Are exotic forest plantations threatening understory vegetation biodiversity?

Samuel Royer-Tardif
Biol. Ph.D.

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Plantations that matter

- 7% of world forests
- 33% of global wood production
- 50% in 2040

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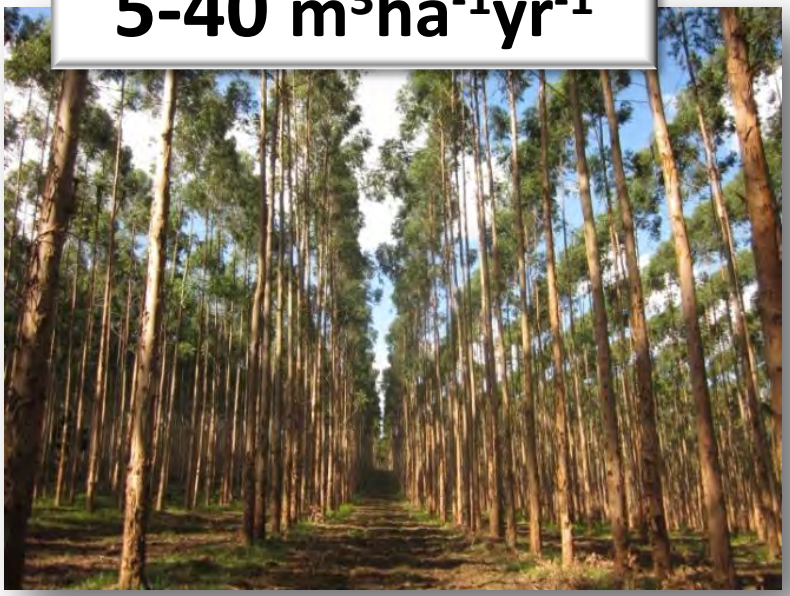
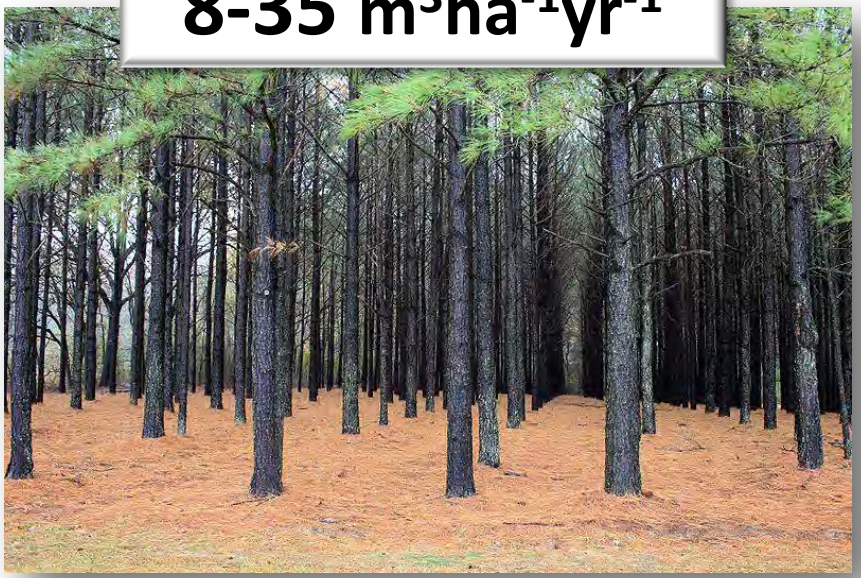
Planting exotic species

Natural forests
1-3 $m^3ha^{-1}yr^{-1}$

5-40 $m^3ha^{-1}yr^{-1}$



8-35 $m^3ha^{-1}yr^{-1}$



Planting exotic species

5-8 $m^3ha^{-1}yr^{-1}$

rlq.uqam.ca

9-37 $m^3ha^{-1}yr^{-1}$

rlq.uqam.ca

Plantations and biodiversity

Plantations and biodiversity

Plantations and biodiversity

Plantations and biodiversity

Are we afraid of exoticism?

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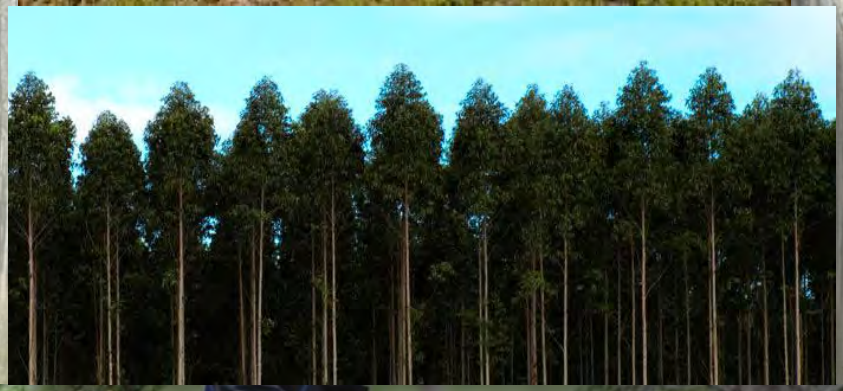


Objectives

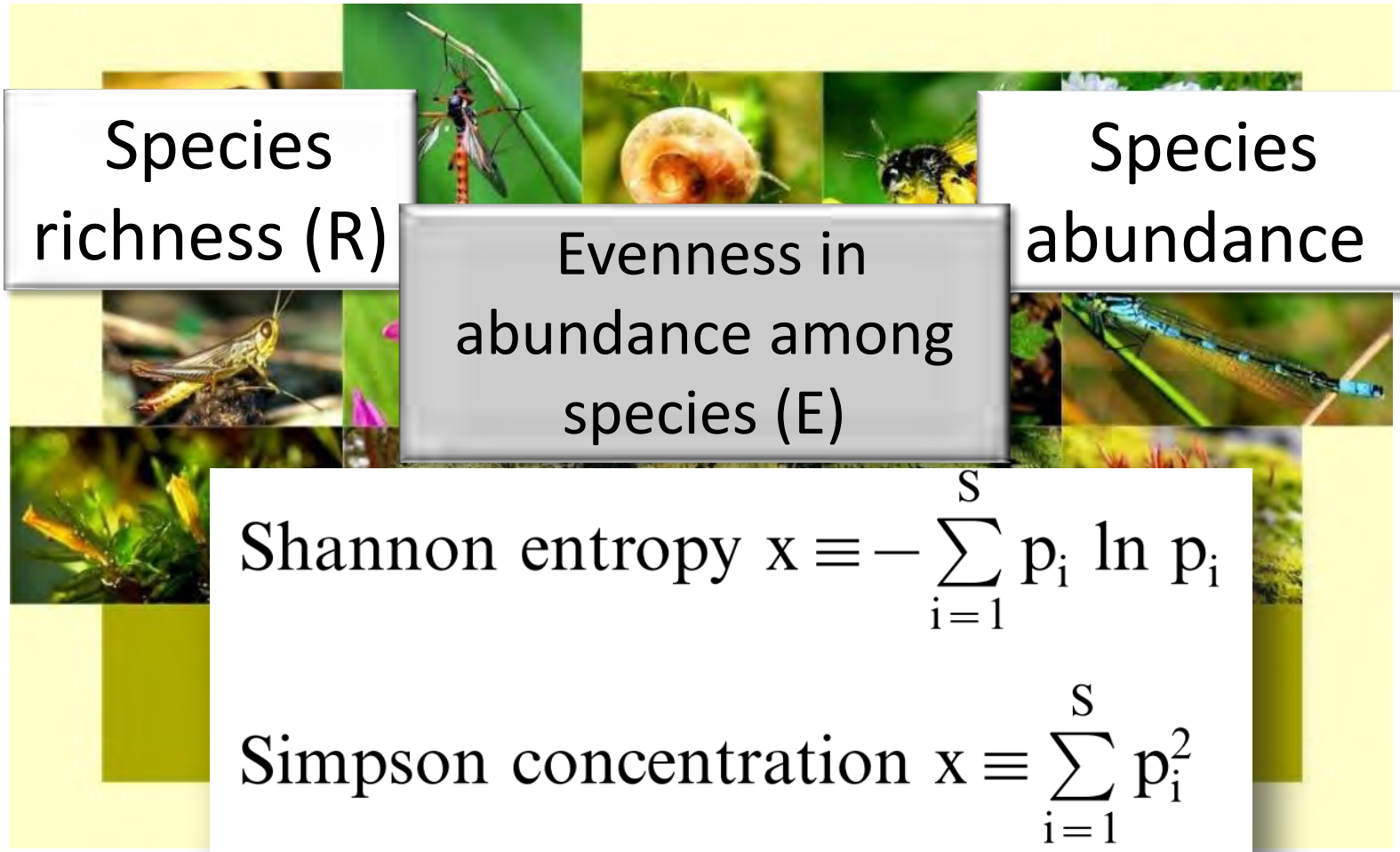
- Compare understory vegetation biodiversity between hybrid tree plantations, naturally regenerated stands and native tree plantations.

Objectives

- Compare understory vegetation **biodiversity** between hybrid tree plantations, naturally regenerated stands and native tree plantations.

What is biodiversity

Variety of life forms = species



Species richness (R)

Evenness in abundance among species (E)

Species abundance

$$\text{Shannon entropy } x \equiv -\sum_{i=1}^{S} p_i \ln p_i$$

$$\text{Simpson concentration } x \equiv \sum_{i=1}^{S} p_i^2$$

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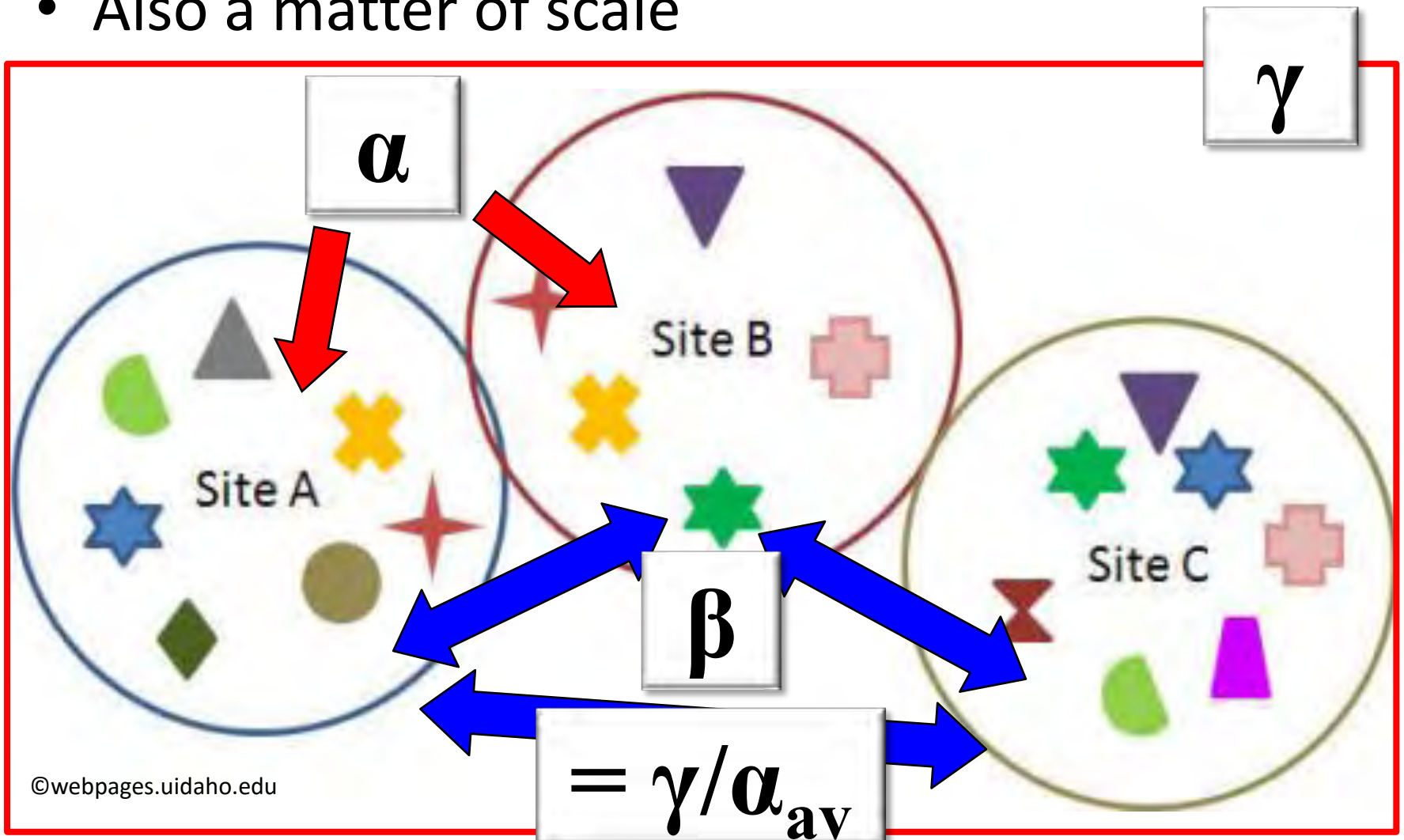
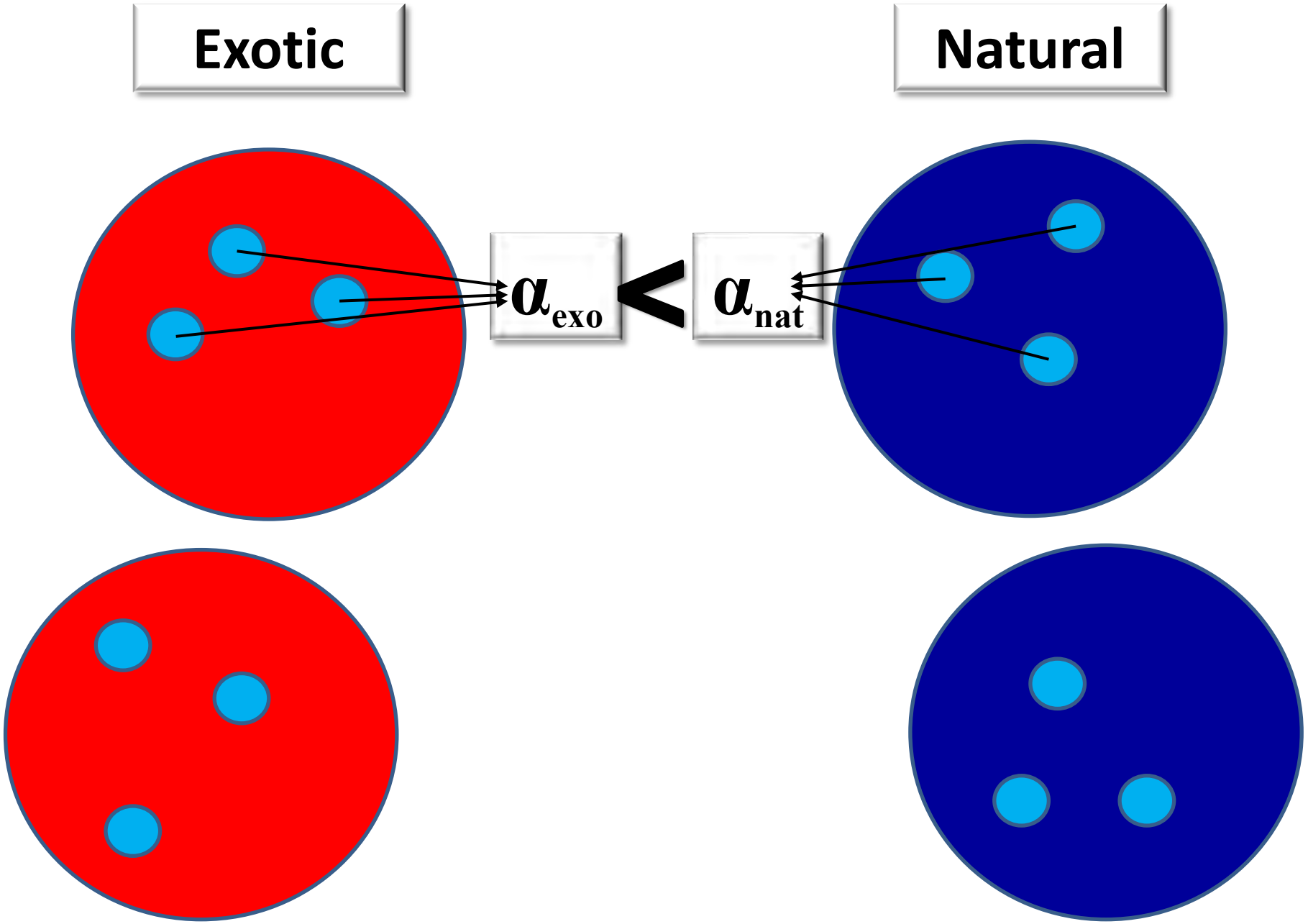
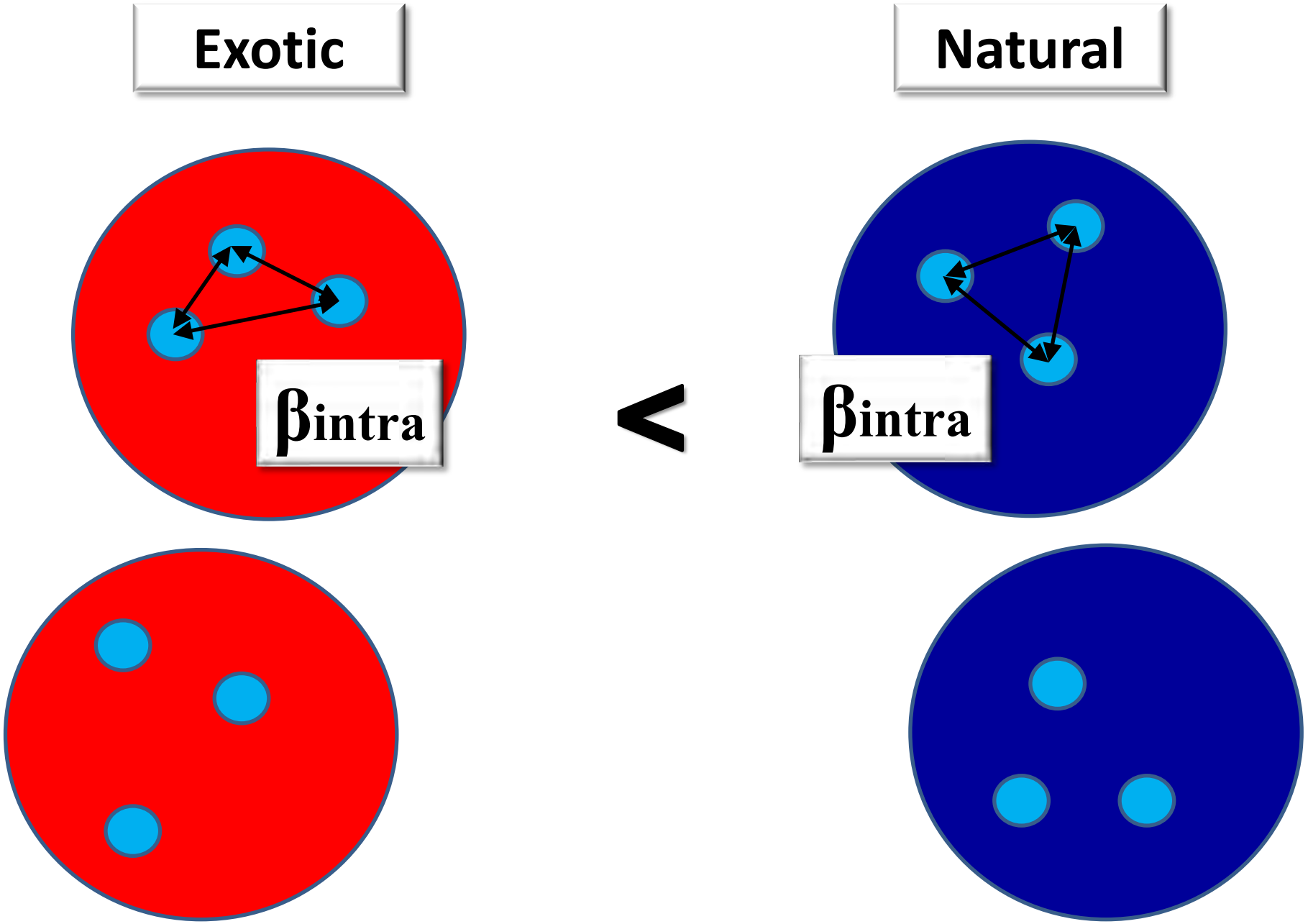
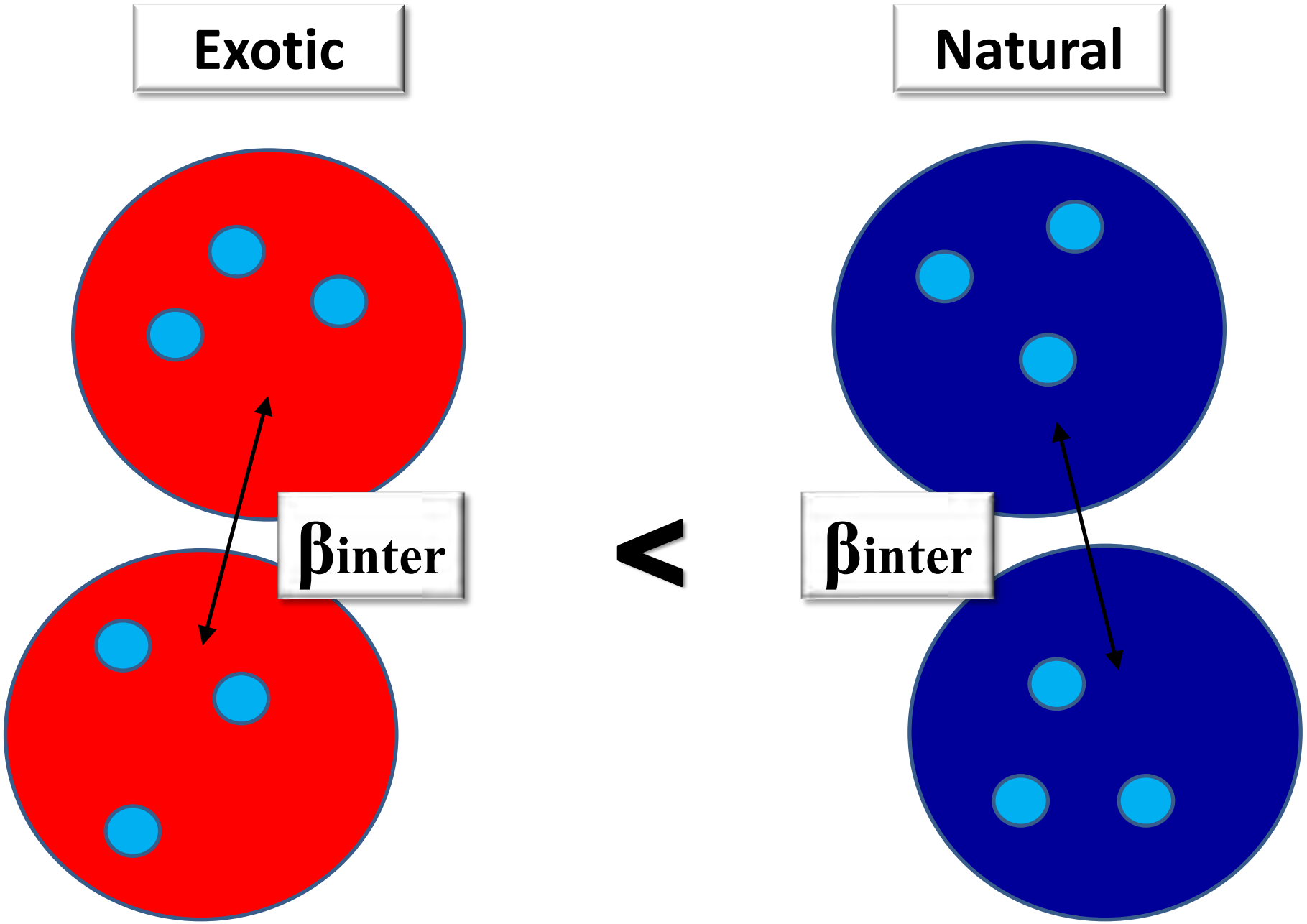
What is biodiversity?

- Also a matter of scale

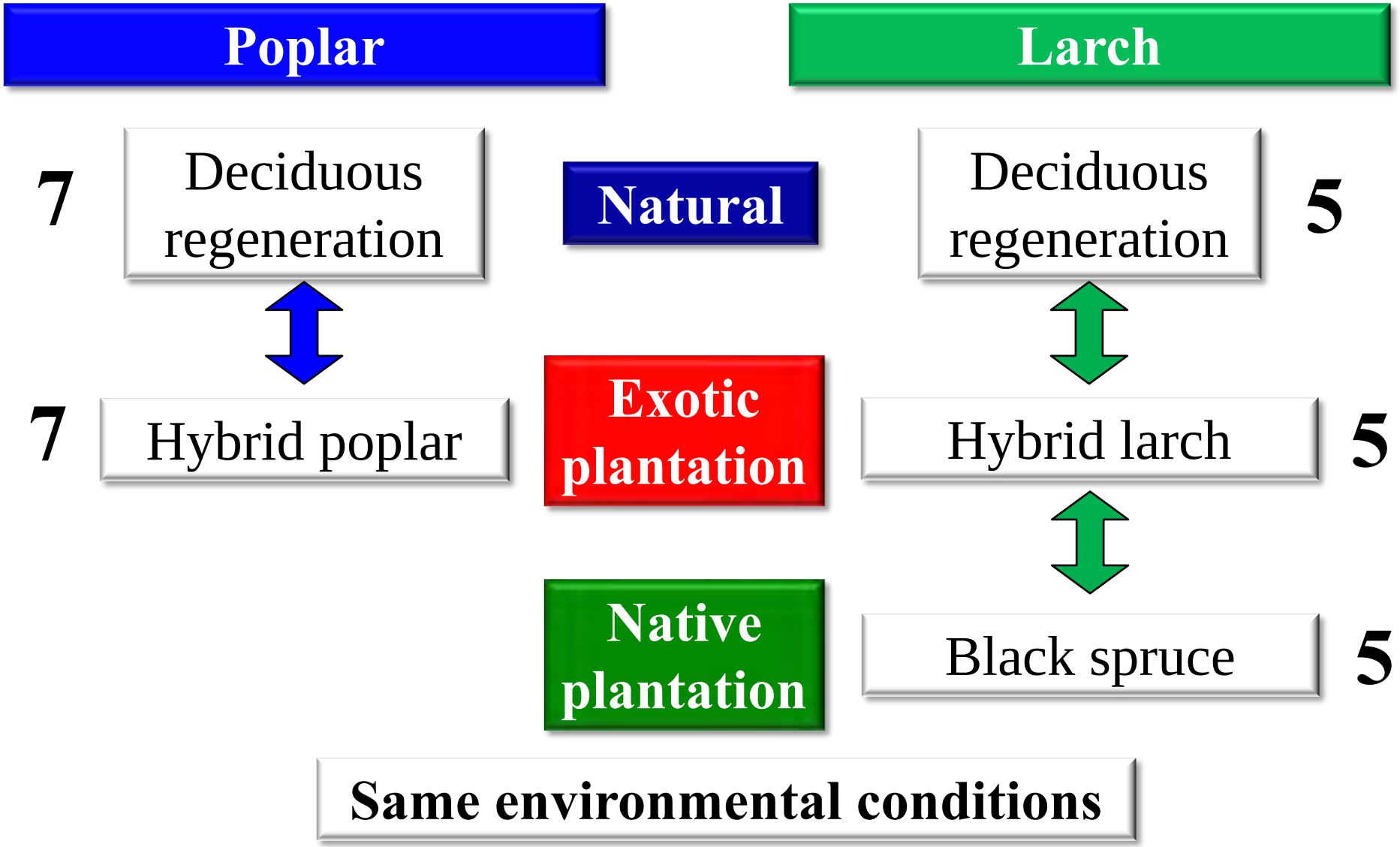



Exotic
Natural
α_{exo}
<
α_{nat}


Exotic
Natural
βintra
<
βintra


Exotic
Natural
βinter
<
βinter

Experimental design



Poplar

D_{α}

$D_{\beta intra}$

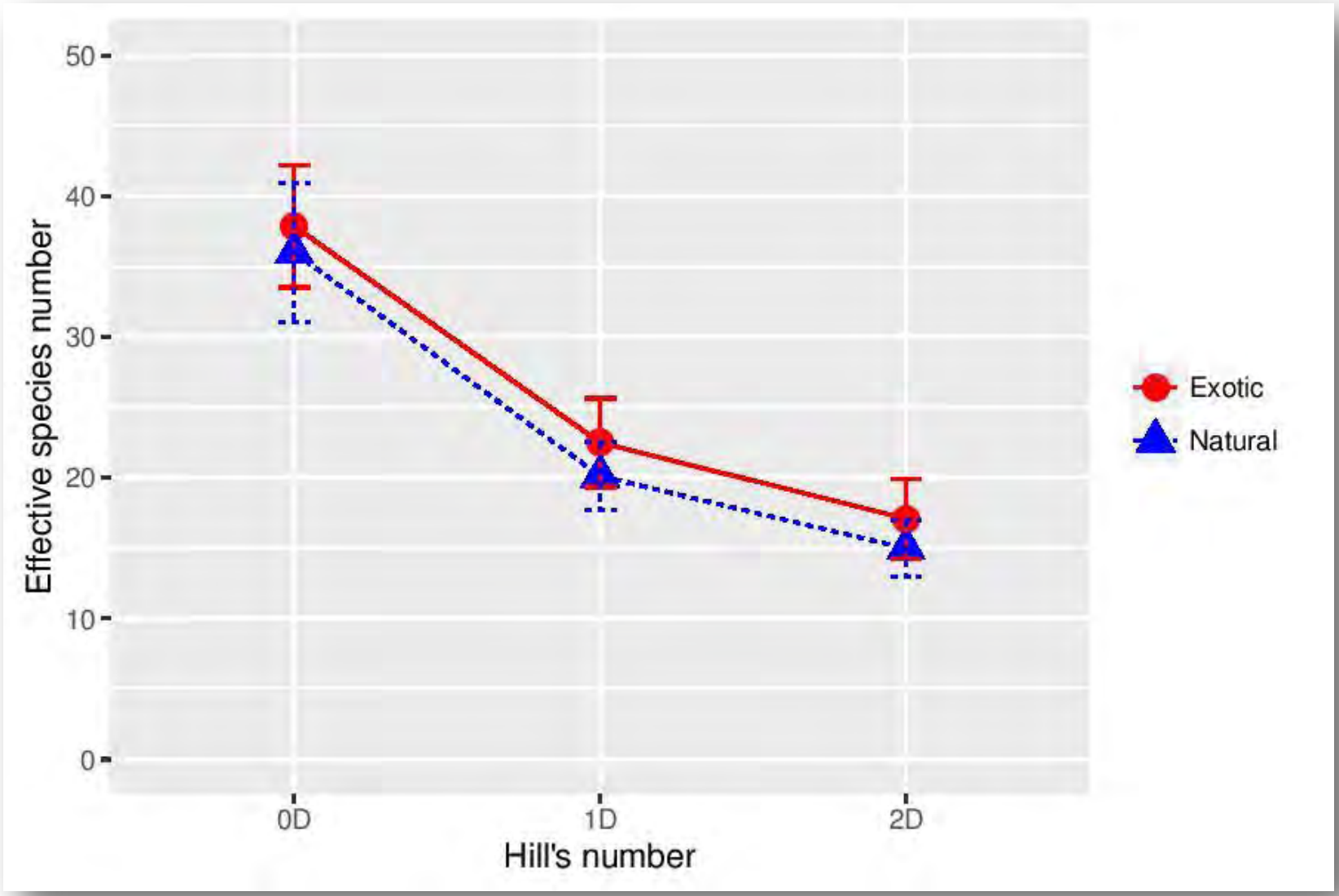
$D_{\beta inter}$

Poplar

D_{α}

$D_{\beta intra}$

$D_{\beta inter}$



Poplar

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$D_{\beta intra}$

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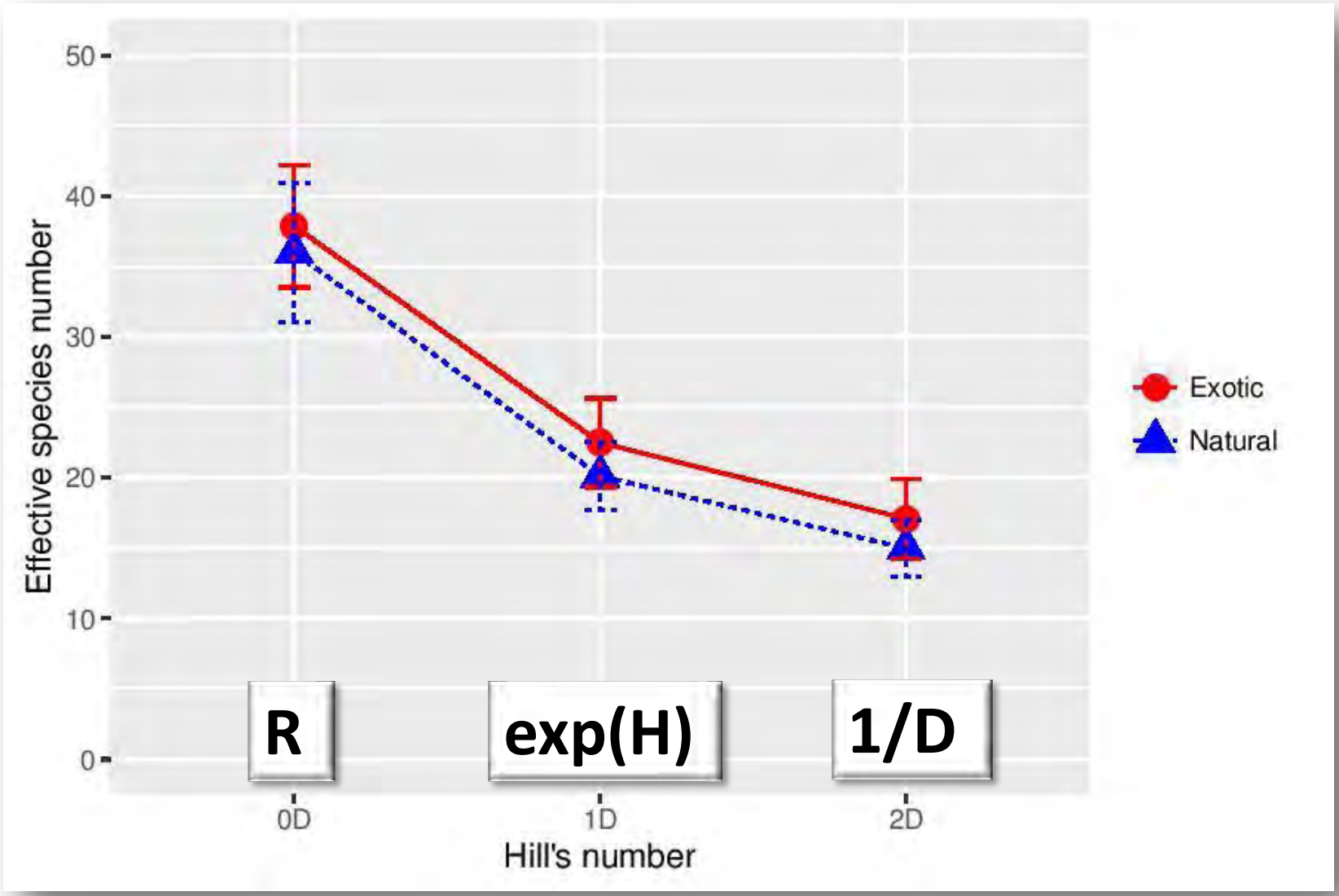

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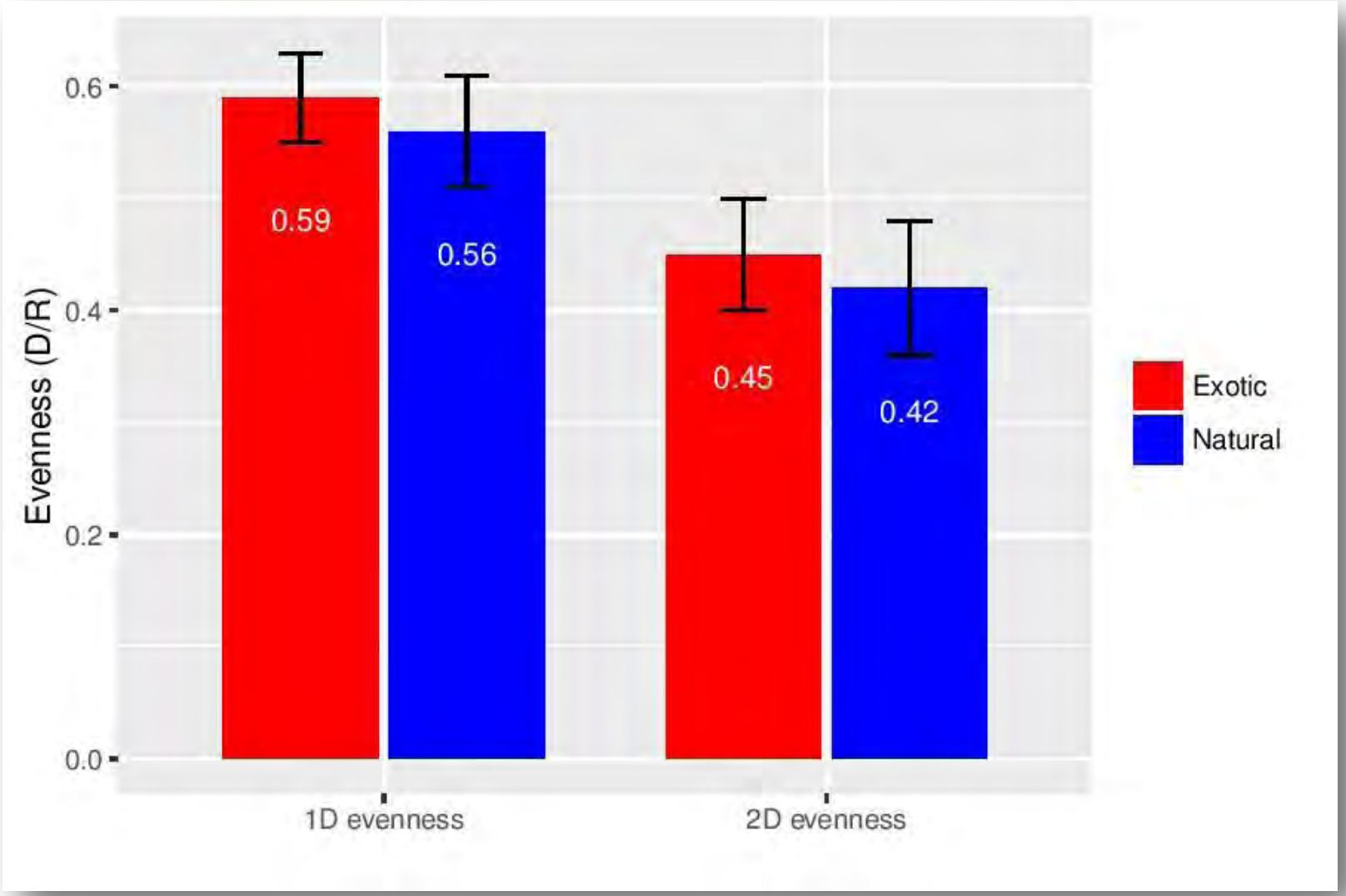

Poplar

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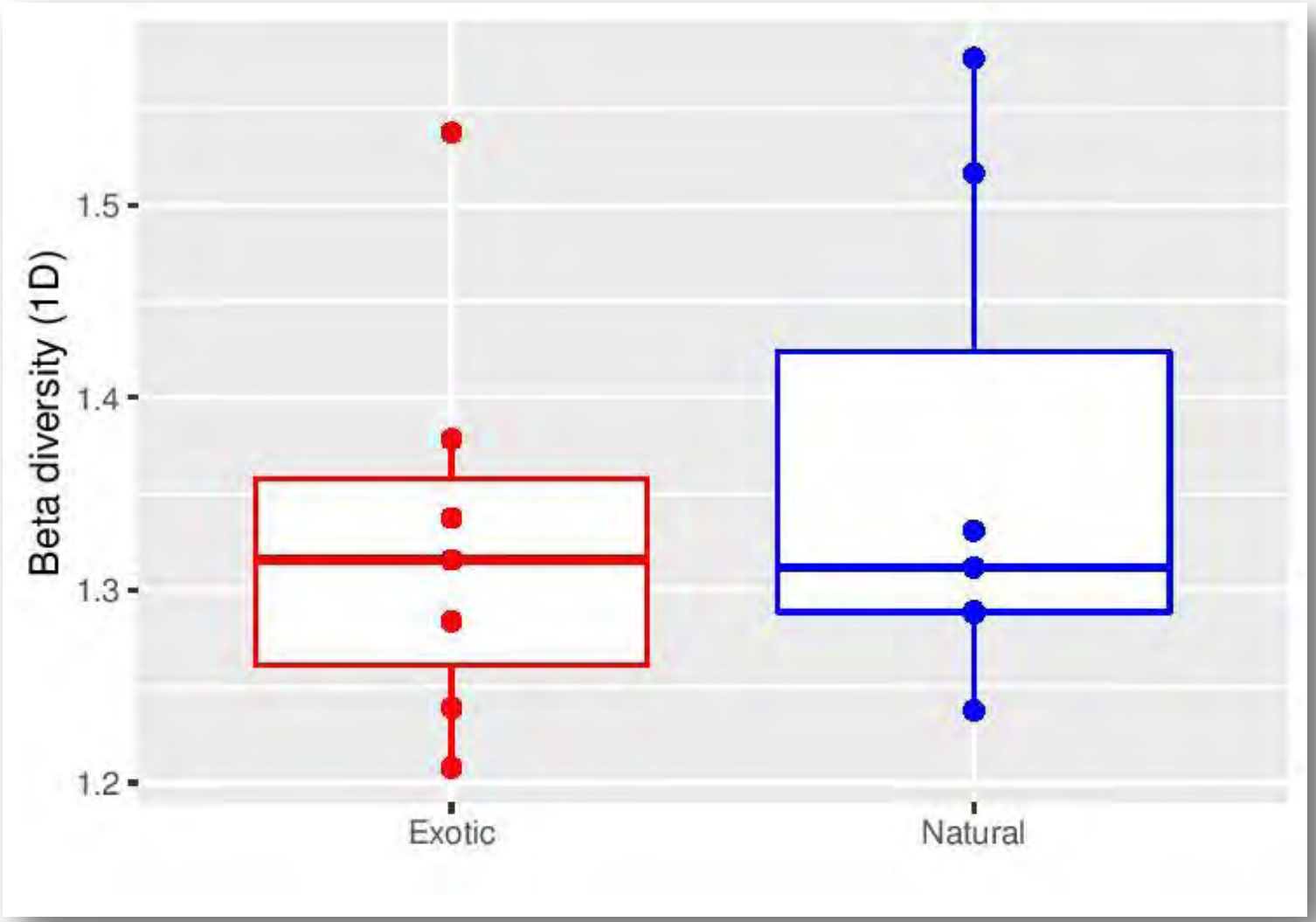


Poplar

D_{α}

$D_{\beta intra}$

$D_{\beta inter}$

Treatment	1Dα (average)	1Dγ	1Dβ
Natural	20.1	27.3	**0.36**
Hybrid poplar	22.5	33.7	**0.50**

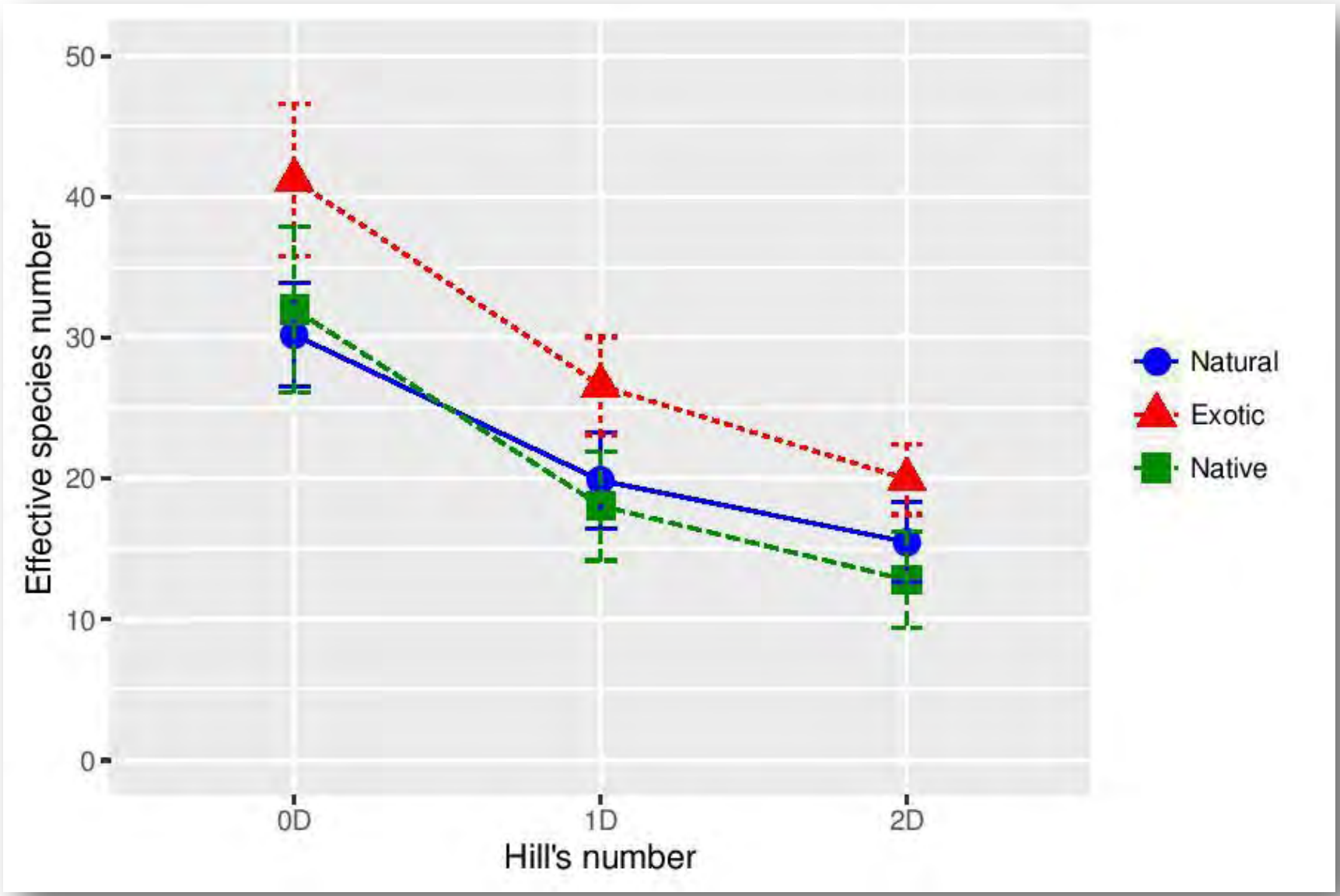
PERMDISP
p=0.1205

Larch

D_{α}

$D_{\beta intra}$

$D_{\beta inter}$

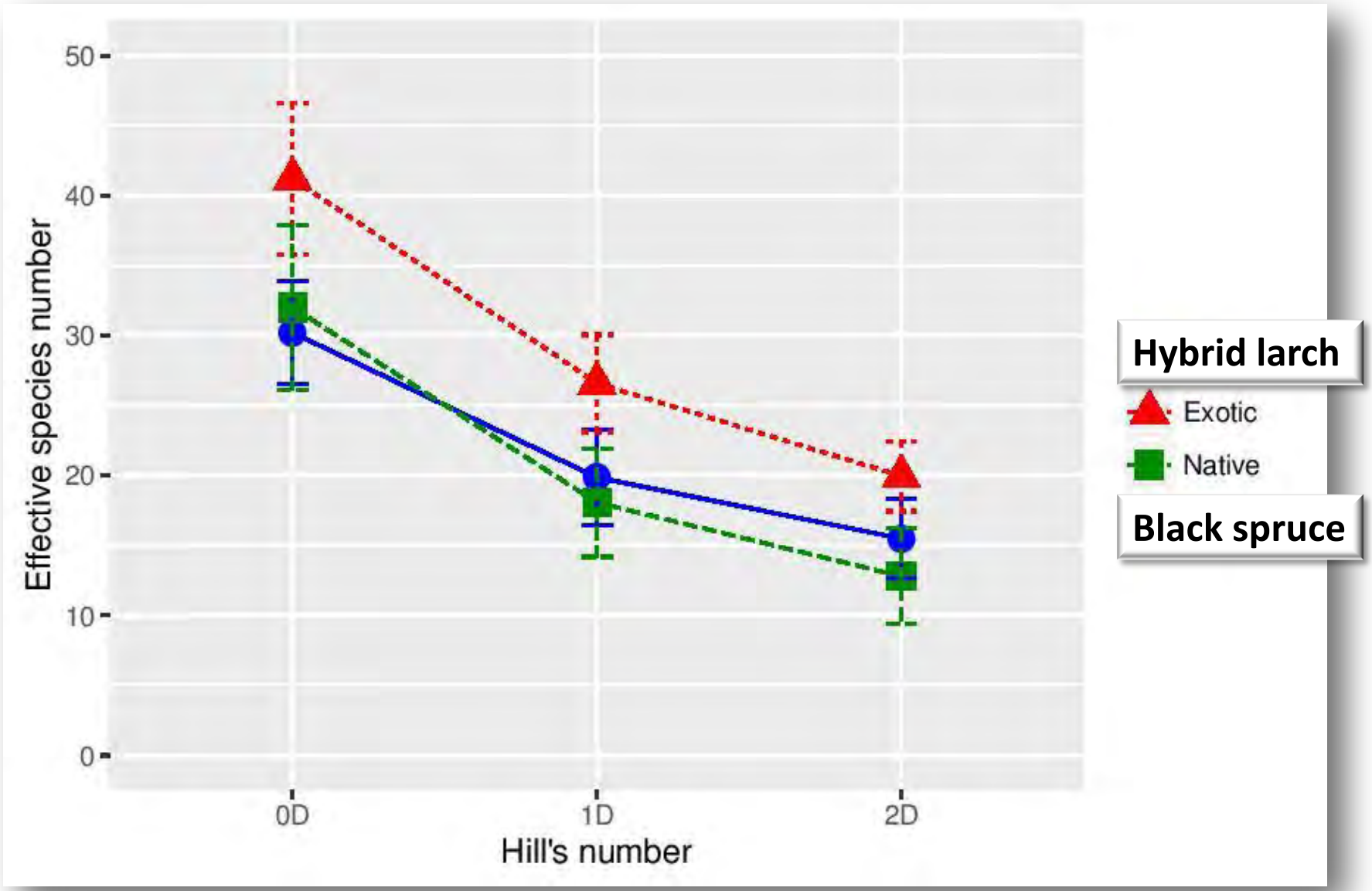


Larch

D_{α}

$D_{\beta intra}$

$D_{\beta inter}$

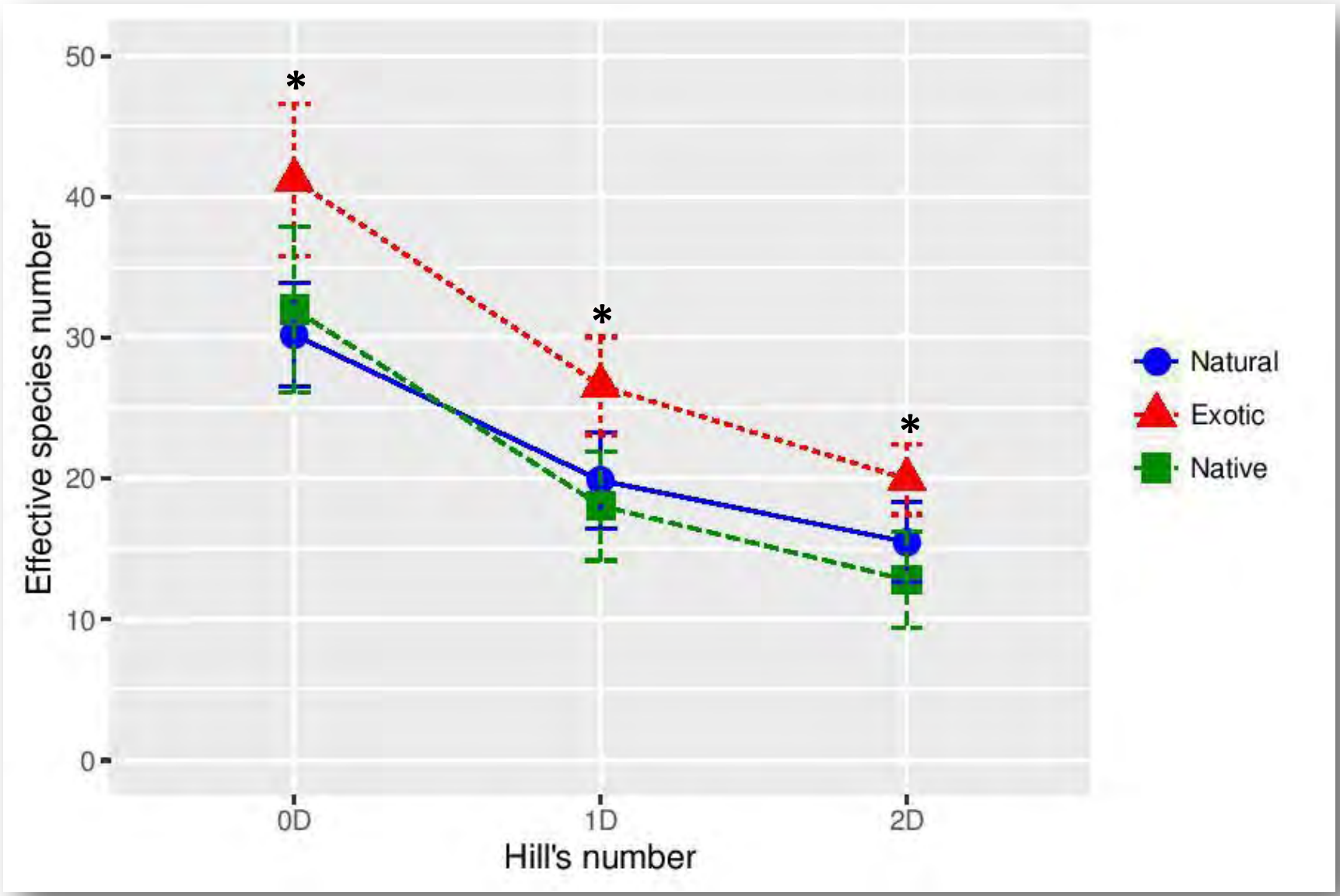


Larch

D_{α}

$D_{\beta intra}$

$D_{\beta inter}$

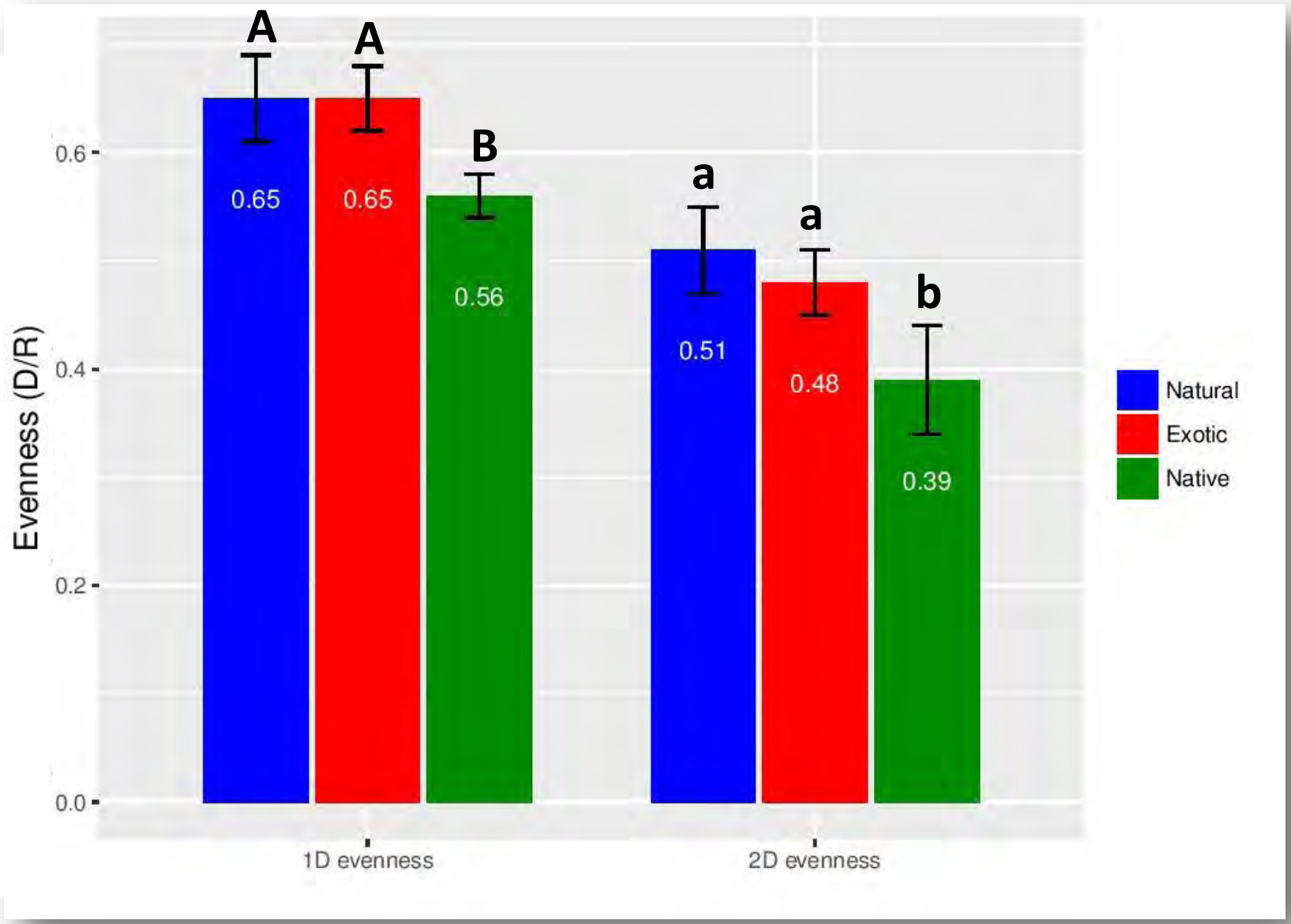


Larch

D_{α}

$D_{\beta intra}$

$D_{\beta inter}$

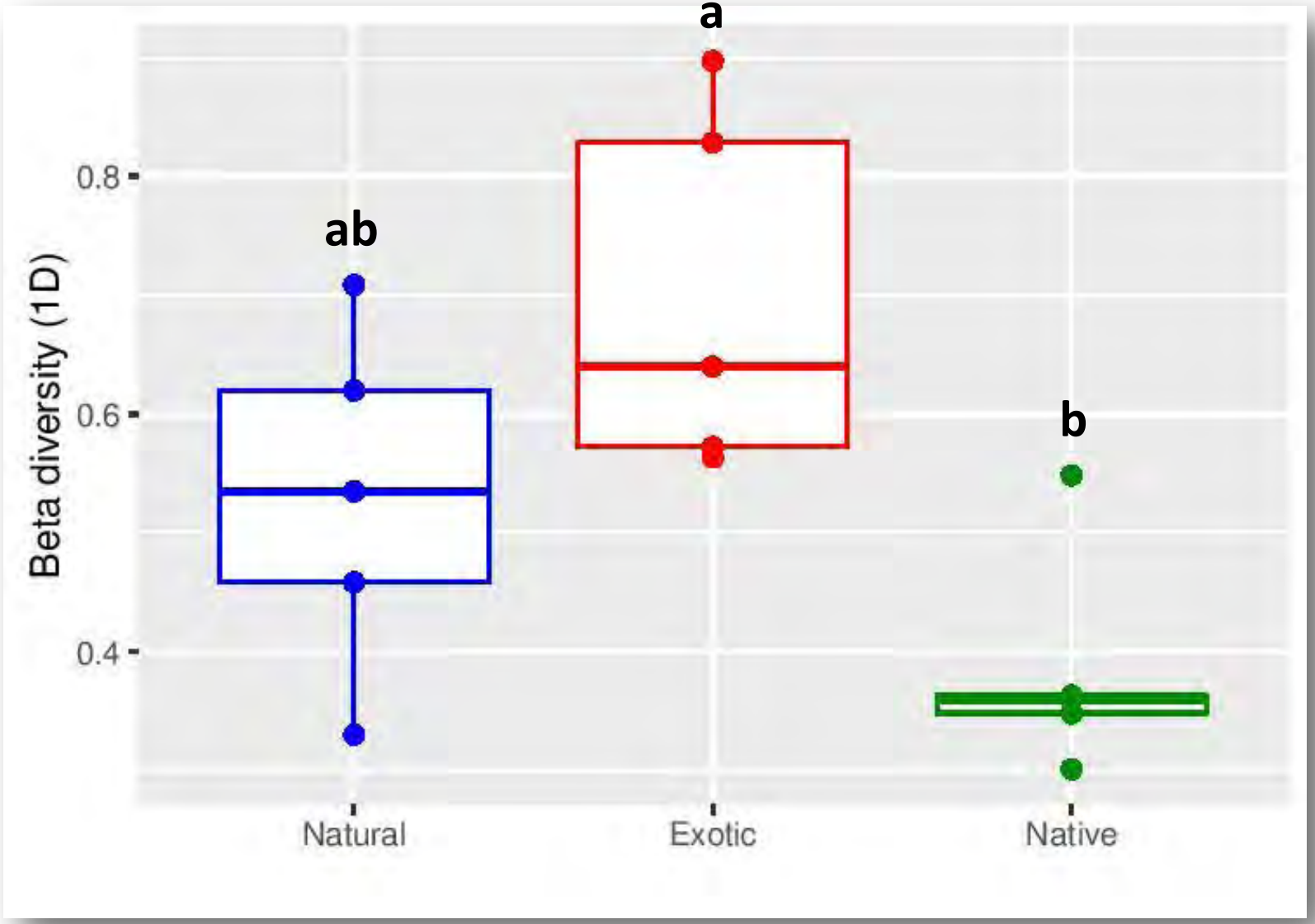


Larch

D_{α}

$D_{\beta intra}$

$D_{\beta inter}$



Larch

D_{α}

$D_{\beta intra}$

$D_{\beta inter}$

Treatment	1Dα (average)	1Dγ	1Dβ
Natural	19.9	28.5	0.43
Hybrid larch	26.6	41.5	0.56
Black spruce	18.1	26.0	0.44

PERMDISP
p=0.4659

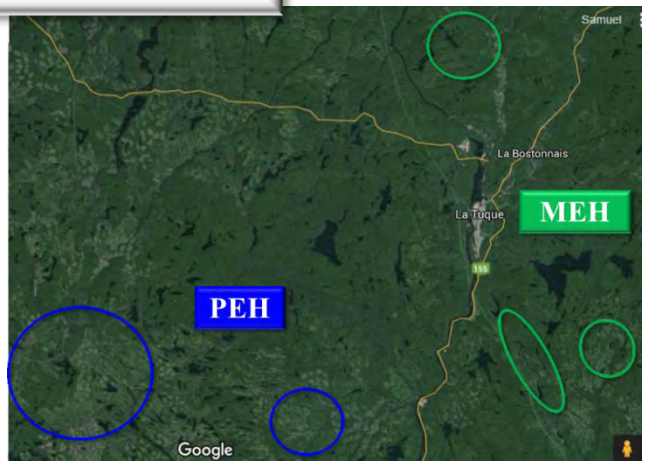
Summary

- Hybrid poplar plantations are as diverse as natural stands

- Hybrid larch plantations are more diverse than natural stands and black spruce plantations.
  - α
  - β_{intra}

?

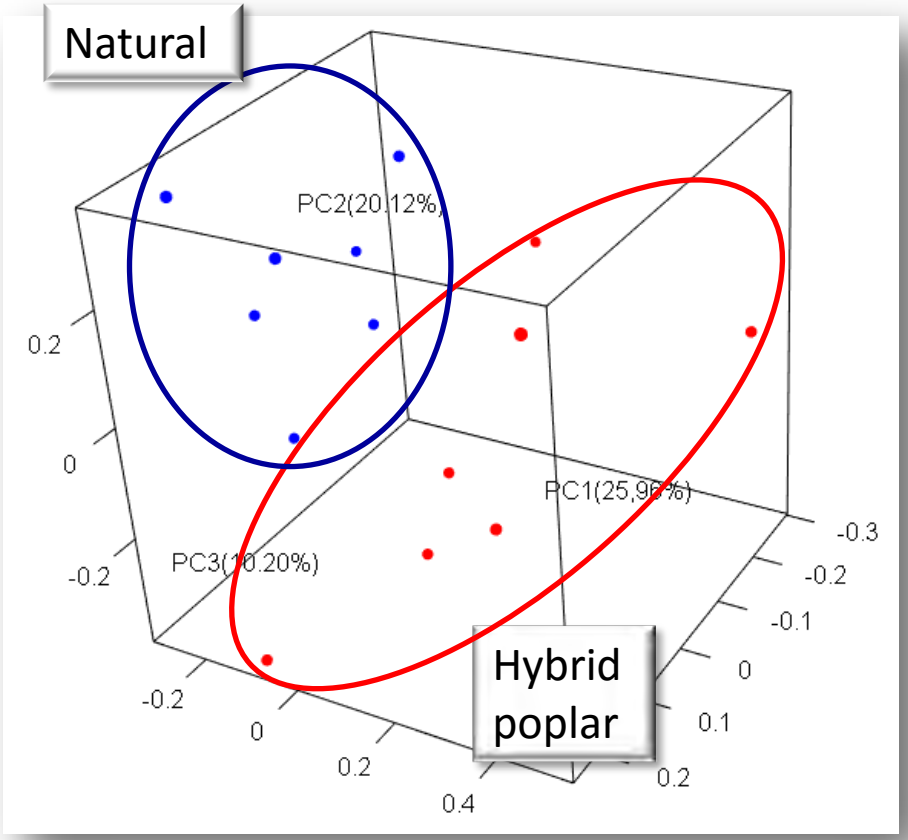
Further steps



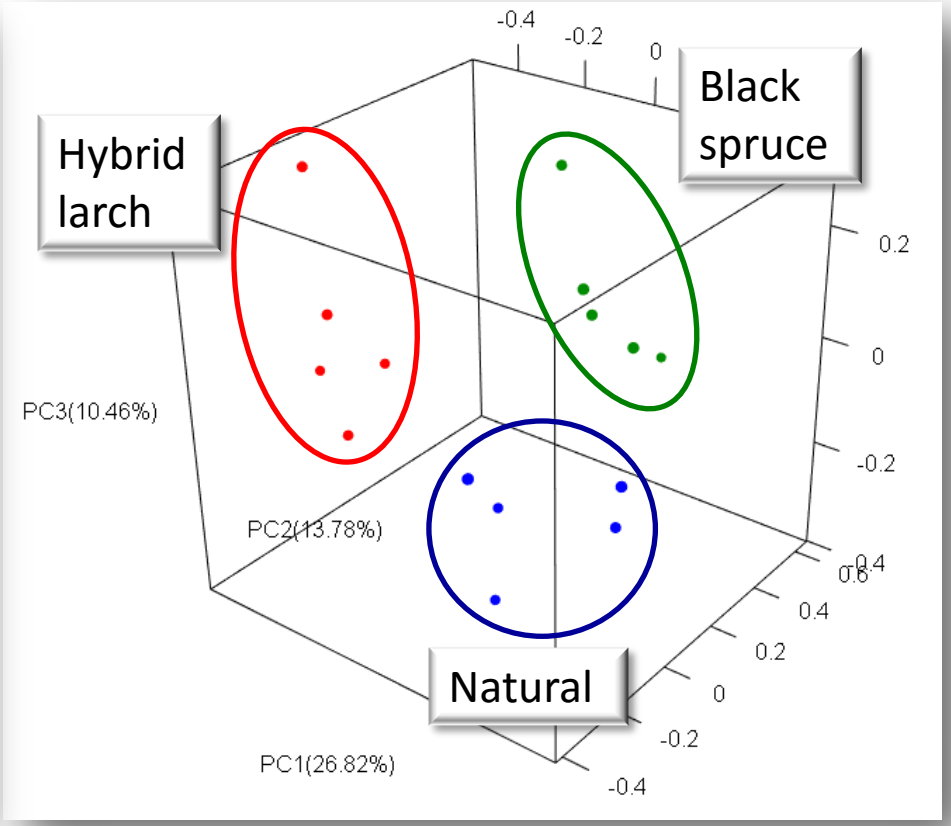
- Multiple regression at the plot level to determine which environmental factor influences biodiversity measures.
- Explore functional diversity
- Explore differences in vegetation composition.

Same abundance of different species

Poplar



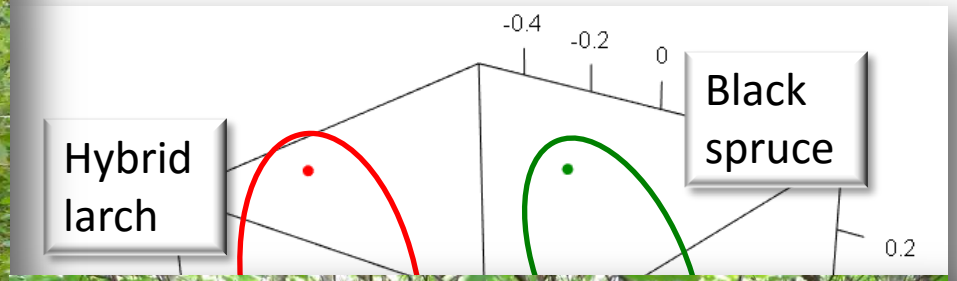
Larch

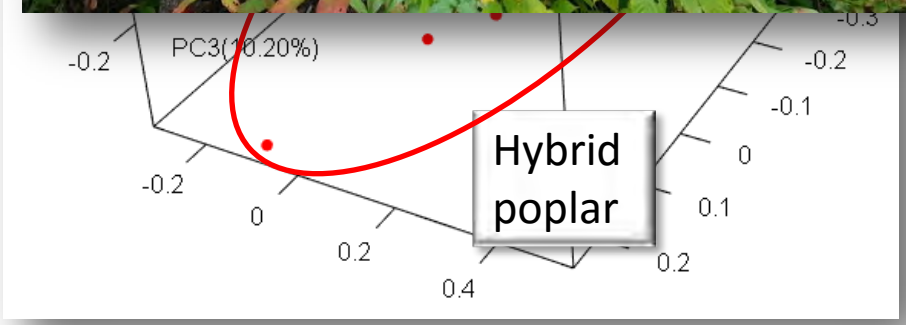


PERMANOVA $p<0.001$

Same abundance of different species

Larch





PERMANOVA

Modélisation de la Complexité de la Forêt

résolu
Produits forestiers

CERFO
Centre d'enseignement et de recherche en foresterie de Sainte-Foy inc.

Ville de La Tuque

CRSNG
NSERC

Forêts, Faune et Parcs
Québec