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Preserving High Quality Habitats for Endangered Species in the Florida Keys

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MAHOGANY

LANCEWOOD

KEYWORDS

HABITAT PRESERVATION, MANAGEMENT, ENDANGERED SPECIES, SPACIAL PATTERNS, SPECIES DIVERSITY

Preserving quality habitats is a critical mission of the U.S. Environmental Protection Agency (U.S. EPA). Together with many federal agencies, numerous state and local governments, and non-governmental organizations (NGOs), the U.S. EPA is looking toward habitat-based management strategies as effective, low-cost tools in preserving safe zones for the growing lists of endangered and threatened species. A core element of my dissertation project is assessing and interpreting the relative roles of dynamic vegetation processes and local spatial patterning in determining habitat quality. The subtropical forests of the Crocodile Lakes Wildlife Refuge in the northern Florida Keys are faced with myriad modern development pressures including road construction, tourism, and illegal harvesting of rare/threatened species. This forest is the most diverse in the continental United States, containing more than 120 tree species. These species are primarily tropical in origin, most of them near the northernmost part of their range. Managers find it difficult to assess the health of these forests, partly due to their high species diversity and partly because they are unfamiliar with the species that occur here.

I am using modern statistical methods (nonmetric multi-dimensional scaling and hierarchical agglomerative clustering) coupled with classical vegetation sampling techniques to provide a precise depiction of how the individual stands of Key Largo forest contribute to landscape-level preservation of a diverse habitat. I expect to explicitly demonstrate the relative roles of forest age and spatially dispersed forest patches in predicting habitat quality as a function of species composition. This analysis is being conducted with Dr. Mike Ross, a scientist at the Southeast Ecosystem Research Center (SERC), who has historic data from these stands and whose collaboration provides a long-term perspective. Our results should provide insight into the temporal processes and spatial patterns that define the globally endangered subtropical hardwood forest habitat type. The U.S. Fish and Wildlife service is charged with the protection of this plant community, and my work should directly influence their management approach in the Crocodile Lakes Wildlife Refuge. Since the U.S. EPA (without whose support this project would not have been possible) has a new and expanding dedication to understand the role of spatial processes in ecological systems, this research could provide a strong basis for diagnosing habitat health and quality in high-diversity sub-tropical forest systems in the years to come.

Introduction:

In 1999 the US Fish and Wildlife Dept. issued the South Florida Multispecies recovery plan, a document created by a broad grouping of local and national stakeholders whose common goal is the effective conservation of exploited, threatened and endangered species of the region. One of the habitats cited as important to protect is the globally imperilled Tropical Hardwood Hammock. This forest type occurs throughout the Caribbean region, and is the habitat in which several of the Federally listed endangered species occur.

North Key Largo

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES NATIVE TO THE FLORIDA KEYS TROPICAL HARDWOOD HAMMOCK INCLUDE:

Eastern Indigo Snake
Drymarchon corais couperi

Key Largo Cottonmouse
Peromyscus gossypinus allapaticola

North Key Largo Tropical Forest
[Shaded Understory]

Key Largo Woodrat
Neotoma floridana smalli

Schaus Swallowtail Butterfly
Heraclides aristodemus ponceanus

Stock Island Tree Snail
Orthalicus reses

Key Tree Cactus
Pilosocereus robinii

North Key Largo Tropical Forest
[Young Forest]

North Key Largo Tropical Forest
[Light Gap]

Tropical harwood forest habitats similar in size, climate, and species composition were historically found throughout the Caribbean region. Human impacts are primarily responsible for their extensive destruction. In fact, due to application of fires, logging, conversion to agriculture and metropolitan human habitats, the proportion of the worlds seasonally dry tropical forests that are actively conserved is less than 1%. While beyond the scope of any national law or single institution, these facts often escape the attention of policy makers, and land managers tasked with the day-to-day concerns of managing local habitats. If we are to be successful in preserving this system though, these same policy makers and land managers must use the available scientific data to inform their management decisions.

In addition to the Federally listed species (which are dominated by animals in the Crocodile Lakes Wildlife Refuge), many plant species native to the tropical hardwood habitat are considered endangered or threatened by the Florida Department of Agriculture (see reference document **http://www.doacs.state.fl.us./pi/enpp/botany/images/Notes2003.pdf**)

Endangered Plants include 26 listed species: *Bourreria cassinifolia (A. Rich.) Griseb., Bourreria radula (Poiret) G. Don, Bourreria succulenta Jacq., Caesalpinia major (Medik.) Dandy and Exell, Caesalpinia pauciflora (Griseb.) C. Wright ex Sauvalle, Calyptranthes zuzygium (L.) Sw., Canella winteriana (L.) Gaertn., Colubrina arborescens (P.Mill.) Sarg., Colubrina cubensis (Jacq.) Brongn., Colubrina elliptica (Sw.) Briz. and Stern., Dalbergia brownii (Jacq.) Schinz, Drypetes diversifolia Krug and Urban, Eugenia confusa DC., Eugenia rhombea (Berg) Krug and Urban, Exostema caribaeum (Jacq.) J.A. Schultes, Guaiacum sanctum L., Gymnanthes lucida Sw., Indigofera hespesis Small, Pseudophoenix sargentii Wendl. ex Sarg., Psychotria ligustrifolia (Northrup) Millsp., Thrinax morrisii H. Wendl., Thrinax radiata Lodd. ex J.A. and J.H. Schult., Trema lamarckianum (J.A. Schultes) Blume, Vallesia antillana Woods., and Zanthoxylum flavum Vahl. out of total 47 species on the entire endangered plant list.*

Threatened plants include 13 species: *Acoelorraphe wrightii (Griseb. and H. Wendl.) H. Wendl., Calyptranthes pallens Griseb., Chrysophyllum oliviforme L., Coccothrinax argentata (Jacq.) L.H. Bailey, Crossopetalum ilicifolium (Poir.) Kantze, Drypetes lateriflora (Sw.) Krug and Urban, Erithalis fruticosa L., Manilkara jaimiqui (C. Wright) Dubard, Maytenus phyllanthoides Benth., Myrcianthes fragrans (Sw.) McVaugh, Reynosia septentrionalis Urban, Solanum donianum Walpers, Swietenia mahagoni (L.) Jacq. of 13 total threatened species in the state.*

Pilosocereus bahamensis (Britt.) Byles and G.D. Rowley is both Federally and State listed as endangered.

Although the USFWS expends extensive effort in preparing single species recovery plans throughout their refuges, in complex habitats (like the American tropics), the high species diversity interacts with presumed coevolved species complexes which are likely to further confound management strategies. Only basic science combined with broad synthesis of published materials, and local knowledge are capable of cutting through this maze of complexity. The EPA's STAR (Science to Achieve Results) and GRO (Greater Research Oppotunities) programs foster the kind of intellectual environment required to deal with these issues.

One core element of my dissertation is designed to compare species composition among forests of different ages in order to gauge the contrasting life history strategies among the tree species groups. Results should indicate the number of groups of species, and the number and role of rare species in each group. I plan to use non-metric multidimensional scaling combined with heirarchichal agglomerative clustering to visualize the differentiation among species groups. Both of these clustering techniques have robust statistically based tests of significance, and are among the most modern techniques available. These types of tests have been recently developed for use in biometric identification procedures, and biologically based pollutant detection sampling procedures, due to the nature and complexity of biological response to fundamental change in local environmental conditions.

Conclusion: While the South Florida Multispecies recovery plan is the specific account of what resources will be allocated where for a few critically imperilled species, the broad needs of habitats still provide the most cost-effective approach for effective management of what are truly globally threatened plant communities. Florida's department of agriculture recognizes this with their list of Endangered, Threatened, and Exploited plant species list, and scientists worldwide recognize this in numerous publications and symposia. In this specific case, the EPA has provided support for my dissertation project designed to investigate the underlying causes of forest compositional patterns in a highly diverse habitat that hosts several federally listed species, and is itself part of a globally imperilled habitat type. By linking tree species composition, diversity, and ecological function to forest development I hope to provide powerful insight into the complex dynamics of landscapes of this forest type, and provide a philosophical framework whereby managers can make informed, intelligent decisions about habitat management strategies. Without EPA support, I could not have studied the habitat from this broad perspective, and would never have been able to make such a meaningful contribution to local habitat managers.

TORCHWOOD

CRABWOOD