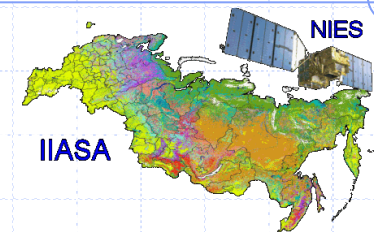# A hybrid Land Cover Dataset for Russia: a new methodology for merging statistics, remote sensing and in-situ information
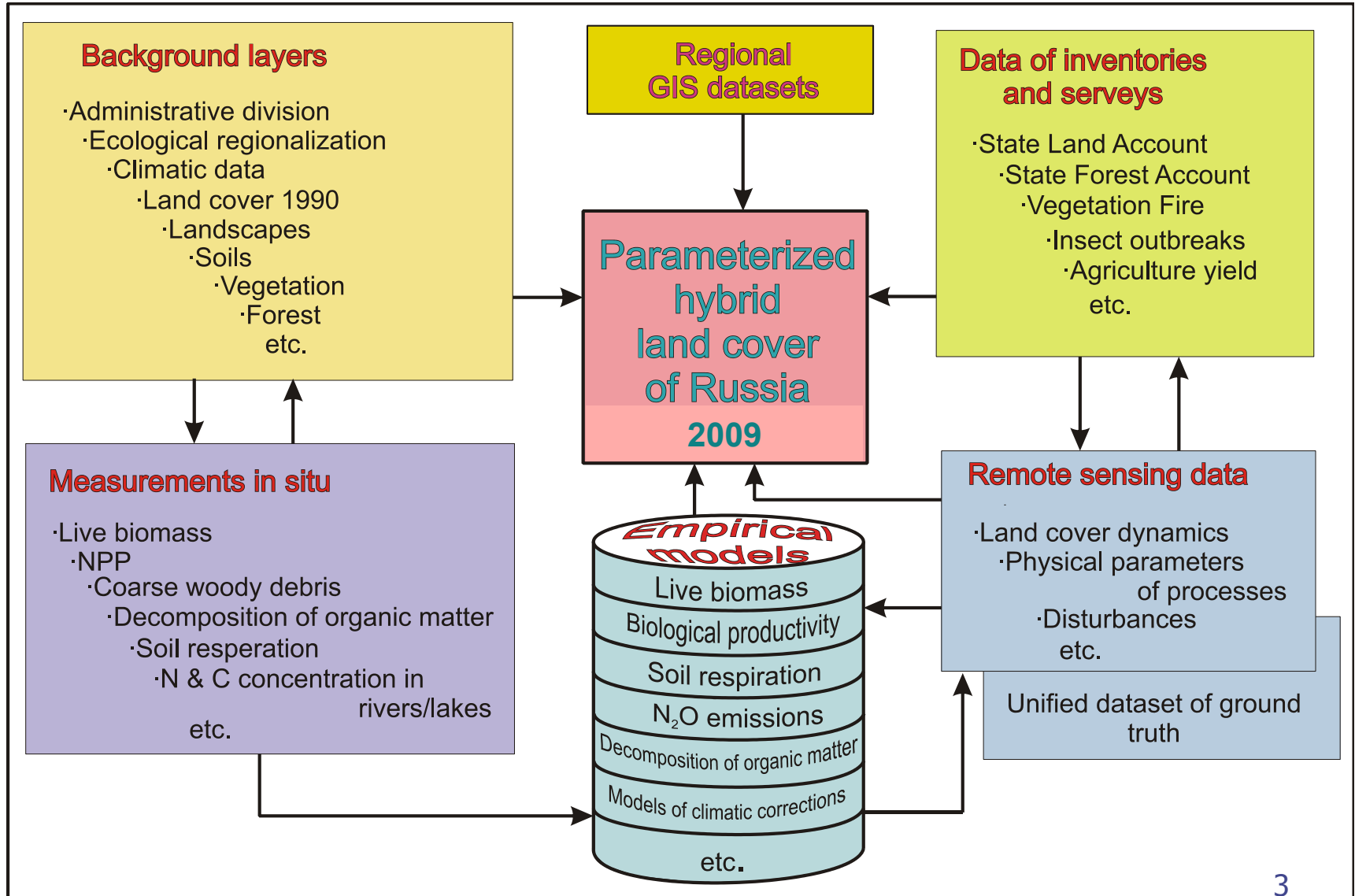
D. Schepaschenko, A. Shvidenko, I. McCallum

NIES

IIASA

The overall objective is development of information base for the verified Terrestrial Biota Full Greenhouse Gas Account for Russia

- ◆ Key words: Full, Verified, Uncertainty
- ◆ Full: ALL ecosystems, ALL processes, ALL biophylic elements continuously in time
- ◆ Verified: (1) reliable and comprehensive assessment of uncertainties; (2) possibility to manage uncertainties
- ◆ Uncertainty is an aggregation of insufficiencies of outputs of the accounting system, regardless of whether those insufficiencies result from a lack of knowledge, intricacy of the system, or other causes

Structure of the Integrated Land Information System

Background layers

·Administrative division
·Ecological regionalization
·Climatic data
·Land cover 1990
·Landscapes
·Soils
·Vegetation
·Forest
etc.

Regional GIS datasets

Data of inventories and serveys

·State Land Account
·State Forest Account
·Vegetation Fire
·Insect outbreaks
·Agriculture yield
etc.

Parameterized hybrid land cover of Russia 2009

Measurements in situ

·Live biomass
·NPP
·Coarse woody debris
·Decomposition of organic matter
·Soil resperation
·N & C concentration in rivers/lakes
etc.

Empirical models

Live biomass
Biological productivity
Soil respiration
N_2O emissions
Decomposition of organic matter
Models of climatic corrections
etc.

Remote sensing data

·Land cover dynamics
·Physical parameters of processes
·Disturbances
etc.

Unified dataset of ground truth

"Basic" layers of the Hybrid land cover

◆ **GIS**

· Administrative division   · Forest enterprises

· Bioclimatic zones   · Vegetation (1:4 Mio)

· Soil (1:2.5 Mio)   · Rivers/lakes & roads/railways (1:1 Mio)

◆ **Remote sensing products** (1 km resolution)

· GLC2000 – Global Land Cover

· MODIS Land Cover

· MODIS NPP

· VCF - Vegetation Continuous Field

· Vegetation Fire (AVHRR & LANDSAT by A.I. Sukhinin)

◆ **Statistics**

· State Land Account (by 81 administrative units)

· State Forest Account (by 1585 forest enterprises, 78439 records)

· Disturbances in forests (by administrative units)

◆ **Models**

· Live biomass   · NPP

· Respiration   · etc.

Spatial distribution optimization of statistic data

We calculated a suitability index (S_{ts}) for each pair: grid of territory (t) and statistics record (s). Then we allocated statistic records to the most suitable place within the territory unit (forest enterprise, administrative region).

Suitability index (S_{ts}) is the quantitative correspondence of statistics (forest and land account) and spatial (remote sensing, GIS) data

$$S_{ts} = \frac{1}{q}\left(\sum_{j=1}^{q} (x_{tj}^{norm} - x_{sj}^{norm})^2 \right)^{1/2} \qquad x_j^{norm} = \frac{x_j - x_{j\min}}{x_{j\max} - x_{j\min}}$$

q - number of parameter;

X_{tj}^{norm}, X_{sj}^{norm} - normalized value of parameter j for territory pixel t and statistic record s;

$X_{j\max}$, $X_{j\min}$ - maximum and minimum values of parameter j within the certain area (forest enterprise, administrative unit).

Parameter	Statistics	Remote sensing/ GIS
Land cover	Land use, tree species	GLC2000; Modis land cover
Tree stocking	Relative stocking	VCF trees
Site quality	Site index	Zone; Soil
NPP	Ground NPP	Modis NPP

Hybrid land cover 2009 – vegetation classes

(1 km resolution)

Veg
- Pine
- Spruce
- Fir
- Larch
- Cedar
- Birch
- Aspen
- Other dominant species
- Open woodland
- Burnt area
- Wetland
- Agriculture
- Grass- & Shrubland
- Water
- Unproductive
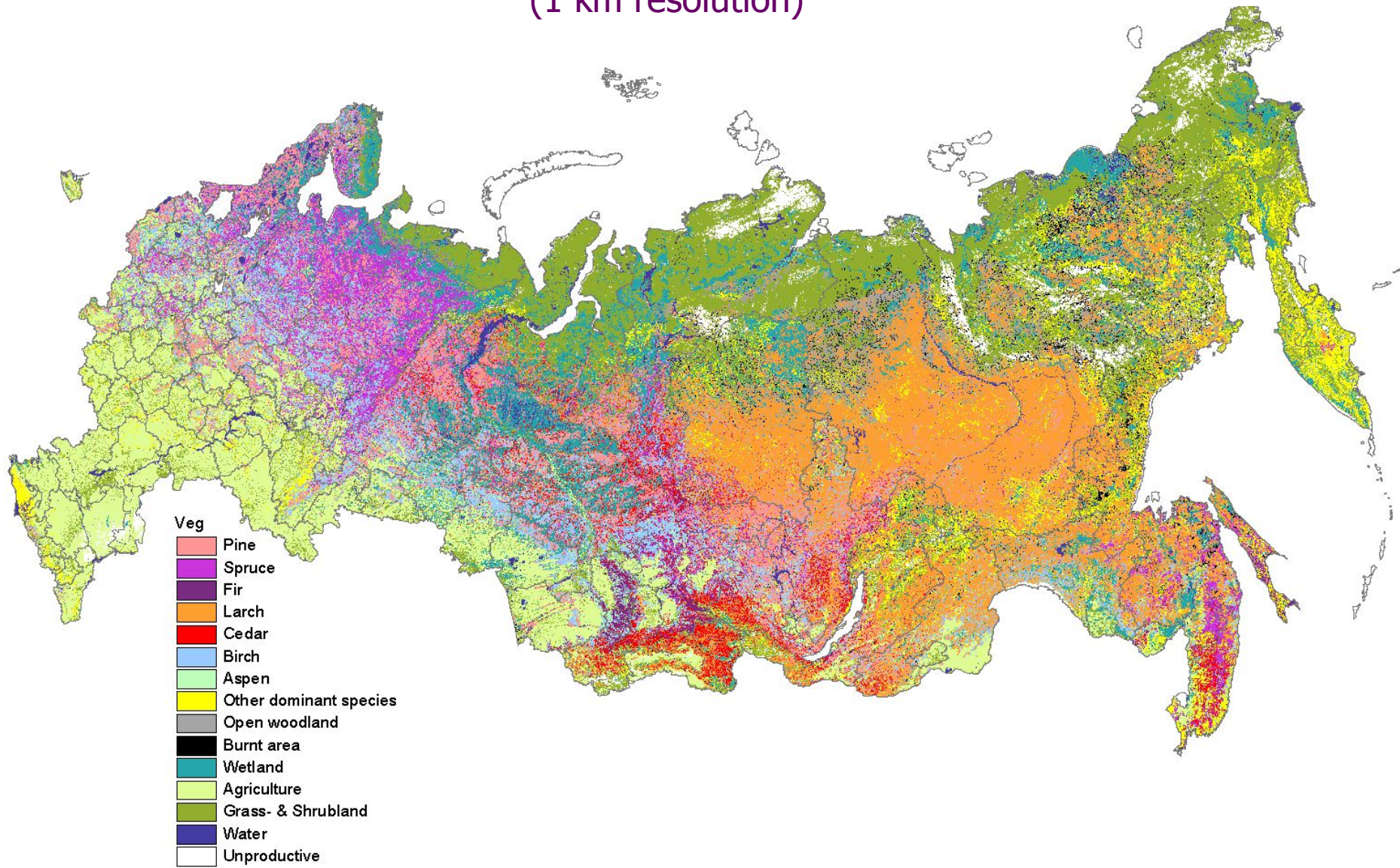
The Land Cover vegetation classes

- **Forest** (78639 units with detailed information about tree species, age class, growing stock, etc.)
- **Open woodland** (32 classes by main tree species and regions)
- **Agriculture** (arable land, hayfield, pasture, fallow, abandoned arable by 81 admin. units)
- **Wetland** (8 classes by 83 regions/zones)
- **Grass- & Shrubland** (about 50 classes)
- **Burnt area**
- **Water**
- **Unproductive**

Hybrid land cover 2009 –South of Siberia

8
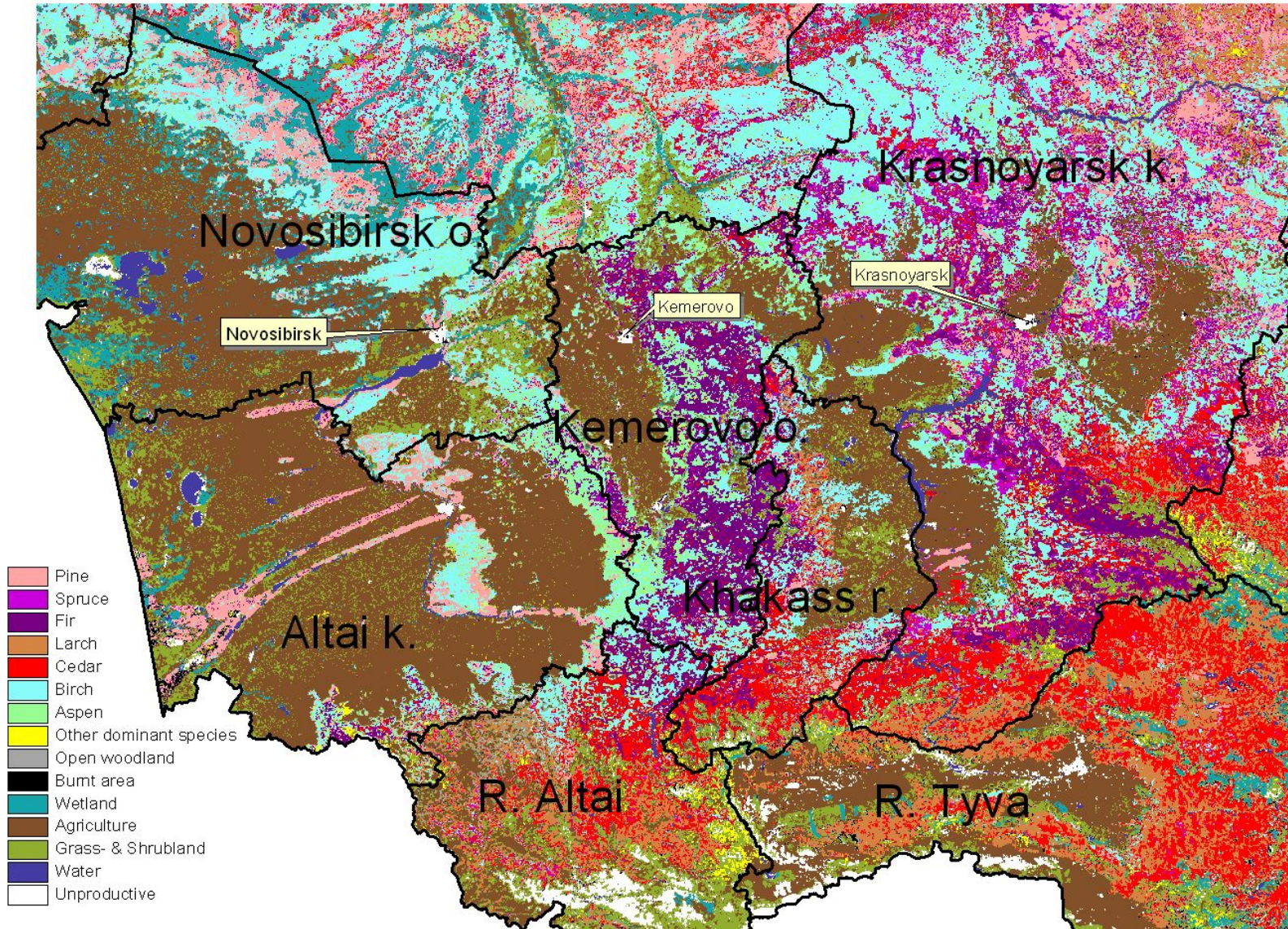
Agreement/confidence classes of the hybrid land cover map (1 & 2 omitted for clarity)

1 (52% of area)   2 (18%)   3 (24%)   4 (4%)   5 (1%)   6 (1%)

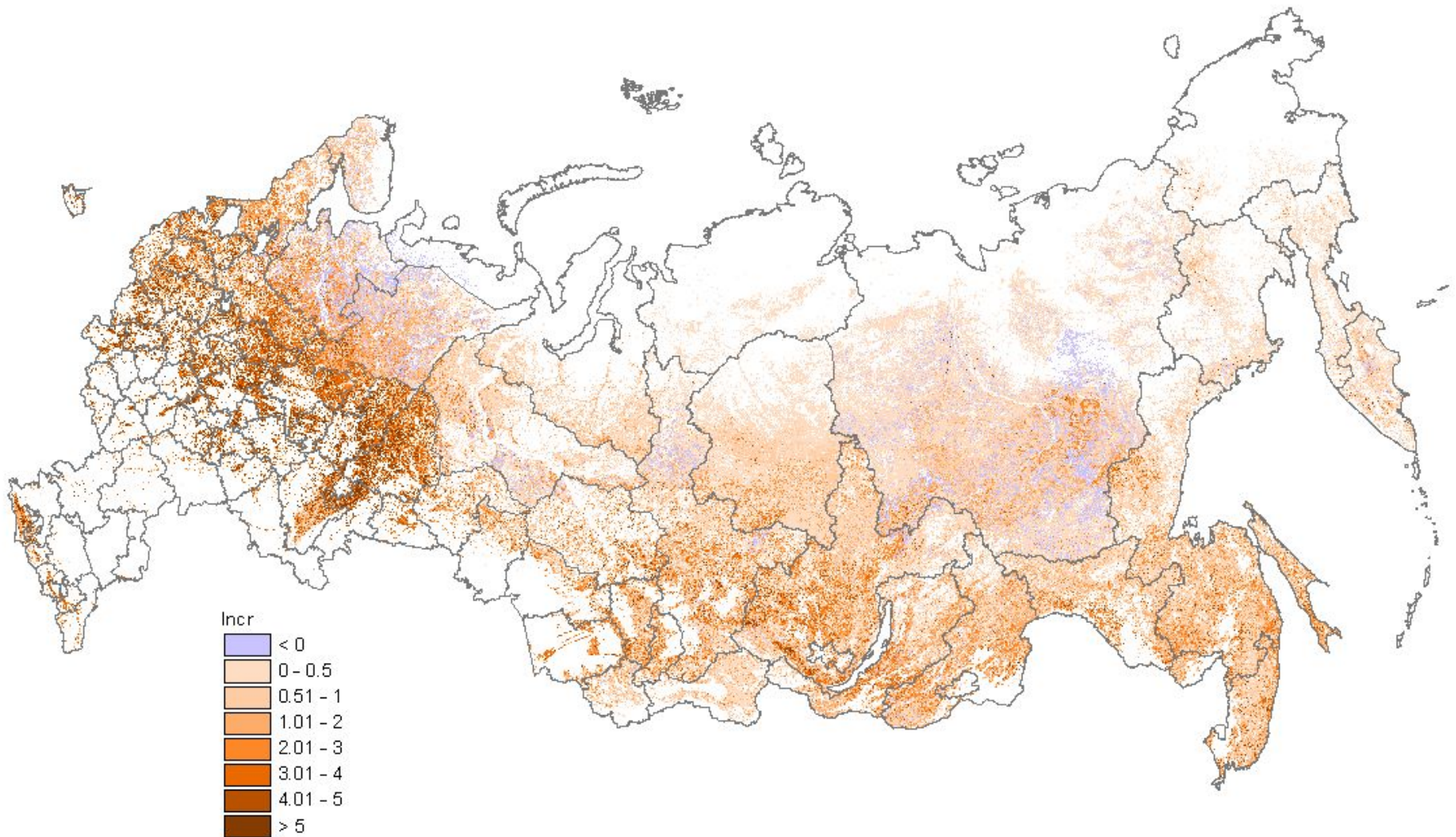High Agreement   Low Agreement
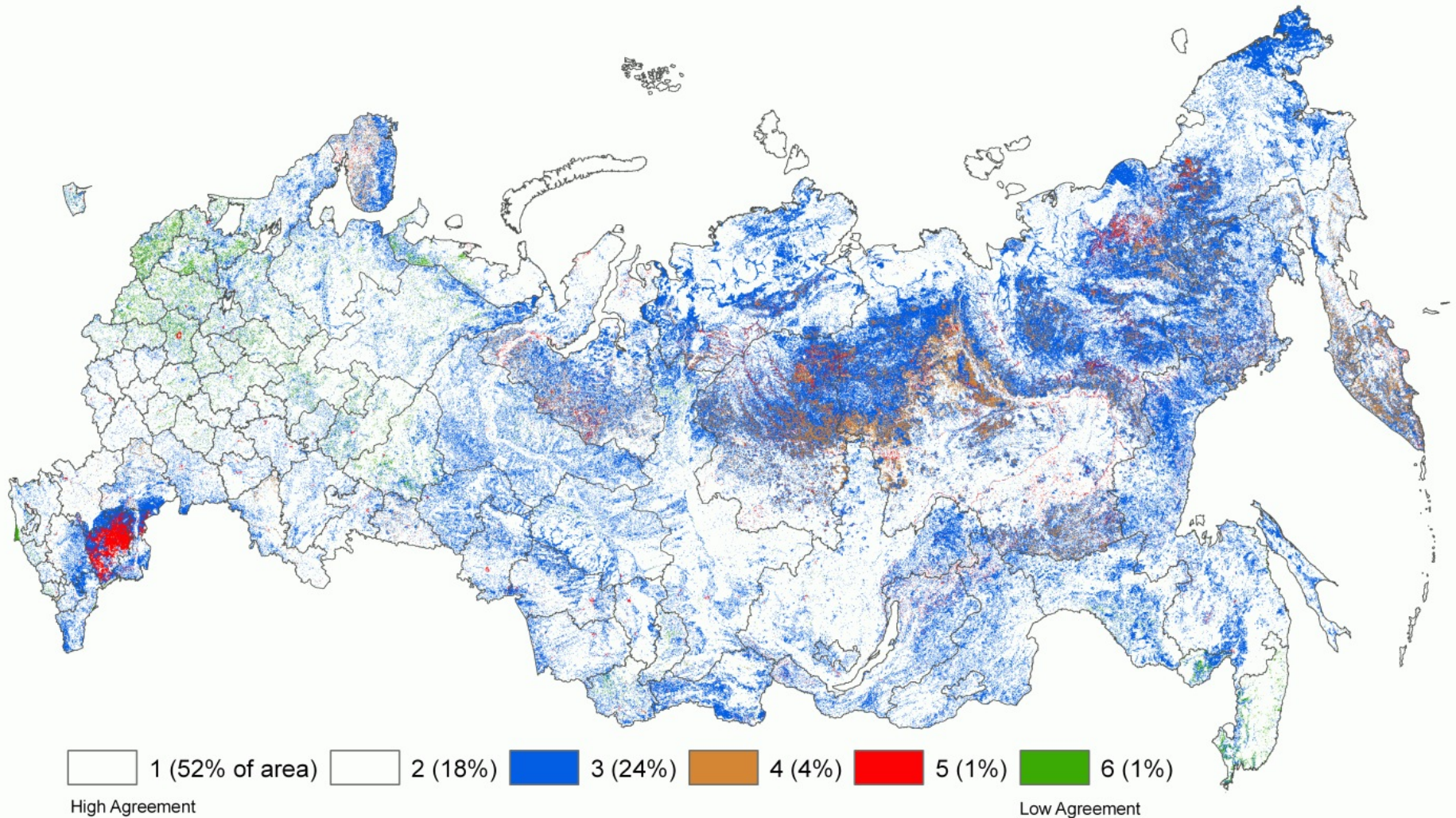
Indicators of forest productivity and carbon budget components

- ◆ Live biomass (by 7 fractions)
- ◆ Growing stock
- ◆ Growth and Mortality
- ◆ Coarse woody debris
- ◆ Net Primary Production (by 6 fractions)
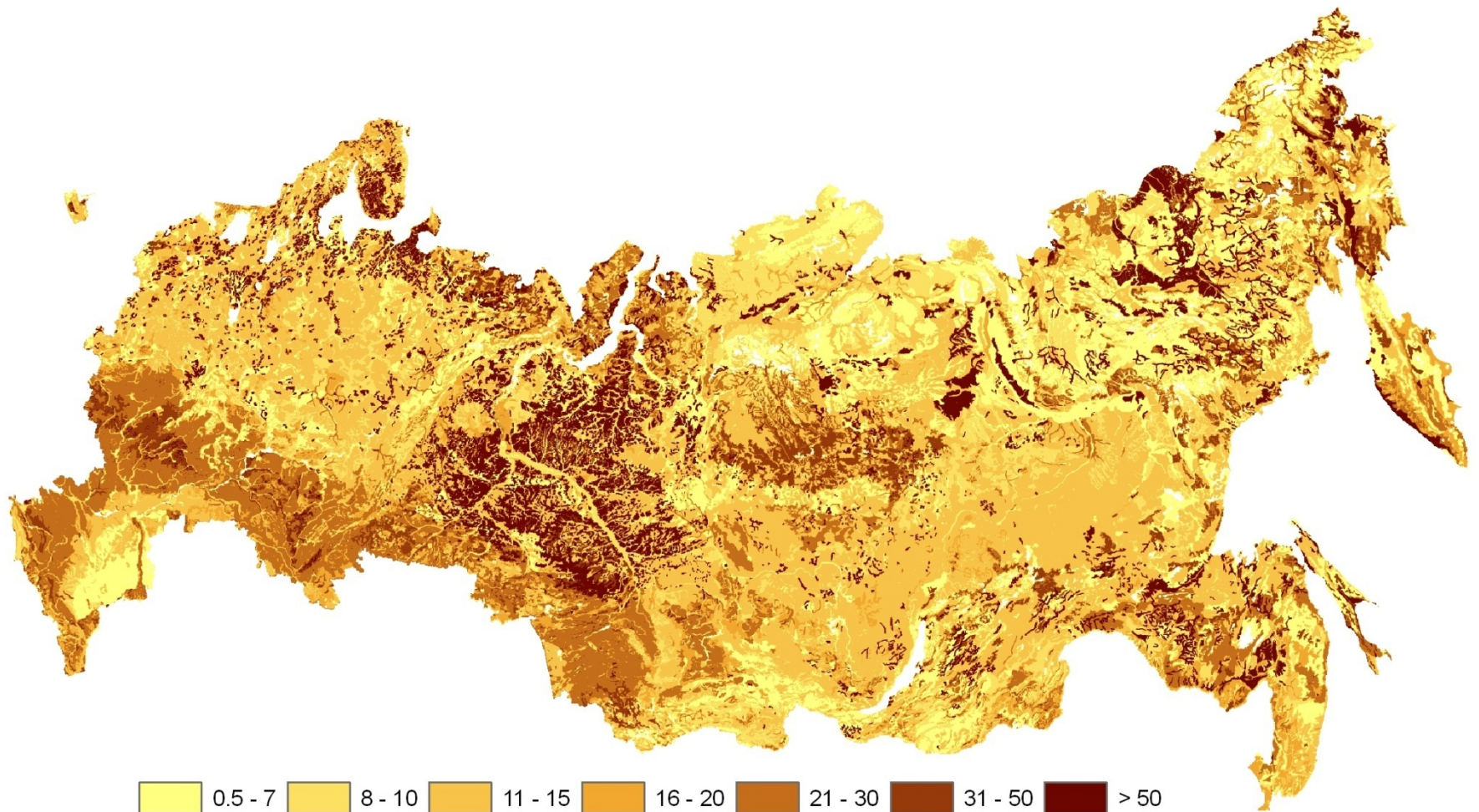- ◆ Heterotrophic respiration
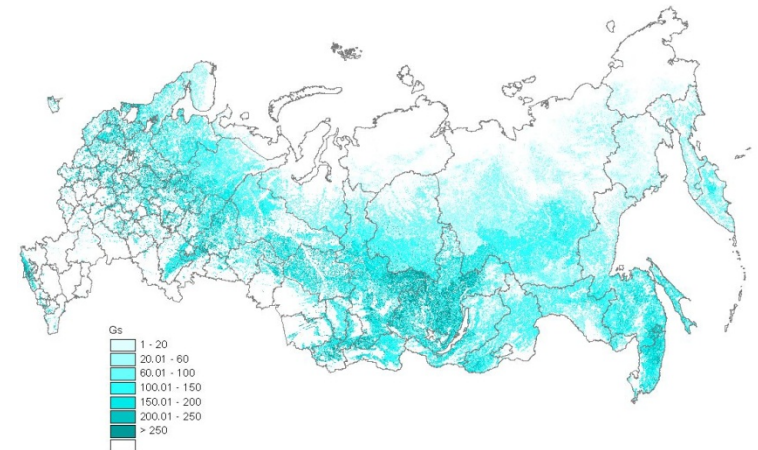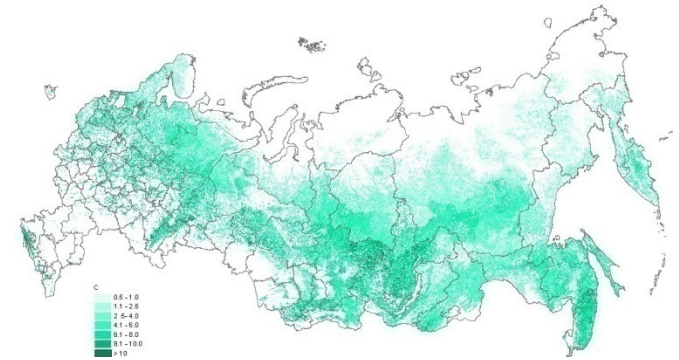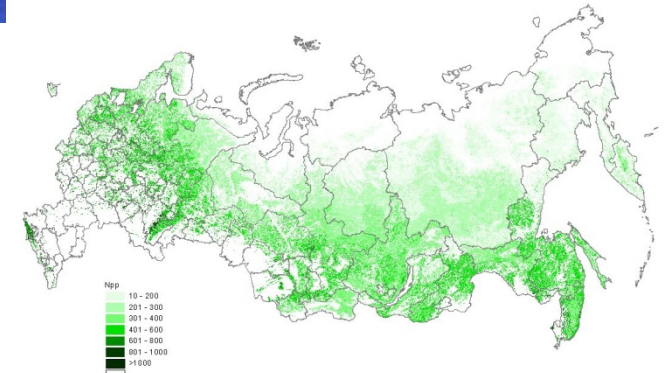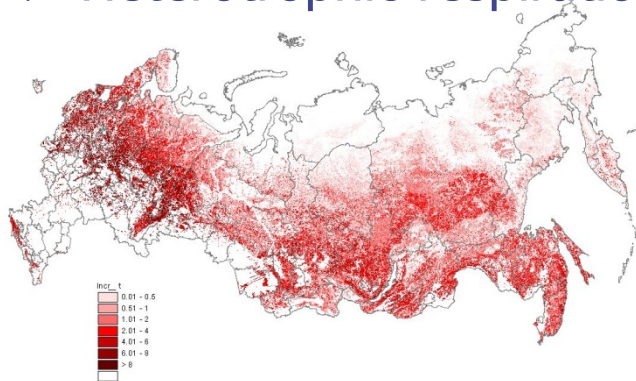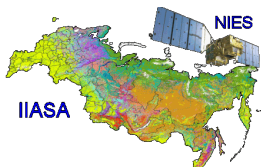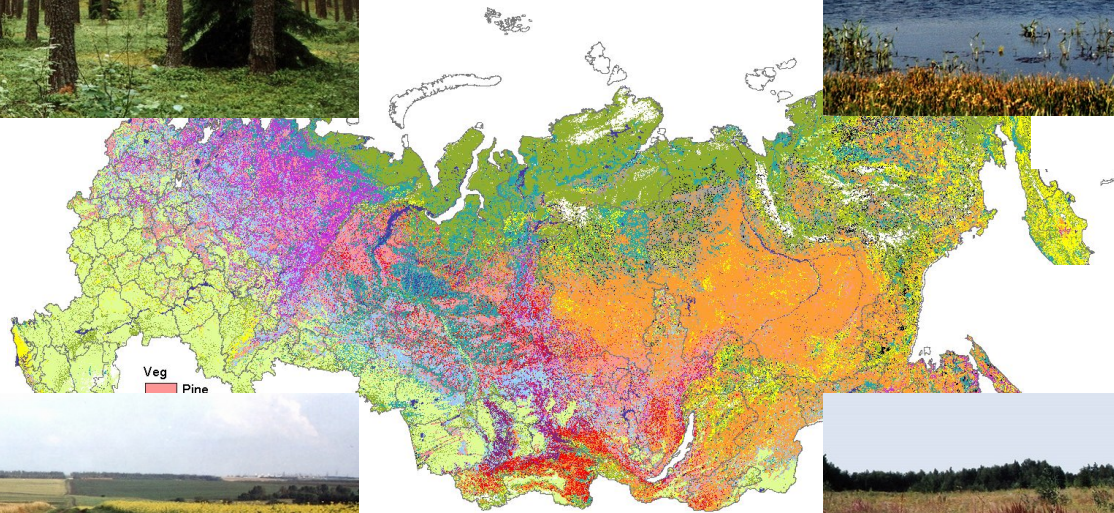
Net Current Growth, m$^3 \cdot$year^{-1}

Incr
- < 0
- 0 – 0.5
- 0.51 – 1
- 1.01 – 2
- 2.01 – 3
- 3.01 – 4
- 4.01 – 5
- > 5

Soil organic carbon density, kg C m^{-2}
(onground organic layer + 1 m soil depth)

0.5 - 7 | 8 - 10 | 11 - 15 | 16 - 20 | 21 - 30 | 31 - 50 | > 50

Thank you for your attention

More information: http://www.iiasa.ac.at/Research/FOR/
russia_ghg.html