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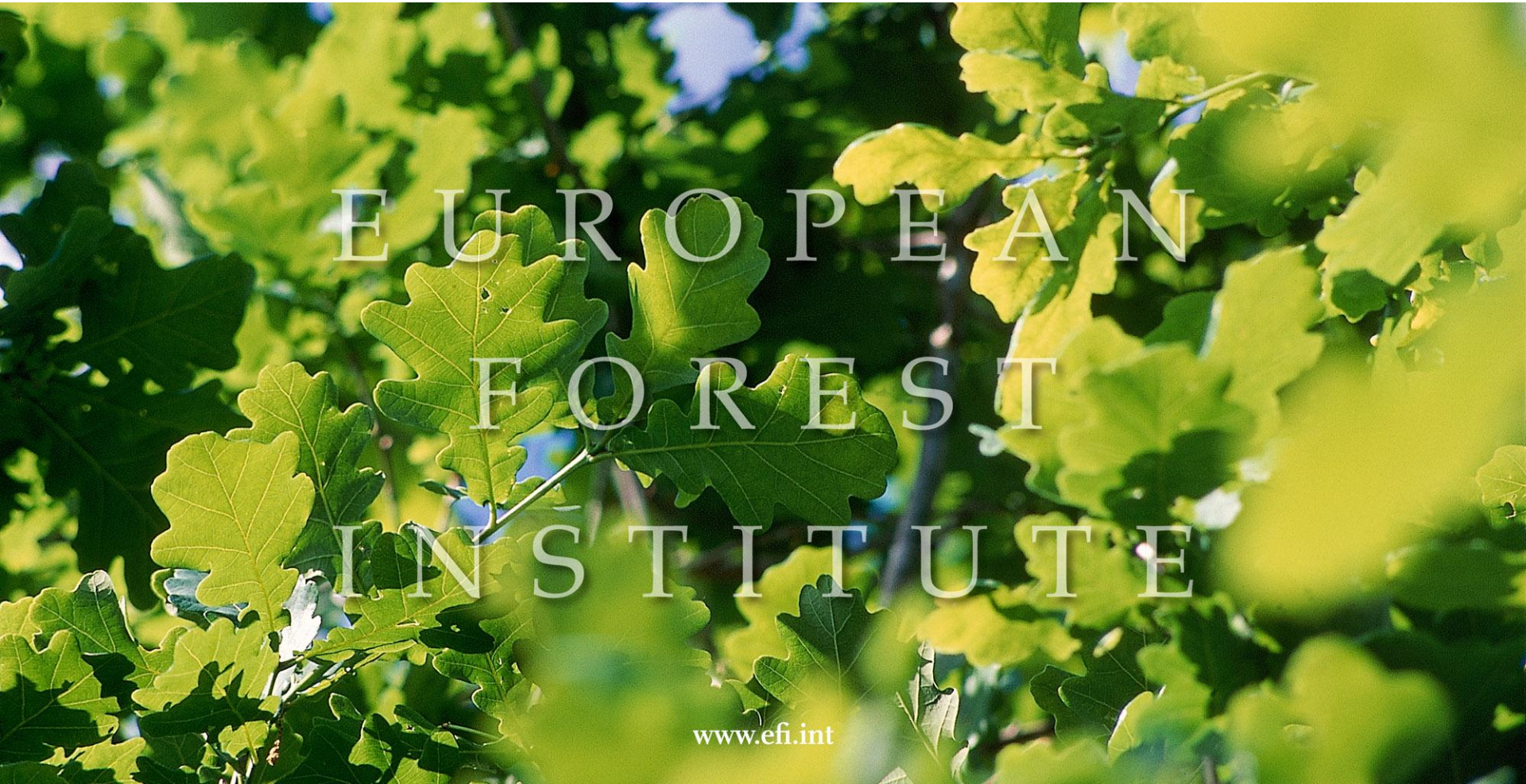



EUROPEAN FOREST INSTITUTE
Christophe Orazio, Marcus Lindner, Bernhard Wolfslehner
How climate change will affect forests in Europe – what we know and what remains uncertain
www.efi.int

Climate Change in Europe

- Legal and policy framework
- Observed and expected impacts
- Adapation options

Legal framework

- The UN Framework convention for climate change -> European climate change programme -> number of legally binding EU policy instruments
- The revision of accountng rules for the UN greenhouse inventory (LULUCF)
  - adoption of decision in 2013 to harmonise accounting rules for emission and removals from soils and forest and
  - updated reporting by Member states
- Reducing Emissions from Deforestation and Degradation (REDD+) -> transfer of carbon credit between developed and developing countries
- Green and White paper on adapting to climate change in europe

Legal framework

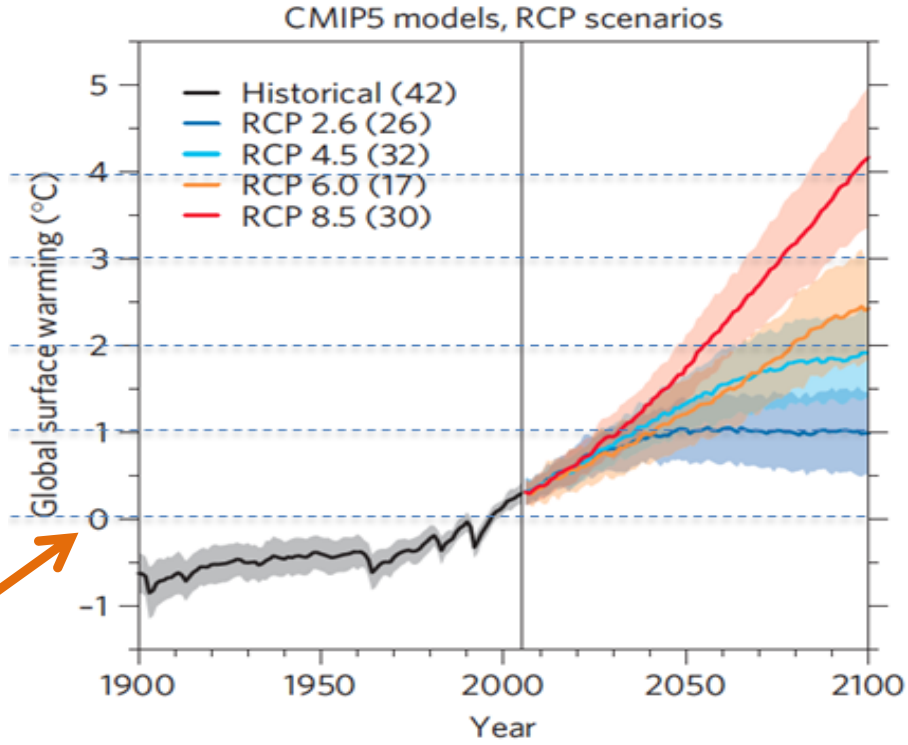
- The new forest strategy should be taken into account in national policies it calld for :
  - Set up a Europewide forest information system
  - Set up a new forest action plan
  - Contribute to the 20-20-20 climate target
- The new Common Agricultural Policy (CAP)
  - Green Direct Payments will cover 30% of the funding sustainable farming practices and climate change mitigation
- Also under Pillar 2 all RDPs will be obliged to spend 30% of their budget on measures that are beneficial for the environment and climate change (and at least 5% on the LEADER approach).

Legal framework

- The new LIFE programme :
  - It includes a climate action programme
  - Forest highligted for biodiversity and carbon sinks
- Energy and climate policy aims at 20-20-20 target
  - EU emission trading system (2003/87/EC) : allow to use credit from projects to enhance forest sinks in other countries
  - Renewable energy directive (2009/28/EC): binding target with high contribution from forest biomass
  - Promotion of Biofuels and the Biomass Action Plan Directive, 2003/30/EC

Potential impacts
Our future climate remains uncertain

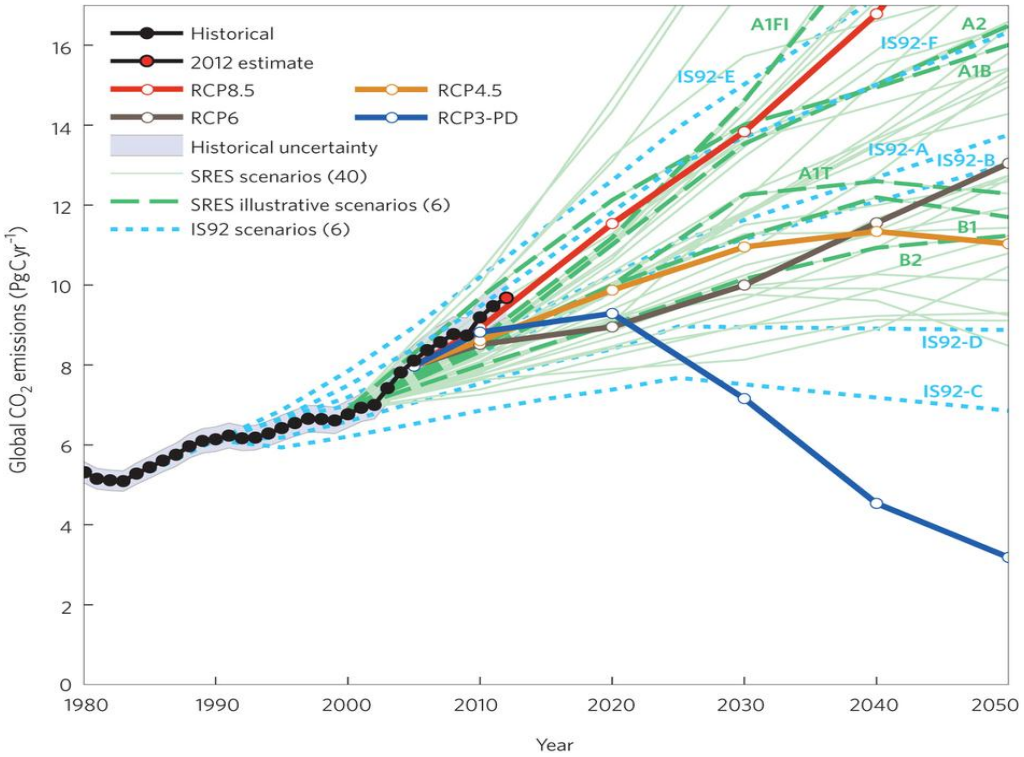
- The Fifth IPCC report introduced new scenarios, so called "Representative Concentration Pathways" (RCP)



Scenario data relative to the observed 1986 – 2005 climate

Knutti & Sedlacek, 2013. *Nature Climate Change*

The emissions of 1980 – 2011 are in line with the high end of scenario emission trajectories



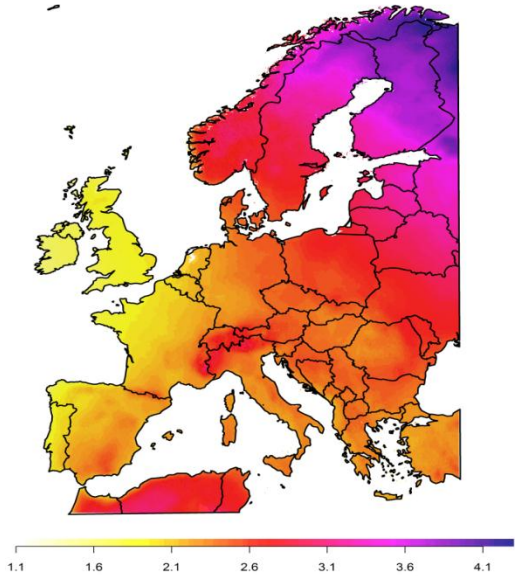
Speed and intensity of changes are unobserved in the last 8000000 Years

Peters et al. 2013. The challenge to keep global warming below 2°C. ***Nature Climate Change* 3**, 4-6.

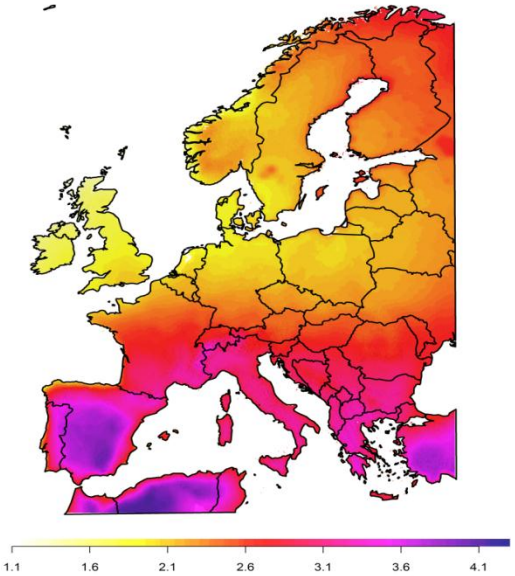
Trends and Uncertainty in Temperatures

Mean and St.dev among 6 RCM's used in MOTIVE for A1B

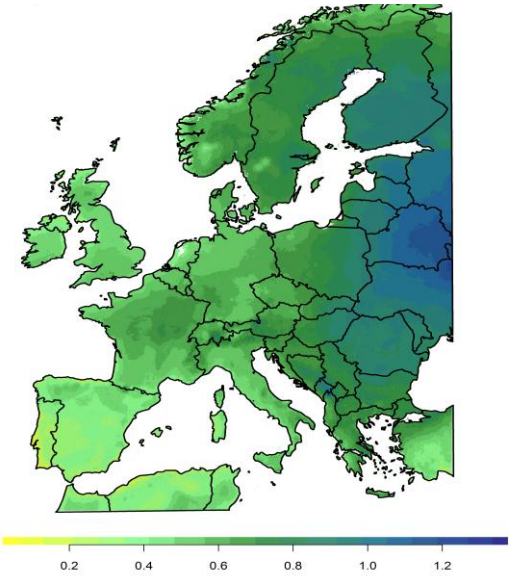
Winter 2051-2080 T-anomaly



Summer 2051-2080 T-anomaly



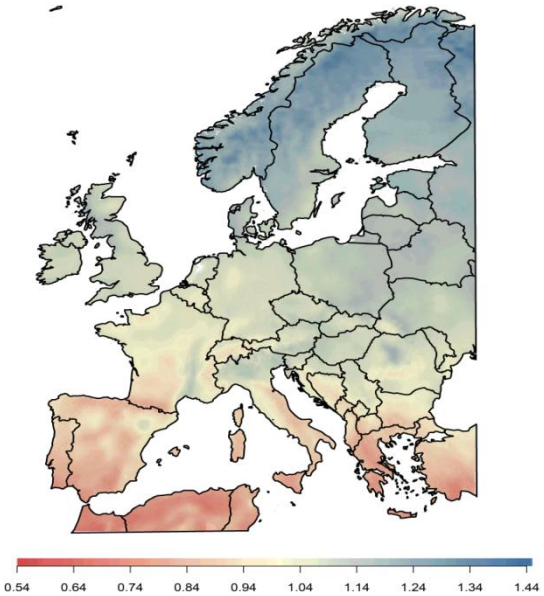
Uncertainty in summer T-anomaly



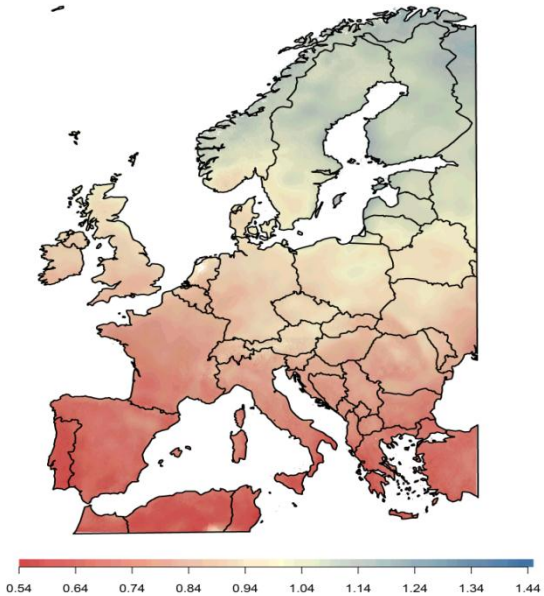
Trends and Uncertainty in Precipitation

Mean and St.dev among 6 RCM's used in MOTIVE for A1B

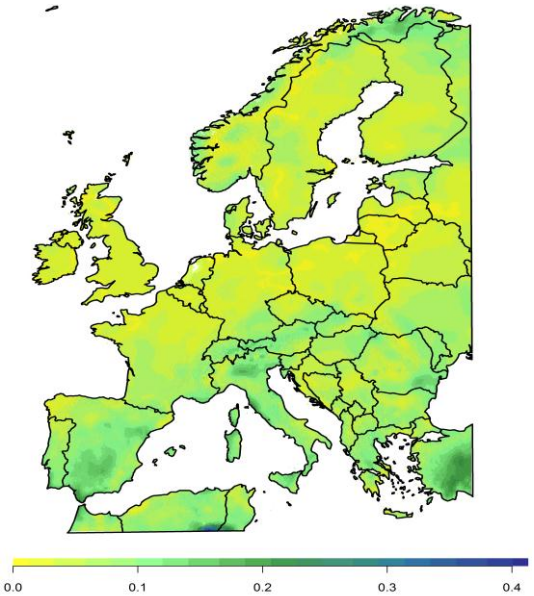
Winter 2051-2080 P-anomaly



Summer 2051-2080 P-anomaly



Uncertainty in summer P-anomaly

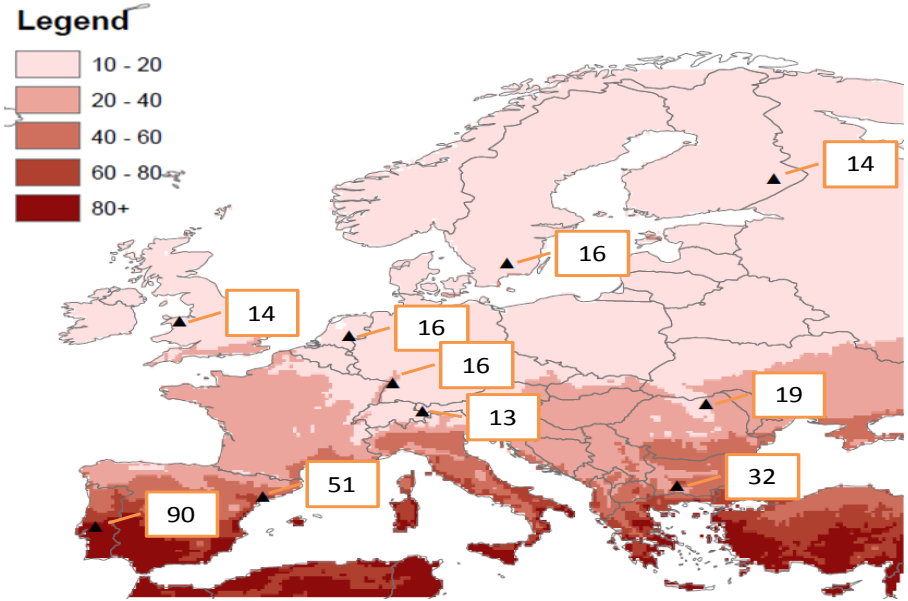


The climate-smart forester says:

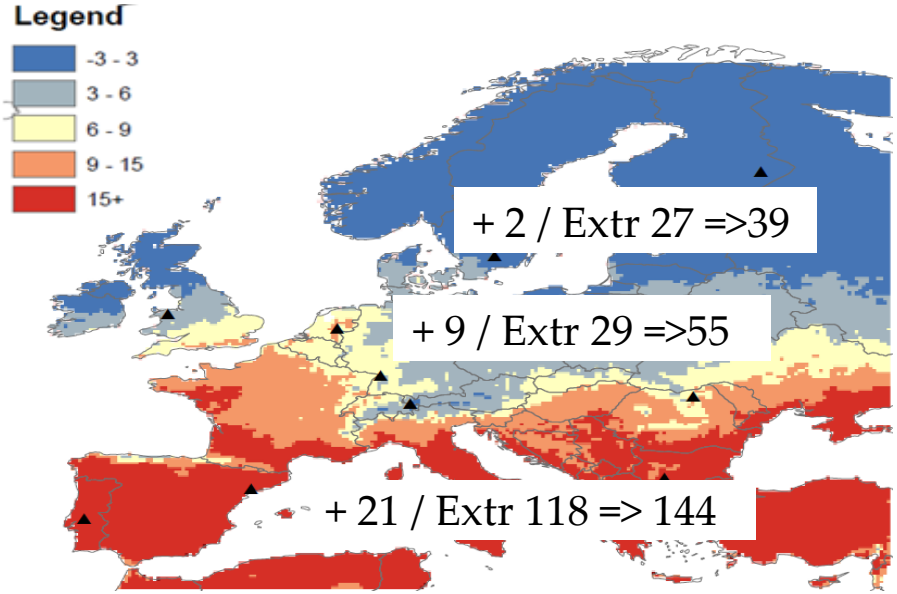
- Climate change differs between regions in Europe
- Seasonal differences are important (winter / summer)
- Climate impact on forest will vary a lot from one site to an other

Abiotic risk
Drought

Annual Maximum Number of Continuous Dry Days (Mean 1961-

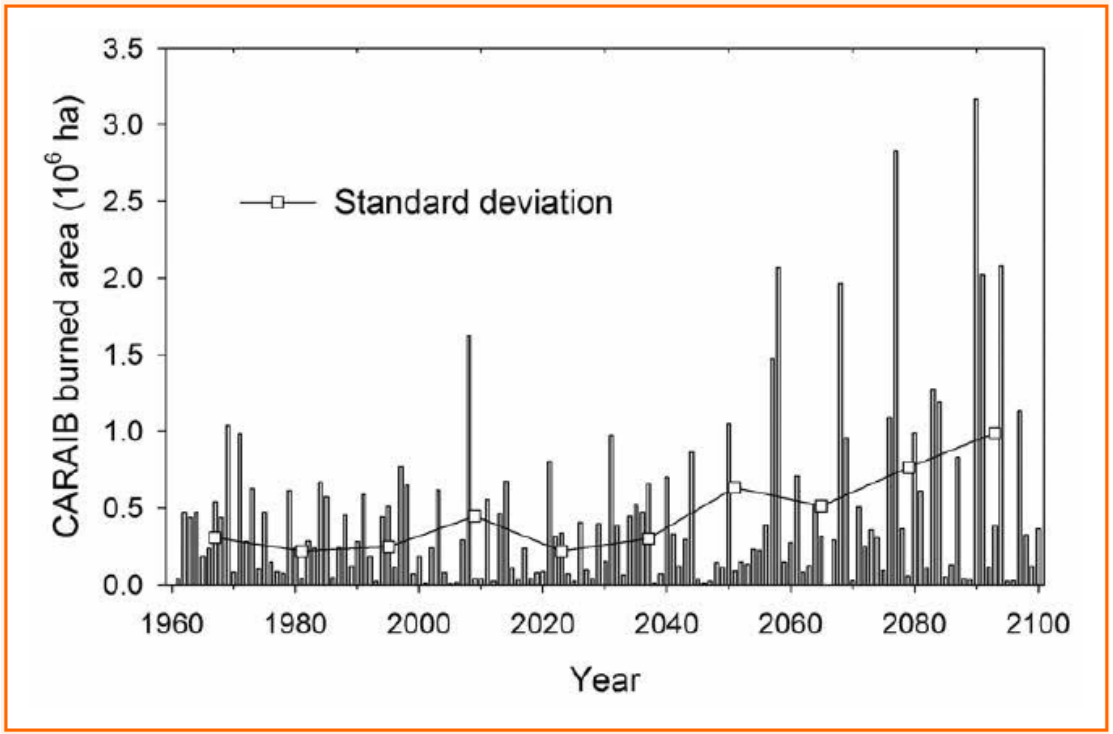


Change (2070-2099 vs. 1961-1990)



Abiotic risk
Change in fire regime risk

Projected wildfire areas in Europe under a scenario with intermediate green house effect gases emission. Source: Dury et al. 2011.



Abiotic risk
Storms

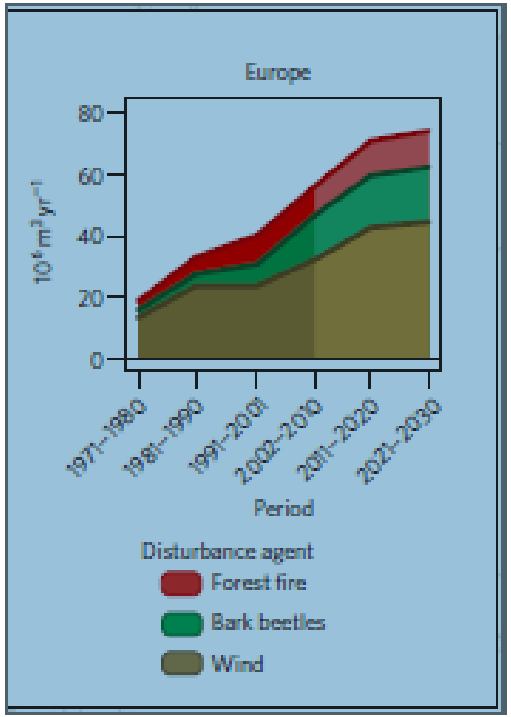
- Damaging storm forecasting highly uncertain
- Possible key changes to storms·
  - Spatial extent of individual storms is expected to change (broader path and/or longer extensions eastwards)·
  - Changes in extreme wind speeds (reduced return period for strong Winds)·
  - The areas most affected by storms may change because of shifts in storm tracks
- Possible impacts :
  - Increase in extreme wind speeds with a consequent higher probability of damage in affected areas.
  - Longer periods of unfrozen soils in for example Fennoscandia leading to reduced root anchorage during the winter.
  - Increased winter precipitation leading to more saturated soils and reduced root anchorage in many parts of Europe.

Biotic risk

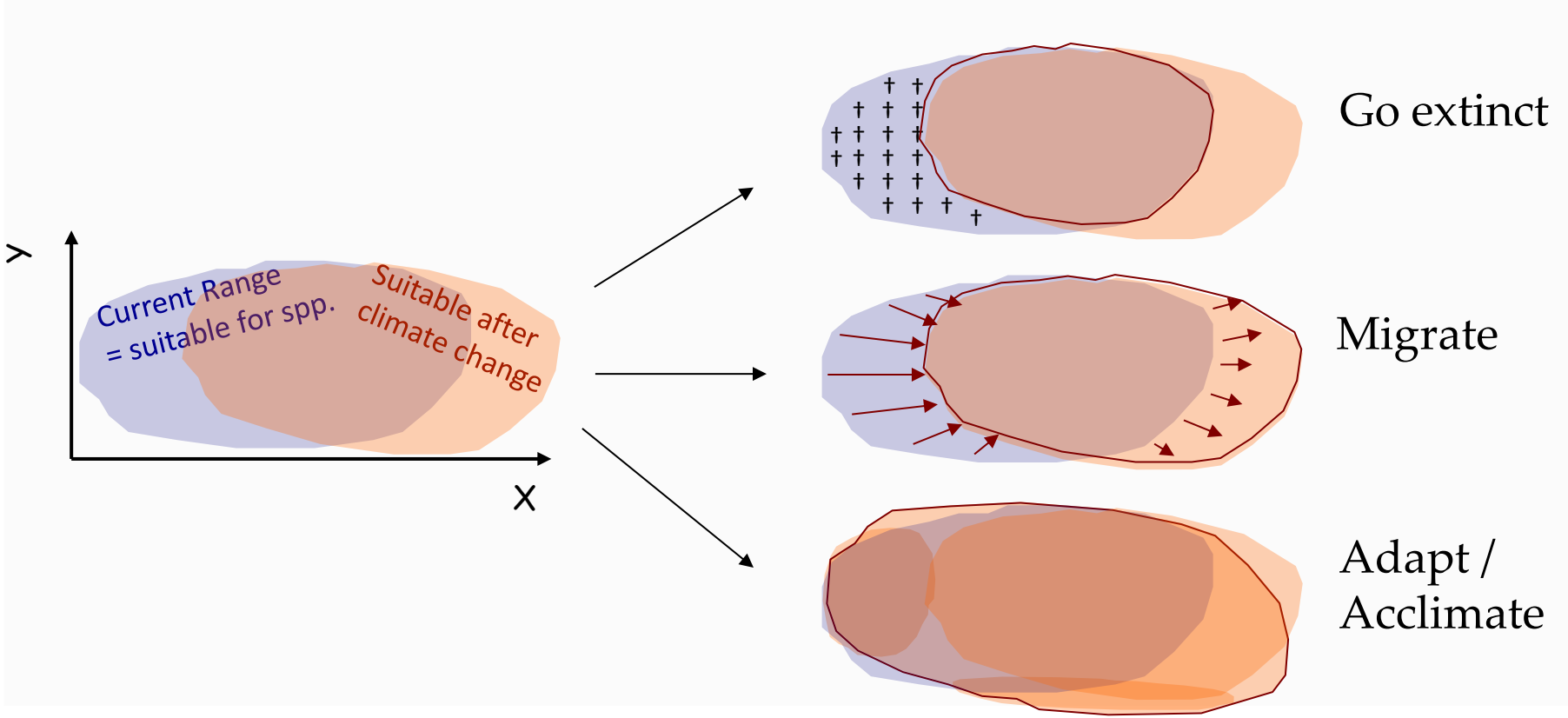
- Climate change according to location can generate adverse conditions for trees, but also for pests and diseases
- Pests
  - Favourised by T Increase, mild winters
  - Possibility for additional generations
  - Extension further north
- Diseases
  - Life cycle accelerated by T increase and more P.
  - More generations
  - Host resistance affected

Climate-smart forestry: risk

- Part of the increase in forest damages can be associated to climate change
- It will reduce efficiency of mitigation strategies



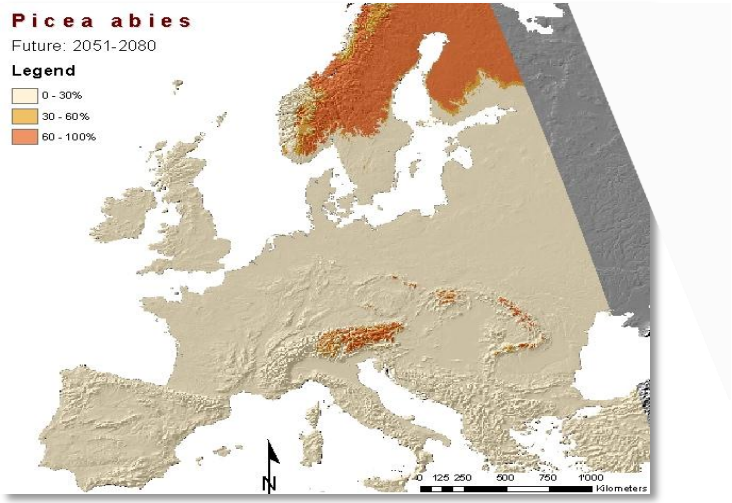
Impact on forest composition

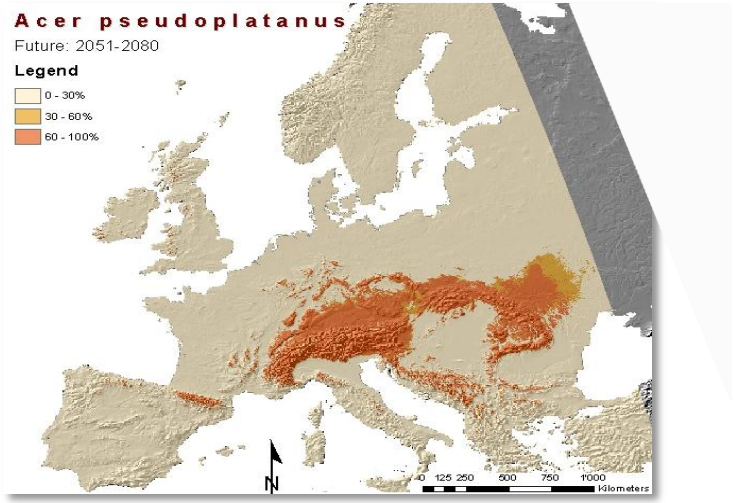


Impact on forest composition

- Montane/Subalpine species
- Ensemble predictions from multiple SDMs and RCMs

Suitable habitats in: 0-30% I 30-60% I 60-100% of all model/climate combinations



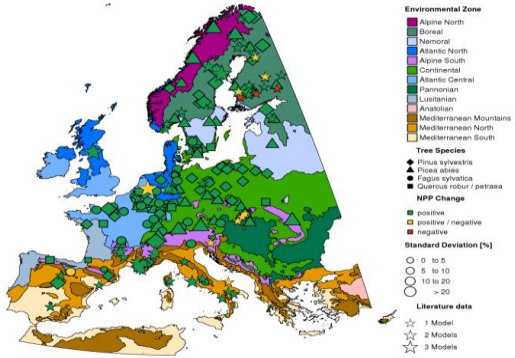


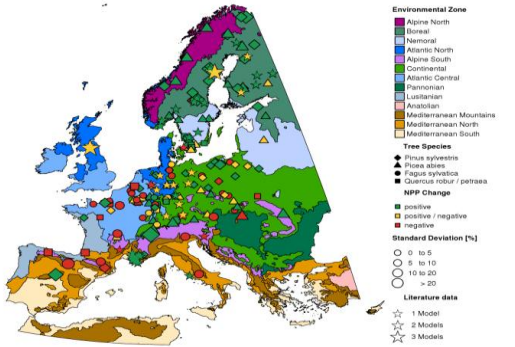
Impact on forest composition: species suitability

- Understanding changes in species suitability is crucial to understand threats and opportunities as basis for adaptive forest management
- Better understanding of physiological limits and genetic adaptation are crucial to interpret envelop model results

Impact on growth and productivity

- Most ecosystem models project increasing NPP in Europe for most of the 21st century
- However, these impacts are strongly driven by the (grossly overestimated) effects of increasing CO_2
- With constant CO_2 these models show in many regions growth declines!
    - (PhD thesis Christopher Reyer, 2013)

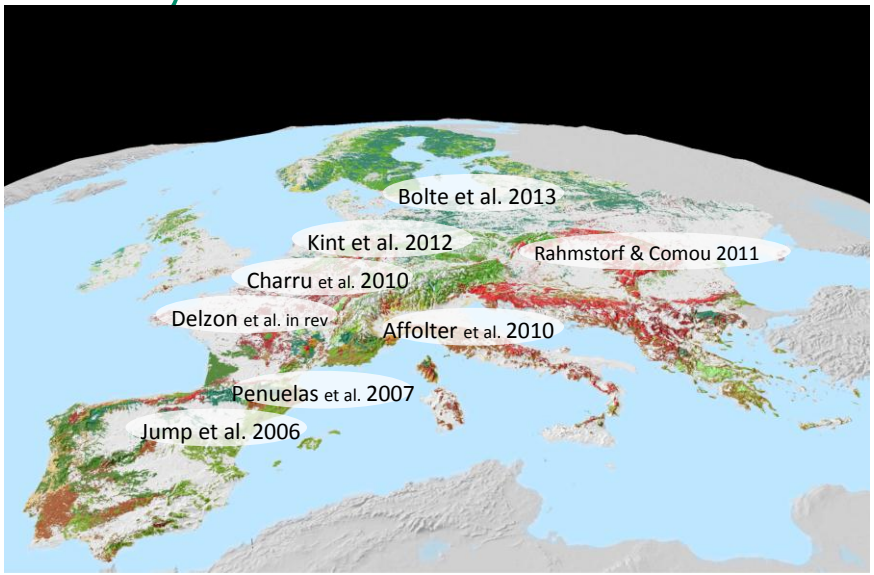




Already observed climate change impacts on growth and productivity

- Since 2005, numerous studies have already documented regional evidence of growth decline and/or changes in species composition

- Many of these were linked with tree responses to disturbances and extreme climate events like the exceptional drought of 2003



Climate-smart forestry: interpreting impacts on forest growth and productivity

- Response are species and sites specific.
- When a forests benefit of CO_2 increase an longer vegetation period this benefit is expected to be lost by risks induced by CC in coming decade(s)
- Be careful when interpreting simulated climate change impacts – simulation models have large uncertainties and do not yet capture extremes and disturbances well enough

Adaptive management : for forest manager

- Shorter rotation and/or reduce exposure
- Extend risk management
- Favour genetic material adapted to actual and future climate in a given area
- Improve water management in case of drought and rain excess

Adaptive management: for decision makers

- Monitor climate change impact at regional level accurately
- Support DSS tools development or manager integrating risk and uncertainty
- Actively prepare for extreme events
- Adapt policy on genetic material use
- Prepare forest sector to changes in wood supply
- Support all mitigation actions to reduce speed and intensity of changes

Conclusions

- Climate change scenarios remain uncertain and this is unlikely to change anytime soon!
- Impact assessments contain simplifications, but our system understanding is improving and it is important to make the right interpretations of uncertainties!
- The challenge for forest management is how to consider the trends and uncertainties in adaptive forest management
- Policy making should help foresters to get access to up-to-date information and educate them how to plan with uncertainties

Thanks for your attention!

http://www.motive-project.net/

www.sumforest.org

http://www.rokfor.eu/

http://www.efiatlantic.efi.int/files/attachments/efiatlantic/2012_rokfor/efi_rokfor_climate_change_a4_210113.pdf

http://www.efi.int/files/attachments/publications/efi_wsctu_3_final_net.pdf

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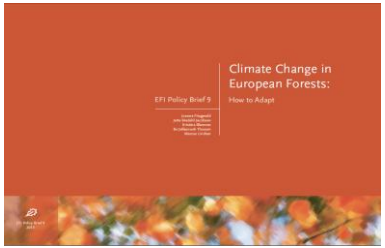

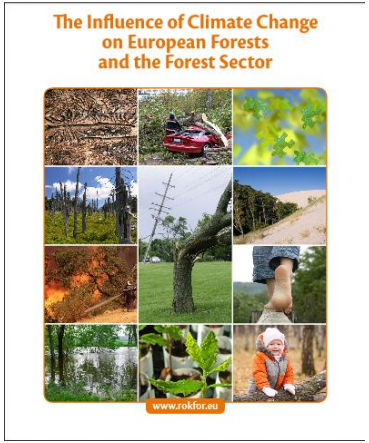

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