SCIENCE AND EDUCATION FOR SUSTAINABLE LIFE
Integrating conservation measures in a changing production forest matrix: Insights from Sweden

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Sweden’s production forestry is intensive, repetitive & efficient

• Third largest exporter of timber, pulp & paper

• >80% of productive standing volume – just two tree species

• Managed intensively via rotational clearcutting of even-aged stands – 5th highest absolute planted forest area
25 years ago Sweden changed its forest act

- Equal status given to environmental and production objectives

- Deregulation from centralized production-focused governance
  - Expected to increase the diversity of silvicultural practices

- More protected forest areas and conservation measures increased in production forests
  - Limited opportunities for large protected forest areas
  - Conservation measures to be integrated at multiple scales in forest lands
Sweden’s integrated forest puzzle today

- **Productive forest**
  - 23 million ha (82%)

- **Unproductive forest**
  - 5 million ha

**How this box is managed has an extensive impact on forest habitat availability**

- **Positive results**
  - Sweden succeeded in spatially integrating conservation
  - Large relative increases in protected areas, dead wood, retention trees

- **But many concerns**
  - 2000 forest species remain on the Swedish red-list
  - 2020 goals for sustainable forests won’t be met

- 19% formally protected
- 5% area voluntary set asides (most < 10 ha)
- 6% area formally protected (most < 100 ha)
- 2% area conservation actions at harvest
There are multiple goals and many possible trajectories for forestry
Storm Gudrun hits in January 2005
Direct impact: Rotation length and habitat availability

Mean habitat area over 150 years for Eurasian treecreeper

![Graph showing change in rotation length and habitat availability](image)

-22%  +22%  +50%
Change in rotation length

Direct impact: Mixture benefits and interactions with stand density

Norway spruce stands to spruce birch mixtures

Standing volume per hectare

Direct impact: Mixture benefits and interactions with stand density

Percentage cover vascular plants

Indirect impact: Implications of forestry for the effectiveness of conservation measures

Integrated conservation increases forest habitat

However, it also increases the vulnerability of conservation measures to changes in forestry practice

Illustration: Martin Holmer
Indirect impact: Implications of forestry for the effectiveness of conservation measures

- Impacts at stand harvest
  - Reduced diversity of signal species of bryophytes and lichens in buffer zones (Hylander & Weibull 2012; Johansson et al., 2018)
  - Reduced diversity of indicator fungi in reserve edge zones (<100 m) (Ruete et al., 2016)

- Impacts at stand maturity
  - Norway spruce proximity decreases beetle diversity of retained oaks (Widerberg et al., 2012)
Concluding thoughts & questions

• Net forest habitat availability depends on both conservation measures and forestry trajectories
  – These two dials need to be “tuned” together to achieve biodiversity goals
  – Important to distinguish between spatial integration versus ‘responsive’ integration

• Many scientific and policy-level uncertainties remain
  – What’s the relationship between forestry intensification (or diversification) and the need for conservation measures?
  – Which increased conservation measures would effectively compensate for particular forms of forestry intensification?

Thanks for listening

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Figure 81. Total forest area protected (1,000 ha) by MCPFE Classes 1.1-1.3, for 2015 (based on available data). Data for Germany and Switzerland based on data for 2010.
Clearcutting of semi-natural forests

The largest intact contiguous forest areas today are 2% the size of the largest areas 50 years ago

Svensson et al., 2018 Landscape trajectory of natural boreal forest loss as an impediment to green infrastructure
Clearcutting of semi-natural forests

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Rotation length and habitat availability

Mean abundance regenerating tree stems per ha in Norway spruce stands of different ages

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Uncertainty compounds with the interactive changes to production forest habitat and the matrix.

- Tree species composition
- Spatial & temporal disturbance patterns
- Forest structures
- Additional issue of homogeneity
• IPCC scenarios
• Planted forestry increasing
• Species require habitat
• Sweden’s forest circumstances
  – How we got here
• Many red-listed,
  – Efficient forestry is very responsive to change – quick to lose and slow to recover
• Examples
  – Continuity forests loss and protected area advancement Svensson
  – Mixtures versus densification
  – Shortened rotation times and retention trees
  – Tree species choice and retained trees
  – Neighboring areas and clearcuts
• The many questions this raises
  – What do we mean by integration (simply spatially integrated or a responsive network).
  – Integrated land-sparing
  – Landscape scale planning
  – Problem with offsetting
  – When to require compensatory actions
Towards this corner, biodiversity is increasingly secure.

Above this threshold habitat requirements of taxa are met.

Towards this corner, the number of threatened species increases.

Felton et al., 2019
So what will happen to forest biodiversity

When we alter the habitat contribution of production stands
And the forest matrix within which protected forest aspects are nested
Sweden’s forest puzzle

Unproductive forest
5 mill. ha

Productive forest
23 mill. ha (82%)

- 19% formally protected
- 5% voluntary set asides
- 6% formally protected areas
- 2% conservation actions at harvest
Affinity of protected areas for low productive areas

Region 1: Mountains
Region 2: Northern boreal
Region 3: Southern boreal
Region 4: Nemoral boreal
Region 5: Nemoral

Skogsstyrelsen. 2019
Direct impact: Most forest area in most of the country is used for production

Changing forestry practices can have a rapid and extensive impact on forest habitat
Regeneration method as percentage of logged area

- **Planting**
- **Scarification**