



# Fine-scale measures for improving biodiversity in managed forests in Norway: knowledge and collaboration

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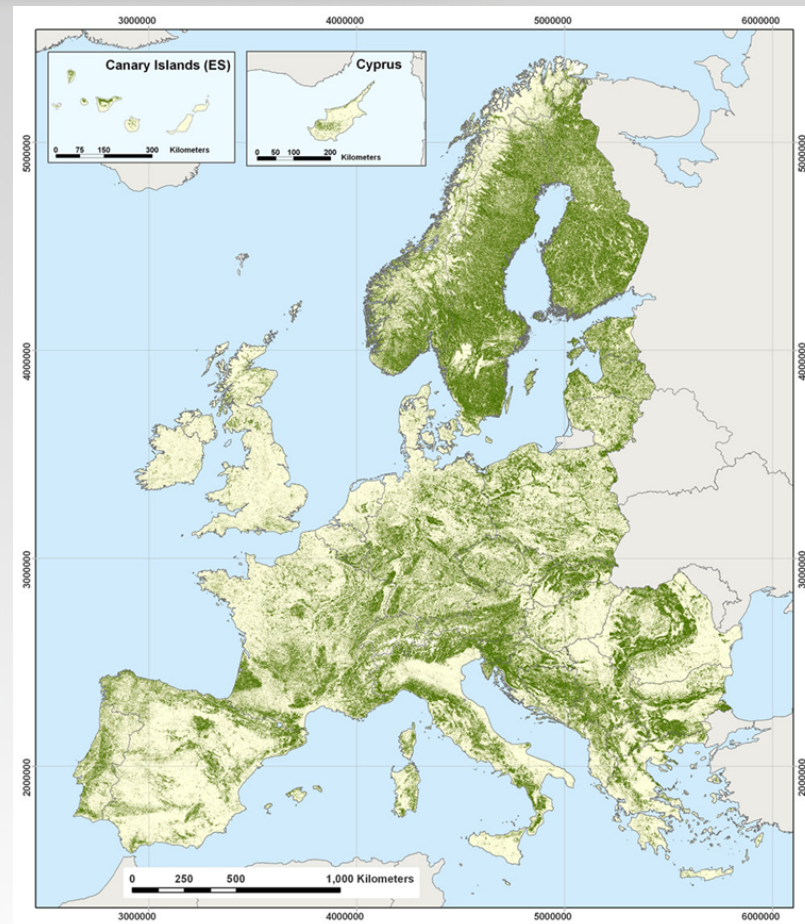


**skog +  
landskap**  
Norwegian Forest and  
Landscape Institute

# The forests of Norway



- 14 (8.6) million ha.
- 58% coniferous, 40% boreal deciduous, and 2% nemoral deciduous forest.
- *Picea abies* and *Pinus sylvestris* are the important commercial tree species.
- About 40% of the annual growth of forest is harvested.
- Most forests (84%) are on private hands, and most properties are small (60 ha).



## A short version of the Norwegian history of environmental issues in forests



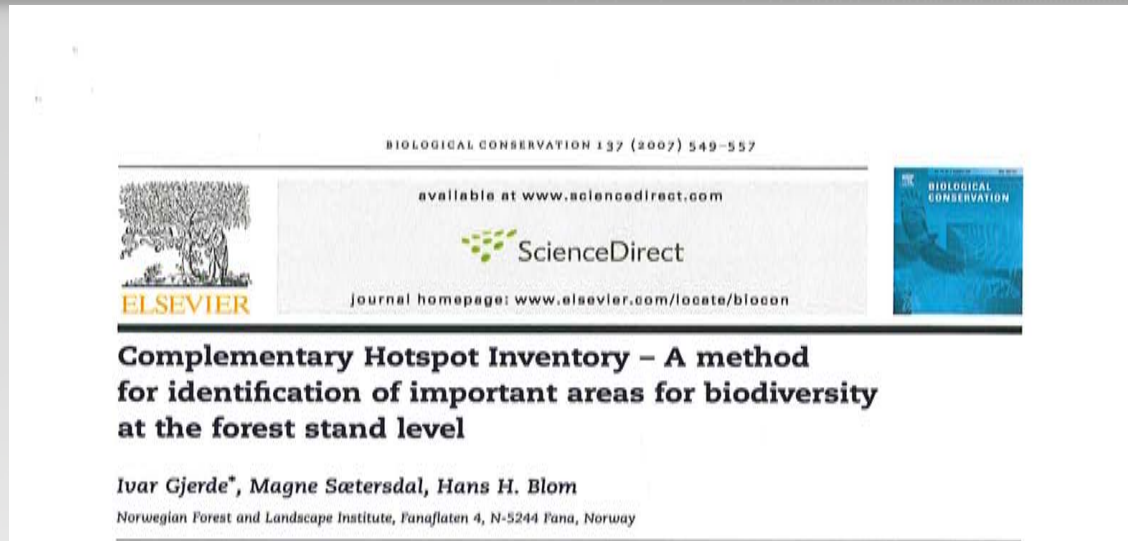
- **1965:** Forestry act. Sustainable harvesting.
- **1990s:** Increasing pressure on forestry from environmentalists.
- **2000:** PEFC (certification of Norwegian forestry).
- **2000:** The CHI method for registering important sites for biodiversity in managed forests presented
- **2006:** New forestry act. Biodiversity.
- **2009:** Biodiversity act (replacing the conservation act from 1970).
- **2010:** The WWF leaves the PEFC.
- **2015:** 75 000 small set-asides («woodland key habitats») in Norwegian managed forests (2%).

## Collaboration between forestry and environmental organizations in Norway



- The Outdoor Life Organization is partner in the PEFC certification.
- Cooperation between the Forest owner association, Nature Conservation Council, and WWF for increasing governmental funds for voluntary forest conservation projects.
- Some collaboration on local projects.

# The Complementary Hotspot Inventory (CHI) approach



- 1) Select threatened/important habitats.
- 2) Define hotspots for each habitat type.
- 3) Identify main environmental gradients that determine species composition.
- 4) Classify habitats according to positions in main environmental gradients.
- 5) Define indicators for main gradient positions.

# CHI for Norwegian managed forests



- **Resolution:** Forest stand scale, minimum 0.2 ha.
- **Targets:** Primarily habitat for red-listed forest species within species-rich taxa with small area demands (vascular plants, bryophytes, fungi, lichens, invertebrates).
- **Habitat types:** Old-growth characteristics (Snags, logs, old trees, Late successions of deciduous trees, trees with pendant lichens, hollow deciduous trees, burned forest); highly nutritious habitats (Luxuriant ground vegetation, trees with nutrient-rich bark, rock walls); highly humid forest habitat (rock walls; clay ravines; gorges).
- **Main gradients:** productivity/pH and humidity.
- **Indicators:** Vegetation types, topography.



# Combining the concepts of Hotspots and complementarity



Humide



Dry



Low

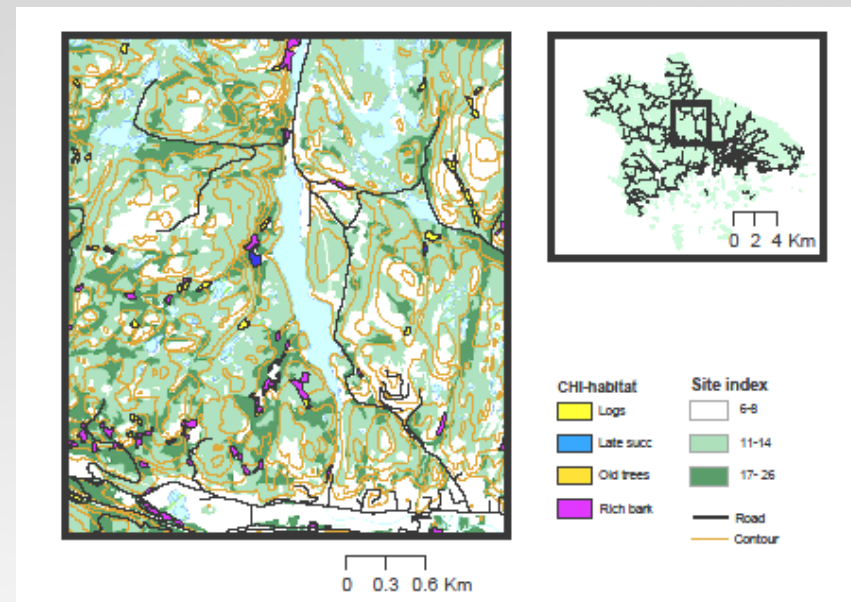
High

Productivity

# The habitat inventory in the field



- Carried out as a part of a forestry plan process.
- Financed by forest owners and governmental subsidies
- Conducted by forest owner organizations, registrars following a detailed instruction.
- Key habitat sites selected in cooperation with forest biologist.
- Included as a part of PEFC certification at the forest association level.





## Using CHI data in «variable retention forestry»



- Retention of selected trees on clearcuts.
- Retention of groups of trees on clearcuts.
- Retention of forest stands (WKHs).
- Retention of forest stands that are kept open by selective harvesting of trees.
- Using clustered CHI habitats as a basis for selecting forest reserves.

## Selective harvesting experiments



- Capercaillie (*Tetrao urogallus*) lekking grounds (Rolstad 1989).
- Capercaillie winter habitats (Gjerde 1991).
- Boreal rain forest lichens (Rolstad et al. 2001).
- The red-listed lichen *Usnea longissima* (Storaunet et al. 2014)

# Capercaillie (*Tetrao urogallus*) lekking grounds, Rolstad, J. (1989)



## Main results:

Number of displaying males on 2 experimentally harvested leks increased more than on 7 untreated control leks.

Moderate thinning/leaving ~500 trees per ha seemed to be acceptable for the birds.

Rostad, J. (1989): Scandinavian Journal of Forestry 4: 99-109.



## Capercaillie winter habitats (Gjerde 1991)



### Main results after experimental treatment of parts of 4 core winter habitats:

- Careful thinned (500-800 trees left per ha) core winter habitats did not affect later use by the species.
- Areas that were heavily thinned (300-400 trees per ha) seemed to be abandoned by the birds.
- Removal of lower layers of spruce affected males but not females.

Gjerde, I. (1991): *Ornis Scandinavica* 22: 205-212.



# Boreal rain forest lichens (Rolstad et al. 2001)



## Main results:

- Former selective harvested volume in 31 studied sites varied between 31% and 124% of present standing volumes.
- Variables describing logging history did not explain significant parts of the variation of present abundance of the lichens.



Rolstad et al. (2001). Ecological Applications 11: 421-43.





## The lichen *Usnea longissima* (Storaunet et al. 2014)



### Main results:

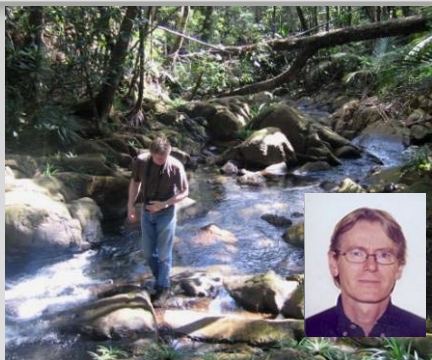
- Five years after thinning of 7 Norway spruce stands with retention of *U. longissima* trees, the number of lichen thalli had increased with 34%.
- Lichen increased mainly in open forest stands, whether they were thinned or not.

Storaunet et al. *Silva Fennica* 48:  
685-703.





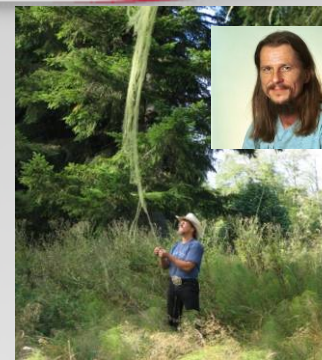
# The Norwegian forest and landscape institute – Biodiversity section



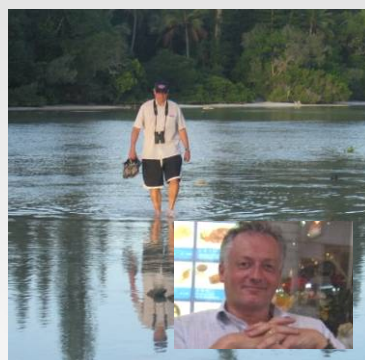
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## Our research



- Provide knowledge relevant for the recording, monitoring, and managing of biodiversity.
- Combine theoretical and applied ecology.
- Include studies on natural disturbance and human impact in projects