

Coefficient of Conservatism Database Development for Wetland Plants Occurring in the Southeast United States

Summary Document

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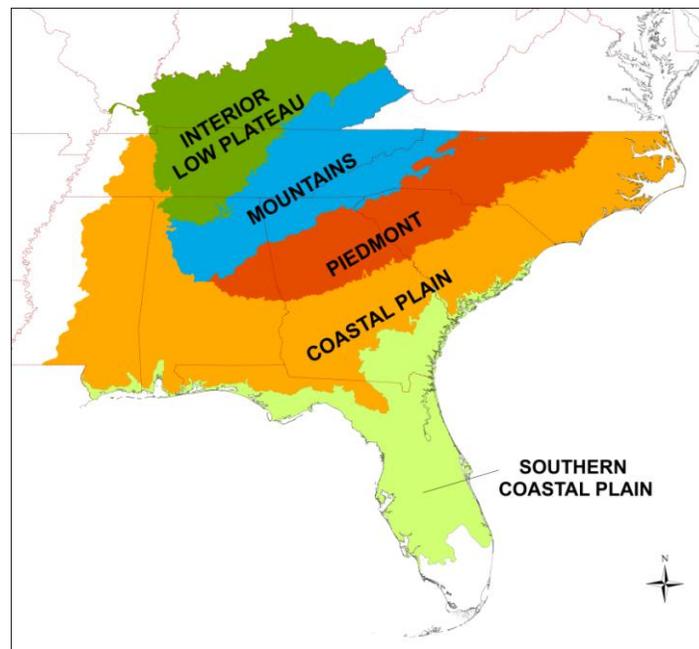
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Introduction:

Floristic quality assessment is a recognized technique for assessing habitat quality of wetland sites. The Floristic Quality Index (FQI), the most widely used metric in floristic quality assessment, employs a measure of conservatism (Coefficient of Conservatism) along with richness of a plant community to derive an estimate of habitat quality. The Coefficient of Conservatism is a number (C value) between 0 and 10 assigned to each species, indicating its fidelity to specific habitat types and degree of ecological tolerance (Taft et al. 1997; Swink & Wilhelm, 1979). Plant species that are obligate to high quality natural areas are given high C values, whereas species typically found in a wide variety of habitats and that are tolerant of disturbance are assigned low C values. Non-native species receive a C value of zero (0).

C values have hitherto been available for selected parts of the Southeast, but a comprehensive wetland C value database has never been developed for much of the Southeast. This project undertook the task of assembling expert botanists to create a large database of C values for wetland plant species occurring across the Southeast. The eight (8) state region of the Southeast includes Kentucky, Tennessee, Mississippi, Alabama, North Carolina, South Carolina, Georgia, and Florida; these are the states within EPA’s Region 4, which funded the effort. Extreme South Florida was excluded because this area already has a working C value list (see Mortellaro et al., 2009), and western Mississippi was also excluded because its ecoregions are Mississippi River alluvial plains and valley rather than typical Southeastern US ecoregions. A map of the project area is shown in Figure 1.

Figure 1. Project area and ecoregions for Southeast wetland plant Coefficient of Conservatism database development project.



C values were developed on an ecoregion basis, rather than state boundary basis. Omernik (1987) Level III Ecoregions were used as an original basis, but since the 11 Level III Ecoregions in the Southeast would have resulted in nearly 11,000 C values needed from botanists, ecoregions were combined into 5 main

“grouped” ecoregions: Interior Low Plateau, Mountains, Piedmont, Coastal Plain, and Southern Coastal Plain (Figure 1). This decision was confirmed by Gerould Wilhelm (pers. comm. 10/24/12), NC Natural Heritage Program botanist Mike Schafale, and by Teresa Magee and Glenn Griffith of the national EPA (pers. comm. 11/5/12) over email. Grouping the ecoregions in this way lessened the total number of scores to be assigned to approximately 7,000. The area under consideration encompassed 476 counties in eight states.

Using GIS layers, I generated a list of counties associated with each ecoregion. Counties straddling ecoregion boundaries were visually assessed and if a county was approximately 75% (three-quarters) or more within one ecoregion, it was considered to be solely in that ecoregion. However, if a county was divided between ecoregions such that any one section was less than 75%, the county was placed into both/all ecoregions.

Preliminary Scoring Database Development:

Plant species information was downloaded from the USDA PLANTS online database in the fall of 2012. This included all vascular plants (and ferns) with records in any of the eight states. The county/ecoregion list was then used to assign ecoregion presence information to each species, based on USDA county record information for each species. Because the 2012 National Wetland Plant List (NWPL) was not yet included in the USDA PLANTS database at the time of download, the 2012 NWPL status information was added to the downloaded database for the two regions in the project area: Eastern Mountains/Piedmont and Atlantic/Gulf Coastal Plain. Wetland plants were defined as those with a NWPL status of Facultative (FAC) or wetter (Facultative Wet-FACW, or Obligate-OBL) in at least one region. The list of plants meeting these criteria became the basis for scoring by botanists (approximately 2,400 unique taxa). Subspecies and varieties were included.

Available C values were obtained for states within EPA Region 4, as well as from some states adjacent to the region (such as Virginia), to provide as a reference point for botanists while assigning scores. State lists (or partial state lists) were included in the botanist’s database from Kentucky, Indiana, Tennessee, West Virginia, North Carolina, Virginia, Mississippi, and Florida. Sources for these reference C values are included in the Appendix.

Because the taxonomic authority for each of these state lists was often an authority other than the USDA, the online Taxonomic Name Resolution Service (TNRS) was used to “convert” names to the USDA accepted names (Boyle et al., 2013). Once matching USDA names were obtained, the C values were able to be joined to the scoring database.

Selection of Botanists:

Botanists were located via networking with southeast regional wetland manager and academic contacts, as well as contacting botanists in all state Natural Heritage Programs. An online survey was created and disseminated via email to garner specific experience and availability information from interested botanists. During selection of botanists, emphasis was placed on field experience with wetland plants over purely academic or herbarium type experience, because the Coefficient of Conservatism scoring system requires knowledge of species’ growth habits and range of tolerance of different environmental

conditions. In general, we sought botanists with at least 15 years of experience with wetland plants, and at least 25% of this time spent in the field in a range of habitat quality. We were able to assemble a group of 15 expert botanists from all over the Southeast, so that all states in this 8-state region were covered by 2-6 botanists, with up to 10 botanists in some areas.

Scoring Method:

In March 2013, a webinar was held with participating botanists to introduce the database and scoring criteria. Twelve (12) botanists participated, along with some DWQ staff. The webinar was recorded and posted online, where it was accessed by two additional botanists who could not attend the webinar in person. Some discussion during the webinar ensued over how to handle natural disturbance vs. anthropogenic disturbance in regards to thinking about species tolerance of disturbance. A revised scoring criteria narrative was arrived at by consensus, then disseminated to botanists by email as a basis for scoring. The narrative was as follows:

The Coefficient of Conservatism concept will be thought of primarily in the context of a species' ability to tolerate anthropogenic alteration. This is a concept distinct from generalized disturbance, specifically natural disturbance, such as fire or flooding. A plant species which requires a high frequency of natural disturbance may receive a high C value, if it shows a low tolerance of anthropogenically-driven alteration. While there is a loose correlation between rarity and high C value, rarity alone is not an indicator of a species tolerance to alteration, and will therefore not be relied upon in the development of C scores.

0-1: Taxa adapted to severe anthropogenic habitat alteration, occurring so frequently that often only brief periods are available for growth and reproduction of the species. These species are also able to colonize areas with high degrees of anthropogenic alteration. Many also do well with severe natural disturbance, but most occurrences are in heavily altered areas. (Zero confidence that a specimen brought into an herbarium was collected from a remnant or high-quality natural area.)

2-3: Taxa associated with somewhat more stable, though degraded, environments.

4-6: Taxa that persist with moderate alteration, but which decline with more intense, long-lasting, or frequent anthropogenic alteration. Many are also present in natural areas, and may be dominant or matrix species with broad habitat tolerance. (A specimen brought into an herbarium may be from either a high-quality natural area or from a moderately altered site).

7-8: Taxa associated mostly with well-established natural areas, but that can be found persisting where the habitat has been degraded somewhat.

9-10: Considered to be restricted to high-quality natural areas, including those which show high frequencies of natural disturbance such as flooding or fire. These species often exhibit a high degree of fidelity to a narrow range of habitat requirements, but may be tolerant of a broader range of high-quality natural habitats. (Nearly 100% confidence that a sample brought into an herbarium was collected from a remnant or high-quality natural area.)

Botanists were emailed the scoring database and asked to use these scoring criteria as a basis to begin pre-scoring prior to a score assignment meeting in June 2013. Pre-assignment was requested on the most broadly-occurring species, ie. those which occurred in 4 or all of the 5 ecoregions. This amounted to approximately 625 species out of the full species list. Botanists were asked to consider each ecoregion separately and provide a score for each ecoregion in which a given species occurred. In May 2013, preliminary scores were obtained from 12 botanists and compiled. Species which had received similar or

identical scores were taken “off the table”, so the face-to-face meeting time could be focused on those species which were more difficult to score, or unassigned. Scores were considered in agreement and the average score was accepted if individual scores were within 2 points of each other (eg. 2 and 4 were not considered different and were averaged to create the final assignment) *and* at least 3 botanists gave a score. Additionally, if 4 or more botanists assigned scores, then a range of 3 was accepted and the average was taken as the final score.

Approximately 7,000 scores were needed to generate the database, given the number of wetland species (~2,400) and their ecoregional occurrence. Twelve botanists scored species prior to the meeting. Approximately 400 species received agreeing scores for all regions of occurrence and were able to be excluded from discussion at the scoring meeting. In addition, further scores for individual regions were also in agreement and able to be excluded from discussion, leaving only the ecoregions that did not receive enough scores or needed revisiting at the meeting to gain consensus. In summary, the prescoring prior to the meeting resulted in 2,086 (30%) accepted final scores out of the 7,065 needed.

The 4-day botanist scoring meeting was held in Cary, NC in June 2013. Eleven botanists attended, and four additional botanists contributed by scoring and reviewing scores remotely because they could not attend the meeting. A list of all participating botanists is provided in the Appendix. Total botanist input into the final database represented 363 combined years of wetland botanical experience.

During the meeting, the overall group was divided into three smaller groups focused on the Interior Low Plateau and Mountains, Coastal Plain and Piedmont, and the Southern Coastal Plain. As a result of botanist discussions, 133 species (also subspecies and varieties) were recommended by the botanists to be excluded. These species were excluded for a variety of reasons, including epiphytes, adventive from outside the Southeast, non-native subspecies/variety, taxonomic changes or redundancy, or cases where so little of the range was within the ecoregion that inclusion was not warranted. During the meeting, 4,330 consensus scores were arrived at in addition to the prescoring, and just 3% of the total scores were tabled for further research.

The Database:

The database created by this effort includes 2,416 scored species and 6,945 C values. One-hundred twenty (120) C values were permanently tabled and labeled as undetermined (UND) in the database because not enough was known by the participating botanists about those species (or those species in certain ecoregions). Users of the database are encouraged to pay attention to the botanists’ notes column in the database, as this information provides insight into C value assignments, particularly in cases where a C value may differ across an ecoregion (eg. *Cyperus distans* is native only in Florida, but the Southern Coastal Plain extends outside of Florida, where this species would have a C value of zero), or instances where the USDA PLANTS database labeled a species as native, but participating botanists determined it to be non-native to the Southeast using a variety of sources.

The database also includes columns placed adjacent to each ecoregion’s C value column which indicate the number of botanists who worked to assign a given C value. This number is reported for all native species (non-natives automatically were assigned a C value of zero). This information yields a de facto

measure of confidence in any given score. A concerted effort was made to have more than one botanist's input into every C value, and in the vast majority of (native species) cases (89.4%), three or more botanists assigned a given C value. Nearly half (45.6%) of the database (native species) C values were assigned by 7-10 botanists.

Literature Cited

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The Taxonomic Name Resolution Service. iPlant Collaborative. Version 3.2 accessed on 23 January 2013 and 14 February 2013. Available at <http://tnrs.iplantcollaborative.org>

Appendix

Source list for reference C values included in scoring database provided to botanists:

FL	Cohen M.J. S. Carstenn, and C.R. Lane. 2004. Floristic quality indices for biotic assessment of depressional marsh condition in Florida. <i>Ecological Applications</i> 14:784-794.
IN	Rothrock, John. 2004. Floristic Quality Assessment in Indiana: The Concept, Use, and Development of Coefficient of Conservatism. Final Report to the EPA for WPD Grant CD975586-01
KY	Web-Published list by Margaret Shea, Deborah White, Douglas M. Ladd, and Marc Evans at Dropseed Nursery website http://www.dropseednursery.com/plants.html
MS	Herman, B.D., J.D. Madsen, G.N. Ervin. 2006. Development of Coefficients of Conservatism for Wetland Vascular Flora of North and Central Mississippi. Mississippi State, Department of Biological Sciences, GeoResources Institute Report.
NC	Weakley, Alan, Peter White, and Johnny Randall. 2012. Unpublished List of Coefficient of Conservatism values for selected plant species occurring in North Carolina. Division of Water Quality, Dept. of Environment and Natural Resources
TN	Preliminary values from Dwayne Estes, Austin Peay University, 2013.
VA	VA Dept. of Environmental Quality http://www.deq.virginia.gov/Programs/Water/WetlandsStreams/MonitoringAssessmentStrategy.aspx
WV	Rentch, James, and James Anderson. 2006. A Floristic Quality Index for West Virginia Wetland and Riparian Plant Communities. Final Report to the USDA CREES, Award No. 2004-38874-02133.

List of participants in the Southeast Wetland Plant Coefficient of Conservatism Panel

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