



Mixed Forests Management in Europe

Felipe Bravo

iuFOR - Universidad de Valladolid

ETS Ing. Agrarias, Universidad de
Valladolid at Palencia



**WARNELL
SPEAKER
SERIES**
Coffee and conversation
on Thursdays throughout
the semester

**Dr. Felipe
Bravo**
Quantitative Silviculture and Forest
Management professor at the
University of Valladolid (Spain)



**Mixed Forest Management
in Europe & the MedFOR
Master's Program**

**3:30 p.m.
Thursday, October 16th
Warnell Building 1,
Room 304**

UNIVERSITY OF
GEORGIA
1785
Warnell School of Forestry
& Natural Resources

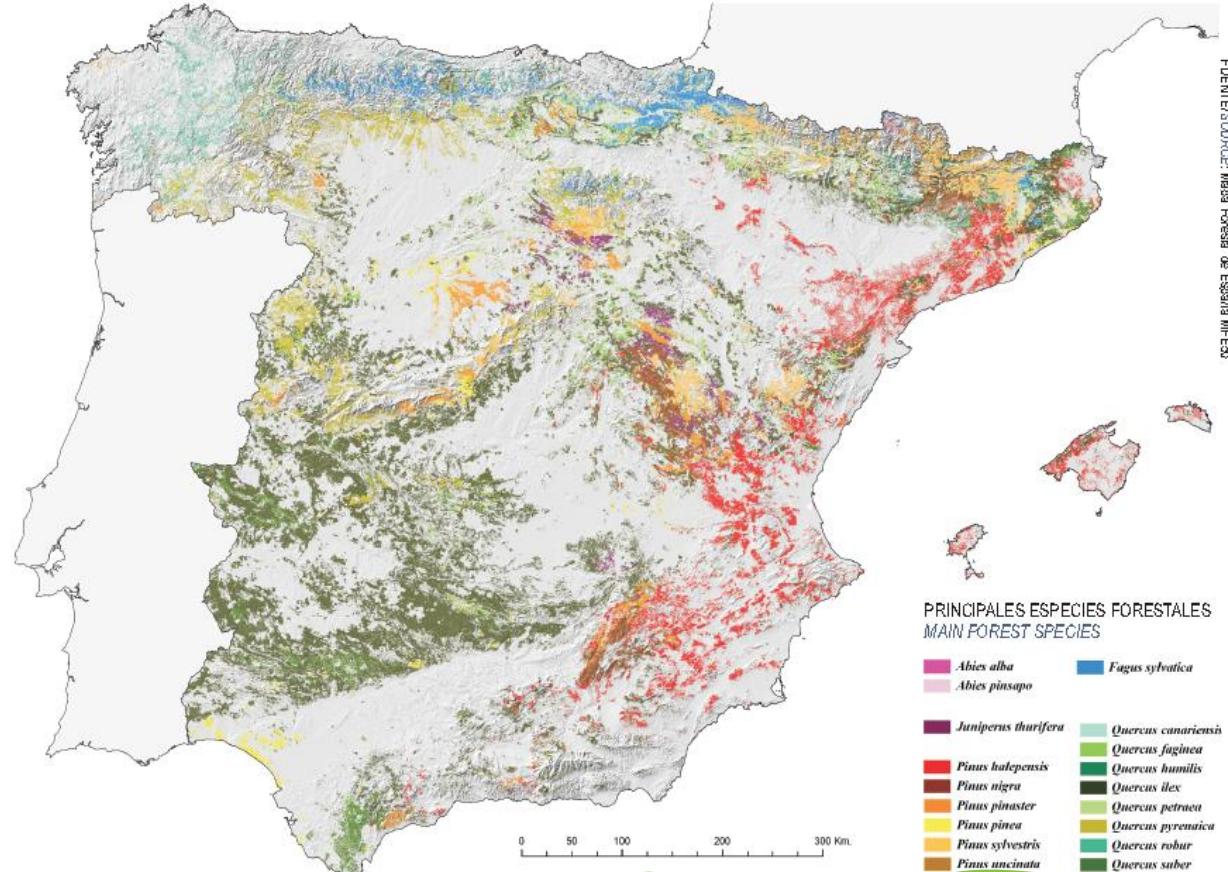
◆ Professor at the University of
Valladolid, Spain

- Quantitative forestry
- Mixed and complex forests silviculture
- Precision forestry

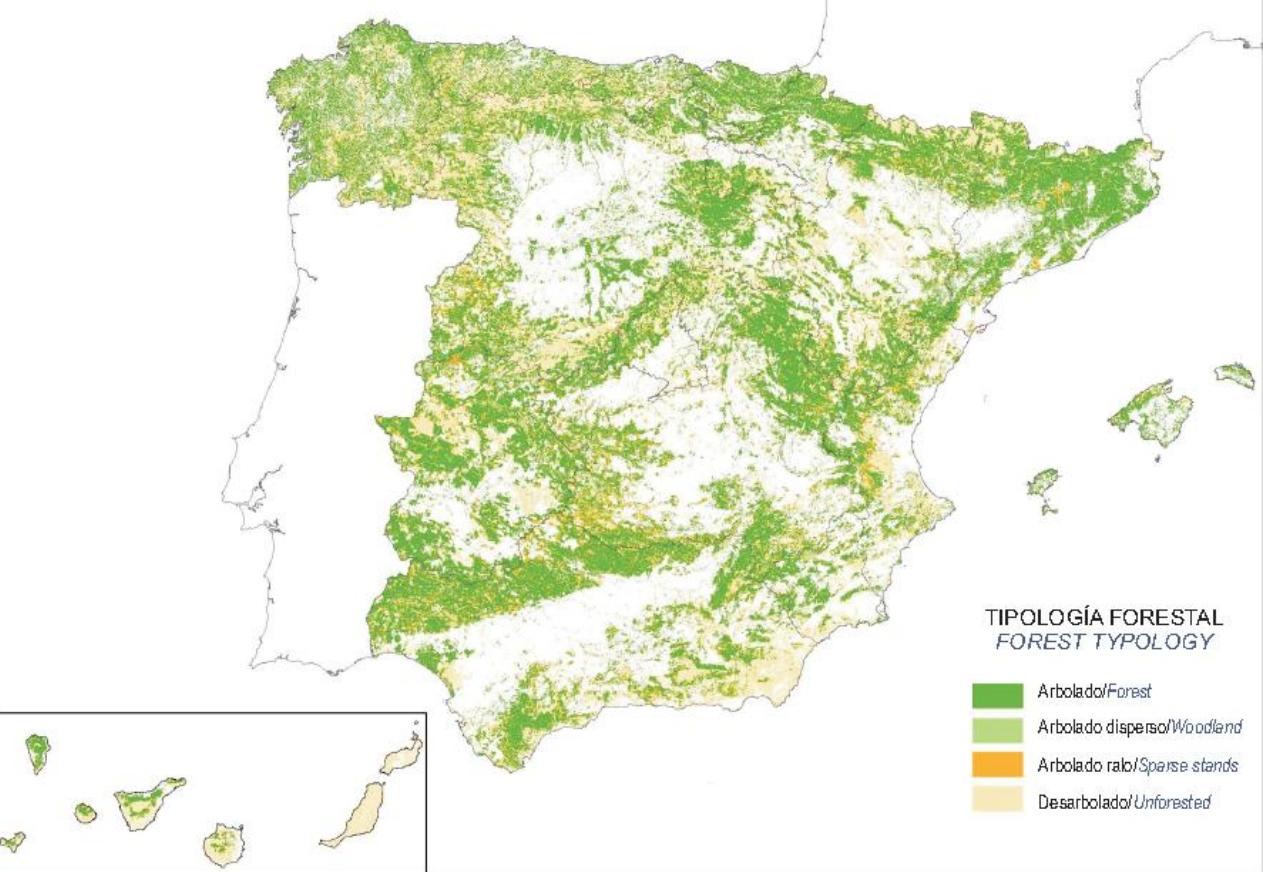


Instituto
Universitario de Investigación
iuFOR GESTIÓN
FORESTAL
SOSTENIBLE

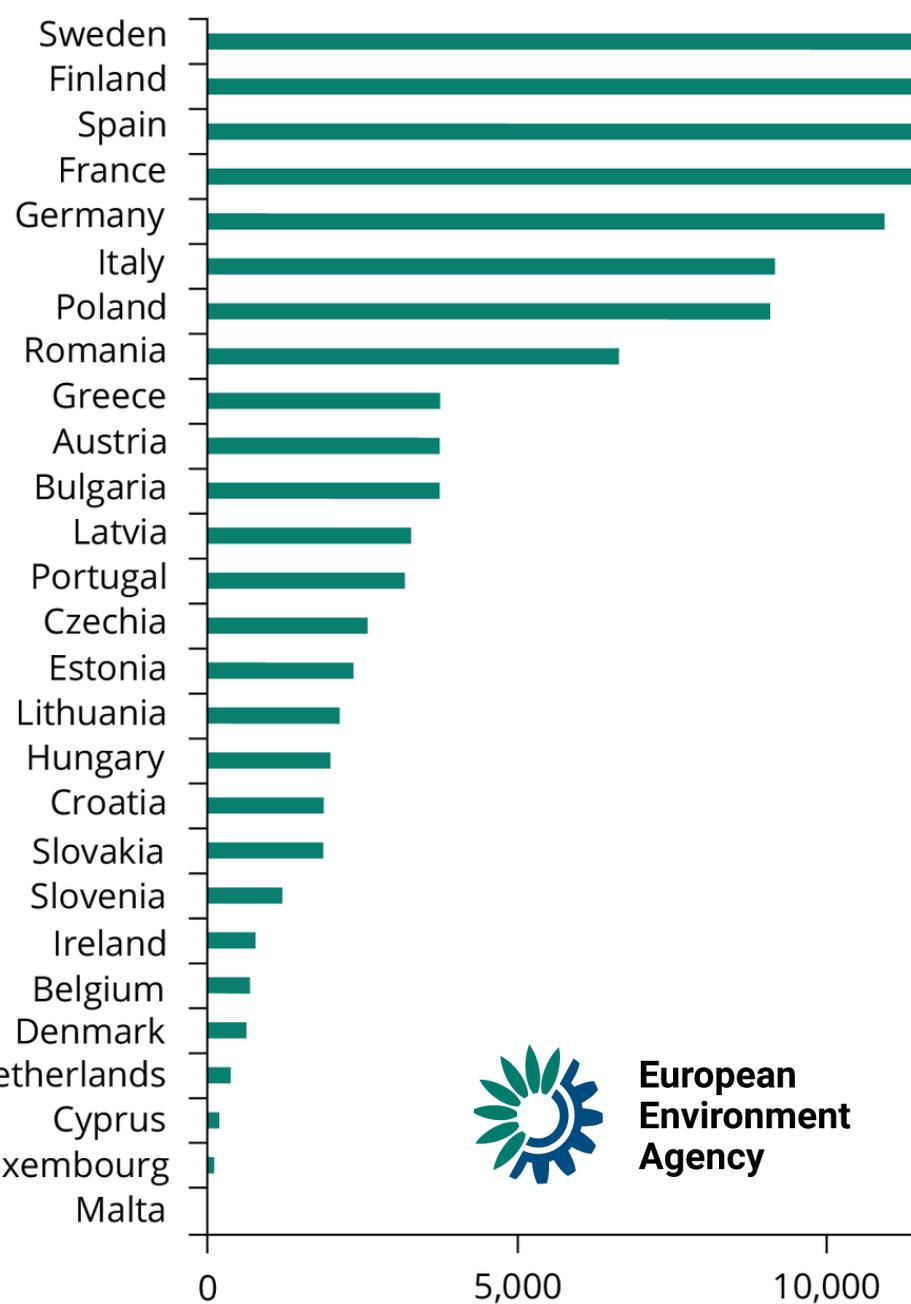




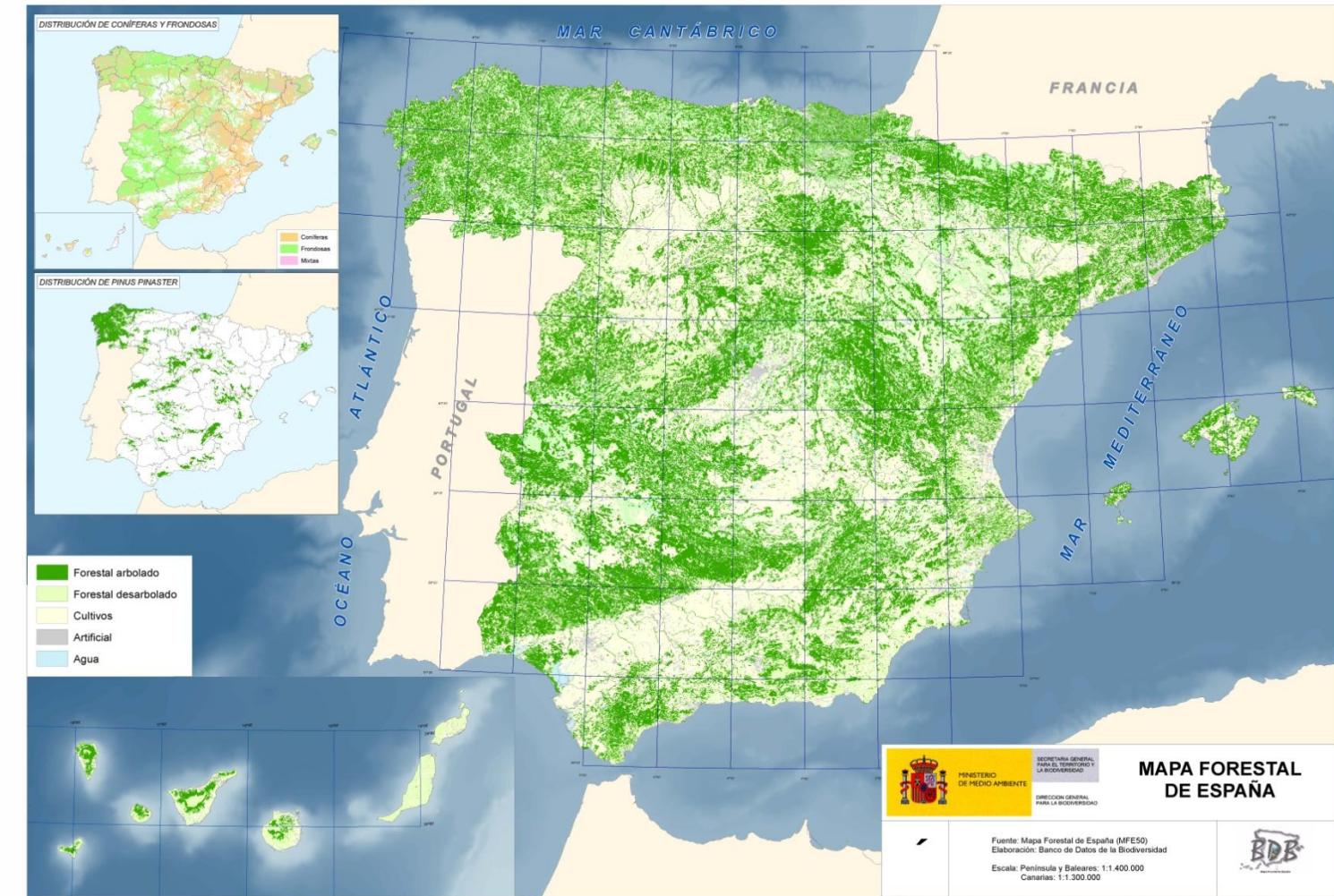
FUENTE/SOURCE: Masa Forestal de España MRFEDS



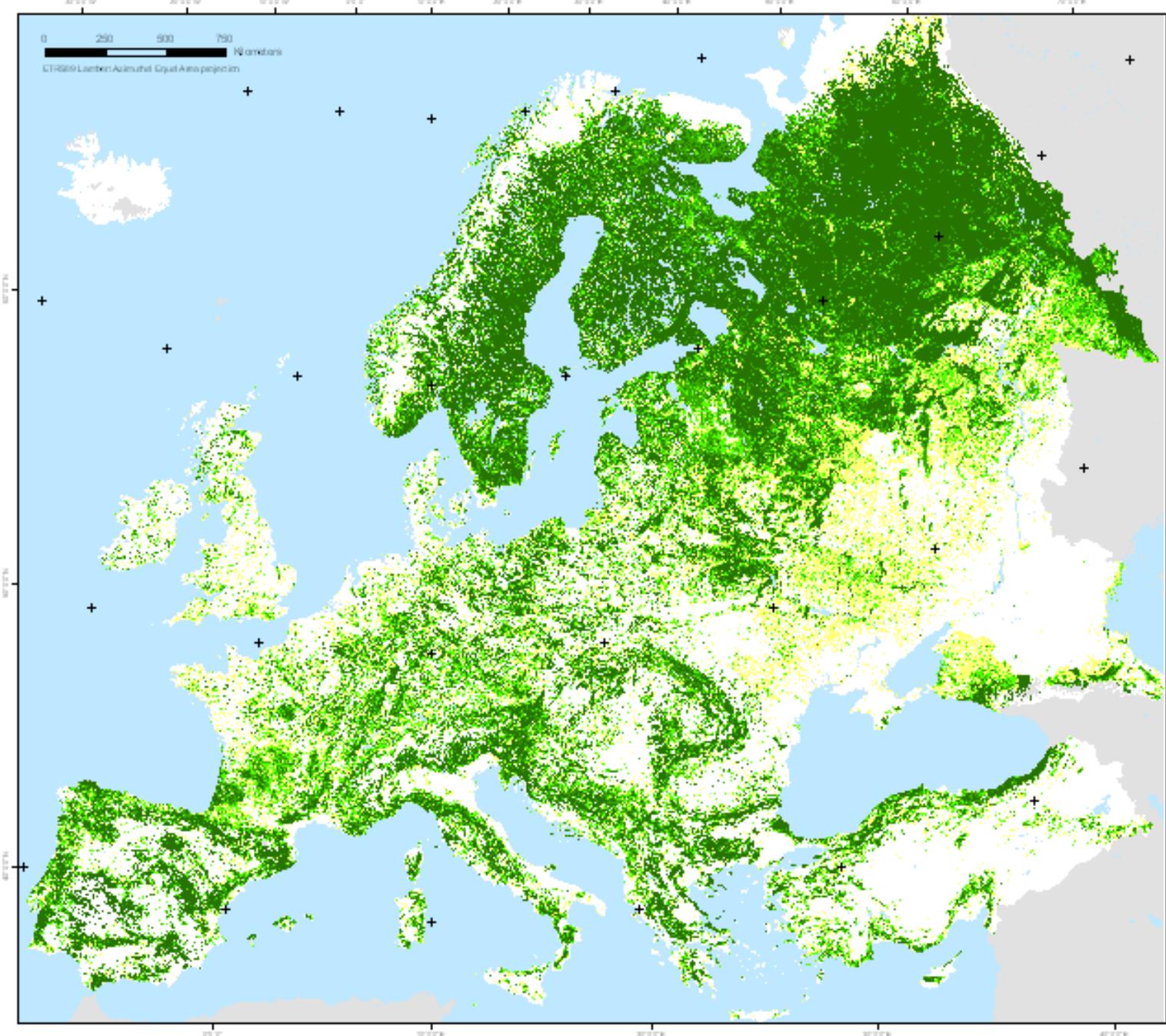
• Forest in Spain, ... really? Even foresters!



3^{er} country in EU-27 by forest area (just after Finland and Sweden)



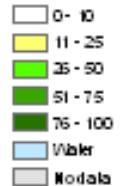
European
Environment
Agency



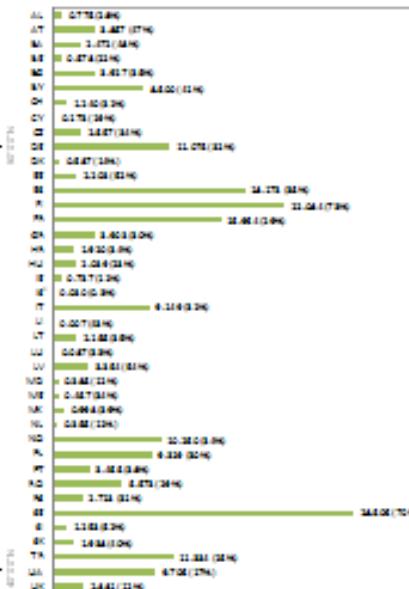
FOREST MAP OF EUROPE

(geographical Europe, Cyprus and Turkey)

Proportion of forest from land area
(% at 1km x 1km resolution)



Forest area by country (Millions ha claimed) and percentage from total land areas:



BRUNNEN HERDING & HÖRZINGER VERLAG

^a based on Forum Europe 2001; not included in map due to lack of available data on internet.

Total forest area shown in the map: 379,396 ha

Two of them: `earthobservation` predicate
to publish map as `http://euso.europa.eu/notebook-map-download`
`swatmap` in `openlava_virtuaL_library` publication in `research_inspire/14`
have been combined with it in at least class 1 to
produce a formal map that corresponds to the official format in memory
available at national and regional level.

Further details:
[newell_in_posix_virtinst_firmware_infrastr_m_sse_ion3](#)

[mapping_services.html](#), [map_of_europe.html](#)

Contact: efm@csj.org.uk

European Forum Institute, December 2011

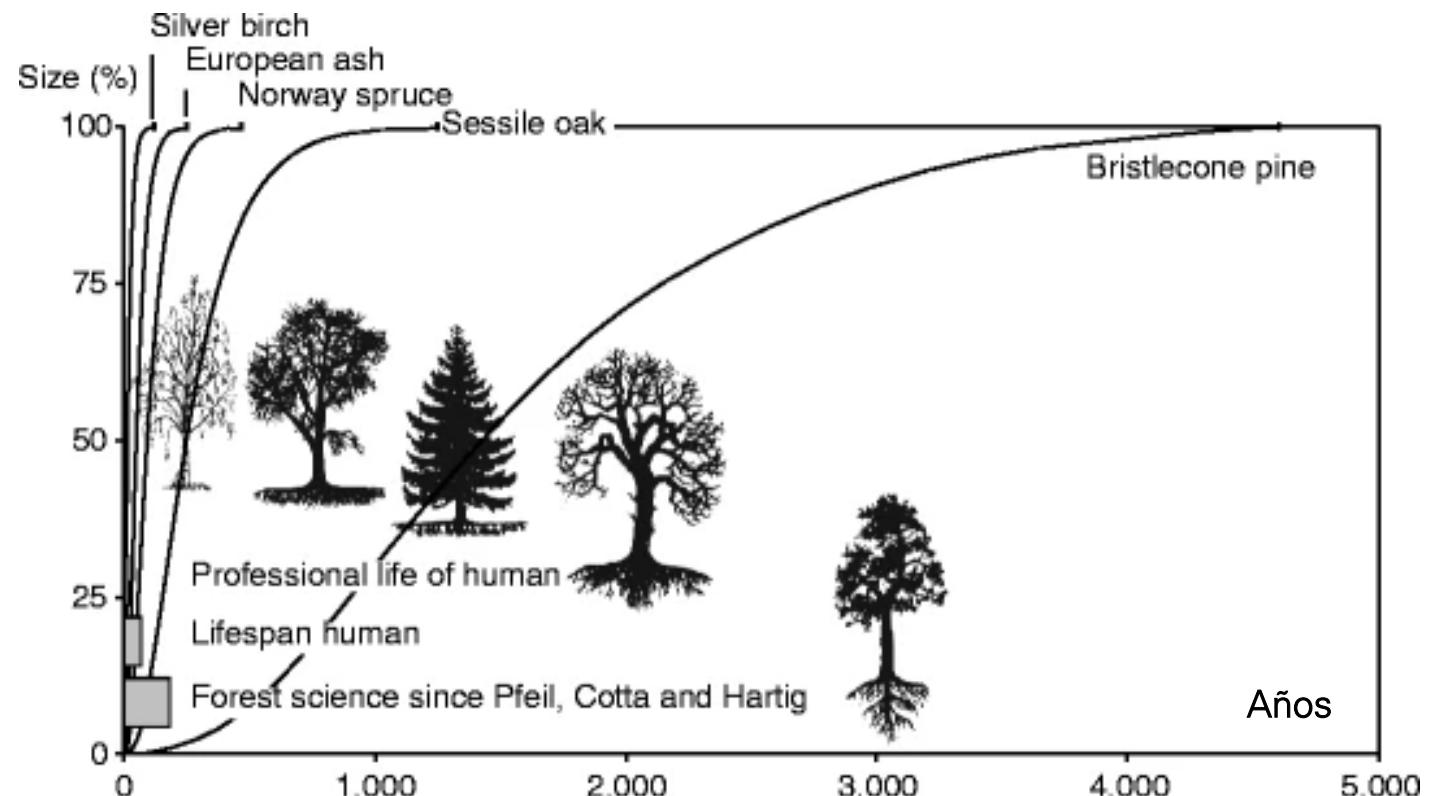
12

100% 用過



EUROPEAN FOREST RESEARCH

Long live organisms



Pretzsch, 2009 | Forest Dynamics, Growth and Yield - Springer



Open systems with fuzzy limits



Systems with feedbacks and memory

Bravo (diseño) y Muñoz (dibujo), 2007 |
El papel de los bosques españoles en la mitigación del cambio climático
Fundación Naturgy





Structured systems



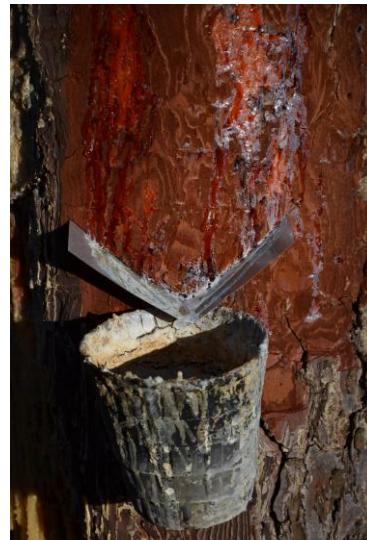
Systems with emergent properties



Multiple ecosystem services



Social interests on management and outcomes



Pilar Valbuena

Each generation of foresters is pretty good at
managing the forests that the last generation of
foresters encountered

Prof. David M. Smith (1921-2009)

Diversity
Complexity

+



Lack of
knowledge and
integration

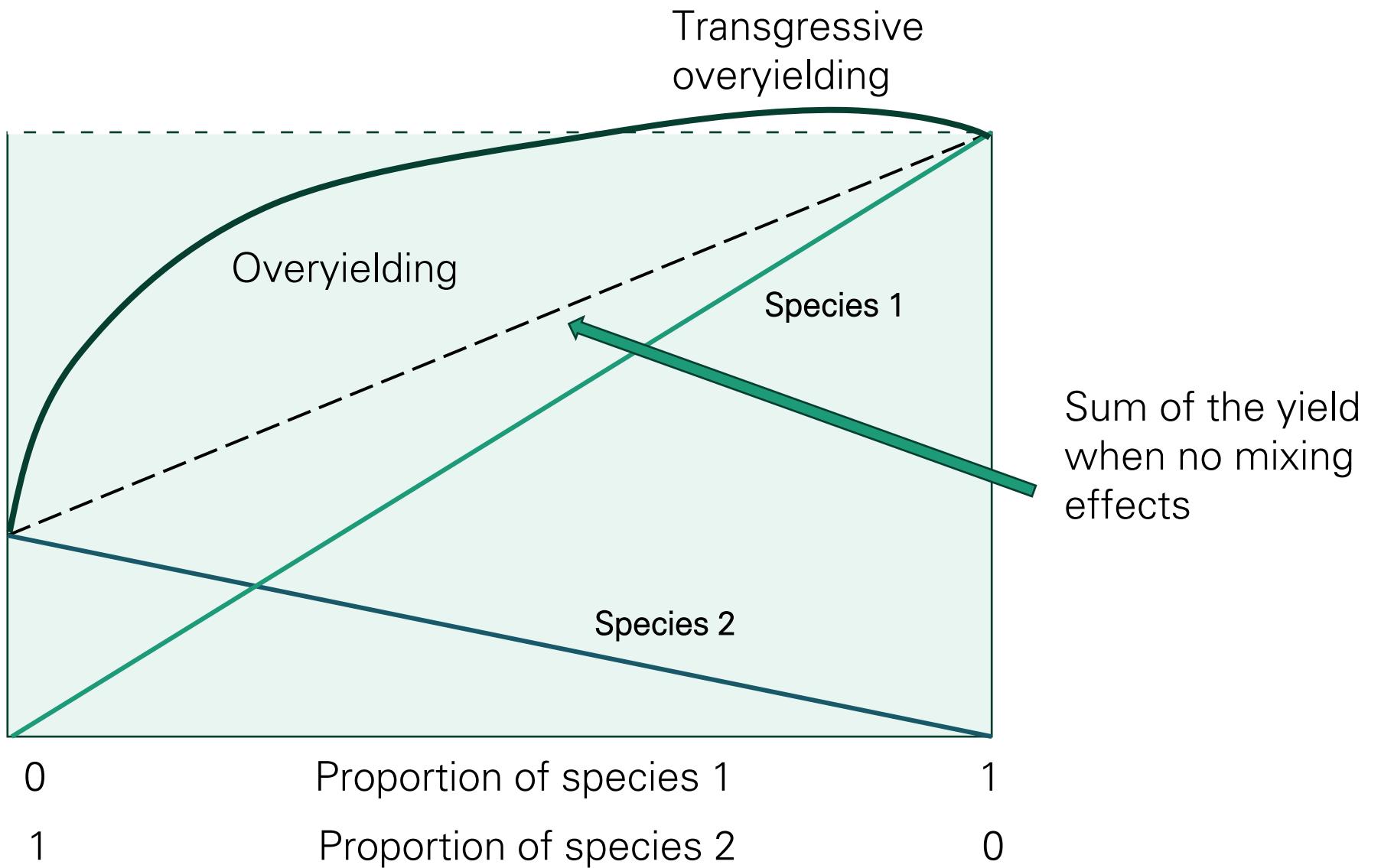
Intensification
Energy input

+

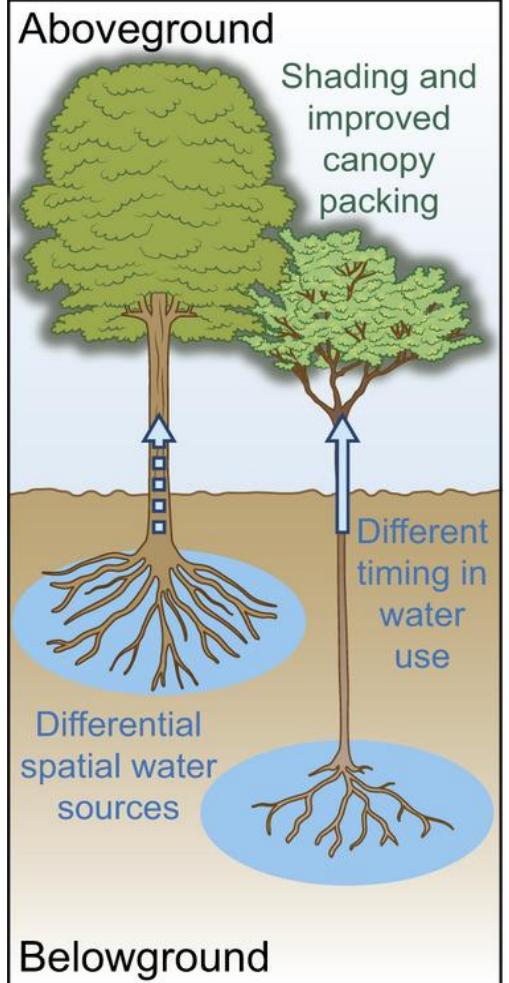
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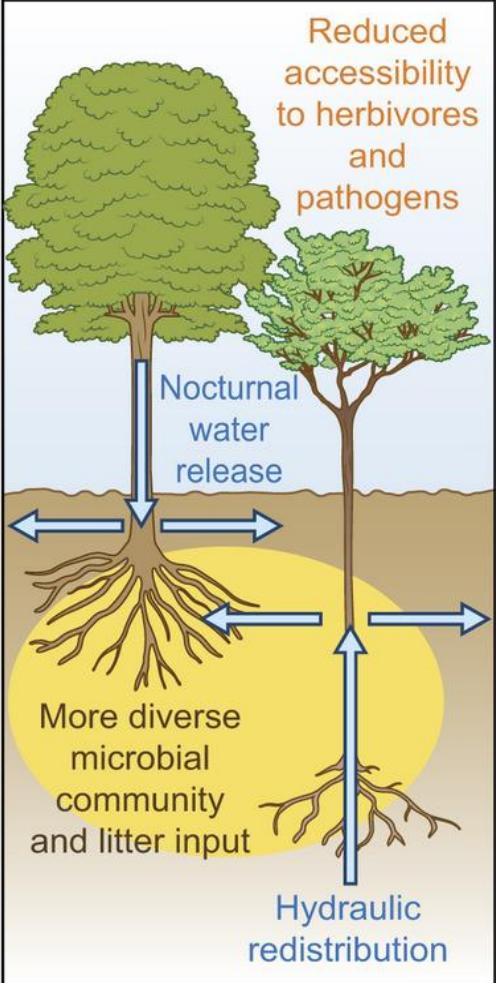
Yield for a
given
Ecosystem
Service



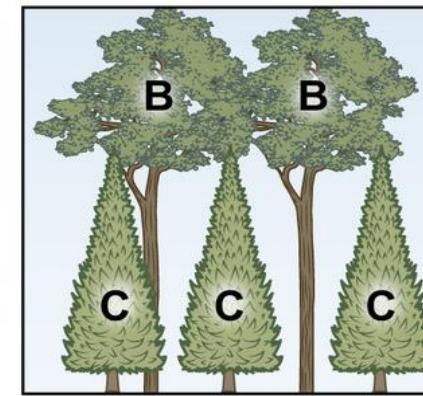
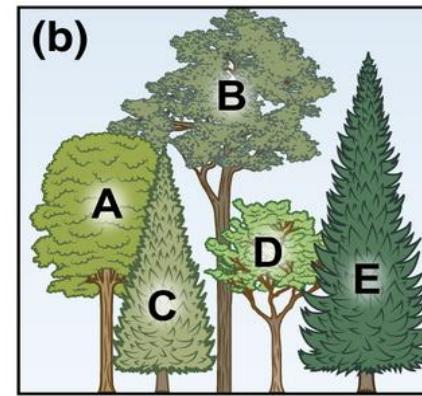
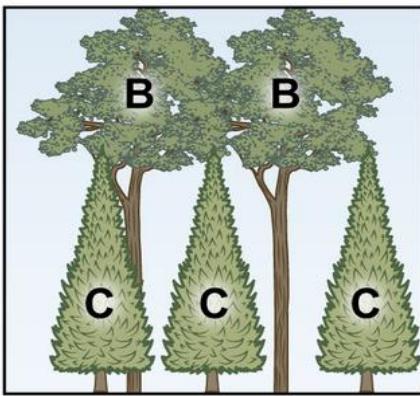
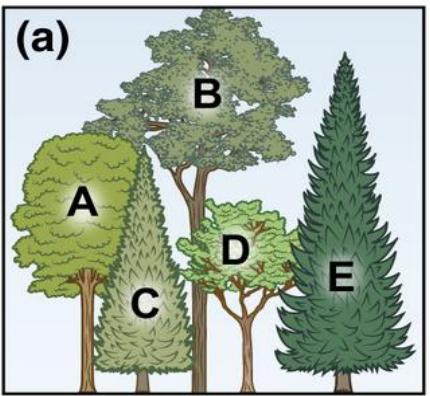
Resource partitioning



Facilitation

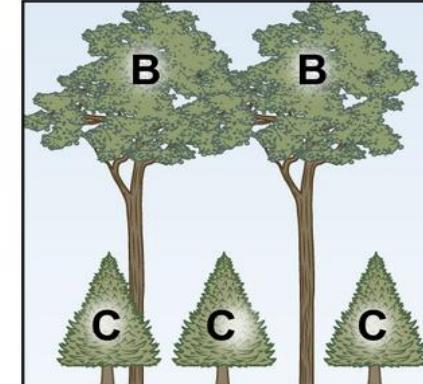
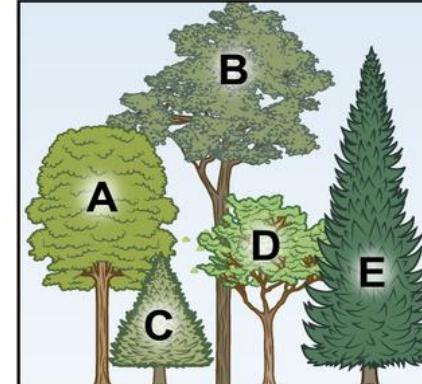
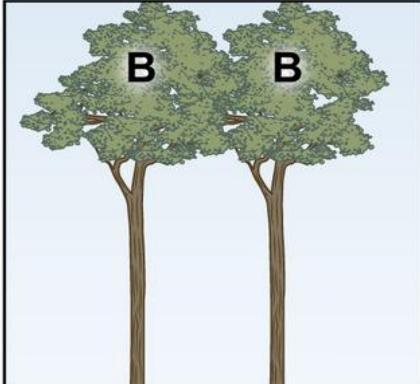
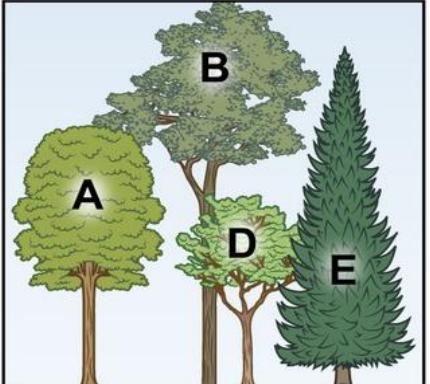


Selection effect



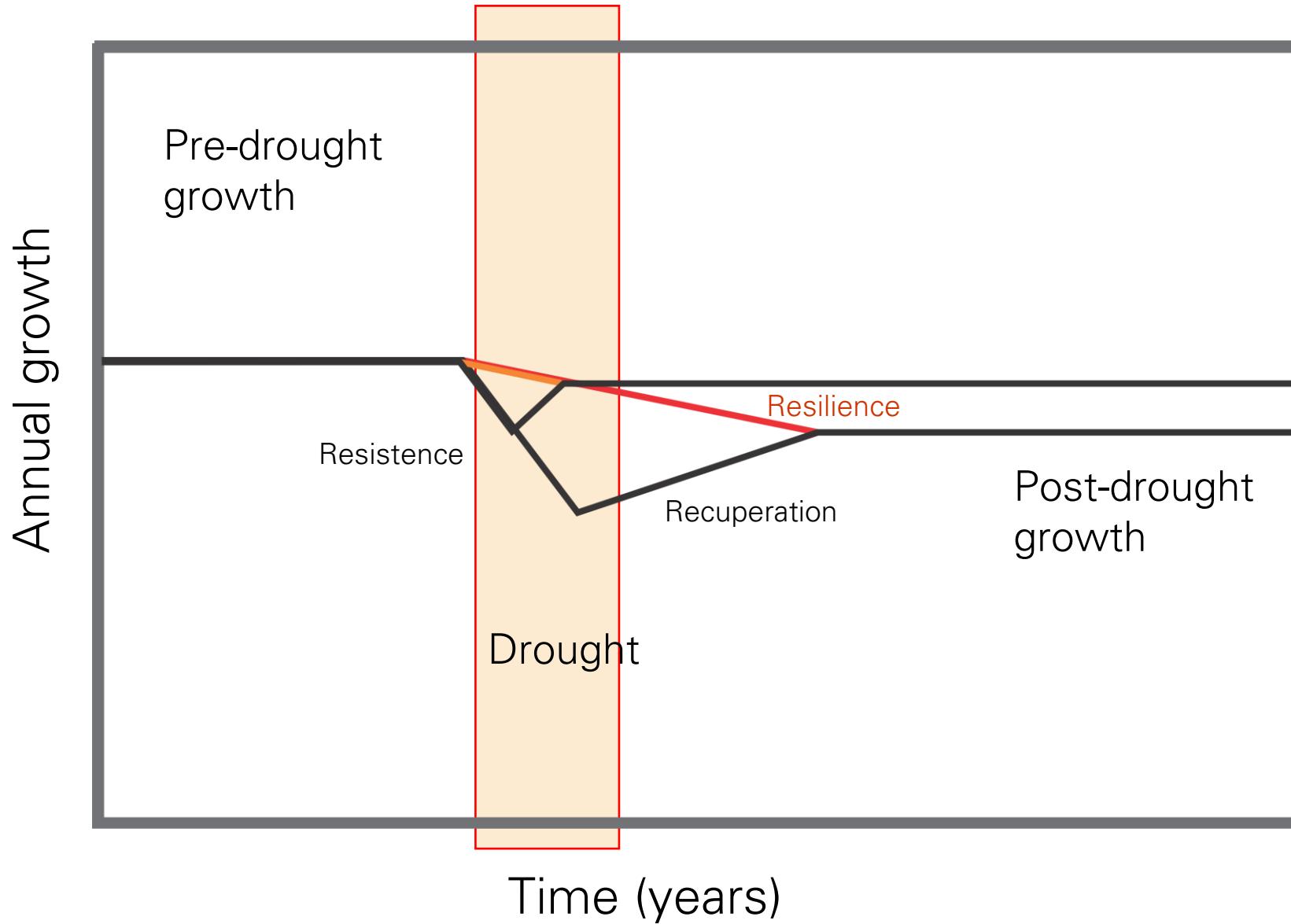
Environmental filtering, e.g. intense drought

Environmental filtering, e.g. intense drought

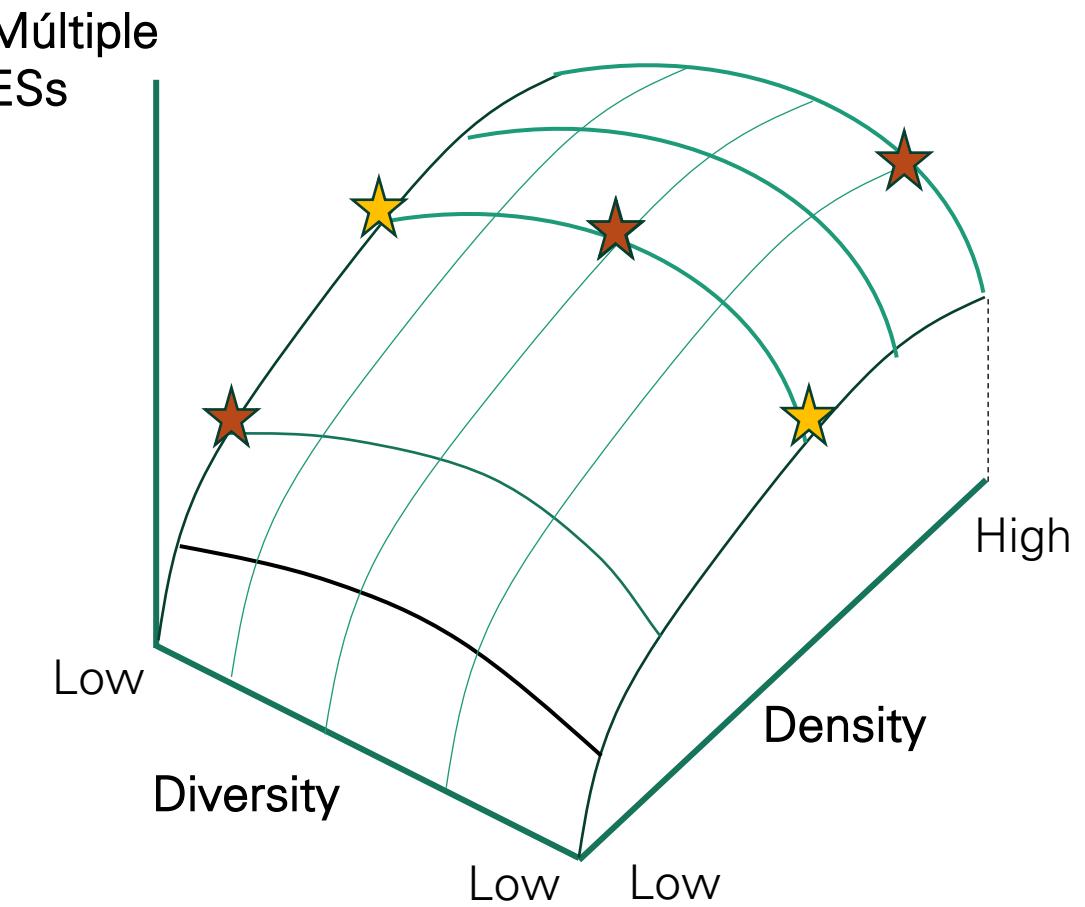
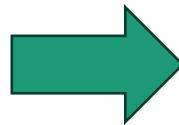
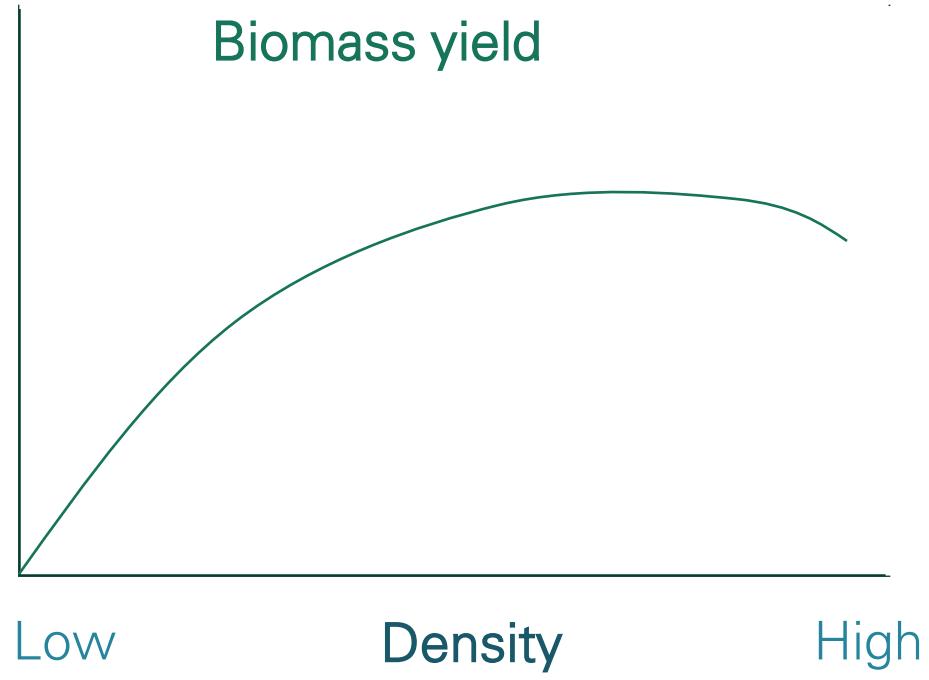


Survival

Yield reduction



Emergent effects of diversity on Ecosystem Services (Ess) provision



What can we do to insight on
ecosystems functioning and the
Ecosystem Services provision in
mixed forests?





Observational studies



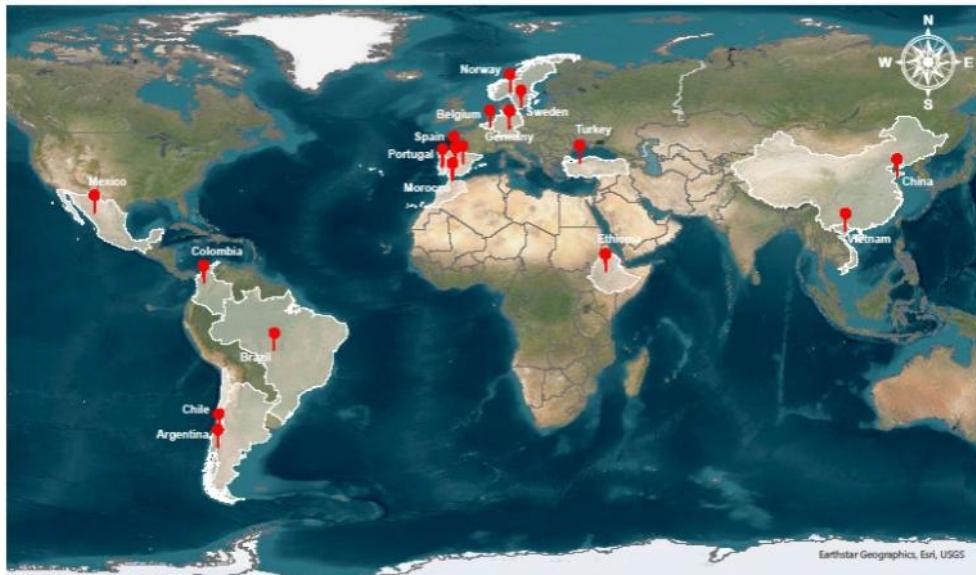
<https://www.laverdaddelosarboles.com/>

| <https://www.comfor-sudoe.eu/>

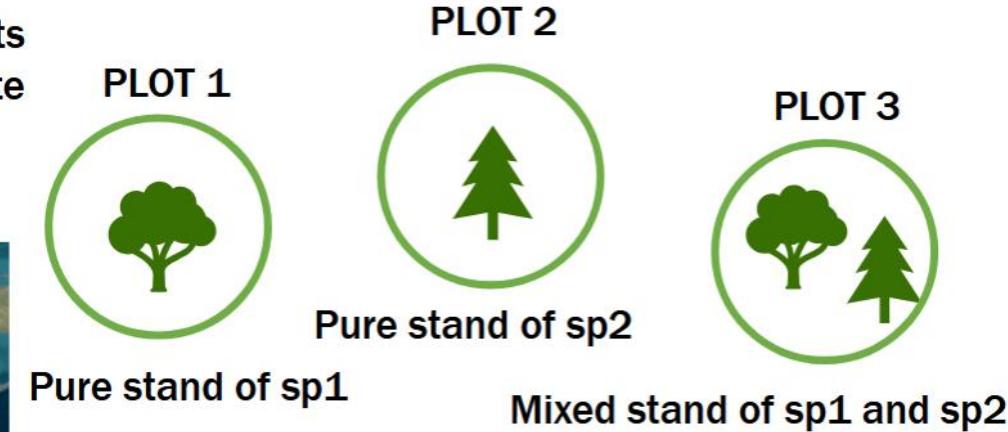
Observational studies

Worldwide triplets network

Triplets encompassing both pure and mixed forests worldwide, across boreal, tropical, and temperate regions in Europe, America, Africa, and Asia.



What is a triplet?



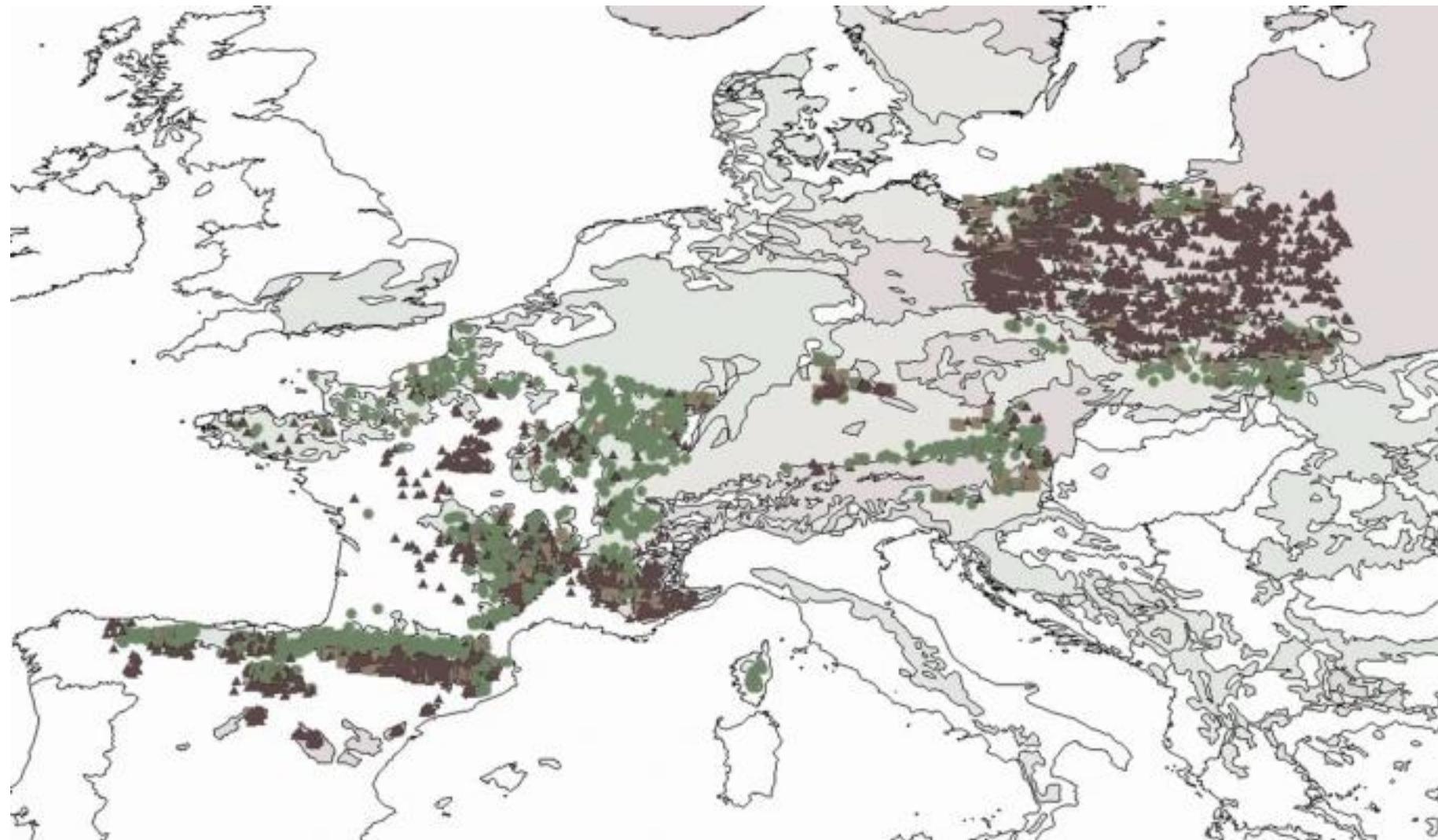
Our data



STATIC DATA: dendrometric variables

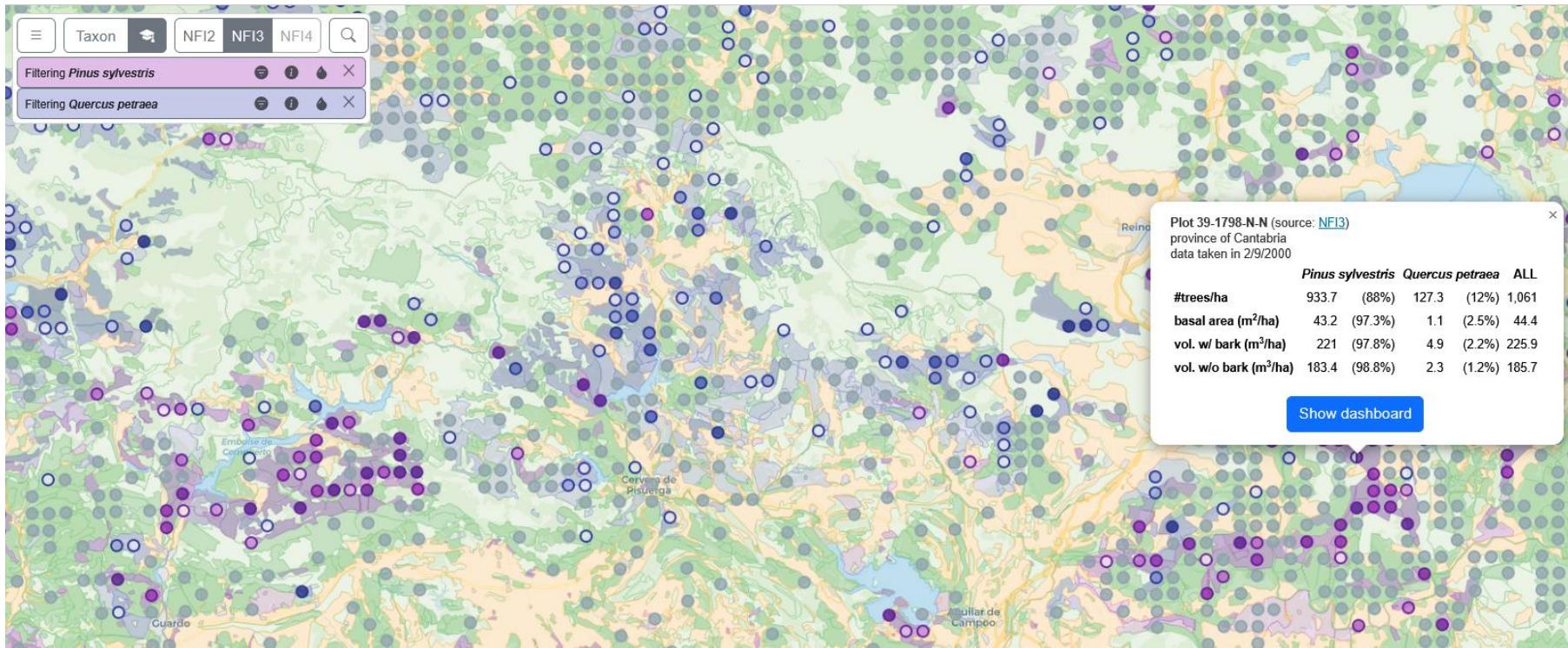
DYNAMIC DATA: growth (cores or inventories over time)

Observational studies



NFI database
Pine-Beech mixed stands

Observational studies

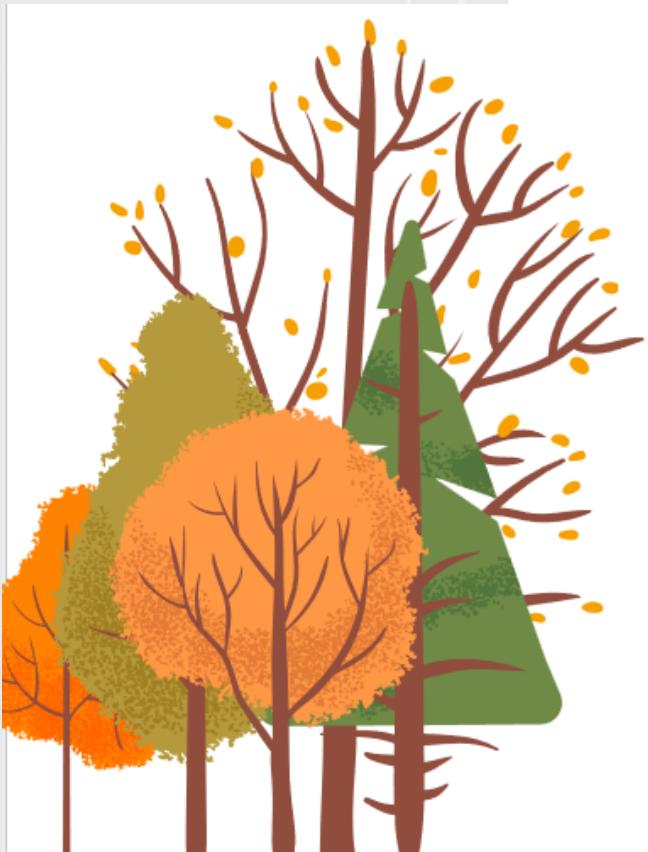


Screening to establish triplets



Experimental studies





FORMIX
N E T W O R K



Experimental network of complex forests and mixed plantations

Montija de Arija (Burgos – Merindades, northern Spain)



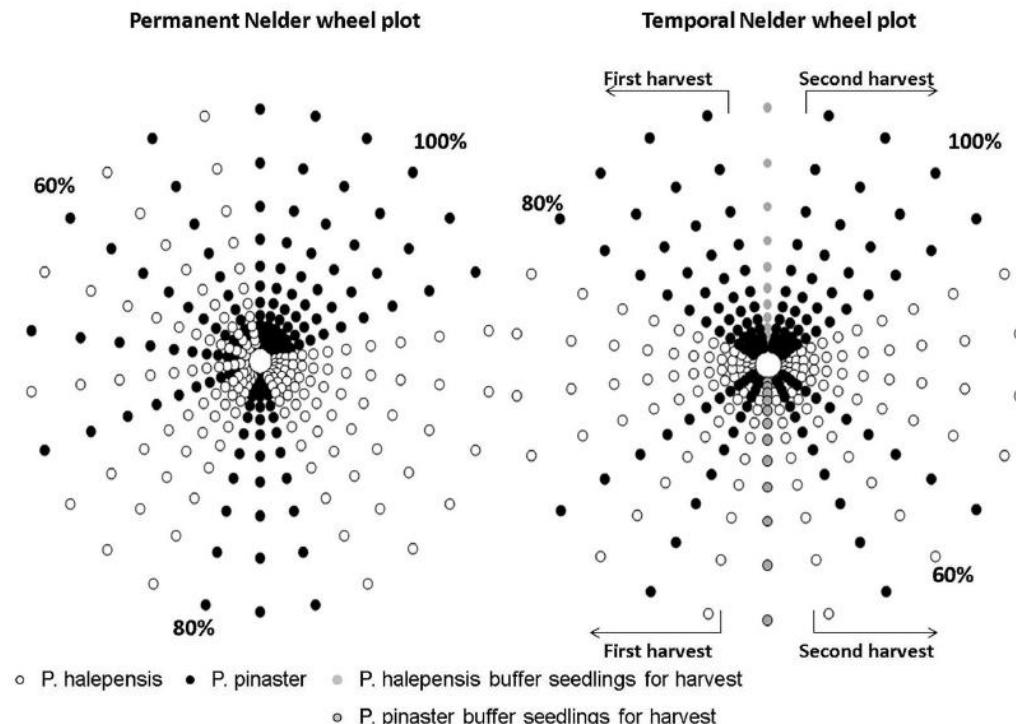
LAND LIFE COMPANY

- **3 blocks** fully randomize (in 3 different patches nearby but representing contrasting sites)
- **3 species:** *P. sylvestris*, *P. nigra*, *Betula alba*
- **1 spatial arrangement** (rectangular grid, 4 by 3 m, row wise, one density, 833.33 trees/ha)
- **7 mixtures:**
 - 3 pure plantations
 - 3 double mixtures (*Pn+Psy* | *Pn+Ba* | *Psyl+Ba*)
 - 1 triple mixture

~ 5.25 ha in total + buffers



NELDER Wheel: mixed plantations



Forestry *An International Journal of Forest Research*

Forestry 2022; 1-13, <https://doi.org/10.1093/forestry/cpac025>



Effect of density on Mediterranean pine seedlings using the Nelder wheel design: analysis of survival and early growth

Irene Ruano^{1,2,*}, Valentín Pando^{1,3} and Felipe Bravo^{1,2}

Forestry *An International Journal of Forest Research*

Forestry 2022; 1-16, <https://doi.org/10.1093/forestry/cpac024>



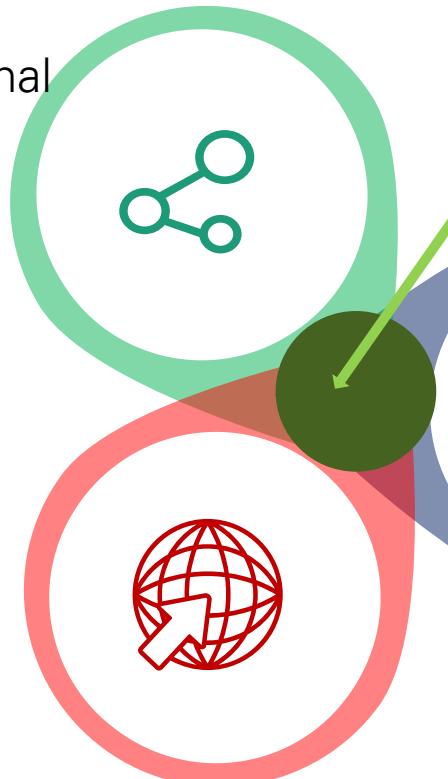
Effect of density on Mediterranean pine seedlings using the Nelder wheel design: analysis of biomass production

Irene Ruano^{1,2,*}, Celia Herrero de Aza^{1,2} and Felipe Bravo^{1,2}



BIOESSAYS in Operational Forestry

Processes
and functional
traits

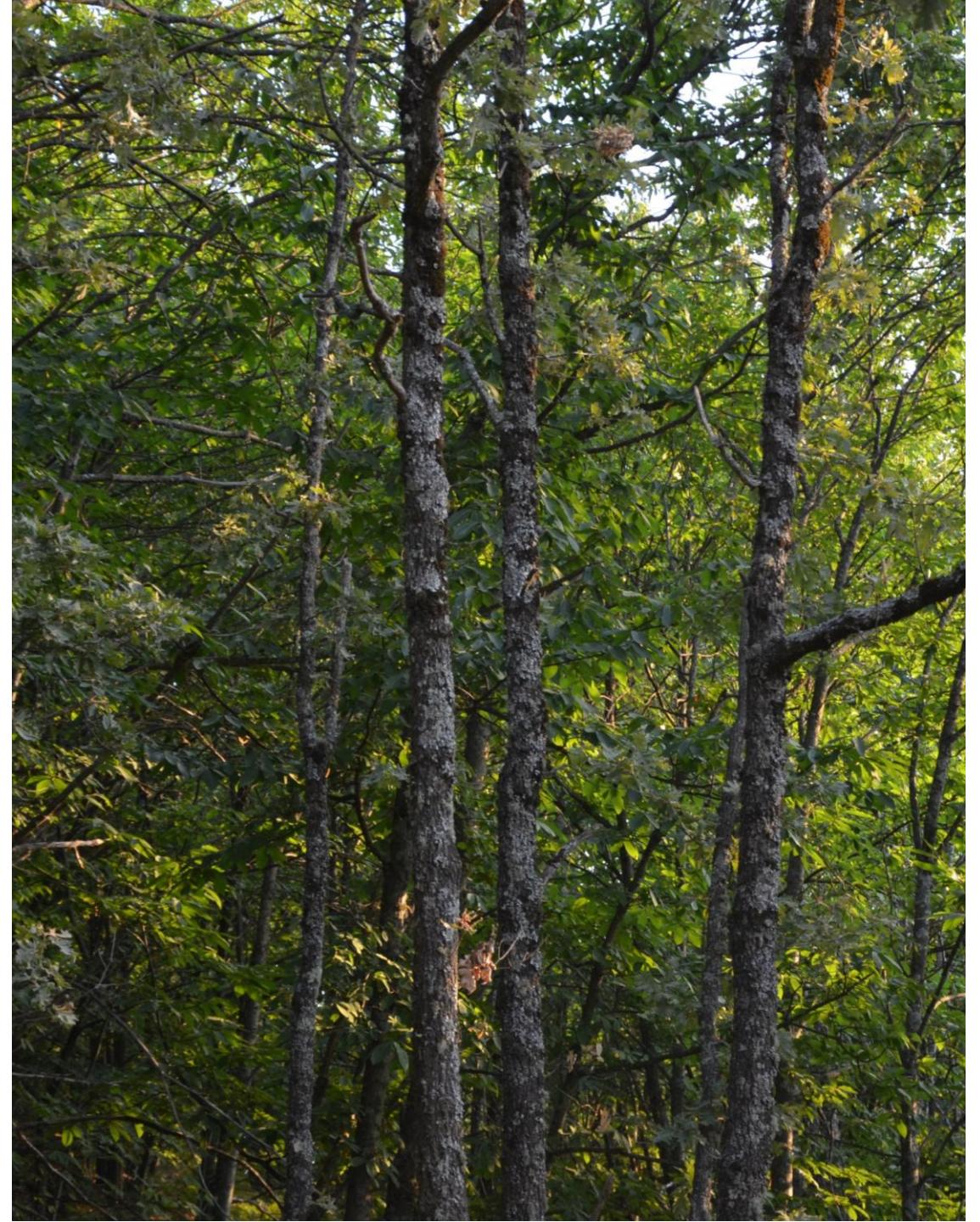


Site

SMART SYLVICULTURE

Sustainable
Mitigation
Adaptation
Resilient
Trade-offs

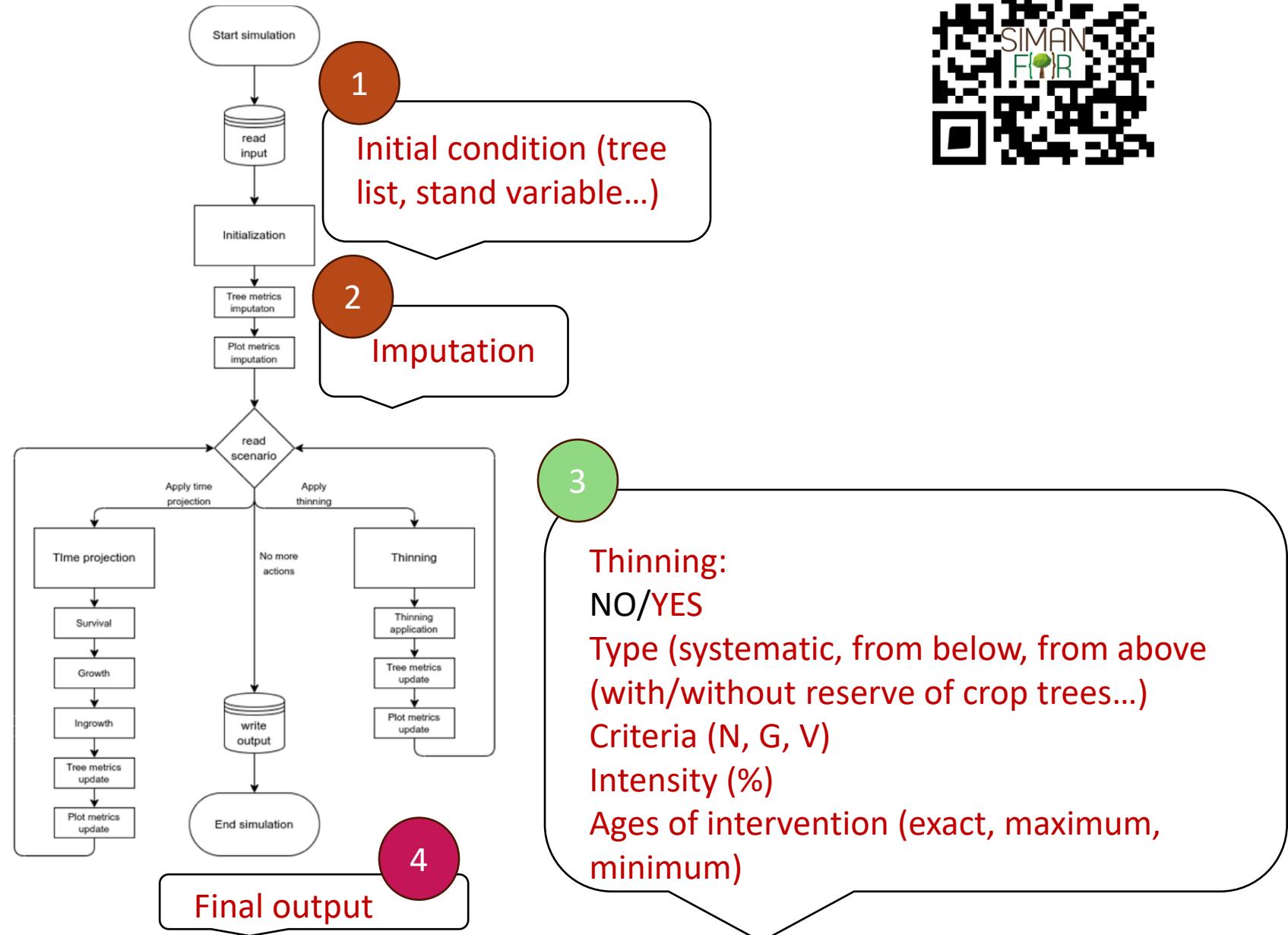
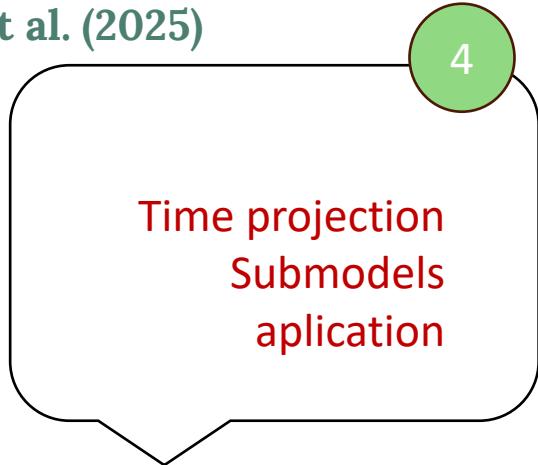
Management
paths



Synthetic data

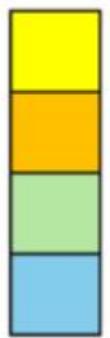


Bravo et al. (2025)

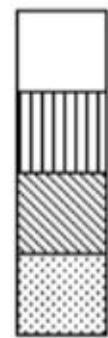




OPTFORESTS



species 1, provenance 1
species 1, provenance 2
species 2, provenance 1
species 2, provenance 2



treatment 1
treatment 2
treatment 3
treatment 4

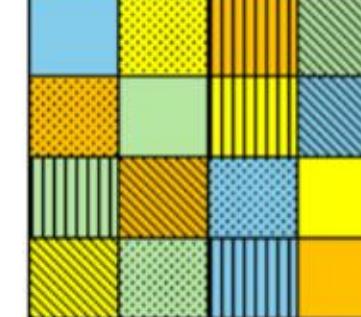
a) plot



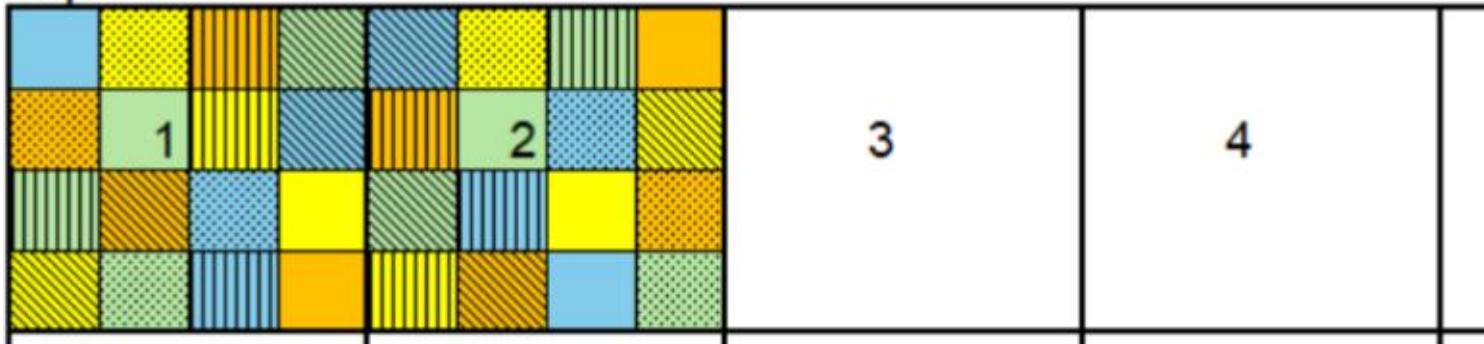
b) incomplete block



c) replicate



d) replicates



Questions? Let's talk

1. Can you describe three **strengths/weaknesses** for the proposed data gathering approaches?
2. Do you want to **explore** Forest Explorer?

Talk Funded by **Warnell School of Forestry and Natural Resources**,
University of Georgia



**Warnell School of Forestry
& Natural Resources**
UNIVERSITY OF GEORGIA

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Mixed Forests Management in Europe

Thank you!!

Felipe Bravo - felipe.bravo@uva.es

Universidad de Valladolid



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**SMART GLOBAL
ECOSYSTEMS**
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