



## SUMMARY

Many people think of the Russian taiga as an unlimited expanse of undisturbed nature. The main purpose of this study was to find out to which extent this notion is true—to answer such questions as

- How should undisturbed nature be defined?
- How can undisturbed natural landscapes be identified?
- Where are the remaining intact natural landscapes?
- What is the economic importance of these areas?
- What is the level of threat?

European Russia, including the Ural mountains, was systematically studied in order to map remaining large intact natural forest landscapes. Large was defined as no smaller than 50,000 hectares in size and at least 10 kilometers in width. One might think of this minimum area as the size of a square with a side of 22 kilometers (although no natural areas are shaped in this way).

There are three reasons for the focus on large areas. First, only sufficiently large areas are capable of

conserving populations of large animals in their natural, undisturbed state, and of letting natural ecological processes such as fire, wind throw, etc take their course. Second, large undisturbed areas are important as a reference that helps in the understanding of already disturbed areas (the vast majority of forest landscapes). Third, large intact areas are often comparatively cheap to conserve, as they tend to rely on remoteness and low productivity as their main sources of protection.

Forest landscapes were mapped. The reason for mapping landscapes instead of individual ecosystems is that the boreal forest is a natural mosaic of integrated ecosystems, such as forests, wetlands, rivers, lakes, and tree-less areas. Separating these ecosystems would not only be difficult but also artificial.

The goal was to find forest landscapes with a minimum of human disturbance. Two things must be realized: that the boundary of human influence often is diffuse, and that areas which are strictly free from

human disturbance no longer remain. In this study, as area was considered to be in an intact natural state if showing no signs of permanent settlements or communications, of industrial forest harvesting during the last 60 years, or mining, land clearing, and other essential human impacts. Traces of low-intensity human disturbance were accepted in the intact areas as "background disturbance". This includes hunting and early high-grading for timber far away from infrastructure.

**O**ne of the biggest problems when delineating intact landscapes is the treatment of forest fires. Fire is a natural component of the boreal ecosystem but not all fires occur for natural reasons. Separating fire scars by cause is usually impossible. In this work fire was treated mainly as an element in the natural dynamics of the boreal ecosystem. An exception was made for fire scars and young regenerated forests on old fire scars that are located directly adjacent to infrastructure. Such areas were considered disturbed, due to the dual likelihood that the fire was caused by humans and that the infrastructure will be a cause of future human disturbance.

**A** three-step procedure was used in the search for remaining intact forest landscapes. To begin with, general geographic maps were used to eliminate obviously disturbed areas (cities, big roads, etc.) and to identify roadless areas large enough to meet the size requirement. In the second phase, two-season medium resolution satellite images from the Russia satellite Resurs (the MSU-SK scanner with a ground resolution of 150 meters per pixel) were used to identify tundra areas and areas with obvious clearcuts, agricultural fields, etc. In the third and last phase, high-resolution Landsat and analogous satellite images (ground resolution typically 30 meters per pixel) were used to identify additional disturbances and to draw the final boundaries of remaining intact landscapes. This approach was used because Landsat images could not be acquired for the entire area of study for budgetary reasons and for lack of availability in some areas.

**F**ield expeditions were carried out in order to assess the actual level of disturbance on the ground in difficult areas, and to verify and improve the interpretation of the satellite images. A total of 67 areas were inspected. Many of the field expeditions included the people who were directly engaged in interpretation of the satellite images.

**T**he result shows that only 14 percent (32 million hectares) of the forest area in European Russia remain in large blocks of intact nature. All of these areas are in the remote far north with the exception of a few large peat bogs. In the rest of European Russia, and very likely in Europe as a whole, large intact natural forest landscapes no longer exist.

**R**emaining intact landscapes tend to be remote, unproductive and poorly stocked in comparison to what is usually considered minimum levels for sustainable forestry. According to the official forest map of the Russian Federation, 87 percent of the intact area has an average production of less than 1m<sup>3</sup> of stemwood per hectare and year. More than half of the area has less than 100m<sup>3</sup> per hectare in mature forest and almost nowhere is the inventory greater than 150 m<sup>3</sup> per hectare. It is interesting to note that the Swedish Forestry Act puts all land with a productivity less than 1m<sup>3</sup> of stemwood per hectare and year off limits to forestry.

**T**o level of threat to the remaining intact forest landscapes was assessed by studying the intensity of logging around their borders during the peak logging season of 1999-2000. Pairs of satellite images were used for this study, which showed that more than 95 percent of the wood in the Karelia and Komi Republics and in the Perm Oblast came from already disturbed areas, and about 90 percent in Archangelsk region. Only in the Arkhangelsk Region was the logging intensity greater near the intact areas than in the more developed parts - an indication of forest depletion in the latter areas.

**T**he forestry significance of the remaining intact forest landscapes is low. Withdrawing these areas from timber production would only factor as a small reduction in the potential wood supply, seen in the perspective of northern European Russia as a whole. For some local logging enterprises, however, the reduction may be significant.

**C**onservation of large intact natural forest landscapes is an important and necessary component of a general conservation strategy, but it is not by itself sufficient. Many ecosystems have already been disturbed to the point where only small fragments, or nothing at all, remains. Mapping of these ecosystem residuals was outside the scope of this study but is an important task for the future.