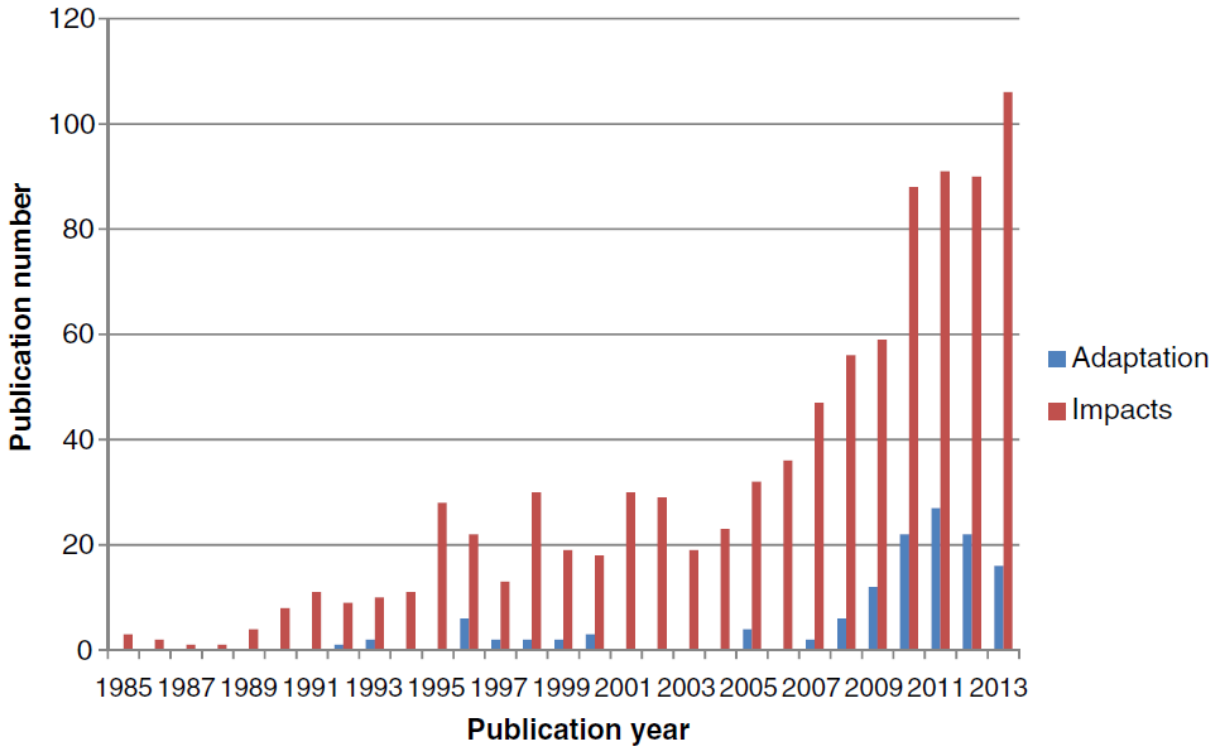
The pathways of adaptation

Hendrik Davi

URFM

Adaptation a Fashionable concept

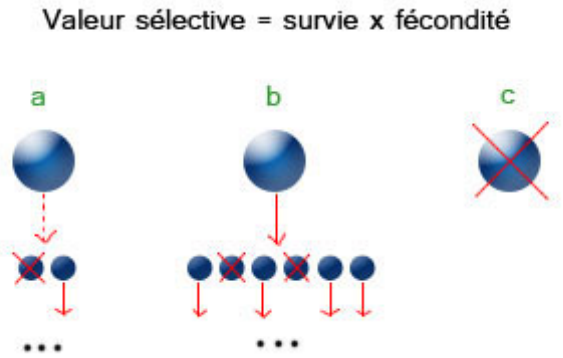


Keenan 2015

Adaptation a multi face concept

- Adaptation of what to what ?

Fitness

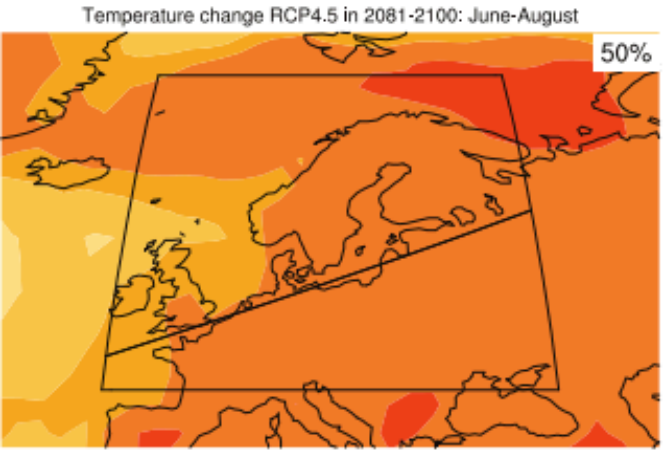


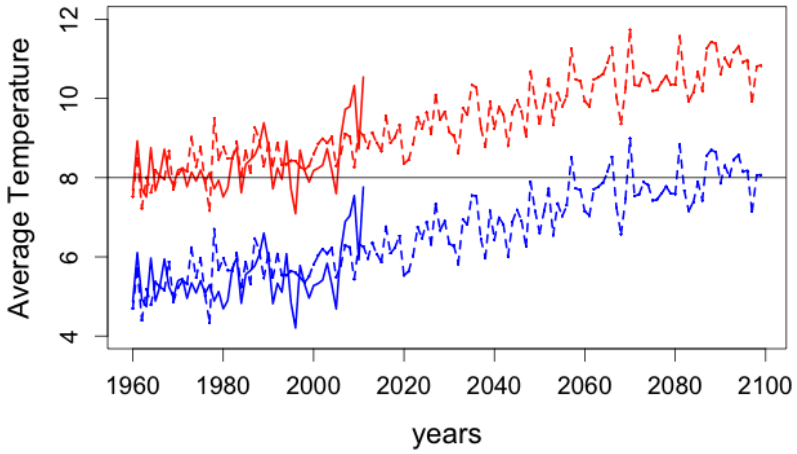
Climate Change

Wood products

Society Change

Impacts of Climate Change

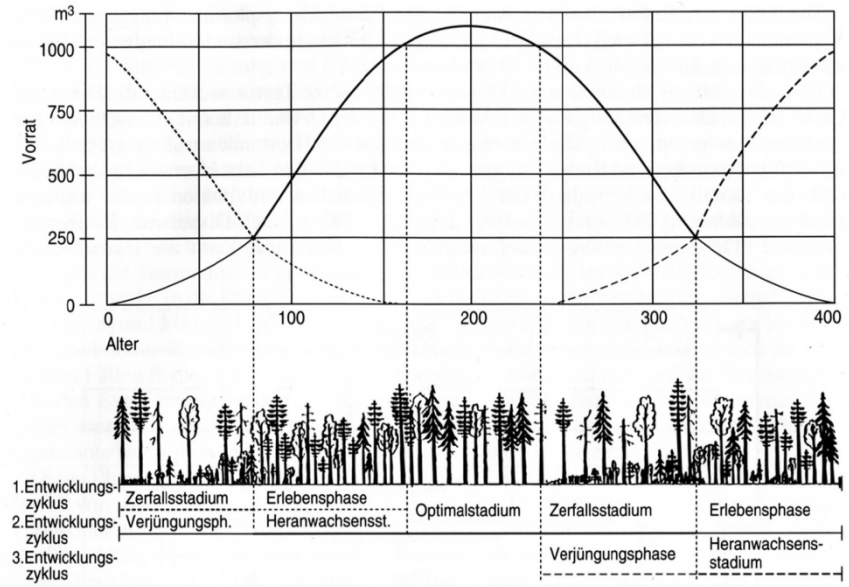


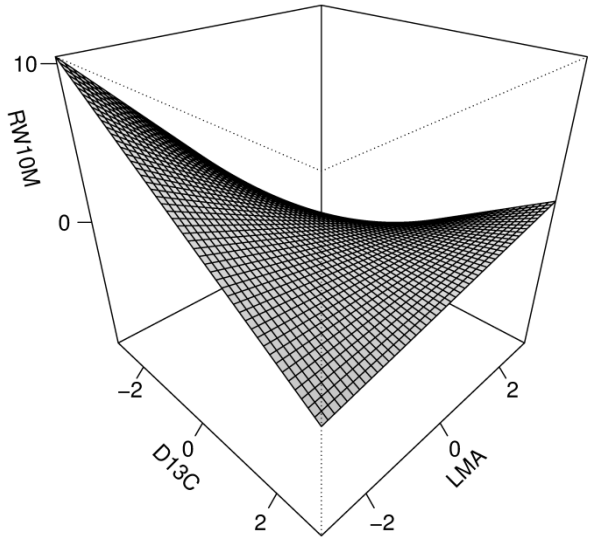


Climate	Risks	Bénéfices
↗ **summer temperature**	↗ drought ↗ heat waves => forest decline, fire	
↘ **summer rain**		
↗ **spring temperatures**	Late frost	↗ vegetation duration
↗ **winter temperatures**	Lack of chilling	↗ photosynthesis of evergreen species
↗ **heavy rains in winter**	Erosion, snow	↗ groundwater reserves

Adaptation a multi face concept

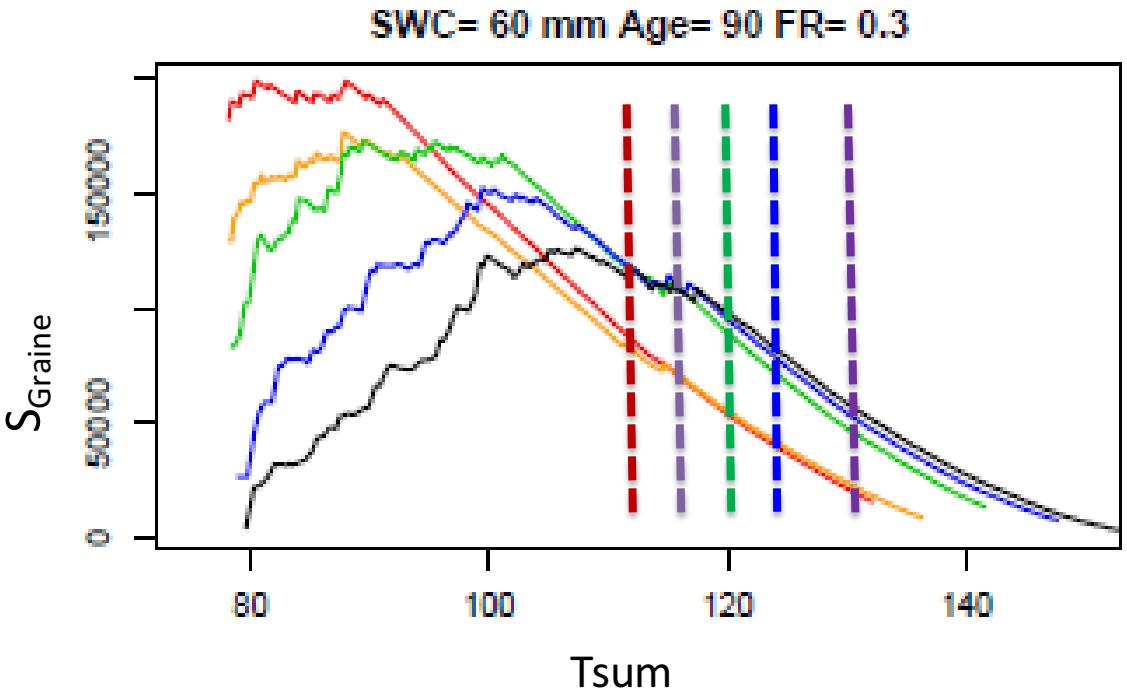
- Adaptation of what to what ?
- Adaptation versus evolution





Adaptation a multi face concept

- Adaptation of what to what ?
- Adaptation versus evolution
- Process versus state



Adaptation a multi face concept

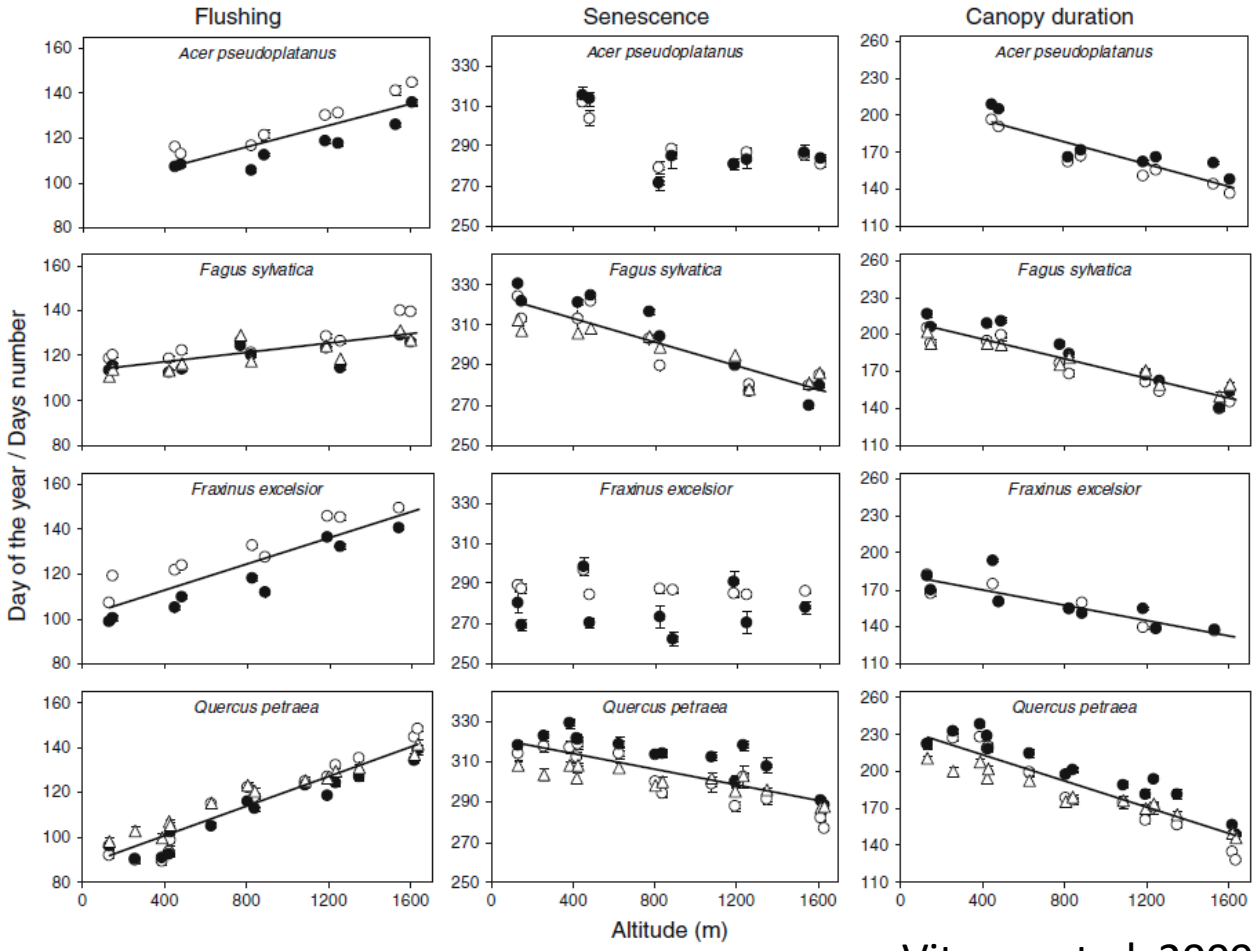
- Adaptation of what to what ?
- Adaptation versus evolution
- Process versus state
- Natural versus human adaptation

1. Traits plasticity
2. Genetic evolution of population
3. Migration throw pollen and seed flows
4. Community change

1. Thinning share
2. Harvest residues
3. Forest rotation
4. New plantations

Plasticity of functional traits at multiple levels

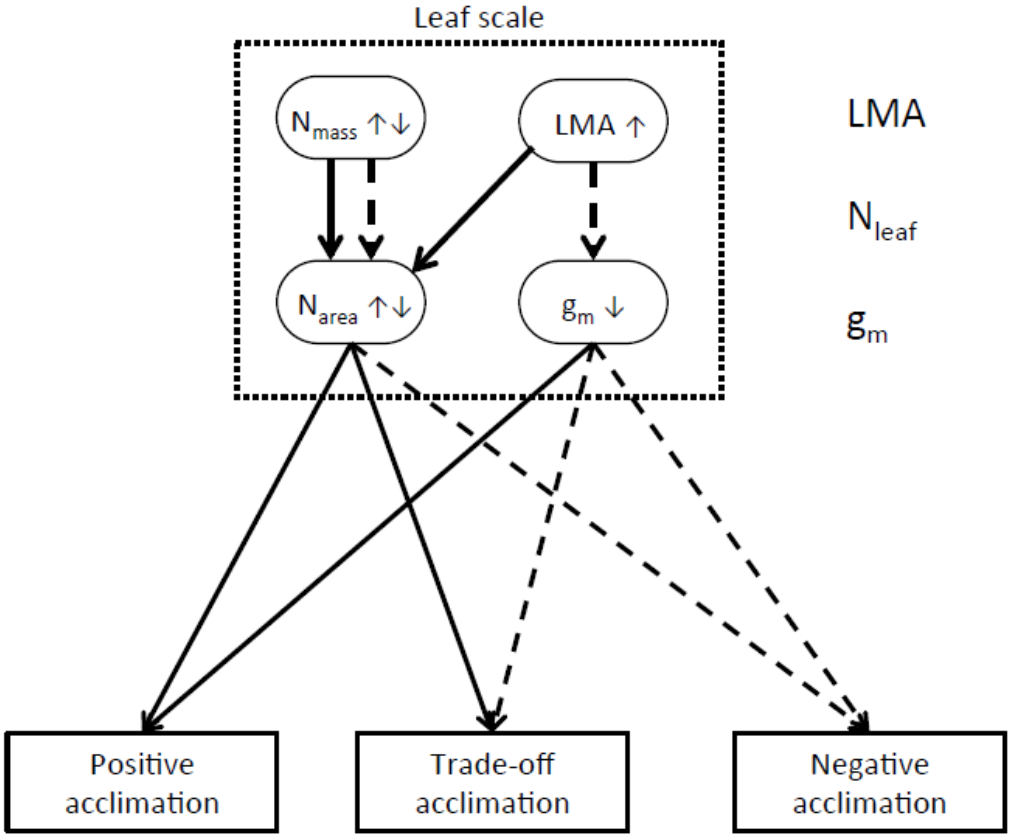
- Phenology : earlier budburst, delayed senescence



Vitasse et al. 2009

Plasticity of functional traits at multiple levels

- Acclimatation to drought at leaf scale

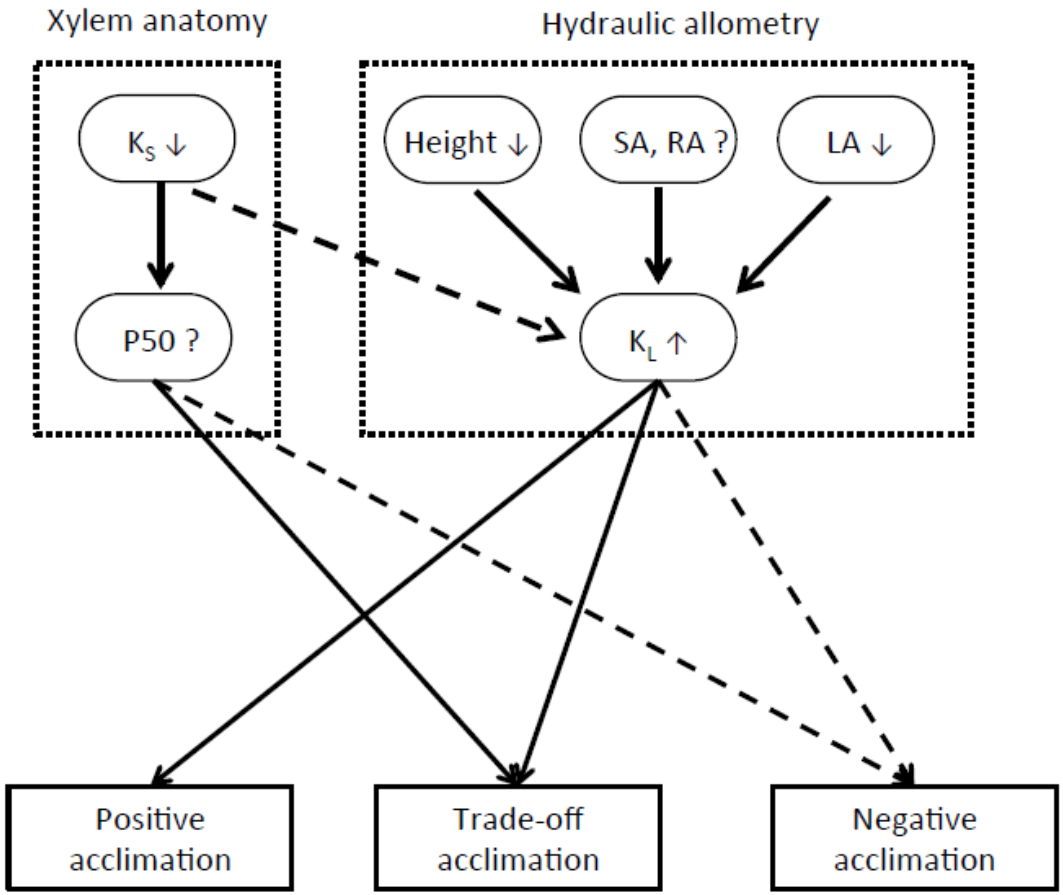


LMA	↗	(Poorter et al. 2009)
N_{leaf}	↗ ou ↘	(Chapin 1980)
g_m	↘ ou ?	(Flexas et al. 2012)

Limousin 2013

Plasticity of functional traits at multiple levels

- Acclimatation to drought at tree scale



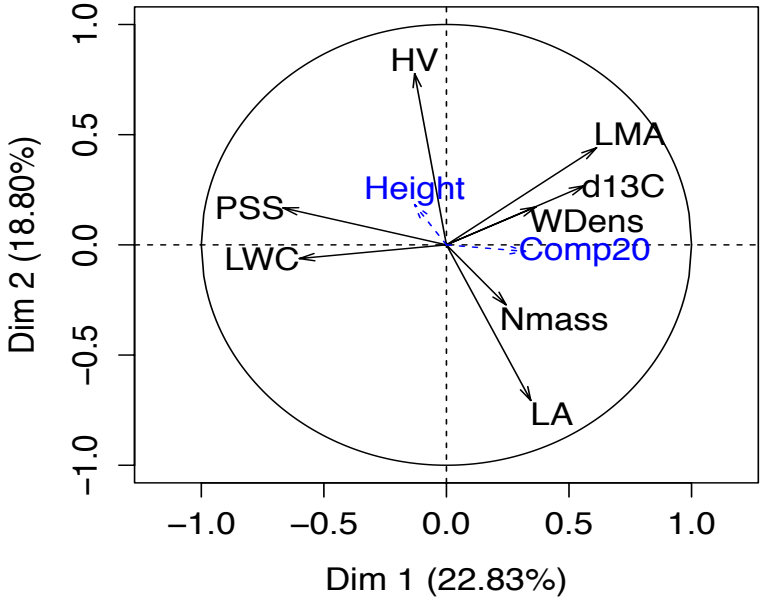
K_S	↘
P50	?
LA/SA	↗
RA	?

Limousin 2013

Towards a multi-traits analysis

Intraspecific variation

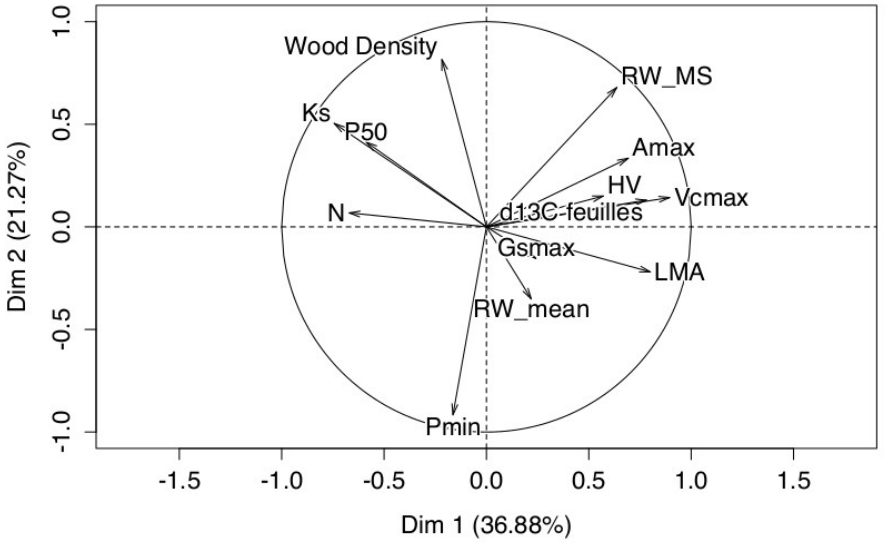
Ressource capture
.VS.
Water Saving



Bontemps et al., 2017

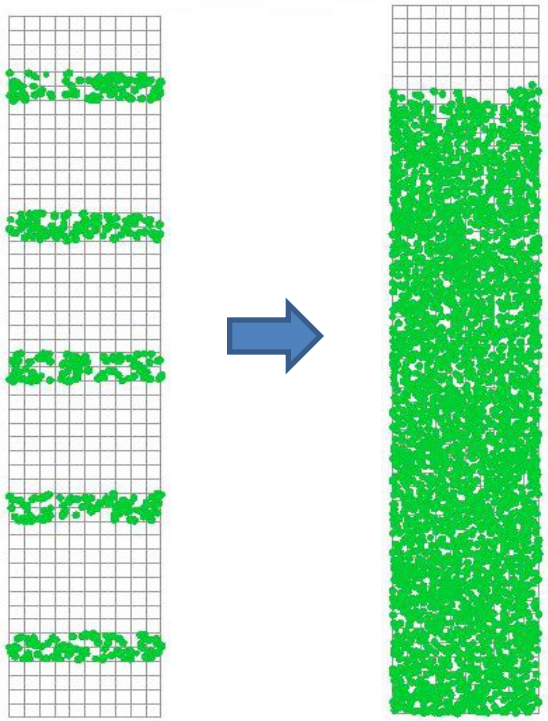
Interpecific variation

Resistance
.VS.
Ressource capture

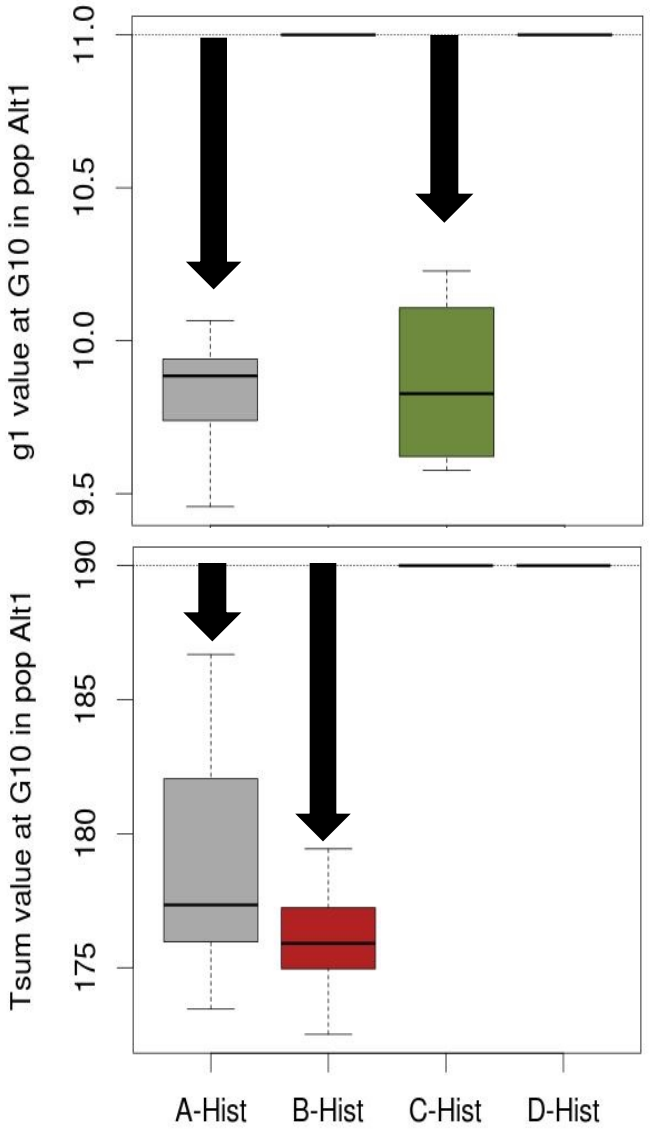


Davi 2016

Using a PDG model to assess future genetic evolution



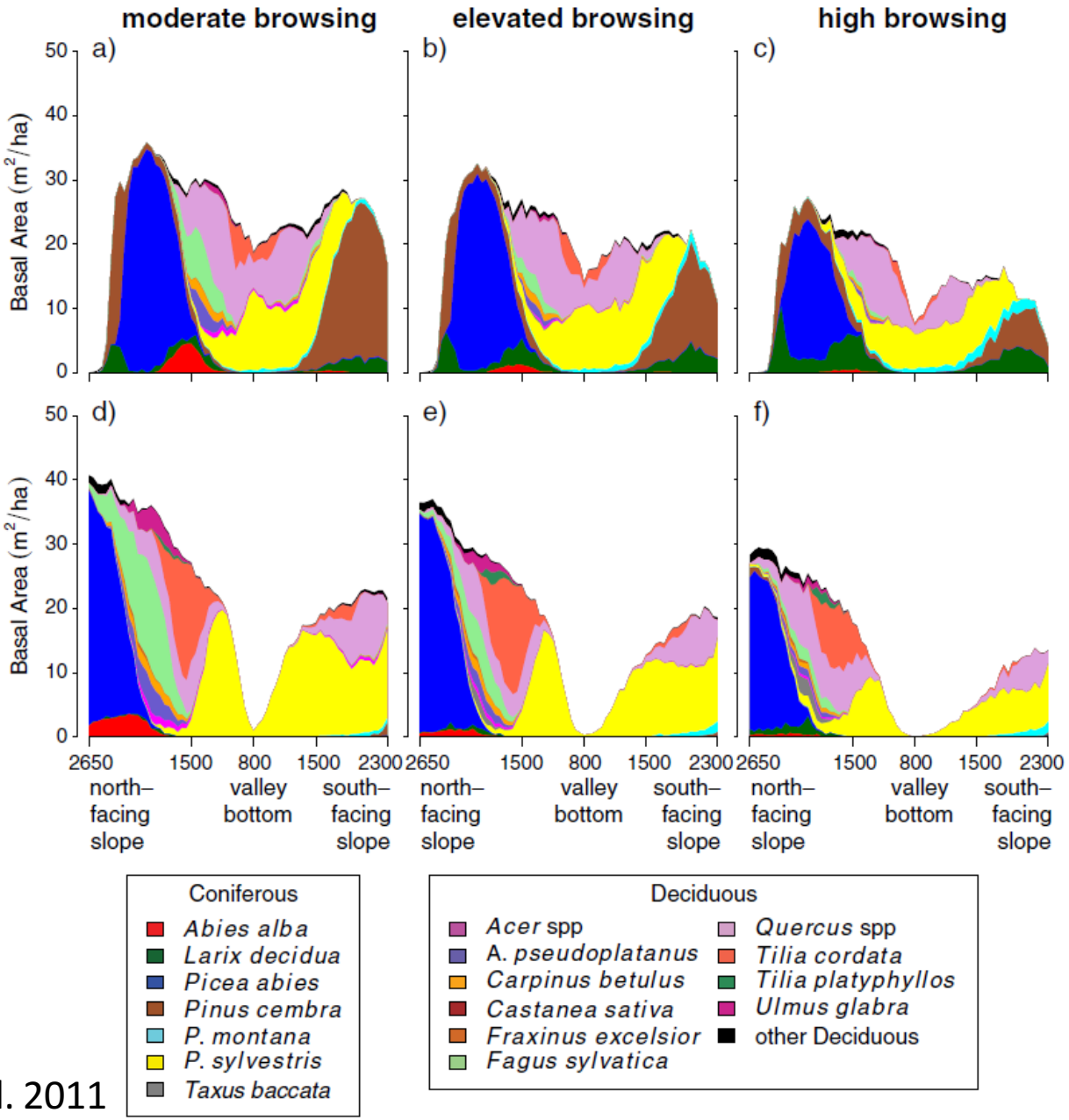
Oddou-Muratorio & Davi 2014
Oddou-Muratorio et al 2016



Using a Gap Model to assess future community composition

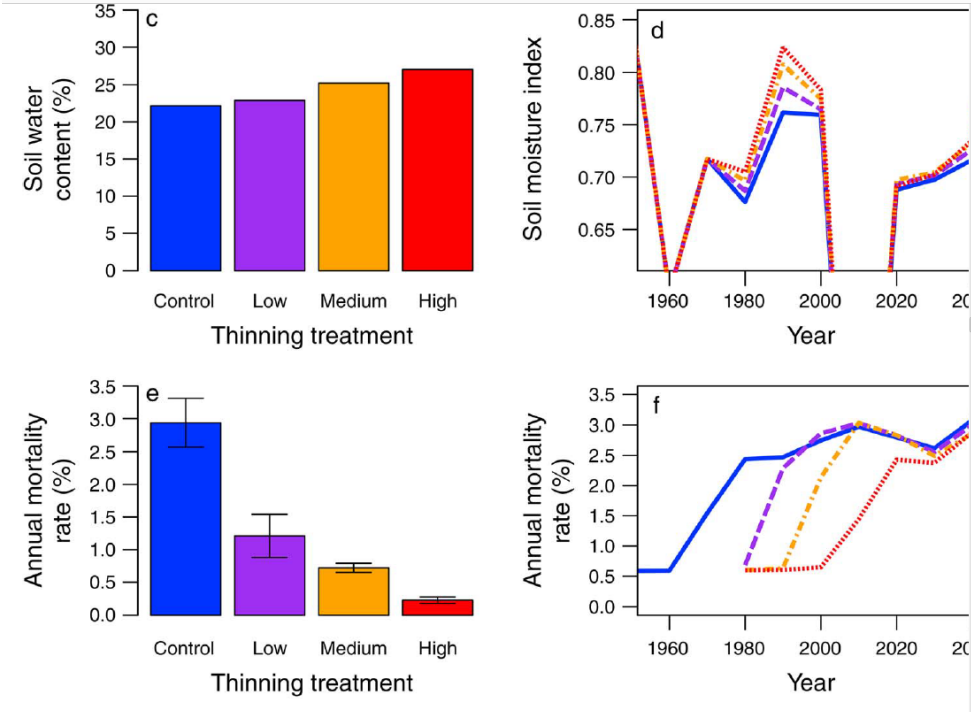
Current climate

Future climate

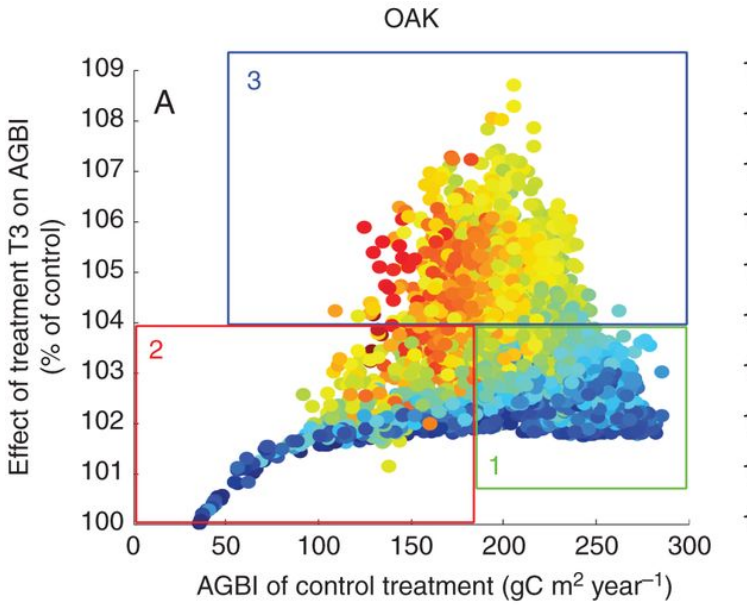


Didion et al. 2011

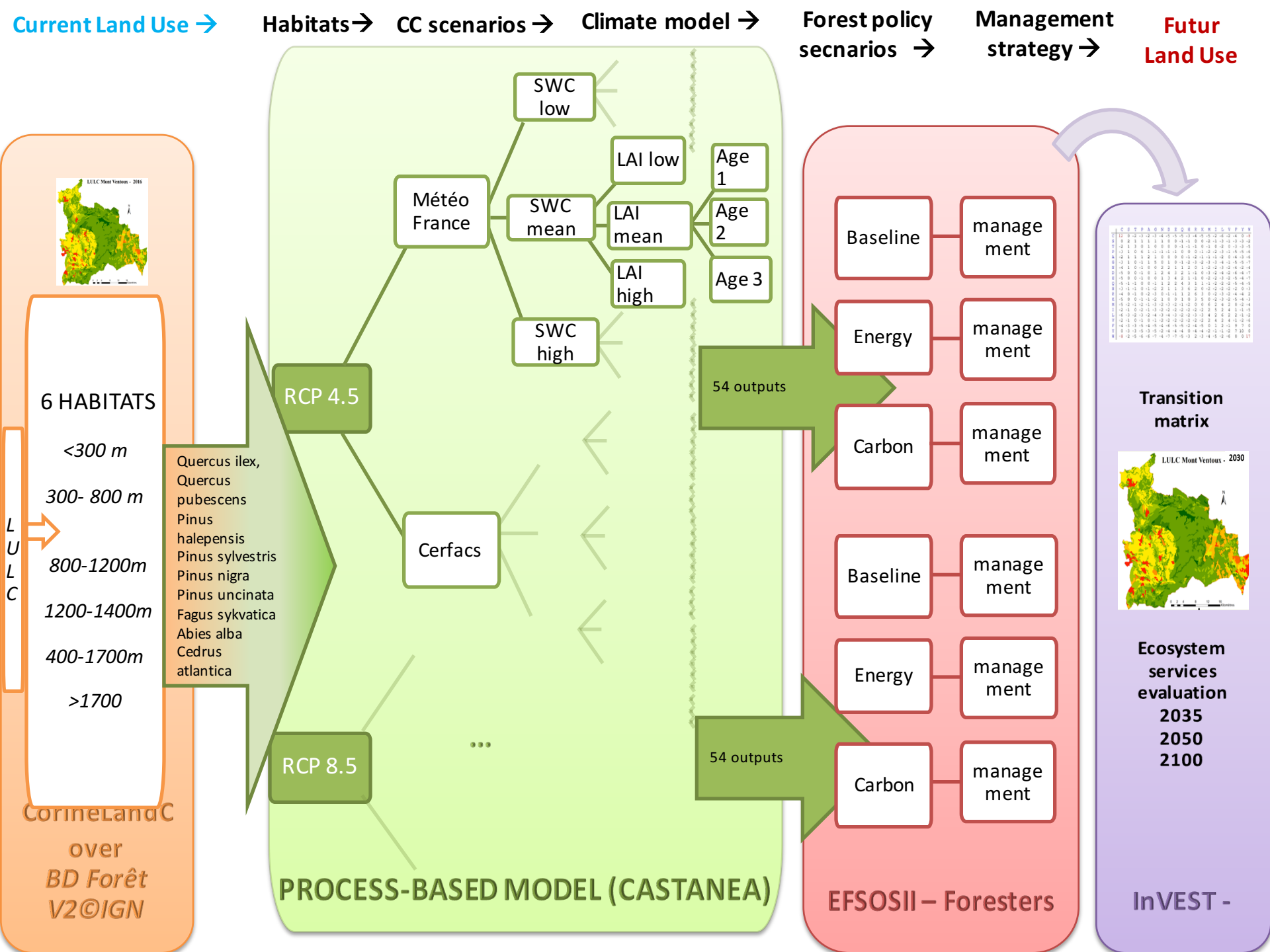
Thinning to save water



Etkin et al., 2015



Guillemot et al. 2014


Current Land Use →
Habitats →
CC scenarios →
Climate model →
Forest policy secnarios →
Management strategy →
Futur Land Use
LULC Mont Ventoux - 2016
6 HABITATS
<300 m
300- 800 m
800-1200m
1200-1400m
400-1700m
>1700
LULC
CorineLandC over BD Forêt V2©IGN
Quercus ilex, Quercus pubescens Pinus halepensis Pinus sylvestris Pinus nigra Pinus uncinata Fagus sykvatica Abies alba Cedrus atlantica
RCP 4.5
RCP 8.5
Météo France
Cerfacs
SWC low
SWC mean
SWC high
LAI low
LAI mean
LAI high
Age 1
Age 2
Age 3
...
PROCESS-BASED MODEL (CASTANEA)
54 outputs
54 outputs
Baseline
Energy
Carbon
Baseline
Energy
Carbon
management
management
management
management
management
management
EFSOSII – Foresters
Transition matrix
LULC Mont Ventoux - 2030
Ecosystem services evaluation
2035
2050
2100
InVEST -

A complex ecosystem

FLAG, MECC, AMTools…

Biodiversité
Gestion forestière
& Politiques publiques

ARBRE, OT-MED, COTE

ACCAF – FORADAPT

1. **Ancillary funds**
2. **Targeted actions**
3. **Networking: synthesis, BDD, models**

TipTree, INFORMED

GRAAL

GENTREE, SPONFOREST

Some gaps in knowledge, models and BDD

1. Reproduction and belowground processes (roots dynamics and water ressources)
2. Relate quantitative genetics, tree physiology, seed dispersal, regeneration and competition models => a common modelling plateform ?
3. A common data ressources of functional traits => TRY ?