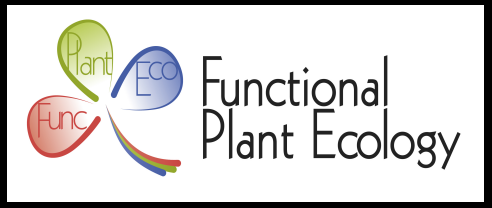
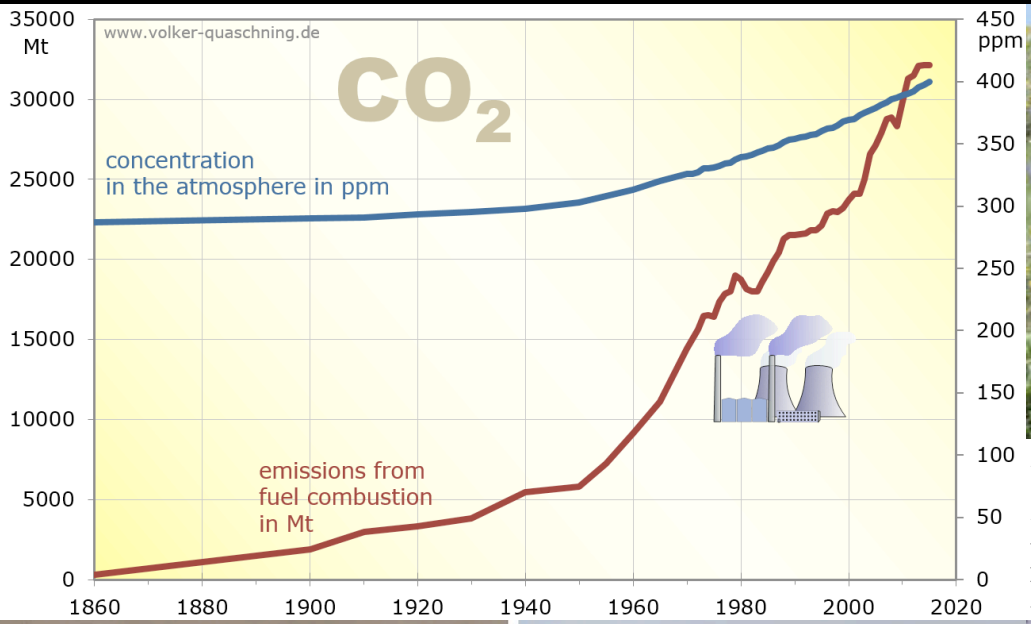
Francesco de Bello

Ecology of functional and phylogenetic differences (in plants)



Ecology

Predict the consequences of global change drivers on biodiversity and the repercussion on the functioning of the ecosystems



Functions and services of the ecosystems

Ecosystems and Human Well-being

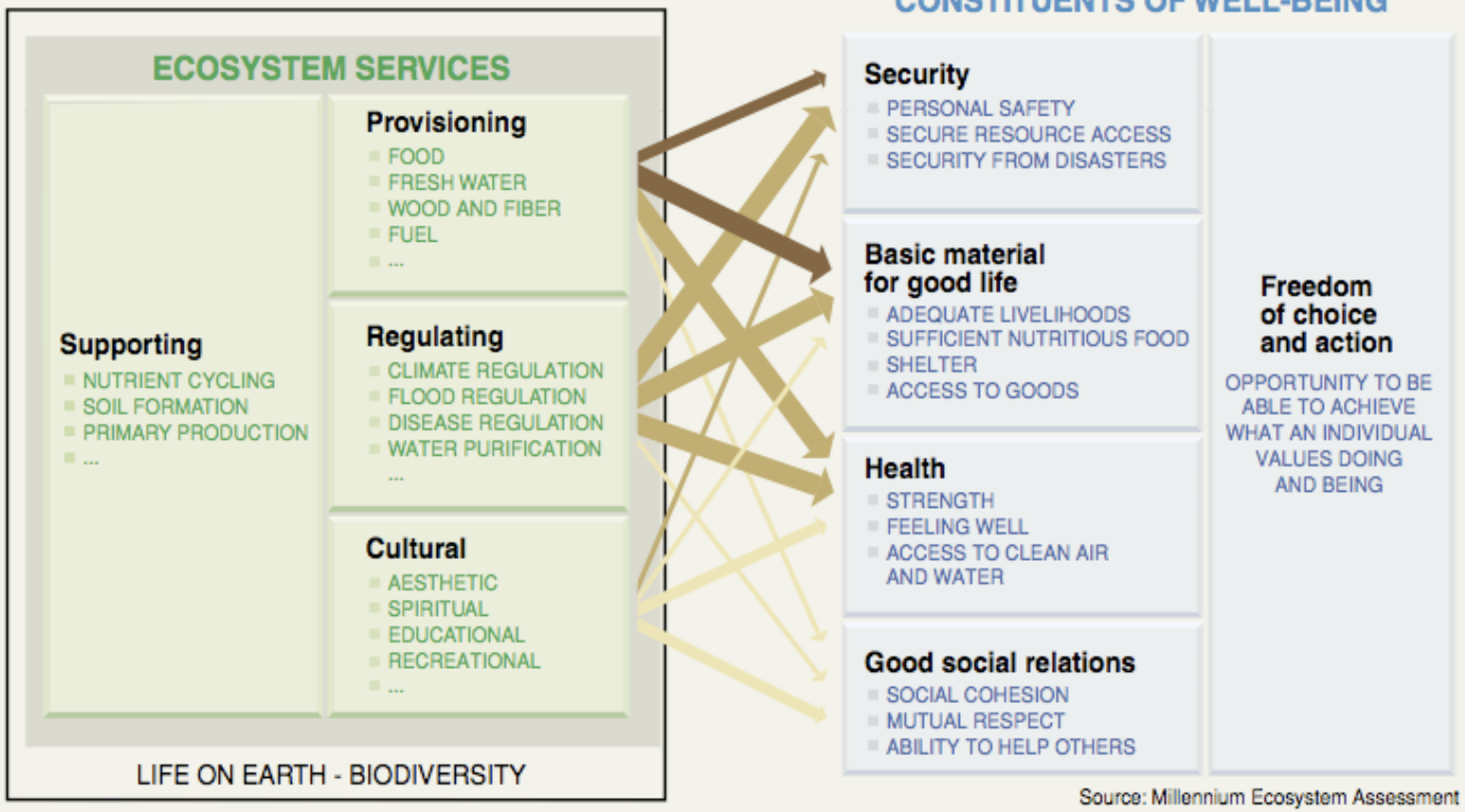
Biodiversity Synthesis

Key Messages

- *Biodiversity benefits people through more than just its contribution to material welfare and livelihoods.*

2005

Millennium Ecosystem Assessment



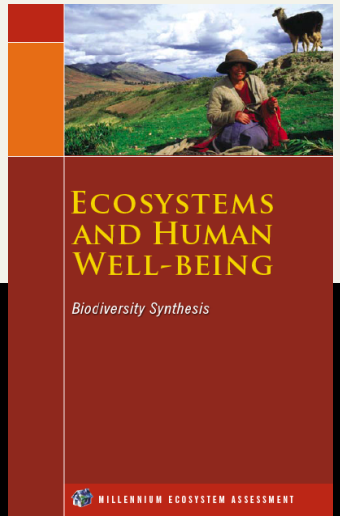
Source: Millennium Ecosystem Assessment

ARROW'S COLOR
Potential for mediation by socioeconomic factors

- Low
- Medium
- High

ARROW'S WIDTH
Intensity of linkages between ecosystem services and human well-being

- Weak
- Medium
- Strong



2005

Global change drivers → **Change in functional traits** → **Ecosystem functions**

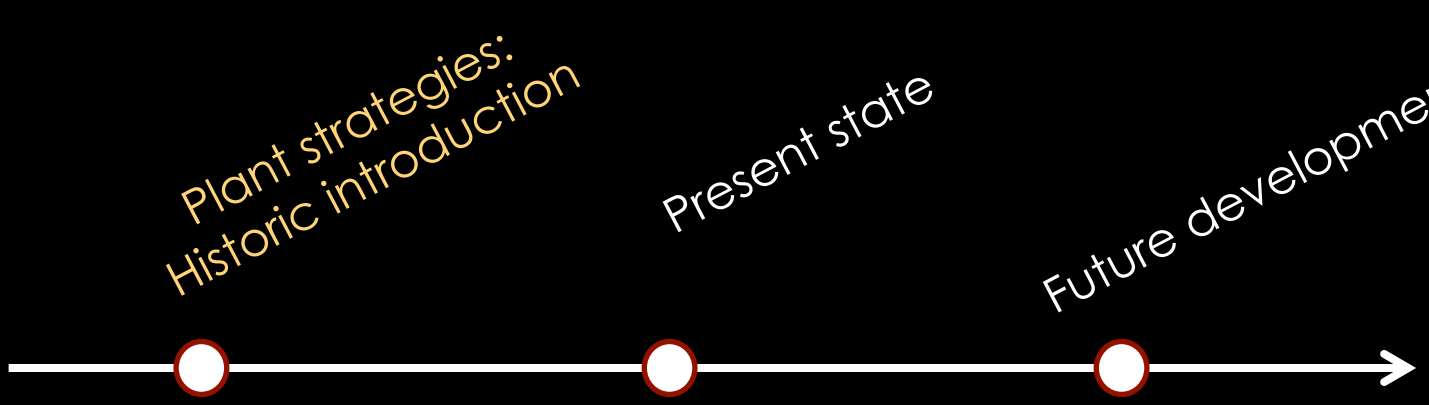




Ecology of differences

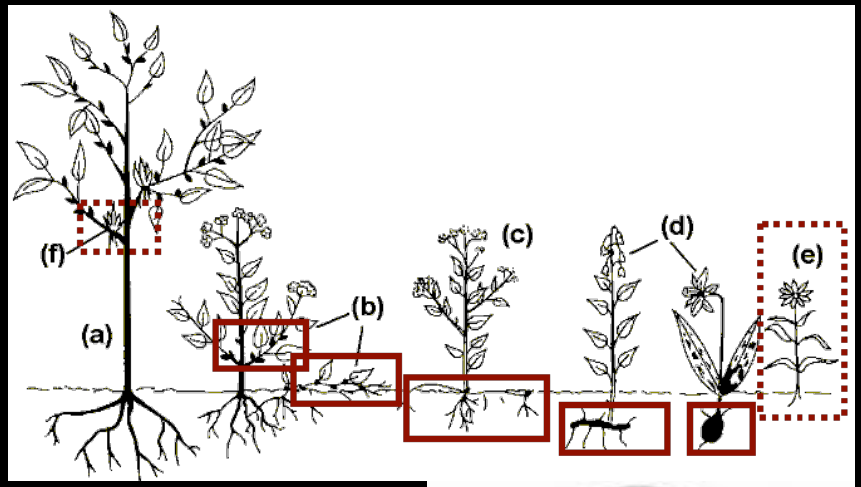
The differences in functional traits within and across organisms gives place to:

- ≠ adaptations to the environment
- ≠ interactions with other organisms
- ≠ effects on the ecosystems



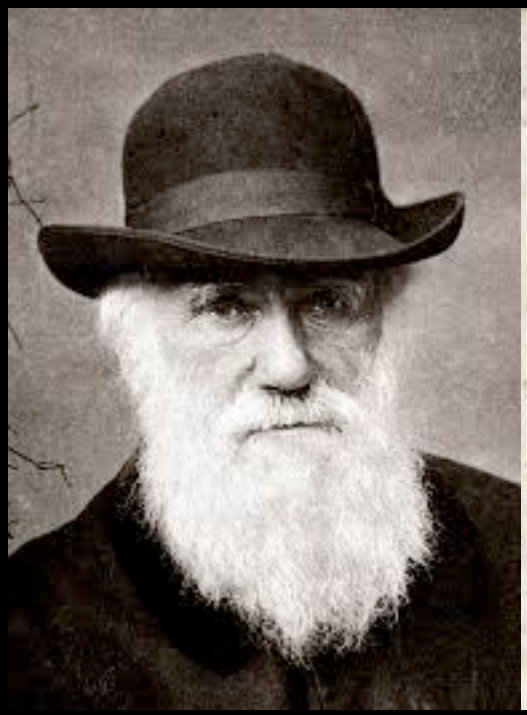
Ecology of differences

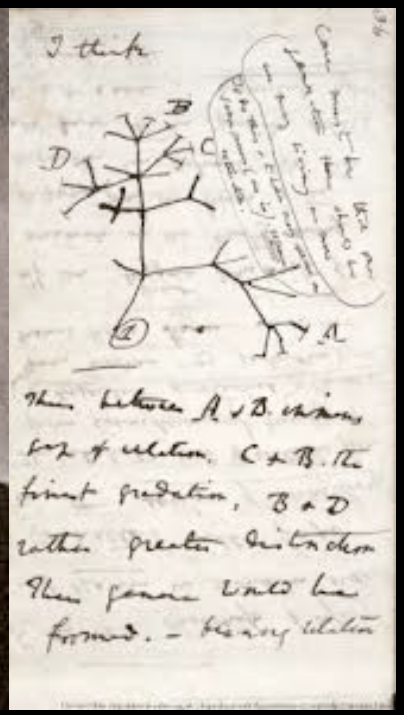
The differences in functional traits within and across organisms



Theophrastus
~300 AC

Darwin 1859





Raunkiaer
1904

Ecology of differences

The differences in functional traits within and across organisms

Hutchinson
1959

AMERICAN NATURALIST

Vol. XCIII May–June, 1959 No. 870

HOMAGE TO SANTA ROSALIA
or
WHY ARE THERE SO MANY KINDS OF ANIMALS?*

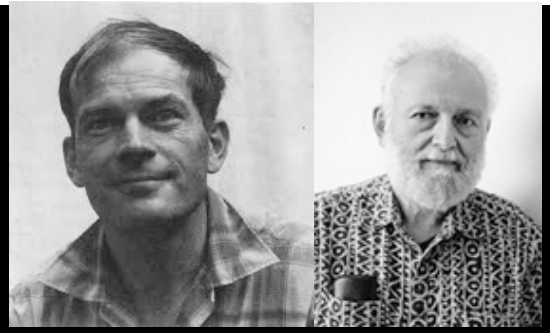
G. E. HUTCHINSON

Vol. 101, No. 921 The American Naturalist September–October, 1967

THE LIMITING SIMILARITY, CONVERGENCE, AND DIVERGENCE OF COEXISTING SPECIES

ROBERT MACARTHUR AND RICHARD LEVINS*

Department of Biology, Princeton University, Princeton, New Jersey, and
Department of Biology, University of Puerto Rico,
Rio Piedras, Puerto Rico



MacArthur & Levins
1967

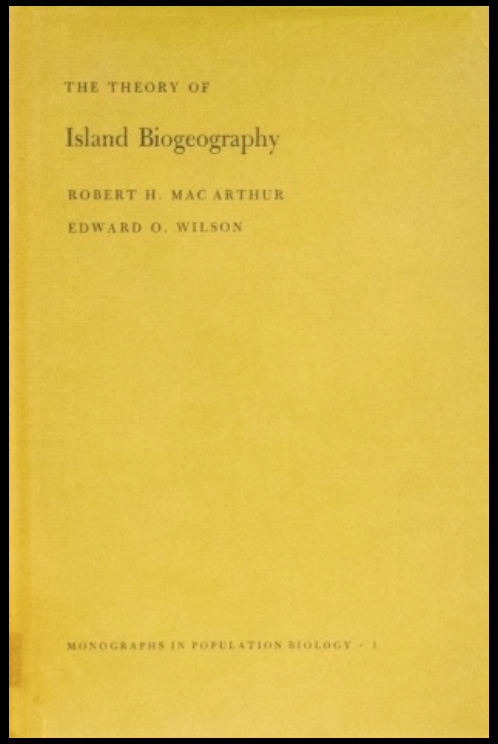
Ecology of differences

The differences in functional traits within and across organisms

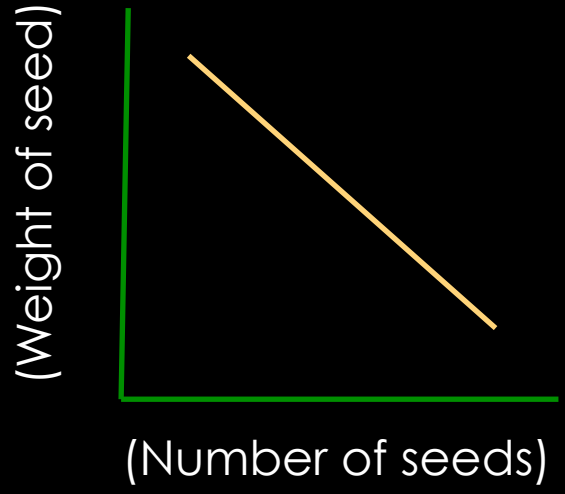
Christmas card, picturing Hutchinson in Santa Rosalia, by Shahid Naeem from Gotelli & Graves (1996)

Trade-offs

Compromise (evolutionary dilemma) in differentiation: by gaining some advantage something else is lost



MacArthur & Wilson 1967

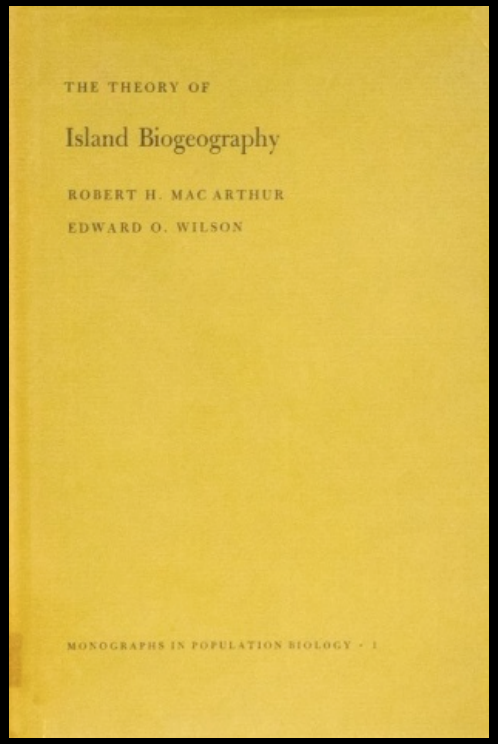


Resistance

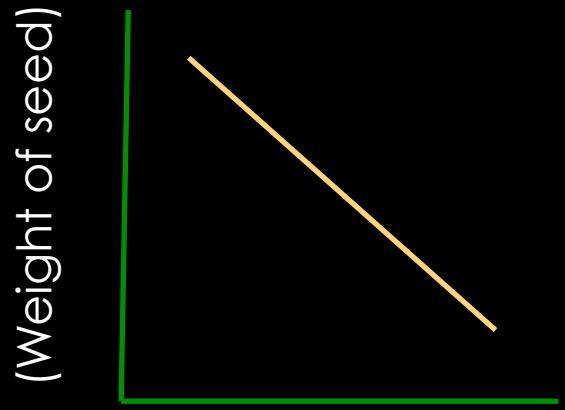
Speed

Trade-offs

Compromise (evolutionary dilemma) in differentiation: by gaining some advantage something else is lost



MacArthur & Wilson 1967



K-selection

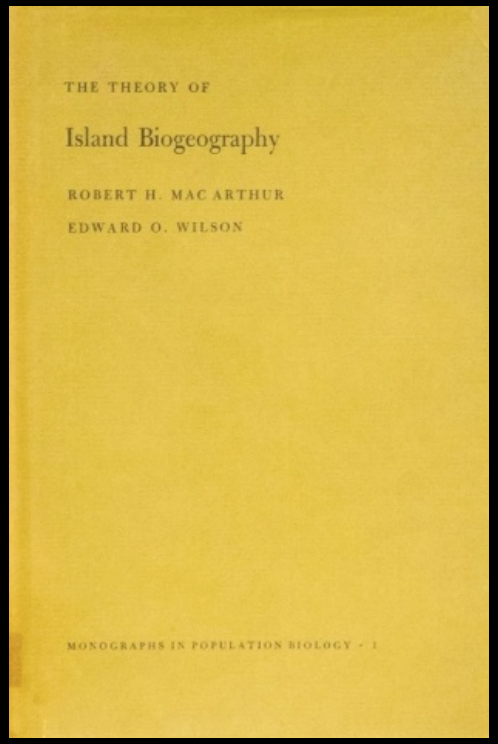
- seed size (energy storage)
- somatic growth
- seeds are able to grow immediately in situ
- good protection against enemies

r-selection

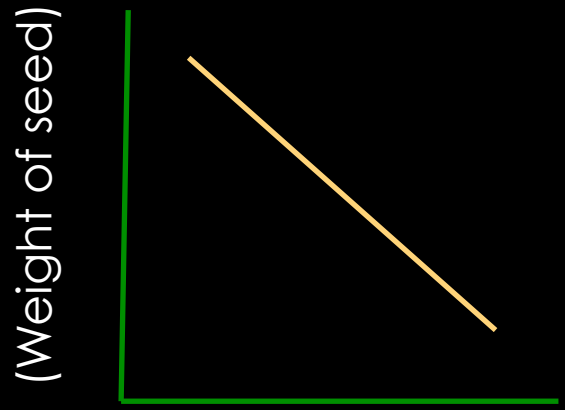
- seed number
- early reproduction
- escape in space or time (dispersal, persistent seed bank)
- fast growth

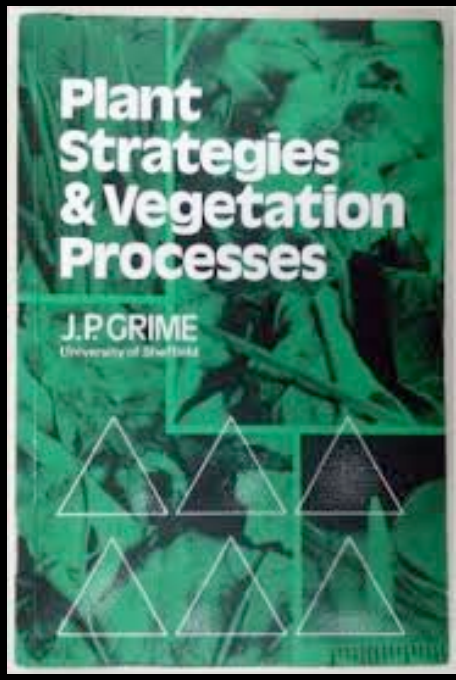
Trade-offs

Compromise (evolutionary dilema) in differentiation: by gaining some advantage something else is lost



MacArthur & Wilson 1967





Grime
1977

S

Stress

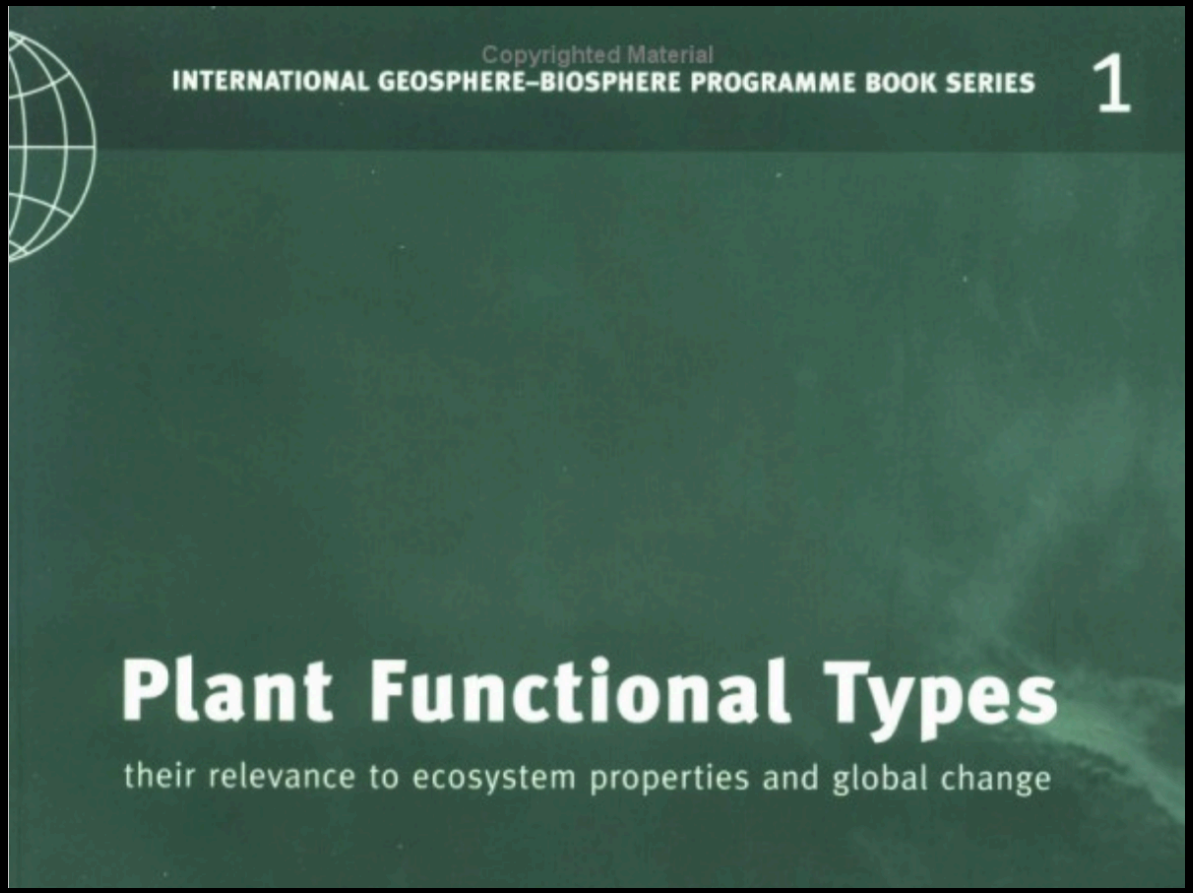
Competition

Ruderality

C

R

Cambio global



Smith, Shugart & Woodward (Ed.)

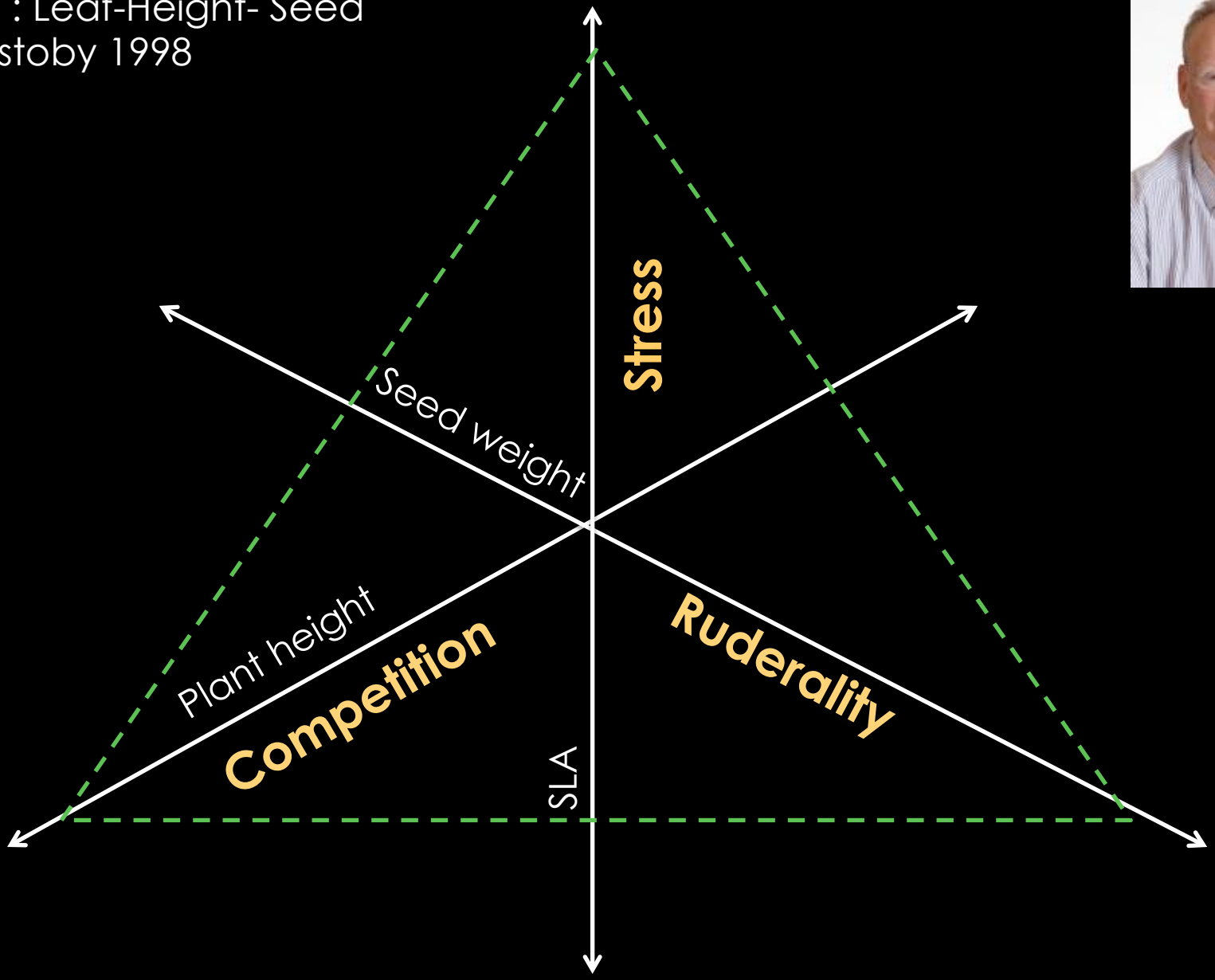
1997

"….we have very little information, in many cases none, about how plants will respond in the future. In order to circumvent this problem, and until more information on species accumulates, we reduce the diversity of species to a diversity of functions and structures…."

S
Stress
Competition
Ruderality
C
R

Oikos1997: 67 atributos (14 regeneración)

LHS : Leaf-Height- Seed
Westoby 1998



1999

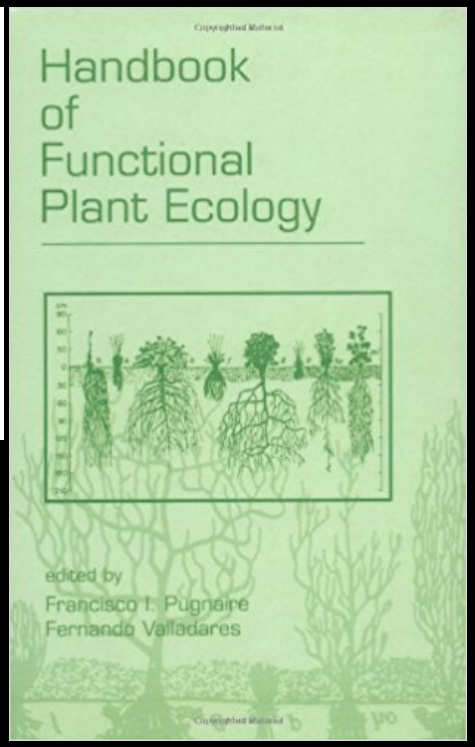
CSIRO PUBLISHING
www.publish.csiro.au/journals/ajb
Australian Journal of Botany, 2003, **51**, 335–380

A handbook of protocols for standardised and easy measurement of plant functional traits worldwide

J. H. C. Cornelissen[A,J], *S. Lavorel*[B], *E. Garnier*[B], *S. Díaz*[C], *N. Buchmann*[D], *D. E. Gurvich*[C], *P. B. Reich*[E], *H. ter Steege*[F], *H. D. Morgan*[G], *M. G. A. van der Heijden*[A], *J. G. Pausas*[H] *and H. Poorter*[I]

2003

Cited>1200 times



TRY

Plant Trait Database

Annu. Rev. Ecol. Evol. Syst. 2015. 46:523–49

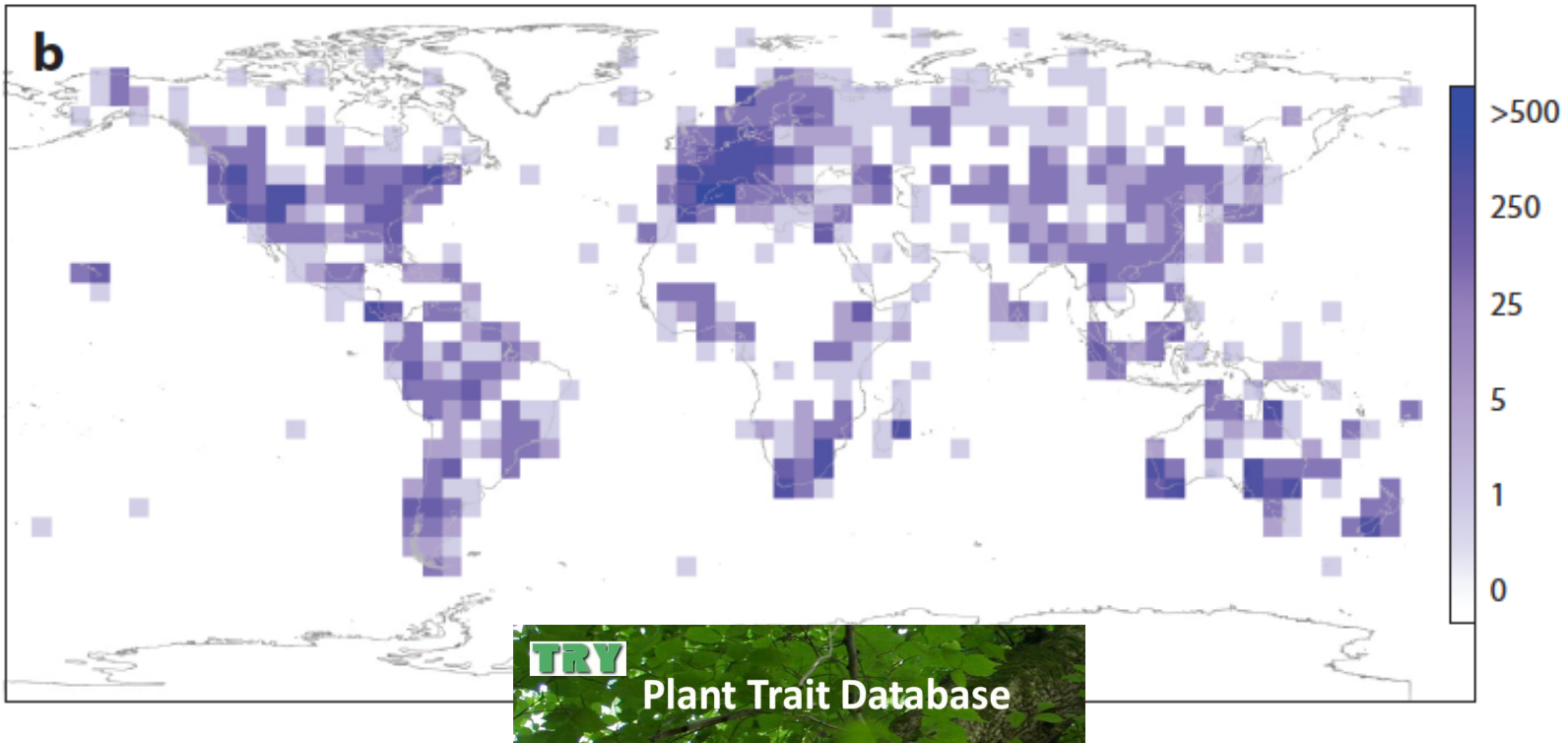
First published online as a Review in Advance on October 28, 2015

The *Annual Review of Ecology, Evolution, and Systematics* is online at ecolsys.annualreviews.org

This article's doi:
10.1146/annurev-ecolsys-112414-054400

Seven Shortfalls that Beset Large-Scale Knowledge of Biodiversity

Joaquín Hortal,[1,2,3,*] Francesco de Bello,[4,5] José Alexandre F. Diniz-Filho,[2] Thomas M. Lewinsohn,[6] Jorge M. Lobo,[1] and Richard J. Ladle[7,8,*]



Functional traits

Characteristics of an organisms that affect its fitness (and effects on the ecosystems) [Violle et al. 2007]

Eric Garnier

Simple trait 1
Simple trait 2
Simple trait 3
Simple trait 4
Simple trait 5
Simple trait X

Competition
Nutrient acquisit.
Fecundity
Recruitment
Life cycle
Tolerance to x&y

Growth/biomass
Reproduction
Survival

Fitness

Easy to measure

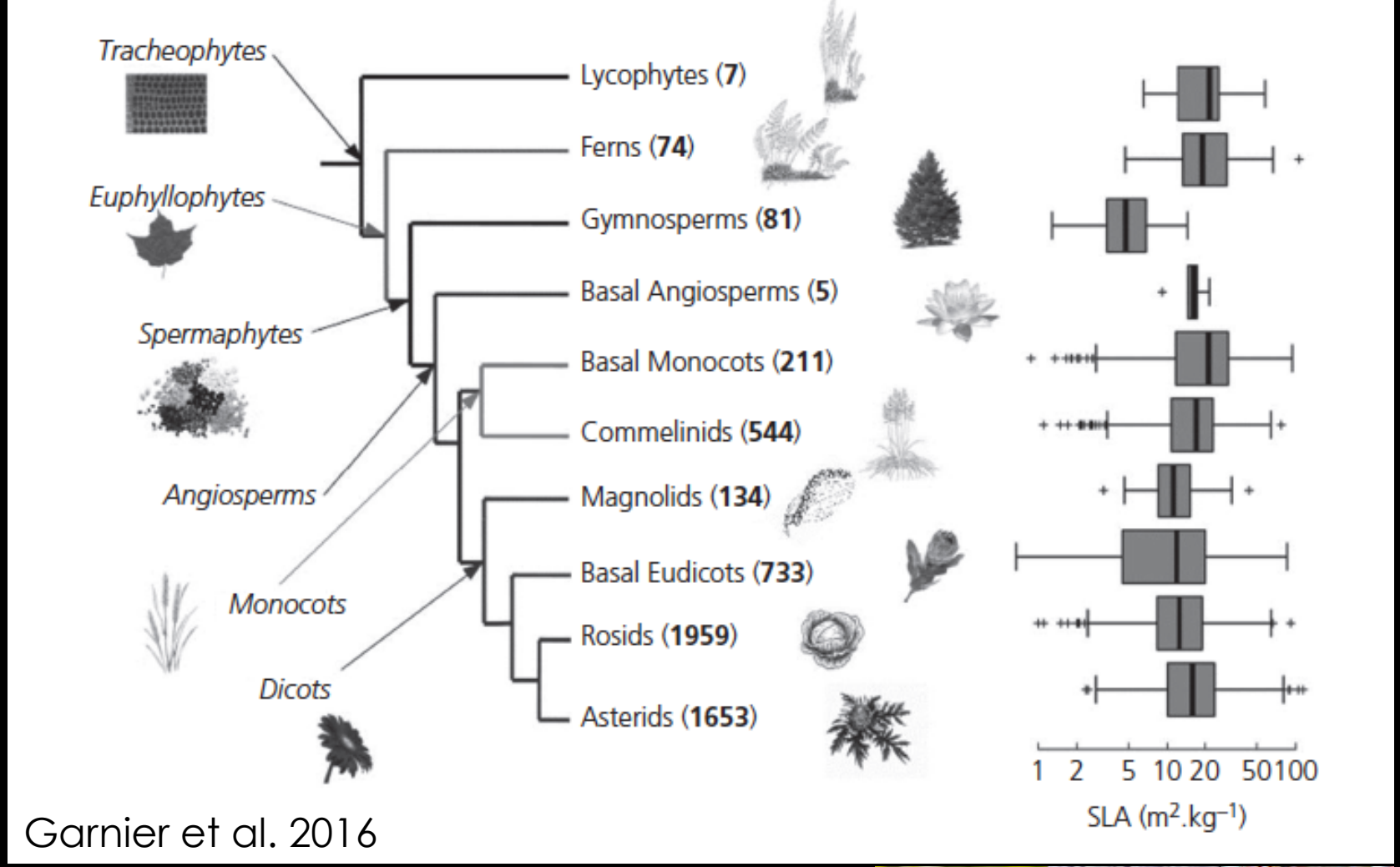
Difficult to measure

More precise

Easy to measure

Functions	Functional markers
Fecundity Dissemination Establishment	Seed mass Reproductive height Reproductive phenology
Light interception Competitive ability	Vegetative height
Resource acquisition Growth Litter decomposition	Leaf size Leaf morpho-anatomical structure Leaf nutrient concentrations
Absorption (nutrients, water) Carbon fluxes (exudation, etc.) Below-ground competition	Density of root tissues Root diameter and length Specific root area

Garnier et al. 2016 Oxford press



Garnier et al. 2016

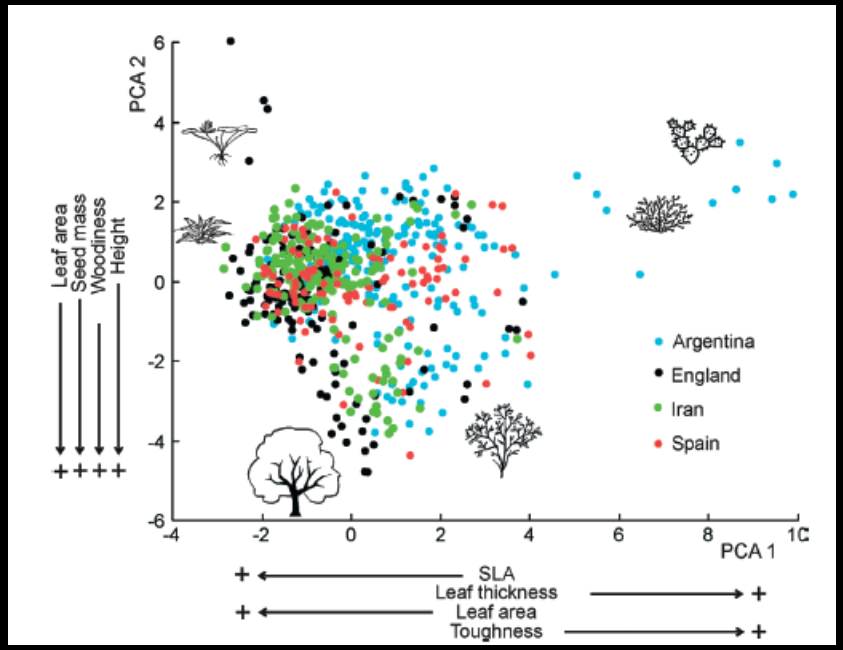
Astrophytum asterais Euphorbia obesa

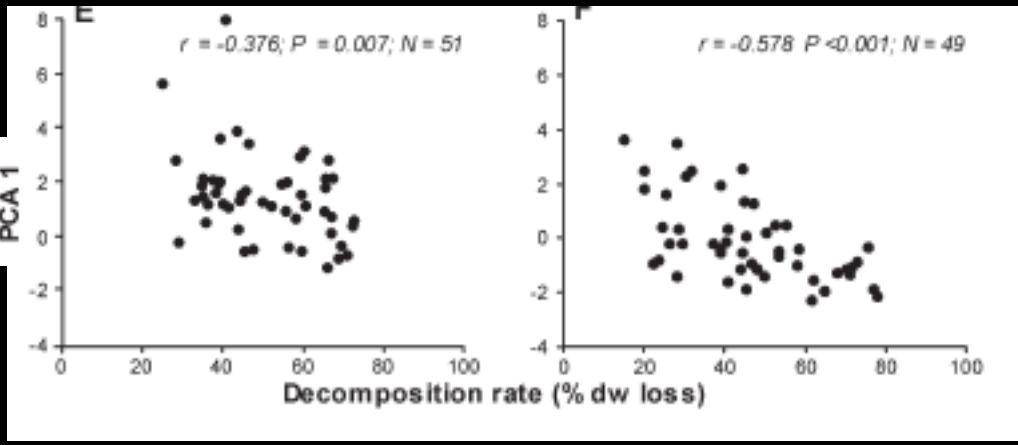
Journal of Vegetation Science 15: 295-304, 2004

The plant traits that drive ecosystems: Evidence from three continents

Díaz, S.[1*]; Hodgson, J.G.[2†]; Thompson, K.[2]; Cabido, M.[1]; Cornelissen, J.H.C.[3]; Jalili, A.[4]; Montserrat-Martí, G.[5]; Grime, J.P.[2]; Zarrinkamar, F.[4]; Asri, Y.[4]; Band, S.R.[2]; Basconcelo,

….more authors





"Leaf economic spectrum"

Trade-offs between species cause effect on the ecosystems

"…to assess…biodiversity it is necessary…using taxonomy (such as the number of species), functional traits…."

Ecosystems and Human Well-being

Biodiversity Synthesis

Key Messages

- *Biodiversity benefits people through more than just its contribution to material welfare and livelihoods.*

2005

MILLENNIUM ECOSYSTEM ASSESSMENT

Cited >1000 times

Functional Ecology 2002
16, 545–556

ESSAY REVIEW

Predicting changes in community composition and ecosystem functioning from plant traits: revisiting the Holy Grail

S. LAVOREL* and E. GARNIER

Centre d' Ecologie Fonctionnelle et Evolutive, CNRS UPR 9056, 1919 route de Mende, 34293 Montpellier Cedex 5, France

ESA Report

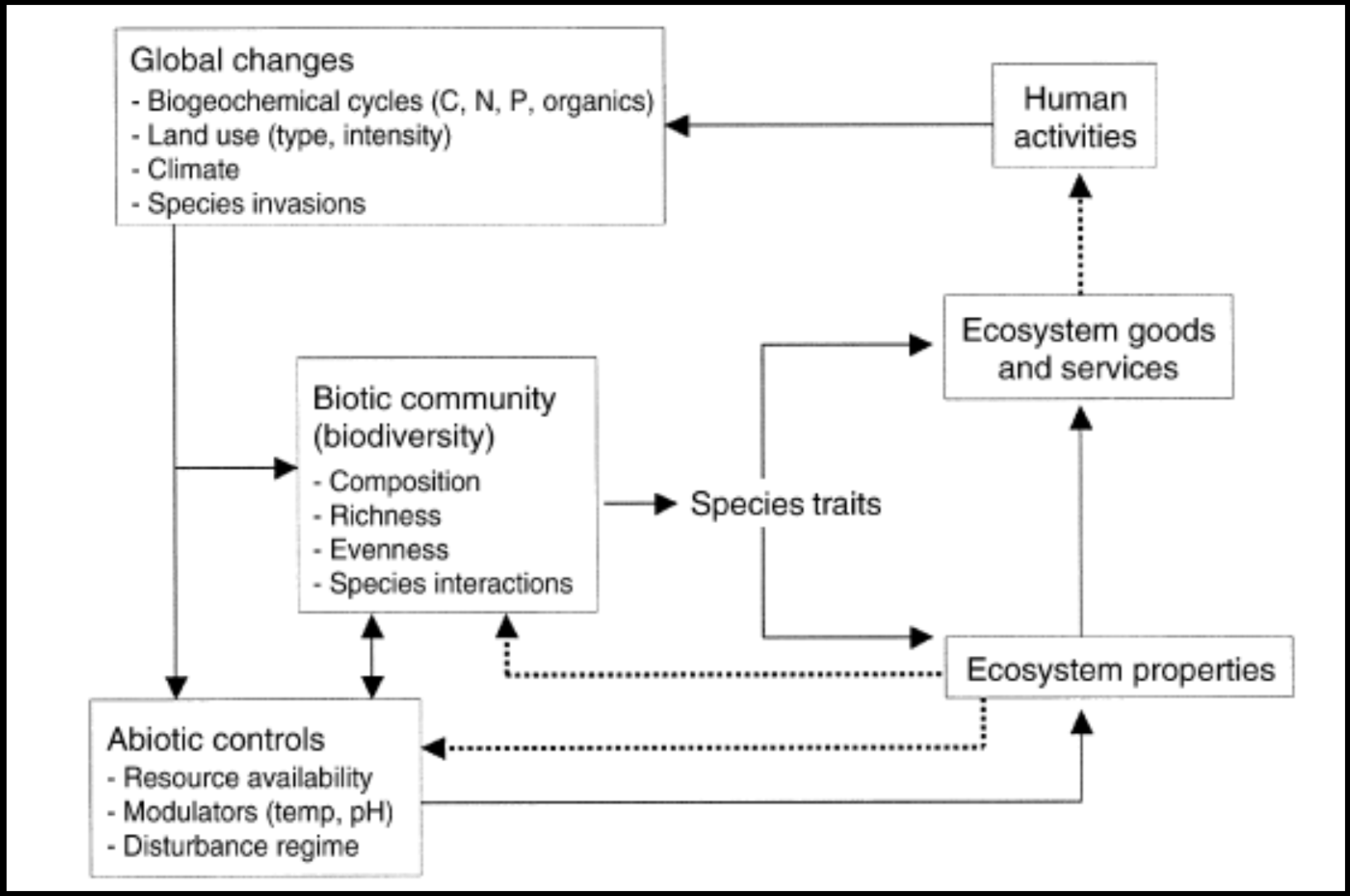
EFFECTS OF BIODIVERSITY ON ECOSYSTEM FUNCTIONING: A CONSENSUS OF CURRENT KNOWLEDGE

D. U. HOOPER,[1,16] F. S. CHAPIN, III,[2] J. J. EWEL,[3] A. HECTOR,[4] P. INCHAUSTI,[5] S. LAVOREL,[6] J. H. LAWTON,[7] D. M. LODGE,[8] M. LOREAU,[9] S. NAEEM,[10] B. SCHMID,[4] H. SETÄLÄ,[11] A. J. SYMSTAD,[12] J. VANDERMEER,[13] AND D. A. WARDLE[14,15]

1) Species' functional characteristics strongly influence ecosystem properties.

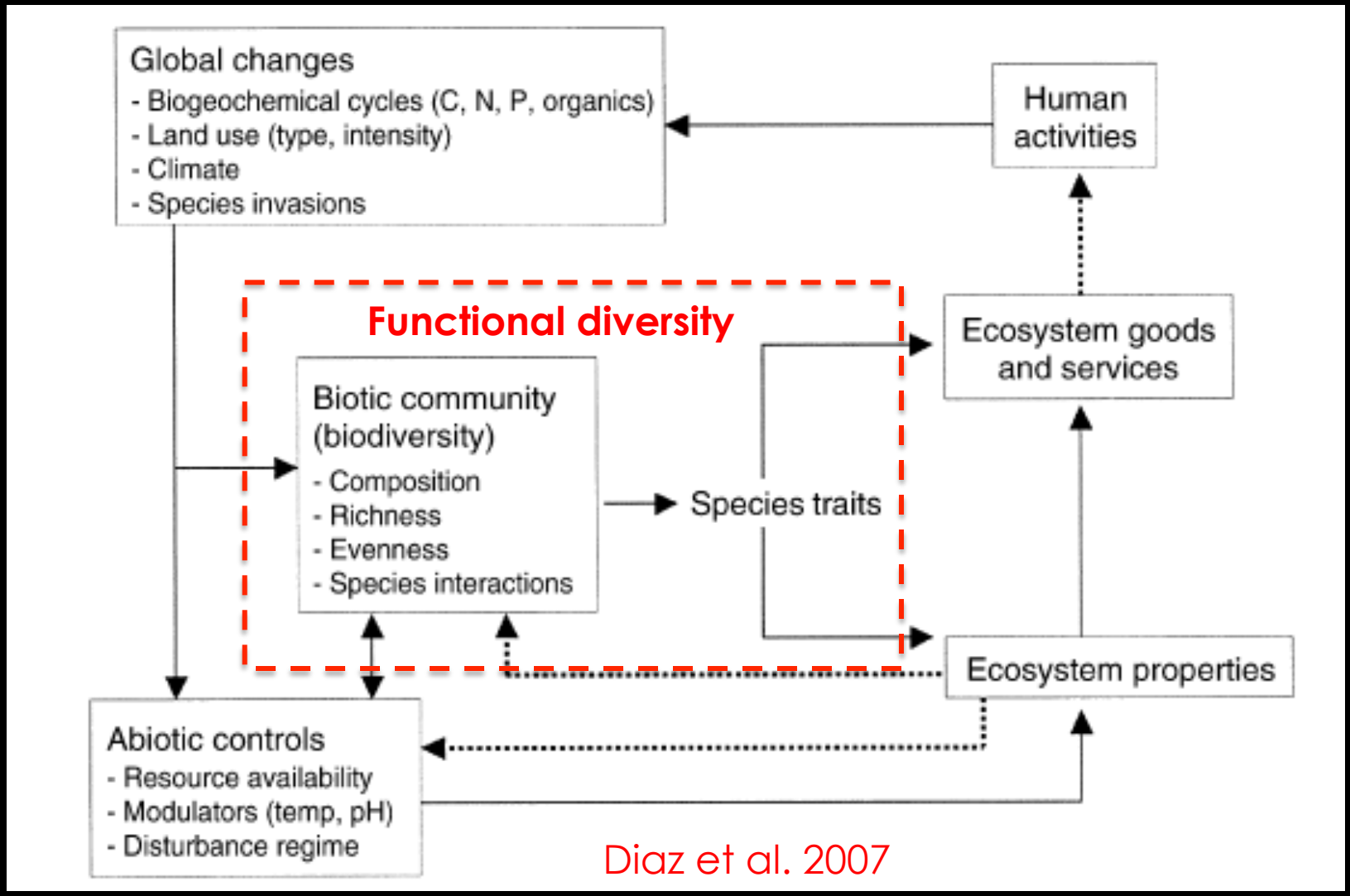
Functional traits

Cited >2800 times



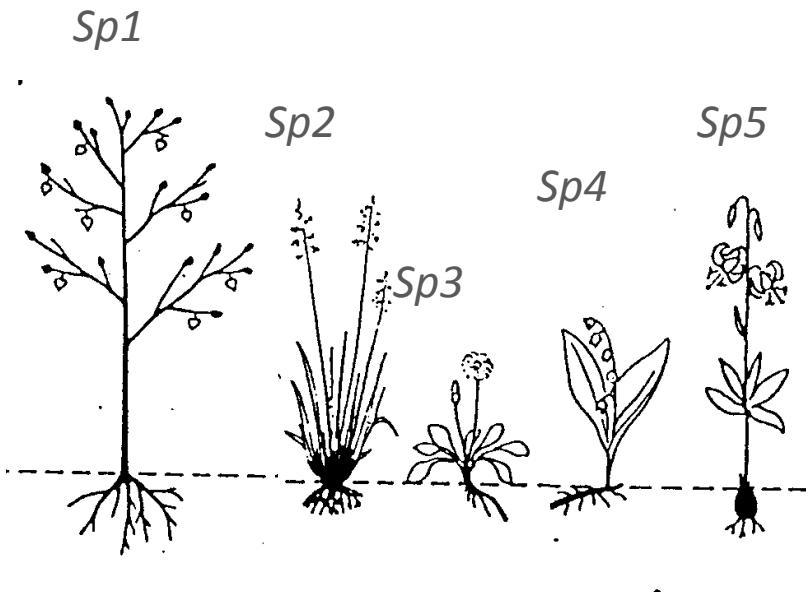
Hooper et al. 2005

Ecology of differences



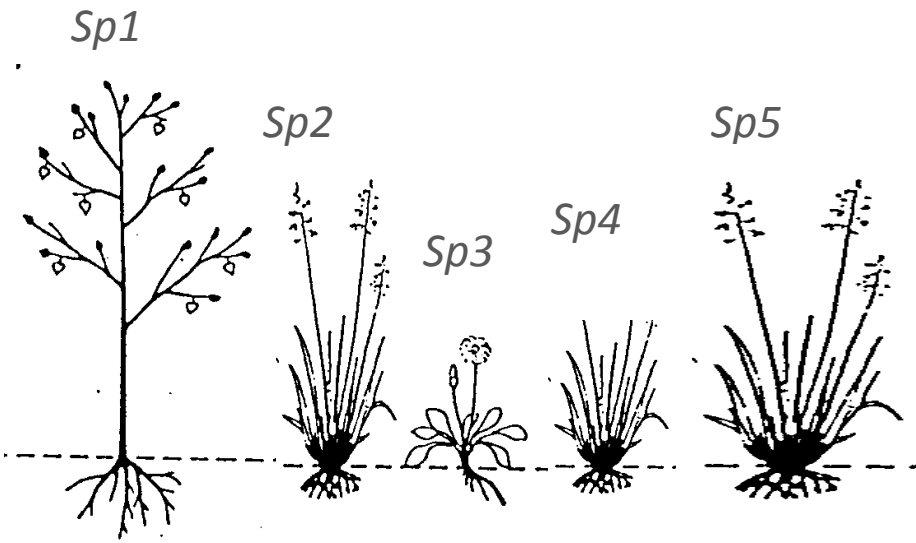
Hooper et al. 2005

Community 1



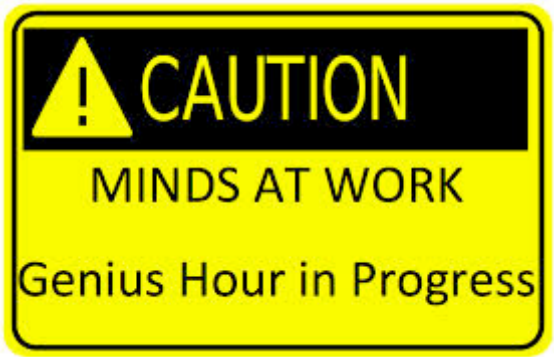
5 taxonomically different species

Community 2



5 taxonomically different species

Who is more diverse???



PNAS

Incorporating plant functional diversity effects in ecosystem service assessments

2007

Sandra Díaz*†, Sandra Lavorel‡, Francesco de Bello‡, Fabien Quétier*‡, Karl Grigulis‡, and T. Matthew Robson‡§

Cozzarelli prize PNAS
ESA Sustanability Science Award

Ecology of differences

The biodiversity revolution

Ecologists are increasingly looking at traits — rather than species — to measure the health of ecosystems.

BY RACHEL CERNANSKY

What do you see in this photo?

Ecología de las diferencias

Taxa or types?

Ecology of differences

Plant strategies:
Historic introduction

Present state

Future developments

Climate

1

2

Landuse

Change in functional traits

3

Ecosystem functions

Functional Ecology 2002
16, 545–556

ESSAY REVIEW

Predicting changes in community composition and ecosystem functioning from plant traits: revisiting the Holy Grail

S. LAVOREL* and E. GARNIER

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Climate

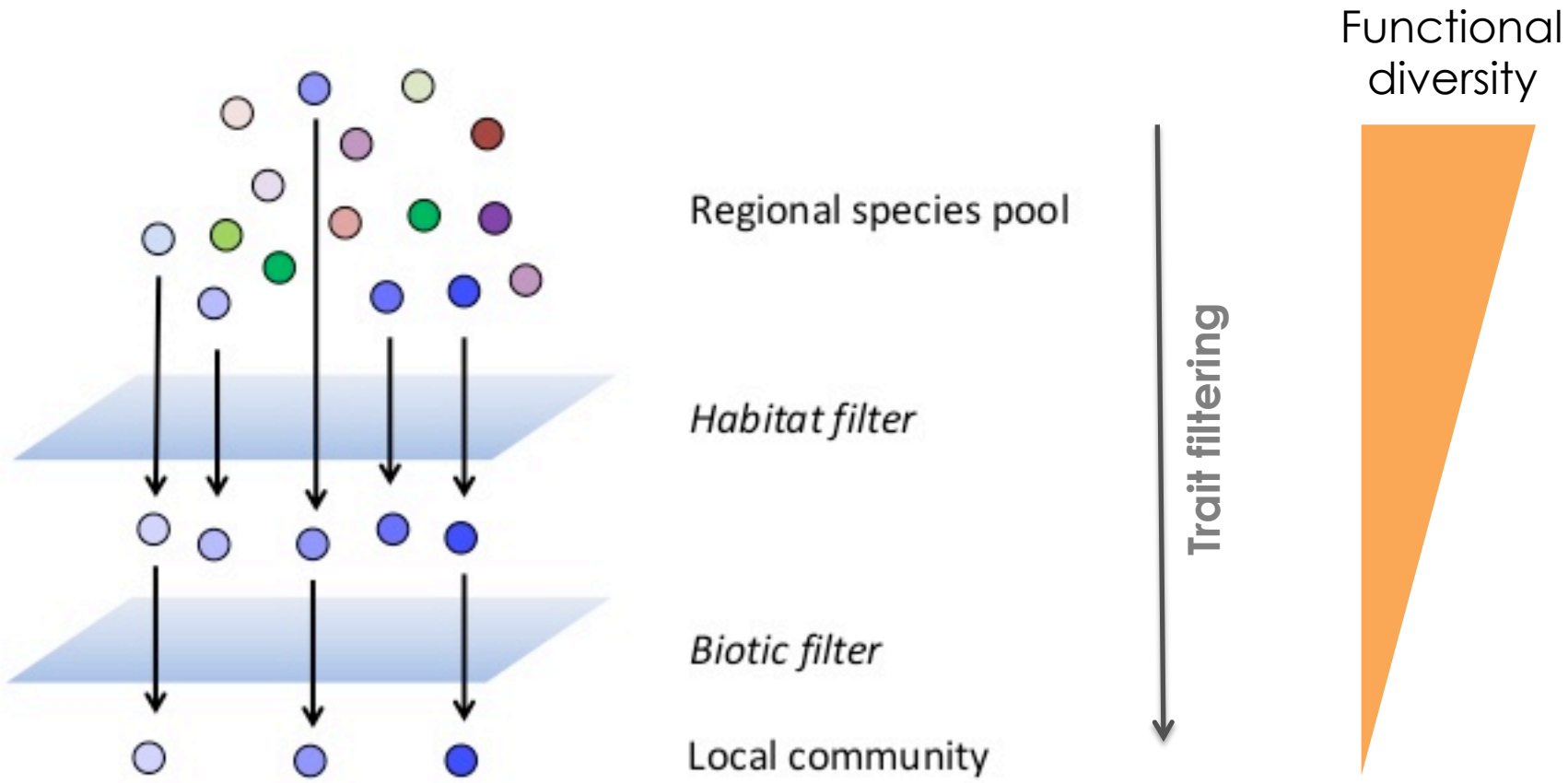
Landuse

Change in functional traits

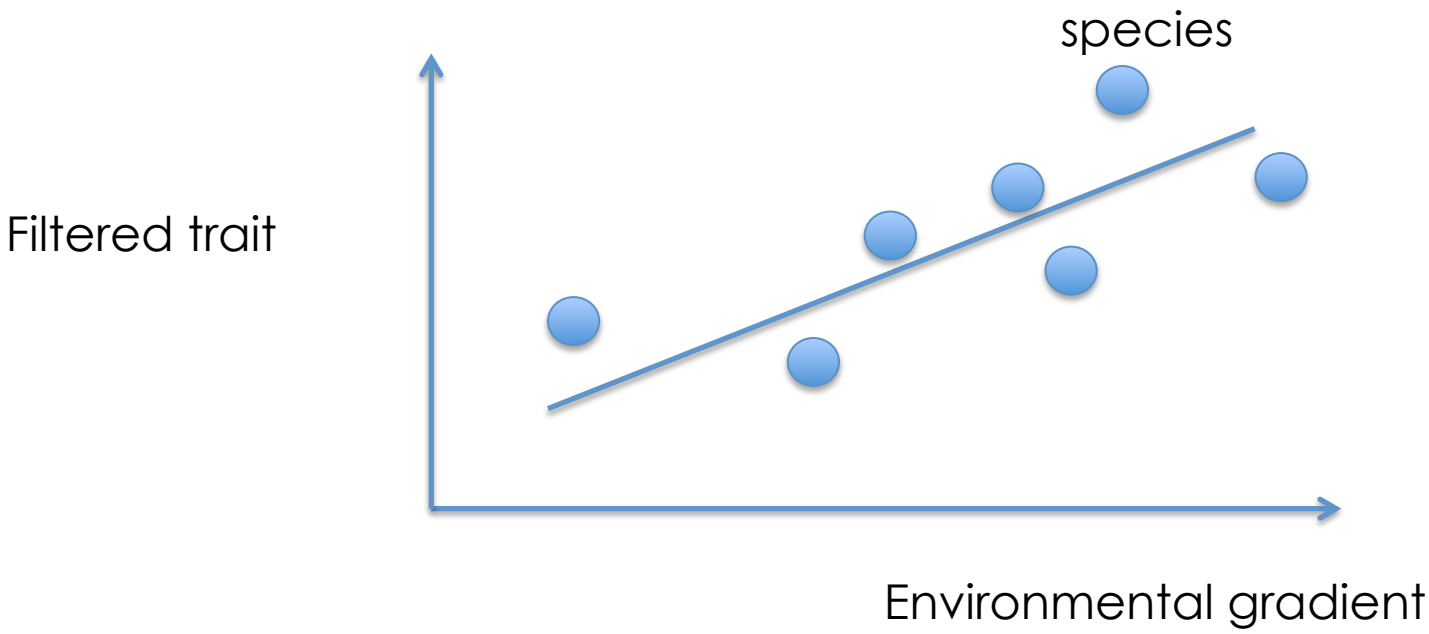
Ecosystem functions

Community assembly

The filter concept

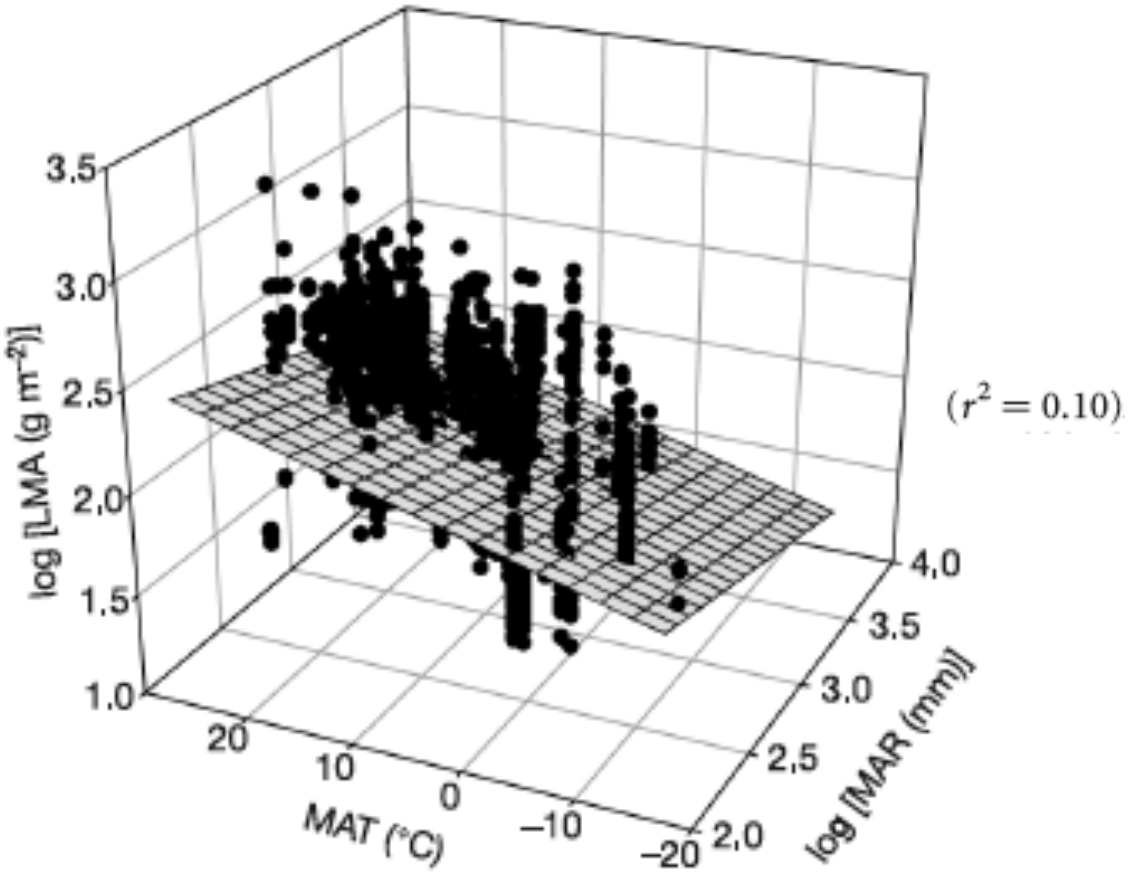


hypothesis



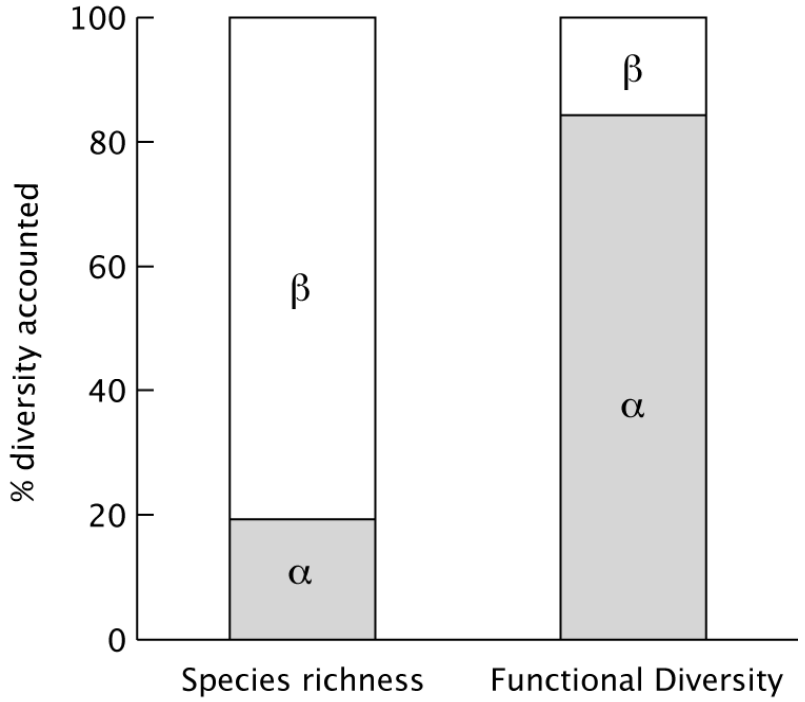
Well….not really!

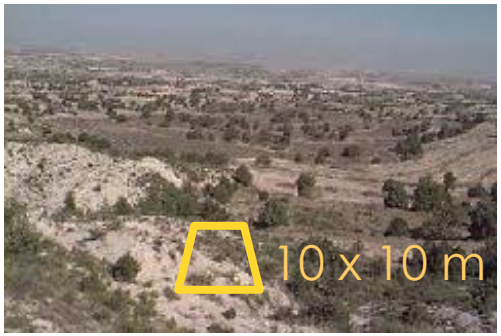
LMA=1/SLA



"much of the total leaf variation occurs among coexisting species"

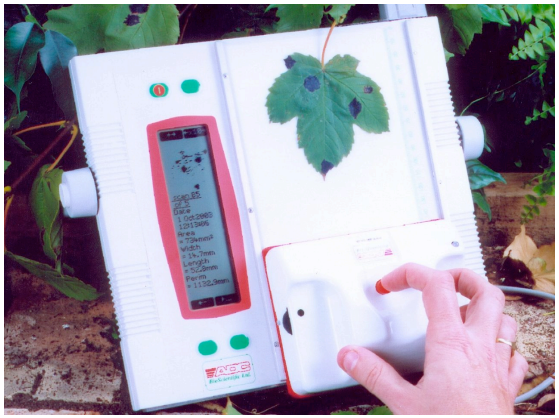
Wright et al. 2004 Nature



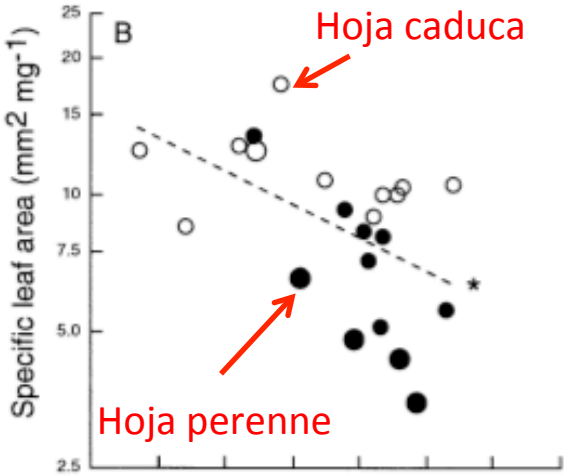


60 plots

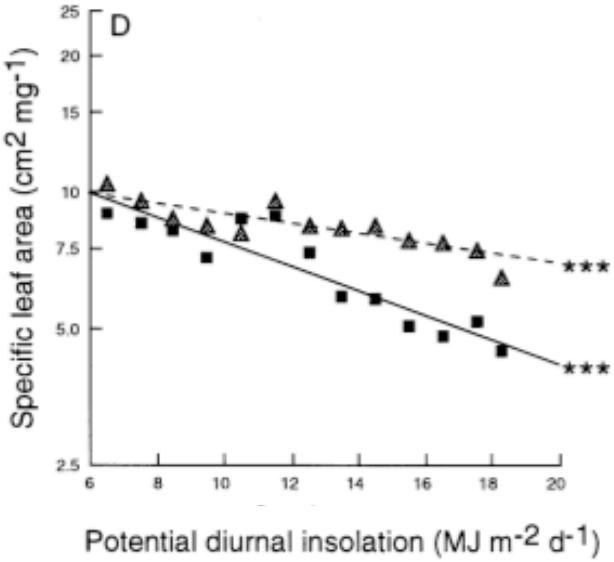
de Bello et al. 2009, 2010 J. Veg. Science



Species levels
(each point is a species)



Community level
(each point is a community)

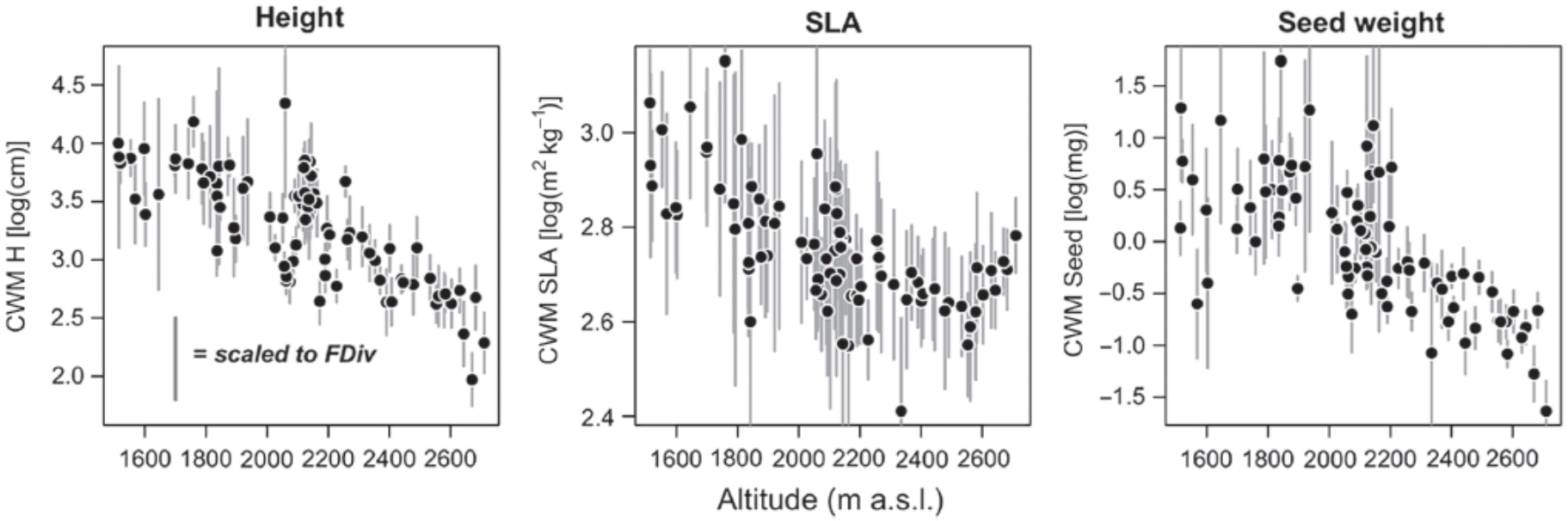


The functional changes along gradients can be shown mostly from the trait of the dominant species

Normal mean

Weighted mean (CWM)

Ackerly et al. 2002 Oecologia



de Bello et al. Ecography 2013

Cooridinated changes in the traits of the dominant species

PLOS ONE

RESEARCH ARTICLE

Functional Trait Changes, Productivity Shifts and Vegetation Stability in Mountain Grasslands during a Short-Term Warming

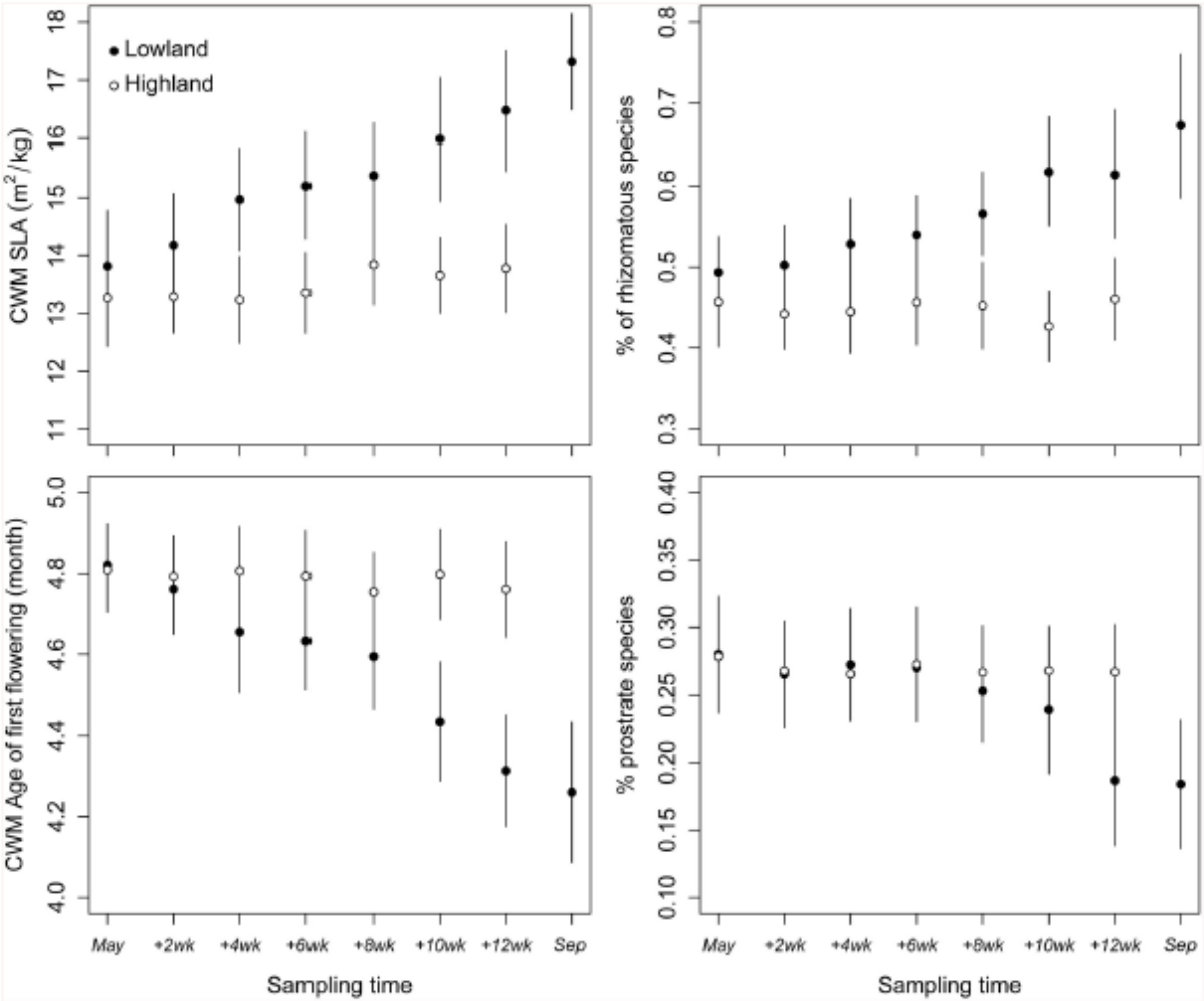
Haifa Debouk[1,2]*, Francesco de Bello[3,4], Maria-Teresa Sebastià[1,2]

PLOS ONE

RESEARCH ARTICLE

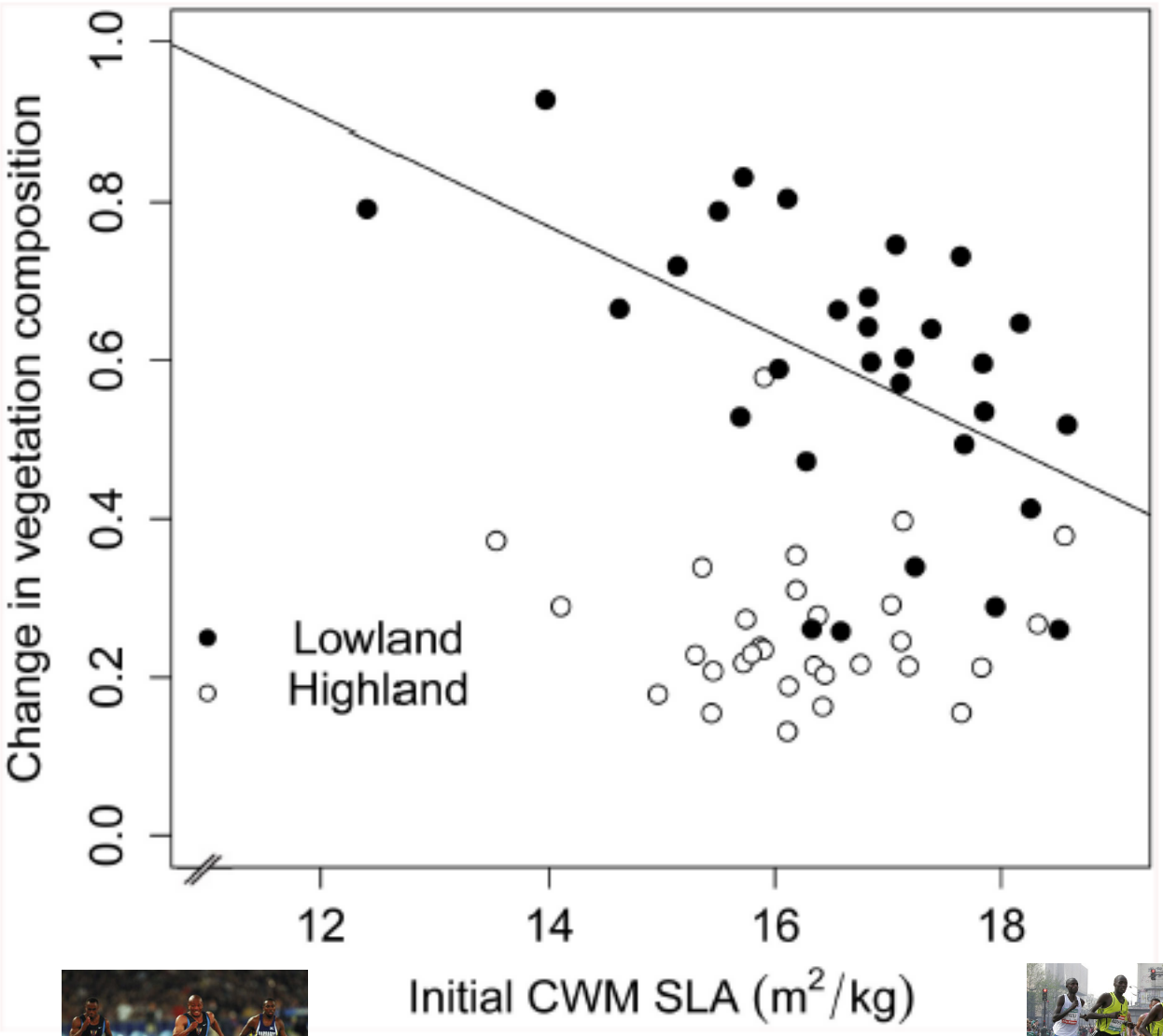
Functional Trait Changes, Productivity Shifts and Vegetation Stability in Mountain Grasslands during a Short-Term Warming

Haifa Debouk[1,2]*, Francesco de Bello[3,4], Maria-Teresa Sebastià[1,2]



Lowland
Highland
CWM SLA (m²/kg)
% of rhizomatous species
CWM Age of first flowering (month)
% prostrate species
May
+2wk
+4wk
+6wk
+8wk
+10wk
+12wk
Sep
Sampling time

Less stable



More stable

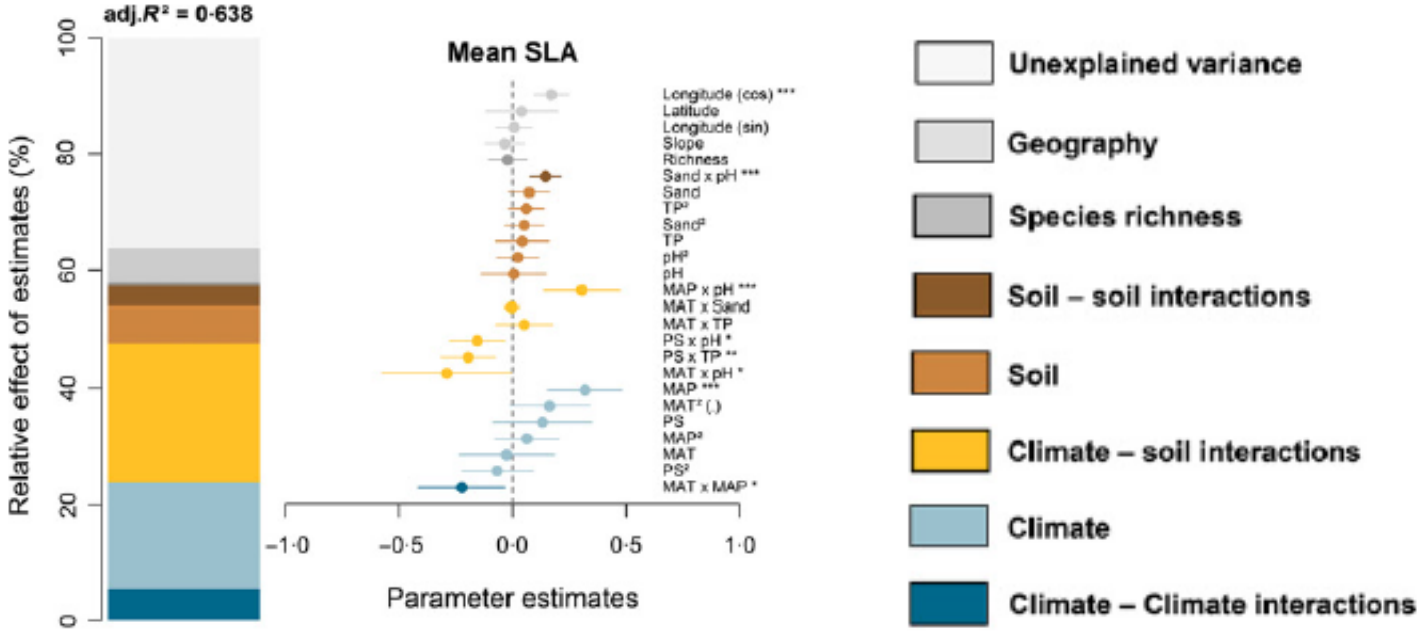
Journal of Ecology

BRITISH ECOLOGICAL SOCIETY

Journal of Ecology doi: 10.1111/1365-2745.12735

Testing the environmental filtering concept in global drylands

Yoann Le Bagousse-Pinguet*[,1,2], Nicolas Gross[2,3,4], Fernando T. Maestre[2], Vincent Maire[5], Francesco de Bello[1,6], Carlos Roberto Fonseca[7], Jens Kattge[8,9], Enrique Valencia[1,2], Jan Leps[1,10] and Pierre Liancourt[6]



Development of indices

Development of indices

Climate

Landuse

Change in functional traits

Ecosystem functions

Journal of Applied Ecology 2005
42, 824–833

Predictive value of plant traits to grazing along a climatic gradient in the Mediterranean

FRANCESCO DE BELLO,* JAN LEPŠ† and MARIA-TERESA SEBASTIÀ*‡

Predictions change depending on the climatic region

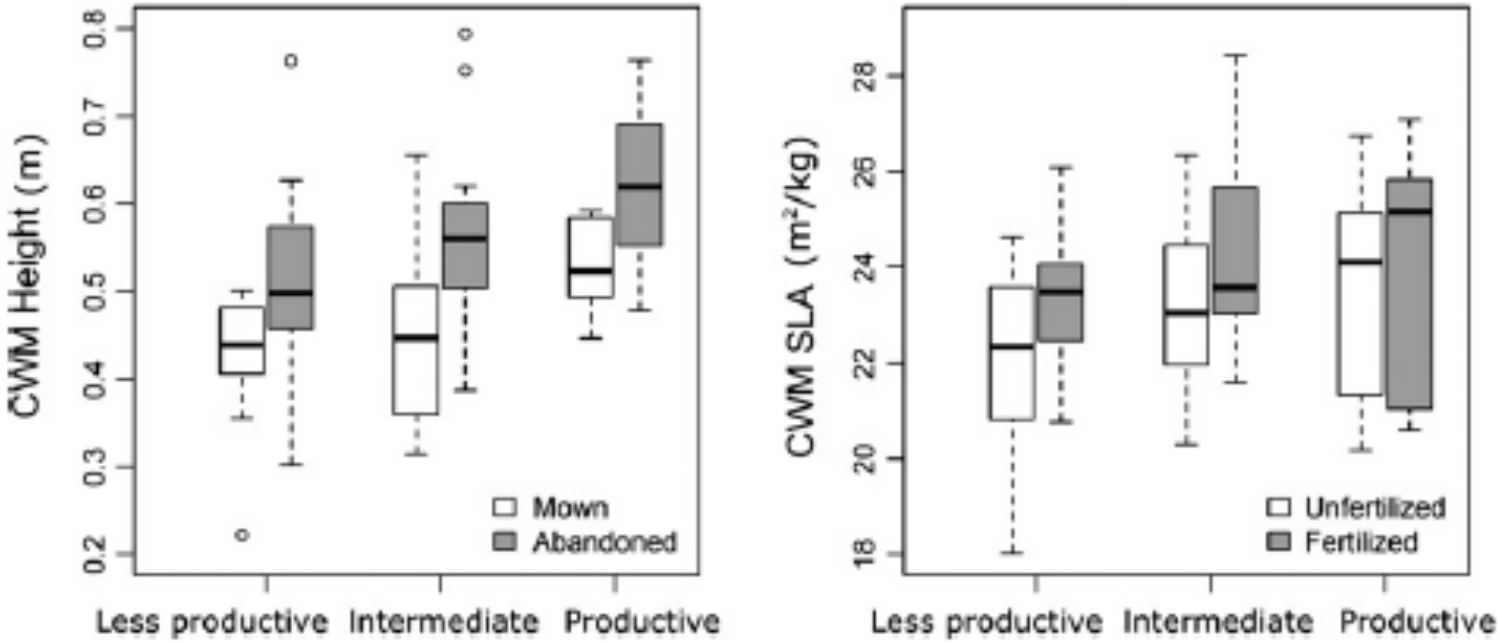
Applied Vegetation Science **19** (2016) 196–205

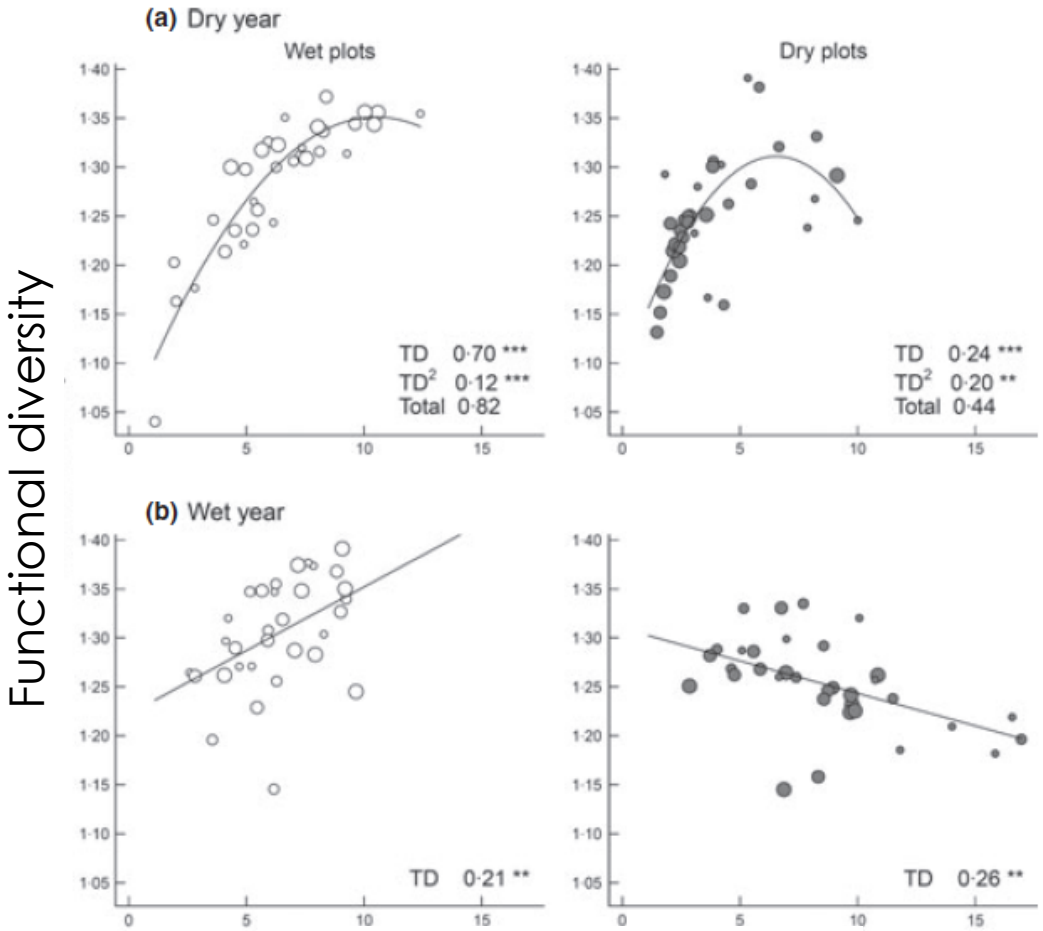
Consistent functional response of meadow species and communities to land-use changes across productivity and soil moisture gradients

x21 sites

Maria Májeková, Štěpán Janeček, Ondřej Mudrák, Jan Horník, Petra Janečková, Michael Bartoš, Karel Fajmon, Šárka Jiráská, Lars Götzenberger, Petr Šmilauer, Jan Lepš & Francesco de Bello

But within a region the predictions are more consistent





Taxonomical and functional diversity are often not related

Journal of Applied Ecology

British Ecological Society

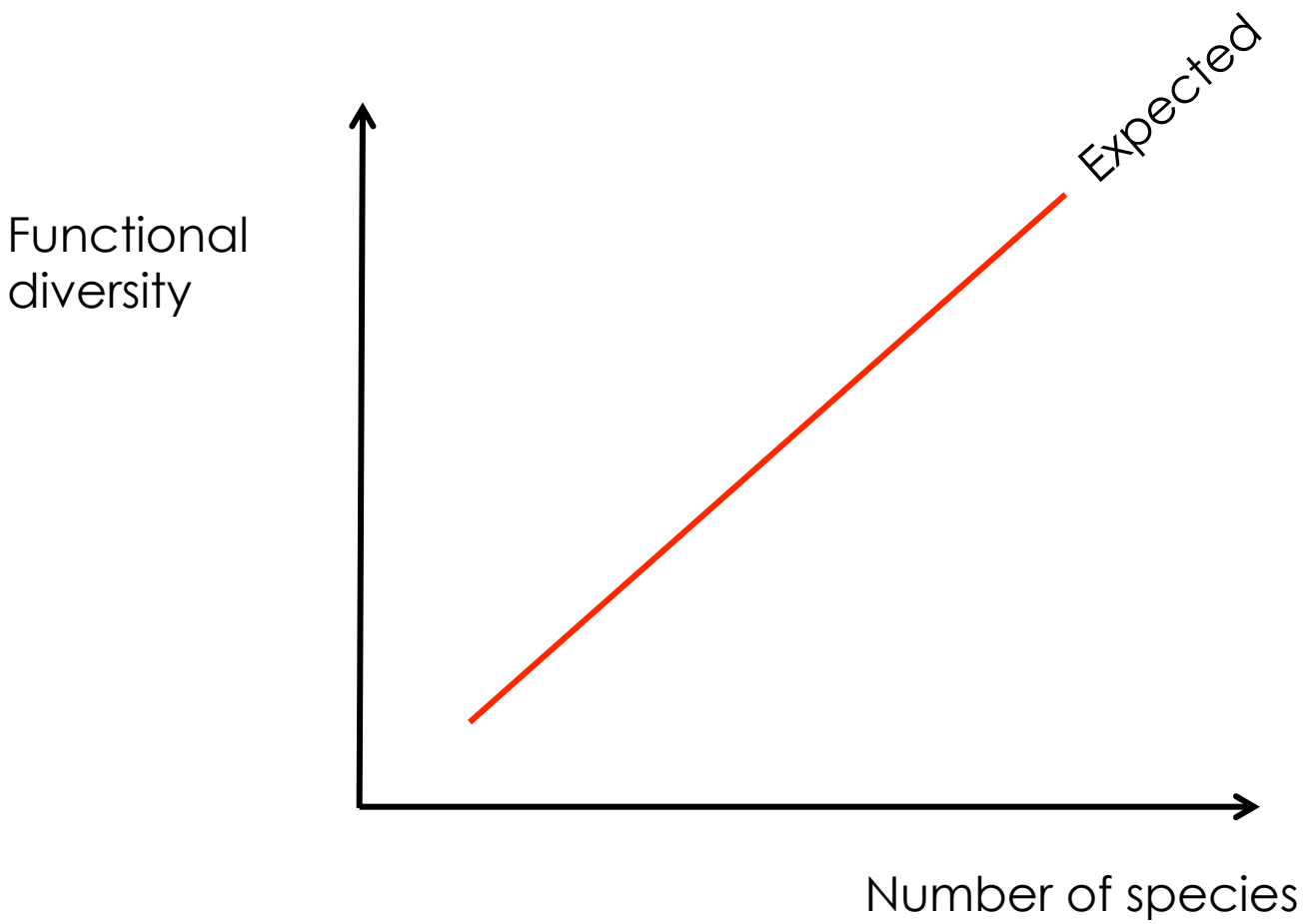
Journal of Applied Ecology 2012, **49**, 1084–1093

doi: 10.1111/j.1365-2664.2012.02193.x

Taxonomical and functional diversity turnover in Mediterranean grasslands: interactions between grazing, habitat type and rainfall

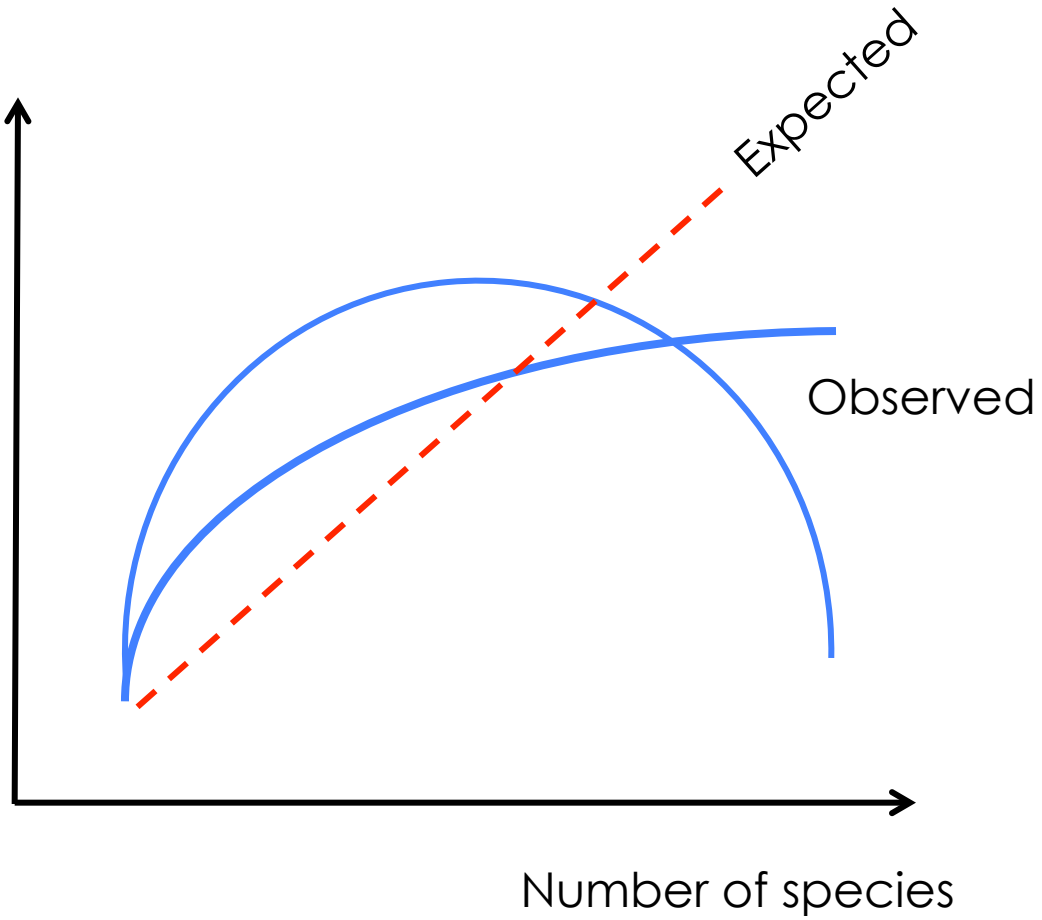
Carlos P. Carmona[1]*, Francisco M. Azcárate[1], Francesco de Bello[2,3], Helios S. Ollero[4], Jan Lepš[3] and Begoña Peco[1]

Hypothesis:
> species, > diversity of trats, > functioning of the ecosystems



Results
The functional and taxonomical diversity vary often differently

de Bello et al. 2006 Ecography, 2010 J. Veg. Science, 2012 Ecology……




The biodiversity revolution

Ecologists are increasingly looking at traits — rather than species — to measure the health of ecosystems.

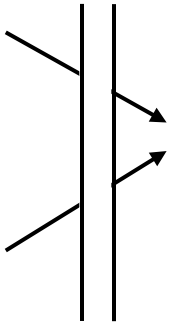
BY RACHEL CERNANSKY

"…the health of an ecosystem may depend not only on the number of species but also on the diversity of traits…."

Filtros bioticos

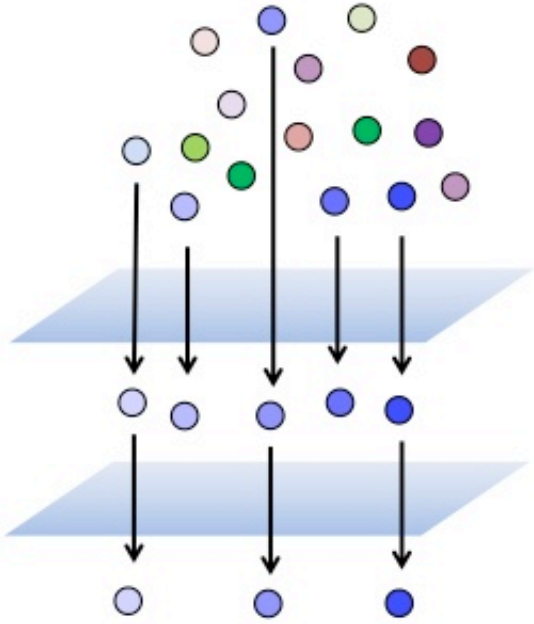
Climate

Landuse



Change in functional traits

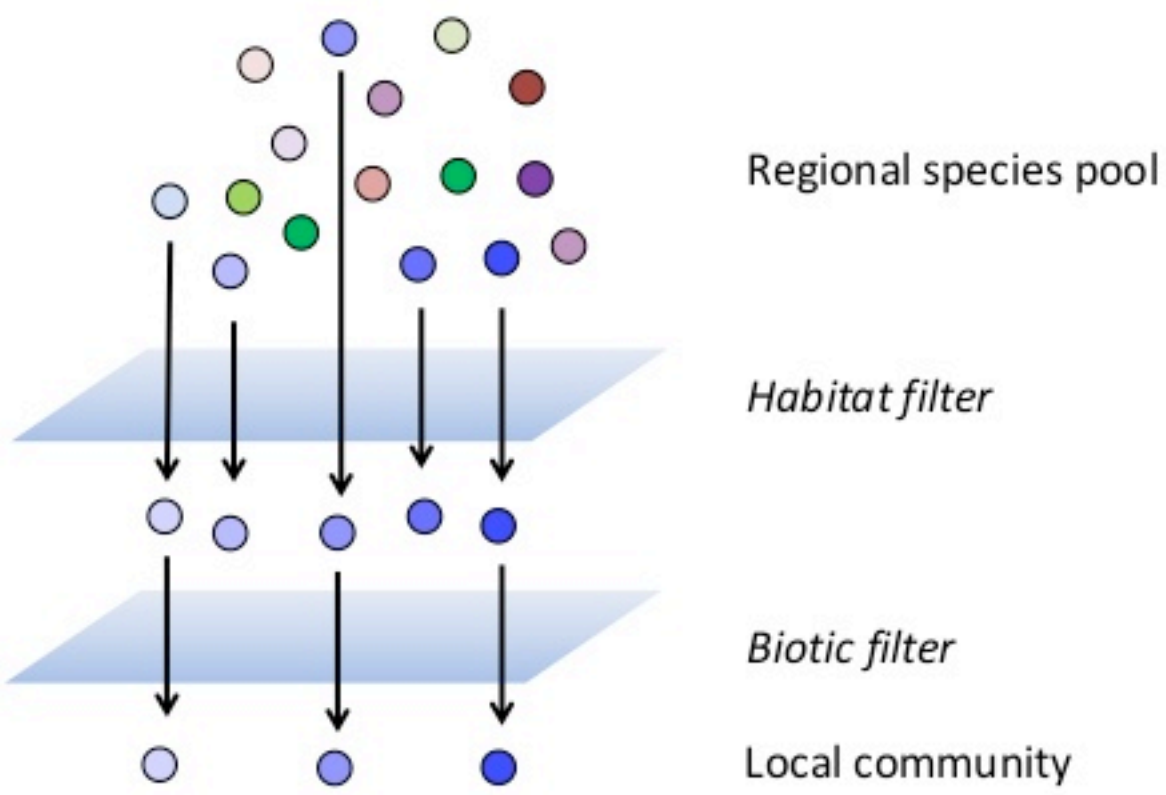
Ecosystem functions



By Jitka Klimešova

Community assembly

The filter concept

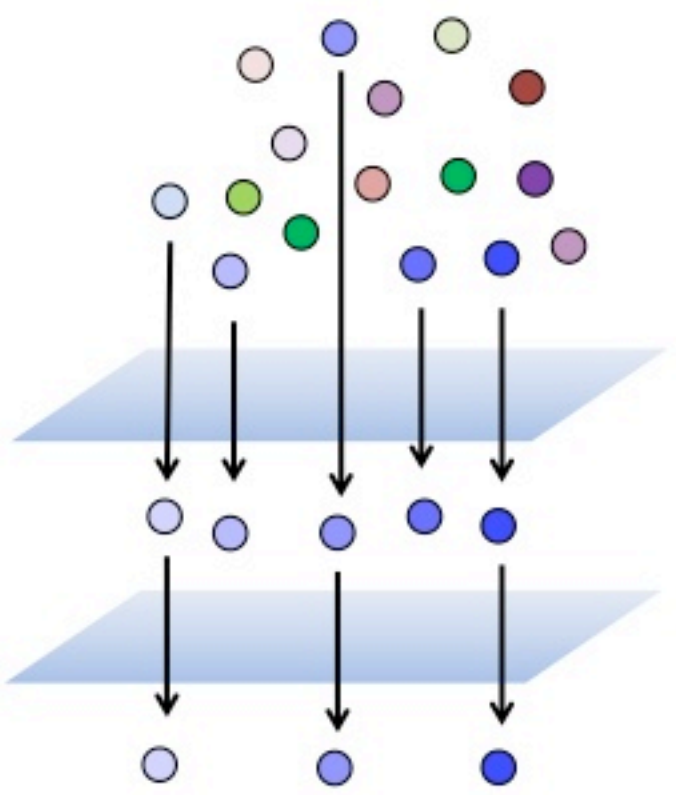


Trait filtering

Functional diversity

Community assembly

The filter concept



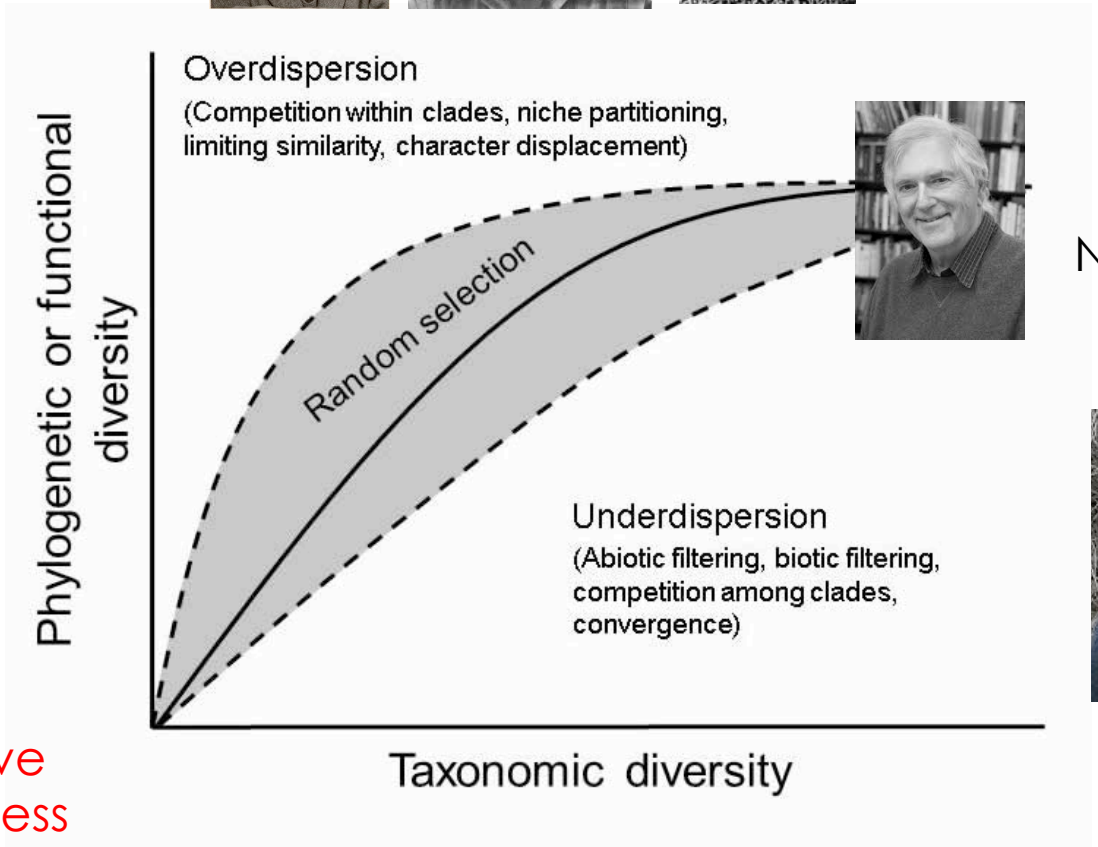
Trait filtering

Functional diversity

Community assembly

The filter concept

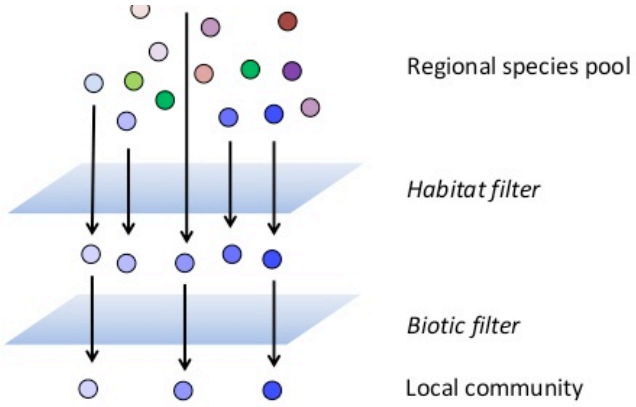




S. Hubbel
Neutral theory**

**species have the same fitness

Community assembly
analysis



Problems with the analyses using random expectations

Global Ecology and Biogeography, (Global Ecol. Biogeogr.) (2012) **21**, 312–317

ECOLOGICAL SOUNDING

The quest for trait convergence and divergence in community assembly: are null-models the magic wand?

Francesco de Bello*

Community assembly
analysis

BIOLOGICAL REVIEWS
Cambridge Philosophical Society
Biol. Rev. (2012), **87**, pp. 111–127.
doi: 10.1111/j.1469-185X.2011.00187.x

Ecological assembly rules in plant communities—approaches, patterns and prospects

Lars Götzenberger[1,*], Francesco de Bello[2], Kari Anne Bråthen[3], John Davison[1], Anne Dubuis[4], Antoine Guisan[4,5], Jan Lepš[6,7], Regina Lindborg[8,9], Mari Moora[1], Meelis Pärtel[1], Loic Pellissier[4], Julien Pottier[4], Pascal Vittoz[4], Kristjan Zobel[1] and Martin Zobel[1]

Ecology, 93(10), 2012, pp. 2263–2273

Functional species pool framework to test for biotic effects on community assembly

Francesco de Bello,[1,2,3,6] Jodi N. Price,[4] Tamara Münkemüller,[2] Jaan Liira,[4] Martin Zobel,[4] Wilfried Thuiller,[2] Pille Gerhold,[4,5] Lars Götzenberger,[4] Sébastien Lavergne,[2] Jan Lepš,[3] Kristjan Zobel,[4] and Meelis Pärtel[4]

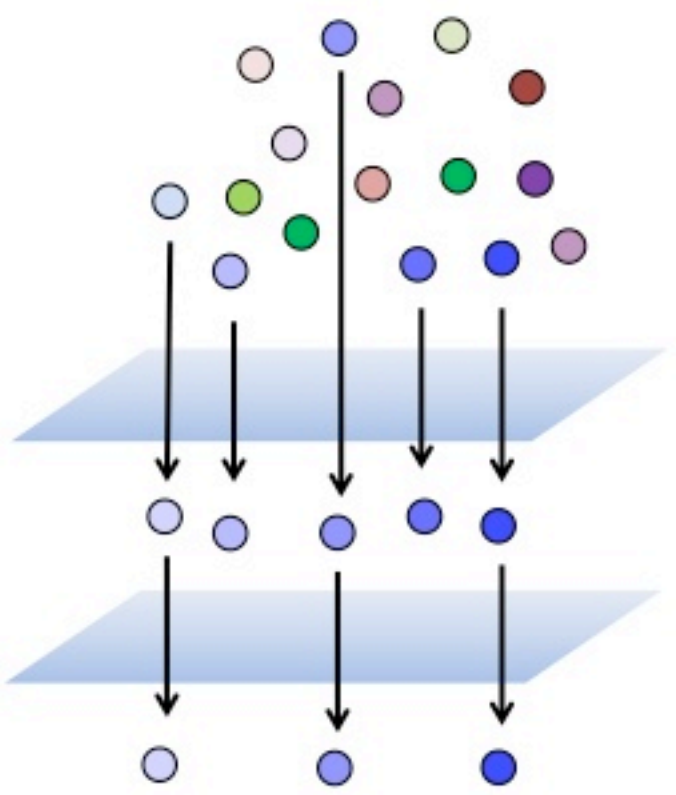
Problems with the analyses
solutions

Journal of Vegetation Science **27** (2016) 1275–1287

Which randomizations detect convergence and divergence in trait-based community assembly? A test of commonly used null models

Lars Götzenberger, Zoltán Botta-Dukát, Jan Lepš, Meelis Pärtel, Martin Zobel & Francesco de Bello

Community assembly
analysis



Trait filtering

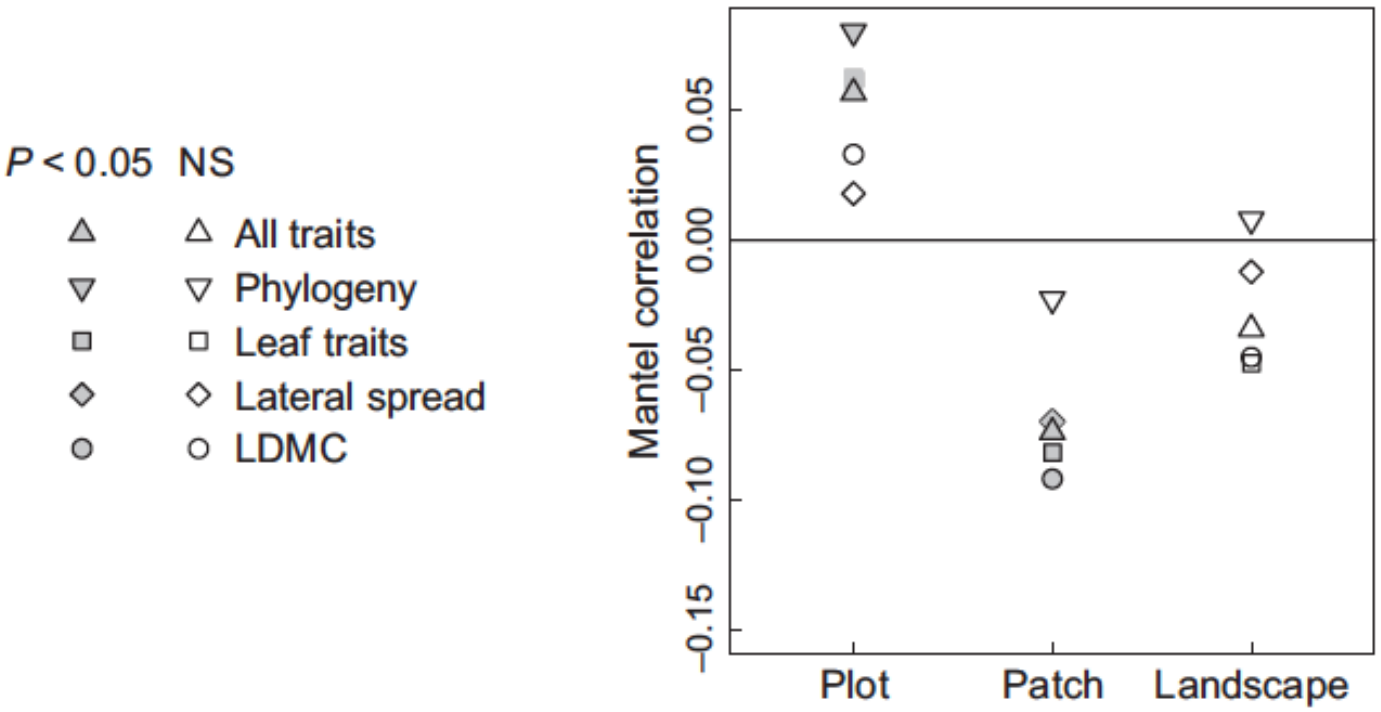
Functional diversity

100 YEARS Journal of Ecology
British Ecological Society
Journal of Ecology 2013, **101**, 1237–1244
doi: 10.1111/1365-2745.12139

Evidence for scale- and disturbance-dependent trait assembly patterns in dry semi-natural grasslands

Francesco de Bello[1,2]*§, Marie Vandewalle[3]§, Triin Reitalu[4]§, Jan Lepš[2], Honor C. Prentice[5], Sandra Lavorel[6] and Martin T. Sykes[3]

A matter of scales



Divergence

Convergence

Community assembly
analysis

100 YEARS Journal of Ecology

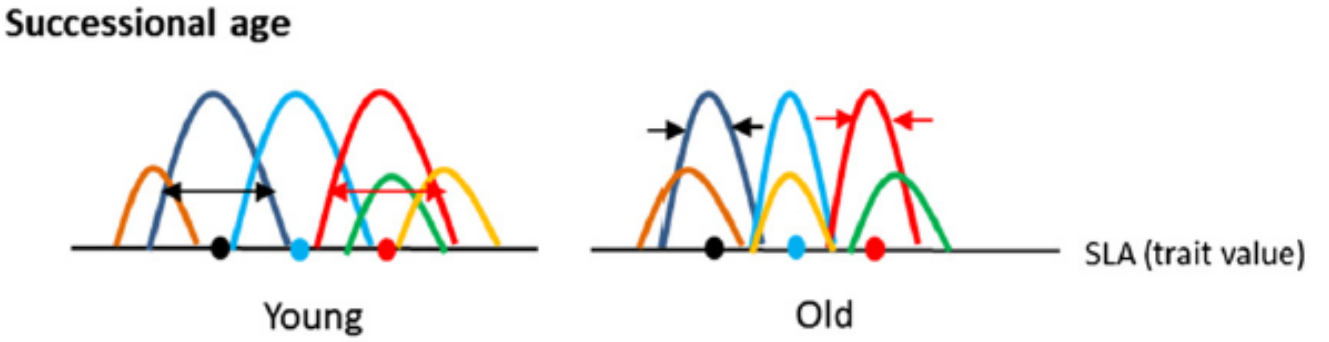
British Ecological Society

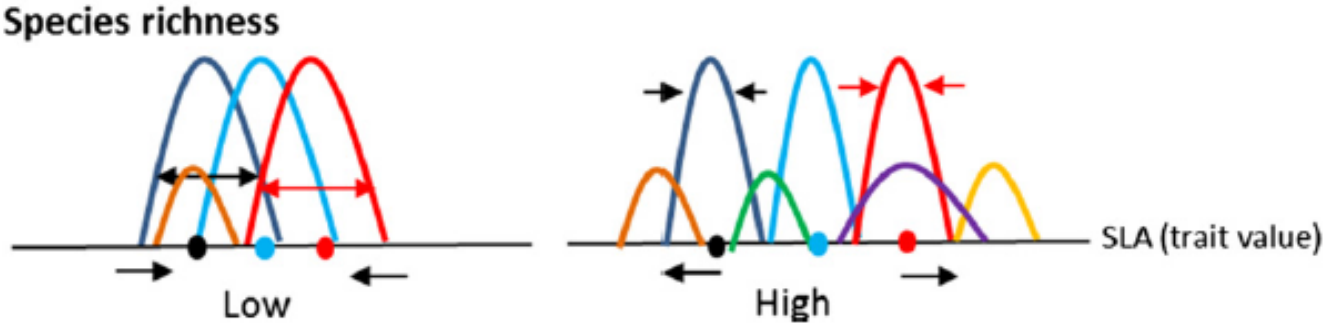
Journal of Ecology doi: 10.1111/1365-2745.12458

Linkage of plant trait space to successional age and species richness in boreal forest understorey vegetation

Bright B. Kumordzi[1]*, Francesco de Bello[2,3], Grégoire T. Freschet[4], Yoann Le Bagousse-Pinguet[2], Jan Lepš[2] and David A. Wardle[1]

Considering Intra-specific data





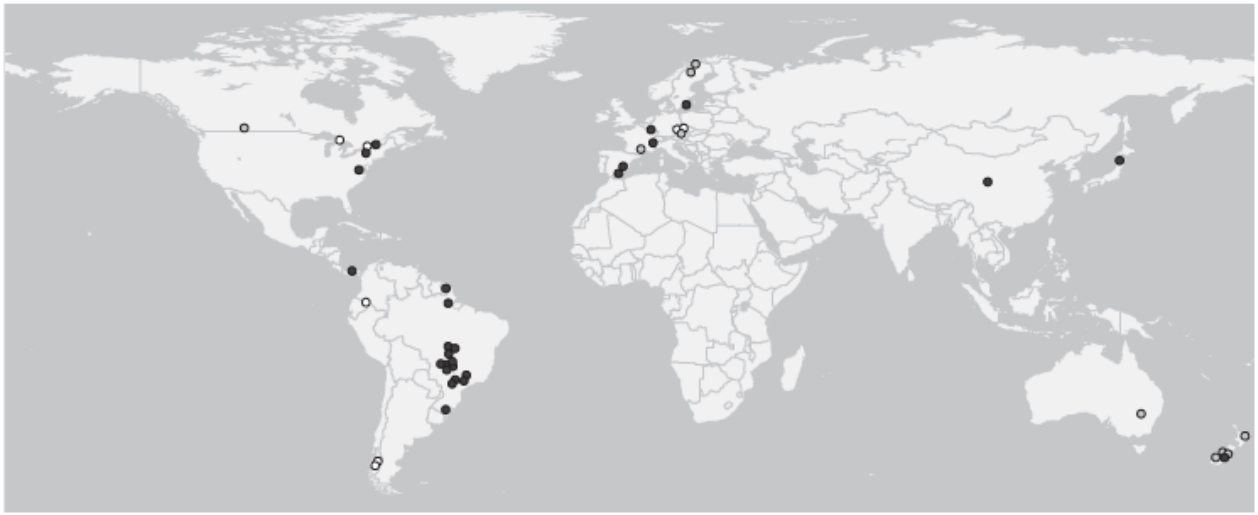
Community assembly
analysis

ECOLOGY LETTERS

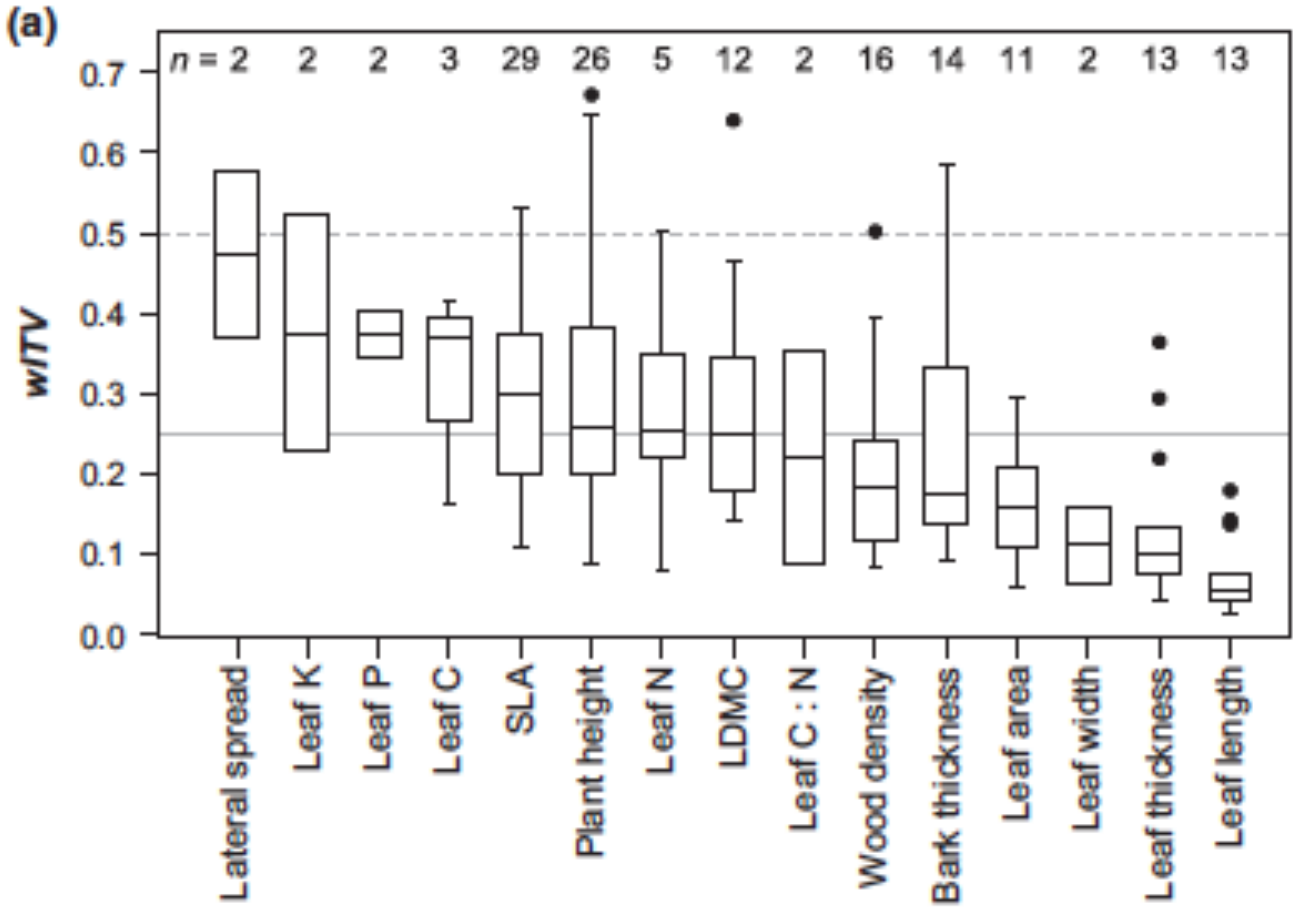
Ecology Letters, (2015) doi: 10.1111/ele.12508

REVIEW AND SYNTHESIS

A global meta-analysis of the relative extent of intraspecific trait variation in plant communities



Many traits are really variable within species (50% of trait variability is within species compared to between species)



ECOLOGY LETTERS
Ecology Letters, (2015) doi: 10.1111/ele.12508

REVIEW AND SYNTHESIS

A global meta-analysis of the relative extent of intraspecific trait variation in plant communities

Climate

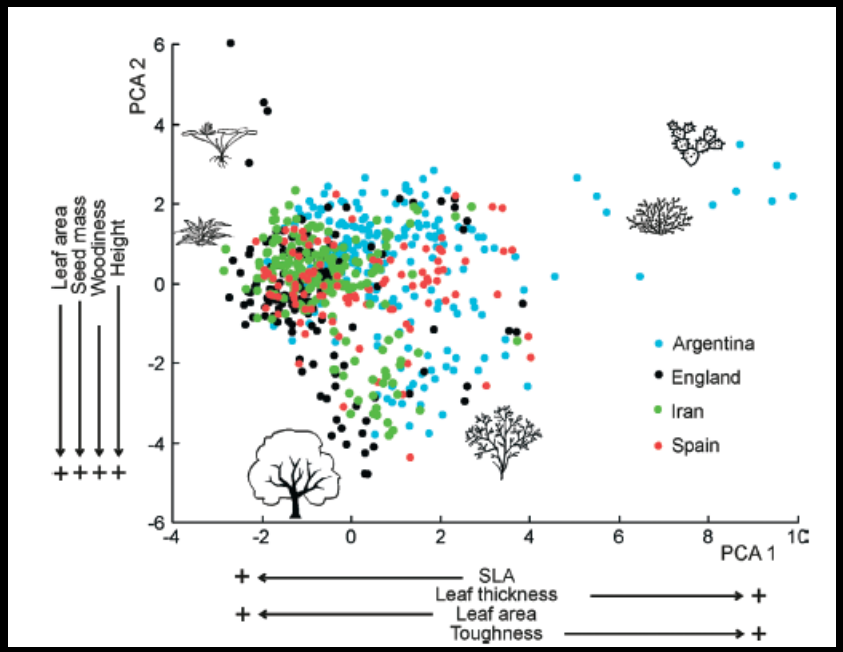
Landuse

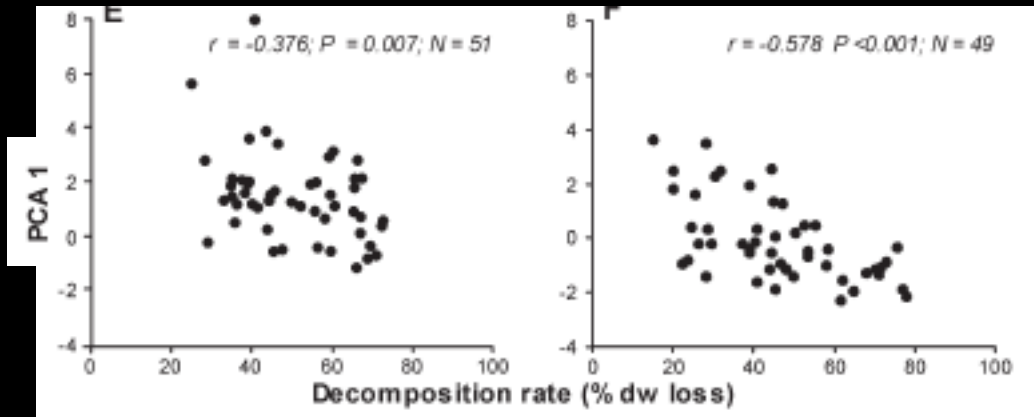
Change in functional traits → **Ecosystem functions**

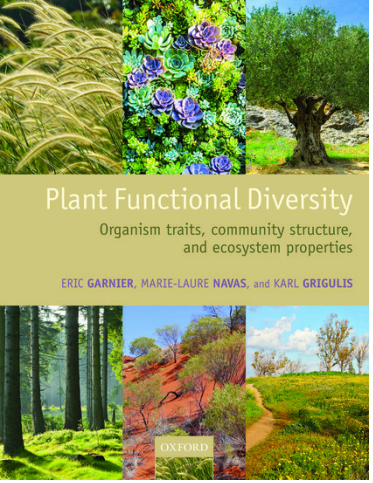
Journal of Vegetation Science 15: 295-304, 2004

The plant traits that drive ecosystems: Evidence from three continents

Díaz, S.[1*]; Hodgson, J.G.[2†]; Thompson, K.[2]; Cabido, M.[1]; Cornelissen, J.H.C.[3]; Jalili, A.[4]; Montserrat-Martí, G.[5]; Grime, J.P.[2]; Zarrinkamar, F.[4]; Asri, Y.[4]; Band, S.R.[2]; Basconcelo,







Garnier et al. 2016 Oxford press

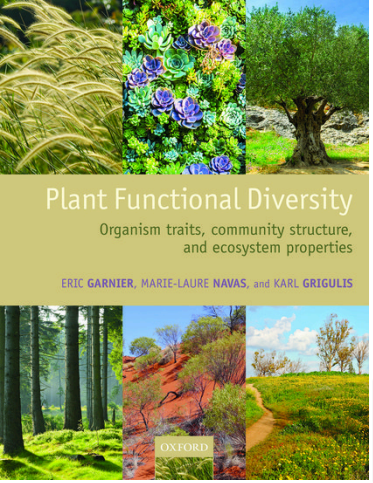
Syndromes of traits generate cascade of multiple combined effects on ecosystem functionality

Biodivers Conserv (2010) 19:2873–2893
DOI 10.1007/s10531-010-9850-9

ORIGINAL PAPER

Towards an assessment of multiple ecosystem processes and services via functional traits

Francesco de Bello · Sandra Lavorel · Sandra Díaz · Richard Harrington · Johannes H. C. Cornelissen · Richard D. Bardgett · Matty P. Berg · Pablo Cipriotti · Christian K. Feld · Daniel Hering · Pedro Martins da Silva · Simon G. Potts · Leonard Sandin · Jose Paulo Sousa · Jonathan Storkey · David A. Wardle · Paula A. Harrison



Garnier et al. 2016 Oxford press

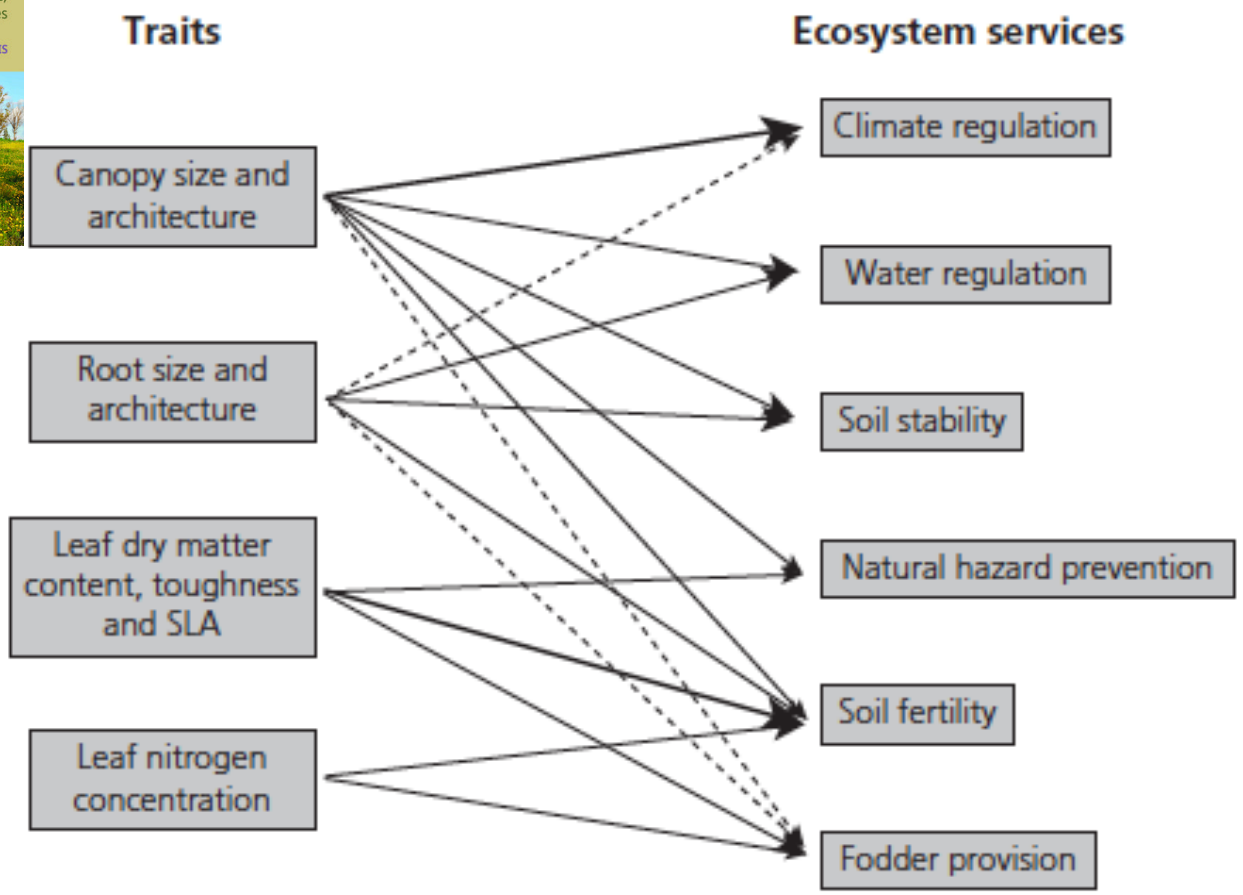
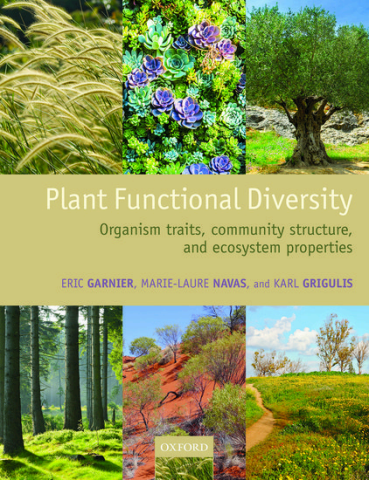


Figure 7.3 Plant traits shown to be significantly involved in the realization of a number of ecosystem services. The thickness of the arrows reflects the significance of the relationships. Taken from de Bello et al. (2010). Reproduced with permission from Springer.

Garnier et al. 2016 Oxford press



Mass ratio hypothesis

Non-additive effects

Factors affecting ecosystem properties:
ex: alpine meadows

Abiotic factors
ex: topography, soil

Community weighted means of traits
ex: CWM_LDMC, LNC

Trait value variability
(e.g. divergence)
ex: Rao_LDMC, LNC

Idiosyncratic species effects
ex: Festuca sp

Finding the best predictive model
ex: forage quantity

- Combination of abiotic and/or diversity factors
- Characterization of relationships between services and factors selected

Figure 7.5 Diagram showing the selection of factors, and in particular of traits, acting on the provision of ecosystem services. The diagram shows the example of the provision of forage by mountain grasslands. The two principal components of the community functional structure are CWM (the community weighted mean) and the functional divergence estimated by the Rao index. LDMC: leaf dry matter content, LNC: leaf nitrogen concentration. After Díaz et al. (2007).

100 YEARS Journal of Ecology

Journal of Ecology 2013, **101**, 29–37 doi: 10.1111/1365-2745.12024

SPECIAL FEATURE

PLANT FUNCTIONAL EFFECTS ON ECOSYSTEM SERVICES

An experimental framework to identify community functional components driving ecosystem processes and services delivery

André T. C. Dias[1]*, Matty P. Berg[1], Francesco de Bello[2], Arend Raoul Van Oosten[1], Karolína Bílá[3,4] and Marco Moretti[3]

Journal of Ecology

Journal of Ecology 2016, **104**, 1400–1409 doi: 10.1111/1365-2745.1260

Exotic or not, leaf trait dissimilarity modulates the effect of dominant species on mixed litter decomposition

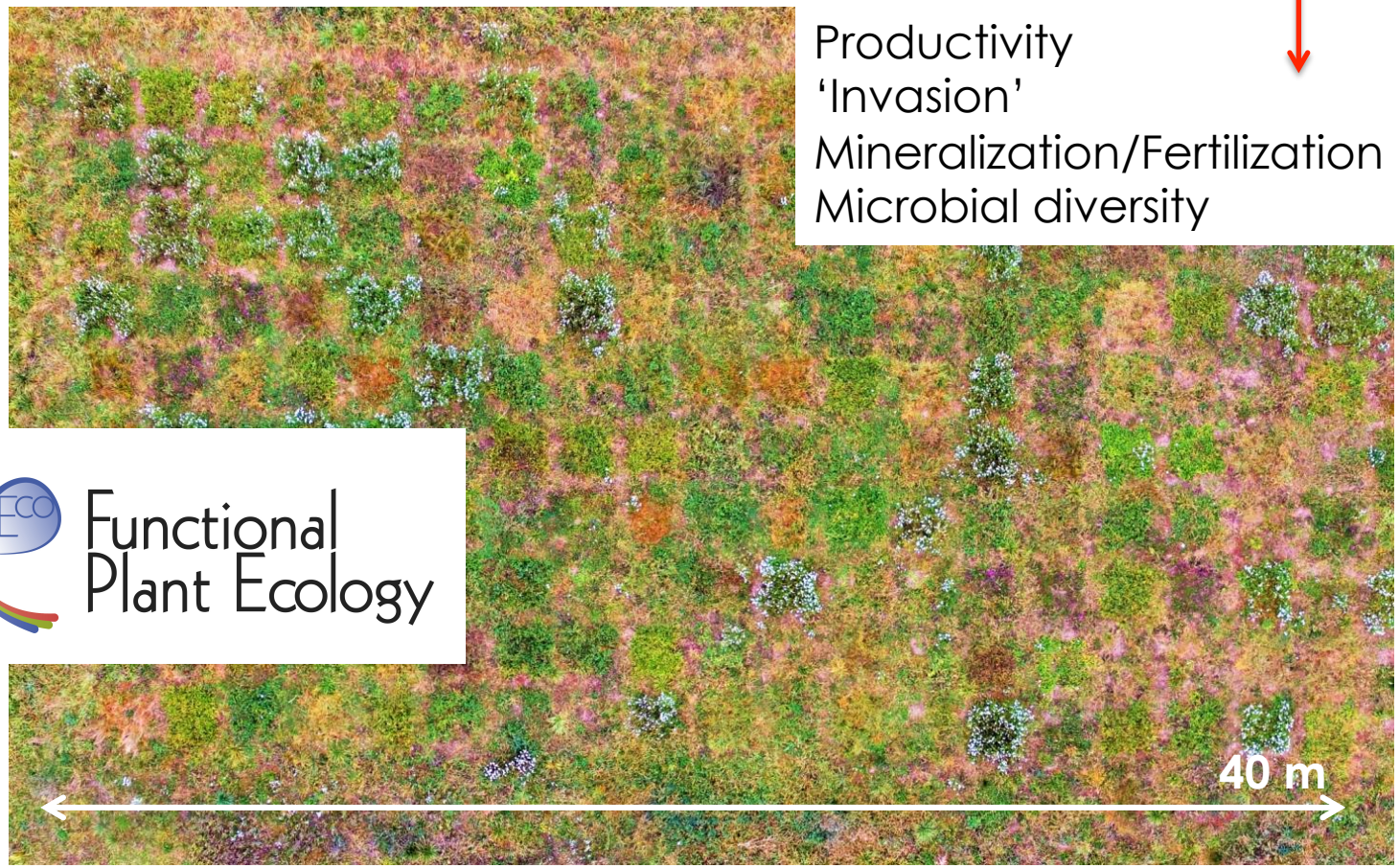
Genevieve E. Finerty[1,2]*, Francesco de Bello[1,2], Karolína Bílá[3,4], Matty P. Berg[5,6], André T.C. Dias[5,7], Gianni B. Pezzatti[4] and Marco Moretti[8]

Experiments to disociate potential effects of biodiversity on ecosystem functions

19 species

200 communities with different levels of trait ‘composition’

Productivity
‘Invasion’
Mineralization/Fertilization
Microbial diversity



Functional Plant Ecology

Ecology of differences

Research lines

Plant strategies:
Historic introduction

Present state

Future developments

Ecology of differences

Oecologia (2016) 180:923–931
DOI 10.1007/s00442-016-3549-x

CrossMark

SPECIAL TOPIC ON FUNCTIONAL TRAITS

Reinforcing loose foundation stones in trait-based plant ecology

Bill Shipley[1] · Francesco De Bello[2,3] · J. Hans C. Cornelissen[4] · Etienne Laliberté[5] · Daniel C. Laughlin[6] · Peter B. Reich[7,8]

Intraspecific trait variability

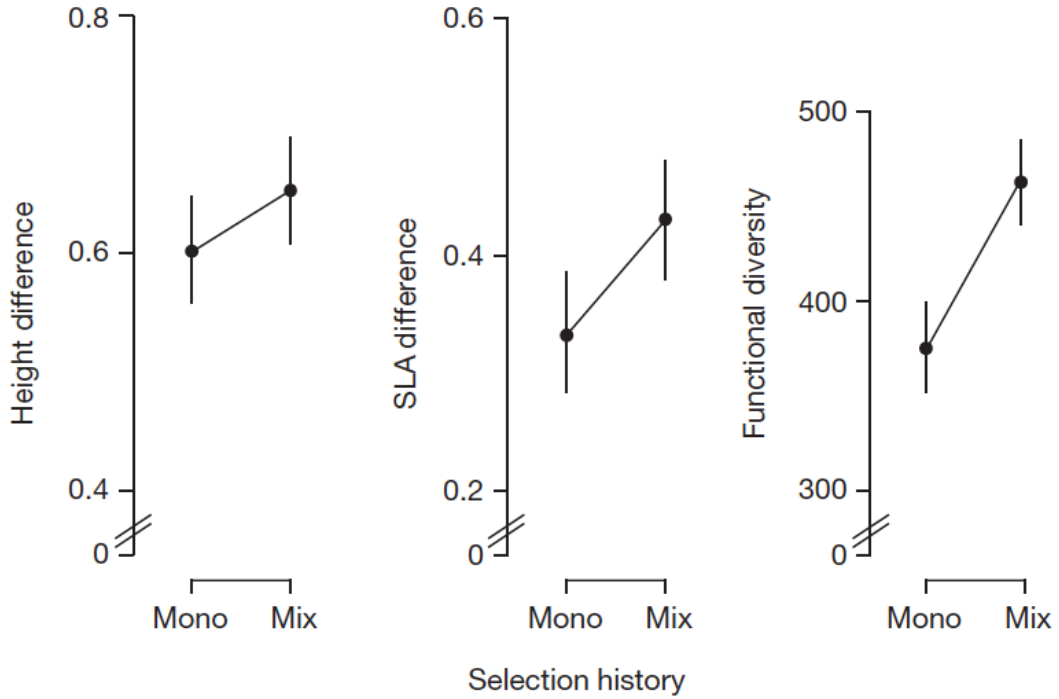
Seleccion vs. plasticity

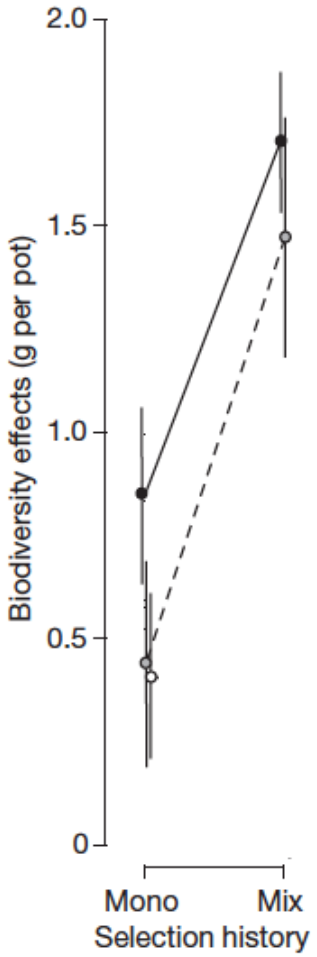
LETTER

doi:10.1038/nature13869

Selection for niche differentiation in plant communities increases biodiversity effects

Debra Zuppinger-Dingley[1], Bernhard Schmid[1], Jana S. Petermann[2,3], Varuna Yadav[1], Gerlinde B. De Deyn[4] & Dan F. B. Flynn[1,5]



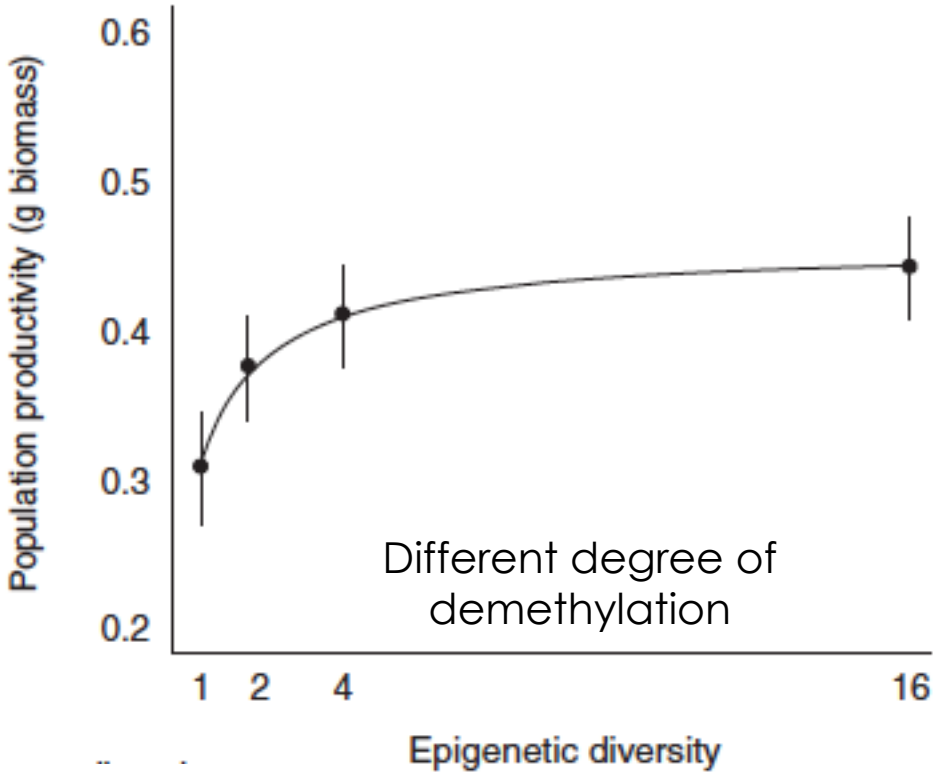


1

Intraspecific trait variability

epigenetic diversity

Latzel et al. 2013
Nature Communication



1

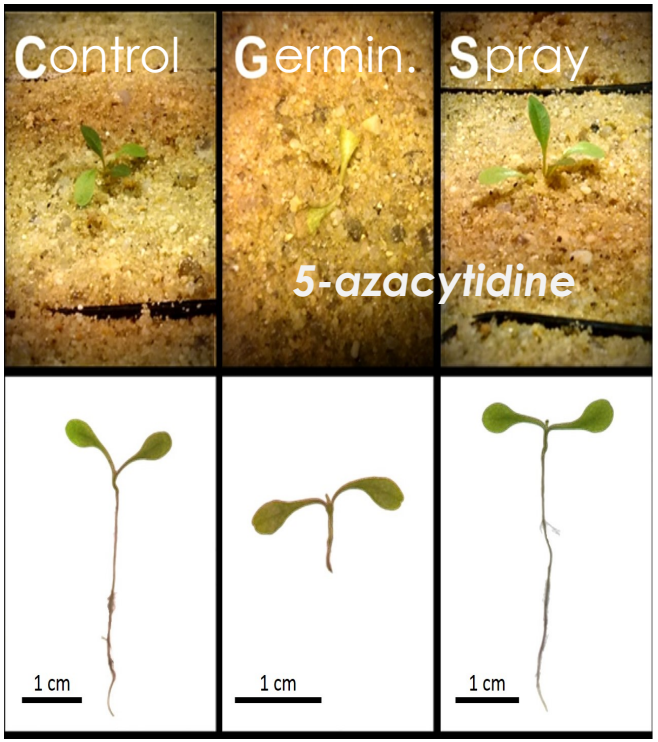
Intraspecific trait variability

epigenetic diversity

Latzel et al. 2013
Nature Communication

+

Demethylation



Puy et al. MEE in press

1

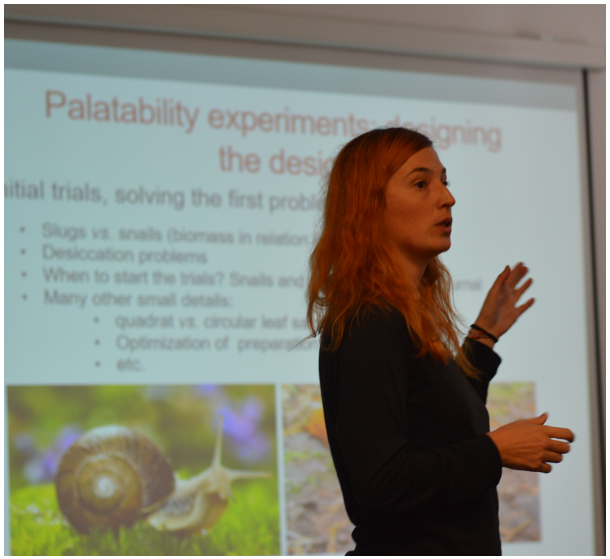
Intraspecific trait variability

Genetic diversity

Diversity of parental effects

1

Intraspecific trait variability



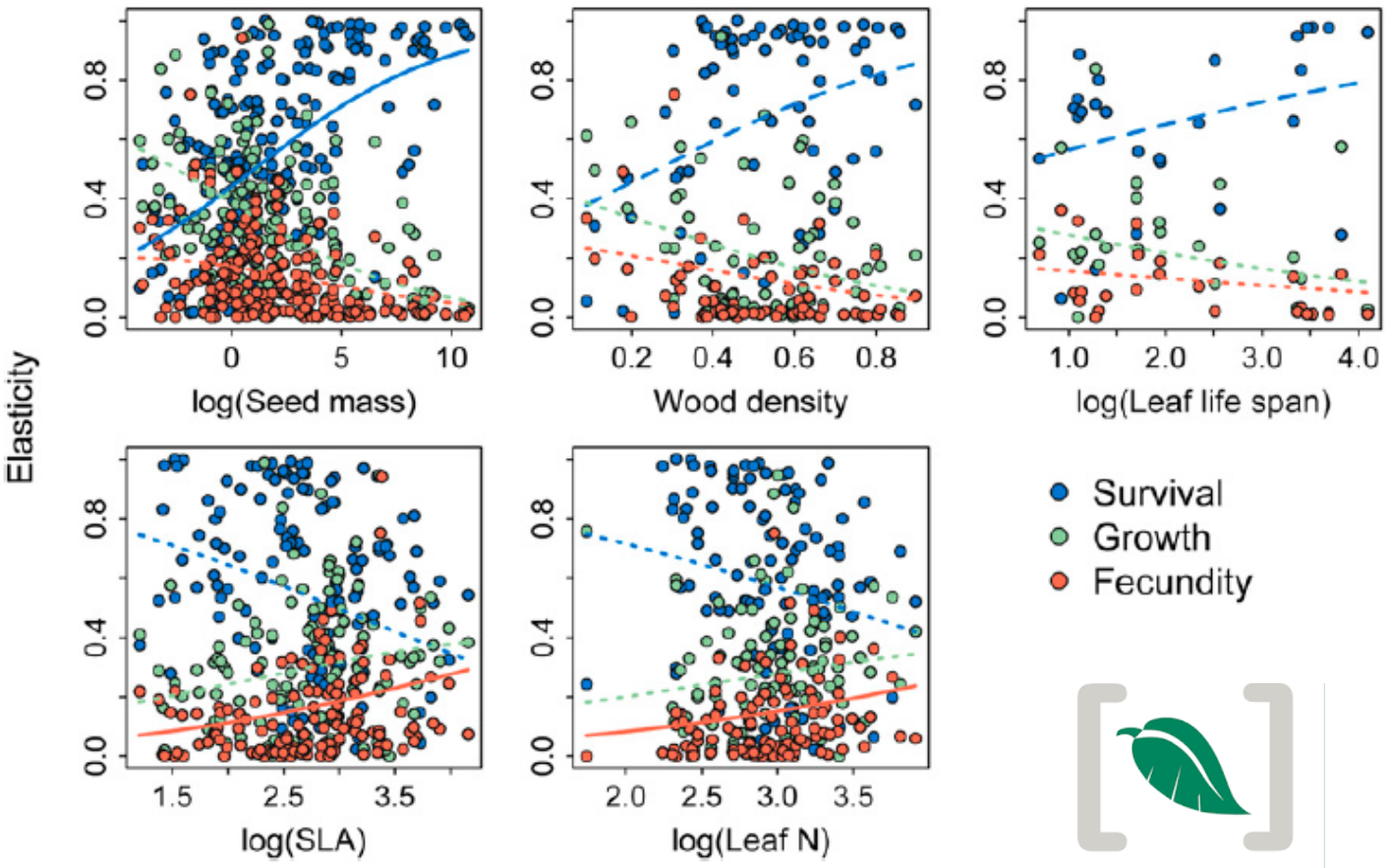
+

Herbivory

Decomposition

2

Relationship trait-fitness



COMPADRE
Plant Matrix Database

+

TRY
Plant Trait Database

PNAS

Functional traits explain variation in plant life history strategies

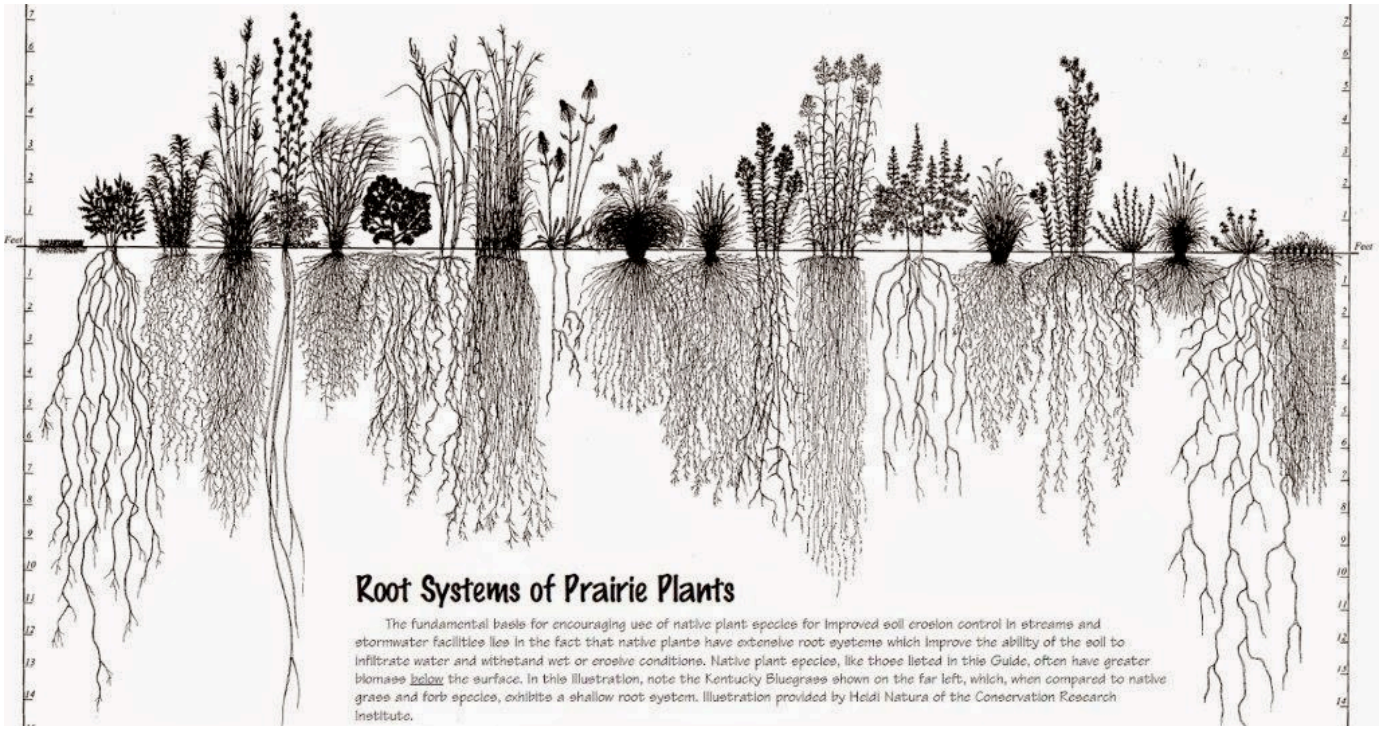
Peter B. Adler[a,1], Roberto Salguero-Gómez[b,c], Aldo Compagnoni[a], Joanna S. Hsu[d], Jayanti Ray-Mukherjee[e], Cyril Mbeau-Ache[f], and Miguel Franco[f]

[a]Department of Wildland Resources and the Ecology Center, Utah State University, Logan, UT 84322; [b]School of Biological Sciences, University of Queensland, Queensland, QLD 4072, Australia; [c]Evolutionary Biodemography Laboratory, Max Planck Institute for Demographic Research, DE-18057 Rostock, Germany; [d]Department of Environmental Science, Policy, and Management, University of California, Berkeley, CA 94720; [e]Westville Campus, University of KwaZulu-Natal, Durban 4000, Republic of South Africa; and [f]School of Biological Sciences, Plymouth University, Plymouth PL4 8AA, United Kingdom

Edited by James H. Brown, University of New Mexico, Albuquerque, NM, and approved December 4, 2013 (received for review August 9, 2013)

2

Relationship trait-fitness



Diseños alternativo
(different solutions with comparable fitness)

2

Relationship trait-fitness

Marks 2007
Evolution

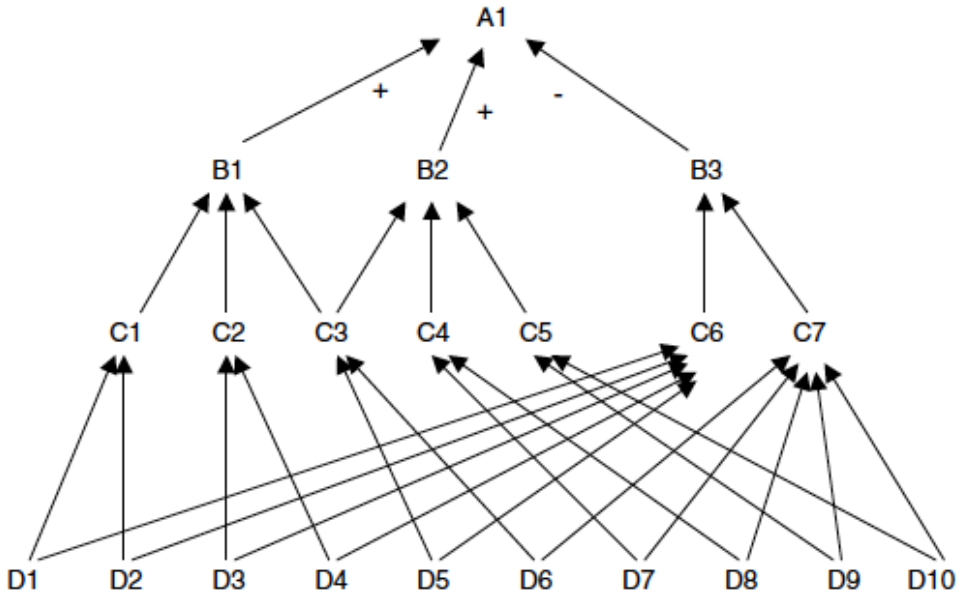


Figure 4. The schematic diagram illustrates the hierarchical network of trait interactions that was used to investigate the cause of multiple optima. When signs are not given next to arrows the

Functional traits

Characteristics of an organisms that affect its fitness (and effects on the ecosystems) [Violle et al. 2007]

Eric Garnier

Simple trait 1
Simple trait 2
Simple trait 3
Simple trait 4
Simple trait 5
Simple trait X

Competition
Nutrient acquisit.
Fecundity
Recruitment
Life cycle
Tolerance to x&y

Growth/biomass
Reproduction
Survival

Fitness

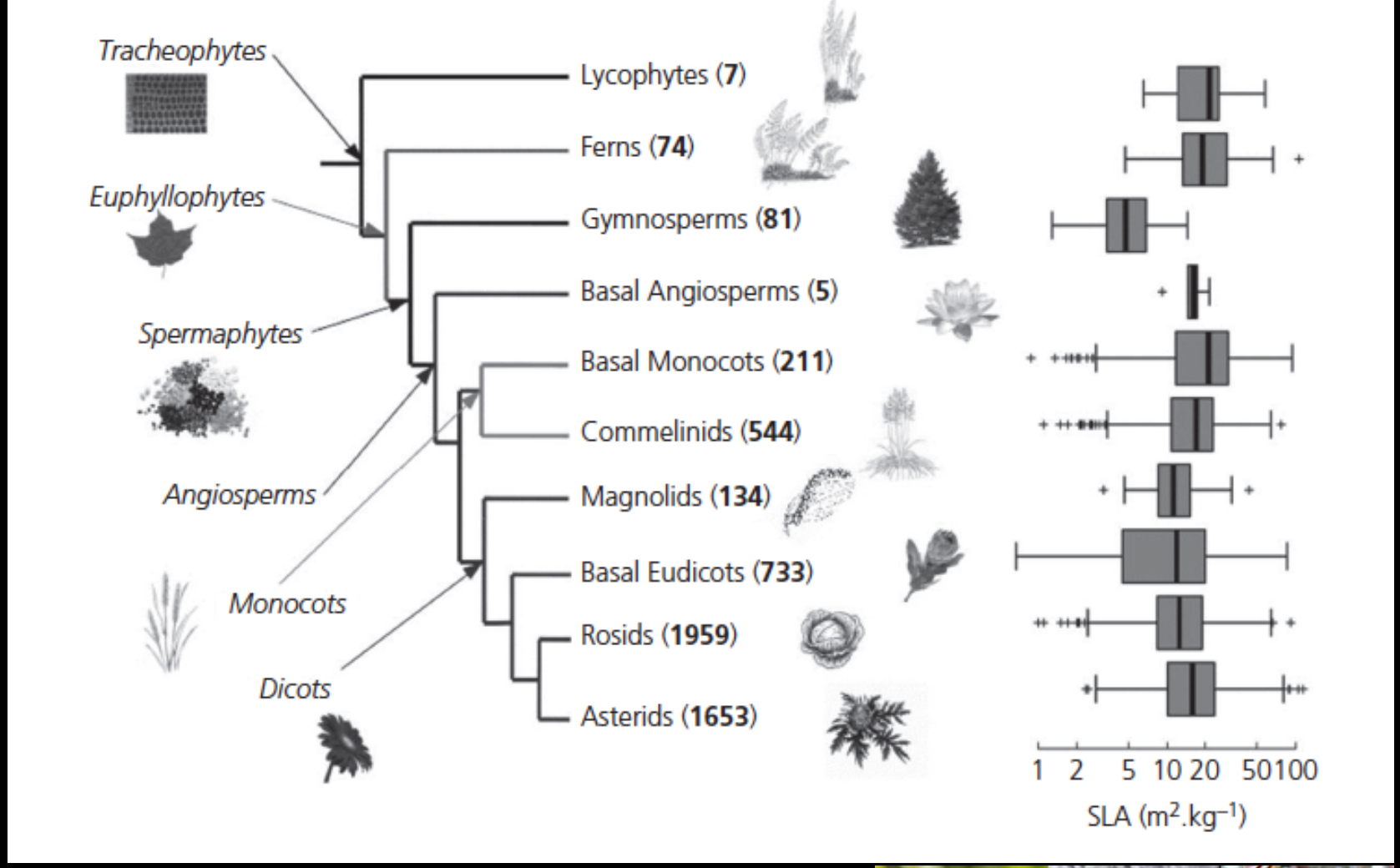
Easy to measure

Difficult to measure

2

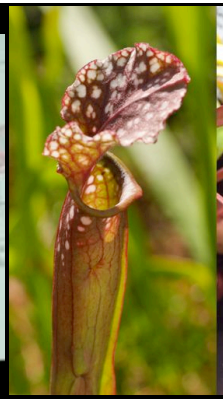
Relationship trait-fitness

Diseños alternativo
(different solutions with comparable fitness)



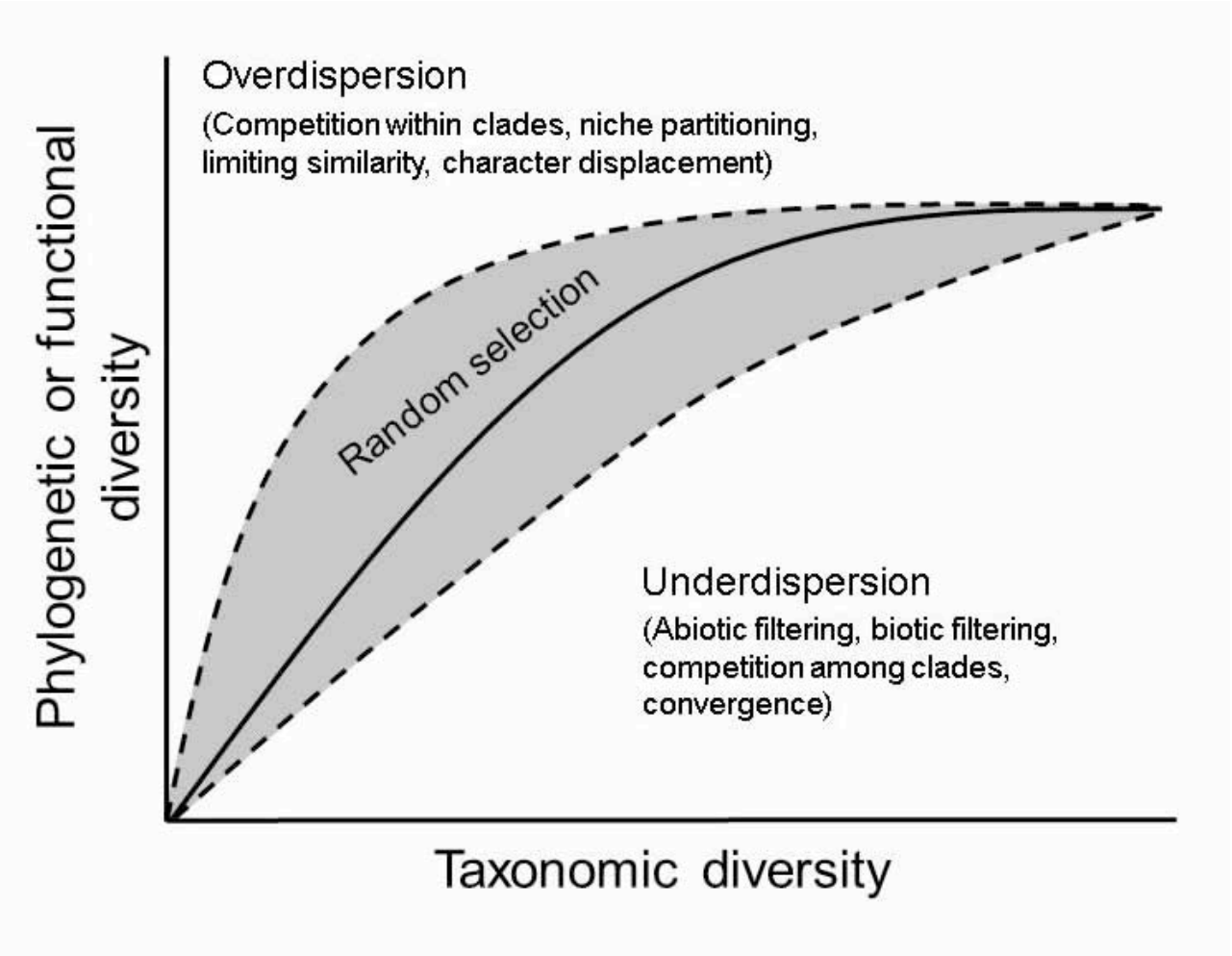
Astrophytum asterais

Euphorbia obesa



Phylogeny and traits

Phylogenetic diversity: a proxy to functional diversity?



Phylogeny and traits

Methods in Ecology and Evolution

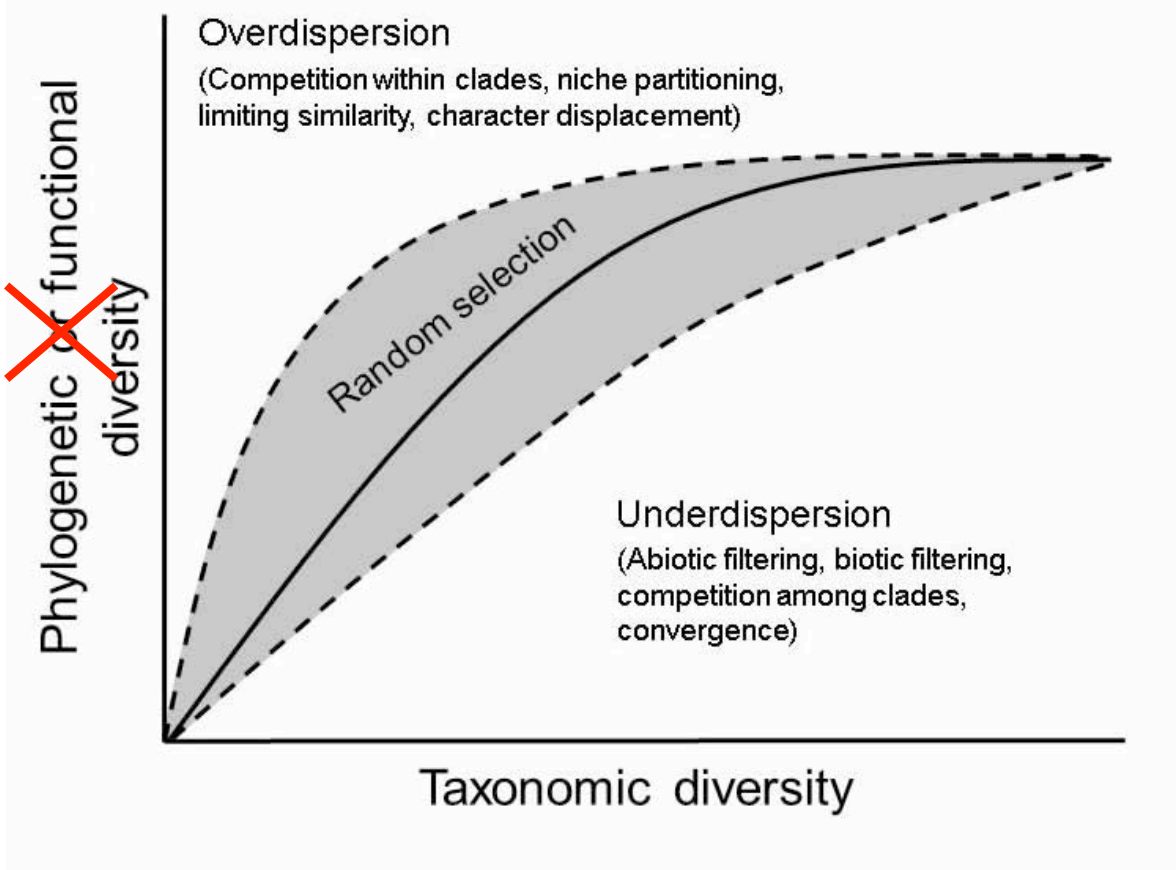
BRITISH ECOLOGICAL SOCIETY

Methods in Ecology and Evolution 2017

doi: 10.1111/2041-210X.12735

Decoupling phylogenetic and functional diversity to reveal hidden signals in community assembly

Francesco de Bello*,†,[1,2], Petr Šmilauer[3], Jose Alexandre F. Diniz-Filho[4], Carlos Perez Carmona[1], Zdeňka Lososová[5], Tomáš Herben[6,7] and Lars Götzenberger†,[2]



Phylogeny and traits

Methods in Ecology and Evolution

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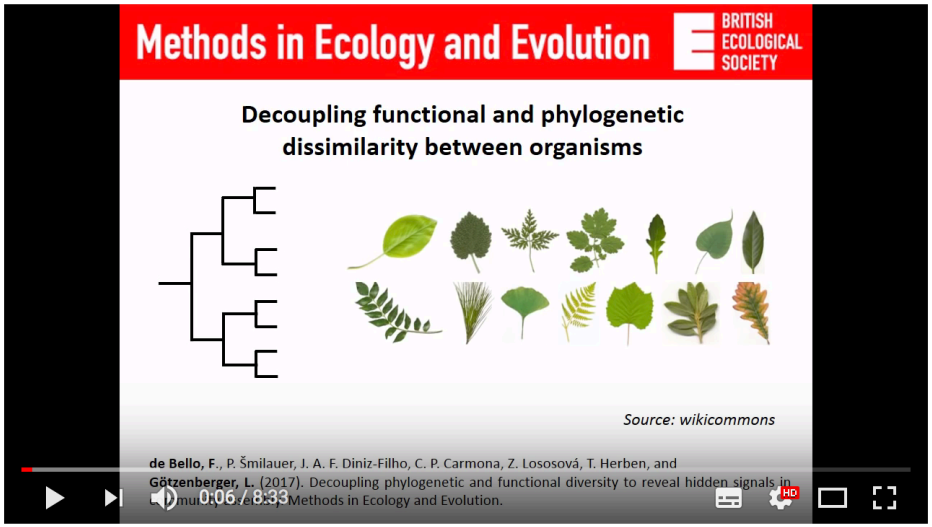
YouTube PT

decoupling traits



Decoupling Functional and Phylogenetic Dissimilarity between Organisms

939 views

15 0 SHARE

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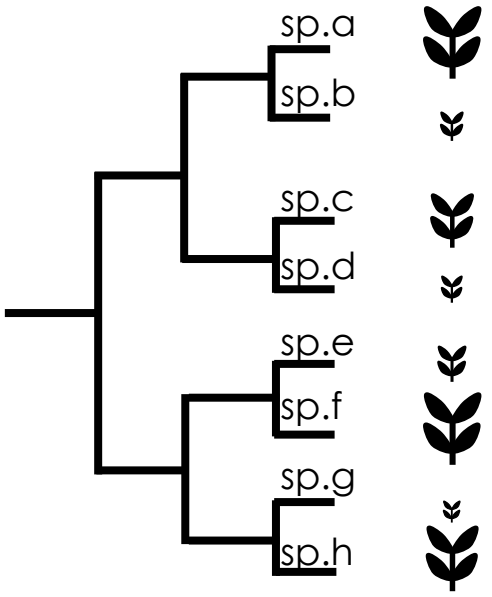
Fdist

Considered trait dissimilarity

Pdist

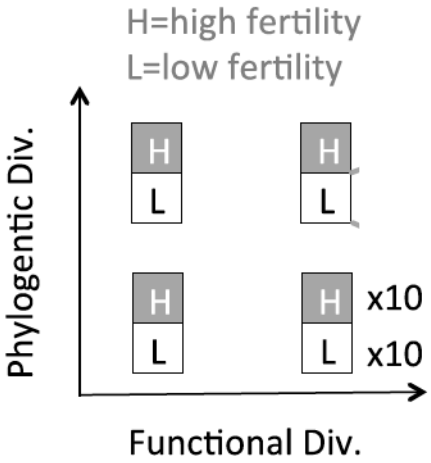
Phylogenetic dissimilarity

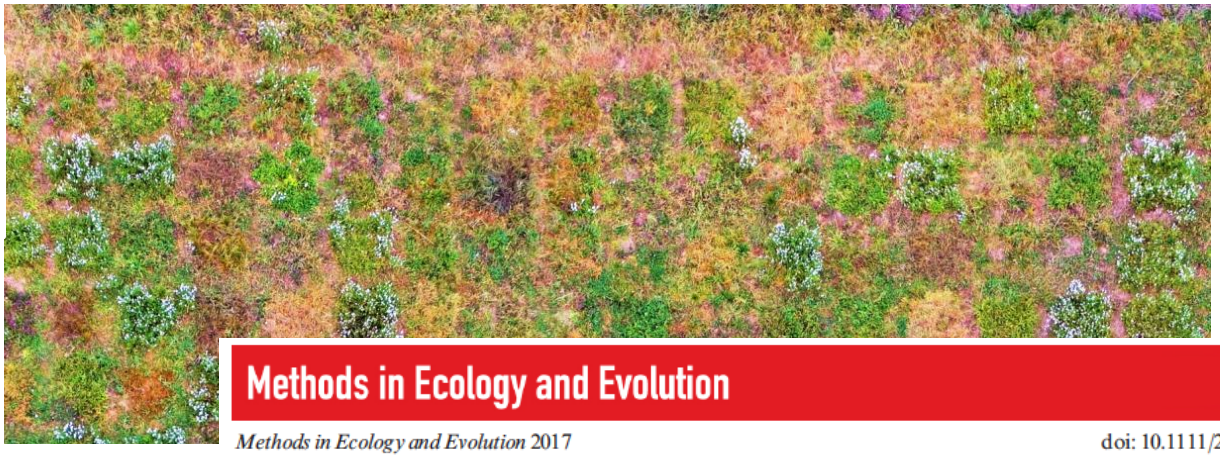
Phylogeny **Trait**



19 species

200 communities with different levels of trait ‘composition’





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Functional Plant Ecology

Decoupling phylogenetic and functional diversity to reveal hidden signals in community assembly

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Phylogeny and traits

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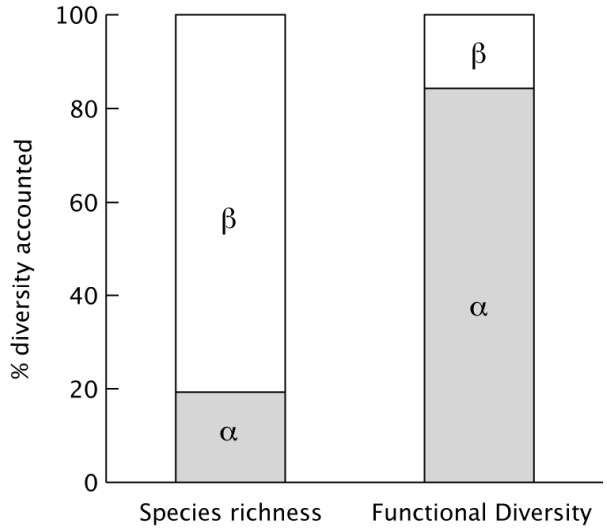
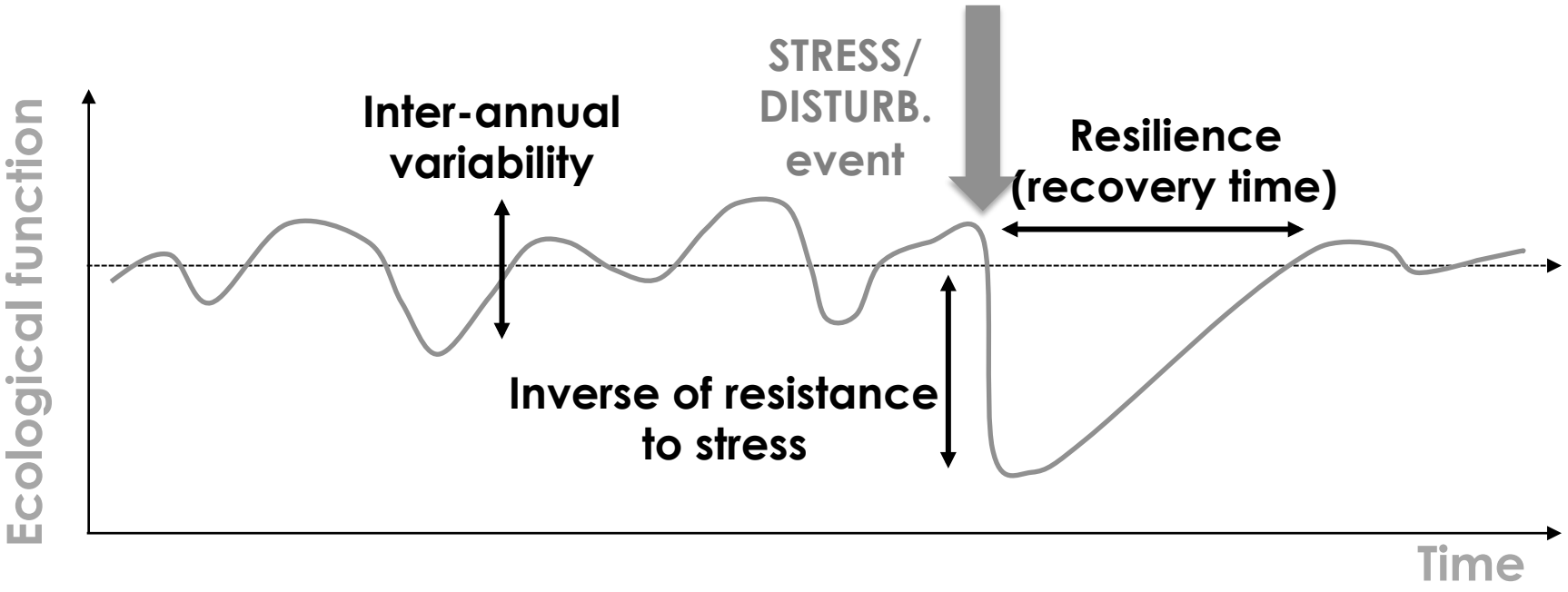


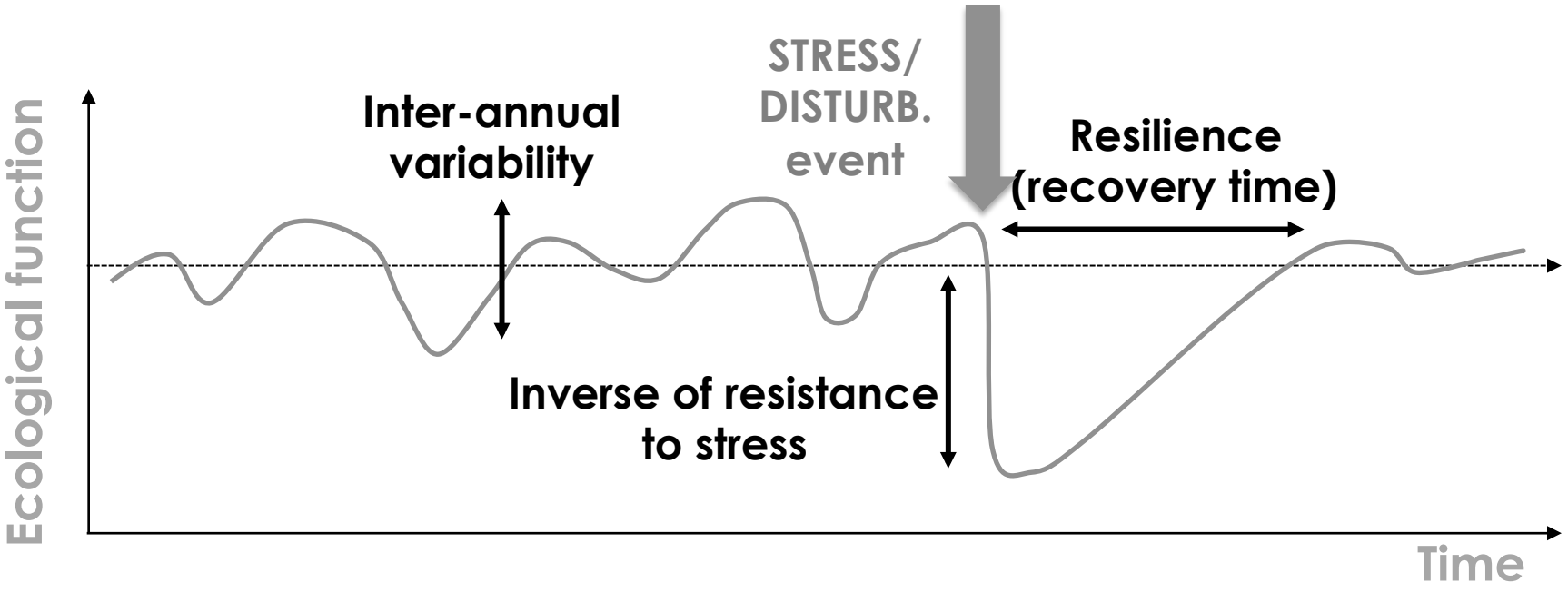
Plants vs. Rest of the world

Temporal stability



The number of species increase stability?

Temporal stability



The number of species increase stability? Well…

VOL. 151, NO. 3 THE AMERICAN NATURALIST MARCH 1998

The Statistical Inevitability of Stability-Diversity Relationships in Community Ecology

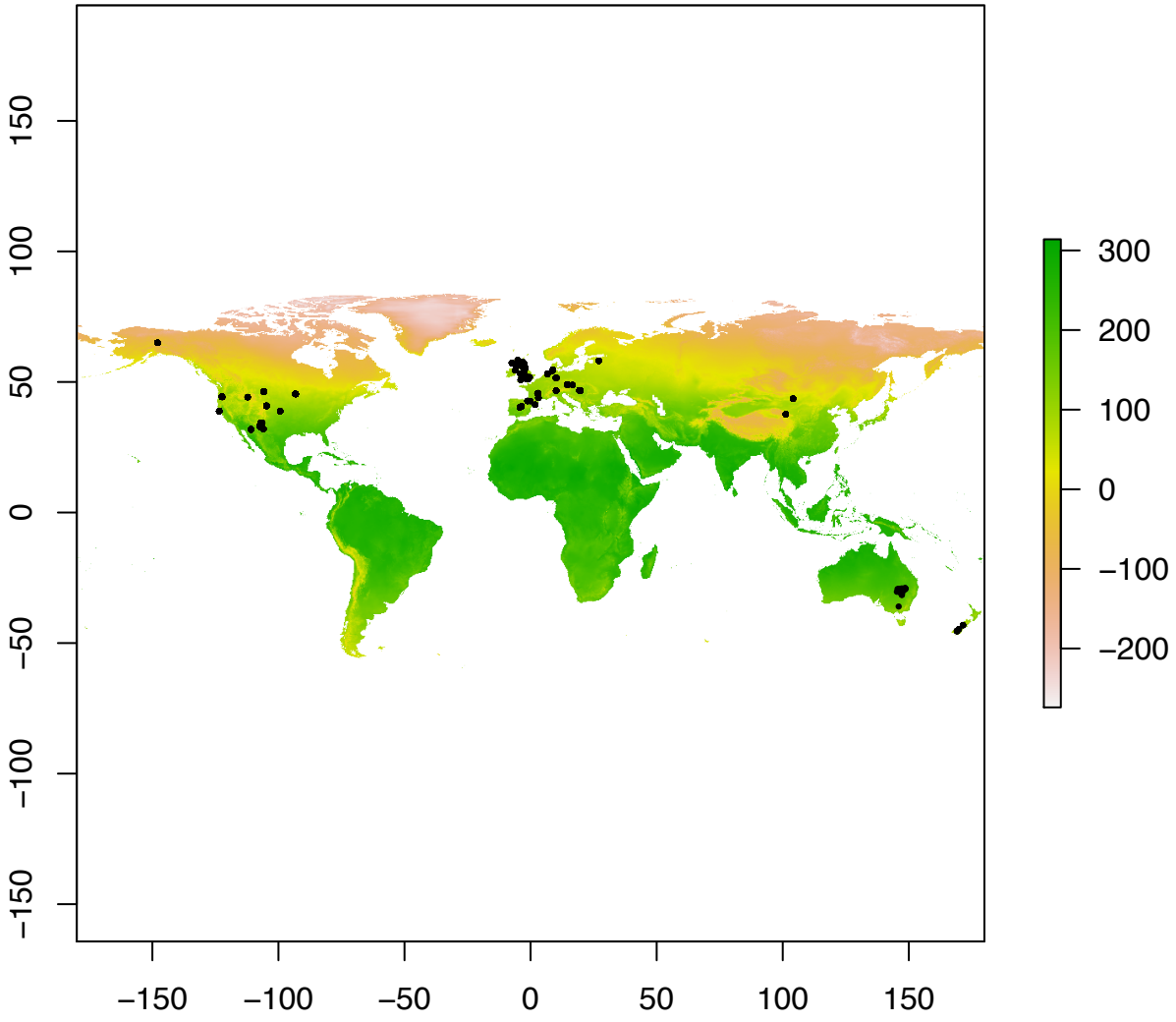
D. F. Doak,* D. Bigger, E. K. Harding, M. A. Marvier, R. E. O'Malley, and D. Thomson†

Network 'LOTVS':
Long-Term Vegetation Sampling

Fluctuaciones temporales de especies y comunidades

LOng-Term Vegetation Sampling

Enrique Valencia



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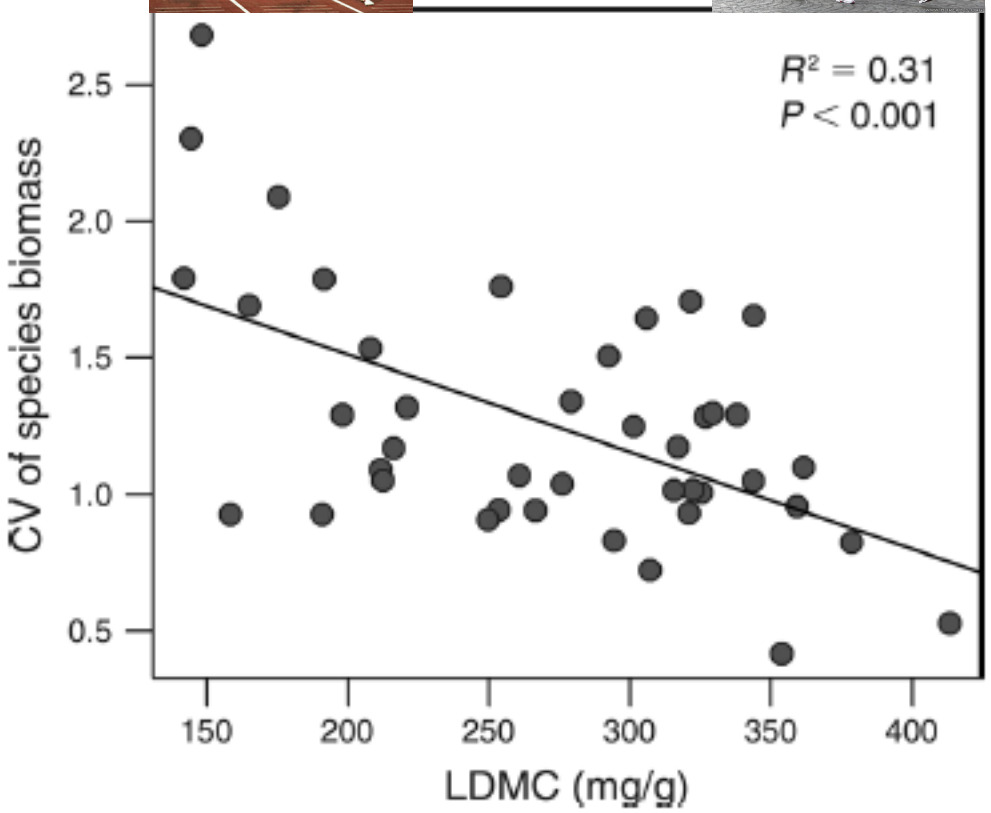
Temporal stability



Majekova et al. 2014

4

Temporal stability

NOT

PNAS

Compensatory dynamics are rare in natural ecological communities

J. E. Houlahan[a,b], D. J. Currie[c], K. Cottenie[d], G. S. Cumming[e], S. K. M. Ernest[f], C. S. Findlay[c], S. D. Fuhlendorf[g], U. Gaedke[h], P. Legendre[i], J. J. Magnuson[j], B. H. McArdle[k], E. H. Muldavin[l], D. Noble[m], R. Russell[n], R. D. Stevens[o], T. J. Willis[p], I. P. Woiwod[q], and S. M. Wondzell[r]

[a]Department of Biology, University of New Brunswick, P.O. Box 5050, Saint John, NB, Canada E2L 4L5; [c]Ottawa–Carleton Institute of Biology, University of Ottawa, Ottawa, ON, Canada K1N 6N5; [d]Department of Integrative Biology, University of Guelph, Guelph, ON, Canada N1G 2W1; [e]Percy FitzPatrick Institute, University of Cape Town, Rondebosch, Cape Town 7701, South Africa; [f]Department of Biology, Utah State University, Logan, UT 84322; [g]Department of Plant and Soil Science, Oklahoma State University, 368 AGH, Stillwater, OK 74078; [h]Institute of Biochemistry and Biology, University of Potsdam, Maulbeerallee 2, D-14469 Potsdam, Germany; [i]Département de Sciences Biologiques, Université de Montréal, C.P. 6128, Succursale Centre-ville, Montréal, PQ, Canada H3C 3J7; [j]Center for Limnology, University of Wisconsin, Madison, WI 53706; [k]Department of Statistics, University of Auckland, Private Bag 92019, Auckland, 1, New Zealand; [l]Department of Biology, University of New Mexico, Albuquerque, NM 18731; [m]National Centre for Ornithology, The

4

Temporal stability

Traits?

Methods in Ecology and Evolution

British Ecological Society

Methods in Ecology and Evolution 2016, 7, 1386–1395

doi: 10.1111/2041-210X.12604

Measuring the functional redundancy of biological communities: a quantitative guide

Carlo Ricotta[1]*, Francesco de Bello[2,3], Marco Moretti[4], Marco Caccianiga[5], Bruno E.L. Cerabolini[6] and Sandrine Pavoine[7]

Trends in Ecology & Evolution

CellPress

Review

Traits Without Borders: Integrating Functional Diversity Across Scales

Carlos P. Carmona,[1,*] Francesco de Bello,[1,2] Norman W.H. Mason,[3] and Jan Lepš[1,4]

4

Estabilidad temporal

LOng–Term Vegetation Sampling

Ecology of differences

Clima

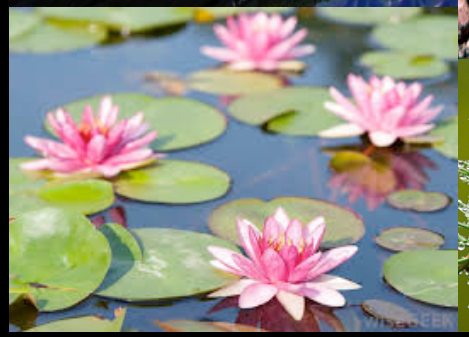
Uso de suelos

Cambio en atributos funcionales → Funciones y servicios ecosistémicos

Plant Eco Func

Functional Plant Ecology






The biodiversity revolution

Ecologists are increasingly looking at traits — rather than species — to measure the health of ecosystems.

BY RACHEL CERNANSKY

LOTUS

LOng-Term Vegetation Sampling

Thanks