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Using regionalization maps in Digital Soil Mapping

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Introduction

In conventional soil mapping, soil-landscape relationships are studied separately for different soil or lithologic-geomorphological zones.

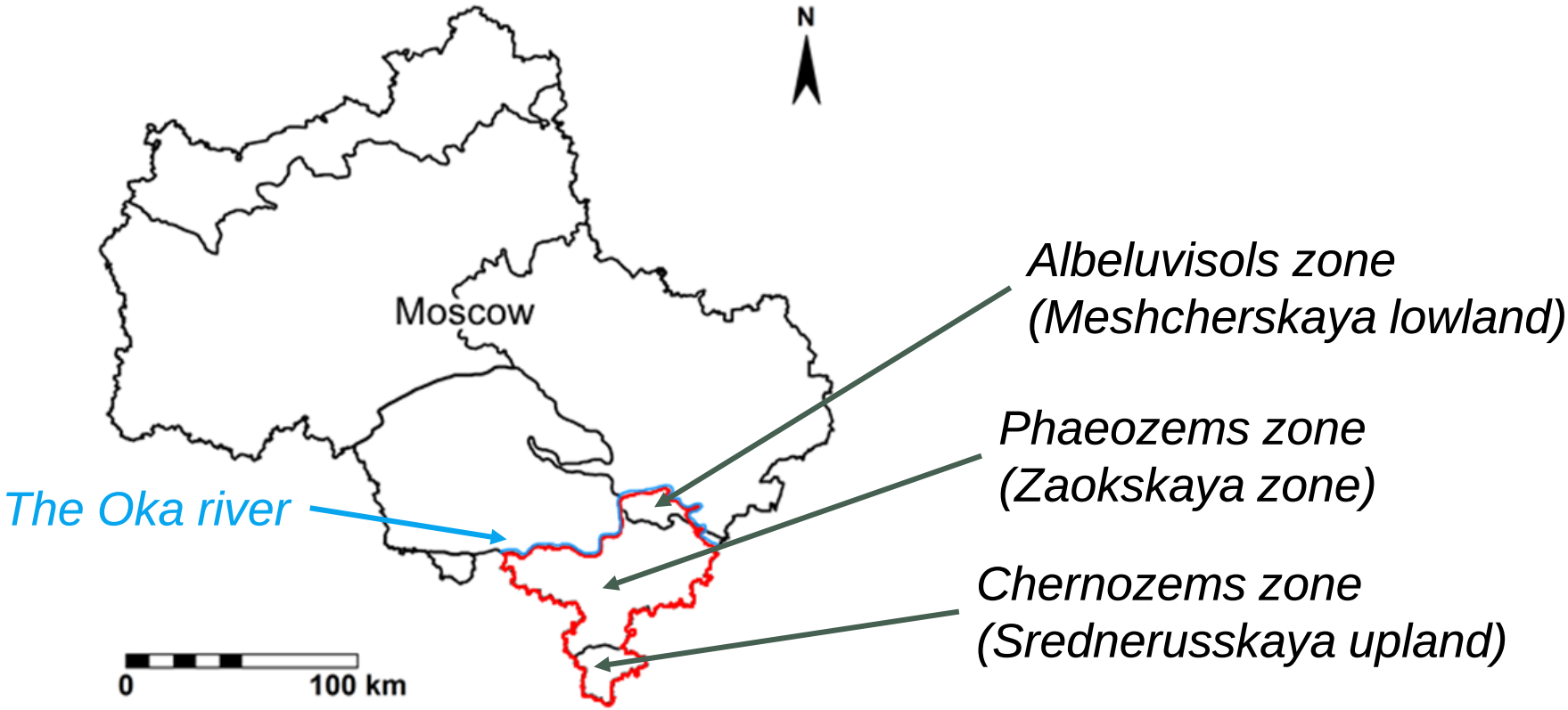
Using regionalization maps allows to build more appropriate rules for soil mapping taking into account the local features of various areas.

Currently regionalization maps have not been used in digital soil mapping and soil-landscape relationships have been established for the entire study area as a whole.

This research provides the comparison of digital soil maps built using or without using regionalization maps.

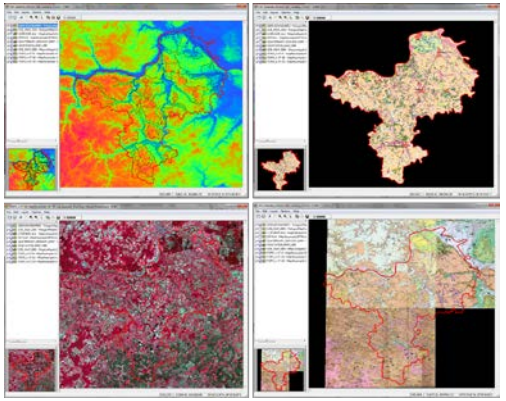
Study area

Soil districts of the Moscow Region
(Ylina, 1974)

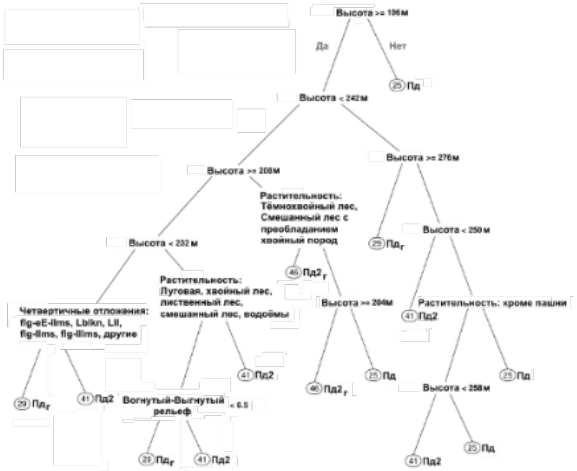


Software

GIS ILWIS (spatial data analysis)



R (statistical analysis)



Data sources

1) Soil map of Zaokskaya part of the Moscow Region (2002 year, scale 1:500 000);
2) Digital Elevation Model SRTM version 4.1 (spatial resolution 90m);
3) Vectorized quaternary map of a scale 1:200 000;
4) Vegetation map based on Landsat 8 (spatial resolution 30m);

Covariates

Soil	**Predominant soil**
Relief	**altitude (-500 – 500 m);** **slope (0 – 25º);** **aspect (N, NE, …);** **floodplains.**
Parent material	**fluvial, glacial, alluvial, etc.**
Vegetation	**pine-spruce, birch-aspen, oak-linden**
Other	**water surface**

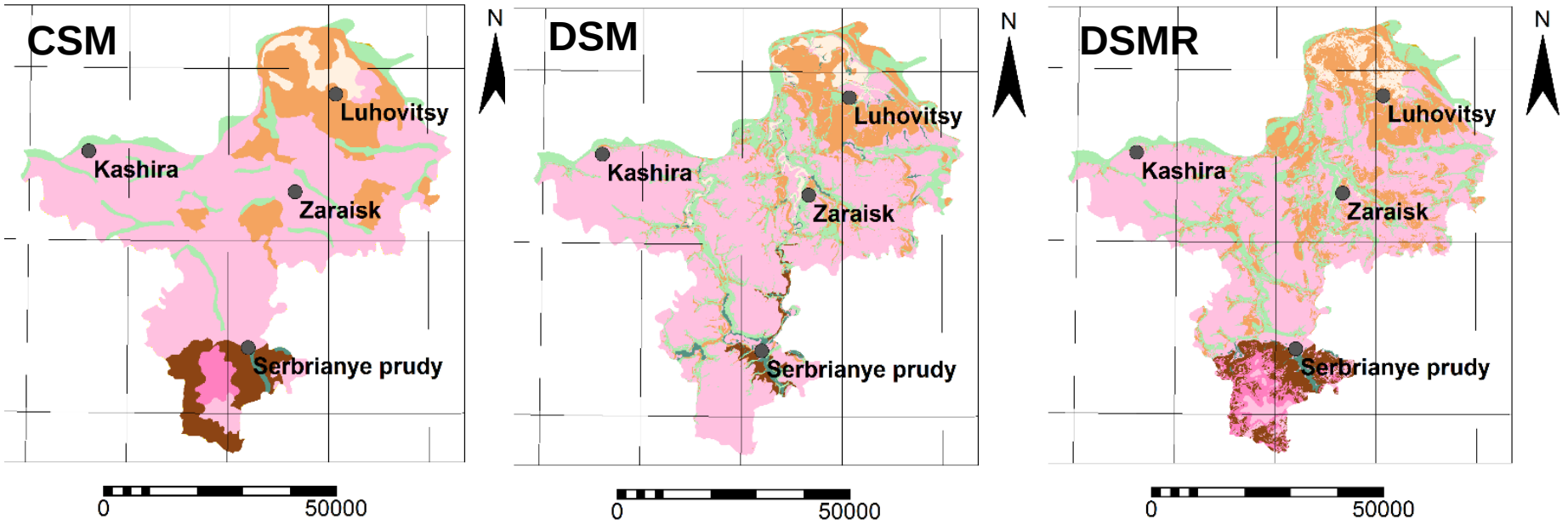
Finding soil-landscape relationships

Classification and Regression Trees – CART (Breiman, 1984) from rpart package in R.

1) First soil map:
   - one tree for the whole study area
   - tree complexity parameter (CP) = 0.0001,
   - sample set of 1000 pixels for every 20 x 20 km
   - equal amount of training pixels for each soil

2) Second soil map:
   - separate tree for each soil zone
   - tree complexity parameter (CP) = 0.001
   - sample set of 1000 pixels for every 20 x 20 km
   - equal amount of training pixels for each soil

Soil maps



Legend

CSM – Conventional Soil Map

DSM – Digital Soil Map

DSMR – Digital Soil Map built using regionalization map

- Haplic Albeluvisols Abruptic
- Umbric Albeluvisols Abruptic
- Cutanic Luvisols
- Greyic Phaeozems Albic
- Luvic Voronic Chernozem
- Umbric Fluvisols Oxyaquic
- Histic Fluvisols Oxyaquic

Field survey

Voronic Chernozems Pachic

Watershed area

The Oseotr river

Verification results

Soil	Area, km^2		
	Conventional map	Digital map	Digital map via regionalization map
Haplic Albeluvisols Abruptic	119	100	113
Umbric Albeluvisols Abruptic	601	537	696
Cutanic Luvisols	2194	2187	1804
Greyic Phaeozems Albic	73	0	126
Luvic Voronic Chernozem	247	42	180
Umbric Fluvisols Oxyaquic	323	638	629
Histic Fluvisols Oxyaquic	13	66	23
Area of match in soil units, %	100	62	66

Conclusions

The use of regionalization map for digital soil mapping has allowed to find out substantiated soil-landscape relationships which take into consideration local features of different areas and to map the soil cover more accurately.

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