ECOLOGY

Importing Timber, Exporting Ecological Impact

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Covering 32% of all forest area, boreal forests are one of the last relatively intact terrestrial biomes and are a critical carbon sink in global climate dynamics (*1*, *2*). Naturally dynamic forest landscapes, with mature and old-growth boreal forests, provide products that are culturally and economically important, from wood-based lumber, pulp, and fuelwood to nonwood products, such as animal meat and fur, mushrooms, nuts and berries, resins, and medicinal extracts (*3*). Intensive wood harvest and conservation of naturally dynamic intact forests tend to be mutually exclusive. In protected areas, where biodiversity is highly valued, wood harvests are limited or banned outright.

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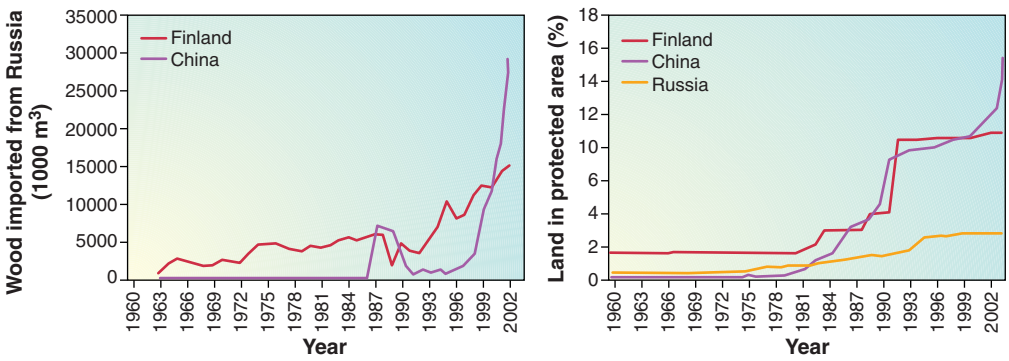
Increasing domestic forest protection without simultaneously decreasing demand for wood necessitates an increase in foreign imports, introducing a negative impact on forest biodiversity elsewhere (*4*). On an international scale, a net gain in forest protection is questionable if local protection shifts logging pressure to natural forests in less privileged areas of the world (*5*–*7*). This is especially problematic as conservation area networks usually function better in landscapes with a shorter land-use history (*8*). Increasing demand for both wood products and forest conservation in Asian and European countries, such as China and Finland, has placed increasing pressure on neighboring forests in Russia.

Russia

Russia supports over half of the boreal forest on the planet and has 20% of global wood resources (*1*, *9*). As of 2000, there were 135 national parks and strict federal nature reserves in Russia, with a total of 40 million ha (*10*). To meet increasing demand for environmental protection, the government has set a goal of 150 parks and reserves, but administrative organization and resources are inadequate and forest protection is progressing slowly (see figure, this page). Although Russia's remote northern forests are relatively intact, forests in northwest Russia decrease by about 3% annually.



Concurrent growth in timber imports and protected areas. Imports of industrial round wood, sawn wood, and wood pulp from Russia into Finland and China (*32*) have increased concurrently with the cumulative area of forest protected from logging [IUCN Categories Ia through VI (*33*)]. Russian data include only federal-level parks and preserves.

The industrial forest sector accounts for 4% of Russia's Gross Domestic Product (GDP) (*9*). Russian forests are state owned and leased to logging companies (both domestic and foreign) for timber harvest, through contracts lasting from 1 to 49 years (*11*). Forest management policies (especially with respect to sustainable harvest and reforestation) often differ among regional governments, and display wide post harvest variation in both wood production and biodiversity conservation. Although the use of more economically efficient timber auctions is increasing, the prevalent system of flat stumpage fees typically values Russian wood at 10% of European prices (*12*).

China

Less than 20% of China is forested, predominantly in the northeastern and southern regions of the country (*13*). Deforestation for cropland, fuelwood, and industrial wood use has accelerated soil erosion and desertification and has caused flooding over large areas. In response, the Chinese government established the Natural Forest Conservation Program (NFCP) in 1998 (*14*). This program bans or restricts logging across more than half of the country and compensates rural communities for reforestation activities and emigration out of heavily impacted areas. The Chinese government has spent an estimated 50 billion yuan (U.S.$6 billion) on the program (*15*), and plans to spend 100 billion yuan (U.S.$12 billion) over 10 years in the NFCP and other programs, to increase China's overall forest area to 26% (*13*, *16*).

China's rapidly growing economy and demand for housing have increased consumption of lumber and other wood products. Decreased tariffs on imported wood, due partly to membership in the World Trade Organization, and limited domestic supply due to the NFCP have made the import of logs from Russia for further processing in China more profitable (*17*) (see figure above, left). In particular, domestic production of high-quality logs has declined since the implementation of the NFCP, and consequently logging in southeastern Russia has targeted predominantly large, mature trees to meet this demand (*11*).

Finland

Boreal forest covers two-thirds of Finland. The forestry sector is responsible for roughly 25% of Finland's exports and 5% of its GDP (*18*, *19*), and products are exported chiefly to western European countries such as the United Kingdom, Germany, and the Netherlands. Less than 10% of Finnish paper and lumber is used domestically. Finnish logging companies procure roundwood throughout northwest Russia, and export both coniferous and decid-

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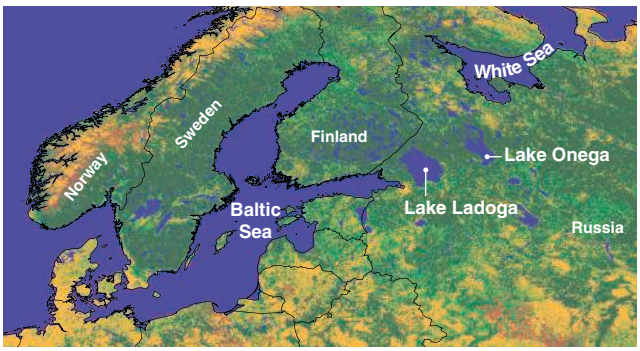
uous species for mills in Finland, although Finn-owned mills have recently been established in Russia. Wood consumption of Finnish industries has increased steadily, more recently based on wood exports from Russia (see left side of figure, p. 359). The Finnish-Russian border marks the transition from Finnish landscapes dominated by intensively managed, privately owned, smaller forest fragments, to Russian landscapes where intact forests with large mature and old-growth stands are delineated by large, clear-cut areas in various stages of succession.

The majority of protected forest is in northern Finland, where large tracts of old-growth forest are more prevalent. However, concern over biodiversity loss in southern Finland [where species richness is higher (*20*)] has initiated conservation incentive programs for private landowners, such as those advanced by the Forest Biodiversity Program for Southern Finland ("METSO program"). Income and demand for forest protection are high in Finland, and Finns have expressed a high willingness to pay for domestic forest protection and species conservation (*21*). In 2004 alone, the Finnish government spent over €50 million (U.S.$62 million) for purchase and maintenance of areas reserved for nature protection in Finland (*22*). Although potential loss of remnants of intact natural forest in northwest Russia has prompted some conservation effort by environmental groups and the Finnish government, many of the proposed protected areas lie along the Finnish-Russian border (*23*).



A potential boomerang. Logging in northwest Russia, particularly in three critical forested corridors between the White Sea, lakes Onega and Ladoga, and the Baltic Sea, may sever the ecological connectivity of Fennoscandian forests to the large forests in Russia (closed and open forests are in dark and light green, other land cover types are in brown and yellow). [Source: (*34*)]

A Potential Boomerang Effect

Finnish forests interact with Russian forests through species dispersal and migration, mainly across three key corridors (see figure, above) (*24*). For some species such as the rare white-backed woodpecker (*Dendrocopos leucotos*), a focal species of late successional stages in deciduous forest, populations in Finland depend on periodic immigrants from Russia to maintain population size and genetic diversity (*25*, *26*).

Forests in northern Finland are a major pathway for boreal species to disperse from Russia into Sweden and Norway (*24*, *26*). If current logging rates continue and harvest patterns fail to mimic natural disturbances and structural diversity (*8*, *27*), northwest Russia will suffer a net loss of large forest patches and a reduction in overall forest age (*23*). The effect of thus altered, more impacted forests in northwest Russia on the long-term diversity and viability of conserved forests in Finland is likely to be negative. Nordic countries therefore have an ecological incentive to assure that forest conservation area networks in northwest Russia are suitably protected and managed and that the activities of timber companies (regardless of origin) do not "boomerang" and degrade conservation efforts in Finland.

Successful forest conservation efforts will be based on a mix of several factors. Intensification of forestry on plantations can increase wood yields on hectares already in use, reducing land used for wood production and sparing existing natural forests for biodiversity conservation. This approach already provides over a third of industrial harvests globally (*28*). Gains in efficiency can be realized through improved logging practices and industrial processes, requiring fewer trees per ton of products manufactured (*29*). Reducing consumption of wood-based products can reduce pressure on forests, as can using alternative materials [although these also have environmental impacts (*5*)]. Finally, emulation of natural forest disturbance regimes in sustainable forest management (*8*, *27*), and spatial landscape scale planning can be used to improve functionality of forest habitat networks and the surrounding matrix (*30*).

The import of wood to meet domestic demand for both conservation targets and consumption is not unique to the countries discussed here [e.g. (*31*)]. Nature conservation policy must therefore acknowledge biogeography and the interaction between domestic protection and international markets, which can cause exported environmental damage to boomerang into countries with high environmental standards. Net conservation of nature (and sustainable forest management) will not occur when natural resource harvests are simply exported abroad.

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