



EO CLINIC || EOC 0018 - ESTIMATING IRRIGATION POTENTIAL IN ROMANIA

FINAL PRESENTATION



- 1. EO Clinic EOC0018 – Introduction, Background, Aim and subordinated objectives of the service**
- 2. EO Clinic EOC0018 – Areas of interest**
- 3. EO Clinic EOC0018 - Methodology, schedule and tasks**
- 4. EO Clinic EOC0018 – Deliverables / Final results**
 - Mapping of Irrigated Areas**
 - Quantification of Irrigation Suitability**
- 5. Follow-up activities**
 - Mapping of Irrigated Areas**
 - Quantification of Irrigation Suitability**
- 6. AOB**



Proposal to support:

Estimating Irrigation Potential in Romania

Technical and Management Part

Support requested by:
World Bank Group (WBG)

WHO IS INVOLVED

Funded by

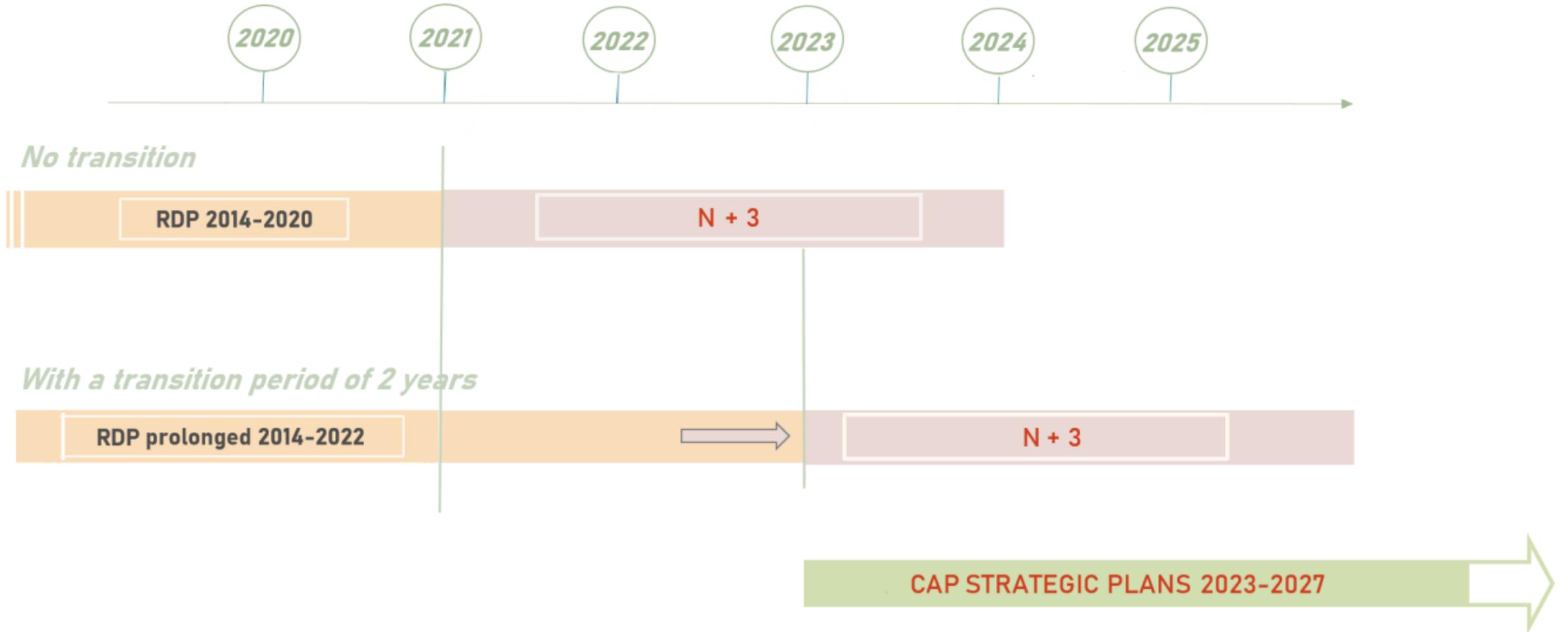


Framework coordination



Technical team





CAP & the irrigation problem in Romania. Timeline for the development of CAP Strategic Plans, established by Regulation (EU) 2020/2220



AIM OF THE SERVICE:

- Mapping and estimating the potential and suitability of selected areas of interest for the implementation of irrigation projects.

SUBORDINATED OBJECTIVES:

- O1: To identify and map the latest status regarding irrigated crops within the selected areas of interest;
- O2: To identify the critical / most vulnerable areas in terms of water demand / irrigation needs;
- O3: To derive a set of indicators / decision markers related to vulnerability in relationship to climate change factors versus irrigation potential and integrate them into a multi-criteria assessment analysis;
- O4: To establish the areas characterized by the highest potential/suitability for the implementation of improved solutions for water storage and irrigation.



Area of interest (AOI)	Area (sqkm)	Major relief units
1.Brăila county	4766	Romanian Plain
2. Prut - Bârlad	3031	Romanian Plain / Bârlad Plateau
3. Arad - Timiș	6498	Western Plain

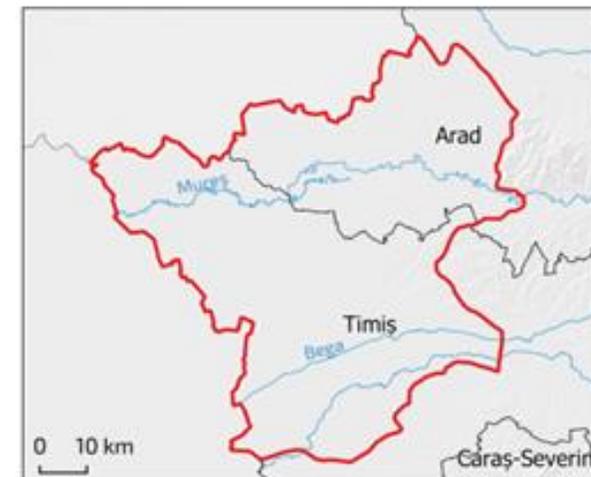
1. AOI Brăila county



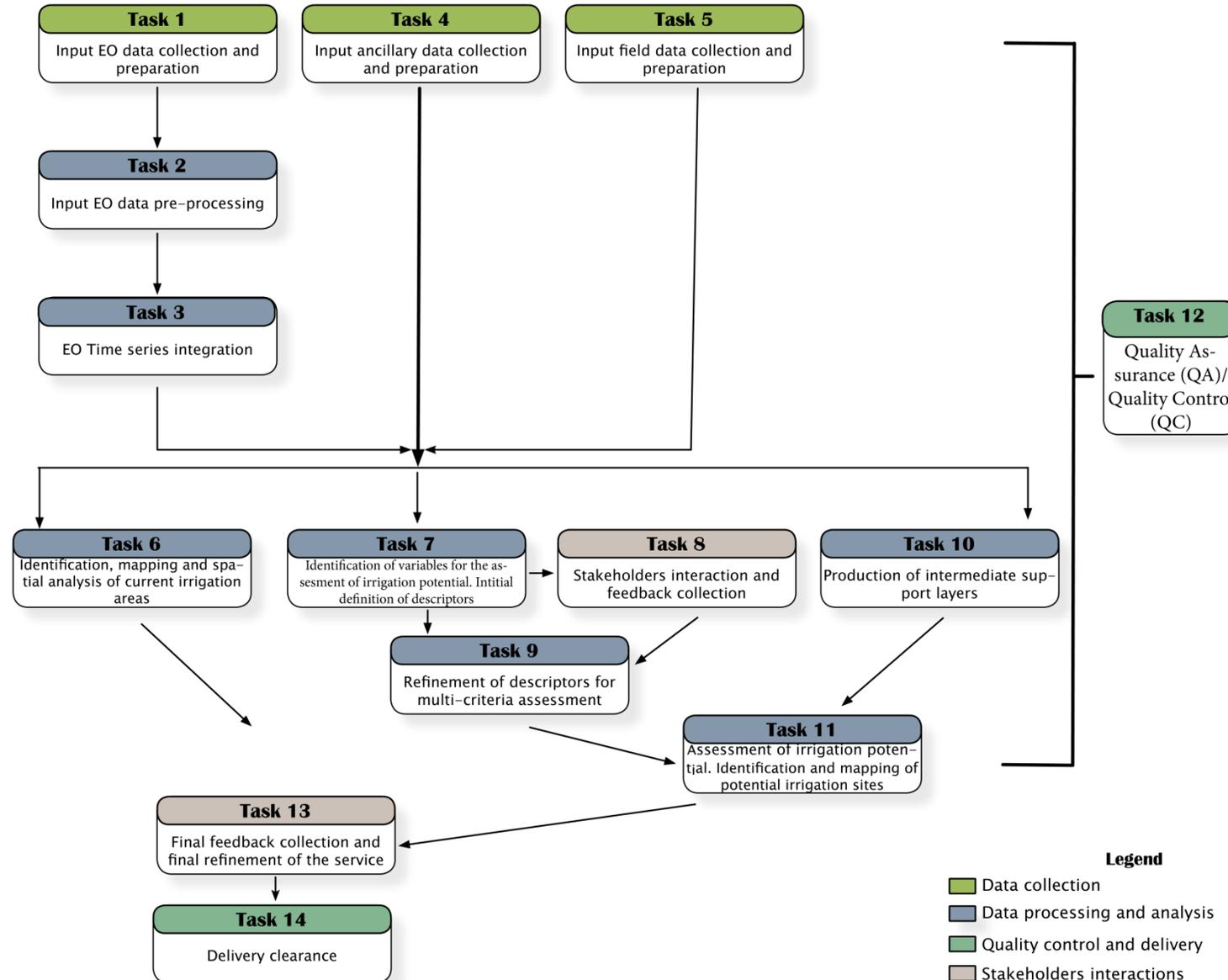
2. AOI Prut - Bârlad



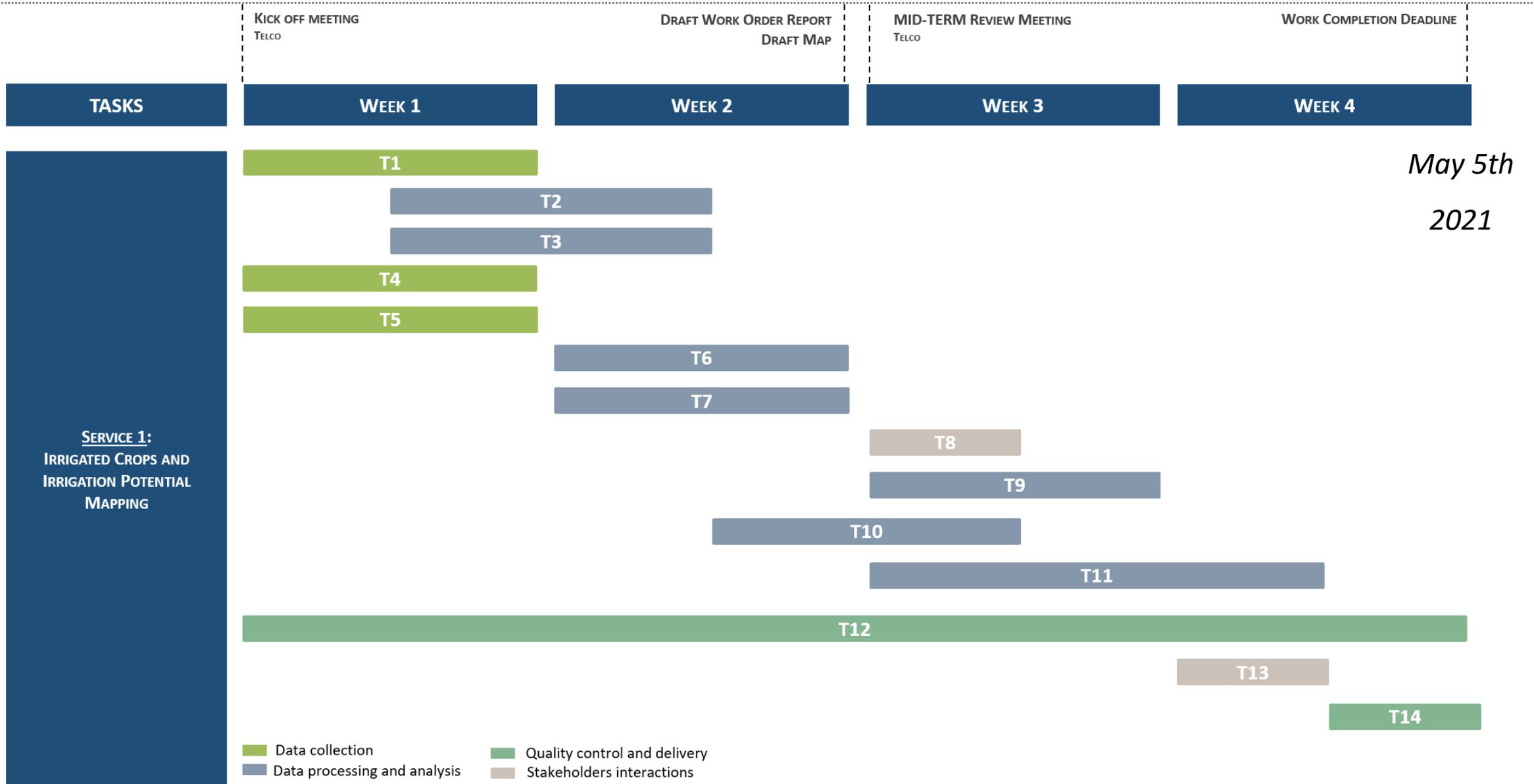
3. AOI Arad - Timiș



EO CLINIC || PROPOSED METHODOLOGY & TASKS



EO CLINIC || PROPOSED SCHEDULE & TASKS





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👤 auxiliary_QGIS_styles_qml

👤 AOI1_Braila_County

👤 AOI3_Arad-Timis

👤 AOI2_Prut-Barlad

Fișiere



📄 List_of_products



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EO Clinic project:
Estimating Irrigation Potential in Romania
Work Order Report
Screenshot extracted from:

📄 EOC0018_WOR_final.pdf

EO Clinic project:

Estimating Irrigation Potential in Romania

Work Order Report

Support requested by:
World Bank Group (WBG)

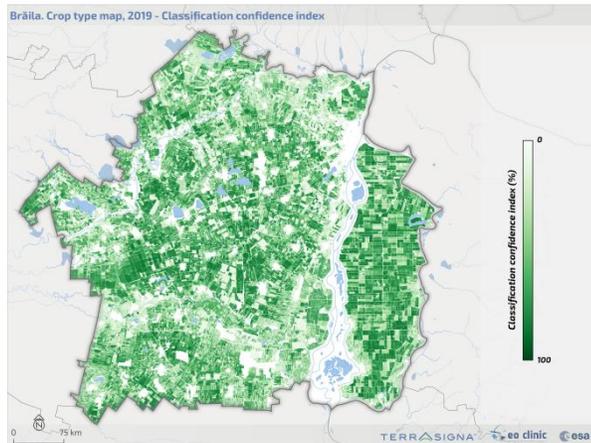
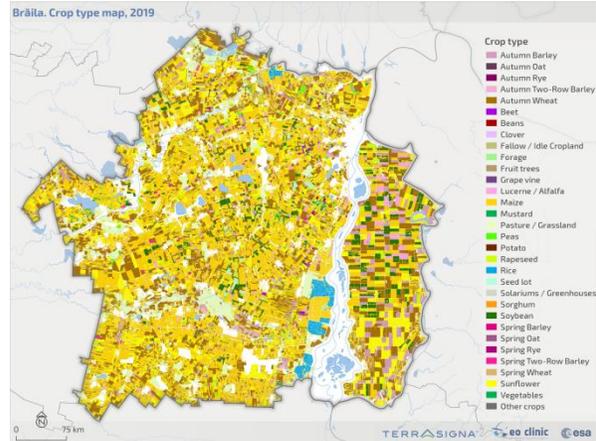




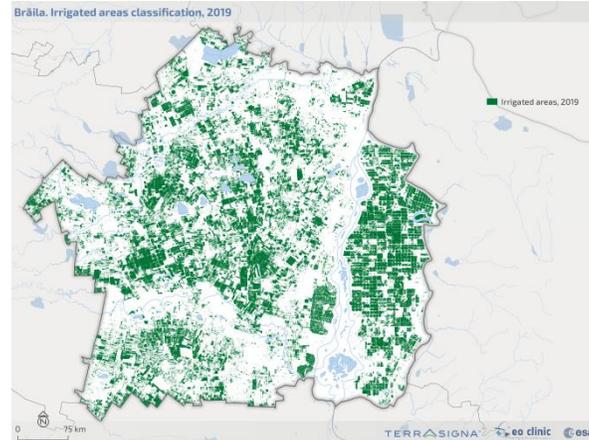
O1: To identify and map the latest status regarding irrigated crops within the selected areas of interest

Product	Count	Resolution	Format	Accuracy
MAPPING OF IRRIGATED AREAS				
Irrigated areas classification (2019)	1	10 m	GeoTIFF / SHP	NA
Crop Type Map (2019)	1	10 m	GeoTIFF / SHP	>90%
Confidence Index – Crop Type Map	1	10 m	GeoTIFF	-
Relevant Statistics	1	-	Table (XLS / CSV)	-
Metadata file	1	-	XML	-

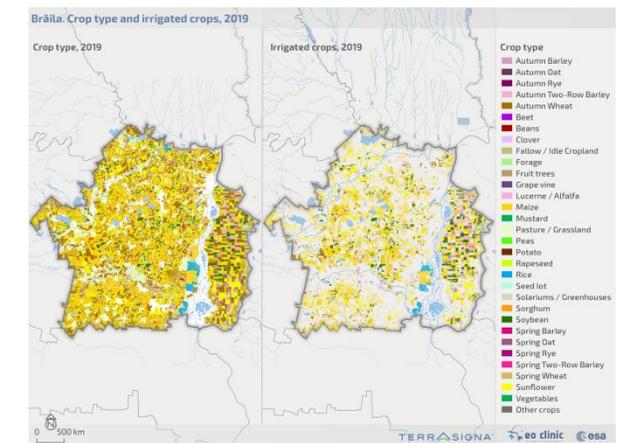
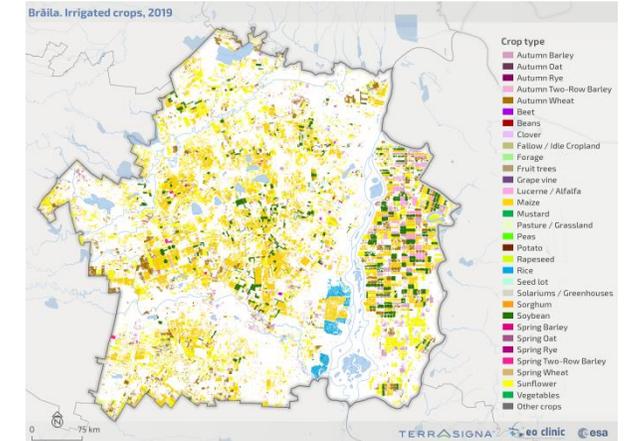
Crop type map (2019), Classification confidence index, Relevant statistics



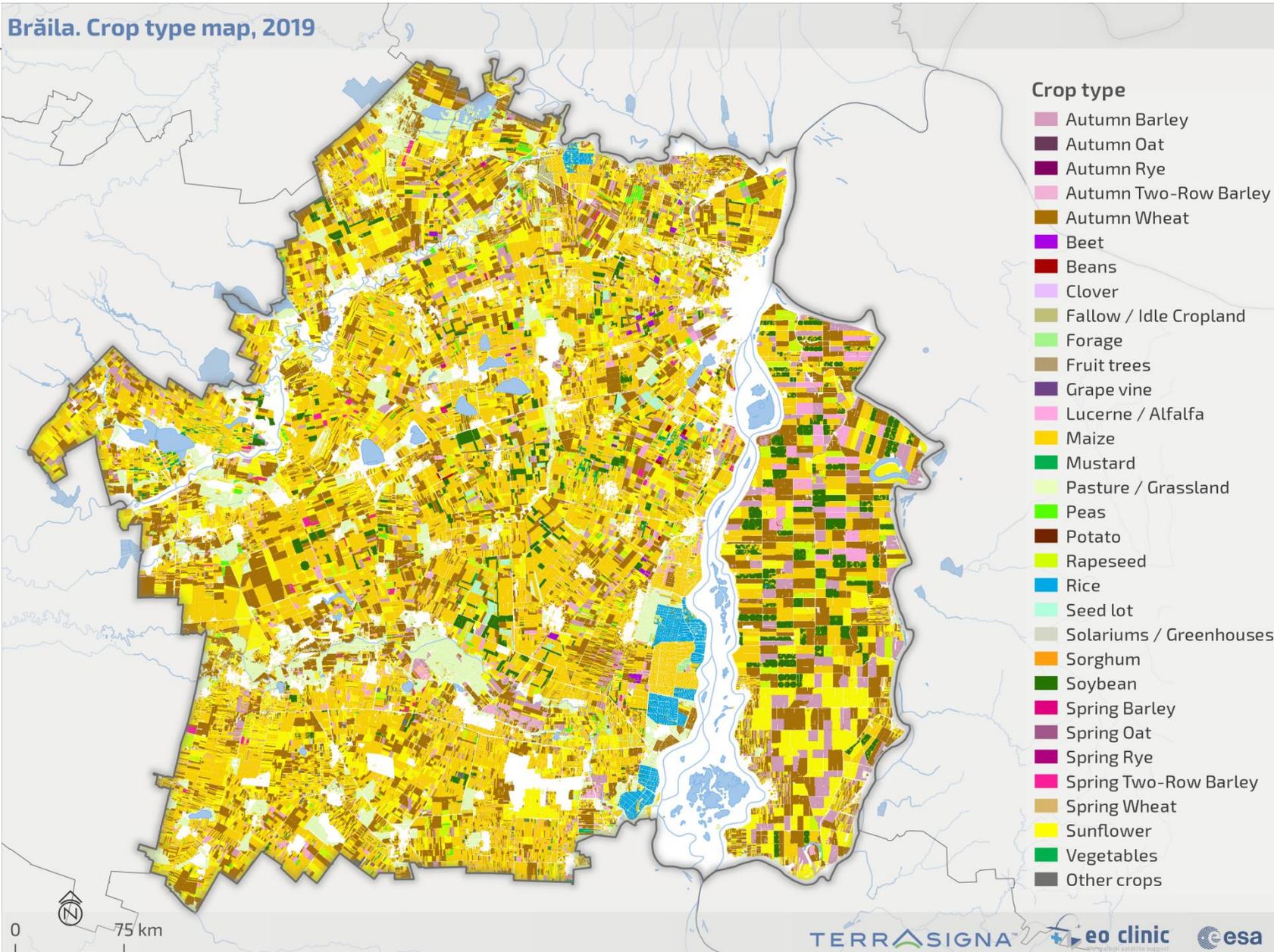
Irrigated areas classification (2019)



Irrigated crops classification (2019), Relevant statistics



EO CLINIC | FINAL RESULTS — MAPPING OF IRRIGATED AREAS

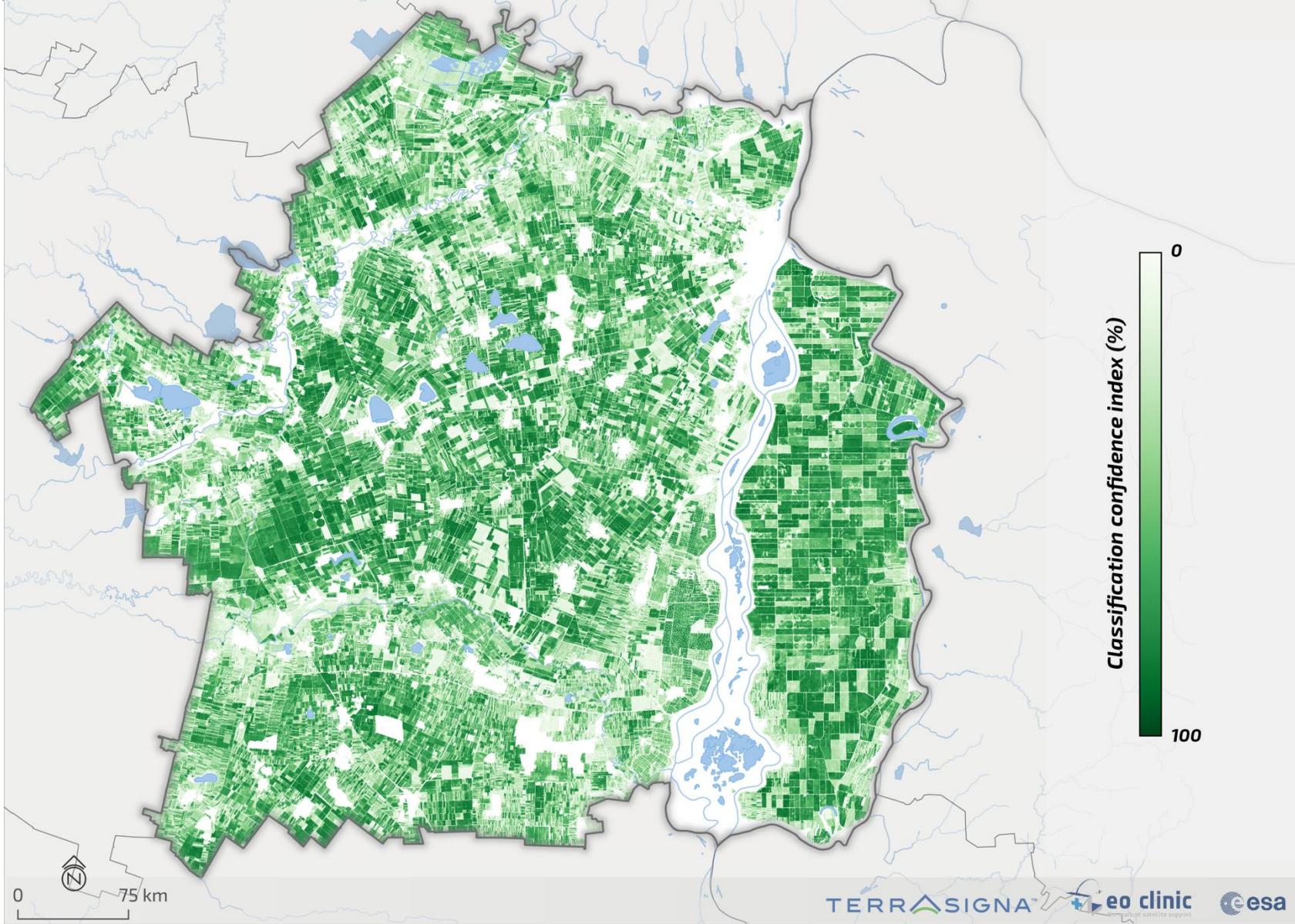


Crop Class	Area (ha)	Percentage (%)
Autumn Barley	18129.09	4.79
Autumn Oat	75.3	0.02
Autumn Rye	3.88	0.00
Autumn Two-Row Barley	1622.34	0.43
Autumn Wheat	81928.53	21.65
Beans	233.24	0.06
Beet	556.5	0.15
Clover	2.47	0.00
Fallow / Idle Cropland	412.62	0.11
Forage	641.14	0.17
Fruit trees	129.49	0.03
Grape vine	53.99	0.01
Lucerne / Alfalfa	11569.97	3.06
Maize	135066.78	35.69
Mustard	54.09	0.01
Pasture / Grassland	27908.91	7.37
Peas	2782.03	0.74
Potato	69.44	0.02
Rapeseed	5619.17	1.48
Rice	3586.72	0.95
Seed lot	1758.88	0.46
Solariums / Greenhouses	8.02	0.00
Sorghum	2.45	0.00
Soybean	14568.1	3.85
Spring Barley	171.66	0.05
Spring Oat	203.69	0.05
Spring Rye	0.36	0.00
Spring Two-Row Barley	1184.23	0.31
Spring Wheat	90.82	0.02
Sunflower	67608.37	17.86
Vegetables	1211.34	0.32
Other crops	1195.77	0.32
Total	378449.39 ha	

EO CLINIC | FINAL RESULTS — MAPPING OF IRRIGATED AREAS



Brăila. Crop type map, 2019 - Classification confidence index



Classification confidence index (%)

0

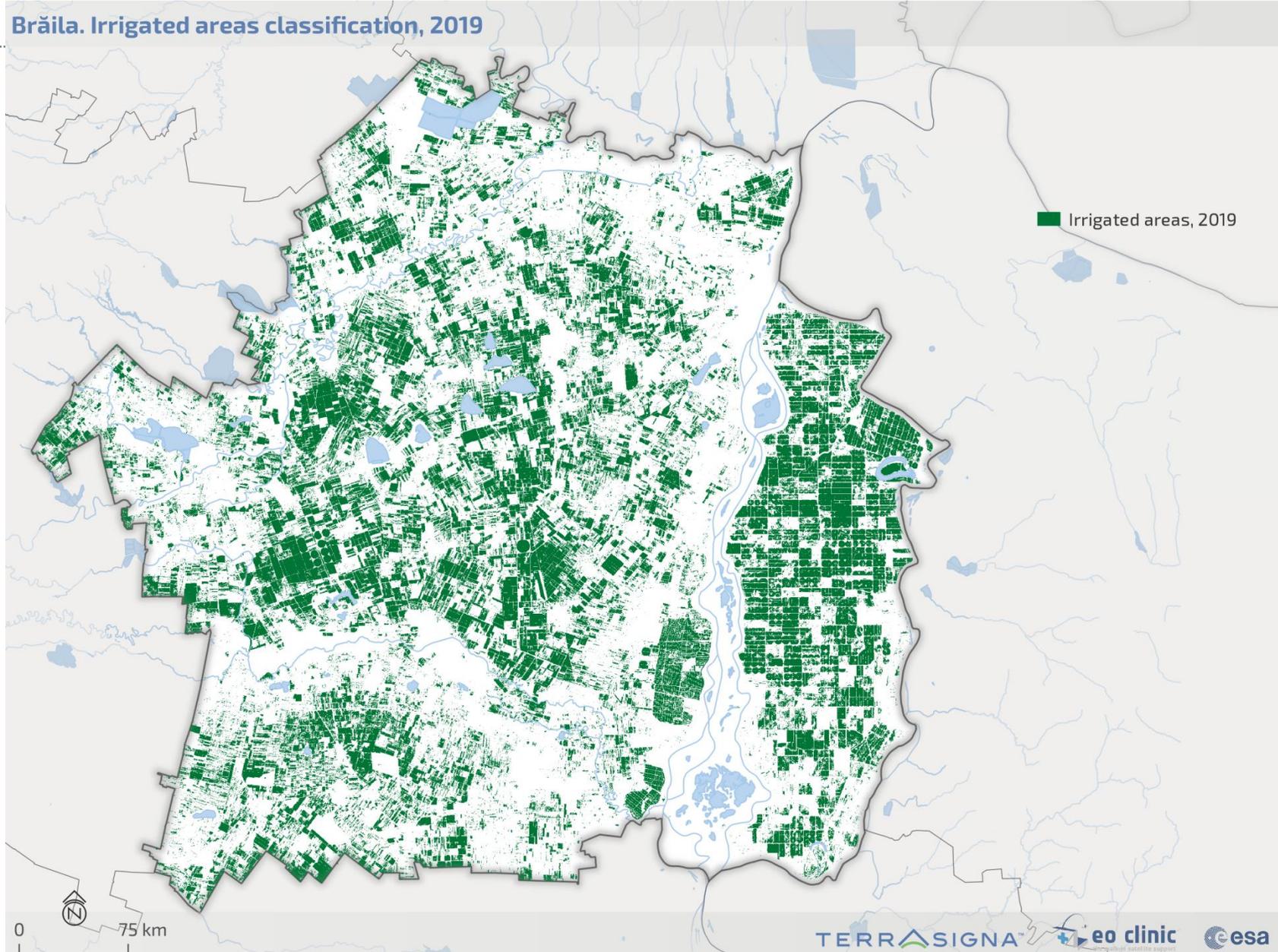
100

0 75 km

EO CLINIC | FINAL RESULTS — MAPPING OF IRRIGATED AREAS



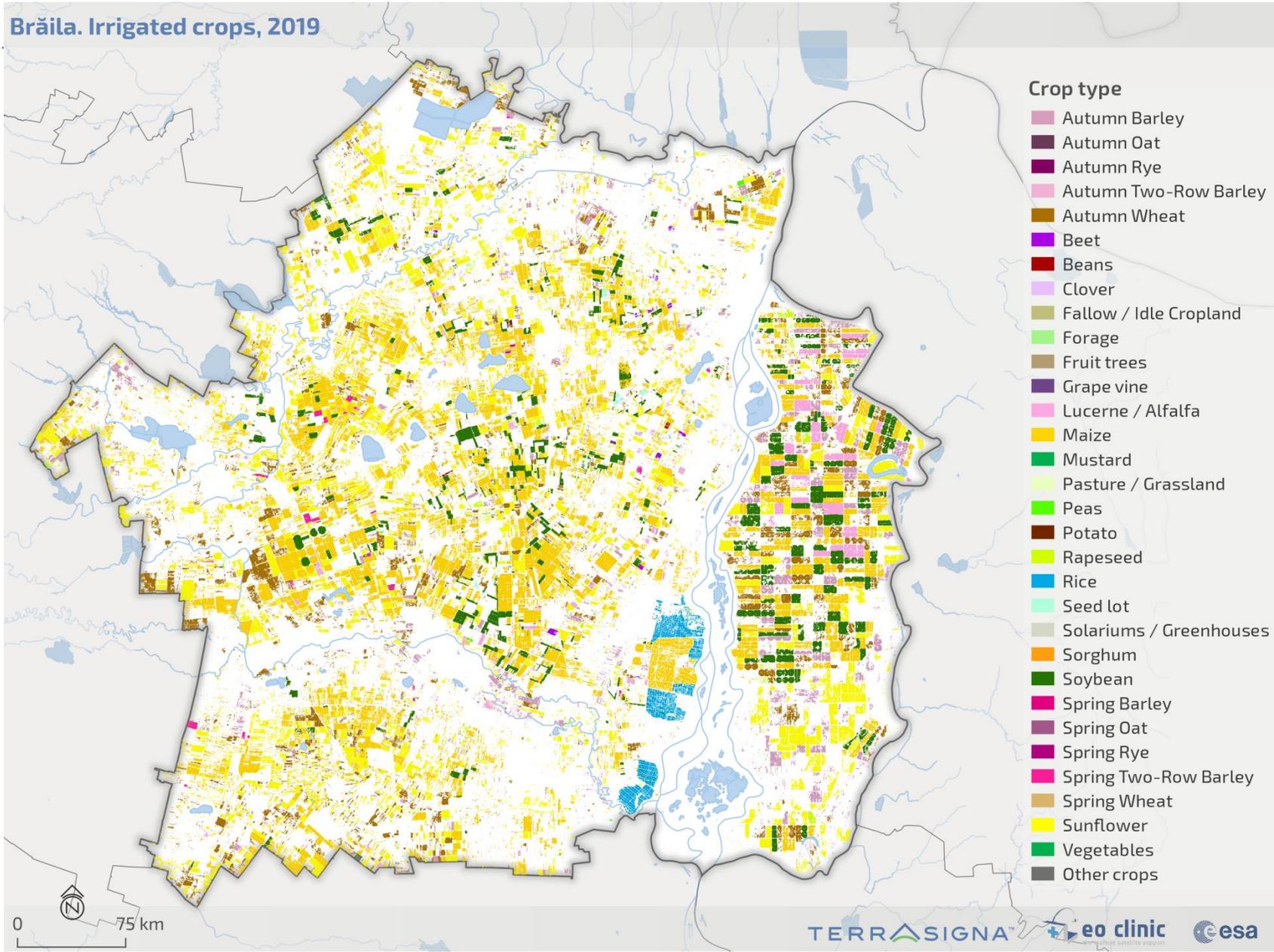
Brăila. Irrigated areas classification, 2019



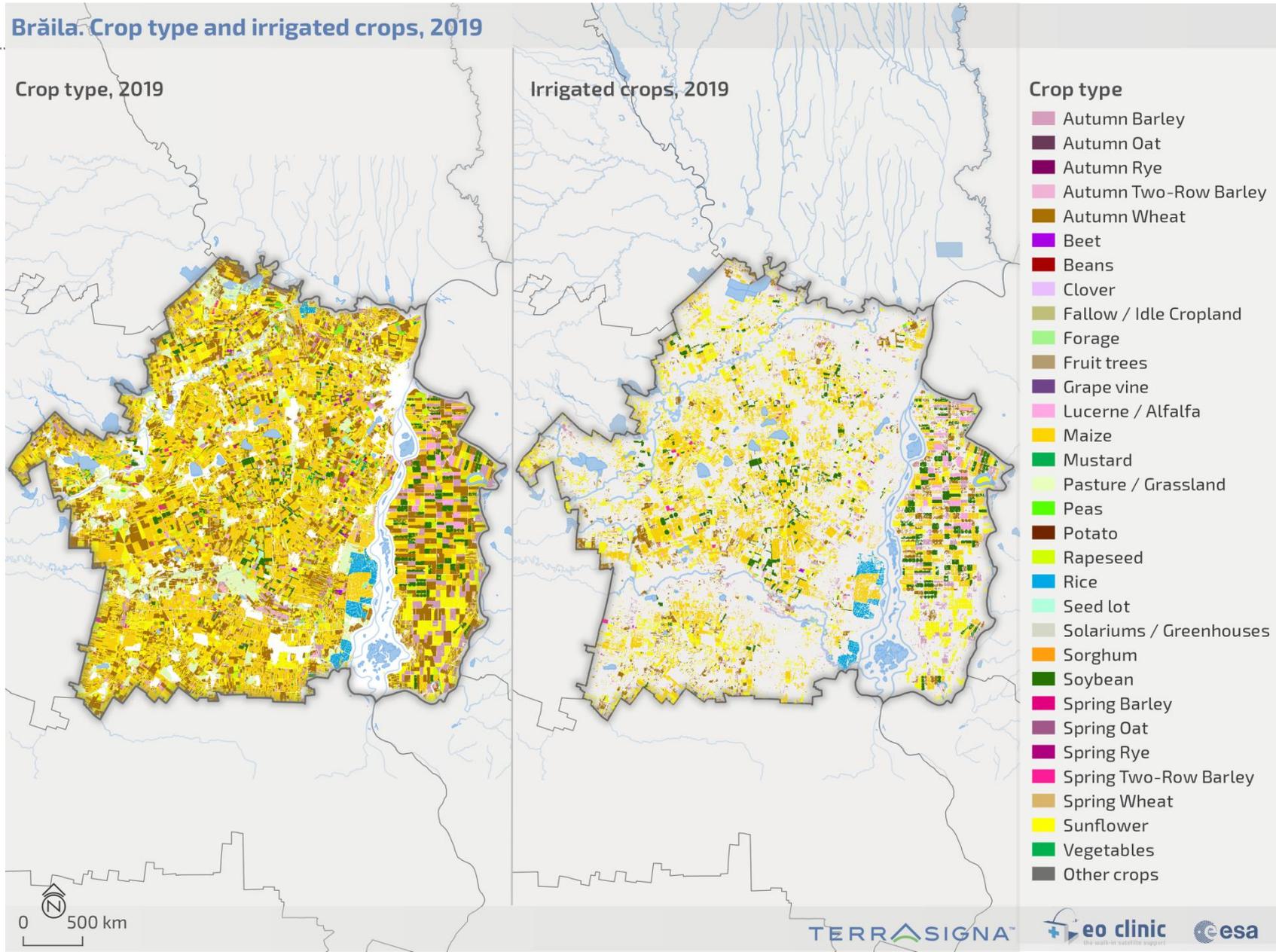
EO CLINIC | FINAL RESULTS — MAPPING OF IRRIGATED AREAS



Brăila. Irrigated crops, 2019



EO CLINIC | FINAL RESULTS — MAPPING OF IRRIGATED AREAS



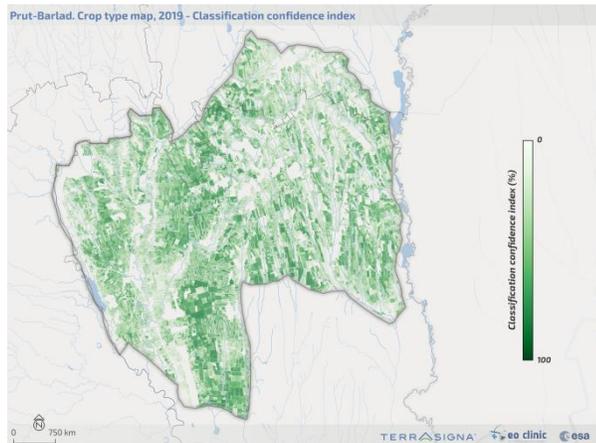
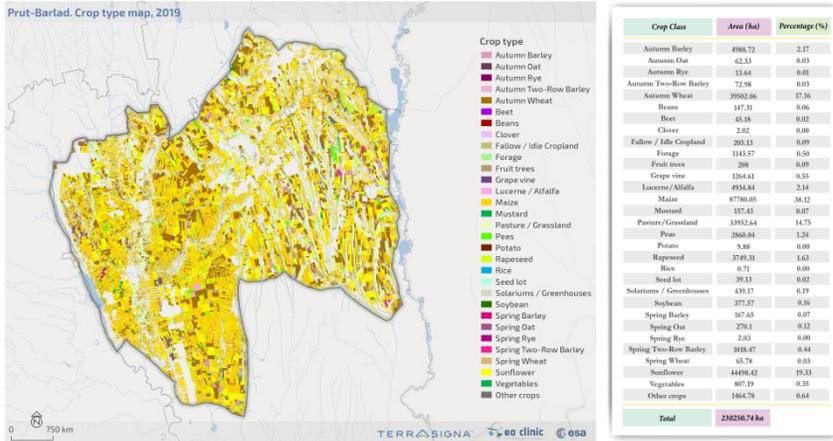


EO CLINIC | FINAL RESULTS – MAPPING OF IRRIGATED AREAS

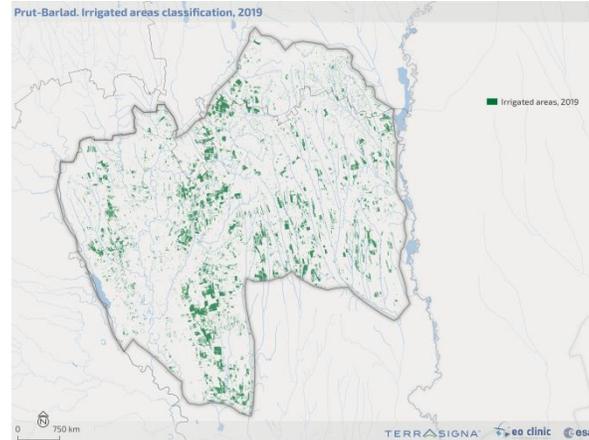
Crop Class	Total surface covered (ha)	Percentage of AOI's agricultural land (%)	Irrigated surface (ha)	Percentage of irrigated surface within the crop class (%)	Percentage of total irrigated crops (%)
Autumn Barley	18129.09	4.79	6808.06	37.55	5.06
Autumn Oat	75.3	0.02	7.5	9.96	0.01
Autumn Rye	3.88	0.00	0.44	11.34	0.00
Autumn Two-Row Barley	1622.34	0.43	616.14	37.98	0.46
Autumn Wheat	81928.53	21.65	15344.67	18.73	11.40
Beans	233.24	0.06	56.31	24.14	0.04
Beet	556.5	0.15	231.39	41.58	0.17
Clover	2.47	0.00	0.1	4.05	0.00
Fallow / Idle Cropland	412.62	0.11	10.16	2.46	0.01
Forage	641.14	0.17	16.18	2.52	0.01
Fruit trees	129.49	0.03	0.09	0.07	0.00
Grape vine	53.99	0.01	0.16	0.30	0.00
Lucerne/Alfalfa	11569.97	3.06	3863.63	33.39	2.87
Maize	135066.78	35.69	53926.05	39.93	40.05
Mustard	54.09	0.01	0.27	0.50	0.00
Pasture/Grassland	27908.91	7.37	135.35	0.48	0.10
Peas	2782.03	0.74	296.79	10.67	0.22
Potato	69.44	0.02	38.06	54.81	0.03
Rapeseed	5619.17	1.48	775.3	13.80	0.58
Rice	3586.72	0.95	2420.24	67.48	1.80
Seed lot	1758.88	0.46	219.3	12.47	0.16
Solariums / Greenhouses	8.02	0.00	-	-	-
Sorghum	2.45	0.00	0.02	0.82	0.00
Soybean	14568.1	3.85	13636.39	93.60	10.13
Spring Barley	171.66	0.05	9.22	5.37	0.01
Spring Oat	203.69	0.05	25.38	12.46	0.02
Spring Rye	0.36	0.00	0.1	27.78	0.00
Spring Two-Row Barley	1184.23	0.31	527.29	44.53	0.39
Spring Wheat	90.82	0.02	41.02	45.17	0.03
Sunflower	67608.37	17.86	35519.56	52.54	26.38
Vegetables	1211.34	0.32	58.81	4.85	0.04
Other crops	1195.77	0.32	47.82	4.00	0.04



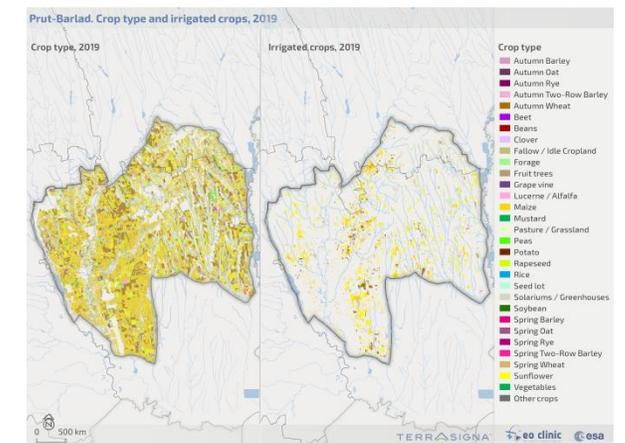
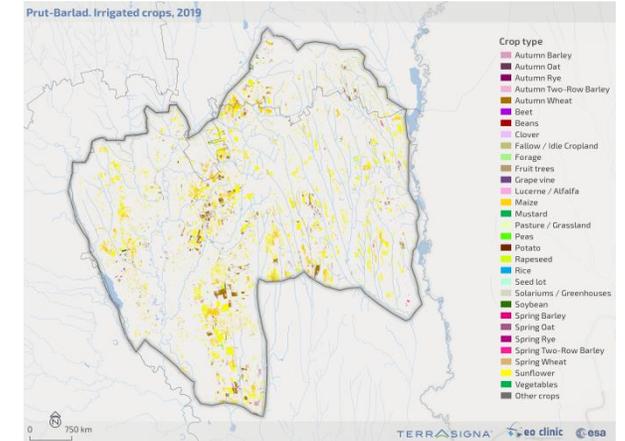
Crop type map (2019), Classification confidence index, Relevant statistics



Irrigated areas classification (2019)



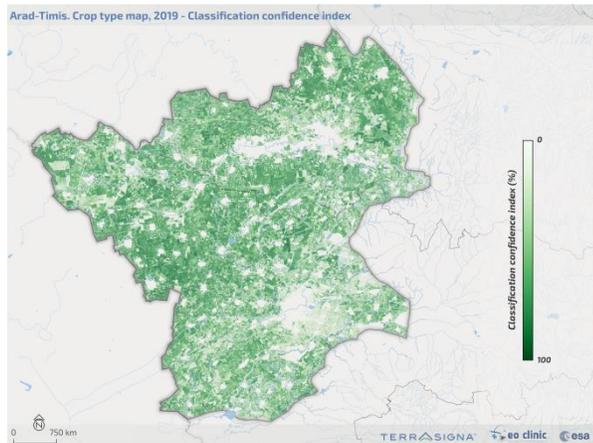
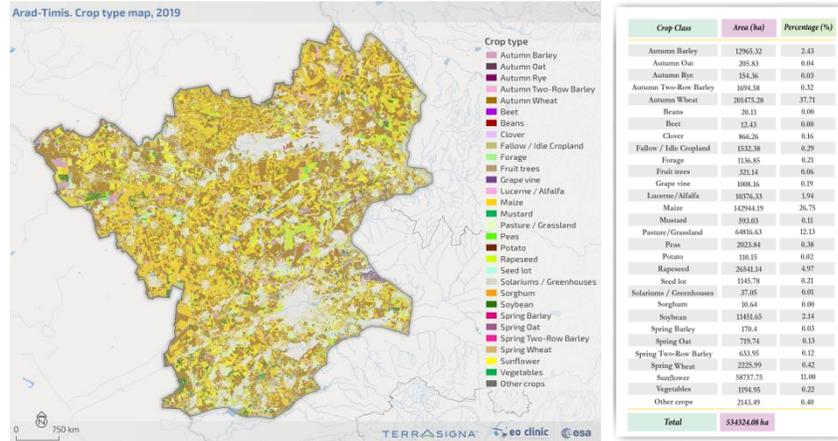
Irrigated crops classification (2019), Relevant statistics



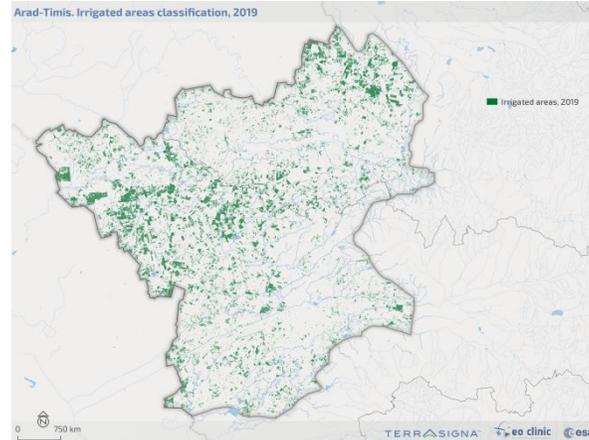
EO CLINIC | FINAL RESULTS — MAPPING OF IRRIGATED AREAS



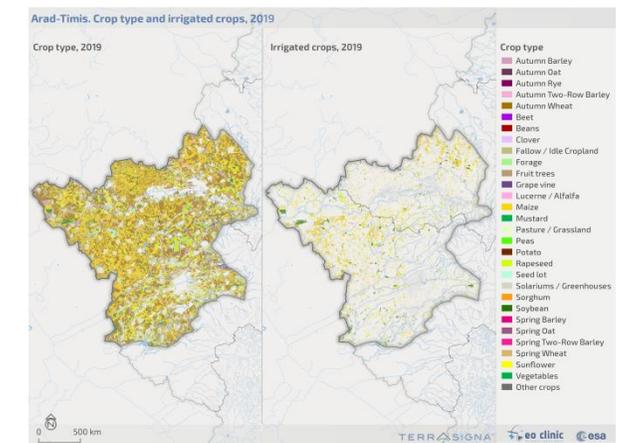
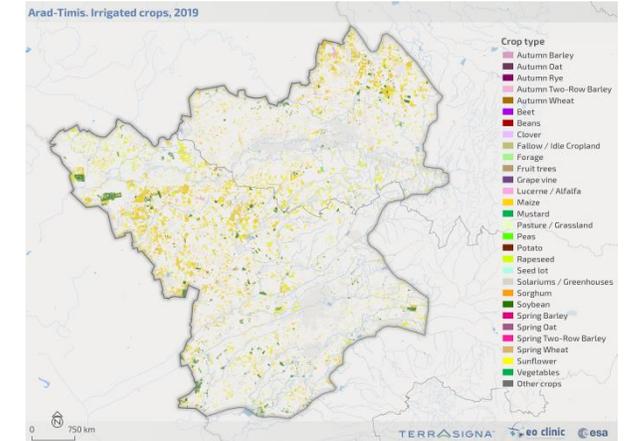
Crop type map (2019), Classification confidence index, Relevant statistics



Irrigated areas classification (2019)



Irrigated crops classification (2019), Relevant statistics





O3: To derive a set of indicators / decision markers related to vulnerability in relationship to climate change factors versus irrigation potential and integrate them into a multi-criteria assessment analysis

Product	Count	Resolution	Format	Accuracy
MULTI-CRITERIA ASSESSMENT ANALYSIS				
MCA variables	1	-	XLS / CSV	-
Metadata files	1	-	XML	-



O2: To identify the critical / most vulnerable areas in terms of water demand / irrigation needs

O4: To establish the areas characterized by the highest potential/suitability for the implementation of improved solutions for water storage and irrigation.

IDENTIFICATION AND MAPPING OF POTENTIAL IRRIGATION SITES

Irrigation Suitability Index	1	Medium-resolution	GeoTIFF	-
Report (including maps and charts)	1	-	DOCX / PDF	-
Description of the identified locations			(maps in PNG)	
Metadata file	1	-	XML	-

→ **3 separate irrigation suitability indexes:**



**WATER
DEFICIT**



**WATER SUPPLY
POTENTIAL**



**SOIL IRRIGATION
SUITABILITY**

EO CLINIC || MULTI-CRITERIA ASSESSMENT ANALYSIS



QUANTIFYING IRRIGATION SUITABILITY. MULTI-CRITERIA ASSESSMENT ANALYSIS



WATER DEFICIT



WATER SUPPLY POTENTIAL



SOIL IRRIGATION SUITABILITY

DROUGHT SEVERITY

(Drought Severity Index)

SOIL MOISTURE

(Soil Water Index)

WATER SOURCES PROXIMITY

SLOPE

IRRIGATION FACILITIES PROXIMITY

SOIL TEXTURE

SOIL STRUCTURE

LIMITATIONS TO AGRICULTURAL USE vs WATER MANAGEMENT INFRASTRUCTURE

EVAPOTRANSPIRATION

NDVI ANOMALIES

INTERNAL DRAINAGE

PLANT AVAILABLE WATER

INTERNAL DRAINAGE

PLANT AVAILABLE WATER

EO CLINIC || MULTI-CRITERIA ASSESSMENT ANALYSIS



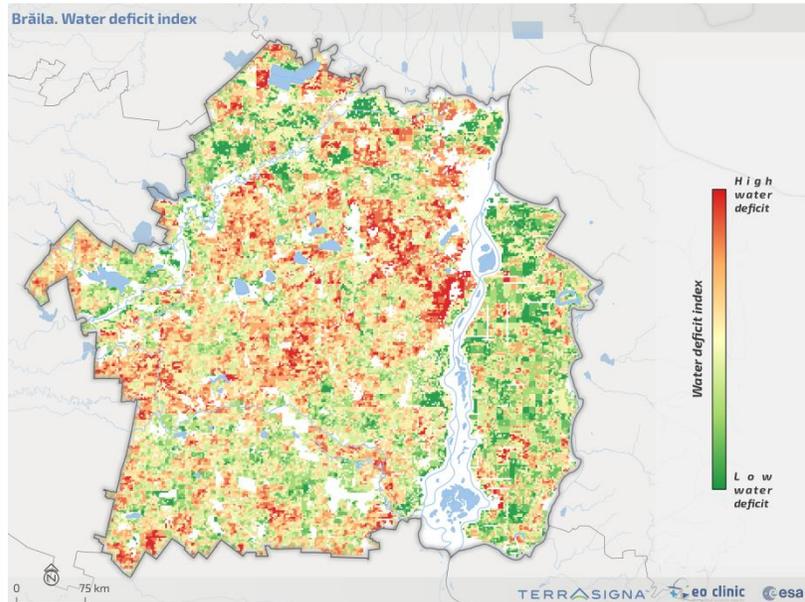
	VARIABLE	SOURCE
WATER DEFICIT	Evapotranspiration	MODIS Evapotranspiration - Net Evapotranspiration 8-Day L4 Global 500m
	NDVI (NDVI Anomalies)	MODIS Vegetation Index Products (NDVI) - Vegetation Indices 16-Day L3 Global 250m
	Soil Water Index (SWI)	Copernicus Global Land Service. Bauer-Marschallinger et al., 2018.
WATER SUPPLY POTENTIAL	Freshwater resources	Romania's topographic reference plan, corresponding to the scale 1: 50000 (TopRo50). Data owner: ANCPI - National Agency for Cadaster and Land Registration
	Existing irrigation infrastructure	Romania's topographic reference plan, corresponding to the scale 1: 50000 (TopRo50). Data owner: ANCPI - National Agency for Cadaster and Land Registration
	Slope	Derived from EU-DEM v 1.1. European Environment Agency (EEA) under the framework of the Copernicus programme - copernicus@eea.europa.eu
SOIL IRRIGATION SUITABILITY	Soil texture	European Soil Database v2.0 (vector and attribute data). Panagos Panos. The European soil database (2006) GEO: connexion, 5 (7), pp. 32-33. ESDB v2.0: The European Soil Database distribution version 2.0, European Commission and the European Soil Bureau Network, CD-ROM, EUR 19945 EN, 2004.
	Soil structure	
	Limitations to agricultural use	
	Water management infrastructure	

EO CLINIC || FINAL RESULTS – QUANTIFICATION OF IRRIGATION SUITABILITY



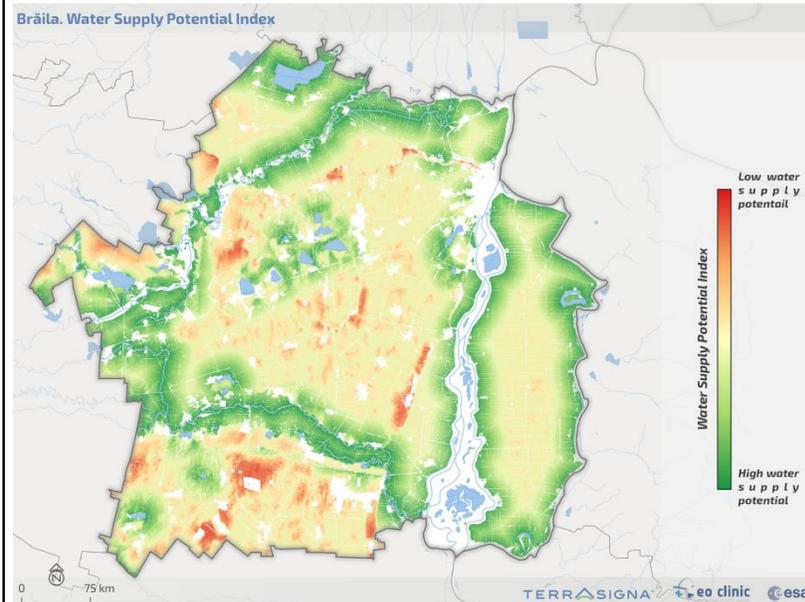
Water Deficit Index

(+ intermediate products)



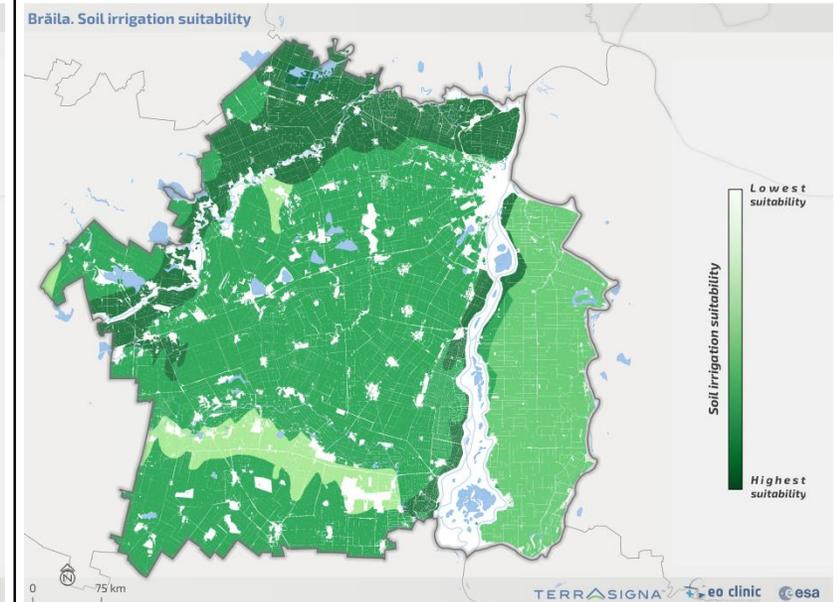
Water Supply Potential Index

(+ intermediate products)

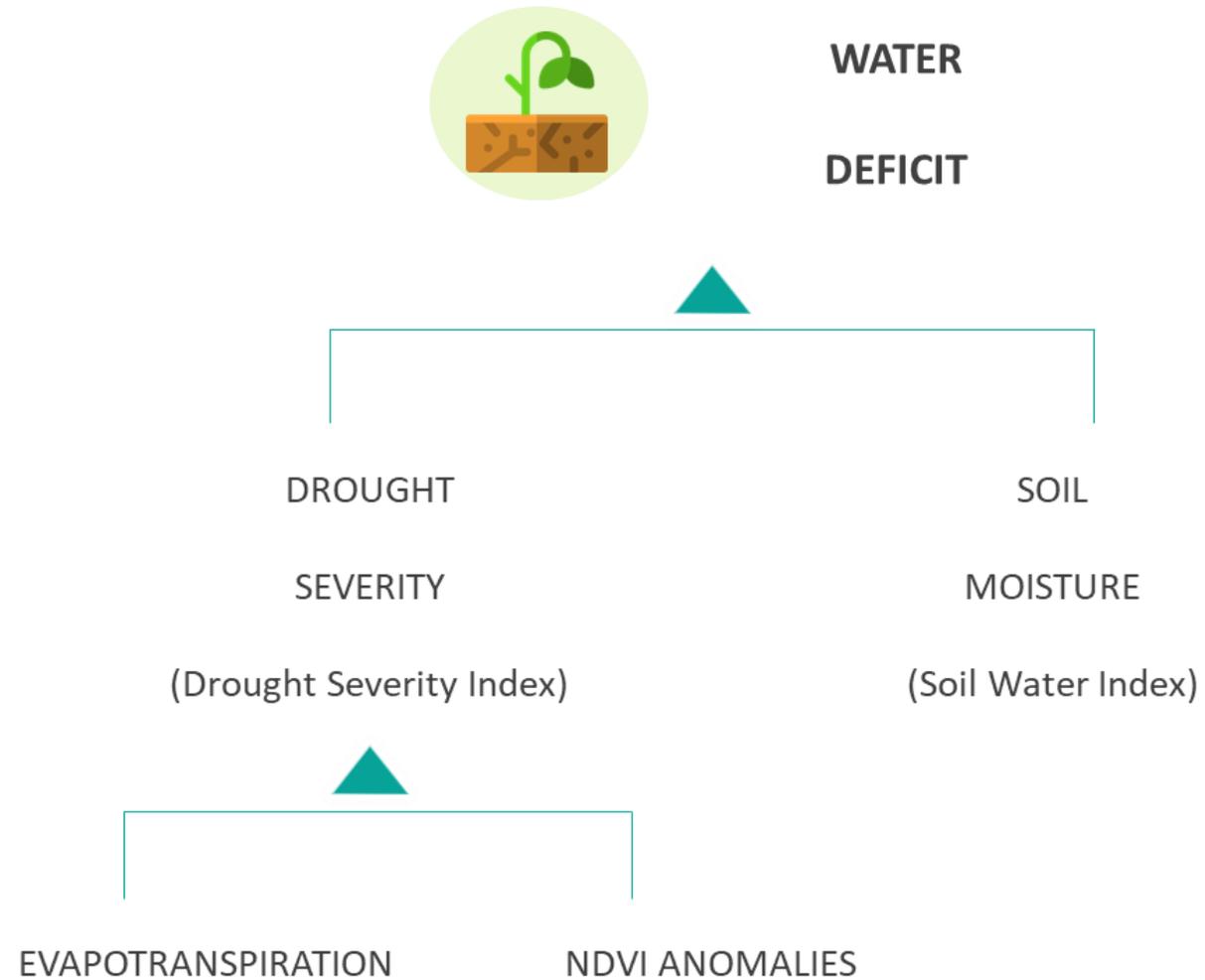


Soil Irrigation Suitability Index

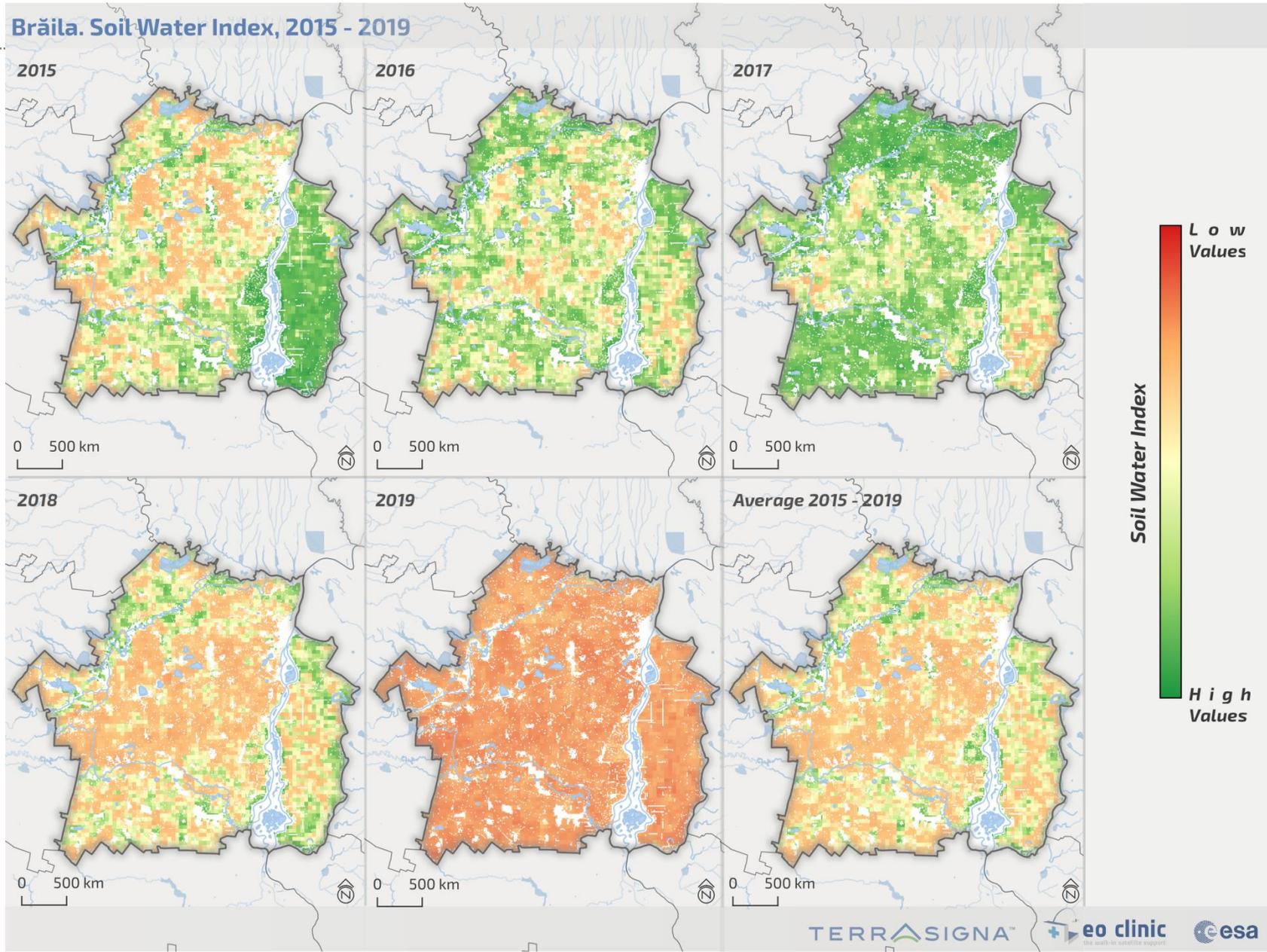
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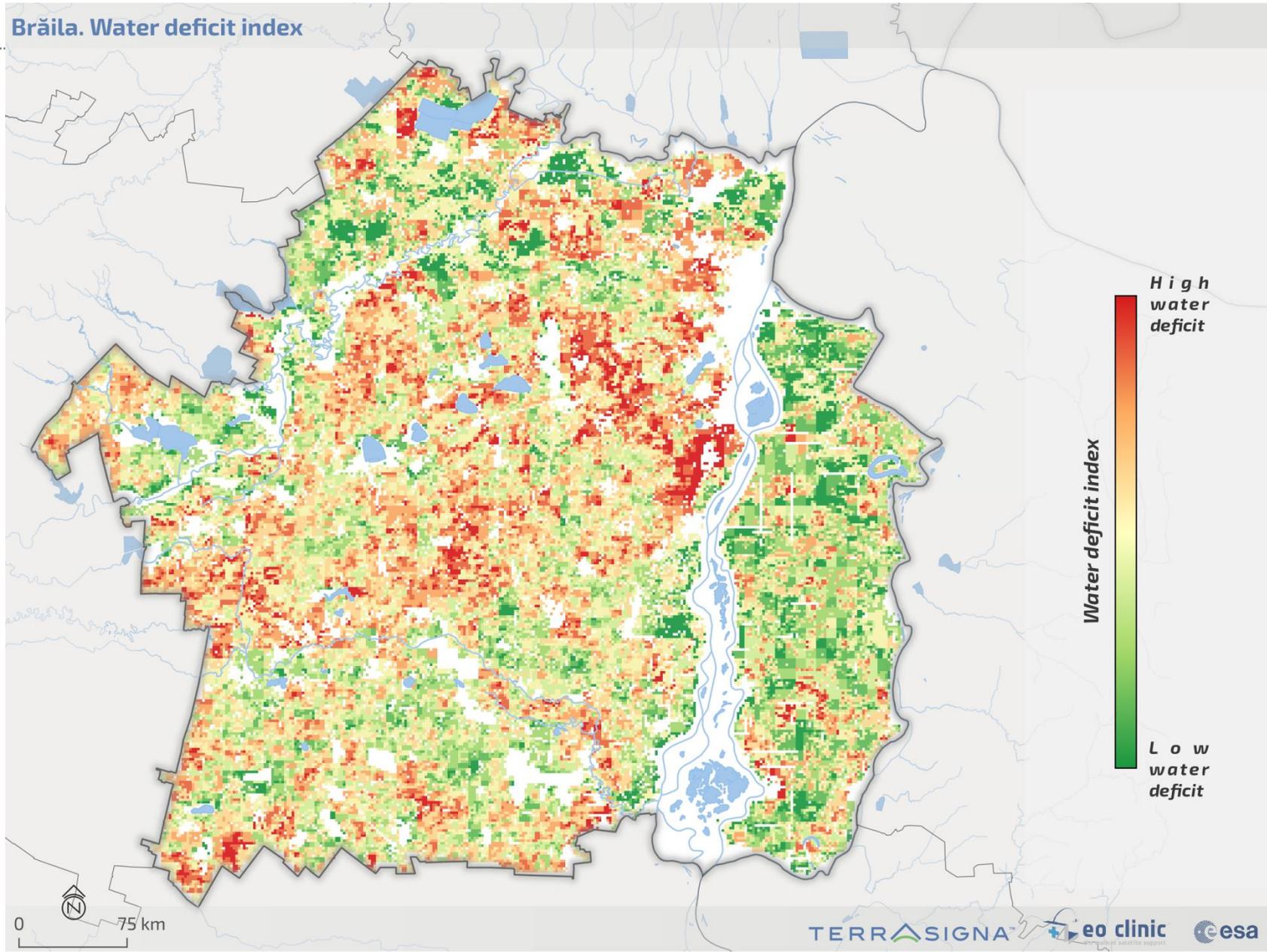


EO CLINIC || FINAL RESULTS – QUANTIFICATION OF IRRIGATION SUITABILITY



EO CLINIC || FINAL RESULTS



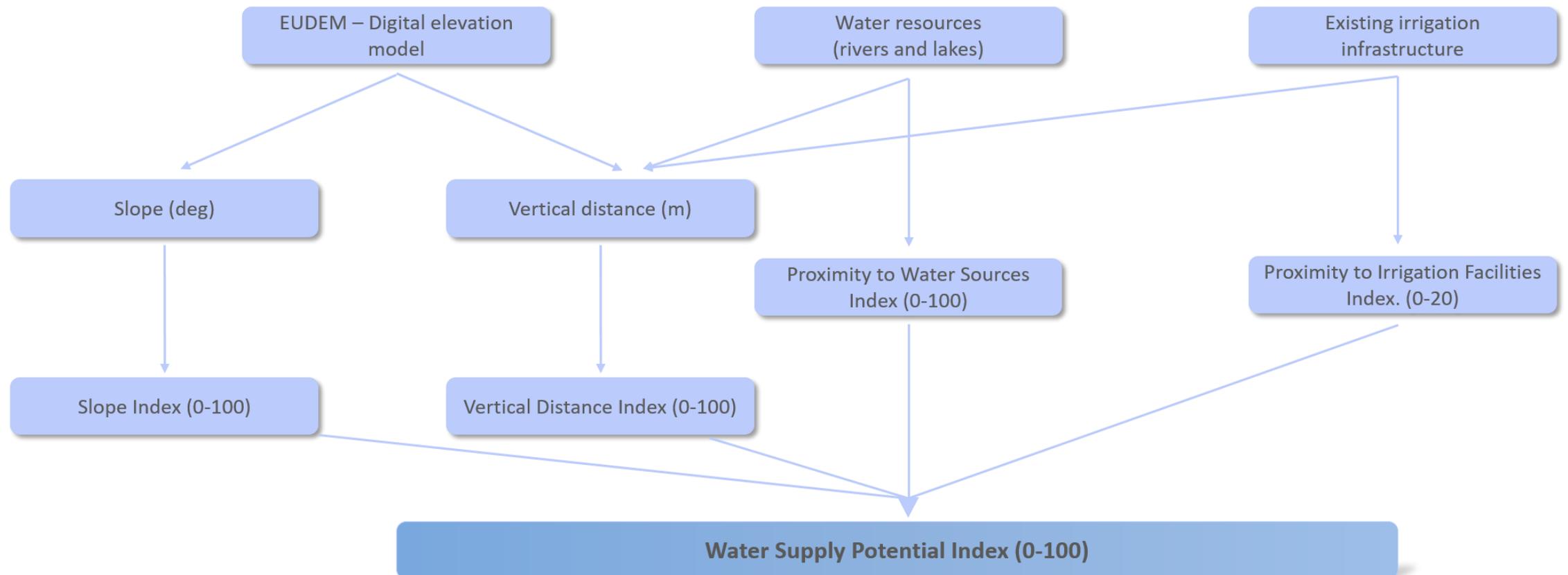


EO CLINIC || FINAL RESULTS – QUANTIFICATION OF IRRIGATION SUITABILITY

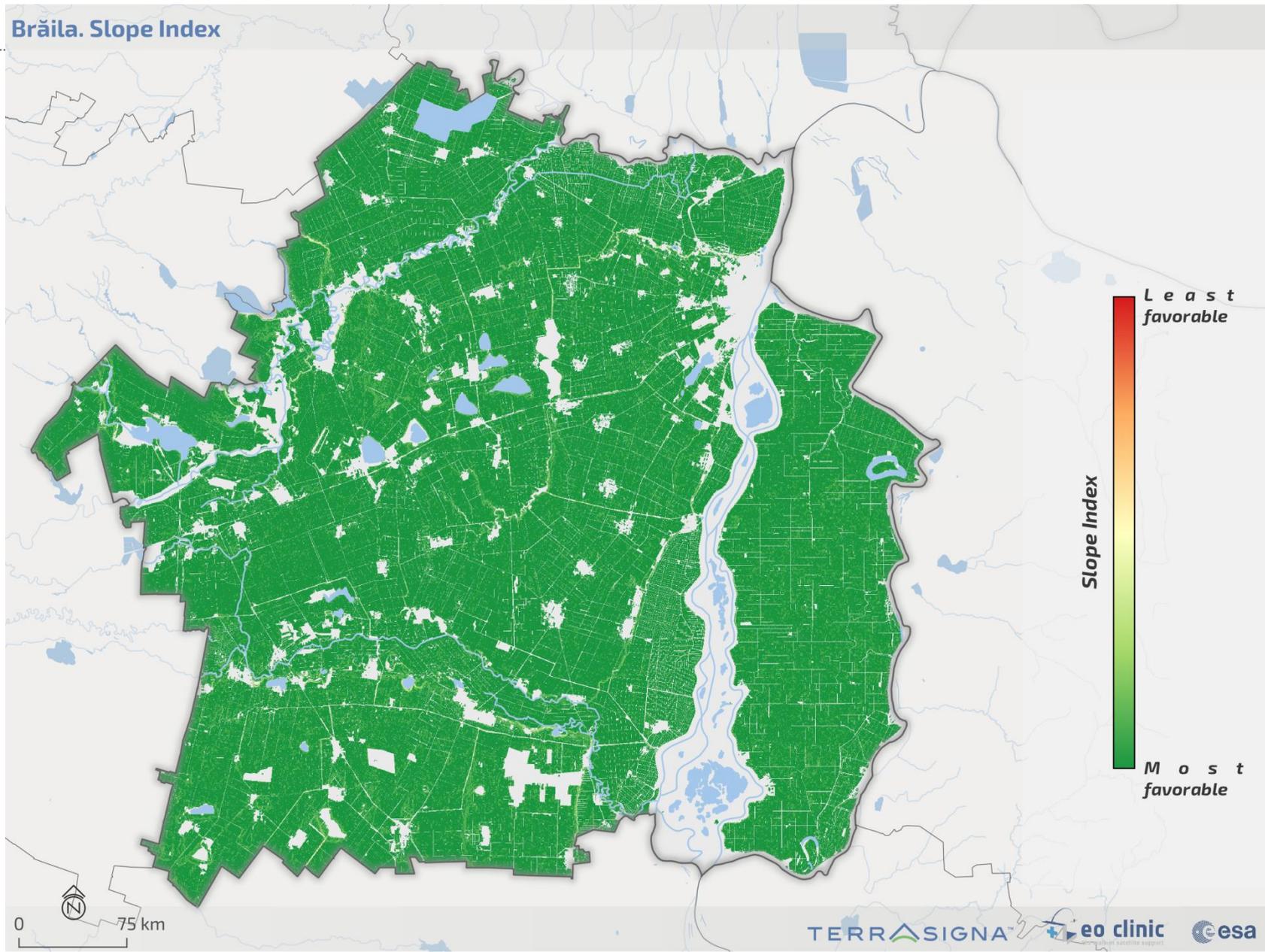


WATER SUPPLY

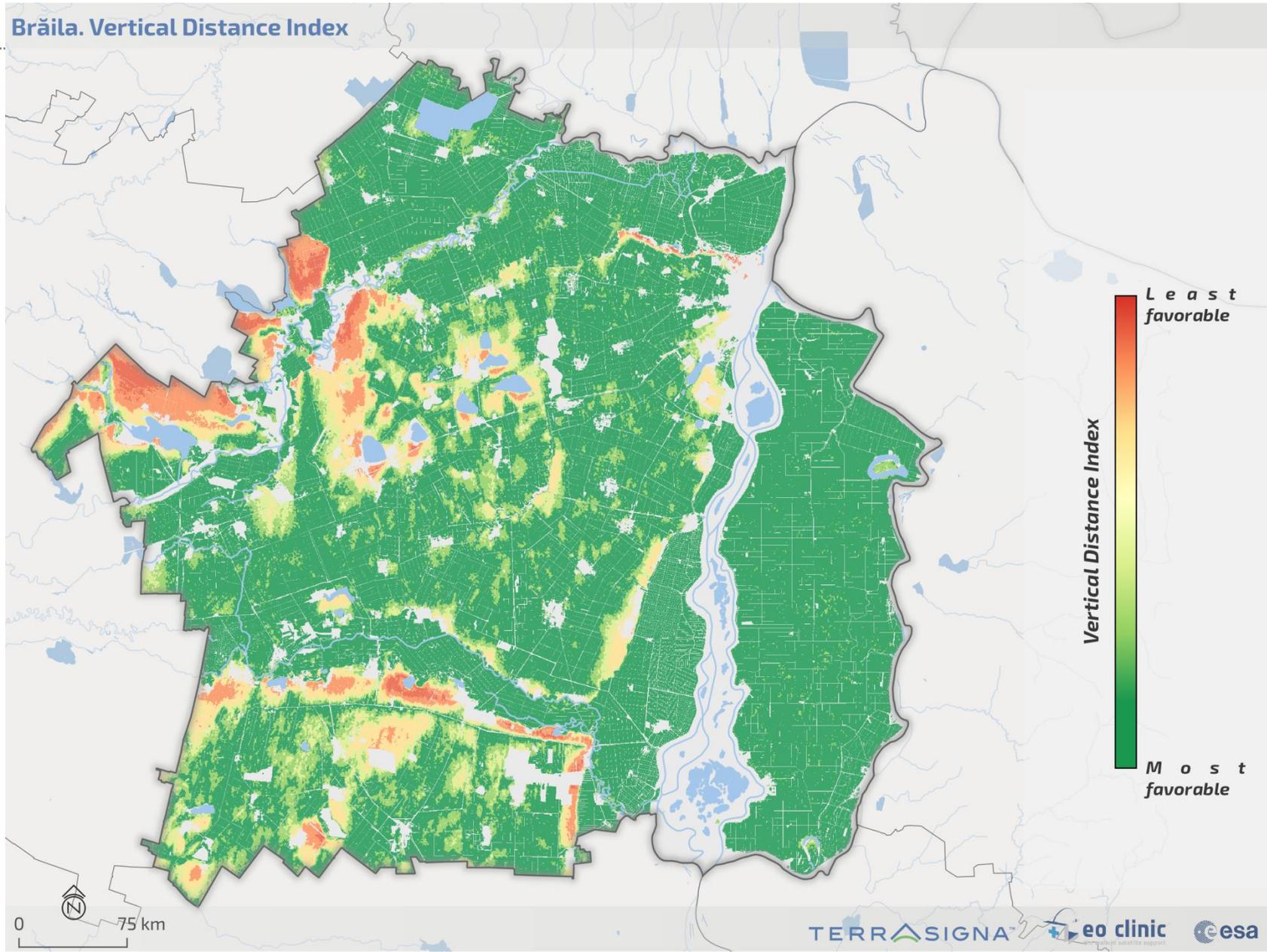
POTENTIAL



EO CLINIC | FINAL RESULTS – QUANTIFICATION OF IRRIGATION SUITABILITY



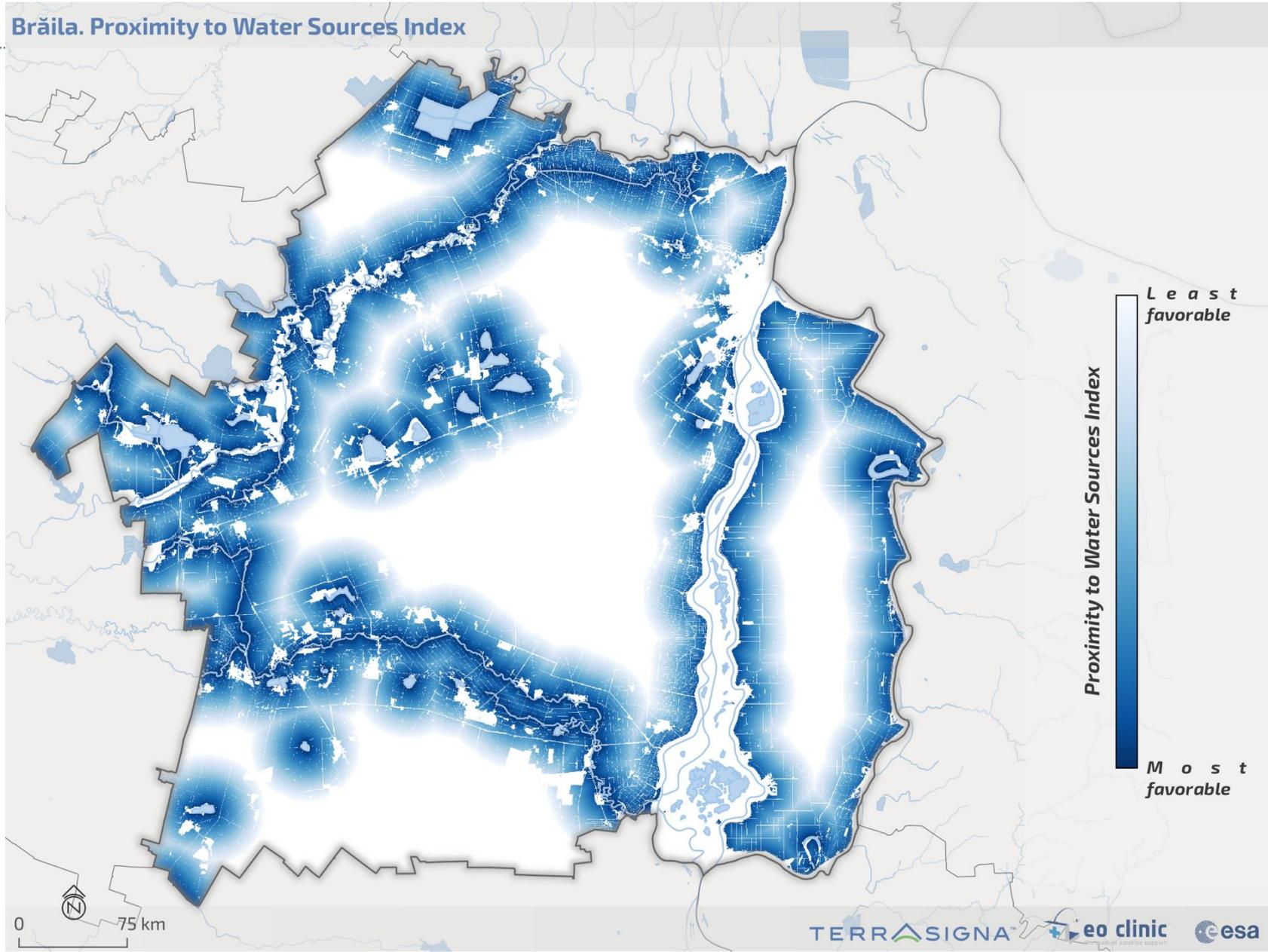
EO CLINIC | FINAL RESULTS – QUANTIFICATION OF IRRIGATION SUITABILITY



EO CLINIC | FINAL RESULTS – QUANTIFICATION OF IRRIGATION SUITABILITY



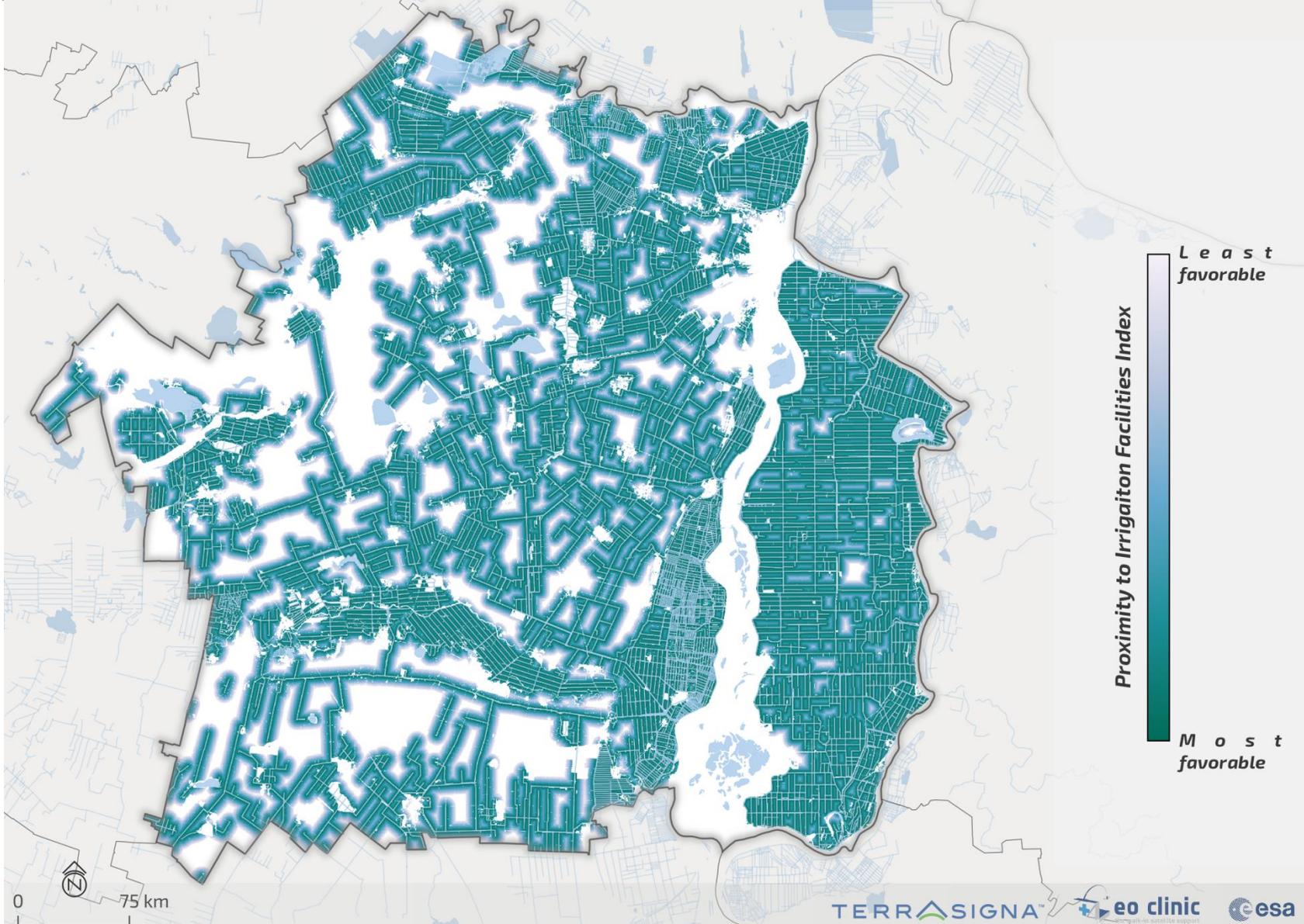
Brăila. Proximity to Water Sources Index



EO CLINIC | FINAL RESULTS – QUANTIFICATION OF IRRIGATION SUITABILITY



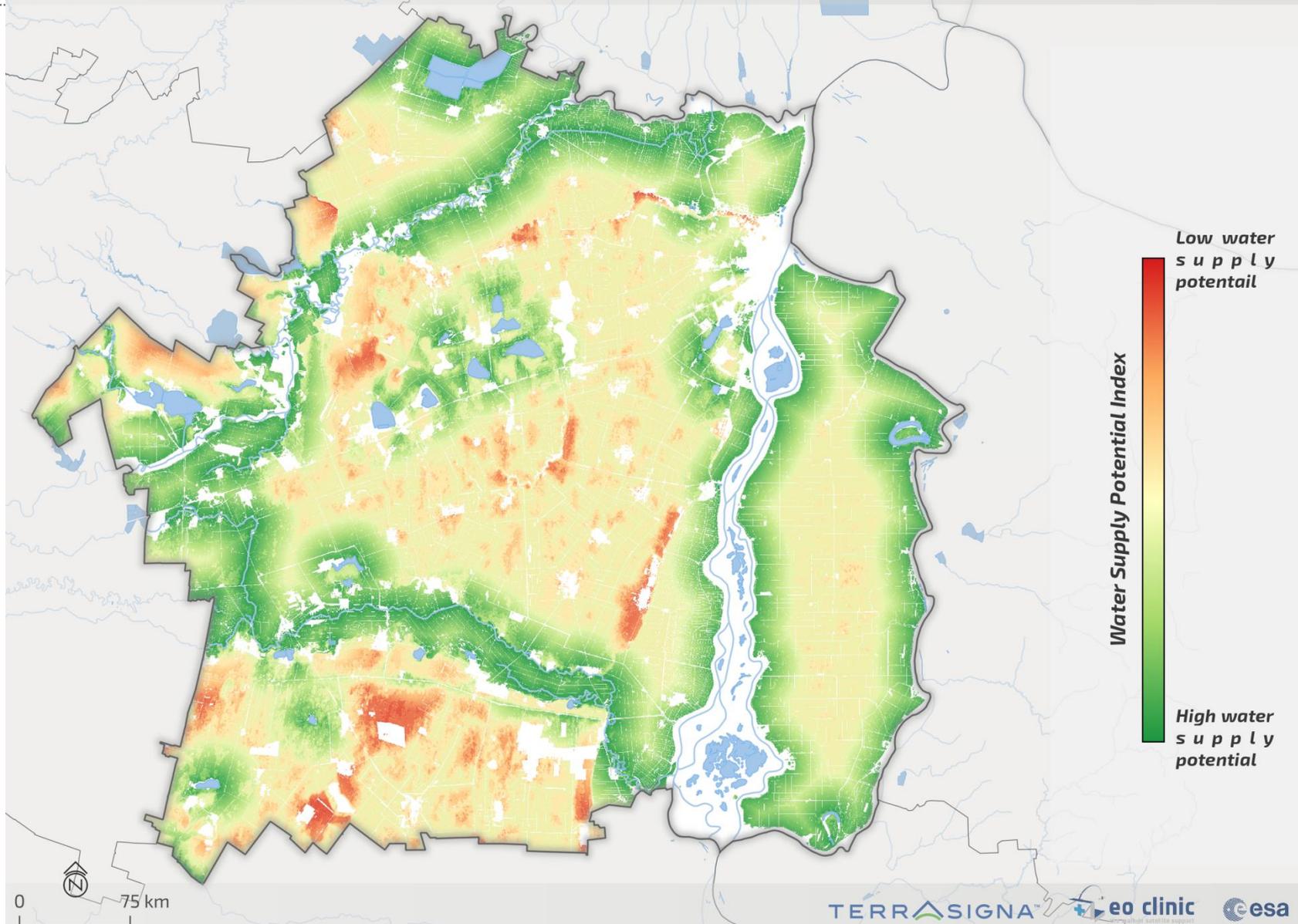
Brăila. Proximity to Irrigation Facilities Index



EO CLINIC | FINAL RESULTS – QUANTIFICATION OF IRRIGATION SUITABILITY



Brăila. Water Supply Potential Index

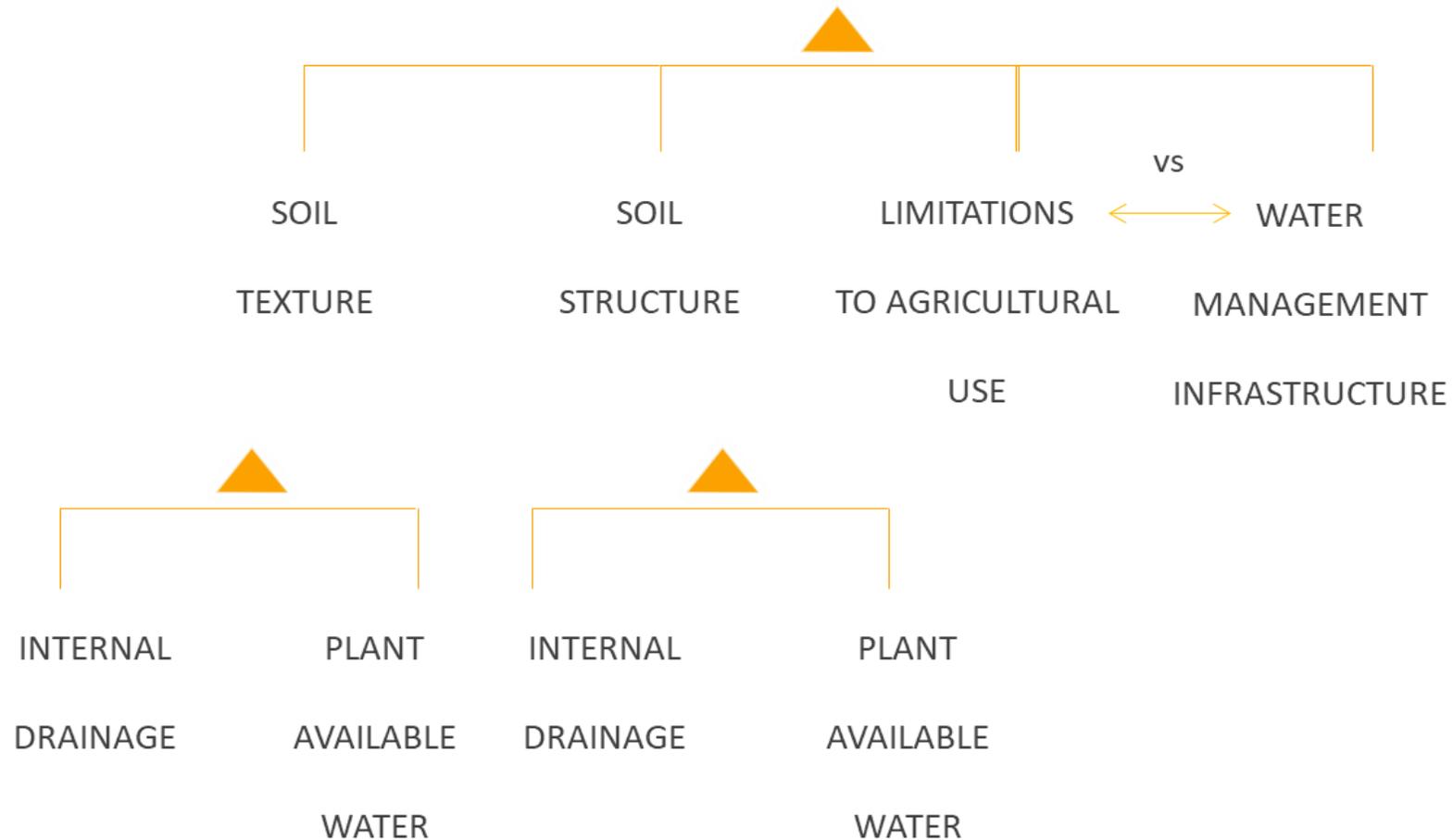


EO CLINIC || FINAL RESULTS – QUANTIFICATION OF IRRIGATION SUITABILITY



SOIL IRRIGATION

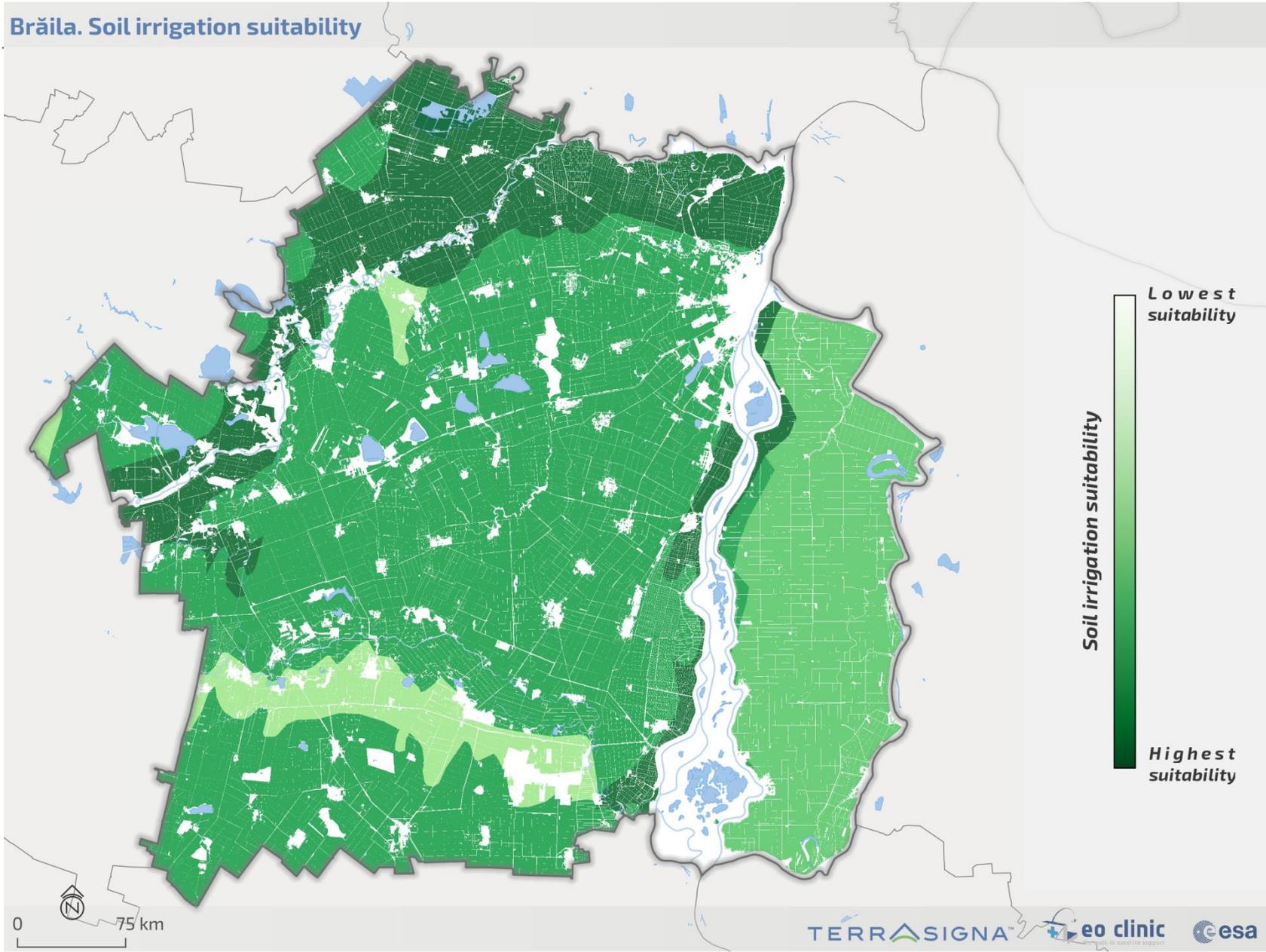
SUITABILITY



EO CLINIC | FINAL RESULTS – QUANTIFICATION OF IRRIGATION SUITABILITY



Brăila. Soil irrigation suitability



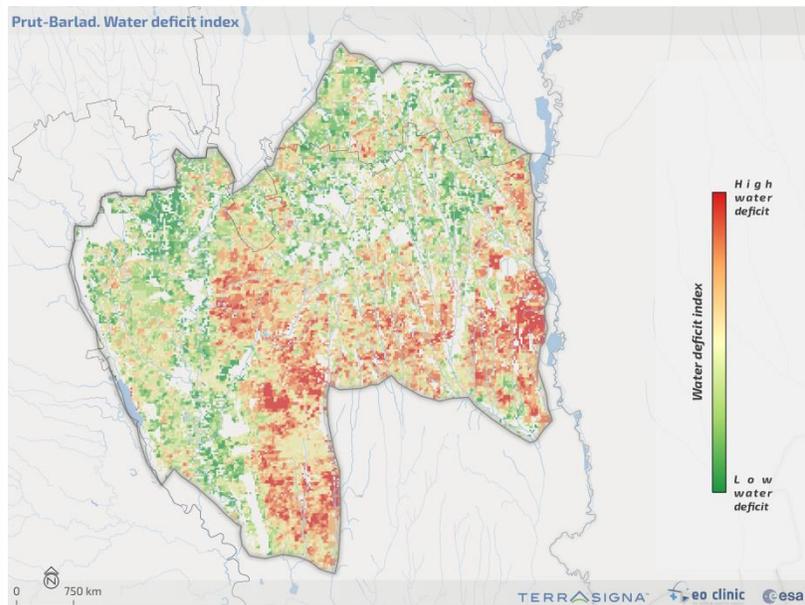
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EO CLINIC | FINAL RESULTS – QUANTIFICATION OF IRRIGATION SUITABILITY



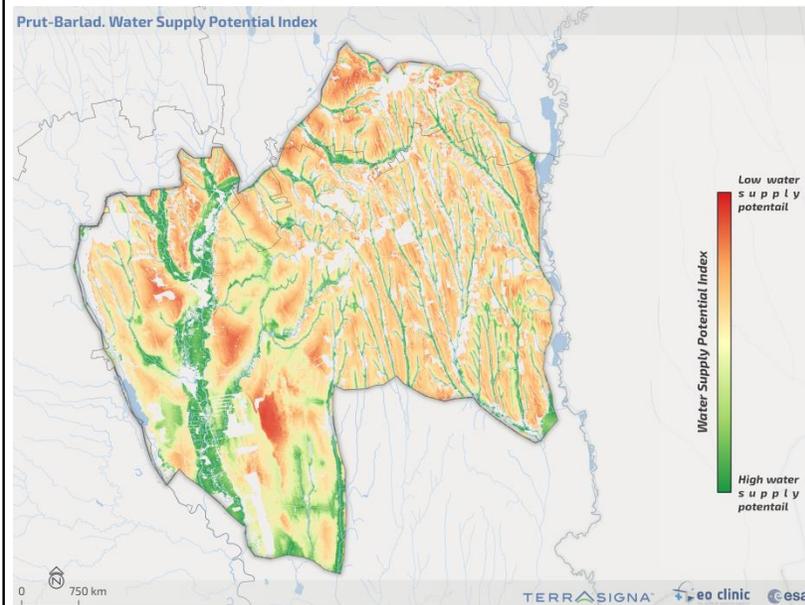
Water Deficit Index

(+ intermediate products)



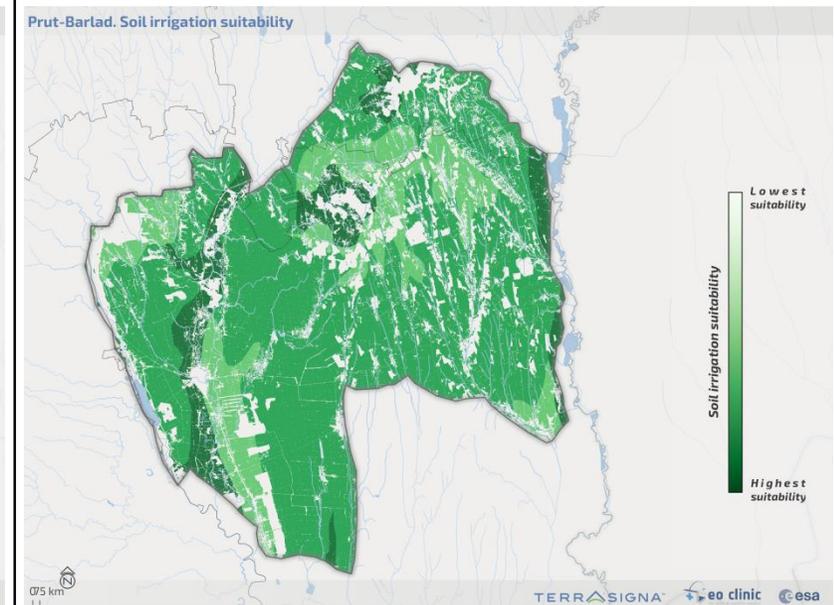
Water Supply Potential Index

(+ intermediate products)



Soil Irrigation Suitability Index

(+ intermediate products)

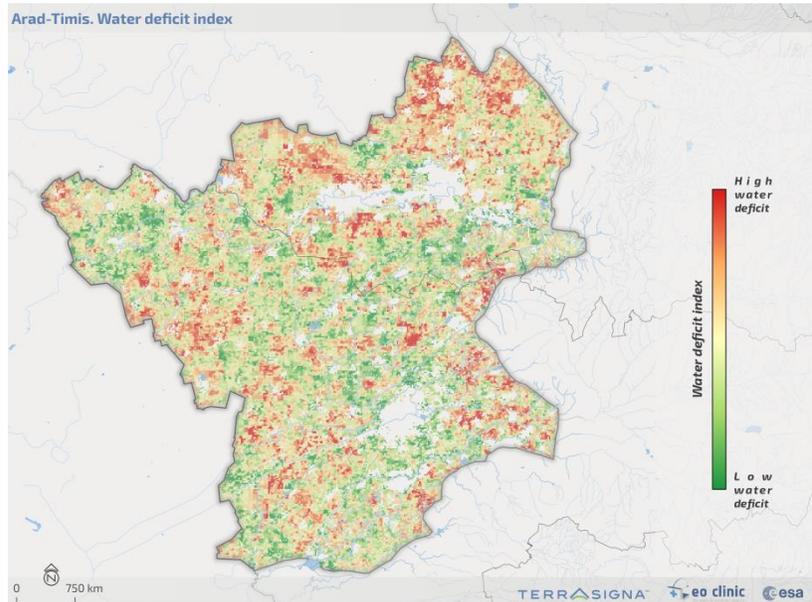


EO CLINIC | FINAL RESULTS – QUANTIFICATION OF IRRIGATION SUITABILITY



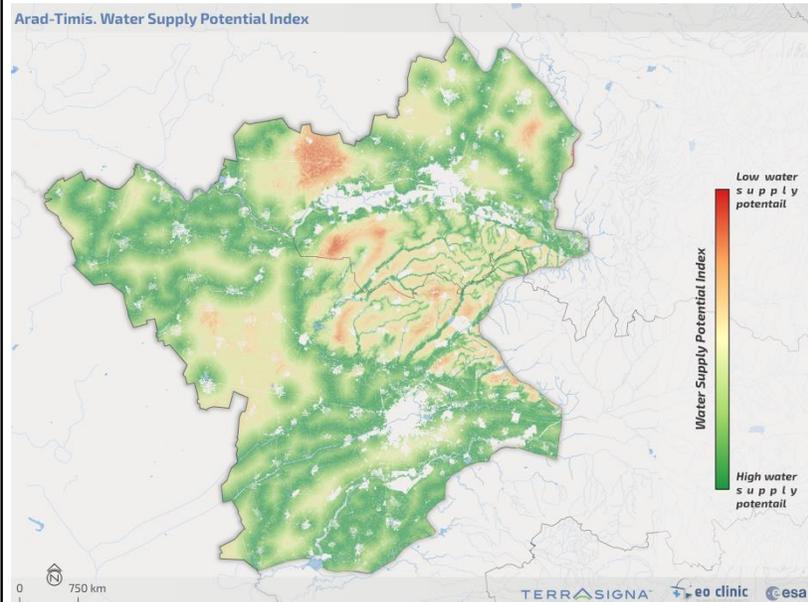
Water Deficit Index

(+ intermediate products)



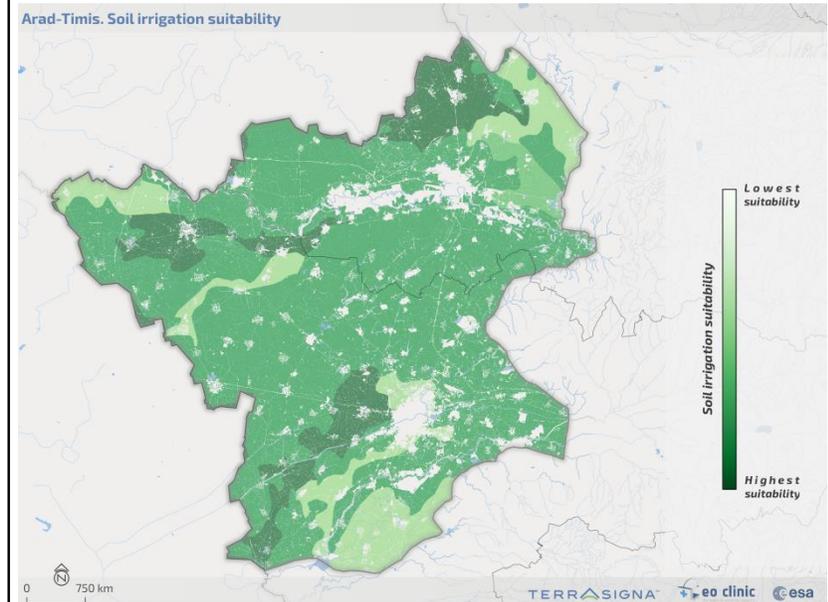
Water Supply Potential Index

(+ intermediate products)



Soil Irrigation Suitability Index

(+ intermediate products)





PART I: Mapping of irrigated areas

- Detailed analysis and mapping of irrigated areas, based on multiple optical very high resolution data.
- A large temporal dimension - changes over the past 30 years:
 - Analyzing the decline of the irrigation facilities;
 - Identifying the areas most prone to drought;
 - Assessing the vulnerability trends in relationship to the seasonal behavior and rainfall variability.
- Integrating the 10 m pan-European High-Resolution Vegetation Phenology and Productivity products (HR-VPP).
- Integration of agricultural productivity data.
- Establishing correlations between crop type maps and agronomic information on plant water needs.
- Usage of additional data, such as field data.
- Correlation / validation with the existing information in the official statistics.
- Further developments of the irrigation mapping methodology (integration of additional filters).



PART I: Mapping of irrigated areas

Datasets useful in follow-up activities

Dataset	Justification / Importance of integration in the analysis	Authorized Institution / Institution that Manages the Dataset
Yearly datasets regarding exact parcel locations (and farmers' declarations regarding crop types)	The dataset is essential for the computation of crop type maps for different agricultural seasons.	APIA (Agenția de Plăți și Intervenție pentru Agricultură - Agency for Payments and Intervention in Agriculture) / MADR (Ministerul Agriculturii și Dezvoltării Rurale - Ministry of Agriculture and Rural Development)
Annual on-site compliance verifications of the farmers that applied for subsidies	The dataset would be extremely useful in validation activities (validating the computed crop type maps).	APIA (Agenția de Plăți și Intervenție pentru Agricultură - Agency for Payments and Intervention in Agriculture) / MADR (Ministerul Agriculturii și Dezvoltării Rurale - Ministry of Agriculture and Rural Development)
Physical blocks in which at least one farmer uses irrigation (extracted from LPIS)	The dataset would be extremely useful in validation activities (validating the irrigated areas classification). The dataset has also been used by the Ministry of Agriculture and Rural Development in analyzing areas facing significant natural constraints.	APIA (Agenția de Plăți și Intervenție pentru Agricultură - Agency for Payments and Intervention in Agriculture) / MADR (Ministerul Agriculturii și Dezvoltării Rurale - Ministry of Agriculture and Rural Development)



PART II: Quantifying Irrigation Suitability

- Detailed analysis of the identified hotspots, based on higher resolution EO data.
- Integration of agricultural productivity data and its dynamics.
- Integration of information on the irrigation efficiency of different agricultural crops (harvest without irrigation / harvest with irrigation - t / ha).
- Integration of information / indicators related to agricultural productivity.
- Integration of agronomic information in order to choose a proper irrigation method
- Validation activities – e.g.: based on information on ANC / based on LUCAS datasets and field photos.
- **Water Deficit:** Extension of the analysis period - at least 20 years; integration of additional datasets.
- **Water Supply Potential:** filtering the freshwater sources datasets according to their specificity and potential for irrigation; clear delineation between working/functional and disaffected existing irrigation infrastructure.
- **Soil Irrigation Suitability:** using a higher resolution data set (eg: Digital soil map of Romania - SIGSTAR 200) would allow the inclusion of additional limitations and restrictions and provide a more accurate image of ground truth.



PART II: Quantifying Irrigation Suitability

Datasets useful in follow-up activities

Dataset	Justification / Importance of integration in the analysis	Authorized Institution / Institution that Manages the Dataset
<p>Existing irrigation systems –</p> <p>Hydrology - Surface water layer (Water Cadastre in Romania)</p>	<p>The dataset is important in computing an indicator regarding the proximity of irrigation facilities, in order to assess the viability of irrigation solutions.</p> <p>What is more, an important information is represented by the exact location of existing irrigation infrastructure, with a clear delineation between working/functional infrastructure and disaffected one - data owner: ANIF (if the data exists and can be provided in a geospatial format).</p>	<p>ANAR (Administrația Națională Apele Române - National Administration "Romanian Waters") /</p> <p>ANIF (Agenția Națională de Îmbunătățiri Funciare - National Agency for Land Improvements)</p>
<p>Freshwater resources</p> <p>Hydrology - Surface water layer (Water Cadastre in Romania)</p>	<p>The dataset is important in computing an indicator regarding the proximity of freshwater resources, in order to assess the viability of irrigation solutions.</p>	<p>ANAR (Administrația Națională Apele Române - National Administration "Romanian Waters")</p>
<p>Water management infrastructure (e.g. water pumping stations, reservoirs, water catchments etc.)</p>	<p>The dataset is important in computing an indicator regarding the proximity of irrigation facilities, in order to assess the viability of irrigation solutions.</p>	<p>World Bank</p> <p>(Past projects of WBG, e.g. - Investment Guide for Water and Wastewater Projects, 2015 - http://documents1.worldbank.org/curated/en/537831467992819404/pdf/Investment-guide-for-water-and-wastewater-projects.pdf, Romania Water Diagnostic Report, 2018)</p>
<p>Digital soil map of Romania (SIGSTAR 200) based on the Soil Map of Romania at a scale of 1:200,000, National Research-Development Institute for Pedology, Agrochemistry and Environmental Protection - ICPA</p>	<p>Data on soil characteristics (e.g. soil type, soil texture) are important in defining the soil ability to drain water, retain moisture and, implicitly, in determining the need for irrigation.</p> <p>The dataset has also been used by the Ministry of Agriculture and Rural Development in determining areas facing significant natural constraints.</p>	<p>ICPA (Institutul Național de Cercetare-Dezvoltare pentru Pedologie, Agrochimie și Protecția Mediului - National Research-Development Institute for Pedology, Agrochemistry and Environmental Protection) /</p> <p>MADR (Ministerul Agriculturii și Dezvoltării Rurale - Ministry of Agriculture and Rural Development)</p>

EO CLINIC || AOB





THANK YOU!

