

Park Oriented Biological Support Proposal

Title: Protecting ecological resources at Acadia National Park through landscape scale conservation and easement planning.

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Problem Statement:

Need

Acadia National Park (ANP) consists of a widely dispersed set of parcels in and adjacent to the Gulf of Maine. Park lands are found on Mt Desert Island, the Schoodic Peninsula, and offshore islands in Knox and Hancock County, Maine and are interspersed by private and other public lands. Because of the interspersed nature of private landholdings with Park property and the potential for increased development, the Park faces major challenges in the preservation and protection of its biological and ecological resources. Development on lands adjacent to the Park continues to intensify and an offshore aquaculture industry and water quality issues have raised concerns about the impacts on the Park's natural resources. Many of these adjacent non-Park parcels and islands are critically important to the integrity of wildlife populations, ecosystem health, and other natural resources within Park boundaries.

The Park has a legislatively authorized conservation easement program that has been used to provide additional protection to critically important private lands (Section 102 (h) of PL 99-420). The 1986 Acadia Park Boundary legislation outlined Acadia NP authority, responsibilities, and guidelines for developing conservation easements. However, the Park has only used broad and general criteria for evaluating conservation easements on adjacent land. These criteria included: the benefit for resource protection and proximity of the easement to the Boundary of the Park and other easements. Increasingly, the Park has recognized that it needs to use a more scientifically based set of criteria that recognizes the broader landscape setting to evaluate potential additions to the easement program. We propose to develop and provide a more scientifically based landscape scale assessment of adjacent non-Park parcels and Park properties that will identify critically important candidates for the Park to consider in their conservation easement program.

Background:

Natural resource planning is an integrative field that collects information from a broad range of disciplines and synthesizes that information into a plan to guide future management decisions. The breadth, amount, and complexity of the information that must be synthesized can be staggering. Thus traditional planning has often used highly

simplified information from the various disciplines: a requirement that is often at odds with the ecological sciences. However, two critical developments have led to a more integrative and sophisticated approach to planning. The advent of geographic information systems and a scientific framework provided by the discipline of landscape ecology allow planners and managers to use a wider array of information and science based context to address critical natural resource management issues.

Overlays of maps of soils, vegetation, wetlands, topography, and protected lands have long been used to identify appropriate and inappropriate locations for future land use. The development of geographic information systems now makes the approach routine. Emerging new technologies, such as GIS, provide an unprecedented opportunity to collect and gather existing databases from the public and private sector to be used in management planning. GIS technology allows the assembly, storage, manipulation, display, and output of geographical and tabular data. A GIS can use different types of data and information from different sources and in different forms in one comprehensive and easy-to-use application. Various GIS tools are being used by Federal Agencies to support management and planning decisions.

Another important advance in natural resource management has been the development of the field of landscape ecology and a scientific framework based on the principles and guidelines developed from recognizing the heterogeneous nature of a land composed of patches, corridors, and a background matrix. In this context, sites are not managed in isolation from the surrounding landscape. Rather, the structure or pattern of the whole landscape and the location of the site within the broader pattern are equally as important as the internal characteristics of the site. Location relative to larger patches, adjacent land-use, configurations, and corridors are also important. The functional flows and movements across the landscape are also critical to consider. Thus corridors, stepping-stones, boundaries, and sources and sinks focus on functioning conduits and barriers. Finally, landscape change places location in the perspective of the mosaic where different elements differ in the rate and direction of change. Thus additional concepts including patch dynamics, meta-populations, and spatially explicit stability mechanisms can also be used as a framework for future planning.

In 1988 and 1991 Acadia National Park worked with the Maine Coast Heritage Trust to prepare an initial inventory of lands of high conservation value that qualified for protection under the Park's Conservation easement program. The criteria that were used in identifying those lands were drawn from the Park's Land Protection Plan. Conservation easements had to possess one or more characteristics: (1) important scenic, ecological, historic, archeological, or cultural resources, (2) shorefront property, or (3) largely undeveloped entire islands. The results were summarized in a series of mylar overlays. Important ecological resources that were considered included parcels that were listed as National Natural Landmarks, significant natural habitats, marine critical areas, significant Maine geologic features, and natural communities of Acadia National Park. The assumption used by the project implied that scarce habitats or ecosystems (and habitats for scarce species) were of the highest importance for consideration by the easement program. This has been a traditional focus of conservationists and has been

largely supplemented by a view that species diversity and ecosystem function are also important considerations for conservation. This shift stems largely from a recognition that any landscape contains many interacting elements and a focus on one or few species or habitats alone may lead to a neglect of important interactions or a failure to maintain the functional integrity of the system. We propose to use a landscape perspective to provide a more rigorous and comprehensive assessment of potential parcels to include in the Acadia NP easement program.

Procedures and Methods:

We have already developed a detailed spatial database for the Mt. Desert Island portion of Acadia National. A total of 11 types of spatial data have been gathered (Appendix A) and include data on roads, vegetation, and land cover, wetlands, surficial and bedrock geology, soils data, hydrologic data, and demographic data. We will extend that database to the other portions of Acadia National Park and adjacent lands and supplement the database with additional land-use information on tax parcels in the study area. In addition, current build-out maps are also being developed by the College of the Atlantic and will be available for incorporation in the GIS. The build-out database is particularly important because it will identify potential risks for non-Park parcels. We will also work with the Park Natural Resource Management Staff to obtain available inventory data of the Park's natural resources. These will provide the location of critical natural resource features as well as sensitive or endangered species. We will also make use of the significant natural habitat, Maine critical areas, and significant geologic features databases of this part of coastal Maine. It is likely that additional data will need to be incorporated into the GIS as well.

A simple population biology based patch-matrix visualization that emphasizes proximity and size and biological resources is not sufficient for our purposes. Instead, we propose to explicitly consider the effects of variations in patch quality, boundary effects, patch context, and connectivity in the landscape on biological, hydrologic, and geologic resources. The impacts of adjacent lands on water quality and the integrity of aquatic resources will be considered as well as the impact to regional groundwater resources. We will first construct a pilot set of landscape based criteria to use in evaluating non-Park parcels and hold a one day workshop with Park Natural Resource Management staff and personnel from the Maine Coastal Heritage Trust who were responsible for the original coarse grained evaluations of conservation easements. Once the evaluation criteria are agreed to, they will be used to evaluate the Greater Acadia National Park landscape using the data layers in the GIS. A list of ranked potential sites for consideration into the conservation easement program and the characteristics of those sites will be generated.

Expected Results or products:

This project will identify sites that should be considered for inclusion in the Park's conservation easement program. Specific products will include a written report to Acadia National Park summarizing the criteria development and a digital map and database of potential sites for the conservation easement program. An integrated series of

natural resource databases in a GIS will also be made available. The protocol used as the basis for the evaluation of conservation easement properties will allow Park resource managers to be pro-active in the protection and management of their lands. The entire GIS will be given to the Park so that future changes in the selection criteria or additional information gathered from the NPS Vital Signs Program can be incorporated into the GIS. Products will also include presentations at national scientific meetings and publication in a peer-reviewed scientific journal.

The intended user of the project results is the resource management staff of Acadia National Park. We will work closely with the Park staff in the development of the databases and construction of the rules to be used in determining suitable parcels for the conservation easement program. Park staff will be actively engaged in providing natural resource management databases, working closely in the development of GIS databases, and help to outline current and future natural resource concerns and potential threats to these resources. The final report will consist of candidates for the conservation easement program, the integrated spatial database, and the criteria used to evaluate non-Park parcels. This information will also be presented orally to Park staff, and in a digital database. The information provided will be used as a basis for further consideration of high priority additions to the conservation easement program. All data generated by this project will be documented by standard metadata descriptions following the profile of the Federal Geographic Data Committee (FGDC) Content Standard for Digital Geospatial Metadata that was developed by the National Biological Information Infrastructure (NBII). Resulting metadata will be provided to the NBII Metadata Clearinghouse.

The following schedule will be used to achieve project goals:

Personnel:

Dr. Glenn Guntenspergen (Landscape Ecologist), Patuxent Wildlife Research Center

Dr. Hilary Neckles (Ecologist), Patuxent Wildlife Research Center

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Education

Ph.D. Virginia Inst. of Marine Science. Marine Science 1990
M.S. University of Minnesota. Wildlife Biology. 1984
B.S. University of Massachusetts. Wildlife Biology. 1980

Primary Interests

Ecology of estuaries and wetlands: seagrasses, freshwater and brackish submerged aquatic vegetation, salt marshes, freshwater emergent marshes; causal relationships underlying ecosystem responses to natural and human-induced disturbance, global change, restoration ecology, management prescriptions, ecological modeling.

Professional Activities (selected)

- *Estuaries* Editorial Board, 2001-present
- Habitat Committee, Gulf of Maine Council on the Marine Environment, 2001-present
- Chair, Estuarine Nutrient Enrichment Work Group, NPS Vital Signs Monitoring Program Steering Committee-Coastal and Barrier Network, 2000-present
- Co-chair, Salt marsh Work Group, Global Program of Action Coalition for the Gulf of Maine, 1998-present
- Wetlands Work Group, U.S. Clean Water Action Plan, 1997-1998
- Submerged Aquatic Vegetation Work Group, Chesapeake Bay Program, 1995-1998
- President, Society of Wetland Scientists, South Central Chapter, 1994

Publications (selected)

Neckles, H. A., H. R. Murkin, and J. A. Cooper. 1990. Influences of seasonal flooding on macroinvertebrate abundance in wetland habitats. *Freshwater Biology* 23:311-322.

Neckles, H. A., R. L. Wetzel, and R. J. Orth. 1993. Relative effects of nutrient enrichment and grazing on epiphyte-macrophyte (*Zostera marina* L.) dynamics. *Oecologia* 93:285-295.

Neckles, H. A., and C. Neill. 1994. Hydrologic control of litter decomposition in seasonally flooded prairie marshes. *Hydrobiologia* 286:155-165.

Neckles, H. A. 1994. Indicators of ecological condition of submerged aquatic vegetation. Pp. 43-50 in H. A. Neckles (ed). Indicator development: seagrass monitoring and research in the Gulf of Mexico. U. S. Environmental Protection Agency, EPA/620/R-94/029.

Moore, K. A., H. A. Neckles, and R. J. Orth. 1996. *Zostera marina* (eelgrass) growth and survival along a gradient of nutrients and turbidity in the lower Chesapeake Bay. *Marine Ecology Progress Series* 142:247-259.

Short, F. T., and H. A. Neckles. 1999. The effects of global climate change on seagrasses. *Aquatic Botany* 63:169-196.

Neckles, H. A., M. Dionne, D. M. Burdick, C. T. Roman, R. Buchsbaum, and E. Hutchins. A monitoring protocol to assess tidal restoration of salt marshes on local and regional scales. *Restoration Ecology* (in press).

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Education

Ph.D.	University of Wisconsin, Plant Biology 1984
M.S.	University of Illinois, Zoology 1977
B.S.	University of Illinois, Biology 1974

Primary Interests

Landscape ecology, wetland systems, plant community organization, urban ecology, influence of land-use on ecosystem processes, global change, restoration ecology, and decision support systems.

Professional Activities (Selected)

- Associate Editor Urban Ecosystems (1998-present)
- Member Science Advisory Board RAMSAR Int. Convention on Wetlands (2001-present)
- U.S. Representative to Urban Workgroup of the UNESCO MAB Program (2000-present)
- Associate Editor Wetlands (1995-1998)
- Secretary-General Society of Wetland Scientists (1995-present)

Publications (Selected)

Guntenspergen, G.R., S. Peterson, S. Liebowitz, and L. Cowardin. 2002. An evaluation of potential indicators for use in monitoring wetland ecosystem health in the Prairie-Pothole Region of the United States. Environmental Monitoring and Assessment. In Press.

Austin, J. T. Sklebar, G.R. Guntenspergen, and T. Buhl. 2000. Effects of roadside transect width on waterfowl and wetland estimates. Wetlands 20:660-672.

Grace, J. and G.R. Guntenspergen. 1999. The effects of landscape position on plant species diversity. EcoScience 6: 320-343.

Guntenspergen, G.R. and J.B. Levenson, 1997. Understory plant species composition in remnant stands along an urban-to-rural land-use gradient, *Urban Ecosystems*, 1: 155-169.

Guntenspergen, G.R., D.R. Cahoon, J. Grace, G.D. Steyer, S. Fournet, M.A. Townson, and A.L. Foote, 1995. Disturbance and recovery of the Louisiana coastal marsh landscape from the impacts of Hurricane Andrew, *J. Coastal Research*, 18: 324-339.

Dunn, C.P., F. Stearns, G.R. Guntenspergen, and D.M. Sharpe, 1993. Ecological benefits of the Conservation Reserve Program, *Conservation Biology*, 7: 132-139.

Appendix A. Spatial data considered for nutrient regression analysis.

Coverage	Type	Scale	Source	Derivation	Classification scheme or parameter
Roads	Line	1:6,000	OGIS, field mapping	Digital line graphs of 1980s USGS Quadrangle maps; 1996 digital orthophotoquadrangles	DOT classes; paved vs. unpaved
Vegetation/Land Cover	Polygon	1:15,840	Acadia National Park	1997 Aerial photography	Generalized vegetation types
National Wetland Inventory	Polygon	1:24,000	OGIS		Types of palustrine wetlands
Surficial Geology	Polygon	1:50,000	Maine Geological Survey	Gilman and others, 1988	Generalized surficial materials types
Bedrock geology	Polygon	1:50,000	Maine Geological Survey	Gilman and others, 1988	Generalized bedrock types
Soils	Polygon	1:???	U. S. Department of Agriculture	SSURGO data (cite Soil Survey of Hancock County Area, Maine)	Generalized soil drainage and thickness classification
Ponds	Polygon	1:24,000	Maine OGIS	USGS topo quad	Total area in basin
Streams	Line	1:24,000	Maine OGIS	USGS topo quad	Length
Houses	Point	1:6,000	USGS	1996 digital orthophotoquadrangles and field mapping	Total number; seasonal or nonseasonal; sewerd or unsewerd.