Seed dispersal connectivity among palm swamp patches in Costa Rica and Nicaragua

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IBED

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Introduction

Ecosystems

Flows of energy

Flows of (genetic) information

Flows of individuals

Other flows...

Conservation (Long term)

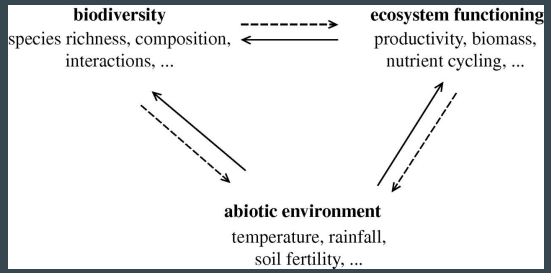
Physical landscape

Anthropogenic Global Impacts

Biodiversity loss

Climate change

Deforestation



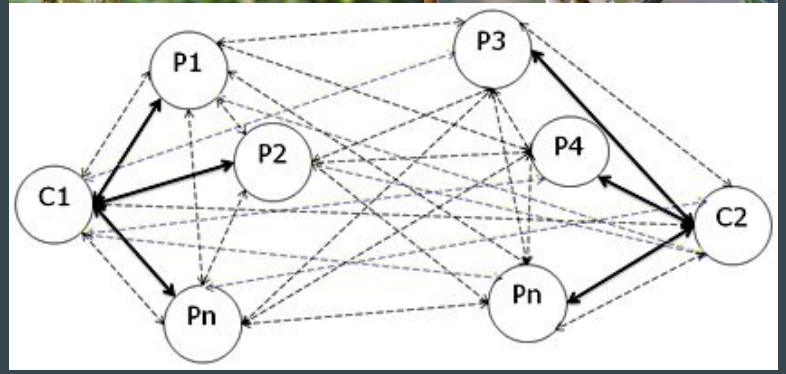
Introduction

Seed Dispersal

- Key Ecological Flow
- Gene flow among populations
- Evolution of mutualistic interactions (e.g. Frugivory in the tropics)

Connectivity = Movement

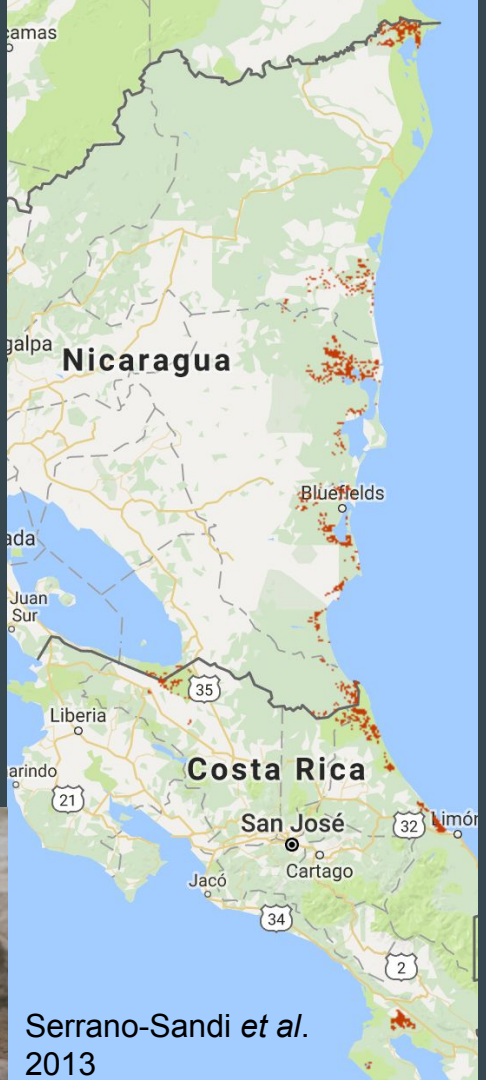
- Structural Connectivity
- Functional Connectivity
- Effective Connectivity



Introduction

Wetlands (palm swamps) dominated by *Raphia taedigera* in Central America

- 22% and 16.24% of wetland area in NI and CR.
- Globally important for carbon sequestration
- *Raphia taedigera*
  - only *Raphia* in America
  - Non-floating seeds
  - Megafaunal fruit traits
- Connectivity poorly understood



Serrano-Sandi *et al*. 2013

Research Questions and Hypothesis

How does connectivity among Raphia taedigera patches varies in function of Tapirus bairdii maximum dispersal distances?

H1) Overall connectivity increases with increasing maximum dispersal distances.

H2) Individual contribution of patches to connectivity is distributed equally

Research Questions and Hypothesis

Are there functional corridors among all patches of Raphia taedigera?

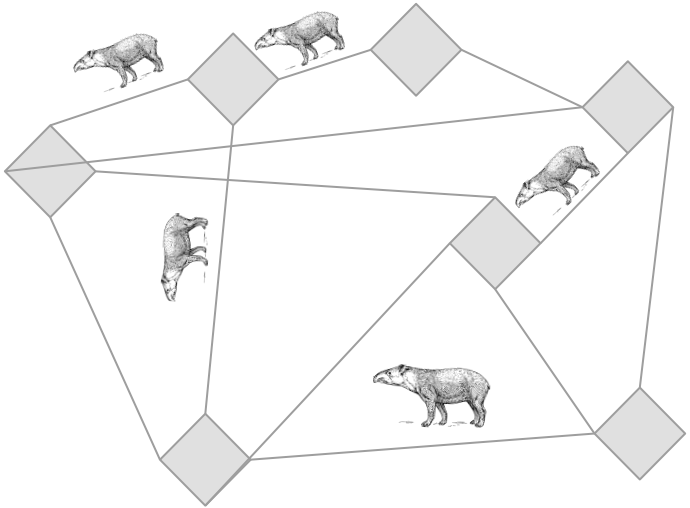
H3) Functional corridors facilitating the movement of *Tapirus bairdii* are present among all *Raphia taedigera* patches

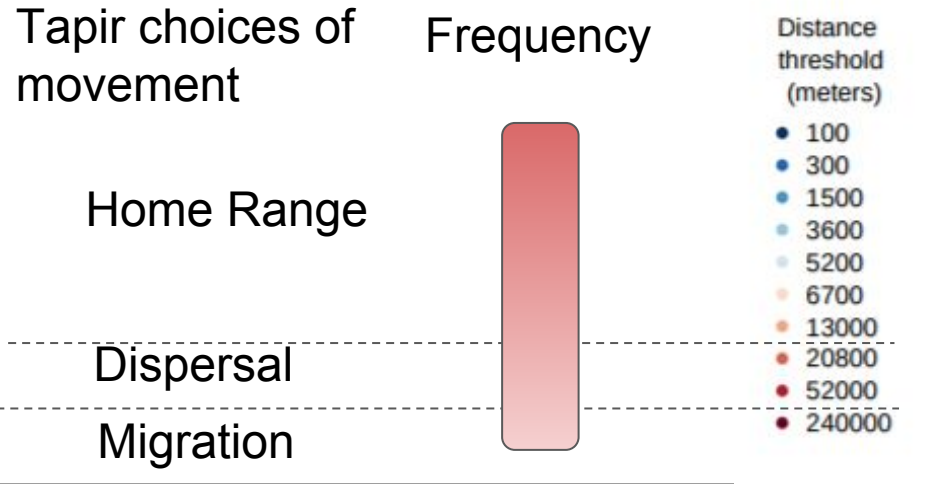
METHODS

Structural connectivity

- Spatial explicit network of patches
  - Based on Serrano-Sandi maps
  - Probability of Connectivity (PC)
  - Patch removal effect (dPC)

- Tapir Movements + Gut Passage Time = Distance thresholds = Tapir choices of movement



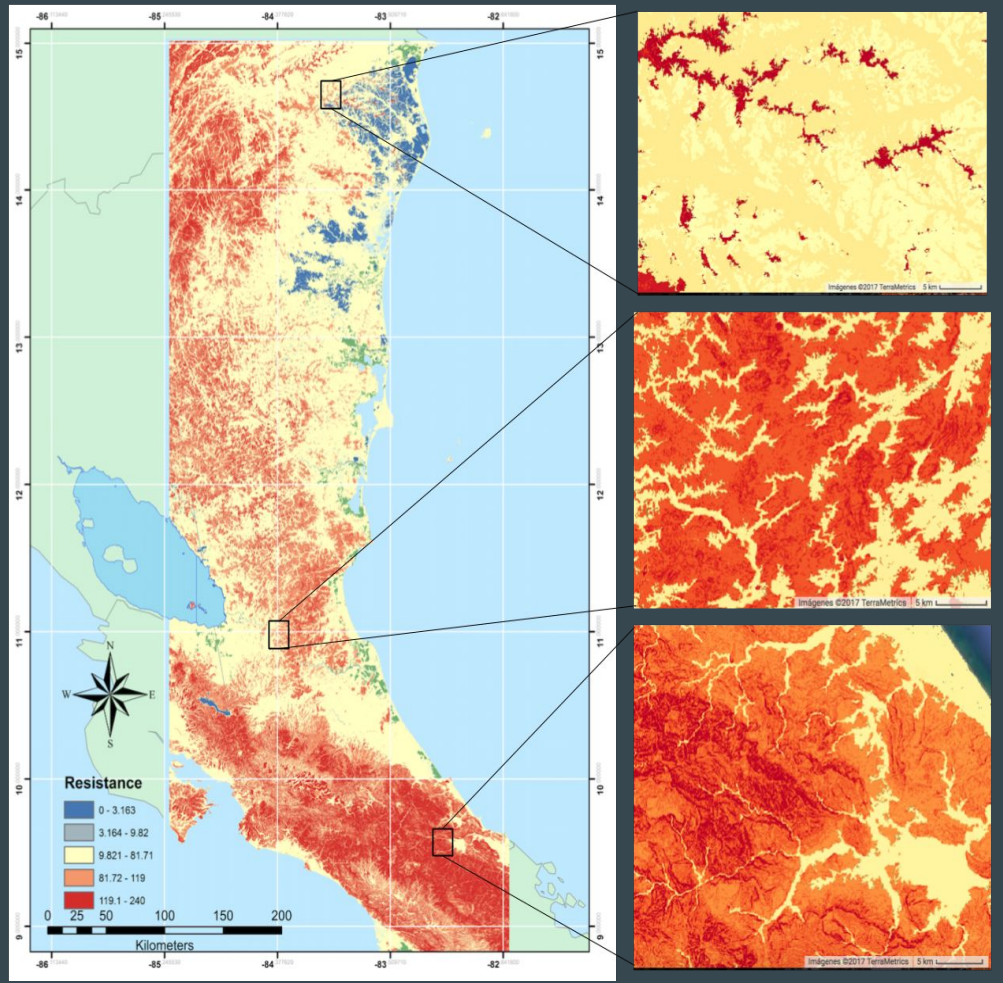


METHODS

Functional connectivity

Landscape resistance layer

Variable	Class	Resistance
Population Density	0-10	3
	10-50	70
	50-120	100
Slope	0-15	0
	15-30	70
	30-90	100
Road Network	1st & 2nd order roads	100
	3rd order roads	70
Distance to water	Water bodies	0
	HAND[1] (< 30m)	10
	HAND (> 30m)	40
Forest TreeCover(%)	0-15	80
	15-40	70
	40-60	30
	60-80	10
	80-100	50
	0	100



METHODS

Functional connectivity

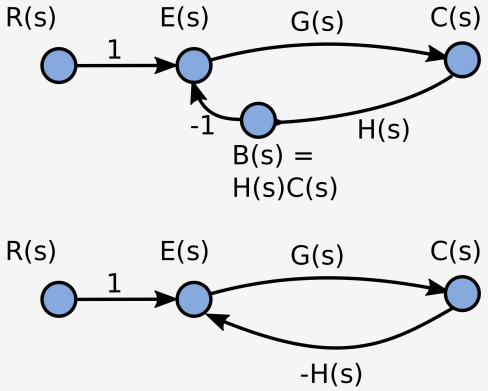
Functional Corridors

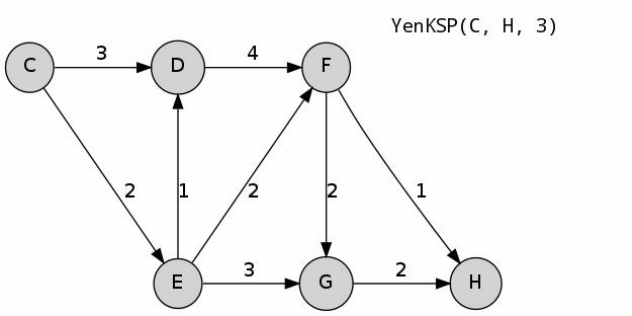
Circuit theory

- Electric current flow among focal nodes

Randomized shortests paths

- Tapir records to random *Raphia* patches
- Based on camera trap observations
- Constrained to a tradeoff between exploration and shortest path

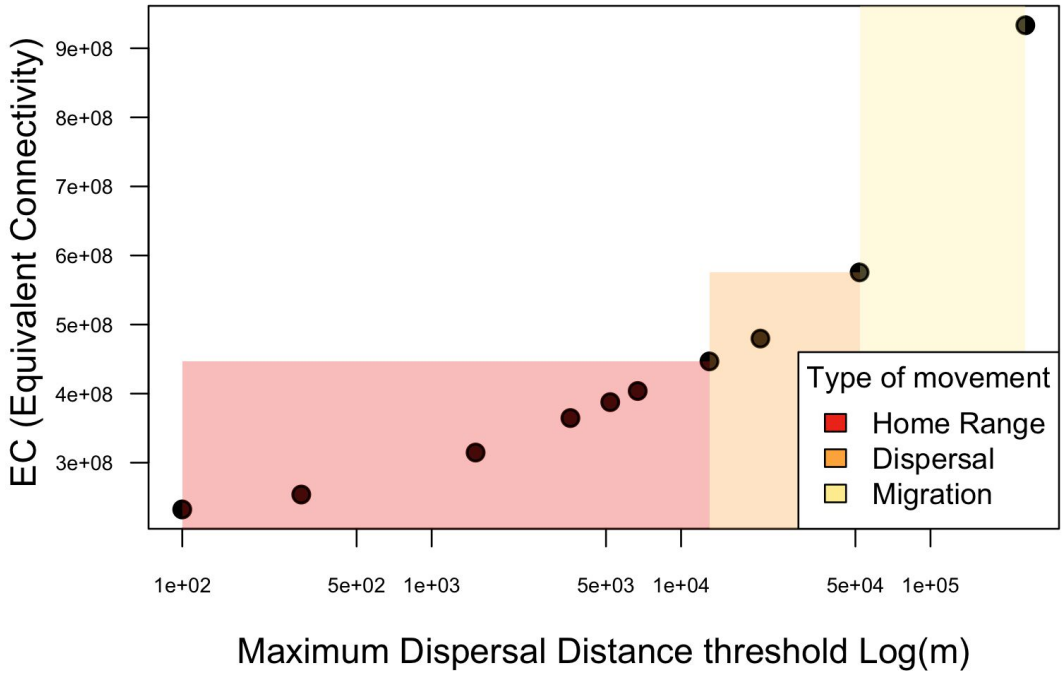




RESULTS AND CONCLUSIONS

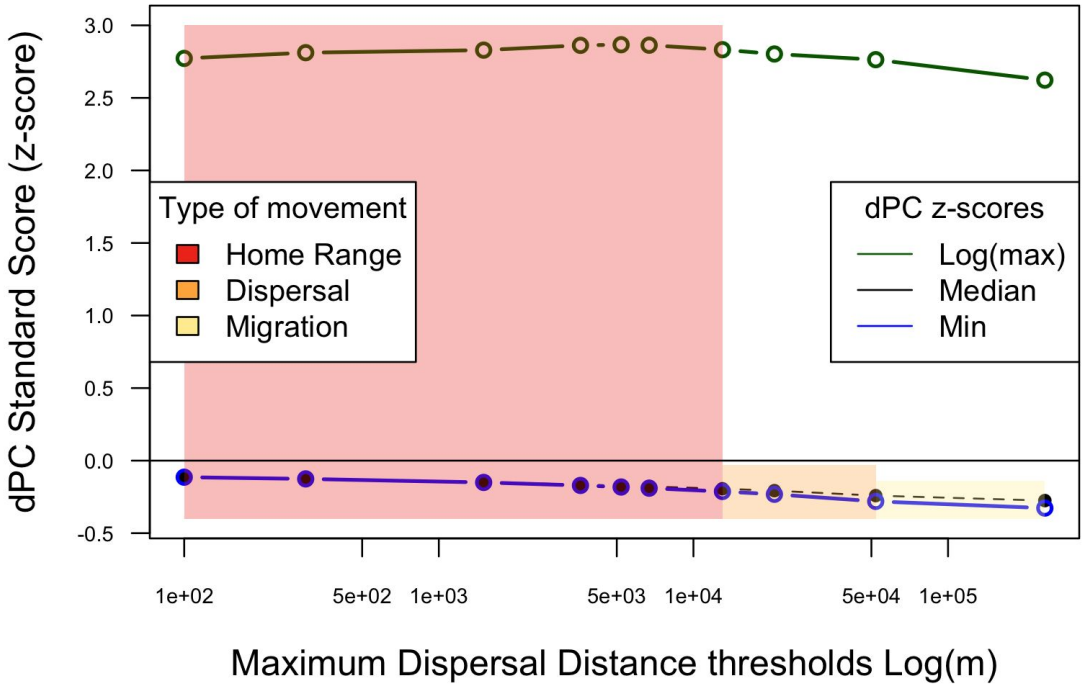
Available area for dispersal increases with max.dispersal distances (H1) ✚ ✚

Changes in long distance dispersal tapir distances (dispersal + migration) greater effects in global connectivity



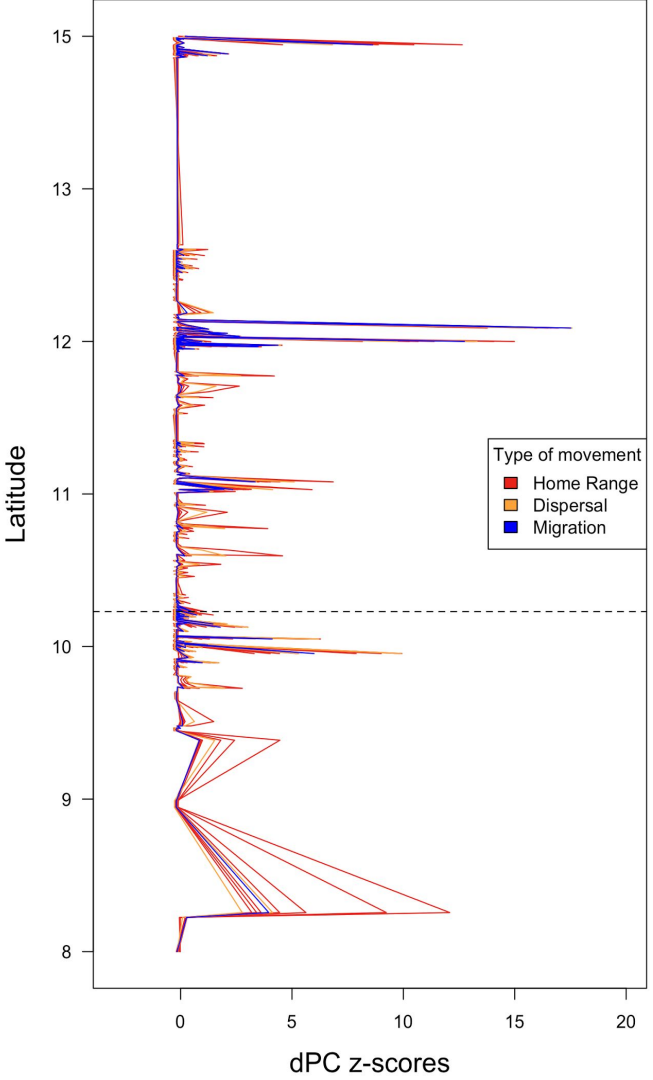
RESULTS AND CONCLUSIONS

Individual patch removal effects on connectivity are much higher for specific few patches (H2) ✖✖



RESULTS AND CONCLUSIONS

Spatial pattern in the distribution of patches important for connectivity

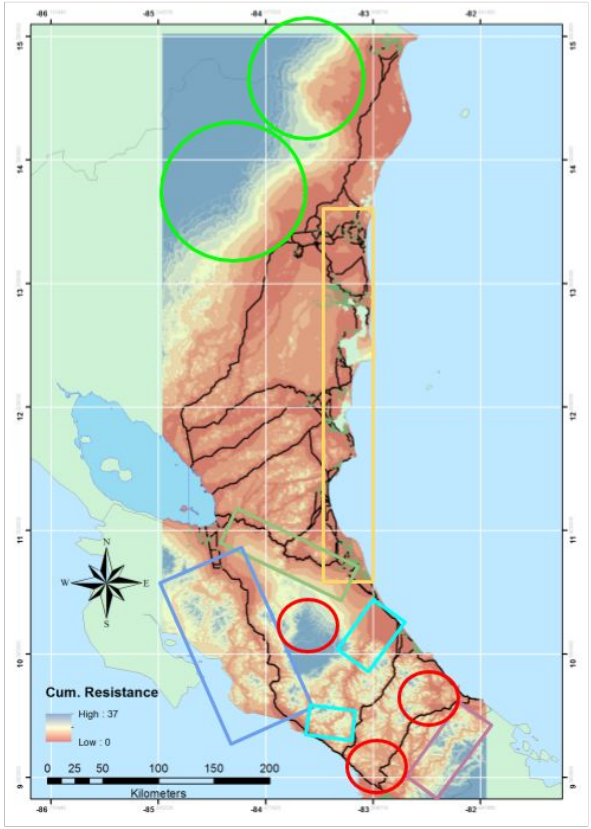


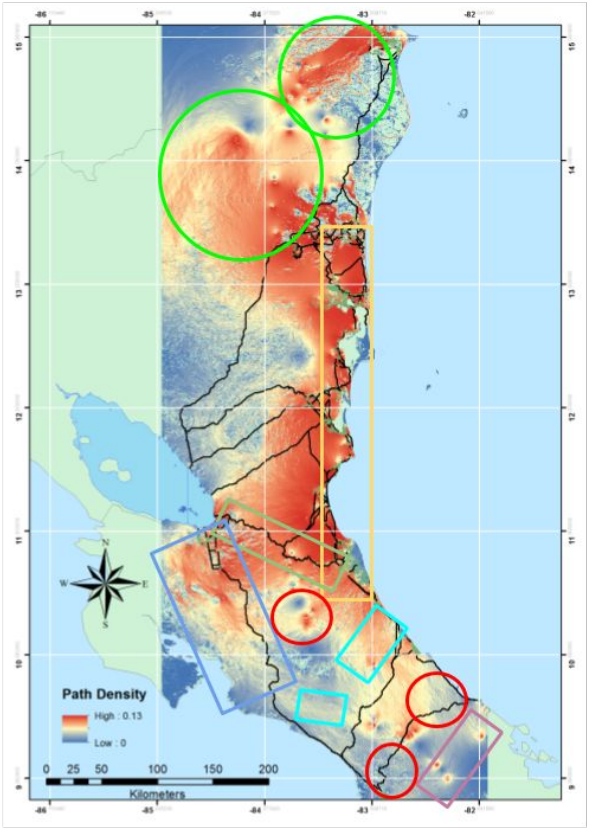
RESULTS AND CONCLUSIONS

Functional Connectivity

Landscape corridors among all patches (H3) ✚ ✚

- Atlantic corridor
- InterOceanic corridors
- Pacific corridors





DISCUSSION

Baseline connectivity scenarios

- Patch network of late 1980s
- Forest coverage 2000

Measure changes in connectivity

- Localized pressures, global effects
  - Patch removal
  - Deforestation landscape matrix
  - MAP

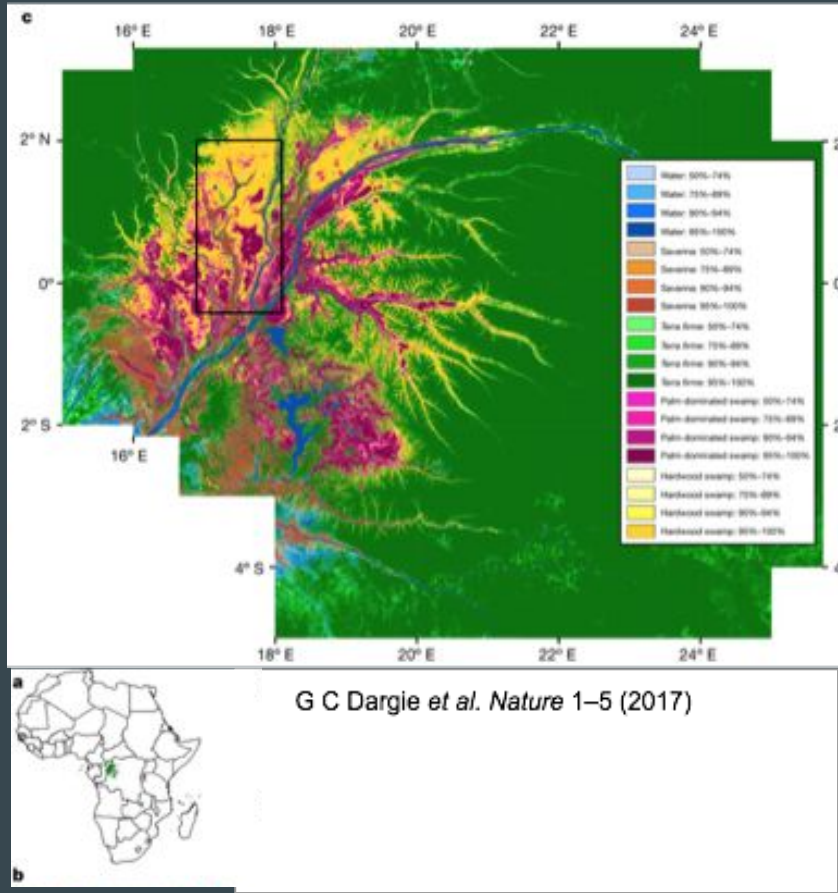
Limitations:

Euclidean distances

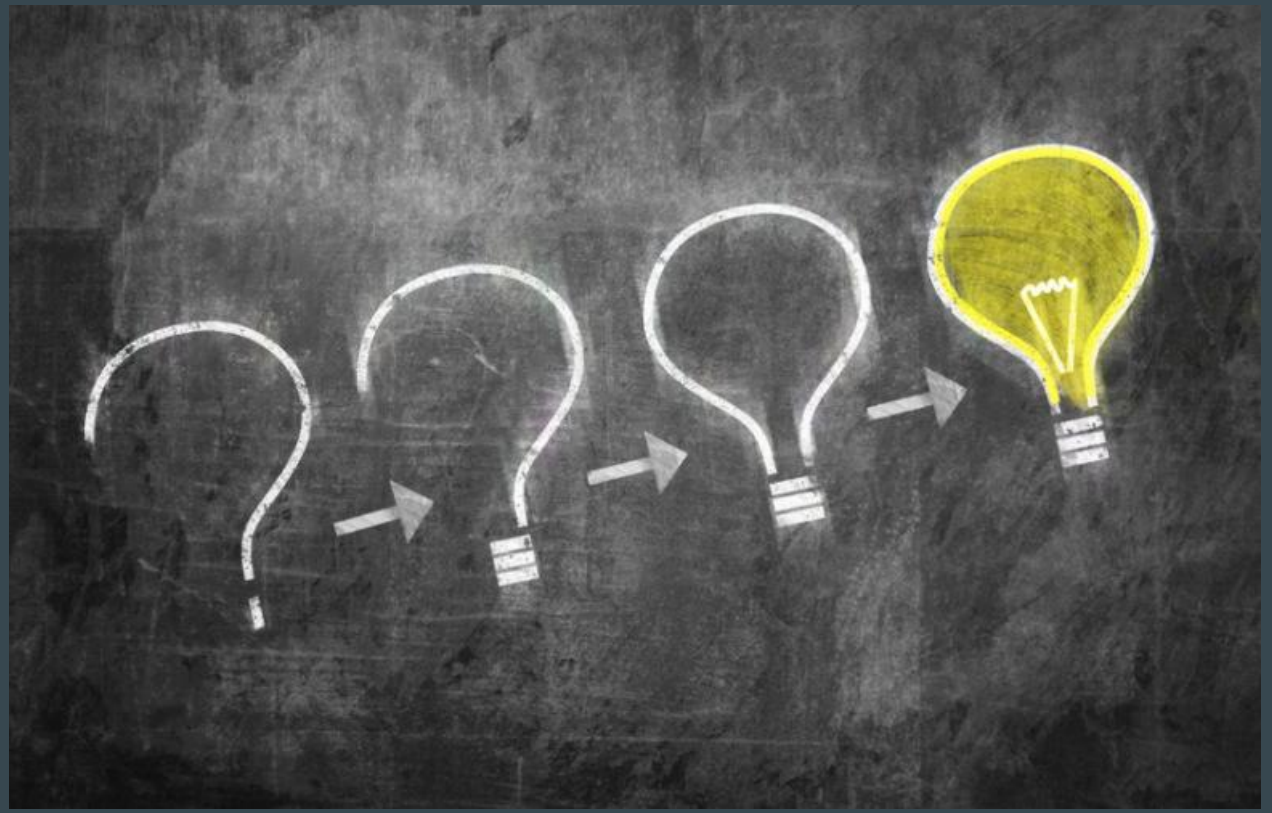
Resistance values and aggregation (Step Selection Models)

PERSPECTIVES

- Monitoring ecological flows and connectivity
  - Large scale composites
  - Sentinel 1 + ASTER (Radar in wetlands)
  - Effective connectivity
- Important areas for conservation
  - Additional species
  - Other variables: e.g. Cultural variables
-



QUESTIONS ?



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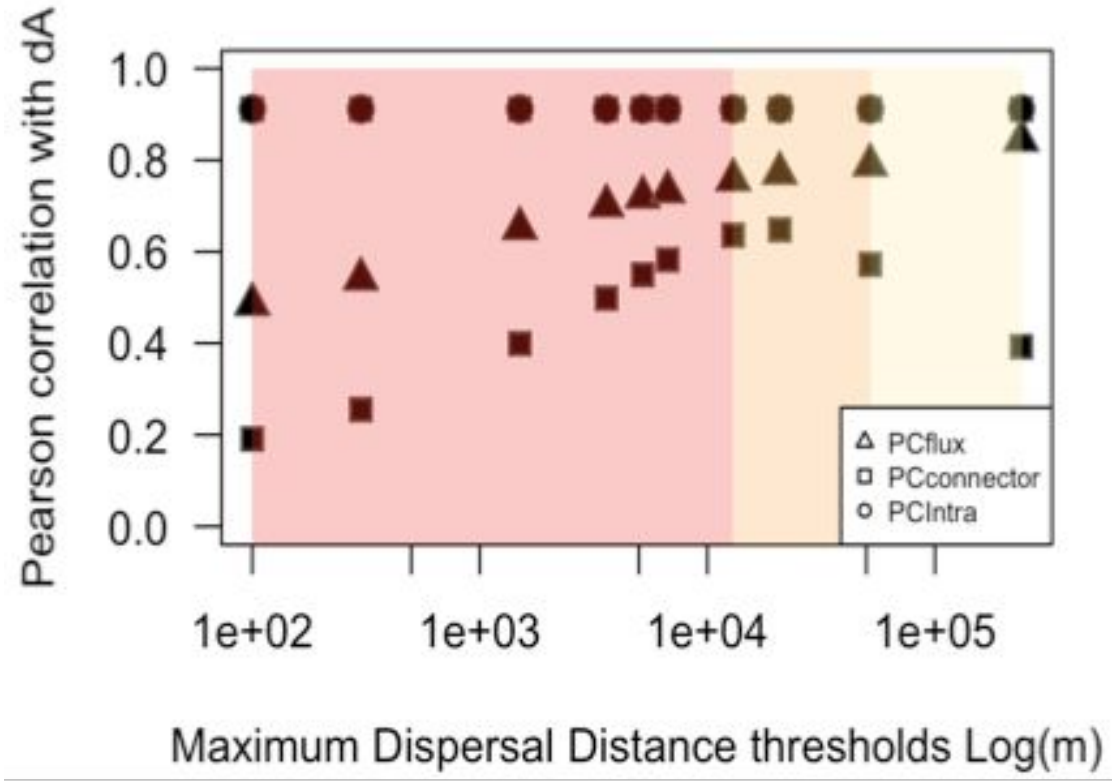
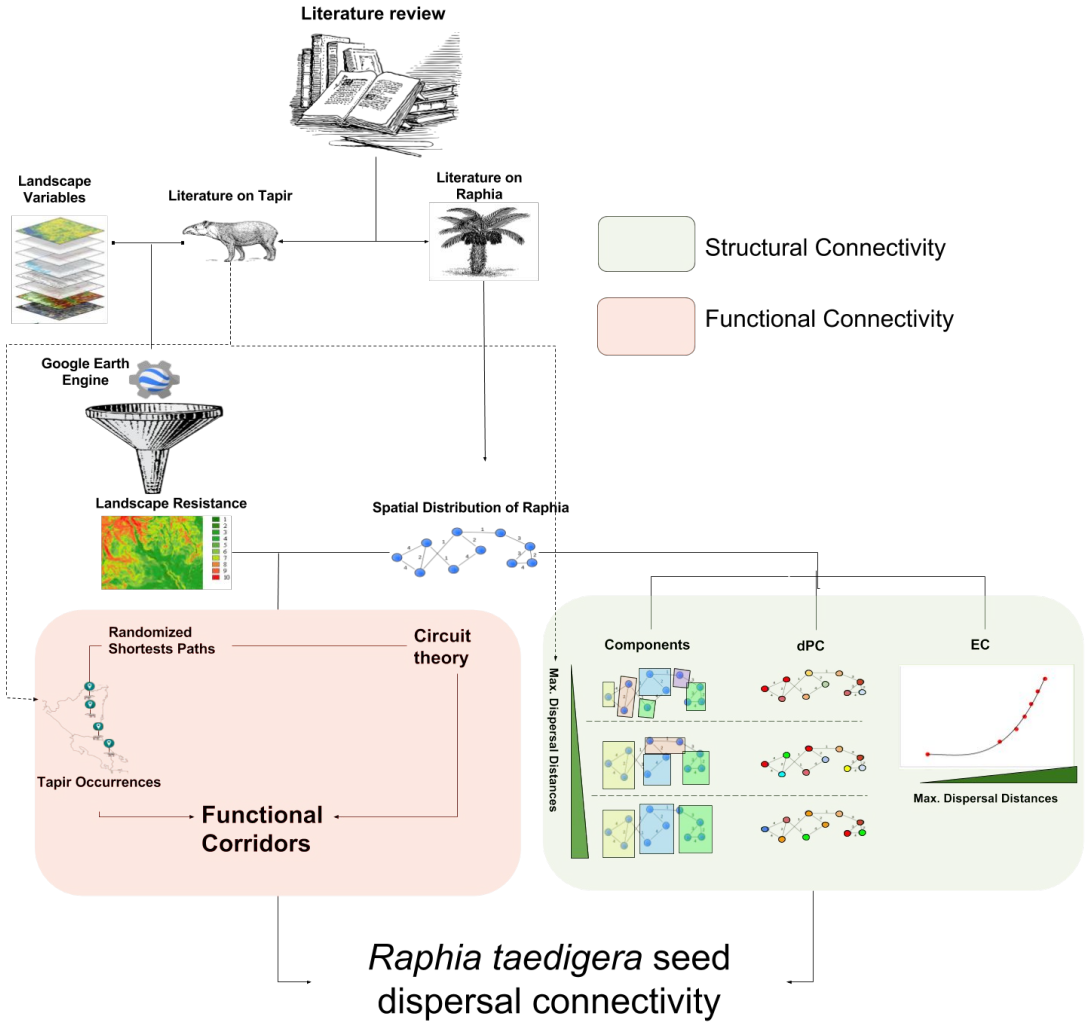
- SENESCYT

RESULTS AND CONCLUSIONS

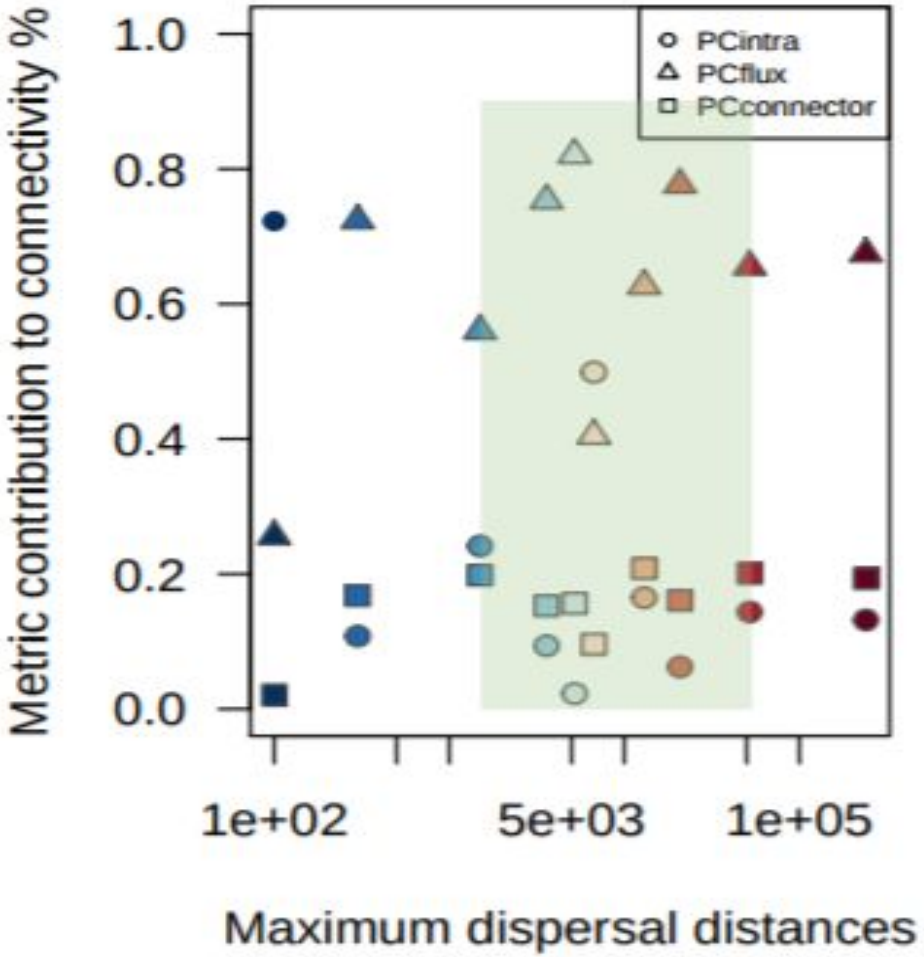
Bigger patches (in Area) are not *necessarily* more important for connectivity



Workflow


Literature review
Landscape Variables
Literature on Tapir
Literature on Raphia
Structural Connectivity
Functional Connectivity
Google Earth Engine
Landscape Resistance
Spatial Distribution of Raphia
Randomized Shortests Paths
Circuit theory
Tapir Occurrences
Functional Corridors
Components
dPC
EC
Max. Dispersal Distances
Max. Dispersal Distances
Raphia taedigera seed dispersal connectivity

dPC fractions



Validation Resistance Layer