



THE ROLE OF LANDSCAPE ON GENETIC DIVERSITY *Euterpe edulis*

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Orientadores: Rosane Collevatti e Milton Ribeiro

Colaboradores: Mauro Galetti, Alexandra Sanches, Rodrigo Bernardo



1990

THE GENETIC
CONSEQUENCES OF
HABITAT FRAGMENTATION¹

*Alan R. Templeton,² Kerry Shaw,²
Eric Routman,² and Scott K. Davis³*

2003



Review

TRENDS in Ecology and Evolution Vol.18 No.4 April 2003

**Landscape genetics: combining
landscape ecology and population
genetics**

Stéphanie Manel¹, Michael K. Schwartz², Gordon Luikart¹ and Pierre Taberlet¹

LANDSCAPE GENETICS: “quantifies the effects of landscape composition, configuration and matrix quality on gene flow and spatial genetic variation.” (Storfer *et al.* 2007).

Effects: Relief

Hydrography

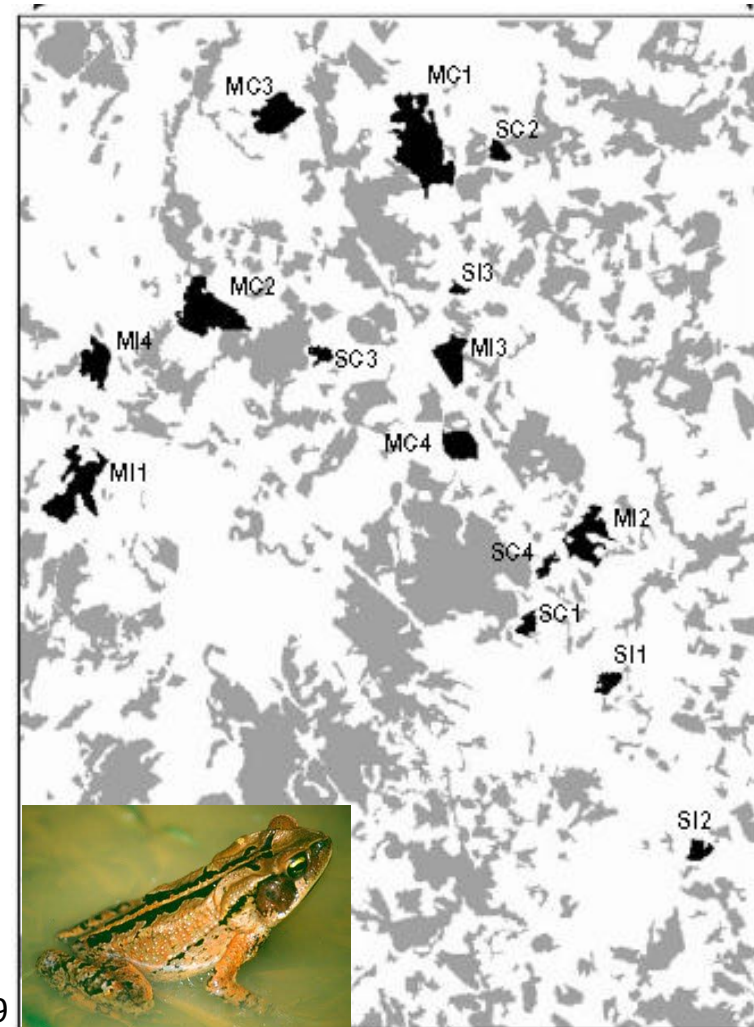
Roads

Corridors

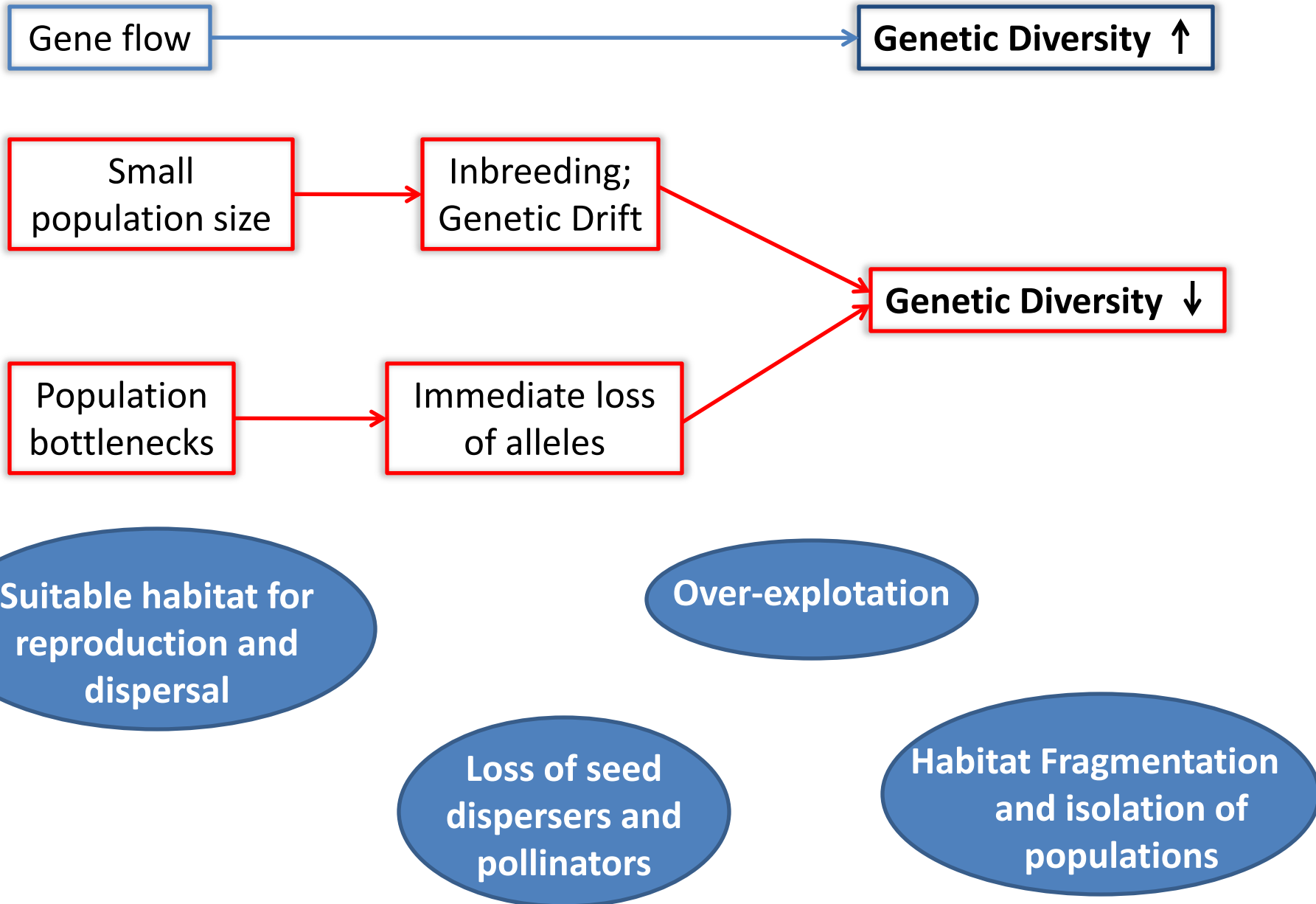
Size

Isolation

Relative contribution of forest amount



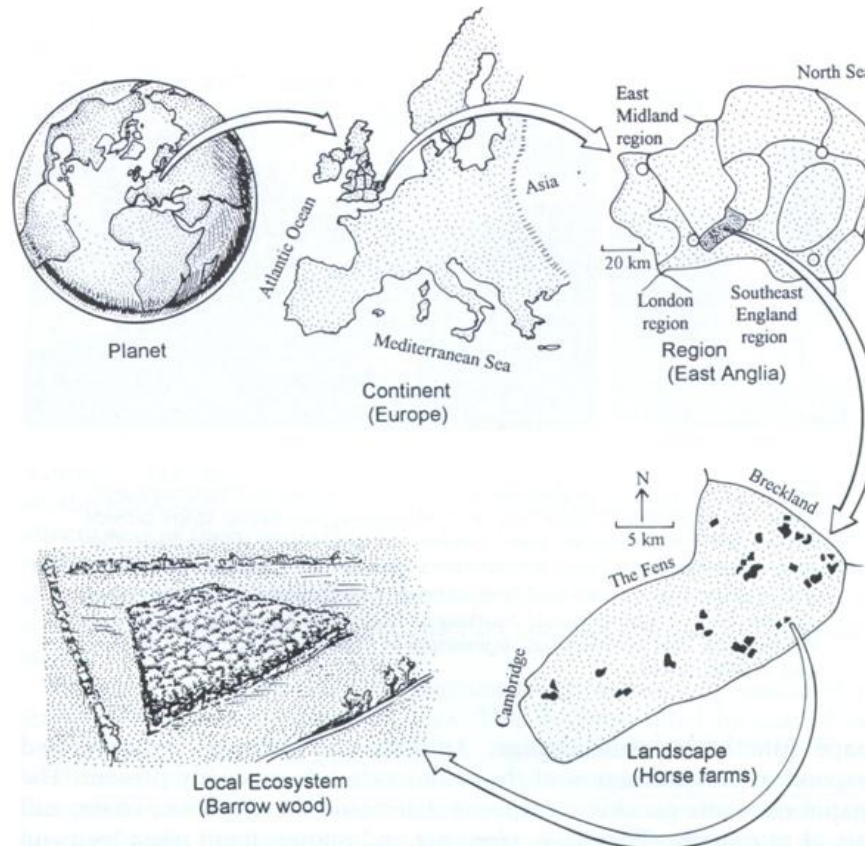
Factors that can affect the genetic diversity



Multi-scale study

Biome

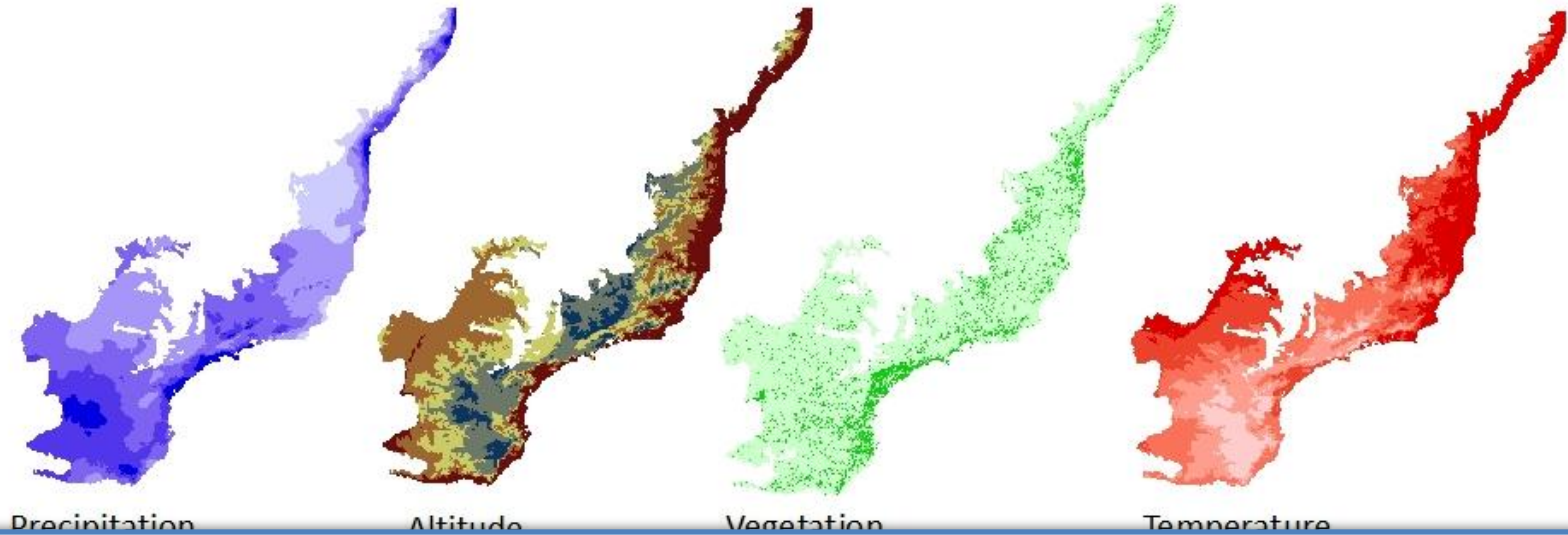
Landscape



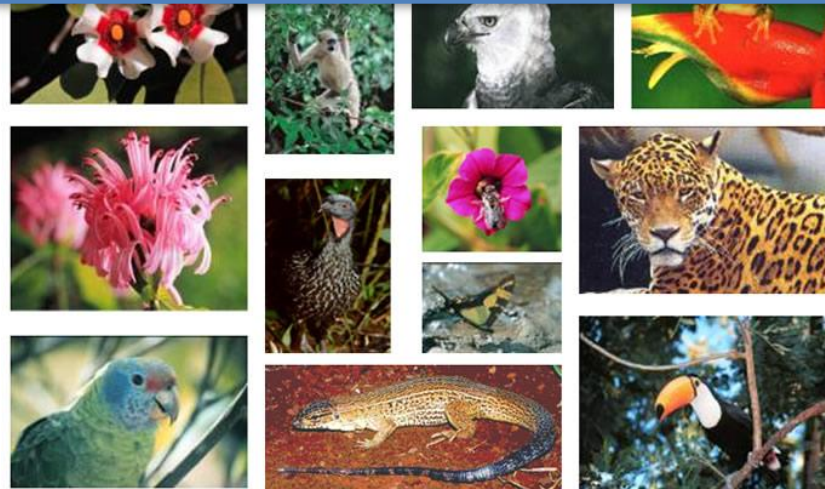
CHAPTER 1

**Linking genetics to landscape:
large scale study for *Euterpe edulis*
along Brazilian Atlantic Rainforest**

Heterogeneity of Atlantic Rainforest



“the forces maintaining species diversity and genetic diversity are similar.” Antonovics, 2003 (Ecology)



Which factors can explain the genetic diversity of *Euterpe edulis* in Atlantic Rainforest?



Foto: João de Deus Medeiros

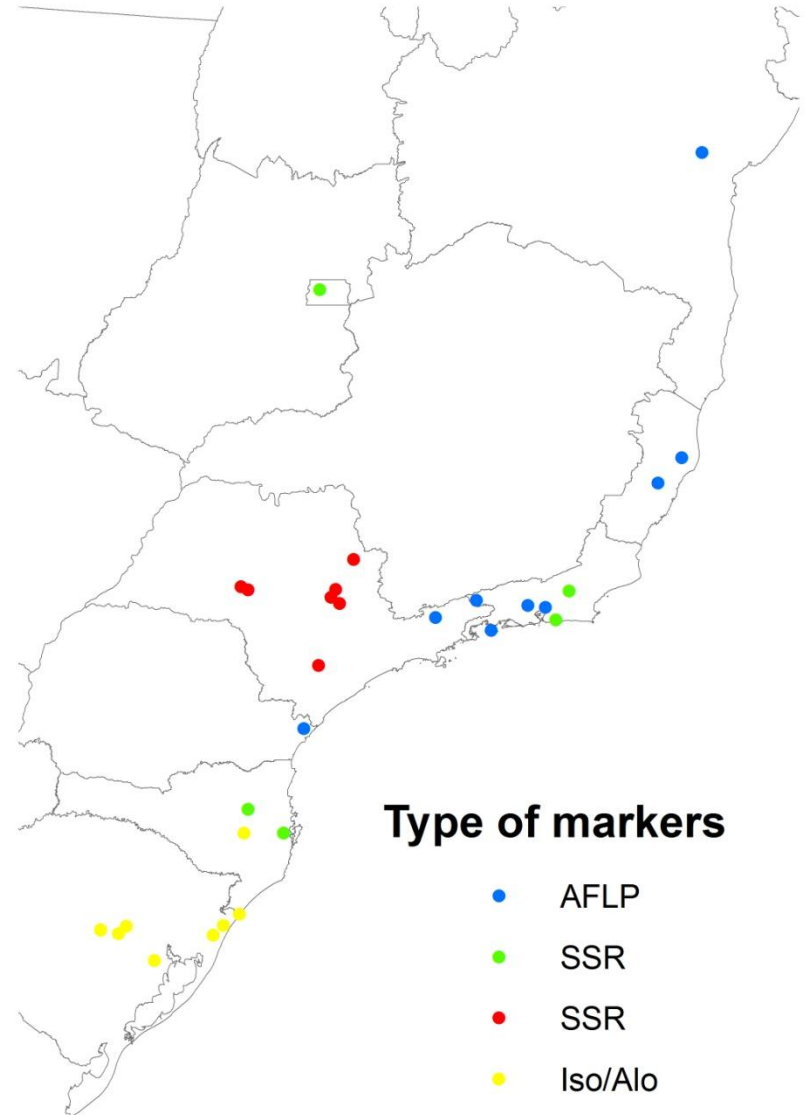
- Widely distributed in the Atlantic Rainforest
- Over-exploitation
- Pollinated and dispersed by animals
- Well-studied

Meta-Analysis

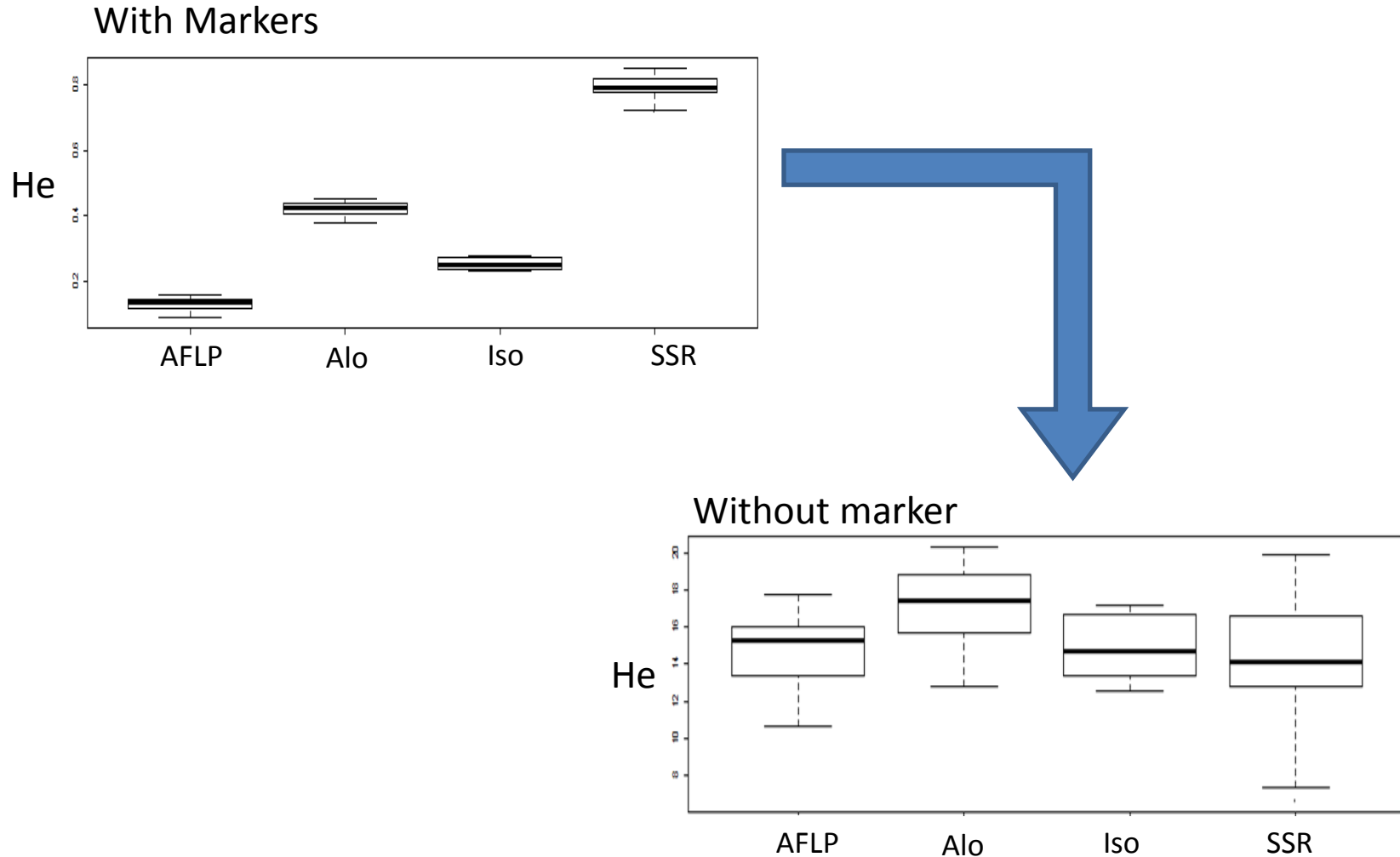
- Published data
 - Collected data
- } 67 sites

Response variables

- F_{is} = endogamy coefficient
- H_e = expected heterozygosity
- Alleles = Number of alleles

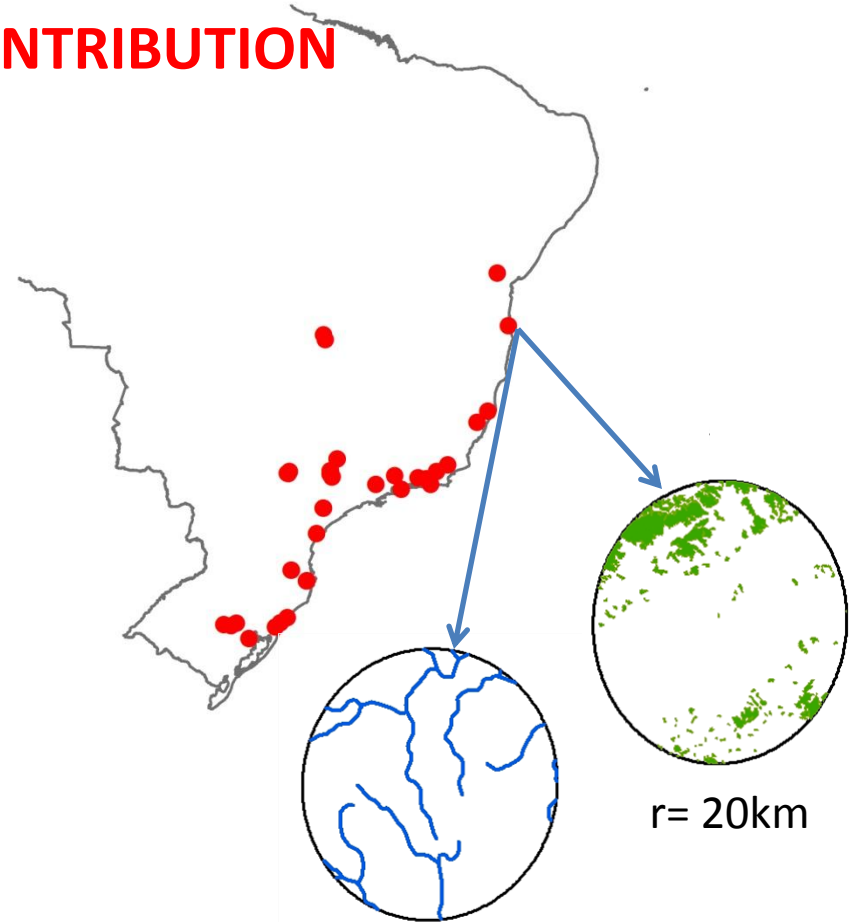


To remove the marker effects: Generalized Linear Models (GLM)



Predictive variables -RELATIVE CONTRIBUTION

- Forest amount
- Defaunation
- Functional connectivity
- Drainage density
- Forest type
- Distance from the Atlantic coast
- Date of settling
- Latitude
- Potential distribution
- Aspect
- Null Model**



**Generalized Additive Models (GAM),
Model Selection, AIC**



-% forest cover

-Latitude

-Potential distribution

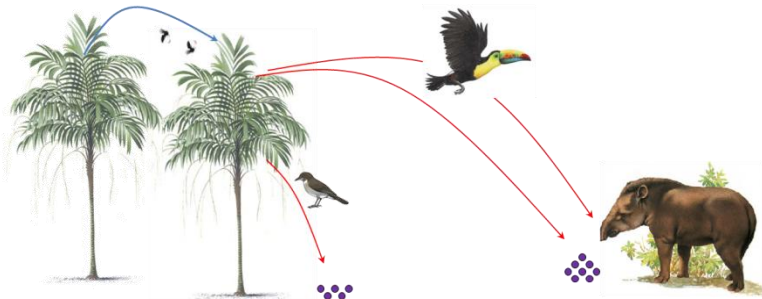
-Aspect

-Drainage

-Forest type

-Distance from the Atlantic coast \downarrow He, Alleles \uparrow Fis

\uparrow He, Alleles \downarrow Fis



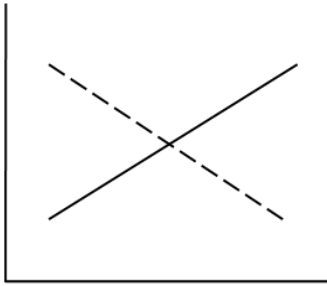
- Defaunation \downarrow He, Alleles \uparrow Fis

-Functional connectivity \uparrow He, Alleles \downarrow Fis

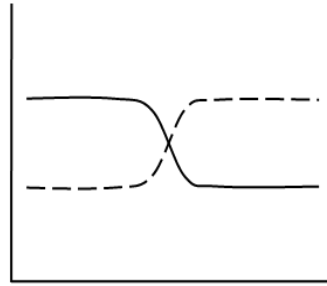


-Date of settling \uparrow He, Alleles \downarrow Fis

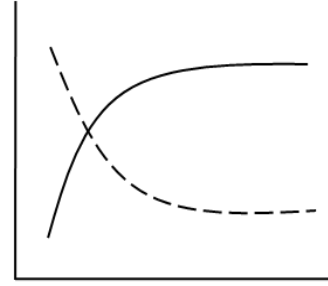
Dranaige Density



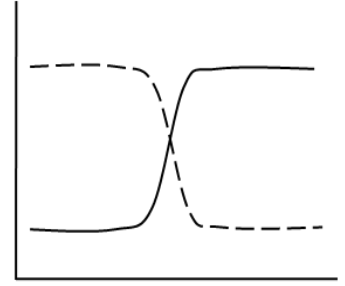
Distance from the coast



Habitat Suitability

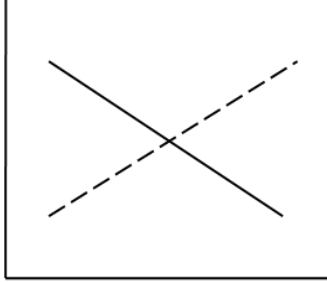


Forest Type

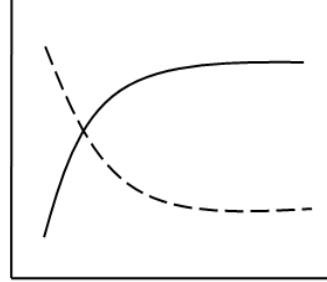


Dry Forest Dense Forest

Northness

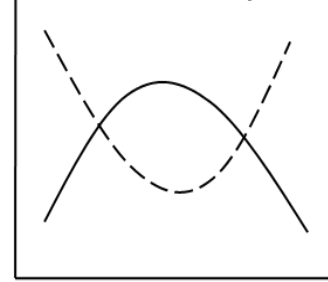


Latitude

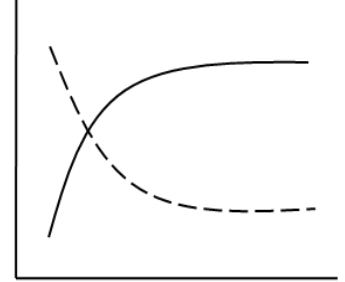


4°S 34°S

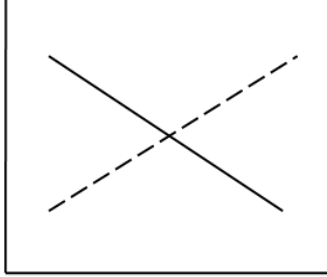
Declivity



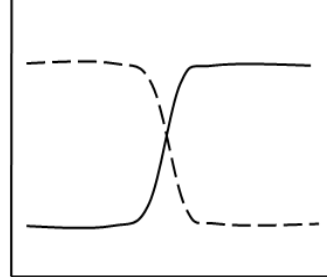
% of Forest Cover



Centre-periphery

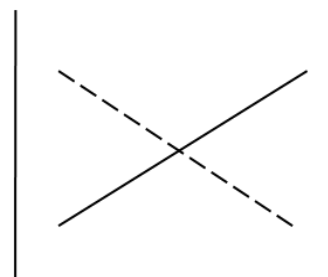


Defaunation

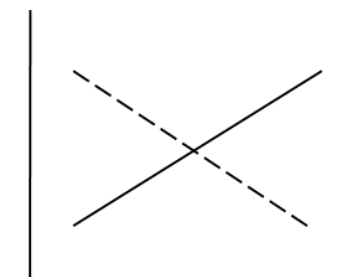


Defaunated Non-Defaunated

Functional Conectivity



Date of settling



----- Fis

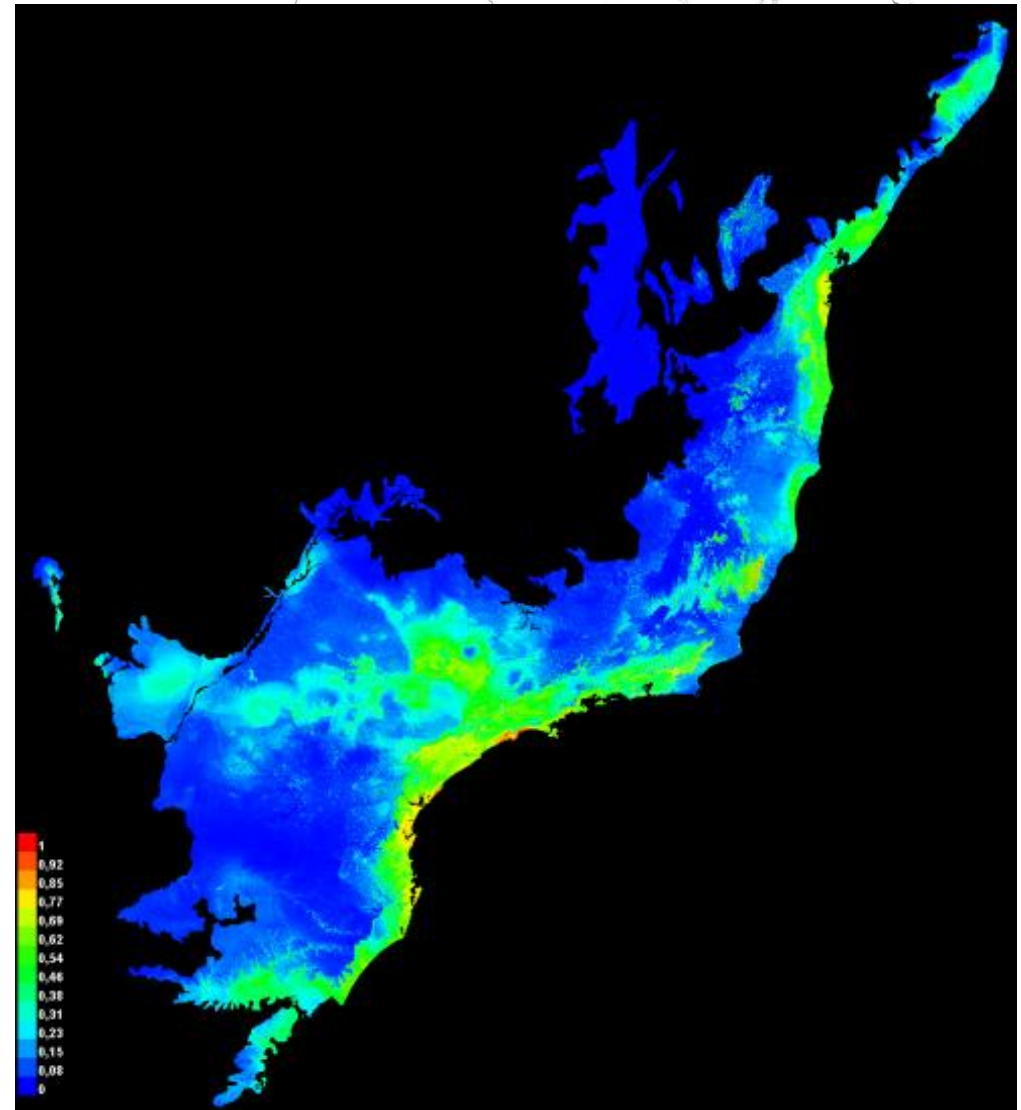
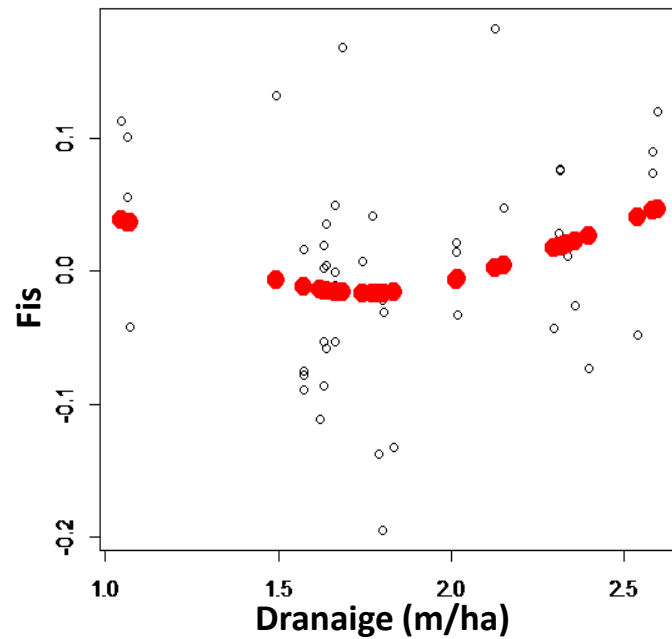
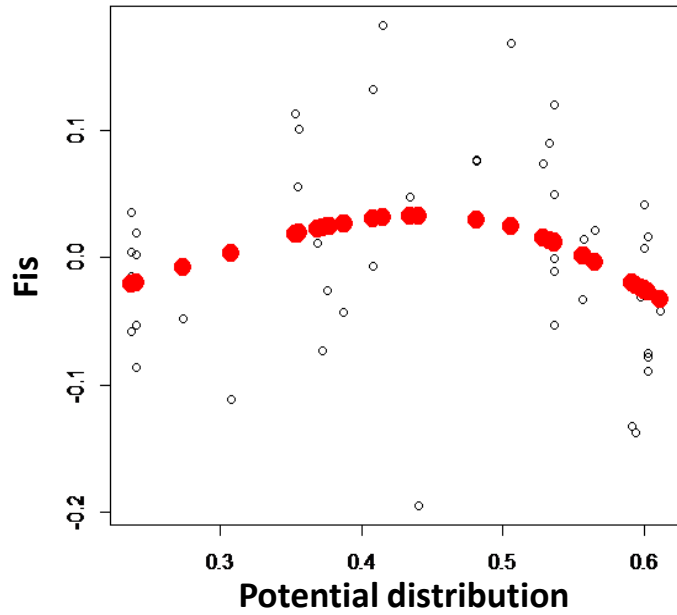
———— He, # Alelos

F_{is} = endogamy coefficient

Model Ranking

Variables	AICc	df	dAICc	weight	
Potential Distribution	-108.3	3	0	0.49	} Best Models
Dranaige	-107	3	1.3	0.25	
Defaunation	-103.7	3	4.6	0.05	
Northness	-103.5	3	4.8	0.04	
Latitude	-103.2	3	5.1	0.03	
Date of settling	-102.4	3	5.9	0.02	
Eastness	-102.2	3	6.1	0.02	
Null Model	-102.0	3	6.3	0.02	
Forest Type	-101.8	3	6.5	0.01	
Functional Conectivity	-101.7	3	6.6	0.01	
% of forest cover	-101.6	3	6.7	0.01	
Distance from the coast	-99.1	3	9.2	0.005	

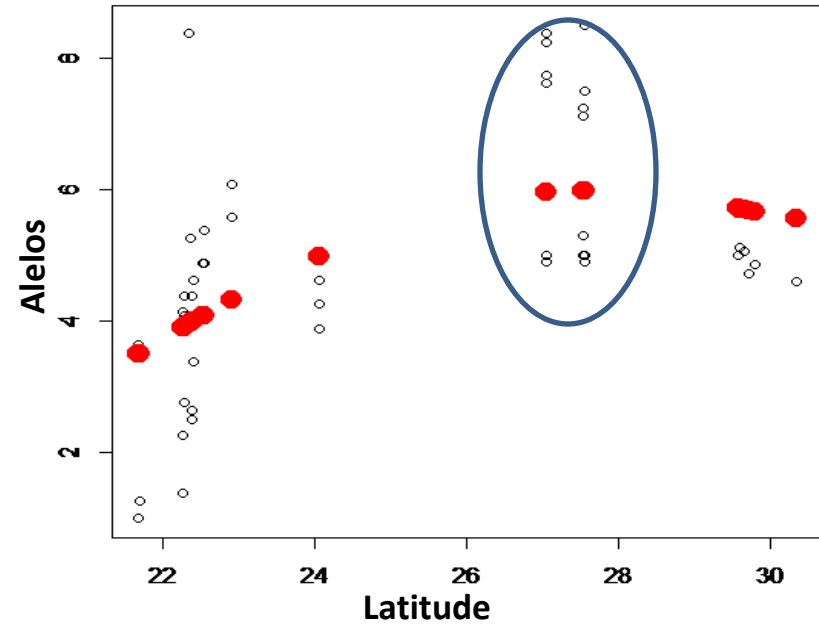
Euterpe edulis distribution model (Maxent)



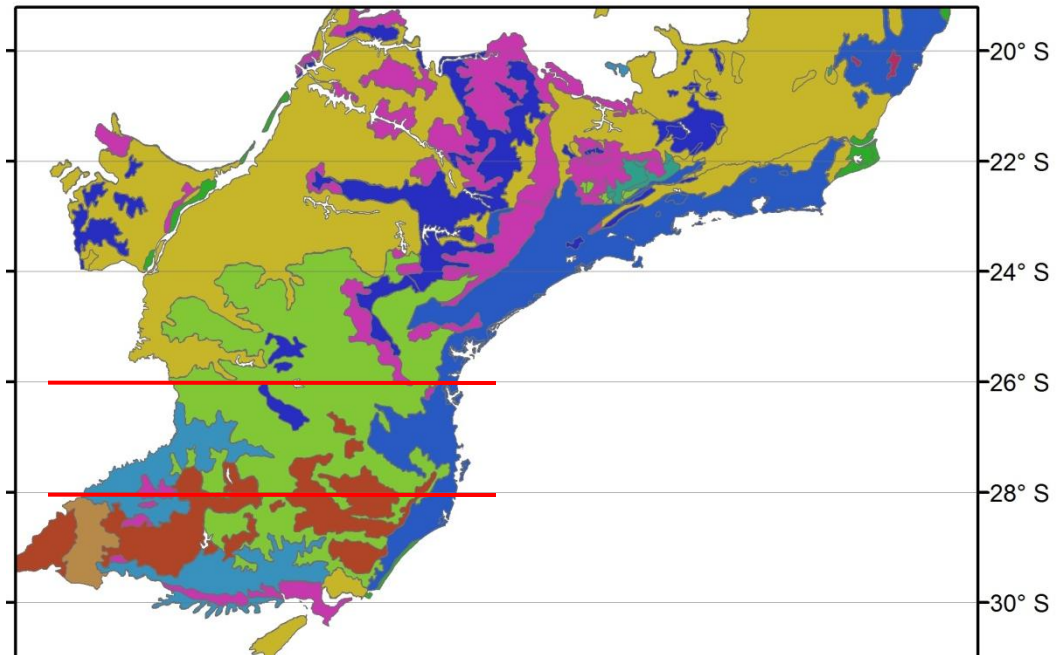
Alleles = Number of alleles

Model Ranking

Variables	AICc	df	dAICc	weight	
Latitude	174.7	3	0	0.95	} Best Models
Distance from the coast	181.9	3	7.1	0.02	
Forest Type	184.2	3	9.4	0.008	
Functional Conectivity	186	3	11.2	0.003	
% of forest cover	187.7	3	13	0.001	
Potential Distribution	191.8	3	17	<0.001	
Dranaige	192.8	3	18.1	<0.001	
Null Model	197.9	3	23.2	<0.001	
Eastness	198.2	3	23.5	<0.001	
Defaunation	199	3	24.2	<0.001	
Date of settling	199.3	3	24.6	<0.001	
Northness	200.8	3	26.1	<0.001	



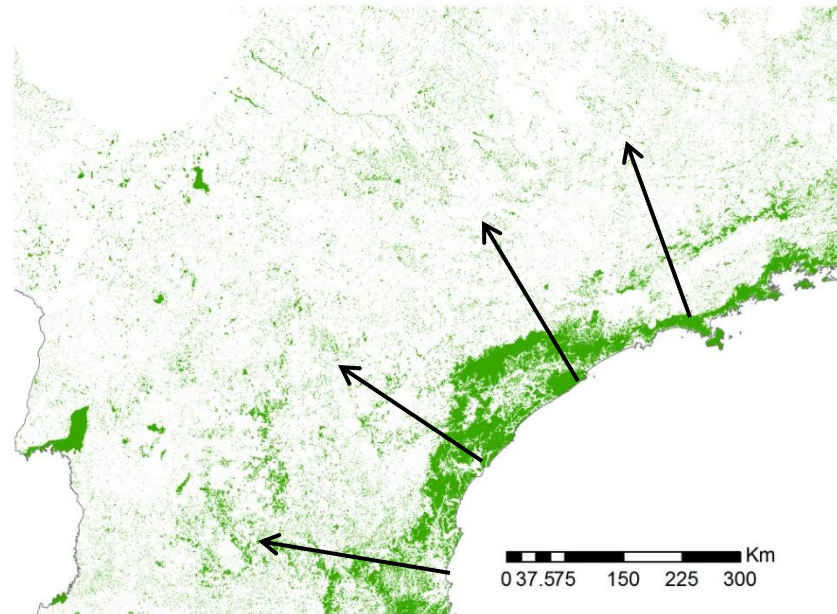
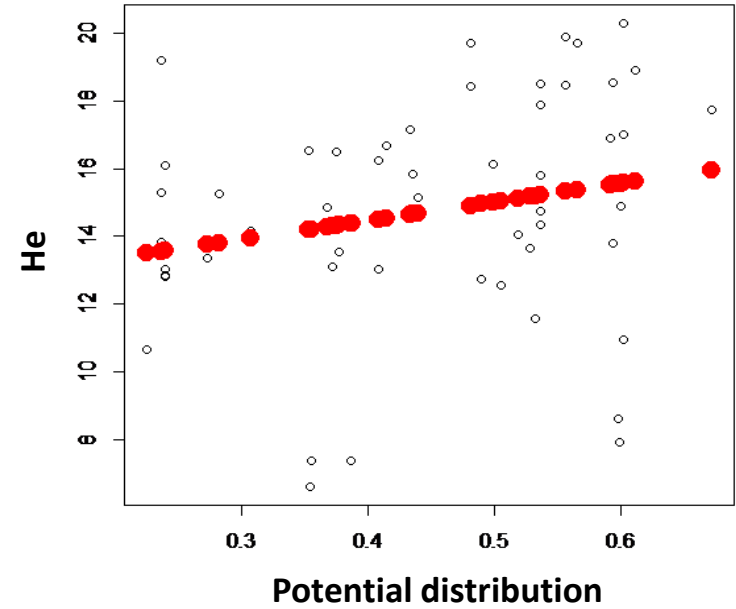
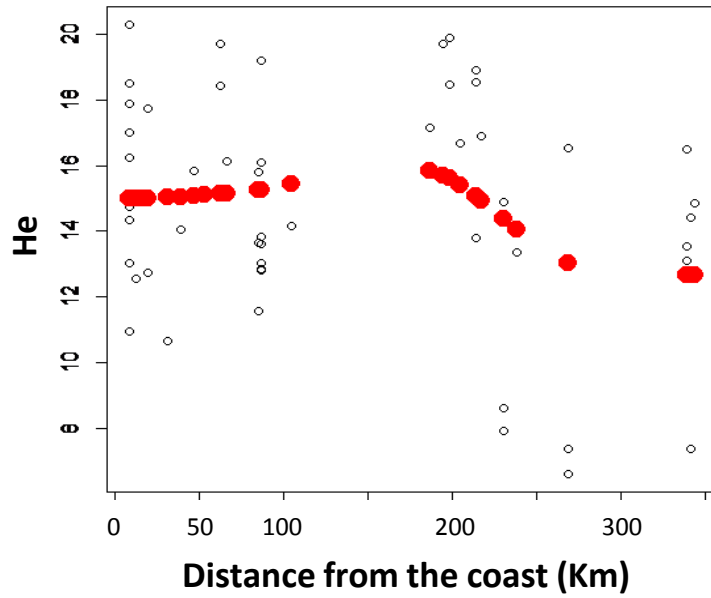
Different Vegetation Type



He = Expected Heterozygosity

Model Ranking

Variables	AICc	df	dAICc	weight	
Distance from the coast	289.3	3	0	0.46	} Best Models
Potential Distribution	291.6	3	2.3	0.14	
Forest Type	293.8	3	4.5	0.049	
% of forest cover	293.9	3	4.6	0.046	
Functional Conectivity	293.9	3	4.6	0.045	
Northness	294	3	4.7	0.044	
Defaunation	294.2	3	4.9	0.040	
Eastness	294.2	3	4.9	0.040	
Null Model	294.2	3	4.9	0.040	
Dranaige	294.9	3	5.6	0.028	
Latitude	294.9	3	5.6	0.027	
Date of settling	295.1	3	5.8	0.026	



Which factors can explain the genetic diversity of *Euterpe edulis* in Atlantic Rainforest?

- **Potencial Distribution**
 - **Dranaige**
 - **Latitude**
- **Distance from the coast**

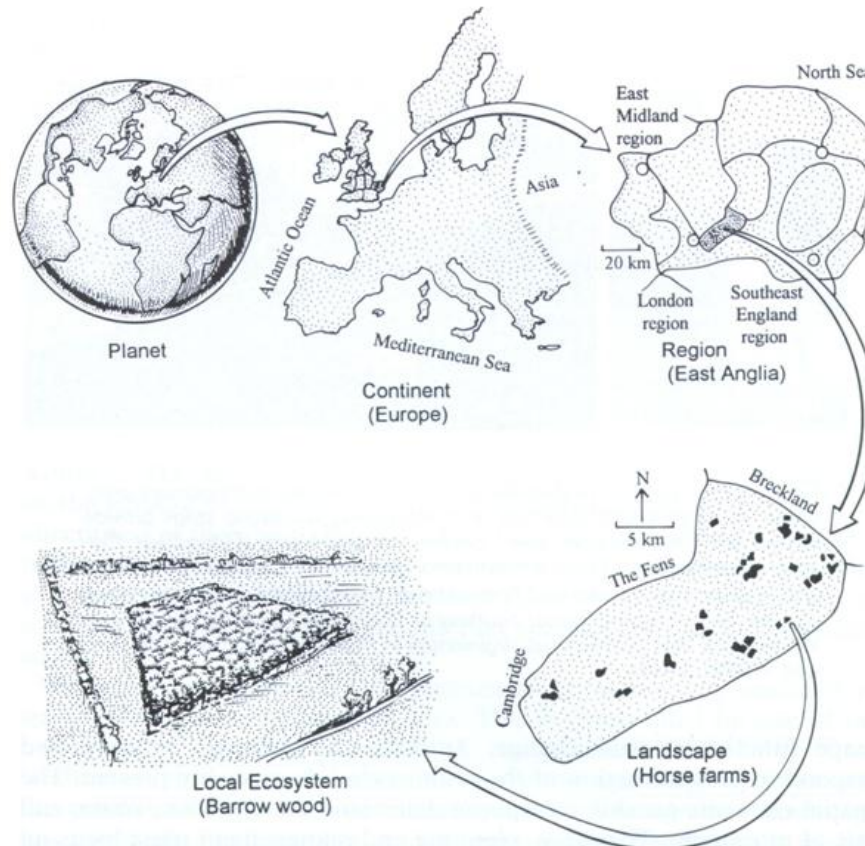


Brazilian Forest Code

Multi-scale study

Biome

Landscape





ECOLOGIA DE PAISAGENS E SUSTENTABILIDADE: CONECTANDO A TEORIA À PRÁTICA DA CONSERVAÇÃO

APRESENTAÇÃO

OBJETIVO DO EVENTO

TEMAS

PROGRAMA

CRONOGRAMA

LOCAL DO EVENTO

INSCRIÇÃO DE RESUMOS

COMISSÕES

SECRETARIA

HOSPEDAGEM E PASSAGENS

LINKS UTEIS

POSTER / ORAL

MINI CURSOS

TAXAS DE INSCRIÇÃO

EDITAL 2014

TRABALHOS PREMIADOS

TRABALHOS PREMIADOS ORAIS

CO.059

RETHINKING EDGE EFFECTS: THE UNACCOUNTED ROLE OF GEOMETRIC CONSTRAINTS

Prevedello JA1, Figueiredo MSL1, Grelle CEV2, Vieira MV2 - 1Universidade Federal do Rio de Janeiro - Programa de Pós-Graduação em Ecologia, 2Universidade Federal do Rio de Janeiro - Depto. de Ecologia

[Marcus Vinícius Vieira](#)

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SP.09

Modelagem ambiental em apoio a políticas públicas

[Carolina Marques Guilen Lima](#) – UFMG

carolmg@gmail.com

CO.089

LINKING GENETICS TO LANDSCAPE: LARGE SCALE STUDY FOR *Euterpe edulis* ALONG BRAZILIAN ATLANTIC RAINFOREST

Carvalho CS1, Galetti M2, Bernardo R2, Sanches A2, Collevatti RG1, Ribeiro MC2 - 1Universidade Federal de Goiás - Instituto de Ciências Biológicas, 2Universidade Estadual Paulista "Júlio de Mesquita Filho" - Departamento de Ecologia

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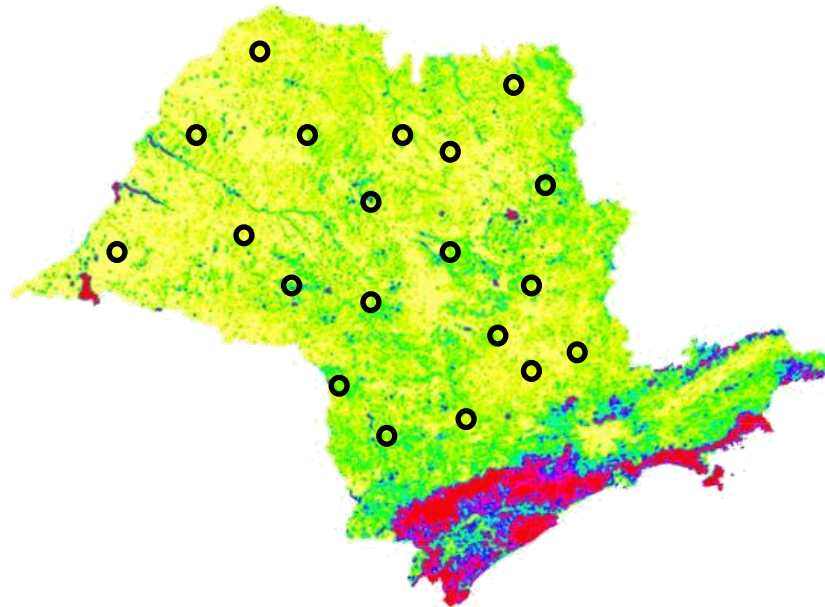
IALE-BR 2012

SALVADOR - BAHIA



CHAPTER 2

Landscape structure effects on the gene flow and genetic structure of *E. edulis*

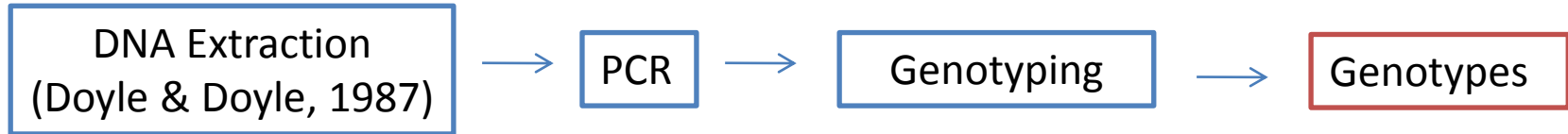


- 8 Landscape $\rightarrow r = 2\text{km}$
- 22 Forest Fragment
- 30 seedling per forest fragment



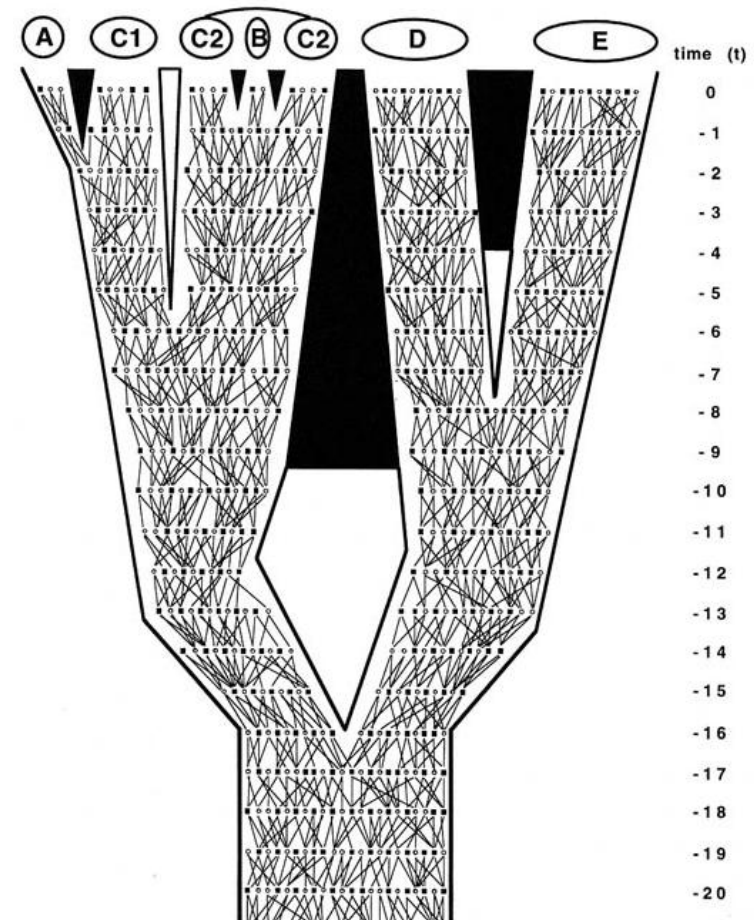
➔ Genetic Parameters

8 loci of SSR



- Gene Flow
- Immigrant per generation
- Population Effective Size
- Expected heterozygosity (H_e)
- Endogamy coefficient (F_{is})

➔ Coalescence Analysis

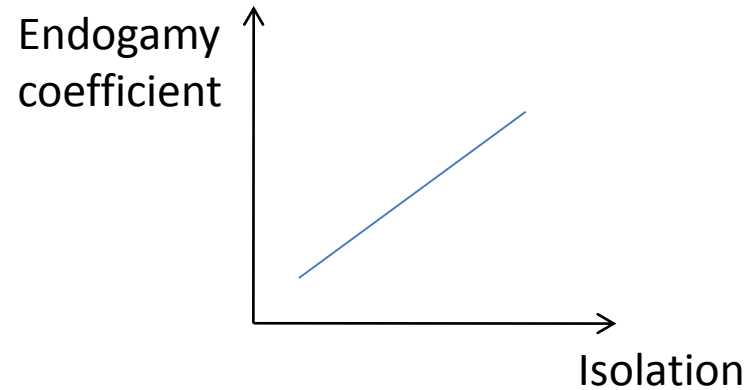
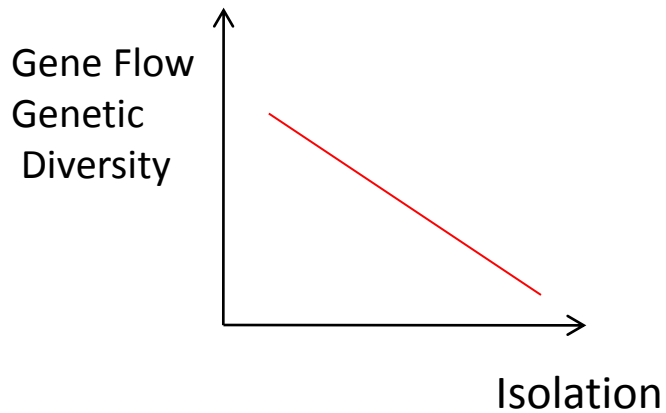
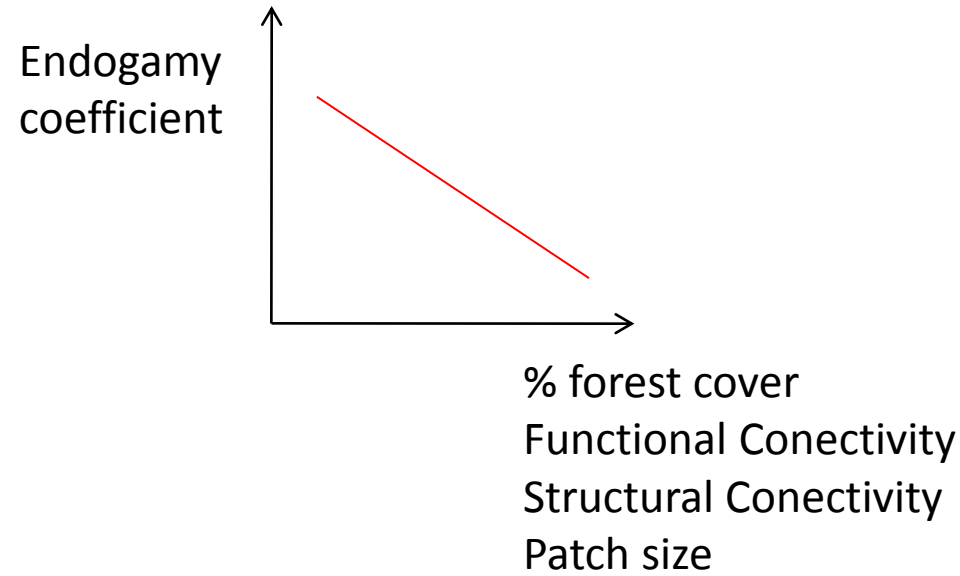
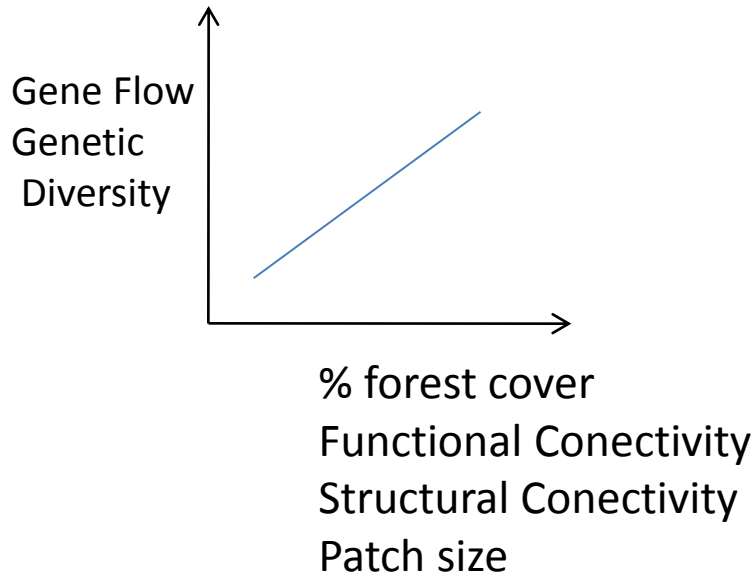


→ Landscape metrics

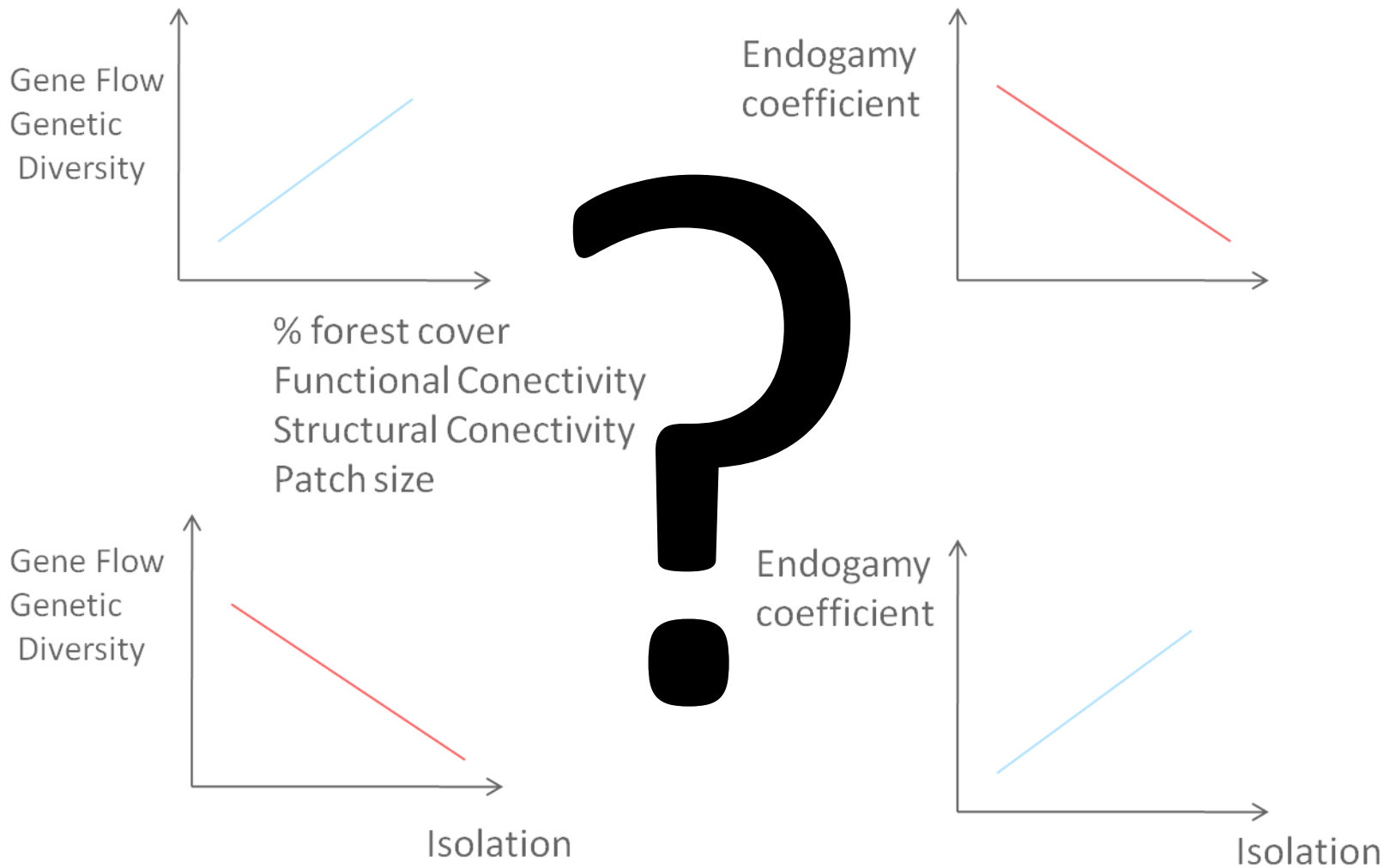
- Forest amount
- Functional connectivity
- Structural connectivity
- Matrix resistance
- Patch size
- Isolation

→ Model Selection and AIC

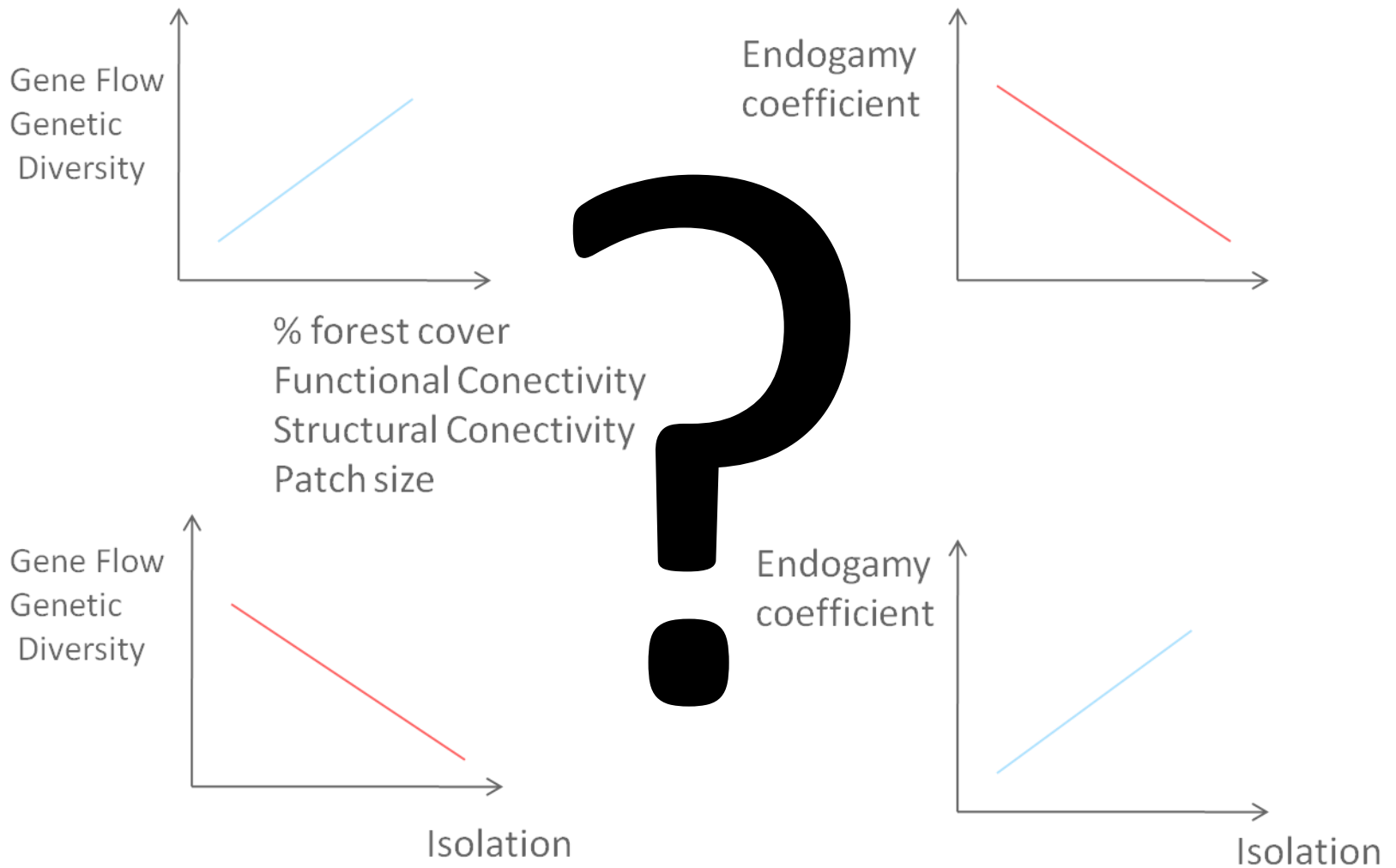
- Patch scale
- Landscape scale



Resistance of gene flow \rightarrow sugar cane = pasture matrix $>$ *Eucaliptus*



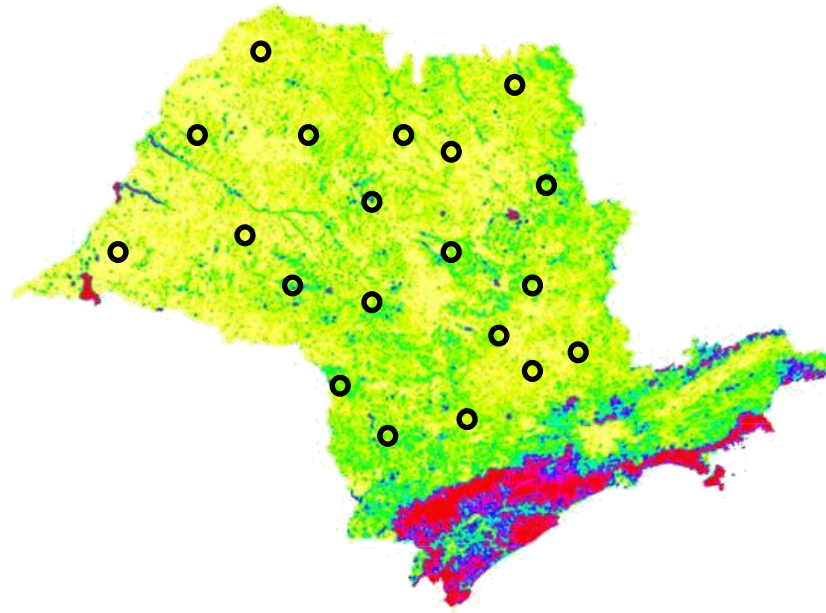
Resistance of gene flow → sugar cane = pasture matrix > *Eucaliptus*



Resistance of gene flow → sugar cane = pasture matrix > *Eucalyptus*

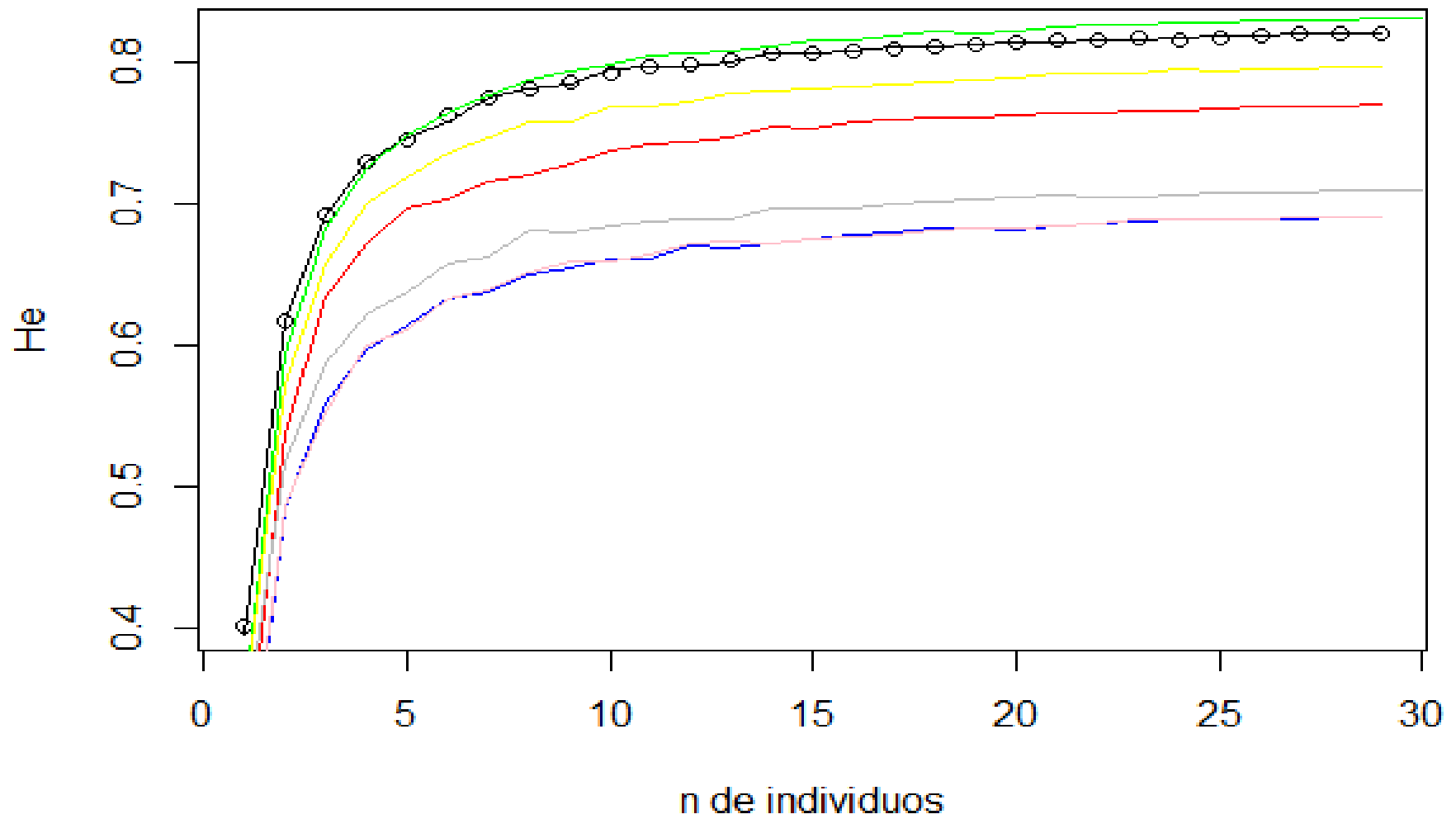
CHAPTER 3

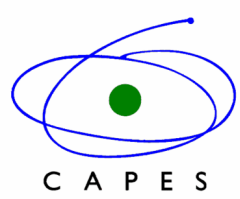
How much samples and/or locus on landscape genetics studies?



- 8 Landscape $\rightarrow r = 2\text{km}$
- 22 Forest Fragment
- 30 seedling per forest fragment







Obrigada!

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