

Sustainability of Boreal Forests and Forestry in a Changing Environment

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Boreal forests comprise one-quarter of global forest area

- Boreal forests hold some 45% of the world stock of growing timber, 15% of the world's carbon in forests and soils, and as estimated, more than 35% of the terrestrial carbon stocks
- Most boreal tree species (~15 in North America; ~35 in Siberia and 5-7 in Fennoscandia) have relatively wide distributions and a large degree of genetic variation due to adjustments to previous large scale climate changes
- Slow tree growth produces strong, narrow-ringed wood with excellent properties as construction timber and uniform fibres suitable for paper-making

People and economies

- Over 60 million people live in the boreal forest region
- Boreal forestry and forest products industries support over a million direct jobs
- The value of ecosystem services (water regulation and purification, carbon sequestration, bird habitat, non-timber forest products, etc.) provided by Canada's boreal forests alone is about USD 90 billion per year
- Most boreal forests are publicly owned, with the exception of Finland, Sweden and Norway (70%, 76% and 80% respectively in private or corporate ownership)

Sustainability in boreal forested landscapes

- Low species richness may reduce both conflicts and options in biodiversity maintenance
- Low tree species diversity can make forests more susceptible (to pests and climate change) and lessen the silvicultural choices available
- Boreal forests sustain some of the world's last wild rivers and remaining wilderness landscapes
- On an increasingly human-populated planet, such wilderness areas have growing non-use values, in addition to providing ecosystem services and opportunities for ecological research and eco-tourism

Drivers threatening boreal sustainability

- Most boreal forests are in the globally enviable position of expecting largely natural and productive landscapes to prevail in the foreseeable future
- Unmanaged boreal forests are often shaped by stand-replacing disturbance regimes
- The conversion to regulated, even-aged stands through clear-cutting and optimised timber production is often resulting in a degree of homogeneity not found in nature
- This can bring the boreal forest landscape far outside the limits of natural and historical variation, though the widespread disturbance-adapted flora and fauna makes this danger less than in tropical forests

Impacts of commercial forestry

- Boreal forests have been commercially harvested for solid wood and pulp-based products for well over a century with efficient approaches and even-aged, single-species stands destined for clear-cutting after approximately 100 years
 - large areas of Siberia and eastern Canada are left for natural regeneration
 - planting of nursery-grown seedlings is more widespread in Fennoscandia and western Canada
- Fundamental changes in forest structure (especially the loss of old trees and dead wood) and dynamics have taken place over the past half-century in some parts of northern Europe and are ongoing in Siberia and Canada today

Challenges arising from economics and trade

- For the advanced economies, such as Canada and Scandinavia, the main challenge is to maintain global competitiveness in existing export markets while continuing to achieve social and environmental objectives
- Russia is a region in transition, and aims to double its forest products industries over the next 10 to 15 years
- In commercially marginal areas the main challenge is to successfully undertake and regulate wood harvesting in a manner that provides economic value while protecting other socially and environmentally significant values
 - failure to do so may undermine the ability of people in these regions to improve their standard of living and sustain their cultures

The shared challenge across the boreal region

- Identifying an appropriate balance of protection and disturbance at stand and landscape levels has emerged as an important challenge to boreal forests
- While pressures will differ across each region, the basic challenge will be the same: how to utilize boreal forest resources while maintaining and enhancing other forest-related values and contributing positively to local and regional economies
- Difficult decisions will have to be made about what constitutes the greatest value in broad segments of the boreal landscape

Social expectations and valuations of boreal forests are diverse and often contradictory

- The rights of indigenous peoples have been reaffirmed or resource management agreements signed, but rights are still not fully respected throughout the region
- Local communities in the sparsely populated northern forests often face trade-offs and internal division over their commitment to place and traditional lifestyles versus the need for a strong wage-based economy

Northern resource-dependent communities

- Northern resource-dependent communities are not only particularly vulnerable to a lack of sustainability on the part of industry or government initiatives, but are also more exposed to the vagaries of global markets and a shifting climate than those more economically diversified
- Despite low population densities and little land use pressure, the world's boreal regions must still achieve a balance of social, economic and ecological values
 - as elsewhere, this balancing exercise inevitably results in some potential for tension within and among communities, and between proponents of greater development and those of greater environmental protection

Present threats facing the boreal forests (1/2): Forest values under industrial forest management

- Industrial use of boreal forests remains controversial, although, for example, 65% of Canadian, 24% of Russian and 10% of Finland's boreal forests are protected or are beyond commercial operability
- The ongoing threats to biodiversity and non-timber forest values may reflect a mismatch of the industrial model of forest management and the multitude of habitat needs
- It has been suggested that the current negative association of homogenous conifer plantations with managed forests will not be reversed simply by superficial modifications to forestry practices

Present threats facing the boreal forests (2/2): Multiple dimensions of climate change

- Surface air temperatures north of 60°N have risen 1-2°C since 1960s; the arctic tree line has advanced into tundra; thermokarst documented in Alaska
- Evidence suggests that direct and indirect climate change impacts are likely to be more pronounced at high latitudes than in most other parts of the world
 - a 4°C to 5°C mean annual temperature increase would have profound implications for forest health and productivity, disturbance risks and competition for the forest land base
- Projections over next century are even more dramatic
 - e.g. the overall area of boreal climate in Russia is expected to decline by 19% and safe travel on ice roads shortened by weeks in northern Canada

Emerging issues (1/4): Restoring forest dynamics

- Efforts to restore forest composition, structure and biodiversity to more natural conditions have become topical themes of public discussion in much of northern Europe
 - efforts to integrate biodiversity conservation with product-oriented forest management continue to play an important role in forest research and extension programs in northern regions and around the world
- Forest ecosystem management, as experimentally implemented in Canada, is based on sound knowledge of natural forest dynamics
 - one of the main ecosystem management objectives is to ensure that forestry allows for some variability within a system's natural range of variation

Emerging issues (2/4): Management imperatives where commercial forestry does not prevail

- Forest ecosystem management takes on different forms in different parts of the circumboreal forest, reflecting regional ecologies, landscape heterogeneity and economies
- Natural disturbances, particularly wildland fire and insect-caused tree death or defoliation – not forest management – overwhelmingly predominate in non-commercial boreal forests around the world

An example on forest management of a wilderness area: Alaska

- Alaska is widely known for its wildlife and scenery – all assets for tourism, scientific study and provisioning traditional users in their homeland
- About 17% of interior Alaska is zoned for fire suppression because of presence of communities and roads
 - achieved a 50% reduction in area burned, 1992-2001
- With high costs of rural energy in Alaska, renewable biomass energy facilities and attached forest management programs have been agreed upon
- Any activities or future plans encounter the scale and pace of climate change

Emerging issues (3/4): Future structure and size of boreal forest industries?

- If climate change mitigation policies are fully adopted worldwide, forest managers will need to balance between
 - maintaining and enhancing biological carbon stocks, and
 - increased demand for renewable wood and fibre products
- The net effect on boreal forests will depend on
 - details of global climate mitigation framework
 - extent to which increased demand for wood products will be met from non-boreal regions
 - development opportunities, challenges, abilities to absorb changes and approaches available in a particular boreal region

Social, economical and institutional trends

- Continuous debate on timber harvesting levels versus environmental goals
 - illegal logging can compromise local and regional conservation plans, government revenues and sustainability of timber supply
- New approaches based on participation of interested parties in decision-making
- Many companies and jurisdictions have joined in third-party forest certification, for competitiveness in international arena
- Relatively limited discussion as yet on how, when and where to adapt boreal forest management to climate change

Conclusions: A boreal prospectus

- Boreal forests, forest industries and communities are largely sustainable even under changing physical and economic conditions
 - boreal biome has good capacity for resilience and adaptation
 - although with limited options, northern communities are exhibiting a new assertive involvement in planning and development
 - as forests are primarily on public land, there are opportunities to act proactively on shifts in climate and markets through landscape and regional planning, integrated land management and alternative models of governance
- The boreal model of extensive forestry – with few silvicultural interventions and long rotations – may have a relative advantage from environmental and sustainability perspectives

Uncertainties about impact of climate change and effectiveness of alternative measures

- Unmitigated climate change would, during the current century, exceed the adaptive capacity of many forests
- Consequently:
 - management policies and practices resulting in net loss of carbon dioxide or methane from northern forests, peatlands and soils must be avoided
 - the challenge is to balance young growing forests and old forests with high carbon stocks in each landscape

Dilemmas in aiming for sustainability

- The greater value of large circumboreal areas – especially where commercial forestry is not viable now or in the foreseeable future – may be in supporting carbon sequestration, freshwater retention, wilderness and wildlife habitat
- Current initiatives for a wood-based biofuel sector should consider the sustainability of forest production and renewal
- The intensively managed forests in Fennoscandia pose a warning that industrial efficiency may be achieved at the expense of biodiversity

The social-ecological diversity of boreal forests represents a wide range of challenges and opportunities

- Dramatic shifts in biophysical and socioeconomic considerations have occurred in the past few decades, and the future will be equally dynamic
 - in view of sustainable environmental management, how much of forest loss can or should be resisted with local climate shifts and land use change?
 - is strong sustainability a reasonable goal in times of high disturbance risk or dramatic environmental change?
 - what is the appropriate spatial scale for sustainability?
- The challenge is to improve our ability to make decisions in a changing world and to be wise enough to make the most constructive and adaptive choices