Russian research landscape in the area of forestry and climate change mitigation

Natalia Lukina

Center for Forest Ecology and Productivity, RAS

Scientific Council on Forests, RAS

General information about forests and forestry

- Area of forests - more than 1179 million ha, Forest cover – 45 %.

In Forest Fund, area covered by forests is 768 million hectares.

- Accordingly legislation, the main goal of forestry is to provide wood

while maintaining environmental protection ecosystem functions of forests.

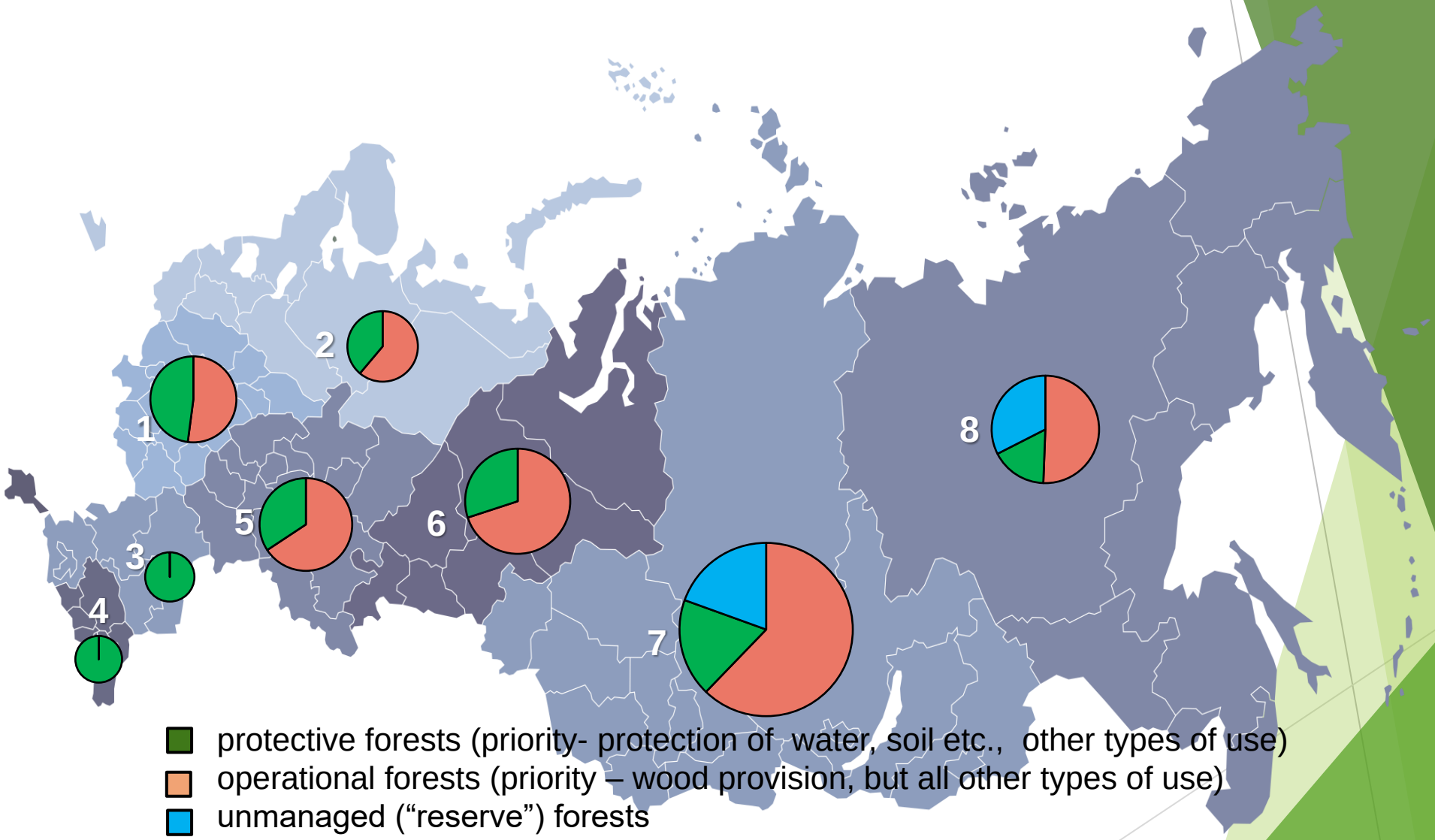
- Extensive forestry model, except for some regions. State ownership, the share

leased forests -22 %.

Concepts in forestry

- Sustainable Forest Management , sustainable forest use.
- Multiple Use Forestry, forests can be used for various purposes.
- Extensive forestry model and Intensive forestry model
- Segregation approach: zoning of forest area for intended purposes: operational (51 %), protective (26%) and reserve (23 %) forests. In real practice, combination of segregation and integration (for instance, high conservation value forest within the operational forests and cuttings in protected forests)

Segregation: zoning of forest area in Russia

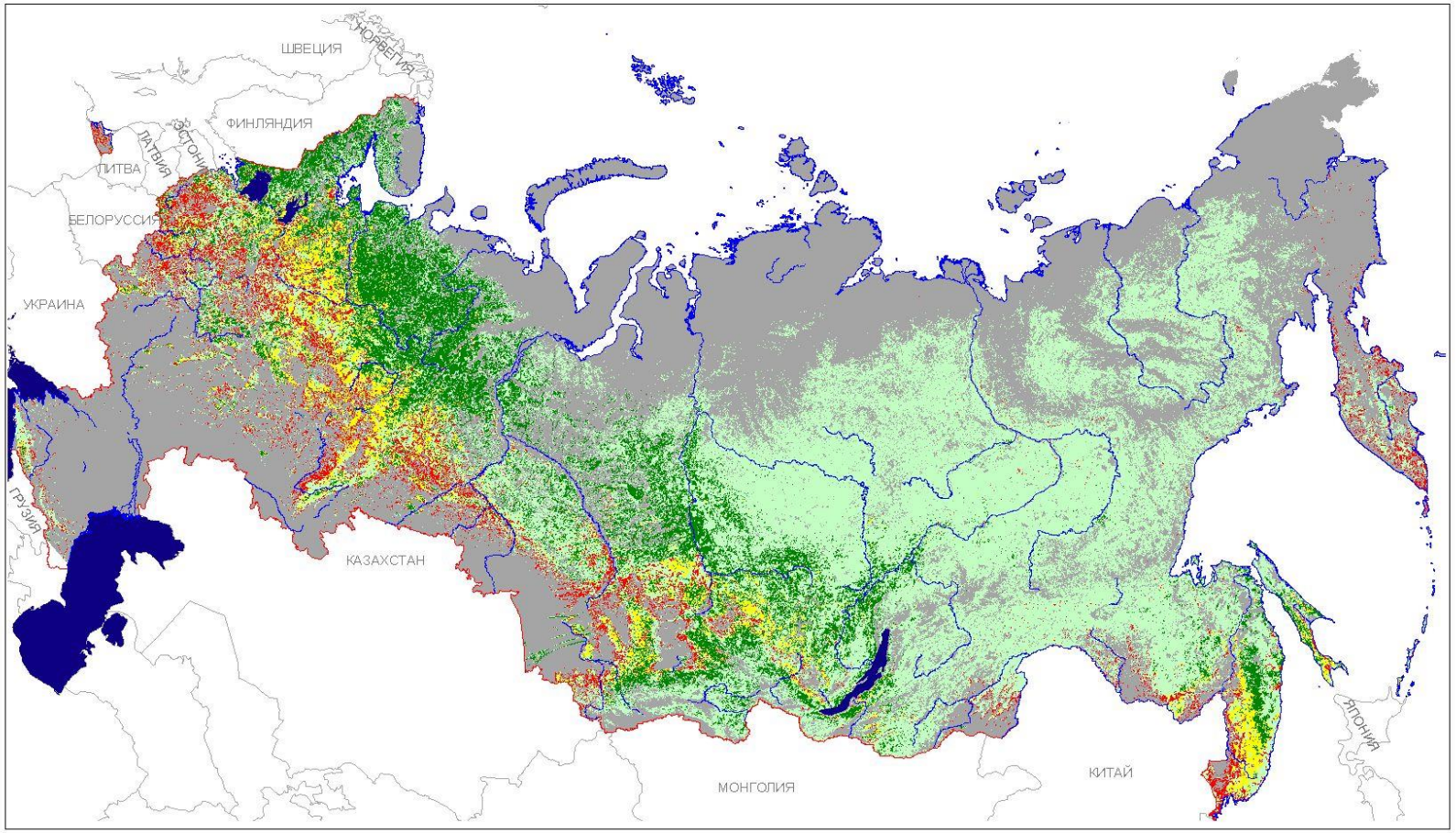


protective forests (priority- protection of water, soil etc., other types of use)
operational forests (priority – wood provision, but all other types of use)
unmanaged (“reserve”) forests

Federal districts
1- Central, 2- Northwestern, 3- Southern, 4- North Caucasian, 5- Volga, 6- Ural, 7-Siberian, 8- Far Eastern

Vegetation cover maps, annually updated using satellite remote sensing data

Forest cover dynamics in Russia



Forest cover GLC 2000

Replacement of coniferous forests by deciduous forests

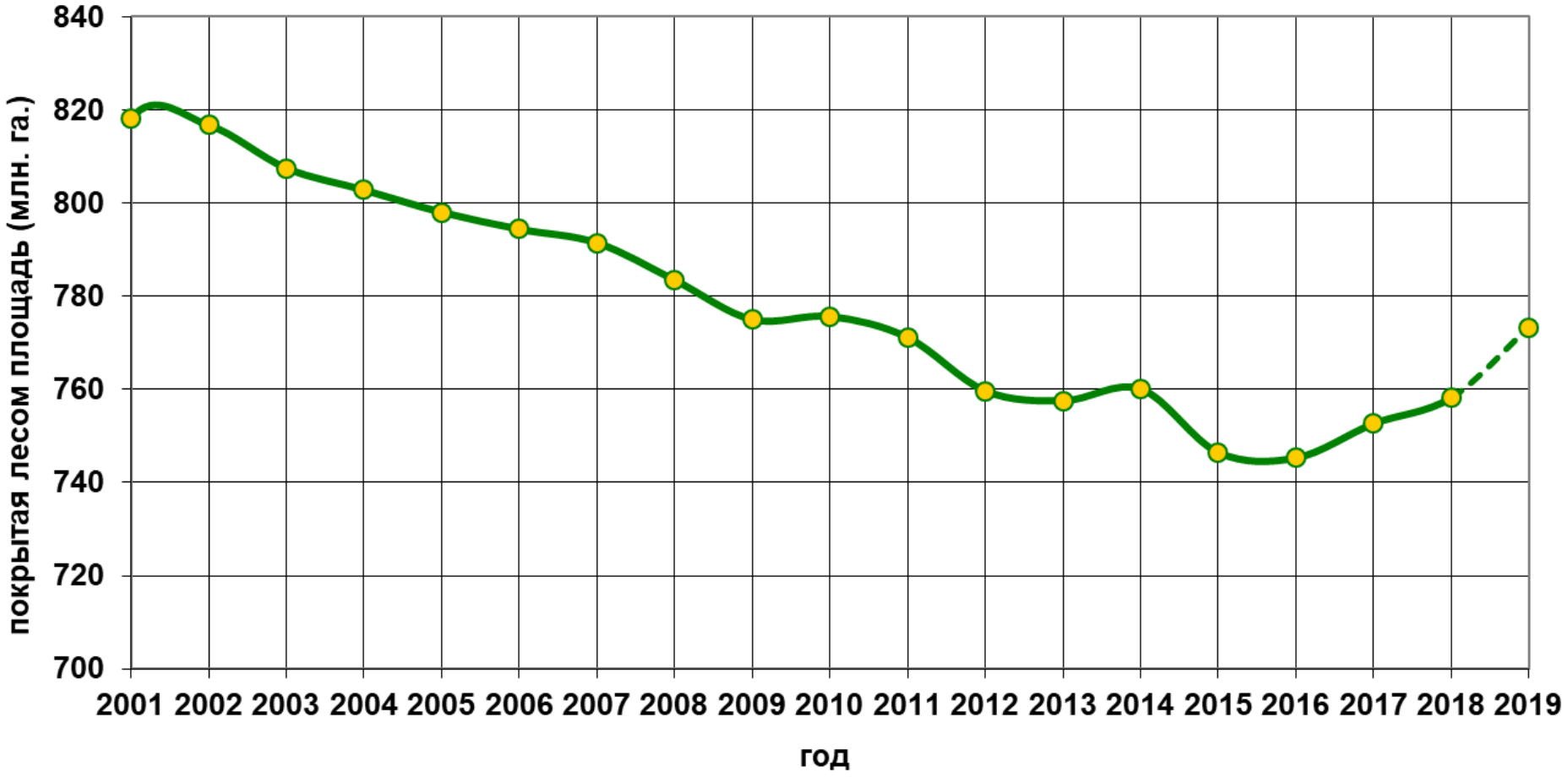
Dark coniferous and pine forests

Forest on abandoned agricultural lands

The forest cover of Russia is highly dynamic. For instance, during the period 2014-2017, the forest damages in Russia were caused by fires (63%), insects outbreaks (15%), extreme weather conditions (11%) and diseases (10%) (Rosstat, 2018)

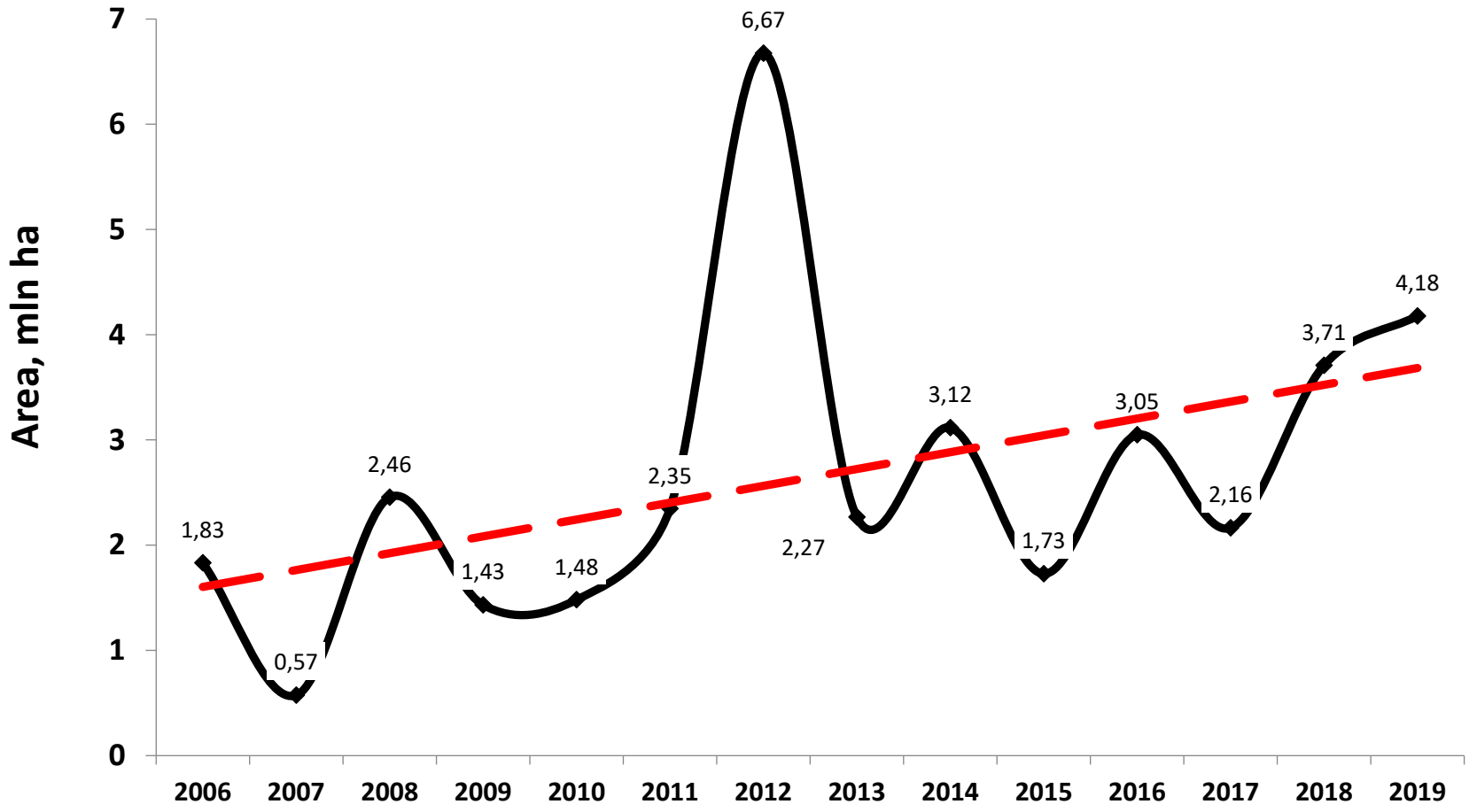
Boreal forest cover is changing very quickly because of combined effects of climate change, fires, insects attacks, fungi diseases, logging. Over the past 10 years, the rate of forest area reduction in Russia is 1.2 million hectares per year (Bartalev, 2019). Permafrost thawing.

Forest area dynamics, million ha



Accordingly remote sensing data (Bartalev, Space Research Institute)

Dead and severely damaged forests subject to fire



Climate change mitigation: national context

Climate change mitigation objectives were adopted in a number of political commitments:

· The Climate Doctrine of the Russian Federation (Government of the Russian Federation, 2009)

· The Decree on reducing greenhouse gases emissions (Government of the Russian Federation, 2013) and its Implementation Plan (Government of the Russian Federation, 2014)

· The Intended Nationally Determined Contribution (INDC) to the Paris Climate Agreement (2015)

· The National Adaptation Plan (2019), and sectoral and industrial plans and programs

· The ratification by the Russian Federation of the Paris Climate Agreement in September 2019

Vladimir Putin signed decree number 666 on the reduction of greenhouse gas emissions of the Russian Federation by 2030 to 70% of the 1990 level, taking into account the maximum possible absorptive capacity of forests (November 04, 2020).

Forests and forestry for climate change mitigation

There are three main complementary ways:

1. Preserve forests with a high level of biodiversity which is a basis for adaptation to climate changes
2. Increase carbon sequestration by managed forest ecosystems.
3. Decarbonization of economy.

1. Preserve forests with a high level of biodiversity

Preserve forests with a high level of biodiversity which is a basis for adaptation to climate changes.

- Intact old-growth forests in reserved forests zone- about 23 % out of total area.
- High conservation value forest areas (HCVF) within operational forest zones.

These forests store carbon, particularly in soils, natural mechanisms of forest biodiversity to adapt to climate change work here

2. Increase carbon sequestration by managed forest ecosystems.

To increase carbon sequestration by managed forests it is necessary:

- to decrease emissions of greenhouse gases from forest fires, diseases, illegal logging,
- to move from dominating model “wood mining” in natural forests to forest growing in operational forests, including plantations (Concept of new Forest Law by Scientific Council of RAS),
- to increase managed forests productivity

But first of all, it is necessary to get reliable information on C budget of Russian forests

Carbon budget of Russian forests

- The available carbon sink estimates for Russian forests vary significantly (from 150 to 960 Mt C yr^{-1}) and contain many uncertainties. The main reason for this variability is the lack of initial data on which the calculations are based. Official data of forest account and soil data are outdated. For instance, accordingly expert estimation wood stock is underestimated significantly (up to 30 %) but the area of forest deaths from fires is also underestimated.
- Russian forests served as a net carbon sink during the last decade. Temporal and spatial variability of the carbon sink is high, particularly for individual regions of the country. This variability is connected with the natural disturbances (fire, insect outbreaks, diseases), and there are areas with disturbed forests (including thawing permafrost) that can become carbon source.

Climatic monitoring in forests is urgently needed

- Improvement of methodological approaches to determining the volume of absorption of greenhouse gases by forests in terms of increasing the accuracy, completeness of the initial data and the comparability of the results.
- Adjustment of the methodology is aimed at using data from the state forest inventory, using remote sensing data, updating regional coefficients of changes in carbon stocks in soil, litter, dead wood , direct observations of carbon flows with eddy covariance methodology.

http://cepl.rssi.ru/confs/forest_management_2020/wp-content/uploads/2020/01/sbornic_materialov_forest_management_2020.pdf

Adaptation plans

- Since 2017 in forest plans information on planned measures to preserve the ecological potential of forests, adapt to climate change and increase the sustainability of forests should be contained.
- These measures should be aimed at preventing forest fires, pest outbreaks. But still, measures to protect forests from fires or pest outbreaks in new forest plans were developed without considering climate change which is related to a lack of systematic and consistent projections of climate change and its impacts on forestry (Leskinen et al, 2020).
- To prevent illegal logging, first of all it is necessary to have an accurate estimate of the volume of illegal forest use (1 % - official data, up to 30 % - accordingly expert estimation)
- A special program of adaptation of Russian forests to future regimes of disturbances is urgently needed. Fires is one of the main factor of disturbances. An appropriate system of forest fire protection should include the analysis of present and future regional fire regimes, the development and implementation of more efficient forest fire protection concepts to prevent large-scale forest disturbances. The development of efficient fire monitoring and creation of mobile systems of fire suppression, improving the legislation and institutional structures of forest management, and SIGNIFICANT increase in funding.
- Plan to reduce greenhouse gas emissions from deforestation and forest degradation (project) is under discussion.

Circular forest-based bioeconomy (CFB)-areas

The Forest Scientific Council of the Russian Academy of Sciences has developed the concept of circular forest-based bioeconomy (CFB) in Russia. Accordingly this concept, the main areas of CFB are :

- (i) biodiversity;
- (ii) forest ecosystem services and multifunctional forestry;
- (iii) forest- based industry in bio-based industry: wooden constructions, products from wood and harvesting residues, wastes, cellulose, hemicellulose, lignin, extractives, pharma products, etc.;
- (iv) smart packaging: wood and fibre-based packaging against plastics and other packaging materials, hygienic and healthcare products, etc.;
- (v) renewable energy solutions, bio-energy products.

Circular forest-based bioeconomy- preconditions

Preconditions for the development of CFB are as follows:

- objective analysis between the sustainability performance of biomass-based and fossil/mineral-based value chains;
- vision and strategic actions, national strategy for CFB development
- forest resources abundance;
- reliable assessment of forest resources and forest dynamics due to the combined influence of natural and anthropogenic factors;
- comprehensive value assessments of forest ecosystem services, and synergies and trade-offs between them;
- sustainable forest management;
- smart biotechnologies;
- awareness in society of the limits and benefits of CFB;
- education and training in the field of bioeconomy;
- international cooperation.

3. Decarbonization of economy

Substitution of carbon-intensive products by products from forest materials

Decarbonization

***Biofuel*.** In Russia, the current annual production of pellets is about 1.4-1.5 Mt, production of briquettes about 0.2-0.3 Mt, and production of fuels chips 1.1 Mt. According to the *Russian Strategy of the Forest Complex until 2030*, the pellet production can grow from 1 100 000 tons per year in 2016 to2 800 000 tons per year in 2030.

Wood and wood-charcoal briquettes ("Forest Technology Company“, A.Pekarets)

An innovative technology of fuel and coal briquettes from larch sawdust has been developed, based on a directed change in the relaxation states of polymer components of wood due to the combined action of temperature and water vapor in preparation for extrusion - crushing, and the extrusion itself.

***Wooden buildings*.**

There are two projects:

- “Available and comfortable housing for Russian citizens”,

The main goals of the first project are to increase the volume of housing construction, allocation of funds for engineering infrastructure of land plots for housing construction and etc. to solve the housing problem of young professionals in rural areas and other categories of citizens.

- “Strategy for developing the building materials industry until 2020”.

The second project supports development of production of construction materials.

At present, wooden construction is characterized by low volumes. Share of buildings with wooden walls is now around 10% of the total. The total amount of residential construction in the Russian Federation in 2030 should encompass 170 Mm3, that is, over 1 m2 per citizen, which corresponds to indexes of developed European countries (Leskinen et al, 2020).

Decarbonization

- **Wood-based textiles**
  In the 1980s the Russian Federation was a leading country in the production of dissolving pulp for viscose (Skripnikov, 2017), but now Russia produced not more than 1% of the viscose dissolving pulp manufactured worldwide. Improved, environmentally friendly technologies related to viscose and new technologies (for example, Lyocell) are needed.
- **Chemicals**

High-purity lignin being the precursor for other chemicals (vanillin, the aromatics benzene, toluene and xylene).

- Several types of **Bioplastics** - the technology for producing certain types of wood-based bioplastics. As an example the production of wood-based plastic lining for beverage cartons. In 2019, it is estimated that more than 40 million milk and yogurt cartons with bioplastic lining were used in Finland, reducing the need for fossil-based plastics by 180,000 kg per year (Leskinen et al, 2020).

Forest science in the area “ forestry- climate change mitigation”

- Development of Forest Policy and Forest legislation for maintaining and restoring the balance between forest ecosystem services in a changing climate
- Development of decision support systems for maintaining and restoring the balance between forest ecosystem services in a changing climate
- Development of markets for climate- regulating forest ecosystems services
- Mechanisms of the combined effects of diversity of biota belonging to different trophic levels on the climate-regulating functions/services of forests to develop measures to adapt to climate change in managed forests
- Approaches to combination of segregation/integration, human intervention/rewilding concepts for delivery of all forest ecosystem services at different forest management levels
- Integration of remote sensing and ground-based monitoring methods for assessment and mapping forest ecosystem services to have updated information for sustainable forest management
- What should be a forestry model that does not lead to a reduction in forest biodiversity in a changing climate at different spatial levels? Does the modern model of intensive forestry meet the challenges of climate change?
- Systematic and consistent projections of climate change and its impacts on forestry at different forest management levels to adapt to climate changes
- Analysis of present and future regional fire regimes, the development and implementation of more efficient forest fire protection concepts, forest fire monitoring, detection, preventing and new methods for fire supression
- Models of climate smart forestry at different forest management levels
- Improved, environmentally friendly technologies for new products from forest materials (wood. cellulose, hemicellulose, lignin , harvesting residues and processing wastes and etc.) including biofuels, wood-based textiles, wood-based bioplastics, high-purity lignin based chemicals and etc. for effective decarbonization of economy

International projects _ CEPF RAS today's experience

ERA-NET SUMFOREST

"Decision-making Support for Forest Ecosystem Services in Europe - Value Assessment, Synergy Effects and Trade-offs" "POLYFORES" (ERA-NET SUMFOREST) (2017-2020)

H2020-RUR-2017-1

Spurring INnovations for Forest ECosystem SERvices in Europe (SINCERE) (2018-2022)

http://cepl.rssi.ru/science/projects/international-projects/

International cooperation

- **RUFORCLIM - Impacts, challenges and opportunities for Russian forests, forestry and forest bioeconomy to respond to climate change**

https://efi.int/sites/default/files/files/publication-bank/2020/efi_wsctu_11_2020.pdf

http://cepl.rssi.ru/news-2020-12-01/


Thank you for attention