EUROPEAN FOREST INSTITUTE

Climate change affects resilience of European/global log supply

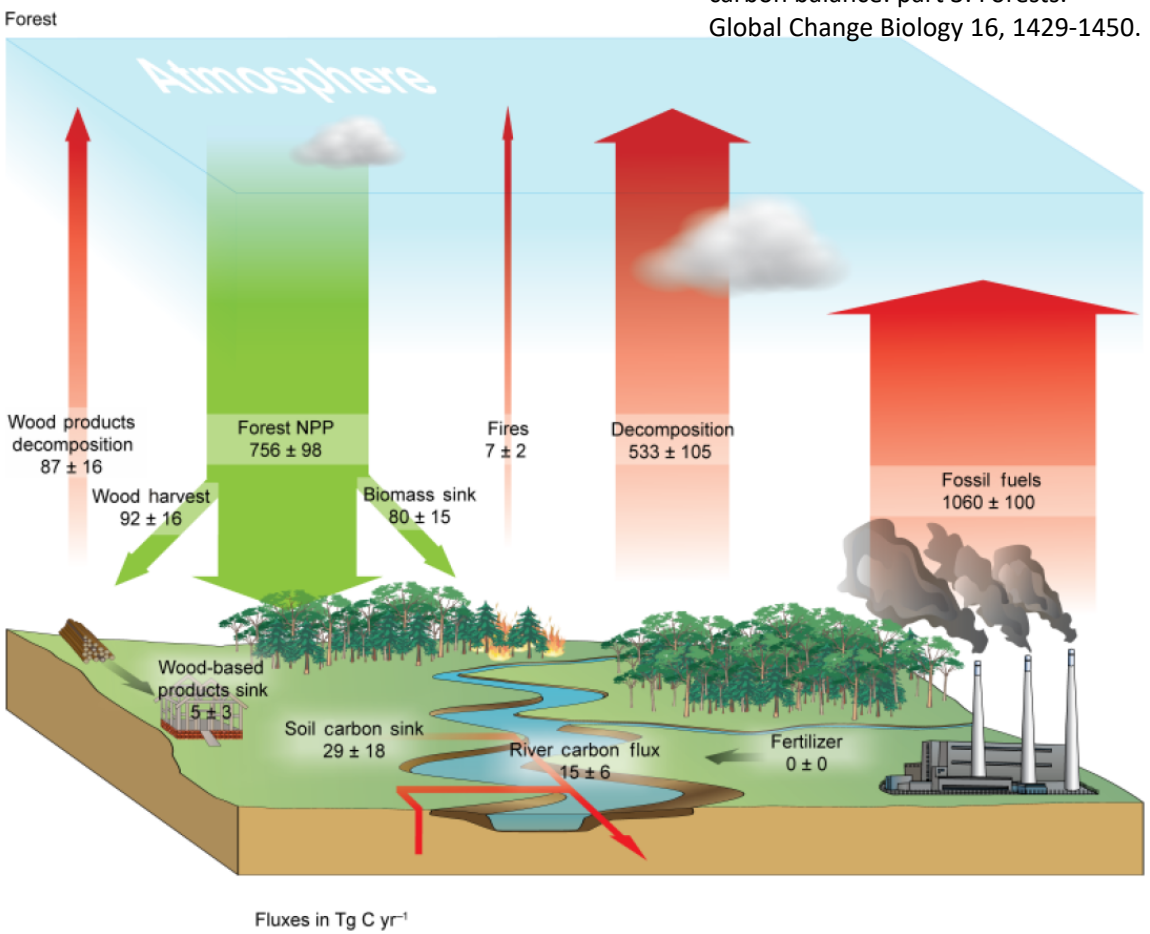
Marcus Lindner

INTERNATIONAL SOFTWOOD CONFERENCE 2021

Helsinki / hybrid conference; October 13-14, 2021

EU forests and forest-based sector: directly affected by climate and important for climate change mitigation

- EU forests: sink of 424 Mt CO_2 (~ **12%** of EU emissions 2015; EU GHG Submission, 2017)
- Harvested wood products: sink of 29 Mt CO_2 (~ **1 %** of EU emissions 2015; EU GHG Submission, 2017)
- Bioenergy from biomass: 7% of total EU energy need (European Commission's Knowledge Centre for Bioeconomy 2019)
- Important substitution effects



Luyssaert et al. 2010: The European carbon balance: part 3: Forests. Global Change Biology 16, 1429-1450.

Climate change poses a major challenge for European forests

Siebengebirge 2020
Foto M. Lindner

… demonstrated by recent extreme events and forest disturbances

A volunteer watches as firefighters use a water hose to extinguish the blaze of a forest fire in the village of Glatsona on Evia island, Greece, in August. (Angelos Tzortzinis/AFP via Getty Images)

Disturbances get more extreme

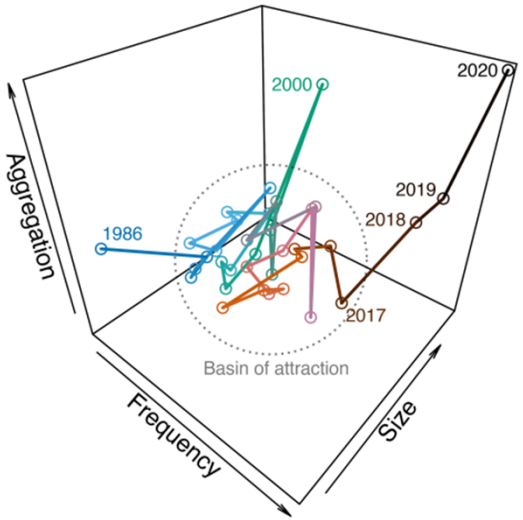
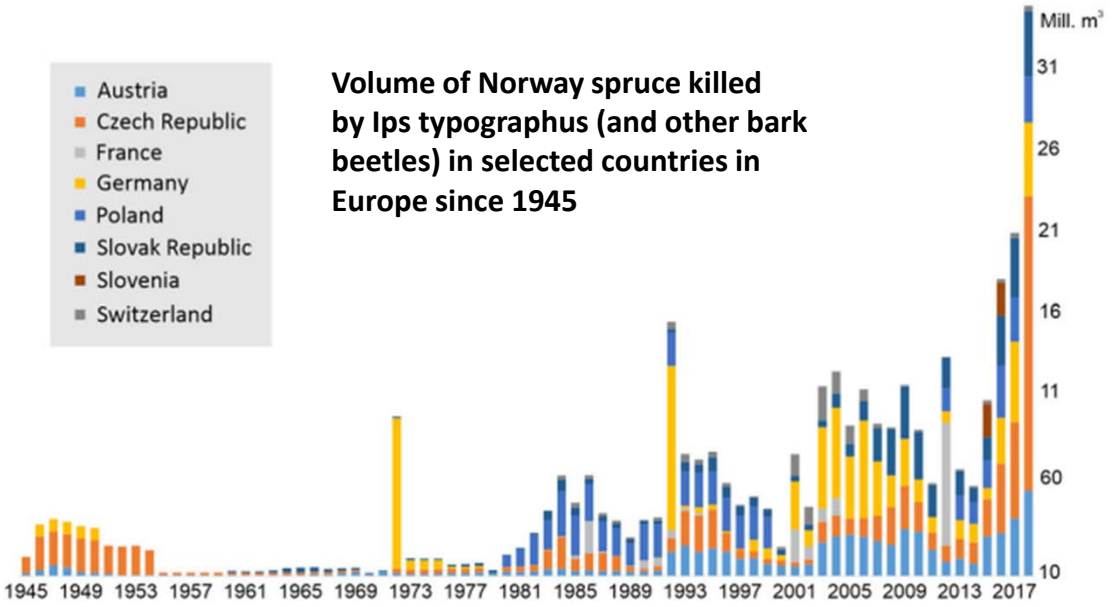


Figure 4. The development of disturbance regime characteristics in Europe's forests in the period 1986–2020. Frequency denotes the average number of disturbances per unit forest area and year, size is the 95 % quantile of the patch size distribution of disturbances, and aggregation is the average spatiotemporal autocorrelation of disturbance patches. The drought of 2018 has pushed Europe's forest disturbance regimes outside of their past basin of attraction.

Senf & Seidl 2021: Biogeosciences 18, 5223-5230

… and reach unprecedented intensity



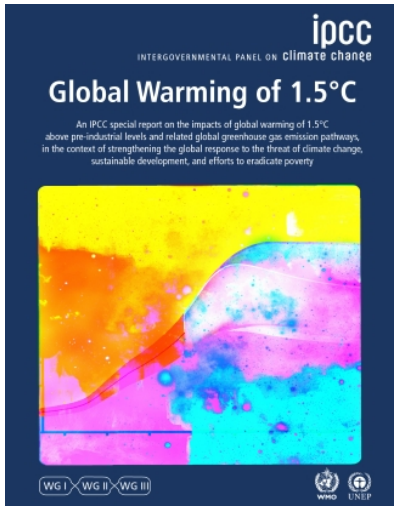
Volume of Norway spruce killed by Ips typographus (and other bark beetles) in selected countries in Europe since 1945

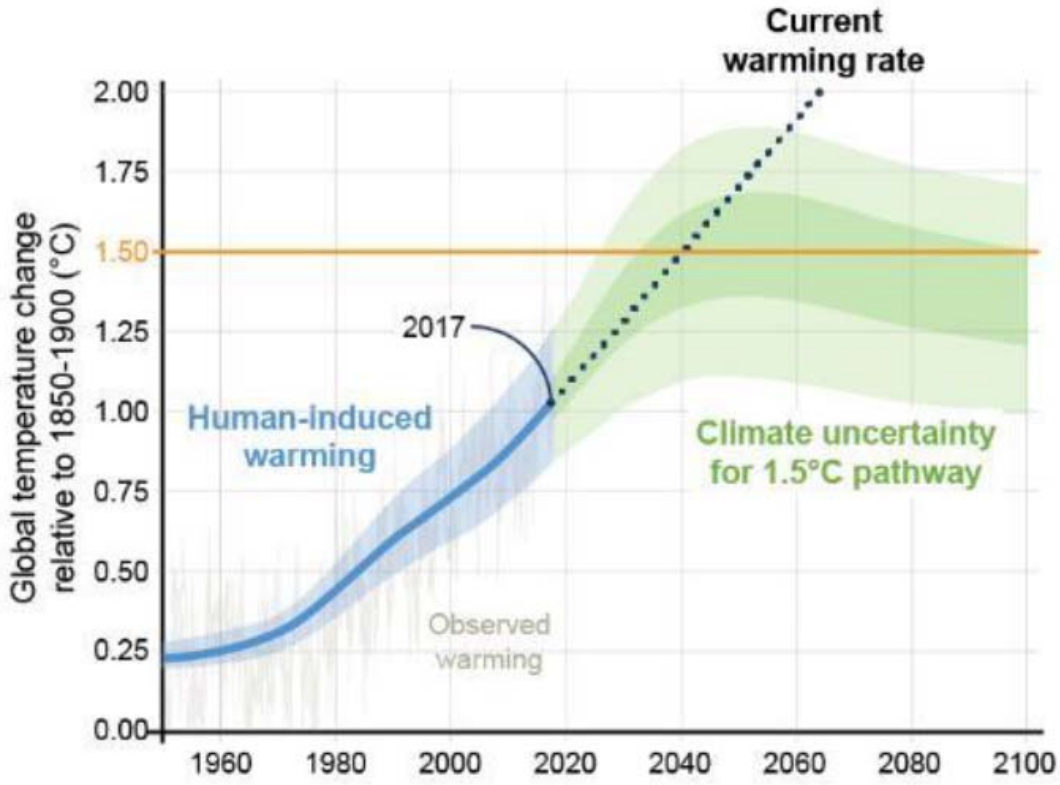
Hlásny et al. 2021: Current Forestry Reports 7: 138-165.

Climate Change is ongoing

IPCC Special report 2018:

GLOBAL WARMING OF 1.5 °C



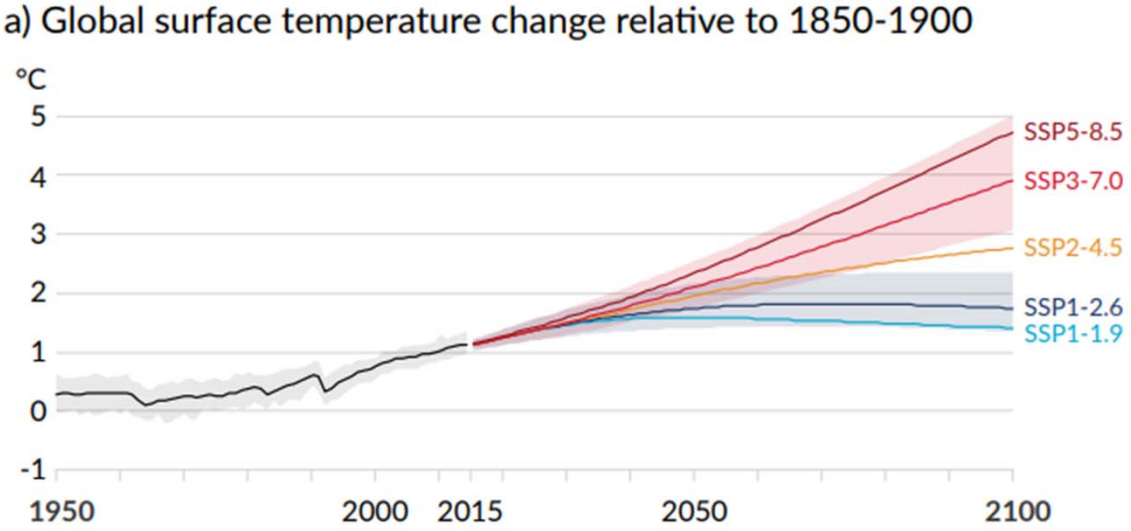


FAQ1.2, Figure 1: Human-induced warming reached approximately 1°C above pre-industrial levels in 2017. At the present rate, global temperatures would reach 1.5°C around 2040.

Climate change projections remain uncertain, largely depending on future policies and human choices

- Everything between +1.5 °C and +5 °C human induced climate warming is still possible
- Current policies lead us towards +3 °C

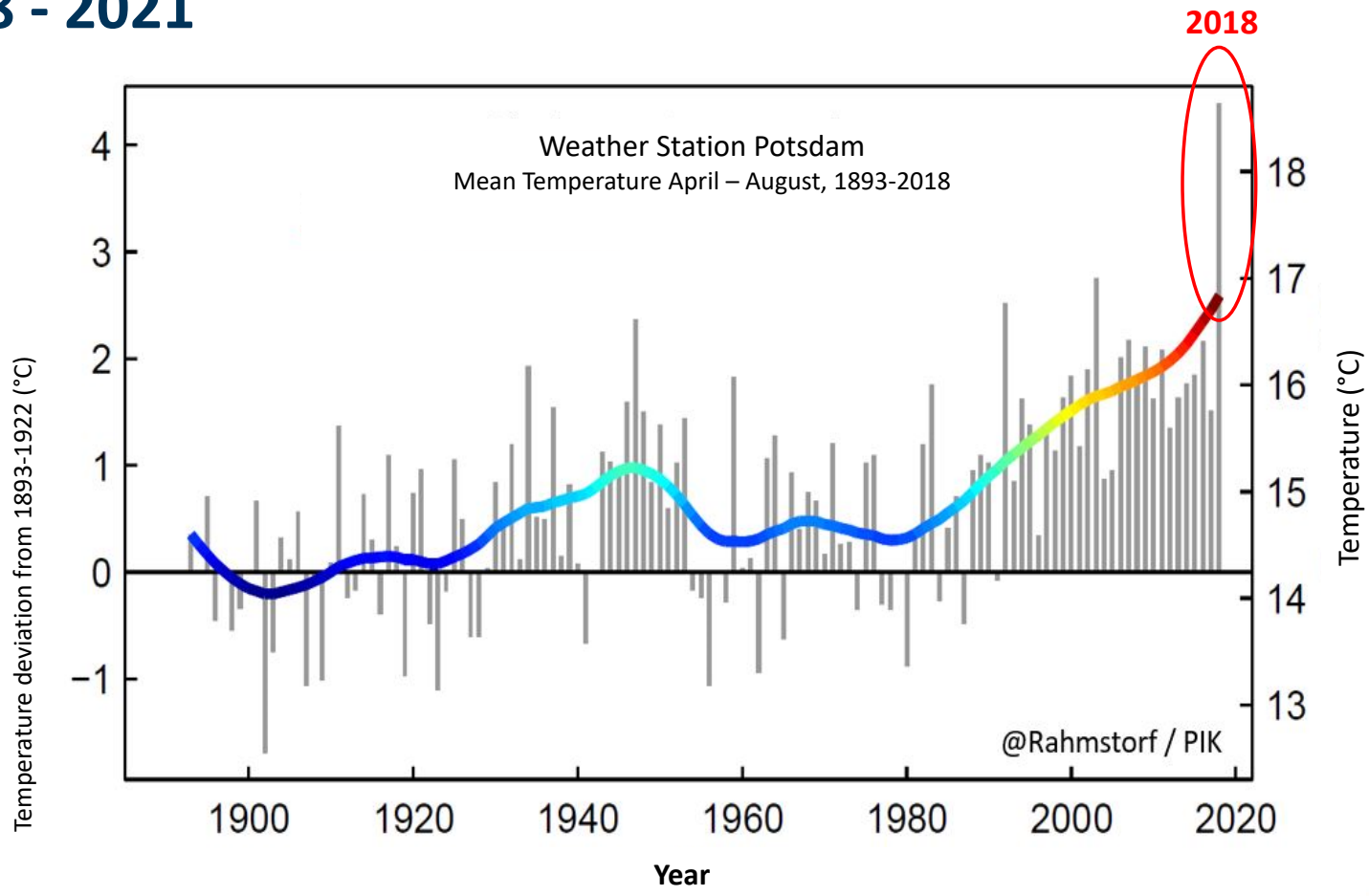
SSP: Shared Socio-economic Pathways;
the second set of numbers (1.9 to 8.5) indicate the approximate level of radiative forcing (in W m–2) resulting from the scenario in the year 2100)



IPCC, 2021: Summary for Policymakers.
In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte et al. (eds.)], Cambridge University Press.

Climate change becomes real: exceptional heat and disturbances affecting Europe in 2018 - 2021

- Multiple **windstorms** in the winter 2017/2018 and November 2018 (storm Vaia, Northeastern Italy)
- Devastating **wildfires** e.g. in Greece, July 2018 and August 2021; but also in Sweden (2018: 25000 ha), …
- **Bark beetle outbreak** with unprecedented damage in many (Central) European countries



What we know (or not yet know) about climate change and European forests

- Even if we manage to keep the Paris 2015 targets, we will face significant climate change affecting European forests

Journal of Environmental Management 146 (2014) 69–83

Contents lists available at ScienceDirect

Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman

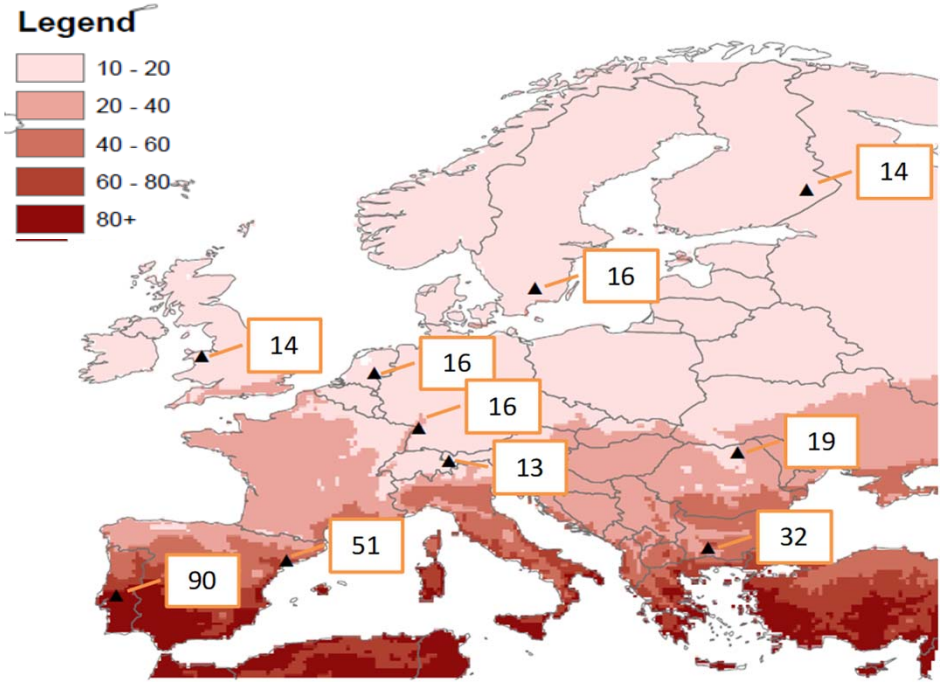
Review

Climate change and European forests: What do we know, what are the uncertainties, and what are the implications for forest management?

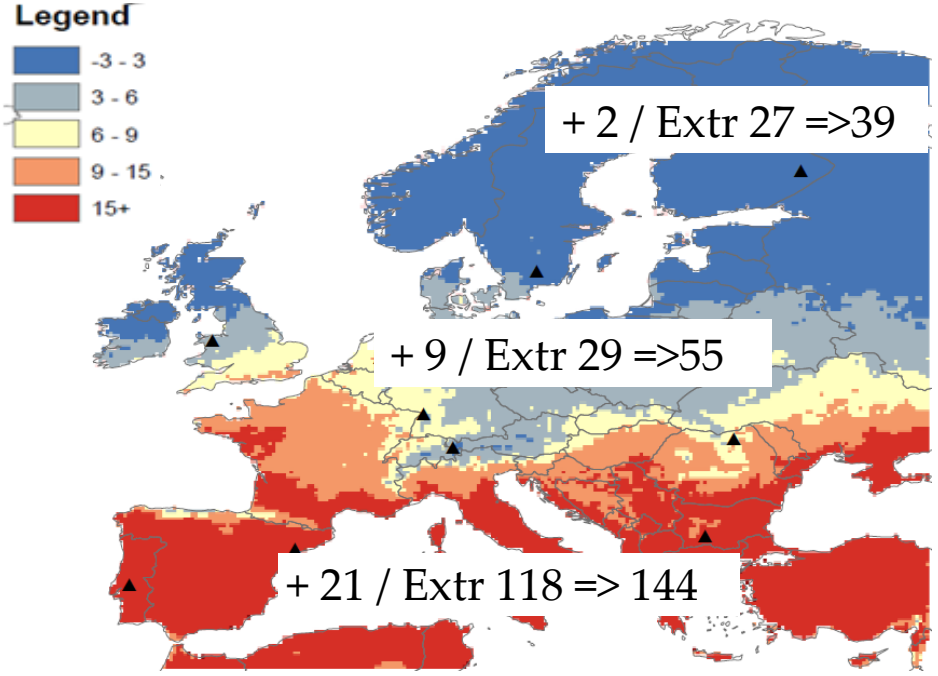
Marcus Lindner [a], Joanne B. Fitzgerald [a,*], Niklaus E. Zimmermann [b], Christopher Reyer [c,d], Sylvain Delzon [e,f], Ernst van der Maaten [g,h], Mart-Jan Schelhaas [i], Petra Lasch [c], Jeannette Eggers [a,j], Marieke van der Maaten-Theunissen [g,h], Felicitas Suckow [c], Achilleas Psomas [b], Benjamin Poulter [b,k], Marc Hanewinkel [b,l]

Abiotic risk - Drought

Annual Maximum Number of Continuous Dry Days (Mean 1961-1990)



Change (2070-2099 vs. 1961-1990)



Lindner et al. 2014. *Journal of Environmental Management*, **146**, 69-83.

Future impacts of climate change

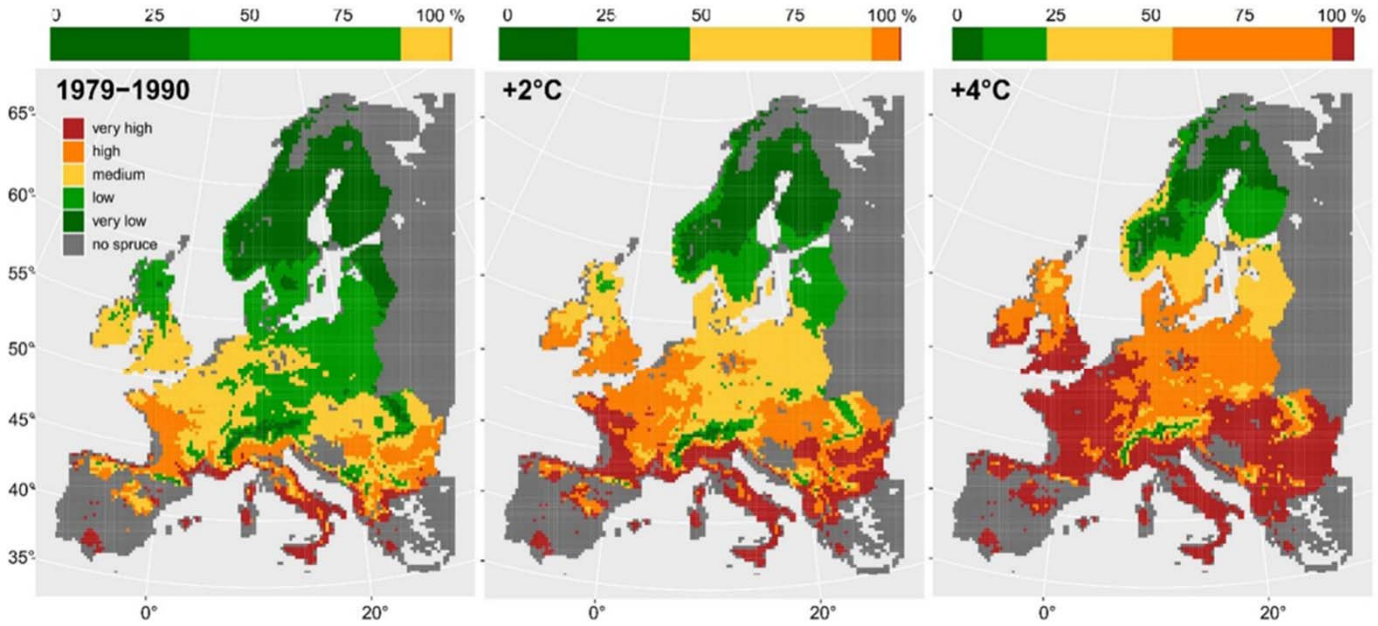
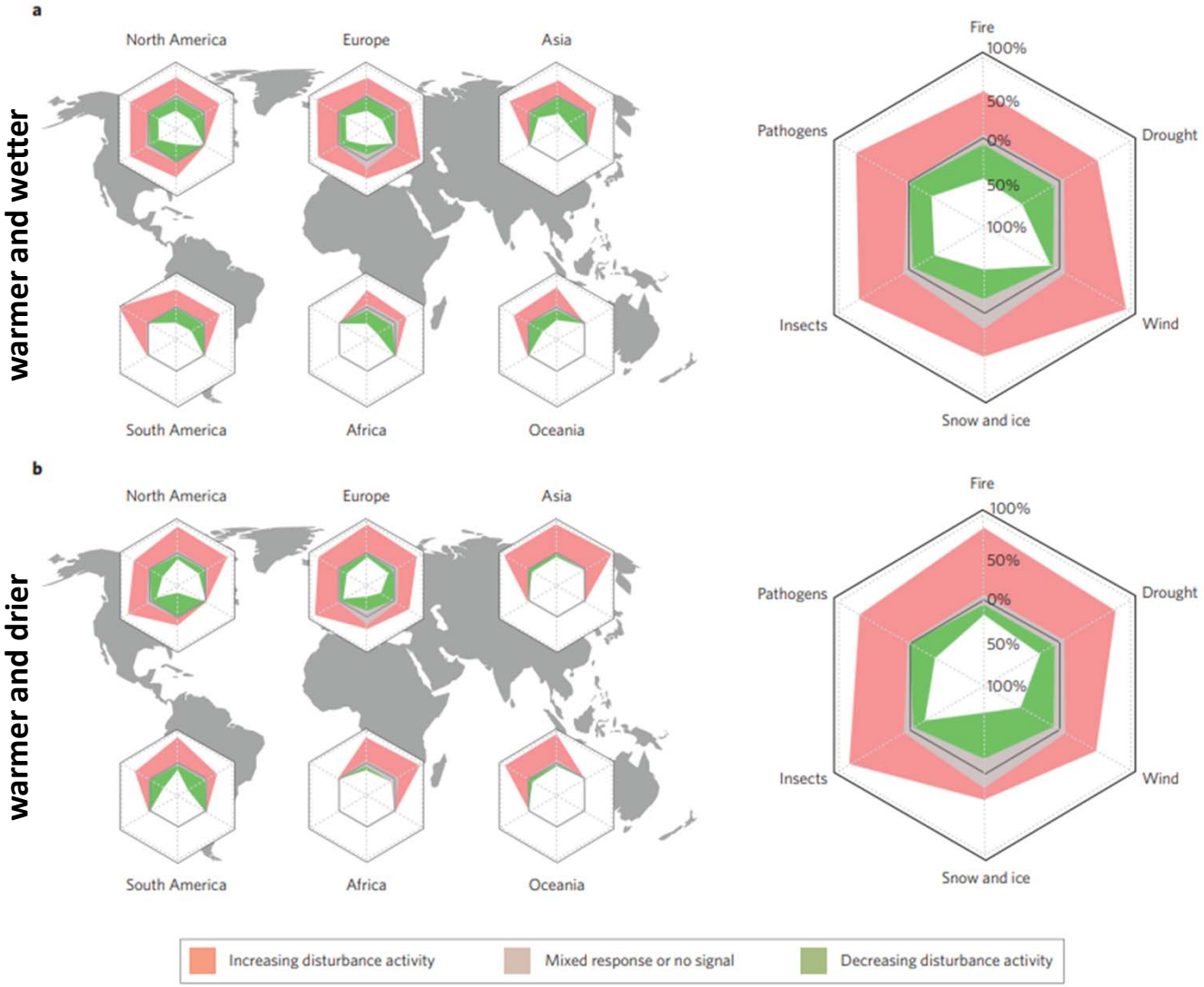


Fig. 4 Probability of a model Norway spruce stand (fully stocked, 100-year-old) being disturbed by bark beetles under historical temperature conditions (1979–1990), and under +2 °C and +4 °C temperature scenarios. Drought conditions were assumed to remain unchanged at the level of 1979–1990; the maps therefore present a conservative estimate. Bars on the top show the relative share of Norway spruce growing stock in Europe in different risk classes. For description of data and methods, see Appendix 2.

… could undermine the role of European forests and the forest-based sector as central pillar of the European Green Deal and the EU Forest Strategy

Hlásny, T. et al. 2021: Current Forestry Reports 7, 138–165.

Forest disturbances under climate change



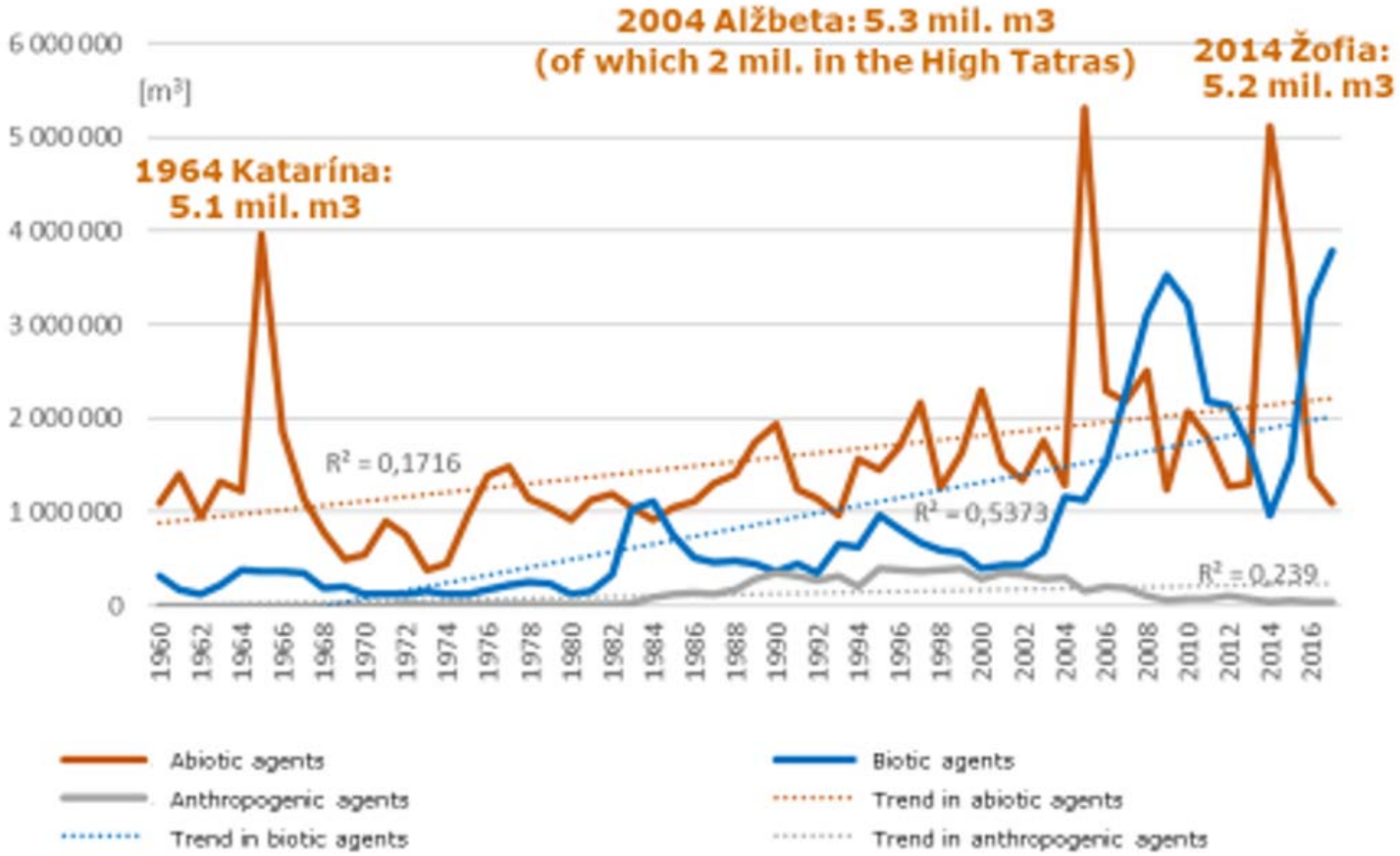
Seidl et al. (2017). Forest disturbances under climate change. Nature Climate Change 7, 395-402.

- Global disturbance response to changing temperature and water availability. Radar surfaces indicate the distribution of evidence (% of observations) for increasing or decreasing disturbance activity under future climate conditions.
- The large radar plots to the right summarize the responses over all continents.

Example of salvage felling in Slovakia since 2004: disturbance agents drive most cuttings

- Cumulative amounts of salvage fellings across all damaging agents exceeded 50% of all recorded fellings since 2005
- Over the decade 2008-2017, share of salvage fellings in total harvest was on average 54.7% (all species) and 77.2% (coniferous species).

Source: National Forest Centre; Forest Protection Service, 2018



Forest owners and value chains need to adapt

RESONATE
Resilient Forests for Society

Siebengebirge 2020
Foto M. Lindner

- Forest owners need better guidance in adapting forest management to cope with climate-induced forest disturbances
- The forest-based sector will require substantial innovation capacity to respond to changes in profitability, unpredictable wood flows, and gradually changing tree species

We need more resilient forest systems

RESONATE
Resilient Forests for Society

Demonstrating wildfire prevention measures in Germany
Foto: WKR Project @EFI-Resilience

- To mitigate increasing disturbance risks, we need to
  - prioritize prevention efforts
  - enhance resilience of European forests and associated value chains

We need more resilient forest systems

RESONATE
Resilient Forests for Society

Continuous cover forestry in a Bavarian State Forest Enterprise;
Foto: Daniel Kraus

- To mitigate increasing disturbance risks, we need to
  - prioritize prevention efforts
  - enhance resilience of European forests and associated value chains

➢ Better scientific understanding is crucial

How can resilience of Europe's forests and forest value chains be improved?

RESONATE
Resilient Forests for Society

Forest resilience? – What exactly does this mean?

- Engineering resilience (Pimm, 1984)

  "The time that it takes for variables to return towards their equilibrium following a disturbance"

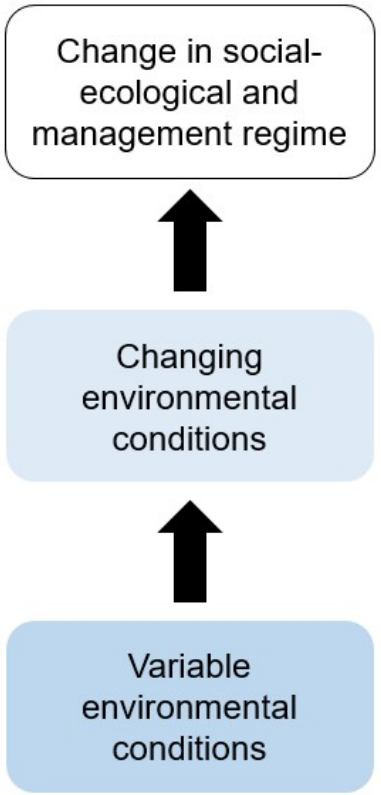
- Ecological resilience (Holling, 1973)

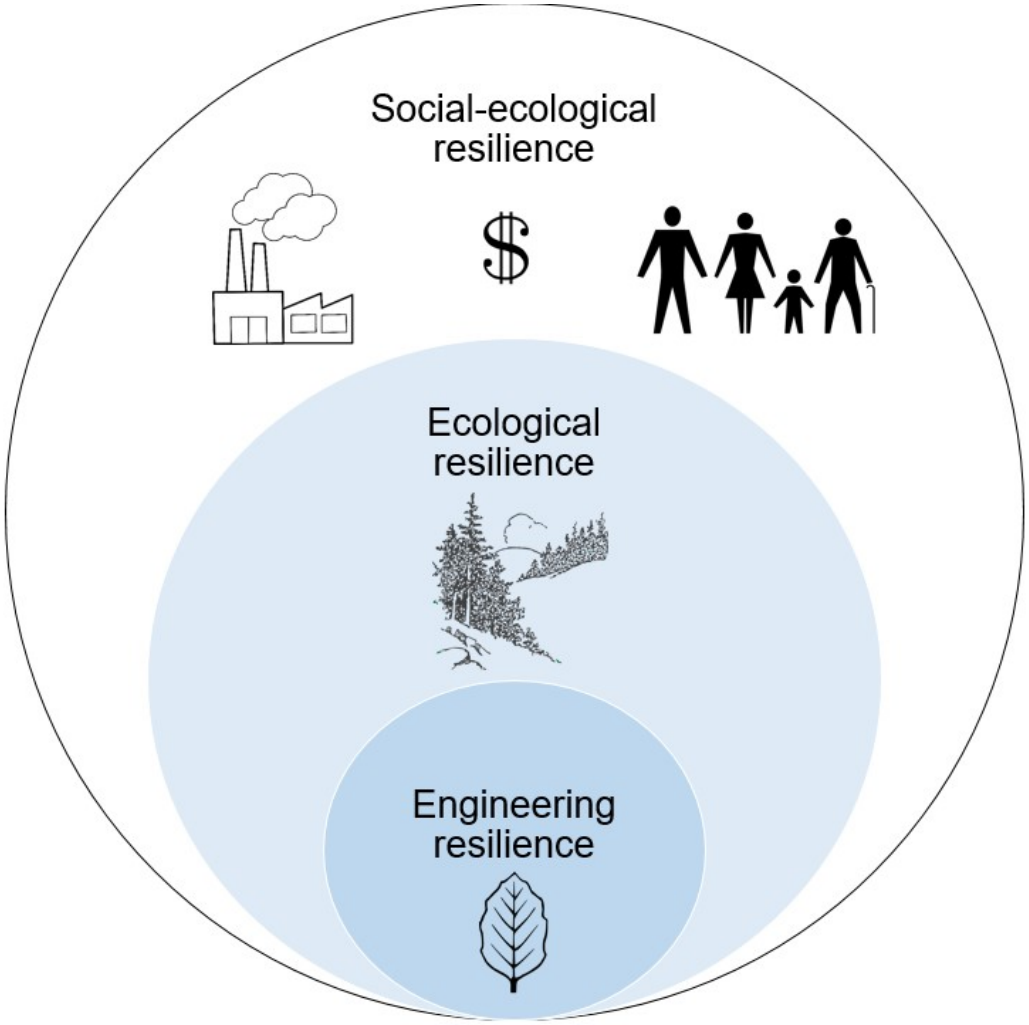
  "The system's capacity to absorb disturbance without changing as well as the ability to self-organize and build adaptive capacity"

- Social-ecological resilience (Resilience Alliance, 2019)

  "The capacity of a social-ecological system to absorb or withstand perturbations and other stressors such that the system remains within the same regime, essentially maintaining its structure and functions. It describes the degree to which the system is capable of self-organization, learning, and adaptation."

Nested hierarchy of resilience concepts

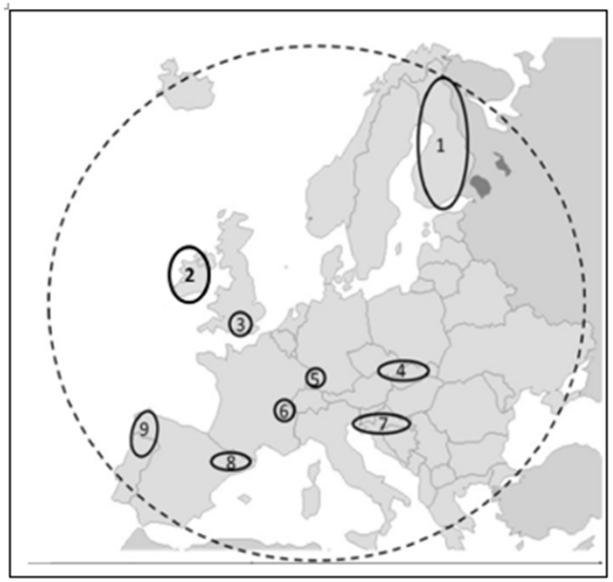




Nikinmaa et al. 2020, Current Forestry Reports
doi 10.1007/s40725-020-00110-x

RESONATE
Resilient Forests for Society

- RESONATE aims to generate the needed knowledge and practices for making European forests, the services they provide, and related economic activities more resilient to future climate change and disturbances.



- Nine regional case studies
- European scale modelling for context and extrapolation

- RESONATE investigates how past and current site factors and management affect forest system resilience in different forest types and management systems across Europe
- Based on scenario analysis, foresight studies with active stakeholder engagement, and policy analysis, response strategies to enhance forest & forest value chain resilience will be elaborated
- RESONATE aims to highlight and balance trade-offs in decision making to deliver user-oriented recommendations and decision support

RESONATE: Resilient forest value chains – enhancing resilience through natural and socio-economic responses. Horizon 2020 RIA, project no. 101000574 (April 2021 – March 2025). Coordinator EFI, 20 partners, Contact: Marcus.Lindner@efi.int

RESONATE
Resilient Forests for Society

Conclusions: Perspectives on forest value chain resilience

Climate change will strongly impact global forests and round wood supply

- Harvesting and log supply will fluctuate more, with higher share of salvage cutting
- Regional supply e.g. of spruce timber may decline abruptly (following the flooded markets)

Resilience concept has potential to guide decision making

- Forest management and forest sector decision making needs strong evidence base
  - Data on past and future climate variability, extreme events and disturbance regimes
  - Understanding of changing species suitability and evolving disturbance risks
- Forward-looking risk management strategies focusing on enhancing forest resilience
  - Understanding drivers of value chain resilience
  - Recognizing bottlenecks in supply chains
- Knowledge on adaptation strategies tailored to the local forest conditions

Thank You for listening – looking forward to your questions …

- Contact: Marcus.Lindner@efi.int
- European Forest Institute www.efi.int

RESONATE
Resilient Forests for Society

- Website will be launched in November: **www.resonateforest.org**
- Follow RESONATE on Twitter now: @RESONATE_forest !

ACKNOWLEDGEMENT

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no **101000574**.