# LAND USE AND LAND COVER CHANGES IN RUSSIA

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## Summary

Land cover and land use information for Russia has been collected from various sources (e.g. local and regional maps, satellite imagery, detailed ground-truth field observations in key areas) and has, subsequently, been evaluated order to analyse land use/cover changes (LUCC). Remote sensing data have been used as a source of information both on spectral properties of different elements of land cover and on their organisation in space, composition, configuration, shape, size, and other aspects of land cover mosaics. Using the combination of remote sensing and field data at different spatial and temporal resolutions helps in better understanding the ways and mechanisms of land cover evolution and dynamics, as well as in updating currently available data on land cover and land use.

Since Russia is going through a process of agricultural restructuring, spatial and statistical data on land use/cover must be evaluated before it can be applied to any scientific research and usage by decision-makers. There are several objectives to LUCC analyses in Russia (methodological, thematic, and practical):

- to evaluate the current state of land cover;
- to define what are the major dynamic trends in land cover for this region and

how did land cover change during the last 100 years (for the whole of Russia) and in particular since 1980 (in more detail for the European part of Russia) under the on-going changes in land use system.

The present-day landscape approach was widely used to map land use and land cover changes in Russia. It helps to explain relationships between land-use practices and land-cover patterns and to consider land use change as a driving force of land cover status and trends. The Present-day landscape was chosen as the core unit of classification, because it comprises various aspects of natural and socio-economic environments.

## 1. Introduction

The main objective of land cover/land use analysis for Russia is to understand better the ways and mechanisms of land cover evolution and dynamics in the country. The study and monitoring of Russia's environment requires an updating of currently available documents and maps on land cover and land use. This work also has to provide new ideas on the appropriate structures of land use and management of forests, agricultural and pastoral resources of Russia. This information comes from various sources that differ in accuracy, level of detail, time of compilation, etc.

Since Russia is going through a process of agricultural restructuring, all available spatial and statistical data on land use/cover must first be properly evaluated in order to provide a better knowledge about the country's land resources. The main objectives (methodological, thematic, and practical) of this land use and land cover change (LUCC) analysis are as follows:

- Study the current state of land cover in Russia.
- Define what are the major dynamic trends in the development of land cover for this region, and how did land cover changes occur during the last 100 years (for the whole of Russia) and especially since 1980 (in more detail for the Central European part of Russia) under the on-going changes in land use system.
- Evaluate what is the physical/geographic meaning of incompatibilities in the contours of maps produced by different techniques.
- What are the advantages/disadvantages of the different sources of information? A basic knowledge of these factors can then be used as an intellectual basis for monitoring land use/ cover changes in the future.

## 2. Land Use and Land Cover Status in Russia

### 2.1. Land Use Structure in Russia

The political and socio-economic changes that have occurred in Russia in recent years have had a considerable impact on land use structure due to the increasing rate of land conversion. Analyses, mapping and modeling of these new trends in vegetation and land-use are needed for a proper understanding of these changes, as well as for a forecasting and efficient land use management. The main land use types that are typical to the Russian territory are listed in Figure 1 below.

Agricultural land includes plowed fields, perennial crops, fallow and grazing lands. The

steppe landscapes of European Russia and southern Siberia are plowed totally. The area of agricultural lands has decreased considerably in recent decades.

Forests occupy about half of the area of Russia (46%). Large areas of original forests are located in the south of the boreal zone in Siberia, in the southern part of the Far East and in the northern part of European Russia. The dominant type of forests comprises conifers (larch, pine and spruce). The current state of forests is characterized by a decrease of the share of coniferous species and a relative increase of the share of less valued small-leaved species. A considerable part of the marshes are of the oligotrophic type, and these are overwhelmingly dominant in the northern regions.

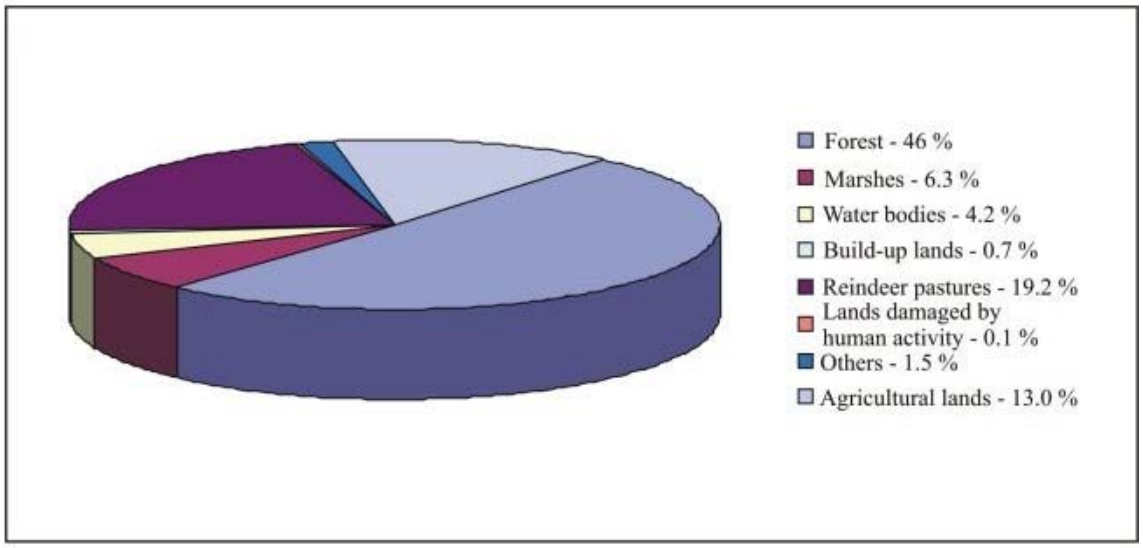


Figure 1. Land use structure in Russia.

Water bodies cover 4.2% of the country's surface and include lakes, rivers, streams and artificial reservoirs. Reindeer pastures are located mostly in the Far East region with almost 30% of all reindeer pastures of Russia being concentrated in the Republic Sakha (Yakutia). Nevertheless, their quality continues to diminish, mainly because of overgrazing, fires and external contamination.

Built-up lands reach a maximum in the Moscow region (4.8%). The surfaces most seriously affected by human activities are those used for mining and geological prospecting. The biggest areas of such land are situated in the Northern Caucasus, Western Siberia and the Far East.

## 2.2. Agricultural Activity and Sustainable Land Policy

Russia's agricultural area (excluding forests) extends over approximately 215 million hectares. This is more than Kazakhstan's (198 million hectares) and Ukraine's (41 million hectares) land surfaces. Irrigation is, at present, relatively unimportant as only about 4% of the arable land is equipped for irrigation. The use intensity of Russian agricultural land is intermediate between the extensive wheat and grazing lands of Kazakhstan and the intensively cultivated Ukrainian lowlands.

About 53% of the planted area in Russia is devoted to grain crops. Some 30% of the grain area is sown in winter crops, and the remaining 70% in spring grain. Since the winter crops tend to be higher yielding, winter grains make up approximately 40% of the Russian grain crops. Other important field crops include sugar beet, flax, sunflower, potatoes, vegetables, feed roots, hay, and fruit. Russian wheat growing conditions are almost similar to those of Canada, USA, and Argentina, and yields lag behind those in Canada by about 10%. Yields of potatoes, sugar beets, and feed, including grasslands and hay, lag behind North American levels much more than do grains. Significant increases in yields as well as efficiency gains can be achieved with these crops through better management and improved technology. Yield increases in grains may be more modest, but increased efficiency in input use and reduced post-harvest losses can bring significant economic gains.

Yields and efficiency in the livestock sector lag much further behind world levels than in the crop sector. Milk yields are at about 6000 to 7000 liter/year/cow, and these are from 50 to 60% of western European levels and 40 to 45% of US levels. Feeding efficiency in meat production is estimated to be approximately half that of western Europe. Low yields in the livestock sector derive in large part from chronic feed shortages, because more animals are kept than can be efficiently fed. The low quality of feed used and the poor genetic stock of animals also reduce productivity in the livestock sector.

Russia was the largest food importer of the former Soviet states, and it has traditionally been a net importer of most food products with the exception of eggs, bread products, potatoes, and fish. In 1990, prior to the recent fall in demand, Russia imported 13% of the meat and 17% of the milk it consumed. Between 68 million and 75 million tons of grain have been used for feed in Russia recently, compared to imports of between 18 and 23 million tons (including inter-republic trade). A one-third reduction in demand for grain for feed would thus turn Russia from a net importer into a net exporter of grain.

Food consumption in Russia, on average, remains adequate in terms of calories and average nutrient level, even with the reduction in 1991 and 1992. Regional variation in food consumption was significant under the old distribution system, and it has become even more so with the disruption in internal trade at the end of 1991 and slow response to formal liberalization of internal trade in 1992.

The problem of agriculture restructuring and sustainable land use in Russia during the period of economic and social reforms is of vital importance for two reasons: economic and environmental. Sustainable use of natural and social resources in Russian agriculture should bring essential economic benefits and save natural resources from exhaustion. On the other hand, ecologically sound agriculture should help to reconcile social needs with the requirements of the environment.

Though the management of natural resources has much improved today as compared to earlier policies, a number of major problems still remain to be solved . These refer in particular to the following issues:

(a) The management of natural resources (soil, forests, etc.) is department-based or

continues to be under the guidance of administrative structures like central ministries or regional administrations). It is not regulated by laws on property or by a functional market economy.

This sectoral approach to resource management is still prevailing. Each department explores its own natural resources and makes environmental decisions only within the narrow limits of its own economic interests. This results in tremendous distortions between sectoral interests and environmental needs. For example, if a land owner judges that agricultural production of the land can only be increased through a fertilization of the soils, any conflict of this action with eventual ecological interests is considered a limitation to his/her production.

b) The exploitation of natural resources is mainly based on economic criteria without taking into account the impact on the environment or on specific elements of the ecosystem. As a result the system becomes less sustainable. Obviously, the unfavorable economic situation in Russia influences its nature management system and gives lower priority to the solution of acute environmental problems.

c) In Russia only quantity of production is taken into consideration to evaluate land quality. Land (soil) or forest degradation, and socio-economic impacts of land use are not taken into account.

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**Bibliography**

Goward, S. N., Tucker C.J. and Dye D. G. (1985). *North American Vegetation Patterns Observed with the NOAA-7 Advanced Very High Resolution Radiometer*. Vegetatio, 64: 3-14. [This article provides useful information on the investigation of vegetation patterns with the help of AVHRR data].

Justice, C. O., Townshend, J. R. G., Holben B. N. and Tucker, C. J. (1985). *Analysis of the Phenology of Global Vegetation using Meteorological Satellite Data*. International Journal of Remote Sensing, 6: 1271-1318. [This publication provides fundamental data on how to use phenological observations from satellites in the study of land cover changes].

Kineman, J.J. and Ohrenschall, M.A.(1992). *Global Ecosystems Database. Version 1.0 (on CD-ROM). Documentation Manual*. EPA Global Climate Research Program. NOAA/NGDC Global Change Database Program. [Provides explanation of Global Ecosystem Database. Documentation manual]

Milanova E.V., Kushlin A.V. and Middleton N.J., eds. (1993). *World Map of Present-Day Landscapes, M., Soyuzkarta*. Map of scale 1:15 000 000 on 4 pages and explanatory note. [This provides explanation of the concept of present-day landscapes, and shows the present-day landscapes of the world].

**Biographical Sketches**

**Elena V. Milanova** is a Professor at the Faculty of Geography, Moscow State University, Russia, where

she teaches and conducts scientific research on land use/cover (LUCC) dynamics, landscape mapping, natural resources' management and environment protection, and prospects for sustainable land use in Russia. She worked out the landscape concept for LUCC study through traditional mapping and remote sensing data and is the author of the landscape hierarchical classificatory scheme for scale-dependent LUCC applications. She has more than 100 scientific publications both in English and Russian, including 9 manuscripts and manuals.

In 1995-1999 she was the leader of projects on Land use/ Land cover and vegetation change in the frame of INTAS (International assistance for former USSR and East European countries) and in the frame of the International VEGETATION Program sponsored by the Centre National des Etudes Spatiales (France). Professor Milanova was a member of the IGBP-HDP LUCC Study Group (under the guidance of Professor Billy Turner) in 1993-96 and took part in elaboration of the LUCC Science Plan. Currently she is a full member of IGU-LUCC Study Group and she took part in preparation of the pilot World Atlas on LUCC (Russia input) and in its editorial commission.

**Maria Sennikova** is a researcher at the Faculty of Geography, Moscow State University, Russia. Her research focuses on Land Use/ Land Cover Change of Russia, landscape mapping for regional and local case studies, and the elaboration of ecological networking for the European part of Russia. She is doing field research for case study areas in Russia. She completed her M.Sc in geography at Moscow State University.

Maria Sennikova participates in the International ECONET Project of WWF, being a specialist in using remote sensing for landscape and land cover analysis. She is a corresponding member of IGU-LUCC Study Group and she took part in the preparation of the pilot World Atlas on LUCC (Russian input).