FINAL REPORT ON CHALLENGE #3:
Agro Environmental Services

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INTRODUCTION

- Background of the challenge
  Main motivation of the challenge is to provide access and support for spatial data utilisation within agro environmental context.
  Challenge has addresses 3 following use cases:
  1. Data access and utilisation
  2. Water canal structural changes
  3. Dynamic changes of landscape identification

- Full explanation of the challenge defining the scope of the effort.

  Challenge aims to identify, process and promote relevant agricultural and environmental spatial data resources in order to demonstrate landscape changes and their impact in two pilot Slovakian regions. Where possible aside from identified available data resources, special focus was to utilise Copernicus and INSPIRE data.

METHODOLOGY

The **methodology** of the report contains the sections that describe the progress and results achieved for the entire challenge.

- Team description + info about any coordination with other organizations, outside agencies
  Wide range of expertise and support has been provided by the experts from public sector bodies (Ministry of environment of the Slovak republic, The Geodesy, Cartography and Cadastre Authority of the Slovak Republic, Slovak water enterprise), universities (Technical university Košice, Slovak agricultural

university, University of West Bohemia) as well as private sector (YMS, Meteoblue, HSRS).

- Technical Background
  In order to implement this challenge and underlying use cases, following technical expertise and solutions has been utilised:
  Technical expertise:
  - Data analysis
    - spatial data analyses - morphometry analysis
    - satellite images processing - indexes calculation
    - spatial analysis - overlay, zonal statistic, focal analyses
  - Data processing
    - data accessing and downloading
      - EO browser
      - Earth explorer USGS
      - MeteoBlue API
    - data pre-processing
      - GIS desktop tools
      - Python scripts
    - data processing
      - Python scripts
      - GIS desktop tools
  - Statistical analyses
    - GIS desktop tools
    - MS Excel

  Technologies:
  - QGIS
  - ArcMap
  - Layman
  - Micka
  - HSlayers-NG
  - Digital innovation hub

Use cases

1. Use case #1: **Data access and utilisation**
   1.1. Description of the process of solution

This use case was designed in order to identify and use relevant spatial data within the agro and environmental domain. Use case aimed to collect an overview about available spatial datasets in Slovakia and prioritise those with

high relevance for the topic addressed by other use-cases within this challenge.
At the same time, where possible and relevant, outcomes of the other use cases were published and made available via OGC WMS and WFS services. Lastly possibilities of the HSlayers and Layman were investigated in order to share the challenge outcomes via webmap app[1] deployed under the AgriHub.sk innovation hub.

1.2. Data & Equipment list

Table 1 List of used data

Provider	Name of dataset/stream	Purpose of use	Source
Ministry of Agriculture and Rural Development of the Slovak Republic	List of spatial 222 datasets	Selection of the priorities for an agri environmental datasets	link
Ministry of Environment of the Slovak Republic	Datasets from Sk national Copernicus contact point	Support for use cases 2+3	link
Slovakian INSPIRE data providers	INSPIRE datasets	Support for use cases 2+3	link

1.3. Detailed implementation plan

Initially, a set of potential geospatial datasets for the agri environmental domain has been prepared and consulted in order to define datasets with high priority for the use-cases addressed by this challenge. Consequently this list was also communicated to the Ministry of Agriculture and Rural Development of the Slovak Republic in order to achieve publishing of the datasets, currently not available via machine readable and standardised interface. Aside from this data inventory, relevant Copernicus and INSPIRE datasets were also identified.
Where possible, outcomes of the use case 2 and 3 started to be published via standardised OGC services[2] (Figure1).
In order to provide easier and faster access to selected datasets, a set of map compositions has been prepared inside the Sk AgriHub Digital innovation hub, providing access to selected outcomes of the use case 2[3] and 3 as well as underlying datasets (Figure 2).

[1] https://www.agrihub.sk/en/mapa
[2] https://maps.geocloud.sk/
[3] https://tinyurl.com/y5tao2so

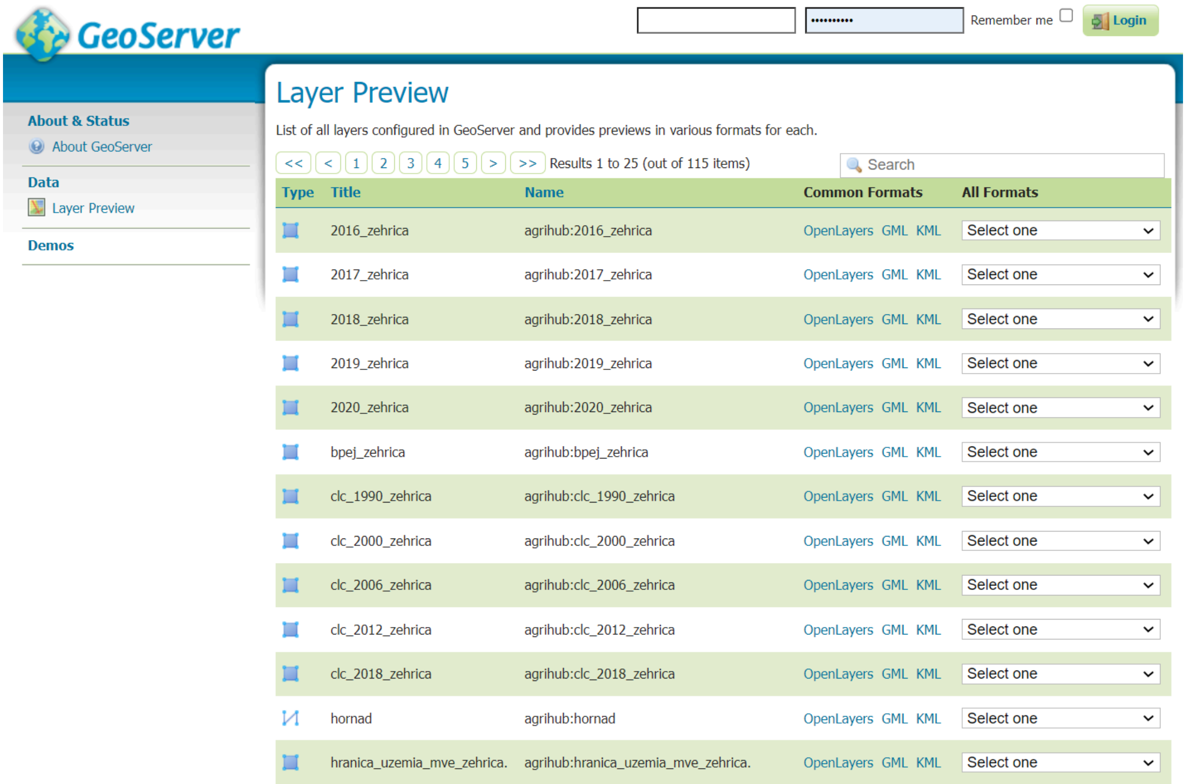


Figure 1. Datasets related to the use cases 2+3 published as OGC services

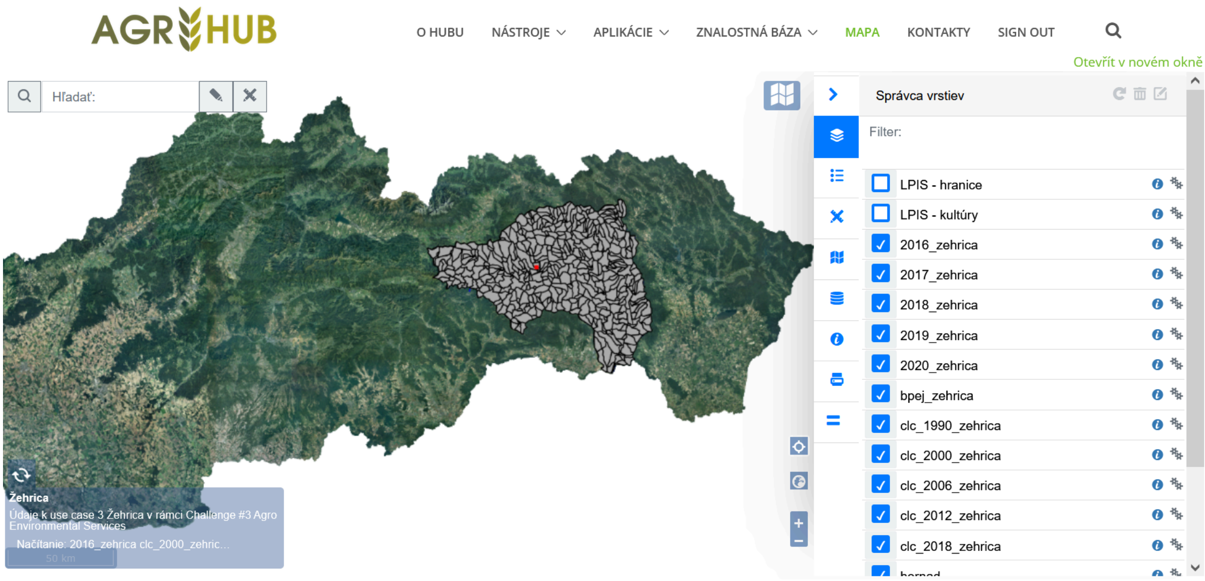


Figure 2. AgriHub platform sharing outcomes of the Challenge #3

1.4. Analysis of needs of stakeholder groups

Challenge in overall aims to address following target groups:

Public sector

- Ministry of Agriculture and Rural Development of the Slovak republic (MARD SR)
- Ministry of Environment of the Slovak republic (ME SR)
- Organizations under the jurisdiction of ministries

Self governance sector

- Košice self-governing region

Private sector

- Large and small farmers
- Business service providers

Academia + R&D

- Universities
- Research institutes

Considering the above stakeholders this use case objective was to arrange the inventory and provision of access to the relevant spatial data from global to local level. There is still a high gap in availability and accessibility of the spatial datasets in agro and environmental domain. Providers are challenged with publishing their data in a standardized and useful way, whilst users are facing difficulties to find and use this geospatial data content and related services for their needs. With the help of investigation of available datasets, publishing those not yet available in the online ecosystem and deploying simple and easy to use desktop and web client applications this gap can be significantly reduced.

1.5. Experimental results

Main results of this use case are represented as:

- List of agro environmental datasets (checklist to be checked how identified datasets are being made available)
- Identified geospatial datasets registered in Copernicus and INSPIRE infrastructure
- Published new outcomes from use case 2+ 3
- Maps compositions made available via AgriHub innovation hub

2. Use case #2: **Water canal structural changes**

2.1. Description of the process of solution

The use case focuses on a microregion located in the South of Eastern Slovakia (bounded by the Bodrog, Latorica, Tisa and Malá Krčava rivers, Figure 1) . Specifical focus is given to the "Somotor canal" connecting the Bodrog river and a system of artificial canals ("water channels"), created mostly in the middle of 20th century. The system of canals used to serve, and some part of the system still serves for irrigation, but also to retain/drain water in the mainly flat agricultural area (Figure 1).

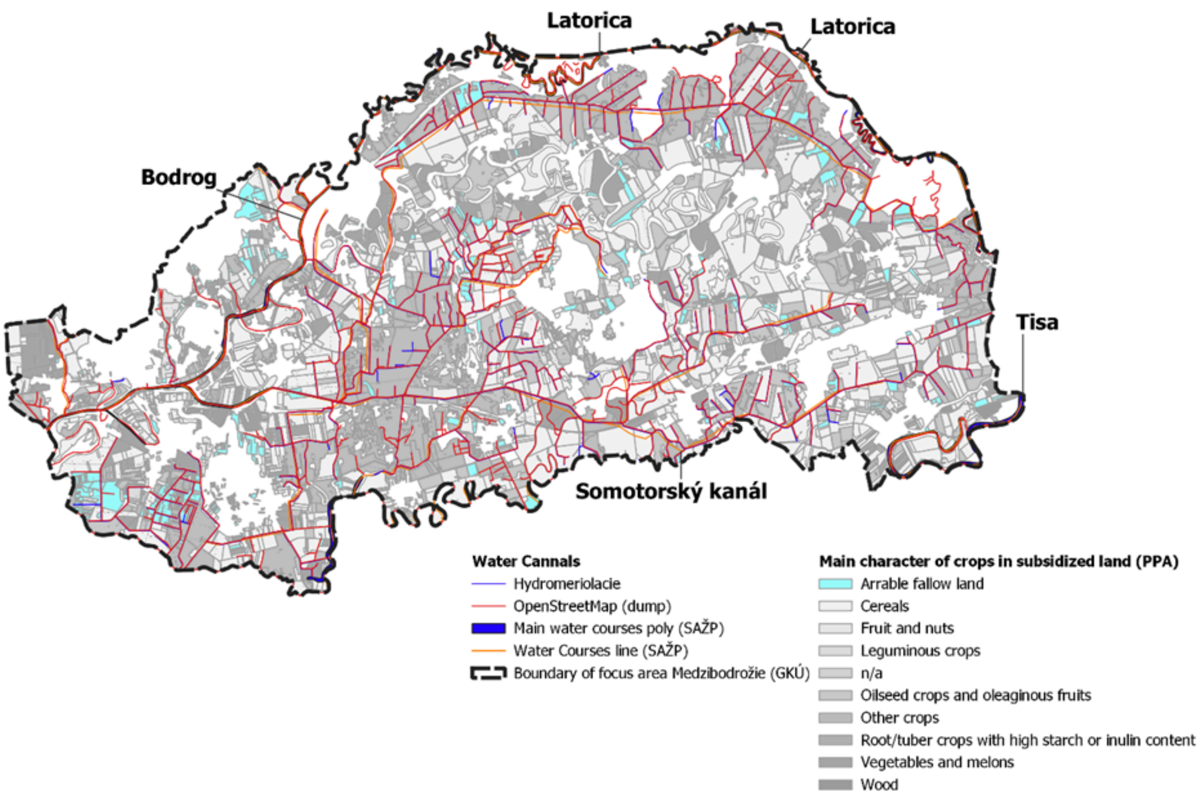


Figure 1. Boundaries of the focus area

Currently 62.23 % of the area's land is subject of requests of subsidization (hereinafter subsidized land) for crops' production or land maintenance (Figure 2.). Only 12.3 % of the subsidized land is represented by areas of land maintenance (Mesophilic permanent grassland (type B), Lowland alluvial stands (type E), Moisture-loving stands of higher positions, bog and kneeless meadows (type F), Moisture-loving vegetation of lower positions (type D), Thermophilic and drought-tolerant permanent grasslands (type A), Arable fallow land).

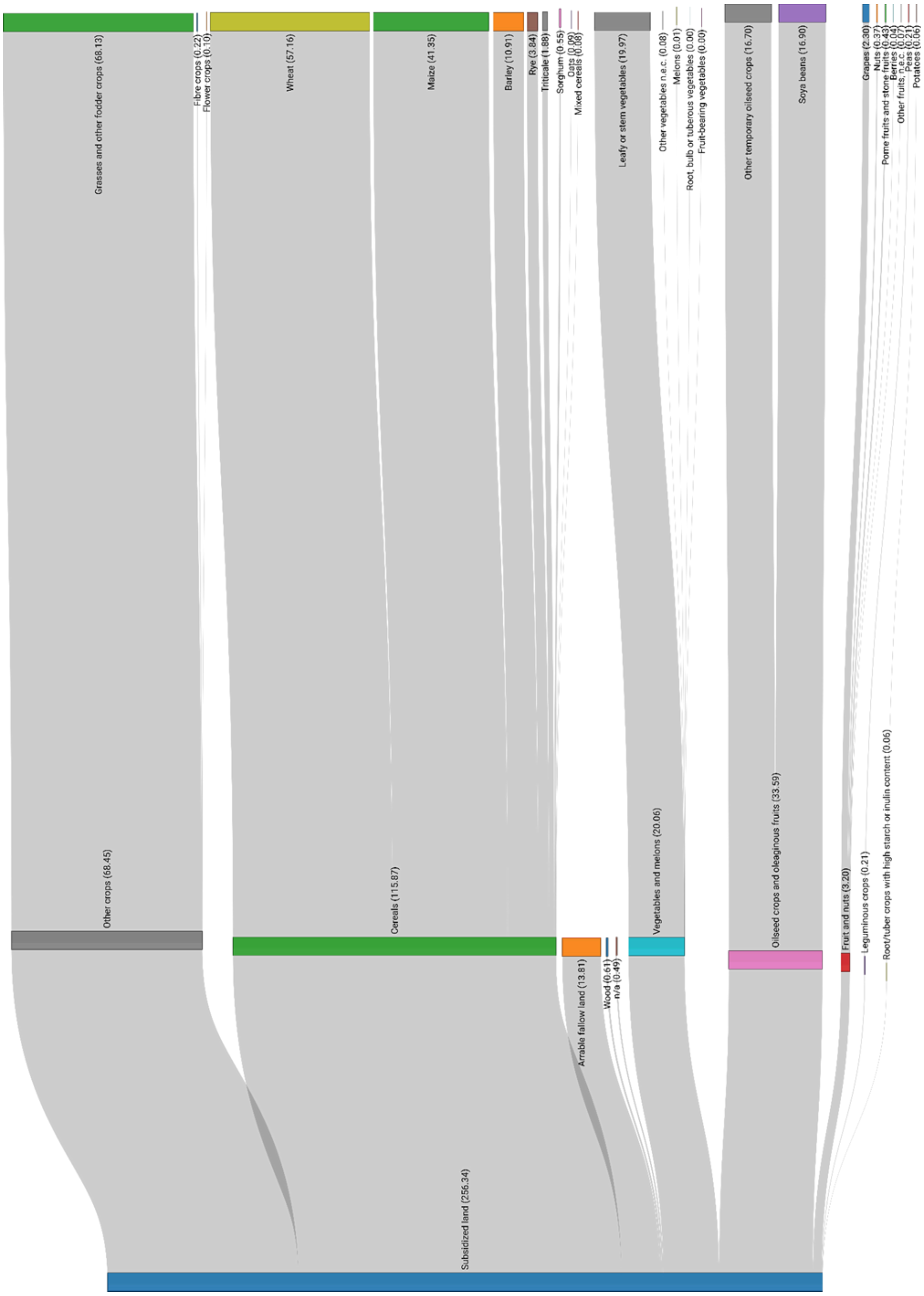


Figure 2. Distribution of subsidized land by declared crops within Medzibodrožie

Even though most of the canals are not maintained, due to their size, their spatial representation/visibility for more detailed assessment differs (Figure 3. - Figure 8.). The global aim of the case is to prove/disprove the necessity of the upper mentioned canals' maintenance for the purposes of irrigation and water retention as prevention for extreme droughts, via their structural changes. Within the current challenge the focus is to find a more precise spatial representation of the Somotor canal.

Figure 3. Somotor channel in the vicinity of Pribeník (Google Street View)

Figure 4. Somotor channel in the vicinity of Pribeník (OpenStreetMap)

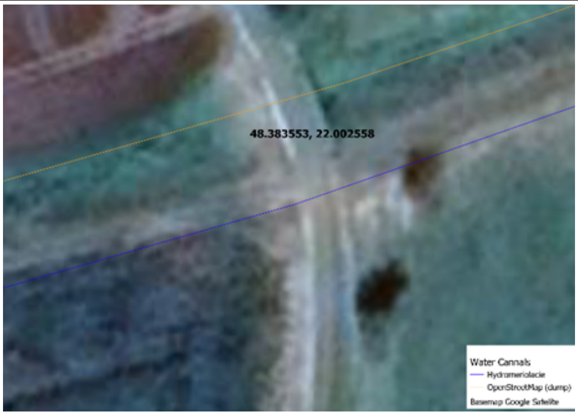


Figure 5. Somotor channel in the vicinity of Pribeník (Google Satelite)

Figure 6. Somotor channel in the vicinity of Pribeník (GKÚ Orto)

Figure 7. Somotor channel in the vicinity of Pribeník (Google Maps)

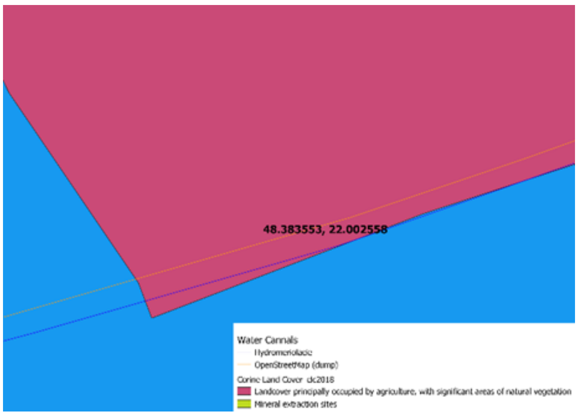


Figure 8. Somotor channel in the vicinity of Pribeník (Corine Land Cover 2018)

2.2. Data & Equipment list

Table 1 List of used data

Provider	Name of dataset/stream	Purpose of use	Source
Geodetic and Cartographic Institute Bratislava (GKÚ)	Administrative units	Administrative boundaries of the focus area	link
Agricultural Paying Agency (PPA)	Subsidized agricultural land	Classification of main crops	link
The Food and Agriculture Organization of the United Nations (FAO)	Indicative Crop Classification for the agricultural census (ICC) Version 1.1	Classification of subsidized land into FAO groups	link
Ministry of Agriculture and Rural Development of the Slovak Repbulic (MPaRVSR)	Shore lines	Base set for identifyng canals's estimate shorelines	link
Slovak Environmental Agency (SAŽP)	Atlas_krajingy_sr:A22	Main watercourses	link
Slovak Environmental Agency	Atlas_krajingy_sr:A20	Watercourses	link
Hydromeliorácie	Courses (canals)	Canals under the administration of the state enterprise Hydromeliorácie	link
OpenStreetMap (SAŽP)	Watercourse	Additional data on cannal layers	link
Geodetic and Cartographic Institute Bratislava (GKÚ)	INSPIRE - Ortometria	Orthoimage tiles for partial clipping	link
Slovak Environmental Agency (SAŽP)	Inspire Protected Sites	Assessment of the canals' and subsidized land relations to protected sites	link
Meteoblue API	historyagro	soilmoisture, temperature, transpiration	link
Meteoblue API	historybasic	precipitation, temperature, relativehumidity	link

List of equipment: QGIS, Posgtresql (w PostGis extension), ogr2ogr,GDAL API, OTB API, python IDLE (scikit-image lib)

2.3. Detailed implementation plan

WP 1 Identification of possibilities of better spatial representation (vector) of water canals

- T1.1 Pilot segmentation of two orthoimagery tiles (GKÚ) containing the course of the Somotor canal via OTB extension
    - Tile Cejkov_0-8 – With visible surface water within the canal's course
    - Tile Kralovsky_Chlmec_3-9 – With no visible surface water within the canal's course
- T 1.2 Comparison of raw vector segments with open vector lines (OSM, SAŽP, Hydromeliorácie, PPA)

WP 2 Assessment of the canals in relations to local agricultural resp. subsidized land

- T 2.1 Distribution of subsidized land along the course of the Somotor canal via FAO classification (Side quest)

WP 3 Identification of water elements via scikit-image

- Test the usability of scikit-image for surface water identification via Slic and Felzenszwalb methods

WP 4 Identification of the areas' historical climate change in relation to agriculture *

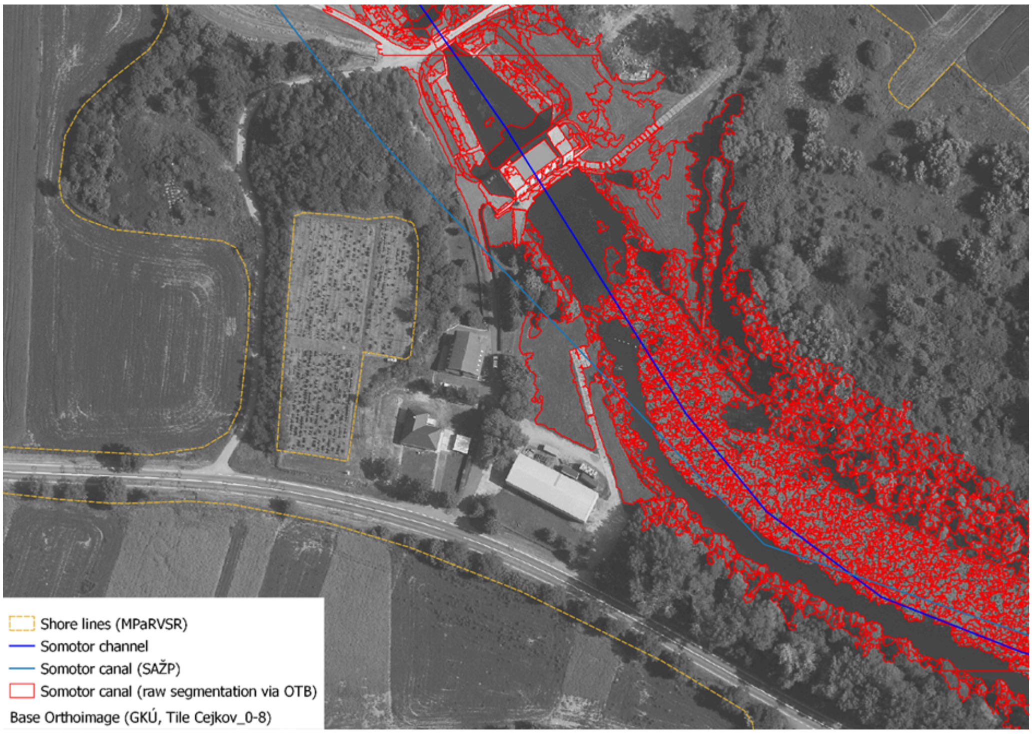
WP 5 Classification of declared crops' in terms of market value, local community value and water needs*

2.4. Analysis of needs of stakeholder group

In recent years the whole focus area has been exposed to extreme seasonal droughts. If the original purposes of the water canals (water retention, flood protection) can be proved, it may serve again (not only) to local crop producers. Currently 248 commercial (and subsidized to some degree) crop producers operate within the area.

2.5. Experimental results

- **Experimental results of T1.1 – T1.2**



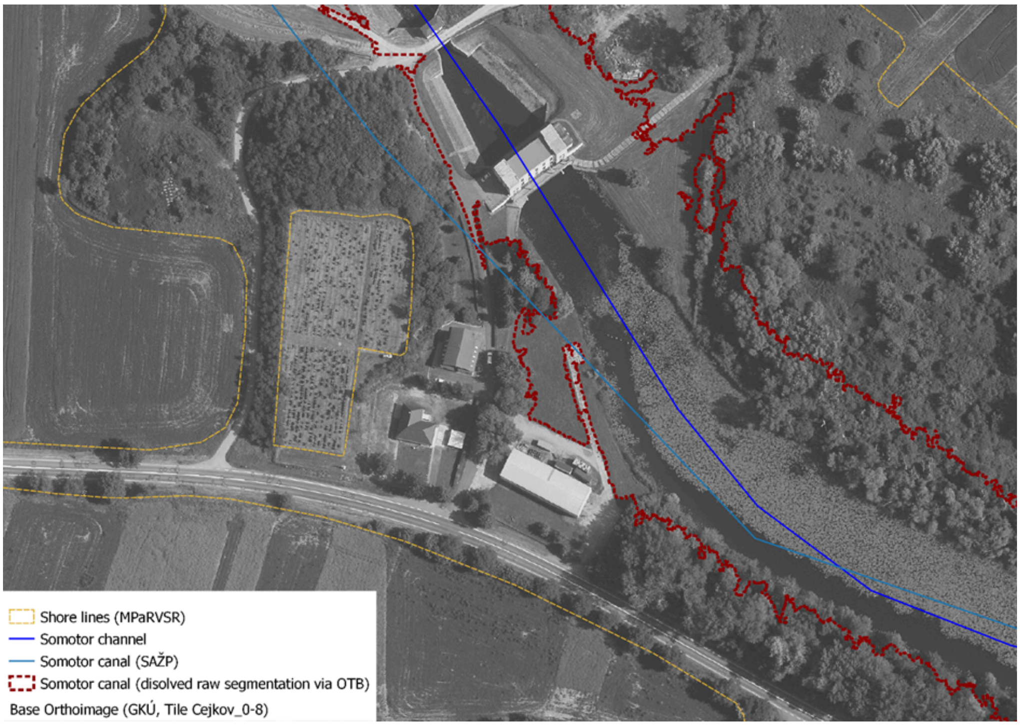


Figure 9. Detail on Somotor canal via OTB's raw segmentation of Tile Cejkov_0-8

Figure 10. Detail on Somotor canal via OTB's raw segmentation of Tile Kralovsky_chlmec_3-9

Experimental results of T2.1

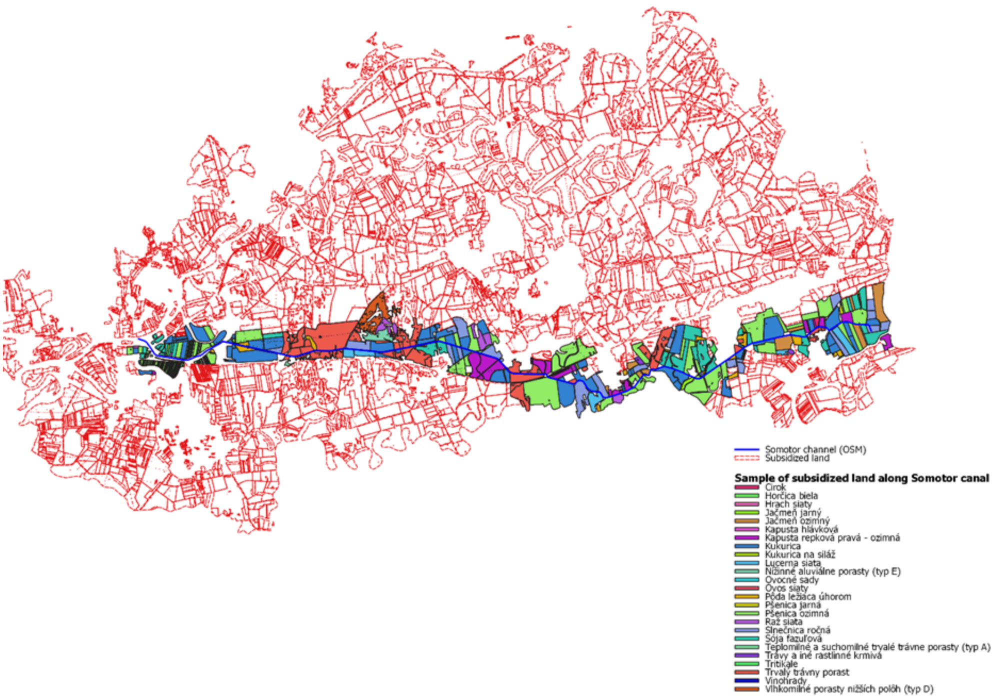


Figure 11. Map of sample of subsidized land along the Somotor canal

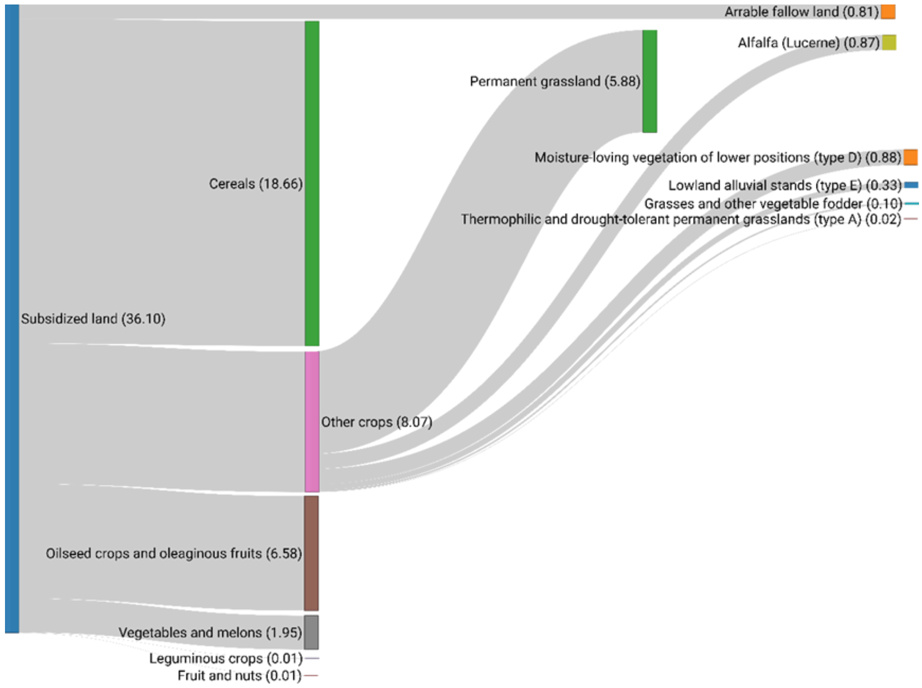
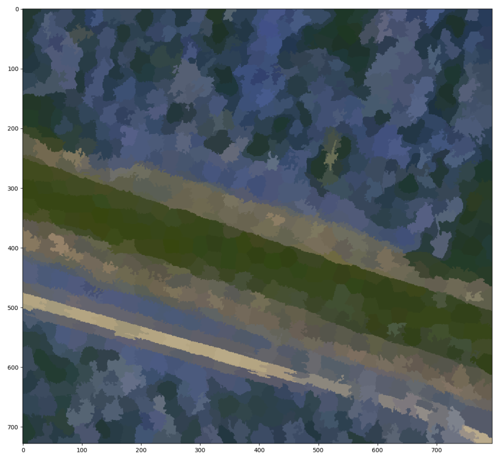


Figure 12. Distribution of the sample via FAO UN's crops' classification (size of land km^2)

Figure 13. Sample clip of Tile Cejkov_0-8

Figure 16. Sample B clip of Tile Cejkov_0-8



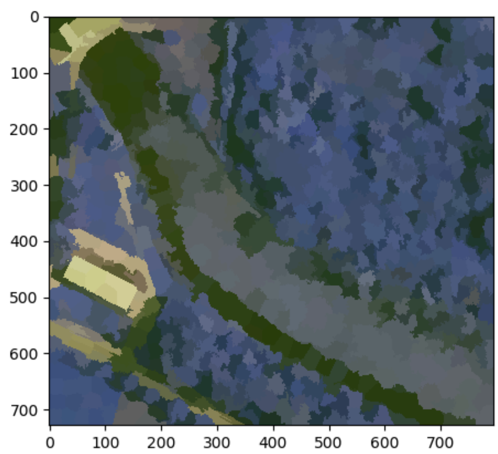


Figure 14. Sample clip of Tile Cejkov_0-8 segmentation via Slic method	Figure 17. Sample B clip of Tile Cejkov_0-8 segmentation via Slic method
 Figure 15. Sample clip of Tile Cejkov_0-8 segmentation via Felzenszwalb method	 Figure 18. Sample B clip of Tile Cejkov_0-8 segmentation via Felzenszwalb method

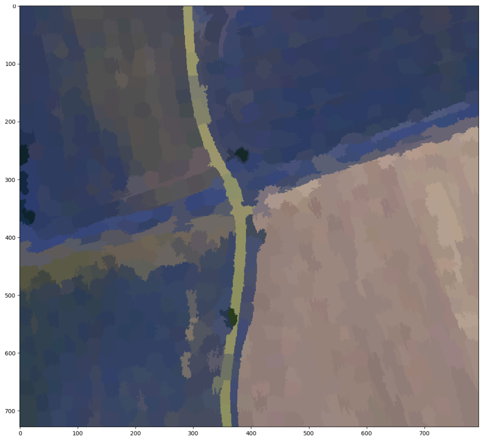
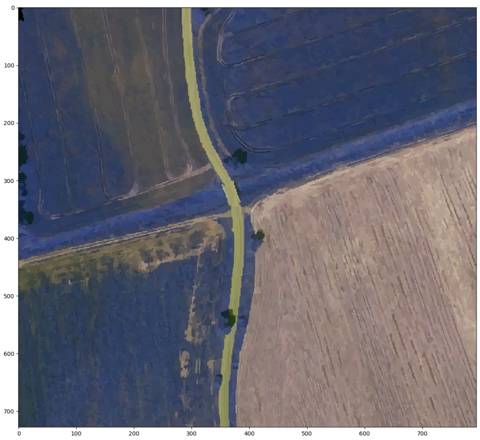
 Figure 19. Sample clip of Tile Kralovsky_Chlmec_3-9	 Figure 20. Sample clip of Tile Kralovsky_Chlmec_3-9 segmentation via Slic method
	

Figure 21. Sample clip of Tile Kralovsky_Chlmec_3-9 segmentation via Felzenszwalb method	

2.5 Discussion of the results and findings and Further improvements

- **Experimental results of T1.1 – T1.2**
    - Overall OTB's segmentation extension outputs' contain several self-intersections, resulting into not-suitable merged objects (e. g. part of shore merged with road visible in Figure. 10.) that can be dealt with in the future.
    - Water surface, water surface's lily cover, the edges of the banks, overgrown part of canals may be distinguished.
    - After additional sorting and some degree of processing, the final outcomes may bring added value to MPaRVSR's data set on shorelines, which only copies the spatial representation of PPA's dataset on Subsidized agricultural land.
    - Clips based on pilot outcome layers' individual objects' overlay could serve as the base for faster sorting and better determination of the canal's surface (structure).
- **Experimental results of T2.1**
    - A large portion of the land within the vicinity of the Canal is declared as Permanent grassland, although at first site it does not differ from other subsidized land.
    - The whole area will be overlayed with the boundaries of protected sites to determine which "only maintained" parcels could actually serve for crops' production.
    - The merged dataset of subsidized land and UN FAO's crops classification (Side quest) currently contains 56 Slovak types of crops. In the future it could serve as the base for classification of all SK crops within UN FAOs framework.
- **Experimental results of T3.1**
    - Both the Slic (n_segments at 1000) and Felzenszwalb methods' outcomes deliver a view with (partially abstract) distinguishable objects of the Canal's sample parts.
    - The combination of the (after additionally sorting) vector outcomes and the outcomes of the Felzenszwalb method, could serve as input data for further canal's classification (surface's nature).

Further improvements

1. After a more precise identification of the Somotor canal surface's structure, the whole process should be automatized via python scripting (using API for OTB, GDAL) to reduce the share of manual work within the efforts of restructuring all canals surface.
2. Afterwards, based on more precise shorelines, the canals (abstract estimate excluding overgrowth with weed) 3D shape should be modelled for the estimate of (minimum) possible volume of water retention.
3. Integration of the area's historical data on temperature, precipitation, relative

humidity, soil temperature, soil moisture, evaporation and surface temperature is reasonable.

4. Since PPA's dataset contains the ID of each crop producer, their opinion on the functionality and necessity of the canals seems like a must.
5. Integration of data on crops' water need per growing period seems also like must. (base from UN FAO).
6. Identification anonymized data on historical volume of produced crops in the area and their general market value.

3. Use case #3: **Dynamic changes of landscape identification**

3.1. Description of the process of solution

The use case is devoted to a comprehensive evaluation of temporal spatial changes in a selected part of the landscape (small fragmented fields with bounds, the influence of an anthropogenic element (small hydroelectric power plant) and post-flood changes) based on spatial analyzes from the various aspects:

- Corine Land Cover
- Topography / morphometry (with derivated analyses of surface flow)
- Normalised Vegetation Index
- Climatological data
- Boundary flow inundation
- Soil types
- Land Parcel Identification System
- Boundaries of declared cultivated land
- Land parcel information system
- Types of land

We assume that the landscape is exposed to pressure/ changes, whether caused by human activity or the stress of climate change itself, manifested in the distribution and intensity of precipitation during the year. The power of the changes is based on both the interactions mentioned by the pressure and the natural resilience or, conversely, the vulnerability of the environmental system. Learning about the processes enables us to reduce their negative impacts or eliminate them through appropriate measures, whether through land-use regimes or technological interventions. The available data considerably limited previous research in this area; it was possible to know the situation from the past only in the case of the previous study or based on comparing the territory with another territory.

The existence and availability of data from remote sensing of the Earth, even historical data from a sufficient time lag to the present, together with the assessment of the vulnerability / resilience of the territory allow us not only to assume but also to verify the existence of processes in the landscape.

We created a methodology and subsequently verified it in the model study area as part of the use case.

As part of the use case, we created a methodology and subsequently verified it in the model area.

3.1.1. Vulnerability / Resilience analysis of landscape

Since we focused on the impact of surface runoff and its dynamic changes, we evaluated the study area primarily in terms of its intensity. To determine the nature of surface runoff, we performed a morphometric analysis of relief focusing on horizontal and vertical curvature, which characterize the acceleration or deceleration of surface processes and their character - concentration or dispersion of the flow itself. We then combined these characteristics with a multicriteria analysis with a slope that affects the processes' intensity. The resulting map identifies areas susceptible to change due to the increase in surface runoff intensity only from the point of view of morphometry.

To increase the accuracy of susceptibility identification, we developed a map of the main soil units from BPEJ data, but the area is characterized by more or less homogeneous medium to heavy soils, so we did not further define the vulnerability map. Methodologically, however, it is necessary to include this factor in the susceptibility.

3.1.2. The analysis of time series changes of the landscape structure

The analysis of time series changes of the landscape structure and its qualitative changes was performed based on a comparison of available satellite images. Due to the construction of a hydropower plant, we started comparing it with its structure. Since Sentinel satellites were not yet in operation in 1998, we used Landsat 4 data downloaded from the USGS Earth Explorer. Despite the more minor differences in the scanned bands, the NDVI values were determined by the same algorithm. In addition to NDVI, we compared areas defined by the Corine Landcover methodology to determine the dynamics between 1990/2000/2006/2012/2018.

For each year, the NDVIs themselves were evaluated, and their values were compared.

In addition to satellite data, we used available data on the Land Parcel Identification System (from the LPIS system) and the polygons themselves from the declarations of payment applications under the Common Agricultural Policy (Boundaries of declared cultivated land). We compared data from 2017 when creating boundaries of declared cultivated land was already mandatory for farmers. Comparing the individual reported soils also pointed out the dynamics in agricultural land use.

3.2. Data & Equipment list

In the methodological workflow, emphasis is placed on the processing of selected types of source data from the following categories:

- open data

- satellite data
- INSPIRE dataset
- geodatabase data model from ground survey

Usable datasets with respect to their time series:

- CLC (time series 1990/2000/2006/2018)
- LPIS (Official SK dataset on identifying agricultural land, time series 2021)
- Remote Sensing data (Sentinel 2; time series 2016-2021, Landsat 5; 1998,2011,2013, NearInfraRed; time series 2016-2021)
- OLU
- Soil map (time series 2019)
- Digital elevation model
- History & Climatological data
- Other registries and geodatabases

Other description of data sources

Table 1 List of used data

Name	Time series	Provider	Format
Copernicus data	2017/2021 TBC NDVI / NDMI	European Space Agency	JPEG 2000
Landsat data	1998,2011,2013	U.S. Geological Survey	TIFF
History & Climate Data	1998/2021	MeteoBlue API	csv /xls
Water basin areas	2010	Slovak water management enterprise	wms/shp
DMR 3.5	2000	Geodesy, Cartography, and Cadastre Authority of the Slovak Republic	ESRI Grid / TIFF
Ortoimagery + NIR (NearInfraRed)	2016-2021	Geodesy, Cartography, and Cadastre Authority of the Slovak Republic/NLC	TIFF
LPIS	2021	https://data.gov.sk/en/dataset/system-identifikacie-polnohospodarskych-pozemkov-lpis	shp

Boundaries of declared cultivated land	2017-2020	Geodesy, Cartography, and Cadastre Authority of the Slovak Republic	shp
BPEJ	2019	https://data.gov.sk/dataset/bonitovane-podnoekologicke-jednotky-bpej	shp
Corine Land Cover	1990/2000/2006/2012/2018	https://copernicus.geocloud.sk/corine-download/	shp
Boundary flow inundation	1998/ 2010	Slovak Water Management Enterprise https://mpt.svp.sk/svp_vmapportal/?basemap=orto2021&zoom=7&lat=48.960333&lng=20.783337	TIFF
Spatial visualisation of small hydroelectric power plant	2018	own processing	dwg

3.3. Flood hazard in Study area

The small hydroelectric power plant Žehrica is located in the northern part of the town of Spišské Vlachy on the Margecianka stream of the same name and is bordered on both sides by the right and left parts of the Branisko stream. The construction of today's MVE began in the early 1990s. The study area of this use case is threatened by floods in terms of extraordinary events. The first and at the same time the largest flood was recorded in 1998, with a flow rate of 60 m3 / s. Another flood event was repeated in the summer of 2010, culminating in a flow rate of 27.5 m3 / s. As can be seen in Figure 1, the area of interest is situated in an extra-urban area, with a predominance of agricultural land.

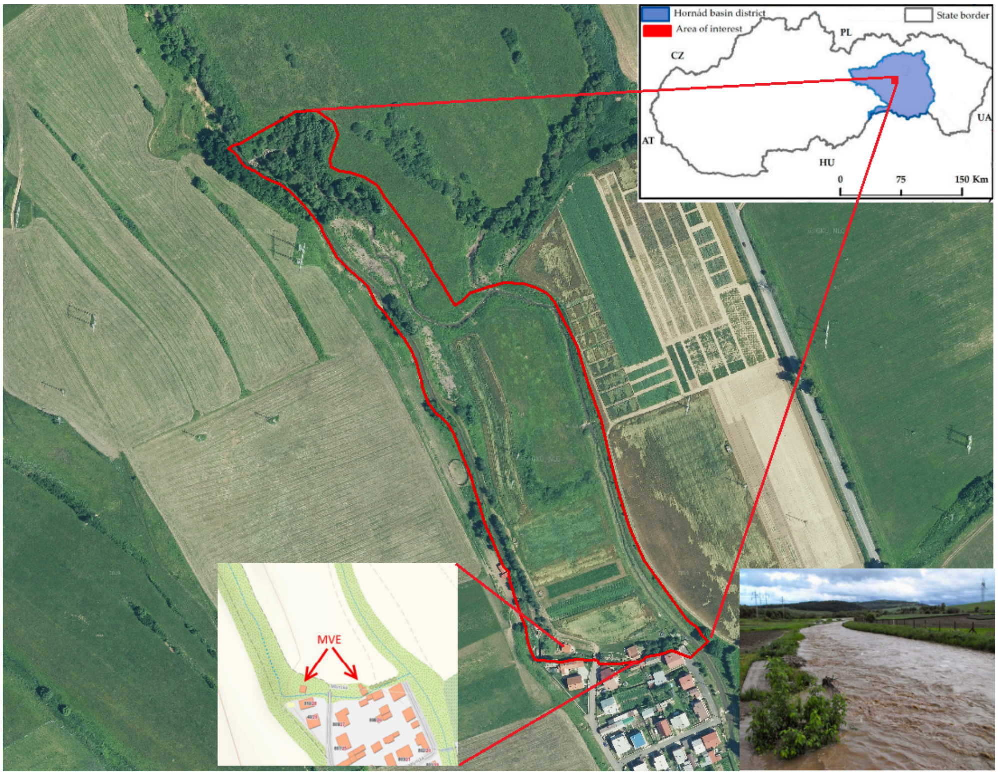
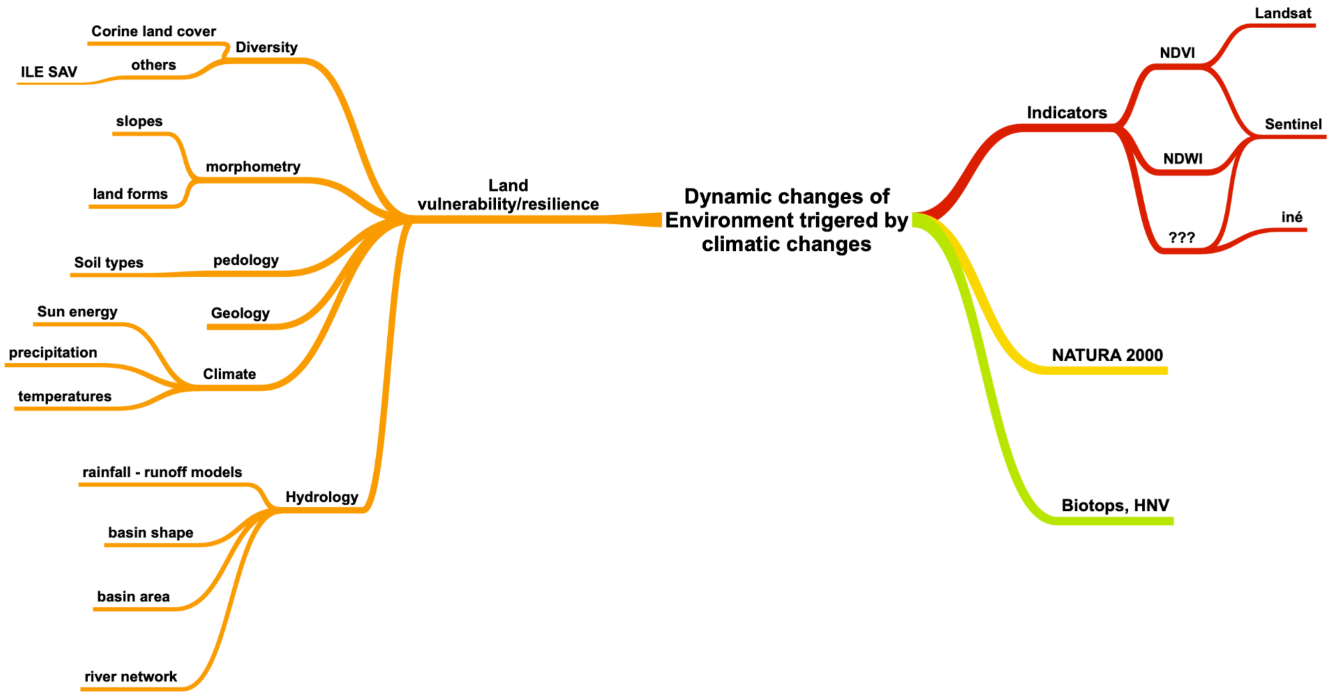


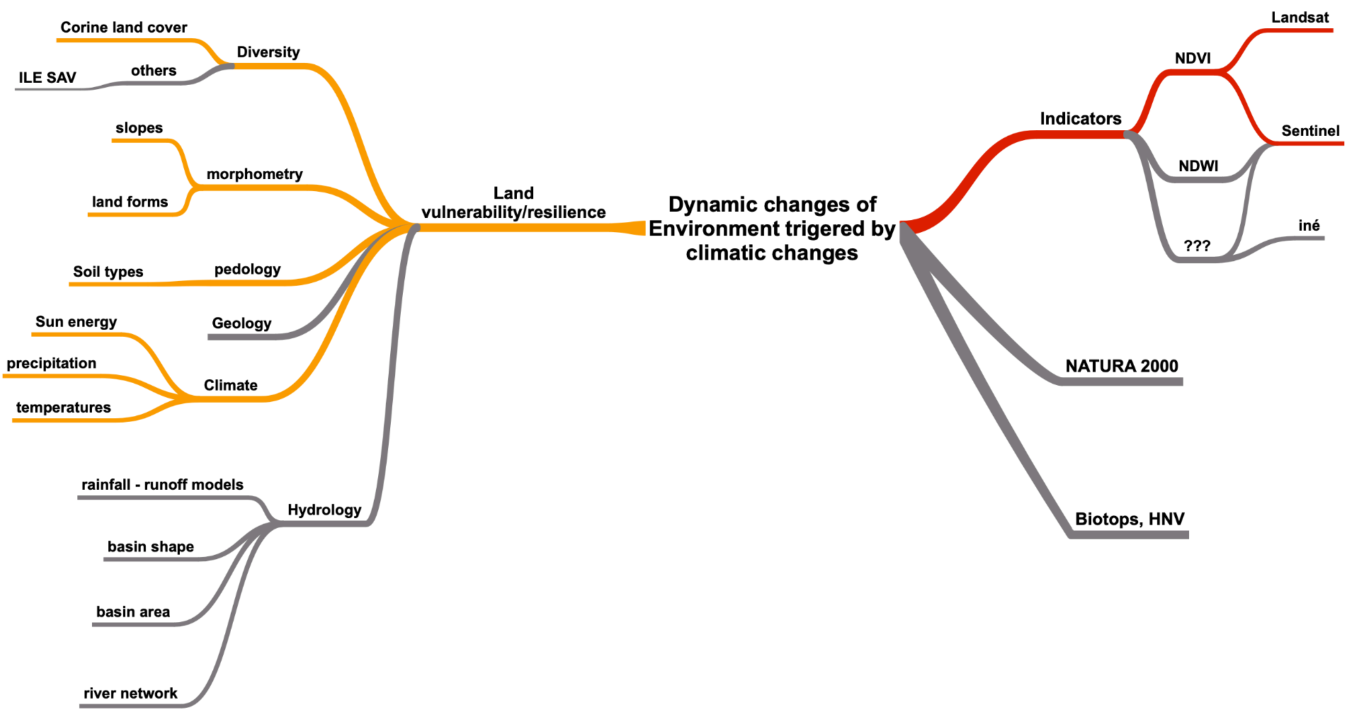
Figure 1 Study area location

3.4. Detailed implementation plan

The complex methodology, partly implemented could be schematized as:



In our use case, we were able to cover (in sheme the red and yellow parts):



But in the future we want to cover the whole methodology and make it applicable for land change identification and most important - forecast, which could be used for taking decisions which could help with sustainable development or at least stabilise the regions.

3.5. Analysis of needs of stakeholder groups

Local farmers already have problems with decreasing production in the area. The farmers could take measures and stabilise the land degradation, or they could simply close farms and leave to better territory. This case will have a big negative impact, the land will not be used any more, and of course in consequence the unemployment will increase. With this negative prognosis, it is clear that there is a big need of getting to know the processes and stabilise them.

3.6. Experimental results - Study area

3.6.1.The analyses of vulnerability / resilience of study area

Several factors define the system's susceptibility to dynamics caused by water activity. Elements of the original landscape structure, such as morphology and soils, are also important. While morphology determines the dynamics of surface runoff and thus its effect on the surface (runoff accumulation, diffuse surface runoff, acceleration or, conversely, deceleration of phenomena), soils react with their vulnerability or resistance to different degrees of degradation processes (physical changes, chemical changes).

3.6.2. Pedology - Soil type characterization

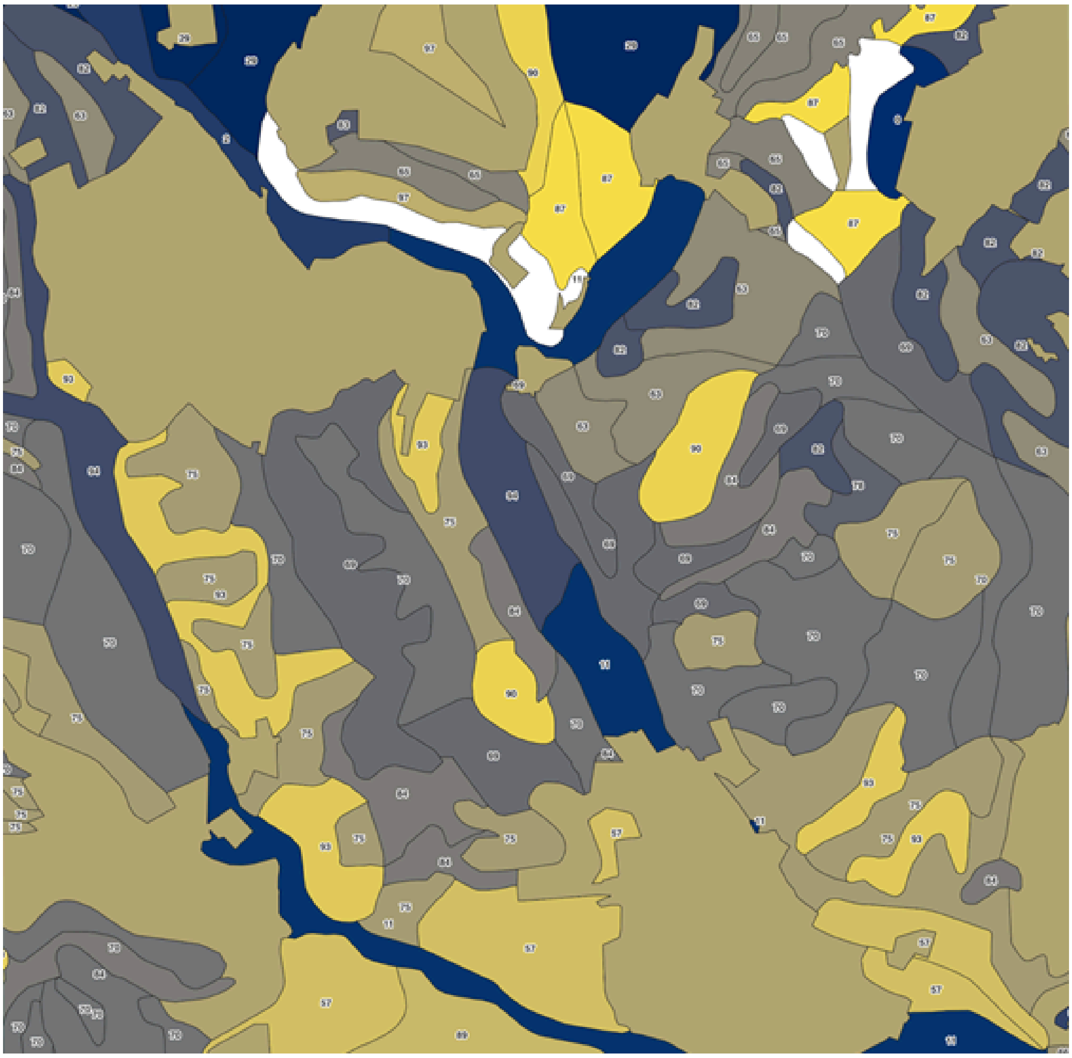


Figure 2 Soil type characterization

Soil type CODE inline with codification in Slovak Republic BPEJ,further description[4].

3.6.3. Topography/DEM analysis

Based on the presented methodology, we focused on monitoring changes in the following groups of morphological characteristics.

4 https://www.researchgate.net/figure/Characteristics-of-the-main-soil-unit-classes-MSU-in-the-study-area_tbl1_321818234

Figure 3 Digital elevation model

Flow accumulation:

Figure 4 Presentation of flow accumulation

Slope was calculated and subsequently reclassified into categories:

Slopes define the intensity and type of slope processes caused by gravitational forces. This input is important for assessing the impacts of torrential rains and the stability of the slopes themselves.

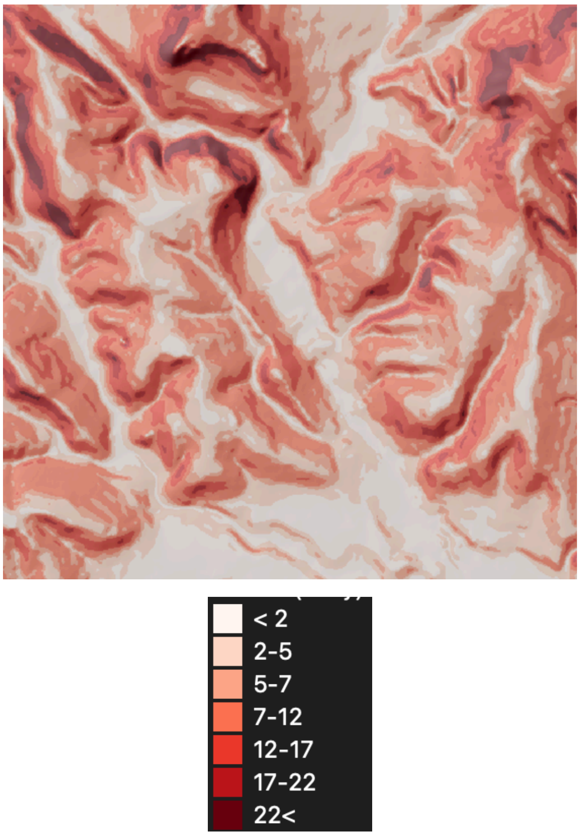


Figure 5 Slope presentation

Curvature - combination of Profile and Horizontal Curvature, this parameter specifies the type of surface flow processes. If the water with small particles increases speed, or decreases it, and if the water is cumulated or spread over the surface.

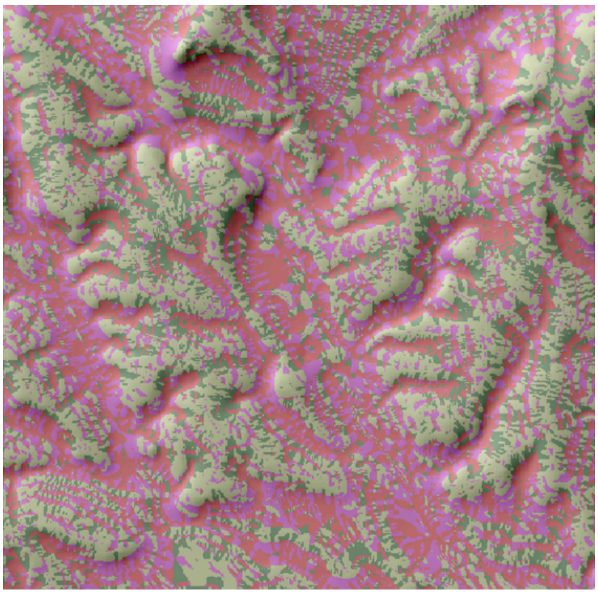


Figure 6 Curvature presentation

Intensity of surface water triggered processes:

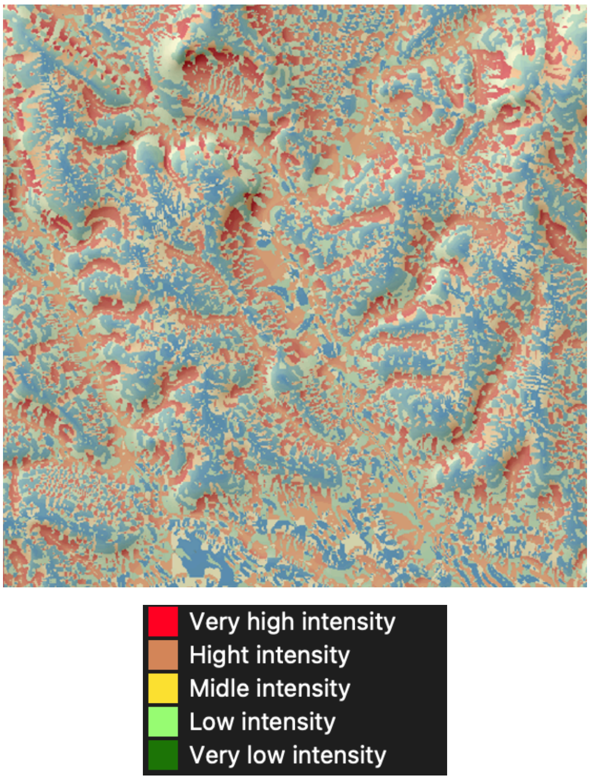
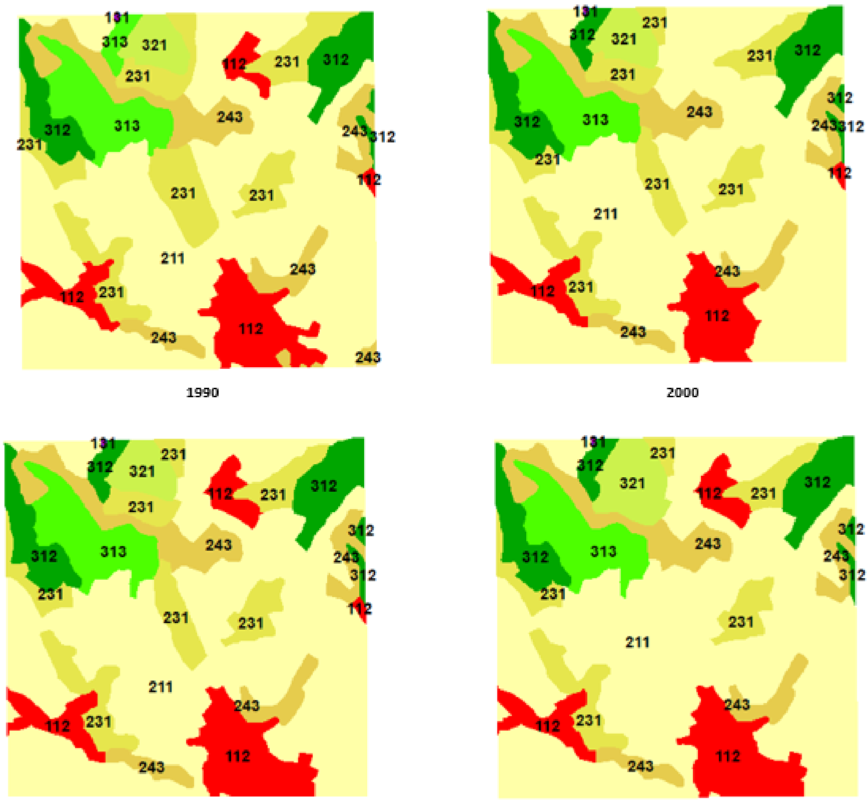
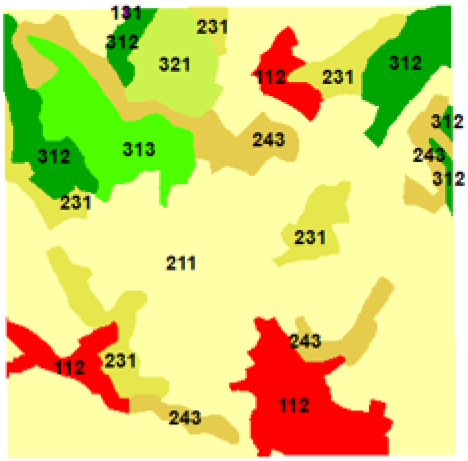


Figure 7 Presentation of surface water triggered processes

3.6.4. The analysis of time series changes of the landscape structure

The trend of spatial change in Corine Land Cover was recorded on two levels: the increase and decrease of areas. The increase was recorded in pastures and natural grass, with significant areas of natural vegetation. Other categories of CLC representation had a declining trend. It was also a cultivated agricultural area. This trend of changes is proportional to the area of the assessed area (5 km x 5 km).





	1990	2000	2006	2012	2018
Discontinuous urban fabric (112)	14.44	11.2	14.73	10.62	10.62
Mineral extraction sites (131)	0.03	0.04	0.02	0.06	0.06
Non-irrigated arable land (211)	1.31	1.42	1.34	1.4	1.4
Pastures (231)	35.03	29.5	29.21	20.6	20.6
Land principally occupied by agriculture, with significant areas of natural vegetation (231)	13.02	11.71	11.33	11.35	11.35
Coniferous forest (312)	22.82	27.35	19.44	19.5	19.5
Mixed forest (313)	3.54	1.41	1.46	1.46	1.46
Natural grasslands (321)	5.66	5.66	5.78	9.32	9.32

Figure 8 Corine land cover changes (1990, 2000,2006,2012, 2018)

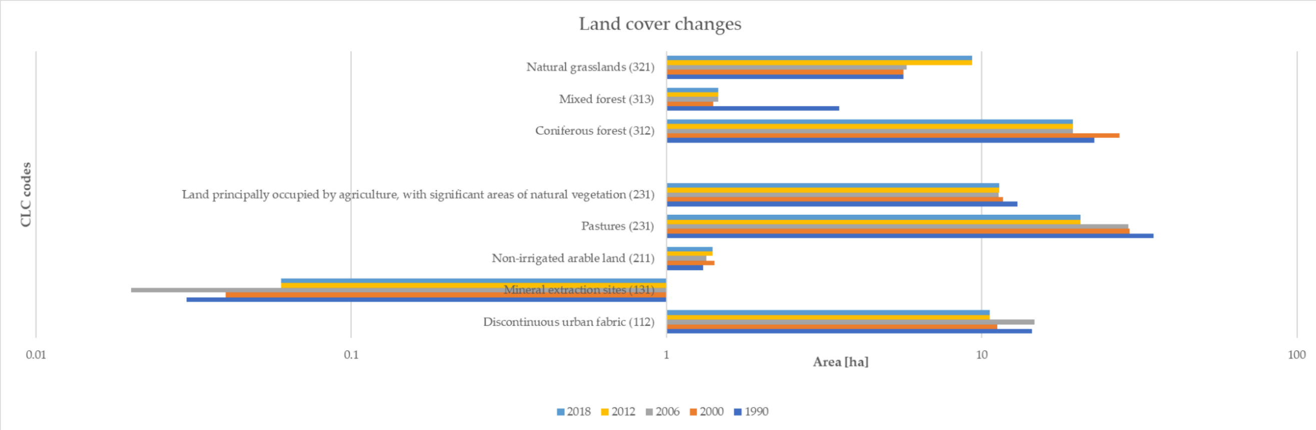
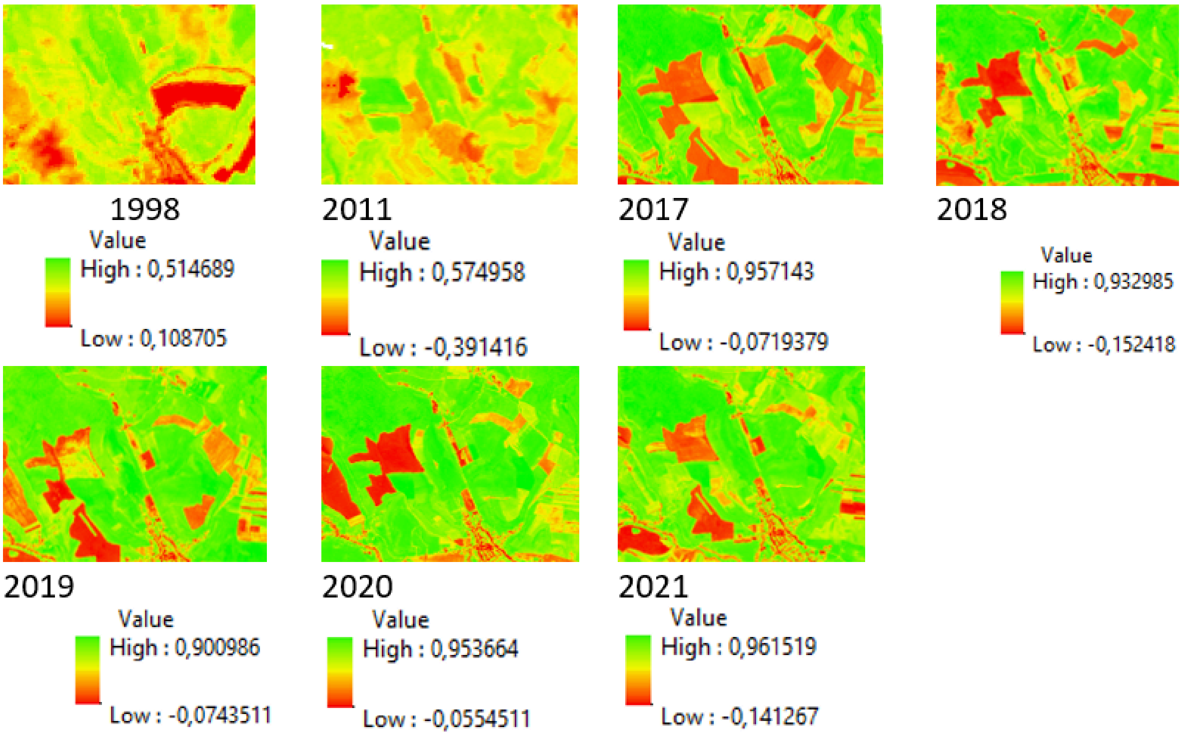


Figure 9 Graphical presentation of the area representation of individual CLC levels and their development of time series changes

NDVI analysis in time series:



Legend of NDVI index

<0.1	Bare soil
0.1 – 0.2	Almost absent canopy cover
0.2 – 0.3	Very low canopy cover
0.3 – 0.4	Low canopy cover, low vigor or very low canopy cover, high vigor
0.4 – 0.5	Mid-low canopy cover, low vigor or low canopy cover, high vigor
0.5 – 0.6	Average canopy cover, low vigor or mid-low canopy cover, high vigor

Figure 10 Graphical presentation of NDVI index - the density-sliced NDVI images for time series 1998, 2011, 2017, 2018,, 2019,2020, 2021

Statistical evaluation - comparison of NDVI values of the country is as follows:

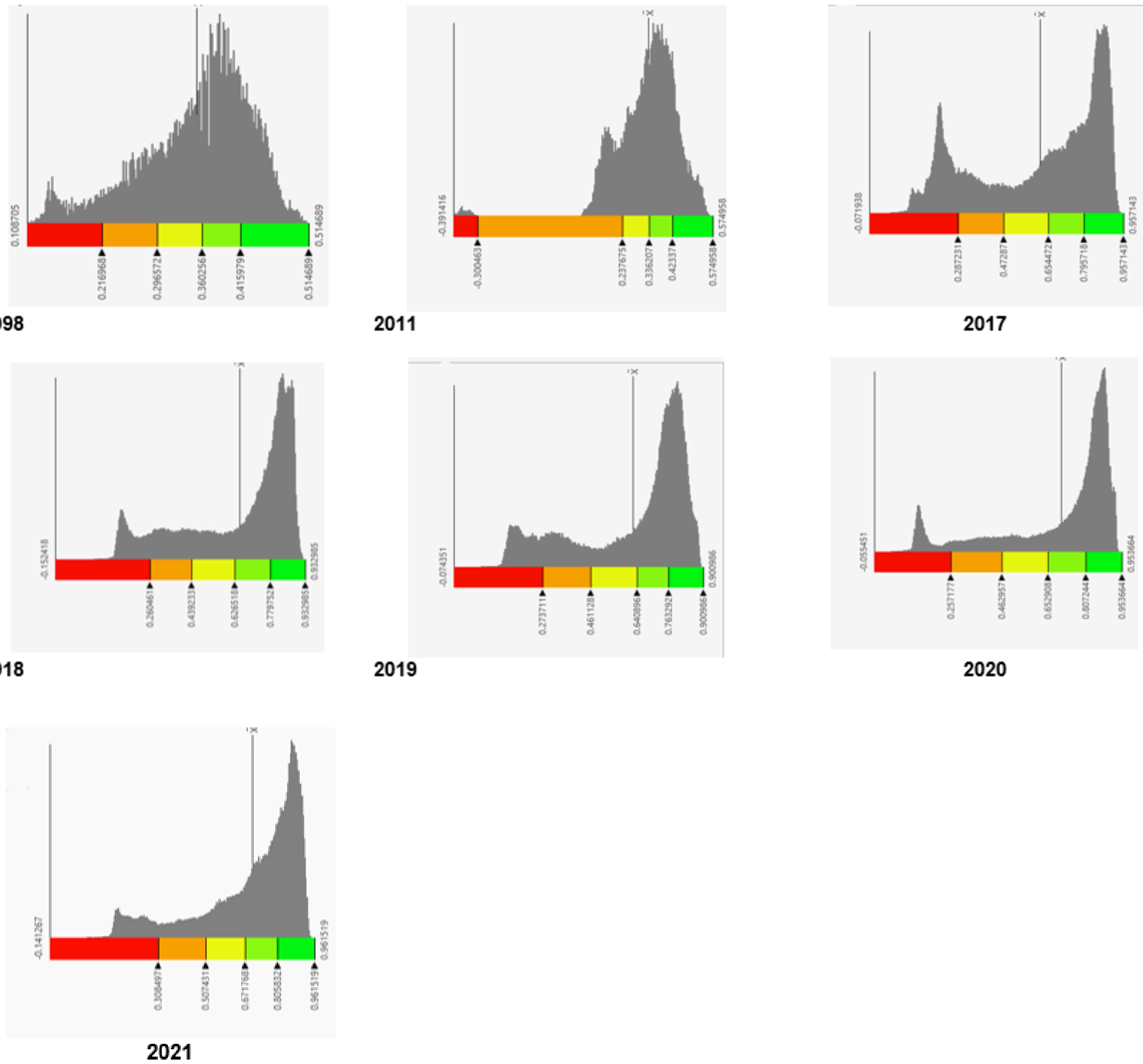


Figure 11 Histograms of NDVI values for time series 1998, 2011, 2017, 2018, 2019,2020, 2021

We will continue our research, adding for years to come. When comparing the NDVI index in the whole territory, there is a noticeable shift in the dynamics of vegetation development (summer period), while the changes occurred during the decade 2010-2020. The most debatable year is 2011, when the representation of healthy vegetation is most visible, which can also identify a reduction in the production potential of agricultural land.

FINDINGS & CONCLUSION

This challenge helped to put together a wide range of various experts, who met for the first time and were able to identify, access, analyse, process and publish information and knowledge related to the target topic of the challenge.
Although the scope was shaped guide widely, results of each identified use case confirmed benefits and new challenges.
First use case focused on data access and utilisation helped to define and set up the data scene with new interesting and promising data sources, but also revealed significant gaps in data availability and quality. In connection to the data and service sharing and presentation layer, AgriHub innovation platform proved to be a promising tool helping to simplify the way how to present and promote data, whilst some specific implementation details are still subject for improvement. Further activities might be focused on additional data investigation and publishing, whilst activities on testing and extension of the AgriHub innovation platform.
In the second use case, the water course network's (including canals) spatial representation's disunity has been identified, both in complexity and extent of information. Alongside the future improvements. The different extent of data at providers should be also addressed in the future.
For the last third use case the initial assumptions that a country under pressure, whether caused by human activity or the pressure of climate change itself, manifested in the distribution and intensity of precipitation during the year, change after a pilot assessment of a small area are confirmed. It will still need to be verified in another territory and with complete datasets. However, the preliminary results also show that the direction set by the authors is correct. In the next hackathon, the issue will address a more detailed analysis of historical data with an emphasis on climatological data in the agriculture sector and crop yields model.

Knowing the dynamics of land change, its use with the help of available data, especially those obtained from satellite data, is an invaluable basis for holistic governance, which is the only response to climate change and other pressures on the territorial ecosystem.