# Resisting at the rear edge

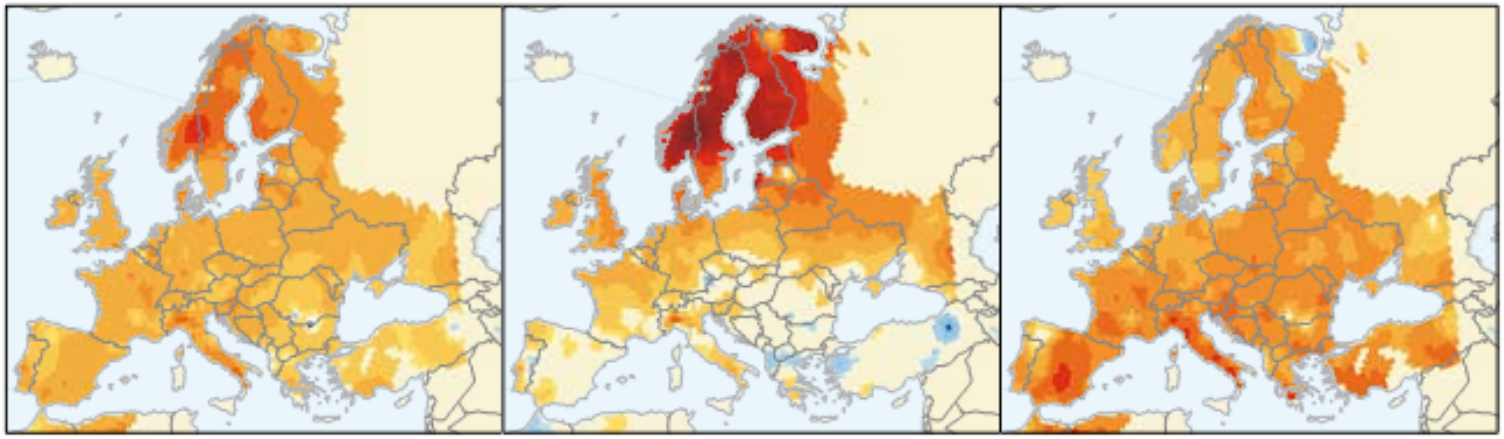
## Ecology and genetics of relict tree populations in southern Europe

**Arndt Hampe & Pedro Jordano**

**Estación Biológica de Doñana (CSIC), Sevilla**

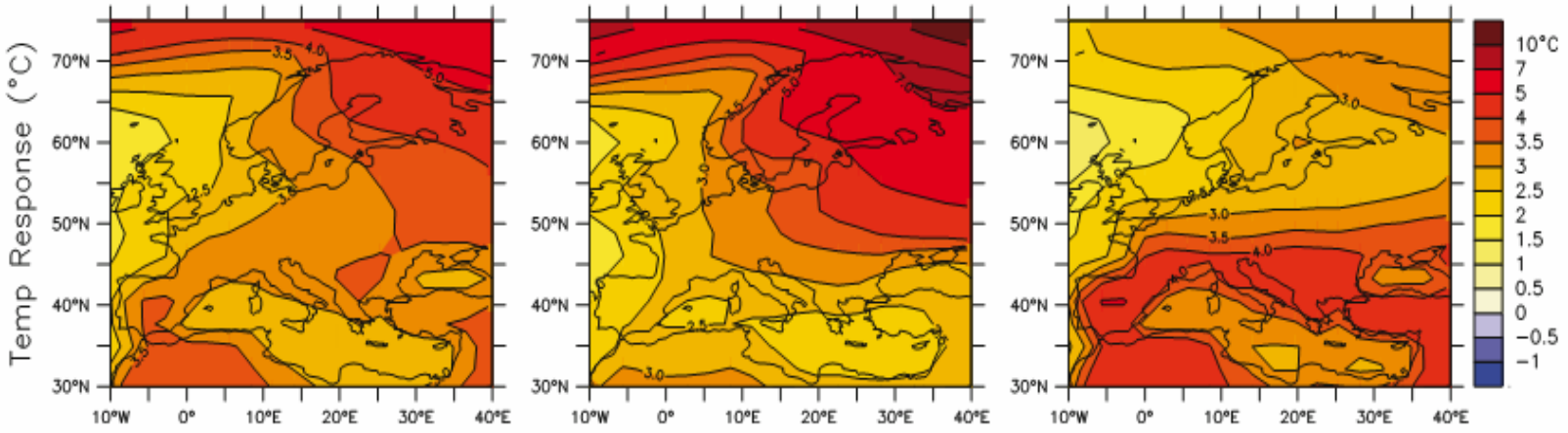
# Modern climate change over southern Europe

1976-2006



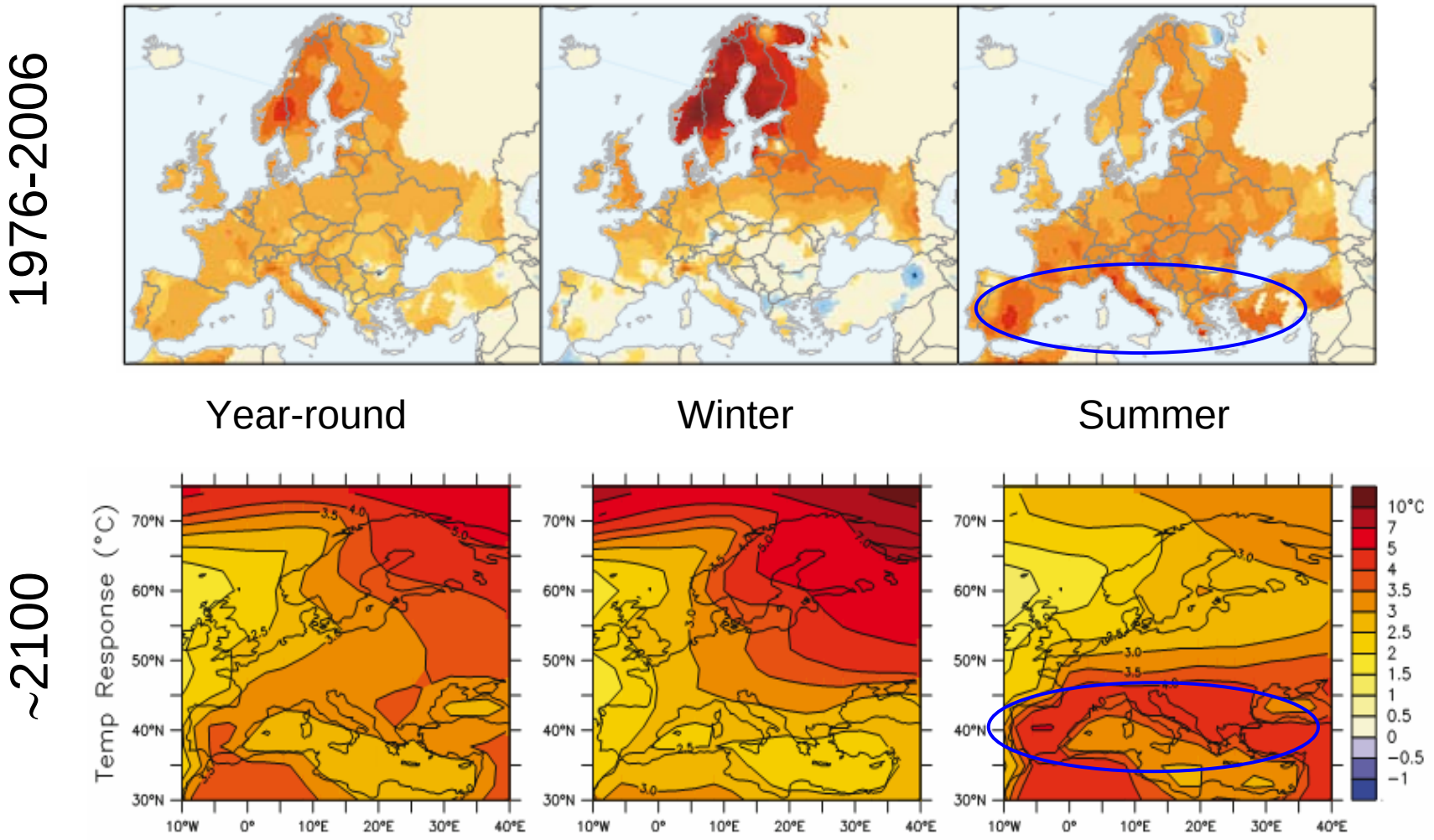
Year-round Winter Summer

~2100




EEA Report (2008) *Impacts of Europe's changing climate*

# Modern climate change over southern Europe




EEA Report (2008) *Impacts of Europe's changing climate*

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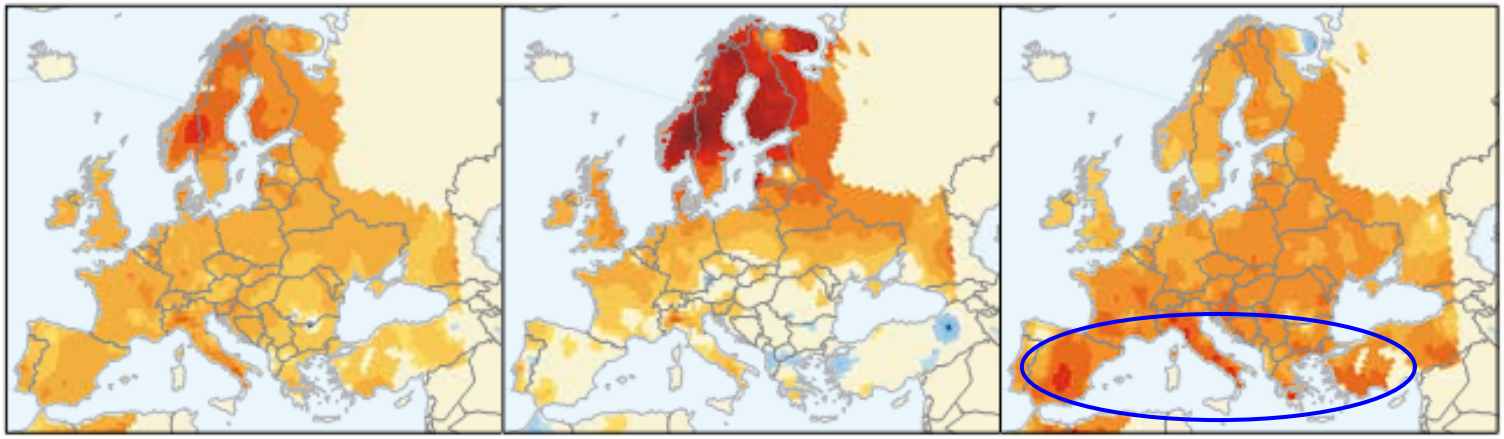

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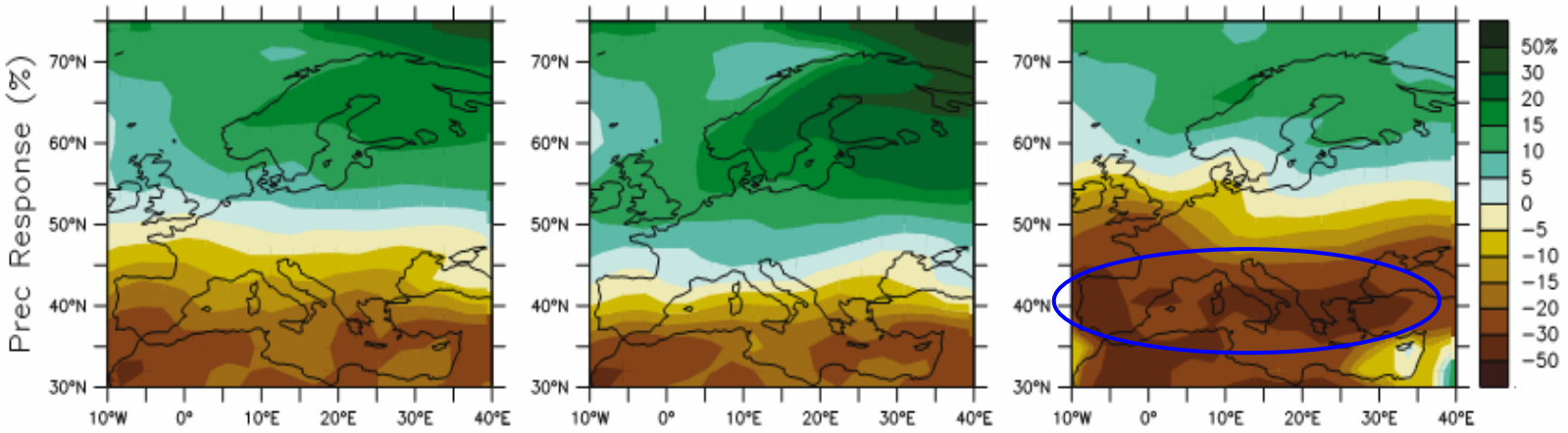
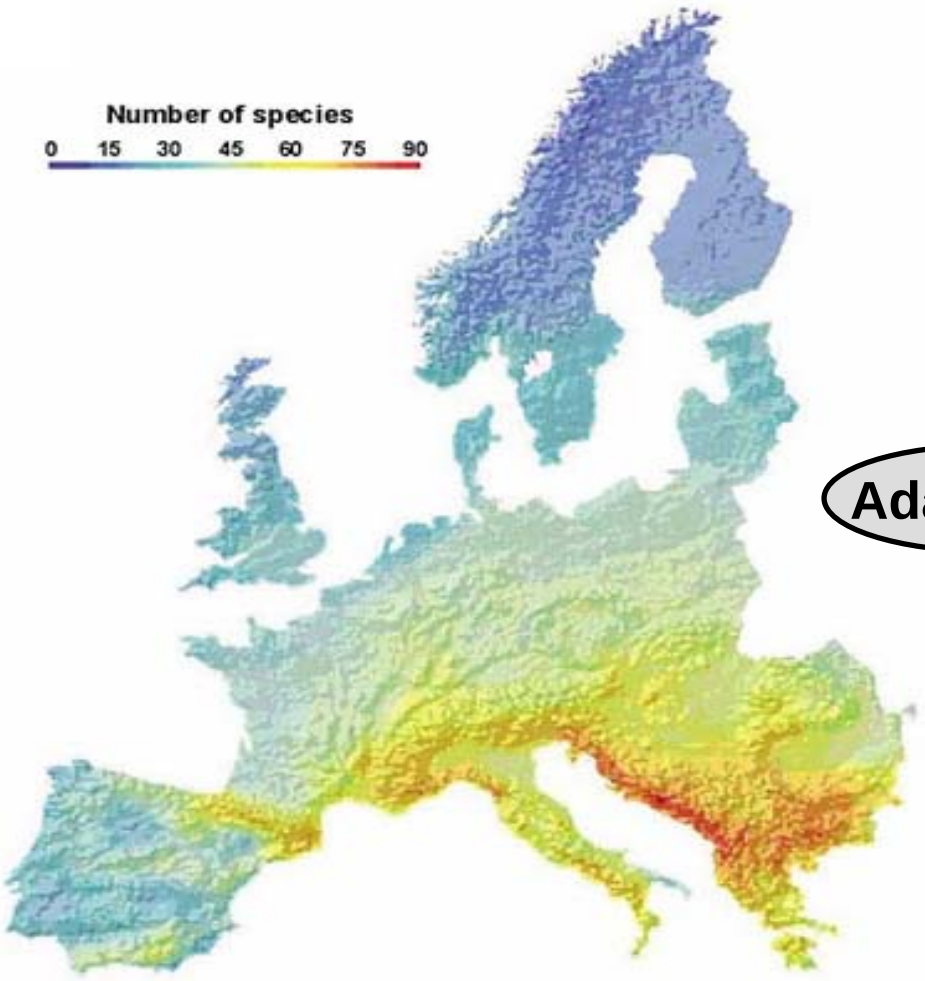
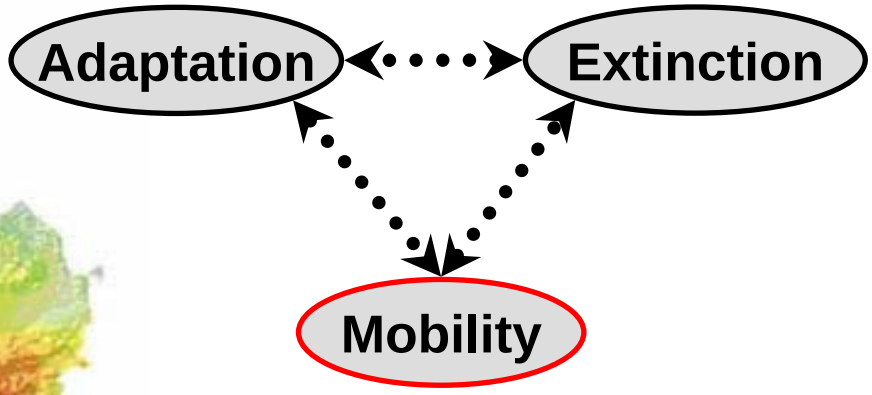



EEA Report (2008) *Impacts of Europe's changing climate*

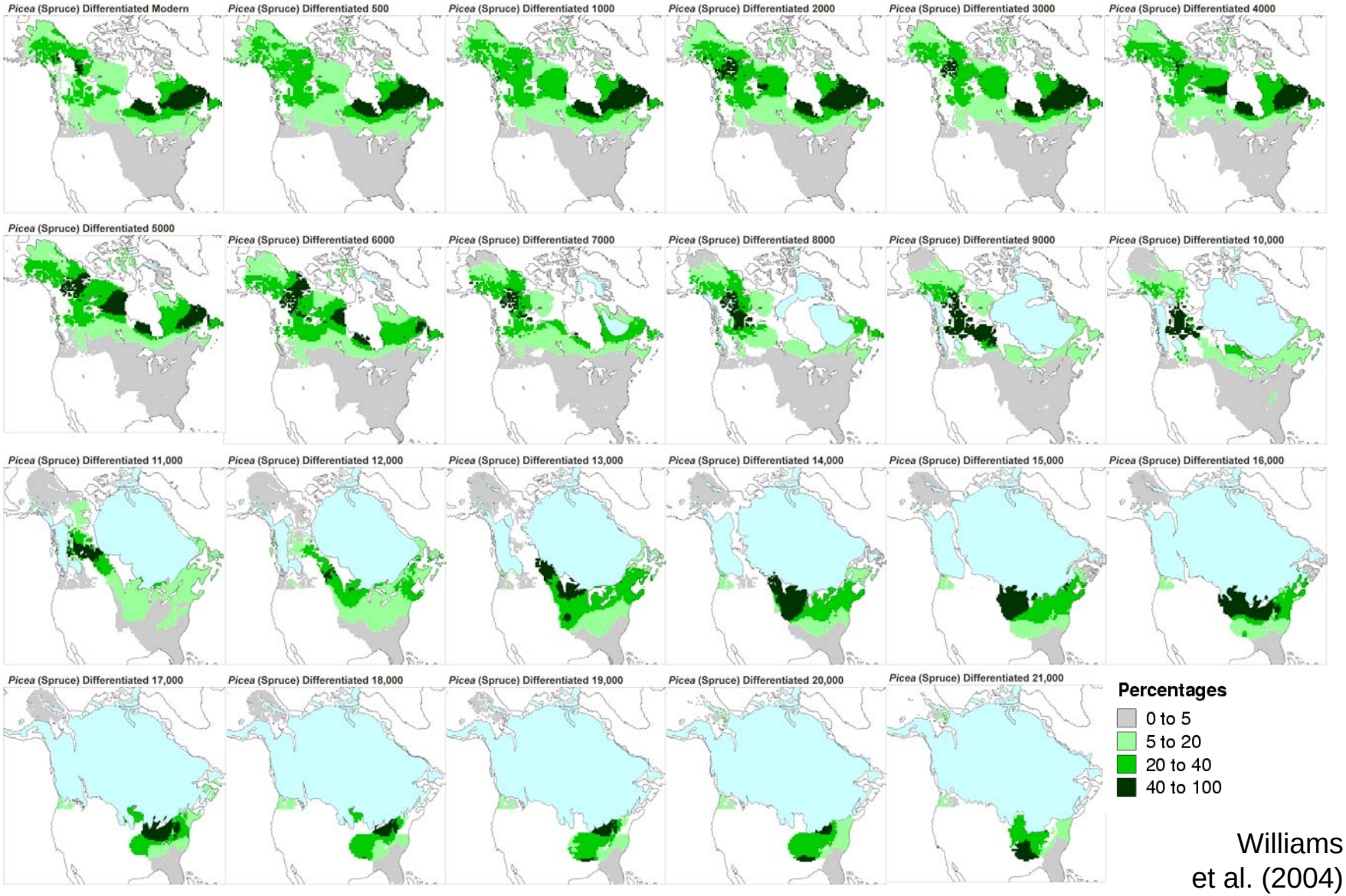
# How will climate change affect the tree flora of southern Europe?



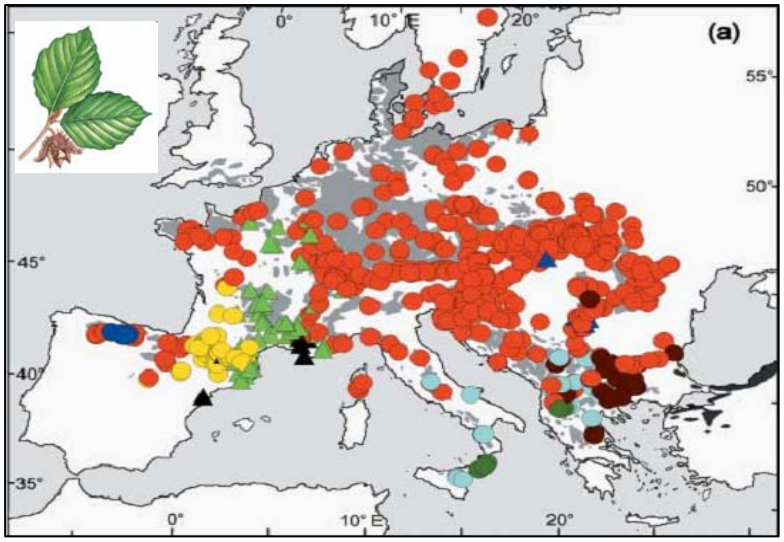

Montoya et al. (2007) *Ecography*

# Trees seem capable of important range shifts



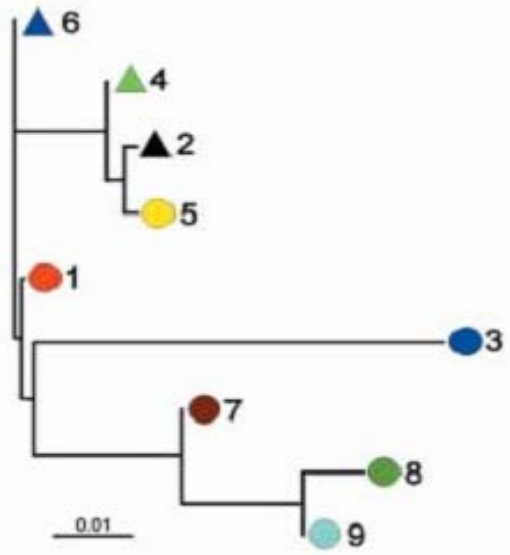

Williams
et al. (2004)
*Ecol Monogr*

# But range shifts = loss of genetic richness




Magri et al. (2006) *New Phytol*

D. Magri



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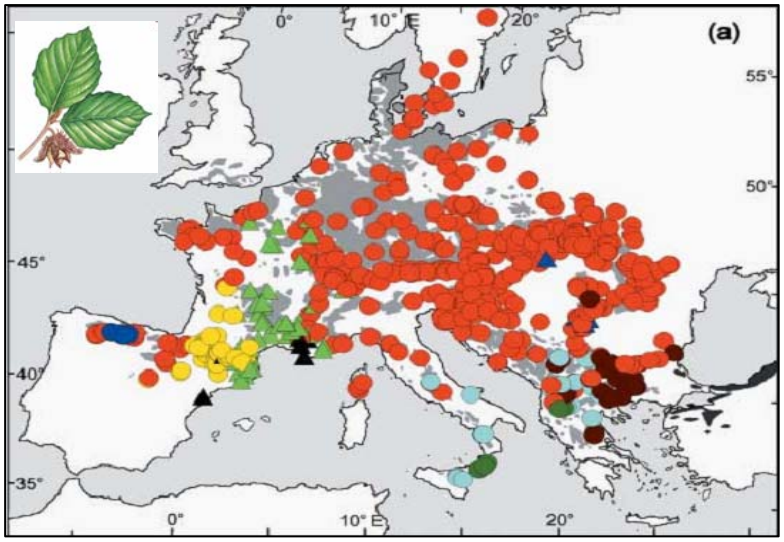
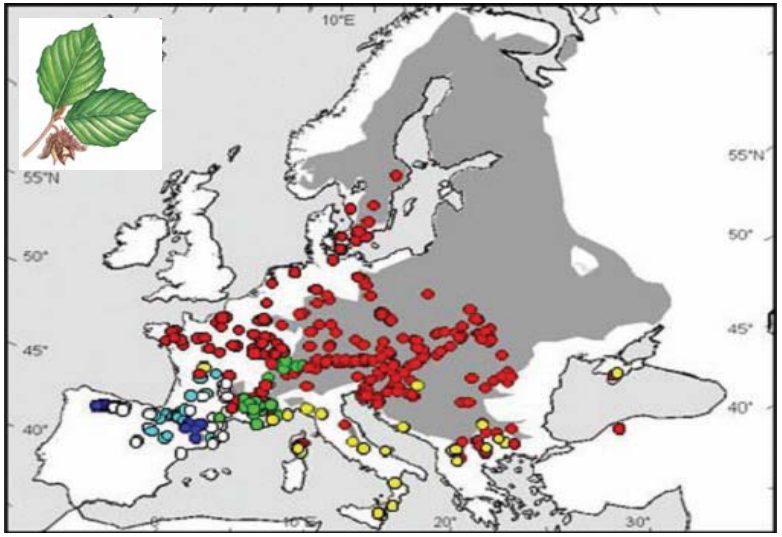
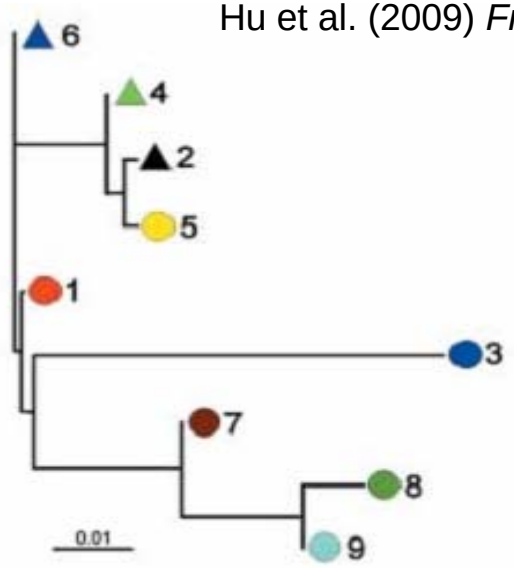



Magri et al. (2006) *New Phytol*

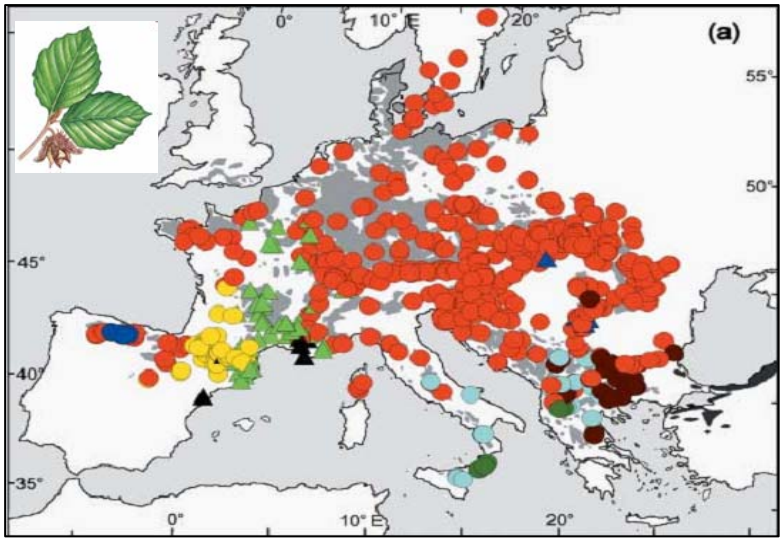



Hu et al. (2009) *Frontiers Ecol Environ*

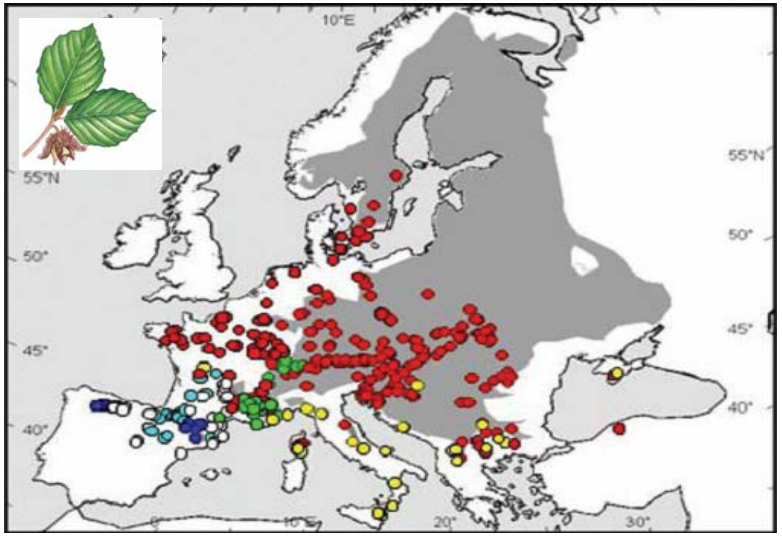
D. Magri



# But range shifts = loss of genetic richness




Magri et al. (2006) *New Phytol*

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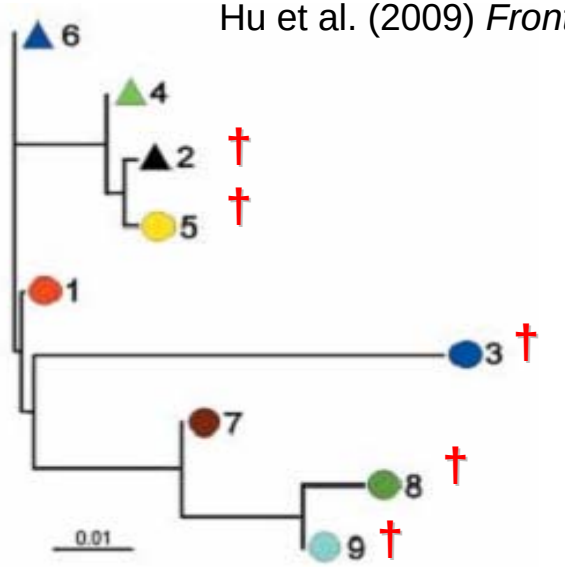
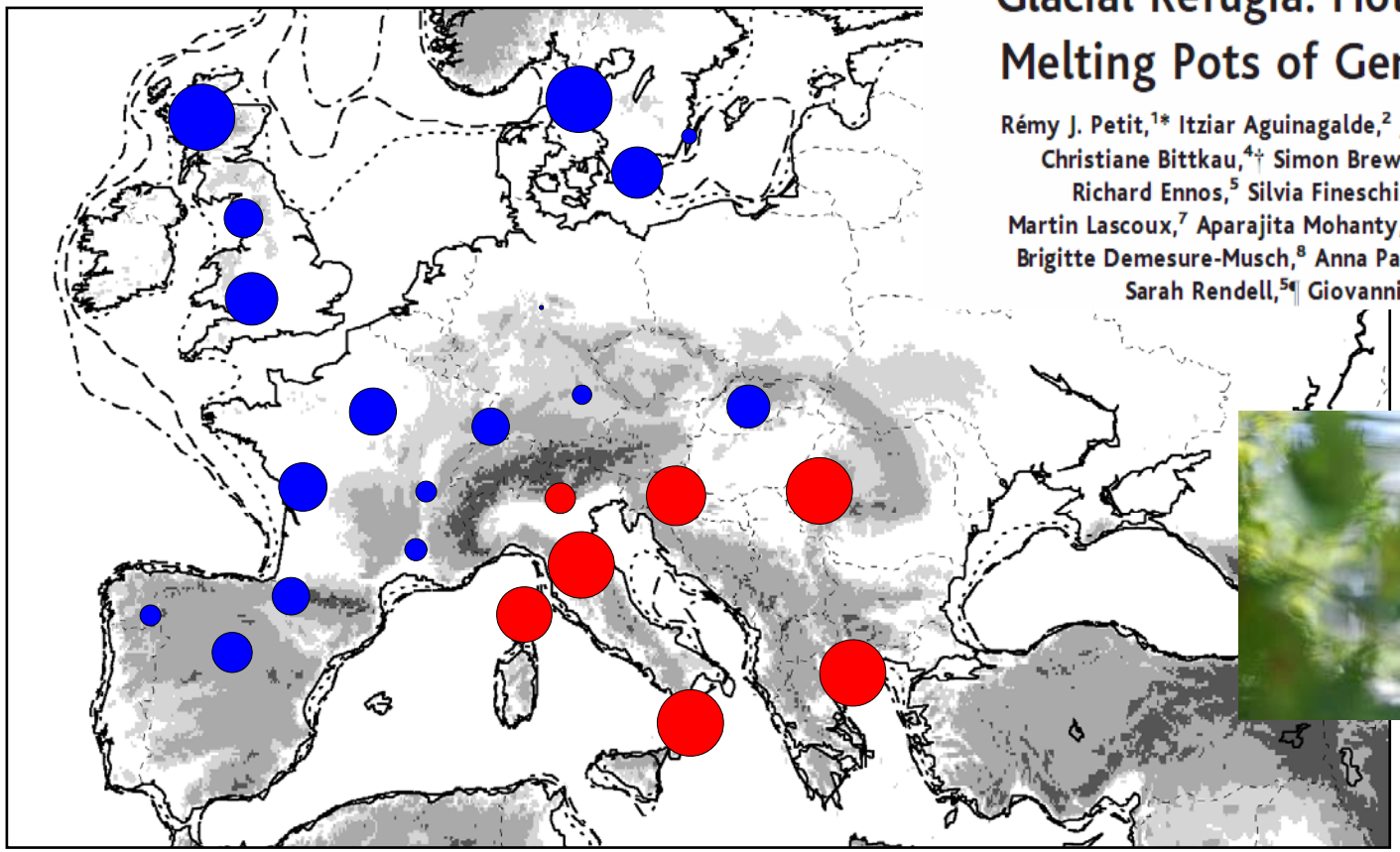


# This loss would be generalized

SCIENCE VOL 300 6 JUNE 2003

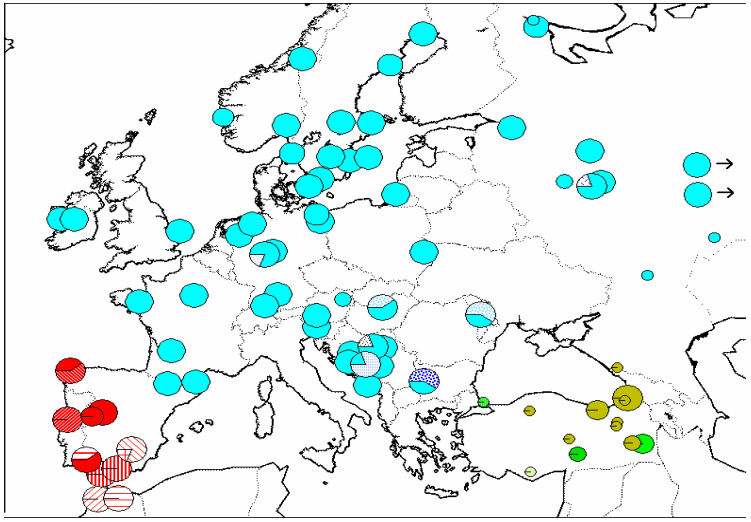


## Glacial Refugia: Hotspots but Not Melting Pots of Genetic Diversity

Rémy J. Petit,[1*] Itziar Aguinagalde,[2] Jacques-Louis de Beaulieu,[3] Christiane Bittkau,[4†] Simon Brewer,[3‡] Rachid Cheddadi,[3] Richard Ennos,[5] Silvia Fineschi,[6] Delphine Grivet,[1§] Martin Lascoux,[7] Aparajita Mohanty,[2‖] Gerhard Müller-Starck,[4] Brigitte Demesure-Musch,[8] Anna Palmé,[7] Juan Pedro Martín,[2] Sarah Rendell,[5¶] Giovanni G. Vendramin[9]

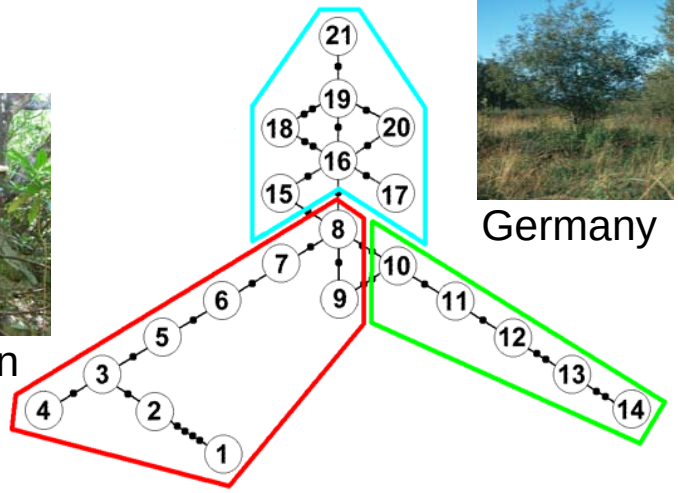
R. Petit

# An example with *Frangula alnus*



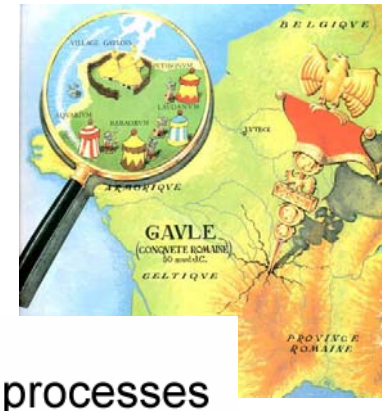
S Spain

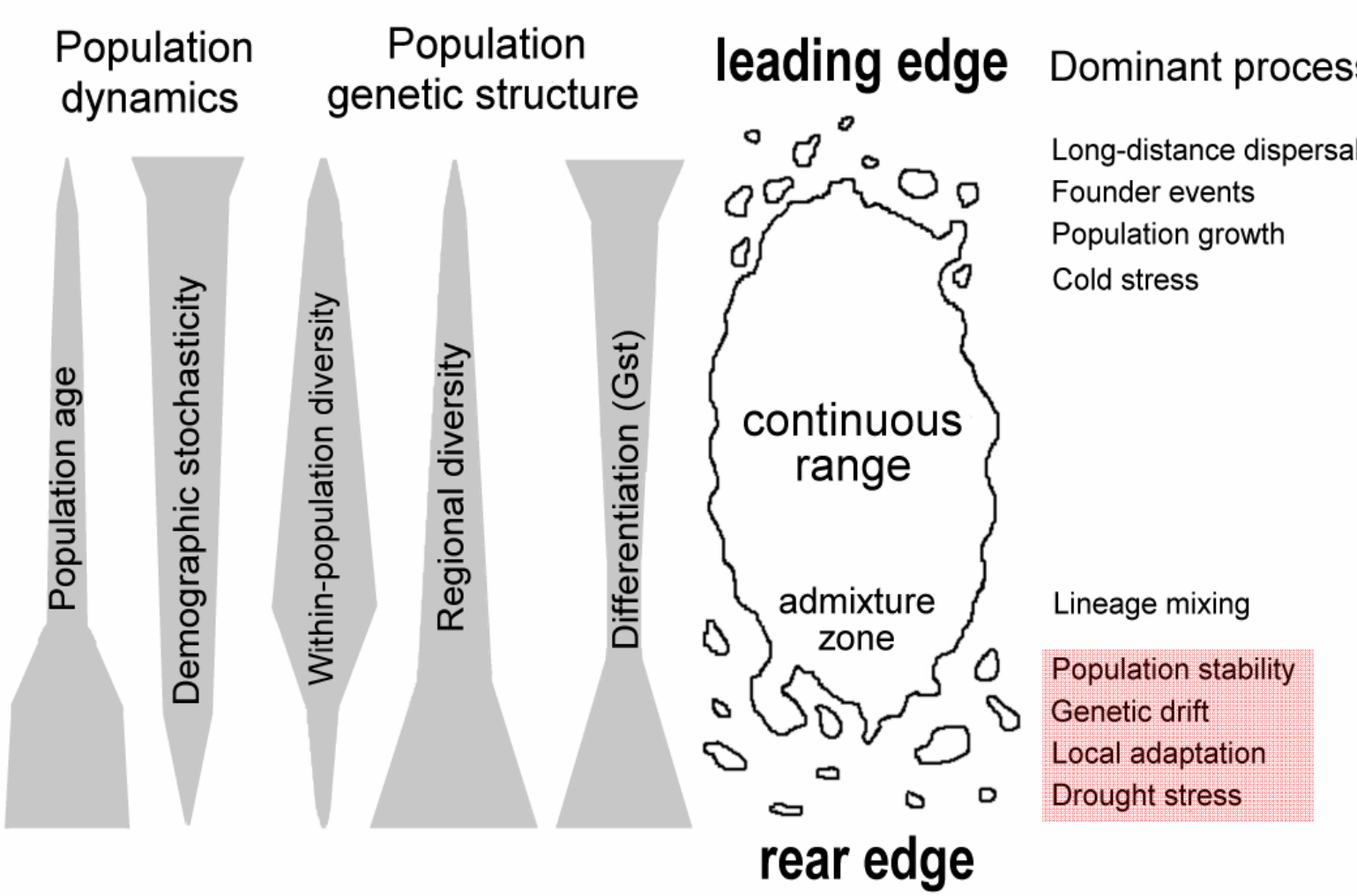
Germany




Hampe et al. (2003) *Mol Ecol*

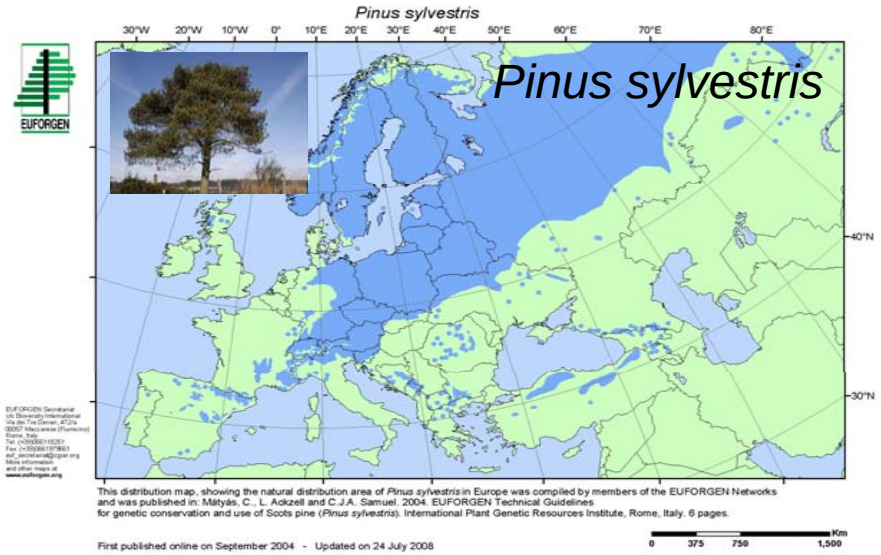
# The “rear edge”

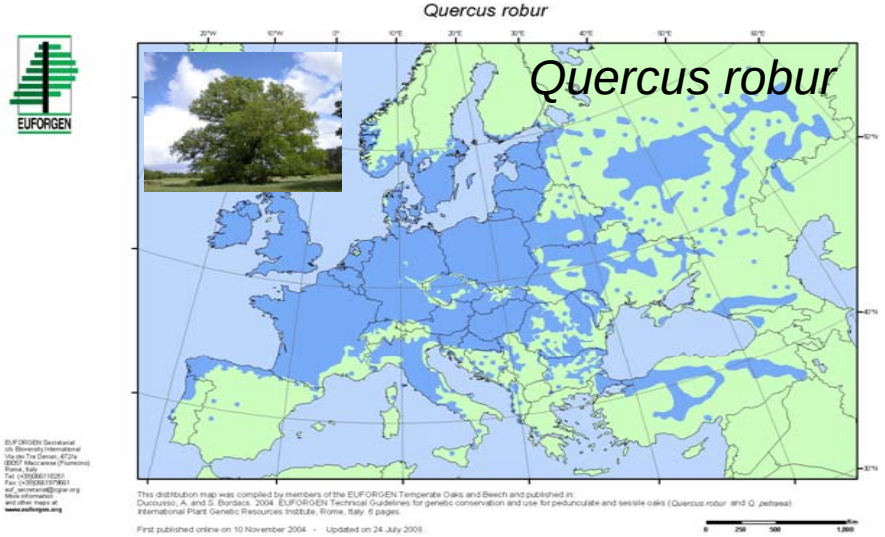


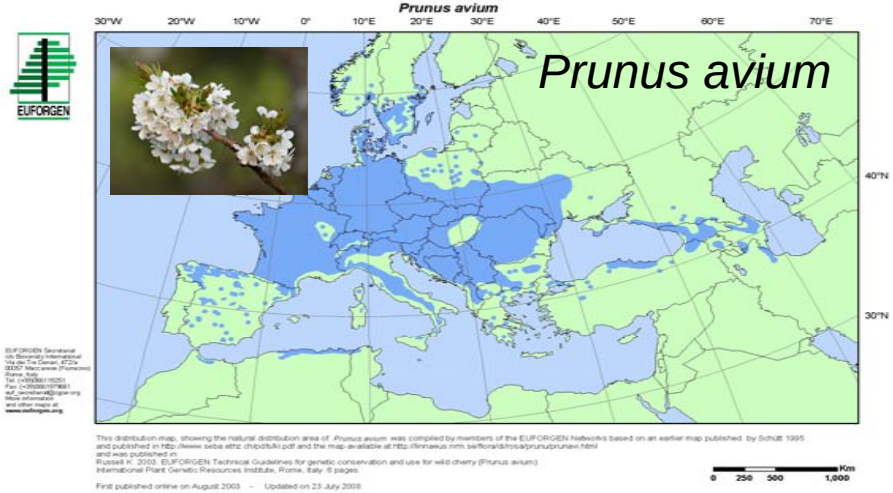




Hampe & Petit (2005) *Ecol Lett*

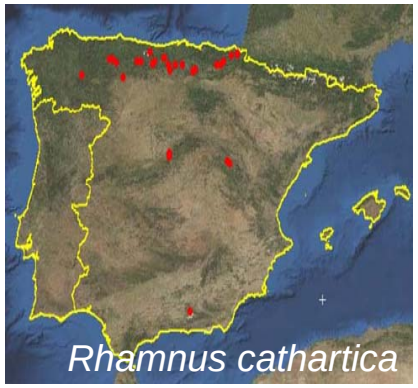
# Most (or all) widespread European trees have a rear edge

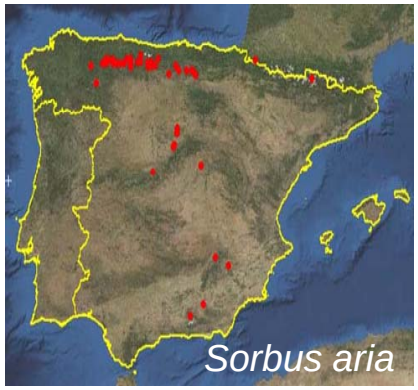


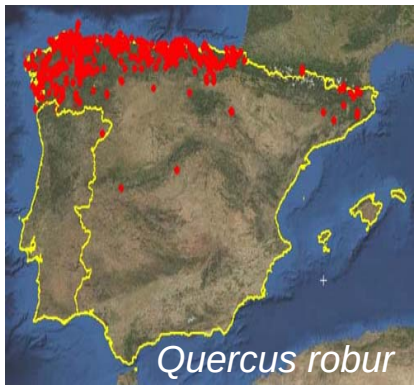



# A close-up on Iberian trees





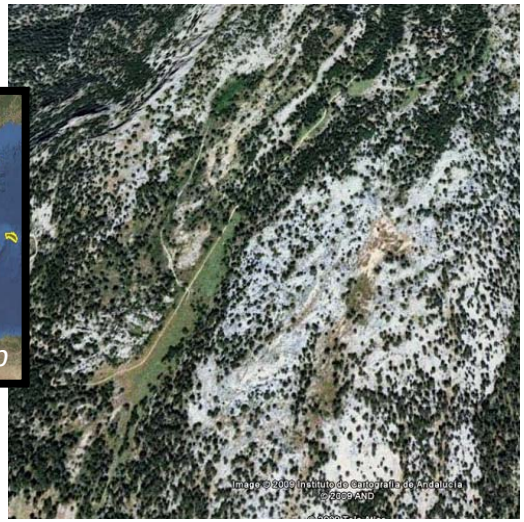







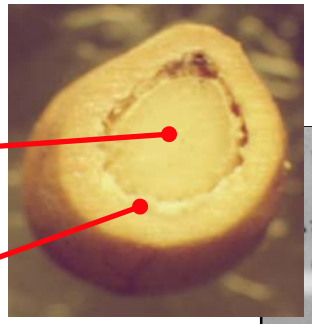


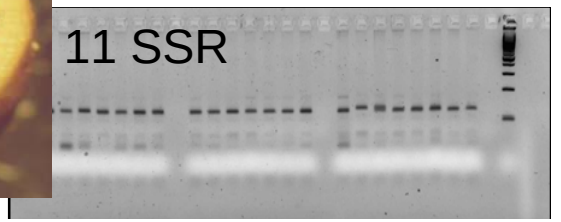
# *Prunus mahaleb* in the Sierra *de Cazorla*

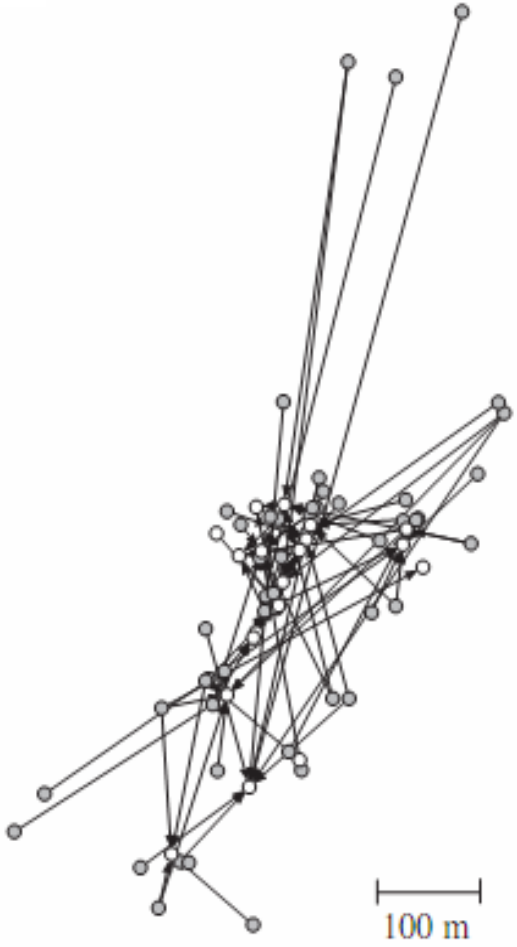


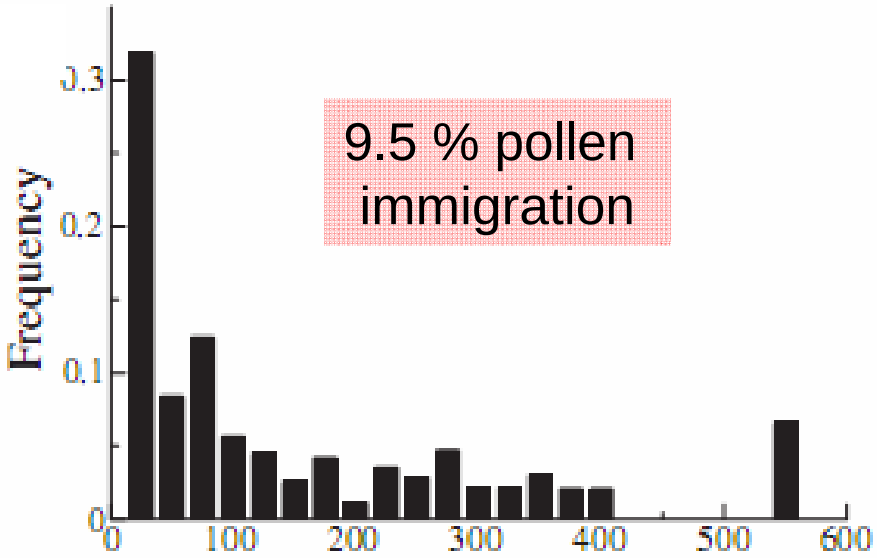
seed traps



# *P. mahaleb*: spatial patterns of pollination

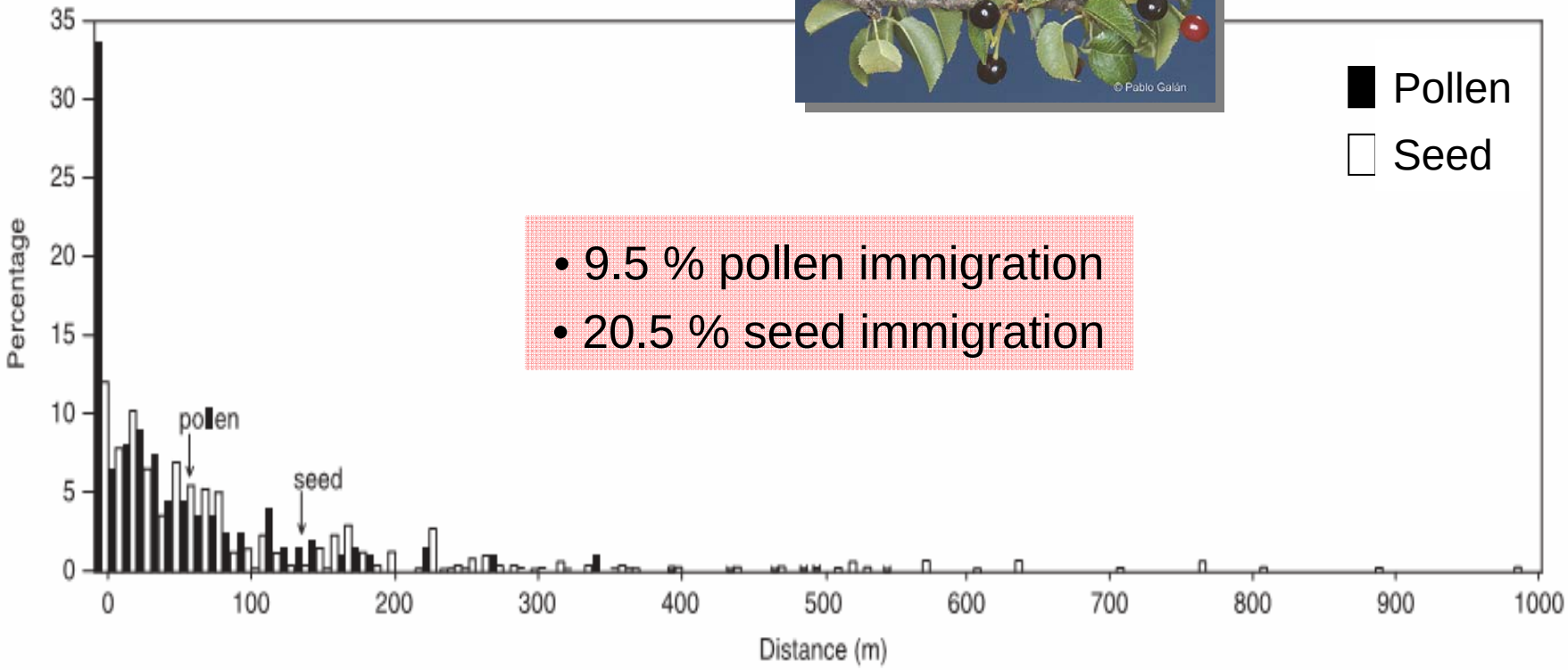



9.5 % pollen immigration

García et al. (2005) *Mol Ecol*

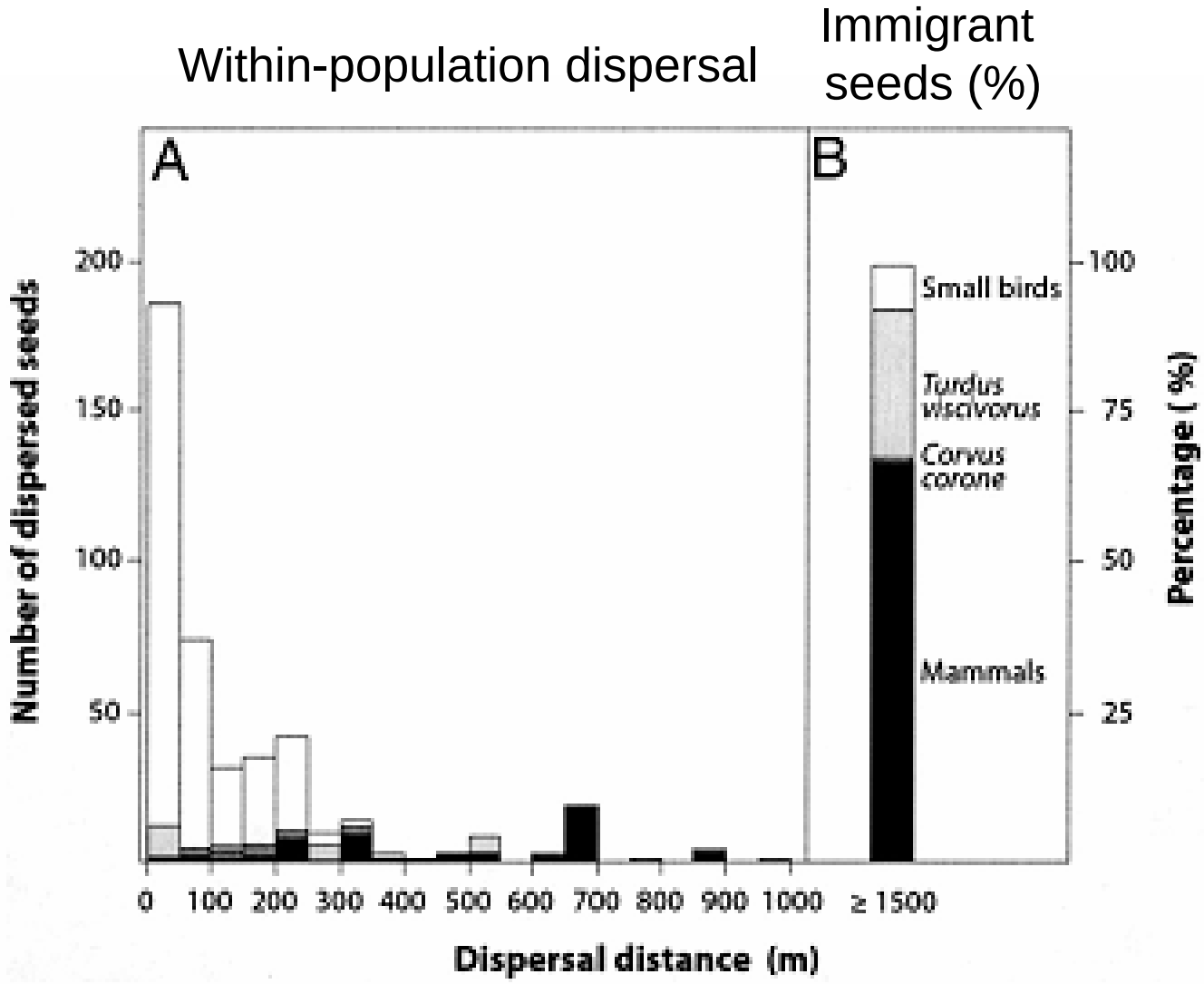
# *P. mahaleb*: pollination and seed dispersal


- 9.5 % pollen immigration
- 20.5 % seed immigration

García et al. (2007) *Mol Ecol*

# *P. mahaleb*: the role of different seed dispersers




Jordano et al. (2007) *PNAS*

# *P. mahaleb*: Putting the pieces together

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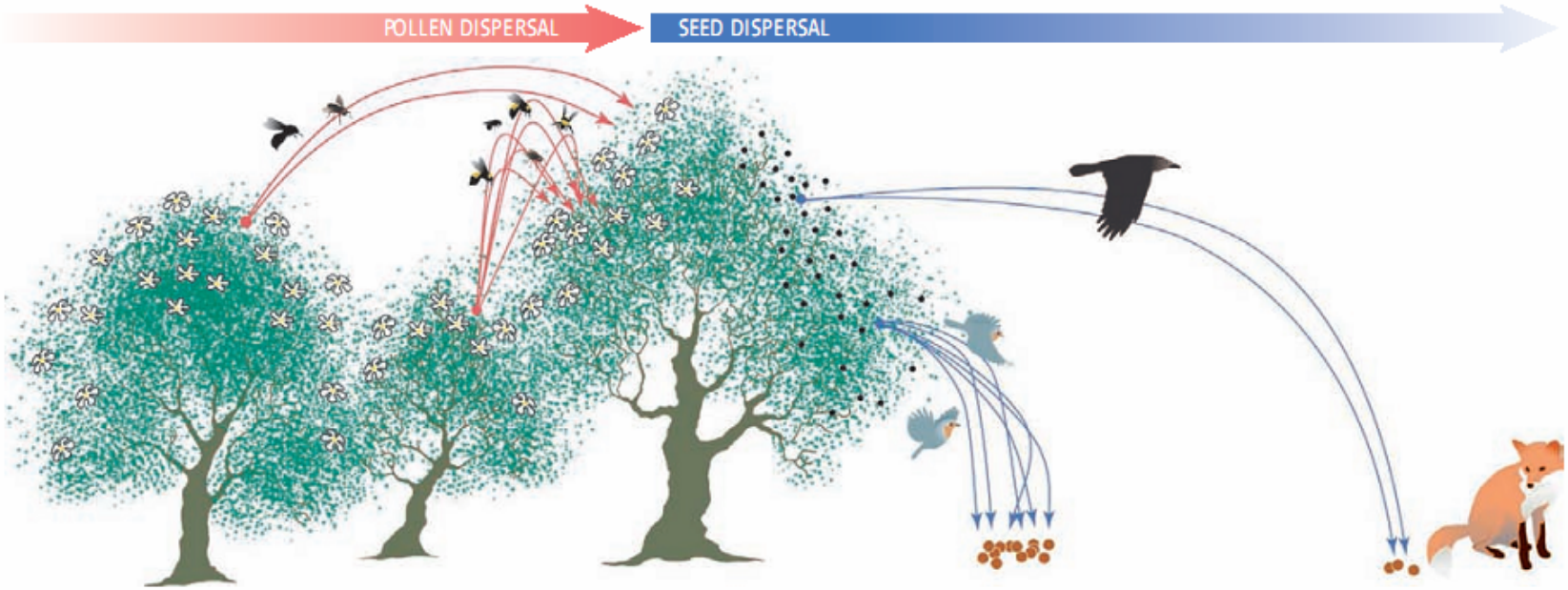
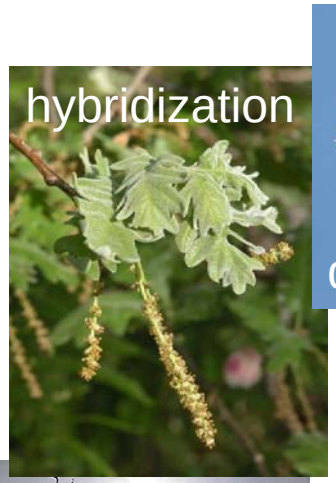
ECOLOGY

## How the Wood Moves

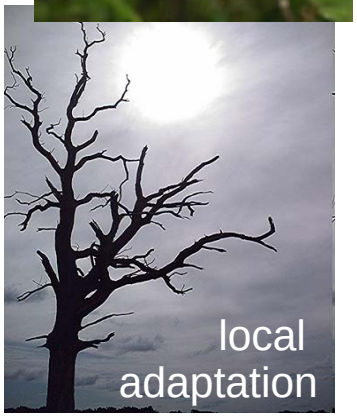
Katriona Shea

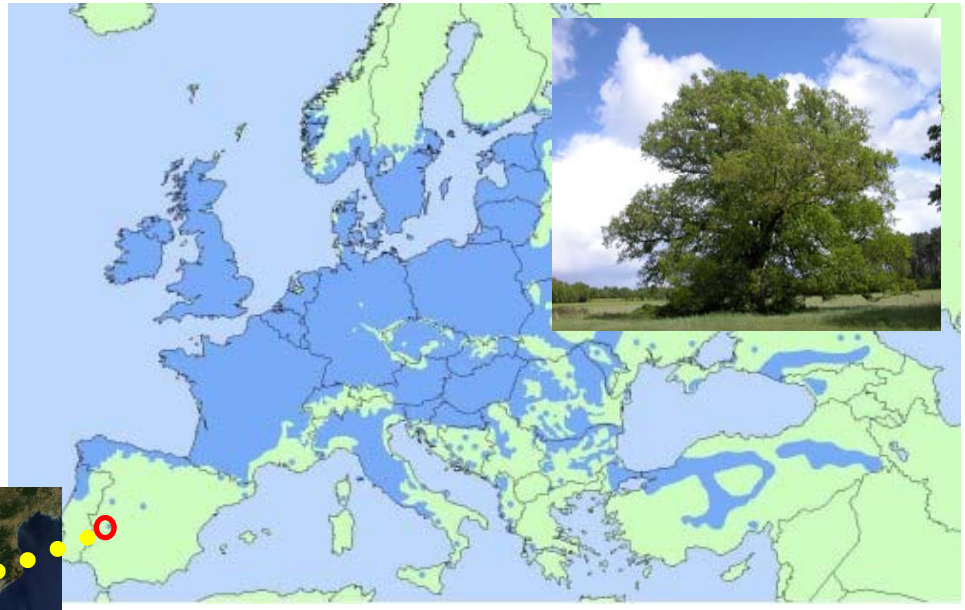


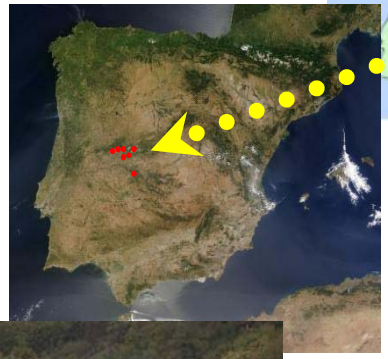
# *Quercus robur* relict stands in Extremadura

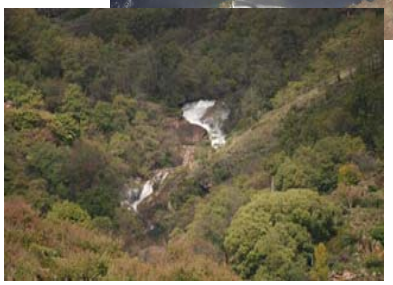






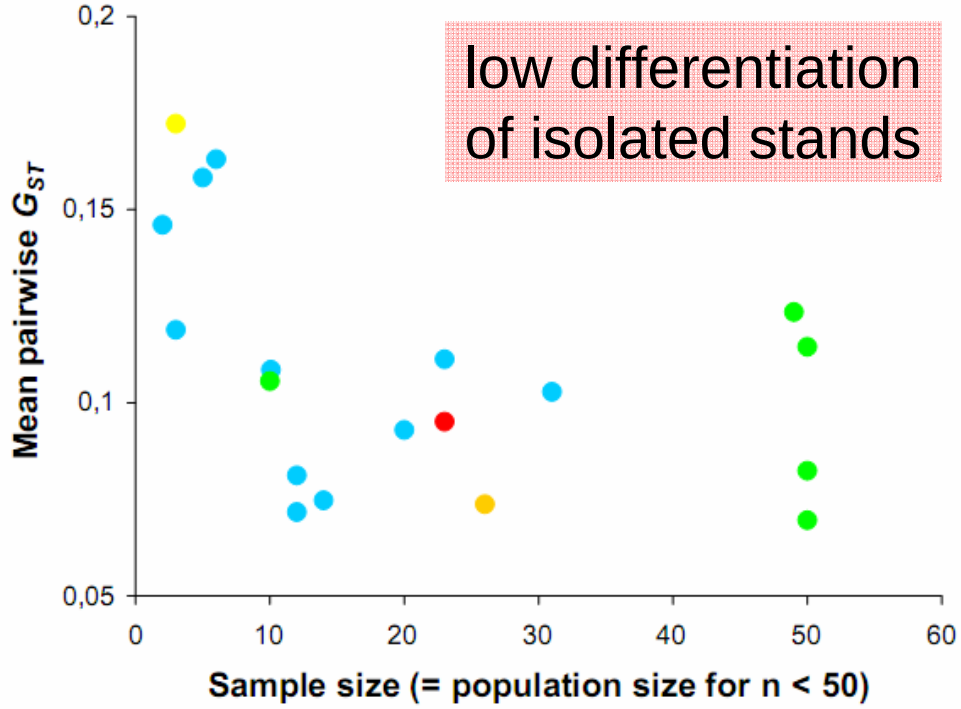





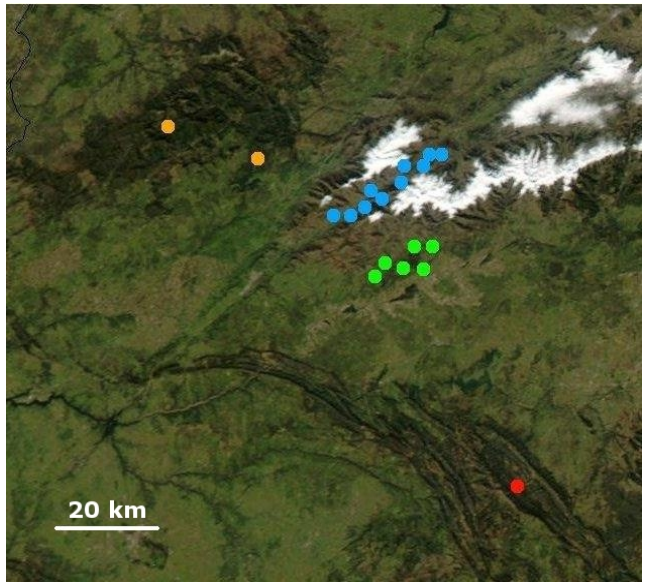


- 19 populations
- 3 to >400 adults
- Different environments
- Different levels of spatial isolation

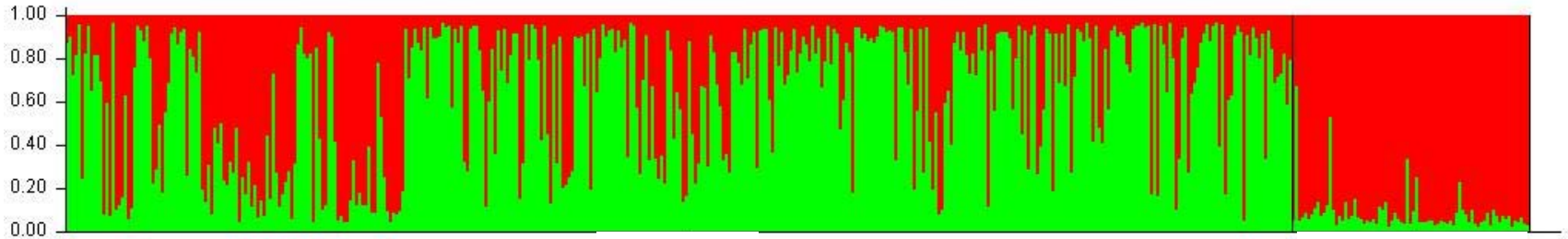
# First results suggest extensive gene flow




low differentiation of isolated stands

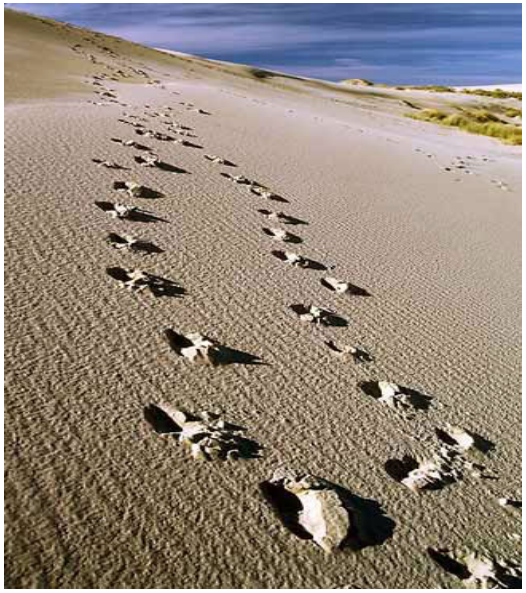


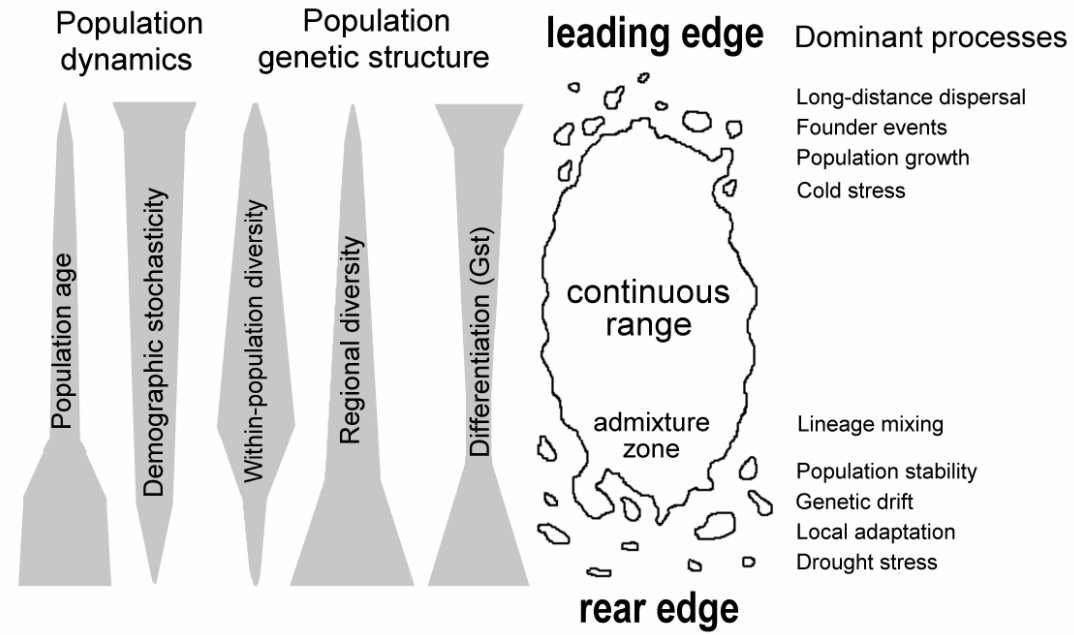

frequent hybridization




*Q. robur* *Q. pyrenaica*

# Rear edge populations: what are the perspectives?






Global Change Biology (2009) **15**, 1557–1569, doi: 10.1111/j.1365-2486.2008.01766.x

**Climate change and plant distribution: local models predict high-elevation persistence**

CHRISTOPHE F. RANDIN*, ROBIN ENGLER*, SIGNE NORMAND†, MASSIMILIANO ZAPPA‡, NIKLAUS E. ZIMMERMANN‡, PETER B. PEARMAN*, PASCAL VITTOZ§, WILFRIED THUILLER¶ and ANTOINE GUISAN*

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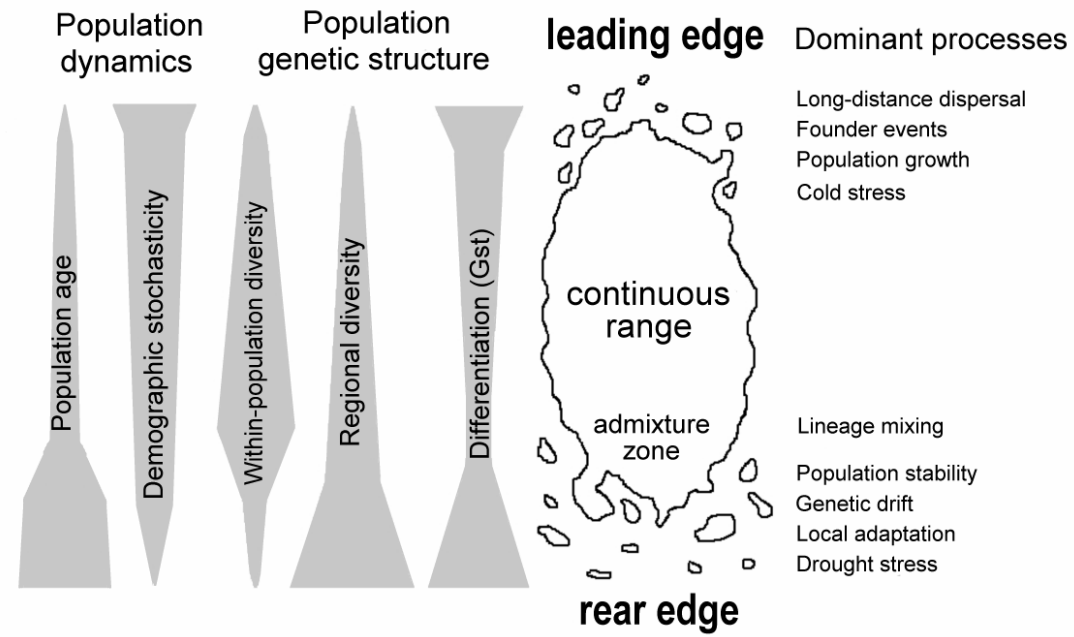


# Acknowledgements


B i o G e C o

Biodiversité, gènes & communautés


Rémy Petit

Integrative Ecology Group, Sevilla


evoltree

MARIE CURIE ACTIONS

GOBIERNO DE ESPAÑA

MINISTERIO DE CIENCIA E INNOVACIÓN