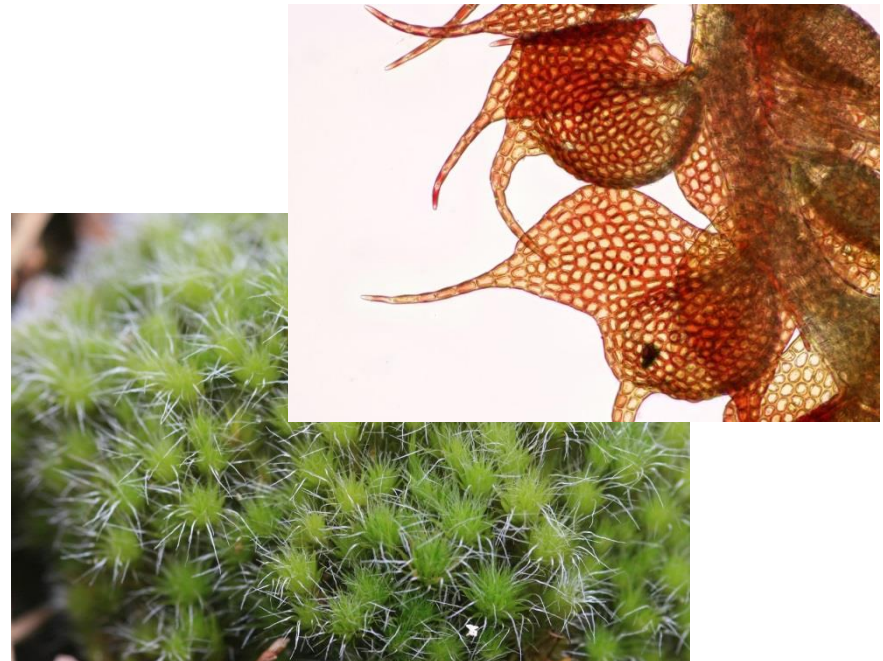


# Introduced tree species in forest: implications for biodiversity

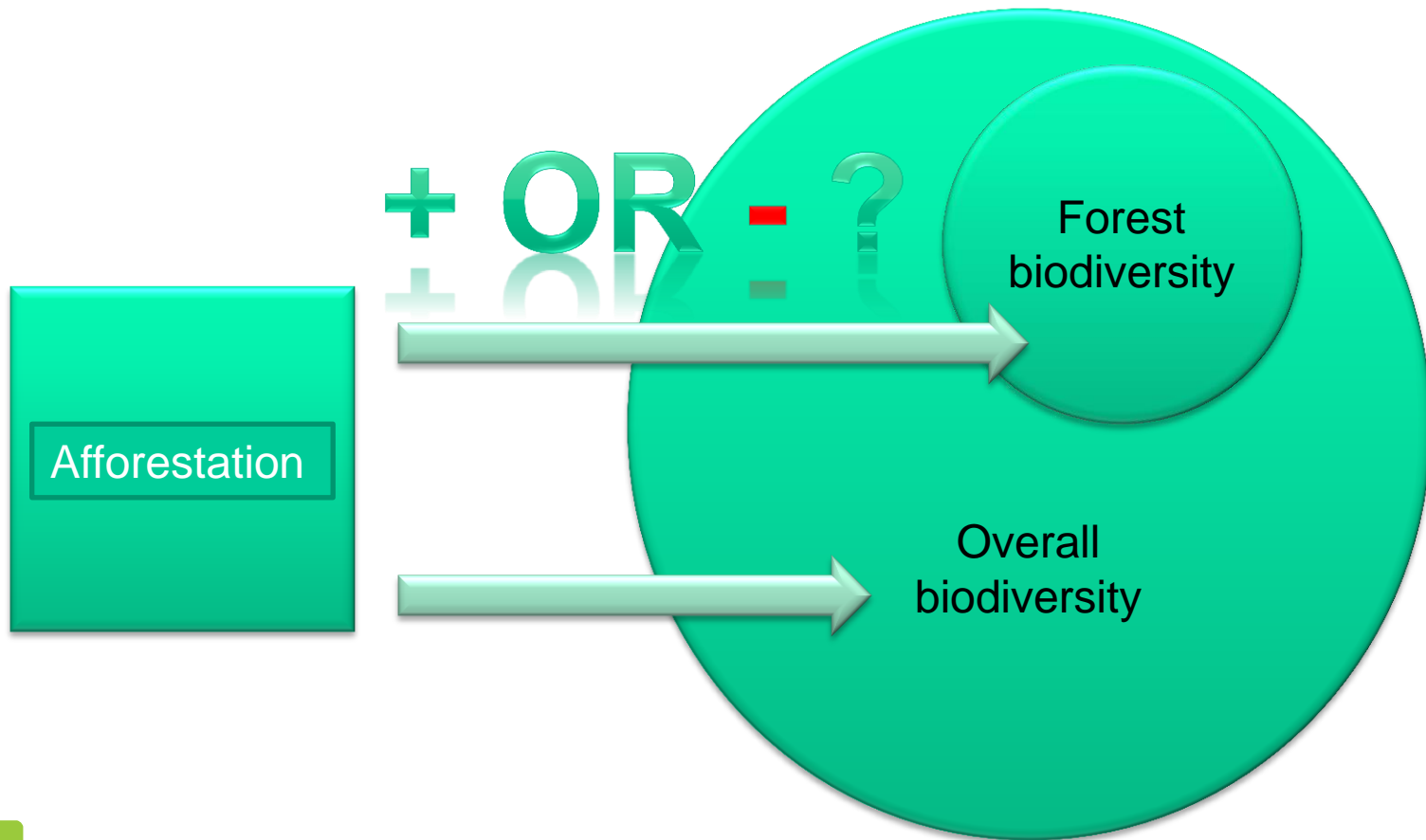
Yann Dumas, Irstea – Nogent-sur-Vernisson, France



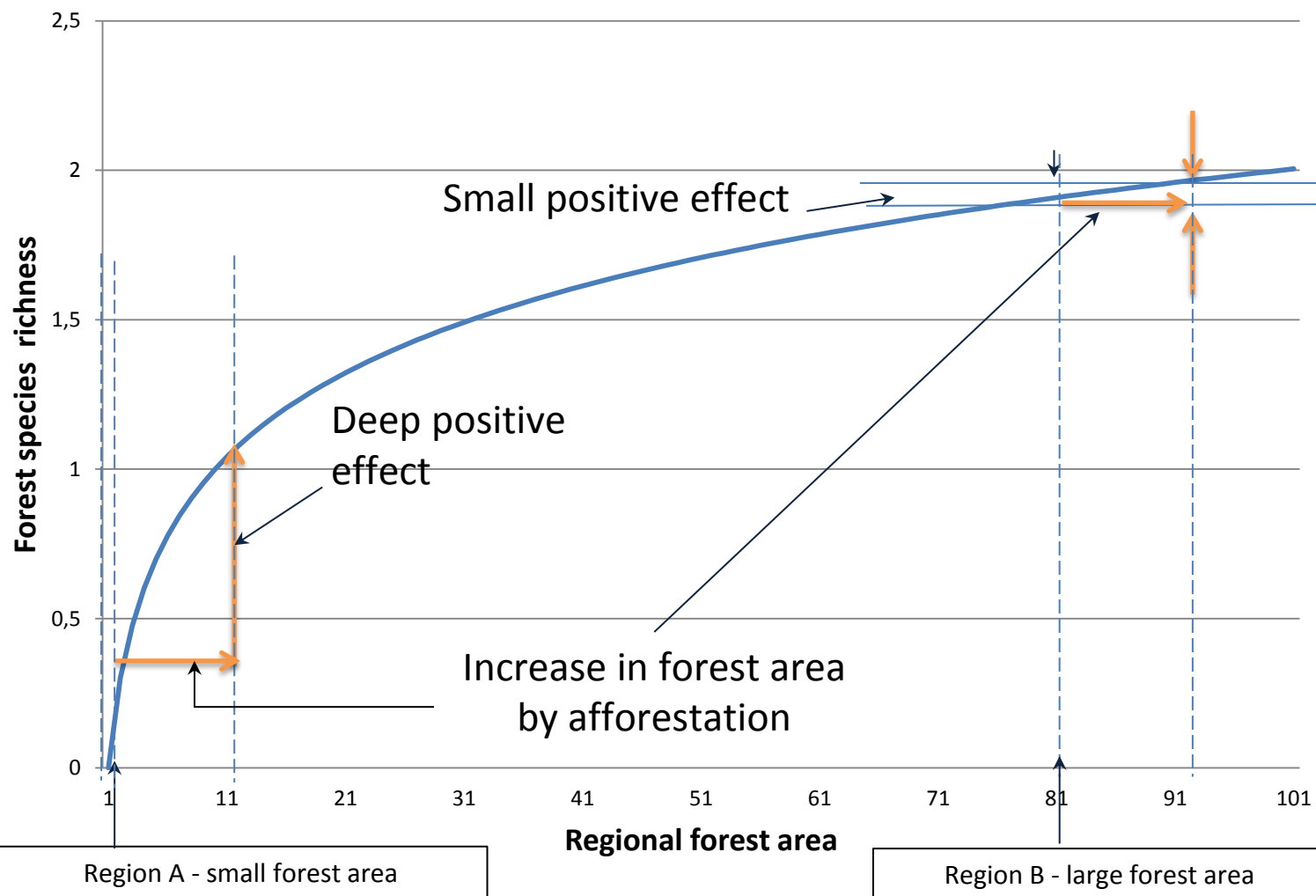
[www.irstea.fr](http://www.irstea.fr)

**Introduced tree species to European forests: challenges and opportunities  
2<sup>nd</sup> – 5<sup>th</sup> November 2016 – Monte Verità, Ascona, Ticino, Switzerland**

# Effects of afforestation on biodiversity



# Effects of afforestation on forest biodiversity depend on the geographical context



# Effect of afforestation on overall biodiversity

Afforestation  
achieved on



Moorland  
Grassland  
Bogs

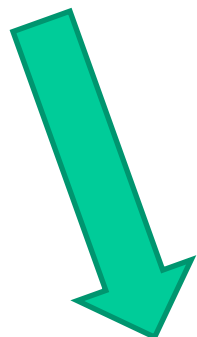
- High heritage value species

Replaced by



Forest  
species

Effect on  
overall  
biodiversity



- Urbanized zone
- Intensive agricultural land
  - Ruderals species, cosmopolitan species

Replaced by

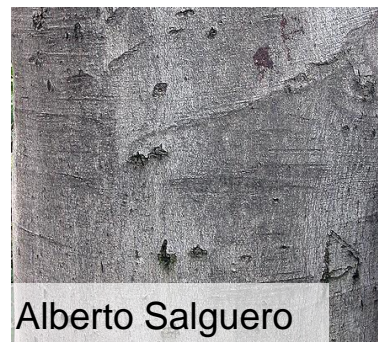


Forest  
species



# Differences between tree species

## Chemical and physical traits of bark and litter



## Microclimate under tree species (light level,...)



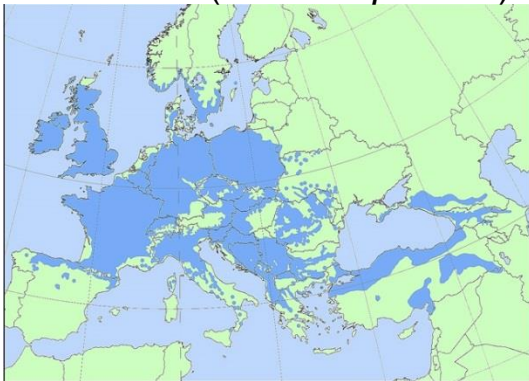
**Introduced tree species to European forests: challenges and opportunities**  
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# Co-evolution phenomenon

Tree species range (Euforgen source)

Sessile oak (*Quercus petraea*)



Scotch pine (*Pinus sylvestris*)



Black pine (*Pinus nigra*)

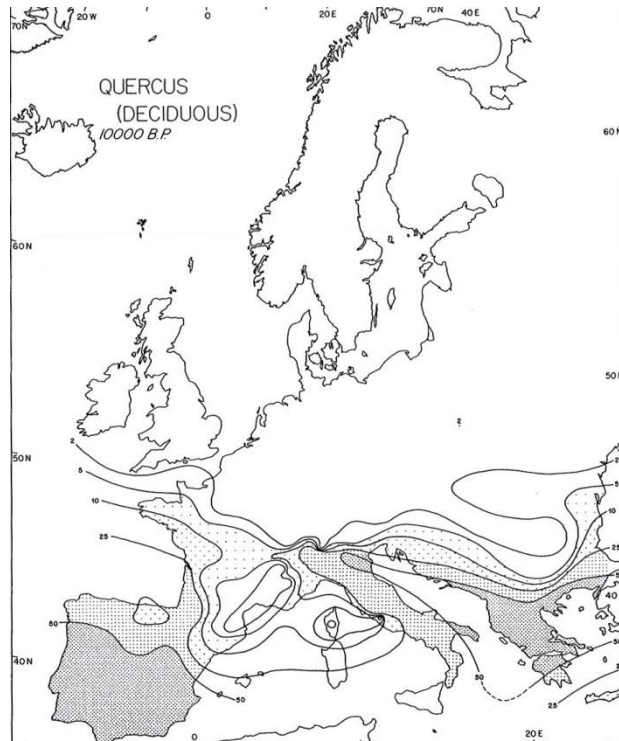


Spanish fir (*Abies pinsapo*)



# Co-evolution phenomenon

## Oak and associated biodiversity, a long history

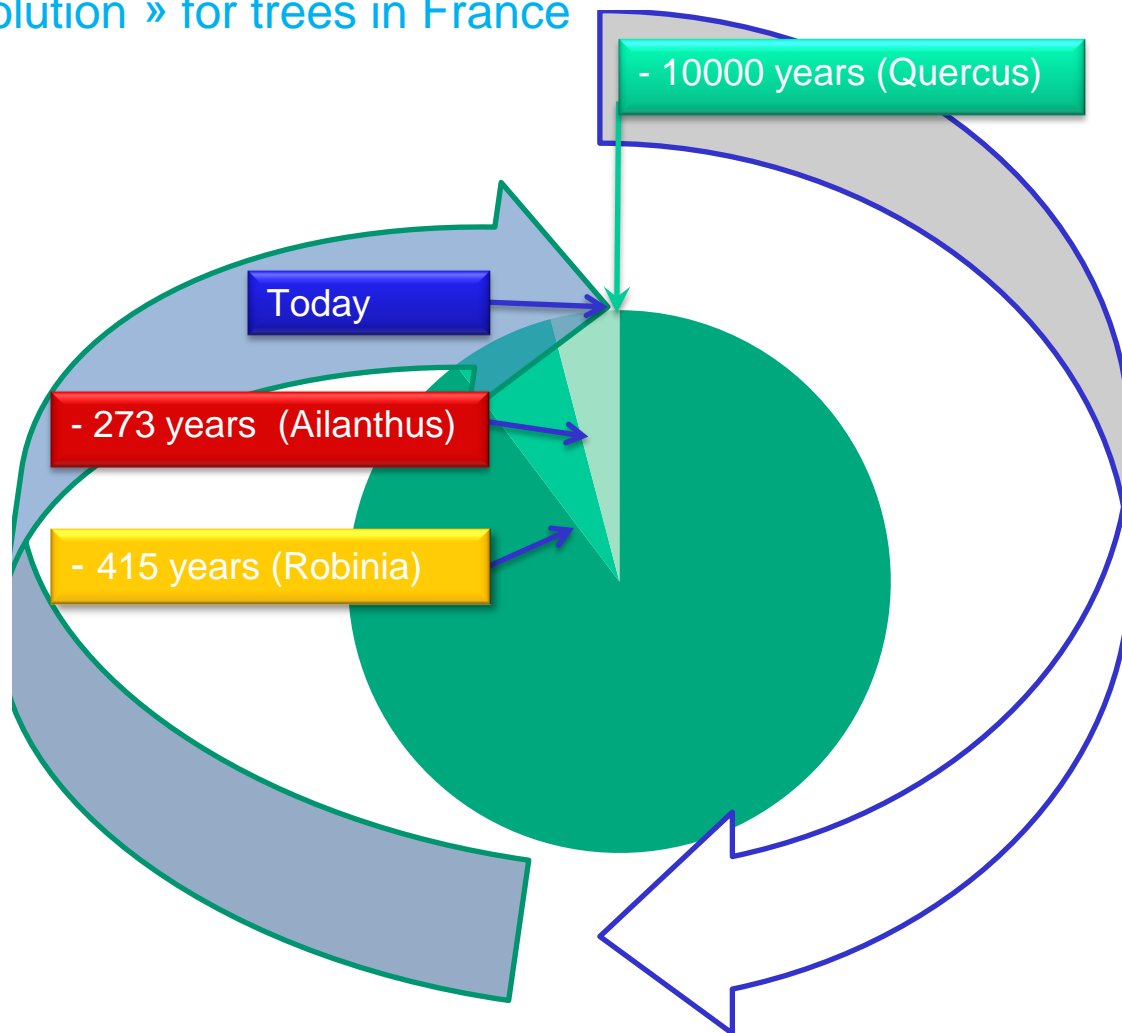


10000 years BP oak species colonize the north of Europe starting with the south-west France

Huntley B. and Birk H.J.B. (1983)

# Co-evolution phenomenon

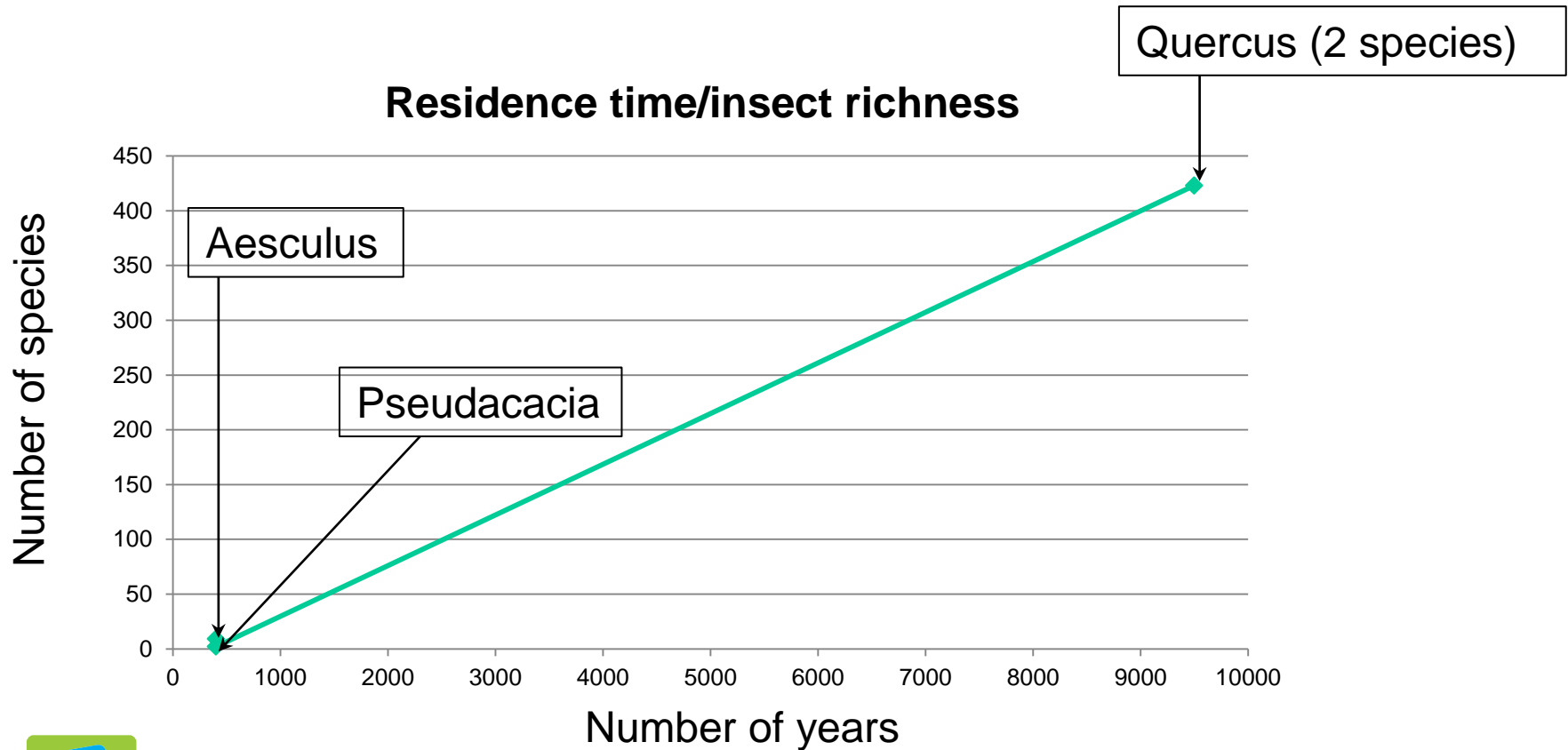
A « clock of co-evolution » for trees in France





# Co-evolution phenomenon

Relationship between residence time and richness in Britain  
(Kennedy and Southwood, 1984)

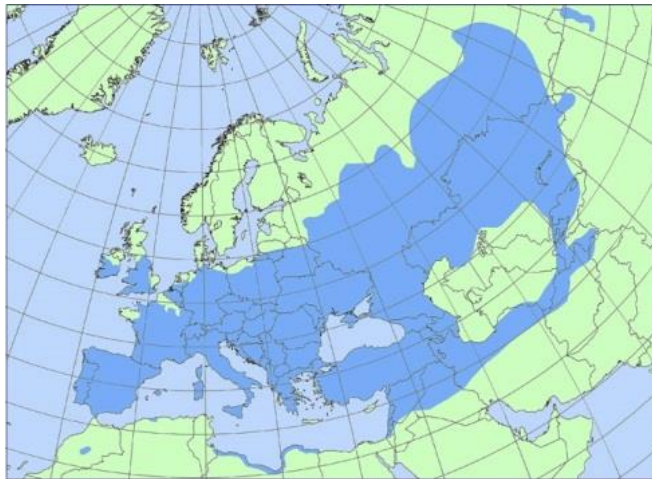


According to Kennedy and Southwood 1984

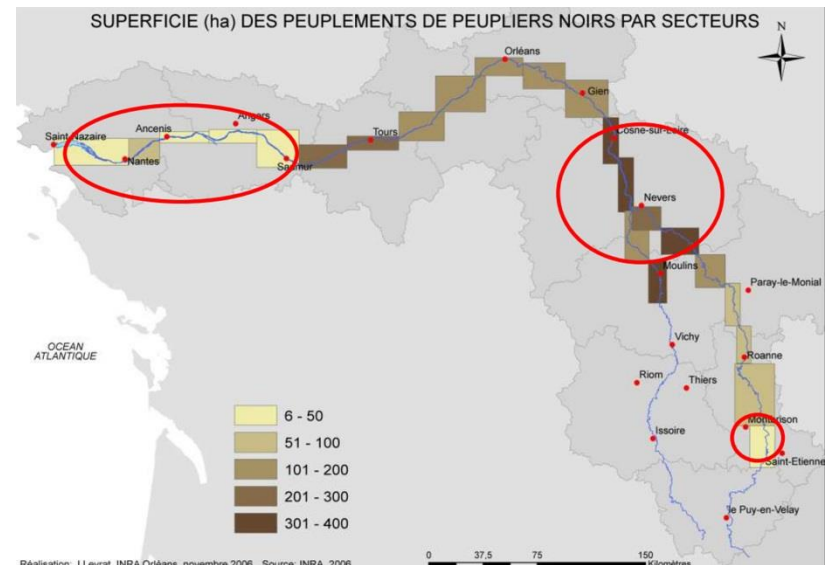
# Co-evolution phenomenon

Tree species range in Europe (Euforgen) and France (Levrat 2006 - Inra)

European black poplar (*Populus nigra*)



Range of black poplar in Loire river basin (France)



Loire river basin area = 117000 km<sup>2</sup>

Probable residence time > 10 000 years (Cottrel et al., 2005)

But area occupied by Black poplar is only 4000 ha (Levrat, 2006)

# Co-evolution phenomenon

Biomareau II research project :

Biodiversity associated to Black poplar > Biodiversity associated to box elder ?



Beaver (Irstea)

Box elder never eaten by beaver (R. Chevalier)



Black poplar eaten by beaver  
(R. Chevalier)



*Syntrichia latifolia* associated to  
black poplar and Box elder  
(P. Boudier)

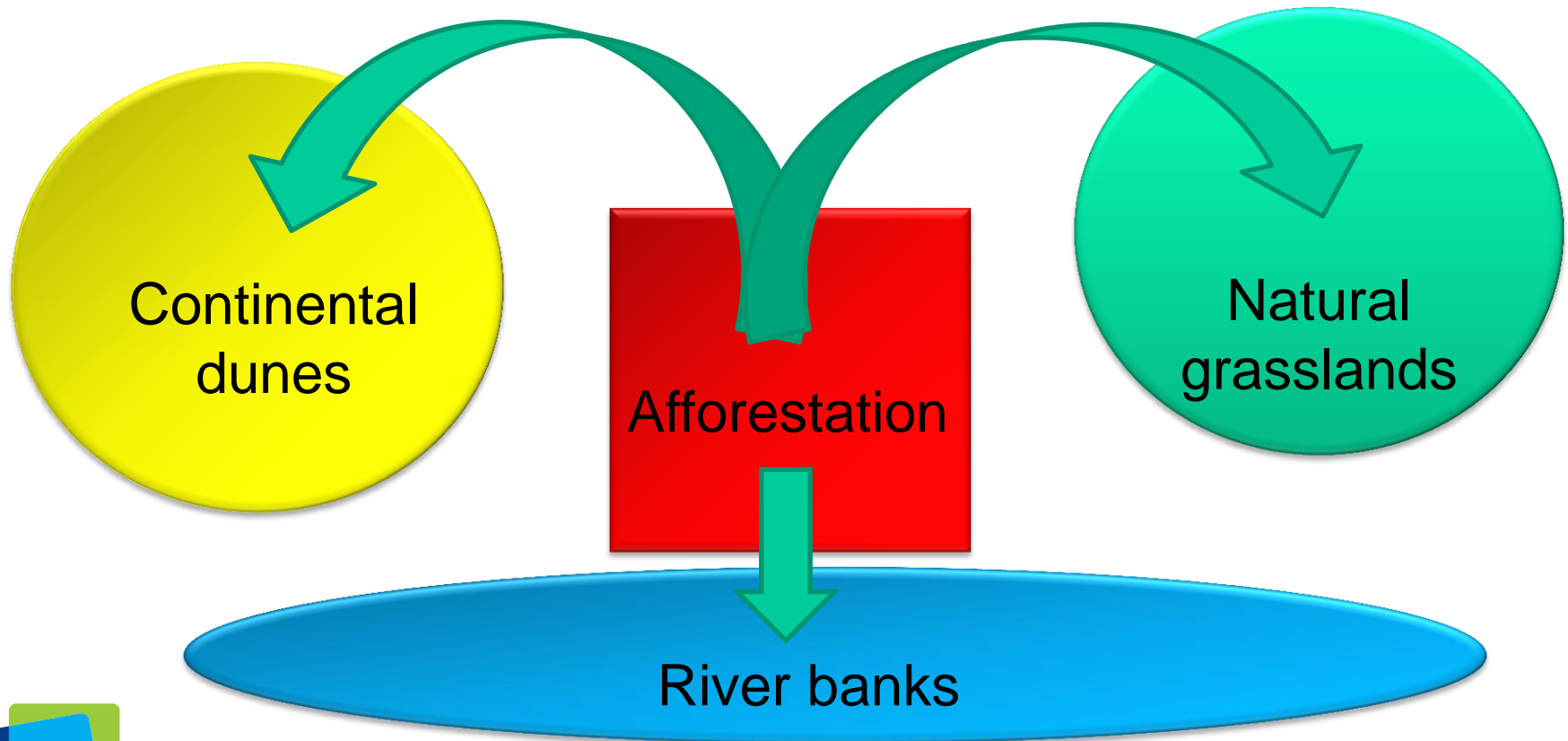
# Special effects of invasives species

## Example of *Ailanthus altissima*

- Strong competitive traits
  - growth
  - drought resistance
  - herbicidal effects
  - salt-tolerant
  - nutrient-poor soils tolerant
  - capacity for detoxification of  $H_2O_2$
- Reproduction
  - seed production
  - dissemination
  - rates of germination
  - vegetative reproduction
  - low level of predation

# Special effects of invasives species

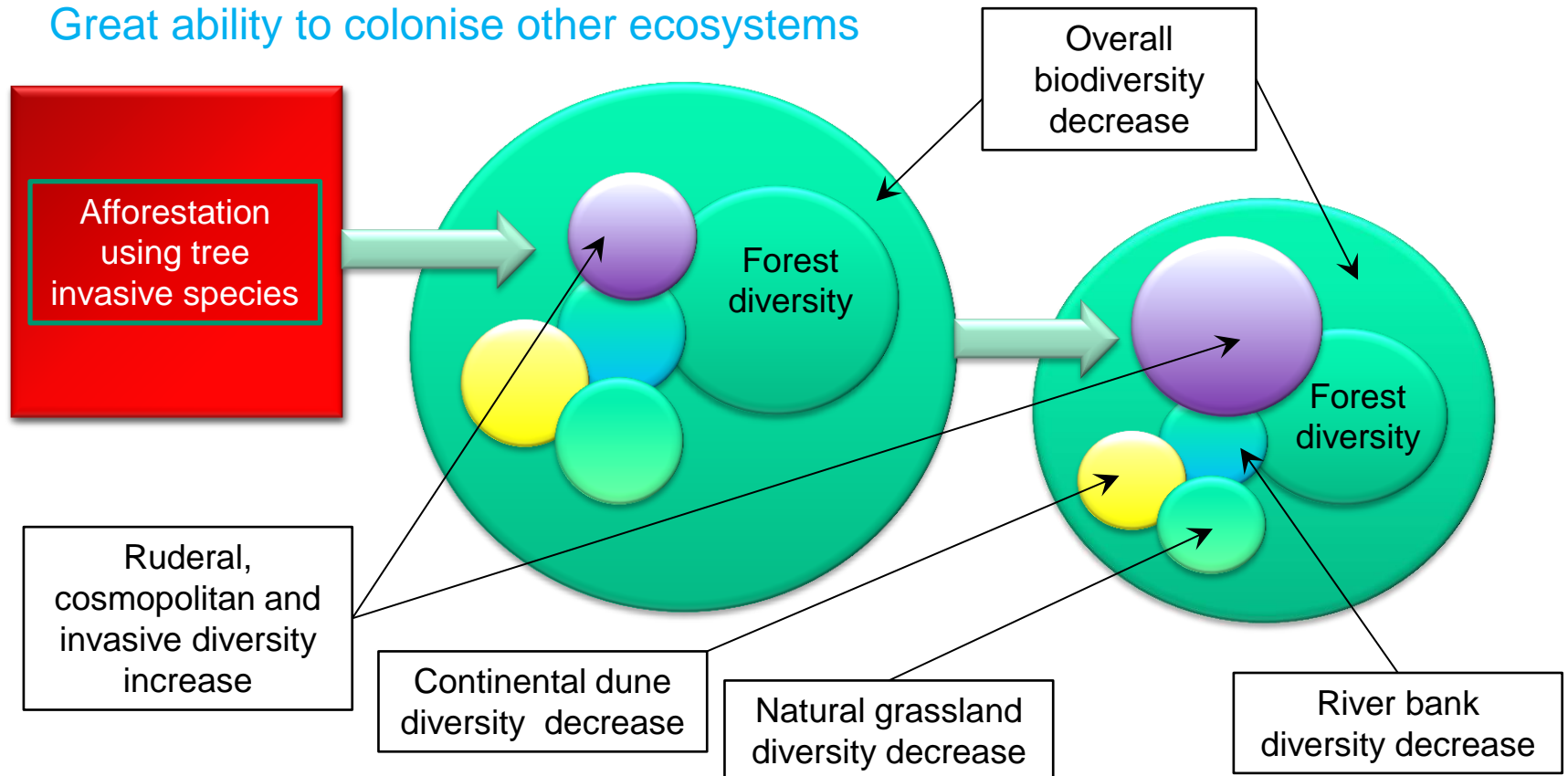
Great ability to colonise other ecosystems





# Special effects of invasives species

Great ability to colonise other ecosystems

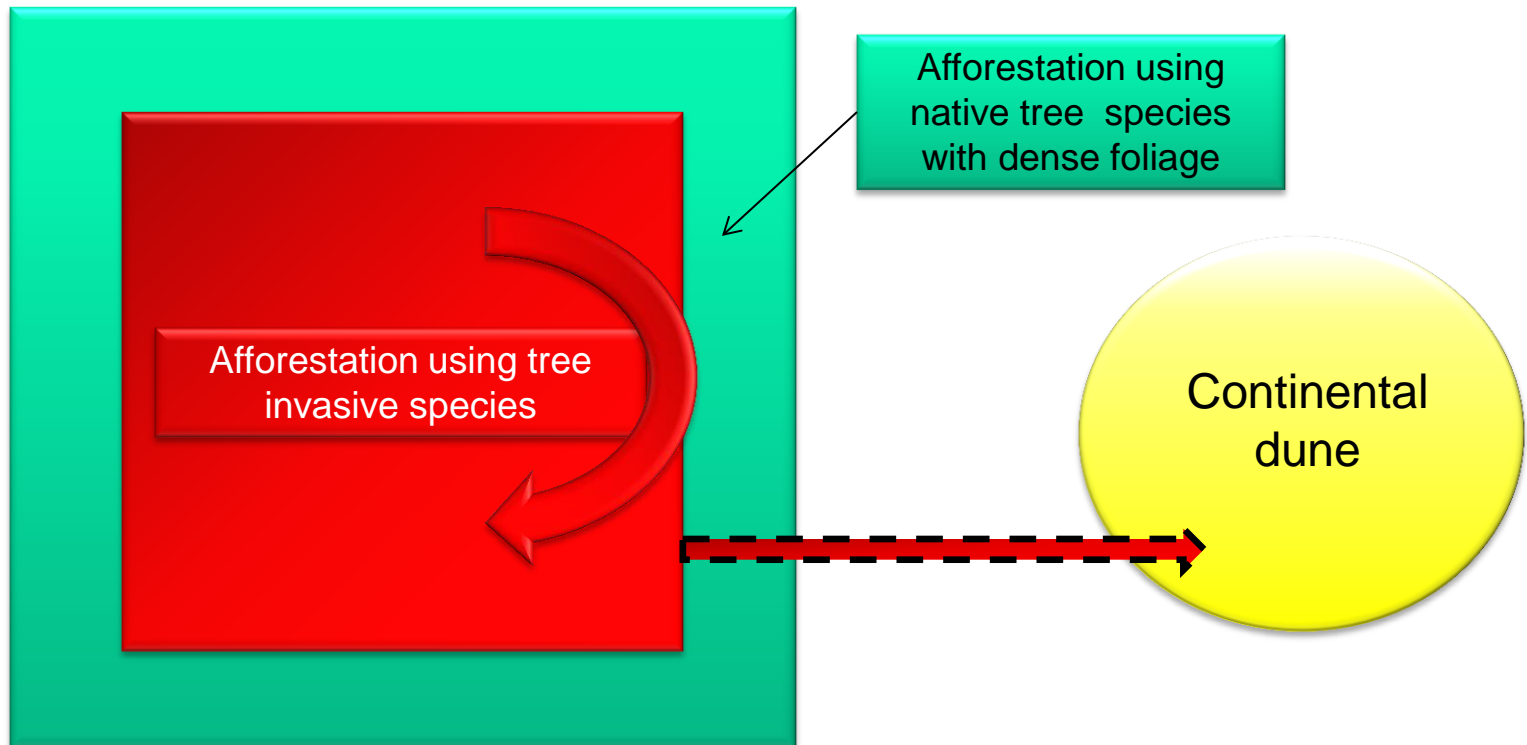


According to Onaindia et al. 2013

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# Special effects of invasives species

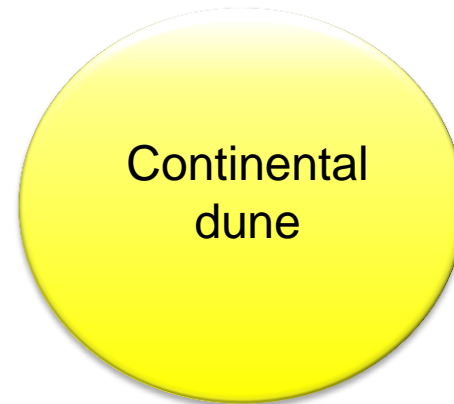
Great ability to colonise other ecosystems



According to Calviño-Cancela and Neumann 2015, and Martin et al. 2009

# Special effects of invasives species

Great ability to colonise other ecosystems

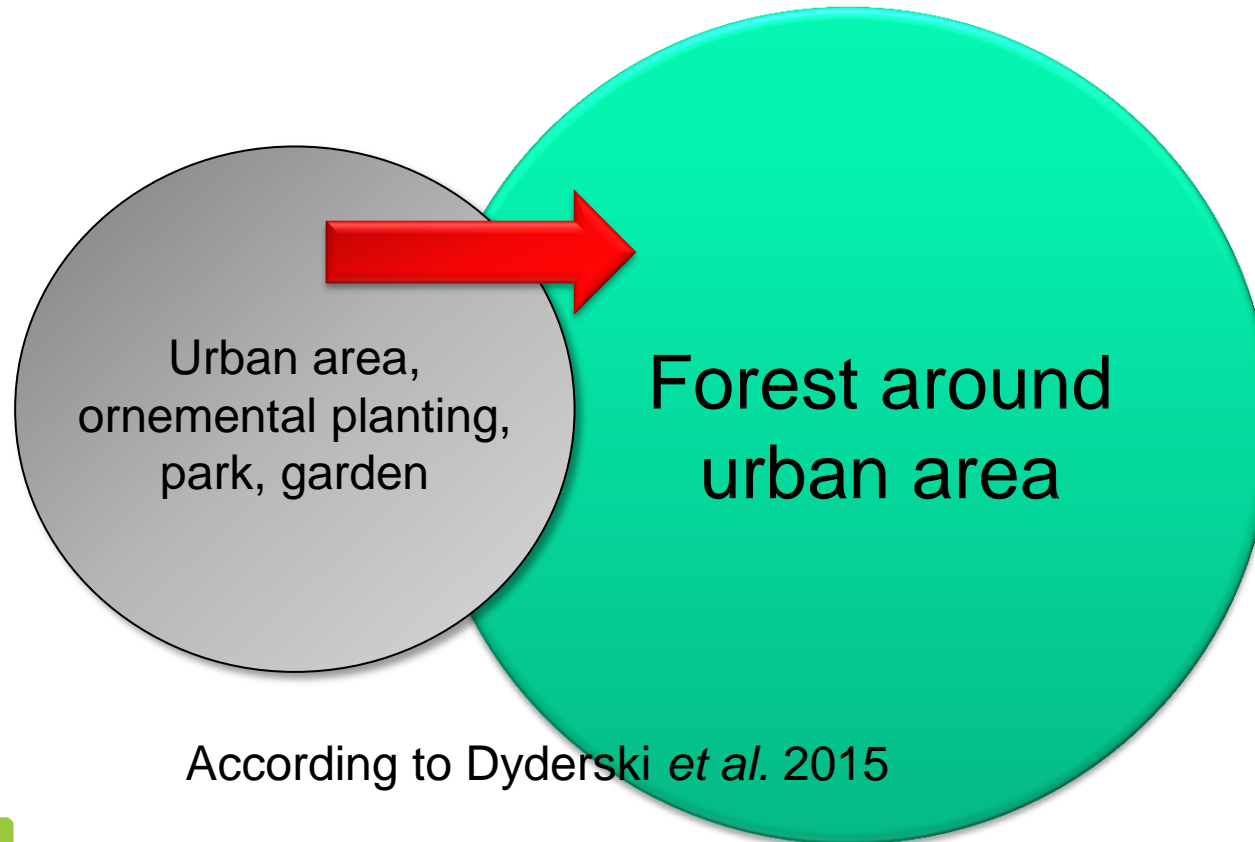


Afforestation with these tree species must be avoid

According to Stupak *et al.* 2011

# Special effects of invasives species

Great ability to colonise other ecosystems



According to Dyderski *et al.* 2015

# Unintentionally introduced associated species

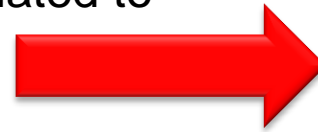


Creeping lady's-tresses was unintentionally introduced into the French lowland forests in the nineteenth century



No negative impact on biodiversity

Fungus or bacteria species associated to eucalypts in Spain



Eucalypts could become invasive

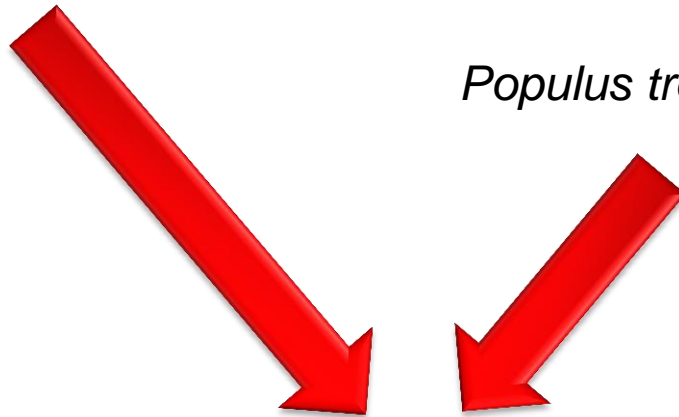
According to Diez, 2005



# Uncontrolled gene flow into wild populations

*Populus nigra* X *Populus nigra* var *italica*

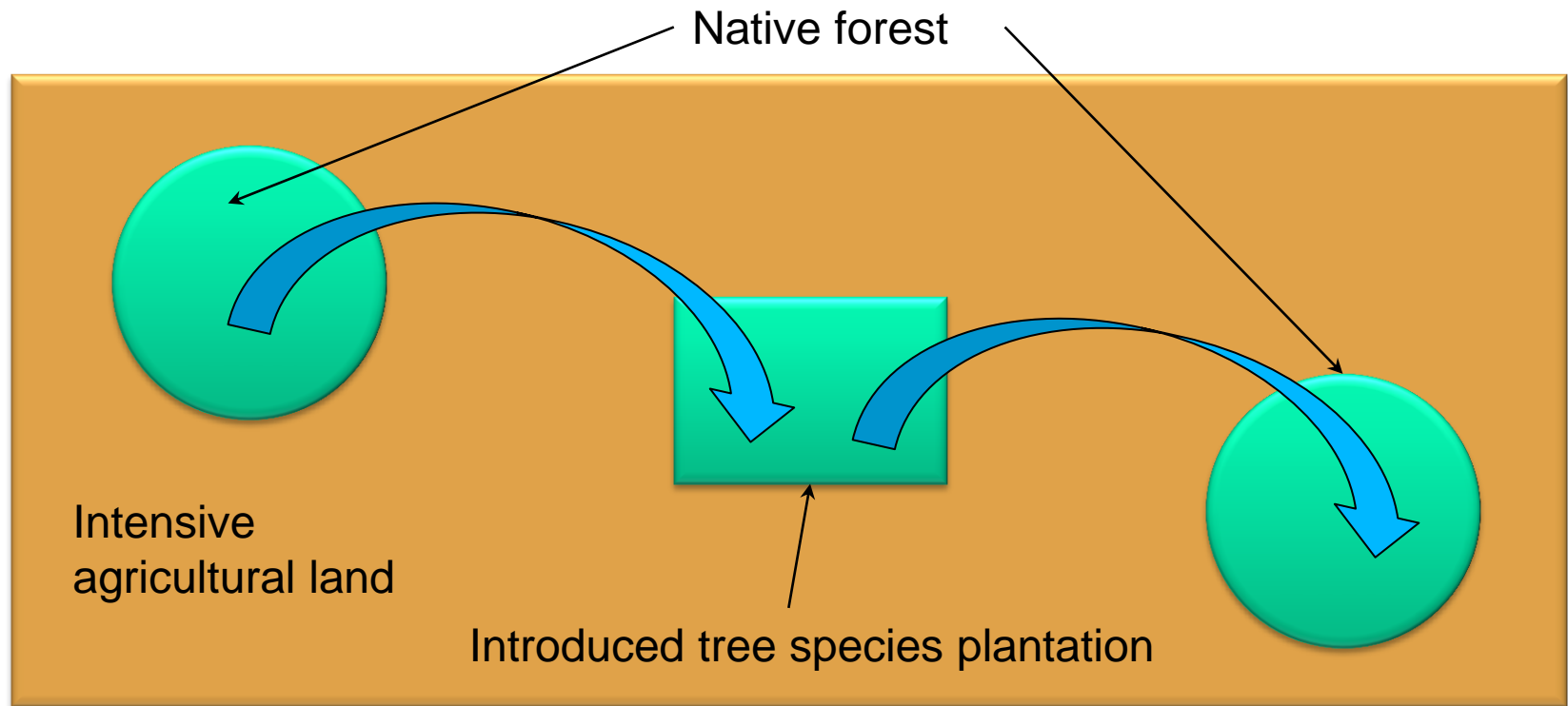
*Populus tremula* L. × *P. tremuloides* Michx.



Hybrid variety of *Populus* unsuitable to natural environment?

According to Felton et al. 2013 and Pautasso, 2009

# Introduced tree species in forest plantations may also have positive effects



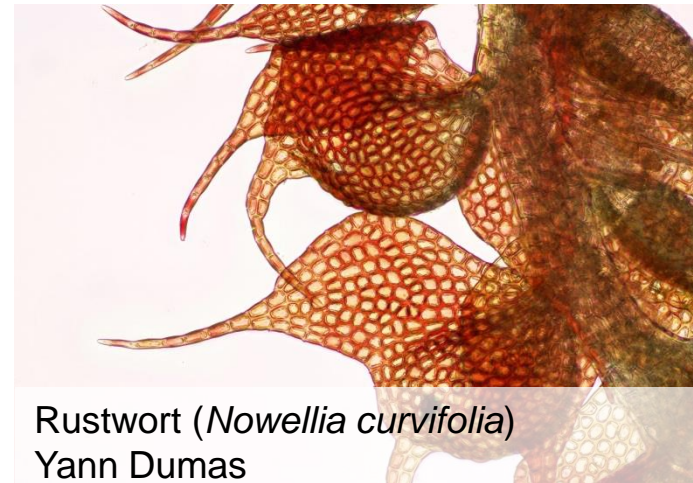
# Silvicultural practices play an important role in increasing biodiversity



- intensive vegetation management
- simplification of the understory layer structure



- moderate thinning
- dead wood and other micro-habitats



Rustwort (*Nowellia curvifolia*)  
Yann Dumas

According to Wallace and Good 1995, Santos *et al.* (2006) and Sparks *et al.* 1996

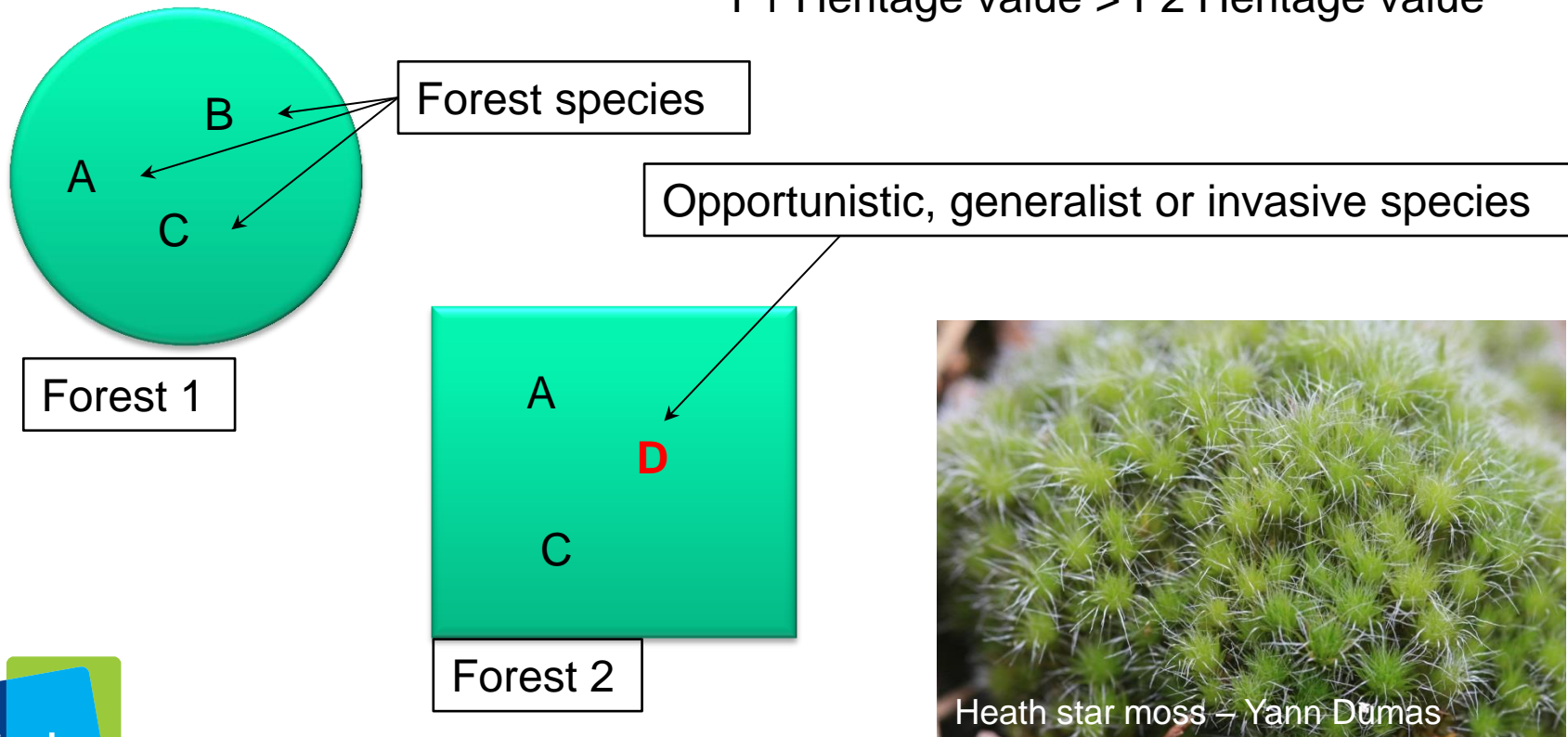
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# Despite the large number of published studies on the effect of introduced tree species on biodiversity...

F1 Species richness = F2 Species richness = 3

But

F1 Heritage value > F2 Heritage value





Thank you very much,  
for your attention !



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