Forest density reduction to minimize the vulnerability of Norway spruce and silver fir to extreme drought – a risk assessment (ForRISK)

PS-112 D4 - Climate change adaptation in forest management: from applied science to implementation | Nr. 3774

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IUFRO 125th Anniversary Congress 2017, 18 – 22 September 2017, Freiburg, Germany

1. CONTEXT

- Climate change may profoundly impact forest ecosystems.
- Reducing stand basal area to provide climate adaptation in the short-term.
- Economic implications and efficiency of proposed strategies need to be assessed (proper risk management) to support decision making.

2. MAIN RESEARCH FOCUS

- Effects of **drought and forest management** on tree growth and ecophysiology of Norway spruce and silver fir.
- **Adaptation** of forests to drought risks, based on **risk assessment** and economic evaluation of management approaches.
- **Management options**, and guidelines, with local stakeholders.

3. WORK PACKAGES (WP)

WP.1 - Analysis of long-term growth trends and **drought vulnerability** of forests *vs* specific values of tree population density.

WP.2 - Investigation of **ecophysiological mechanisms** during and after extreme drought in relation to tree population density of Norway spruce and silver fir stands.

WP.3 - **Risk assessment**, economic evaluation and development of optimized management strategies to adapt Norway spruce and silver fir forests to extreme drought events.

4. MAIN EXPECTED OUTCOMES

- **Tree- and stand-level growth responses** to drought and management (tree rings).
- **Intra-annual ecophysiological processes** and mechanisms during and after drought (isotopes).
- **Mechanistic ecosystem model** for Norway spruce and silver fir (model MuSICA).
- **Economic risk assessment and evaluation** of different management treatments to reduce drought vulnerability (classical risk management approach).
- Optimized drought **adaptation strategies**, considering climate change uncertainties.
- **Engagement** of stakeholders/forest practitioners.

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5. PRELIMINARY RESULTS

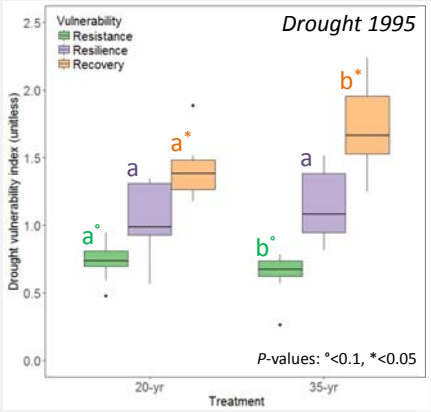

Fig. 1. Resistance, resilience, and recovery to drought (drought 1995) of Norway spruce and silver fir. Shelterwood experiment, Black Forest, DE. Treatments: 20-yr with lower basal area, 35-yr with higher basal area.

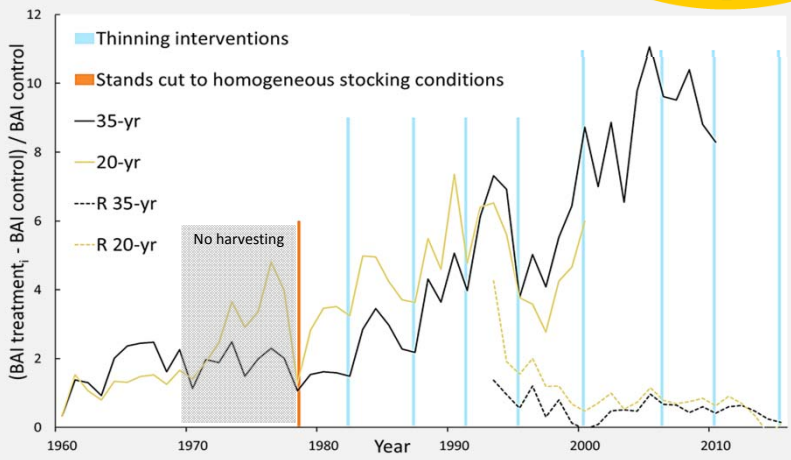

Fig. 2. Tree basal area increment (BAI) of Norway spruce and silver fir for each treatment relative to the control for the period 1960-2016. Shelterwood experiment, Black Forest, DE. Treatments: 20-yr / 35-yr=regeneration period (20-yr with lower basal area, 35-yr with higher basal area), R=regeneration (i.e., trees established after the beginning of the experiment in the early 80s).

Fig. 3. Simulated stand basal area compared with measured inventory data (first model test) for the period 1981-2015. Shelterwood experiment, Black Forest, DE. Species: Norway spruce and silver fir.

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