

2004 Progress Report: Vegetative Indicators of Condition, Integrity, and Sustainability of Great Lakes Coastal Wetlands

EPA Grant Number: R828675-02

Subproject: *This is subproject number 02, established and managed by the Center Director under grant R828675*

Center: [Great Lakes Environmental Indicators Project](#)

Center Director: [Gerald J. Niemi](#)

Title: Vegetative Indicators of Condition, Integrity, and Sustainability of Great Lakes Coastal Wetlands

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EPA Project Officer: Barbara Levinson

Project Period: January 10, 2001 to January 9, 2005 (Extended to January 9, 2006)

Project Period Covered by this Report: January 11, 2004 to January 9, 2005

RFA: [Environmental Indicators in the Estuarine Environment Research Program \(2002\)](#)

Research Category: [Estuarine and Great Lakes Program \(EaGLE\)](#)

Description:

Objective: Specific objectives of this subproject are to:

1. identify vegetative indicators of condition of Great Lakes coastal wetlands that can be measured at a variety of scales,
2. develop relationships between environmental stressors and those vegetative indicators,
3. make recommendations about the utility and reliability of vegetative indicators to guide managers toward long-term sustainable development.

Progress Summary: All groups within the GLEI Wetland Vegetation subproject worked on data analysis and manuscript preparation during 2004. The subproject held its fourth annual field camp in Madison, WI, on August 20-21, 2004. The field camp is the only time during the year when all subproject personnel assemble in one location. The main objectives of the 2004 field camp were to discuss findings and future manuscripts. Field exercises were conducted to introduce new SDSU graduate student Mirela Tulbure to the visual cover estimation methods used by all field personnel.

The SDSU group conducted field campaigns to collect vegetation data in support of the remote sensing effort. Field teams traveled to the western shore of Green Bay to collect ground truth on 7-10 July, 23-26 September, and 21-25 October. Field reconnaissance was also collected for the Duluth Quickbird site on 1-2 October. Data collected included:

1. GPS points of target species,
2. sketch vegetation maps of each sample site,
3. digital photos of each sample site-wide view in each direction and series along transect,
4. identify major wetland species within each site area,
5. GPS points of other major wetland plant associations.

During the July field campaign, we visited the Point au Sauble wetland (segment 306, complex 1106). Comparing the current vegetation with the vegetation recorded by the UW-Madison group in 2001, we realized that the vegetation had completely changed to a monoculture of *Phragmites australis*, which was present in only scattered locations in 2001. We collected new vegetation data to document this dramatic change, and a manuscript is in preparation.

The GLEI Vegetation subgroup participated in several other meetings directly related to GLEI:

24-28 May 2004	Assessing the Great Lakes I and II (special sessions at the International Association for Great Lakes Research), Waterloo, Ontario, presentations by Aaron Boers and Carol Johnston
13-14 Sept. 2004	GLEI Data Integration and Analysis Meeting, Duluth MN, subproject report by Carol Johnston
29 Sep.-1 Oct. 2003	Fourth All EaGLe Meeting, Bodega Bay CA, subproject report by Carol Johnston

Michael Bourdaghs, who was the field team leader for the Duluth group throughout the project, successfully defended his thesis in April 2004 (see Publications) and received his MS degree in biology. A manuscript based on his thesis research is nearly ready for submission (see Future Activities).

Another student trained under this award has obtained full-time employment, the fourth student from this subproject to be successfully placed in the environmental science workforce. Laura Ladwig (2003 field assistant, UW-Madison group) was hired as a marine ecology technician at the Evolutionary Ecology Laboratory at the Virginia Institute of Marine Science in Gloucester Point, Virginia.

As a result of the research conducted by GLEI, the Coastal Management Program of the Wisconsin Department of Administration engaged J. Zedler, C. Frieswyk and A. Boers to develop the dominance index into an indicator to help with wetland habitat assessment. Maps of dominants and types of dominance were prepared for Wisconsin including about two dozen coastal wetlands. This approach was further discussed at a workshop of the Great Lakes Regional Meeting of Coastal Management Programs, co-led by Christin Frieswyk of this Vegetation subproject and Alberto Vargas of the Wisconsin Coastal Management Program (see Publications and Presentations). Zedler and Frieswyk continue to develop the indicator, testing its ability to detect temporal changes in how a species dominates vegetation, and which species are dominant.

Future Activities: The main activity during 2005 will be to write and publish manuscripts. One manuscript is currently in revision after being reviewed for publication in *Ecological Applications* (see Publications list), one manuscript is nearly ready for submission, and others are in preparation. The Vegetation subproject is also working with John Brazner on the integrated indicator manuscript.

In preparation: Bourdaghs, M., C.A. Johnston, R. Regal. Properties and performance of the Floristic Quality Index in Great Lakes coastal wetlands. For submission to *Ecological Applications*.

Joy Zedler has initiated a new series of "fact sheets" that are being published as "Arboretum Leaflets" for eventual dissemination on the Wisconsin arboretum web site. One of these will be about assessing dominance in plant communities. They will be advertised at the University of Wisconsin's annual Arboretum Science Day, which draws local agency personnel, as well as NGO members and the public.

Graduate students Christin Frieswyk (University of Wisconsin-Madison) and Lynn Vacarro (Cornell University) continue to work on their graduate studies. Lynn's MS thesis, "Patterns and mechanisms of *Typha* dominance in wetlands across the Great Lakes," will be the subject of a future presentation at the joint INTECOL/Ecological Society of America meeting in Montreal this August. Christin's PhD dissertation is entitled "The behavior of *Typha* species in Lake Michigan coastal wetlands and the implications for ecosystem resilience." She has finished most of the analysis of her seed bank study (described in 2003 Progress Report) and is hoping to defend during the fall 2005.

Cumulative Publications and Presentations: Total Count: 33

<u>Type</u>	<u>Citation</u>
Journal	Johnston, C.A., P. Meysembourg. 2002. Comparison of the Wisconsin and National Wetlands Inventories. <i>Wetlands</i> 22:386-405.
Journal	Johnston, C.A. 2003. Shrub species as indicators of wetland sedimentation. <i>Wetlands</i> 23:911-920. (Funded by completed EPA Grant No. R804823, but related to the current research)
Journal	Kercher, S.M., C.B. Frieswyk, J.B. Zedler. 2003. Quality control approaches reveal effects of sampling teams and estimation methods for assessing plant cover in temperate herbaceous wetlands. <i>Journal of Vegetation Science</i> 14:899-906.
Journal	Danz, N.P., R.R. Regal, G.J. Niemi, V.J. Brady, T. Hollenhorst, L.B. Johnson, G.E. Host, J.M. Hanowski, C.A. Johnston, T. Brown, J. Kingston, J.R. Kelly. Environmentally stratified sampling design for the development of Great Lakes environmental indicators. <i>Environmental Monitoring and Assessment</i> 102:41-65.
Journal	Frieswyk, C.B., C.A. Johnston, J.B. Zedler. In revision. Measuring dominance among co-occurring plants. Submitted to <i>Ecological Applications</i> .
Book Chapter	Zedler, J.B., K.W. Potter. 2005. Southern Wisconsin herbaceous wetlands. In Don Waller and Tom Rooney, eds. <i>Vanishing present</i> . University of Wisconsin Press.

- Thesis Johnson, Charlene. 2003. Predicting the vegetational composition of a wetland created from dredged material in Duluth-Superior Harbor. MS thesis. Department of Biology, University of Minnesota Duluth.
- Thesis Bourdaghs, Michael. 2004. Properties and performance of the floristic quality index in Great Lakes coastal wetlands. MS thesis. Department of Biology, University of Minnesota, Duluth.
- Thesis Ladwig, Laura. 2004. *Typha x glauca* and *Phragmites australis* expansion in Peter's Marsh, Wisconsin. Senior thesis. Department of Botany, University of Wisconsin-Madison.
- Oral Presentation Vacarro, L. 2003. Plant functional diversity in wetlands and the potential impacts on decomposition and nutrient cycling. Natural Resources Graduate Student Association Symposium, Cornell University, Ithaca, NY. 24 January.
- Oral Presentation Johnston, C.A., P. Meysembourg, T. Hollenhorst. 2003. GIS-derived indicators of environmental stressors and ecosystem responses of Great Lakes coastal wetlands. 17th Annual Meeting of the Society for Conservation Biology. Duluth, MN. 28 June - 2 July.
- Oral Presentation Frieswyk, C.B., J.B. Zedler. 2003. Many types of dominance. 17th Annual Meeting of the Society for Conservation Biology. Duluth, MN. 28 June - 2 July.
- Oral Presentation Johnston, C.A., B.L. Bedford, M. Bourdaghs, T. Brown, C. Frieswyk, L. Vaccaro, J. Zedler. 2003. Plants as environmental indicators in Great Lakes coastal wetlands. 88th Annual Meeting of the Ecological Society of America. Savannah, Georgia. 3-8 August.
- Oral Presentation Danz, N.P., L.B. Johnson, G.J. Niemi, R.R. Regal, J. Schuldt, V. Brady, J. Brazner, M. Bourdaghs, C. Johnston, T. Brown, J.M. Hanowski. 2003. Integrating a fish, bird, and plant wetland indicator using regional ecological normalization. EPA All-EaGLes Meeting, Bodega Bay, CA. 3-6 December.
- Oral Presentation Wolter, P., G. Niemi, C. Johnston. 2003. Development of environmental indicators for the U.S. Great Lakes basin using remote sensing technology. EPA All-EaGLes Meeting, Bodega Bay, CA. 3-6 December.
- Oral Presentation Vaccaro, L.E. 2004. Patterns of cattail dominance and vegetation structure in wetlands across the Great Lakes. Natural Resources Graduate Student Association Symposium, Cornell University, Ithaca, NY. 20 January.
- Oral Presentation Johnston, C.A. 2004. Are wetland vegetation indicators useful for Great Rivers? First Public Symposium on Great Rivers Issues, Godfrey, IL. 15 April.

- Oral Presentation Frieswyk, C.B., C.A. Johnston, J.B. Zedler. 2004. Forms of dominance in wetland plants: a potential indicator of integrity. U.W. Arboretum Science Day, Madison, WI. 17 May.
- Oral Presentation Frieswyk, C.B., A.M. Boers, C.A. Johnston, J.B. Zedler. 2004. Cattail dominance as an indicator. 47th Annual Conference on Great Lakes Research, Waterloo, ON. 24-28 May.
- Oral Presentation Johnston, C.A., B.L. Bedford, M. Bourdaghs, T. Brown, C.B. Frieswyk, L.E. Vaccaro, J.B. Zedler. 2004. Plants as environmental indicators in Great Lakes coastal wetlands. 47th Annual Conference on Great Lakes Research, Waterloo, ON. 24-28 May.
- Oral Presentation Zedler, J.B., J. Verhoeven. 2004. Restoring wetland biodiversity: why, where & how? INTECOL, Utrecht, Netherlands. 25-30 July.
- Oral Presentation Frieswyk, C.B., C.A. Johnston, J.B. Zedler. 2004. Quantifying and qualifying dominance in vegetation. 89th Annual Meeting of the Ecological Society of America, Portland OR. 1-6 August.
- Oral Presentation Johnston, C.A., M. Bourdaghs, T. Brown, C. Frieswyk, J. Zedler, B. Bedford, L. Vaccaro. 2004. Plants as environmental indicators in Great Lakes coastal wetlands. Rushmore Regional Conference on Biocomplexity, Sioux Falls, SD. 11-12 August.
- Oral Presentation Johnston, C.A., J. Chang, M. Tulbure, T. Brown, M. Bourdaghs, C. Frieswyk, J. Zedler, B. Bedford, L. Vaccaro. 2004. Wetland plant species assemblages: Developing new and testing existing indicators. Estuarine and Great Lakes Coastal Indicators Program Annual Meeting, Duluth, MN. 30 Sept. - 1 Oct.
- Oral Presentation Frieswyk, C., A. Vargas (discussion leaders). 2004. Wetland indicators for the National Coastal Management Performance Measurement System. Great Lakes Regional Meeting of Coastal Management Programs, Milwaukee, WI. Sept. 13-15.
- Oral Presentation Zedler, J., C. Frieswyk, with C. Johnston. 2005. Long-term monitoring and indicators of coastal wetland health. Wisconsin Wetland Association 10th Annual Wetland Science Forum. Green Bay, WI. 26 Jan.
- Oral Presentation Frieswyk, C., Zedler, J. 2005. Do seed banks confer resilience to coastal wetlands invaded by cattail? Wisconsin Wetland Association 10th Annual Wetland Science Forum. Green Bay, WI. Jan. 26.
- Poster Bourdaghs, Michael. 2003. The relationship between sampling area, species richness, and the Floristic Quality Assessment Index. 17th Annual Meeting of the Society for Conservation Biology. Duluth, MN. 28 June - 2 July.

- Poster Niemi, G., R. Axler, V. Brady, J. Hanowski, G. Host, L. Johnson, C. Johnston, J. Kingston, R. Regal, C. Richards, D. Swackhamer, R. Howe, J. Ciborowski, S. Bradbury. 2003. Development of environmental indicators for the U.S. Great Lakes coastal region. EPA All-EaGLes Meeting, Bodega Bay, CA. 3-6 December.
- Poster Bourdaghs, Michael, Carol A. Johnston. 2003. The relationship between sampling area, species richness, and the Floristic Quality Assessment Index. EPA All-EaGLes Meeting, Bodega Bay, CA. 3-6 December.
- Poster Frieswyk, C.B., C.A. Johnston, J.B. Zedler. 2004. Measuring dominance among co-occurring plants (poster). Coastal Society, Newport RI. 23-26 May.
- Poster Vaccaro, L.E., C.A. Johnston, B.L. Bedford. 2004. Patterns of cattail abundance and its impact on vegetation structure in Great Lake wetlands. 25th Annual Meeting of the Society of Wetland Scientists, Seattle, WA. 18-23 July.
- Poster Pengra, B., J. Chang, C.A. Johnston. 2004. Influence of coastal geology on wetland abundance in the Great Lakes. Rushmore Regional Conference on Biocomplexity, Sioux Falls, SD. 11-12 August.

Supplemental Keywords: *vegetative indicators, coastal wetlands, floristic quality assessment index, ecosystem resilience, emergent marshes, Great Lakes, environmental indicators*

Relevant Websites: <http://glei.nrri.umn.edu>