

Metacommunity structure of dry tropical forests at the distal end of the Florida peninsula

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Florida is a zone of transition between tree species of temperate and West Indian (tropical) origin, thus likely to see notable shifts in composition with changing climate

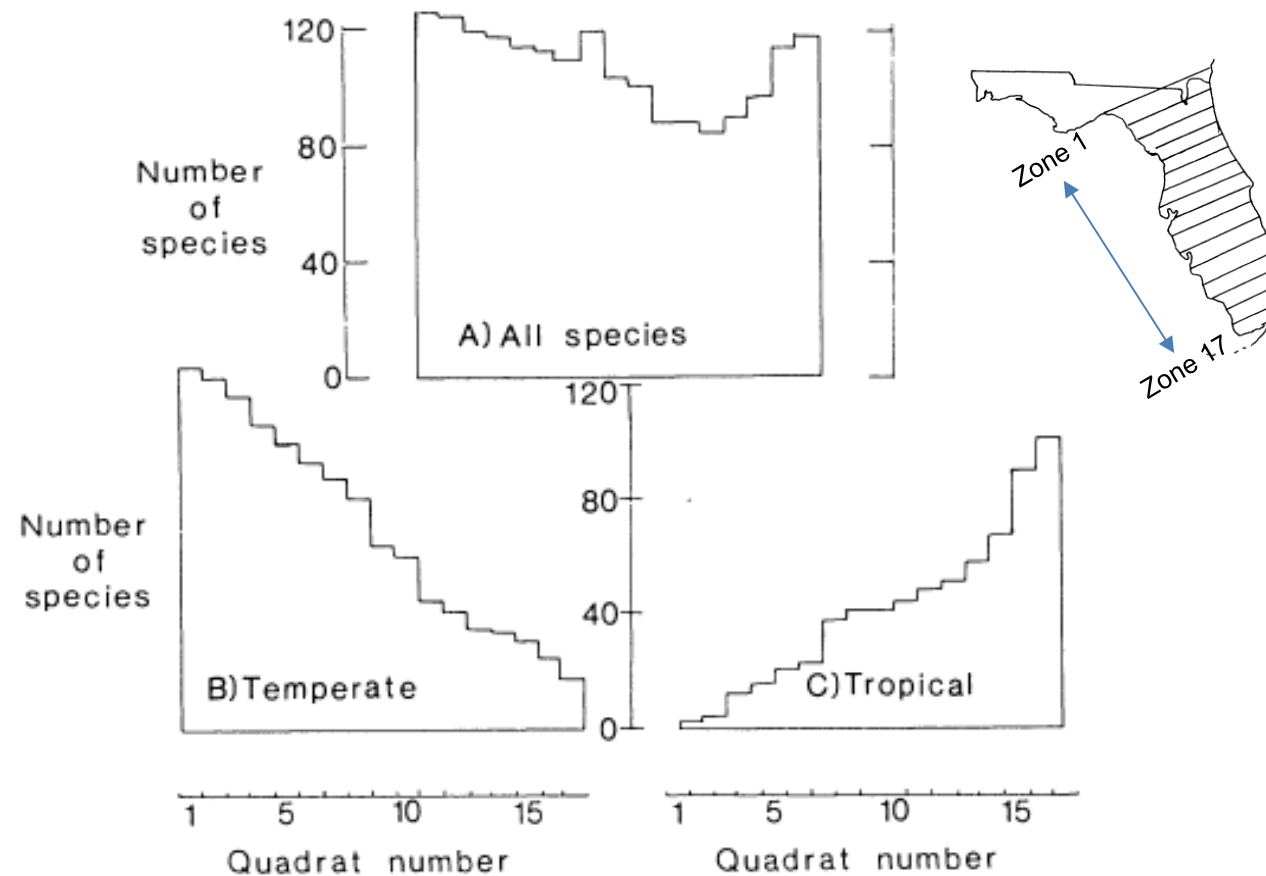
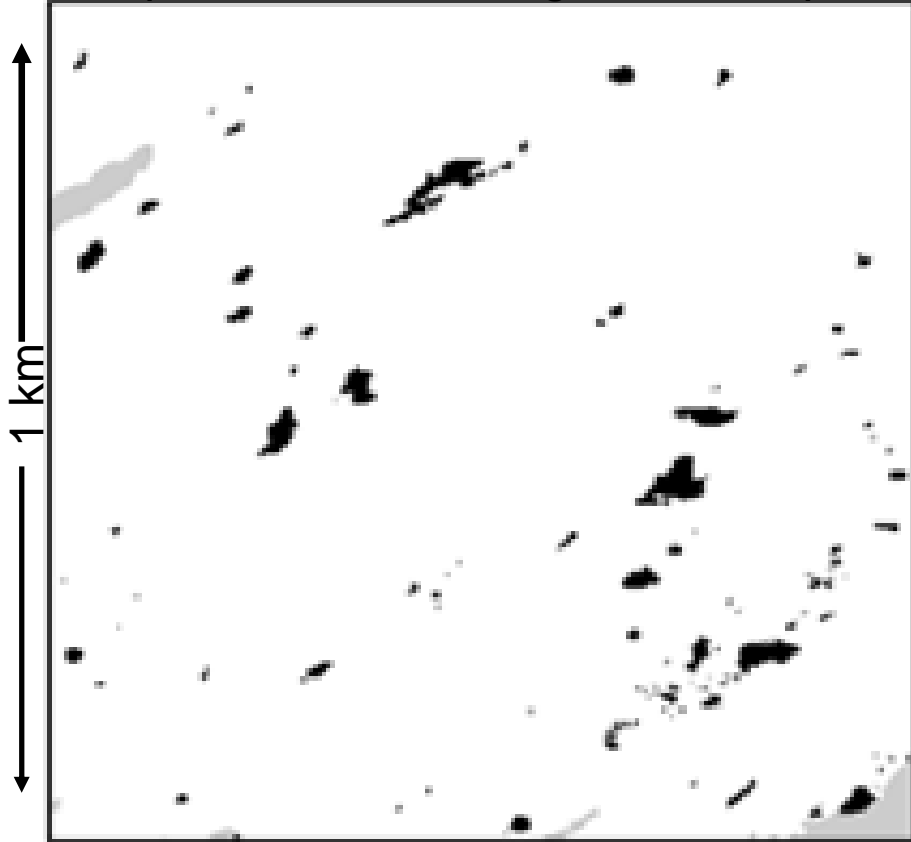


FIG. 4. Histograms of species diversity of woody flora of peninsular Florida by quadrat. (A) All species combined; (B) temperate species; and (C) tropical species.

What is a metacommunity?

(“... a set of local communities linked by the dispersal of multiple potentially interacting species”; Leibold et al. 2004)

Tree patches in an Everglades marl prairie

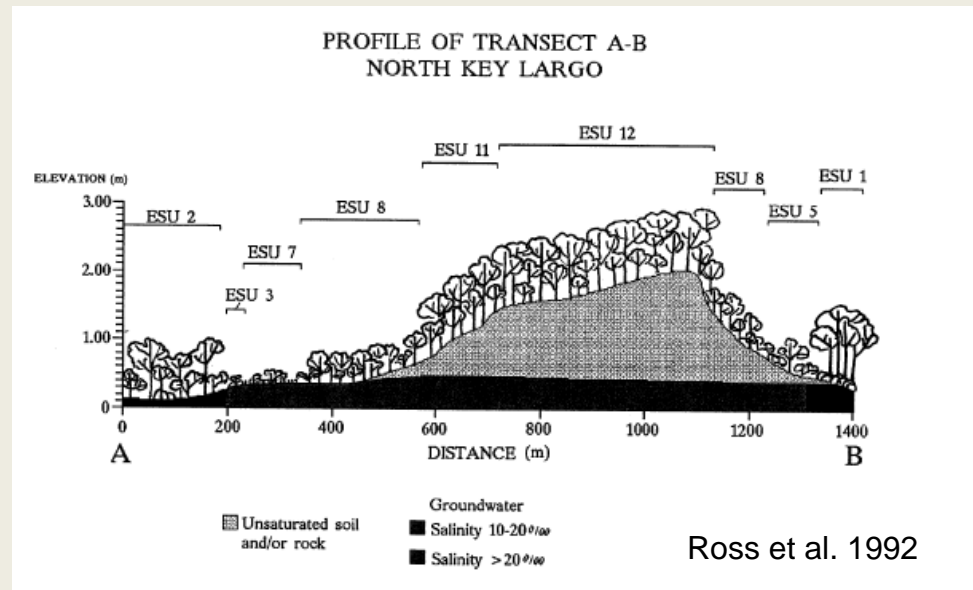
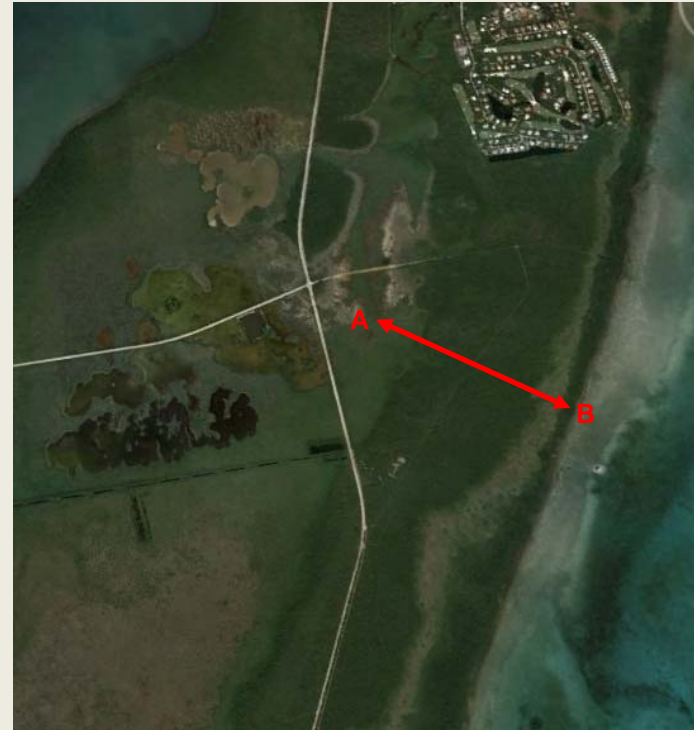


In migration, species will move through real landscapes, where

(1) appropriate habitat is patchy, and

(2) interactions among & within patches is paramount

Hardwood “hammock” in the Keys are rooted on limestone outcrops & embedded in coastal wetlands



Hardwood forests in mainland pine forests, marl prairies, & Everglades peatlands

1. Hammocks in these mainland landscapes are also nucleated on limestone surfaces.
2. Outcroppings become **smaller and more isolated** from Keys → pineland → prairie → peatland landscape.



Tree island in pine forest, Everglades National Park



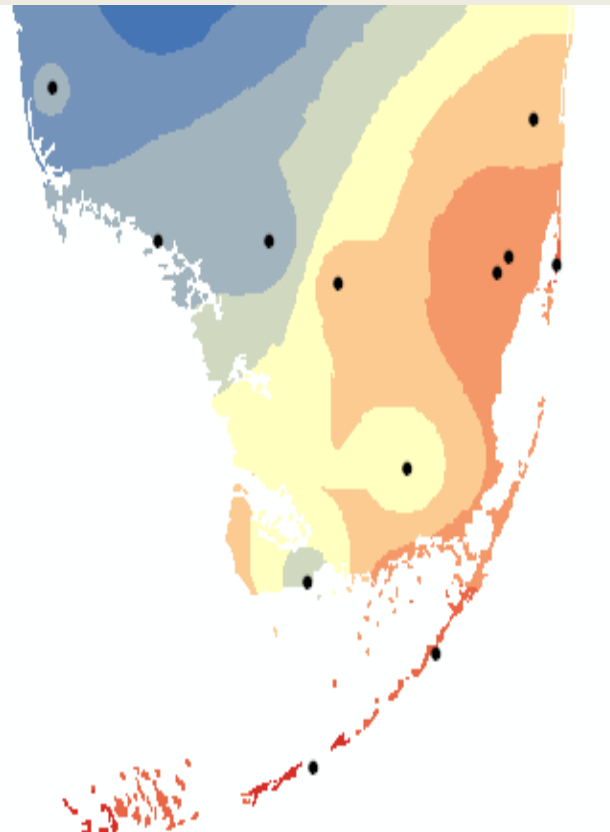
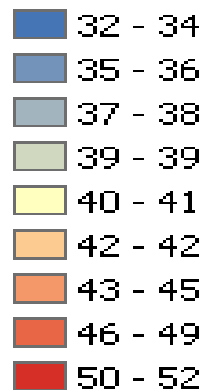
Tree islands in a seasonally flooded marl prairie



Tree island in interior Everglades peatland

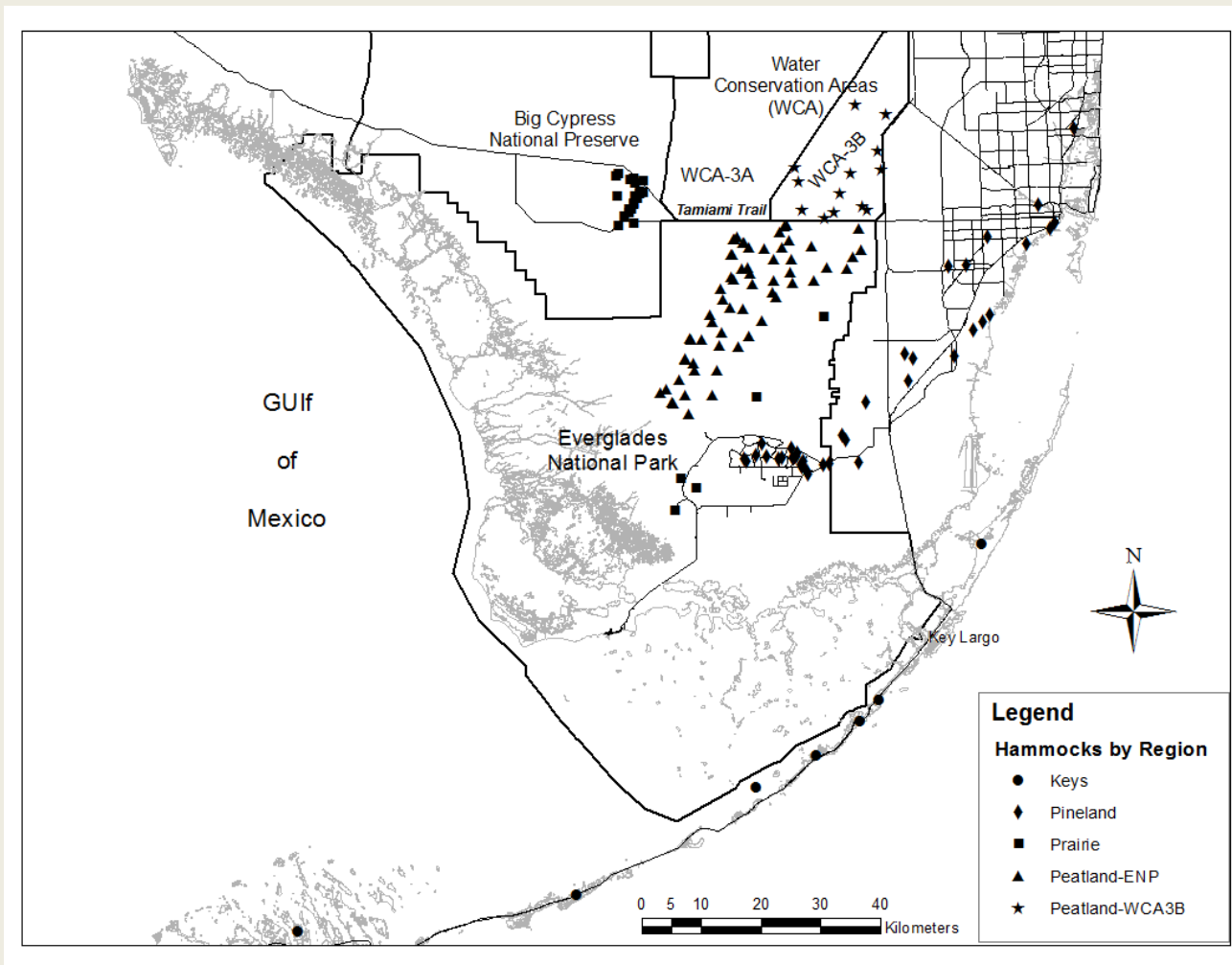
Regional temperature variation - minimum temperatures in south Florida decrease from SE to NW

**Mean January
minimum (^oF),
1980-2010**



In this study we looked at effects of **hammock area, **isolation**, and **temperature** on metacommunity structure**

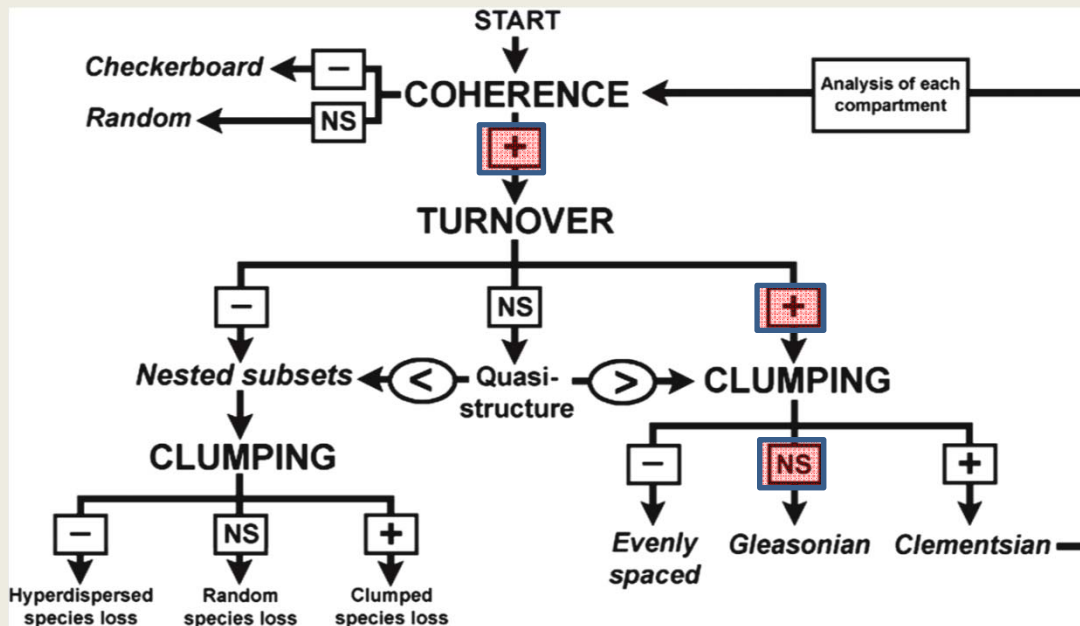
A sample from the South Florida hammock metacommunity



1. Data sources: complete tree species list from 144 sites from 6 sources
2. Analytical approach: EMS approach to describe metacommunity structure, followed by incorporation of **site** and **community** variables.

EMS approach to metacommunity analysis (Presley et al. 2010) - species & sites in P/A matrix first arranged along underlying gradient, determined from ordination.

- Positive coherence** – few embedded absences; species respond to same environmental factors.
- Positive turnover** – spp that begin early along the gradient, end early.
- Random range boundary clumping** – “Gleasonian” pattern.



Presley et al. 2010

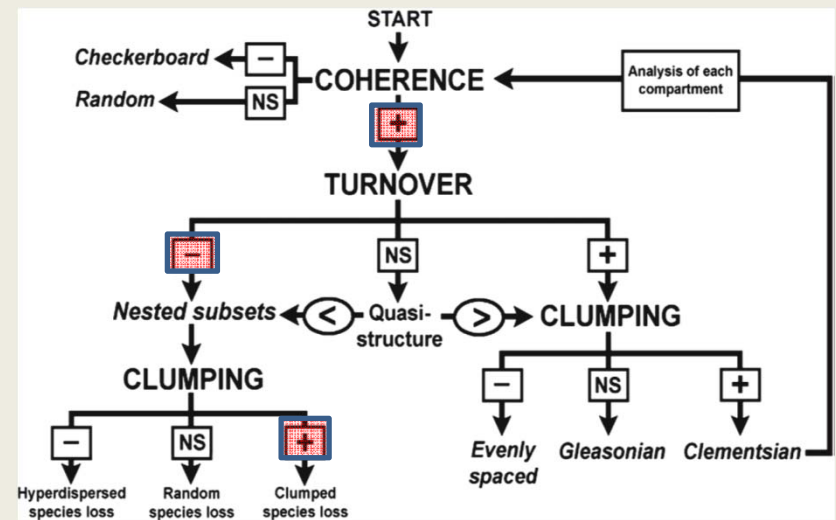
	Species									
	1	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0	0
	1	1	1	0	0	0	0	0	0	0
	1	1	1	1	0	0	0	0	0	0
	1	1	1	1	1	1	0	0	0	0
	0	1	1	1	1	1	0	0	0	0
	0	1	1	1	1	1	0	0	0	0
	0	0	0	1	1	1	0	0	0	0
	0	0	0	0	1	1	1	1	0	0
	0	0	0	0	0	0	1	1	0	0
	0	0	0	0	0	0	1	1	1	1
	0	0	0	0	0	0	1	1	1	1
	0	0	0	0	0	0	0	0	1	1
	0	0	0	0	0	0	0	0	1	1

Expected (?) pattern for Florida upland forests

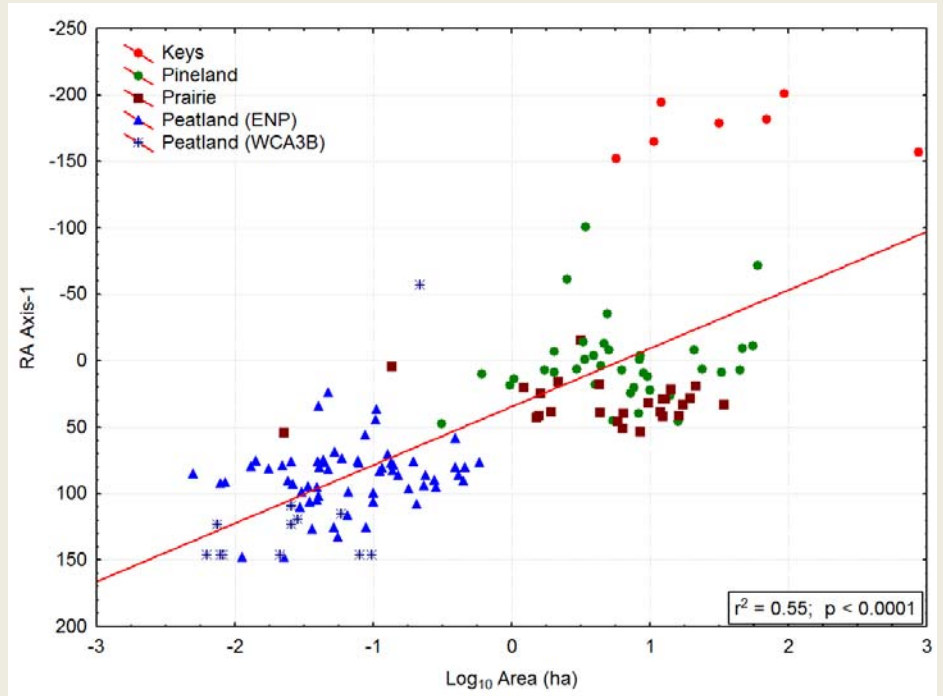
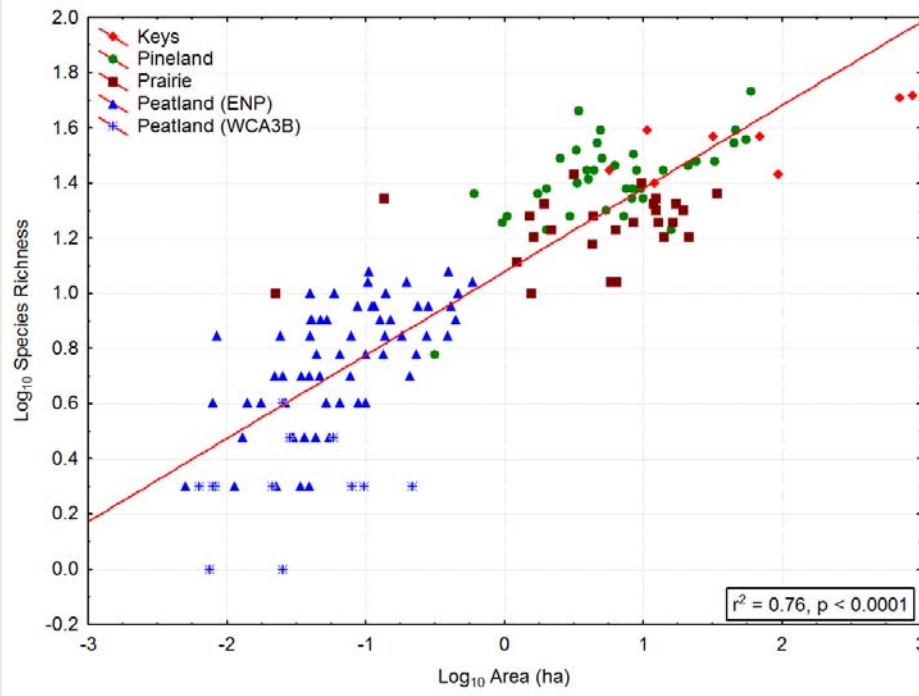
Accessory site and community variables

Variable Type	Habitat-related	Dispersal-related	Climate-related
Potential Environmental Filter	Hammock size (AREA)	Availability of local seed sources (Neighbor Proximity Index; NPI)	Local cold temperature regime (Minimum January Temperature; MJT)
Associated community-aggregated traits	Successional status (Successional Position Index – SPI)	Long distance dispersal (% fleshy fruited species)	Cold temperature sensitivity (Cold Temperature Index; CTI)

Metacommunity structure: positively coherent, negative species turnover (nested), clumped range boundaries

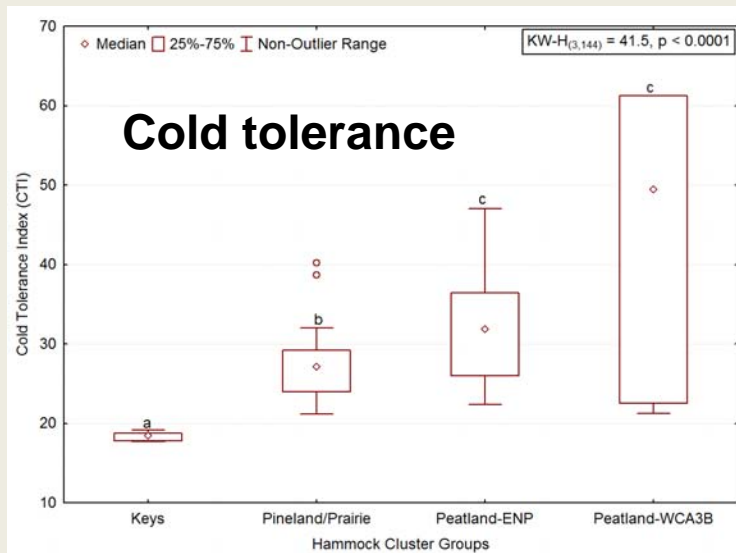
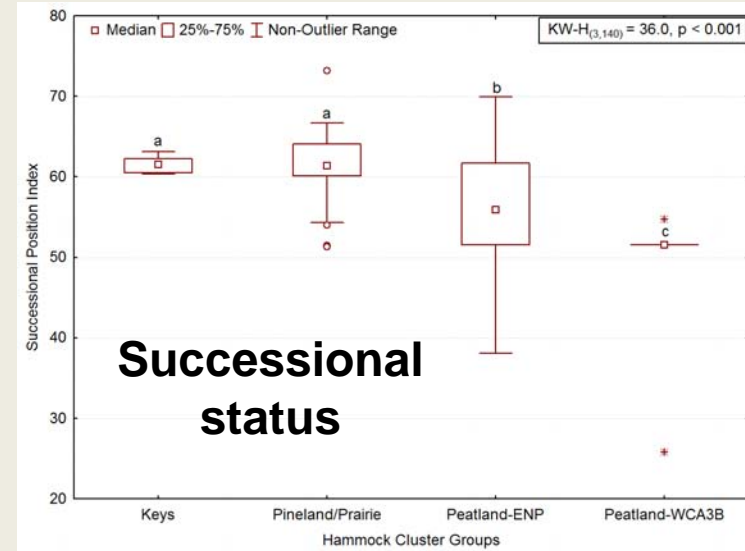
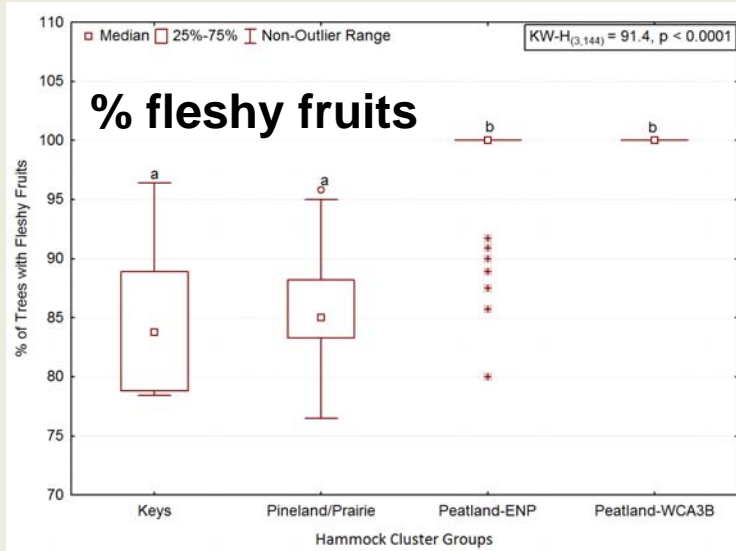


Relationships among site variables, tree species richness, and forest composition



1. **Log (Area)** explained 76% of variation in the log of **species richness**.
2. **Log (Area) ALSO** explained 55% of variation in **first ordination axis**.
3. Addition of **Minimum January Temperature** to composition model increased variance explained to 77%.
4. For small islands, **Neighbor Proximity Index** and **log (Area)** both contributed significantly to model predicting **composition** ($R^2=0.39$)

Mean functional traits of tree assemblages across the environmental gradient



Assemblages in small, isolated, species-poor interior islands were characterized by:

- (1) Animal-dispersed seed
- (2) Early successional status
- (3) High cold-tolerance

Conclusions

1. In S FL, tropical hardwood hammocks from the Keys to Everglades interior are found along a complex gradient of decreasing habitat size, decreasing winter temperature, and increasing isolation.
2. Along this gradient, forests become less diverse, and comprised of a distinct group of early successional, fleshy-fruited, relatively cold-tolerant tropical species.
3. As the climate warms, we can expect species migration to be constrained by the same factors that determine species assembly today, e.g., fragment size & dispersal limitation.