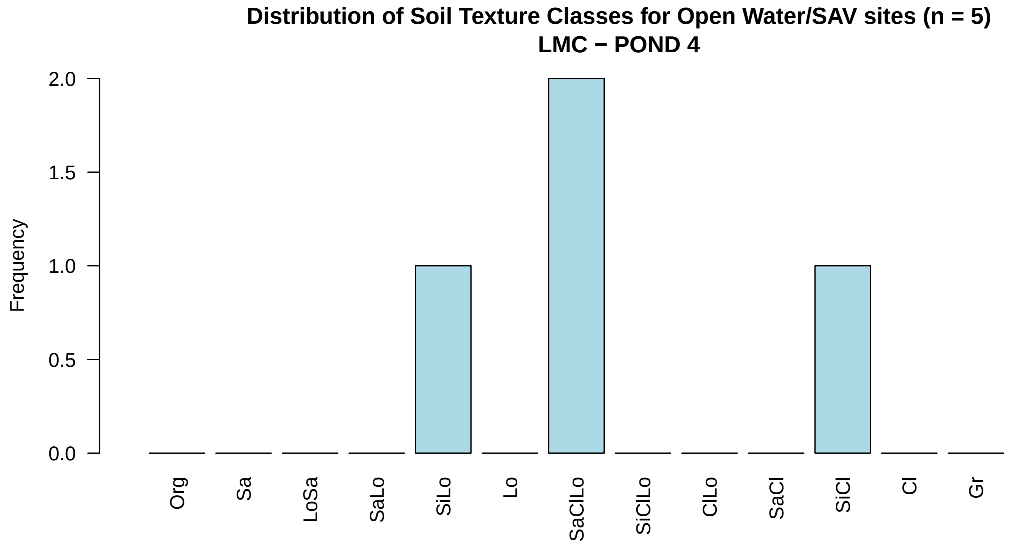
	n	Min	Mean	SE	Max
Water depth	18	0	44.83	5.73	84
Secchi Depth	18	0	44.83	5.73	84
pH level	17	7	7.84	0.08	8.3
Specific Conductivity	17	161.6	206.52	6.08	253.9
Salinity	17	0.1	0.14	0.01	0.2
Temperature	17	3.1	7.42	0.53	10.7

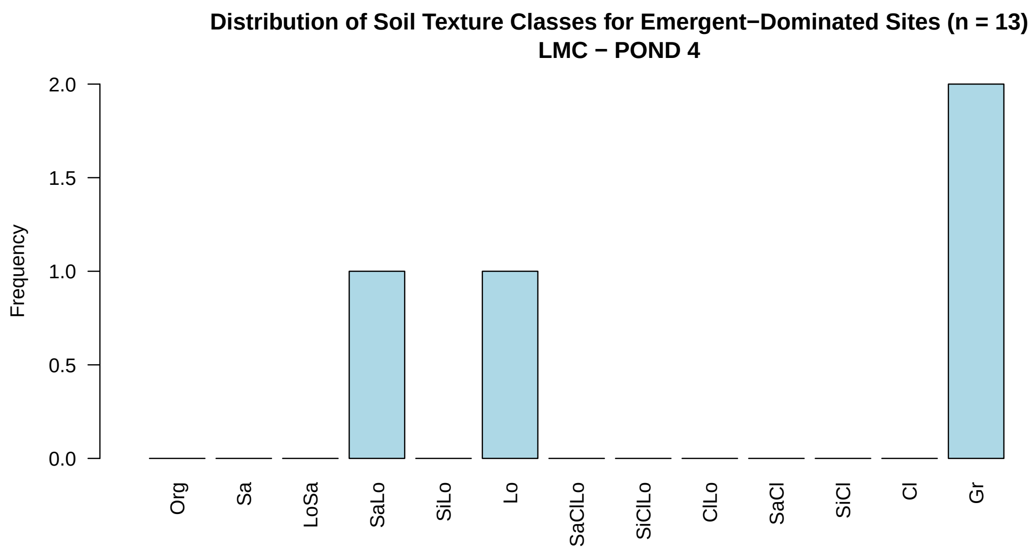
Table 30: Summary of water quality information for ocular survey, SAV point locations at LMC - POND 4.

	n	Min	Mean	SE	Max
Water depth	5	33	59.4	8.54	80
Secchi Depth	5	33	59.4	8.54	80
pH level	5	7.6	7.99	0.12	8.2
Specific Conductivity	5	176.6	215.12	11.4	238.9
Salinity	5	0.1	0.14	0.02	0.2
Temperature	5	5.5	8.34	0.84	9.9

Table 31: Summary of water quality information for ocular survey, Non-SAV point locations at LMC - POND 4.

	n	Min	Mean	SE	Max
Water depth	13	0	39.23	6.75	84
Secchi Depth	13	0	39.23	6.75	84
pH level	12	7	7.78	0.1	8.3
Specific Conductivity	12	161.6	202.94	7.25	253.9
Salinity	12	0.1	0.14	0.01	0.2
Temperature	12	3.1	7.03	0.66	10.7


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 5)
LMC − POND 4
Frequency
2.0
1.5
1.0
0.5
0.0
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 13)
LMC − POND 4
Frequency
2.0
1.5
1.0
0.5
0.0
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr

2.2.8 CMS - Big Pond

Table 32: Design-based estimate of mean percent canopy coverage for vegetation present at CMS - BIG POND. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 36), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 15; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 21). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	27.2	(15.9, 38.5)	23	50.1	(27.1, 73.2)	12	10.8	(5.5, 16.2)	11
SAV	CHARA	11.7	(5, 18.3)	11	28	(14.7, 41.3)	11			
SAV	FILAL.FL	0.7	(0, 1.8)	1	1.7	(0, 4.4)	1			
SAV	FILAL.WC	0.6	(0, 1.3)	3	1.5	(0, 3)	3			
SAV	MOSS	Trace	(0, 0.1)	1				Trace	(0, 0.1)	1
SAV	NAFL	Trace	(0, 0.1)	1	0.1	(0, 0.2)	1			
SAV	POFO3	Trace	(0, 0.1)	1	0.1	(0, 0.2)	1			
SAV	POPU7	2.9	(0, 6.2)	4	7	(0, 14.6)	4			
SAV	PORI2	0.4	(0, 1)	1	0.9	(0, 2.5)	1			
SAV	RAAQ	0.1	(0, 0.1)	1	0.1	(0, 0.4)	1			
SAV	STFIF	1.5	(0.5, 2.4)	8	3.5	(1.5, 5.5)	8			
SAV	STPE15	4.9	(1, 8.9)	5	11.9	(3.1, 20.7)	5			
SAV	ZAPA	2	(0.2, 3.8)	5	4.7	(0.6, 8.8)	5			
E	ALGR	Trace	(0, 0.1)	1	0.1	(0, 0.2)	1			
E	ALISM	Trace	(0, 0.1)	1	0.1	(0, 0.2)	1			
E	JUBA	0.1	(0, 0.1)	1				0.1	(0, 0.2)	1
E	MEAR4	0.8	(0, 1.8)	6				1.4	(0, 3)	6
E	MENTH	0.1	(0, 0.1)	1				0.1	(0, 0.2)	1
E	RESID.SE	2.8	(0.7, 5)	6				4.9	(1.3, 8.4)	6
E	RESID.TE	36.6	(25.6, 47.5)	21				62.7	(51, 74.4)	21
E	SCAC3	1.6	(0.4, 2.8)	12				2.7	(0.7, 4.7)	12
E	SCPU10	0.2	(0, 0.4)	2				0.3	(0, 0.7)	2
E	SEHY	0.7	(0, 1.3)	3				1.1	(0.1, 2.2)	3
E	TYLA	2.3	(0.4, 4.3)	6				4	(0.8, 7.2)	6
E	TYPHA	0.5	(0.1, 0.9)	6				0.9	(0.3, 1.4)	6
R	CHENO	0.9	(0, 2.2)	2				1.5	(0, 3.8)	2
R	CIAR4	3.8	(1.6, 6)	8				6.6	(3.1, 10.1)	8
R	GLLE3	0.1	(0, 0.1)	1				0.1	(0, 0.2)	1
R	KOSC	Trace	(0, 0.1)	1				Trace	(0, 0.1)	1

Growth Form	Species Code	All Sites			Open Water Sites			Emergent Sites		
		Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
R	RUCR	Trace	(0, 0.1)	1				Trace	(0, 0.1)	1
R	UNFOR	0.9	(0.2, 1.6)	7				1.5	(0.3, 2.6)	7
R	UNGRA	1	(0, 2.6)	2				1.8	(0, 4.5)	2

Table 33: Summary of water quality information for all ocular survey point locations at CMS - BIG POND.

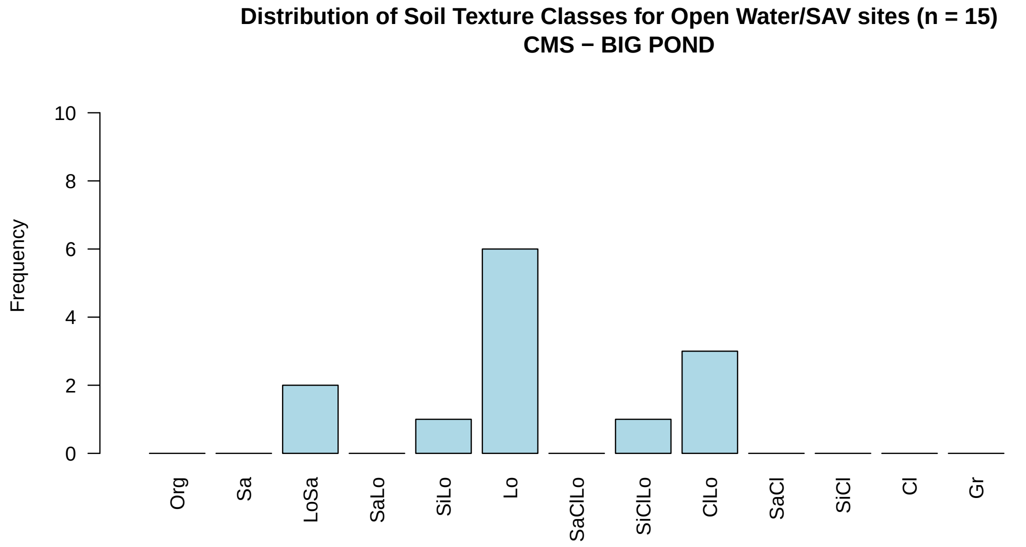
	n	Min	Mean	SE	Max
Water depth	36	0	15.11	2.99	56
Secchi Depth	36	0	15.11	2.99	56
pH level	18	8.2	8.92	0.13	9.7
Specific Conductivity	18	219.8	256.08	5.88	291.4
Salinity	18	0	0.09	0.01	0.1
Temperature	18	12.7	18.16	0.89	22.5

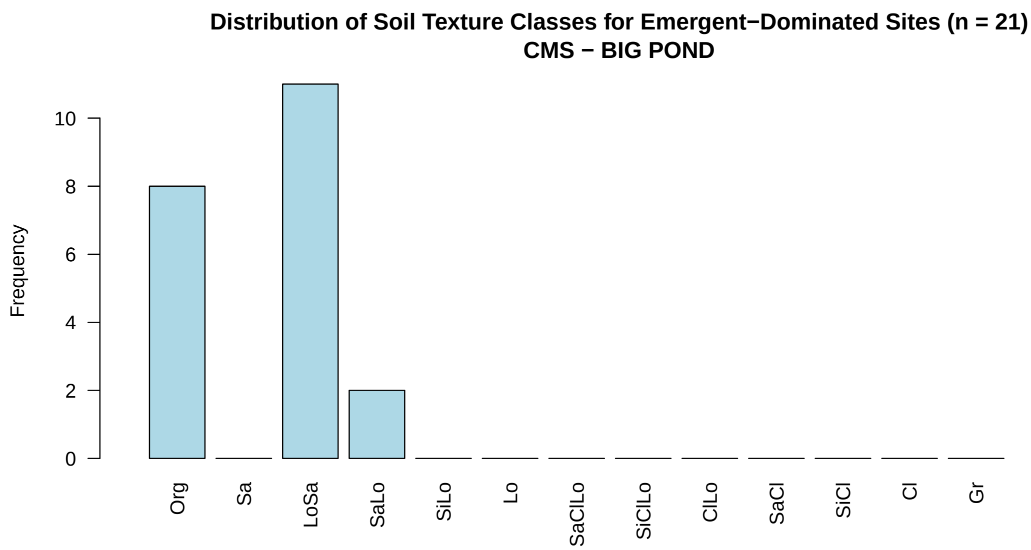
Table 34: Summary of water quality information for ocular survey, SAV point locations at CMS - BIG POND.

	n	Min	Mean	SE	Max
Water depth	15	9	31.6	3.7	56
Secchi Depth	15	9	31.6	3.7	56
pH level	15	8.2	9	0.14	9.7
Specific Conductivity	15	219.8	250.3	5.97	288.7
Salinity	15	0.1	0.1	0	0.1
Temperature	15	12.7	18.3	1.02	22.5

Table 35: Summary of water quality information for ocular survey, Non-SAV point locations at CMS - BIG POND.

	n	Min	Mean	SE	Max
Water depth	21	0	3.33	1.85	31
Secchi Depth	21	0	3.33	1.85	31
pH level	3	8.2	8.3	0.04	8.3
Specific Conductivity	3	275.1	284.77	4.94	291.4
Salinity	3	0	0.07	0.03	0.1
Temperature	3	14.5	17.37	1.88	20.9


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 15)
CMS − BIG POND
Frequency
0
2
4
6
8
10
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 21)
CMS − BIG POND
Frequency
0
2
4
6
8
10
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr

2.2.9 CMS - Redhead

Table 36: Design-based estimate of mean percent canopy coverage for vegetation present at CMS - REDHEAD. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 28), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 17; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 11). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	29.7	(19.7, 39.8)	24	46.8	(34.4, 59.2)	17	3.3	(1.4, 5.2)	7
SAV	CAHE2	0.1	(0, 0.3)	1	0.2	(0, 0.5)	1			
SAV	CHARA	18.7	(9.8, 27.6)	14	30.4	(17.7, 43.1)	13	0.5	(0, 1.4)	1
SAV	FILAL.FL	1.1	(0, 2.3)	3	1.5	(0, 3.4)	2	0.5	(0, 1.4)	1
SAV	FILAL.WC	0.9	(0, 2.4)	1	1.5	(0, 3.9)	1			
SAV	MYSI	0.5	(0, 1.2)	2	0.8	(0, 1.9)	2			
SAV	PORI2	0.1	(0, 0.2)	2	0.2	(0, 0.4)	2			
SAV	POTAM	0.1	(0, 0.2)	1	0.1	(0, 0.3)	1			
SAV	RAAQ	0.9	(0, 1.8)	4	1.4	(0, 2.9)	4			
SAV	STFIF	2.8	(0.6, 5)	10	4.6	(1.1, 8.1)	10			
SAV	STPE15	5.7	(1.2, 10.3)	6	9.4	(2.2, 16.6)	6			
SAV	UTVU	0.3	(0, 0.7)	2	0.4	(0, 1.1)	1	0.1	(0, 0.2)	1
SAV	ZAPA	0.2	(0, 0.6)	2	0.4	(0, 0.9)	2			
E	ALGR	0.2	(0, 0.5)	3	0.4	(0, 0.8)	3			
E	CAREX	0.4	(0, 1)	2				1.1	(0, 2.6)	2
E	ELPA3	2.9	(0, 7.7)	1				7.4	(0, 19.5)	1
E	JUBA	0.4	(0, 0.8)	4	0.1	(0, 0.2)	1	0.9	(0, 1.8)	3
E	MUAS	2.9	(0, 7.7)	1				7.5	(0, 19.7)	1
E	PEAM	0.4	(0, 0.9)	1	0.6	(0, 1.6)	1			
E	RESID.SE	3.2	(0.1, 6.4)	4	2.2	(0, 5.8)	1	4.9	(0, 10.9)	3
E	RESID.TE	23.5	(12.6, 34.5)	14	1.8	(0.2, 3.5)	4	57.1	(39.5, 74.7)	10
E	SCAC3	1.6	(0.5, 2.8)	8	0.1	(0, 0.3)	1	4	(1.4, 6.6)	7
E	SCPU10	0.1	(0, 0.2)	2				0.3	(0, 0.6)	2
E	SCTA2	1.5	(0.2, 2.7)	6	0.9	(0, 2.3)	1	2.4	(0.1, 4.6)	5
E	TYPHA	0.1	(0, 0.3)	1				0.3	(0, 0.7)	1
R	CHENO	0.6	(0, 1.7)	1				1.6	(0, 4.3)	1
R	CIAR4	3.1	(0.5, 5.8)	6				8	(1.8, 14.2)	6
R	UNFOR	0.2	(0, 0.6)	3				0.6	(0, 1.4)	3
R	UNGRA	Trace	(0, 0.1)	1				0.1	(0, 0.2)	1

Table 37: Summary of water quality information for all ocular survey point locations at CMS - REDHEAD.

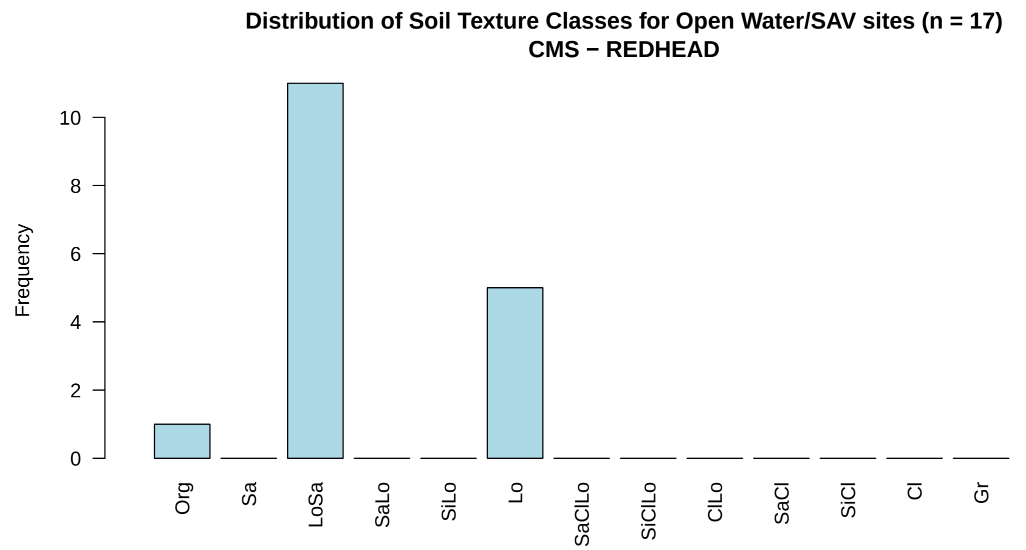
	n	Min	Mean	SE	Max
Water depth	28	0	35.2	4.84	83
Secchi Depth	28	0	35.2	4.84	83
pH level	23	7.3	8.9	0.12	9.6
Specific Conductivity	23	199.1	225.4	2.14	239
Salinity	23	0.1	0.1	0	0.1
Temperature	23	18.7	22.6	0.49	29.2

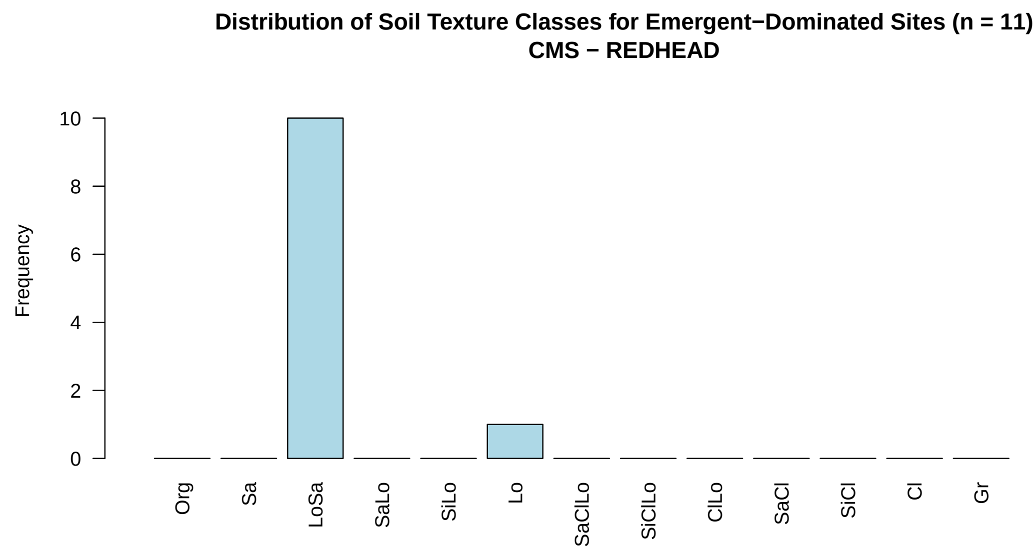
Table 38: Summary of water quality information for ocular survey, SAV point locations at CMS - REDHEAD.

	n	Min	Mean	SE	Max
Water depth	17	26	51.6	4.23	83
Secchi Depth	17	26	51.6	4.23	83
pH level	17	7.3	9.1	0.13	9.6
Specific Conductivity	17	199.1	225.1	2.73	239
Salinity	17	0.1	0.1	0	0.1
Temperature	17	18.7	22.4	0.45	25.8

Table 39: Summary of water quality information for ocular survey, Non-SAV point locations at CMS - REDHEAD.

	n	Min	Mean	SE	Max
Water depth	11	0	9.9	3.38	29
Secchi Depth	11	0	9.9	3.38	29
pH level	6	7.9	8.3	0.13	8.9
Specific Conductivity	6	218.2	226.3	3.09	238.7
Salinity	6	0.1	0.1	0	0.1
Temperature	6	19.9	23.1	1.48	29.2


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 17)
CMS − REDHEAD
Frequency
0
2
4
6
8
10
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 11)
CMS − REDHEAD
Frequency
0
2
4
6
8
10
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr

2.2.10 CMS - Sandhole Lake

Table 40: Design-based estimate of mean percent canopy coverage for vegetation present at CMS - SANDHOLE LAKE. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 75), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 27; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 48). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	27.3	(21, 33.5)	68	57.4	(45.3, 69.5)	26	10.3	(8, 12.6)	42
SAV	CEDE4	Trace	(0, 0)	1	Trace	(0, 0.1)	1			
SAV	CHARA	1.6	(0, 3.6)	6	4.4	(0, 9.9)	6			
SAV	ELCA7	0.1	(0, 0.4)	2	0.4	(0, 1)	2			
SAV	FILAL.FL	0.2	(0, 0.4)	4	0.6	(0.1, 1)	4			
SAV	FILAL.WC	5.5	(2.7, 8.3)	18	14.9	(8, 21.9)	17	0.2	(0, 0.4)	1
SAV	NAFL	Trace	(0, 0)	1	Trace	(0, 0.1)	1			
SAV	NAGU	Trace	(0, 0.1)	1	0.1	(0, 0.2)	1			
SAV	NAJAS	Trace	(0, 0.1)	2	0.1	(0, 0.2)	2			
SAV	POFO3	0.2	(0, 0.3)	5	0.5	(0.1, 1)	5			
SAV	POPU7	0.1	(0, 0.2)	3	0.3	(0, 0.5)	3			
SAV	POTAM	Trace	(0, 0.1)	1	0.1	(0, 0.3)	1			
SAV	POZO	Trace	(0, 0.1)	1	0.1	(0, 0.3)	1			
SAV	RANUN	1.2	(0, 2.5)	6	0.3	(0, 0.7)	1	1.7	(0, 3.7)	5
SAV	STFIF	0.1	(0, 0.2)	3	0.2	(0, 0.4)	3			
SAV	STPE15	10.6	(5.6, 15.5)	15	29.4	(17.7, 41)	15			
SAV	ZAPA	0.8	(0, 1.8)	5	2.3	(0, 4.8)	5			
E	ALGR	0.2	(0, 0.4)	4	0.6	(0.1, 1)	4			
E	ALISM	0.1	(0, 0.2)	1	0.2	(0, 0.5)	1			
E	CAREX	0.2	(0, 0.5)	4	0.4	(0, 1)	1	0.1	(0, 0.3)	3
E	ELAC	0.1	(0, 0.2)	1	0.2	(0, 0.5)	1			
E	ELPA3	0.9	(0, 2)	3				1.3	(0, 3.1)	3
E	JUBA	0.4	(0.2, 0.6)	10	0.2	(0, 0.5)	2	0.5	(0.2, 0.8)	8
E	JUNCUS	Trace	(0, 0.1)	1				Trace	(0, 0.1)	1
E	JUTO	0.2	(0, 0.4)	6				0.4	(0.1, 0.6)	6
E	MEAR4	0.3	(0.1, 0.5)	9				0.5	(0.2, 0.8)	9
E	MENTH	0.2	(0, 0.4)	1				0.2	(0, 0.7)	1
E	PEAM	3.7	(1.3, 6.1)	14				5.8	(2.1, 9.5)	14
E	POAN5	1	(0, 2.1)	4	Trace	(0, 0.1)	1	1.6	(0, 3.2)	3

Growth Form	Species Code	All Sites			Open Water Sites			Emergent Sites		
		Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
E	RESID	2	(0, 4.4)	2				3.2	(0, 6.9)	2
E	RESID.SE	8.7	(5.7, 11.6)	31	0.6	(0, 1.5)	1	13.3	(9.1, 17.5)	30
E	RESID.TE	11.3	(7.3, 15.3)	33	Trace	(0, 0.1)	1	17.7	(12, 23.4)	32
E	SCAC3	2	(0.9, 3.1)	31	Trace	(0, 0.1)	1	3.1	(1.4, 4.8)	30
E	SCPU10	1.3	(0, 2.8)	3				2	(0, 4.3)	3
E	TYPHA	Trace	(0, 0)	1				Trace	(0, 0.1)	1
R	ALAE	2	(0.3, 3.7)	9	0.7	(0, 2)	1	2.7	(0.2, 5.2)	8
R	ASTER	0.1	(0, 0.1)	3				0.1	(0, 0.2)	3
R	ASTRA	0.8	(0, 1.9)	2				1.2	(0, 2.9)	2
R	CHENO	1.7	(0.1, 3.2)	3				2.6	(0.2, 5)	3
R	CIAR4	7.7	(5.3, 10.1)	31				12	(8.7, 15.3)	31
R	GLLE3	0.6	(0.1, 1.1)	5				0.9	(0.1, 1.7)	5
R	HOJU	5.4	(1.9, 8.8)	14	0.1	(0, 0.3)	1	8.4	(3.1, 13.6)	13
R	KOSC	0.8	(0, 1.6)	6	0.1	(0, 0.3)	1	1.2	(0, 2.4)	5
R	PACA6	Trace	(0, 0)	1				Trace	(0, 0.1)	1
R	PEPE19	0.3	(0, 0.7)	6	Trace	(0, 0.1)	1	0.5	(0, 1)	5
R	PLMA2	0.1	(0, 0.2)	1				0.1	(0, 0.4)	1
R	SAEX	0.5	(0, 1)	4				0.7	(0, 1.5)	4
R	SONCH	0.1	(0, 0.3)	1				0.2	(0, 0.4)	1
R	UNFOR	2.7	(1.1, 4.4)	27	0.7	(0, 1.5)	3	3.9	(1.4, 6.4)	24
R	UNGRA	Trace	(0, 0.1)	3	Trace	(0, 0.1)	1	Trace	(0, 0.1)	2
R	URDI	1.1	(0, 2.3)	5				1.7	(0, 3.5)	5

Table 41: Summary of water quality information for all ocular survey point locations at CMS - SANDHOLE LAKE.

	n	Min	Mean	SE	Max
Water depth	75	0	20.4	4.2	147
Secchi Depth	75	0	20.4	4.2	147
pH level	24	9.4	9.9	0.06	10.7
Specific Conductivity	24	167.9	184.1	1.48	197.8
Salinity	24	0.1	0.1	0	0.1
Temperature	24	14.9	19.6	0.75	27.2

Table 42: Summary of water quality information for ocular survey, SAV point locations at CMS - SANDHOLE LAKE.

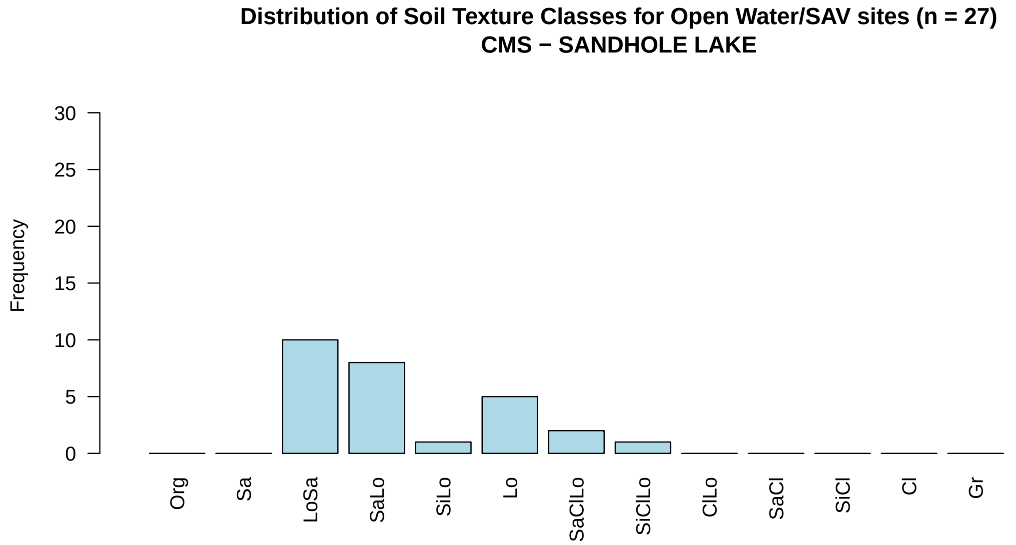
	n	Min	Mean	SE	Max
Water depth	27	0	52.2	7.65	147
Secchi Depth	27	0	52.2	7.65	147
pH level	23	9.4	9.9	0.06	10.7
Specific Conductivity	23	167.9	183.8	1.51	197.8
Salinity	23	0.1	0.1	0	0.1
Temperature	23	14.9	19.6	0.79	27.2

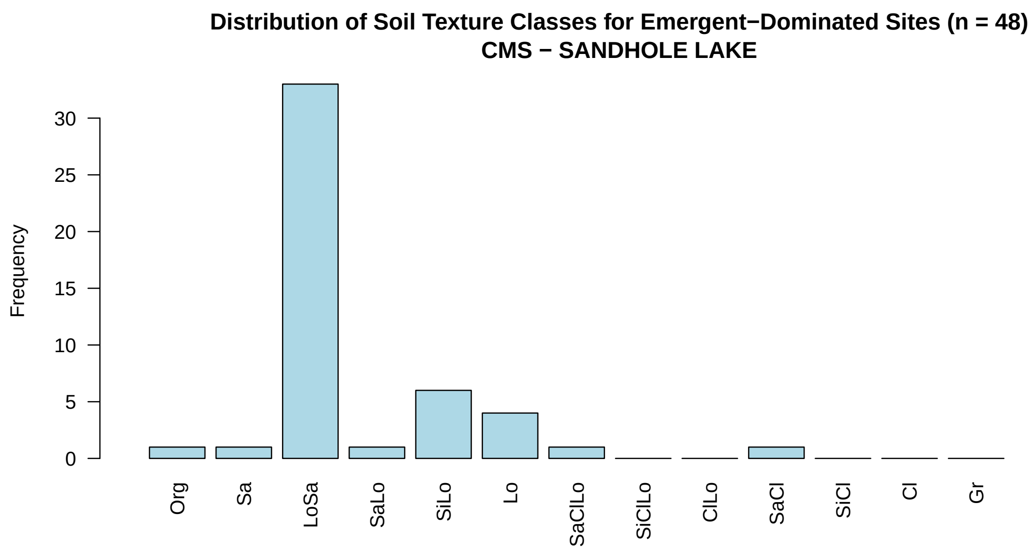
Table 43: Summary of water quality information for ocular survey, Non-SAV point locations at CMS - SANDHOLE LAKE.

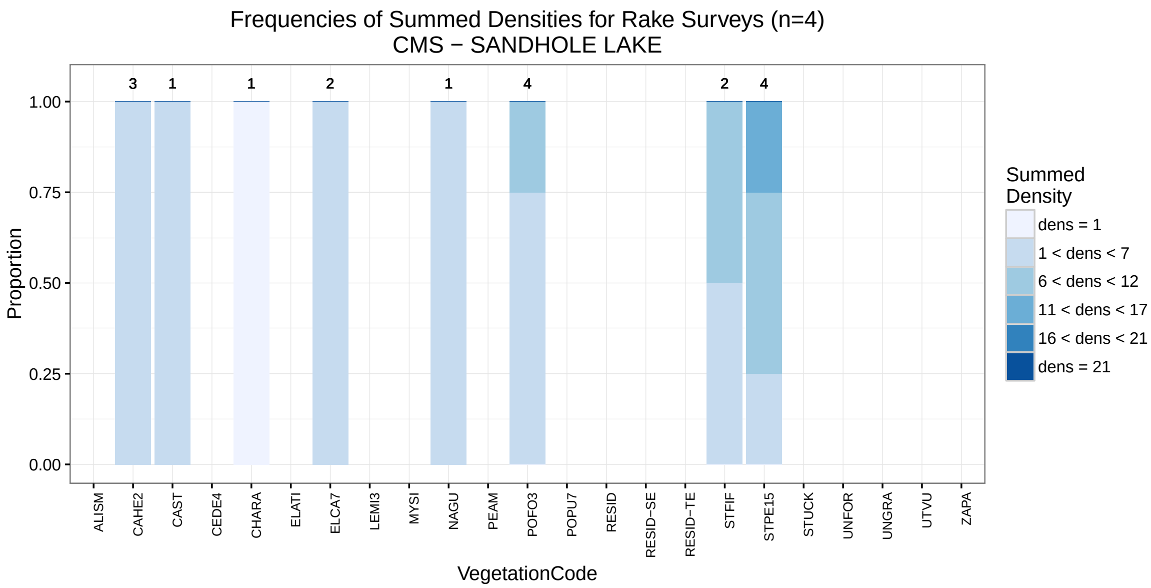
	n	Min	Mean	SE	Max
Water depth	48	0	2.5	2.5	120
Secchi Depth	48	0	2.5	2.5	120
pH level	1		10.05		
Specific Conductivity	1		191.8		
Salinity	1		0.1		
Temperature	1		20.4		

Table 44: Summary of water quality information for rake survey point locations at CMS - SANDHOLE LAKE.

	n	Min	Mean	SE	Max
Water depth	4	70	117.2	16.69	147
Secchi Depth	4	52	112.8	20.99	147
pH level	4	9.1	9.8	0.24	10.1
Specific Conductivity	4	190.1	195.9	5.05	211
Salinity	4	0.1	0.1	0	0.1
Temperature	4	17.2	18.7	0.67	20.4


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 27)
CMS − SANDHOLE LAKE
Frequency
0
5
10
15
20
25
30
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 48)
CMS − SANDHOLE LAKE
Frequency
0
5
10
15
20
25
30
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Frequencies of Summed Densities for Rake Surveys (n=4)
CMS − SANDHOLE LAKE
Proportion
1.00
0.75
0.50
0.25
0.00
3
1
1
2
1
4
2
4
ALISM
CAHE2
CAST
CEDE4
CHARA
ELATI
ELCA7
LEMI3
MYSI
NAGU
PEAM
POFO3
POPU7
RESID
RESID−SE
RESID−TE
STFIF
STPE15
STUCK
UNFOR
UNGRA
UTVU
ZAPA
VegetationCode
Summed Density
dens = 1
1 < dens < 7
6 < dens < 12
11 < dens < 17
16 < dens < 21
dens = 21

2.2.11 GYL - Beavertail

Table 45: Design-based estimate of mean percent canopy coverage for vegetation present at GYL - BEAVERTAIL. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 122), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 56; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 66). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	6	(3.6, 8.4)	59	11.5	(6.6, 16.4)	40	1.3	(0.8, 1.9)	19
SAV	CEDE4	Trace	(0, 0.1)	1	0.1	(0, 0.1)	1			
SAV	CHARA	21.6	(16.1, 27)	41	47	(37.8, 56.1)	41			
SAV	FILAL.FL	0.1	(0, 0.2)	6	0.2	(0, 0.3)	4	Trace	(0, 0.1)	2
SAV	FILAL.WC	4.2	(1.9, 6.5)	22	8.7	(3.9, 13.4)	19	0.5	(0, 0.9)	3
SAV	FOAN2	0.1	(0.1, 0.2)	9				0.3	(0.1, 0.4)	9
SAV	HIVU2	2.9	(1, 4.8)	10	6.1	(2.1, 10)	8	0.2	(0, 0.5)	2
SAV	LEMI3	1.5	(0.3, 2.7)	37	2.6	(0, 5.1)	17	0.5	(0.3, 0.8)	20
SAV	MYRIO	4.3	(2.3, 6.2)	35	8.9	(4.9, 12.9)	31	0.4	(0, 0.8)	4
SAV	MYSI	0.2	(0, 0.6)	1	0.5	(0, 1.3)	1			
SAV	MYVE3	Trace	(0, 0)	1	Trace	(0, 0)	1			
SAV	POFO3	0.2	(0, 0.4)	3	0.4	(0, 0.8)	3			
SAV	RAAQ	8	(4.8, 11.2)	32	17.4	(11, 23.9)	31	Trace	(0, 0)	1
SAV	RAFL	Trace	(0, 0.1)	2	Trace	(0, 0.1)	1	Trace	(0, 0.1)	1
SAV	STFIF	0.8	(0.1, 1.5)	14	1.7	(0.2, 3.2)	14			
SAV	STPE15	0.5	(0, 1.1)	5	1.2	(0, 2.5)	5			
SAV	UTVU	0.1	(0, 0.3)	3	0.3	(0, 0.7)	2	Trace	(0, 0)	1
SAV	ZAPA	Trace	(0, 0)	1	Trace	(0, 0)	1			
E	CAUT	6.7	(3.9, 9.4)	18				12.3	(7.6, 17.1)	18
E	ELPA3	Trace	(0, 0)	1				Trace	(0, 0)	1
E	JUBA	0.2	(0, 0.6)	1				0.5	(0, 1.2)	1
E	JUNCUS	Trace	(0, 0)	1				Trace	(0, 0)	1
E	MEAR4	0.1	(0, 0.3)	2				0.2	(0, 0.6)	2
E	PEAM	0.1	(0, 0.3)	3				0.2	(0, 0.5)	3
E	RESID	1.8	(0.6, 3)	7				3.3	(1.1, 5.6)	7
E	RESID.SE	1	(0.4, 1.7)	8				1.9	(0.7, 3.2)	8
E	RESID.TE	35.6	(29.6, 41.5)	59	1.4	(0.1, 2.8)	3	64.5	(57.9, 71.2)	56
E	SCAC3	5.7	(4.4, 6.9)	59	0.1	(0, 0.2)	2	10.4	(8.6, 12.3)	57
E	SCTA2	Trace	(0, 0)	2	Trace	(0, 0)	1	Trace	(0, 0)	1

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
E	SEHY	Trace	(0, 0)	1				Trace	(0, 0.1)	1
E	SPEU	0.1	(0, 0.3)	1				0.2	(0, 0.6)	1
E	TYAN	Trace	(0, 0)	1				Trace	(0, 0.1)	1
E	TYGL	0.3	(0.1, 0.6)	7	0.3	(0, 0.7)	1	0.4	(0.1, 0.7)	6
E	TYLA	1.5	(0.9, 2)	28	1	(0, 2)	4	1.9	(1.2, 2.5)	24
E	TYPHA	0.4	(0, 0.8)	11				0.8	(0.1, 1.4)	11
R	UNFOR	0.2	(0.1, 0.3)	14				0.3	(0.2, 0.5)	14

Table 46: Summary of water quality information for all ocular survey point locations at GYL - BEAVERTAIL.

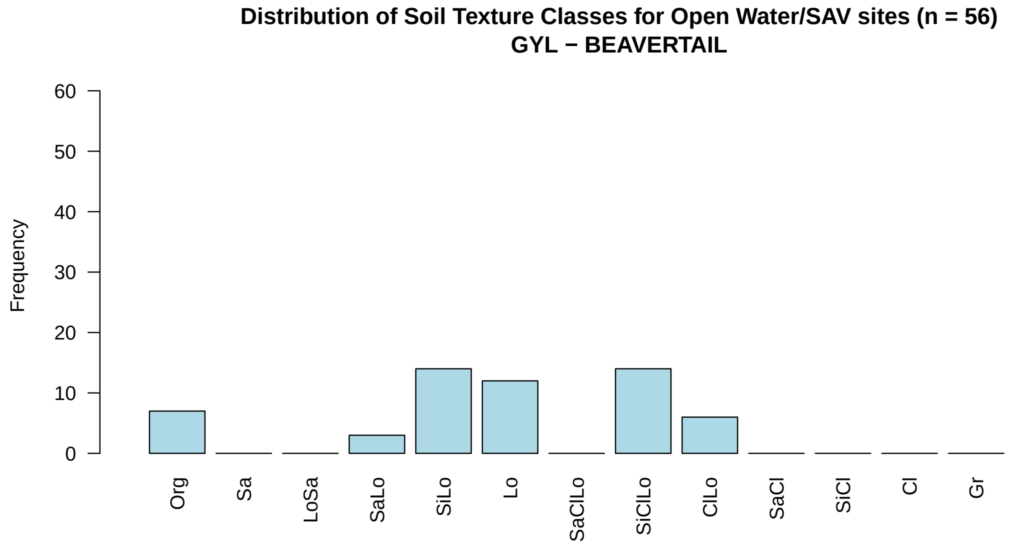
	n	Min	Mean	SE	Max
Water depth	122	0	22.18	1.35	52
Secchi Depth	122	0	22.18	1.35	52
pH level	97	6.76	7.93	0.08	9.7
Specific Conductivity	97	134.3	308.11	8.33	543
Salinity	97	0.02	0.14	0.01	0.3
Temperature	97	14.2	18.63	0.28	25.7

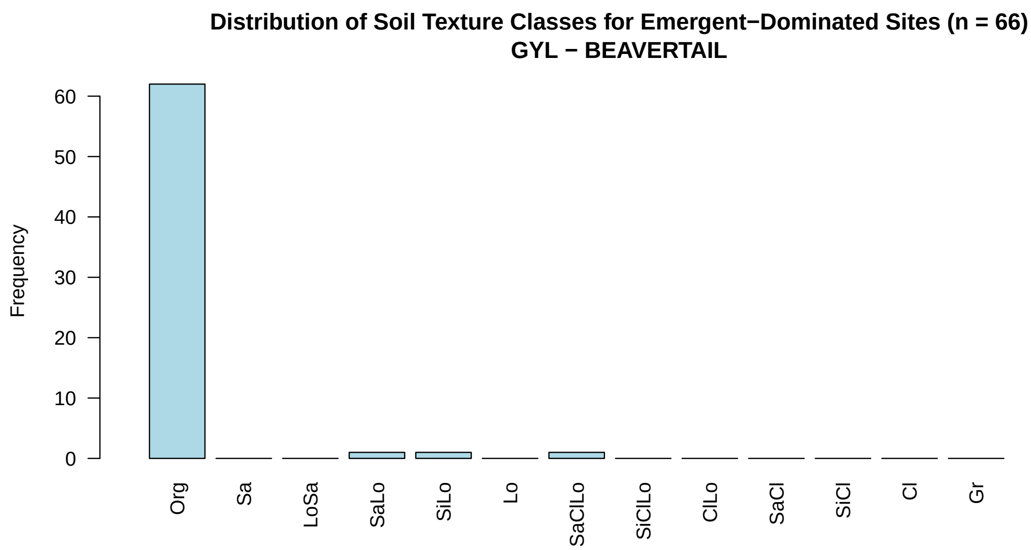
Table 47: Summary of water quality information for ocular survey, SAV point locations at GYL - BEAVERTAIL.

	n	Min	Mean	SE	Max
Water depth	56	20	35.27	0.8	52
Secchi Depth	56	20	35.27	0.8	52
pH level	56	6.87	8.41	0.09	9.7
Specific Conductivity	56	173.8	276.21	7.19	392.5
Salinity	56	0.02	0.12	0.01	0.2
Temperature	56	15.9	19.94	0.35	25.7

Table 48: Summary of water quality information for ocular survey, Non-SAV point locations at GYL - BEAVERTAIL.

	n	Min	Mean	SE	Max
Water depth	66	0	11.08	1.29	38
Secchi Depth	66	0	11.08	1.29	38
pH level	41	6.8	7.28	0.04	7.8
Specific Conductivity	41	134.3	351.68	14.67	543
Salinity	41	0.1	0.18	0.01	0.3
Temperature	41	14.2	16.84	0.28	22.3


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 56)
GYL − BEAVERTAIL
Frequency
0
10
20
30
40
50
60
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 66)
GYL − BEAVERTAIL
Frequency
0
10
20
30
40
50
60
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr

2.2.12 GYL - Big Bend

Table 49: Design-based estimate of mean percent canopy coverage for vegetation present at GYL - BIG BEND. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 108), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 24; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 84). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	4.2	(2.4, 5.9)	43	9.6	(2.9, 16.3)	13	2.6	(1.5, 3.7)	30
SAV	CEDE4	3	(1.2, 4.8)	15	13.2	(5.9, 20.5)	11	0.1	(0, 0.1)	4
SAV	CHARA	0.6	(0, 1.4)	5	2.7	(0, 5.9)	4	Trace	(0, 0.1)	1
SAV	FILAL.FL	0.6	(0.2, 1.1)	13	1.7	(0, 3.5)	5	0.3	(0.1, 0.6)	8
SAV	FILAL.WC	2	(0.3, 3.6)	10	7.5	(0.5, 14.4)	8	0.4	(0, 1)	2
SAV	FOAN2	1.6	(0.6, 2.6)	11	2.3	(0, 6.1)	1	1.4	(0.6, 2.2)	10
SAV	HIVU2	2	(0.7, 3.2)	20	3.7	(0, 8.5)	4	1.5	(0.6, 2.3)	16
SAV	LEMI3	0.8	(0.6, 1)	51	0.5	(0.1, 0.8)	7	0.9	(0.7, 1.1)	44
SAV	LETR	0.2	(0.1, 0.3)	16	0.5	(0, 0.9)	6	0.2	(0.1, 0.2)	10
SAV	MOSS	1.1	(0, 2.2)	8				1.4	(0, 2.8)	8
SAV	MYRIO	1	(0.2, 1.8)	7	4.1	(0.7, 7.5)	4	0.1	(0, 0.2)	3
SAV	MYSI	4.7	(2, 7.4)	11	21.1	(10.4, 31.8)	10	Trace	(0, 0.1)	1
SAV	MYVE3	1.3	(0, 2.8)	5	5.8	(0, 12.4)	4	Trace	(0, 0)	1
SAV	POFO3	1	(0, 2.2)	4	4.6	(0, 9.7)	4			
SAV	POGR8	0.5	(0.1, 0.9)	5				0.6	(0.1, 1.1)	5
SAV	POPU7	0.7	(0.1, 1.4)	6	3.2	(0.4, 6.1)	6			
SAV	PORI2	Trace	(0, 0.1)	1	0.2	(0, 0.6)	1			
SAV	RAAQ	Trace	(0, 0.1)	1				0.1	(0, 0.2)	1
SAV	RAFL	0.5	(0.1, 1)	11	0.1	(0, 0.2)	1	0.7	(0.1, 1.3)	10
SAV	RIFL4	0.4	(0.2, 0.7)	23	Trace	(0, 0.1)	1	0.6	(0.2, 0.9)	22
SAV	RINA	2.4	(1.3, 3.6)	60	2.5	(0, 6.3)	4	2.4	(1.5, 3.4)	56
SAV	STFIF	0.4	(0, 0.9)	7	1.8	(0, 3.8)	7			
SAV	STPE15	1.4	(0, 3)	9	5.2	(0, 11.8)	8	0.4	(0, 0.9)	1
SAV	UTMI	0.1	(0, 0.1)	3				0.1	(0, 0.2)	3
SAV	UTVU	0.5	(0.3, 0.8)	20	0.4	(0, 0.8)	3	0.6	(0.3, 0.9)	17
SAV	WOGL2	2.6	(1.1, 4.1)	15	9.3	(4.4, 14.2)	13	0.7	(0, 1.9)	2
E	ALTR7	Trace	(0, 0.1)	3				0.1	(0, 0.1)	3
E	CAUT	3.2	(1.2, 5.3)	11	0.4	(0, 1.1)	1	4	(1.4, 6.7)	10
E	ELAC	0.1	(0, 0.2)	6	Trace	(0, 0.1)	1	0.1	(0, 0.2)	5

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
E	ELPA3	4.4	(2.3, 6.5)	22	2.8	(0.1, 5.5)	4	4.9	(2.2, 7.5)	18
E	JUBA	4.6	(2.5, 6.8)	20				6	(3.2, 8.7)	20
E	JUNCUS	0.1	(0, 0.3)	2	Trace	(0, 0.1)	1	0.1	(0, 0.4)	1
E	MEAR4	2	(1, 3)	25				2.6	(1.3, 3.8)	25
E	PEAM	1	(0.4, 1.6)	16				1.3	(0.5, 2)	16
E	PHAR3	0.1	(0, 0.2)	2				0.1	(0, 0.2)	2
E	POAN5	0.6	(0, 1.1)	5				0.7	(0, 1.4)	5
E	RESID	1.4	(0, 2.9)	4	0.4	(0, 1.1)	1	1.7	(0, 3.6)	3
E	RESID.SE	5.3	(3.7, 7)	50	1.2	(0.1, 2.4)	5	6.5	(4.4, 8.5)	45
E	RESID.TE	20.5	(16.2, 24.8)	49	0.5	(0, 1.4)	1	26.2	(21.2, 31.3)	48
E	SACU	0.1	(0, 0.1)	4				0.1	(0, 0.1)	4
E	SAGIT	Trace	(0, 0)	1	Trace	(0, 0.1)	1			
E	SCAC3	0.1	(0, 0.3)	1				0.1	(0, 0.4)	1
E	SEHY	0.8	(0.5, 1.2)	18				1.1	(0.6, 1.6)	18
E	SISU2	0.1	(0, 0.2)	6				0.2	(0, 0.3)	6
E	SPAN2	Trace	(0, 0.1)	1	0.1	(0, 0.3)	1			
E	SPARG	0.1	(0, 0.3)	3				0.1	(0, 0.3)	3
E	SPEU	7.4	(4.9, 10)	37	2.8	(0.3, 5.2)	5	8.8	(5.6, 11.9)	32
E	TRMA20	1.8	(0.7, 2.8)	13	0.2	(0, 0.6)	1	2.2	(0.9, 3.6)	12
E	TYGL	0.8	(0.3, 1.4)	8	Trace	(0, 0.1)	1	1.1	(0.3, 1.8)	7
E	TYLA	8.2	(6, 10.4)	41	0.7	(0, 1.4)	3	10.4	(7.6, 13.1)	38
E	TYPHA	4.7	(2.6, 6.9)	16				6.1	(3.4, 8.8)	16
R	CHAN9	0.2	(0, 0.4)	1				0.2	(0, 0.6)	1
R	CIAR4	0.1	(0, 0.4)	2				0.2	(0, 0.5)	2
R	UNFOR	0.4	(0.2, 0.6)	20	Trace	(0, 0.1)	1	0.5	(0.2, 0.7)	19
R	UNGRA	0.5	(0.1, 0.9)	12	0.1	(0, 0.3)	1	0.6	(0.1, 1.1)	11

Table 50: Summary of water quality information for all ocular survey point locations at GYL - BIG BEND.

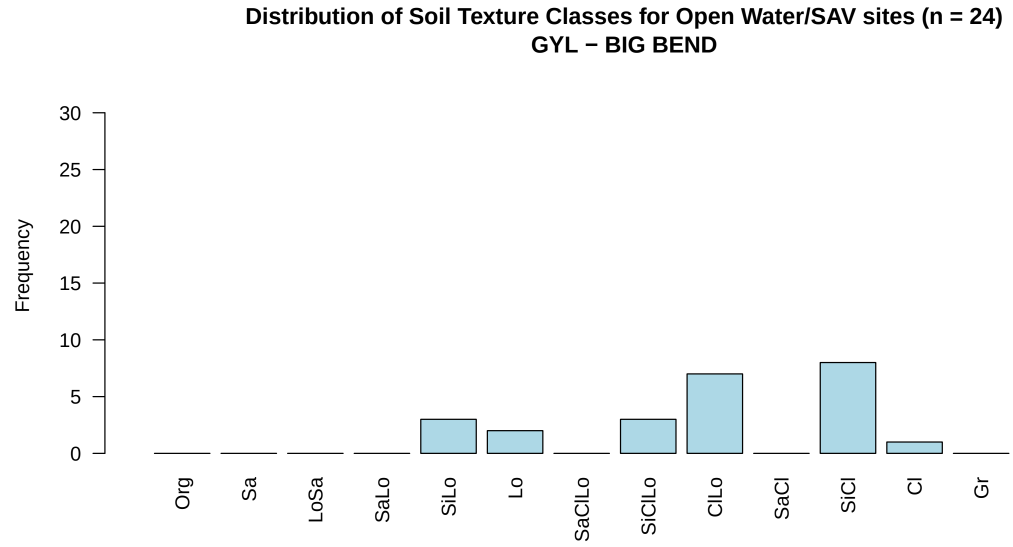
	n	Min	Mean	SE	Max
Water depth	108	0	19.7	1.85	77
Secchi Depth	108	0	19.7	1.85	77
pH level	81	6.8	7.6	0.07	9.7
Specific Conductivity	81	164.4	606.4	24.33	2043
Salinity	81	0.1	0.3	0.01	1
Temperature	81	11.9	16.1	0.26	21.6

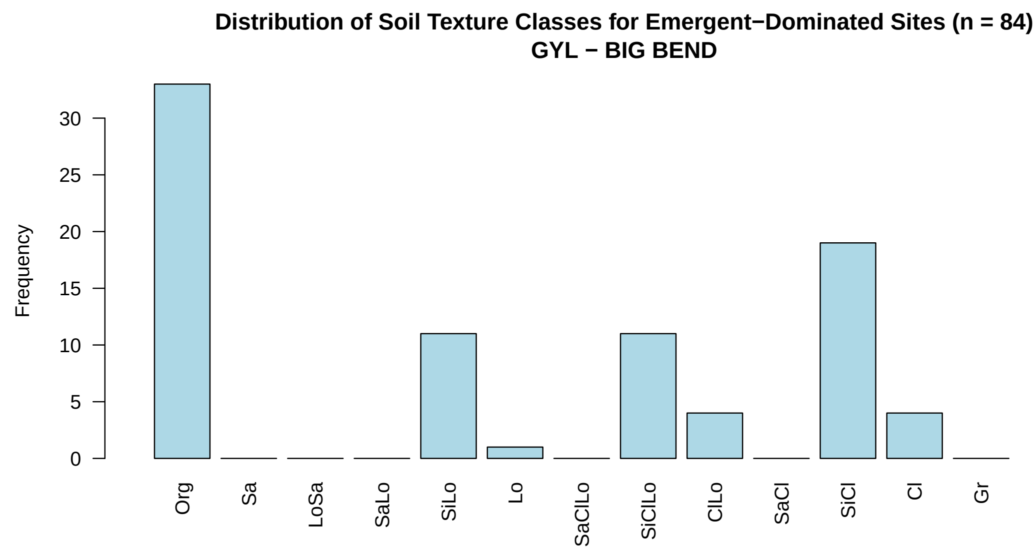
Table 51: Summary of water quality information for ocular survey, SAV point locations at GYL - BIG BEND.

	n	Min	Mean	SE	Max
Water depth	24	0	47.21	3.51	77
Secchi Depth	24	0	47.21	3.51	77
pH level	23	7.2	8.24	0.15	9.7
Specific Conductivity	23	392.4	488.47	18.23	788
Salinity	23	0.2	0.24	0.01	0.4
Temperature	23	12.3	17.55	0.46	21.3

Table 52: Summary of water quality information for ocular survey, Non-SAV point locations at GYL - BIG BEND.

	n	Min	Mean	SE	Max
Water depth	84	0	11.89	1.17	55
Secchi Depth	84	0	11.89	1.17	55
pH level	58	6.8	7.4	0.04	9
Specific Conductivity	58	164.4	653.23	31.21	2043
Salinity	58	0.1	0.33	0.02	1
Temperature	58	11.9	15.59	0.28	22


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 24)
GYL − BIG BEND
Frequency
0
5
10
15
20
25
30
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 84)
GYL − BIG BEND
Frequency
0
5
10
15
20
25
30
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr

2.2.13 GYL - Lakefront

Table 53: Design-based estimate of mean percent canopy coverage for vegetation present at GYL - LAKEFRONT. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 89), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 12; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 77). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	1.1	(0.5, 1.7)	19	3.6	(0.9, 6.2)	7	0.7	(0.2, 1.3)	12
SAV	CHARA	5.2	(1.6, 8.7)	10	37.6	(16, 59.1)	8	0.1	(0, 0.2)	2
SAV	FILAL.FL	0.2	(0, 0.6)	2				0.3	(0, 0.7)	2
SAV	FILAL.WC	2.4	(0, 5.6)	9	15.2	(0, 38.8)	4	0.4	(0, 0.8)	5
SAV	FOAN2	0.3	(0, 0.6)	2				0.3	(0, 0.7)	2
SAV	HIVU2	3.9	(1.4, 6.3)	9	28.5	(15.1, 41.9)	8	Trace	(0, 0.1)	1
SAV	LEMI3	0.4	(0.3, 0.5)	26	0.3	(0.1, 0.6)	4	0.4	(0.2, 0.5)	22
SAV	MOSS	0.3	(0.1, 0.5)	6				0.3	(0.1, 0.5)	6
SAV	MYRIO	1	(0, 2.2)	2	7.6	(0, 16.3)	2			
SAV	MYSI	0.1	(0, 0.3)	3	0.8	(0, 1.8)	2	Trace	(0, 0)	1
SAV	MYVE3	1.8	(0, 3.6)	5	13.4	(0.7, 26.2)	5			
SAV	POFO3	Trace	(0, 0)	1	0.1	(0, 0.2)	1			
SAV	POFR3	Trace	(0, 0.1)	1	0.2	(0, 0.4)	1			
SAV	POPU7	Trace	(0, 0)	1	0.1	(0, 0.2)	1			
SAV	RAAQ	0.1	(0, 0.2)	2	0.5	(0, 1.2)	2			
SAV	RAFL	0.2	(0, 0.6)	1				0.3	(0, 0.7)	1
SAV	RINA	0.1	(0, 0.1)	4	0.2	(0, 0.4)	2	0.1	(0, 0.1)	2
SAV	STFIF	0.2	(0, 0.5)	4	1.8	(0, 3.8)	4			
SAV	STPE15	0.1	(0, 0.2)	3	0.7	(0, 1.4)	3			
SAV	UTMI	Trace	(0, 0)	1	0.1	(0, 0.2)	1			
SAV	UTVU	0.9	(0.2, 1.6)	10	3.8	(0.1, 7.4)	5	0.5	(0, 1)	5
E	CAUT	5.8	(2.6, 9)	14				6.7	(3, 10.3)	14
E	JUBA	0.3	(0, 0.7)	3				0.4	(0, 0.8)	3
E	MEAR4	0.3	(0, 0.7)	4				0.4	(0, 0.8)	4
E	PEAM	0.6	(0, 1.3)	5				0.7	(0, 1.5)	5
E	RESID	29.6	(22.7, 36.5)	34				34.2	(26.6, 41.8)	34
E	RESID.SE	1.1	(0.1, 2.1)	8				1.3	(0.1, 2.4)	8
E	RESID.TE	34	(27.1, 40.8)	42	0.8	(0, 2)	1	39.2	(31.7, 46.6)	41
E	SCAC3	9.3	(7.7, 10.8)	71	0.1	(0, 0.2)	1	10.7	(9.1, 12.3)	70

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
E	SEHY	0.1	(0, 0.2)	3				0.1	(0, 0.2)	3
E	SISU2	Trace	(0, 0)	1				Trace	(0, 0)	1
E	SPARG	Trace	(0, 0.1)	2				0.1	(0, 0.1)	2
E	SPEU	0.4	(0.1, 0.8)	5				0.5	(0.1, 0.9)	5
E	TRMA20	Trace	(0, 0)	1				Trace	(0, 0)	1
E	TYAN	0.1	(0, 0.2)	2				0.1	(0, 0.2)	2
E	TYGL	0.4	(0, 0.7)	5				0.4	(0.1, 0.8)	5
E	TYLA	1.2	(0.6, 1.7)	19				1.3	(0.7, 2)	19
E	TYPHA	1.1	(0.5, 1.7)	24				1.3	(0.6, 2)	24
R	UNFOR	0.1	(0, 0.2)	7				0.1	(0, 0.2)	7
R	UNGRA	Trace	(0, 0)	1	0.1	(0, 0.2)	1			

Table 54: Summary of water quality information for all ocular survey point locations at GYL - LAKEFRONT.

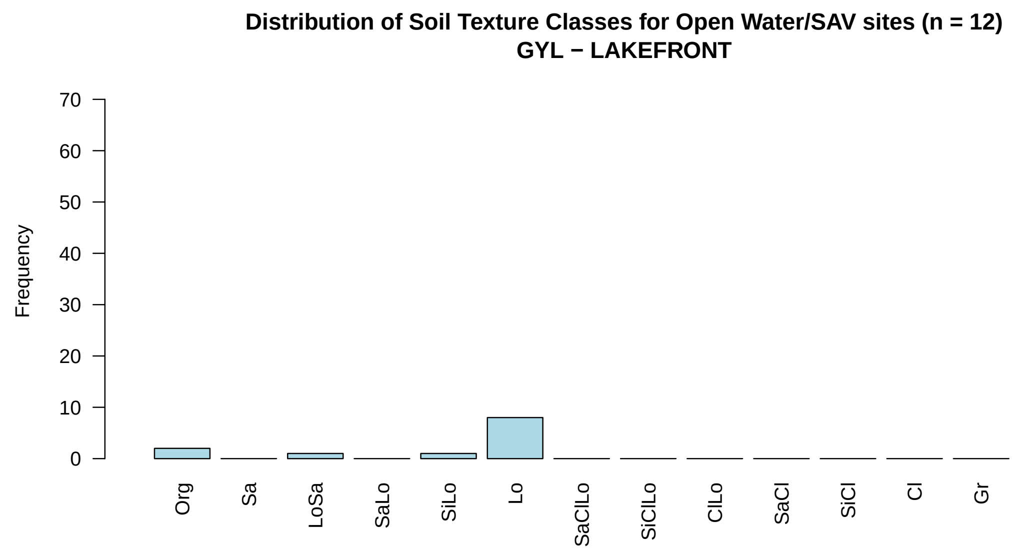
	n	Min	Mean	SE	Max
Water depth	89	0	14.57	1.15	41
Secchi Depth	89	0	14.57	1.15	41
pH level	71	6.8	7.33	0.05	8.8
Specific Conductivity	71	166.7	371.92	8.91	548
Salinity	71	0.1	0.19	0	0.3
Temperature	71	10.7	16.46	0.36	25.4

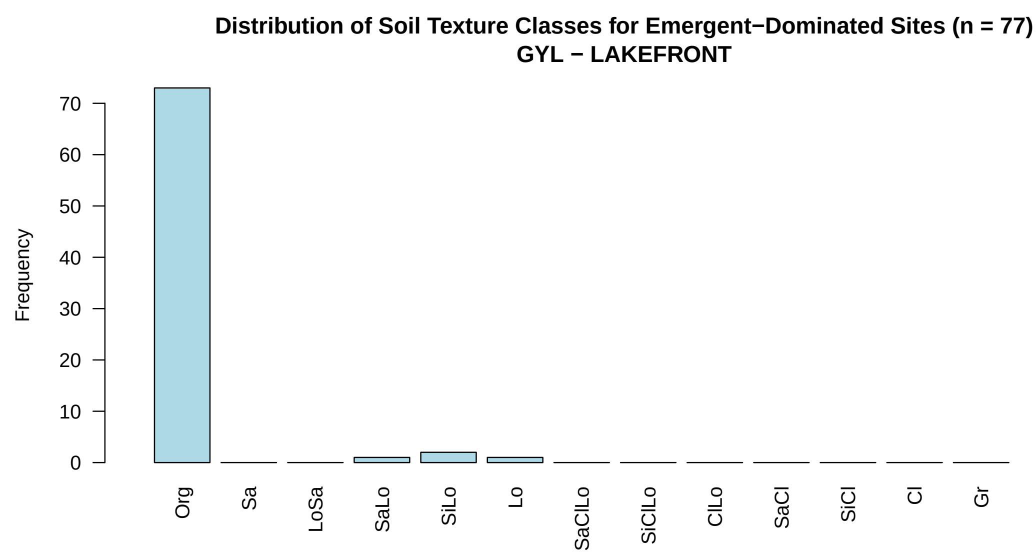
Table 55: Summary of water quality information for ocular survey, SAV point locations at GYL - LAKEFRONT.

	n	Min	Mean	SE	Max
Water depth	12	24	33.2	1.61	41
Secchi Depth	12	24	33.2	1.61	41
pH level	12	7	8	0.17	8.8
Specific Conductivity	12	341	386.2	11.14	478
Salinity	12	0.2	0.2	0	0.2
Temperature	12	12.4	19.8	1.19	25.4

Table 56: Summary of water quality information for ocular survey, Non-SAV point locations at GYL - LAKEFRONT.

	n	Min	Mean	SE	Max
Water depth	77	0	11.66	0.95	33
Secchi Depth	77	0	11.66	0.95	33
pH level	59	6.8	7.2	0.03	7.8
Specific Conductivity	59	166.7	369.01	10.47	548
Salinity	59	0.1	0.19	0.01	0.3
Temperature	59	10.7	15.78	0.29	20.6





2.2.14 GYL - Outlet East

Table 57: Design-based estimate of mean percent canopy coverage for vegetation present at GYL - OUTLET EAST. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 80), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 52; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 28). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	26.8	(20.9, 32.7)	52	39.9	(32.5, 47.4)	37	2.4	(1.3, 3.4)	15
SAV	CEDE4	0.5	(0.1, 0.9)	8	0.5	(0.1, 0.8)	7	0.5	(0, 1.4)	1
SAV	CHARA	2.4	(0.3, 4.4)	8	3.6	(0.4, 6.7)	6	0.1	(0, 0.3)	2
SAV	FILAL.FL	1.6	(0.4, 2.8)	16	2.5	(0.7, 4.3)	15	0.1	(0, 0.3)	1
SAV	FILAL.WC	3.2	(1.1, 5.2)	17	4.9	(1.7, 8)	17			
SAV	HIVU2	0.3	(0, 0.6)	3	0.4	(0, 0.9)	3			
SAV	LEMI3	0.7	(0.4, 1)	30	0.3	(0.1, 0.4)	11	1.4	(0.6, 2.2)	19
SAV	LETR	0.2	(0.1, 0.3)	13	0.2	(0.1, 0.4)	9	0.2	(0, 0.4)	4
SAV	MOSS	Trace	(0, 0.1)	1				0.1	(0, 0.2)	1
SAV	MYRIO	12.4	(6.3, 18.6)	17	18.7	(9.6, 27.8)	15	0.9	(0, 2.2)	2
SAV	MYSI	1.2	(0, 2.6)	5	1.8	(0, 3.9)	4	0.2	(0, 0.5)	1
SAV	MYVE3	0.4	(0, 0.8)	4	0.6	(0, 1.2)	4			
SAV	NUPO.FL	27.9	(21.1, 34.8)	32	43	(34.2, 51.8)	32			
SAV	NUPO.SU	10.4	(7.6, 13.2)	34	16	(12.3, 19.8)	34			
SAV	PONA4	Trace	(0, 0.1)	1	Trace	(0, 0.1)	1			
SAV	POTAM	Trace	(0, 0.1)	1	Trace	(0, 0.1)	1			
SAV	RAFL	Trace	(0, 0.1)	2				0.1	(0, 0.2)	2
SAV	RESID.SU	2.9	(0.5, 5.3)	6	4.5	(0.8, 8.2)	6			
SAV	RIFL4	0.2	(0.1, 0.3)	12	0.1	(0.1, 0.2)	7	0.4	(0.1, 0.7)	5
SAV	RINA	0.3	(0.2, 0.4)	14	0.1	(0, 0.1)	3	0.8	(0.4, 1.1)	11
SAV	STFIF	0.3	(0, 0.7)	2	0.4	(0, 1.1)	2			
SAV	STPE15	0.1	(0, 0.2)	1	0.1	(0, 0.4)	1			
SAV	UTMI	Trace	(0, 0)	1	Trace	(0, 0.1)	1			
SAV	UTVU	5.7	(3.5, 7.9)	51	6.6	(3.6, 9.6)	38	4.1	(1.2, 7.1)	13
E	CARO6	1.1	(0, 2.7)	3				3.2	(0, 7.7)	3
E	CAUT	11.9	(5.9, 17.9)	13				33.9	(18.9, 48.9)	13
E	ELPA3	1.5	(0, 3.4)	6				4.2	(0, 9.6)	6
E	JUBA	0.1	(0, 0.3)	1				0.4	(0, 0.9)	1
E	MEAR4	Trace	(0, 0.1)	1				0.1	(0, 0.4)	1

Growth Form	Species Code	All Sites Mean	All Sites 90% CI	All Sites n	Open Water Sites Mean	Open Water Sites 90% CI	Open Water Sites n	Emergent Sites Mean	Emergent Sites 90% CI	Emergent Sites n
E	PEAM	0.1	(0, 0.3)	2				0.3	(0, 0.8)	2
E	RESID	15.5	(10, 20.9)	40	11.8	(7.1, 16.6)	29	22.2	(9.4, 34.9)	11
E	RESID.SE	1.9	(0.8, 3)	10	0.5	(0, 1.4)	1	4.5	(2, 6.9)	9
E	RESID.TE	6.7	(2.6, 10.8)	10	0.2	(0, 0.6)	2	18.7	(7.7, 29.6)	8
E	SCAC3	4.8	(2.7, 6.9)	17	0.3	(0, 0.7)	3	13.1	(8, 18.2)	14
E	SCTA2	0.1	(0, 0.2)	3	0.1	(0, 0.2)	1	0.1	(0, 0.2)	2
E	SEHY	Trace	(0, 0.1)	1				0.1	(0, 0.2)	1
E	SISU2	Trace	(0, 0)	1				Trace	(0, 0.1)	1
E	SPEU	1.4	(0.2, 2.5)	8				3.9	(0.8, 7)	8
E	TYLA	Trace	(0, 0)	1				Trace	(0, 0.1)	1
E	TYPHA	0.5	(0, 1)	6				1.4	(0, 2.9)	6
R	UNFOR	Trace	(0, 0.1)	2				0.1	(0, 0.2)	2
R	UNGRA	0.1	(0, 0.1)	2				0.2	(0, 0.4)	2

Table 58: Summary of water quality information for all ocular survey point locations at GYL - OUTLET EAST.

	n	Min	Mean	SE	Max
Water depth	80	0	36.9	2.1	74
Secchi Depth	80	0	36.9	2.1	74
pH level	76	6.8	7.41	0.02	8
Specific Conductivity	76	347.1	523.55	6.74	617
Salinity	76	0.2	0.27	0.01	0.3
Temperature	76	8.4	14.54	0.24	19.9

Table 59: Summary of water quality information for ocular survey, SAV point locations at GYL - OUTLET EAST.

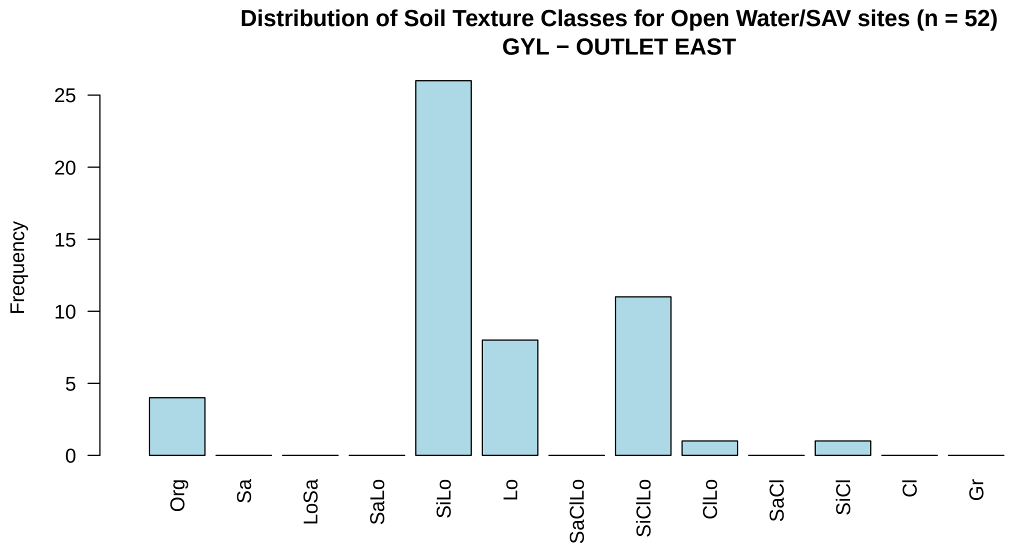
	n	Min	Mean	SE	Max
Water depth	52	29	48.65	1.44	74
Secchi Depth	52	29	48.65	1.44	74
pH level	52	7	7.43	0.03	8
Specific Conductivity	52	347.1	519.28	8.28	602
Salinity	52	0.2	0.27	0.01	0.3
Temperature	52	11.9	15.4	0.21	19.9

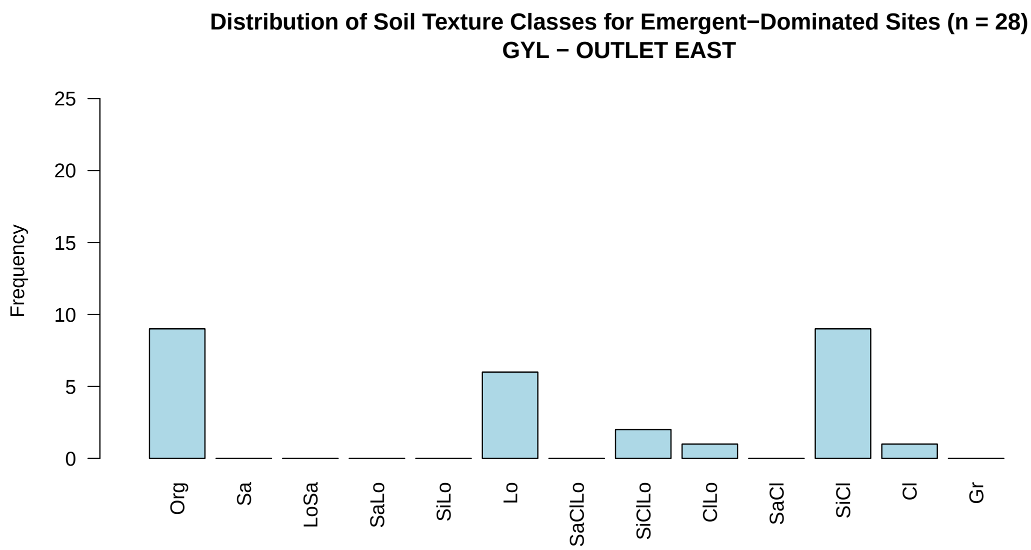
Table 60: Summary of water quality information for ocular survey, Non-SAV point locations at GYL - OUTLET EAST.

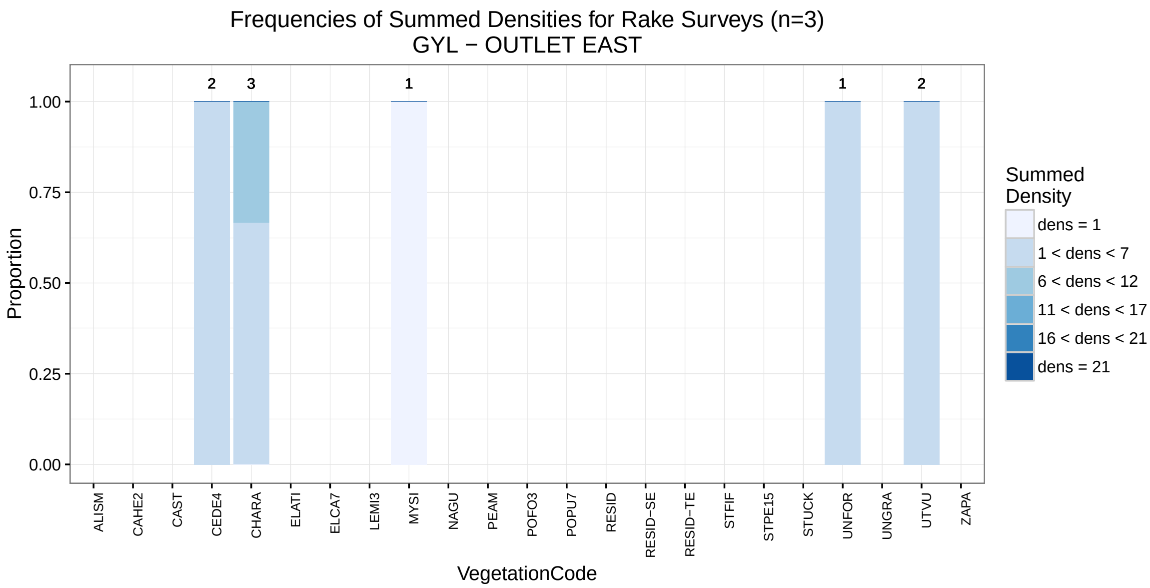
	n	Min	Mean	SE	Max
Water depth	28	0	15.07	1.59	34
Secchi Depth	28	0	15.07	1.59	34
pH level	24	6.8	7.35	0.04	7.7
Specific Conductivity	24	398.5	532.8	11.62	617
Salinity	24	0.2	0.28	0.01	0.3
Temperature	24	8.4	12.68	0.43	16.2

Table 61: Summary of water quality information for rake survey point locations at GYL - OUTLET EAST.

	n	Min	Mean	SE	Max
Water depth	3	64	71.33	5.46	82
Secchi Depth	3	60	64	2.31	68
pH level	3	7.2	7.46	0.12	7.6
Specific Conductivity	3	421.2	504.4	42.27	559
Salinity	3	0.2	0.27	0.03	0.3
Temperature	3	15.3	16.57	0.64	17.4


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 52)
GYL − OUTLET EAST
Frequency
0
5
10
15
20
25
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 28)
GYL − OUTLET EAST
Frequency
0
5
10
15
20
25
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Frequencies of Summed Densities for Rake Surveys (n=3)
GYL − OUTLET EAST
Proportion
1.00
0.75
0.50
0.25
0.00
2
3
1
1
2
ALISM
CAHE2
CAST
CEDE4
CHARA
ELATI
ELCA7
LEMI3
MYSI
NAGU
PEAM
POFO3
POPU7
RESID
RESID−SE
RESID−TE
STFIF
STPE15
STUCK
UNFOR
UNGRA
UTVU
ZAPA
VegetationCode
Summed Density
dens = 1
1 < dens < 7
6 < dens < 12
11 < dens < 17
16 < dens < 21
dens = 21

2.2.15 BRL - Bloomington

Table 62: Design-based estimate of mean percent canopy coverage for vegetation present at BRL - BLOOMINGTON. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 118), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 9; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 109). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	5.3	(3, 7.7)	35	35.9	(14.4, 57.4)	7	2.8	(1.6, 4.1)	28
SAV	CHARA	1.1	(0, 2.5)	6	14.3	(0, 32.1)	4	Trace	(0, 0.1)	2
SAV	FILAL.FL	0.7	(0.2, 1.1)	12	0.3	(0, 0.9)	1	0.7	(0.2, 1.1)	11
SAV	FILAL.WC	1.9	(0.5, 3.4)	19	16.1	(0, 33.8)	2	0.8	(0.3, 1.3)	17
SAV	HIVU2	Trace	(0, 0.1)	1				Trace	(0, 0.1)	1
SAV	LEMI3	0.4	(0, 0.8)	18	0.1	(0, 0.3)	1	0.4	(0, 0.8)	17
SAV	LETR	Trace	(0, 0)	1				Trace	(0, 0)	1
SAV	MOSS	0.3	(0, 0.6)	7				0.3	(0, 0.6)	7
SAV	MYSI	0.6	(0, 1.5)	4	7.6	(0, 19.8)	2	Trace	(0, 0.1)	2
SAV	POFO3	Trace	(0, 0.1)	3	0.4	(0, 0.8)	3			
SAV	POFR3	Trace	(0, 0)	1				Trace	(0, 0)	1
SAV	PONA4	0.1	(0, 0.2)	1				0.1	(0, 0.2)	1
SAV	RESID.SU	0.8	(0, 2.2)	1				0.9	(0, 2.4)	1
SAV	RIFL4	1.6	(0, 3.5)	2	21	(0, 43.9)	2			
SAV	STFIF	0.7	(0, 1.7)	5	8.9	(0, 22.3)	3	Trace	(0, 0)	2
SAV	UTVU	1.3	(0.9, 1.7)	51	1.6	(0, 3.9)	2	1.3	(0.9, 1.7)	49
SAV	ZAPA	Trace	(0, 0.1)	2	0.6	(0, 1.3)	2			
E	CAREX	Trace	(0, 0)	1				Trace	(0, 0)	1
E	JUBA	1.7	(0.2, 3.2)	5	0.2	(0, 0.6)	1	1.8	(0.2, 3.5)	4
E	MEAR4	0.1	(0, 0.2)	1	1.1	(0, 2.9)	1			
E	PEAM	0.5	(0, 1.1)	4	0.7	(0, 1.8)	1	0.5	(0, 1.1)	3
E	RESID	13.8	(8.9, 18.7)	19				14.9	(9.7, 20.2)	19
E	RESID.SE	0.6	(0.1, 1)	5				0.6	(0.1, 1.1)	5
E	RESID.TE	59.6	(54, 65.7)	90	4.2	(0, 8.4)	3	64.2	(58.2, 70.2)	87
E	SACU	Trace	(0, 0)	1				Trace	(0, 0)	1
E	SAGIT	Trace	(0, 0.1)	2	0.4	(0, 1.2)	1	Trace	(0, 0)	1
E	SCAC3	7.1	(5.2, 9.1)	90	0.7	(0.2, 1.1)	4	7.7	(5.6, 9.8)	86
E	SCTA2	2.8	(2.1, 3.6)	75	0.6	(0.1, 1)	3	3	(2.2, 3.8)	72
E	SISU2	Trace	(0, 0)	1	0.1	(0, 0.3)	1			

Growth Form	Species Code	All Sites Mean	90% CI	n	Open Water Sites Mean	90% CI	n	Emergent Sites Mean	90% CI	n
E	TYAN	0.1	(0, 0.1)	1				0.1	(0, 0.1)	1
E	VERON	Trace	(0, 0.1)	2	0.2	(0, 0.6)	1	Trace	(0, 0)	1
R	AGST2	Trace	(0, 0)	1				Trace	(0, 0)	1
R	ASTER	Trace	(0, 0)	1				Trace	(0, 0)	1
R	CHENO	Trace	(0, 0.1)	1	0.6	(0, 1.5)	1			
R	CIAR4	Trace	(0, 0)	1	0.2	(0, 0.6)	1			
R	HOJU	0.1	(0, 0.3)	3				0.1	(0, 0.3)	3
R	UNFOR	0.1	(0, 0.1)	6	0.3	(0, 0.7)	2	Trace	(0, 0.1)	4
R	UNGRA	0.2	(0.1, 0.2)	10	0.3	(0, 0.9)	1	0.1	(0, 0.2)	9

Table 63: Summary of water quality information for all ocular survey point locations at BRL - BLOOMINGTON.

	n	Min	Mean	SE	Max
Water depth	118	0	22.18	1.2	78
Secchi Depth	118	0	22.18	1.2	78
pH level	115	7.1	7.89	0.03	8.9
Specific Conductivity	115	5.8	1329.66	59.4	3244
Salinity	115	0	0.75	0.08	9
Temperature	115	12.2	22.87	0.41	31.2

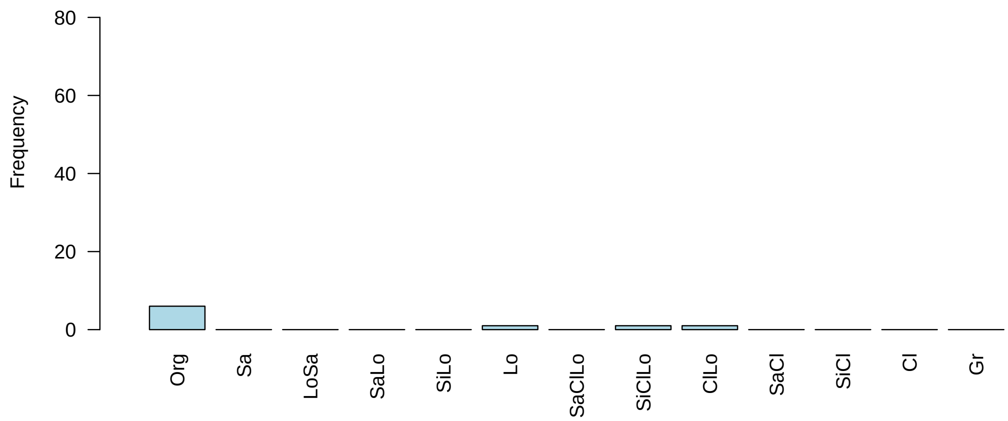
Table 64: Summary of water quality information for ocular survey, SAV point locations at BRL - BLOOMINGTON.

	n	Min	Mean	SE	Max
Water depth	9	0	37.3	8.4	78
Secchi Depth	9	0	37.3	8.4	78
pH level	8	7.2	7.8	0.16	8.4
Specific Conductivity	8	5.8	941.9	234.56	1841
Salinity	8	0.1	1.5	1.07	9
Temperature	8	19.5	23	1.33	30.7

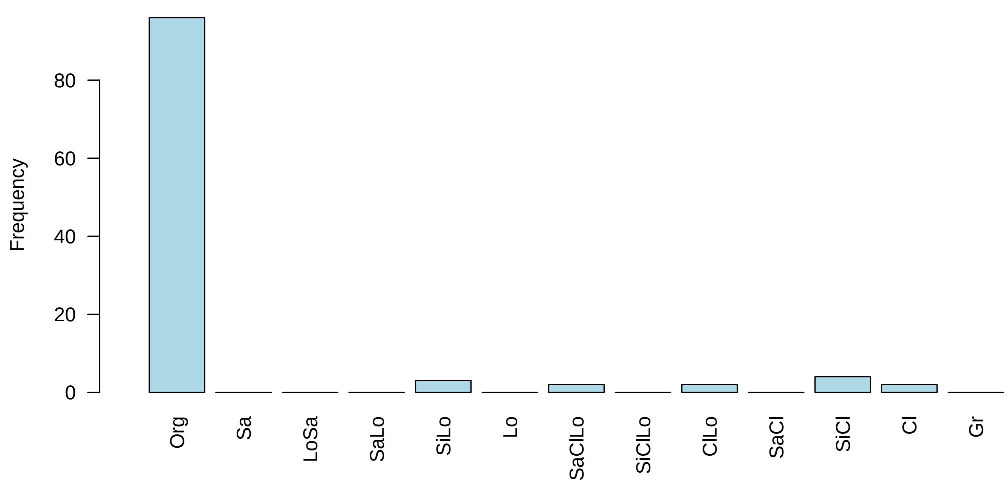
Table 65: Summary of water quality information for ocular survey, Non-SAV point locations at BRL - BLOOMINGTON.

	n	Min	Mean	SE	Max
Water depth	109	0	20.93	1.04	60
Secchi Depth	109	0	20.93	1.04	60
pH level	107	7.1	7.9	0.03	8.9
Specific Conductivity	107	11.6	1358.65	60.76	3244
Salinity	107	0	0.69	0.03	1.7
Temperature	107	12.2	22.86	0.43	31.2

Distribution of Soil Texture Classes for Open Water/SAV sites (n = 9)
BRL − BLOOMINGTON



Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 109)
BRL − BLOOMINGTON



2.2.16 BRL - Bunn Lake

Table 66: Design-based estimate of mean percent canopy coverage for vegetation present at BRL - BUNN LAKE. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 119), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 32; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 87). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	11.1	(7.6, 14.6)	64	33	(22.6, 43.4)	27	3	(1.8, 4.2)	37
SAV	CAHE2	Trace	(0, 0)	1				Trace	(0, 0.1)	1
SAV	CHARA	9	(5.2, 12.9)	21	33.1	(21.3, 44.9)	20	0.2	(0, 0.5)	1
SAV	FILAL.FL	2.1	(0.3, 3.9)	14	5.8	(0, 12.1)	6	0.8	(0, 1.5)	8
SAV	FILAL.WC	5.8	(3, 8.6)	24	16.4	(7.9, 24.9)	15	1.9	(0.1, 3.7)	9
SAV	HIVU2	0.8	(0, 2)	4	2.9	(0, 7.3)	3	Trace	(0, 0.1)	1
SAV	LEMI3	0.8	(0.1, 1.4)	26	0.3	(0, 0.7)	6	0.9	(0, 1.8)	20
SAV	MOSS	0.5	(0.1, 0.9)	9				0.6	(0.1, 1.2)	9
SAV	MYSI	6.3	(3, 9.7)	17	23.6	(12.4, 34.7)	16	Trace	(0, 0)	1
SAV	POTAM	Trace	(0, 0.1)	2	0.1	(0, 0.3)	2			
SAV	RAFL	Trace	(0, 0)	1				Trace	(0, 0)	1
SAV	RIFL4	Trace	(0, 0)	1				Trace	(0, 0)	1
SAV	STFIF	0.1	(0, 0.1)	5	0.2	(0.1, 0.4)	5			
SAV	STUCK	Trace	(0, 0)	1	Trace	(0, 0.1)	1			
SAV	UTVU	2.8	(1, 4.6)	25	2.6	(0.4, 4.8)	10	2.9	(0.6, 5.2)	15
SAV	ZAPA	0.2	(0, 0.5)	5	0.9	(0, 2)	5			
E	BOMA7	0.1	(0, 0.3)	1	0.5	(0, 1.2)	1			
E	CAREX	0.1	(0, 0.1)	2				0.1	(0, 0.2)	2
E	ELAC	Trace	(0, 0)	1				Trace	(0, 0)	1
E	ELEOC	0.3	(0, 0.7)	1				0.3	(0, 0.9)	1
E	JUBA	0.6	(0, 1.5)	2				0.8	(0, 2)	2
E	MEAR4	Trace	(0, 0)	1				Trace	(0, 0.1)	1
E	PEAM	0.3	(0.1, 0.6)	13				0.5	(0.1, 0.9)	13
E	PHAR3	0.1	(0, 0.2)	1				0.1	(0, 0.3)	1
E	POAN5	0.2	(0, 0.5)	3				0.3	(0, 0.6)	3
E	RESID	32	(25.3, 38.6)	45	0.2	(0, 0.4)	1	43.7	(35.5, 51.8)	44
E	RESID.SE	0.3	(0, 0.7)	2	0.9	(0, 2.5)	1	Trace	(0, 0.1)	1
E	RESID.TE	29	(22.6, 35.4)	42	0.4	(0, 1)	2	39.5	(31.5, 47.5)	40
E	SCAC3	4	(2.8, 5.1)	66	1.2	(0, 3)	3	5	(3.6, 6.4)	63

Growth Form	Species Code	All Sites			Open Water Sites			Emergent Sites		
		Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
E	SCTA2	0.1	(0, 0.3)	6				0.2	(0, 0.4)	6
E	TRMA20	Trace	(0, 0)	1				Trace	(0, 0)	1
E	TYGL	Trace	(0, 0)	1				Trace	(0, 0.1)	1
E	TYLA	0.1	(0, 0.3)	3				0.1	(0, 0.3)	3
E	VERON	Trace	(0, 0.1)	1				Trace	(0, 0.1)	1
R	ALPR3	0.1	(0, 0.1)	2				0.1	(0, 0.2)	2
R	ASTER	0.2	(0, 0.6)	1				0.3	(0, 0.8)	1
R	CIAR4	Trace	(0, 0)	1				Trace	(0, 0)	1
R	HOJU	0.1	(0, 0.3)	1				0.1	(0, 0.4)	1
R	UNFOR	0.1	(0, 0.1)	9	Trace	(0, 0.1)	1	0.1	(0, 0.2)	8
R	UNGRA	0.1	(0, 0.1)	3				0.1	(0, 0.2)	3

Table 67: Summary of water quality information for all ocular survey point locations at BRL - BUNN LAKE.

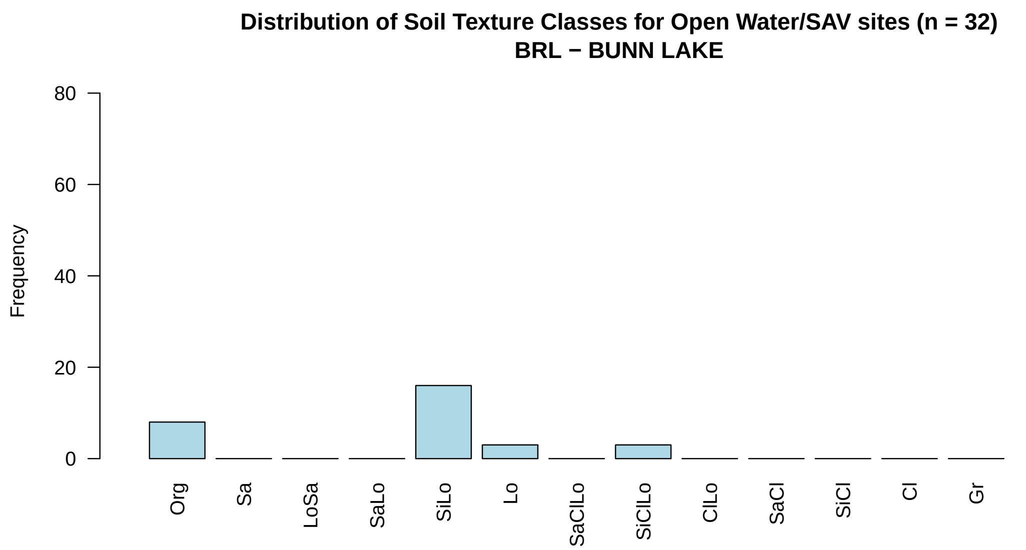
	n	Min	Mean	SE	Max
Water depth	119	0	29.22	2.03	83
Secchi Depth	119	0	29.22	2.03	83
pH level	112	7.1	8.04	0.08	10.3
Specific Conductivity	112	278.2	848.57	16.22	1458
Salinity	112	0.1	0.46	0.05	5.4
Temperature	112	10.6	18.42	0.4	30.8

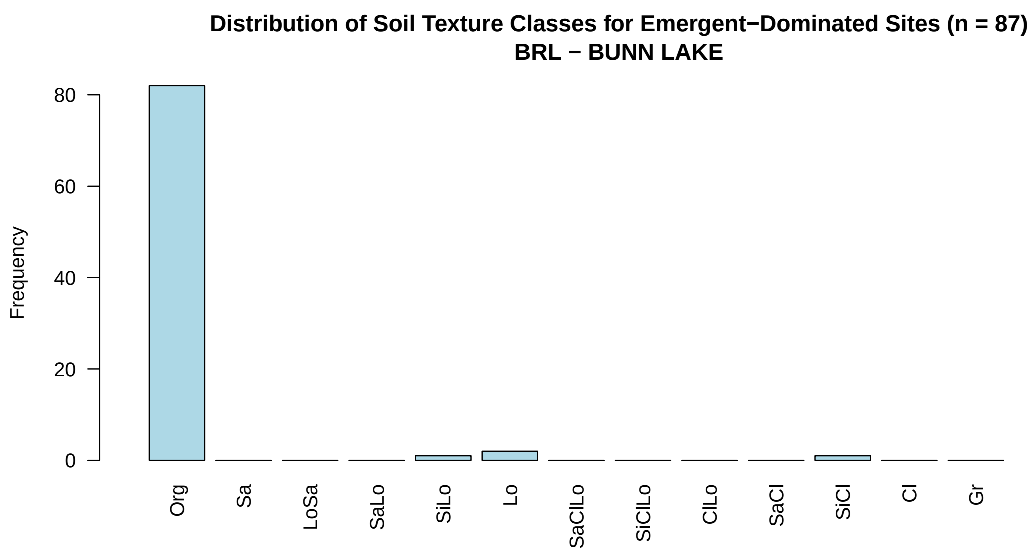
Table 68: Summary of water quality information for ocular survey, SAV point locations at BRL - BUNN LAKE.

	n	Min	Mean	SE	Max
Water depth	32	6	57.34	3.53	83
Secchi Depth	32	6	57.34	3.53	83
pH level	32	7.1	8.96	0.17	10.3
Specific Conductivity	32	415.8	754.77	22.77	1013
Salinity	32	0.2	0.53	0.16	5.4
Temperature	32	17.3	21.52	0.38	27.3

Table 69: Summary of water quality information for ocular survey, Non-SAV point locations at BRL - BUNN LAKE.

	n	Min	Mean	SE	Max
Water depth	87	0	18.87	1.21	68
Secchi Depth	87	0	18.87	1.21	68
pH level	80	7.1	7.67	0.04	9.1
Specific Conductivity	80	278.2	886.09	19.34	1458
Salinity	80	0.1	0.44	0.01	0.7
Temperature	80	10.6	17.17	0.47	30.8





2.2.17 BRL - Rainbow

Table 70: Design-based estimate of mean percent canopy coverage for vegetation present at BRL - RAINBOW. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 116), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 31; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 85). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	11.1	(7.5, 14.7)	60	29.2	(18, 40.5)	22	4.5	(3, 6.1)	38
SAV	CEDE4	1.2	(0, 2.4)	4	4.4	(0, 8.8)	4			
SAV	CHARA	9.2	(5.1, 13.2)	20	34.4	(21.8, 46.9)	20			
SAV	FILAL.FL	3.2	(1.5, 4.8)	33	7	(1.4, 12.6)	11	1.7	(0.8, 2.7)	22
SAV	FILAL.WC	3.4	(1.5, 5.3)	26	9.9	(3.6, 16.2)	15	1	(0.2, 1.9)	11
SAV	FOAN2	Trace	(0, 0.1)	2				Trace	(0, 0.1)	2
SAV	LEMI3	0.6	(0.4, 0.9)	39	0.5	(0, 0.9)	6	0.7	(0.4, 1)	33
SAV	LETR	0.1	(0, 0.1)	6	0.1	(0, 0.1)	2	0.1	(0, 0.1)	4
SAV	MOSS	0.1	(0, 0.1)	3				0.1	(0, 0.2)	3
SAV	MYRIO	0.1	(0, 0.1)	1	0.2	(0, 0.5)	1			
SAV	MYSI	0.8	(0, 1.9)	6	2.8	(0, 7.2)	5	Trace	(0, 0)	1
SAV	POFO3	0.2	(0, 0.3)	3	0.6	(0, 1.3)	3			
SAV	POPU7	Trace	(0, 0.1)	1	0.2	(0, 0.4)	1			
SAV	RIFL4	Trace	(0, 0)	3				Trace	(0, 0.1)	3
SAV	RINA	Trace	(0, 0)	3	Trace	(0, 0.1)	1	Trace	(0, 0.1)	2
SAV	STFIF	2.6	(0.5, 4.7)	12	9.6	(2.2, 17.1)	11	Trace	(0, 0)	1
SAV	STPE15	2.8	(0.6, 4.9)	6	10.3	(2.7, 18)	6			
SAV	STUCK	Trace	(0, 0.1)	1	0.2	(0, 0.4)	1			
SAV	UTVU	2	(0.9, 3.1)	27	3.5	(0.9, 6.2)	9	1.4	(0.3, 2.6)	18
SAV	ZAPA	0.3	(0, 0.6)	2	1	(0, 2.1)	2			
E	BOMA7	Trace	(0, 0)	1				Trace	(0, 0.1)	1
E	CAUT	Trace	(0, 0)	1				Trace	(0, 0.1)	1
E	JUBA	0.4	(0, 0.7)	4				0.5	(0, 1)	4
E	MEAR4	0.1	(0, 0.1)	1				0.1	(0, 0.2)	1
E	PEAM	Trace	(0, 0.1)	1				Trace	(0, 0.1)	1
E	RESID	12	(7.8, 16.1)	21	0.1	(0, 0.2)	1	16.3	(10.8, 21.8)	20
E	RESID.TE	42	(35.9, 48.2)	69	0.7	(0, 1.6)	4	57.1	(50.5, 63.7)	65
E	SAGIT	0.7	(0, 1.8)	1				0.9	(0, 2.5)	1
E	SCAC3	12.5	(10.4, 14.6)	84	1.2	(0, 2.8)	4	16.6	(14.2, 19.1)	80

Growth Form	Species Code	All Sites			Open Water Sites			Emergent Sites		
		Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
E	SCTA2	0.2	(0, 0.3)	8	0.1	(0, 0.1)	2	0.2	(0, 0.4)	6
E	TYAN	0.3	(0, 0.7)	3				0.4	(0, 0.9)	3
E	TYGL	0.1	(0, 0.3)	2	0.2	(0, 0.4)	1	0.1	(0, 0.3)	1
E	TYLA	0.6	(0, 1.1)	5	0.8	(0, 2.1)	1	0.5	(0, 1.1)	4
E	TYPHA	0.1	(0, 0.1)	8	Trace	(0, 0.1)	1	0.1	(0, 0.1)	7
E	VERON	Trace	(0, 0)	1				Trace	(0, 0)	1
R	CHENO	Trace	(0, 0.1)	1				Trace	(0, 0.1)	1
R	CIAR4	Trace	(0, 0.1)	1				Trace	(0, 0.1)	1
R	RUMEX	Trace	(0, 0)	1				Trace	(0, 0)	1
R	SONCH	Trace	(0, 0)	1				Trace	(0, 0)	1
R	UNFOR	Trace	(0, 0.1)	5				0.1	(0, 0.1)	5
R	UNGRA	Trace	(0, 0.1)	4				Trace	(0, 0.1)	4

Table 71: Summary of water quality information for all ocular survey point locations at BRL - RAINBOW.

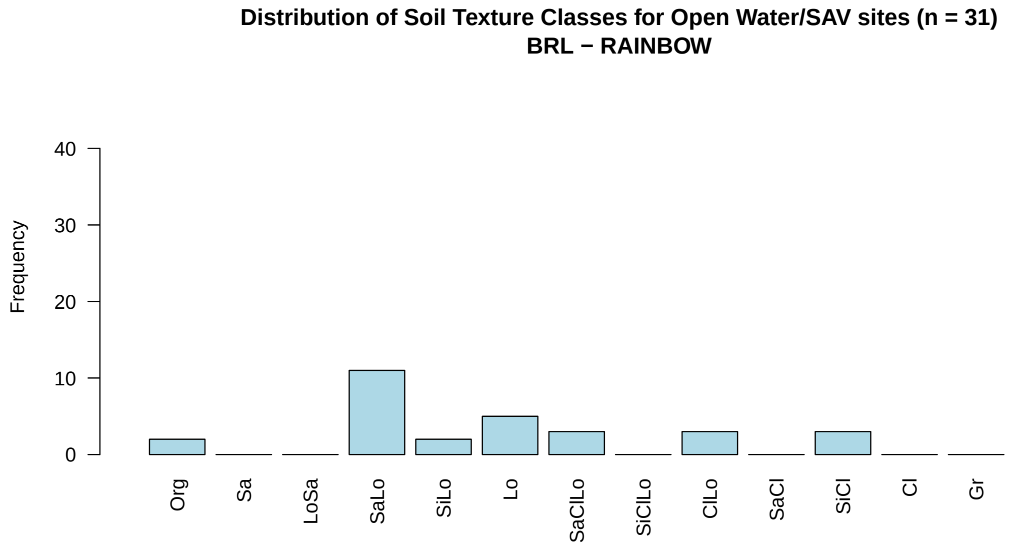
	n	Min	Mean	SE	Max
Water depth	116	0	21.72	2.19	97
Secchi Depth	116	0	21.72	2.19	97
pH level	85	7	7.99	0.08	10.1
Specific Conductivity	85	421.9	1251.19	78	4903
Salinity	85	0.2	0.63	0.04	2.6
Temperature	85	10.8	19.94	0.36	26.5

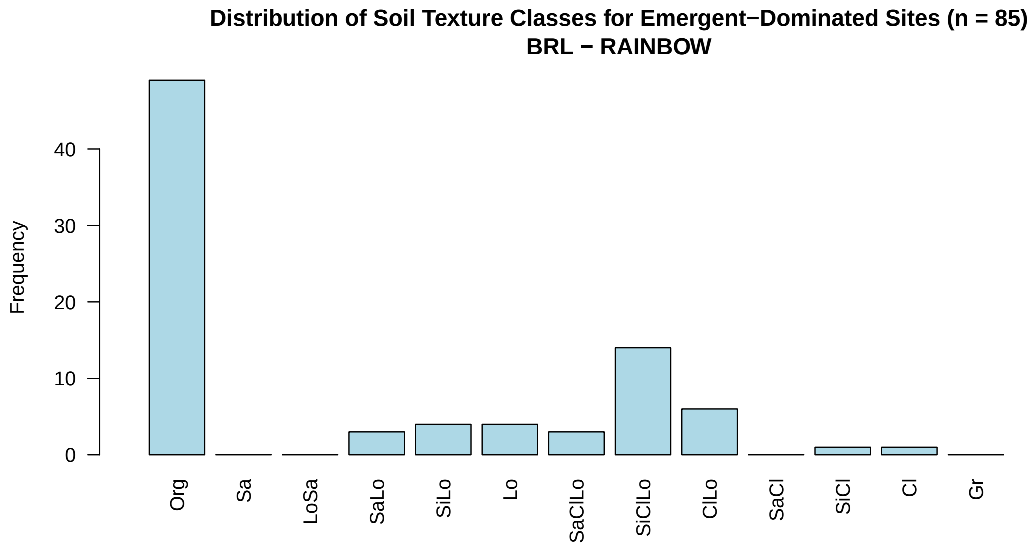
Table 72: Summary of water quality information for ocular survey, SAV point locations at BRL - RAINBOW.

	n	Min	Mean	SE	Max
Water depth	31	0	49.94	4.49	97
Secchi Depth	31	0	49.94	4.49	97
pH level	29	7	8.68	0.16	10.1
Specific Conductivity	29	673	1128.48	119.45	3671
Salinity	29	0.3	0.57	0.06	1.9
Temperature	29	13.6	21.09	0.53	24.9

Table 73: Summary of water quality information for ocular survey, Non-SAV point locations at BRL - RAINBOW.

	n	Min	Mean	SE	Max
Water depth	85	0	11.44	1.27	51
Secchi Depth	85	0	11.44	1.27	51
pH level	56	7	7.63	0.05	8.9
Specific Conductivity	56	421.9	1314.73	100.63	4903
Salinity	56	0.2	0.66	0.05	2.6
Temperature	56	10.8	19.35	0.45	26.5





2.2.18 FHS - Avocet

Table 74: Design-based estimate of mean percent canopy coverage for vegetation present at FHS - AVOCET. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 106), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 38; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 68). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	42.1	(33.9, 50.2)	87	101.9	(92, 111.8)	38	8.6	(6.1, 11.2)	49
SAV	RESID.SU	1.6	(0.5, 2.7)	17	0.3	(0, 0.5)	6	2.3	(0.6, 4.1)	11
E	ASCLE	Trace	(0, 0.1)	2	0.1	(0, 0.1)	1	Trace	(0, 0)	1
E	DISP	4.9	(2.4, 7.4)	25	0.3	(0, 0.6)	4	7.5	(3.7, 11.3)	21
E	ELEOC	Trace	(0, 0)	1				Trace	(0, 0.1)	1
E	JUBA	0.5	(0, 1.2)	2	0.1	(0, 0.1)	1	0.7	(0, 1.9)	1
E	PHAU7	0.1	(0, 0.3)	4				0.2	(0, 0.4)	4
E	RESID	13	(7.3, 18.7)	26	0.2	(0, 0.4)	2	20.2	(11.6, 28.8)	24
E	RESID.SE	0.4	(0, 1.1)	3	0.1	(0, 0.2)	1	0.6	(0, 1.6)	2
E	RESID.TE	35.2	(26.3, 44)	55	1.1	(0, 2.4)	5	54.2	(41.9, 66.5)	50
E	SAUT2	1.2	(0, 2.5)	15	0.5	(0.2, 0.8)	9	1.6	(0, 3.7)	6
E	SCAC3	0.1	(0, 0.1)	4				0.1	(0, 0.2)	4
E	SCAM6	0.1	(0, 0.1)	4				0.1	(0, 0.2)	4
E	SCHOE6	0.1	(0, 0.2)	9	Trace	(0, 0.1)	1	0.2	(0.1, 0.4)	8
E	TYPHA	0.1	(0, 0.1)	3				0.1	(0, 0.2)	3
R	ALOC2	0.2	(0, 0.4)	5	0.6	(0.1, 1.2)	5			
R	ASTRA	0.8	(0.2, 1.5)	18	1.9	(0.1, 3.6)	12	0.2	(0, 0.4)	6
R	CHENO	Trace	(0, 0)	1				Trace	(0, 0)	1
R	CHINO	1	(0, 1.9)	18	0.4	(0.1, 0.6)	8	1.3	(0, 2.8)	10
R	CHRU	0.3	(0.1, 0.4)	12	0.3	(0, 0.5)	4	0.3	(0.1, 0.5)	8
R	CHSI2	Trace	(0, 0.1)	2				Trace	(0, 0.1)	2
R	ERPI5	Trace	(0, 0)	1				Trace	(0, 0.1)	1
R	HIJA	Trace	(0, 0.1)	1				0.1	(0, 0.2)	1
R	KOSC	16	(11.3, 20.7)	49	5.4	(2.6, 8.1)	14	22	(15.1, 28.8)	35
R	MONU	Trace	(0, 0)	1				Trace	(0, 0)	1
R	SUCA2	0.2	(0.1, 0.3)	9	0.2	(0, 0.4)	5	0.1	(0, 0.2)	4

Table 75: Summary of water quality information for all ocular survey point locations at FHS - AVOCET.

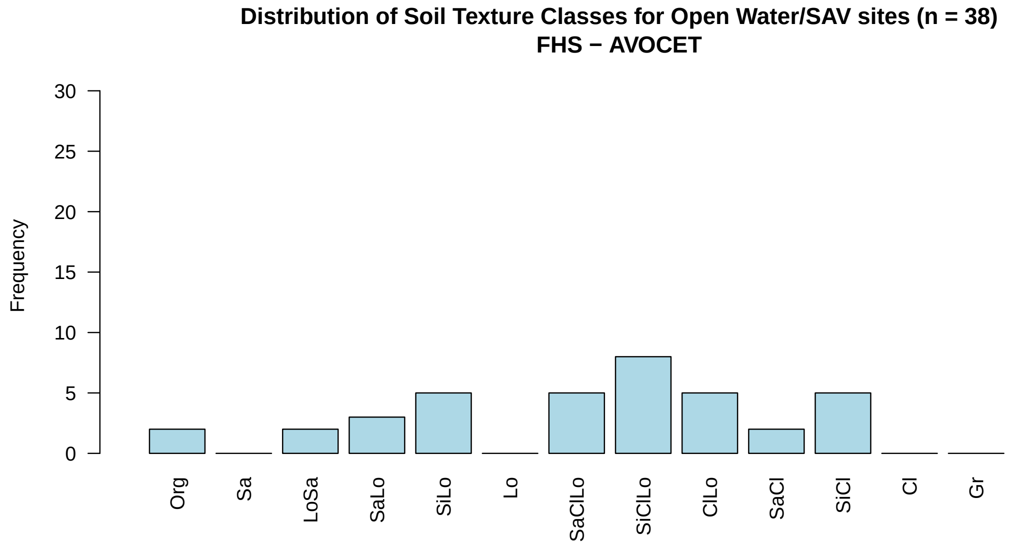
	n	Min	Mean	SE	Max
Water depth	106	0	0	0	0
Secchi Depth	106	0	0	0	0
pH level	NA				
Specific Conductivity	NA				
Salinity	NA				
Temperature	NA				

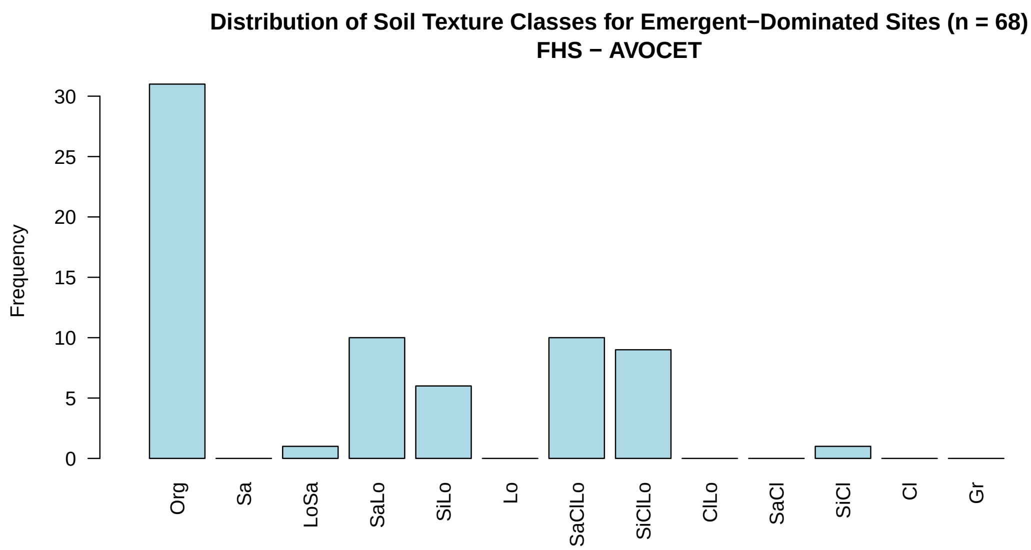
Table 76: Summary of water quality information for ocular survey, SAV point locations at FHS - AVOCET.

	n	Min	Mean	SE	Max
Water depth	38	0	0	0	0
Secchi Depth	38	0	0	0	0
pH level	NA				
Specific Conductivity	NA				
Salinity	NA				
Temperature	NA				

Table 77: Summary of water quality information for ocular survey, Non-SAV point locations at FHS - AVOCET.

	n	Min	Mean	SE	Max
Water depth	68	0	0	0	0
Secchi Depth	68	0	0	0	0
pH level	NA				
Specific Conductivity	NA				
Salinity	NA				
Temperature	NA				


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 38)
FHS − AVOCET
Frequency
0
5
10
15
20
25
30
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 68)
FHS − AVOCET
Frequency
0
5
10
15
20
25
30
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr

2.2.19 FHS - Curlew

Table 78: Design-based estimate of mean percent canopy coverage for vegetation present at FHS - CURLEW. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 74), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 56; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 18). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	4.6	(2.5, 6.7)	31	5.7	(3, 8.4)	24	1.2	(0.5, 1.9)	7
SAV	CHVU	66.1	(51.4, 80.9)	59	84.8	(67.2, 102.4)	52	8.1	(2.9, 13.2)	7
SAV	FILAL	0.1	(0, 0.1)	1				0.2	(0, 0.6)	1
SAV	FILAL.WC	0.4	(0, 0.9)	4	0.6	(0, 1.2)	3	0.1	(0, 0.2)	1
SAV	RESID.SU	1.1	(0.1, 2.2)	6	0.9	(0, 2)	4	1.7	(0, 4.5)	2
SAV	RUMA5	21	(14.6, 27.4)	41	27.7	(19.7, 35.6)	38	0.3	(0, 0.7)	3
SAV	STPE15	3.4	(0.3, 6.6)	4	4.5	(0.4, 8.7)	4			
E	DISP	4.1	(0.7, 7.4)	10	3.2	(0, 6.7)	6	6.7	(0, 15.6)	4
E	JUBA	0.1	(0, 0.2)	3	Trace	(0, 0)	1	0.4	(0, 1)	2
E	PHAU7	0.4	(0, 1)	6	0.1	(0, 0.1)	2	1.6	(0, 3.9)	4
E	RESID	2.2	(0, 4.7)	3	1.8	(0, 4.6)	2	3.5	(0, 9.3)	1
E	RESID.SE	1	(0, 2.7)	1				4.2	(0, 11)	1
E	RESID.TE	21.9	(10.9, 32.9)	26	1.8	(0.4, 3.1)	10	84.4	(48.6, 120.3)	16
E	SCAM6	7.7	(4, 11.4)	17	1	(0, 2.3)	4	28.6	(17, 40.2)	13
E	SCHOE6	3.7	(0.1, 7.3)	8	0.5	(0, 1)	2	13.6	(0, 27.9)	6
E	TYPHA	0.5	(0, 1)	3	0.3	(0, 0.7)	2	1	(0, 2.6)	1

Table 79: Summary of water quality information for all ocular survey point locations at FHS - CURLEW.

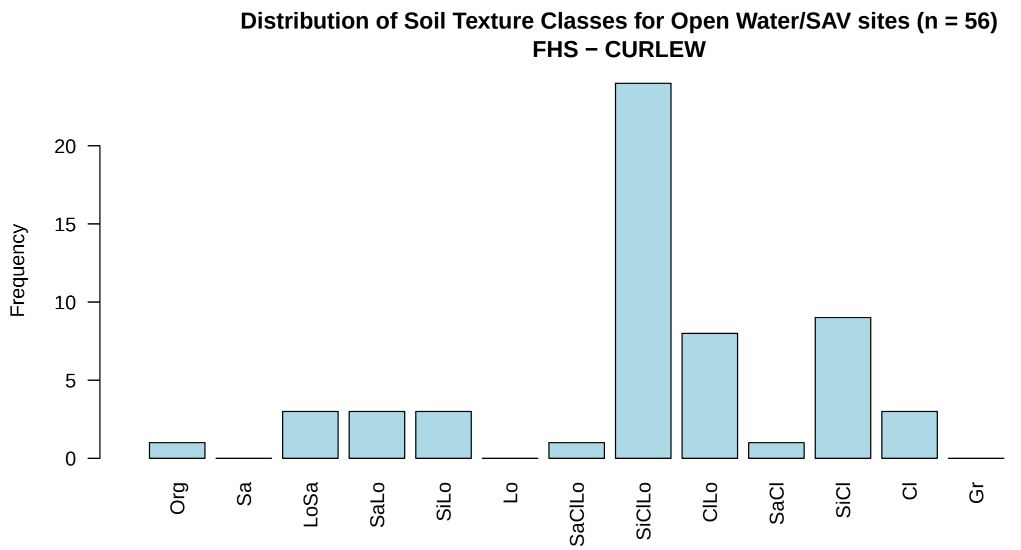
	n	Min	Mean	SE	Max
Water depth	74	0	25.2	1.68	65
Secchi Depth	74	0	25.2	1.68	65
pH level	72	7.5	8.9	0.07	10.1
Specific Conductivity	72	1008	4615.2	161.47	9388
Salinity	72	1.8	2.6	0.1	5.7
Temperature	72	14.7	21.6	0.35	28.6

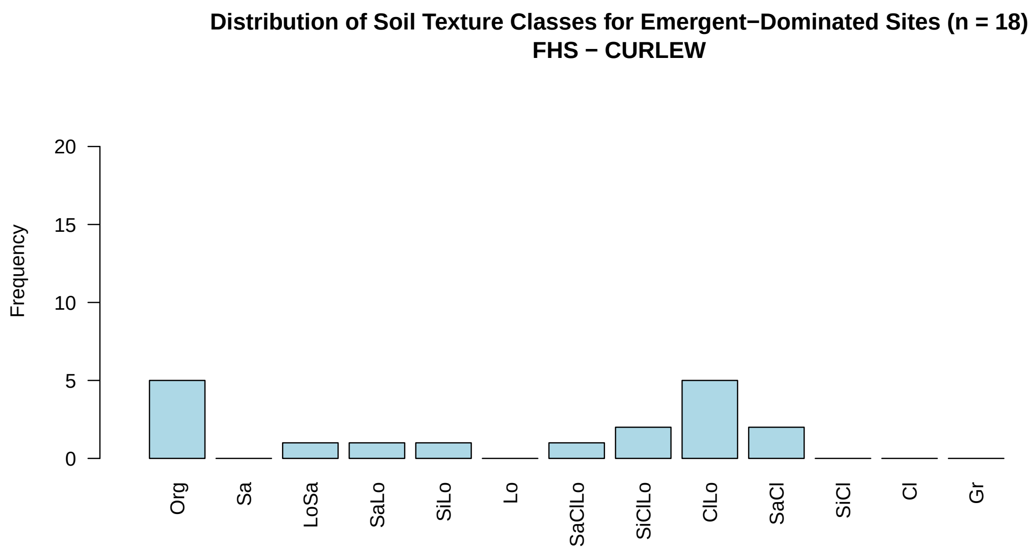
Table 80: Summary of water quality information for ocular survey, SAV point locations at FHS - CURLEW.

	n	Min	Mean	SE	Max
Water depth	56	4	28.6	1.77	65
Secchi Depth	56	4	28.6	1.77	65
pH level	56	7.5	9	0.08	10.1
Specific Conductivity	56	1008	4625.5	177.03	9164
Salinity	56	1.8	2.6	0.11	5.7
Temperature	56	17.1	22.1	0.35	28.6

Table 81: Summary of water quality information for ocular survey, Non-SAV point locations at FHS - CURLEW.

	n	Min	Mean	SE	Max
Water depth	18	0	14.7	3.12	56
Secchi Depth	18	0	14.7	3.12	56
pH level	16	7.9	8.4	0.13	9.4
Specific Conductivity	16	3426	4579.2	391.21	9388
Salinity	16	1.8	2.5	0.22	5.1
Temperature	16	14.7	19.6	0.85	27.7


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 56)
FHS − CURLEW
Frequency
0
5
10
15
20
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 18)
FHS − CURLEW
Frequency
0
5
10
15
20
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr

2.2.20 FHS - Ibis

Table 82: Design-based estimate of mean percent canopy coverage for vegetation present at FHS - IBIS. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 63), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 60; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 3). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	12.7	(5.6, 19.9)	28	13.2	(5.7, 20.6)	27	4	(0, 10.6)	1
SAV	CHVU	77.3	(60.7, 93.9)	52	81.2	(64.1, 98.2)	52			
SAV	FILAL.WC	1.7	(0, 3.8)	2	1.8	(0, 4)	2			
SAV	RESID.SU	2.1	(0, 5.1)	2				44.7	(0, 102.5)	2
SAV	RUMA5	24.5	(17.1, 31.9)	45	25.1	(17.3, 32.8)	44	13.3	(0, 35.3)	1
SAV	STPE15	2.5	(0, 5.5)	4	2.6	(0, 5.7)	4			
E	BOMA7	1	(0, 2.3)	2				20.7	(0, 44.1)	2
E	DISP	12.2	(4, 20.4)	24	6.2	(0.9, 11.5)	21	132.7	(52.3, 213.1)	3
E	ECBE2	0.1	(0, 0.2)	1	0.1	(0, 0.3)	1			
E	JUBA	0.7	(0, 1.8)	1				14	(0, 37)	1
E	PHAU7	0.1	(0, 0.3)	1	0.1	(0, 0.4)	1			
E	RESID.TE	0.5	(0, 1.3)	1	0.5	(0, 1.4)	1			
E	SCAC3	0.3	(0, 0.9)	1	0.4	(0, 1)	1			
E	TYPHA	0.1	(0, 0.2)	1				1.3	(0, 3.5)	1

Table 83: Summary of water quality information for all ocular survey point locations at FHS - IBIS.

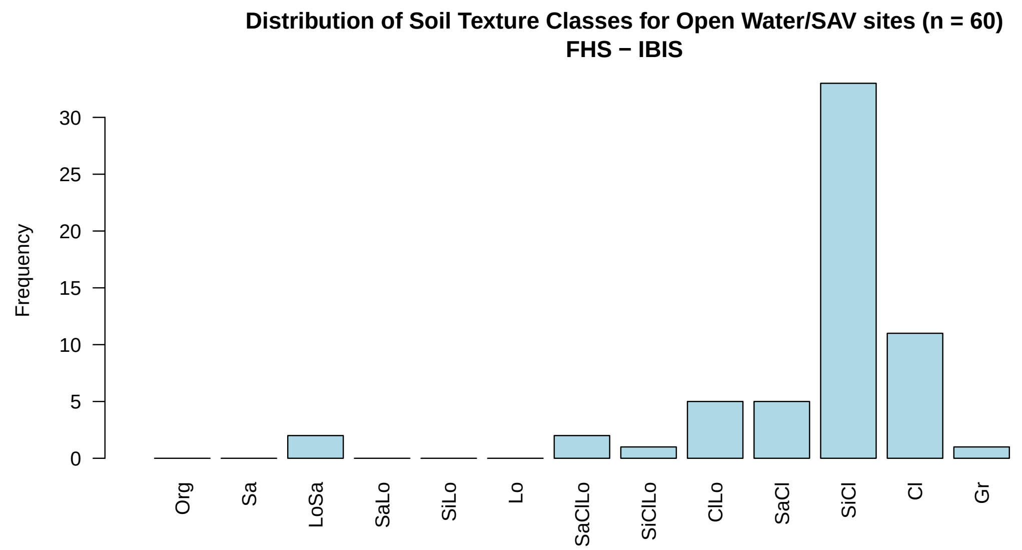
	n	Min	Mean	SE	Max
Water depth	63	0	41.8	3.74	110
Secchi Depth	63	0	41.8	3.74	110
pH level	60	8.6	10	0.05	11
Specific Conductivity	60	7693	9676.8	209.56	17980
Salinity	60	4.3	5.4	0.13	11
Temperature	60	10	23.2	0.4	30

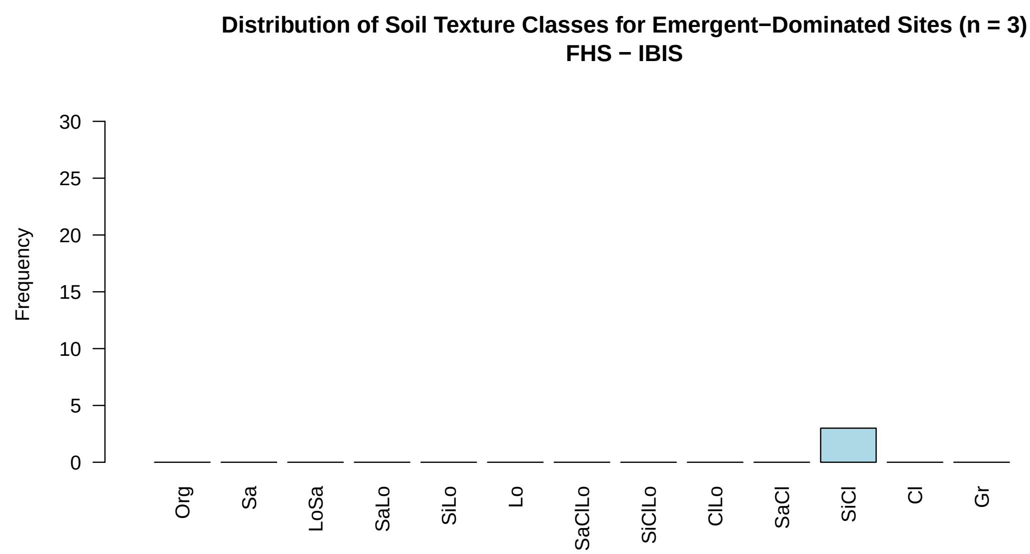
Table 84: Summary of water quality information for ocular survey, SAV point locations at FHS - IBIS.

	n	Min	Mean	SE	Max
Water depth	60	0	43.8	3.74	110
Secchi Depth	60	0	43.8	3.74	110
pH level	59	8.6	10	0.06	11
Specific Conductivity	59	7693	9635.4	208.94	17980
Salinity	59	4.3	5.4	0.13	11
Temperature	59	10	23.2	0.4	30

Table 85: Summary of water quality information for ocular survey, Non-SAV point locations at FHS - IBIS.

	n	Min	Mean	SE	Max
Water depth	3	0	2.33	2.33	7
Secchi Depth	3	0	2.33	2.33	7
pH level	1		9.6		
Specific Conductivity	1		12120		
Salinity	1		6.91		
Temperature	1		25.13		


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 60)
FHS − IBIS
Frequency
0
5
10
15
20
25
30
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 3)
FHS − IBIS
Frequency
0
5
10
15
20
25
30
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr

2.2.21 FHS - Mallard

Table 86: Design-based estimate of mean percent canopy coverage for vegetation present at FHS - MALLARD. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 89), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 61; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 28). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	3.5	(1.5, 5.5)	42	3.4	(0.6, 6.2)	29	3.7	(1.5, 5.9)	13
SAV	CHVU	68.3	(57.7, 79)	68	97.8	(87, 108.6)	59	4	(1.6, 6.5)	9
SAV	FILAL	0.9	(0, 2.2)	6	0.2	(0, 0.4)	4	2.5	(0, 6.6)	2
SAV	FILAL.WC	0.5	(0, 1.3)	5	0.7	(0, 1.8)	4	0.1	(0, 0.4)	1
SAV	MYRIO	0.1	(0, 0.3)	2	0.2	(0, 0.5)	2			
SAV	NAMA	Trace	(0, 0)	1	Trace	(0, 0)	1			
SAV	RESID.SU	0.3	(0, 0.6)	3	Trace	(0, 0)	1	0.8	(0, 2)	2
SAV	RUMA5	8.7	(5.1, 12.3)	35	12.4	(7.4, 17.5)	34	0.5	(0, 1.4)	1
SAV	STPE15	0.1	(0, 0.2)	2	Trace	(0, 0)	1	0.3	(0, 0.8)	1
E	ASCLE	0.2	(0, 0.4)	2	0.2	(0, 0.5)	1	0.1	(0, 0.4)	1
E	BEER	Trace	(0, 0)	1				Trace	(0, 0.1)	1
E	DISP	0.1	(0, 0.2)	4				0.3	(0.1, 0.6)	4
E	PHAU7	0.6	(0, 1.5)	2	Trace	(0, 0)	1	1.8	(0, 4.7)	1
E	RESID.TE	19.2	(13.2, 25.3)	37	0.6	(0.2, 1.1)	10	59.8	(48.1, 71.4)	27
E	SCAC3	1.4	(0, 3)	4	0.1	(0, 0.2)	1	4.3	(0, 9.3)	3
E	SCAM6	6.2	(3.1, 9.2)	15	1	(0.2, 1.7)	4	17.6	(9, 26.1)	11
E	SCHOE6	0.7	(0, 1.8)	5				2.4	(0, 5.8)	5
E	TYAN	0.9	(0, 2.5)	1				3	(0, 7.8)	1
E	TYPHA	0.6	(0, 1.4)	2				2	(0, 4.4)	2
R	ASTRA	0.6	(0, 1.6)	1				2	(0, 5.2)	1
R	CHRU	Trace	(0, 0.1)	2				0.1	(0, 0.2)	2
R	KOSC	1.8	(0, 3.6)	6	0.2	(0, 0.6)	1	5.2	(0, 10.8)	5
R	LELA2	Trace	(0, 0)	1				Trace	(0, 0.1)	1
R	SUCA2	0.2	(0, 0.5)	3	0.3	(0, 0.7)	2	0.1	(0, 0.3)	1

Table 87: Summary of water quality information for all ocular survey point locations at FHS - MALLARD.

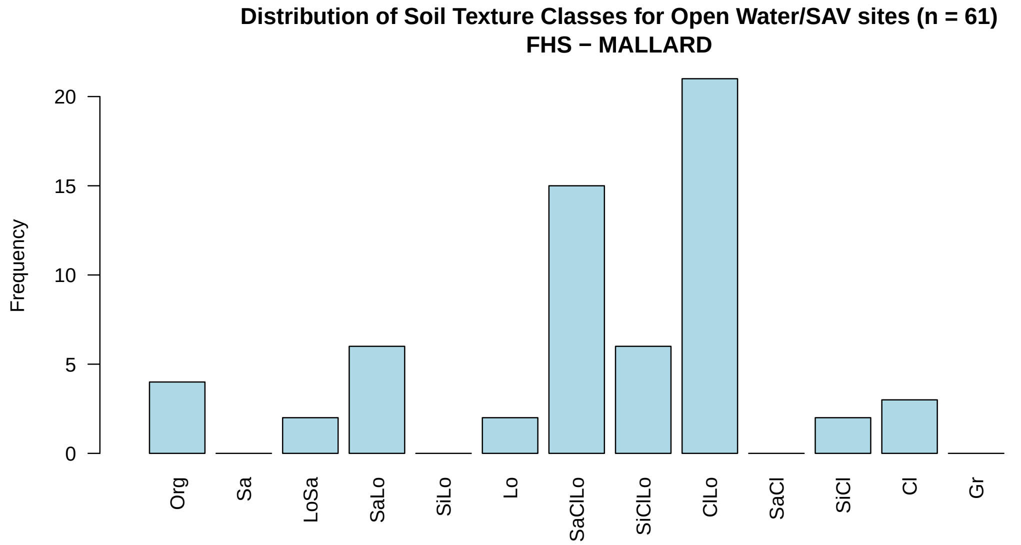
	n	Min	Mean	SE	Max
Water depth	89	0	29	2.14	78
Secchi Depth	89	0	29	2.14	78
pH level	79	6.7	8.4	0.09	9.9
Specific Conductivity	79	3152	3675.3	102.57	8836
Salinity	79	1.6	2	0.1	8
Temperature	79	15.9	21.5	0.38	30.3

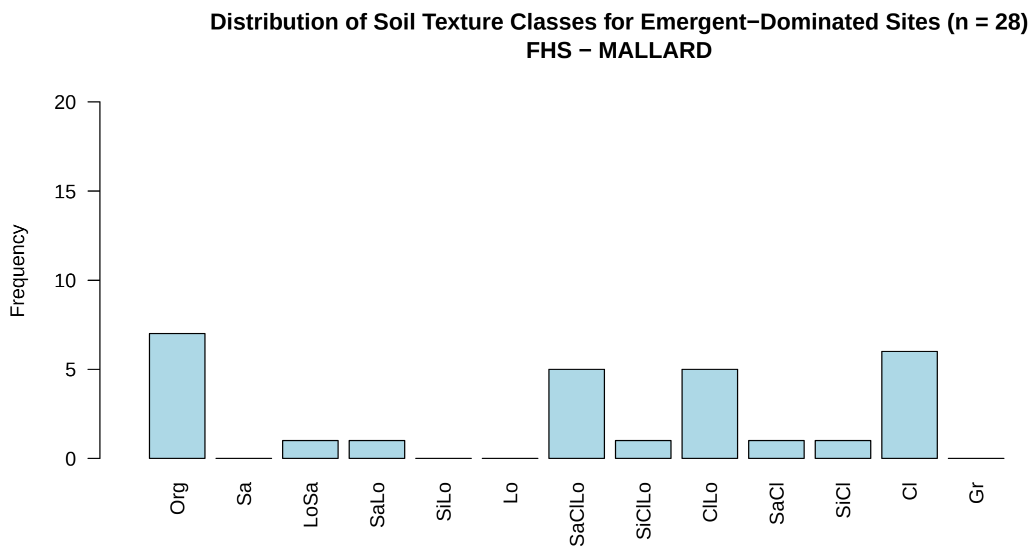
Table 88: Summary of water quality information for ocular survey, SAV point locations at FHS - MALLARD.

	n	Min	Mean	SE	Max
Water depth	61	0	37.4	2.31	78
Secchi Depth	61	0	37.4	2.31	78
pH level	59	6.8	8.7	0.08	9.9
Specific Conductivity	59	3152	3460.7	52.83	5812
Salinity	59	1.6	1.8	0.03	3.2
Temperature	59	15.9	21.7	0.43	30.3

Table 89: Summary of water quality information for ocular survey, Non-SAV point locations at FHS - MALLARD.

	n	Min	Mean	SE	Max
Water depth	28	0	10.6	1.82	37
Secchi Depth	28	0	10.6	1.82	37
pH level	20	6.7	7.6	0.13	8.9
Specific Conductivity	20	3158	4308.4	342.36	8836
Salinity	20	1.6	2.6	0.35	8
Temperature	20	16.4	20.8	0.84	29.2


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 61)
FHS − MALLARD
Frequency
0
5
10
15
20
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 28)
FHS − MALLARD
Frequency
0
5
10
15
20
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr

2.2.22 FHS - Shoveler

Table 90: Design-based estimate of mean percent canopy coverage for vegetation present at FHS - SHOVELER. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 79), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 55; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 24). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	4.8	(2.7, 6.8)	38	4.8	(2.2, 7.4)	25	4.7	(1.5, 7.9)	13
SAV	CHVU	65.8	(51.1, 80.6)	51	93.9	(76, 111.7)	49	1.7	(0, 4)	2
SAV	FILAL.WC	4.5	(0.8, 8.1)	7	4.1	(0.3, 7.8)	5	5.4	(0, 14)	2
SAV	RUMA5	13.8	(8.3, 19.3)	26	19.7	(12.2, 27.2)	25	0.3	(0, 0.9)	1
SAV	STPE15	1.4	(0, 3.4)	3	1.9	(0, 4.9)	3			
E	ASCLE	0.2	(0, 0.4)	2				0.5	(0, 1.2)	2
E	BOMA7	0.1	(0, 0.2)	2				0.3	(0, 0.8)	2
E	DISP	13.9	(7, 20.8)	21	0.9	(0, 1.8)	5	43.8	(24.4, 63.2)	16
E	JUBA	1	(0, 2.2)	3				3.4	(0, 7.1)	3
E	RESID	0.8	(0, 1.9)	4	0.1	(0, 0.2)	2	2.3	(0, 6)	2
E	RESID.SE	2.9	(0, 7.6)	2	0.1	(0, 0.2)	1	9.4	(0, 24.9)	1
E	RESID.TE	16.1	(8.3, 23.9)	19	0.2	(0, 0.5)	2	52.6	(31.2, 73.9)	17
E	SAUT2	Trace	(0, 0.1)	1				0.1	(0, 0.2)	1
E	SCAC3	0.7	(0, 1.7)	2				2.4	(0, 5.5)	2
E	SCAM6	3.6	(0.2, 7)	6	0.3	(0, 0.8)	1	11.1	(0.3, 22)	5
E	SCHOE6	1.5	(0.2, 2.8)	5				5	(0.9, 9.2)	5
E	TYAN	0.1	(0, 0.1)	1				0.2	(0, 0.4)	1
E	TYLA	0.2	(0, 0.5)	2				0.8	(0, 1.7)	2
E	TYPHA	2.3	(0, 4.6)	3				7.4	(0, 15.1)	3
R	ASTER	Trace	(0, 0.1)	1				0.1	(0, 0.3)	1
R	KOSC	Trace	(0, 0.1)	1				0.1	(0, 0.3)	1
R	SPAI	1.1	(0, 2.8)	1				3.5	(0, 9.4)	1
R	SUCA2	0.1	(0, 0.1)	1				0.2	(0, 0.4)	1

Table 91: Summary of water quality information for all ocular survey point locations at FHS - SHOVELER.

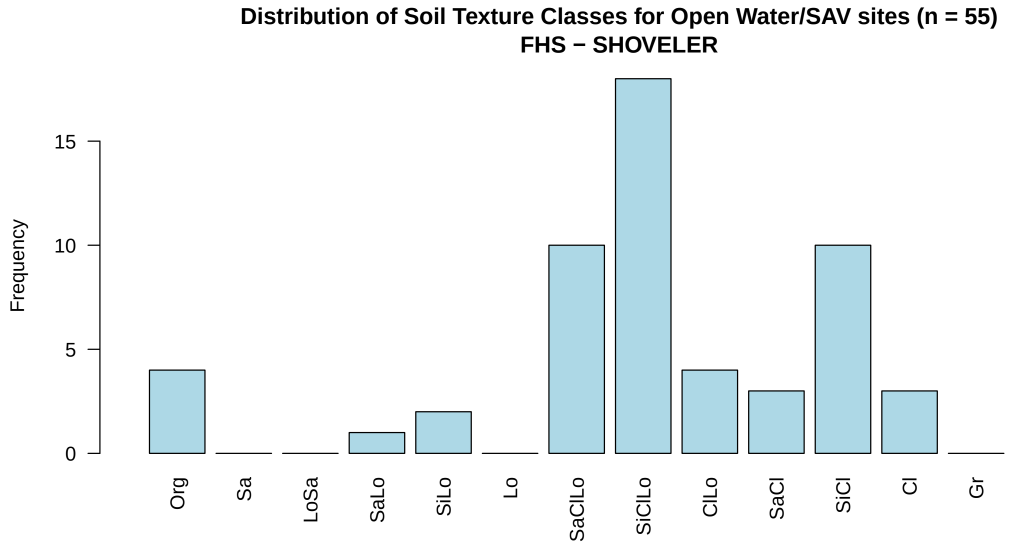
	n	Min	Mean	SE	Max
Water depth	79	0	38.2	3.23	120
Secchi Depth	79	0	38.2	3.23	120
pH level	71	7.1	9.5	0.1	10.5
Specific Conductivity	71	3229	4882.6	125.59	9110
Salinity	71	1.7	2.6	0.07	5.1
Temperature	71	15	20.3	0.34	30.3

Table 92: Summary of water quality information for ocular survey, SAV point locations at FHS - SHOVELER.

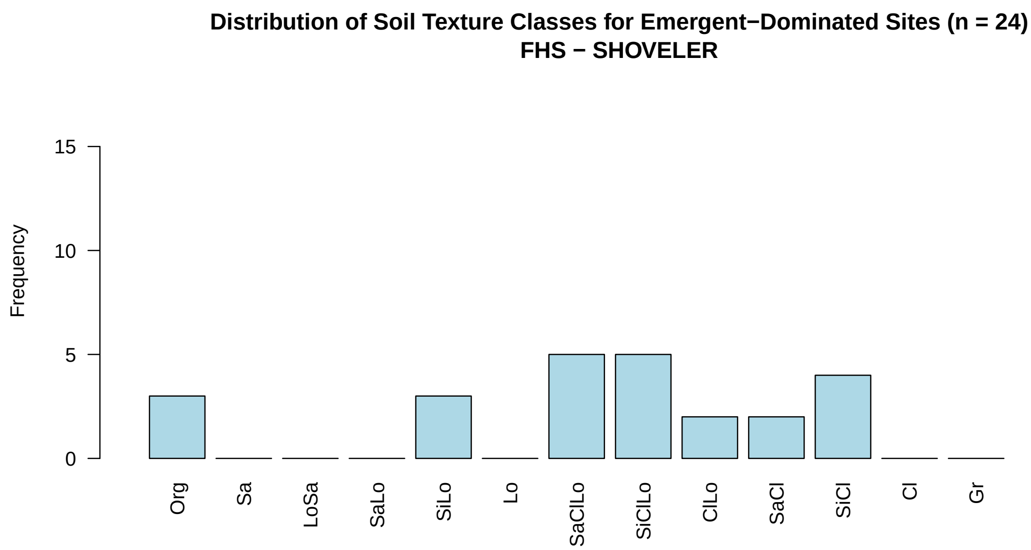
	n	Min	Mean	SE	Max
Water depth	55	8	50.5	3.43	120
Secchi Depth	55	8	50.5	3.43	120
pH level	55	8.5	9.8	0.07	10.5
Specific Conductivity	55	3229	4932	120.39	6010
Salinity	55	1.7	2.7	0.07	3.7
Temperature	55	15.1	20.7	0.38	30.3

Table 93: Summary of water quality information for ocular survey, Non-SAV point locations at FHS - SHOVELER.

	n	Min	Mean	SE	Max
Water depth	24	0	9.8	1.7	25
Secchi Depth	24	0	9.8	1.7	25
pH level	16	7.1	8.5	0.21	9.7
Specific Conductivity	16	3620	4712.8	380.51	9110
Salinity	16	1.9	2.6	0.23	5.1
Temperature	16	15	19	0.64	23.6



Distribution of Soil Texture Classes for Open Water/SAV sites (n = 55)
FHS − SHOVELER
Frequency
0
5
10
15
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr



Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 24)
FHS − SHOVELER
Frequency
0
5
10
15
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr

2.2.23 MLH - 4WO2

Table 94: Design-based estimate of mean percent canopy coverage for vegetation present at MLH - 4WO2. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 124), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 49; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 75). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	39.8	(35.1, 44.4)	103	73.2	(69.2, 77.1)	49	17.9	(14.8, 21.1)	54
E	DISP	2	(0.7, 3.2)	12	1.2	(0.2, 2.2)	7	2.5	(0.5, 4.5)	5
E	RESID	2.9	(1.7, 4)	41	2.3	(1.2, 3.3)	17	3.3	(1.5, 5.1)	24
E	RESID.SE	2.1	(1.2, 2.9)	30	2.1	(1, 3.2)	19	2	(0.8, 3.3)	11
R	CHENO	0.1	(0, 0.3)	4	0.2	(0, 0.6)	2	0.1	(0, 0.1)	2
R	CHMU3	1.6	(0.2, 3)	7	0.3	(0, 0.7)	2	2.5	(0.3, 4.8)	5
R	HOJU	44.7	(39.1, 50.3)	109	17.9	(14.3, 21.4)	42	62.2	(55, 69.4)	67
R	KOSC	1	(0.1, 1.8)	6	1.1	(0, 2.3)	4	0.9	(0, 2)	2
R	UNFOR	6	(3.4, 8.5)	22	1.8	(0.1, 3.5)	7	8.7	(4.7, 12.7)	15

Table 95: Summary of water quality information for all ocular survey point locations at MLH - 4WO2.

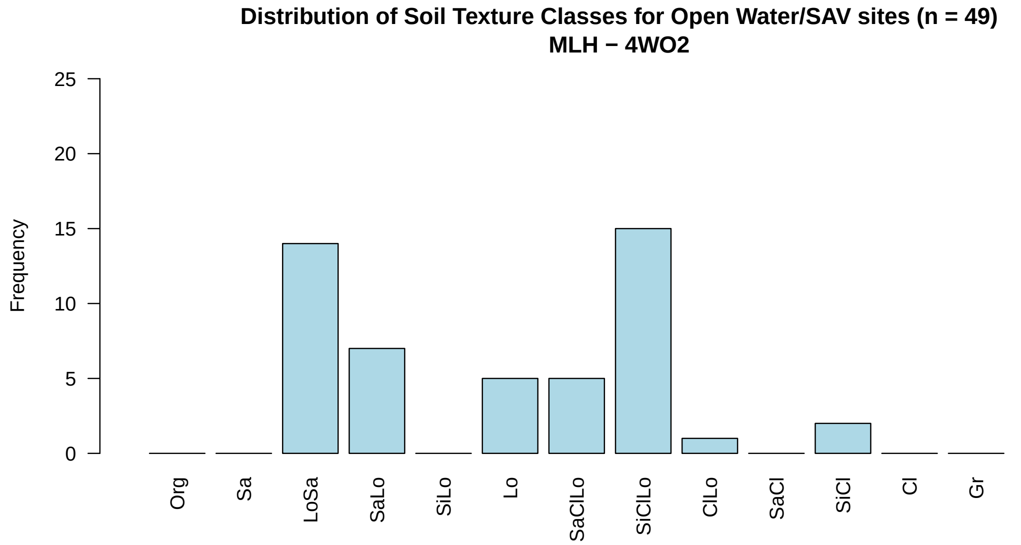
	n	Min	Mean	SE	Max
Water depth	124	0	0	0	0
Secchi Depth	124	0	0	0	0
pH level	NA				
Specific Conductivity	NA				
Salinity	NA				
Temperature	NA				

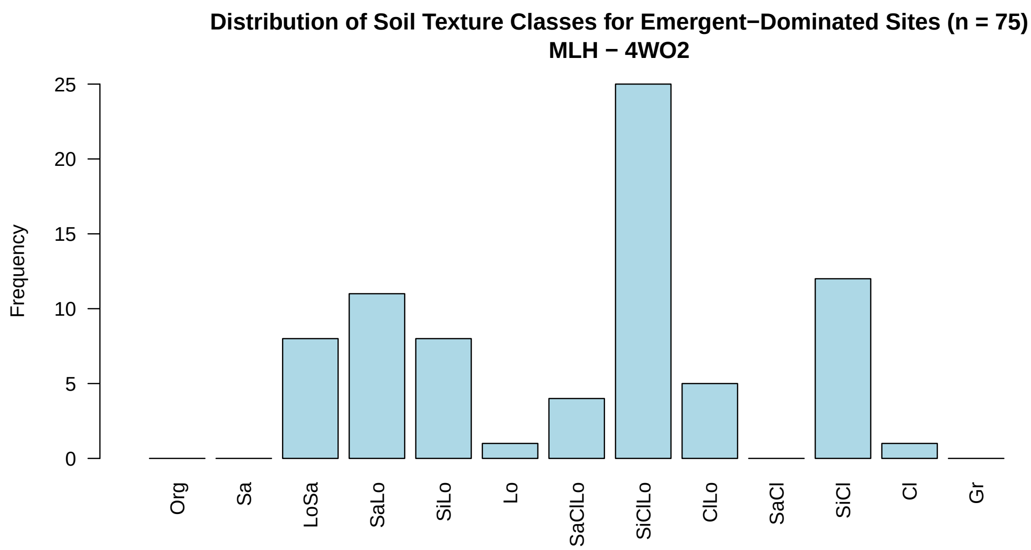
Table 96: Summary of water quality information for ocular survey, SAV point locations at MLH - 4WO2.

	n	Min	Mean	SE	Max
Water depth	49	0	0	0	0
Secchi Depth	49	0	0	0	0
pH level	NA				
Specific Conductivity	NA				
Salinity	NA				
Temperature	NA				

Table 97: Summary of water quality information for ocular survey, Non-SAV point locations at MLH - 4WO2.

	n	Min	Mean	SE	Max
Water depth	75	0	0	0	0
Secchi Depth	75	0	0	0	0
pH level	NA				
Specific Conductivity	NA				
Salinity	NA				
Temperature	NA				


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 49)
MLH − 4WO2
Frequency
0
5
10
15
20
25
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 75)
MLH − 4WO2
Frequency
0
5
10
15
20
25
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr

2.2.24 MLH - 5CBR

Table 98: Design-based estimate of mean percent canopy coverage for vegetation present at MLH - 5CBR. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 1), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 1; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 0). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	100	(NA, NA)	1	100	(NA, NA)	1		(NA, NA)	

Table 99: Summary of water quality information for all ocular survey point locations at MLH - 5CBR.

	n	Min	Mean	SE	Max
Water depth	1		9		
Secchi Depth	1		9		
pH level	NA				
Specific Conductivity	NA				
Salinity	NA				
Temperature	NA				

Table 100: Summary of water quality information for ocular survey, SAV point locations at MLH - 5CBR.

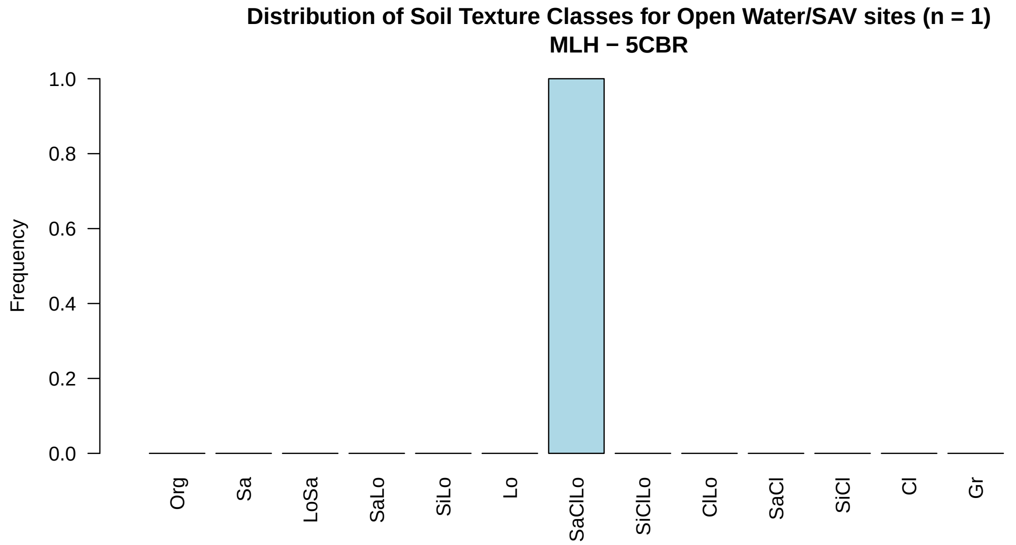
	n	Min	Mean	SE	Max
Water depth	1		9		
Secchi Depth	1		9		
pH level	NA				
Specific Conductivity	NA				
Salinity	NA				
Temperature	NA				

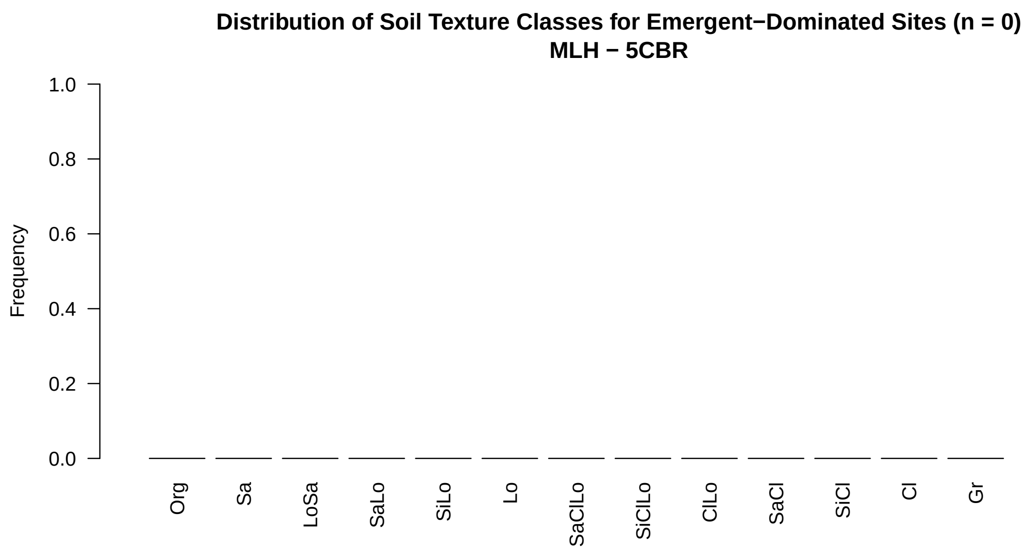
Table 101: Summary of water quality information for ocular survey, Non-SAV point locations at MLH - 5CBR.

	n	Min	Mean	SE	Max
Water depth	NA				
Secchi Depth	NA				
pH level	NA				
Specific Conductivity	NA				
Salinity	NA				
Temperature	NA				

Table 102: Summary of water quality information for rake survey point locations at MLH - 5CBR.

	n	Min	Mean	SE	Max
Water depth	116	1	12.4	0.58	26
Secchi Depth	115	1	2.9	0.03	3
pH level	NA				
Specific Conductivity	NA				
Salinity	NA				
Temperature	NA				


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 1)
MLH − 5CBR
Frequency
1.0
0.8
0.6
0.4
0.2
0.0
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 0)
MLH − 5CBR
Frequency
1.0
0.8
0.6
0.4
0.2
0.0
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr

2.2.25 MLH - 5CMI

Table 103: Summary of water quality information for rake survey point locations at MLH - 5CMI.

	n	Min	Mean	SE	Max
Water depth	116	12	31.9	1	114
Secchi Depth	99	3	3	0	3
pH level	71	9	9.2	0.01	9.8
Specific Conductivity	71	14	21.8	0.43	29.1
Salinity	NA				
Temperature	71	20	23.3	0.21	29.8

2.2.26 MLH - Benson Res - North

Table 104: Design-based estimate of mean percent canopy coverage for vegetation present at MLH - BENSON N. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 30), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 14; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 16). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	AZFI	2	(0, 5)	2				3.7	(0, 9.3)	2
SAV	BARESU	12.9	(6.3, 19.6)	26	22.6	(10, 35.3)	14	4.4	(0.9, 8)	12
SAV	CEDE4	0.1	(0, 0.1)	2	0.1	(0, 0.3)	2			
SAV	ELODEA	0.1	(0, 0.2)	3	0.2	(0, 0.4)	3			
SAV	ISOETES	0.2	(0, 0.5)	3	0.5	(0, 1.1)	3			
SAV	LEMI3	0.8	(0.2, 1.4)	12	0.6	(0.2, 0.9)	6	1	(0, 2)	6
SAV	MOSS	0.1	(0, 0.1)	2				0.1	(0, 0.3)	2
SAV	POFO3	21.4	(10.5, 32.4)	10	45.9	(27.5, 64.3)	10			
SAV	PONA4	5.6	(0.3, 10.9)	11	12	(1, 23)	11			
SAV	RANUN	Trace	(0, 0.1)	1				0.1	(0, 0.2)	1
SAV	RIFL4	0.2	(0.1, 0.4)	5				0.4	(0.1, 0.7)	5
SAV	STPE15	6.7	(0.7, 12.7)	4	14.4	(2.2, 26.5)	4			
E	CAUT	0.5	(0, 1.3)	1				0.9	(0, 2.5)	1
E	ELAC	Trace	(0, 0.1)	1	0.1	(0, 0.2)	1			
E	MEAR4	1.6	(0, 4.2)	1				3	(0, 7.9)	1
E	PHAR3	1	(0, 2.6)	1				1.9	(0, 5)	1
E	RESID.SE	3.9	(0.3, 7.5)	5				7.3	(0.7, 13.9)	5
E	RESID.TE	18.4	(9.3, 27.5)	13				34.6	(20.4, 48.7)	13
E	SCAC3	10.5	(3.8, 17.2)	12	1.8	(0, 4.7)	1	18.1	(6.5, 29.7)	11
E	SCTA2	0.1	(0, 0.1)	2				0.1	(0, 0.3)	2
E	SPEU	7.8	(1.2, 14.4)	7	1.8	(0, 4.7)	1	13.1	(1.1, 25)	6
E	TYAN	Trace	(0, 0.1)	1				0.1	(0, 0.2)	1
E	TYLA	0.2	(0, 0.5)	1				0.4	(0, 1)	1
E	VERON	0.5	(0, 1.3)	1				0.9	(0, 2.5)	1
R	CHENO	0.1	(0, 0.2)	1				0.1	(0, 0.3)	1
R	CIAR4	0.1	(0, 0.3)	1				0.2	(0, 0.5)	1
R	UNFOR	5	(0.8, 9.3)	10				9.4	(1.8, 17.1)	10
R	UNGRA	0.2	(0, 0.4)	2				0.4	(0, 0.8)	2
R	URDI	Trace	(0, 0.1)	1				0.1	(0, 0.2)	1

Table 105: Summary of water quality information for all ocular survey point locations at MLH - BENSON N.

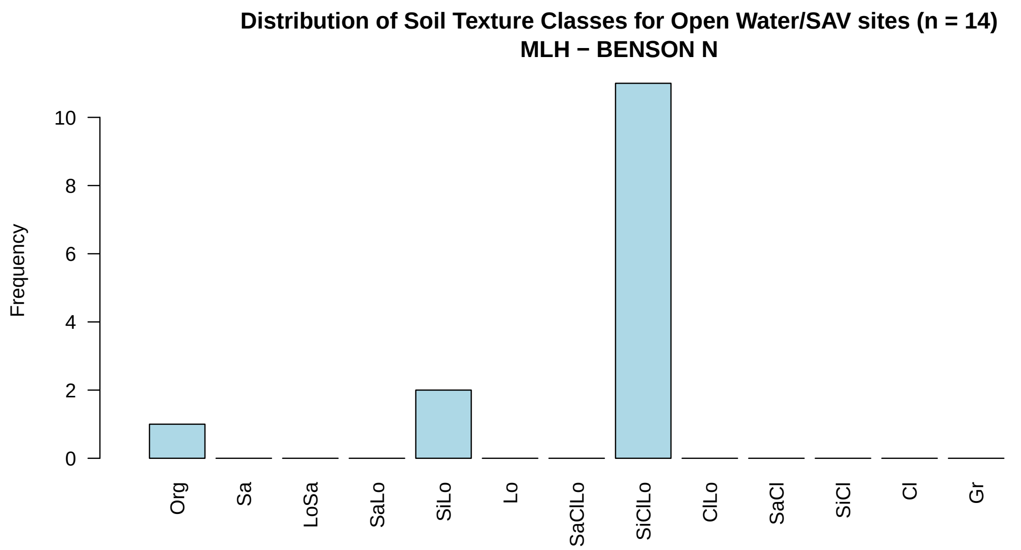
	n	Min	Mean	SE	Max
Water depth	30	0	4.8	1.23	18
Secchi Depth	30	0	4.8	1.23	18
pH level	NA				
Specific Conductivity	NA				
Salinity	NA				
Temperature	NA				

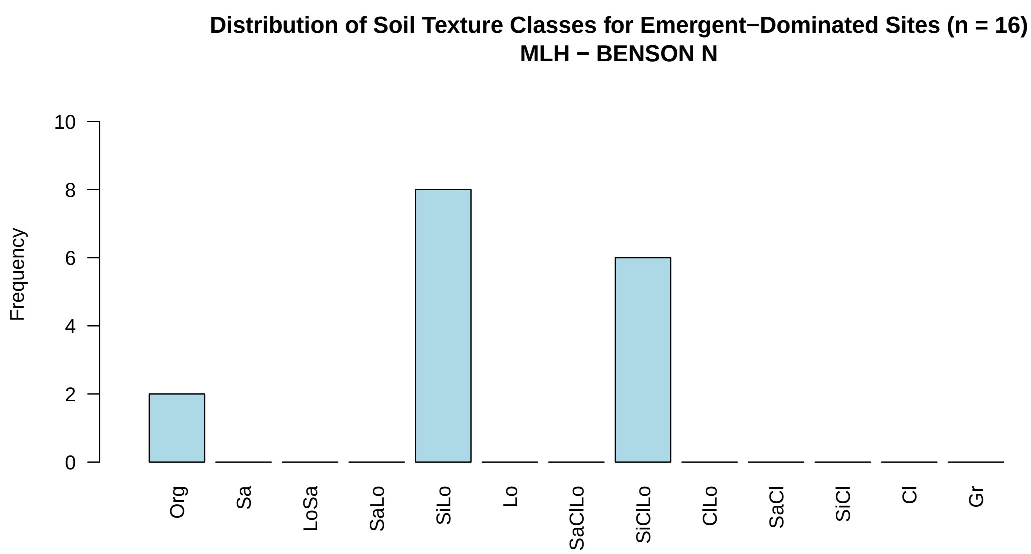
Table 106: Summary of water quality information for ocular survey, SAV point locations at MLH - BENSON N.

	n	Min	Mean	SE	Max
Water depth	14	0	10	1.69	18
Secchi Depth	14	0	10	1.69	18
pH level	NA				
Specific Conductivity	NA				
Salinity	NA				
Temperature	NA				

Table 107: Summary of water quality information for ocular survey, Non-SAV point locations at MLH - BENSON N.

	n	Min	Mean	SE	Max
Water depth	16	0	0	0	0
Secchi Depth	16	0	0	0	0
pH level	NA				
Specific Conductivity	NA				
Salinity	NA				
Temperature	NA				


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 14)
MLH − BENSON N
Frequency
0
2
4
6
8
10
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 16)
MLH − BENSON N
Frequency
0
2
4
6
8
10
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr

2.2.27 MLH - Boca Lake

Table 108: Design-based estimate of mean percent canopy coverage for vegetation present at MLH - BOCA. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 72), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 4; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 68). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	7.6	(3.6, 11.5)	22	80	(64.1, 95.9)	4	3.3	(1.4, 5.2)	18
SAV	FILAL.WC	Trace	(0, 0)	1				Trace	(0, 0)	1
SAV	LEMI3	Trace	(0, 0)	1	0.2	(0, 0.7)	1			
SAV	RESID.SU	0.1	(0, 0.2)	1				0.1	(0, 0.2)	1
SAV	WOGL2	Trace	(0, 0)	1				Trace	(0, 0)	1
SAV	ZAPA	0.3	(0, 0.8)	2	6	(0, 13.8)	2			
E	CAREX	0.3	(0, 0.7)	1				0.3	(0, 0.8)	1
E	CASY	1.1	(0, 2.3)	7	5	(0, 13.2)	1	0.9	(0, 2.1)	6
E	DISP	0.3	(0, 0.9)	1				0.4	(0, 1)	1
E	JUBA	0.4	(0, 1)	1				0.4	(0, 1.1)	1
E	MEAR4	Trace	(0, 0)	1				Trace	(0, 0)	1
E	MUAS	Trace	(0, 0.1)	1				Trace	(0, 0.1)	1
E	PHAR3	21.8	(15.4, 28.2)	37				23.1	(16.4, 29.8)	37
E	PORI3	0.5	(0, 1.1)	6				0.6	(0, 1.2)	6
E	RESID.SE	20.3	(15.7, 25)	58	1.8	(0.7, 2.8)	3	21.4	(16.6, 26.3)	55
R	BRTE	Trace	(0, 0)	1				Trace	(0, 0)	1
R	CHAL7	0.1	(0, 0.4)	1				0.1	(0, 0.4)	1
R	CIAR4	3.2	(1.3, 5.1)	12				3.4	(1.4, 5.4)	12
R	DESO2	1	(0, 2.8)	1				1.1	(0, 2.9)	1
R	GNPA	0.1	(0, 0.4)	1				0.1	(0, 0.4)	1
R	HOJU	18.4	(12.3, 24.4)	28				19.5	(13.1, 25.8)	28
R	KOSC	0.6	(0, 1.5)	1				0.6	(0, 1.6)	1
R	LASE	6.3	(3.3, 9.4)	20				6.7	(3.5, 9.9)	20
R	LELA2	2.4	(0.4, 4.4)	7				2.5	(0.4, 4.7)	7
R	PEMA24	2.5	(0.2, 4.9)	5	6.2	(0, 16.5)	1	2.3	(0, 4.8)	4
R	TATA2	Trace	(0, 0.1)	2				Trace	(0, 0.1)	2
R	THAR5	0.7	(0.1, 1.3)	4				0.7	(0.1, 1.4)	4
R	UNFOR	0.2	(0, 0.5)	5	0.2	(0, 0.7)	1	0.2	(0, 0.5)	4
R	UNGRA	7.2	(3.3, 11.1)	23	0.5	(0, 1)	2	7.6	(3.5, 11.7)	21

Growth Form	Species Code	All Sites			Open Water Sites			Emergent Sites		
		Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
R	URDI	0.1	(0, 0.2)	2				0.1	(0, 0.2)	2
	POLSP.	Trace	(0, 0)	1				Trace	(0, 0)	1

Table 109: Summary of water quality information for all ocular survey point locations at MLH - BOCA.

	n	Min	Mean	SE	Max
Water depth	72	0	1.08	0.48	25
Secchi Depth	72	0	1.08	0.48	25
pH level	6	6.5	7.63	0.27	8.4
Specific Conductivity	6	123.5	255.38	77.7	605
Salinity	6	0.1	0.15	0.03	0.3
Temperature	6	15.8	23.95	2.09	29.1

Table 110: Summary of water quality information for ocular survey, SAV point locations at MLH - BOCA.

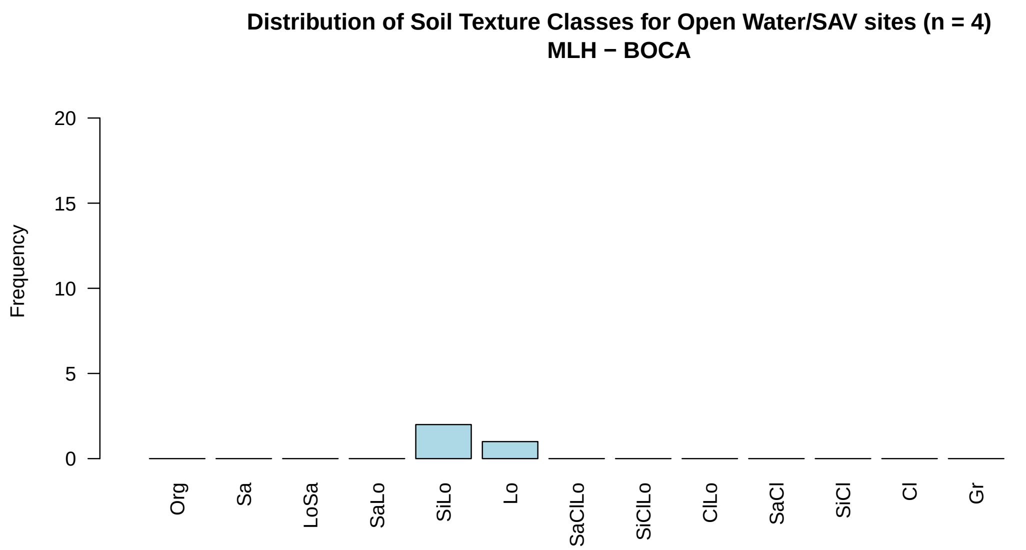
	n	Min	Mean	SE	Max
Water depth	4	0	11.75	5.51	25
Secchi Depth	4	0	11.75	5.51	25
pH level	3	6.5	7.21	0.38	7.6
Specific Conductivity	3	123.5	200.63	73.81	348.2
Salinity	3	0.1	0.13	0.03	0.2
Temperature	3	15.8	19.77	2.03	22.5

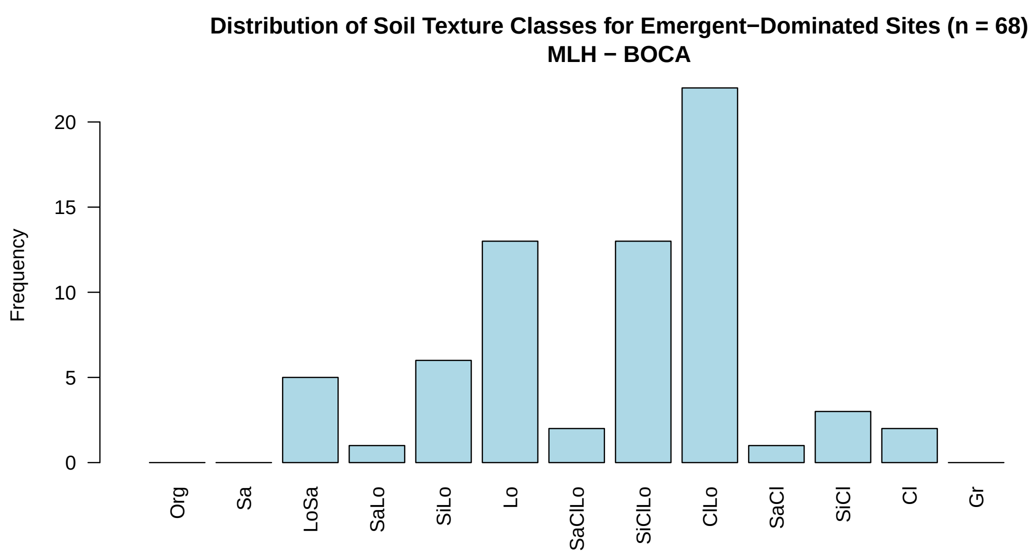
Table 111: Summary of water quality information for ocular survey, Non-SAV point locations at MLH - BOCA.

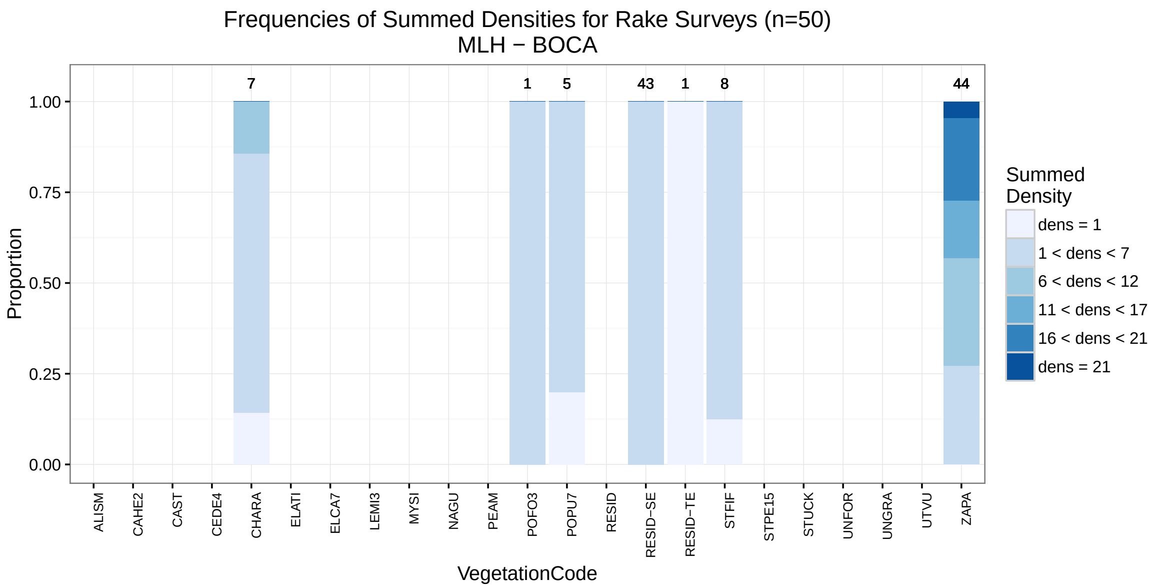
	n	Min	Mean	SE	Max
Water depth	68	0	0.46	0.27	13
Secchi Depth	68	0	0.46	0.27	13
pH level	3	7.7	8.05	0.21	8.4
Specific Conductivity	3	160	310.13	147.44	605
Salinity	3	0.1	0.17	0.07	0.3
Temperature	3	27.5	28.13	0.49	29.1

Table 112: Summary of water quality information for rake survey point locations at MLH - BOCA.

	n	Min	Mean	SE	Max
Water depth	50	4	27.2	1.46	41
Secchi Depth	50	3	13.1	0.65	25
pH level	50	6.5	8.5	0.12	9.9
Specific Conductivity	50	119.6	397.8	20.72	718
Salinity	50	0.1	0.2	0.01	0.4
Temperature	50	15.8	20.9	0.44	29.1







Frequencies of Summed Densities for Rake Surveys (n=50)
MLH − BOCA
Proportion
1.00
0.75
0.50
0.25
0.00
7
1
5
43
1
8
44
ALISM
CAHE2
CAST
CEDE4
CHARA
ELATI
ELCA7
LEMI3
MYSI
NAGU
PEAM
POFO3
POPU7
RESID
RESID−SE
RESID−TE
STFIF
STPE15
STUCK
UNFOR
UNGRA
UTVU
ZAPA
VegetationCode
Summed
Density
dens = 1
1 < dens < 7
6 < dens < 12
11 < dens < 17
16 < dens < 21
dens = 21

2.2.28 MLH - West Knox Reservoir

Table 113: Design-based estimate of mean percent canopy coverage for vegetation present at MLH - WEST KNOX RESERVOIR. Estimates of mean canopy cover are given for all GRTS points within the sampling unit (n = 27), as well as post-stratified by dominant vegetation type, where Open Water Sites were dominated by SAV species (n = 3; see Figure 9 for list of SAV and open water species codes), and Emergent indicates those sites characterized by emergent species (n = 24). Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent). Mean percent canopy cover and 90% confidence intervals were calculated using the design-based, local GRTS variance estimate. The number of sites with non-zero cover is indicated by the column 'n' among all sites and among post-stratified sites. Left endpoints on intervals were set to 0 if originally negative. When percent cover was estimated < 0.05%, the mean appears as 'Trace'.

Growth	Species	All Sites			Open Water Sites			Emergent Sites		
Form	Code	Mean	90% CI	n	Mean	90% CI	n	Mean	90% CI	n
SAV	BARESU	14.1	(6.8, 21.5)	18	73	(61.5, 84.5)	3	6.8	(3.6, 10)	15
SAV	LEMI3	Trace	(0, 0.1)	1	0.3	(0, 0.9)	1			
SAV	STFIF	0.4	(0, 1.2)	1	4	(0, 10.6)	1			
SAV	WOGL2	0.9	(0, 2.1)	2	7.7	(0, 17.9)	2			
E	CAAT3	0.1	(0, 0.3)	2				0.2	(0, 0.4)	2
E	CAREX	3.3	(0, 7.1)	2				3.8	(0, 8)	2
E	ELAC	20.1	(8.9, 31.3)	9				22.6	(10.3, 35)	9
E	ELPA3	0.4	(0, 1.1)	2				0.5	(0, 1.2)	2
E	JUBA	0.7	(0, 1.6)	2				0.8	(0, 1.8)	2
E	PHAR3	13.5	(6.1, 20.9)	11	8.3	(0, 22)	1	14.2	(6, 22.3)	10
E	PORI3	8	(2.8, 13.2)	10				9	(3.3, 14.7)	10
E	RESID	4.6	(0, 9.3)	4	0.3	(0, 0.9)	1	5.1	(0, 10.4)	3
E	RESID.SE	7.7	(3.3, 12.1)	13	1	(0, 2.6)	1	8.5	(3.6, 13.4)	12
E	RESID.TE	4.3	(0, 9.1)	3				4.8	(0, 10.2)	3
E	SCAC3	0.5	(0, 1.3)	1				0.5	(0, 1.4)	1
E	TYAN	0.6	(0, 1.5)	3				0.7	(0, 1.7)	3
E	VEPE2	Trace	(0, 0.1)	1				Trace	(0, 0.1)	1
R	ALAE	0.2	(0, 0.5)	2	1.7	(0, 4.4)	1	Trace	(0, 0.1)	1
R	CIAR4	0.6	(0.1, 1.1)	4				0.7	(0.2, 1.3)	4
R	GNPA	1.2	(0, 2.7)	6				1.4	(0, 3.1)	6
R	HOJU	4.3	(0.5, 8)	7	1	(0, 2.6)	1	4.7	(0.4, 8.9)	6
R	LASE	0.4	(0, 1)	3				0.5	(0, 1.1)	3
R	PEMA24	5.6	(0.5, 10.7)	9	0.3	(0, 0.9)	1	6.3	(0.6, 12)	8
R	TATA2	1.6	(0.1, 3)	5				1.8	(0.2, 3.3)	5
R	THAR5	Trace	(0, 0.1)	1				Trace	(0, 0.1)	1
R	UNFOR	2.9	(0.4, 5.5)	4				3.3	(0.4, 6.2)	4
R	UNGRA	0.8	(0.1, 1.5)	5				0.9	(0.1, 1.7)	5
	POLSP.	2.9	(0.1, 5.6)	6	2.3	(0, 6.2)	1	3	(0, 6)	5

Table 114: Summary of water quality information for all ocular survey point locations at MLH - WEST KNOX RESERVOIR.

	n	Min	Mean	SE	Max
Water depth	27	0	0.3	0.21	4
Secchi Depth	27	0	0.3	0.21	4
pH level	2	8.5	8.5	0.03	8.5
Specific Conductivity	2	438.7	443.2	4.55	447.8
Salinity	2	0.2	0.2	0	0.2
Temperature	2	33.5	33.8	0.3	34.1

Table 115: Summary of water quality information for ocular survey, SAV point locations at MLH - WEST KNOX RESERVOIR.

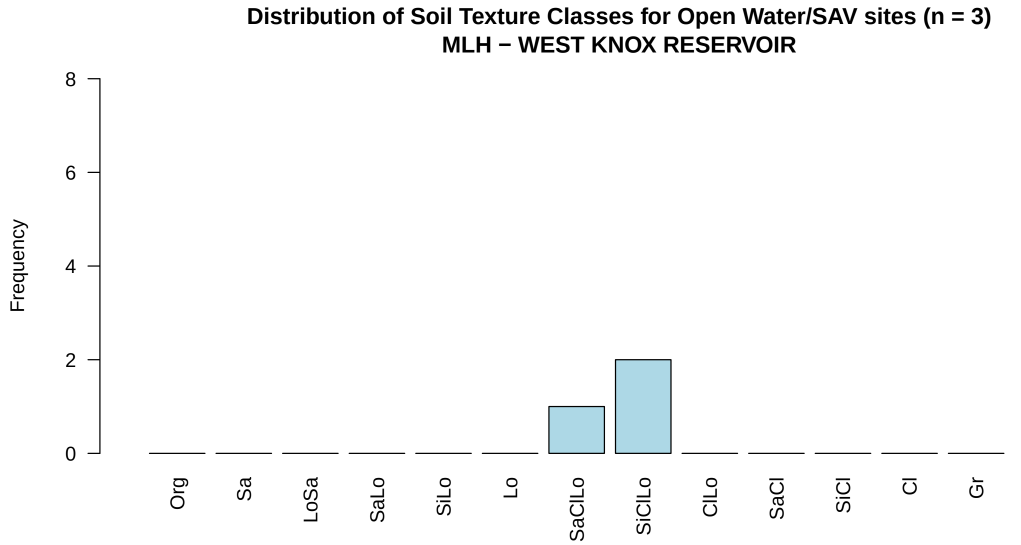
	n	Min	Mean	SE	Max
Water depth	3	0	2.7	1.33	4
Secchi Depth	3	0	2.7	1.33	4
pH level	2	8.5	8.5	0.03	8.5
Specific Conductivity	2	438.7	443.2	4.55	447.8
Salinity	2	0.2	0.2	0	0.2
Temperature	2	33.5	33.8	0.3	34.1

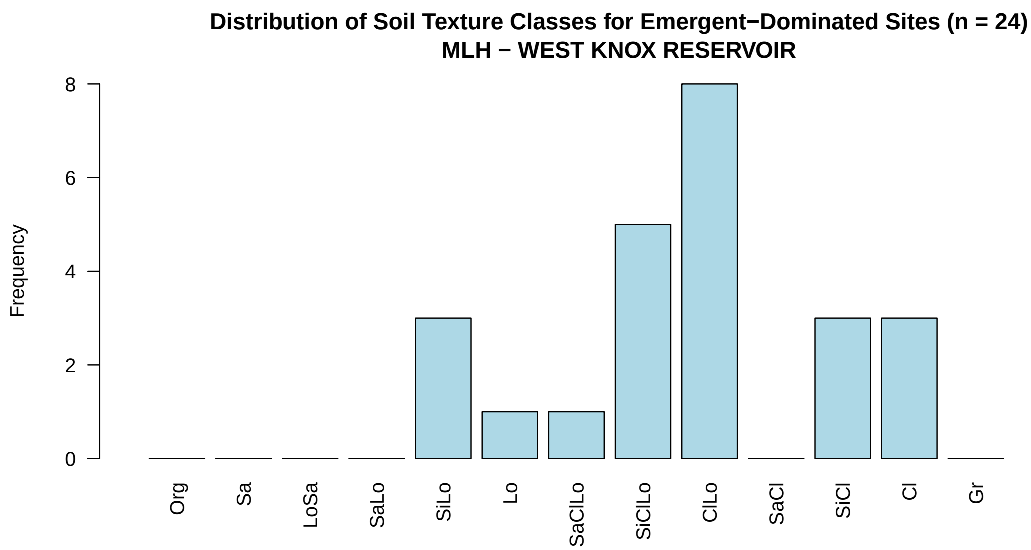
Table 116: Summary of water quality information for ocular survey, Non-SAV point locations at MLH - WEST KNOX RESERVOIR.

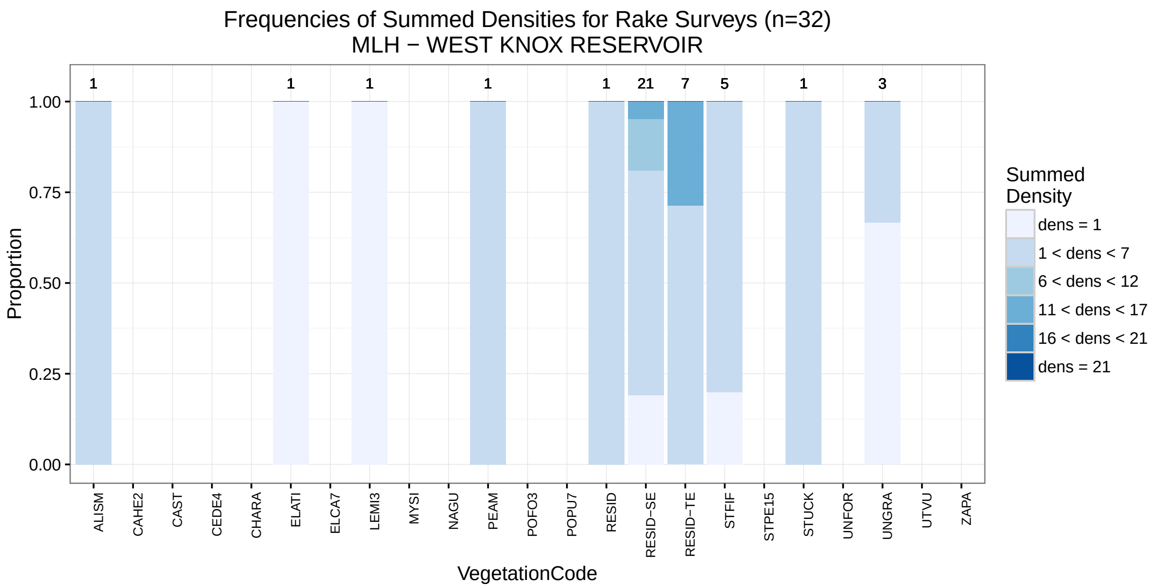
	n	Min	Mean	SE	Max
Water depth	24	0	0	0	0
Secchi Depth	24	0	0	0	0
pH level	NA				
Specific Conductivity	NA				
Salinity	NA				
Temperature	NA				

Table 117: Summary of water quality information for rake survey point locations at MLH - WEST KNOX RESERVOIR.

	n	Min	Mean	SE	Max
Water depth	32	4	25.6	1.98	39
Secchi Depth	32	3	5.9	0.57	23
pH level	32	7.7	8.5	0.04	8.9
Specific Conductivity	32	339.8	407.1	4.53	447.8
Salinity	32	0.2	0.2	0	0.2
Temperature	32	17.8	24.4	0.88	33.5


Distribution of Soil Texture Classes for Open Water/SAV sites (n = 3)
MLH − WEST KNOX RESERVOIR
Frequency
0
2
4
6
8
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Distribution of Soil Texture Classes for Emergent−Dominated Sites (n = 24)
MLH − WEST KNOX RESERVOIR
Frequency
0
2
4
6
8
Org
Sa
LoSa
SaLo
SiLo
Lo
SaClLo
SiClLo
ClLo
SaCl
SiCl
Cl
Gr


Frequencies of Summed Densities for Rake Surveys (n=32)
MLH − WEST KNOX RESERVOIR
Proportion
1.00
0.75
0.50
0.25
0.00
1
1
1
1
1
21
7
5
1
3
ALISM
CAHE2
CAST
CEDE4
CHARA
ELATI
ELCA7
LEMI3
MYSI
NAGU
PEAM
POFO3
POPU7
RESID
RESID−SE
RESID−TE
STFIF
STPE15
STUCK
UNFOR
UNGRA
UTVU
ZAPA
VegetationCode
Summed Density
dens = 1
1 < dens < 7
6 < dens < 12
11 < dens < 17
16 < dens < 21
dens = 21

3 Appendix C: Species Codes

Table 109. List of species, common names, species niches, and codes used throughout this report. Species codes are from the USDA PLANTS database, cross-referenced with the Integrated Taxonomic Information System. Growth form is included for each species: SAV (submerged aquatic vegetation), E (perennial emergent), or R. (annual ruderal emergent), and is defined in section 2.2.

Code	Species	Common Name	Growth Form
AGAL3	Agrostis alba	creeping bentgrass	R
AGSC5	Agrostis scabra	rough bentgrass	R
AGST2	Agrostis stolonifera	creeping bentgrass	R
ALAE	Alopecurus aequalis	shortawn foxtail	R
ALGR	Alisma gramineum	narroleaf water plantain	E
ALISM	Alisma spp.	water plantain	E
ALOC2	Allenrolfea occidentalis	iodinebush	R
ALPL	Alisma plantago-aquatica	European water plantain	E
ALPR3	Alopecurus pratensis	meadow foxtail	R
ALTR7	Alisma triviale	northern water plantain	E
ARBI2	Artemisia biennis	biennial wormwood	R
ARGEN	Argentina spp.	silverweed	E
ASCLE	Asclepias spp.	milkweed	E
ASTER	Aster spp.	aster	R
ASTRA	Astragalus spp.	milkvetch	R
ATPO2	Atriplex powellii	Powell's saltweed	R
AVFA	Avena fatua	wild oat	R
AZFI	Azolla microphylla	Mexican mosquito fern	SAV
AZOLL	Azolla spp.	mosquitofern	SAV
BARESU	Bare substrate		SAV
BEER	Berula erecta	cutleaf waterparsnip	E
BESY	Beckmannia syzigachne	American sloughgrass	E
BLGRALG		blue-green algae	SAV
BOMA7	Bolboschoenus maritimus		E
BRTE	Bromus tectorum	cheatgrass	R
CAAT3	Carex athrostachya	slenderbeak sedge	E
CACA	Calamagrostis canadensis	bluejoint reedgrass	R
CAHE2	Callitriche hermaphroditica	northern water-starwort	SAV
CALLI6	Callitriche spp.	water-starwort	SAV
CAMAS	Camassia spp.	camas	E
CANE2	Carex nebrascensis	Nebraska sedge	E
CANU4	Carduus nutans	nodding plumeless thistle	R
CAREX	Carex spp.	sedge	E
CARO6	Carex rostrata	beaked sedge	E
CAST	Callitriche stagnalis	pond water-starwort	SAV
CASY	Carex sychnocephala	manyhead sedge	E
CATA2	Camissonia tanacetifolia	tansyleaf evening primrose	R
CAUT	Carex utriculata	Northwest territory sedge	E
CEDE4	Ceratophyllum demersum	coon's tail	SAV

Table 109. Species list cont.

Code	Species	Common Name	Growth Form
CHAL7	Chenopodium album	lambsquarters	R
CHAN9	Chamerion angustifolium	fireweed	R
CHARA	Chara spp.	muskgrasses	SAV
CHBE4	Chenopodium berlandieri	pitseed goosefoot	R
CHENO	Chenopodium spp.	goosefoot	R
CHFR3	Chenopodium fremontii	Fremont's goosefoot	R
CHGL3	Chenopodium glaucum	oakleaf goosefoot	R
CHINO	Chenopodium incanum	mealy goosefoot	R
CHMU3	Chenopodium murale	nettleleaf goosefoot	R
CHRU	Chenopodium rubrum	red goosefoot	R
CHSI2	Chenopodium simplex	mapleleaf goosefoot	R
CHVU	Chara vulgaris	common stonewort	SAV
CIAR4	Cirsium arvense	Canada thistle	R
CRUSTSP	Crust spp.		SAV
DESO2	Descurainia sophia	herb sophia	R
DISP	Distichlis spicata	saltgrass	E
ECBE2	Echinodorus berteroi	upright burhead	E
ELAC	Eleocharis acicularis	needle spikerush	E
ELATI	Elatine spp.	waterwort	SAV
ELCA7	Elodea canadensis	Canadian waterweed	SAV
ELEOC	Eleocharis spp.	spikerush	E
ELNU2	Elodea nuttallii	western waterweed	SAV
ELODEA	Elodea spp.	waterweed	SAV
ELPA3	Eleocharis palustris	common spikerush	E
ELYMU	Elymus spp.	wildrye	R
EPCIC	Epilobium ciliatum	fringed willowherb	R
EPPA	Epilobium palustre	marsh willowherb	R
ERPI5	Erioneuron pilosum	hairy woollygrass	R
FILAL	Filamentous algae		SAV
FILAL-FL	Floating filamentous algae		SAV
FILAL-WC	Water column filamentous algae		SAV
FOAN2	Fontinalis antipyretica	antifever fontinalis moss	SAV
GATR2	Galium trifidum	threepetal bedstraw	E
GLFL2	Glyceria fluitans	water mannagrass	E
GLGR	Glyceria grandis	American mannagrass	E
GLLE3	Glycyrrhiza lepidota	American licorice	R
GNPA	Gnaphalium palustre	western marsh cudweed	R
HESPE6	Hesperocnide spp.	stingingnettle	R
HIJA	Pleuraphis jamesii	James' galleta	R
HIVU2	Hippuris vulgaris	common mare's-tail	SAV
HOJU	Hordeum jubatum	foxtail barley	R
ISOETES	Isoetes spp.	quillwort	SAV
JUAR2	Juncus arcticus	arctic rush	E
JUBA	Juncus balticus	Baltic rush	E
JUNCUS	Juncus spp.	rush	E

Table 109. Species list cont.

Code	Species	Common Name	Growth Form
JUTO	Juncus torreyi	Torrey's rush	E
KOELE	Koeleria spp.	junegrass	R
KOSC	Bassia scoparia	burning bush (kochia)	R
LASE	Lactuca serriola	prickly lettuce	R
LELA2	Lepidium latifolium	broadleaved pepperweed	R
LEMI3	Lemna minor	common duckweed	SAV
LEMNA	Lemna spp.	duckweed	SAV
LETR	Lemna trisulca	star duckweed	SAV
LIAQ	Limosella aquatica	water mudwort	SAV
LOPE3	Lomatium peckianum	Peck's desertparsley	R
MARSI	Marsilea spp.	waterclover	E
MEAQ	Mentha aquatica	water mint	E
MEAR4	Mentha arvensis	wild mint	E
MELU	Medicago lupulina	black medick	R
MENTH	Mentha spp.	mint	E
MEOF	Melilotus officinalis	sweetclover	R
MONU	Monolepis nuttalliana	Nuttall's povertyweed	R
MOSS	Bryophyta	moss	SAV
MUAS	Muhlenbergia asperifolia	scratchgrass	E
MYRIO	Myriophyllum spp.	watermilfoil	SAV
MYSI	Myriophyllum sibiricum	shortspike watermilfoil	SAV
MYVE3	Myriophyllum verticillatum	whorl-leaf watermilfoil	SAV
NAFL	Najas flexilis	nodding waternymph	SAV
NAGU	Najas guadalupensis	southern waternymph	SAV
NAJAS	Najas species	naiad	SAV
NAMA	Najas marina	spiny naiad	SAV
NAOF	Nasturtium officinale	watercress	SAV
NITELL	Nitella spp.	brittlewort	SAV
NULU	Nuphar lutea	yellow pond-lily	SAV
NUPO-FL	Nuphar polysepala	Rocky Mountain pond-lily	SAV
NUPO-SU	Nuphar polysepala	Rocky Mountain pond-lily	SAV
ONAC	Onopordum acanthium	Scotch thistle	R
PACA6	Panicum capillare	witchgrass	R
PEAM	Persicaria amphibia	water knotweed	E
PEHY	Persicaria hydropiperoides	swamp smartweed	E
PELA22	Persicaria lapathifolium	curlytop knotweed	R
PEMA24	Persicaria maculosa	spotted ladysthumb	R
PEPE19	Persicaria pensylvanicum	Pennsylvania smartweed	R
PERSIC	Persicaria spp.	smartweed	
PHAR3	Phalaris arundinacea	reed canarygrass	E
PHAU7	Phragmites australis	common reed	E
PHPR3	Phleum pratense	timothy	R
PLMA2	Plantago major	common plantain	R
PLSC2	Plagiobothrys scouleri	Scouler's popcorn flower	E
POAN5	Potentilla anserina	silverweed cinquefoil	E

Table 109. Species list cont.

Code	Species	Common Name	Growth Form
POFO3	Potamogeton foliosus	leafy pondweed	SAV
POFR3	Potamogeton friesii	Fries' pondweed	SAV
POGL9	Potentilla glandulosa	sticky cinquefoil	R
POGR8	Potamogeton gramineus	variableleaf pondweed	SAV
POLSP	Polygynum spp.	smartweed	
PONA4	Potamogeton natans	floating pondweed	SAV
PONE	Poa nemoralis	wood bluegrass	R
POPA15	Potentilla paradoxa	Paradox cinquefoil	E
POPA2	Poa palustris	fowl bluegrass	R
POPR	Poa pratensis	Kentucky bluegrass	R
POPR5	Potamogeton praelongus	whitestem pondweed	SAV
POPU7	Potamogeton pusillus	small pondweed	SAV
PORI2	Potamogeton richardsonii	Richardson's pondweed	SAV
PORI3	Potentilla rivalis	brook cinquefoil	E
POTAM	Potamogeton spp.	pondweed	SAV
POTEN	Potentilla spp.	cinquefoil	E
POZO	Potamogeton zosteriformis	flatstem pondweed	SAV
RAAQ	Ranunculus aquatilis	white water crowfoot	SAV
RACY	Ranunculus cymbalaria	alkali buttercup	E
RAFL	Ranunculus flabellaris	yellow water buttercup	SAV
RANUN	Ranunculus spp.	unknown buttercup	SAV
RAPE2	Ranunculus pensylvanicus	Pennsylvania buttercup	E
RASC3	Ranunculus sceleratus	cursed buttercup	E
RESID	Residual vegetation		E
RESID-SE	Residual vegetation - short emergent		E
RESID-SU	Residual vegetation - submerged	ONLY for 2015 SAV on mudflat	SAV
RESID-TE	Residual vegetation - tall emergent		E
RIFL4	Riccia fluitans	riccia	SAV
RINA	Ricciocarpus natans	purple-fringed riccia	SAV
ROIS2	Rorippa islandica	northern marsh yellowcress	E
ROPA2	Rorippa palustris	bog yellowcress	E
RORIPPA	Rorippa spp.	yellowcress	E
RUCI2	Ruppia cirrhosa	spiral ditchgrass	SAV
RUCR	Rumex crispus	curly dock	R
RUMA4	Rumex maritimus	golden dock	R
RUMA5	Ruppia maritima	widgeongrass	SAV
RUMEX	Rumex spp.	dock	R
SACU	Sagittaria cuneata	arumleaf arrowhead	E
SAEX	Salix exigua	narrowleaf willow	R
SAGIT	Sagittaria spp.	arrowhead	E
SARI	Sagittaria rigida	sessilefruit arrowhead	E
SARU	Salicornia rubra	red swampfire	E
SATR12	Salsola tragus	prickly Russian thistle	R
SAUT2	Sarcocornia utahensis	Utah swampfie	E
SCAC3	Schoenoplectus acutus	hardstem bulrush	E

Table 109. Species list cont.

Code	Species	Common Name	Growth Form
SCAM6	Schoenoplectus americanus	chairmaker's bulrush	E
SCHOE6	Schoenoplectus spp.	bulrush	E
SCMA8	Schoenoplectus maritimus	cosmopolitan bulrush	E
SCPU10	Schoenoplectus pungens	common threesquare	E
SCRO5	Schoenoplectus robustus	sturdy bulrush	E
SCSU10	Schoenoplectus subterminalis	swaying bulrush	E
SCTA2	Schoenoplectus tabernaemontani	sofstem bulrush	E
SEHY	Senecio hydrophiloides	tall groundsel	E
SEHY2	Senecio hydrophilus	water ragwort	E
SEOR6	Sericocarpus oregonensis	Oregon whitetop aster	R
SISU2	Sium suave	hemlock waterparsnip	E
SOAR2	Sonchus arvensis	field sowthistle	R
SODU	Solanum dulcamara	climbing nightshade	R
SONCH	Sonchus spp.	sowthistle	R
SOOL	Sonchus oleraceus	common sowthistle	R
SPAI	Sporobolus airoides	alkali sacaton	R
SPAN2	Sparganium angustifolium	narrowleaf bur-reed	E
SPARG	Sparganium spp.	bur-reed	E
SPEU	Sparganium eurycarpum	broadfruit bur-reed	E
SPPO	Spirodela polyrrhiza	greater duckweed	SAV
STFIF	Stuckenia filiformis	fineleaf pondweed	SAV
STPE15	Stuckenia pectinata	sago pondweed	SAV
STUCK	Stuckenia spp.	pondweed	SAV
STVA8	Stuckenia vaginata	sheathed pondweed	SAV
SUCA2	Suaeda calceoliformis	Pursh seepweed	R
TAOF	Taraxacum officinale	common dandelion	R
TATA2	Taraxia tanacetifolia	tansyleaf evening primrose	R
TAVU	Tanacetum vulgare	common tansy	R
THAR5	Thlaspi arvense	field pennycress	R
TRDU	Tragopogon dubius	goatsbeard	R
TRLO	Trifolium longipes	longstalk clover	R
TRMA20	Triglochin maritima	seaside arrowgrass	E
TYAN	Typha angustifolia	narrowleaf cattail	E
TYGL	Typha x glauca	hybrid cattail	E
TYLA	Typha latifolia	broadleaf cattail	E
TYPHA	Typha spp.	cattail	E
UNFOR	Unknown forb		R
UNGRA	Unknown graminoid		R
URDI	Urtica dioica	stinging nettle	R
UTGI	Utricularia gibba	humped bladderwort	SAV
UTMI	Utricularia minor	lesser bladderwort	SAV
UTVU	Utricularia macrorhiza	common bladderwort	SAV
VEAN2	Veronica anagallis-aquatica	water speedwell	E
VECA7	Veronica catenata	chain speedwell	E
VEPE2	Veronica peregrina	neckweed	E

Table 109. Species list cont.

Code	Species	Common Name	Growth Form
VERON	Veronica spp.	speedwell	E
VESC2	Veronica scutellata	skullcap speedwell	E
WOGL2	Wolffiella gladiata	florida mudmidget	SAV
WOLFF	Wolffia spp.	watermeal	SAV
ZAPA	Zannichellia palustris	horned pondweed	SAV

4 Appendix D: Refuge Codes

Table 110. Codes used to delineate the eight national wildlife refuges that had participating field units and were sampled within USFWS regions one and six.

Refuge Code	Refuge
BDW	Bowdoin NWR
BRL	Bear Lake NWR
CMS	Camas NWR
FHS	Fish Springs NWR
GYL	Grays Lake NWR
LMC	Lee Metcalf NWR
MDL	Medicine Lake NWR
MLH	Malheur NWR