

International Seminar on
"Soils as the foundation for resilient forests in a changing environment
– viewed through the lens of Criteria and Indicators"

29th January 2015



*Impact by logging practices on soil in boreal forests
which overtly affected by climate change*

Maria Palenova

**All-Russian Research Institute for Silviculture and Mechanization of Forestry
Russia**



Logging affects the following natural components of forest ecosystems:

- vegetation
- soils
- fauna
- surface waters
- atmospheric air



Impact by logging practices on soil



- The impacts on soils:
 - soil productivity decline
 - soil erosion
 - change of physical properties

- Productivity (fertility) decline is explained by the fact that most of the biogenic organic matter is stored in trees and disappears when the trees are cut away, and by a significant decrease of soil organic matter and elements after cutting.

- After logging:
 - the soils are exposed to direct sun and heavy rains
 - the carbon and nitrogen balance, pH, and concentration of exchangeable bases undergo drastic changes

Logging and soil erosion



Pyssa River Basin

- ❑ Soil erosion is provoked by topsoil disturbance during skidding.
- ❑ Physical qualities of soil are mainly affected by changes of its bulk density, porosity, and filtration factor.
- ❑ During the first two years after logging, soil erosion intensity reaches hundreds of cubic metres per hectare on slopes of 10–20°. Main losses of soils occur within the first 5–6 years.

For soil in boreal forests there are important points for attention

- *Permafrost*
- Soil-forming factors
- *Soil carbon*

Soil and permafrost in boreal forests



Soil and permafrost in boreal forests





Permafrost ice on the south slopes. The ice sheets are so close to the surface that a disturbance of natural vegetation can lead to the landsliding of water saturated soil over melting ice.



Gentle slope of the left side of the valley of the river Kyuchyus. Wetland soil moves so fast that reminds mudflow.

Historical land-use impacts

Felling

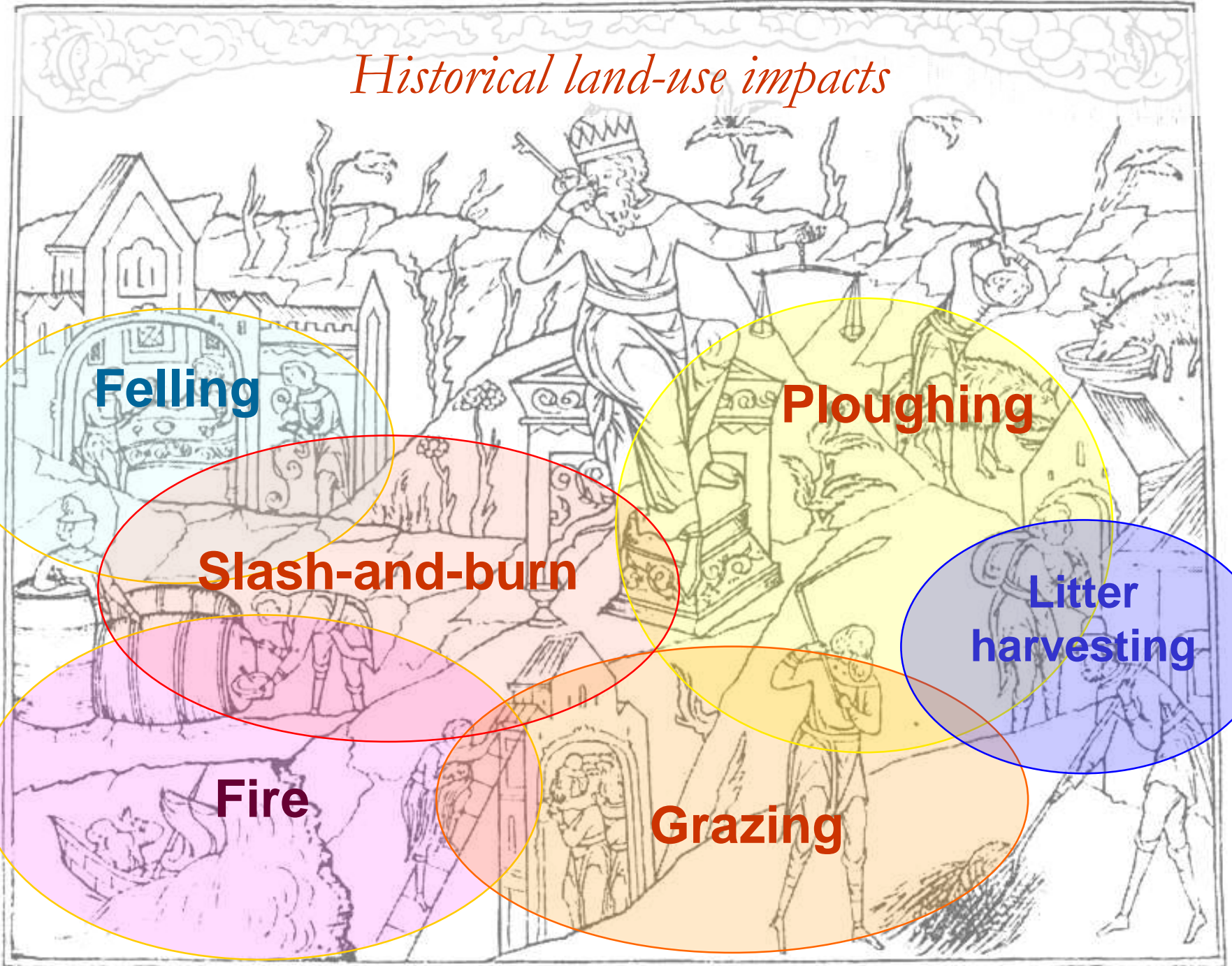
Ploughing

Slash-and-burn

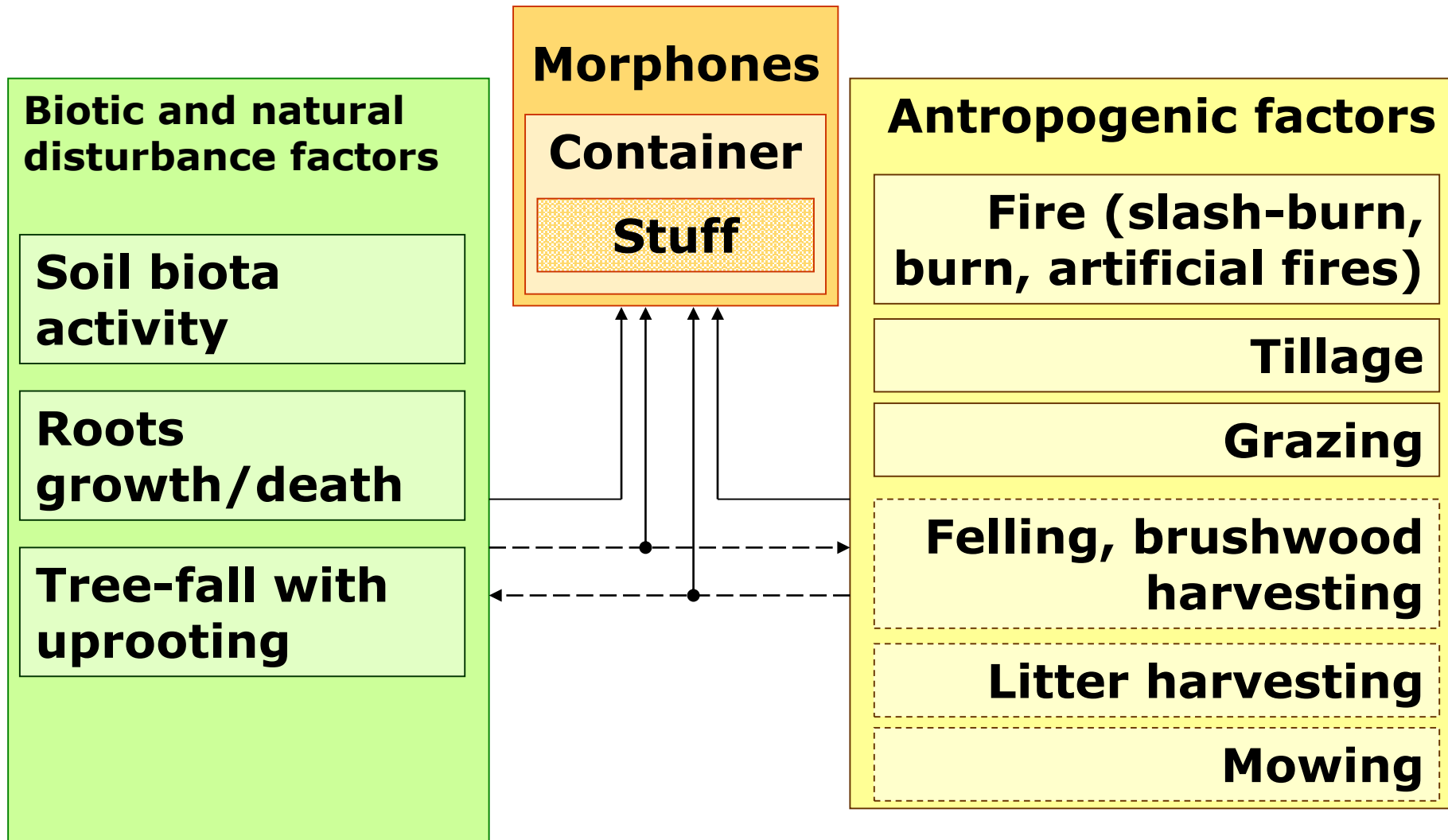
**Litter
harvesting**

Fire

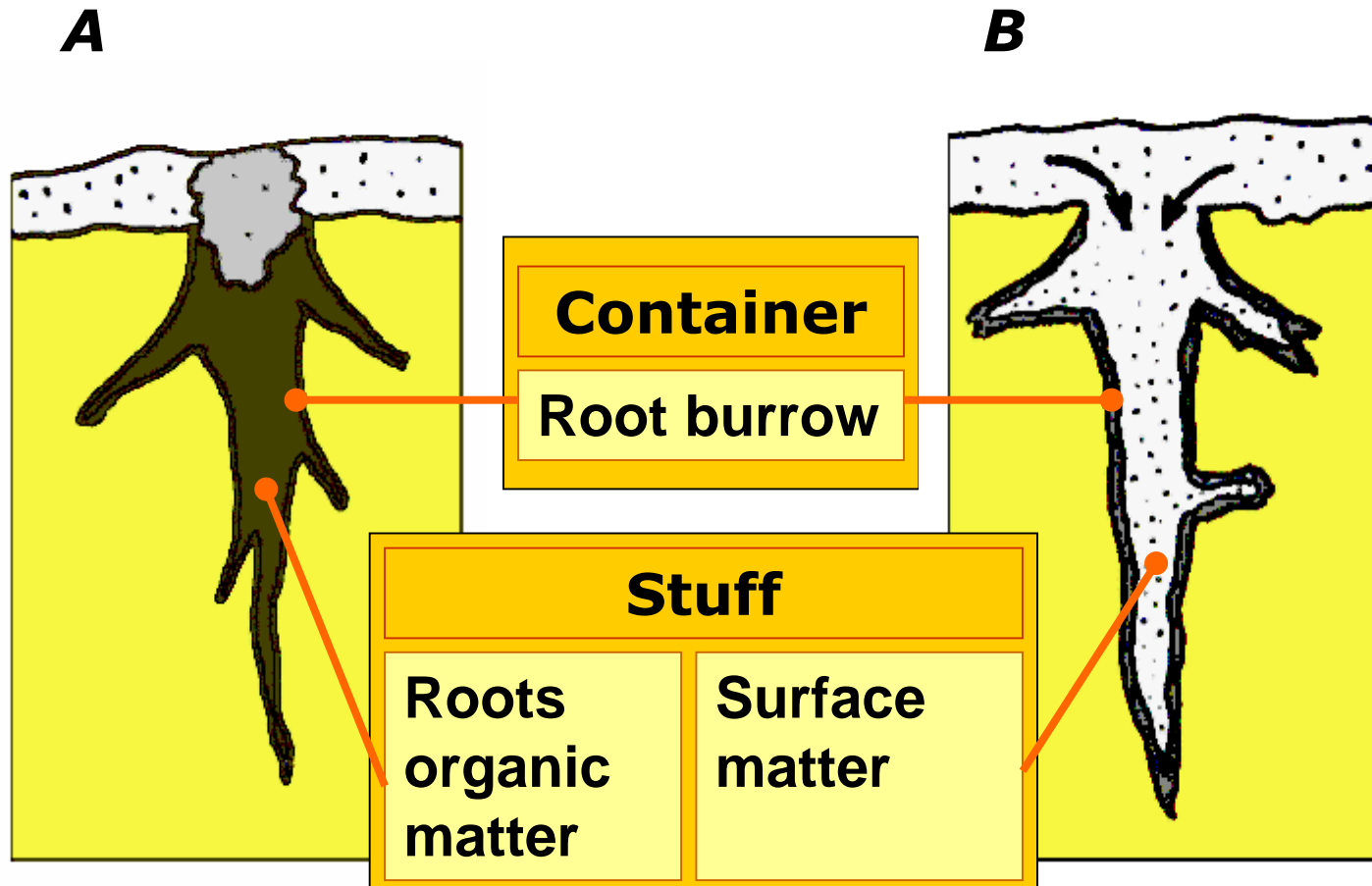
Grazing



Macromorphological elements of soil - the “morphones” - are formed as a result of natural and anthropogenic impacts on the ecosystem



*Difference between traces of hardwood (A) and softwood (B)
roots after wind-break or logging*



Tree-fall mosaic

Now well-expressed (occurred at different times) tree-fall mosaics attend at tall herb forests



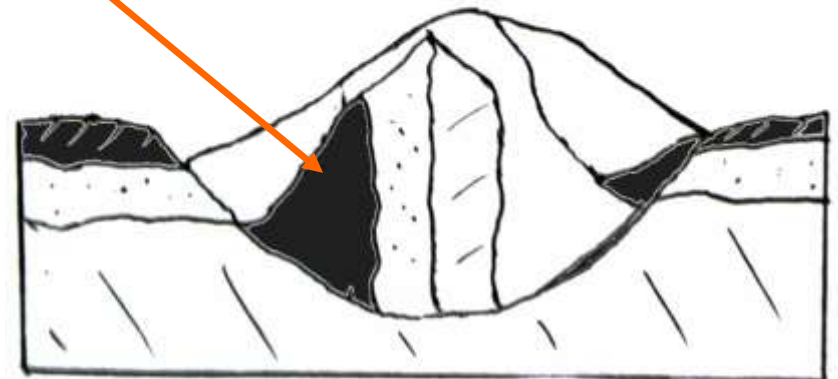
Solitary or catastrophic tree-falls attend at other forest types



Pits after tree-fall is the significant “depots” of the surface soil organic matter

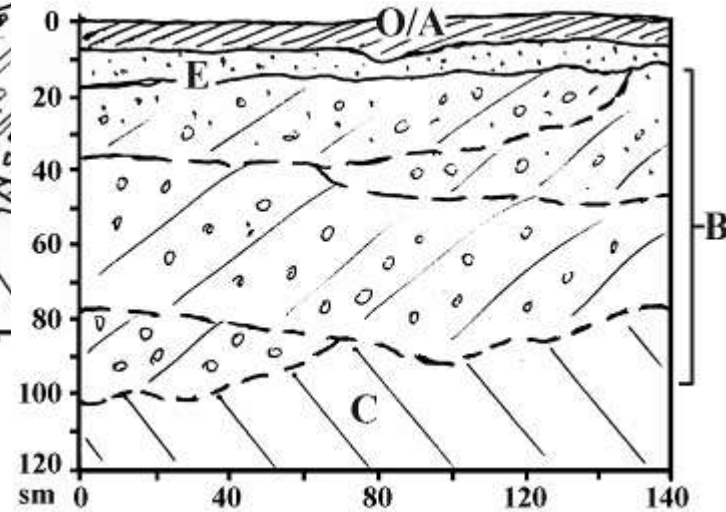
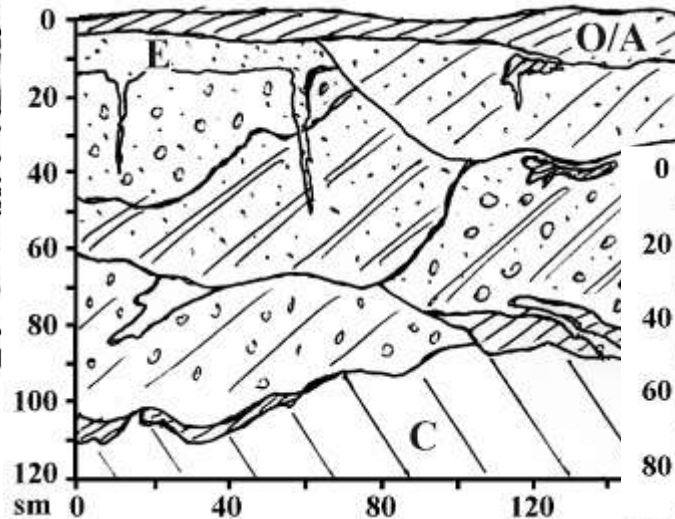
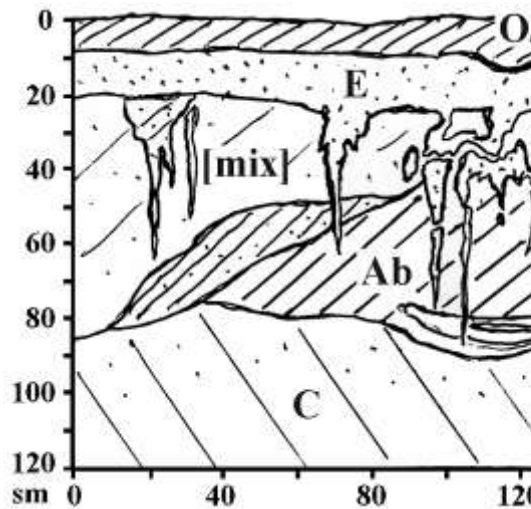
Surface organic matter is kept mainly in peripheral parts of the pit

The main “depot” of surface organic matter is in a front part of pits formed after tree-fall with back shifting



Traces of tree-fall

Middle and bottom layers of soil profiles were presented by matters in pits and root burrows



*Preservation of large carbon stock of boreal forest soil
is crucial*

Soil profiles of different history



without agricultural use



**after agricultural use,
mainly slash-and-burn**

Komi republic, European Russia

Soil profiles of different history



without agricultural use



**after long-term
agricultural use, mainly
shifting agriculture**

Vologda region, European Russia

Soil profiles of different history



without agricultural use



**after long-term
agricultural use, mainly
three-field system
without fertilization**

Kaluga region, European Russia

Carbon pools of ecosystems of Russia

A. Shvidenko, International Institute for Applied Systems Analysis

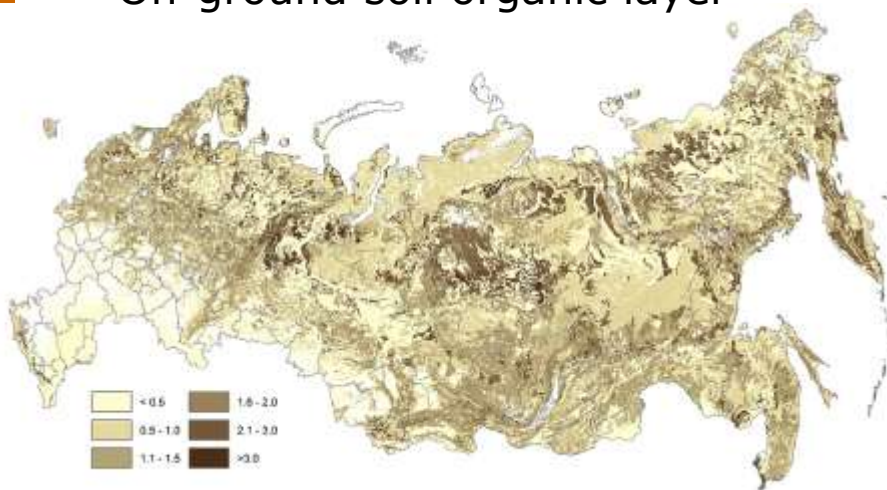
Live biomass of all ecosystems



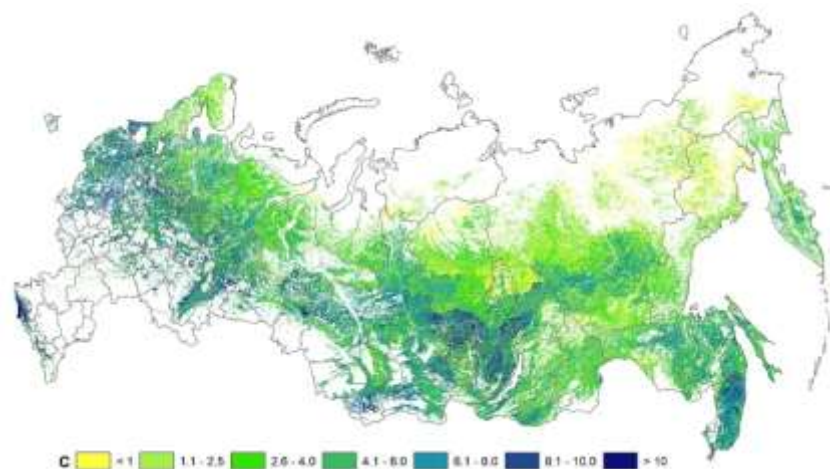
Forest carbon pools (Pg C), 2009

Live biomass	37.5
Coarse woody debris	7.0
Litter carbon	8.3
Soil carbon	136.2
Total	193.4

On-ground soil organic layer



Forest live biomass



*Best management practices and
relevant legislation
to protect soil resources in forest*

Komi Model Forest

“Recommendations on forest soil conservation during logging operations in the Komi Republic” were elaborated and approved in the Komi Model Forest

← → ↻



Komi Regional Non-Profit Foundation
Silver taiga

Learning from nature

❖ [Komi Model Forest](#)

- ❖ [Main page](#)
- ❖ [About Foundation](#)
- ❖ **[Projects](#)**
- ❖ [Services](#)
- ❖ [Be Our Volunteer](#)
- ❖ [Press about our projects](#)
- ❖ [Guestbook](#)
- ❖ [Links](#)
- ❖ [Archive of information](#)



Model Forest



Late Autumn



Training in the Forest

Best management practices and relevant legislation to protect soil resources



Exposure of harvesting waste on tracks of forwarders and harvesters is one possibility to minimise soil compaction.

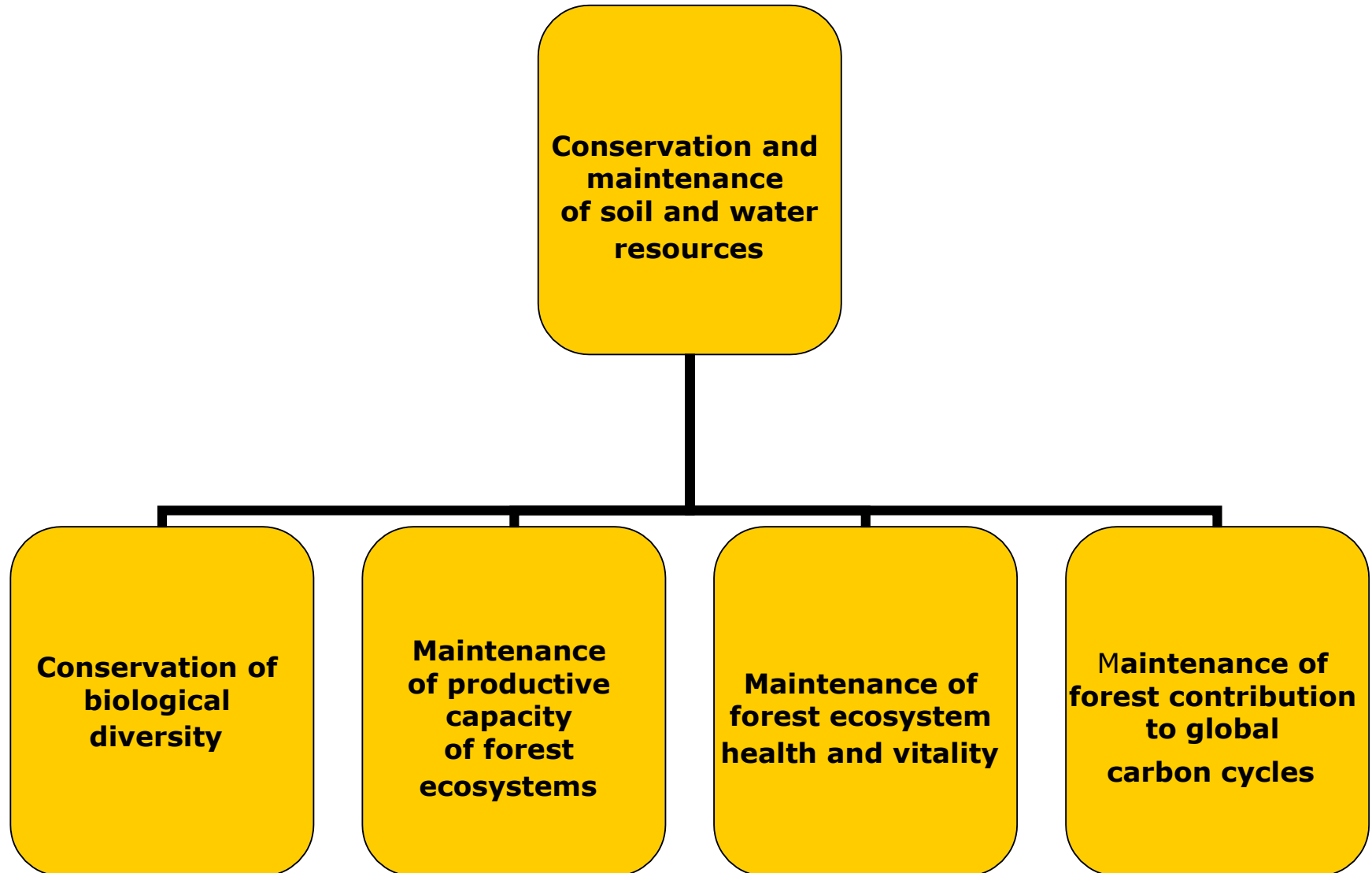
Plastic mobile grids are quick and easy to use as well.





Soils as the foundation for resilient forests in a changing environment

– view through the lens of Criteria and Indicators





*Thank You
for Your Attention!*

LITERATURE

- V. Gelman et al. **Impacts of forest management practices on forest carbon**
- M. Bobrowski **Forest soils of European Russia: biotic and anthropogenic factors of formation**
- Yu. Murzin **Permafrost in the river valley Kyuchyus**
- Komi Regional Non-Profit Foundation "Silver Taiga" <http://silvertaiga.ru/en/main/>
- A. Shvidenko **Carbon budget of Russian forests**