LandPress: Land-use management to ensure ecosystem service delivery under new pressures in heathlands

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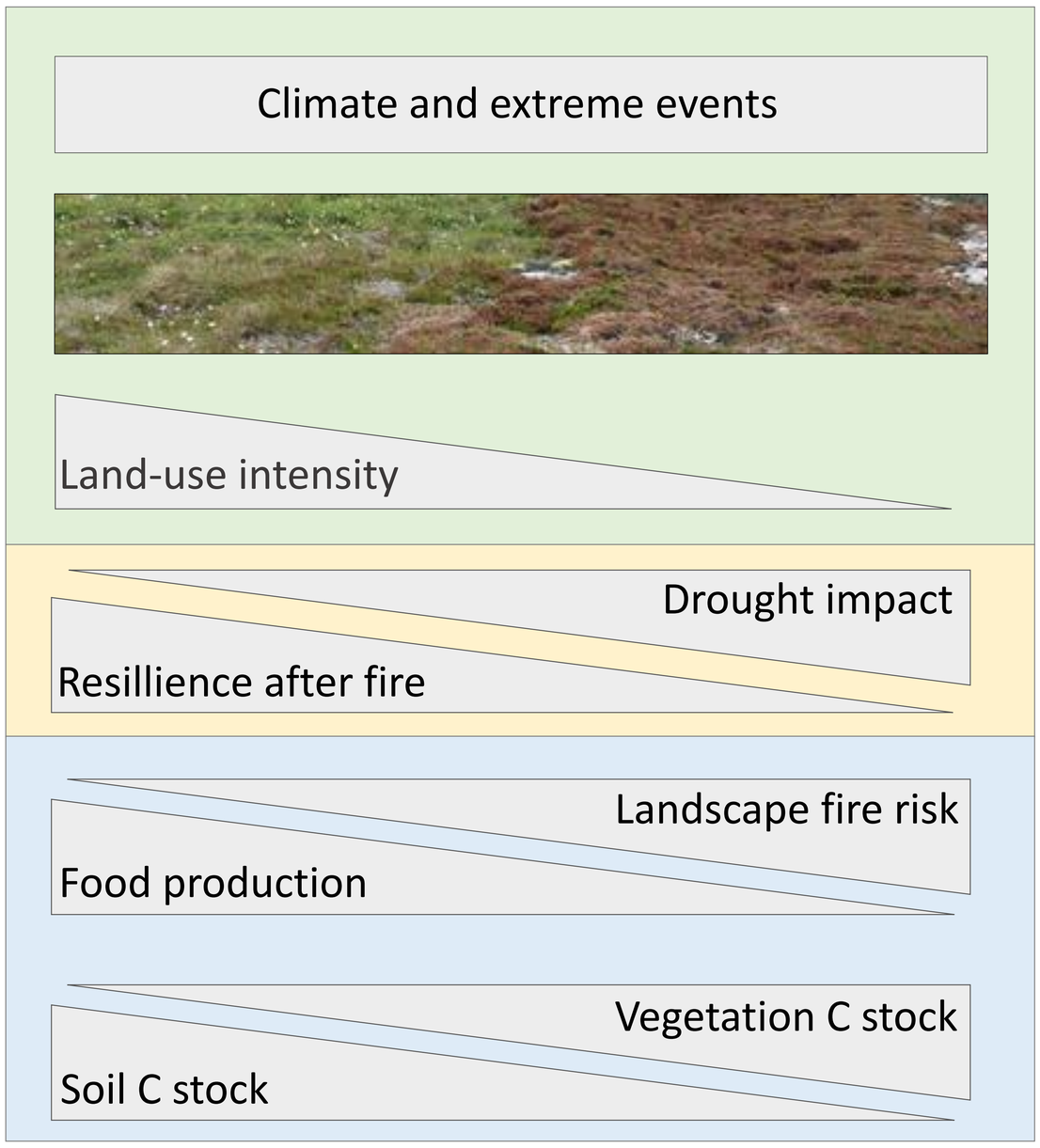
The case study

A major winter drought in 2014 led to massive heather dieback in coastal heathlands, as well as consecutive landscape fires. LandPress uses this "natural experiment" to explore the impact of land-use change in combination with extreme climatic events in terms of vegetation change, ecosystem resilience, ecosystem services provisioning, sustainability, and evidence-based management and fire-risk prevention.

Prescribed burning is a key tool in traditional mangement of coastal Calluna *heathlands.*



Conceptual diagram showing the hypothesised impacts of management cessation in interaction with more frequent extreme events due to climate change.

Natural and social drivers

The heaths date back several millennia and were created and maintained by a land-use regime involving extensive free-range grazing and prescribed burning. Managed heathlands are typically burnt on a decadal scale, resulting in a cyclical successional pattern, where *Calluna* passes through characteristic before a new fire is set and the cycle starts again. Cessation of management has turned the heathlands into a red-listed landscape in Norway and the EU. To understand how climate change works in interaction with land use intensity will be crucial for future heathland management.

Ecosystem dynamics

We hypothesize that heathlands in early regenerative stages are less susceptible to winter drought damage than old and degenerative heathlands and that ecosystem resilience is higher in managed than in old and degenerative *Calluna* stands.

Ecosystem services

Traditionally, farming provided employment and food security for the rural population, in addition to providing several ecosystem services and important habitats. The decline of land-use intensity and large-scale successional changes are not only leading to reduced goods, but also potential increased costs, especially in terms of more severe wildfires. We also hypothesize that the total carbon stock is higher in well-managed than in abandoned heats.

WP1: Quantifying the extent and magnitude of the *Calluna* dieback

By using colour aerial photos, we will quantify the amount of damaged and dead *Calluna* along the coast on a landscape scale and assess how this varies with land use, local climatic conditions, vegetation type, soil condition, and life-cycle stage.

Drought-damaged coastal heath in Nordland.

WP 2: Impacts of severe drought events on heathlands ecosystem functioning

Drought experiments will be established in field sites along a bioclimatic gradient following the coordinated distributed experimental IDE**, imposing an extreme drought over a four-year period.

Contrast between damaged and healthy Calluna.

WP 3: Land use as a means to restore ecosystem resilience after dieback

A Before-After-Control-Impact experimental design with 'fire' and 'climate' as contrasts and repeated measurements for the response to test if prescribed fire can restore ecosystem resilience after dieback.

Prescribed burning of heath.

WP 4: Ecosystem services in coastal heathlands

Study the ecosystem services of the coastal heathland and the synergies and trade-offs between the different ecosystem services, including Benefit-Cost Analysis (BCA) to compare the total economic value to society of heathland management compared to abandonment.

Wildfire at Flatanger in 2014. Copyright VG.

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**International Drought Experiment. See www.drought-net.org/

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