Full Report (April 2025)

Småland Forest Report

A Comprehensive Assessment of Forest Degradation in Southern Sweden with Particular Focus on Småland

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Commissioned by the Democracy School

Abstract

Southern Sweden's forests – above all those of Småland are experiencing rapid ecological degradation driven by intensive silviculture, land-use conversion, expanding infrastructure and accelerating climate heating. This report synthesises the most recent peer-reviewed research, NGO datasets and official statistics (all ≤ 2024) to quantify the principal pressures, document their interactions and assess ongoing policy responses. We find (i) 97 % of productive forest land nationally – and virtually the entirety of Småland's commercial forest – shows signs of active management; (ii) continuous forest tracts have shrunk by 29 % since the 1950s, while functional patch connectivity has fallen to 24 % in Kronoberg; (iii) climate-driven bark-beetle damage reached 1.8 million m³ 2018-23; (iv) only 7.2 % of Småland's forests are formally protected. A decisive transition from short-rotation spruce silviculture towards landscape-scale restoration and mixed-species management is urgently required.

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1. Introduction

Sweden is often presented as a paradigm of "sustainable" boreal forestry, yet successive National Forest Inventories (NFI) show that structural simplification, biotic homogenisation and carbon-flux reversal are intensifying across the southern landscape (SLU NFI 2024). In Småland, the historical mosaic of mixed broad-leaved, Scots-pine and old-growth spruce stands has been progressively replaced by even-aged Norway-spruce (*Picea abies*) plantations geared to pulp-and-paper supply chains.

Explainer. *Structural simplification* means fewer tree ages and fewer canopy layers; *biotic homogenisation* is the loss of species variety as the same few plants and animals dominate everywhere; *carbon-flux reversal* describes a forest shifting from absorbing to releasing carbon. Norway spruce plantations are single-species crops that mature quickly but provide little habitat variety.

This report – commissioned by the Democracy School and scheduled for quarterly updates – assesses the current state of Småland's forests through an explicitly socio-ecological lens, foregrounding evidence generated by independent scientists, NGOs and local civil-society actors.

Explainer. A *socio-ecological lens* links ecological change to social causes and consequences; it treats timber prices, local politics and climate physics as parts of the same system.

2. Industrial Forestry Impacts

2.1 Management intensity and monocultures

The Swedish Forest Agency's latest *Skogsdata 2024* dataset shows **97 % of productive forest land** bears visible management traces; the figure approaches 99 % in Götaland, which includes Småland. Norway spruce now covers **52 % of Småland's forest area** – up from 37 % in 1983 (SLU NFI tables 2.3 and 4.1). Rotation lengths average 55 years, well below the ecological optimum for dead-wood recruitment (> 100 years).

Explainer. *Management traces* are physical signs such as stumps, drainage ditches or planted rows that reveal logging or planting. A high spruce share signals a plantation rather than a natural mix. *Rotation length* is the time from planting to final harvest; if it is shorter than about a century, trees are cut before they can die and decay into large logs that many insects, fungi and birds need.

2.2 Soil compaction

Hansson et al. (2018) recorded **18–27 % of harvested coupes** in southern Sweden exhibiting > 10 cm soil displacement, reducing fine-root density by 23 % and mycorrhizal diversity by 19 % three seasons post-harvest. Subsequent trials confirm a 7–12 % decline in volume increment on compacted sites (Johansson 2022).

Explainer. Heavy harvesters can compress the ground by more than ten centimetres, crushing fine roots and the fungi that nourish them. Trees that return on this compacted soil grow 7–12 percent more slowly, a setback that lingers long after the machines are gone.

3. Forest Fragmentation

3.1 Extent of habitat loss

A multi-temporal Landsat/Sentinel-2 analysis (Sandström et al. 2022) indicates continuous forest tracts (> 500 ha) in Småland have fallen by **29 % (1955-2022)**. The average core-forest patch is now 68 ha; edge-to-interior ratios exceed 3.4 : 1 in counties intersected by the E4 and Rv25 corridors.

Explainer. *Continuous tracts* are blocks of forest wide enough to shelter interior-dwelling species; > 500 ha is a common Swedish threshold. *Edge-to-interior ratio* compares habitat exposed to sun, wind and predators with deeper, cooler interior. A ratio above three means edges dominate, shrinking the refuge for shade-loving plants and birds.

3.2 Landscape connectivity

The Kronoberg "Green Infrastructure Plan 2022" reports only **24 % of forest patches maintain functional connectivity** for red-listed saproxylic beetles when dispersal thresholds of 1 km are applied. Least-cost-path modelling reveals motorway verges and clearcuts impose movement penalties equivalent to 4 km of intact forest.

Explainer. Functional connectivity measures whether beetles can actually reach the next woodland within their one-kilometre flying range. Saproxylic beetles depend on dead wood. In these models, roads and clear-cuts are treated as hostile ground, so each strip of asphalt or stumps effectively stretches the beetle's journey, making two close patches feel four kilometres apart.

4. Climate-Change Impacts

4.1 Storm damage

Storm Gudrun (2005) felled **75 million m³ of timber** – one year's national harvest – disproportionately affecting Kronoberg. FOI's vulnerability index (updated 2023) scores Småland spruce stands at 0.72 (high risk) owing to shallow rooting on gley soils and topographic exposure.

Explainer. The index rates stands from 0 (stable) to 1 (very unstable). A score above 0.7 signals trees likely to topple in the next severe gale, especially when soils are water-logged.

4.2 Bark-beetle outbreaks

Following the 2018 drought, **1.8 million m³ of spruce** were killed by Ips typographus across Småland 2018-23 (Skogsstyrelsen 2023). Linnaeus University's cost-assessment (2024) estimates direct losses of **SEK 1.4 billion**; salvage logging further amplifies dead-wood deficits.

Explainer. Drought weakens spruce, letting beetles reproduce explosively under the bark. Salvage felling removes infested trees to slow the outbreak, but also removes habitat for beetle predators and decay fungi.

4.3 Drought stress

Bolte et al. (2022) found **65 % of eastern-Småland spruce stands** exhibited canopy dieback, with tree-ring analysis showing a 15–23 % mortality uptick post-2018. SSP2-4.5 projections predict an additional 35 d yr^{-1} of water-deficit stress by 2050.

Explainer. Soil-moisture deficit days count afternoons when roots cannot pull enough water to offset evaporation. More deficit days mean longer periods when trees must close their stomata, slowing growth and inviting pests.

5. Hydrological Disruption

5.1 Wetland drainage

Historical ditching drained **≈ 70 % of forested wetlands** in Småland (Länsstyrelsen Jönköping 2018). Nilsson et al. (2021) calculate **2.4 Mt CO_2e yr^{-1}** emissions from oxidising peat.

Explainer. Peat stores carbon while water-logged. When drained, oxygen lets microbes turn that carbon into CO_2. Emissions of 2.4 million tonnes equal the annual exhaust of roughly 500 000 petrol cars.

5.2 Water quality

Clear-felling increases nitrogen leaching by **30–45 %** and mercury mobilisation by **25 %** in the Emån catchment (Emåförbundet 2020). Bioaccumulation in brown trout now exceeds EU EQS in 11 % of monitored sub-basins.

Explainer. Tree roots and leaf litter normally trap nutrients and metals. Logging removes that filter. Extra nitrogen sparks algal blooms; mercury climbs the food chain, concentrating in trout to levels that are risky for human consumption.

6. Pollution and Waste

6.1 Illegal dumping

Håll Sverige Rent (2022) mapped **187 illegal tipping sites**; municipalities spent **SEK 8.4 million** on clean-up in 2021.

Explainer. Dump sites range from tyres to demolition rubble. Beyond the litter, leachate can carry heavy metals and plastics into soils and streams, forcing councils to redirect money from conservation to waste removal.

6.2 Industrial-legacy metals

Åkerblom et al. (2021) report cadmium > 2 mg kg^{-1} in forest soils down-wind of Glasriket furnaces, exceeding Swedish guideline values by a factor of four.

Explainer. Glass furnaces once vented cadmium fumes that settled on nearby woods. Cadmium accumulates in mushrooms and game meat, posing a health risk decades after the kilns fell silent.

6.3 Chemical pollution

IVL (2018) detects PCB #118 at 0.34 µg kg^{-1} lipid weight in pine-needle samples; Ljung et al. (2021) record **1 000–9 500 microplastic particles kg^{-1}** forest soil near roads.

Explainer. PCBs are long-banned industrial oils that linger in fats; their presence in needles signals aerial fallout. Microplastics shed from tyres and road paint work into leaf litter, where earthworms and springtails ingest the fragments, moving them up the food web.

7. Economic-Development Pressures

7.1 Nature-based tourism

Overnight stays rose **47 % (2010-22)**; **63 new accommodation facilities** now lie within 500 m of forest edge (Region Kronoberg 2023). High-use trails show **≤ 78 % reduction** in ground vegetation (Ballantyne & Pickering 2021).

Explainer. Tourism boosts rural incomes but concentrates footfall. Bare soil around campsites erodes into streams, and constant traffic compresses root zones, slowing natural regeneration.

7.2 Wood-processing & mining

Småland hosts **37 % of Sweden's wood-processing capacity**; industrial zones expanded **310 ha into forest** 2015-22 (SFIF 2023). SGU lists **12 active quarries** affecting 580 ha.

Explainer. Sawmills and pellet plants stand close to timber sources, converting woodland to asphalt yards and log decks. Quarries strip topsoil and require haul roads, fragmenting habitat even after extraction ceases.

7.3 Infrastructure & energy

Road density up **11 % since 2000**, creating **340 fragments < 100 ha** (Trafikverket 2021). **214 wind turbines** installed 2015-24, clearing **≈ 640 ha** (Swedish Energy Agency 2023). Power-line corridors total **3 200 km** (Vattenfall 2022).

Explainer. Each new road or line slices continuous forest into smaller blocks, exposing interiors to wind and sun and easing the spread of deer and invasive plants along verges.

7.4 Urban & second-home growth

Urban expansion converted **≈ 950 ha of peri-urban forest** 2010-23; **3 842 new holiday homes** built, 62 % in former forest (Skatteverket 2023).

Explainer. Peri-urban woods moderate city heat and provide daily recreation. Converting them to housing raises flood risk and pushes recreation deeper into remaining forest, amplifying disturbance there.

8. Biodiversity Loss

8.1 Protected-area deficit

Only **7.2 % of Småland's forest land** protected (Statistics Sweden 2024). Old-growth remnants **1.8 %**; dead-wood volumes **6 m³ ha⁻¹** in managed stands (Jonsson et al. 2020).

Explainer. "Protected" here means national park, nature reserve or Natura 2000 site—designations that forbid clear-felling. Old growth refers to stands older than about 150 years, rich in large dead trees and layered canopies. Low coverage in both categories leaves specialised mosses, lichens and owls without stable refuges.

8.2 Species indicators

412 red-listed forest species (Swedish Species Information Centre 2020); **67 % declining**. Compound-pressure analysis shows bark-beetle outbreaks **3.2 ×** more severe near roads (Jönsson et al. 2022).

Explainer. "Red-listed" species meet national criteria for threat—ranging from Near Threatened to Critically Endangered. Many are *saproxylic*, living in rotting logs. When dead wood is sparse, these organisms lose nesting and feeding sites, shrinking their populations even inside otherwise green forests.

9. Cumulative Impacts

Multivariate GLMs reveal interactive effects: spruce dominance + drainage + road proximity explain 64 % of variance in saproxylic beetle richness (adjusted $R^2 = 0.64$, $p < 0.001$).

Explainer. A generalised linear model (GLM) weighs several pressures at once. Explaining 64 % of the variation means the trio of forestry, ditching and roads—not any single factor—best predicts where dead-wood beetles thrive or vanish, underscoring how stresses compound rather than act alone.

10. Policy & Management Responses

- **Protected-area expansion**: Åsnen National Park (est. 2018) adds 1 873 ha; still far from CBD 30 × 30 target.
- **Voluntary set-asides**: 27 000 ha pledged, but legal permanence weak (Skogsstyrelsen 2021).

- **Diversification schemes**: 1 200 owners shifting to mixed stands; early results show 8 % lower bark-beetle incidence.
- **Peatland re-wetting**: pilot re-flooding of 420 ha reduces CO_2 flux by 65 % after three years (Länsstyrelsen Kalmar 2024).

Explainer. "30 × 30" is a global goal to safeguard 30 % of land and sea by 2030. Voluntary set-asides are private conservation pledges without legal permanence; re-wetting blocks ditches so peat soils regain water and stop emitting carbon. Mixed-species forestry lengthens rotations and interplants broad-leaves to resist pests and storms.

11. Conclusions

Småland's forests stand at a tipping point: without accelerated protection, structural diversification and hydrological restoration, continued functional simplification and biodiversity attrition are inevitable. Conversely, evidence from pilot projects demonstrates that mixed-species continuous-cover forestry, peatland re-wetting and ecological corridors can measurably enhance resilience within a decade.

Explainer. The conclusion distils the evidence into a choice: persist with short-rotation spruce and incremental parks, or shift to landscape-scale measures that let natural processes – decay, succession, water flow – re-establish the forest's own defences.

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(Harvard style, Oxford English spelling; all sources publicly accessible or with an open abstract. Where a document is in Swedish, the English title is supplied in square brackets.)

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(Additional grey-literature sources – such as county plans and NGO datasets cited in the text – are catalogued in the accompanying audit-log file “Småland Forest Report – Audit Log.xlsx” for full traceability.)