A geographic information system for assessing the suitability of Romanian land to crops and land use

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United Nations/Romania International Conference on Space Solutions for Sustainable Agriculture and Precision Farming
Cluj-Napoca, Romania, 06-10 May 2019

Contents

Land suitability (LS)

The **fitness** of a given type of **land** for a **defined use**

Favorability according to the environmental conditions

Specific purposes

Practical nature

- Favorability of a crop or land use
- Production capacity
- Land improvements
- Pedo-ameliorative actions

Why is important ?

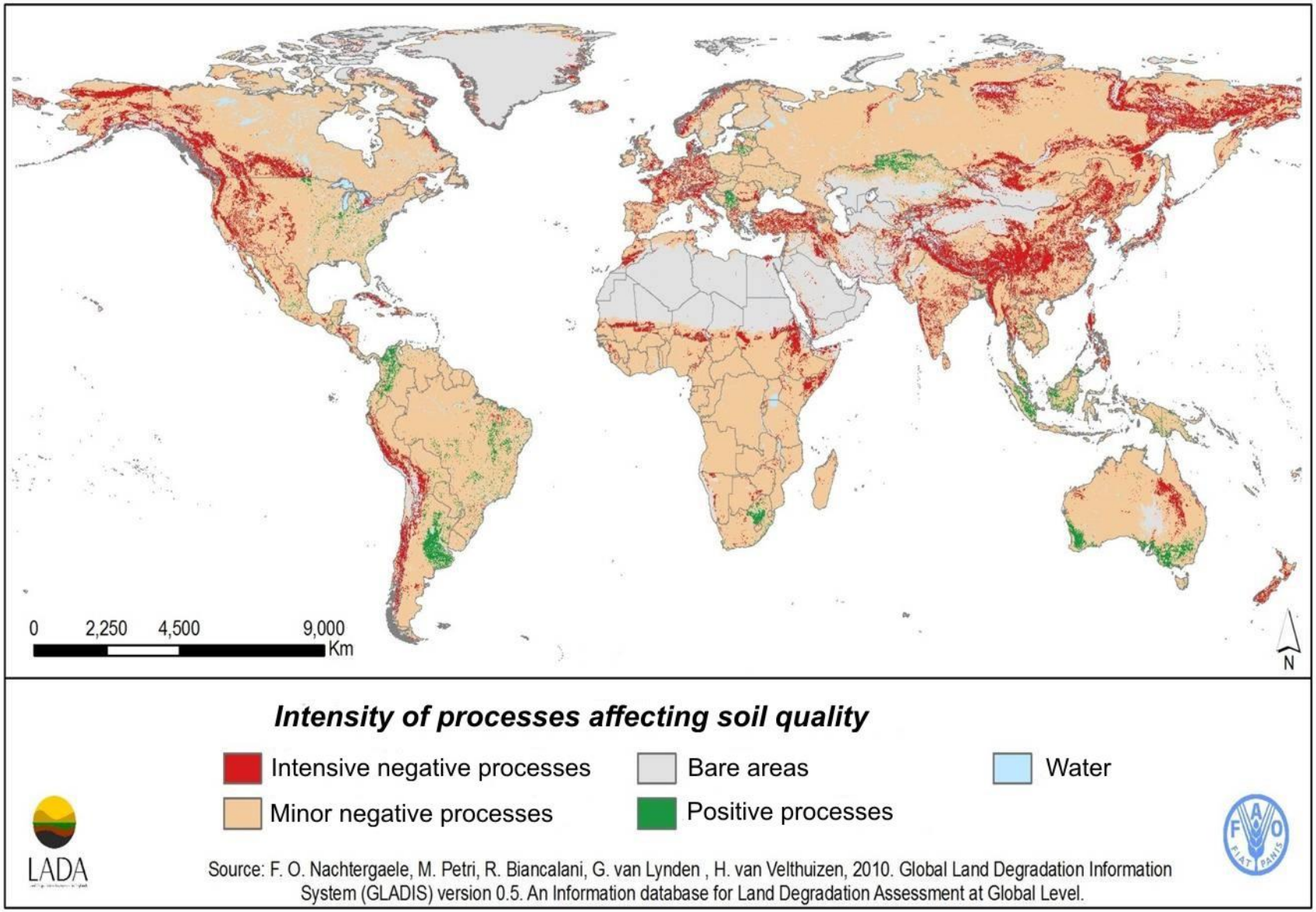
FAO

Very high risk
↓
the trend is almost irreversible without major changes in farming practices

33% of world agricultural land has disappeared or is severely degraded

2.5 cm of soil = 500 years

- **Continuous plowing of the fields**
- **Use of chemical fertilizers**
- **Monocropping / Inappropriate rotation of crops**
- **Overgrazing**
- **Natural processes (climatic, erosion, etc.)**


0
2,250
4,500
9,000
Km
N
Intensity of processes affecting soil quality
Intensive negative processes
Minor negative processes
Bare areas
Positive processes
Water
LADA
Source: F. O. Nachtergaele, M. Petri, R. Biancalani, G. van Lynden , H. van Velthuizen, 2010. Global Land Degradation Information System (GLADIS) version 0.5. An Information database for Land Degradation Assessment at Global Level.

Romanian methodology for LS

- based on in-depth knowledge of the plant growth conditions

- designed as a relational database = tables with suitability values

ICPA and OSPA

Environmental conditions of the land

17 Ecopedological indicators

Conditions for plant growth

topography	• slope • landslides
climate	• mean annual temperature • average annual precipitation
hydrologic	• groundwater level • flooding risk • humidity excess
soil	• humus content in 0-50 cm • edaphic volume • soil pH in 0-20 cm • carbonate content • soil pollution • soil texture in 0-20 cm • salinization/alkalinization • gleization • pseudogleization • total porosity of restrictive horizon

Uses

PS	Pasture	FN	Hayfield	AR	Arable

Pomiculture

MR	Apple tree	PN	Plum tree	CS	Apricot tree
PR	Pear tree	CV	Cherry tree	PC	Peach tree
VV	Grapery for wine	VM	Grapery for food		

Crops

GR	wheat	SF	sugar beet	CN	hemp
OR	barley	SO	soy	LU	alfalfa-lucerne
PB	corn	MF	pea/bean	TR	clover
FS	sunflower	IU	linseed for oil	LG	vegetables
CT	potato	IF	linseed for tow		

LS assessment

Non-spatial — point with measurements

Each indicator — suitability coefficient

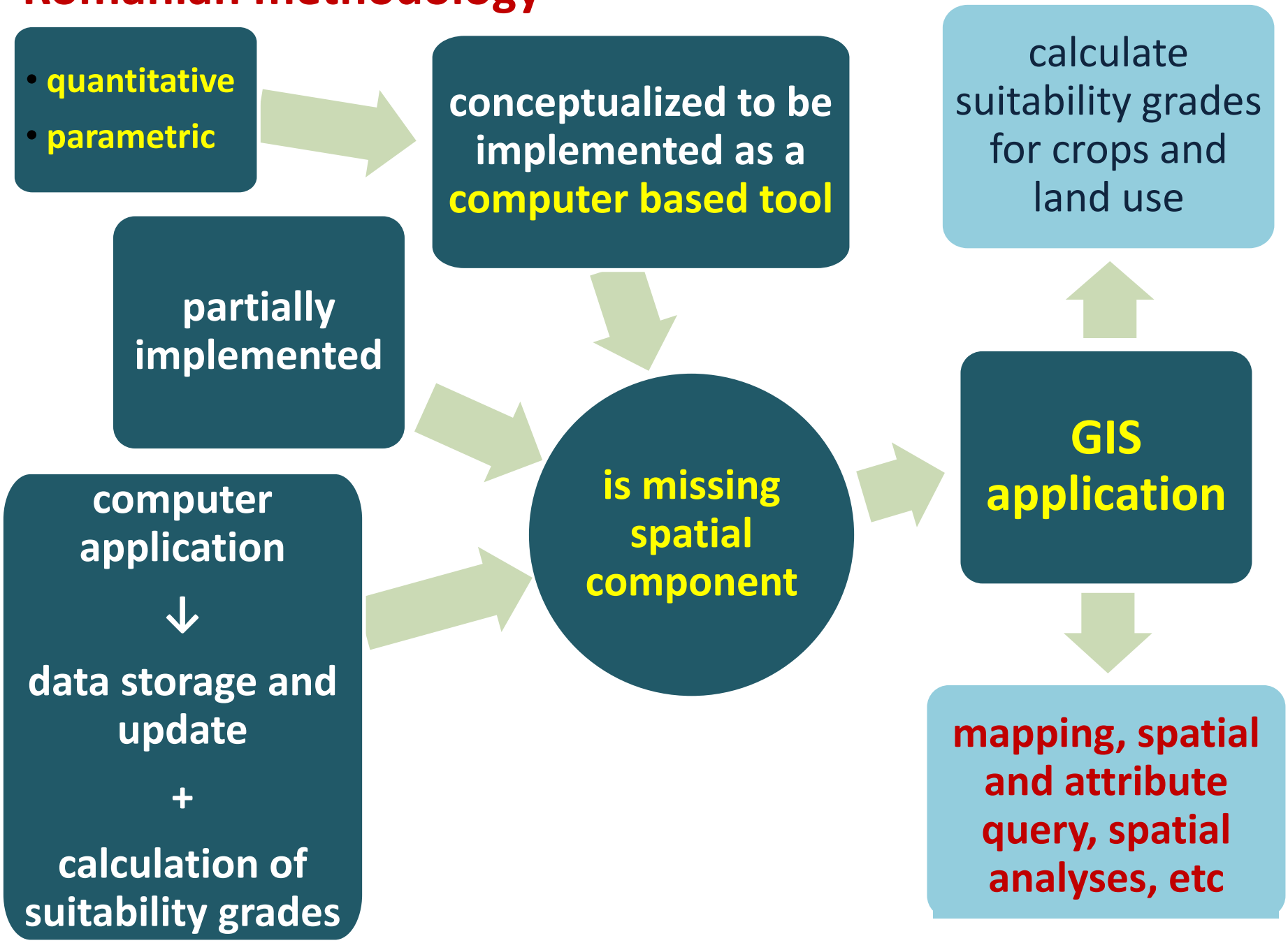
0 – unsuitable; 1 - optimal

Formula — multiplication of 17 indicators coefficient x 100

Crop / Use	Indicators																Suitability grade
	Mean annual temperature	Average annual precipitation	Gleization	Pseudogleization	Salinization/ alkalinization	Soil texture (0-20 cm)	Soil pollution	Slope	Landslides	Groundwater level	Flooding	Total porosity of restrictive horizon	CO_3 content	Soil pH (0-20 cm)	Edaphic volume	Humus content (0-50 cm)	Humidity excess	
	3C	4C	14	15	16,17	23	29	33	38	39	40	44	61	63	133	144	181	
	10,5	650	2	0	00	50	02	01	00	02,0	1	5	0	5,2	175	90	2	
	Coefficient																	
GR	1	1	1	1	1	1	1	1	1	0.8	0.8	1	1	1	1	0.8	1	51.2

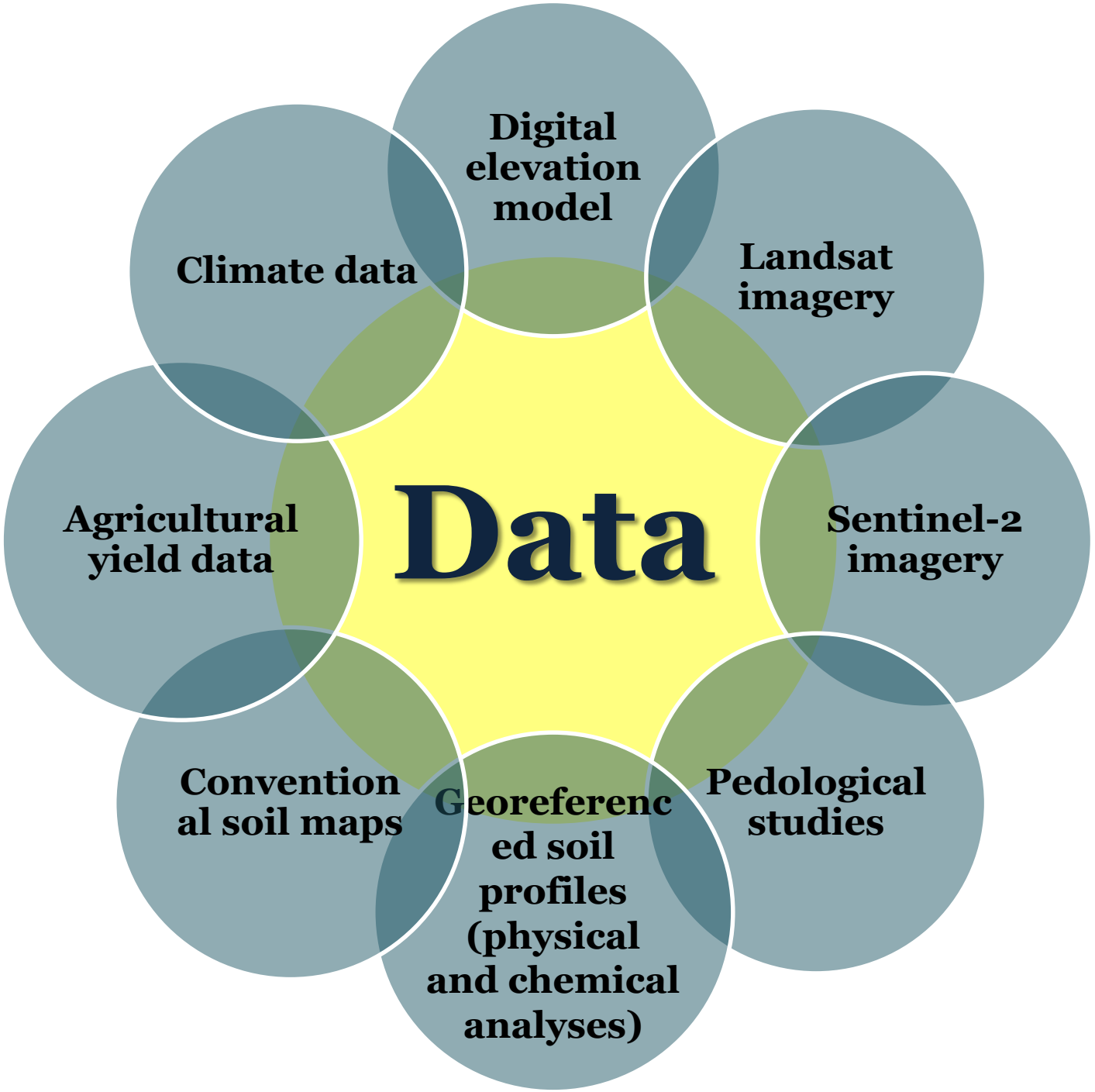
Favorability	Suitability grade
Not suitable	< 10
Marginally suitable	10 - 30
Moderately suitable	30 – 40
Suitable	40 - 60
Highly Suitable	> 60

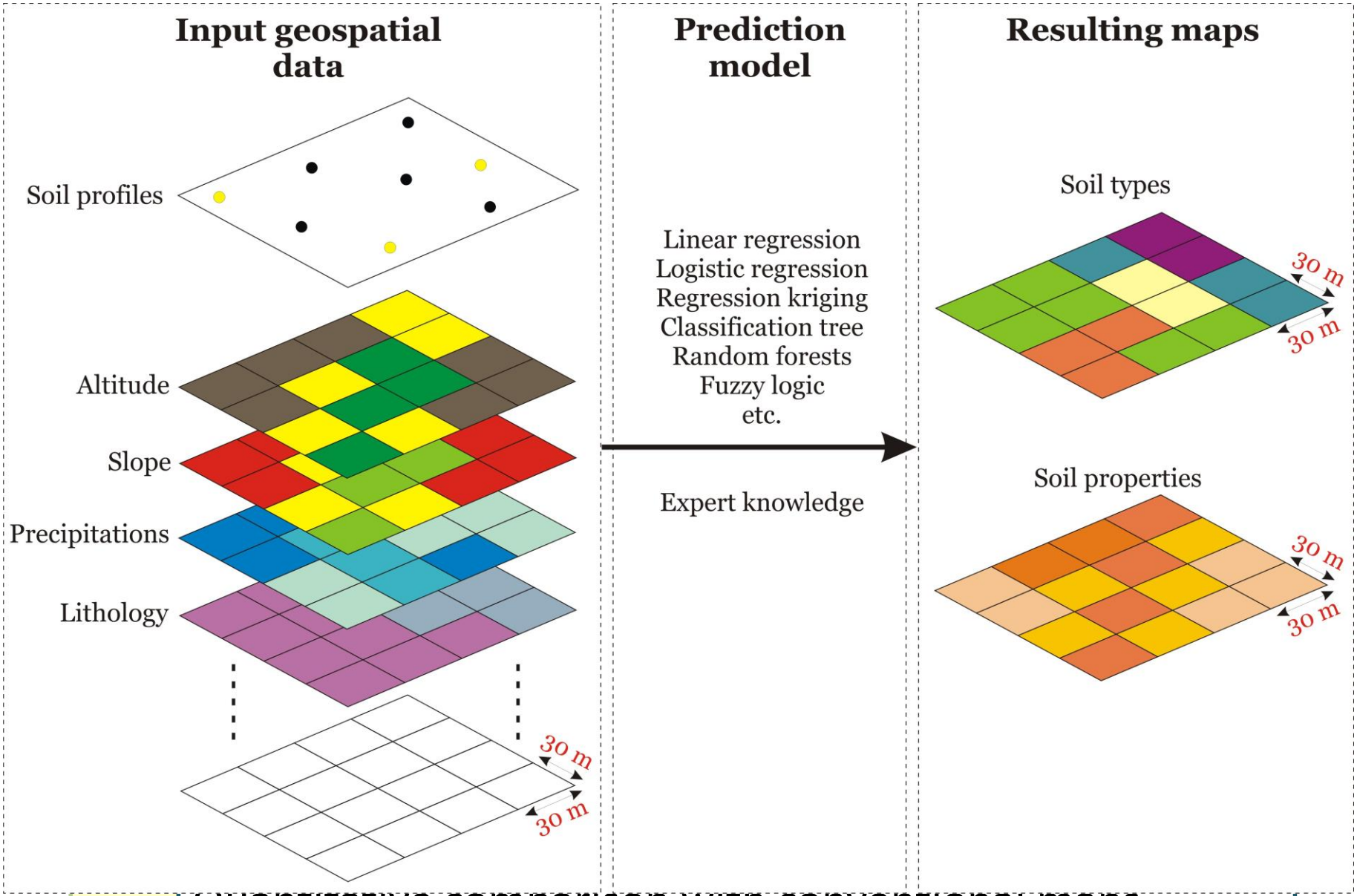
Romanian methodology



Objective: development of a GIS application for calculation and mapping of the land suitability relevant to the Romanian crops and land use

Evaluate LS at **regional and local scale** in a region from north-western Romania

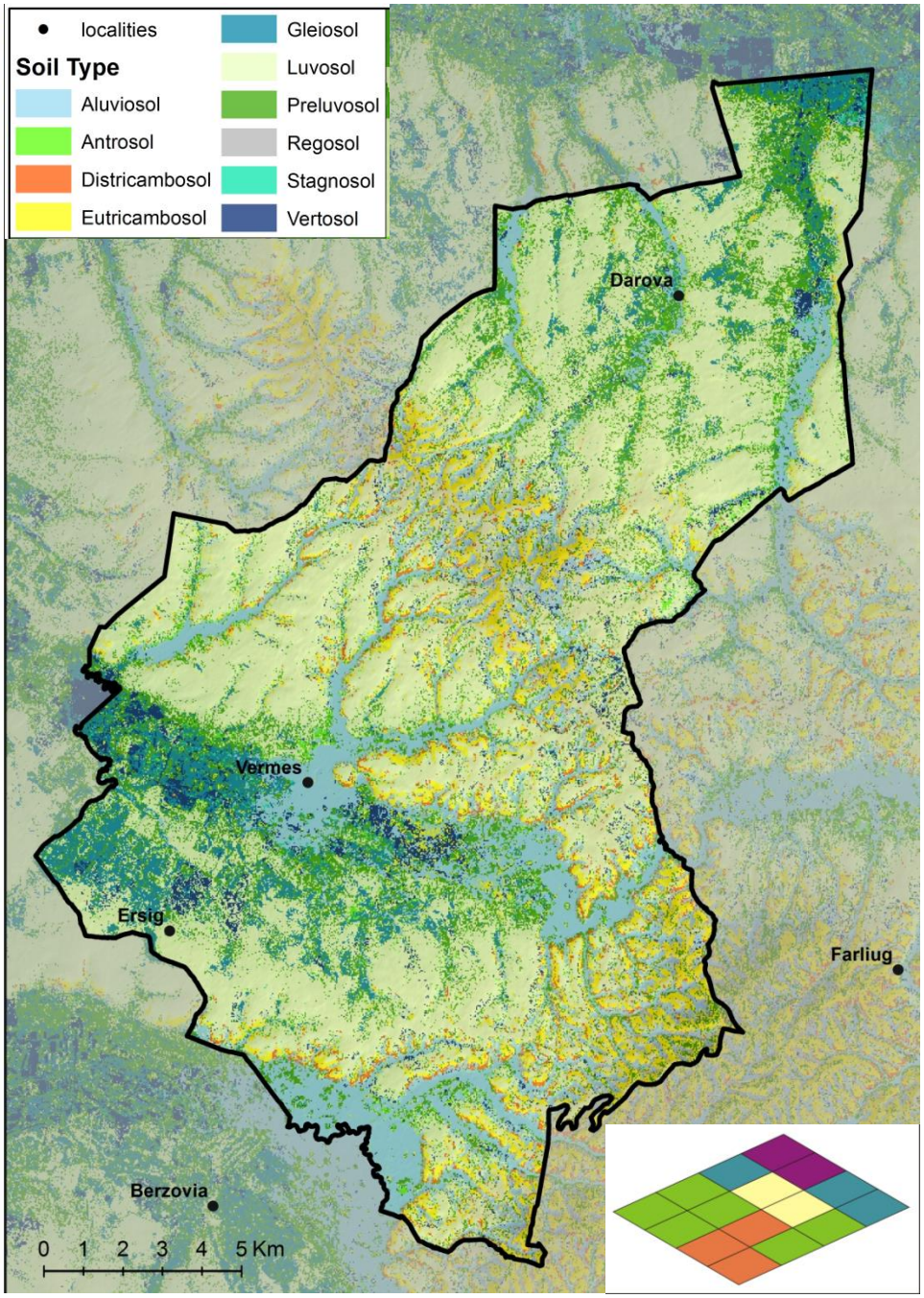

Data
Digital elevation model
Landsat imagery
Sentinel-2 imagery
Pedological studies
Georeferenced soil profiles (physical and chemical analyses)
Conventional soil maps
Agricultural yield data
Climate data



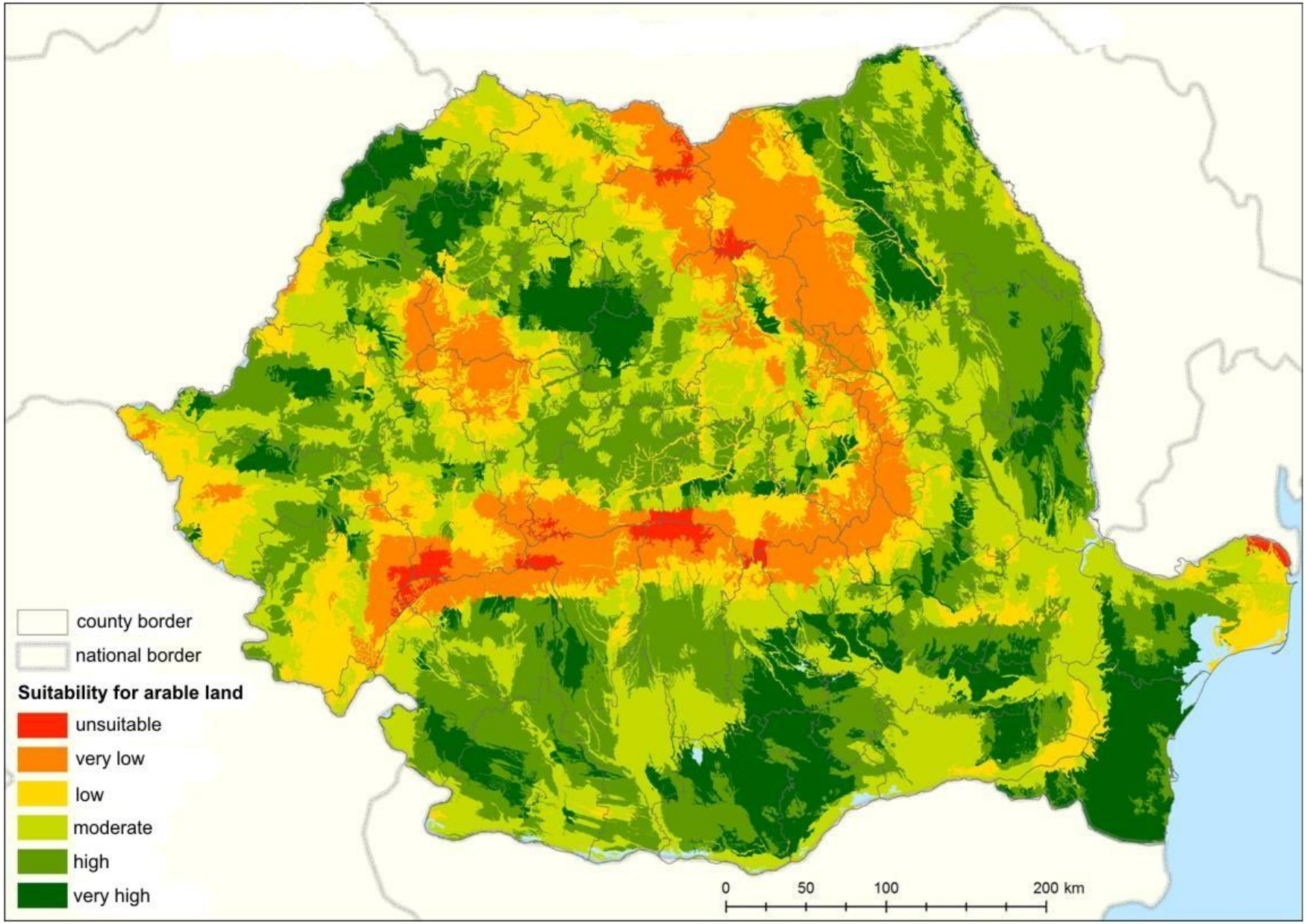
Quantitative comparison with conventional maps

Quantitative comparison with actual agricultural yield

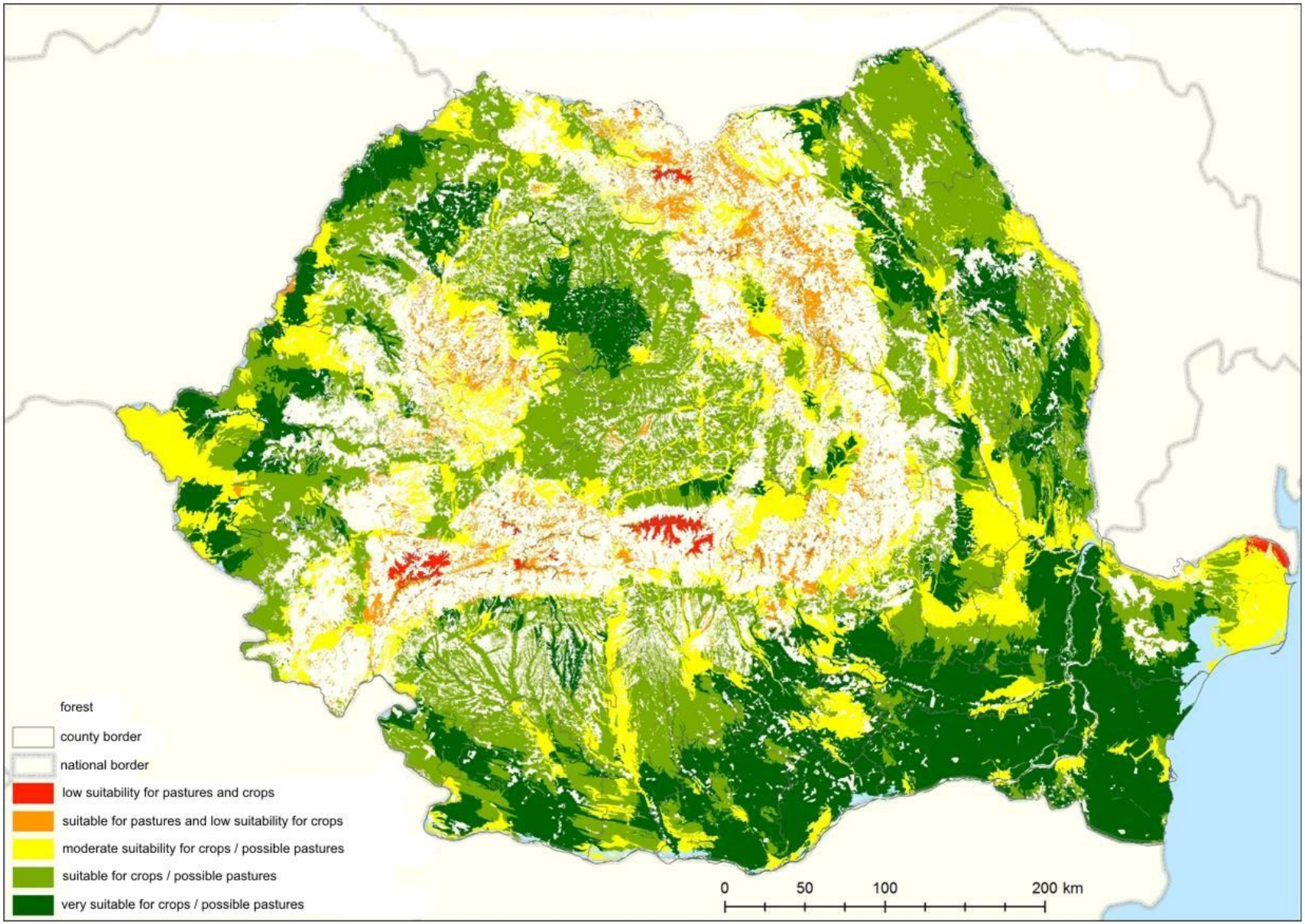
Digital soil mapping


localities
Soil Type
Aluviosol
Antrosol
Districambosol
Eutricambosol
Gleiosol
Luvosol
Preluvosol
Regosol
Stagnosol
Vertosol
Darova
Vermes
Ersig
Farliug
Berzovia
0 1 2 3 4 5 Km

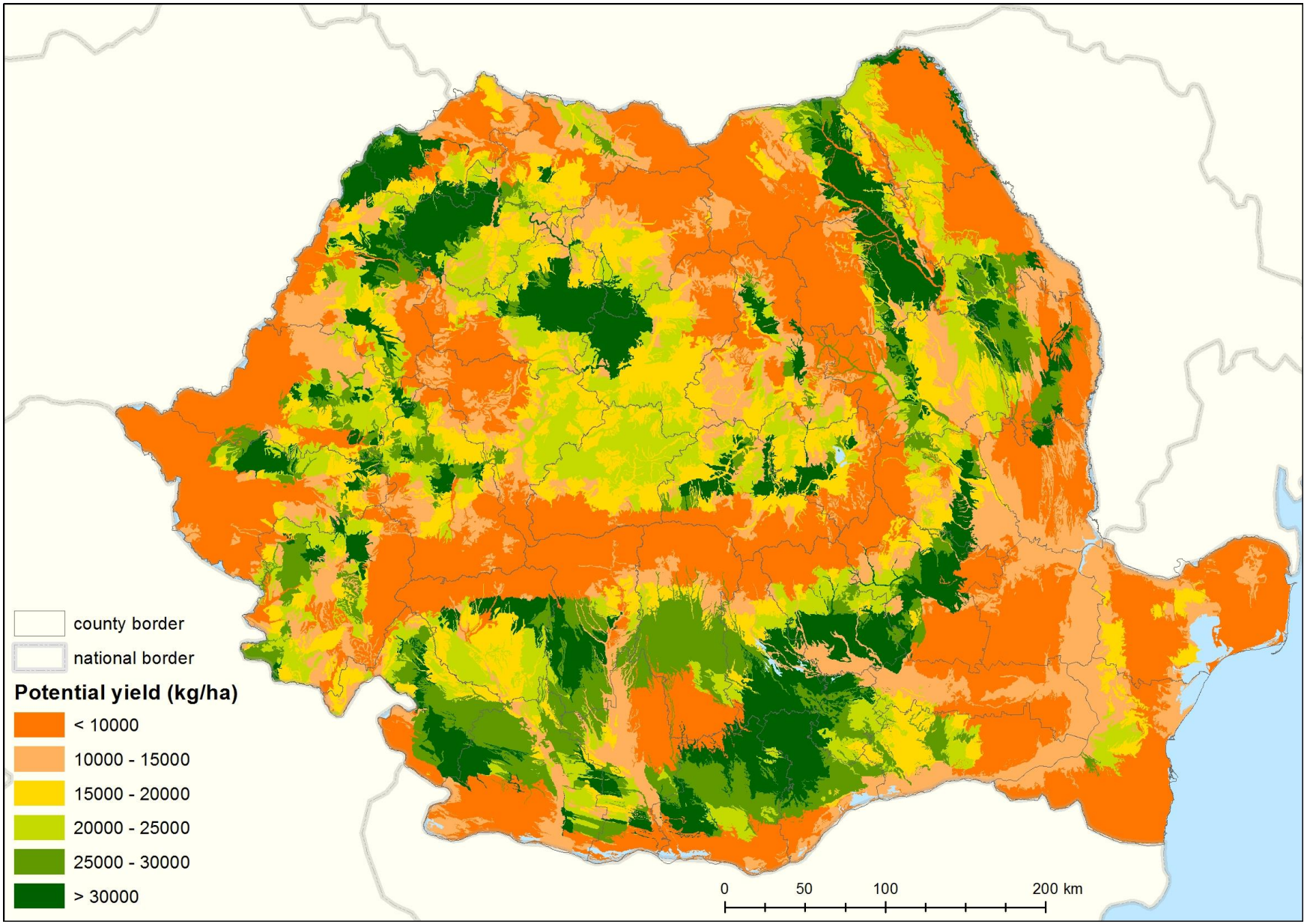
Applications of land suitability at national scale



Land use options: crops / pastures

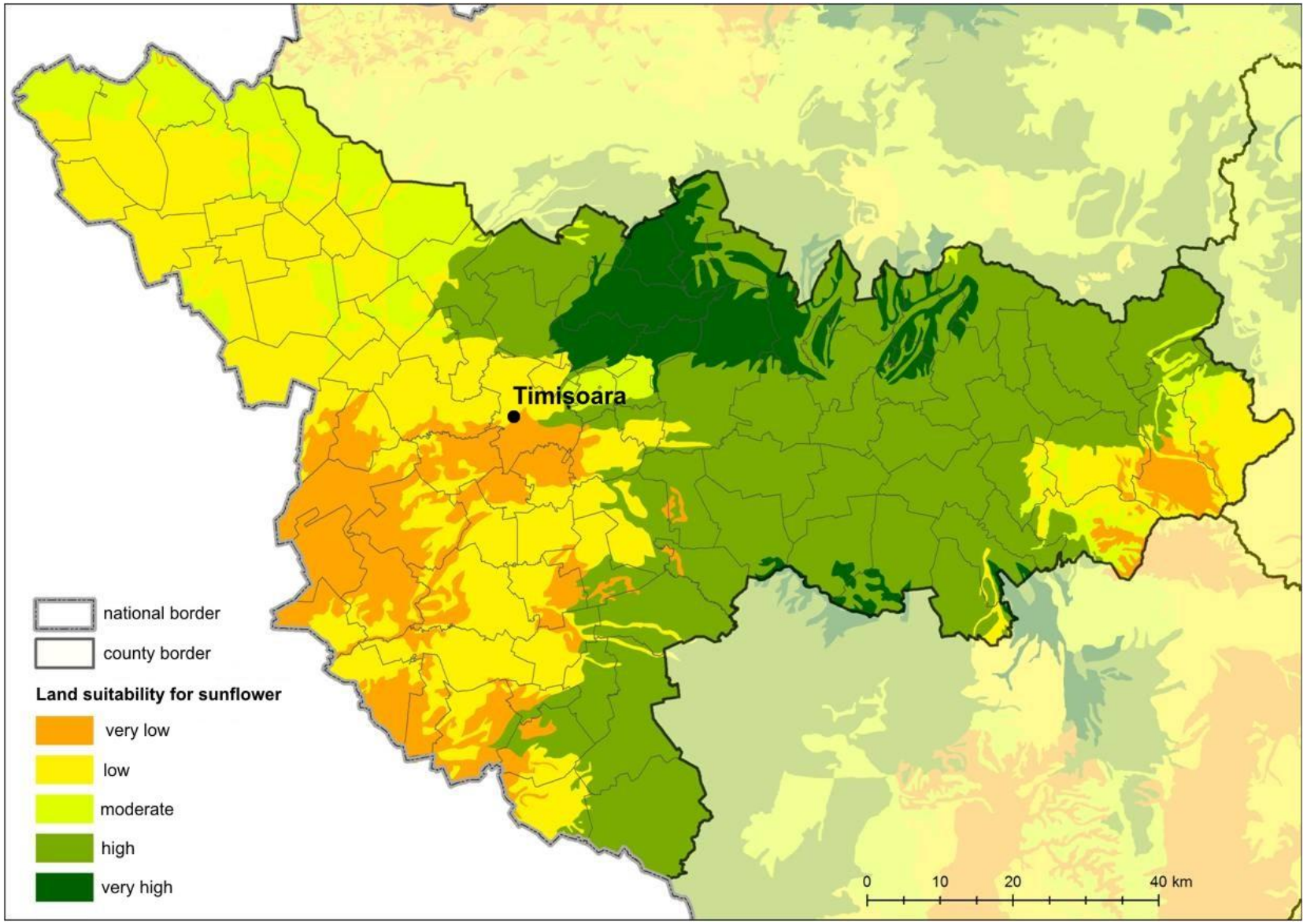


Potential yield of potato

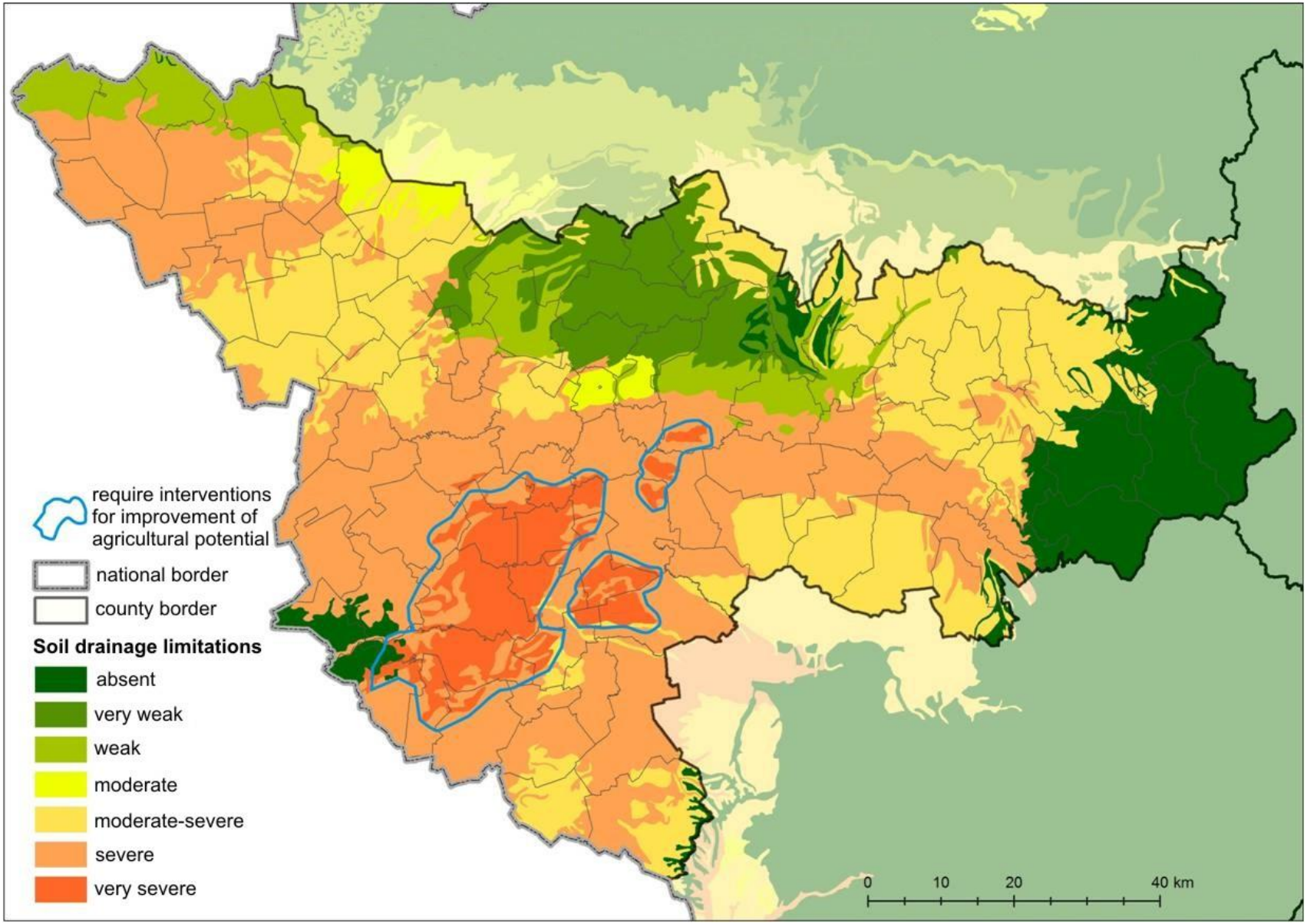


Applications of land suitability at county level

Land suitability for sunflower

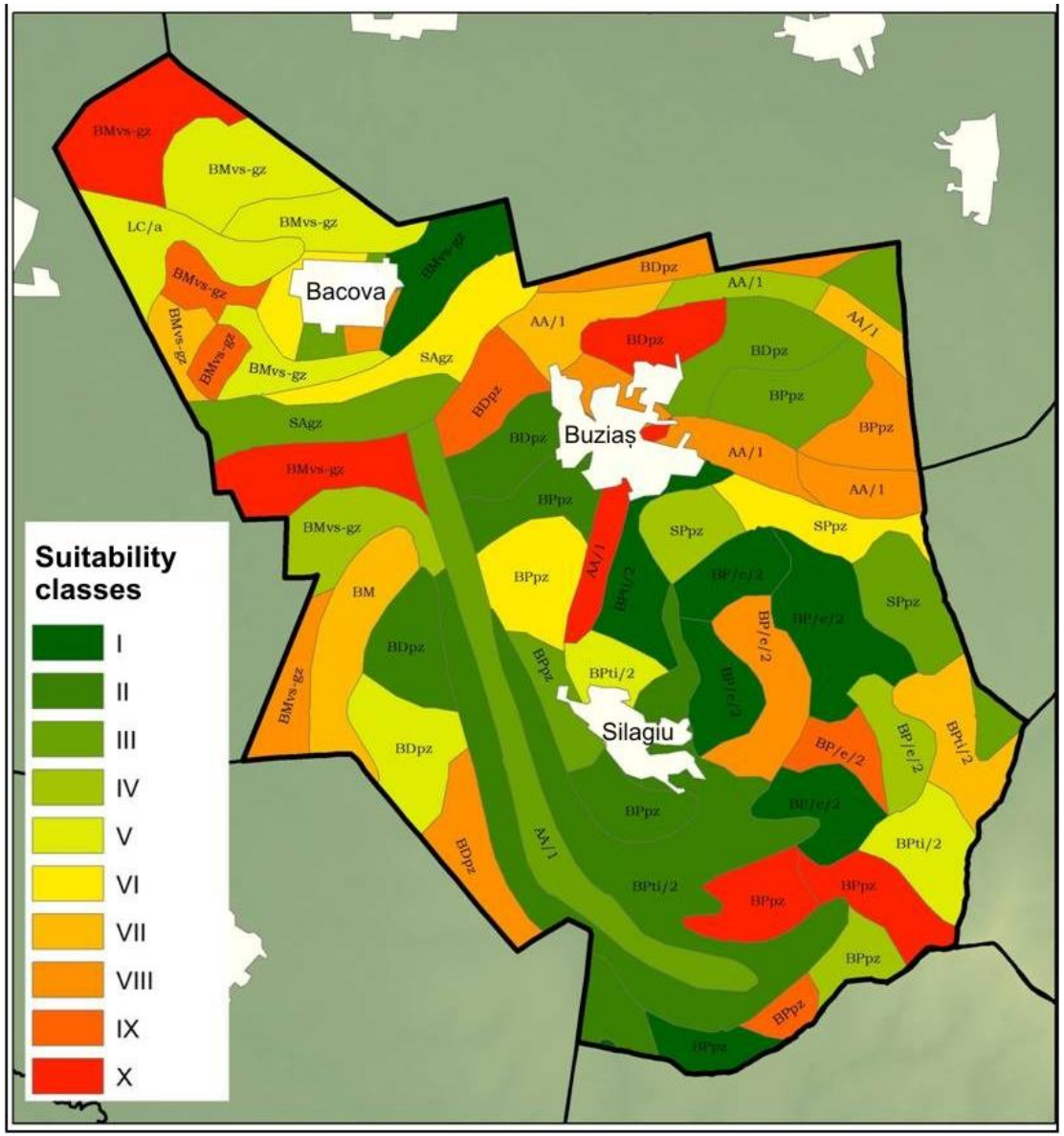


Land limitations

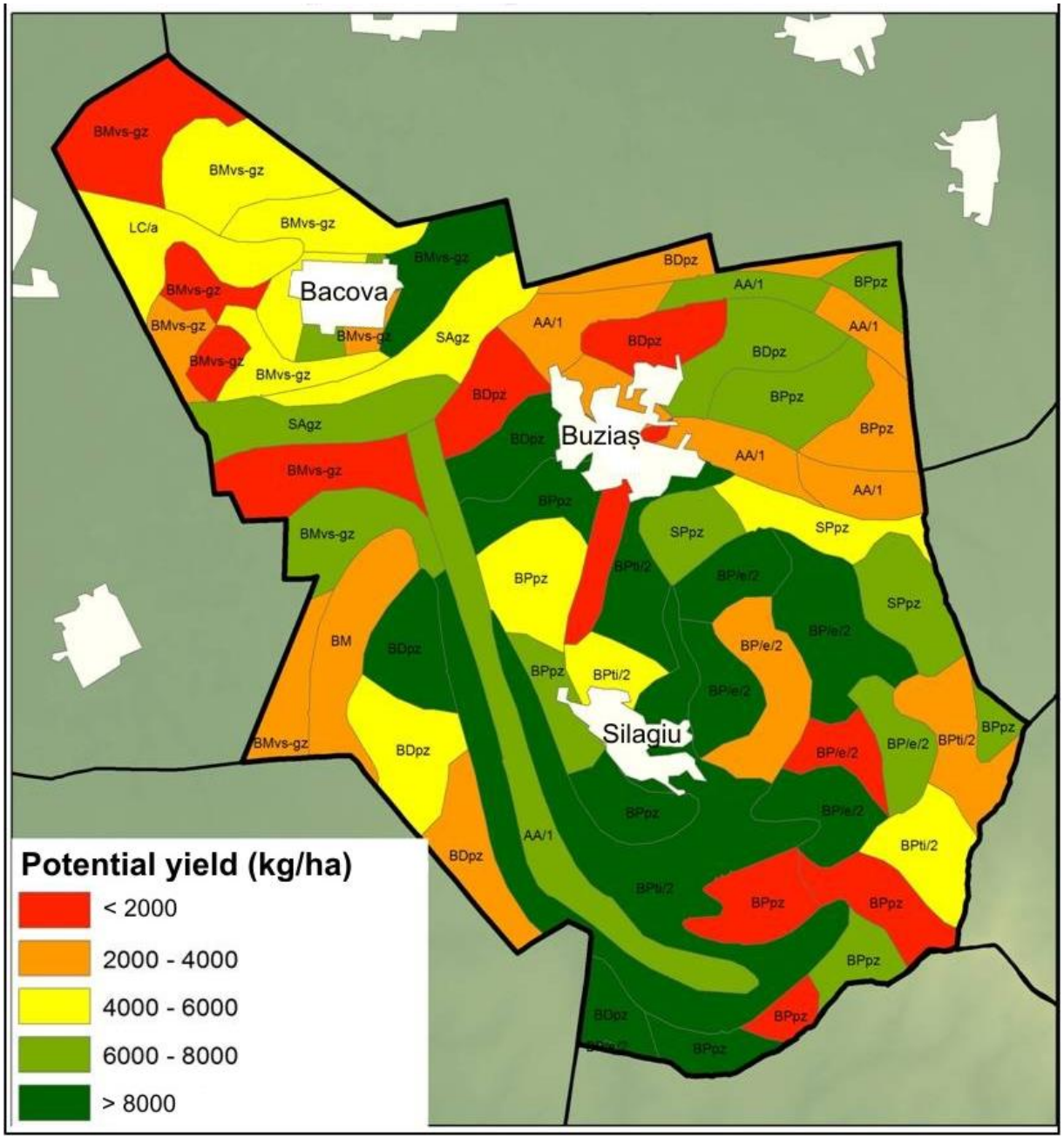


Applications of land suitability at locality level

Land suitability for cherry tree



Potential yield of cherry tree



Results of the application

- Spatial database
- Complex spatial and attribute query
- Tables with land unit area and suitability grades
- Soil property maps
- Suitability maps
- Maps of land limitations
- Auxiliary maps (relief units, lithology, erosion)

Land suitability using GIS

Digital maps ⟶ could be used in field navigation

Faster

Could be **continuously updated and improved**

More **accurate** results

Overcome subjectivity

Discussion

- availability of input data
- data resolution and accuracy
- GMO ?

Thank you !