

Conserving rare plants in locally-protected urban forest fragments: A case study from Miami-Dade County, Florida



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ABSTRACT

We consider Miami-Dade County's Environmentally Endangered Lands (EEL) network of preserves as a means to conserve rare plant species in urban and suburban forest fragments. In this rapidly urbanizing landscape, upland forests are at particularly high risk of development. We examined the number of rare plant species present in preserves based on the site area, ecosystem type and management practices using the EEL database maintained by the county and a database of plant species inventories collected by the Institute for Regional Conservation. About 99% of the area of the EEL system is located in southern Miami-Dade. Pine rockland forests are primarily in the outer suburbs of the county where fire can be used most effectively for management. Hardwood hammock forests are distributed throughout the county including within the urban core. All 56 EEL forested sites under study contained at least one rare plant species. Small sites often contained high numbers of rare species per unit area, but presumably at lower population sizes. The type of upland forest was not related to the mean richness of rare or state-listed plant species. Public access was not related to the mean richness of rare plants, but was negatively associated with the richness of state-listed plant species.

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1. Introduction

South Florida has seen very rapid growth of human populations and economic development over the past century and, by 2010, Miami-Dade County's population was about 2.5 million (United States Census Bureau, 2010). Most development has occurred on the higher elevational limestone Miami rock ridge (Fig. 1) where flooding is least likely. Upland forests became increasingly rare through the 20th century as rock-plowing and other farming techniques drove conversion to agricultural lands (Smith et al., 2011). More recently, drainage and canalization allowed agriculture to advance beyond the rock ridge and continue into the vast former marshes of the eastern Everglades (Carden, 2004).

In 1990, Miami-Dade County began purchasing upland forest sites and other threatened parcels through the Environmentally Endangered Lands (EEL) program (Alonso and Heinen, 2011) after

citizens passed a dedicated property tax millage. In addition to this fee-simple conservation program, the county later began the EEL Covenant Program by providing landowners with property tax relief in exchange for preserving forest fragments on private property (Giannini and Heinen, 2014) provided they follow an approved management plan. The two main upland forest types preserved under EEL are pine rocklands and hardwood hammocks.

Worldwide, areas with high plant endemism are characterized by the confluence of geological and climatological conditions that produce unique and relatively stable habitats over time (e.g. Heinen and Shrestha-Acharya, 2011; Liu et al., 2014). Pine rockland forests in South Florida are no exception; they are exclusive to relatively high-elevation limestone outcrops that are fire-prone areas at high risk of development. They are noted for their unique combination of temperate and tropical flora and a large number of rare endemic plants, many of which are either state or federally listed (Avery and Loope, 1980; O'Brien, 1998; Powell and Maschinski, 2012). Despite a high richness of understory plants, pine rocklands are dominated by one canopy tree species, South Florida Slash Pine (*Pinus elliottii* var. *densa*; Simpson, 1920). Today within the county pine rocklands are limited to parts of eastern Everglades National Park and scattered natural areas throughout the urban and suburban matrix of Miami-Dade. Pine rocklands require fire for effective management,

Abbreviations: EEL, Environmentally Endangered Lands; IRC, Institute for Regional Conservation; FNAI, Florida Natural Areas Inventory; FTBG, Fairchild Tropical Botanic Garden.

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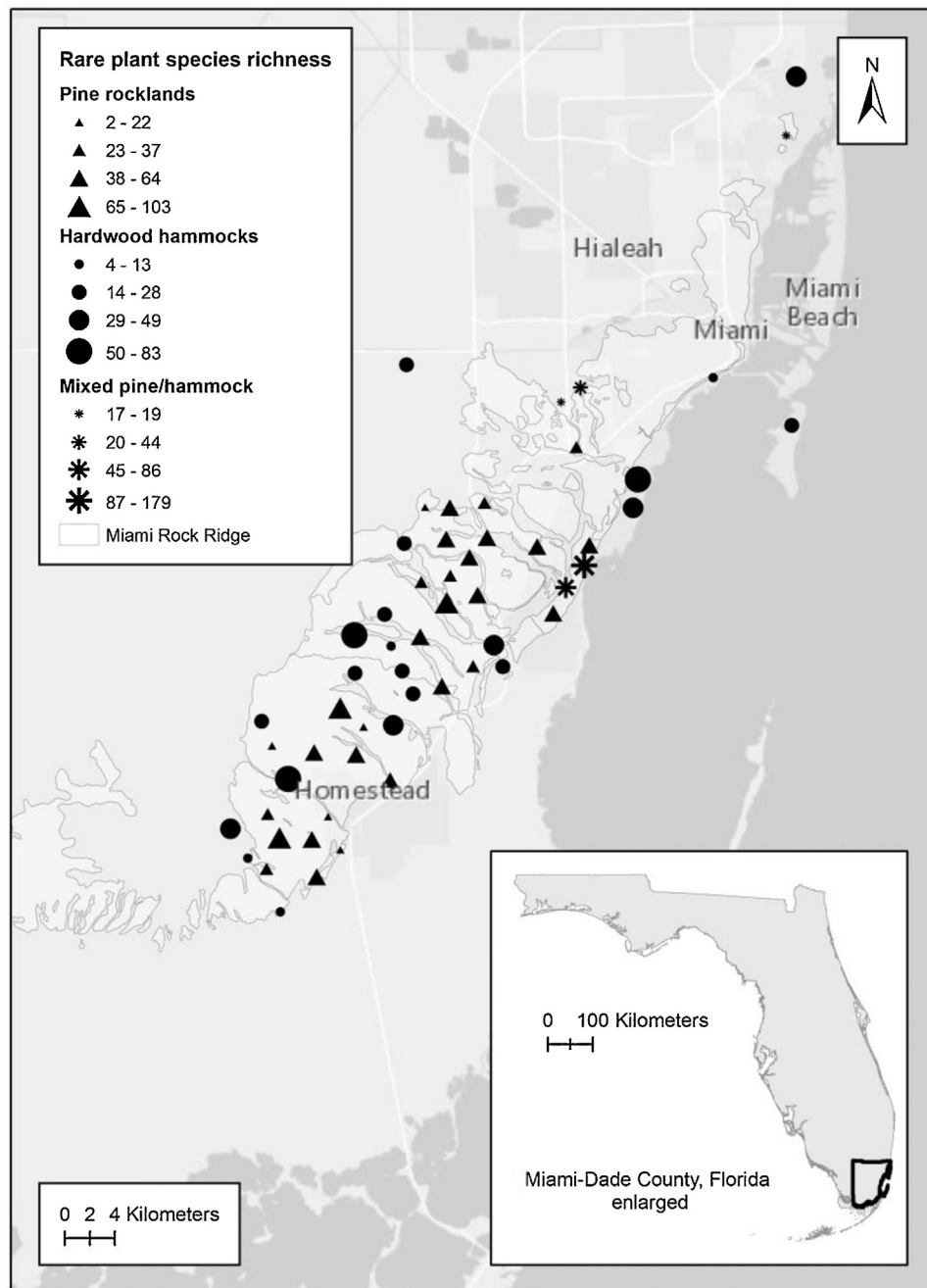


Fig. 1. This representation of the EEL pine rockland and hardwood hammock forests indicates the richness of rare plant species at each site. The symbol used indicates ecosystem type, larger symbols indicate greater richness of rare species. Some markers have been geographically dispersed to display nearby sites. Site additions with plant species lists present were displayed as separate markers. Miami is the urban core of this county, and suburban development follows the shape of the Miami rock ridge southwest towards Homestead. Miami rock ridge shape file used with permission of Fairchild Tropical Botanic Garden.

which is politically difficult in densely populated areas (Lloyd and Slater, 2012; Possley et al., 2014).

Tropical hardwood hammocks, like pine rocklands, form on higher and drier land than surrounding freshwater marshes. These tropical dry forests are populated by a wide variety of evergreen and deciduous trees, many of which produce fruits of high importance to migratory birds and frugivorous mammals (Karim and Main, 2009; McCleery et al., 2006). Much of the vegetation is of West Indian origin in contrast to the majority of vegetation along the east coast of the United States. Tropical hardwood hammocks form over thin, well-drained, organic soils (Ross et al., 2003). Pine rocklands and tropical hardwood hammocks are two endpoints of a successional gradient; that is, fire will remove hammock and allow

for pine regeneration, while fire suppression will allow hardwood hammock vegetation to dominate (Alexander, 1967).

While efforts to restore South Florida forests have increased, the challenges to management have not abated. Dozens of invasive plant species have established in pine rocklands, compared to just four problematic species noted in the 1970s (Loope et al., 1979). Prescribed burning is difficult as urban sprawl continues into formerly agricultural areas of southwest Miami-Dade County where the majority of EEL preserves are located. Mechanical thinning of hardwoods was investigated as an alternative to fire in urban pine rocklands with mixed results and much higher costs than controlled burns (Maschinski et al., 2005). Researchers have reported that thinning is not a desirable substitute but can be beneficial as a

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