



European Commission
Agriculture and Rural Development



Climate change impacts on EU forests and possible adaptation measures

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Europe's rural areas in action - Facing the challenges of tomorrow

Limassol, Cyprus, October 16-17, 2008



EUROPEAN FOREST INSTITUTE

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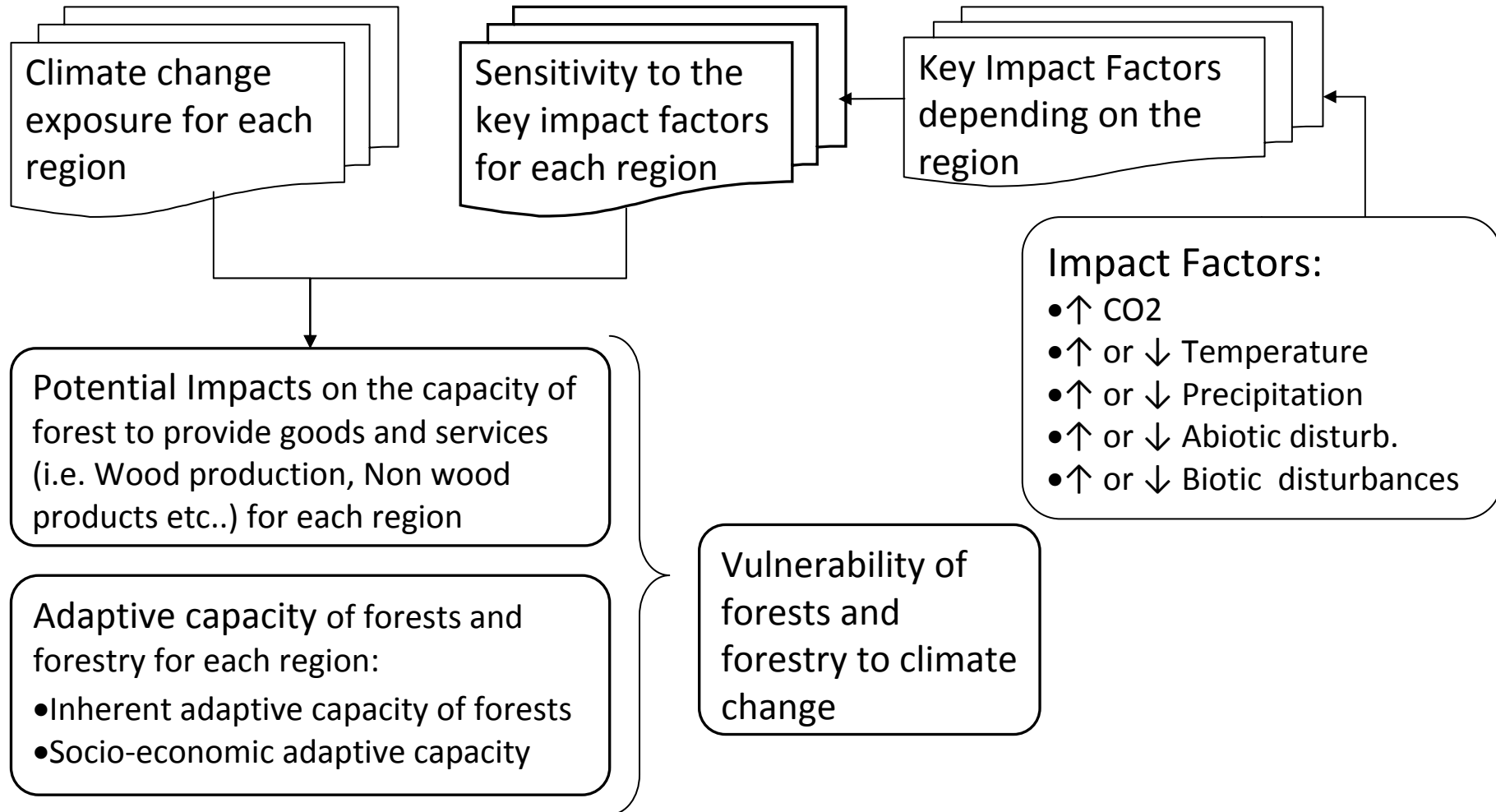


Objectives of the study

- to synthesise the existing knowledge about observed and projected **impacts of climate change** on forests in Europe
- to review the capacity of forests and forestry to adapt to climate change (**adaptive capacity**)
- to analyse **vulnerability** of forests and forestry to climate change in different European regions
- to review potential **adaptation strategies** and to survey existing and planned measures in EU member states



Methodological assessment framework





Impact Factors: Atmospheric CO₂ increase

- increases photosynthesis rates
- increases water use efficiency
- species show variable responses
- very important effects in water limited areas like Mediterranean regions, less important in Northern latitudes



FACE Experiment assessing effects of increased CO₂ levels on the structure and function of northern forest ecosystems



Impact Factors: Changes in Temperature and Precipitation



- Temperature effects can be positive or negative depending on environmental conditions in the region
- Higher T with sufficient P may **improve growth**
- Rising T without increase in P or decreasing P can lead to **drought** and thus **reduce growth**
- Some species more sensitive than others. In Mediterranean conditions most species will suffer from droughts





Impact Factors: Abiotic disturbances (wind, snow, fire)

- extreme weather patterns (drought, flooding, wind storms) are projected to intensify and will have several direct and indirect impacts
- Fire and wind damage affect forest productivity, partial or complete loss of wood and cause imbalanced stand age-structures
- Fire can have several detrimental effects on soil, e.g. loss of nutrients through volatilisation, leaching and erosion
- Broken and uprooted trees left in forest are breeding material for insects which cause secondary damage
- Harvesting salvaged wood is dangerous and expensive and the large volumes distorts markets





Impact Factors: Biotic disturbances

- Direct effects on target species (herbivores and pathogens)
 - Changes in life-cycles and suitable habitats
- Indirect effects through changes in plant nutritional quality, plant resistance or community interactions
 - Storm events increase the incidence of pest outbreaks
 - higher probability of open tree wounds allows the entry of pathogen species





Impact Factors – Summary

- Not all the impact factors are negative
- Impacts depend also on the region analysed

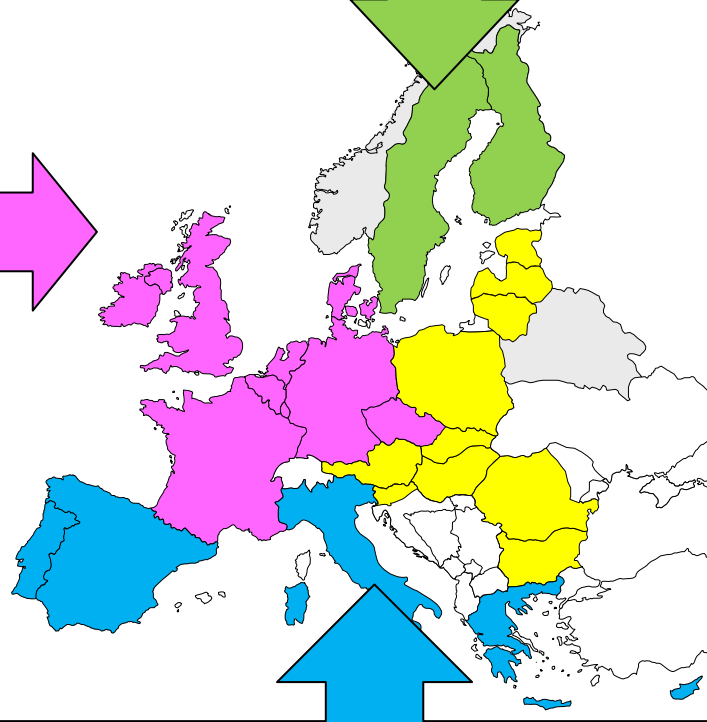
Impact Factor	Positive Impacts	Negative Impacts
↑ Temperature	↑ Growth in Northern EU	↓ Growth in Mediterranean region ↑ Difficulties to forest management operations in Boreal regions
↑ CO ₂	↑ Water use efficiency ↑ Forest growth	-
↑ or ↓ Precipitation	↑ P in the north will increase forest growth	↓ P in Southern areas will increase droughts and ↓ forest productivity
Biotic disturbances	-	↓ Forest productivity
Abiotic disturbances	-	↑ Fires specially in Mediterranean regions will ↓ forest productivity and ↑ erosion



CC Sensitivity and Potential Impacts in Europe

+ forest growth
↑ abiotic and biotic disturbances
– difficult winter harvesting

+ / – forest growth
↑ wind and fire disturbances
? Shifting species composition

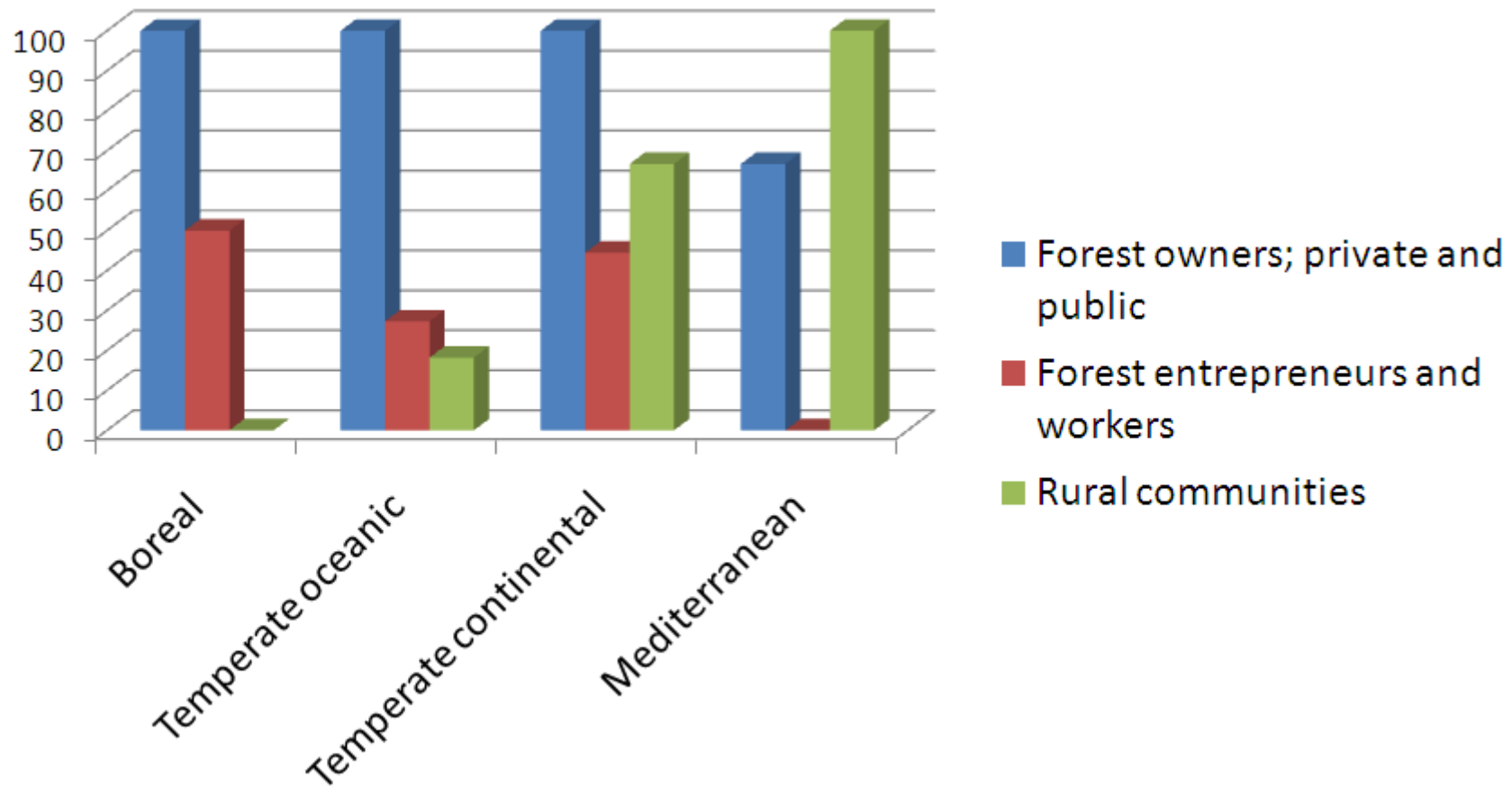


+ / – forest growth
↑ wind and fire disturbances
? Shifting species composition

– forest growth
↑ fire disturbances
↑ erosion risk



Perceived impacts and link to rural development





Climate Change Impacts and Vulnerability of European forests - Conclusions

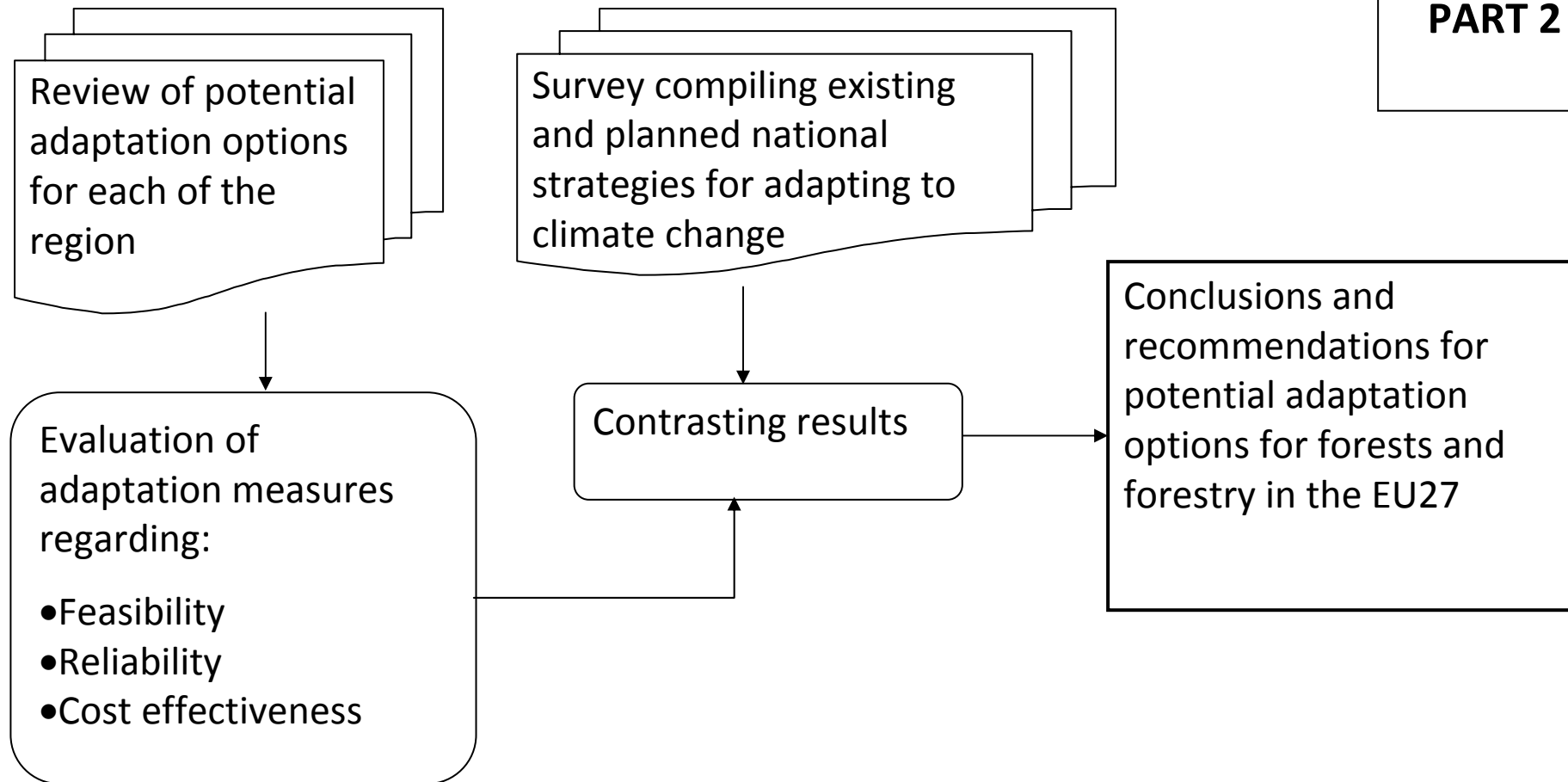
- Rich literature on climate change sensitivity and potential impacts, but not all regions are well covered (at least in accessible literature)
- Adaptive capacity rarely studied systematically
- Vulnerability assessments of ecosystem goods and services urgently needed in most regions



Study on impacts of climate change on European forests and **options for adaptation**

Service Contract with DG Agriculture (Dec 07 – Nov 08)

PART 2





Adaptation strategies

- should aim to increase the flexibility in management of vulnerable ecosystems
- enhance the inherent adaptability of the species and ecosystem processes
- reduce trends in environmental and social pressures that increase vulnerability to climate variability

(Hulme, P.E. 2005, J. appl. Ecology 42, 784-794)

Reducing vulnerability involves both a reduction to the exposure to climate stress and an increase in adaptive capacity

(J.-E. Parry *et al.* 2005)





Adaptation strategies at different levels

Level of action

Stand level

Adaptation actions

- forest regeneration
- tending and thinning of stands
- harvesting

Forest management

- management planning
- forest protection

Policy level

- infrastructure and transport
- nurseries and forest tree breeding
- further adaptation
- integration in risk management and policy



Adaptation measures

Scientific perspective

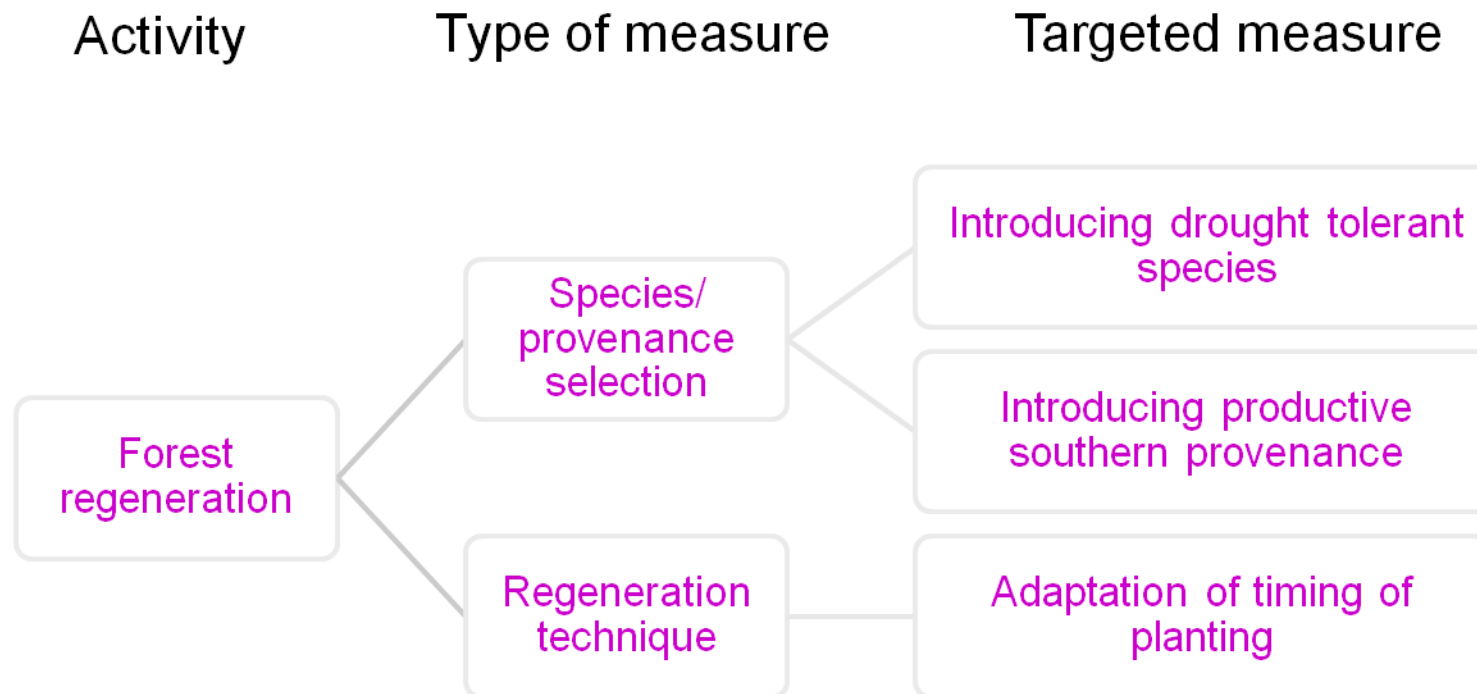
- expert assessment based on review of literature

Ongoing and planned measures in EU member states

- questionnaire to Ministeries and national research institutes



Analysis of questionnaire answers





Number of measures at different action levels

Level of action	Adaptation actions	Number of measures
Stand level	Forest regeneration	27
	Tending and thinning of stands	10
	Harvesting	19
Forest management	Management planning	20
	Forest protection	20
Policy level	Infrastructure and transport	15
	Nurseries and forest tree breeding	18
	Further adaptation integration in risk management and policy	43
Other measures	Other measures	17



Boreal region

- Earlier and stronger thinnings
- Shorter rotation periods
- Better harvesting techniques on non-frozen soils



Foto: K. Sjoberg



Temperate oceanic region

- Adapt management to increased disturbance risk
- Choose better adapted species and provenances
- Close-to-nature forestry vs. exotic plantation species

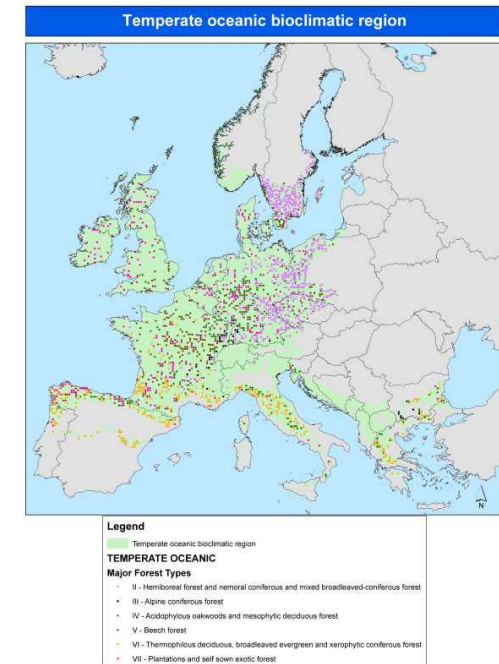


Foto: T. Standovar



Temperate continental region

- Afforestation facing new difficulties
- Choose drought tolerant species and provenances
- Close-to-nature forestry, more stable stand structures



Foto: A. Barbati



Mediterranean region

- Coordinated response to increased fire risk
- Management for better drought tolerance
- Research on protection against soil erosion

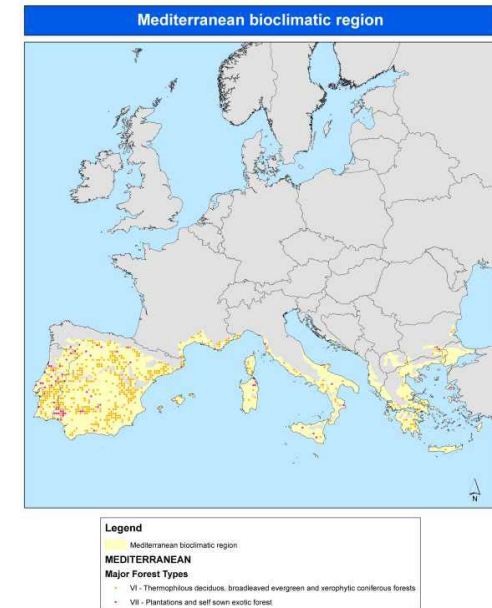


Foto: A. Barbati



Main motives of adaptation measures

1. Minimize impacts of disturbances
2. Ensure wood production
3. Ensure ecosystem services



Discussion points from adaptation measure survey

- Many ongoing and planned measures are focusing on reducing disturbance risks
- Very little attention on potential benefits
- More research is needed
- Dissemination of information is important (Foresters, forest owners, decision makers)



Needs for adaptation in rural areas

- Forest goods and services are important particularly in rural areas
- In regions with active forest management, forest owners need support to adapt management practices in regeneration, tending of stands, and early thinnings
- In the Mediterranean region, communities need support to secure forest ecosystem services



Conclusions

- Climate change poses great risks, but also some opportunities
- Rural areas will be strongly affected
- Suitable adaptation measures differ between regions
- Adaptive capacity is much higher in the Boreal and Temperate-oceanic regions
- The Mediterranean and Temperate-continental regions are most vulnerable and require specific support



Thank you for your attention!

Acknowledgement:

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