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Consequences of the disturbance of spruce and pine forests on forestry and the cultural landscape in Saxony

FORESTS´ FUTURE 2022: Consequences of Bark Beetle Calamity for the Future of Forestry in Central Europe

Sachsenforst

Dr. Dirk-Roger Eisenhauer, Sven Sonnemann, Lutz-Florian Otto,
Franz Matschulla, Rainer Gemballa, Dr. Sven Martens, Karina Hoffmann, Dr. Heino Wolf
Dirk-Roger.Eisenhauer@smekul.Sachsen.de
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Structure

1. The Federal State of Saxony
2. Reasons for the calamity
3. The disturbance dynamics
4. Systematic development of resilience
5. Current challenges
6. Conclusion

The Federal State of Saxony

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Key figures

- Administrative information
  - 18,450 km²
  - approx. 4 million inhabitants
  - Bordering the Czech Republic in the south and Poland in the east
- Topography
  - Lowland in northern Saxony, hill country affected by loess in central Saxony and low mountain areas in the south

The Federal State of Saxony

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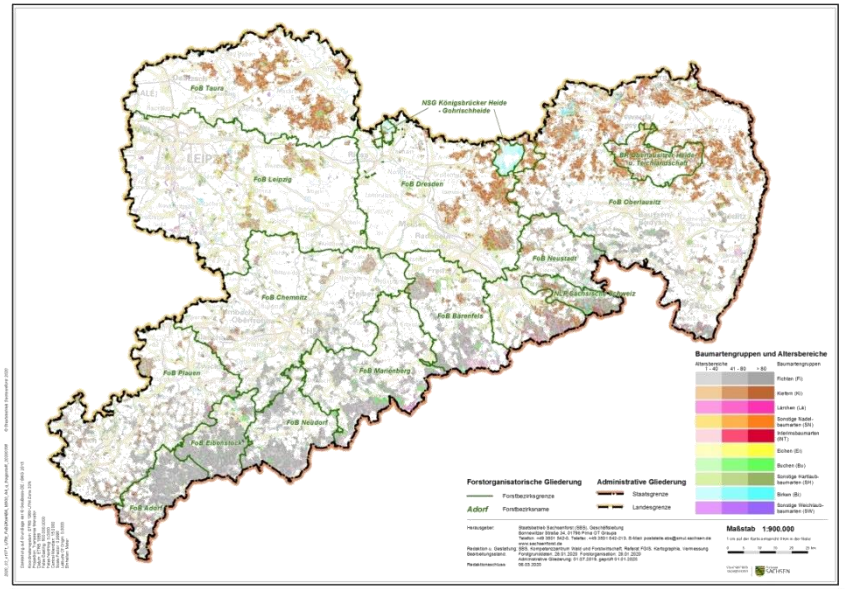
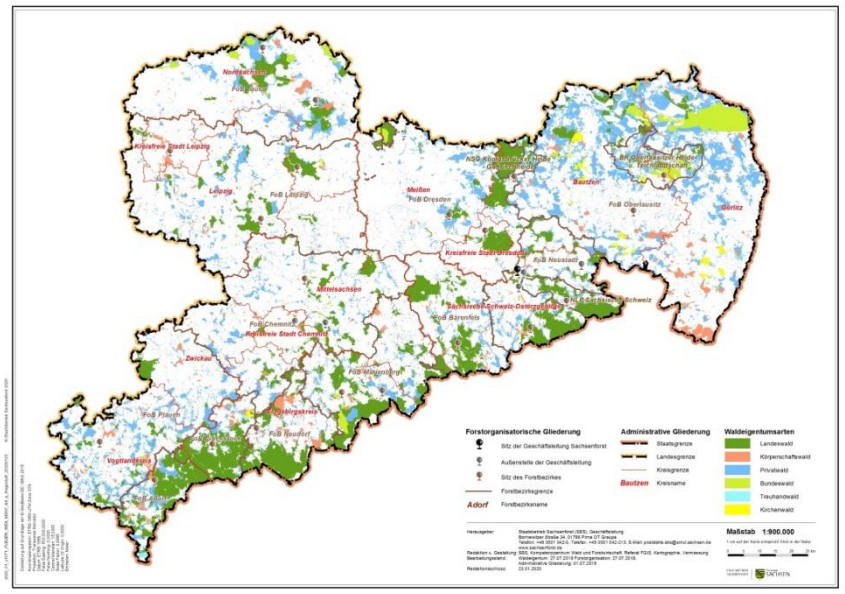
Key figures

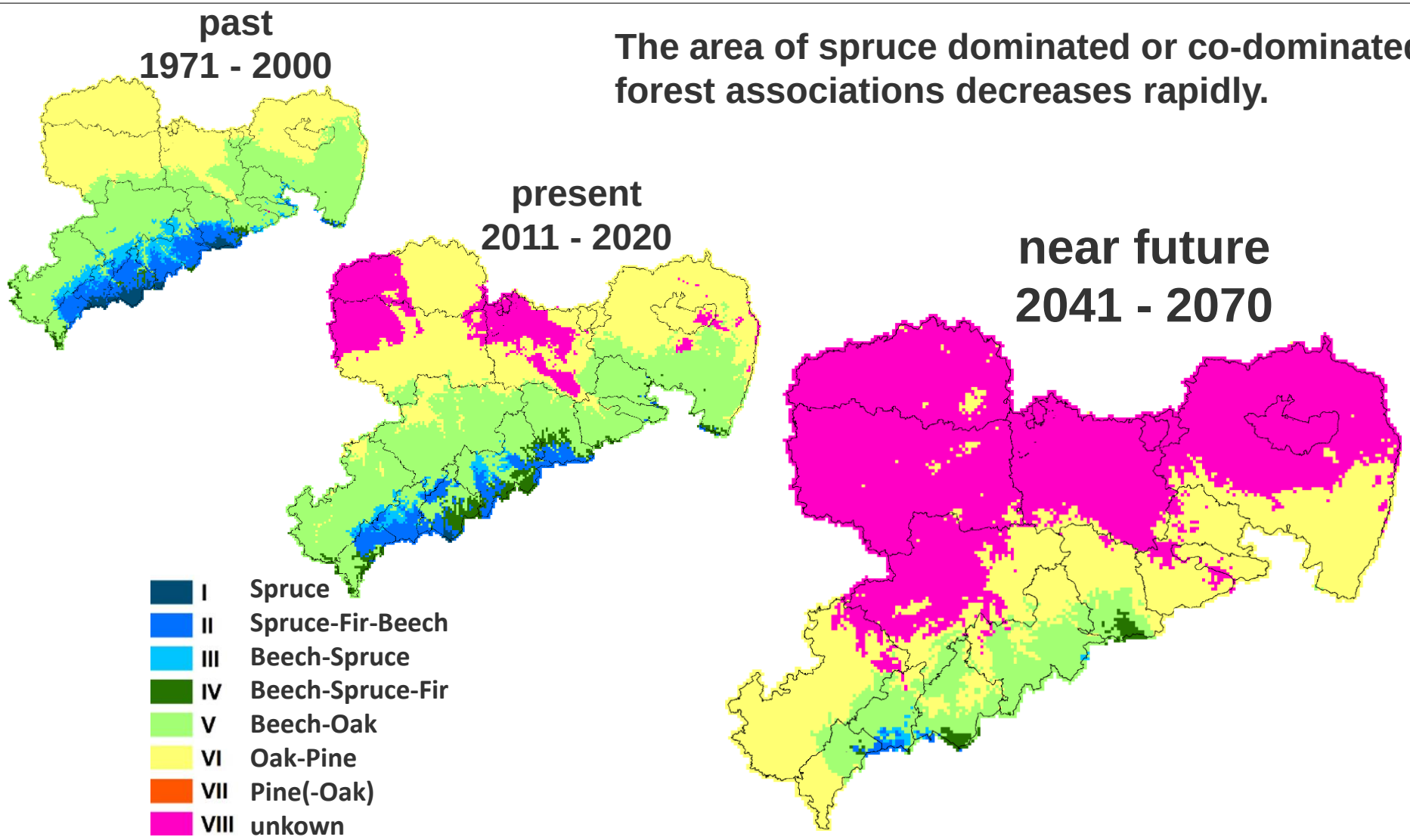
- Forest distribution and characteristics
  - Forest area: 520,539 ha (28,2 %)
  - Large private forest complexes, especially in northern and eastern Saxony, however **dominance of small private forests**
  - Main tree species:
    - 35% (**state forest 52%**) Norway spruce, 31 % Scots pine, 7 % Silver birch, 6% Oak, 3% Beech
  - Ownership structure:
    - 52,3% public forest (state, federal and communal), **47,7%** private forest





Critical drift of climatic site conditions regarding actual and potential areal of Norway spruce

The area of spruce dominated or co-dominated forest associations decreases rapidly.



Spruce stands

DBH structure of growing stock as a function of age

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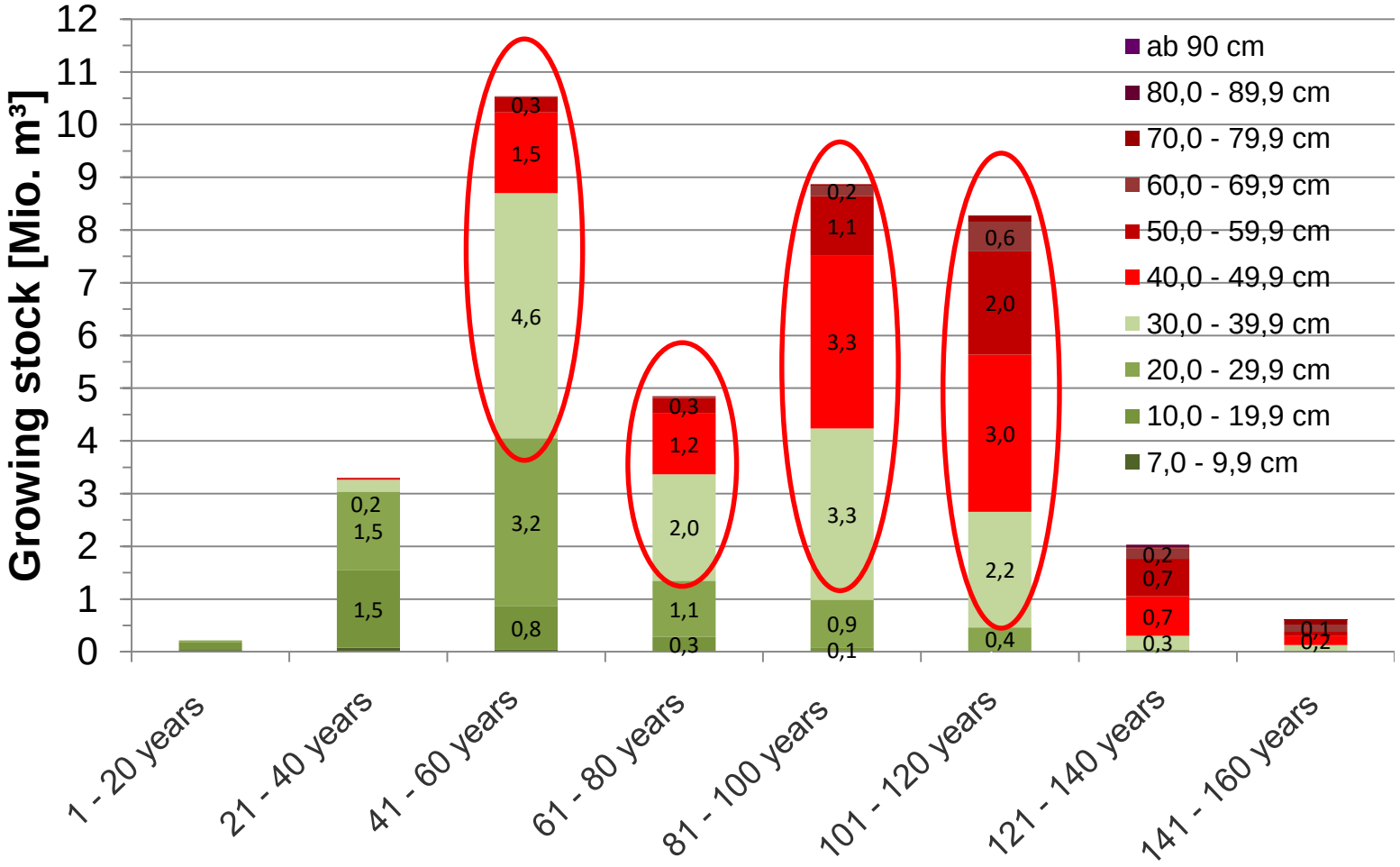
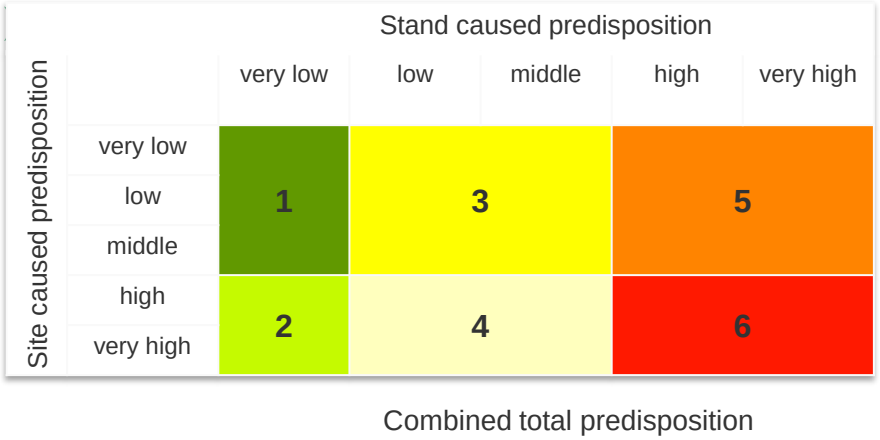


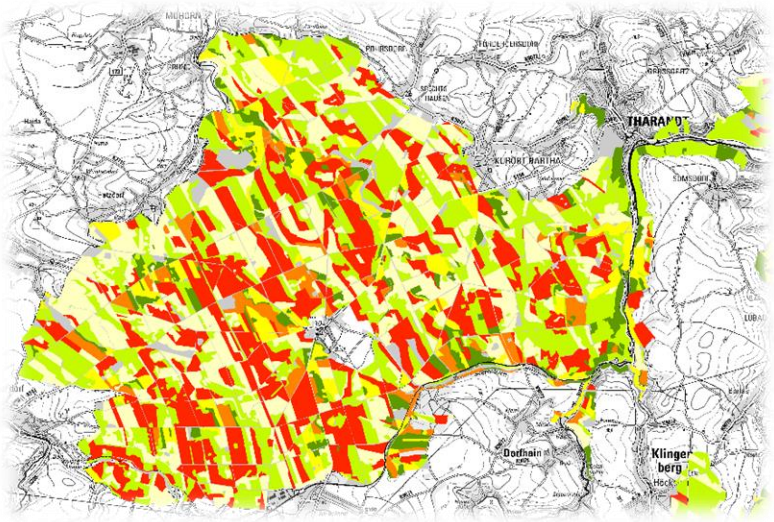
Estimation of predisposition to disturbances by storm, snow, bark beetle *(Ips typ. L.)* [BOKU, Austria in Cooperation with KWuF, Saxony]

- Input parameters:

site
(pot. generation number of bark beetle, cwb, soil hydrology, nutrient potential of site)

stand
(level of spruce at tree species composition, age, stand density)





The influence of the timber stock on the development of unplanned timber harvest as a result of disturbances

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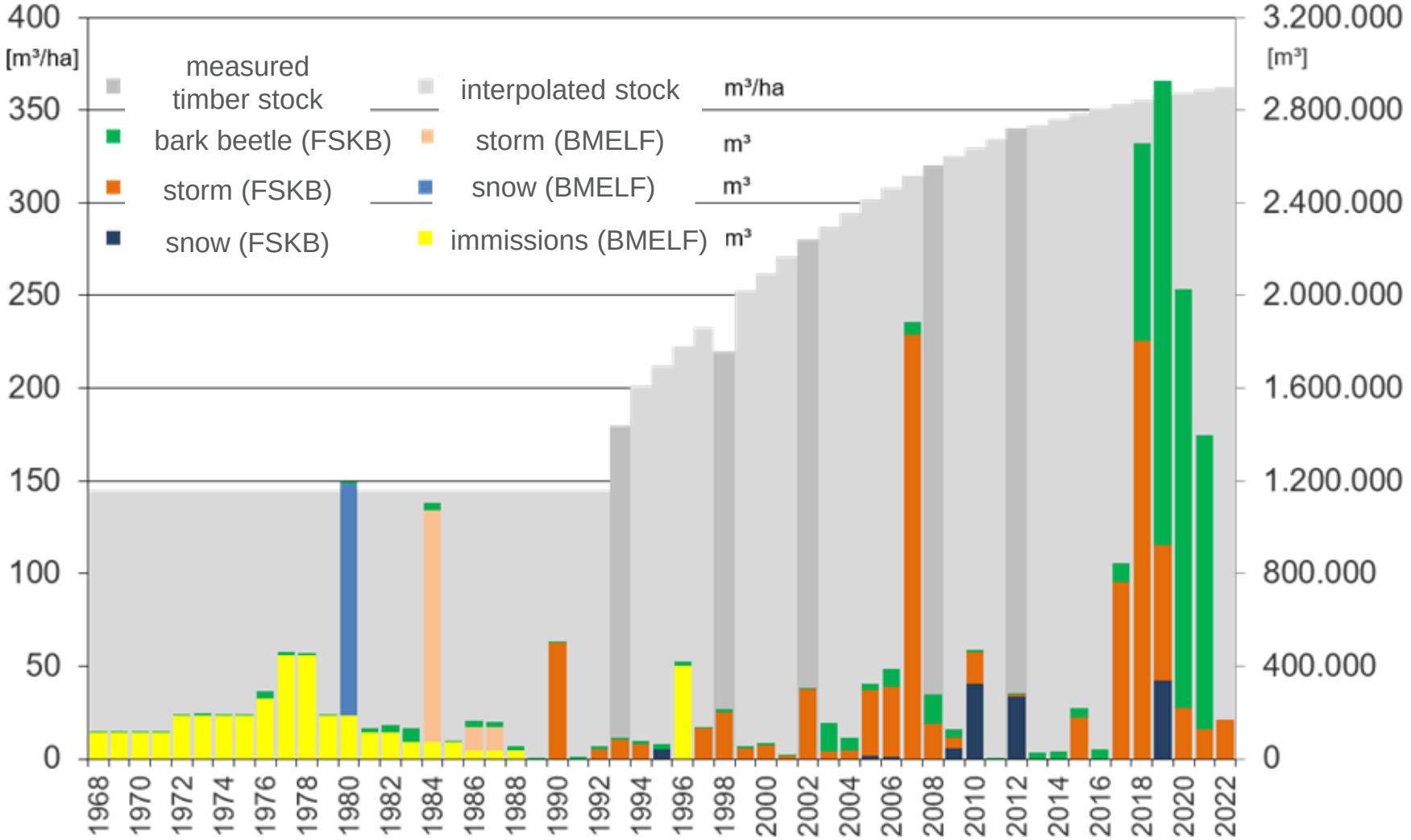

Risk of large-scale system collapse in the entire low mountain range

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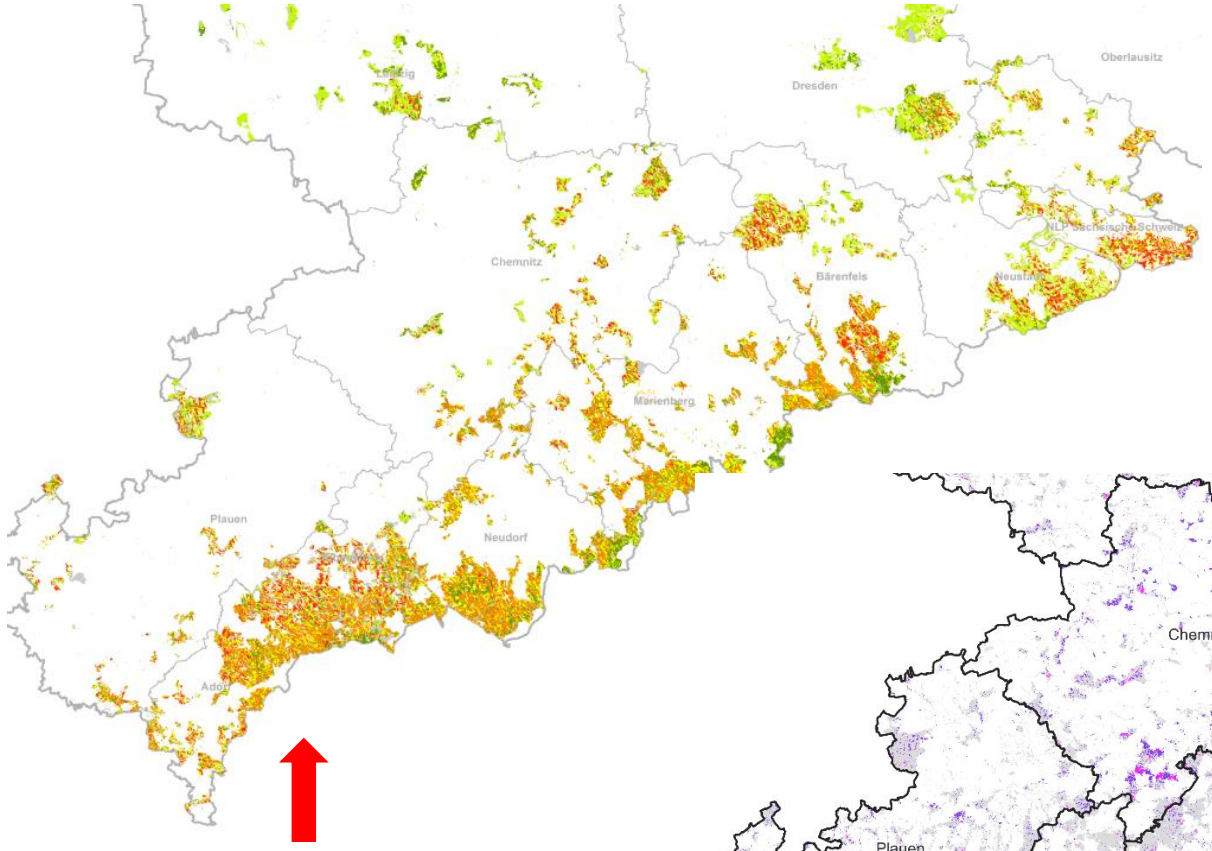
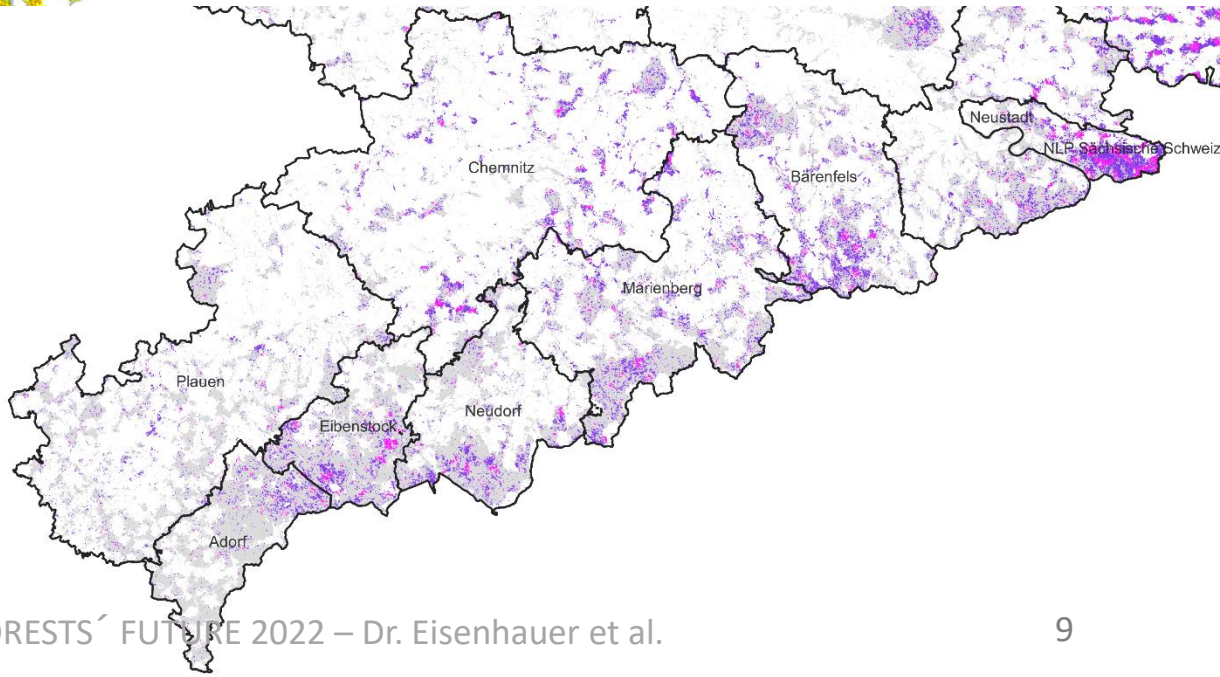


Damaged area monitoring using Sentinel-2 data (data status October 2021)



Estimated predisposition to disturbances

Collapse of forest effects

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Individual forest stands of a forest area

- local forest functions (e.g. erosion protection)
- example: bark beetle in the Vogtland region

Forests of water catchment areas

- runoff regulation
- large-scale immission-induced death of spruce stands during GDR times / interim tree species

Forests of one region - lowlands, hill country, low mountains

- carbon storage
- so far no examples in Saxony (since 2018 loss of current stock larger than increment)

Quantification of climate and land-surface related impacts on basin scale E_T*

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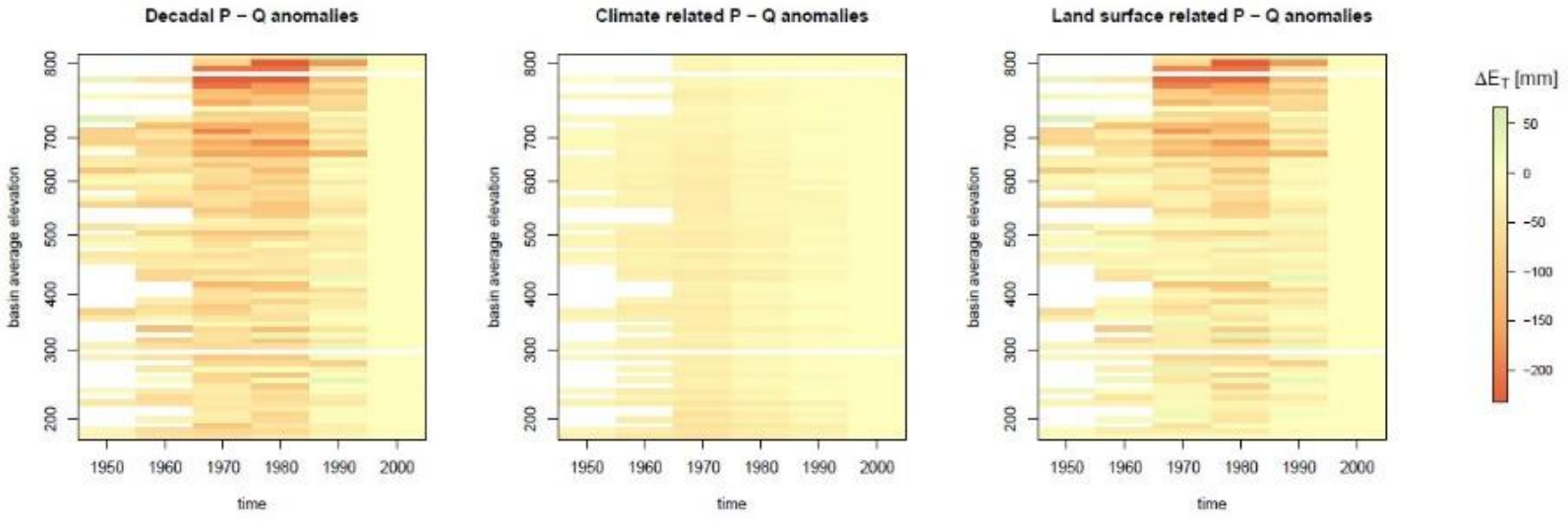

Figure S1: Decadal $P - Q$ anomalies with respect to the last decade (2000-2009). Panel (a) observed anomalies, (b) attribution to climate changes, (c) attribution to land surface changes. All images have time on the x-axis, basin elevation on y-axis, and colored anomalies with the same color scale for all images.

*Renner et al. (2014): „Separating the effects of changes in land over and climate: a hydro-meteorological analysis of the past 60 yr in Saxony, Germany

If the expected risks will occur…

- the **functionality of the Saxon cultural landscape,**
- the **climate protection,**
- the **level** and **continuity of regional wood supply,**
- the **yield level** and **yield continuity** of the state forest enterprise and forestry enterprises of all forms of ownership accompanied by increasing **efforts and costs, and also**
- **the socio-economic ballance** in forest-dominated rural areas and beyond

will significantly decreased and disturbed.

Conclusion:

The current crisis of forestry has reached an resource - economical and environmental dimension together with a long-term impact potential!

What we have done:
Systematic development of resilience 2006 – 2018

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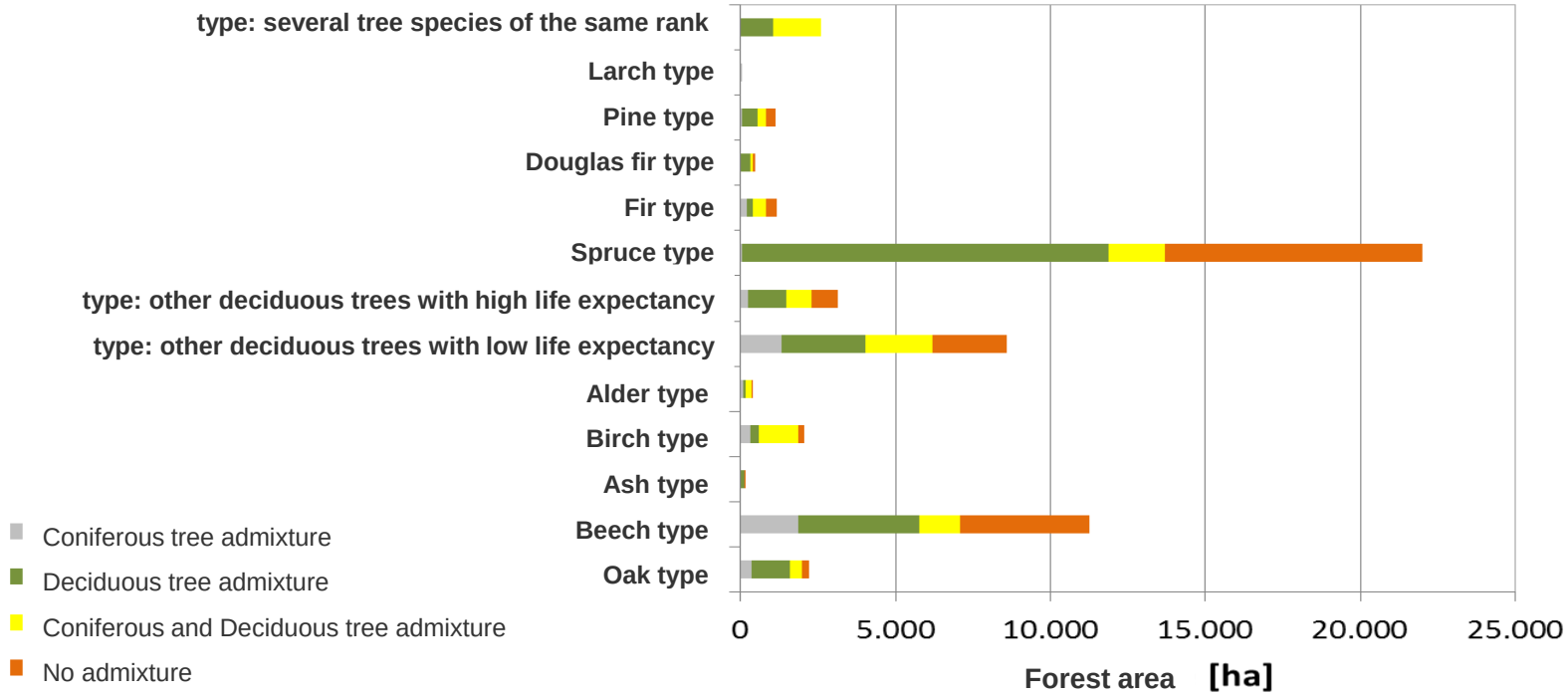
Results of the National Forest Inventories (2002, 2012):

- Rejuvenation is present on an area of approx. 106,000 ha (~ 20 % of the forest area)
- + 42,000 ha total increase of rejuvenated area
- + 29,000 ha (+ 130 %) in state forest



… effects a much higher resilience in the current spiral of system disturbances

What we have done:
Systematic development of resilience 2006 – 2018

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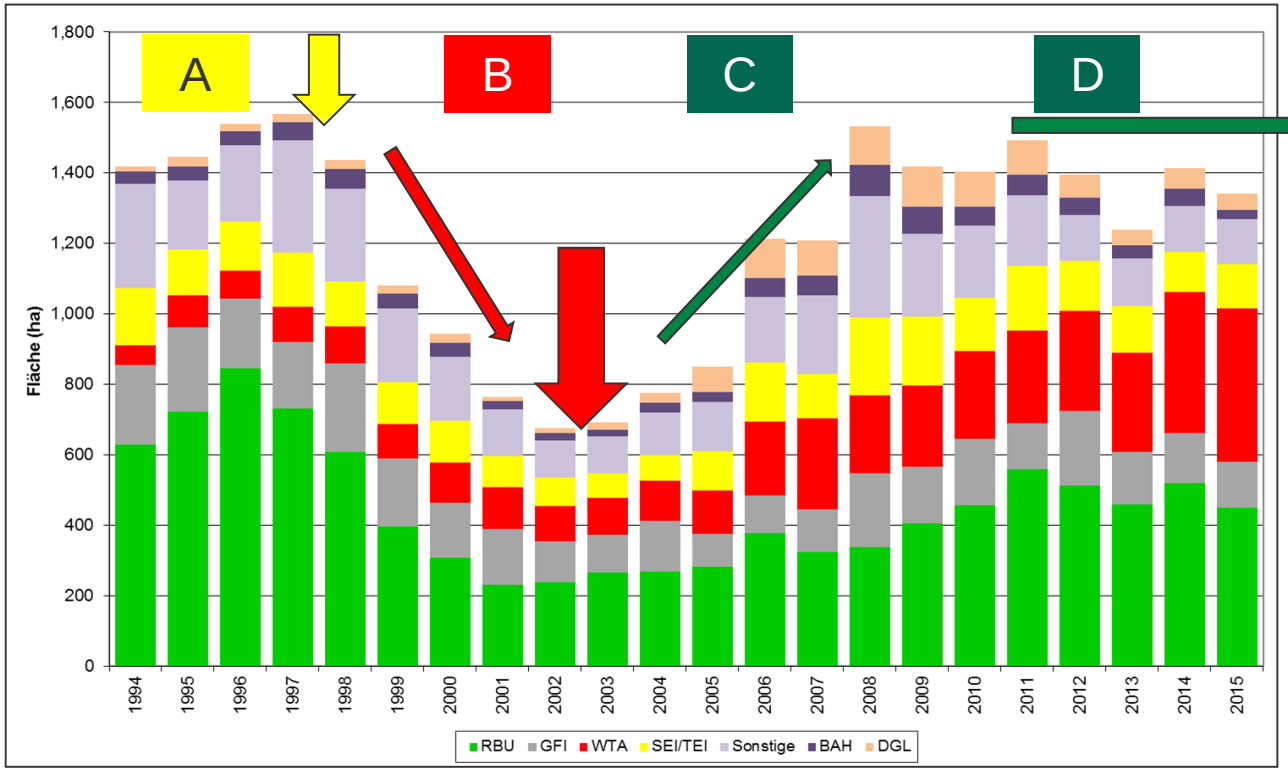

Enforcement (C,D):

- **2006 - 2018, an area of 1,200 ha was artificially rejuvenated each year (state forest area = 220,000 ha)**

→ site-adapted tree species composition and integration of natural regeneration

- **Availability of resources determines performance framework of the state forestry enterprise**

Consequences 2006 – 2018: Systematic development of resilience

- On **30,000 ha**, the tree species composition of the rejuvenation layer **corresponds** to the forest development target
- On **51,000 ha,** the rejuvenation layer is **fully** established, **site-adapted** composition of tree species with differences to the forest development target
- On **46,000 ha, initial phase,** changes in tree species composition were **initiated**

*Reference area: 180,000 ha state forest with existing site mapping

→ the current situation **differs fundamentally** from the situation in 2007 (KYRILL)

→ the **system collapse** in spruce and pine forests is buffered on the **majority** of the areas by different **development phases of the subsequent forest generation**

Conclusion

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- Forestry / Silviculture → expression and execution of changing social demands and target systems.
- The Art of forest management → continuity, directed towards strategic success potentials

Ecologically oriented, multifunctional - integrative forest management with partial (!) segregation