



Northeast Regional Floristic Quality Assessment Tools for Wetland Assessments



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PROJECT ABSTRACT

Floristic Quality Assessment (FQA) is a robust, botanically based method for assessing the quality of ecological communities and natural areas. Integral to the method is that each native plant species in a state or region is assigned a Coefficient of Conservatism, or C value, based on its response to stressors. Species of high C values (7-10) are expected to be largely restricted to areas with minimal anthropogenic disturbances or adapted to unique natural conditions (including natural disturbances), whereas species with low C values (1-3) are expected to be largely found in ruderal or highly degraded habitats. Exotics typically receive a 0. In the Northeast Region (including six New England states and New York), C values were completed at the state level in 2011, whereby every species in each state was assigned a C value based on statewide “average behavior.” But jurisdictional units are not optimal for addressing changes in species behavior. For this reason, the Environmental Protection Agency (EPA) and New England Interstate Water Pollution Control Commission (NEIWPCC) have supported the development of ecoregional C values, including in the Northeast. For this project, we developed ecoregional C values as follows: 1) developed a regional plant species list (3441 species, 152 subspecies or varieties and 42 hybrids) and assigned distribution by the five EPA Level III ecoregions (58, 59, 82, 83, and 84) that cover the 6 New England states of EPA Region 1, and much of New York. We used USDA PLANTS as the botanical standard; 2) assigned ecoregional (e)C values for each species, starting with an automated integration of state C values from the 2011 project, then using a team approach to produce eC values for each of the five ecoregions; 3) validated the scientific rigor of the FQA methodology by demonstrating that FQA indices, such as Mean C and Cover-Weighted (CW) Mean C, performed moderately better in responding to changing ecological conditions when based on eC values than on state C values. We found that metric performance differed by community type grouping (e.g., bogs and fens had higher CW-mean C values for high quality sites than did floodplain forests or swamps); 4) upgraded the Universal FQA Calculator website to improve its functionality for wetland data, and enhanced NatureServe’s EcoObs ecology database with a user-friendly interface that can manage the plot and site data needed for these ecoregionally based FQA calculations. Both the website and the database now contain the five ecoregional spreadsheets developed for this project. Together these improvements provide a scientifically defensible and publicly accessible ecoregional FQA method across the northeast region.

I. INTRODUCTION

Floristic Quality Assessment (FQA) is a robust, botanically based method for assessing the quality of species composition of ecological community occurrences and natural areas (Swink and Wilhelm 1979, Taft et al. 1997, Herman et al. 1997). Integral to the method is that each plant species in a state or region is assigned a Coefficient of Conservatism, or C value, based on its tolerance to degradation and dependence on pristine natural habitats and processes (Swink & Wilhelm 1994). The C values range from 0 to 10; the most highly conservative species (C values >7) are typically found under historic, natural, and restricted ecological conditions and are sensitive to anthropogenic disturbances; whereas the least conservative species (C values <3) are adapted to or tolerant of a wide range of anthropogenic disturbances. Integrating the C values of all species at a site into one or more FQA metrics can provide a

valuable indicator of the condition at a site (Swink and Wilhelm 1979, Miller and Wardrop 2006, DeBerry et al. 2015).

Multiple studies have now demonstrated the effectiveness of various FQA metrics in helping inform our understanding of ecological condition, particularly for wetlands (USEPA 2002, Lopez and Fennessy 2002, Matthews 2003, Bourdaghs et al. 2006, Wardrop et al. 2007, Bried et al. 2013), though validation is an ongoing process (Mabry et al. 2018). The U.S. Environmental Protection Agency (EPA) recognized the merits of the approach and encouraged state and regional development of the method for state wetland assessments (USEPA 2002, Medley and Scozzafava 2009). The method is more cost effective and logistically easier than other wetland assessment methods (Miller and Wardrop 2006, Cretini et al. 2011). FQA is also used in combination with other wetland assessment metrics, such as the multi-metric approach of NatureServe's Ecological Integrity Assessment (Faber-Langendoen et al 2008, 2016), and EPA's Vegetation Multi-Metric Index (VMMI) for the National Wetland Condition Assessment (Serenbetz 2016). There have also been adaptations to make the method less taxonomically demanding, by relying on dominant species or on readily recognizable species (Bourdaghs 2012). Although much of the interest has focused on wetland ecosystems, the approach is also applicable to upland ecosystem types (Francis et al. 2000, Taft et al. 2006, Mabry et al. 2018). For a recent summary of the FQA methodology for wetlands, see DeBerry et al. (2015).

There have been criticisms of the method, including that the coefficients have inherent bias because they are subjectively assigned by a team of botanists, insufficiently validated, or too strongly influenced by rarity (see references in Matthews et al. 2015). But as Taft et al. (1997) stated at the outset of development of FQAs, "The FQA method, though subjective, permits dispassionate and repeatable application because its value judgments are predetermined." Testing of the approach for assessing ecological condition has continued over the years, largely by comparing the response of the metrics to a predetermined anthropogenic disturbance gradient (Lopez and Fennessy 2002, Wardrop et al. 2007, Bried et al. 2013). Matthews et al. (2015) took a different approach; rather than assessing response of species to a gradient (or axis) of human degradation (which can be challenging to validate), they tested the degree to which individual species tended to co-occur with species of similar C values. They found that species C values were positively correlated with the average C value of their co-occurring species, i.e. species with high C values tended to occur at a site with other species with high C values, confirming the consistency of scoring the C values. The authors recommended that C values be developed through an iterative approach, whereby, after the initial assignment, ongoing validation is conducted using empirical datasets or monitoring programs. C values can then be reassigned by a review panel.

Developing C values has often been based on state boundaries, where a comprehensive flora is often readily available (for a current list of available state FQAs, see DeBarry et al. 2015, Table 1; Freyman et al. 2016, Table 1). Development of state FQAs has also been encouraged to support state wetland program assessments. In the northeast, all 7 states (Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont) completed C values in 2011 for all plant species in each state, under the leadership of the New England Interstate Water Pollution Control Commission (NEIWPC) (Bried et al. 2012). Despite the success of the methods at the state level, Bried et al. (2012) identified several problems with extending these results to the regional level:

- Differences in C value ratings among states "suggests that a floristic quality assessment in one state will have a different meaning from the assessment in another state."
- "Findings further imply that state lists should not be combined into a composite CoC for the region."

Because there is strong interest in a regional approach to wetland assessments, there was a desire to address these challenges, primarily by developing C values at an ecoregional level, rather than state level (e.g. Chamberlain et al. 2012). In addition, there is concern that metrics based on the C values may need to be tailored to specific wetland types. We further explore these two challenges:

1. The assigned C values were based on state boundaries, limiting our understanding of how a species responds regionally to stressors. A species may be a generalist in one part of its range and a specialist in another part. For example, balsam fir (*Abies balsamea*) is a widespread species in native forests of northern New England and northern New York, regenerates well after clearcutting and fires, and can occasionally be found regenerating on abandoned farmlands and old fields (D'Orangeville et al. 2008). But it becomes increasingly specialized and may be less tolerant of anthropogenic disturbances in forests of southern New England and New York. Detecting these differences requires an ecoregional approach.

2. A second challenge for the FQA method, is that some metrics incorporate species richness, on the presumption that greater diversity also reflects higher quality. However, ecological community types naturally differ in species diversity. For example, bogs or salt marshes are typically species poor communities as compared to calcareous hardwood swamps or fens, and thus the range of FQA values expected for high quality examples of the former may be quite different than for the latter (Cretini et al. 2011). For that reason, it has been recommended that validation and interpretation of FQA metrics be completed within relatively similar community types (Ervin et al. 2006, Johnston et al. 2009, Bourdaghs 2012). In addition, others recommend using metrics, such as Mean C, that do not incorporate species richness.

In addition to these challenges, the application of the FQA as a regional tool would benefit from readily available and publicly accessible databases or web tools. Recently, a Universal FQA Calculator (universalfqa.org) was developed to provide access to the increasing number of FQA databases and to provide a web-based data entry tool that enables user to calculate FQA metrics on the web (Freyman et al. 2016). This tool allows practitioners to input their species lists and readily access the C values for their site(s), so that various FQA metrics can be readily calculated. However, the Universal FQA Calculator is currently limited in how it handles typical vegetation plot data from ecologists, and does not provide database management tools for the submitted data. To meet this need requires vegetation or site floristics databases.

In this study, we sought to improve the use of FQA for northeastern ecologists, especially for wetland programs, by addressing the following objectives:

Objective 1: Ecoregional Regional Species: Develop a regional plant list for the seven states in the northeast, based on standard plant taxonomy, and determine the ecoregional distribution of each species in the five ecoregions that cover EPA Region 1.

Objective 2. Ecoregional C values. Assign ecoregional (e)C values for all species in the northeast using the knowledge already compiled at the state level (Bried et al. 2012), but evaluated based on the species response to anthropogenic disturbances within and across the five ecoregions.

Objective 3. FQA Validation. Validate the FQA methodology for assessing wetland quality in the northeast, including assessing how well various FQA metrics respond to an anthropogenic disturbance gradient and the degree to which those responses vary by natural community types.

Objective 4. Regional Database with Web and Database Tools. Develop tools that will accomplish the following: a) improve the current Universal FQA Calculator for ecologically-based datasets and b) improve NatureServe’s EcoObs database to manage vegetation and site floristic datasets that are needed for FQA applications.

II. METHODOLOGY

A. Study Area and Team

Study Area: EPA Region 1 includes the six New England states of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont). The five EPA level III ecoregions (58, 59, 82, 83, and 84, in Griffith et al. 2009) that cover these states also extend into New York (Fig. 1). For that reason we included the New York part of those ecoregions (but not ecoregions 60 and 62). All seven states were also part of the initial Northeast project of Bried et al. (2012). A large portion of ecoregion 84 occurs in New Jersey, but no C values were available for that state when this project started. Those C value are now available (Walz et al. 2017), and it will be beneficial to re-evaluate our C values for ecoregion 84 in light of the new information.

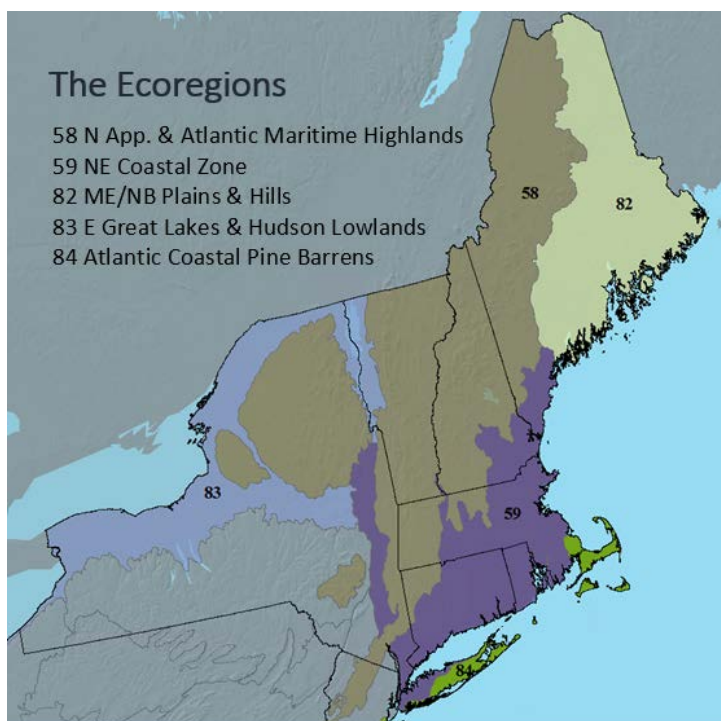


Figure 1. Level III ecoregions (Griffith et al. 2009) in EPA Region 1 (six New England states). The map shows the full extent of the ecoregions in the U.S., except for Ecoregion 84, which extends into New Jersey’s coastal plain.

Team: We formed a team of five state and regional botanists-ecologists, all of whom had extensive experience with a state flora and/or the region’s flora and had experience with prior C value assignments (Table 1). Two of the team members, Don Cameron and Art Gilman were part of the

original state-based FQA process (Appendix 1). Our work was overseen by a Technical Advisory Committee that regularly reviewed our progress (Appendix 2).

Table 1. Members of the Ecoregional Floristic Quality Assessment Team.

State or Region	Name	Affiliation	Primary Ecoregional Responsibility
Connecticut	Kenneth J. Metzler	Adjunct Professor, Environmental Education/Science Education Department, Southern Connecticut State University, New Haven, CT	59, and assist with 83.
Maine	Don Cameron	Botanist/Ecologist, Maine Natural Areas Program, Augusta, Maine.	82, and assist on 58 and 59 for plant species that occur in Maine.
New York	Richard M. Ring	Research Scientist (Botanist), New York Natural Heritage Program, Albany, NY.	83 and 84, an assist with 58.
Vermont	Arthur V. Gilman	Principal, Gilman & Briggs Environmental, Barre, VT.	58, and assist with 83
Northeast Region	Lesley Sneddon	National Ecologist, NatureServe, Boston, MA.	Regional review

B. Method 1. Regional Species List by Ecoregion.

Species List: We collected and compiled existing northeast plant data using the USDA PLANTS database (USDA, NRCS 2016) as the taxonomic authority for the development of our regional list, as was done previously for the region (Bried et al. 2012). This list provided a consistent standard for all state FQA lists within the Northeast Region (www.neiwpcc.org/wetlands/nebawwg.asp), and allowed us to compare our lists with other states and regions that also used USDA PLANTS as their taxonomic source (e.g., the Mid-Atlantic Floristic Quality Assessment Project). We focused on species level taxonomy as the most practical for field biologists using FQA methods, but retained some subspecies or varieties that had distinct C values.

Ecoregional Distribution: We downloaded the USDA PLANTS list for the 7 states in the Northeast Region from the USDA website. We used county distribution to create the initial list of taxa by Level III ecoregion (Fig. 2). County information was available through USDA PLANTS and was supplemented with county data from individual state floras where needed. Where counties straddle the ecoregion line, we added the species to both ecoregions. If a species was only reported from an ecoregion based on a county that straddled the line, we added a question mark to its ecoregion distribution. We added readily available information from PLANTS on nativity, growth form, and duration (annual, biennial, perennial). We also consulted available floras, such as the New England flora (*Flora Novae-Angliae*, Haines 2011) and a recently revised catalogue of the vascular plants of New York (Werier 2017) to help assess nativity and distribution. We continued to update the ecoregional distribution throughout the process.

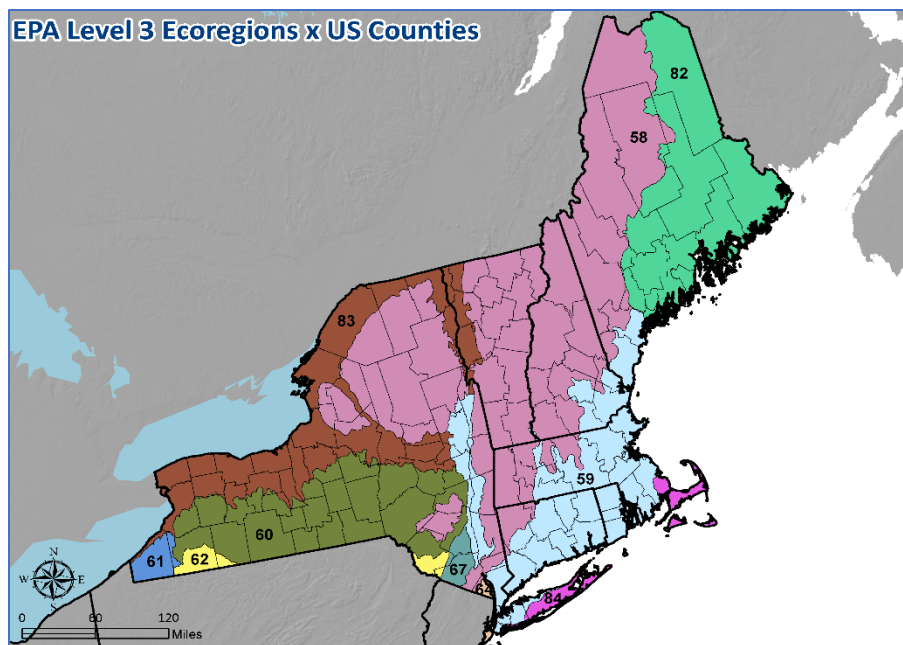


Figure 2. Intersection of county borders with ecoregional boundaries. The large number of counties contained within one ecoregion made it feasible to use USDA PLANTS distribution to generate a first approximation of an ecoregional species list.

C. Method 2. Assigning Ecoregional C values.

C values: Regional coefficient values were assigned based on a scale of 0 to 10 (Table 2), guided by the definitions of Bried et al. (2012).

Table 2. Guiding definitions for coefficients of conservatism, or C values, assigned to the vascular flora of New York and New England (from Bried et al. 2012).

CoC	Criteria
0	Non-native with wide range of ecological tolerances. Often these are opportunistic of intact undisturbed habitats.
1 to 2	Native invasive or widespread native that is not typical of (or only marginally typical of) a particular plant community; tolerant of anthropogenic disturbance.
3 to 5	Native with an intermediate range of ecological tolerances and may typify a stable native community, but may also persist under some anthropogenic disturbance.
6 to 8	Native with a narrow range of ecological tolerances and typically associated with a stable community.
9 to 10	Native with a narrow range of ecological tolerances, high fidelity to particular habitat conditions, and sensitive to anthropogenic disturbance.

Nonnative Species: For species that are nonnative to the entire region (New England and New York), we did not review ecoregional distribution, because if the species is found in any of the ecoregions, its C value is “0” regardless of the ecoregion. But for a species that is native somewhere in the ecoregion, we

displayed the ecoregion where it is nonnative as a “0”, where it is native with a “C value > 0”, and where it is absent, with a blank.

Species and Subspecies or Varieties: When integrating species C values based on the 2011 state lists into a single database, we faced the issue of what to do when one state assigned a C value to a subspecies or variety but the other state did not. We used the following rules:

1. When varieties within a species had the same C value we eliminated the varieties to reduce the taxonomic level of expertise expected to conduct FQAs.
2. If one state completed C values for varieties but other states did not, we eliminated the variety and used the lower C value for the species level C value.

Our goal was to produce an operational list of vascular plant taxa suitable for an ecoregional FQA methodology, not to create a definitive catalogue of the flora of each region.

Initial ecoregional (e)C value Automation: We first automated the process of establishing eC values, using the state based coefficients. We used the following steps to automate the process:

1. We compiled all state-based C values from Bried et al. (2012) into a single database, except that we replaced the 2011 New York FQA list with the version developed at the 2015 workshop (R. Ring pers. comm 2016).
2. We calculate an eC value for each species, in each ecoregion in which it was reported, based on the average of the C values for each state, weighted by the percentage of the state’s area found in the ecoregion. For example, *Abies balsamea* occurs in Ecoregion 83, and in the two states, New York and Vermont, covered by the ecoregion. But in EPA ecoregion 83, NY contains 90.6% of the ecoregion and VT covers 9.4%. In NY, its state C value was 6, and in VT, its state C value was 3. The calculated eC value for ecoregion 83 is thus $(.906 \times 6) + (.094 \times 3) = 5.72$, which was rounded to 6. Expert review then lowered this rank to 5. A more complex example for *Abies balsamea* is shown for ecoregion 58 (Fig. 3).

Northeastern Highlands (58)												
Accepted Name	State-Assigned Coefficients						Ecoregional Coefficients - Summary and Final Values					
	2%	5%	29%	16%	29%	17%	Wtd Avg	Range (state CoC values)	Round Wtd CoC	Accept (Y/N)	Revised CoC	CoC Comment
Abies balsamea	8	7	3	3	6	3	4.2	5	4	Yes	4	

a)

Accepted Name	CoC_58	CoC_59	CoC_82	CoC_83	CoC_84	CoC Range
Abies balsamea	4	6	3	5		3

b)

Figure 3. Explanatory figures for generating ecoregional C values. a) Calculation of an ecoregional score for *Abies balsamea* (balsam fir) in ecoergion 58, using the state C value and the proportion of a state found in the ecoregion. The initial calculation was then reviewed by the lead botanist for the ecoregion (Table 1). If the rounded calculated score was rejected, a note was added. b) Summary of the ecoregional C values assigned to balsam fir in each of the ecoregions in which it occurs. The process is summarized for Ecoegion 58 in Figure a, and the same process was used for the other ecoregions. The final column shows the ecoregional range of 3 (i.e., the lowest C value is 3 and the highest is 6).

- Each ecoregional team lead (Table 1) reviewed the calculated eC value scores for all species in their ecoregion. Team leads flagged all species needing further review or consultations, as well as revised the calculated eC values where they felt appropriate, to produce a first set of eC values for each ecoregion.

Ecoregional workshop review. We reviewed all species needing review at a 2 1/2 day workshop on April 18-20, 2017 at the Albany Pine Bush center. We prioritized our review as follows:

- Our 7-state list initially contained 3697 taxa found in the 5 ecoregions, of which 1172 (32%) are nonnative; their eC value is automatically 0 in any ecoregion in which they occurred (Table 2).
- For the remaining initial list of 2,525 native species, we prioritized our review for species with initial eC value ranges of 3 or more (522 taxa). For example, our spreadsheet showed preliminary eC values for *Abies balsamea* (balsam fir) had a preliminary ecoregional range of 3 (Fig. 3b), whereas *Acer saccharinum* (silver maple) and *Acer saccharum* (sugar maple) both had an ecoregional range of 1. Thus, we examined the eC values for *Abies balsamea* at the workshop, but not for silver or sugar maple. We did not attempt to reconcile the ecoregional range in C values that differed by 1 or 2 (together 1,373 species), as this was too demanding an effort, with little added value.

- d. We conducted expert review for all 552 species to see if there was an ecoregional basis for the distinction. For example, if the differences in eC values between ecoregions could be explained based on differences in species behavior to anthropogenic disturbances (i.e. more tolerant in one ecoregion, less so in another), then distinct eC values were retained. Otherwise, we revised the eC values to be more consistent across ecoregions. For example, expert review supported the different ecoregional scores for *Abies balsamea*, as it occurs more commonly in both disturbed areas and undisturbed natural areas in ecoregion 82, and was more restricted to undisturbed natural areas in ecoregions 59 and 83 (Fig 3b). All expert-based eC values were added back into the database.
- f. We minimized the use of subspecies and varieties. Applying FQA requires good botanical knowledge, and the need for this expertise can limit its application (DeBerry et al. 2015). This challenge increases when subspecies or varieties of a species have distinct C or eC values. We retained subspecies in our taxa list whenever they had eC values greater than 2. But, this adds an additional taxonomic burden to the user, and we have added a species-based eC value for all species with differing subspecies or variety eC values, by taking the lower of the two values, except in the case of the native versus nonnative subspecies or variety, where we took the average. For example, high bush cranberry, which is treated as a single species in USDA PLANTS and in *Flora Novae-angliae* (*Viburnum opulus*), contains a native subspecies (*Viburnum opulus* ssp. *trilobum*) and a European subspecies (*Viburnum opulus* ssp. *opulus*). The native subspecies has eC values that range from 3 (ecoregion 84) to 4 (ecoregions 58, 59, 83), whereas the nonnative subspecies has an eC value of 0 wherever it occurs.
- g. We uploaded all of our decisions, including a few changes to be consistent with USDA PLANTS, on eC values into our ecoregional database and made them available for public review. Review comments helped clarify ecoregional distribution of nonnative species, and those changes were added to the database.

D. Method 3. FQA Validation

We compiled two datasets to test FQA metrics, using both the old state C values and the new eC values. The two data sets were made available by the Maine Natural Areas Program and the Vermont Natural Heritage Inventory. Both programs are part of the Natural Heritage Network and have, as part of their mission, the documentation of exemplary or best extant locations of natural communities across their state. Thus, these sites represent reference standard conditions. The Maine data set contained a wider range of conditions, as the goal of their study was to gather data across the disturbance gradient. A primary method used by the Network for determining condition is the Element Occurrence (EORANK). For ecological communities, EORANKs provide a succinct assessment of estimated ecological integrity and probability of persistence of an occurrence, based on assessment of its condition, size, and landscape context (NatureServe 2002, Faber-Langendoen et al. 2016). The ecological integrity component of an EORANK is particularly focused on the condition and landscape context factors, with size added in as part of overall persistence and conservation value (Faber-Langendoen et al. 2016). We used either condition and landscape context together (= ecological integrity score), or condition rank alone to determine the “condition gradient,” depending on available program data. The gradient varies from A (intact or excellent rating) to D (severely disturbed, or poor) (Table 1 in Faber-Langendoen et al. 2016). The occurrences or locations to which these ranks are applied vary from small patches to large extents of a natural community types. Both programs also collected plot data within an occurrence and placed the plot in a representative part of the occurrence. Plots were 400 m² in size. A standard set of vegetation data were collected, including a full vascular plant species list, with cover estimates, and a

vegetation structure profile. For the Maine data, some locations were sampled using a meandering species list with cover values, but we included these data too, because species richness and mean C values were not significantly different between this method and their plot data methods.

The Maine data included 151 wetlands sites, with the bulk of the data concentrated in the two best documented types: large floodplain forests (115) and northern swamps (25) (Schlawin 2018). Vermont data included 398 plots, across five types: hardwood swamps (31), softwood swamps (24), open alkaline peatlands (22), open acidic peatlands (67), and oak-pine-northern hardwood forests (24). Maine projects gave greater emphasis to documenting the full range of swamp and floodplain conditions, so sites spanned the condition (ecological integrity) gradient from A to C. In addition, Maine used a scoring technique that provided a continuous scoring of condition from 4.0 (excellent) to 1.0 (poor). Because Vermont data emphasized the most exemplary stands, we largely focused on A and B condition comparisons with their data.

Data from both states were standardized to USDA PLANTS taxonomy. Plot coordinates were used to determine which ecoregion a plot was in, and eC values for that ecoregion were used to calculate both Mean C and Cover Weighted-Mean C (CW-Mean C) metrics (DeBerry et al. 2015). Most of Vermont (~90%) is covered by ecoregion 58, with small areas of ecoregion 83 (9%), and 59 (~1%). Maine is covered almost equally by Ecoregions 82 (~55%) and 58 (~42%), with a small sliver of ecoregion 59 (~3%). Maine staff calculated the FQA metrics using both the old state C values and the new eC values in their database, and then exported the metric scores to the NatureServe team. Vermont data were imported into NatureServe's EcoObs database (Faber-Langendoen et al. 2016), where FQA metric scores were calculated. Vermont data will also be exported to VegBank (vegbank.org), where they will be made publicly available.

Validation Analysis 1. Ecoregional C value validation. We assessed whether the FQA metrics based on the eC value assigned to a species improved our interpretation of its response to the ecological integrity or condition gradient, as compared to the FQA metric values that used the original state C values. We did this comparison to determine if FQA metrics based on eC values showed a better response to an anthropogenic disturbance or condition gradient than did FQA metrics based on state C values. Our data sets were all within a state, so our validation test is fairly stringent – that is, we are testing whether, within a state that has two or three ecoregions, metrics based on eC values improved our assessment of condition over the state C values. Criteria for assessing improvement included a) higher r^2 value in a regression of FQA metrics in relation to a condition gradient (Maine), and b) higher F value in a boxplot/ANOVA comparison of FQA metric scores in relation to A, B and C condition ratings (Maine, Vermont).

Validation Analysis 2. Do FQA Metric Responses vary by Wetland Type? We compared values for two FQA metrics: Mean C and CW-Mean C. In Maine, we assessed scoring across A, B, and C ranked sites for the two wetland types. For Vermont, we focused on the A and B ranked sites for five natural community types.

We used R version 3.4.2 for statistical analyses (R Development Team 2017). Mean scores among condition ratings from the one-way ANOVAs were compared using Tukey HSD.

E. Method 4. Regional Database with Web and Database Tools

Field data that are needed for FQA metrics typically consist of a comprehensive species list for a plot or site, with an estimate of canopy cover (see Validation above). Data management tools are needed for both the core FQA data themselves (i.e., species lists in a plot or site, cover values, ecoregion and state location, and C values) and the full suite of site data associated with such records (location, ownership, vegetation structure, soil conditions, hydrology conditions, management observations etc.). Although it would be highly desirable to have an integrated set of web tools, our goal was limited: to ensure that users have both web and desktop database tools that readily provide these functions, even if not all in one tool. Our methods were designed to build on existing tools.

Improved Website Capabilities of Universal FQA Calculator: The Universal FQA Calculator website (universalfqa.org) provides a basic interface tool that a) contains the typical fields needed for entering in FQA data, and b) provides a way to download the data in a spreadsheet after it is entered. But it had several limitations in handling vegetation plot data, calculating metrics based on cover data, and documenting ecological characteristics of a site. We worked with Will Freyman, the website designer, to enhance the functionality of the website to address these limitations.

Improved functionality of NatureServe's EcoObs Database tool: NatureServe has designed a Microsoft Access® vegetation plot database called EcoObs (or Ecological Observations) to manage plot data within and across states (Faber-Langendoen et al. 2016). The database provides the capability to manage C values and species taxonomy (including synonymy between different floristic standards (such as USDA PLANTS and *Flora Novae Angliae*). It is already in use in neighboring states of the Northeast, including Pennsylvania and New Jersey, and is now being used in New Hampshire. We added a number of improvements to make it usable for handling eC values and calculating a variety of FQA metrics. We demonstrated its functionality in the process of completing our validation analyses (see above).

III. RESULTS AND DISCUSSION

A. Regional FQA Species List

Our final list of species for the 5 ecoregions combined contained 3441 species, of which 1067 (31.0%) were nonnative and 2374 are native (Table 3). We focused on species level C values, as that is the most practical level for field biologists, but eventually we also retained 152 subspecies or varieties when they had distinct C values (excluding species for which there was only one subspecies or variety in our region). We also retained 42 hybrids. For practical reasons we also retained 81 genera, whose species were all exotic, because a field biologist would only need to know the genus in order to confidently assign a C value of 0. Thus our full final list included 3686 taxa with 1176 exotic taxa.

Our list of taxa needed for FQA assessments (3697 taxa) cannot be compared directly with than that of Bried et al. (2012), because we sought to make the taxonomy as operation as possible, by only retaining

subspecies or varieties where C values differed. Bried et al. (2012) reported 4511 vascular plant taxa in the region, of which 1437 (31.8%) were nonnative in one or more states, leaving 3074 native taxa.

B. Ecoregional Distribution and C value

Distribution: We initially generated a list of taxa by ecoregion, which we then revised through team-based expert review. This review generated our working list of taxa by ecoregion, and for which our botanical team reviewed all C values for taxa with an ecoregional range of 3 or more. Our species level counts by ecoregion were: *ecoregion 58*: 3059 species, 919 exotic; *ecoregion 59*: 2809 species, 989 exotic; *ecoregion 82*: 2302 species, 1076 exotic; *ecoregion 83*: 3072 species, 1066 exotic; *ecoregion 84*: 2019 species, 481 exotic. The count for ecoregion 84 is low, because less than half of the ecoregion was included in our study area.

Ecoregional C value: Prior to the workshop, we generated an initial list of 552 native taxa (21.8% of all native taxa) with ecoregional ranges of 3 or more. After workshop review, we retained only 143 native taxa (5.7% of all native taxa) with ecoregional ranges of 3 or more (Table 3). Furthermore, prior to the workshop 109 species had ecoregional ranges of 5 or more, whereas after the workshop only 9 did.

These 9 species are reported in Table 4. Further review of the ecoregional values for these species is needed.

Table 3. Spread of eC value ranges across all taxa. Ecoregional range represents the maximum difference in eC values across the 5 ecoregions. See Figure 3 for process of determining ecoregional range. Total taxa include some genera, subspecies, varieties and hybrids. The total species count for the five ecoregions is 3441.

Ecoregional Range of C values	Total Taxa	
	PRE WORKSHOP	POST WORKSHOP
0	836	987
1	688	805
2	466	576
3	298	112
4	145	22
5	54	5
6	33	3
7	18	1
8	4	0
Total Native Taxa	2525	2510
Total Nonnatives	1172	1176
TOTAL TAXA	3697	3686

Table 4. The taxa with the largest ecoregional range in C-values; that is, where ecoregional range of eC values is ≥ 5 . Nine species are shown, in alphabetical order.

Accepted Symbol	Accepted Name	eC Value by Ecoregion					
		58	59	82	83	84	Range
CHBE4	Chenopodium berlandieri	5	5	2	8	8	6
CUCE	Cuscuta cephalanthi	6	5		10	6	5
LEMO8	Leymus mollis	5	8	6		10	5
POBU2	Polygonum buxiforme	4	5	7	1	5	6
POER2	Polygonum erectum	4	5	2	8	6	6
PORA3	Polygonum ramosissimum	4	6	5	1	3	5
PSMI6	Pseudognaphalium micradenium	10	5		10	10	5
SALY2	Salvia lyrata	10	3		10		7
THOC2	Thuja occidentalis	5	8	3	5	7	5

C. FQA Validation

Validation Analysis 1. Ecoregional C value validation.

In Maine, the CW-Mean C metric showed a positive correlation to a condition gradient (EIA score based on condition and landscape context) using both old state and new eC values, affirming the overall usefulness of this FQA metric in tracking wetland condition (Fig. 4a). The relationship was much stronger for swamps than for floodplain forests (Fig. 4b, c), indicating that floodplain forests tended to have more generalist species that span the disturbance gradient. In addition, for all types and for large river floodplains, the metrics based on the new eC values typically showed a modest improvement in responding to wetland condition, as compared to the metrics based on old state C values (Fig. 4, Table 5). The metrics based on eC values were also typically higher than the metrics based on the state C values. There was a slight, but not significant, improvement in the responsiveness of eC values to the gradient, as shown in the slightly steeper slope of the relationship, especially for the “all wetland types” regression (Fig 4a). A steeper slope is an improvement because it means that there is a stronger metric response to the gradient of fair to excellent sites.

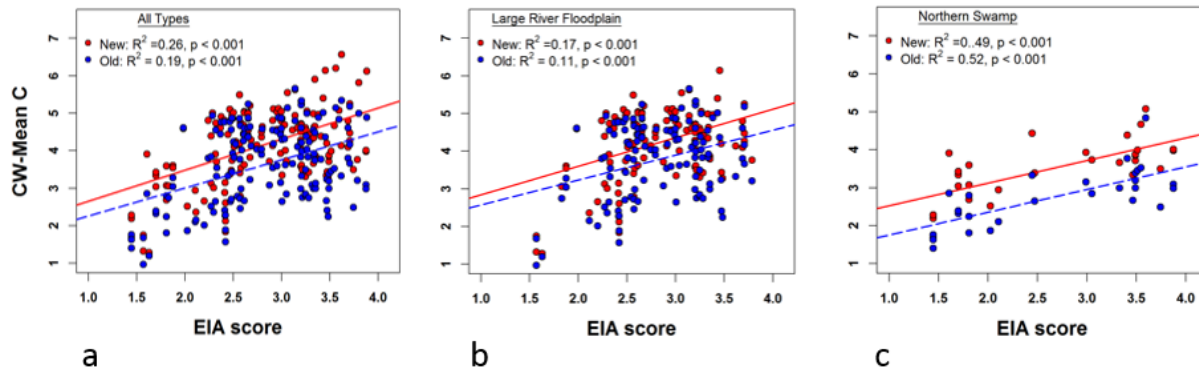


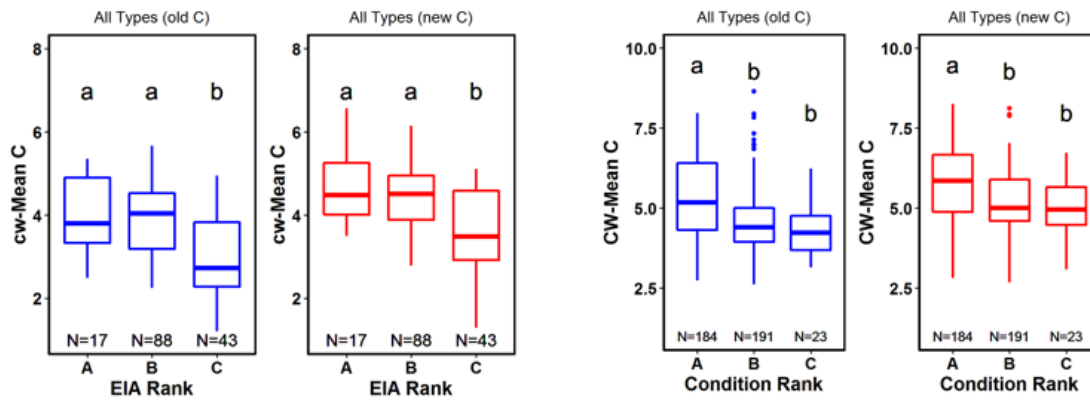
Figure 4. Maine data. Response of the Cover Weighted-Mean C metric to a “condition gradient,” based on the ecological integrity assessment (EIA) score. a) All wetland types, b) large floodplain forest, c) northern swamp.

Table 5. Maine Data. Response of the Cover Weighted-Mean C and Mean C metrics to a “condition gradient” when based on state C values or eC values (see also Fig. 2). AIC (Akaike Information Criterion) is an estimator of the relative quality of the two regression models, with lower values indicating a better fit. The relative likelihood statistic compares the likelihood that the eC values model is better than the state C values model, with higher values indicating a better model. ***p < 0.001

	r^2		AIC		Relative Likelihood	
	State C	eC	State C	eC	StateC	eC
All Wetlands						
Mean C	0.28***	0.31***	264.4	236.3	< 0.001	0.99
CW-Mean C	0.19***	0.26***	411.4	379.2	< 0.001	0.99
Large Floodplain						
Mean C	0.12***	0.19***	169.8	159.3	< 0.01	0.99
CW-Mean C	0.11***	0.17***	315.2	287.4	< 0.001	0.99
Northern Swamp						
Mean C	0.60***	0.55***	29.3	37.8	0.986	0.014
CW-Mean C	0.52***	0.49***	46.8	50.8	0.88	0.12

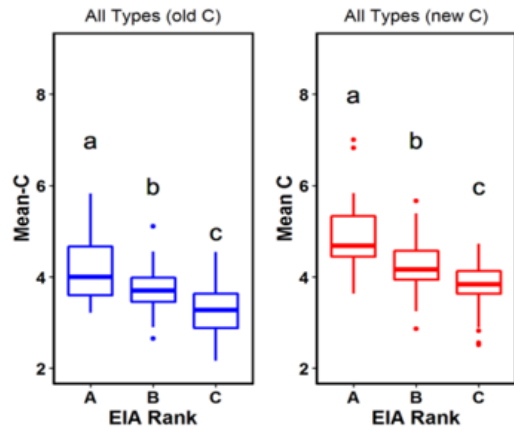
A categorical view of the FQA metrics response to the condition gradient was also informative for both Maine and Vermont data (Fig. 5). When comparing all sites, the CW-Mean C scores were significantly different between either A versus B and C, or A and B versus C (Fig 5a, b). In Maine, the same pattern was observed for Floodplain Forests and Northern Swamps, all types (Fig. 6). These results appear to be affected by sample size, because Maine data were low for A ranked sites and Vermont data were low for C ranked sites. By comparison, the Mean C metric for Maine showed distinct scores for A, B, and C sites (Fig. 5c). Further investigation is needed to determine why it performed better than the CW-Mean C metric with the Maine dataset, but it may have to do with the different eC-values for *Thuja occidentalis*

in ecoregion 82 versus 58, combined with changes in abundance that may not reflect changes in condition (J. Schlawin pers. comm 2018).



a. Maine – all types

b. Vermont – all types



c. Maine – all types

Figure 5. Maine and Vermont data, comparing categorical response of FQA metric scores to condition ratings across all types. a) CW-Mean C for Maine, b) CW-Mean C for Vermont, c) Mean C for Maine.

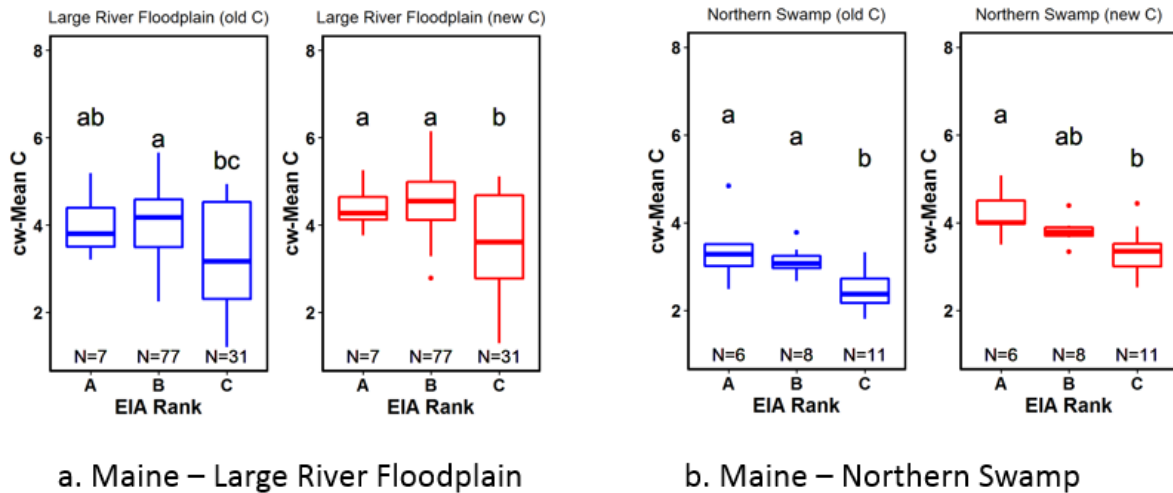


Figure 6. Maine data, comparing categorical response of Cover Weighted-Mean C values to condition ratings. Data are shown for specific wetland types: a) Large River Floodplain (115 sites) and b) Northern Swamp (25 sites). The number of plots for A ranked sites is low.

Validation Analysis 2. Do FQA metric Responses vary by Wetland Type?

Previous analyses looked at metric responses to the condition gradient both in general and by community type. Here we asked whether the level of response in metric scores differed by wetland types. We had sufficient data to address this for A-ranked sites for both Maine and Vermont data. Vermont data for both Alkaline and Acidic Peatlands had significantly higher CW-Mean C values than did Hardwood or Conifer Swamps (Fig. 7a). The CW-Mean C scores for Maine swamps were also comparable to Vermont's swamps in CW-Mean C values (Fig. 7b) (we did not have sufficient floodplain forest data in Vermont to compare with Maine floodplain forests). These trends are consistent with those of Bourdaghs (2012), who also reported the highest mean C values for A-ranked sites in open and conifer bogs. Peatlands tend to have more conservative species, even though species richness is low (species richness in 400 m² plots in Vermont varied in A and B sites from 11-13 for both peatland types, as compared to 22-24 for softwood swamps and 40-44 for hardwood swamps).

By integrating the analyses shown in Figures 4 and 5, our data suggest how thresholds for FQA metrics scores can be generated for distinguishing A ranked sites from B or C ranked sites. For both the Large River Floodplain and Northern Swamp sites in Maine, the Cover Weighted-Mean C score was significantly different between A and C ranked sites, but the differences (and our ability to set thresholds) was stronger for Northern Swamps (Fig. 7b).

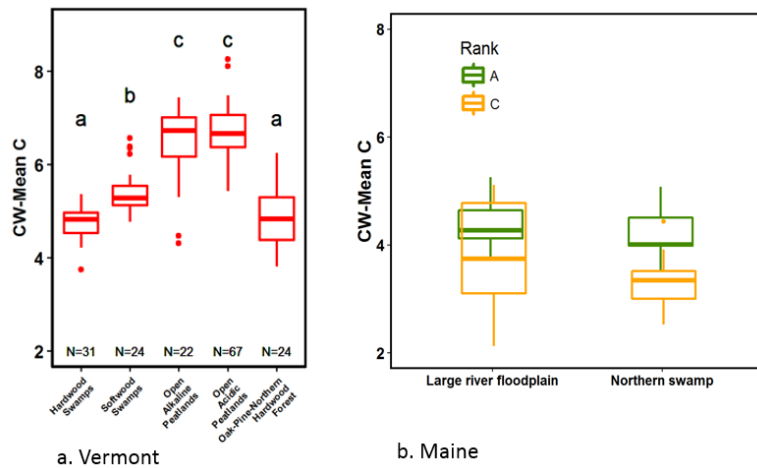


Figure 7. Comparison of Mean C and Cover Weighted Mean C scores across natural community types in a) Vermont – 5 types, all A-ranked sites: hardwood swamps (31), softwood swamps (24), open alkaline peatlands (22), open acidic peatlands (67), and oak-pine-northern hardwood forests (24). b) Maine – 2 types, showing A and C ranked sites: Large river floodplain (115) and Northern Swamp (25). CW-Mean C is based on the eC Values.

We draw the following conclusions from these validation analyses:

- FQA metrics based on either state or ecoregional (e)C values showed a positive response to a wetland condition gradient, validating the FQA metrics as a valuable tool for assessing wetland condition.
- Metrics based on eC values often showed a minor to moderate improvement in tracking changes in condition, suggesting eC values better reflected changes in a species behavior across its range, even within a state. We can expect that comparisons made across states would show even more improvement, and our development of eC values makes that possible. Although these improvements were not substantial, they may reflect the degree to which many northeast states are relatively small and ecologically homogeneous, such that ecological behavior did not differ strongly within any given state. This also translated into a need for only modest modification of C values when integrating state C values into eC values.
- We emphasized Cover Weighted-Mean C scores in our comparisons, but Mean C scores sometimes performed as well or better (e.g., Fig. 3a vs 3c). Further exploration of the choice of metrics for assessing wetland condition is needed.
- Metrics scores differed by community type using both state and eC values, but eC values showed a tighter set of values for A-ranked thresholds across community types. Better datasets are needed that span the full condition gradient in order to set metric thresholds. In addition, it will be helpful to have consistent wetland classifications within and across ecoregions to guide the setting of these thresholds.
- Finally, the moderate to low correlations between FQA metrics and the condition ratings suggest that other factors in wetland condition are not accounted for by the FQA metrics. These findings support the use of other vegetation metrics to more fully account for wetland condition, as done by

EPA's vegetation multi-metric index (VMMI), or even a larger suite of wetland condition metrics, including hydrology, soils and buffer (Faber-Langendoen et al. 2016).

D. Web and Database Tools

Web Tool – Universal FQA Calculator

We enhanced the universal FQA website by making the following changes to the universalfqa.org website:

- Allow users to create, edit, save, and delete plots.
- For each plot, allow users to enter:
 - Basic plot information, including:
 - Name
 - Description
 - Size of plot
 - Cover method
 - Location
 - The ecoregion in which the plot resides
 - Field team members
 - Environmental description
 - Stratum method
 - Subplot method
 - List of species found within the full plot, including subplots/quadrats and “rest of plot.” Each list entry includes:
 - Species
 - Cover class or percent coverage
 - Sub-plot (if applicable)
 - The community type the plot represents, or for site lists, the one or more community types found at the site.
 - Fields for recording ecoregion and state in the FQA lists. Allows users to quickly find available state and *eC values* for their projects.
 - Updated help page on the FQA website.

All of these changes are detailed in Appendix 4. All 5 ecoregional FQA databases/spreadsheets have been uploaded to the website and are now publicly available:

- There are separate spreadsheets for each ecoregion:
 - 58, 59, 82, 83, 84
- The spreadsheets indicate which states these ecoregions apply to:
 - 58 CT, MA, ME, NH, NY, VT
 - 59 CT, MA, NH, NY, RI, VT
 - 82 ME
 - 83 NY, VT

- 84 MA, NY, RI (a sliver on Block Island).

The website has a download capability, so that data entered on the website, could, if desired, be imported into EcoObs for ongoing data management. Formal integration of the website with EcoObs was not feasible, as EcoObs is an Access Database, not suitable for the kind of dynamism required for a website, where multiple users could be putting in data simultaneously. Building a whole new web database was also not feasible. Rather, the upgraded Universal FQA Calculator website and the EcoObs regional database provide compatible ways for getting access to the ecoregional FQA information and calculations, with limited interoperability.

Database Tool - EcoObs

We upgraded the EcoObs (or Ecological Observations) database to serve as a regional database tool, one that readily provides FQA calculations. Wetland field assessment data typically include a comprehensive species list for a plot or site, with an estimate of canopy cover. These data are now readily linked to the FQA database with its C or eC values to generate a wide variety of FQA metrics (Fig. 8). The database already provides the capability to manage species (including synonymy between different floristic standards, such as USDA PLANTS and *Flora Novae Angliae*) and their FQA values. Thus it provides the needed data management tools for Northeast FQA data.

Figure 8. Screenshot of FQA indices and related metrics that can be calculated in NatureServe's EcoObs database.

Improvement made to the EcoObs database as part of this project include:

- Allows for calculation of rapid FQA based on a threshold for species cover (e.g., only include species with $\geq 5\%$ cover)
- VMMI and component metrics:
 - Floristic Quality Index
 - Relative Importance of Native Plant Species
 - Count of Disturbance Tolerant Species
 - Relative Native Monocot Cover
- Relative Native Cover
- Total Native Cover
- Total Nonnative Cover
- Calculate FQA metrics by growth form (trees, shrubs, herbaceous, nonvascular)

IV. CONCLUSIONS

A. Project Results

Regional Species List by Ecoregion.

A list of plant species, based on USDA PLANTS (USDA, NRCS 2016) is provided for the project area and for each of the five Level III ecoregions in the Northeast. Our full project list included 3686 taxa with 1176 exotic taxa. Within this list, we recorded 3441 species, of which 1067 (31.0%) were nonnative and 2374 are native.

Ecoregional C values.

We focused on species level *eC* values, as that is the most practical level for field biologists, but we also retained 152 subspecies or varieties when they had distinct C values (excluding species for which there was only one subspecies or variety in our region), as well 42 hybrids and 81 genera, whose species were all exotic. Only 9 taxa had *eC* values with a range of 5 or more across the 5 ecoregions.

FQA Validation.

The ecoregional based FQA metrics were validated using datasets from Maine and Vermont. FQA metrics for assessed wetland condition performed better when using the *eC* values as compared to state C values. Metric scores for A-ranked sites differed significantly by natural community type.

Web and Database Tools.

We built on the existing strengths of the universal FQA website (universalFQA.org) and NatureServe's database tools, particularly EcoObs, to provide tools that a) makes available all C values for the Northeast Region, by ecoregion and b) manages the plot and site data that are submitted for FQA calculations, and c) has either a web-based or Access-based data entry tool for species lists. EcoObs is available to partners, and is in use within the NatureServe Network and among various state agencies.

B. Future Considerations:

It is difficult to establish an ecoregional species list, because plant distribution data are not readily available at the county level. Further, maintaining the ecoregional list will be difficult because plant distribution data are not typically managed using Omernik ecoregions. Still, our current ecoregional lists, with their emphasis on species level taxonomy, appear to be comprehensive enough to meet most FQA needs.

The number of ecoregional variants is relatively low as a percentage of the region (or state) flora. Future consideration in developing ecoregional species lists would be to coordinate them with state-based species lists, where a state list is amended to include ecoregional variants, where needed. Users could then choose either a state-wide C value or an eC value.

Our eC values for New York did not include Ecoregion 60 (High Allegheny Plateau). And our assessment of Ecoregion 84 (Coastal Plain) did not include the New Jersey portion. New Jersey has now completed a state FQA list (Kathleen Walz pers. comm. 2017). By completing the New York ecoregions and integrating New Jersey FQA results into a Northeast and MidAtlantic ecoregional products, EPA and wetland assessment partners would have access to a comprehensive set of ecoregional scores from Maine to the Carolinas.

The completion of this product opens up the possibility of developing regional wetland reference datasets that can serve as benchmark sites for multiple projects, including restoration and mitigation evaluations and statewide wetland assessments (Brooks et al. 2016). These efforts will be further enhanced by the use of consistent regional and national classification systems that allow wetland ecologists to standardize the use of FQA metrics by wetland types (Bourdagh's 2012). In the northeast, state natural community classifications are already integrated into the U.S. National Vegetation Classification (usnvc.org), providing a ready solution to standardizing wetland classifications. In addition, the Hydrogeomorphic (HGM) classification also provides an important guide to standardizing wetland assessments.

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VI. APPENDICES

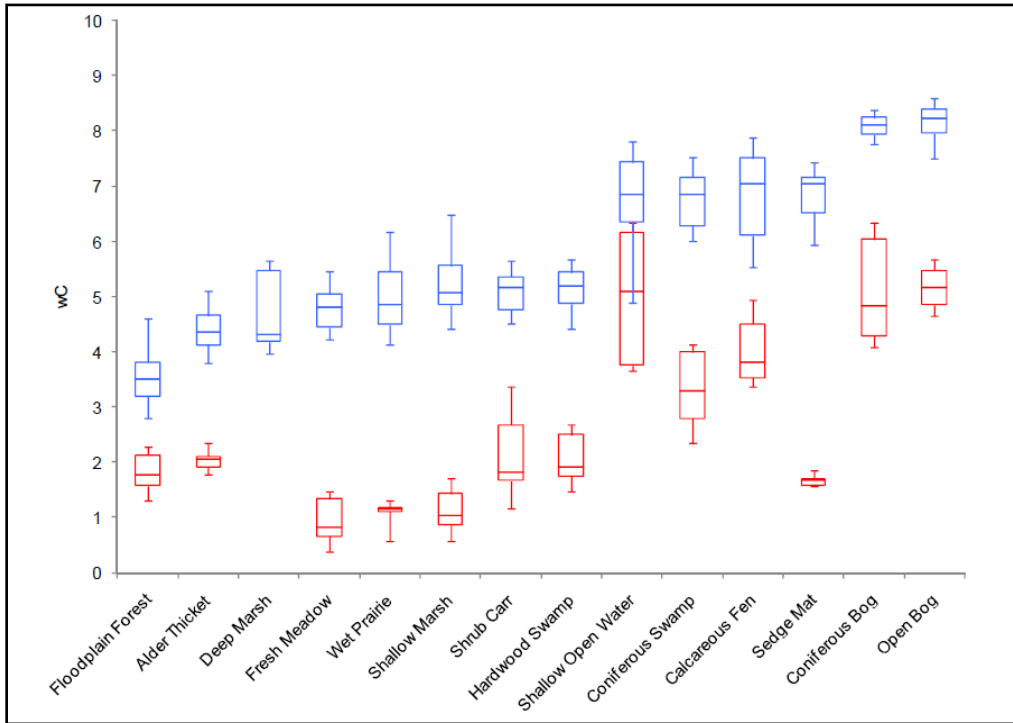
APPENDIX 1. Members of the 2012 State-Based FQA for New England and New York (Bried et al. 2012).

State	Name	Affiliation
Connecticut	Don Schall	
Maine	Matt Arsenault and Sue Gawler	
Massachusetts	Ted Elliman	
New Hampshire	Dan Sperduto	
New York	Dave Werier and Steve Young	
Rhode Island	Rick Enser	
Vermont	Art Gilman	

APPENDIX 2. Members of the Technical Advisory Committee.

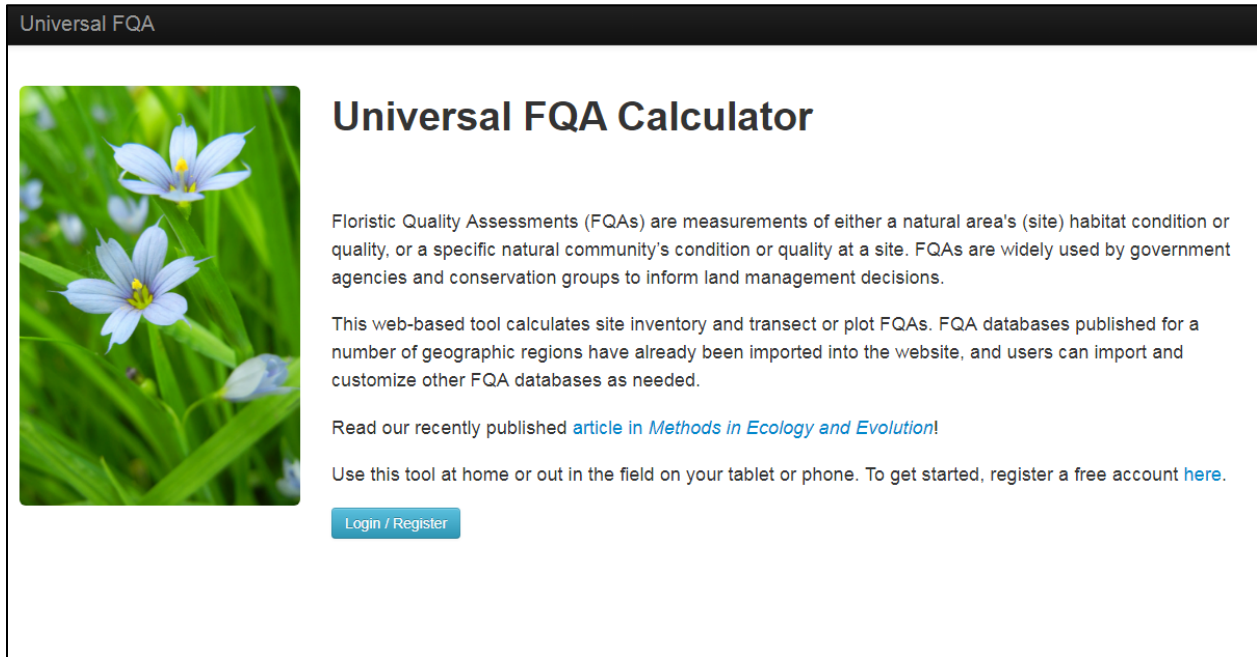
Name	Agency or Organization
Alafat, Beth	Environmental Protection Agency
Connors, Beth	Maine Department of Environmental Protection
Crystall, Sandy	New Hampshire Department of Environmental Services
DiFranco, Jeanne	Maine Department of Environmental Protection
Friesner, Richard	New England Interstate Water Pollution Control Commission
Gilmore, Robert	Connecticut Department of Energy and Environmental Protection
Hohn, Charlie	Vermont Department of Environmental Conservation
Jennings, Michael	New England Interstate Water Pollution Control Commission
Kucher, Tom	Rhode Island Natural History Survey
Lapierre, Laura	Vermont Department of Environmental Conservation
Murphy, Carol	Rhode Island Department of Environmental Management
McHugh, Mike	Massachusetts Department of Environmental Protection
Minkin, Paul	U.S. Army Corps of Engineers
Nichols, William	New Hampshire Natural Heritage Bureau
Rhodes, Lisa	Massachusetts Department of Environmental Protection
Roth, Kim	New England Interstate Water Pollution Control Commission
Smith-Williams, Donna	US Environmental Protection Agency
Wernerehl, Bob	Massachusetts Natural Heritage & Endangered Species Program

APPENDIX 3. Example of calibration of FQA metrics by ecological community type (Bourdagh 2012).



Appendix 3 - Figure. Box and Whisker plots based on weighted mean C-values (wC) for a range of community types in Minnesota. Blues plots display the distribution of scores on minimally disturbed sites (presettlement conditions) and red plots display the distribution of scores on severely disturbed sites. Sites are arranged according to an increasing wC-values for the minimally disturbed sites (from Bourdagh 2012).

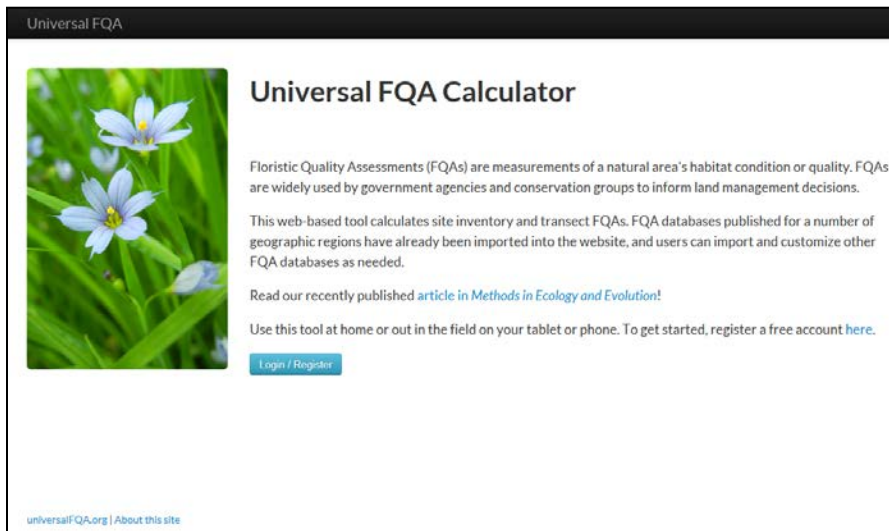
A. APPENDIX 4. Screen shots of UniversalFQA.org website and improvements



SUMMARY OF CHANGES TO UNIVERSAL FQA WEBSITE.

Home Page

PREVIOUS




REVISION – no change

About this Website:

PREVIOUS

Universal FQA



About this website

The [Universal Floristic Quality Assessment \(FQA\) Calculator](#) is an open source project licensed for use under [GPLv3](#). Get the code on [GitHub](#).

The [Universal FQA Calculator](#) is completely free for any user, and was developed for [Openlands](#) by [Will Freyman](#). Questions or comments should be sent to willfreyman@gmail.com.

Photo of *Sisyrinchium angustifolium* © [Lisa Culp](#). Used with permission.


Citation:
Freyman, W.A., L.A. Masters, and S. Packard. 2016. The Universal Floristic Quality Assessment (FQA) Calculator: an online tool for ecological assessment and monitoring. *Methods in Ecology and Evolution* 7(3): 380–383

Read the article [here](#). If you publish an assessment you should also cite the FQA database used to calculate the assessment.

universalFQA.org | [About this site](#)

REVISION – NatureServe contribution noted

Universal FQA



About this website

The [Universal Floristic Quality Assessment \(FQA\) Calculator](#) is an open source project licensed for use under [GPLv3](#). Get the code on [GitHub](#).

The [Universal FQA Calculator](#) is completely free for any user, and was developed for [Openlands](#) by [Will Freyman](#). Questions or comments should be sent to willfreyman@gmail.com.


Enhancements to this site were developed by  [NatureServe](#), a nonprofit conservation science and technology organization providing the scientific basis for effective conservation action.

Photo of *Sisyrinchium angustifolium* © [Lisa Culp](#). Used with permission.


Citation:
Freyman, W.A., L.A. Masters, and S. Packard. 2016. The Universal Floristic Quality Assessment (FQA) Calculator: an online tool for ecological assessment and monitoring. *Methods in Ecology and Evolution* 7(3): 380–383

Read the article [here](#). If you publish an assessment you should also cite the FQA database used to calculate the assessment.

universalFQA.org | [About this site](#)

Login

PREVIOUS



Welcome to the Universal FQA Calculator

To save site inventory and transect FQA studies, or to upload and share regional FQA databases you will need to create a free account.

Already have an account?

Email:

Password:

[Lost your password?](#)

Create new account:

First name:

Last name:

Email:

Password:


Password (again):

[universalFQA.org](#) | [About this site](#)

REVISION – no change

Your Assessments

PREVIOUS



Your Assessments

[New Inventory](#) [New Transect](#) [Download Summary](#) [View All Public Assessments](#)

Your Inventory Assessments


Assessment Name	Date	Site	Practitioner	FQA Database	Public / Private	Options
Charles Pond SNA EIA	2016-08-24	Charles Pond SNA	Andy Clark, Shannon Menard	Wisconsin - Midwest Region, 2014	public	View Edit Download Delete
Old field	2016-08-22	Bat Bunker Oldfield	Don Faber-Langendoen	Michigan, 2014	public	View Edit Download Delete
Rapid Assessment 2016	2016-07-28	Bat Bunker Woods	Don Faber-Langendoen	Michigan, 2014	private	View Edit Download Delete

Your Transect Assessments

Assessment Name	Date	Site	Practitioner	FQA Database	Public / Private	Options
June1 2017 demo	2017-06-01	Bat Bunker Beach	DFL	Appalachian Mtn (EPA Ecoregions 66,67,68,69) of KY, TN, NC, SC, GA, AL, 2013	public	View Edit Download Delete
Charles Pond SNA L3	2016-08-24	Charles Pond SNA	A. Clark, S. Menard	Wisconsin - Midwest Region, 2014	public	View Edit Download Delete
Bat Bunker Woods Macroplot1	2016-08-22	Bat Bunker Beach	Don Faber-Langendoen	Michigan, 2014	public	View Edit Download Delete

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REVISION- Addition of the "...Plot Assessment" option. And Cover Method is specified.



Your Assessments

[New Inventory](#) [New Transect/Plot](#) [Download Summary](#) [View All Public Assessments](#)

Your Inventory Assessments

Assessment Name	Date	Site	Practitioner	FQA Database	Public / Private	Options
Charles Pond SNA EIA	2016-08-24	Charles Pond SNA	Andy Clark, Shannon Menard	Wisconsin - Midwest Region, 2014	public	View Edit Download Delete
Old field	2016-08-22	Bat Bunker Oldfield	Don Faber-Langendoen	Michigan, 2014	public	View Edit Download Delete
Rapid Assessment 2016	2016-07-28	Bat Bunker Woods	Don Faber-Langendoen	Michigan, 2014	private	View Edit Download Delete

Your Transect **Plot** Assessments


Assessment Name	Date	Site	Practitioner	FQA Database	Public / Private	Cover Method	Options
June1 2017 demo	2017-06-01	Bat Bunker Beach	DFL	Appalachian Mtn (EPA Ecoregions 66,67,68,69) of KY, TN, NC, SC, GA, AL, 2013	public	% Cover (0 - 100)	View Edit Download Delete
Charles Pond SNA L3	2016-08-24	Charles Pond SNA	A. Clark, S. Menard	Wisconsin - Midwest Region, 2014	public	% Cover (0 - 100)	View Edit Download Delete
Bat Bunker Woods Macroplot1	2016-08-22	Bat Bunker Beach	Don Faber-Langendoen	Michigan, 2014	public	% Cover (0 - 100)	View Edit Download Delete

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HELP TAB - Introduction

VI-7

PREVIOUS



Documentation

[Introduction](#) [FAQ](#) [Terminology](#)

Floristic Quality Assessments (FQAs) are measurements of a natural area's habitat condition or quality. FQAs are widely used by government agencies and conservation groups to inform land management decisions.

This web-based tool calculates site inventory and transect FQAs. FQA databases published for a number of geographic regions have already been imported into the website, and users can import and customize other FQA databases as needed.

For more information, see:

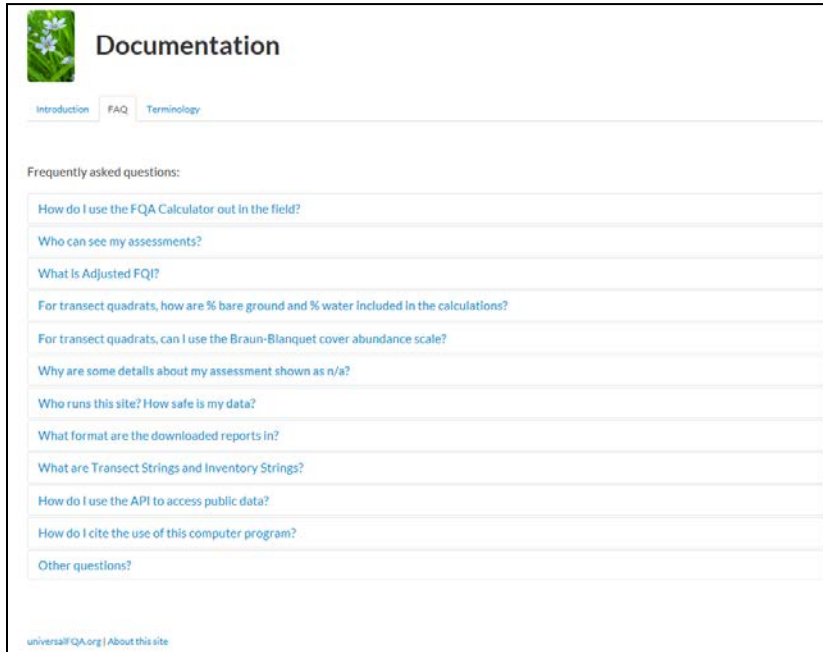
- [Frequently Asked Questions](#)
- [Terminology and Calculations](#)

universalFQA.org | [About this site](#)

REVISION – no change

HELP TAB – FAQs

PREVIOUS



Documentation

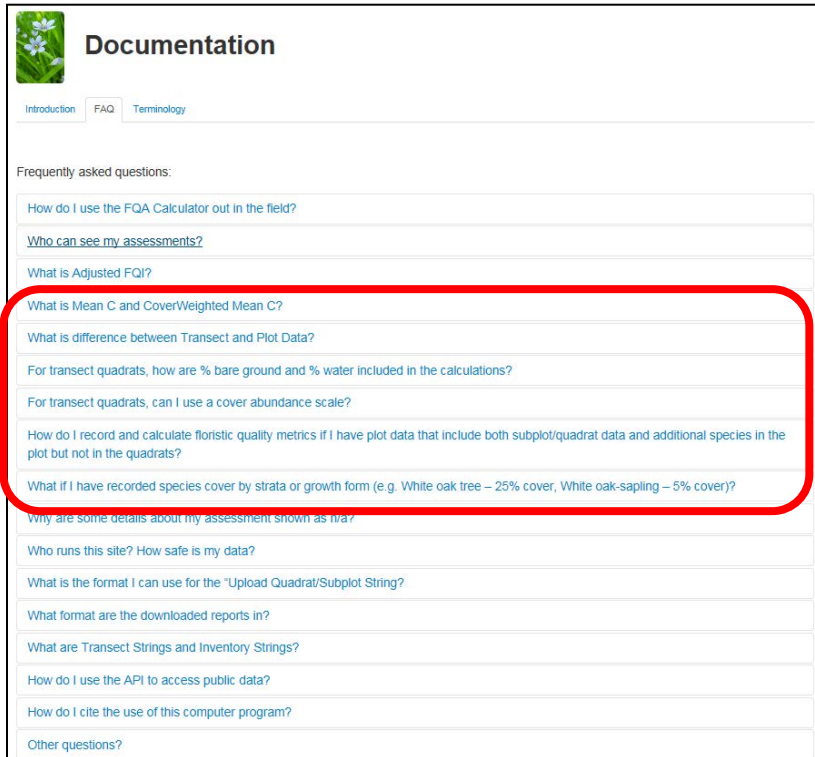
Introduction **FAQ** Terminology

Frequently asked questions:

- How do I use the FQA Calculator out in the field?
- Who can see my assessments?
- What is Adjusted FQI?
- For transect quadrats, how are % bare ground and % water included in the calculations?
- For transect quadrats, can I use the Braun-Blanquet cover abundance scale?
- Why are some details about my assessment shown as n/a?
- Who runs this site? How safe is my data?
- What format are the downloaded reports in?
- What are Transect Strings and Inventory Strings?
- How do I use the API to access public data?
- How do I cite the use of this computer program?
- Other questions?

universallfqa.org | About this site

REVISION – added 4 new Qs, 1 modified Q &As. Starting with, *What Is Mean C and CoverWeighted Mean C?*



Documentation


Introduction **FAQ** Terminology

Frequently asked questions:

- How do I use the FQA Calculator out in the field?
- Who can see my assessments?
- What is Adjusted FQI?
- What is Mean C and CoverWeighted Mean C?**
- What is difference between Transect and Plot Data?**
- For transect quadrats, how are % bare ground and % water included in the calculations?
- For transect quadrats, can I use a cover abundance scale?
- How do I record and calculate floristic quality metrics if I have plot data that include both subplot/quadrat data and additional species in the plot but not in the quadrats?
- What if I have recorded species cover by strata or growth form (e.g. White oak tree – 25% cover, White oak-sapling – 5% cover)?
- Why are some details about my assessment shown as n/a?
- Who runs this site? How safe is my data?
- What is the format I can use for the "Upload Quadrat/Subplot String"?
- What format are the downloaded reports in?
- What are Transect Strings and Inventory Strings?
- How do I use the API to access public data?
- How do I cite the use of this computer program?
- Other questions?

HELP TAB – Terminology

PREVIOUS



Documentation

Introduction
FAQ
Terminology

Below are descriptions of the calculations used for Inventory and Transect assessments where species i has the conservatism coefficient C_i and the wetness coefficient W_i . The wetness coefficients correspond with the USFWS Wetland Indicator Status.

Term	Description	Calculation
Total species richness	Total number of native and non-native species.	N_t
Native species richness	Number of native species.	N_n
Mean wetness	Mean wetness coefficient for all species.	$\overline{W}_t = \frac{\sum_{i=0}^t W_i}{N_t}$
Native mean wetness	Mean wetness coefficient for native species.	$\overline{W}_n = \frac{\sum_{i=0}^n W_i}{N_n}$
Total mean C	Mean conservatism coefficient for all native and non-native species.	$\overline{C}_t = \frac{\sum_{i=0}^t C_i}{N_t}$
Native mean C	Mean conservatism coefficient for native species.	$\overline{C}_n = \frac{\sum_{i=0}^n C_i}{N_n}$
Total FQI	Floristic quality index: total mean C multiplied by the square root of the total species richness.	$I_t = \overline{C}_t \sqrt{N_t}$
Native FQI	Floristic quality index: native mean C multiplied by the square root of the native species richness.	$I_n = \overline{C}_n \sqrt{N_n}$
Adjusted FQI	Adjusted floristic quality index: 100 multiplied by the native mean C divided by 10 and multiplied by the square root of the native species richness divided by total species richness.	$I' = 100 \left(\frac{\overline{C}_n}{10} \right) \left(\frac{\sqrt{N_n}}{\sqrt{N_t}} \right)$

This table describes additional calculations used for Transect assessments where species i has the percent cover γ_i .

This table describes additional calculations used for Transect assessments where species i has the percent cover γ_i .


Term	Description	Calculation
Quadrat-level cover-weighted mean C	The sum of each native and non-native species' conservatism coefficient multiplied by its cover divided by the total cover for all species.	$\overline{C}_{t\gamma} = \frac{\sum_{i=0}^t C_i \gamma_i}{\sum_{i=0}^t \gamma_i}$
Quadrat-level cover-weighted native mean C	The sum of each native species' conservatism coefficient multiplied by its cover divided by the total cover for all native species.	$\overline{C}_{n\gamma} = \frac{\sum_{i=0}^n C_i \gamma_i}{\sum_{i=0}^n \gamma_i}$
Transect-level cover-weighted mean C	The sum of each native and non-native species' conservatism coefficient multiplied by its mean cover divided by the sum of each species' mean cover.	$\overline{C}_{t\gamma} = \frac{\sum_{i=0}^t C_i \overline{\gamma}_i}{\sum_{i=0}^t \overline{\gamma}_i}$
Transect-level cover-weighted native mean C	The sum of each native species' conservatism coefficient multiplied by its mean cover divided by the sum of each native species' mean cover.	$\overline{C}_{n\gamma} = \frac{\sum_{i=0}^n C_i \overline{\gamma}_i}{\sum_{i=0}^n \overline{\gamma}_i}$
Cover-weighted FQI	Cover-weighted total mean C multiplied by the square root of the total species richness.	$I_{t\gamma} = \overline{C}_{t\gamma} \sqrt{N_t}$
Cover-weighted Native FQI	Cover-weighted native mean C multiplied by the square root of the native species richness.	$I_{n\gamma} = \overline{C}_{n\gamma} \sqrt{N_n}$
Relative frequency (%)	The frequency of this species or physiognomic group divided by the frequency of all species or physiognomic groups.	$\mu_r = 100 \left(\mu_i / \sum_{i=0}^t \mu_i \right)$
Relative coverage (%)	The total coverage of this species or physiognomic group divided by the total coverage of all species or physiognomic groups.	$\gamma_r = 100 \left(\gamma_i / \sum_{i=0}^t \gamma_i \right)$
Relative importance value	The average of relative frequency and relative coverage.	$RIV = (\mu_r + \gamma_r) / 2$

REVISION – no change.

Possible Revision: Should we add the following: The top set of terms are based solely on presence/absence data (for Inventory data across an entire site, or presence/absence by quadrat). Bottom terms include abundance-weighted options.

SELECTED INVENTORY ASSESSMENT - SUMMARY PAGE

PREVIOUS



Inventory Assessment

[Edit This Inventory](#)
[Download Report](#)
[Done](#)

Charles Pond SNA EIA

» Date & Location:
 2016-08-24
 Charles Pond SNA
 Oconto, Wisconsin, USA

» Details:
 Practitioner: Andy Clark, Shannon Menard
 Latitude: 44 76 732
 Longitude: 87 93 664
 Weather Notes:
 Duration Notes: 4 hours
 Community Type Notes: Northern Sedge Meadow
 Other Notes: Dominants > 5% are listed based on a walk through the sedge meadow.
 This assessment is public (viewable by all users of this website).

» Conservatism-Based Metrics:
 Total Mean C: 6
 Native Mean C: 6
 Total FQI: 10.4
 Native FQI: 10.4
 Adjusted FQI: 60
 % C value 0-3: 0%
 % C value 4-6: 66.7%
 % C value 7-10: 33.3%
 Native Tree Mean C: n/a
 Native Shrub Mean C: n/a
 Native Herbaceous Mean C: 6

» Species Richness:
 Total Species: 3
 Native Species: 3 (100%)
 Non-native Species: 0 (0%)

» Species Wetness:
 Mean Wetness: -5
 Native Mean Wetness: -5

» FQA Database:
 Region: Wisconsin - Midwest Region
 Year Published: 2014
 Description:
 Parker E.C., Curran M., Waechter Z.S., Grosskopf E.A. 2014. Wisconsin FQA (Floristic Quality Assessment) Databases for Midwest and Northcentral-Northeast Regions for Universal FQA Calculator Web site (<http://universalfqa.org/>).

» Physiognomy Metrics:
 Tree: 0 (0%)
 Shrub: 0 (0%)
 Vine: 0 (0%)
 Forb: 0 (0%)
 Grass: 1 (33.3%)
 Sedge: 2 (66.7%)
 Rush: 0 (0%)
 Fern: 0 (0%)
 Bryophyte: 0 (0%)

» Duration Metrics:
 Annual: 0 (0%)
 Perennial: 3 (100%)
 Biennial: 0 (0%)
 Native Annual: 0 (0%)
 Native Perennial: 3 (100%)
 Native Biennial: 0 (0%)

» Species:


Scientific Name	Family	Acronym	Native?	C	W	Physiognomy	Duration	Common Name
Calamagrostis canadensis; calamagrostis macouniana; calamagrostis anomala; calamagrostis atropurpurea; calamagrostis expansa var. robusta; calamagrostis inexpansa var. cuprea; calamagrostis inexpansa var. robusta	Poaceae	CALCAN	native	5	-5	grass	perennial	blue-joint grass
Carex lacustris; carex riparia var. lacustris	Cyperaceae	CXLACU	native	6	-5	sedge	perennial	common lake sedge
Carex stricta; carex strictior; carex xerocarpa	Cyperaceae	CXSTRI	native	7	-5	sedge	perennial	hummock sedge

REVISION – no changes.

SELECTED TRANSECT/PLOT ASSESSMENT - SUMMARY PAGE

[reminder, you get here by going to “Your assessments” then clicking on an individual Transect/Plot Assessment]

PREVIOUS



Transect Assessment

[Edit This Transect](#) [Download Report](#) [Done](#)

Charles Pond SNA L3

» **Date & Location:**
2016-08-24
Charles Pond SNA
Oconto, Wisconsin, USA

» **FQA Database:**
Region: Wisconsin - Midwest Region
Year Published: 2014
Description:
Parker E.C., Curran M., Waechter Z.S., Grosskopf E.A. 2014. Wisconsin FQA (Floristic Quality Assessment) Databases for Midwest and Northcentral-Northeast Regions for Universal FQA Calculator Web site (<http://universalfqa.org/>).

» **Details:**
Practitioner: A. Clark, S. Menard
Latitude: 44.76730
Longitude: 87.93653
Weather Notes:
Duration Notes:
Community Type Notes: Northern Sedge Meadow
Other Notes: **We used plots A1 (labeled 1A on field form), B2 (labeled 2B on field form), C1 (labeled 3A on field form). Photo # 3185
This assessment is public (viewable by all users of this website).


» **Conservatism-Based Metrics:**
Total Mean C: 4.4
Cover-weighted Mean C: 5.2
Native Mean C: 4.5
Total FQI: 22
Native FQI: 22
Cover-weighted FQI: 26
Cover-weighted Native FQI: 25.5
Adjusted FQI: 44.1
% C value 0: 4%

» **Species Richness:**
Total Species: 25
Native Species: 24 (96%)
Non-native Species: 1 (4%)

» **Species Wetness:**
Mean Wetness: -3.5
Native Mean Wetness: -3.7

» **Duration Metrics:**
Annual: 1 (4%)
Perennial: 23 (92%)
Biennial: 1 (4%)
Native Annual: 1 (4%)
Native Perennial: 22 (88%)
Native Biennial: 1 (4%)

REVISION – Expanded field options in “Details.”: New Section “Transect/Plot Design”



Transect/Plot Assessment

[Edit This Transect/Plot](#) [Download Report](#) [Done](#)

Charles Pond SNA L3

» **Date & Location:**
2016-08-24
Charles Pond SNA
Oconto, Wisconsin, USA

» **FQA Database:**
Region: Wisconsin - Midwest Region
Year Published: 2014
Description:
Parker E.C., Curran M., Waechter Z.S., Grosskopf E.A. 2014. Wisconsin FQA (Floristic Quality Assessment) Databases for Midwest and Northcentral-Northeast Regions for Universal FQA Calculator Web site (<http://universalfqa.org/>).

» **Details:**
Practitioner: A. Clark, S. Menard
Latitude: 44.76730
Longitude: 87.93653
Community Code:
Community Name: ash-basswood forest
Community Type Notes: Northern Sedge Meadow
Weather Notes: nice weather
Duration Notes: long day
Environmental Description: wet
Other Notes: **We used plots A1 (labeled 1A on field form), B2 (labeled 2B on field form), C1 (labeled 3A on field form). Photo # 3185
This assessment is public (viewable by all users of this website).

» **Transect/Plot Design:**
Transect or Plot: Transect
Plot Size (m²):
Quadrat/Subplot Size (m²):
Transect Length (m): 500 m
Sampling Design Description: five 100 m transects
Cover Method: % Cover (0 - 100)

» **Conservatism-Based Metrics:**
Total Mean C: 3.9
Cover-weighted Mean C: 4.3
Native Mean C: 4.5
Total FQI: 20.6
Native FQI: 22
Cover-weighted FQI: 22.8
Cover-weighted Native FQI: 24
Adjusted FQI: 41.7
% C value 0: 14.3%
% C value 1-3: 25%
% C value 4-6: 42.9%
% C value 7-10: 17.9%

» **Species Richness:**
Total Species: 28
Native Species: 24 (85.7%)
Non-native Species: 4 (14.3%)

» **Species Wetness:**
Mean Wetness: -3.5
Native Mean Wetness: -3.7

» **Duration Metrics:**
Annual: 1 (3.6%)
Perennial: 26 (92.9%)
Biennial: 1 (3.6%)
Native Annual: 1 (3.6%)
Native Perennial: 22 (78.6%)
Native Biennial: 1 (3.6%)

QUADRAT DATA

PREVIOUS

VI-12

» Quadrat Level Metrics:													
Quadrat	Species Richness	Native Species Richness	Total Mean C	Native Mean C	Total FQI	Native FQI	Cover-weighted FQI	Cover-weighted Native FQI	Adjusted FQI	Mean Wetness	Mean Native Wetness	Latitude	Longitude
A1ff1A	17	16	4.4	4.7	18.1	18.8	23.5	23.2	45.6	-3.5	-3.8	n/a	n/a
B2ff2B	8	8	3.5	3.5	9.9	9.9	14.1	14.1	35	-2.9	-2.9	n/a	n/a
C1ff3A	19	19	4.7	4.7	20.5	20.5	21.8	21.8	47	-3.6	-3.6	n/a	n/a
Average	14.7	14.3	4.2	4.3	16.2	16.4	19.8	19.7	42.5	-3.3	-3.4	n/a	n/a
Standard Deviation	4.8	4.6	0.5	0.6	4.5	4.6	4.1	4	5.4	0.3	0.4	n/a	n/a

» Quadrat A1ff1A Species:										
Scientific Name	Family	Acronym	% Cover	Nativity	C	W	Physiognomy	Duration	Common Name	
<i>Calamagrostis canadensis</i> ; <i>calamagrostis macouniana</i> ; <i>calamagrostis anomala</i> ; <i>calamagrostis atropurpurea</i> ; <i>calamagrostis expansa</i> var. <i>robusta</i> ; <i>calamagrostis inexpansa</i> var. <i>cuprea</i> ; <i>calamagrostis inexpansa</i> var. <i>robusta</i>	Poaceae	CALCAN	10	native	5	-5	grass	perennial	blue-joint grass	
<i>Calystegia sepium</i> ; <i>convolvulus sepium</i> ; <i>convolvulus nashii</i> ; <i>convolvulus repens</i>	Convolvulaceae	CALSEP	1	native	2	0	vine	perennial	hedge bindweed	
<i>Campanula aparinoides</i> ; <i>campanula uliginosa</i>	Campanulaceae	CAMAPA	3	native	7	-5	forb	perennial	marsh bellflower	
<i>Carex lacustris</i> ; <i>carex riparia</i> var. <i>lacustris</i>	Cyperaceae	CXLACU	50	native	6	-5	sedge	perennial	common lake sedge	
<i>Carex stricta</i> ; <i>carex strictior</i> ; <i>carex xerocarpa</i>	Cyperaceae	CXSTRI	30	native	7	-5	sedge	perennial	hummock sedge	


REVISIONS – added a column for cover range (midpoint) so that if cover scale is used, the midpoint cover is provided and used in all cover weighted terms.

» Quadrat/Subplot Level Metrics:													
Quadrat/Subplot	Species Richness	Native Species Richness	Total Mean C	Native Mean C	Total FQI	Native FQI	Cover-weighted FQI	Cover-weighted Native FQI	Adjusted FQI	Mean Wetness	Mean Native Wetness	Latitude	Longitude
A1ff1A	17	16	4.4	4.7	18.1	18.8	23.5	23.2	45.6	-3.5	-3.8	n/a	n/a
B2ff2B	8	8	3.5	3.5	9.9	9.9	14.1	14.1	35	-2.9	-2.9	n/a	n/a
C1ff3A	19	19	4.7	4.7	20.5	20.5	21.8	21.8	47	-3.6	-3.6	n/a	n/a
D1bogus	8	5	3.4	5.4	9.6	12.1	10.7	10.1	42.7	-4.3	-4.6	n/a	n/a
Average	13	12	4	4.6	14.5	15.3	17.5	17.3	42.6	-3.6	-3.7	n/a	n/a
Standard Deviation	5	5.7	0.6	0.7	4.9	4.4	5.3	5.4	4.6	0.5	0.6	n/a	n/a

» Quadrat/Subplot A1ff1A Species:										
Scientific Name	Family	Acronym	% Cover	Cover Range (Midpt)	Nativity	C	W	Physiognomy	Duration	Common Name
<i>Calamagrostis canadensis</i> ; <i>calamagrostis macouniana</i> ; <i>calamagrostis anomala</i> ; <i>calamagrostis atropurpurea</i> ; <i>calamagrostis expansa</i> var. <i>robusta</i> ; <i>calamagrostis inexpansa</i> var. <i>cuprea</i> ; <i>calamagrostis inexpansa</i> var. <i>robusta</i>	Poaceae	CALCAN	10	% Cover (0 - 100)	native	5	-5	grass	perennial	blue-joint grass
<i>Calystegia sepium</i> ; <i>convolvulus sepium</i> ; <i>convolvulus nashii</i> ; <i>convolvulus repens</i>	Convolvulaceae	CALSEP	1	% Cover (0 - 100)	native	2	0	vine	perennial	hedge bindweed
<i>Campanula aparinoides</i> ; <i>campanula uliginosa</i>	Campanulaceae	CAMAPA	3	% Cover (0 - 100)	native	7	-5	forb	perennial	marsh bellflower
<i>Carex lacustris</i> ; <i>carex riparia</i> var. <i>lacustris</i>	Cyperaceae	CXLACU	50	% Cover (0 - 100)	native	6	-5	sedge	perennial	common lake sedge
<i>Carex stricta</i> ; <i>carex strictior</i> ; <i>carex xerocarpa</i>	Cyperaceae	CXSTRI	30	% Cover (0 - 100)	native	7	-5	sedge	perennial	hummock sedge

DATA ENTRY. PART 1: SPECIFYING TRANSECT OR PLOT DESIGN

PREVIOUS: Only Transect and Quadrat data allowed.



Edit Transect Assessment

[Save Changes and View Results](#) [Cancel](#)

Month:

Day:

Year:

Site:
[Edit Selected Site](#) [Create New Site](#)

Assessment Name: *

Practitioner: *

Latitude:

Longitude:

Public (viewable by all users of this site)
 Private (viewable only by you)

Weather Notes:

Duration Notes:

Community Type Notes:

Other Notes:

FQA Database:

[Change FQA Database](#)

REVISIONS (next page)

REVISIONS. Headers introduced (“Date & Location,” “Details”, “Transect/Plot Design”). Plots with Quadrats or Subplots terminology added.



Edit Transect/Plot Assessment

[Save Changes and View Results](#) [Cancel](#)

Date & Location:

Month:

Day:

Year:

Site:

Site State/Province: Wisconsin

[Edit Selected Site](#) [Create New Site](#)

Details:

Assessment Name:

Practitioner:

Latitude:

Longitude:

Community Code:

Community Name:

Community Type Notes:

Public (Viewable by all users of this site)
 Private (Viewable only by you)

Weather Notes:

Duration Notes:

Environmental Description:

Other Notes:

Transect/Plot Design:

Transect
 Plot

Plot Size (m²):

Quadrat/Subplot Size (m²):

Transect Length (m):

Sampling Design Description:

Cover Method:

FQA Database:

DATA ENTRY. PART 2: TRANSECTS/QUADRATS, OR PLOTS, SUBPLOTS AND QUADRATS
PREVIOUS

FQA Database:
 Wisconsin - Midwest Region, [Change FQA Database](#)

Quadrats:
[Add New Quadrat](#)

Select which quadrats you want actively included in the FQA calculations. The unselected quadrats will remain saved here if you wish to include them in the future.

Active?	Quadrat	Species Richness	Latitude	Longitude	
<input checked="" type="checkbox"/>	A1M1A	17	n/a	n/a	Edit Delete
<input checked="" type="checkbox"/>	B2M2B	8	n/a	n/a	Edit Delete
<input checked="" type="checkbox"/>	C1M3A	19	n/a	n/a	Edit Delete

[Browse...](#)

[Upload Quadrat Group](#) (optional)

Finished making changes?
[Save Changes and View Results](#) [Cancel](#)

[universalFQA.org](#) | [About this site](#)

REVISIONS

FQA Database:
 Wisconsin - Midwest Region, 2014
 [Change FQA Database](#)

Quadrats/Subplots:
[Add New Quadrat/Subplot](#) Add a standard quadrat/subplot or a pseudo quadrat/subplot for adding species to the Full TransectPlot. Outside the TransectPlot, or Rest of TransectPlot.

Select which quadrats/subplots you want actively included in the FQA calculations. The unselected quadrats/subplots will remain saved here if you wish to include them in the future.

Active?	Quadrat/Subplot	Species Richness	Latitude	Longitude	
<input checked="" type="checkbox"/>	A1M1A	17	n/a	n/a	Edit Delete
<input checked="" type="checkbox"/>	B2M2B	8	n/a	n/a	Edit Delete
<input checked="" type="checkbox"/>	C1M3A	19	n/a	n/a	Edit Delete
<input checked="" type="checkbox"/>	D1ooqut	8	n/a	n/a	Edit Delete

[Browse...](#)


[Upload Quadrat/Subplot Group](#) (optional)

Finished making changes?
[Save Changes and View Results](#) [Cancel](#)

[universalFQA.org](#) | [About this site](#)

DATA ENTRY. PART 3: ADD NEW QUADRAT/SUBPLOT

PREVIOUS



New Quadrat

Quadrat Number or Name: *

Latitude: (optional)

Longitude: (optional)

% Bare Ground: (optional)

% Water: (optional)

To Add Species Individually:

Scientific Name % Cover Acronym % Cover Common Name % Cover

To Add Species In Bulk:

List each species and their percent coverage separated by a comma. For example: "Acorus calamus, 20, Allisma subcordatum, 15, Anemone virginiana, 5, etc."

List of scientific names
 List of acronyms
 List of common names

To Remove Species:

Select the species to remove and click remove at the bottom of the list.

Scientific Name	Family	Acronym	% Cover	Native?	C	W	Physiognomy	Duration	Common Name
You have not entered any species yet.									

REVISIONS – next page

REVISION – allows you to add

1. new quadrats/subplots (as with previous version).
2. Add in a single large transect/macroplot with species and cover data. Plot only has one Quadrat/Subplot (terminology is awkward in this case, but use of a single plot will be clear from the description of Plot Design (i.e. a single plot with no subplots or quadrats).
3. Add in species in Rest of Transect/Plot, but not in one of the quadrats/subplots.
4. Add in nearby species outside the Transect/Plot
5. Specify the cover method used.

New Quadrat/Subplot

Quadrat/Subplot
 Full Transect/Plot
 Outside Transect/Plot
 Rest of Transect/Plot

Quadrat/Subplot Number or Name: *

Latitude: (optional)

Longitude: (optional)

% Bare Ground: (optional)

% Water: (optional)

Transect/Plot Cover Method:

% Cover (0 - 100)

To Add Species Individually:

Scientific Name: Acronym: Common Name:

% Cover: % Range (Midpt): Add % Cover: % Range (Midpt): Add % Cover: % Range (Midpt): Add

To Add Species In Bulk:

List each species and their cover value separated by a comma. For example: "Acorus calamus, 20, Allisma subcoar datum, 15, Anemone virginiana, 5, etc."

List of scientific names
 List of acronyms
 List of common names

Add Species

To Remove Species:

Select the species to remove and click remove at the bottom of the list.

Scientific Name	Family	Acronym	% Cover	Cover Range/Midpoint	Native?	C	W	Physlognomy	Duration	Common Name
You have not entered any species yet.										

Remove Selected Species

E.g. When "RestofPlot is Chosen, it is stored as if were equivalent to a plot. It remains unchecked.

Quadrats/Subplots:

[Add New Quadrat/Subplot](#) Add a standard quadrat/subplot or a pseudo quadrat/subplot for adding species to the Full Transect/Plot, Outside the Transect/Plot, or Rest of Transect/Plot.

Select which quadrats/subplots you want actively included in the FQA calculations. The unselected quadrats/subplots will remain saved here if you wish to include them in the future.

Active?	Quadrat/Subplot	Species Richness	Latitude	Longitude	
<input checked="" type="checkbox"/>	A1#1A	17	n/a	n/a	Edit Delete
<input checked="" type="checkbox"/>	B2#2B	8	n/a	n/a	Edit Delete
<input checked="" type="checkbox"/>	C1#3A	19	n/a	n/a	Edit Delete
<input checked="" type="checkbox"/>	D1#bogus	8	n/a	n/a	Edit Delete
<input type="checkbox"/>	RestOfTransectPlot	2	n/a	n/a	Edit Delete

REVISIONS (cont'd)

With this option of adding in additional species, one has to be careful about viewing results.

To get meaningful **quadrat level** data, leave the “Restof Plot” unchecked. But note that all summary data in the sections entitled “Conservatism-Based Metrics”, “Physiognomic Relative Importance Values,” and “Species Relative Importance Values” do NOT include these “RestofPlot” Species.

» Quadrat/Subplot Level Metrics:

Quadrat/Subplot	Species Richness	Native Species Richness	Total Mean C	Native Mean C	Total FQI	Native FQI	Cover-weighted FQI	Cover-weighted Native FQI	Adjusted FQI	Mean Wetness	Mean Native Wetness	Latitude	Longitude
A1ff1A	17	16	4.4	4.7	18.1	18.8	23.5	23.2	45.6	-3.5	-3.8	n/a	n/a
B2ff2B	8	8	3.5	3.5	9.9	9.9	14.1	14.1	35	-2.9	-2.9	n/a	n/a
C1ff3A	19	19	4.7	4.7	20.5	20.5	21.8	21.8	47	-3.6	-3.6	n/a	n/a
D1bogus	8	5	3.4	5.4	9.6	12.1	10.7	10.1	42.7	-4.3	-4.6	n/a	n/a
Average	13	12	4	4.6	14.5	15.3	17.5	17.3	42.6	-3.6	-3.7	n/a	n/a
Standard Deviation	5	5.7	0.6	0.7	4.9	4.4	5.3	5.4	4.6	0.5	0.6	n/a	n/a

To get meaningful total transect or plot data, make sure the “Restof Plot” is checked. Now the quadrat data summary, including the average and the standard deviation, still show up, but they will not be meaningful, because “RestofPlot” is treated as a quadrat.

» Quadrat/Subplot Level Metrics:

Quadrat/Subplot	Species Richness	Native Species Richness	Total Mean C	Native Mean C	Total FQI	Native FQI	Cover-weighted FQI	Cover-weighted Native FQI	Adjusted FQI	Mean Wetness	Mean Native Wetness	Latitude	Longitude
A1ff1A	17	16	4.4	4.7	18.1	18.8	23.5	23.2	45.6	-3.5	-3.8	n/a	n/a
B2ff2B	8	8	3.5	3.5	9.9	9.9	14.1	14.1	35	-2.9	-2.9	n/a	n/a
C1ff3A	19	19	4.7	4.7	20.5	20.5	21.8	21.8	47	-3.6	-3.6	n/a	n/a
D1bogus	8	5	3.4	5.4	9.6	12.1	10.7	10.1	42.7	-4.3	-4.6	n/a	n/a
RestOfTransectPlot	2	2	8	8	11.3	11.3	11.9	11.9	80	-4	-4	n/a	n/a
Average	10.8	10	4.8	5.3	13.9	14.5	16.4	16.2	50.1	-3.7	-3.8	n/a	n/a
Standard Deviation	6.3	6.5	1.7	1.5	4.5	4.3	5.2	5.3	15.5	0.5	0.6	n/a	n/a


But all summary Conservatism data in the sections entitled Metrics”, “Physiognomic Relative Importance Values,” and “Species Relative Importance Values” DO include these “RestofPlot” Species.

Ideally, these summary pages would be clearly labelled as to whether or not only quadrat/subplot data are used, or if additional data are used, but that will take a substantial amount of additional

programming. For now, the website provides greater flexibility for plot and transect based data, but users will need to be careful about how the summary and quadrat data are calculated.

UPLOADING AN FQA DATABASE

PREVIOUS



Upload New Public FQA Database

[Cancel](#)

Help expand this tool by uploading your region's list of species and their coefficients of conservatism. If you need help, [contact us](#).

» **1. Enter the FQA Database Details:**

Region Name: (What region does this database cover?)*

Year Published: (When was this database originally developed?)*

Description: (Who or what organization developed this database? Provide a citation of the published source if possible.)*

» **2. Format the spreadsheet to upload:**

REVISION: Add in State, Province, and Omernik EPA Region III



Upload New Public FQA Database

Cancel

Help expand this tool by uploading your region's list of species and their coefficients of conservatism. If you need help, [contact us](#).

» 1. Enter the FQA Database Details:

Region Name: (What region does this database cover?)*

Year Published: (When was this database originally developed?)*

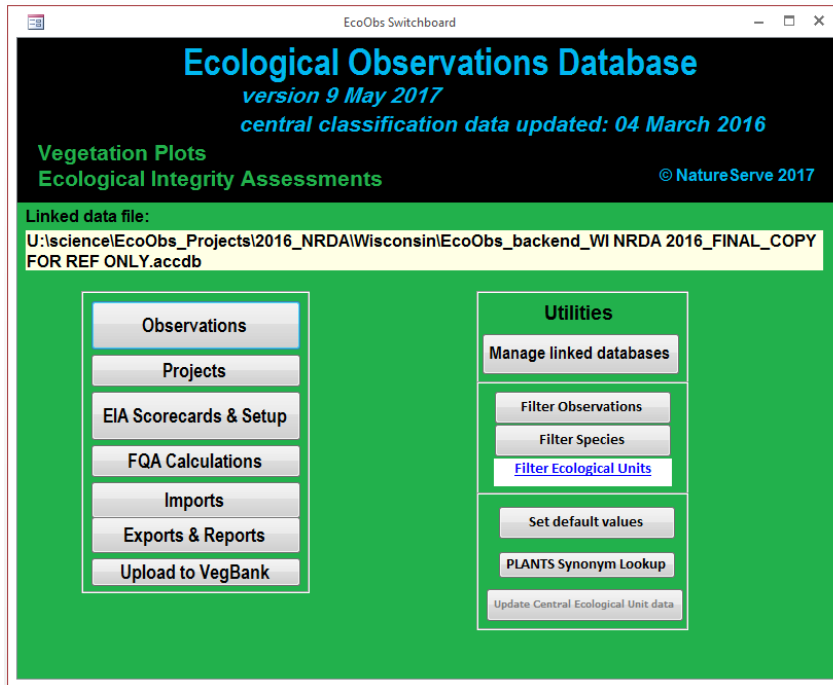
Description: (Who or what organization developed this database? Provide a citation of the published source if possible.)*

States and/or Provinces: (Select all that apply)

Omernik Level 3 Ecoregions: (Select all that apply)

» 2. Format the spreadsheet to upload:

B. APPENDIX 5. Screen Shots from EcoObs



1.

2. Exclude "Nearby" Exclude Species with %
 siteArea_types Cover less than:

Warning: ALWAYS recalculate total cover.
 There is no check for missing total cover values in your data and
 calculated cover values are not updated automatically after edits.
 Field-collected total cover values override calculated values.

3. Choose the FQA species list to use

4.

5. Limit FQA calculations to these growth forms:

All Herbaceous (inclu. aquatic)
 Trees Non-Vascular
 Shrubs

6. Choose which Floristic Quality Assessment metrics you want to calculate.
 Hover your mouse over each checkbox for the equation.

<input checked="" type="checkbox"/> Species Richness	<input checked="" type="checkbox"/> Cover-weighted Mean C
<input checked="" type="checkbox"/> Mean C	<input checked="" type="checkbox"/> Cover-weighted Native Mean C
<input checked="" type="checkbox"/> Native Mean C	<input checked="" type="checkbox"/> Cover-weighted FQI
<input checked="" type="checkbox"/> FQI (Floristic Quality Index)	<input checked="" type="checkbox"/> Cover-weighted Native FQI
<input checked="" type="checkbox"/> Native FQI	<input checked="" type="checkbox"/> Cover-weighted Adjusted FQI
<input checked="" type="checkbox"/> Adjusted FQI	<input checked="" type="checkbox"/> Relative Native Cover
<input checked="" type="checkbox"/> PSI (Plant Stewardship Index)	<input checked="" type="checkbox"/> Total Native, Nonnative Cover
<input checked="" type="checkbox"/> VMMI (Vegetation Multimetric Index)	
<input checked="" type="checkbox"/> Relative Native Monocot Cover	<input checked="" type="checkbox"/> Count Disturbance Tolerant Species

7.

C. APPENDIX 6. Ecoregional C-values for the Northeast

See Attached Spreadsheet: Northeast FQA_NEIWPCF_FINAL Appendix 6_Ecoregional C