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Performance of rapid floristic quality assessment indices for increasing cost-effectiveness of wetland condition evaluation

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ABSTRACT

This project tested whether rapid floristic quality indices can be used in North Carolina's diverse wetland types, given the many cost-saving benefits that can be realized from using such indices. Vegetation plot data from 2030 North Carolina wetland plots were analyzed to test how well two floristic quality assessment indices, based on cover-dominant species and based on non-graminoid species, were correlated with full index values based on a comprehensive species list.

Dominance based indices (Mean C and FQI) significantly correlated with Mean C and FQI using all species, but Mean C was more strongly correlated than FQI. Mean C of cover-dominant species correlated with the Ohio Rapid Assessment Method, but could only distinguish the lowest and highest North Carolina Wetland Assessment Method ratings. Removal of graminoids as a group, which are difficult to identify, did not appear to affect Mean C, even in herbaceous wetlands, though some wetlands were comprised of only graminoids; a dominance based index would still be useful in graminoid marshes. The availability of this cost-saving assessment tool will benefit researchers and practitioners looking for more expedient ways of assessing wetland quality or validating rapid assessments with direct measurements.

1. Introduction

Tremendous population growth in North Carolina and many other areas in the Southeast has put increasing pressure on wetland and stream resources from increased urbanization, nutrient loading, and coverage by invasive and exotic plants. Wetland monitoring is imperative for helping states and tribes better manage and protect wetland resources.

The US Environmental Protection Agency describes a three-tiered framework for wetlands monitoring and assessment. Level 1, or landscape scale assessment, exclusively uses GIS data to produce landscape metrics describing wetland condition. Level 2, or rapid assessment, utilizes simple metrics based on readily observable characteristics or stressors on location, to place a wetland on a gradient of disturbance and ecological integrity. Level 3, or intensive site assessment, requires directly gathering detailed measurements of biological taxa and/or hydrogeomorphic function. Level 3 assessment often includes vegetation data collection, soil analysis, and/or faunal surveys, which then can be valuable for validating and refining Level 2 and Level 1 assessment methods.

Floristic quality assessment is a Level 3 measure of vegetation composition which has proven to be an excellent indicator of wetland quality and condition (Lopez and Fennessy, 2002, Bourdaghs et al., 2006, Miller and Wardrop, 2006, Rocchio, 2007; Taft et al., 1997). Floristic quality assessment has been shown to be robust to successional changes, natural variability, and turnover in taxonomic composition (Spyreas et al., 2012, Bried et al., 2013, Deimeke et al., 2013). Two floristic quality assessment metrics, the Floristic Quality Index (FQI) and Mean C (part of the FQI) are being used throughout the Southeast in Florida (Cohen et al., 2004), Georgia (Zomlefer et al., 2013), Kentucky (Shea et al., unknown date), Mississippi (Ervin et al., 2006), North Carolina (Yepsen, 2012), and Tennessee (Elam, 2015), as well as in many states outside of the Southeast (Wilhelm and Mazur, 2016). Floristic quality indices make use of species-specific Coefficients of Conservatism (C values), numbers from 0 to 10 which are based on plant species' habitat requirements. High C values are associated with species restricted to high quality, undegraded habitats; low C values represent species found in a broad range of habitats, usually with a strong tolerance for anthropogenic disturbance. C values are assigned by expert botanists, and, although they are subjective, have been shown to carry a great deal of ecological information, especially when considered collectively for species assemblages (Matthews et al., 2015).

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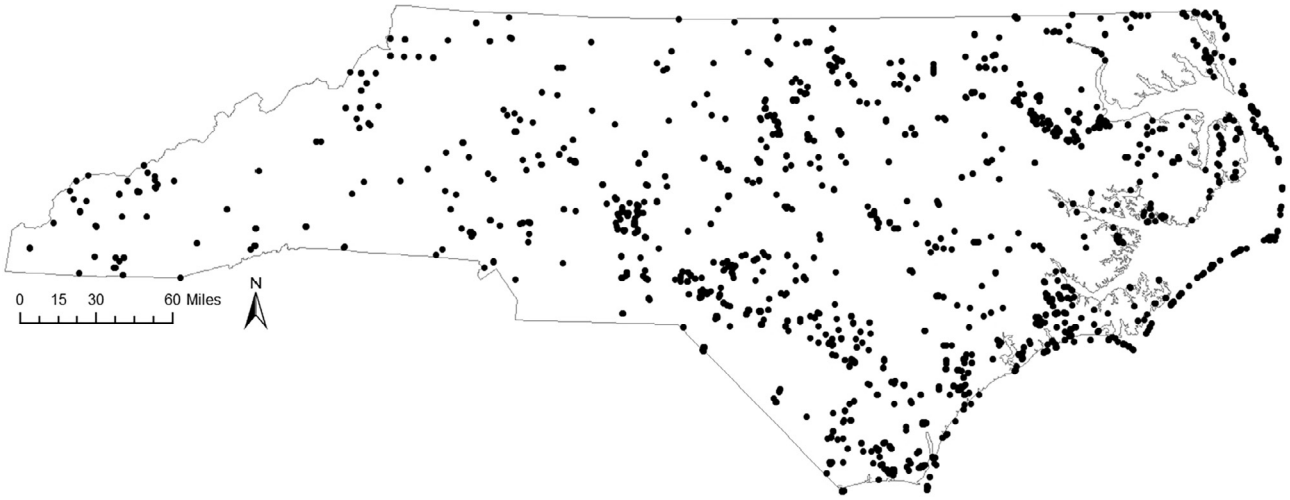

Fig. 1. Map of wetland vegetation plot locations in North Carolina (n = 2030).

Table 1
Data sources used for testing the rapid floristic indices.

Data Source	Years Collected	Number of Wetland Plots
NC Division of Water Resources Projects (NC DWR)	2005–2016	92
National Wetland Condition Assessment (NWCA) North Carolina Plots	2011–2016	92
Carolina Vegetation Survey (CVS)	1981–2015	1818
National Park Service (NPS)	1997–2010	28

Although it is an excellent way to evaluate wetland condition, one drawback to floristic quality assessment has been the typical requirement that every plant within a sampling area be identified to species-level. This often requires significant time commitment and sampling personnel with a high level of expertise. Often states, especially in the southeastern United States, do not monitor their wetlands regularly, or at all, due to time and cost constraints. Rapid methods will allow more sustainable and efficient monitoring of natural wetlands, assessing of impact areas and restoration success, and location of priority conservation areas.

Currently, only a few rapid floristic quality indices have been tested. In Minnesota, Bourdaghs (2012) has successfully developed a timed meandering sampling method as a way of reducing the time required. His team created a species checklist for the most common and easiest to identify species for inclusion in their rapid FQI. Testing showed no significant difference between the rapid FQI and the full FQI in Minnesota. A rapid FQI based only on cover-dominant species has also been tested in Pennsylvania with promising results, but it was only tested for

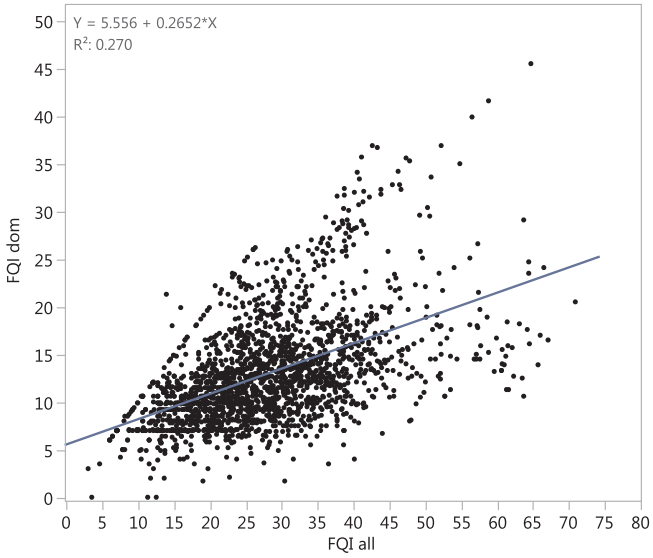

Fig. 3. Pearson correlation of FQI_{dom} (dominant species only) with FQI_{all} (all species) ($r = 0.52$, $p < 0.0001$, $n = 2030$).

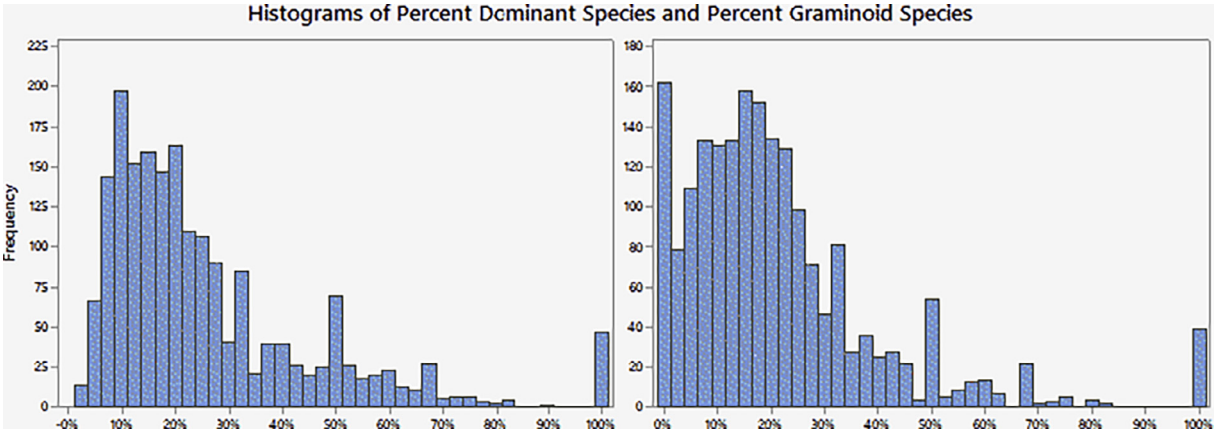

Fig. 2. Histograms of percentage of total species which qualified as cover-dominant species and percentage of graminoid species (n = 2030).

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