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Technology for Local and Regional-Scale Assessment of Agricultural Landscape Dynamics Within the Framework of EU Common Agriculture Policy (CAP)

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PROJECT CONCEPT. MAIN OBJECTIVES

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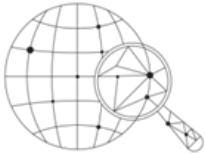
Technology for using Copernicus data to survey the dynamics of Romanian agricultural landscape in the context of economic transition and Common Agricultural Policy

The Research, Development and Innovation STAR Programme – Space Technology and Advanced Research



MAIN PURPOSE

identification and quantification of the changes that arable land in Romania faced after 1990, in correlation with the dynamics of both the environmental and the political factors.

OBJECTIVES

- Mapping land use/land cover for different moments
- Mapping land cover dynamics
- Computing fragmentation indices
- Correlating the results obtained with a series of political events
- Comparison in terms of land fragmentation
- Establishing patterns/ evolution models

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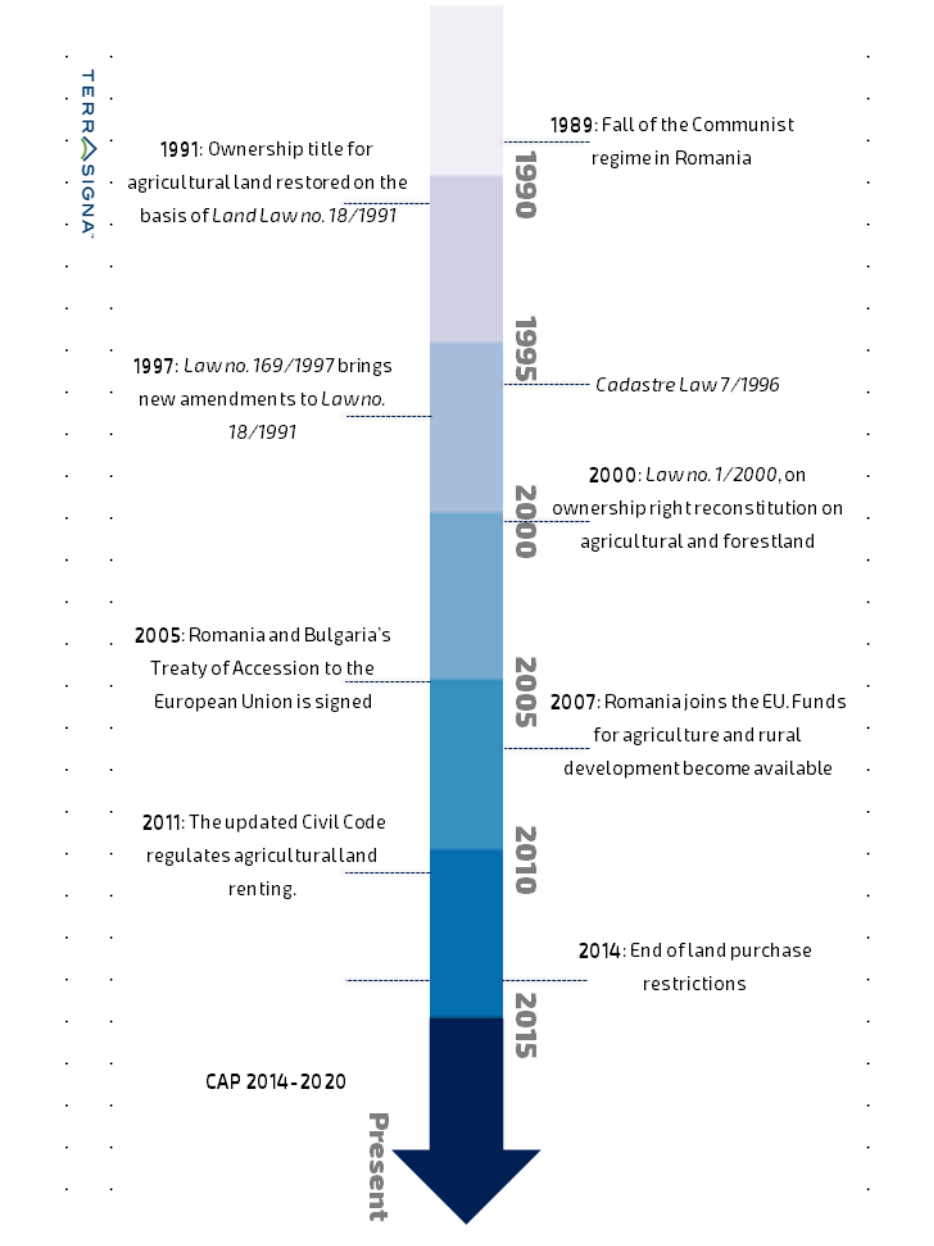
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1989: Fall of the Communist regime in Romania
1990
1991: Ownership title for agricultural land restored on the basis of *Land Law no. 18/1991*
1995
1997: *Law no. 169/1997* brings new amendments to *Law no. 18/1991*
Cadastre Law 7/1996
2000: *Law no. 1/2000*, on ownership right reconstitution on agricultural and forestland
2000
2005: Romania and Bulgaria's Treaty of Accession to the European Union is signed
2005
2007: Romania joins the EU. Funds for agriculture and rural development become available
2011: The updated Civil Code regulates agricultural land renting.
2010
2014: End of land purchase restrictions
2015
CAP 2014-2020
Present

LAND FRAGMENTATION

LAND CONSOLIDATION

- Crop diversification
- Land quality
- Organic farming

- Agricultural and rural development
- Land market development

- Agricultural productivity
- Land grabbing
- Rural life quality

METHODOLOGY

I. Achieving and preparing the data

1 Clear delineation of the areas of interest

Defining the sampling system

Relief unit	S (sqkm)	% S	Total number of administrative units	Number of rural administrative units	Number of sampling units
Dobrogea Plateau	10159.52	7.35	113	97	**18**
Romanian Plain	48968.38	35.43	851	770	**90**
Western Plain	16194.58	11.72	247	216	**30**
Moldavian Plateau	22954.68	16.61	431	399	**40**
Getic Plateau	13823.51	10.00	323	294	**25**
Mehedinți Plateau	801.64	0.58	20	17	**2**
Transylvanian Plateau	25297.44	18.30	421	373	**45**
TOTAL	**138199.75**	2273 (from the total number of 3181 administrative units)			**250**

Statistically significant for:

- confidence interval: 90 %
- margin of error: 4,91 %

TEC-LAND. SAMPLING AREAS

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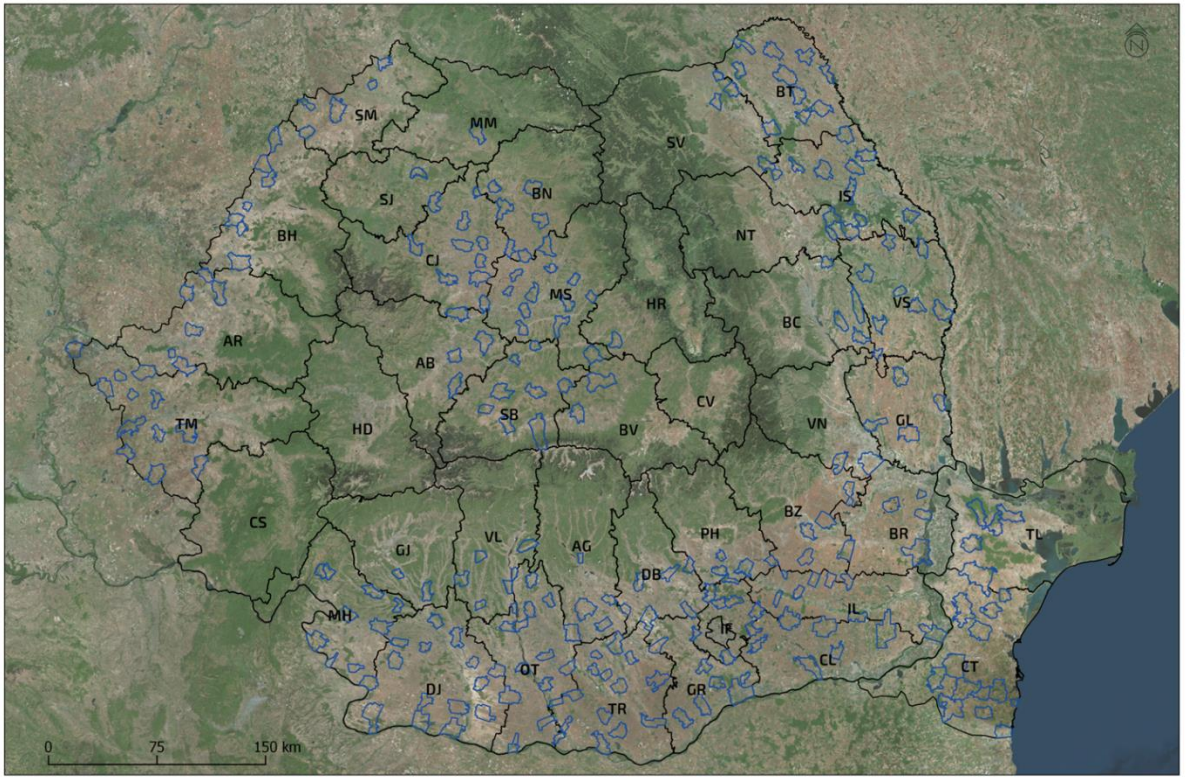

TEC-LAND. DISTRIBUTION OF THE SAMPLING AREAS PER COUNTY

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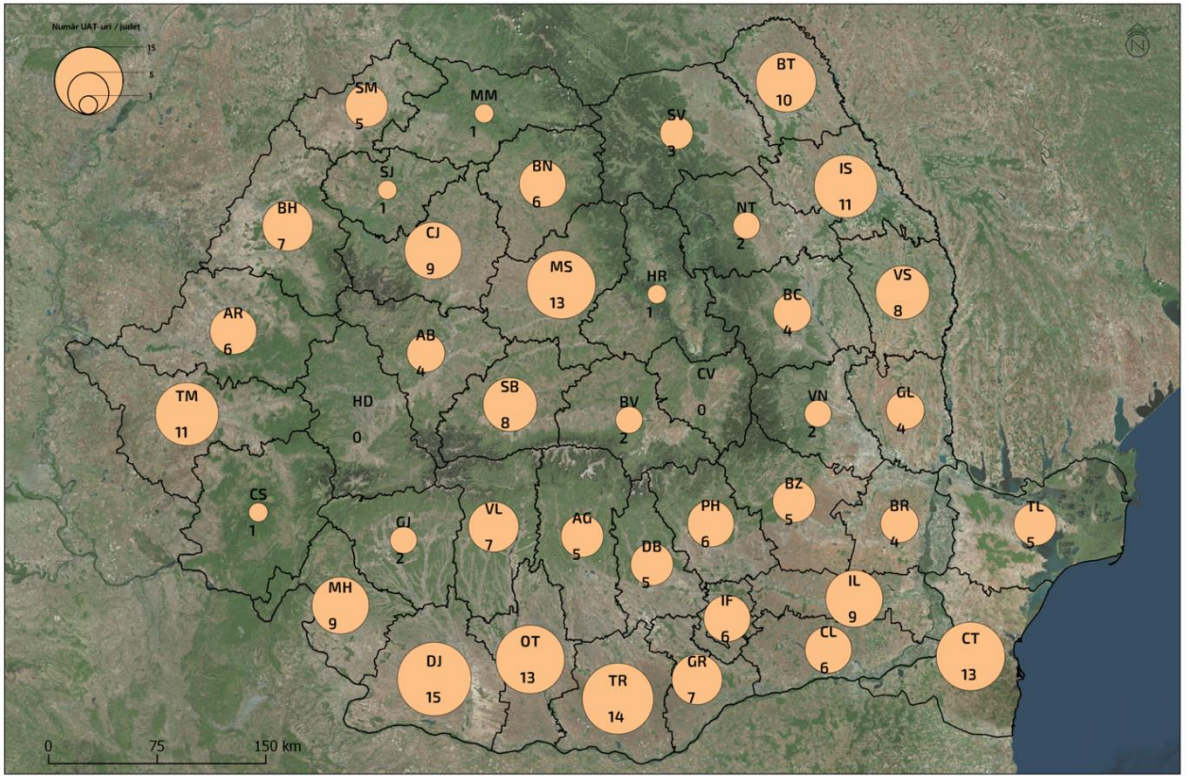

TEC-LAND. DISTRIBUTION OF THE SAMPLING AREAS INSIDE THE LANDSAT-8 GRANULES

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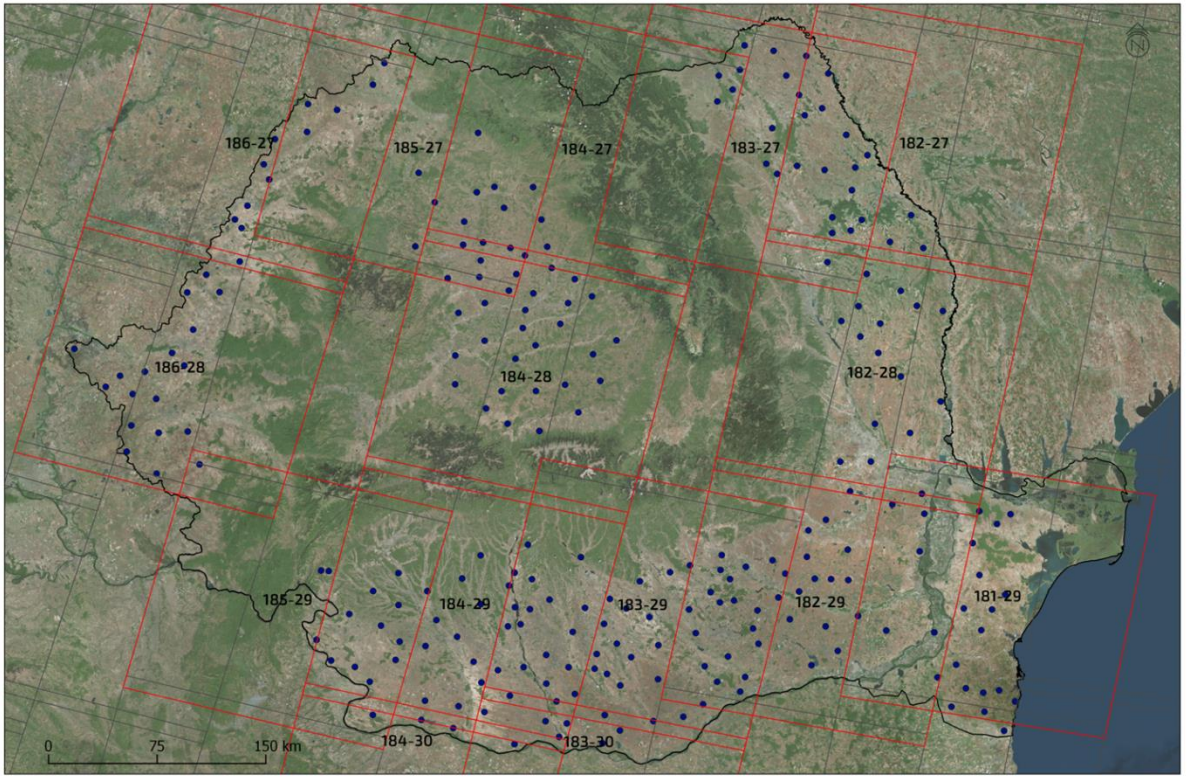

TEC-LAND. DISTRIBUTION OF THE SAMPLING AREAS INSIDE THE SENTINEL-2 GRANULES

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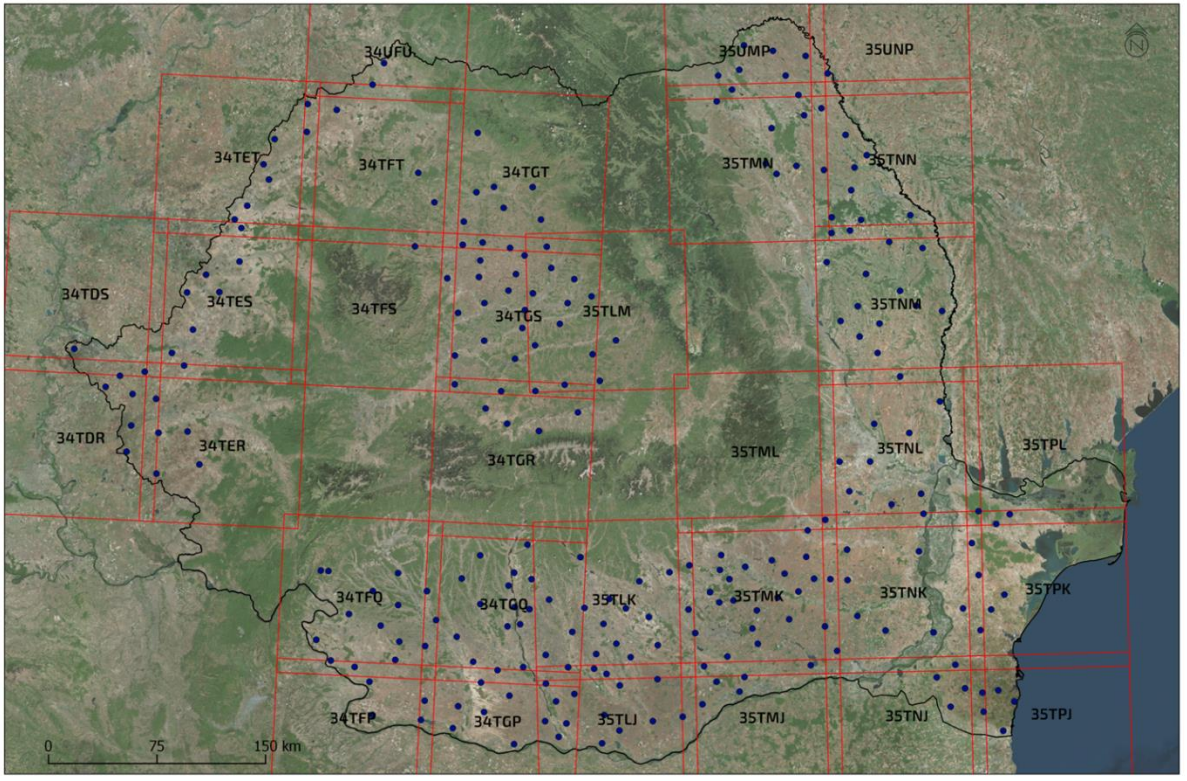

TEC-LAND. MAIN TEST AREAS FOR THE SOCIO-ECONOMIC ANALYSIS

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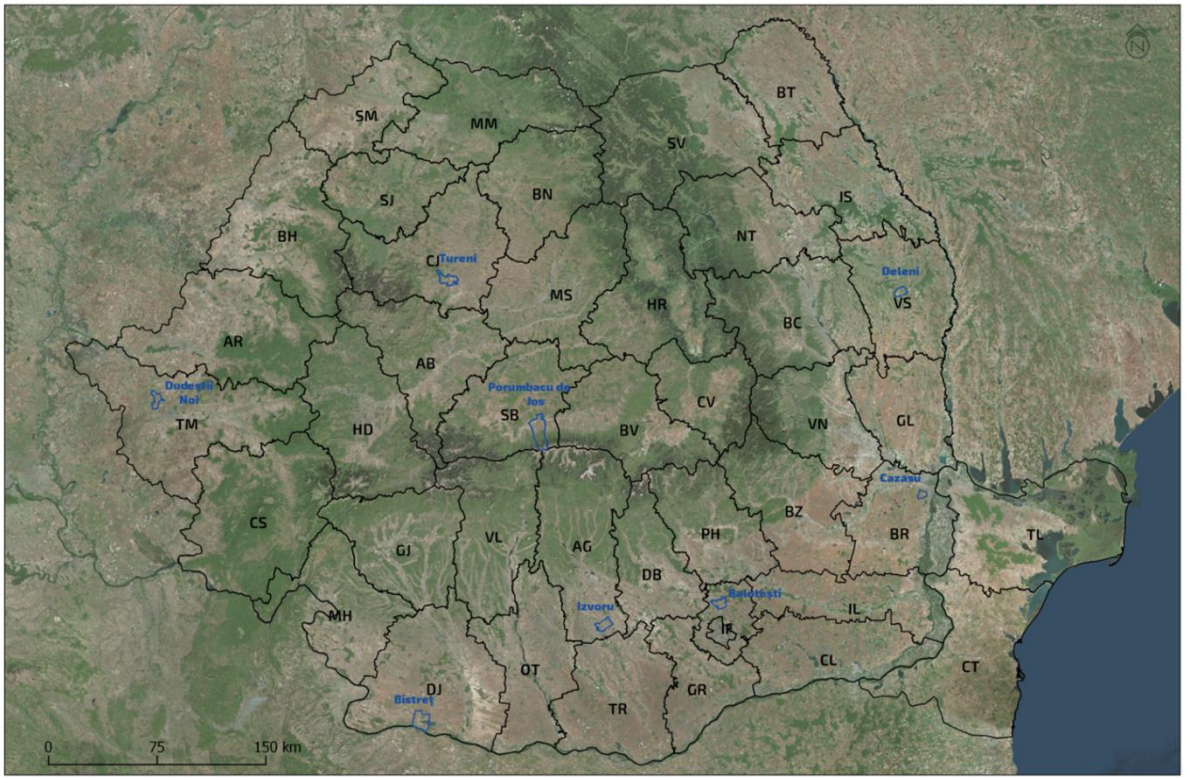


I. Achieving and preparing the data

1 Clear delineation of the areas of interest

Defining the sampling system

2 Satellite imagery acquisition / download

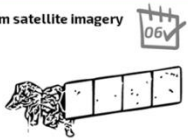
Level 1-C

Indexing and storing the images

1 Data extracted from satellite imagery

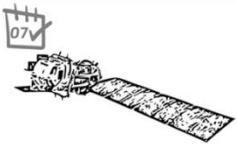
Landsat 4 – 5

T1 – T5



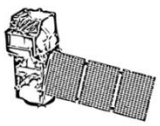
Landsat 7

T4 (2000)



Landsat 8

T6



Sentinel 2

T6

I. Achieving and preparing the data

1. Clear delineation of the areas of interest

Defining the sampling system

2. Satellite imagery acquisition / download

Level 1-C

Indexing and storing the images

3. Collecting geomorphological, climatic, socio-economic data

1 Data extracted from satellite imagery

Landsat 4 – 5	Landsat 7	Landsat 8	Sentinel 2
T1 – T5	T4 (2000)	T6	T6

2 Geomorphological data

Indicators:

- Altitude
- Slope
- Aspect

3 Climatic data

Indicators:

- Temperature
- Precipitation
- Humidity

4 Socio-economic data

I. Achieving and preparing the data

1. Clear delineation of the areas of interest

Defining the sampling system

2. Satellite imagery acquisition / download

Level 1-C

Indexing and storing the images

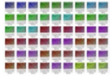
3. Collecting geomorphological, climatic, socio-economic data

4. Image preprocessing

(atmospheric corrections, layer stacking, pan-sharpening)

5. Deriving additional satellite products

(band combinations, indices regarding vegetation type / health)

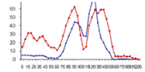


II. Processing and analysis

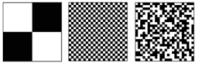
6 Supervised classification. Extraction of the arable land mask (binary format)

7 Segmentation. Extraction of the arable land plots

8 Calculation of fragmentation indices and analysis of their evolution



9 Reporting the results at physical and administrative units' level. Establishing patterns



10 Results' interpretation. Establishing correlations with different types of variables

MAIN RESULTS

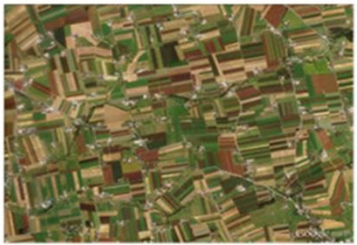
RESULTS

1. **Administrative unit level – detailed analysis**

2. **Administrative unit level**

3. **Regional / county-scale level**

4. **National-scale level**



COMPUTED INDICES

1 Indices regarding the area and density of the arable land plots

- Number of plots
- Average number of plots per inhabitant
- Average plots' area
- RI (Reduction Index)
- CC (Consolidation Coefficient)

2 Indices regarding the edge and shape of the arable land plots

- TE (Total Edge)
- ED (Edge Density)
- SI (Shape Index)
- MSI (Mean Shape Index)
- AWMSI (Area-Weighted Mean Shape Index)
- FD (Fractal Dimensions)

LAND FRAGMENTATION / LAND CONSOLIDATION TRENDS IN BALOTESTI, ROMANIA (1990 – 2017)

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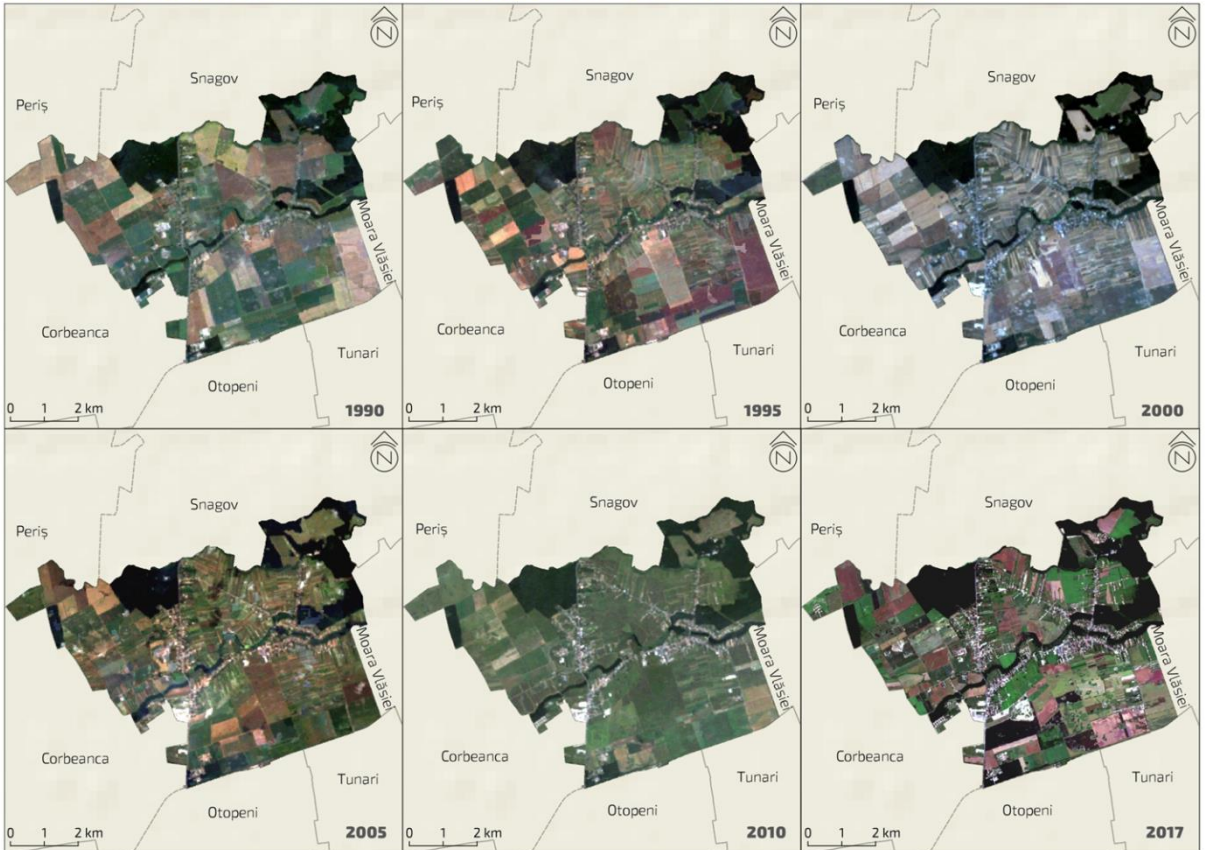

LAND FRAGMENTATION / LAND CONSOLIDATION TRENDS IN BALOTESTI, ROMANIA (1990 – 2017)

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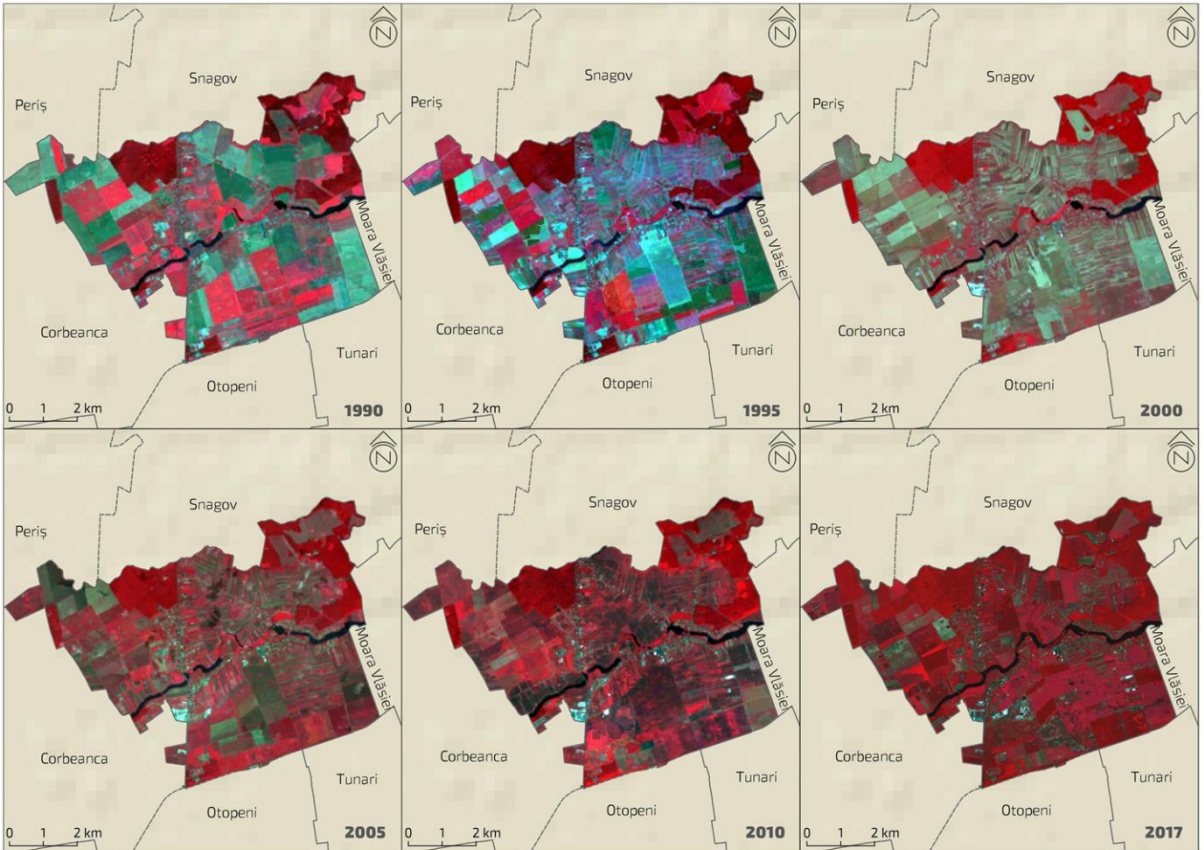

LAND FRAGMENTATION / LAND CONSOLIDATION TRENDS IN BALOTESTI, ROMANIA (1990 – 2017)

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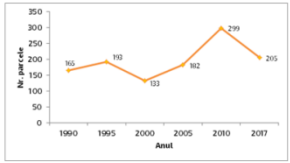
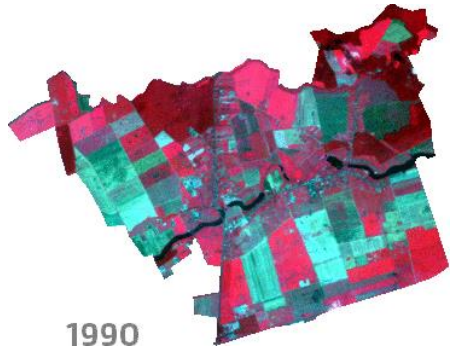
LAND FRAGMENTATION / LAND CONSOLIDATION TRENDS IN BALOTESTI, ROMANIA (1990 – 2017)

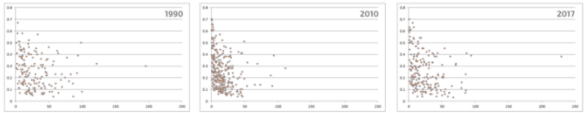
București-Ilfov Development Region

Evolution of the number of arable land plots





Evolution of the shape index



Evolution of fragmentation indices

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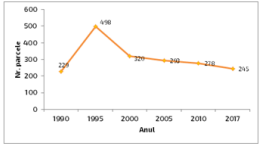
LAND FRAGMENTATION / LAND CONSOLIDATION TRENDS IN BISTRET, ROMANIA (1990 – 2017)

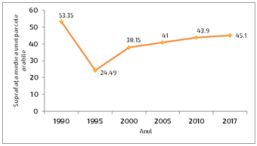
1990

SW – Oltenia Development Region

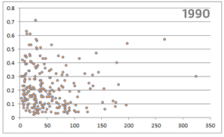
Evolution of the number of arable land plots

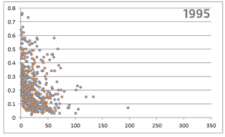


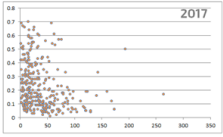
Evolution of fragmentation indices



Evolution of the shape index







TEC-LAND. SPATIAL DISTRIBUTION OF ARABLE LAND IN ROMANIA (2017)

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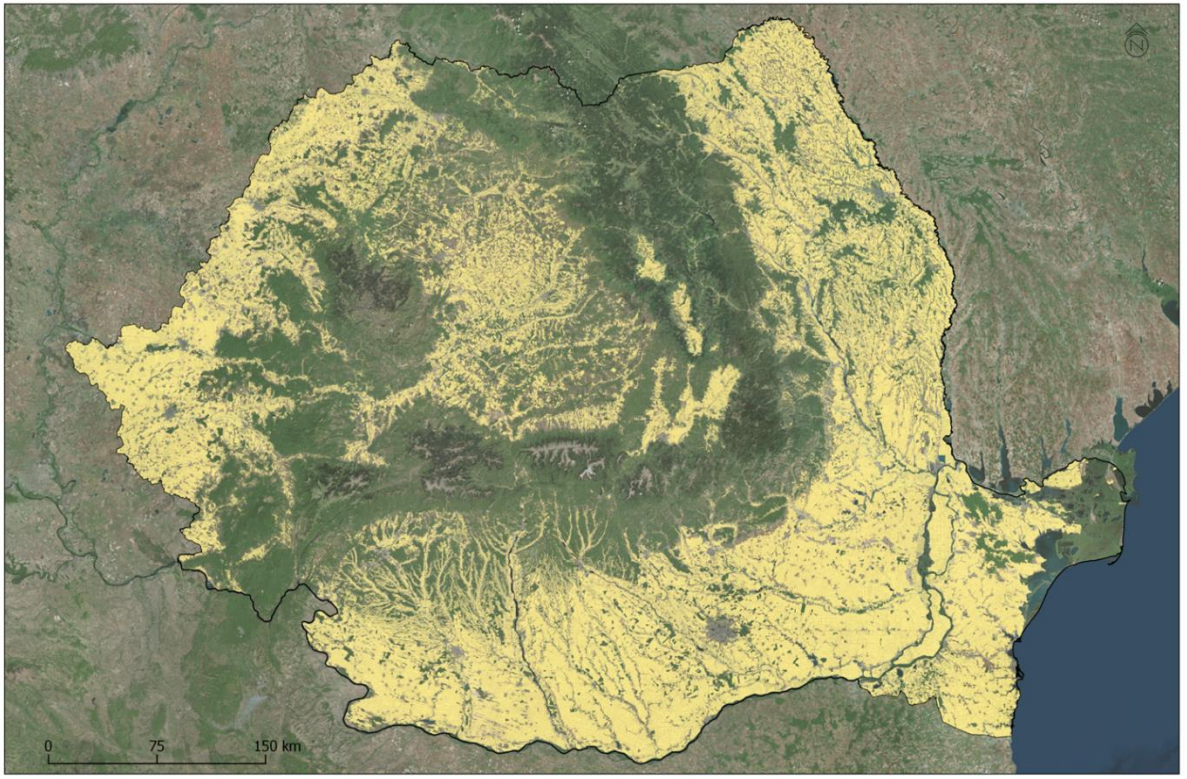

TEC-LAND. AVERAGE SIZE OF AN ARABLE LAND PLOT PER COUNTY (2017)

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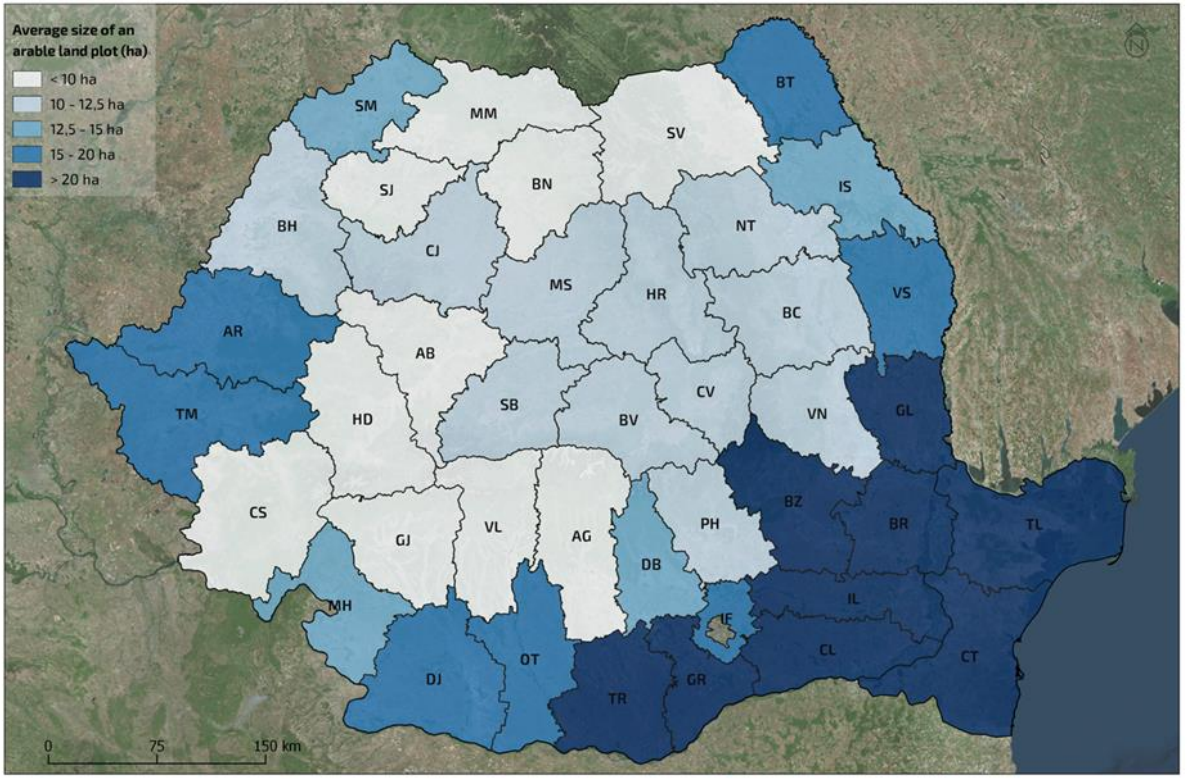

TEC-LAND. AVERAGE SIZE OF AN ARABLE LAND PLOT PER ADMINISTRATIVE UNIT (2017)

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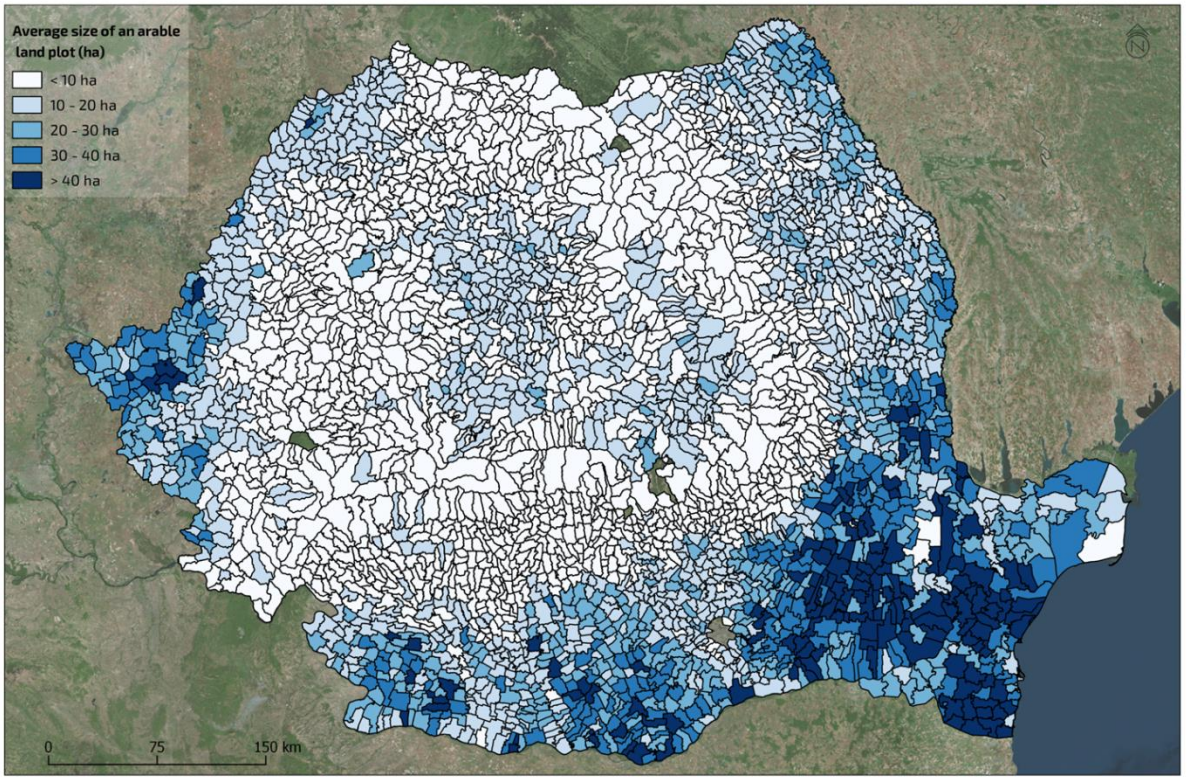

TEC-LAND. ARABLE LAND PRICES IN ROMANIA (2016)

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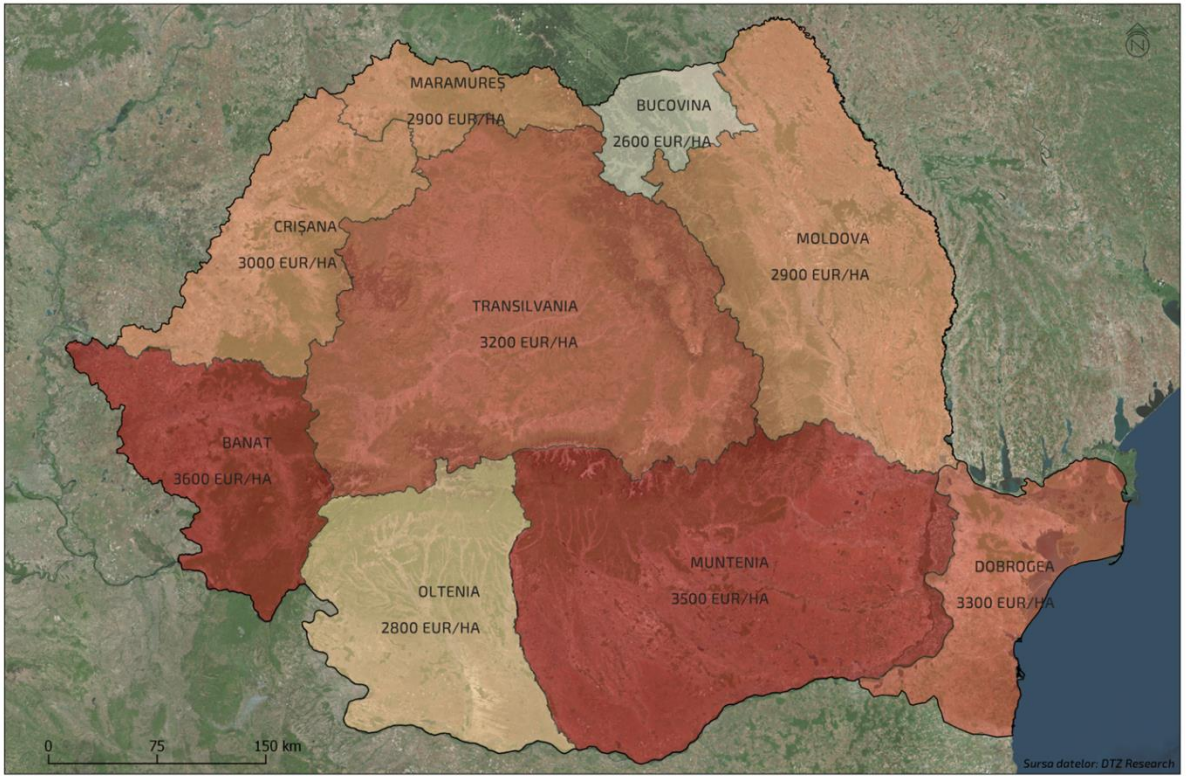

TEC-LAND. ARABLE LAND PRICES IN ROMANIA (2016)

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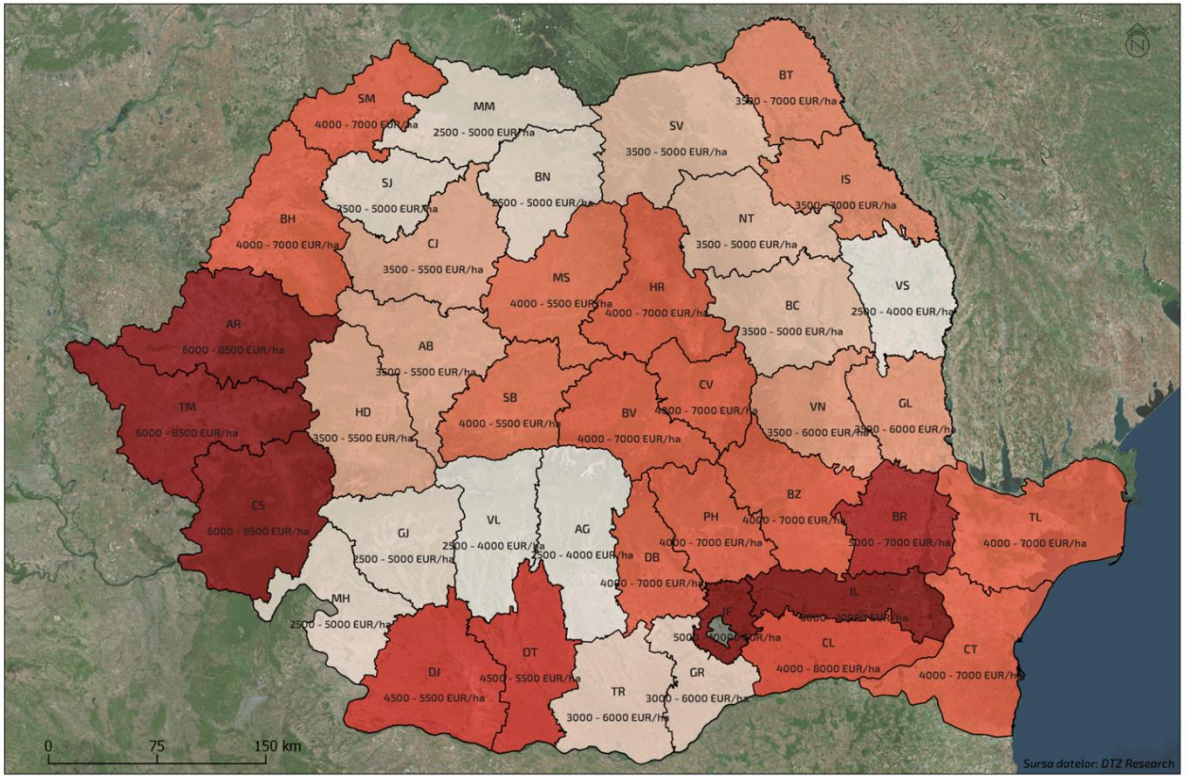

CONCLUSIONS

C 1 Changes regarding arable land in Romania in the post-communist period are closely related to both the environmental factors and the dynamics of political factors.

C 2 The use of Earth Observation (EO) data is a practical option in analyzing the long-term dynamics of agricultural landscapes.

C 3 There are clear differences regarding the temporal evolution of the arable land fragmentation / consolidation process across the different counties and historical provinces.

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Coordinator: Terrasigna

Partners: USAMV – University of Agronomic Sciences and Veterinary Medicine Bucharest

IEA –The Institute of Agricultural and Food Economics of the Romanian Academy

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