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WINTER

Deliverable 4.1

Visualization of data and production of interactive material

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EXECUTIVE SUMMARY

The Deliverable 4.1 is related with the collection and homogenization of the processed data from selected case studies in the Western Macedonia region, Konin region, and Ruhr area. This data serves as input for the Web Interactive Platform under development for Task 4.2. Particularly, a geodatabase was created for the cloud-based platform to integrate and homogenize the collected data in tabular form and as features classes, following to the ESRI Standard. The database includes both spatial (e.g., regional boundaries, Land Cover types, mining area boundaries) and non-spatial information (e.g., texts, photos, diagrams). This database supports the development of narrative stories for the Western Macedonia region, the Konin region, and the Ruhr area on the ArcGIS Online platform. In general, the developed geospatial datasets consist of 50 feature classes from subtasks 2.3.1 and 2.3.2. These databases contain mainly processed datasets representing regional administrative and open-pit mine boundaries, land cover classes (using a Machine Learning approach (subtask task 2.3.1), Corine Land Cover products and Renewable Energy Source data (subtask 2.3.2). The provided data offer valuable information in terms of spatiotemporal land cover changes over time, potentially resulting from mining activities or other environmental factors. The data are hosted in a cloud-based database and are available for download upon request.

1. INTRODUCTION

This report is related to Deliverable 4.1 “Visualization of data and production of interactive material”. Specifically, this text includes the collection and the homogenization of the geospatial data (Figure 1.1), derived reports, multimedia and supplementary material from the selected case studies (Western Macedonia region, Konin region and Ruhr area) as an input for the Web Interactive Platform that is under progress for the Task 4.2. Particularly, this document provides a detailed description of the data from the implemented tasks of 2.1, 2.2. and 2.3.

Figure 1.1 Illustrated features of the WINTER database. Map data: © 2023 HERE, Garmin, FAO, NOAA, USGS.

According to these tasks a geodatabase was created and homogenized for the cloud-based platform. In order to integrate and homogenize, geospatial data were formed in both tabular form (Attribute tables) and as shape files/feature classes adhering to the ESRI Standard. The chosen coordinate reference system was the ETRS89 (European Terrestrial Reference System), aligning with the recommendations of the WFD GIS Working Group and the INSPIRE directive for pan-European spatial data collection, storage, and analysis. The development of the database was implemented using the ESRI’s commercial software package ArcGIS Desktop 10.8.2, ArcGIS Online, and ArcGIS Pro. The visualized material is available online in the following link: https://storymaps.arcgis.com/collections/103a6d18368f45559bf6ec5014009b25. The available database can be accessed through the WINTER project's website (Figure 1.2) and is hosted at the following link:

https://github.com/WINTER-project-eu/WINTER_EU_Database/blob/main/README.md.

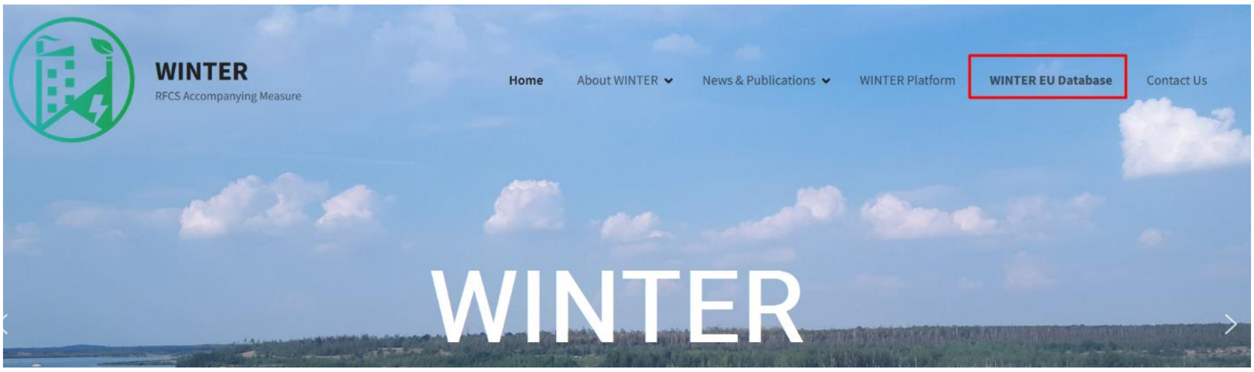


Figure 1.2 Screenshot showing the button that directs users to the WINTER EU Database.

Specifically, the database (Table 1) includes both spatial (e.g., regional boundaries, Land Cover types, mining area's boundaries etc.) and non-spatial information (e.g., texts, photos, diagrams). Particularly, the texts and photos that have been collected and processed are part of the material for the narrative story-telling maps that will be delivered upon the end of the project. This material has been utilized for developing narrative stories for the Western Macedonia region, the Konin region and the Ruhr area on the ArcGIS Online platform. All the non-spatial information that was used in the story-telling maps has been visualised and converted into PDF format and is accessible online in the aforementioned folder.

Table 1.1 List of sources for the web platform by type.

Type (Spatial / Non-Spatial)	Data layer/description	Source
Land Cover/Land Use	Vector file/ polygon	Corine Land Cover (CLC)
Regional & open-pit mines boundaries	Vector file/polygon	Subtask 2.3.1
Land Cover maps	Vector file/ polygon	Subtask 2.3.1
Digital suitability maps	Vector file/polygon	Subtask 2.3.2
Mine Rehabilitation and Reclamation Showcases	Texts & Images	Task 2.1
Legal framework and legislations	Texts	Task 2.2
Global Wind Atlas	Raster feature	Global Wind Atlas v 3.3
Global Solar Atlas	Raster feature	Global Solar Atlas v 2.8
FABDEM (Forest And Buildings removed	Raster feature	University of BRISTOL

Copernicus Digital Elevation Model)		

2. DATA VISUALIZATION

Regarding the geospatial dataset, 6 geodatabases (Figure 2.1) of 50 feature classes, were created for the subtasks 3.2.1 and 3.2.2. Specifically, four geodatabases were created for subtask 2.3.1 divided into the three regions and the geographical boundaries. These relational databases contain a series of vector layers, each representing regional & open-pit mine boundaries, land cover classes that have been classified using a Machine Learning (ML) approach and Corine Land Cover products. Particularly, the ML layers are specifically located to open-pit mines in Western Macedonia (Amyntaio & Ptolemaida) and Konin region (Kazimierz, Jozwin, and Adamow) covering the time period from 2018 to 2021. Additionally, the databases include Corine Land Cover layers from different years (1990, 2000, 2006, 2012, 2018) for the Western Macedonia region, Konin region and Rurh area. These layers offer valuable information regarding the spatiotemporal land cover changes over time, potentially as a result of mining activities or other environmental factors.

Moreover, two geodatabases were created for the subtask 2.3.2 divided by regions. Particularly, these geodatabases include vector layers related to the identification of potentially suitable sites for the installation of Renewable Energy Sources (RES). Specifically, the RES types are Wind (WP) and Photovoltaic (PV) Parks as well as areas where both types of RES could potentially be installed. Furthermore, these layers are located in Western Macedonia region and in the selected open-pit mines of Konin region (Adamow, Kazimierz, and Jozwin).

Each layer within the geodatabases are specifically named to reflect their purpose and location, such as land cover types, suitable sites for RES, and area's boundaries.

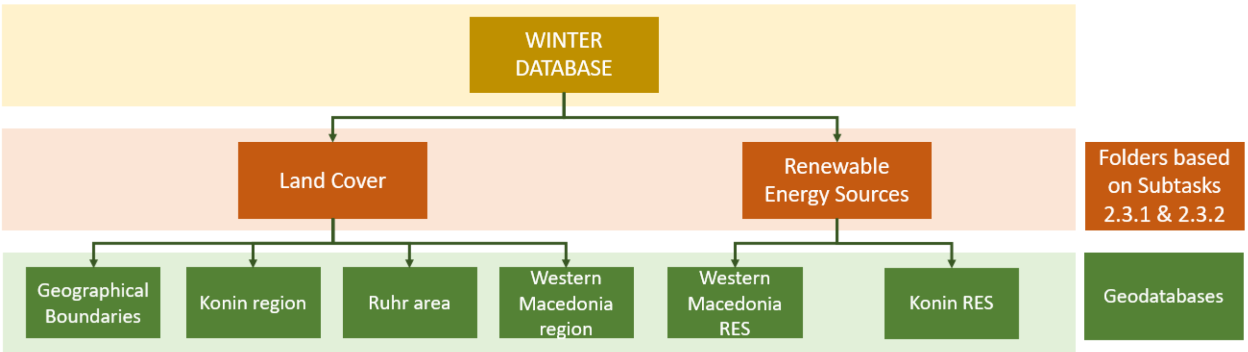


Figure 2.1 Schema of the geodatabase structure that was developed during the project.

The detailed information about the geodatabases about the number of layers and their description are presented in the following tables and figures.

The first geodatabase, named **Geographic Boundaries**, contains the following vector layers (Table 2.1 & Figure 2.2):

Table 2.1 Descriptive table of shapefiles from the **Geographic boundaries** geodatabase.

Feature	Description
Mining_areas	The borders of the five open-pit mines in Western Macedonia (Amynteo, Ptolemadia) and Konin (Adamow, Jozwin, Kazimierz) regions.
Regional_boundaries	The administrative boundaries of the Ruhr area, the Western Macedonia region, and the Konin region

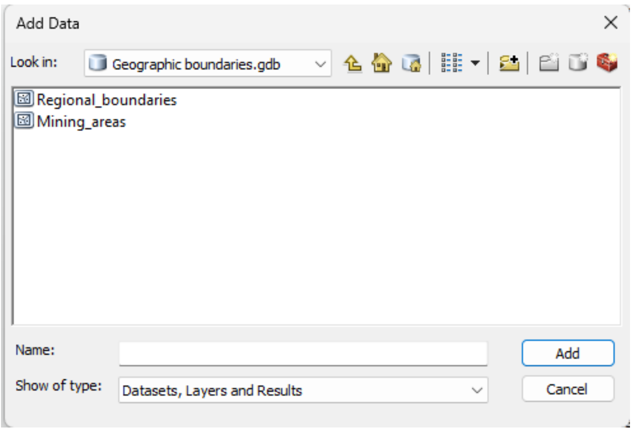


Figure 2.2 Visualization of shapefiles from the **Geographic boundaries** geodatabase.

The second geodatabase, titled as a **Konin region**, contains the following vector layers (Table 2.2 & Figure 2.3):

Table 2.2 Descriptive table of shapefiles from the **Konin region** geodatabase.

Feature	Year	Area	Description
LC_Kazimierz_2018	2018	Kazimierz open-pit mine	The land cover classes classified by using a machine learning approach
LC_Kazimierz_2019	2019		
LC_Kazimierz_2020	2020		
LC_Kazimierz_2021	2021		
LC_Jozwin_2018	2018	Jozwin open-pit mine	
LC_Jozwin_2019	2019		
LC_Jozwin_2020	2020		

LC_Jozwin_2021	2021		
LC_ Adamow_2018	2018	Adamow open-pit mine	
LC_ Adamow_2019	2019		
LC_ Adamow_2020	2020		
LC_ Adamow_2021	2021		
CLC_Konin_1990	1990	Konin region	Copernicus Land Monitoring Service
CLC_Konin_2000	2000		
CLC_Konin_2006	2006		
CLC_Konin_2012	2012		
CLC_Konin_2018	2018		

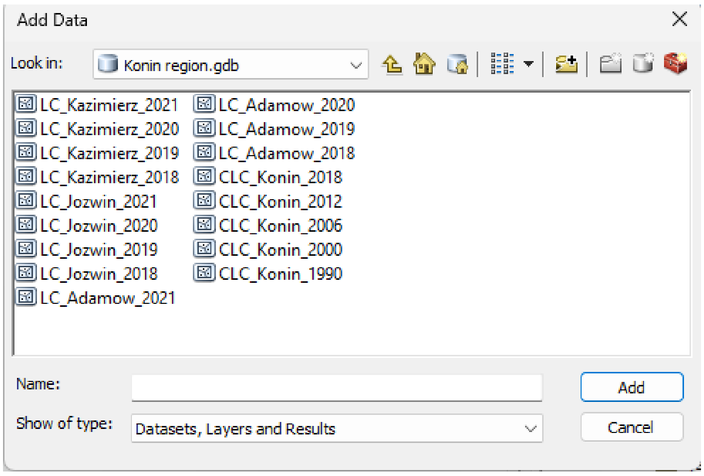


Figure 2.3 Visualization of shapefiles from the **Konin region** geodatabase.

The third geodatabase, titled as **Western Macedonia region**, contains the following vector layers (Table 2.3 & Figure 2.4):

Table 2.3 Descriptive table of shapefiles from the **Western Macedonia region** geodatabase.

Feature	Year	Area	Description
LC_Amynteo_2018	2018	Amynteo open-pit mine	The land cover classes classified by using a machine learning approach
LC_ Amynteo _2019	2019		
LC_ Amynteo _2020	2020		
LC_ Amynteo _2021	2021		
LC_Ptolemaida_2018	2018		

LC_ Ptolemaida _2019	2019	Ptolemaida open-pit mine	
LC_ Ptolemaida _2020	2020		
LC_ Ptolemaida _2021	2021		
CLC_WM_1990	1990	Western Macedonia region	Copernicus Land Monitoring Service
CLC_ WM _2000	2000		
CLC_ WM _2006	2006		
CLC_ WM _2012	2012		
CLC_ WM _2018	2018		

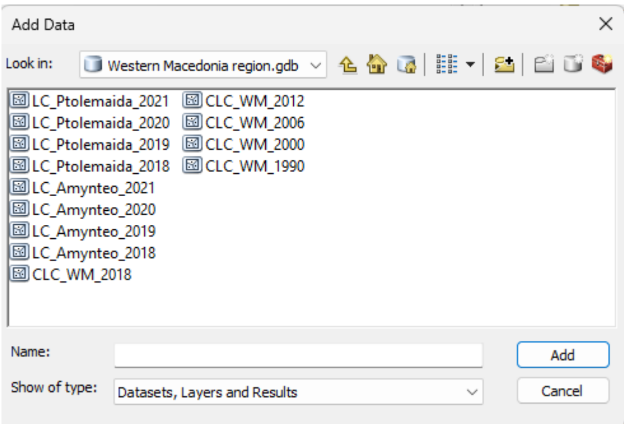


Figure 2.4 Visualization of shapefiles from the **Western Macedonia region** geodatabase.

The fourth geodatabase, titled as **Ruhr area**, contains the following vector layers (Table 2.4 & Figure 2.5):

Table 2.4 Descriptive table of shapefiles from the **Ruhr area** geodatabase.

Feature	Year	Area	Description
CLC_Ruhr_1990	1990	Ruhr	Copernicus Land Monitoring Service
CLC_ Ruhr _2000	2000		
CLC_ Ruhr _2006	2006		
CLC_ Ruhr _2012	2012		
CLC_ Ruhr _2018	2018		

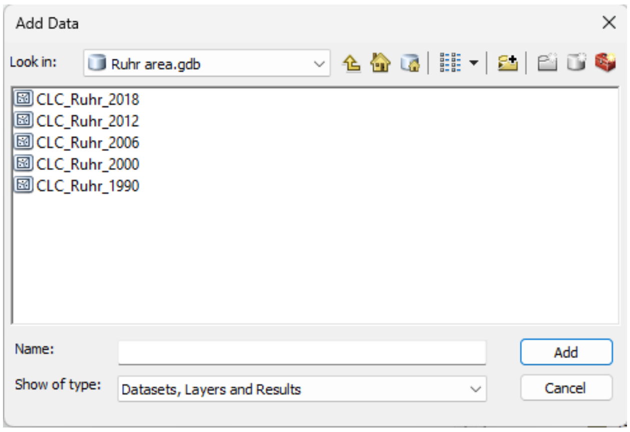


Figure 2.5 Visualization of shapefiles from the **Ruhr area** geodatabase.

The fifth geodatabase, titled as **Western Macedonia RES**, contains the following vector layers (Table 2.5 & Figure 2.6):

Table 2.5 Descriptive table of shapefiles from the **Western Macedonia RES** geodatabase.

Feature	**Description**
suitable_WP_WM	The potentially suitable sites for the installation of Wind parks
suitable_PV_WM	The potentially suitable sites for the installation of Photovoltaic parks
overlapped_RES_WM	Overlapped areas that are suitable for the installation of both Renewable Energy Sources types
WM_study_area	Study area's geographical boundaries in the Western Macedonia region

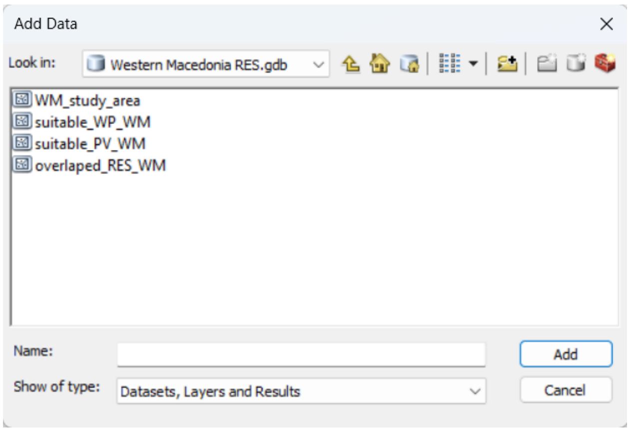


Figure 2.6 Visualization of shapefiles from the **Western Macedonia RES** geodatabase.

The sixth geodatabase, titled as **Konin RES**, contains the following vector layers (Table 2.6 & Figure 2.7):

Table 2.6 Descriptive table of shapefiles from the **Konin RES** geodatabase.

Feature	Area	Description
suitable_WP_Adamow	Adamow open-pit mine	The potentially suitable sites for the installation of Wind parks
suitable_WP_Jozwin	Jozwin open-pit mine	
suitable_WP_Kazimierz	Kazimierz open-pit mine	
suitable_PV_Adamow	Adamow open-pit mine	The potentially suitable sites for the installation of Photovoltaic parks
suitable_PV_ Jozwin	Jozwin open-pit mine	
suitable_PV_ Kazimierz	Kazimierz open-pit mine	
overlapped_RES_Adamow	Adamow open-pit mine	Overlapped areas that are suitable for the installation of both

overlapped_RES_ Jozwin	Jozwin open-pit mine	Renewable Energy Sources types
overlapped_RES_ Kazimierz	Kazimierz open-pit mine	

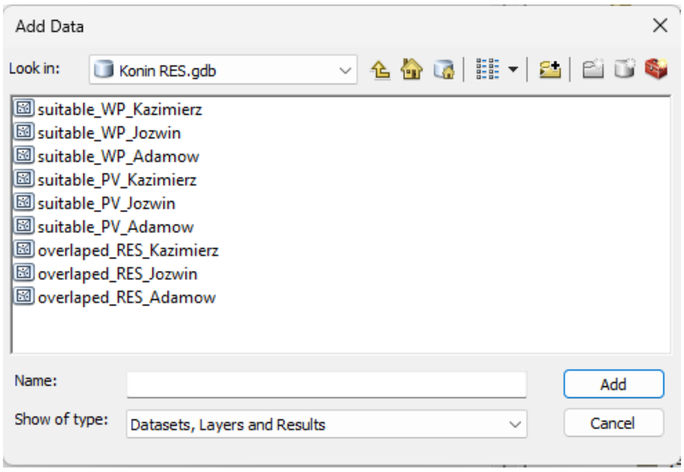


Figure 2.7 Visualization of shapefiles from the **Konin RES** geodatabase.

3. GEOSPATIAL DATASET DESCRIPTION

The following section provides a description of the geospatial data included in the existing geodatabases.

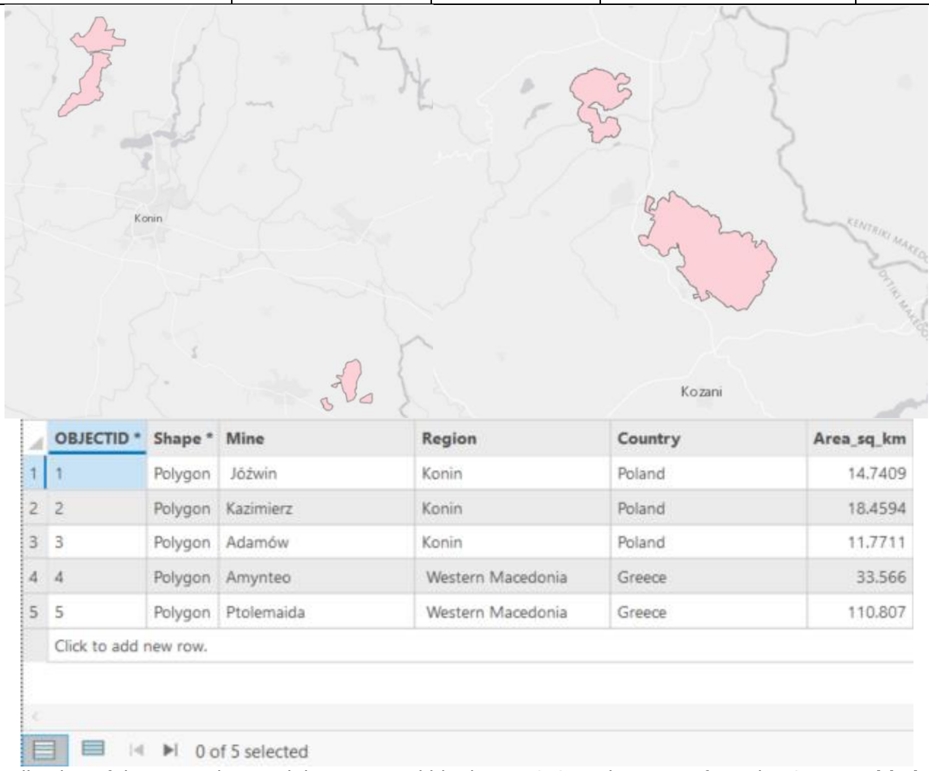
i. GEOGRAPHIC BOUNDARIES

The first geodatabase with the title **"Geographic boundaries"** includes 2 features regarding the mining areas and the regional boundaries of the WINTER project. Specifically, the shapefile of the mining areas (Table 3.1 & Figure 3.1) consist of 5 entities that illustrating the boundaries of open-pit mines in the Western Macedonia and Konin regions. The attribute table contains information about the names of the mines (Mine), the region (Region) and the country (Country) which they belong, and the area coverage in square kilometers (Area_sq_km). Additionally, the second shapefile about the regional boundaries contains 3 entities, representing the Ruhr area, Western Macedonia, and Konin regions (Table 3.1 & Figure 3.2). Particularly, the attribute table provides information about the names of the regions (Region), their country (Country), their area coverage in square kilometers (Area_sq_km), and the population of each region (Population).

Table 3.1 Descriptive table of shapefiles from the **Geographic boundaries** geodatabase.

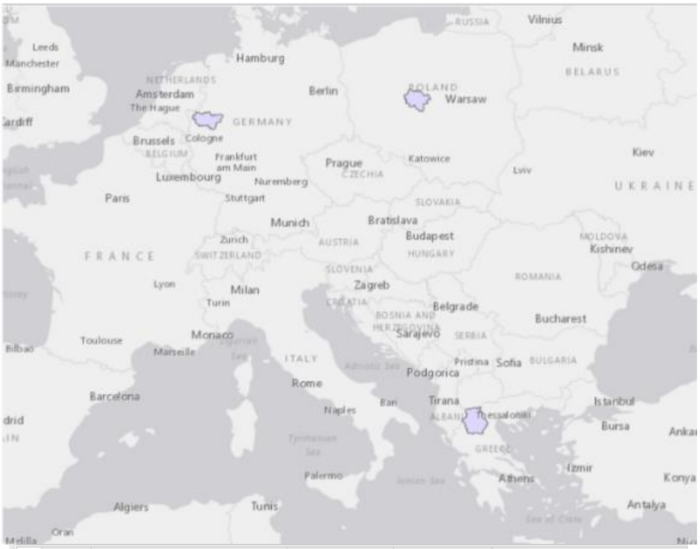
Feature	**Geometry Type**	**Number of Entities**	**Fields (type)**	**Description**
Mining_areas	Polygon	5	Mine (Text), Region (Text), Country (Text), Area_sq_km (Numeric)	Illustrating the boundaries of open-pit mines in Western Macedonia and Konin regions

Regional_boundaries	Polygon	3	Region (Text), Country (Text), Area_sq_km (Numeric), Population (Numeric)	Representing the regional boundaries of the Ruhr area, Western Macedonia, and Konin regions



	OBJECTID *	Shape *	Mine	Region	Country	Area_sq_km
1	1	Polygon	Jóźwin	Konin	Poland	14.7409
2	2	Polygon	Kazimierz	Konin	Poland	18.4594
3	3	Polygon	Adamów	Konin	Poland	11.7711
4	4	Polygon	Amynteo	Western Macedonia	Greece	33.566
5	5	Polygon	Ptolemaida	Western Macedonia	Greece	110.807

Figure 3.1 Visualization of the vector layer mining_areas within the ArcGIS environment, from the **Geographic boundaries.gdb** geodatabase.



FID *	Region	Area_sq_km	Population	Country
1	Konin	4438	3471812	Poland
2	Rurh	4426	5100000	Germany
3	Western Macedonia	9461	255000	Greece

Click to add new row.

0 of 3 selected

Figure 3.2 Visualization of the vector layer regional_boundaries within the ArcGIS environment, from the **Geographic boundaries.gdb** geodatabase.

ii. KONIN REGION

The second relational database with the name "**Konin region"** contains a number of 17 features, each of them representing different year of Land Cover and Land Uses within the open-pit mines and the wider area in Konin region, spanning from 1990 to 2021. These shapefiles, with polygon geometry, vary in their number of entities, illustrating the evolving landscape over three decades divided to Corine Land Cover products and Land Cover products.

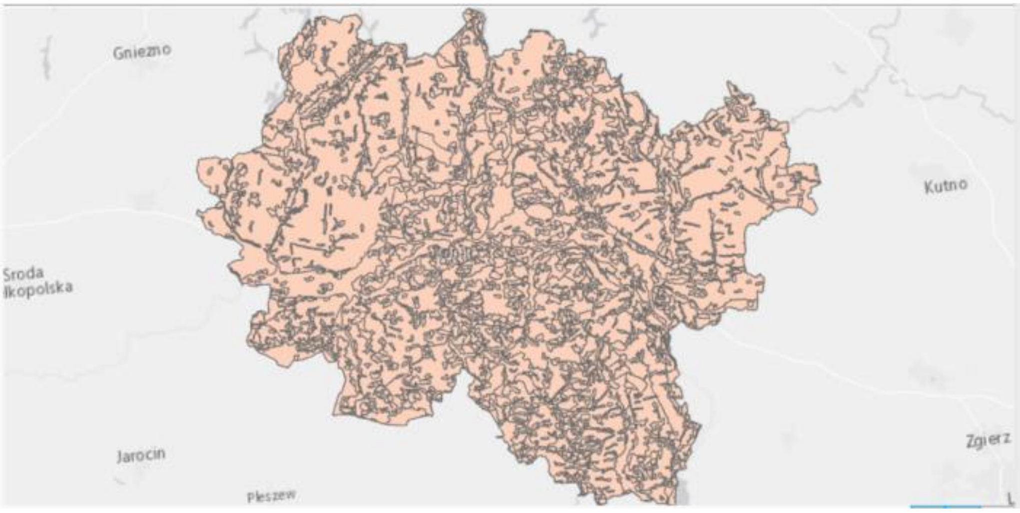
CORINE LAND COVER (CLC)

The CLC_Konin layers (1990 to 2018) (Figure 3.3 to 3.7) focuses on the boundaries of Konin region, illustrating the Corine Land Cover (CLC) datasets with detailed attribute tables containing information about the Corine Land Cover codes (Code_90 to Code_18 for each respective year), class descriptions (Class), and area coverage in square kilometers (Area_sq_km) (Table 3.2).

Table 3.2 Detailed description of the Corine Land Cover features from the **Konin region** geodatabase.

Feature	Year	Geometry Type	Number of Entities	Fields (type)
CLC_Konin_1990	1990	Polygon	1692	Code_90 (Text), Class (Text), Area_sq_km (Numeric)
CLC_Konin_2000	2000	Polygon	1765	Code_00 (Text), Class (Text), Area_sq_km (Numeric)

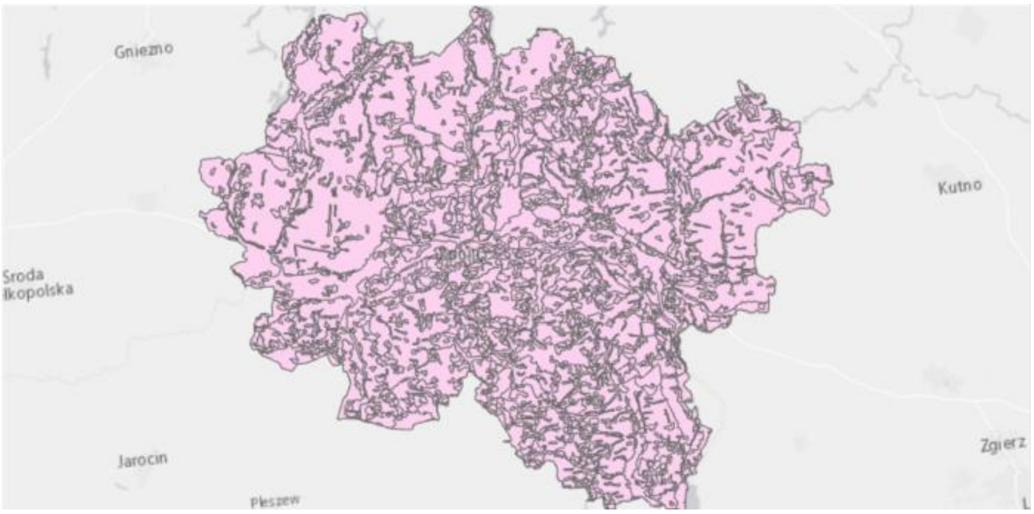
CLC_Konin_2006	2006	Polygon	1803	Code_06 (Text), Class (Text), Area_sq_km (Numeric)
CLC_Konin_2012	2012	Polygon	1871	Code_12 (Text), Class (Text), Area_sq_km (Numeric)
CLC_Konin_2018	2018	Polygon	1913	Code_18 (Text), Class (Text), Area_sq_km (Numeric)



	OBJECTID *	Shape *	code_90	Class	Area_sq_km
1	1	Polygon	112	Urban fabric	0.284531
2	2	Polygon	112	Urban fabric	0.622237
3	3	Polygon	112	Urban fabric	0.318828
4	4	Polygon	112	Urban fabric	0.847414
5	5	Polygon	112	Urban fabric	0.322584
6	6	Polygon	112	Urban fabric	0.673696
7	7	Polygon	112	Urban fabric	0.259914
8	8	Polygon	112	Urban fabric	0.306882
9	9	Polygon	112	Urban fabric	0.370128
10	10	Polygon	112	Urban fabric	0.390499
11	11	Polygon	112	Urban fabric	0.405969

0 of 1,692 selected

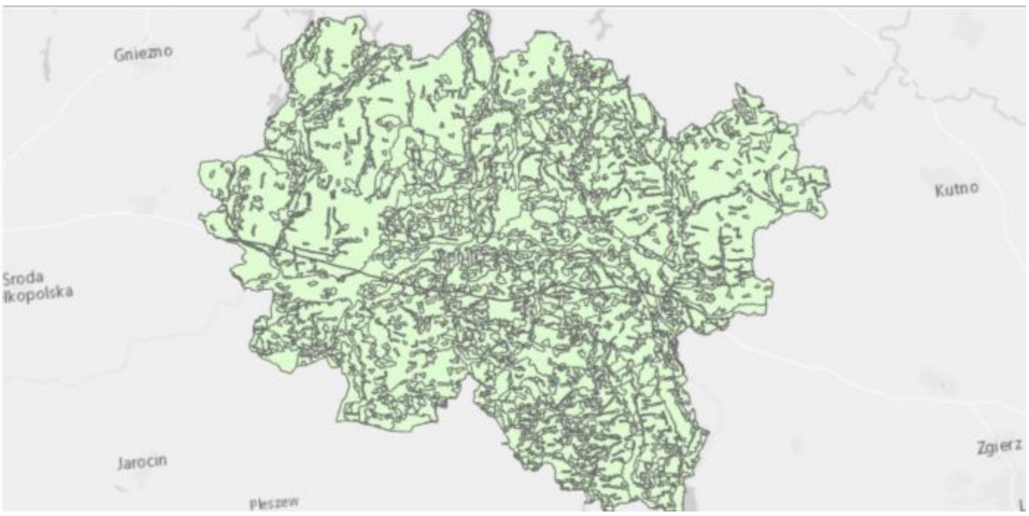
Figure 3.3 Visualization of the vector layer CLC_Konin_1990 within the ArcGIS environment, from the **Konin region.gdb** geodatabase.



	OBJECTID *	Shape *	code_00	Class	Area_sq_km
1	1	Polygon	112	Urban fabric	0.284531
2	2	Polygon	112	Urban fabric	0.424211
3	3	Polygon	112	Urban fabric	0.345182
4	4	Polygon	112	Urban fabric	0.311835
5	5	Polygon	112	Urban fabric	0.355213
6	6	Polygon	112	Urban fabric	0.622238
7	7	Polygon	112	Urban fabric	0.318831
8	8	Polygon	112	Urban fabric	0.940705
9	9	Polygon	112	Urban fabric	0.532456
10	10	Polygon	112	Urban fabric	0.322593
11	11	Polygon	112	Urban fabric	0.664094

0 of 1,765 selected

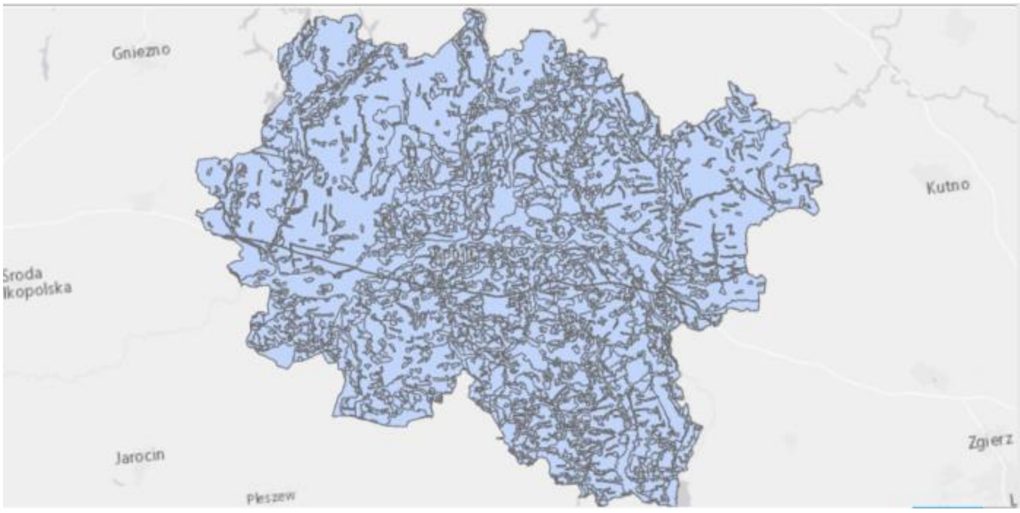
Figure 3.4 Visualization of the vector layer CLC_Konin_2000 within the ArcGIS environment, from the **Konin region.gdb** geodatabase.



	OBJECTID *	Shape *	Code_06	Class	Area_sq_km
1	1	Polygon	112	Urban fabric	0.385308
2	2	Polygon	112	Urban fabric	0.470682
3	3	Polygon	112	Urban fabric	0.150168
4	4	Polygon	231	Pastures	1.11758
5	5	Polygon	231	Pastures	0.936455
6	6	Polygon	231	Pastures	0.307146
7	7	Polygon	242	Heterogeneous agricult...	0.013065
8	8	Polygon	242	Heterogeneous agricult...	0.275956
9	9	Polygon	242	Heterogeneous agricult...	0.376524
10	10	Polygon	242	Heterogeneous agricult...	0.324015
11	11	Polygon	242	Heterogeneous agricult...	0.420888

0 of 1,801 selected

Figure 3.5 Visualization of the vector layer CLC_Konin_2006 within the ArcGIS environment, from the **Konin region.gdb** geodatabase.



	OBJECTID *	Shape *	Code_12	Class	Area_sq_km
1	1	Polygon	112	Urban fabric	0.026843
2	2	Polygon	112	Urban fabric	0.351371
3	3	Polygon	112	Urban fabric	0.264925
4	4	Polygon	112	Urban fabric	0.424211
5	5	Polygon	112	Urban fabric	0.345181
6	6	Polygon	112	Urban fabric	0.311835
7	7	Polygon	112	Urban fabric	0.355213
8	8	Polygon	112	Urban fabric	0.277248
9	9	Polygon	112	Urban fabric	0.741272
10	10	Polygon	112	Urban fabric	0.346037
11	11	Polygon	112	Urban fabric	0.308203

0 of 1,871 selected

Figure 3.6 Visualization of the vector layer CLC_Konin_2012 within the ArcGIS environment, from the **Konin region.gdb** geodatabase.

	OBJECTID *	Shape *	Code_18	Class	Area_sq_km
1	1	Polygon	112	Urban fabric	0.026843
2	2	Polygon	112	Urban fabric	0.351371
3	3	Polygon	112	Urban fabric	0.264925
4	4	Polygon	112	Urban fabric	0.424211
5	5	Polygon	112	Urban fabric	0.345181
6	6	Polygon	112	Urban fabric	0.311835
7	7	Polygon	112	Urban fabric	0.355213
8	8	Polygon	112	Urban fabric	0.277248
9	9	Polygon	112	Urban fabric	0.741272
10	10	Polygon	112	Urban fabric	0.346037
11	11	Polygon	112	Urban fabric	0.308203

0 of 1,913 selected

Figure 3.7 Visualization of the vector layer CLC_Konin_2018 within the ArcGIS environment, from the **Konin region.gdb** geodatabase.

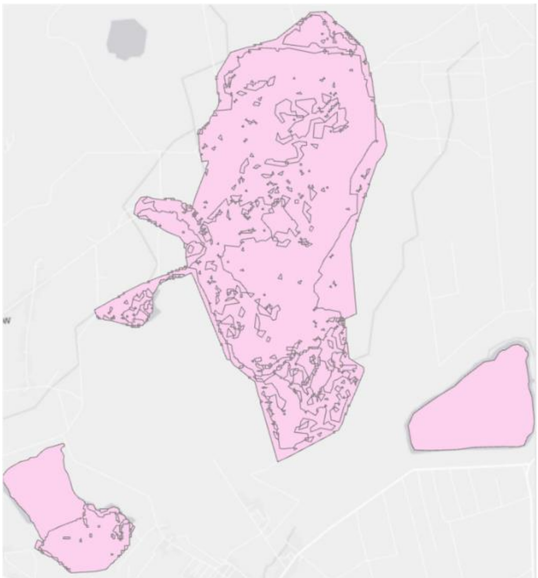
LAND COVER (LC)

The LC_Adamow, LC_Jozwin, and LC_Kazimierz series (2018 to 2021) present Land Cover classes in specific open-pit mines, based on the machine learning classification approach (Figure 3.8 to 3.19). These datasets, containing 4 to 5 entities each, with detailed attribute table about the area coverage in square kilometres (Area), the year of the product (Year), and Land Cover classes (Class) (Table 3.3).

Table 3.3 Detailed description of the Corine Land Cover features from the **Konin region** geodatabase.

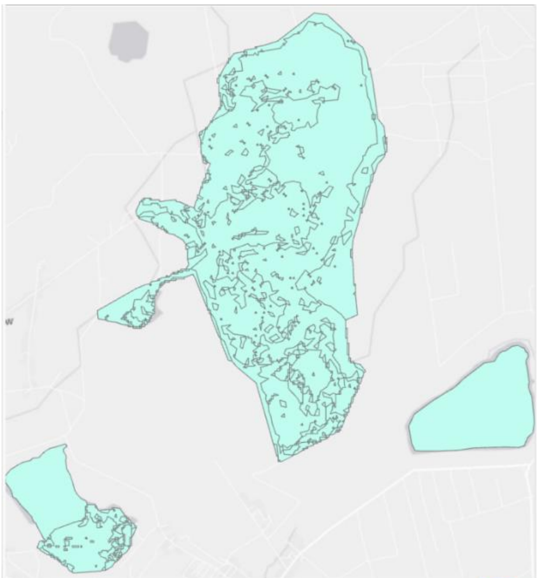
Feature	Year	Geometry Type	Number of Entities	Attributes
LC_Adamow_2018	2018	Polygon	5	Area (Numeric), Year (Text), Class (Text)
LC_Adamow_2019	2019	Polygon	5	Area (Numeric), Year (Text), Class (Text)

LC_Adamow_2020	2020	Polygon	5	Area (Numeric), Year (Text), Class (Text)
LC_Adamow_2021	2021	Polygon	5	Area (Numeric), Year (Text), Class (Text)
LC_Jozwin_2018	2018	Polygon	4	Area (Numeric), Year (Text), Class (Text)
LC_Jozwin_2019	2019	Polygon	4	Area (Numeric), Year (Text), Class (Text)
LC_Jozwin_2020	2020	Polygon	4	Area (Numeric), Year (Text), Class (Text)
LC_Jozwin_2021	2021	Polygon	4	Area (Numeric), Year (Text), Class (Text)
LC_Kazimierz_2018	2018	Polygon	5	Area (Numeric), Year (Text), Class (Text)
LC_Kazimierz_2019	2019	Polygon	5	Area (Numeric), Year (Text), Class (Text)
LC_Kazimierz_2020	2020	Polygon	5	Area (Numeric), Year (Text), Class (Text)
LC_Kazimierz_2021	2021	Polygon	5	Area (Numeric), Year (Text), Class (Text)



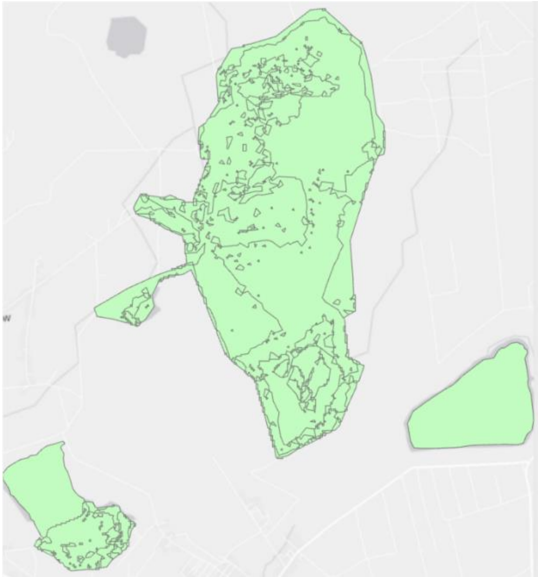
	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	1	1	1.08802	2018	Vegetation
2	2	Polygon	2	6	5.68715	2018	Mining active area
3	3	Polygon	4	5	2.7602	2018	Bare soil
4	4	Polygon	237	4	2.08901	2018	Water bodies
5	5	Polygon	293	5	0.133691	2018	Infrastructures

Figure 3.8 Visualization of the vector layer LC_Adamow_2018 within the ArcGIS environment, from the **Konin region.gdb** geodatabase.



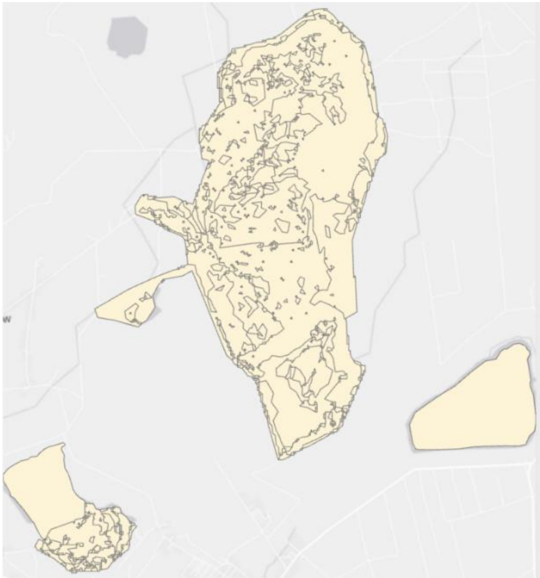
	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	1	5	3.54462	2019	Bare soil
2	2	Polygon	2	1	0.849296	2019	Vegetation
3	3	Polygon	3	2	5.00467	2019	Mining active area
4	4	Polygon	25	4	2.22154	2019	Water bodies
5	5	Polygon	250	2	0.13906	2019	Infrastructures

Figure 3.9 Visualization of the vector layer LC_Adamow_2019 within the ArcGIS environment, from the **Konin region.gdb** geodatabase.



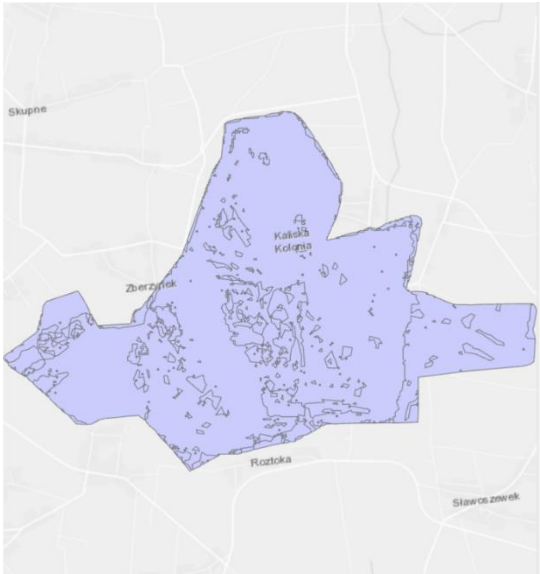
	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	1	1	0.911176	2020	Vegetation
2	2	Polygon	2	2	5.09587	2020	Mining active area
3	3	Polygon	8	5	3.44662	2020	Bare soil
4	4	Polygon	132	4	2.18705	2020	Water bodies
5	5	Polygon	316	2	0.119332	2020	Infrastructures

Figure 3.10 Visualization of the vector layer LC_Adamow_2020 within the ArcGIS environment, from the **Konin region.gdb** geodatabase.



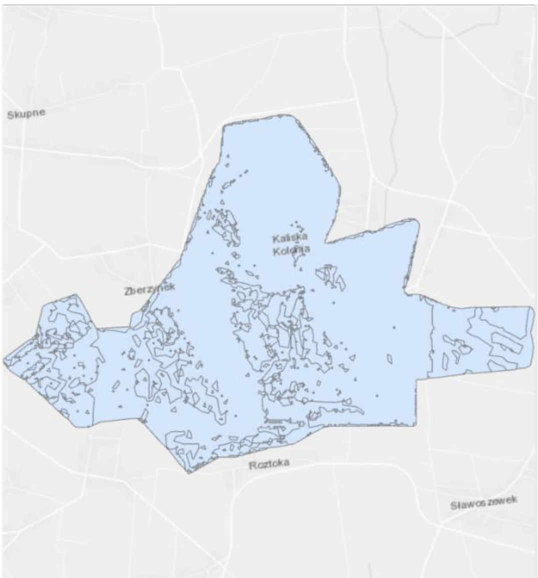
	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	1	1	1.82608	2021	Vegetation
2	2	Polygon	2	5	3.03878	2021	Bare soil
3	3	Polygon	4	6	4.55533	2021	Mining active area
4	4	Polygon	237	4	2.23902	2021	Water bodies
5	5	Polygon	430	2	0.101406	2021	Infrastructures

Figure 3.11 Visualization of the vector layer LC_Adamow_2021 within the ArcGIS environment, from the **Konin region.gdb** geodatabase.



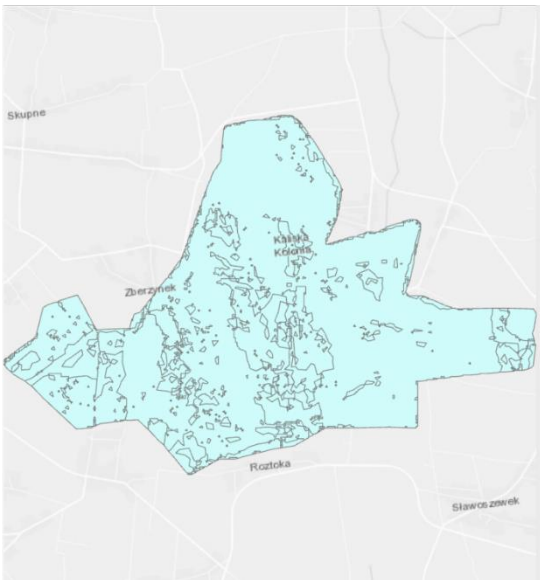
	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	1	5	3.44154	2018	Bare soil
2	2	Polygon	2	6	10.7542	2018	Mining active area
3	3	Polygon	13	1	0.403149	2018	Vegetation
4	4	Polygon	121	4	0.099319	2018	Water bodies

Figure 3.12 Visualization of the vector layer LC_Jozwin_2018 within the ArcGIS environment, from the **Konin region.gdb** geodatabase.



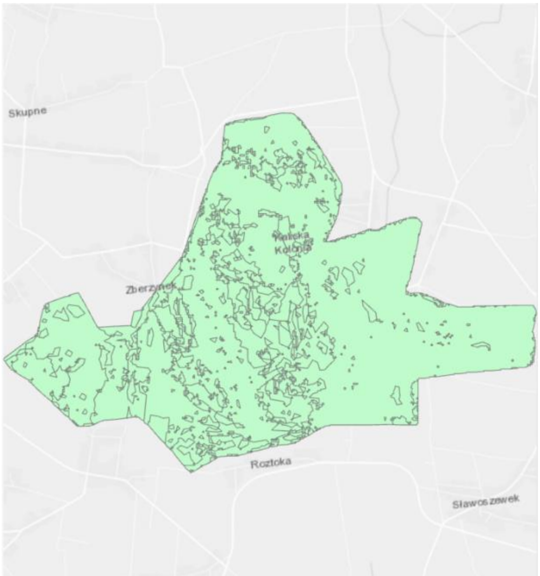
OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	Polygon	1	5	3.29172	2019	Bare soil
2	Polygon	2	2	10.41	2019	Mining active area
3	Polygon	3	1	0.833516	2019	Vegetation
4	Polygon	62	4	0.158706	2019	Water bodies

Figure 3.13 Visualization of the vector layer LC_Jozwin_2019 within the ArcGIS environment, from the **Konin region.gdb** geodatabase.



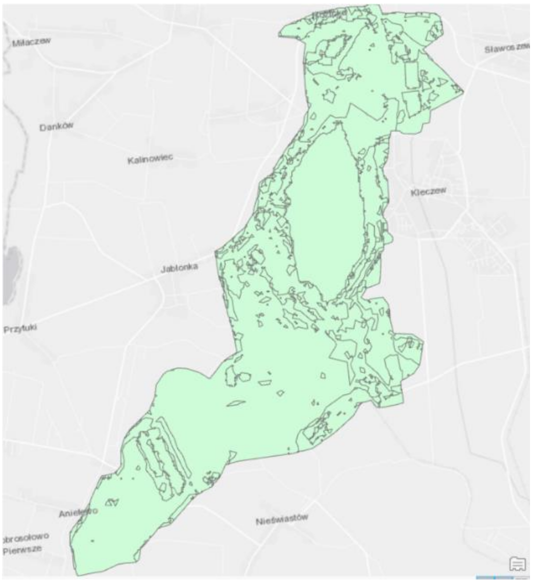
	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	1	6	9.96714	2020	Mining active area
2	2	Polygon	2	5	2.7844	2020	Bare soil
3	3	Polygon	12	1	1.76762	2020	Vegetation
4	4	Polygon	83	4	0.179199	2020	Water bodies

Figure 3.14 Visualization of the vector layer LC_Jozwin_2020 within the ArcGIS environment, from the **Konin region.gdb** geodatabase.



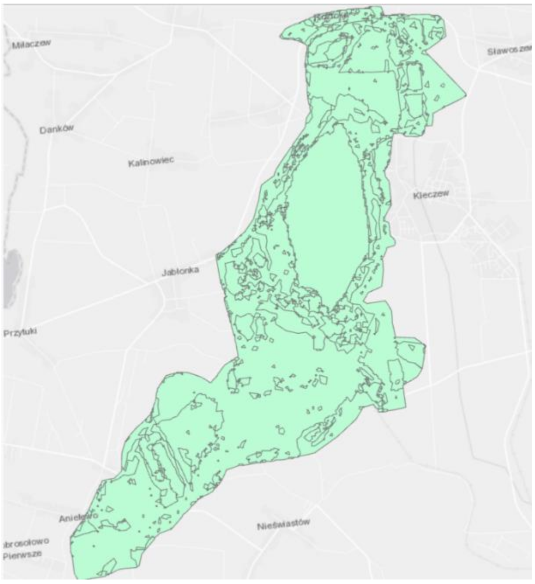
	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	1	5	3.02189	2021	Bare soil
2	2	Polygon	6	1	2.02259	2021	Vegetation
3	3	Polygon	7	2	9.45615	2021	Mining active area
4	4	Polygon	54	4	0.189881	2021	Water bodies

Figure 3.15 Visualization of the vector layer LC_Jozwin_2021 within the ArcGIS environment, from the **Konin region.gdb** geodatabase.



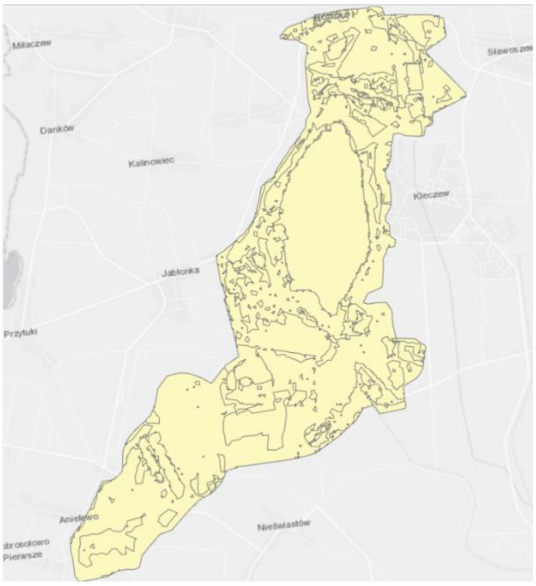
	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	946	6	2.32794	2018	Mining active area
2	2	Polygon	963	1	2.0523	2018	Vegetation
3	3	Polygon	964	5	11.1086	2018	Bare soil
4	4	Polygon	1134	4	2.86265	2018	Water bodies
5	5	Polygon	1307	2	0.050312	2018	Infrastructures

Figure 3.16 Visualization of the vector layer LC_Kazimierz_2018 within the ArcGIS environment, from the **Konin region.gdb** geodatabase.



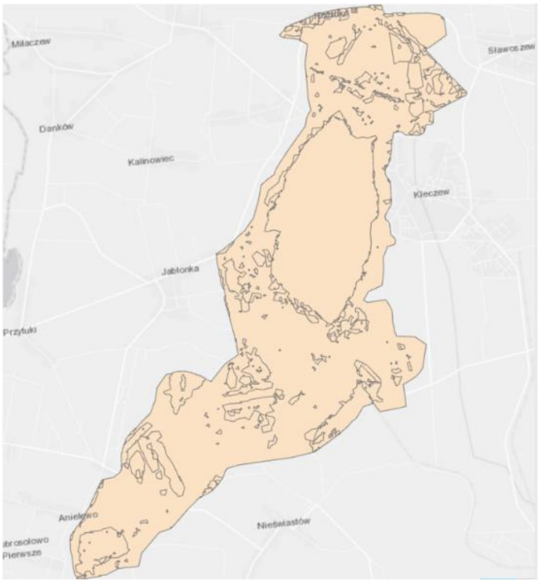
	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	1072	5	8.83529	2019	Bare soil
2	2	Polygon	1073	6	2.12628	2019	Mining active area
3	3	Polygon	1084	1	4.39437	2019	Vegetation
4	4	Polygon	1288	4	2.97645	2019	Water bodies
5	5	Polygon	2143	2	0.072156	2019	Infrastructures

Figure 3.17 Visualization of the vector layer LC_Kazimierz_2019 within the ArcGIS environment, from the **Konin region.gdb** geodatabase.



	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	1205	1	9.68225	2020	Vegetation
2	2	Polygon	1206	2	0.611027	2020	Mining active area
3	3	Polygon	1208	5	4.74778	2020	Bare soil
4	4	Polygon	1335	4	3.29472	2020	Water bodies
5	5	Polygon	1944	2	0.062499	2020	Infrastructures

Figure 3.18 Visualization of the vector layer LC_Kazimierz_2020 within the ArcGIS environment, from the **Konin region.gdb** geodatabase.



	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	1799	6	0.470089	2021	Mining active area
2	2	Polygon	1802	1	11.6393	2021	Vegetation
3	3	Polygon	1817	5	2.18893	2021	Bare soil
4	4	Polygon	1924	4	4.04519	2021	Water bodies
5	5	Polygon	2518	2	0.067953	2021	Infrastructures

Figure 3.19 Visualization of the vector layer LC_Kazimierz_2021 within the ArcGIS environment, from the **Konin region.gdb** geodatabase.

iii. WESTERN MACEDONIA REGION

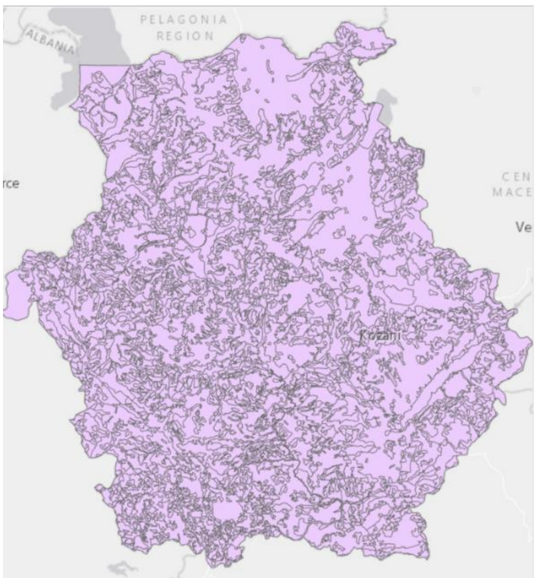
The third geodatabase called **Western Macedonia region** contains a set of 13 layers, presenting the Land Cover and Land Uses within the Western Macedonia region, in the Amynteo and Ptolemaida open-pit mines, during the time period from 1990 to 2021. Specifically, the features are separated into Corine Land Cover and Land Cover products.

CORINE LAND COVER (CLC)

The CLC_WM features (1990 to 2018) representing the Corine Land Cover products of the Western Macedonia region (Figure 3.20 to 3.24), providing detailed attribute tables about the Corine Land Cover codes (Code_90 to Code_18 for each respective year), Land Cover class (Class), and area coverage in square kilometres (Area_sq_km) (Table 3.4).

Table 3.4 Detailed description of the Corine Land Cover features from the **Western Macedonia region** geodatabase.

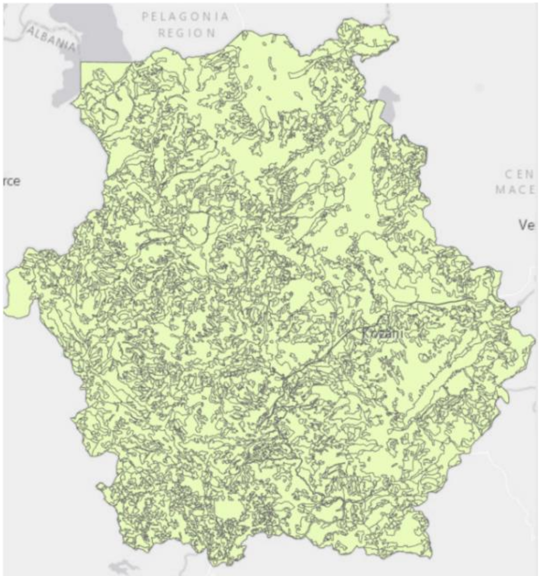
Feature	Year	Geometry Type	Number of Entities	Fields (type)
CLC_WM_1990	1990	Polygon	2352	Code_90 (Text), Class (Text), Area_sq_km (Numeric)
CLC_WM_2000	2000	Polygon	2380	Code_00 (Text), Class (Text), Area_sq_km (Numeric)
CLC_WM_2006	2006	Polygon	2426	Code_06 (Text), Class (Text), Area_sq_km (Numeric)
CLC_WM_2012	2012	Polygon	2981	Code_12 (Text), Class (Text), Area_sq_km (Numeric)
CLC_WM_2018	2018	Polygon	3008	Code_18 (Text), Class (Text), Area_sq_km (Numeric)



	OBJECTID *	Shape *	code_90	Class	Area_sq_km
1	1	Polygon	111	Urban fabric	0.61
2	2	Polygon	111	Urban fabric	0.37
3	3	Polygon	112	Urban fabric	0.33
4	4	Polygon	112	Urban fabric	0.33
5	5	Polygon	112	Urban fabric	0.41
6	6	Polygon	112	Urban fabric	0.93
7	7	Polygon	112	Urban fabric	0.26
8	8	Polygon	112	Urban fabric	0.25
9	9	Polygon	112	Urban fabric	0.26
10	10	Polygon	112	Urban fabric	0.28

0 of 2,352 selected

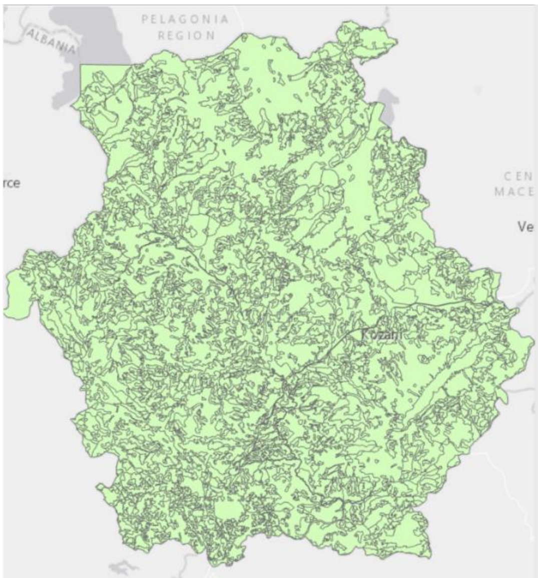
Figure 3.20 Visualization of the vector layer CLC_WM_1990 within the ArcGIS environment, from the **Western Macedonia region.gdb** geodatabase.



	OBJECTID *	Shape *	code_00	Class	Area_sq_km
1	1	Polygon	111	Urban fabric	0.61
2	2	Polygon	111	Urban fabric	0.37
3	3	Polygon	112	Urban fabric	0.33
4	4	Polygon	112	Urban fabric	0.33
5	5	Polygon	112	Urban fabric	0.41
6	6	Polygon	112	Urban fabric	0.93
7	7	Polygon	112	Urban fabric	0.26
8	8	Polygon	112	Urban fabric	0.25
9	9	Polygon	112	Urban fabric	0.26
10	10	Polygon	112	Urban fabric	0.28

0 of 2,380 selected

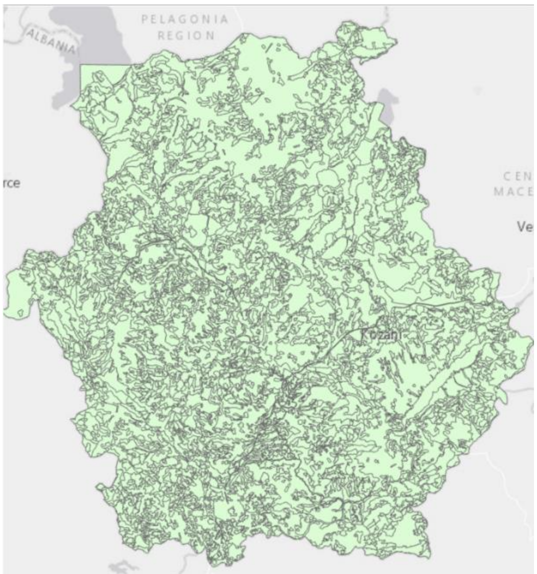
Figure 3.21 Visualization of the vector layer CLC_WM_2000 within the ArcGIS environment, from the **Western Macedonia region.gdb** geodatabase.



	OBJECTID *	Shape *	Code_06	Class	Area_sq_km
1	1	Polygon	111	Urban fabric	0.61
2	2	Polygon	112	Urban fabric	0.35
3	3	Polygon	112	Urban fabric	0.33
4	4	Polygon	112	Urban fabric	0.41
5	5	Polygon	112	Urban fabric	0.93
6	6	Polygon	112	Urban fabric	0.29
7	7	Polygon	112	Urban fabric	0.25
8	8	Polygon	112	Urban fabric	0.41
9	9	Polygon	112	Urban fabric	0.28
10	10	Polygon	112	Urban fabric	0.41

0 of 2,426 selected

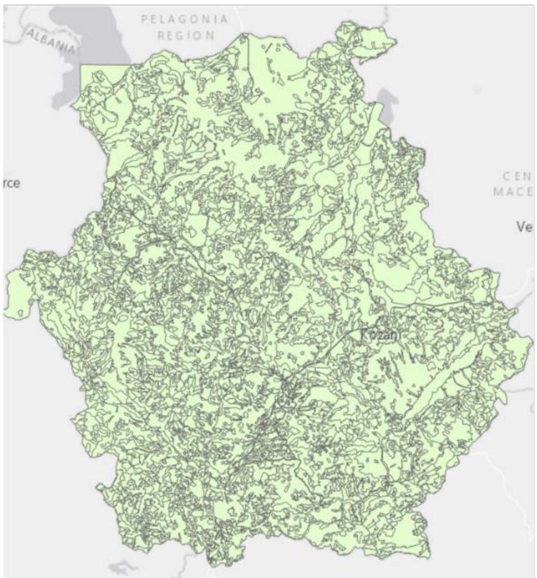
Figure 3.22 Visualization of the vector layer CLC_WM_2006 within the ArcGIS environment, from the **Western Macedonia region.gdb** geodatabase.



	OBJECTID *	Shape *	Code_12	Class	Area_sq_km
1	1	Polygon	111	Urban fabric	0.61
2	2	Polygon	112	Urban fabric	0.29
3	3	Polygon	112	Urban fabric	0.26
4	4	Polygon	112	Urban fabric	0.27
5	5	Polygon	112	Urban fabric	0.42
6	6	Polygon	112	Urban fabric	0.26
7	7	Polygon	112	Urban fabric	0.31
8	8	Polygon	112	Urban fabric	0.97
9	9	Polygon	112	Urban fabric	0.27
10	10	Polygon	112	Urban fabric	0.25

0 of 2,981 selected

Figure 3.23 Visualization of the vector layer CLC_WM_2012 within the ArcGIS environment, from the **Western Macedonia region.gdb** geodatabase.



	OBJECTID *	Shape *	Code_18	Class	Area_sq_km
1	1	Polygon	111	Urban fabric	0.61
2	2	Polygon	112	Urban fabric	0.29
3	3	Polygon	112	Urban fabric	0.26
4	4	Polygon	112	Urban fabric	0.27
5	5	Polygon	112	Urban fabric	0.42
6	6	Polygon	112	Urban fabric	0.26
7	7	Polygon	112	Urban fabric	0.31
8	8	Polygon	112	Urban fabric	0.97
9	9	Polygon	112	Urban fabric	0.27
10	10	Polygon	112	Urban fabric	0.25

0 of 3,008 selected

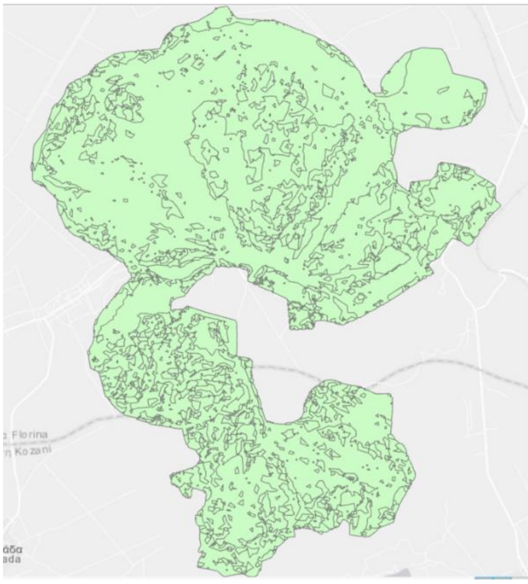
Figure 3.24 Visualization of the vector layer CLC_WM_2018 within the ArcGIS environment, from **the Western Macedonia region.gdb** geodatabase.

LAND COVER (LC)

The LC_Amynteo and LC_Ptolemaida layers (2018 to 2021) (Figure 3.25 to 3.32) focusing on the specific open-pit mines, each containing 5 entities based on the ML classification approach. Specifically, the attribute table of each feature includes information about the area coverage in square kilometres (Area), the observed year (Year), and the Land Cover classes (Class) (Table 3.5).

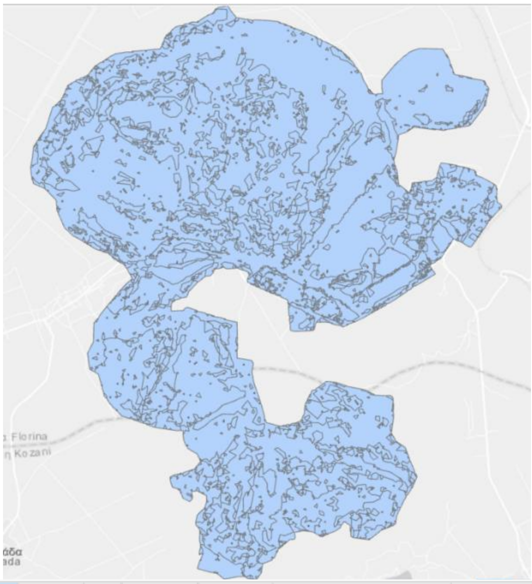
Table 3.5 Detailed description of the Land Cover features from the **Western Macedonia region** geodatabase.

Feature	Year	Geometry Type	Number of Entities	Fields (type)
LC_Amynteo_2018	2018	Polygon	5	Area (Numeric), Year (Text), Class (Text)
LC_Amynteo_2019	2019	Polygon	5	Area (Numeric), Year (Text), Class (Text)
LC_Amynteo_2020	2020	Polygon	5	Area (Numeric), Year (Text), Class (Text)
LC_Amynteo_2021	2021	Polygon	5	Area (Numeric), Year (Text), Class (Text)
LC_Ptolemaida_2018	2018	Polygon	5	Area (Numeric), Year (Text), Class (Text)
LC_Ptolemaida_2019	2019	Polygon	5	Area (Numeric), Year (Text), Class (Text)
LC_Ptolemaida_2020	2020	Polygon	5	Area (Numeric), Year (Text), Class (Text)
LC_Ptolemaida_2021	2021	Polygon	5	Area (Numeric), Year (Text), Class (Text)



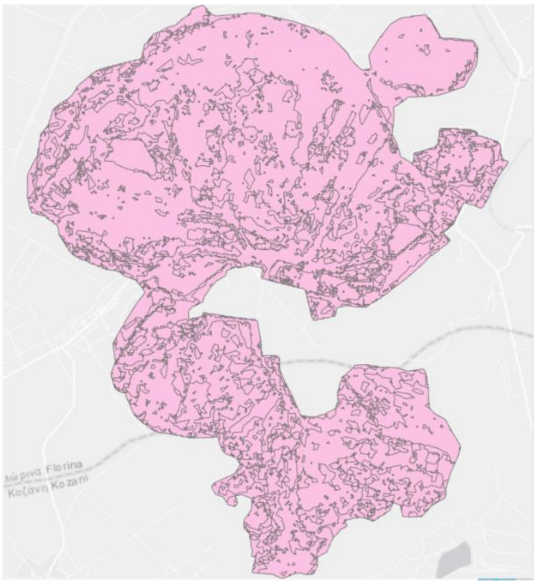
	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	1	6	19.2422	2018	Mining active area
2	2	Polygon	3	5	9.12856	2018	Bare soil
3	3	Polygon	10	2	0.685693	2018	Infrastructures
4	4	Polygon	18	1	4.24845	2018	Vegetation
5	5	Polygon	83	4	0.074944	2018	Water bodies

Figure 3.25 Visualization of the vector layer LC_Amynteo_2018 within the ArcGIS environment, from the **Western Macedonia region.gdb** geodatabase.



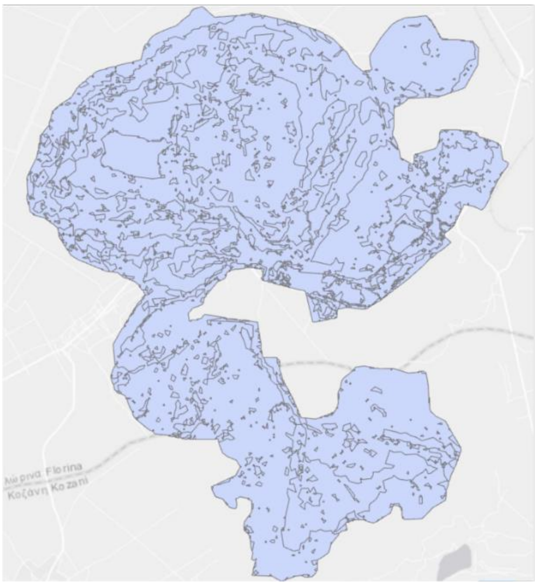
	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	1	6	16.748	2019	Mining active area
2	2	Polygon	3	5	12.2551	2019	Bare soil
3	3	Polygon	23	1	3.53277	2019	Vegetation
4	4	Polygon	80	4	0.116582	2019	Water bodies
5	5	Polygon	745	2	0.825629	2019	Infrastructures

Figure 3.26 Visualization of the vector layer LC_Amynteo_2019 within the ArcGIS environment, from the **Western Macedonia region.gdb** geodatabase.



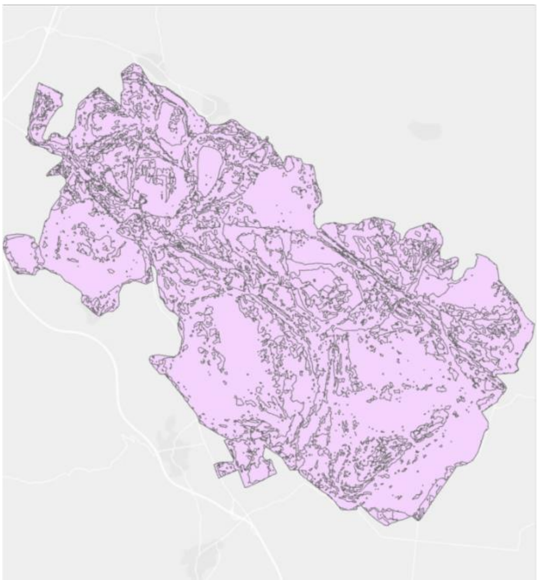
	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	1	1	8.27098	2020	Vegetation
2	2	Polygon	3	6	13.6535	2020	Mining active area
3	3	Polygon	4	5	10.6178	2020	Bare soil
4	4	Polygon	72	4	0.324152	2020	Water bodies
5	5	Polygon	262	2	0.604612	2020	Infrastructures

Figure 3.27 Visualization of the vector layer LC_Amynteo_2020 within the ArcGIS environment, from the **Western Macedonia region.gdb** geodatabase.



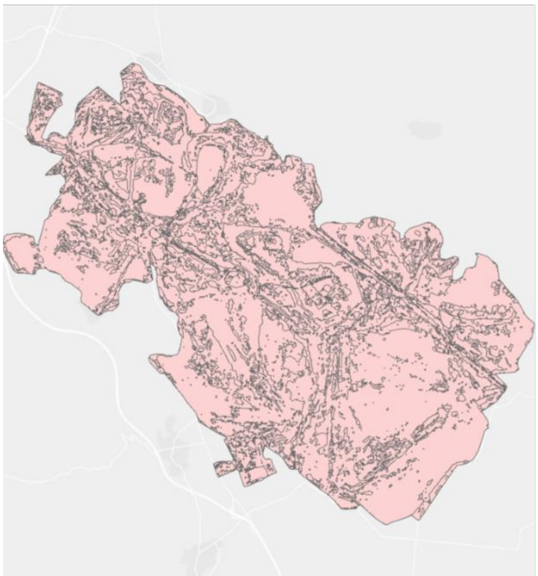
	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	1	5	19.3324	2021	Bare soil
2	2	Polygon	3	6	10.6113	2021	Mining active area
3	3	Polygon	15	2	0.719203	2021	Infrastructures
4	4	Polygon	52	1	2.26244	2021	Vegetation
5	5	Polygon	97	4	0.548635	2021	Water bodies

Figure 3.28 Visualization of the vector layer LC_Amynteo_2021 within the ArcGIS environment, from the **Western Macedonia region.gdb** geodatabase.



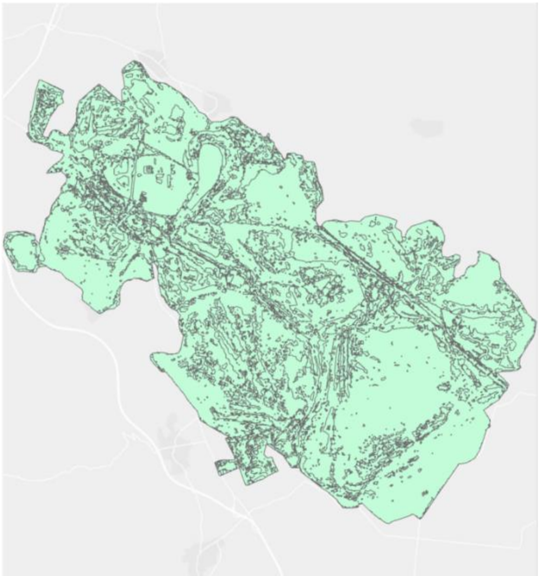
	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	2576	5	32.1067	2018	Bare soil
2	2	Polygon	2583	1	14.212	2018	Vegetation
3	3	Polygon	2588	4	0.676754	2018	Water bodies
4	4	Polygon	2592	6	60.2964	2018	Mining active area
5	5	Polygon	2819	2	3.20367	2018	Infrastructures

Figure 3.29 Visualization of the vector layer LC_Ptolemaida_2018 within the ArcGIS environment, from the **Western Macedonia region.gdb** geodatabase.



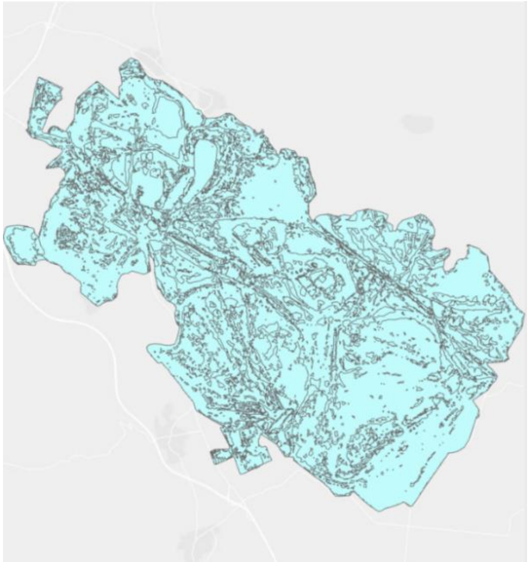
	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	3909	6	56.7548	2019	Mining active area
2	2	Polygon	3910	5	31.9025	2019	Bare soil
3	3	Polygon	3913	1	18.0272	2019	Vegetation
4	4	Polygon	3934	4	0.717236	2019	Water bodies
5	5	Polygon	4129	6	3.24704	2019	Infrastructures

Figure 3.30 Visualization of the vector layer LC_Ptolemadia_2019 within the ArcGIS environment, from the **Western Macedonia region.gdb** geodatabase.



	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	4941	1	26.751	2020	Vegetation
2	2	Polygon	4942	6	53.0577	2020	Processing site
3	3	Polygon	4945	5	26.7522	2020	Bare soil
4	4	Polygon	4985	4	0.61007	2020	Water bodies
5	5	Polygon	5127	2	3.46381	2020	Infrastructures

Figure 3.31 Visualization of the vector layer LC_Ptolemadia_2020 within the ArcGIS environment, from the **Western Macedonia region.gdb** geodatabase.



	OBJECTID *	Shape *	Id	gridcode	Area	Year	Class
1	1	Polygon	2797	6	51.5708	2021	Mining active area
2	2	Polygon	2800	5	37.2174	2021	Bare soil
3	3	Polygon	2803	1	18.1271	2021	Vegetation
4	4	Polygon	2829	4	0.630044	2021	Water bodies
5	5	Polygon	3021	6	3.09269	2021	Infrastructures

Figure 3.32 Visualization of the vector layer LC_Ptolemadia_2021 within the ArcGIS environment, from **the Western Macedonia region.gdb** geodatabase.

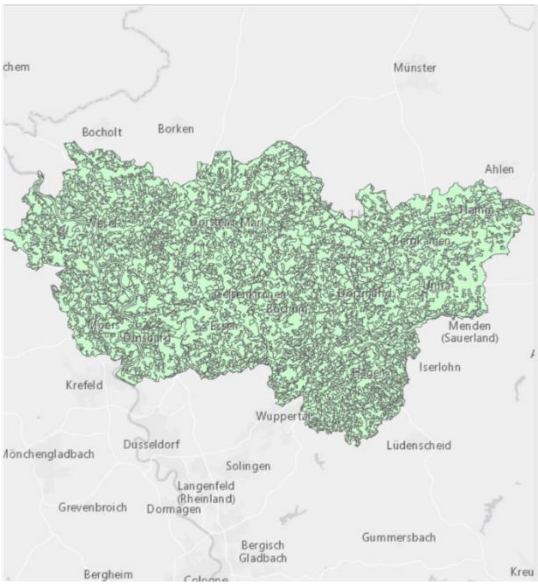
iv. RUHR AREA

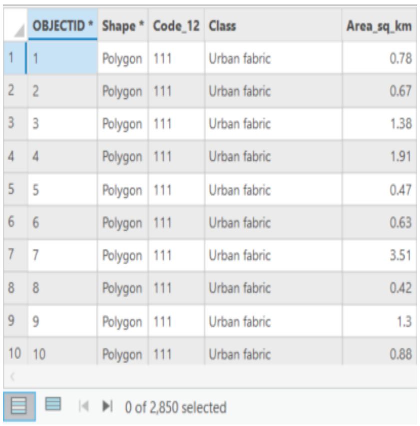
The fourth relational database with the name **Ruhr area** includes 5 layers about the Land Cover (LC) and Land Uses (LU) in the Ruhr area, during the time period between 1990 to 2018 (Figure 3.33 to 3.37). Each feature, characterized by polygon geometry, presenting the LC/LU of the area for a specific time period. These datasets illustrate the changes in the landscape over the three decades. The attribute tables within these layers including information about the Corine Land Cover code (Code_90 to Code_18 for each respective year), the Land Cover class, and the area coverage in square kilometres.

Table 3.6 Detailed description of the Corine Land Cover features from the **Ruhr area** geodatabase.

Feature	Year	Geometry Type	Number of Entities	Fields (type)
CLC_Ruhr_1990	1990	Polygon	2850	Code_90 (Text), Class (Text), Area_sq_km (Numeric)
CLC_Ruhr_2000	2000	Polygon	2608	Code_00 (Text), Class (Text), Area_sq_km (Numeric)

CLC_Ruhr_2006	2006	Polygon	2594	Code_06 (Text), Class (Text), Area_sq_km (Numeric)
CLC_Ruhr_2012	2012	Polygon	2850	Code_12 (Text), Class (Text), Area_sq_km (Numeric)
CLC_Ruhr_2018	2018	Polygon	2352	Code_18 (Text), Class (Text), Area_sq_km (Numeric)

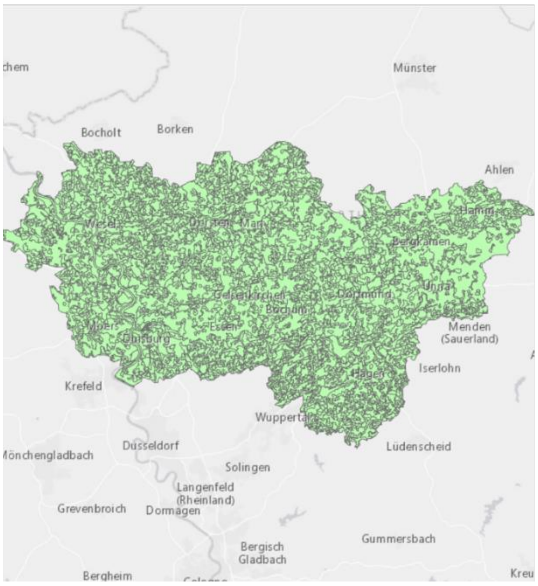




	OBJECTID *	Shape *	Code_12	Class	Area_sq_km
1	1	Polygon	111	Urban fabric	0.78
2	2	Polygon	111	Urban fabric	0.67
3	3	Polygon	111	Urban fabric	1.38
4	4	Polygon	111	Urban fabric	1.91
5	5	Polygon	111	Urban fabric	0.47
6	6	Polygon	111	Urban fabric	0.63
7	7	Polygon	111	Urban fabric	3.51
8	8	Polygon	111	Urban fabric	0.42
9	9	Polygon	111	Urban fabric	1.3
10	10	Polygon	111	Urban fabric	0.88

0 of 2,850 selected

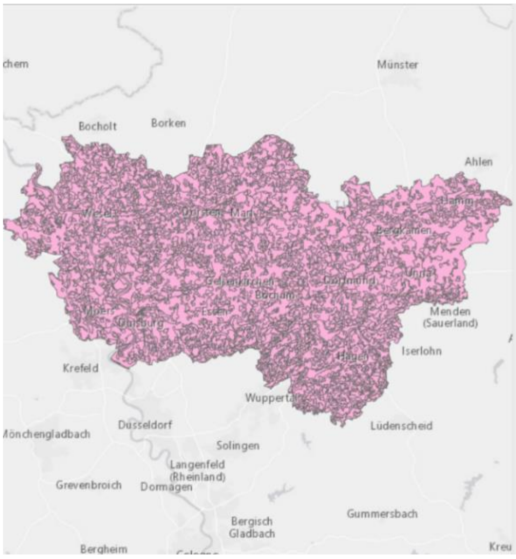
Figure 3.33 Visualization of the vector layer CLC_Ruhr_1990 within the ArcGIS environment, from the **Western Macedonia region.gdb** geodatabase.



	OBJECTID *	Shape *	code_00	Class	Area_sq_km
1	1	Polygon	111	Urban fabric	0.73
2	2	Polygon	111	Urban fabric	1.04
3	3	Polygon	111	Urban fabric	0.37
4	4	Polygon	111	Urban fabric	0.63
5	5	Polygon	111	Urban fabric	0.36
6	6	Polygon	111	Urban fabric	1.7
7	7	Polygon	111	Urban fabric	0.42
8	8	Polygon	111	Urban fabric	0.52
9	9	Polygon	111	Urban fabric	1.11
10	10	Polygon	111	Urban fabric	1.32

0 of 2,608 selected

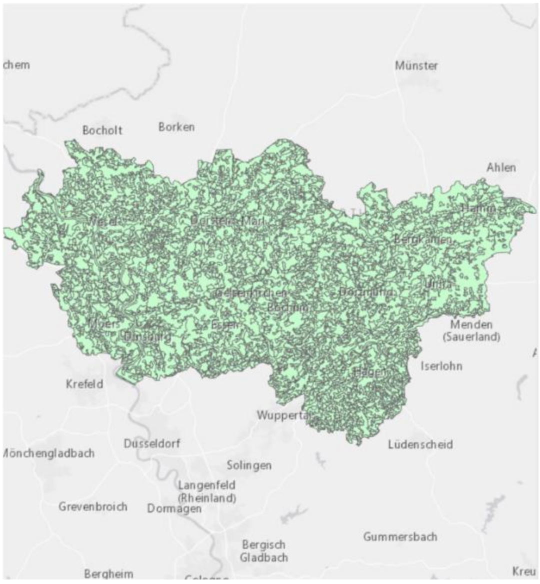
Figure 3.34 Visualization of the vector layer CLC_Ruhr_2000 within the ArcGIS environment, from the **Western Macedonia region.gdb** geodatabase.



	OBJECTID *	Shape *	Code_06	Class	Area_sq_km
1	1	Polygon	112	Urban fabric	0.56
2	2	Polygon	112	Urban fabric	0.01
3	3	Polygon	112	Urban fabric	1.47
4	4	Polygon	112	Urban fabric	0.31
5	5	Polygon	112	Urban fabric	0.53
6	6	Polygon	112	Urban fabric	0.56
7	7	Polygon	112	Urban fabric	0.47
8	8	Polygon	121	Industrial, commercial a...	0.84
9	9	Polygon	121	Industrial, commercial a...	0.42
10	10	Polygon	121	Industrial, commercial a...	0.28

0 of 2,594 selected

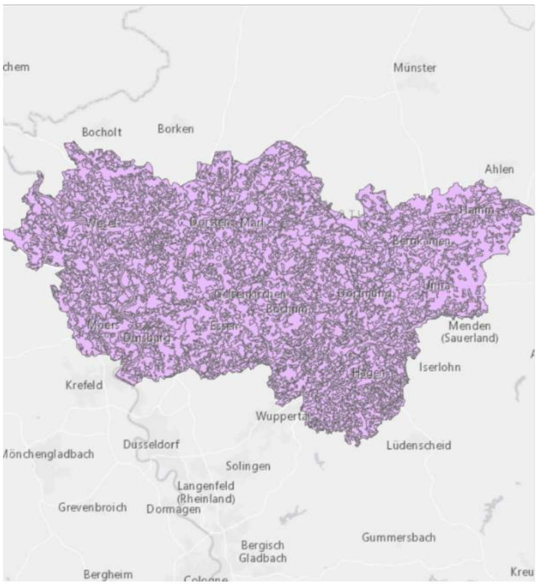
Figure 3.35 Visualization of the vector layer CLC_Ruhr_2006 within the ArcGIS environment, from the **Western Macedonia region.gdb** geodatabase.



	OBJECTID *	Shape *	Code_12	Class	Area_sq_km
1	1	Polygon	111	Urban fabric	0.78
2	2	Polygon	111	Urban fabric	0.67
3	3	Polygon	111	Urban fabric	1.38
4	4	Polygon	111	Urban fabric	1.91
5	5	Polygon	111	Urban fabric	0.47
6	6	Polygon	111	Urban fabric	0.63
7	7	Polygon	111	Urban fabric	3.51
8	8	Polygon	111	Urban fabric	0.42
9	9	Polygon	111	Urban fabric	1.3
10	10	Polygon	111	Urban fabric	0.88

0 of 2,850 selected

Figure 3.36 Visualization of the vector layer CLC_Ruhr_2012 within the ArcGIS environment, from the **Western Macedonia region.gdb** geodatabase.



	OBJECTID *	Shape *	Code_18	Class	Area_sq_km
1	1	Polygon	111	Urban fabric	0.78
2	2	Polygon	111	Urban fabric	0.67
3	3	Polygon	111	Urban fabric	1.38
4	4	Polygon	111	Urban fabric	1.91
5	5	Polygon	111	Urban fabric	0.47
6	6	Polygon	111	Urban fabric	0.63
7	7	Polygon	111	Urban fabric	3.51
8	8	Polygon	111	Urban fabric	0.42
9	9	Polygon	111	Urban fabric	1.28
10	10	Polygon	111	Urban fabric	0.88

0 of 2,870 selected

Figure 3.37 Visualization of the vector layer CLC_Ruhr_2018 within the ArcGIS environment, from the **Western Macedonia region.gdb** geodatabase.

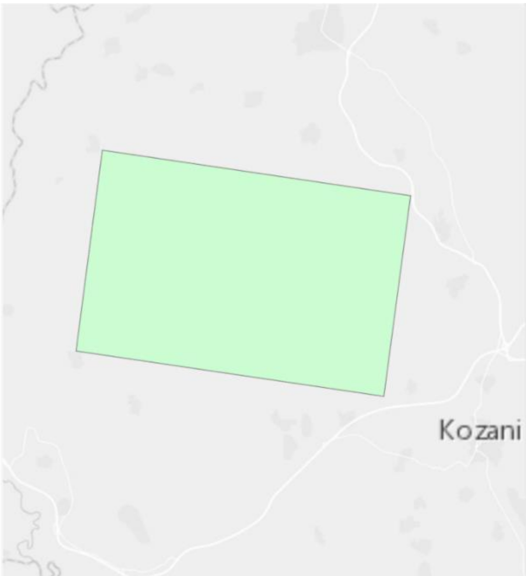
Renewable energy Sources data

v. Western Macedonia RES

The fifth geodatabase with the name **Western Macedonia RES** is based on Renewable Energy Source planning in Western Macedonia region. Particularly, contains detailed features that illustrating the potential suitable sites for the Photovoltaic (PV) and Wind Park (WP) installations (Figure 3.38 to 3.41). Specifically, the geodatabase contains 4 features of polygon geometry related with the study area boundaries, the potentially suitable sites for PV and WP installation and the overlapped areas for both RES types. Each feature includes specific attributes related with geospatial information and area coverage in square kilometers (Table 3.7).

Table 3.7 Detailed description of the Corine Land Cover features from the **Western Macedonia RES** geodatabase.

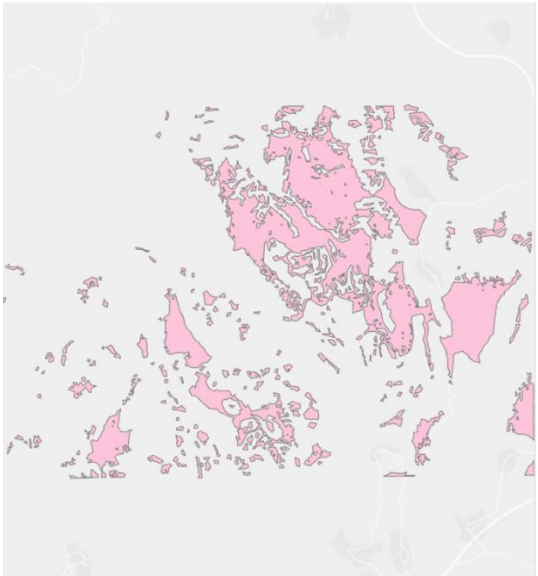
Features	Geometry Type	Number of Entities	Fields (type)	Description
WM_study_area	Polygon	1	Area (Numeric)	Boundaries of study area
suitable_PV_WM	Polygon	313	Region (Text), Country (Text), Area (Numeric)	Potentially suitable areas for Photovoltaic parks
suitable_WP_WM	Polygon	26	Region (Text), Country (Text), Area (Numeric)	Potentially suitable areas for Wind parks
overlapped_RES_WM	Polygon	74	Region (Text), Country (Text), Area (Numeric)	Overlapped areas suitable for both Photovoltaic and Wind parks



	OBJECTID *	Shape *	Area
1	1	Polygon Z	210.192773
	Click to add new row.		

0 of 1 selected

Figure 3.38 Visualization of the vector layer WM_study_area within the ArcGIS environment, from the **Western Macedonia RES.gdb** geodatabase.



	OBJECTID *	Shape *	Region	Country	Area
1	1	Polygon ZM	Western Macedonia	Greece	0.012377
2	2	Polygon ZM	Western Macedonia	Greece	0.005012
3	3	Polygon ZM	Western Macedonia	Greece	0.06425
4	4	Polygon ZM	Western Macedonia	Greece	0.014098
5	5	Polygon ZM	Western Macedonia	Greece	0.030141
6	6	Polygon ZM	Western Macedonia	Greece	0.03846
7	7	Polygon ZM	Western Macedonia	Greece	0.044744
8	8	Polygon ZM	Western Macedonia	Greece	0.011185
9	9	Polygon ZM	Western Macedonia	Greece	0.062115
10	10	Polygon ZM	Western Macedonia	Greece	0.02917
11	11	Polygon ZM	Western Macedonia	Greece	0.005469
12	12	Polygon ZM	Western Macedonia	Greece	0.019525

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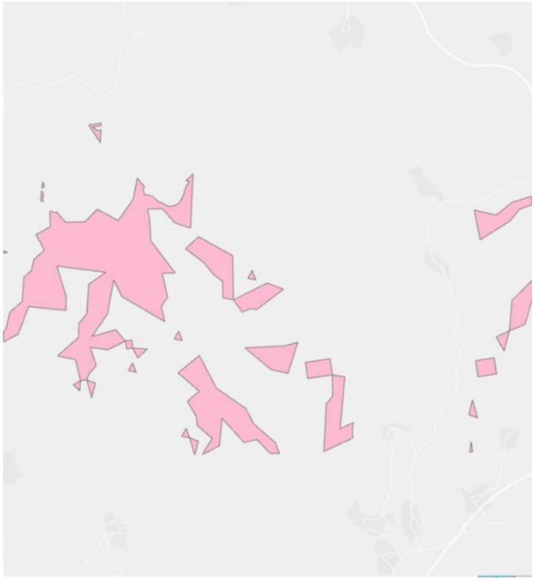
Figure 3.39 Visualization of the vector layer suitable_PV_WM within the ArcGIS environment, from the **Western Macedonia RES.gdb** geodatabase.



	OBJECTID *	Shape *	Region	Country	Area
1	1	Polygon ZM	Western Macedonia	Greece	0.01572
2	2	Polygon ZM	Western Macedonia	Greece	0.079686
3	3	Polygon ZM	Western Macedonia	Greece	0.040371
4	4	Polygon ZM	Western Macedonia	Greece	0.080518
5	5	Polygon ZM	Western Macedonia	Greece	0.040359
6	6	Polygon ZM	Western Macedonia	Greece	0.080489
7	7	Polygon ZM	Western Macedonia	Greece	1.400022
8	8	Polygon ZM	Western Macedonia	Greece	0.040358
9	9	Polygon ZM	Western Macedonia	Greece	0.471626
10	10	Polygon ZM	Western Macedonia	Greece	0.353758
11	11	Polygon ZM	Western Macedonia	Greece	3.816683
12	12	Polygon ZM	Western Macedonia	Greece	0.079562

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Figure 3.40 Visualization of the vector layer suitable_WP_WM within the ArcGIS environment, from the **Western Macedonia RES.gdb** geodatabase.

	OBJECTID *	Shape *	Region	Country	Area
1	1	Polygon ZM	Western Macedonia	Greece	0.013258
2	2	Polygon ZM	Western Macedonia	Greece	0.045656
3	3	Polygon ZM	Western Macedonia	Greece	0.028667
4	4	Polygon ZM	Western Macedonia	Greece	0.007154
5	5	Polygon ZM	Western Macedonia	Greece	0.007163
6	6	Polygon ZM	Western Macedonia	Greece	0.006086
7	7	Polygon ZM	Western Macedonia	Greece	0.010846
8	8	Polygon ZM	Western Macedonia	Greece	0.010787
9	9	Polygon ZM	Western Macedonia	Greece	0.006257
10	10	Polygon ZM	Western Macedonia	Greece	0.022997
11	11	Polygon ZM	Western Macedonia	Greece	0.013671
12	12	Polygon ZM	Western Macedonia	Greece	0.01155

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Figure 3.41 Visualization of the vector layer overlapped_RES_WM within the ArcGIS environment, from the **Western Macedonia RES.gdb** geodatabase.

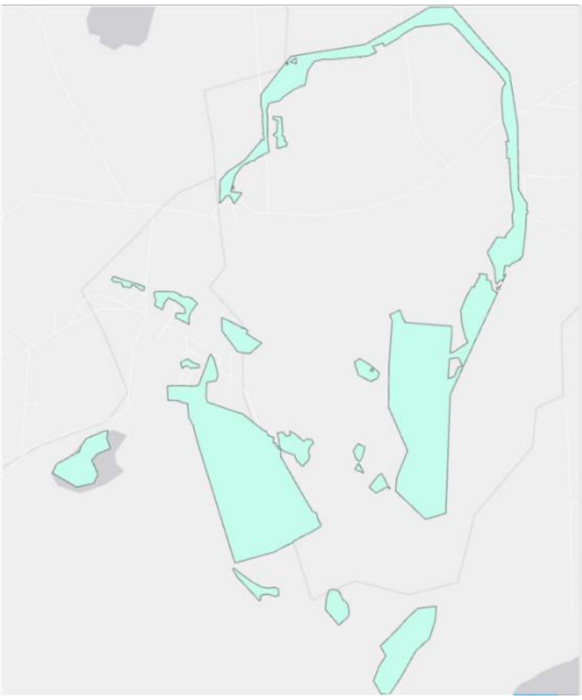
vi. KONIN RES

The sixth relational database titled **Konin RES** includes 9 features presenting the potential suitable locations for Renewable Energy Sources installations, specifically Photovoltaic (PV) and Wind parks, in three open-pit mines (Adamow, Kazimierz, Jozwin) located in Konin region (Figure 3.42 to 3.50). Each shapefile contains attributes related to the name of the mine (Mine), the region (Region), the country (Country), and area coverage in square kilometres (Area) (Table 3.8).

Table 3.8 Detailed description of the Corine Land Cover features from the **Konin RES** geodatabase.

Features	Geometry Type	Number of Entities	Fields (type)	Description
Suitable_PV_Adamow	Polygon	18	Mine (Text), Region (Text), Country (Text), Area (Numeric)	Suitable areas for Photovoltaic parks in Adamow mine
suitable_WP_Adamow	Polygon	11	Mine (Text), Region (Text), Country (Text), Area (Numeric)	Suitable areas for Wind parks in Adamow mine
overlapped_RES_Adamow	Polygon	40	Mine (Text), Region (Text), Country (Text), Area (Numeric)	Overlapped suitable areas for PV and Wind parks in Adamow mine
Suitable_PV_Kazimierz	Polygon	51	Mine (Text), Region (Text), Country (Text), Area (Numeric)	Suitable areas for Photovoltaic parks in Kazimierz mine

suitable_WP_Kazimierz	Polygon	39	Mine (Text), Region (Text), Country (Text), Area (Numeric)	Suitable areas for Wind parks in Kazimierz mine
overlapped_RES_Kazimierz	Polygon	40	Mine (Text), Region (Text), Country (Text), Area (Numeric)	Overlapped suitable areas for PV and Wind parks in Kazimierz mine
suitable_PV_Jozwin	Polygon	6	Mine (Text), Region (Text), Country (Text), Area (Numeric)	Suitable areas for Photovoltaic parks in Jozwin mine
suitable_WP_Jozwin	Polygon	14	Mine (Text), Region (Text), Country (Text), Area (Numeric)	Suitable areas for Wind parks in Jozwin mine
overlapped_RES_Jozwin	Polygon	7	Mine (Text), Region (Text), Country (Text), Area (Numeric)	Overlapped suitable areas for PV and Wind parks in Jozwin mine



	OBJECTID *	Shape *	Mine	Region	Country	Area
1	1	Polygon	Adamów	Konin	Poland	0.029319
2	2	Polygon	Adamów	Konin	Poland	0.010571
3	3	Polygon	Adamów	Konin	Poland	0.001839
4	4	Polygon	Adamów	Konin	Poland	0.006637
5	5	Polygon	Adamów	Konin	Poland	0.035181
6	6	Polygon	Adamów	Konin	Poland	0.005481
7	7	Polygon	Adamów	Konin	Poland	0.016776
8	8	Polygon	Adamów	Konin	Poland	0.000439
9	9	Polygon	Adamów	Konin	Poland	0.00771
10	10	Polygon	Adamów	Konin	Poland	0.011437
11	11	Polygon	Adamów	Konin	Poland	0.635492
12	12	Polygon	Adamów	Konin	Poland	0.403018
13	13	Polygon	Adamów	Konin	Poland	0.037254
14	14	Polygon	Adamów	Konin	Poland	0.667439
15	15	Polygon	Adamów	Konin	Poland	0.13217
16	16	Polygon	Adamów	Konin	Poland	0.030459
17	17	Polygon	Adamów	Konin	Poland	0.081466
18	18	Polygon	Adamów	Konin	Poland	0.020573

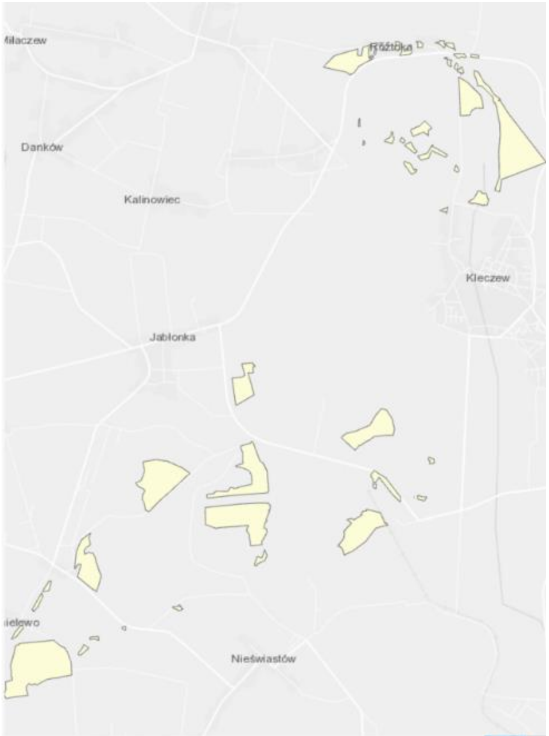
Figure 3.42 Visualization of the vector layer suitable_PV_Adamow within the ArcGIS environment, from the **Konin RES.gdb** geodatabase.

	OBJECTID *	Shape *	Mine	Region	Country	Area
1	1	Polygon	Adamów	Konin	Poland	0.024364
2	2	Polygon	Adamów	Konin	Poland	0.005481
3	3	Polygon	Adamów	Konin	Poland	0.007087
4	4	Polygon	Adamów	Konin	Poland	0.001017
5	5	Polygon	Adamów	Konin	Poland	0.003378
6	6	Polygon	Adamów	Konin	Poland	0.004704
7	7	Polygon	Adamów	Konin	Poland	0.354221
8	8	Polygon	Adamów	Konin	Poland	0.77344
9	9	Polygon	Adamów	Konin	Poland	0.659844
10	10	Polygon	Adamów	Konin	Poland	0.21489
11	11	Polygon	Adamów	Konin	Poland	0.055729

Figure 3.43 Visualization of the vector layer suitable_WP_Adamow within the ArcGIS environment, from **the Konin RES.gdb** geodatabase.

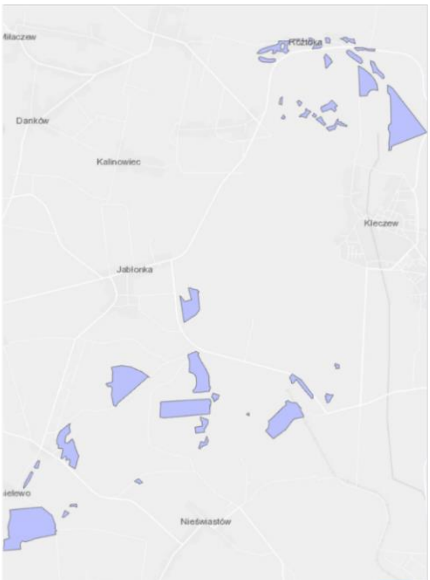
	OBJECTID *	Shape *	Mine	Region	Country	Area
1	1	Polygon	Adamów	Konin	Poland	0.024242
2	2	Polygon	Adamów	Konin	Poland	0.005481
3	3	Polygon	Adamów	Konin	Poland	0.004704
4	4	Polygon	Adamów	Konin	Poland	0.34854
5	5	Polygon	Adamów	Konin	Poland	0.00179
6	6	Polygon	Adamów	Konin	Poland	0.650168
7	7	Polygon	Adamów	Konin	Poland	0.022122
8	8	Polygon	Adamów	Konin	Poland	0.010571
9	9	Polygon	Adamów	Konin	Poland	0.605403
10	10	Polygon	Adamów	Konin	Poland	0.1306
11	11	Polygon	Adamów	Konin	Poland	0.05557

Figure 3.44 Visualization of the vector layer overlapped_RES_Adamow within the ArcGIS environment, from the **Konin RES.gdb** geodatabase.



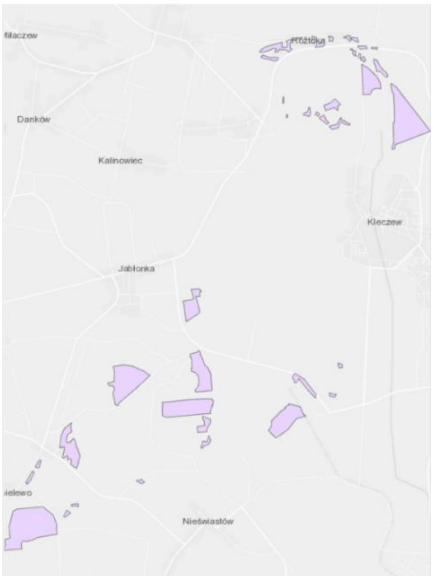
	OBJECTID *	Shape *	Mine	Region	Country	Area
1	1	Polygon	Kazimierz	Konin	Poland	0.003428
2	2	Polygon	Kazimierz	Konin	Poland	0.001548
3	3	Polygon	Kazimierz	Konin	Poland	0.00438
4	4	Polygon	Kazimierz	Konin	Poland	0.008642
5	5	Polygon	Kazimierz	Konin	Poland	0.0063
6	6	Polygon	Kazimierz	Konin	Poland	0.010934
7	7	Polygon	Kazimierz	Konin	Poland	0.119614
8	8	Polygon	Kazimierz	Konin	Poland	0.000023
9	9	Polygon	Kazimierz	Konin	Poland	0.004273
10	10	Polygon	Kazimierz	Konin	Poland	0.001863
11	11	Polygon	Kazimierz	Konin	Poland	0.030787
12	12	Polygon	Kazimierz	Konin	Poland	0.003871
13	13	Polygon	Kazimierz	Konin	Poland	0.002937
14	14	Polygon	Kazimierz	Konin	Poland	0.002795
15	15	Polygon	Kazimierz	Konin	Poland	0.008306
16	16	Polygon	Kazimierz	Konin	Poland	0.000837
17	17	Polygon	Kazimierz	Konin	Poland	0.002349
18	18	Polygon	Kazimierz	Konin	Poland	0.007259
19	19	Polygon	Kazimierz	Konin	Poland	0.024154
20	20	Polygon	Kazimierz	Konin	Poland	0.00133
21	21	Polygon	Kazimierz	Konin	Poland	0.003457
22	22	Polygon	Kazimierz	Konin	Poland	0.00247
23	23	Polygon	Kazimierz	Konin	Poland	0.003161
24	24	Polygon	Kazimierz	Konin	Poland	0.00054

Figure 3.45 Visualization of the vector layer suitable_PV_Kazimierz within the ArcGIS environment, from the **Konin RES.gdb** geodatabase.



	OBJECTID *	Shape *	Mine	Region	Country	Area
1	1	Polygon	Kazimierz	Konin	Poland	0.003428
2	2	Polygon	Kazimierz	Konin	Poland	0.005161
3	3	Polygon	Kazimierz	Konin	Poland	0.010233
4	4	Polygon	Kazimierz	Konin	Poland	0.005478
5	5	Polygon	Kazimierz	Konin	Poland	0.010934
6	6	Polygon	Kazimierz	Konin	Poland	0.026472
7	7	Polygon	Kazimierz	Konin	Poland	0.001075
8	8	Polygon	Kazimierz	Konin	Poland	0.01028
9	9	Polygon	Kazimierz	Konin	Poland	0.008812
10	10	Polygon	Kazimierz	Konin	Poland	0.031039
11	11	Polygon	Kazimierz	Konin	Poland	0.003871
12	12	Polygon	Kazimierz	Konin	Poland	0.008306
13	13	Polygon	Kazimierz	Konin	Poland	0.002224
14	14	Polygon	Kazimierz	Konin	Poland	0.002349
15	15	Polygon	Kazimierz	Konin	Poland	0.003513
16	16	Polygon	Kazimierz	Konin	Poland	0.025203
17	17	Polygon	Kazimierz	Konin	Poland	0.003939
18	18	Polygon	Kazimierz	Konin	Poland	0.014237
19	19	Polygon	Kazimierz	Konin	Poland	0.010795
20	20	Polygon	Kazimierz	Konin	Poland	0.01036
21	21	Polygon	Kazimierz	Konin	Poland	0.000833
22	22	Polygon	Kazimierz	Konin	Poland	0.006067

Figure 3.46 Visualization of the vector layer suitable_WP_Kazimierz within the ArcGIS environment, from the **Konin RES.gdb** geodatabase.

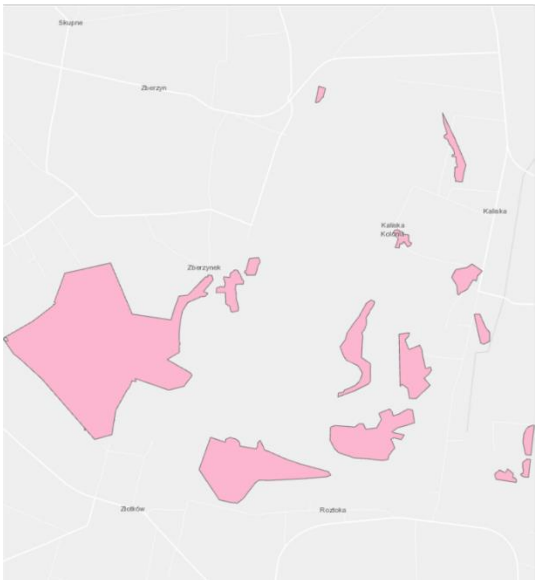


	OBJECTID *	Shape *	Mine	Region	Country	Area
1	1	Polygon	Kazimierz	Konin	Poland	0.003428
2	2	Polygon	Kazimierz	Konin	Poland	0.004171
3	3	Polygon	Kazimierz	Konin	Poland	0.008197
4	4	Polygon	Kazimierz	Konin	Poland	0.005478
5	5	Polygon	Kazimierz	Konin	Poland	0.010935
6	6	Polygon	Kazimierz	Konin	Poland	0.026472
7	7	Polygon	Kazimierz	Konin	Poland	0.004273
8	8	Polygon	Kazimierz	Konin	Poland	0.030629
9	9	Polygon	Kazimierz	Konin	Poland	0.003871
10	10	Polygon	Kazimierz	Konin	Poland	0.008306
11	11	Polygon	Kazimierz	Konin	Poland	0.000837
12	12	Polygon	Kazimierz	Konin	Poland	0.002349
13	13	Polygon	Kazimierz	Konin	Poland	0.024125
14	14	Polygon	Kazimierz	Konin	Poland	0.00133
15	15	Polygon	Kazimierz	Konin	Poland	0.010876
16	16	Polygon	Kazimierz	Konin	Poland	0.002314
17	17	Polygon	Kazimierz	Konin	Poland	0.005508
18	18	Polygon	Kazimierz	Konin	Poland	0.01036
19	19	Polygon	Kazimierz	Konin	Poland	0.000833

Figure 3.47 Visualization of the vector layer overlapped_RES_Kazimierz within the ArcGIS environment, from the **Konin RES.gdb** geodatabase.

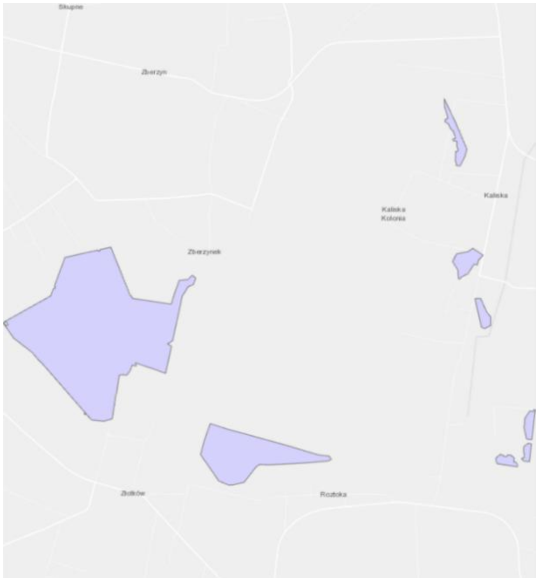
	OBJECTID *	Shape *	Mine	Region	Country	Area
1	1	Polygon	Jóźwin	Konin	Poland	0.024796
2	2	Polygon	Jóźwin	Konin	Poland	0.044493
3	3	Polygon	Jóźwin	Konin	Poland	1.64214
4	4	Polygon	Jóźwin	Konin	Poland	0.083433
5	5	Polygon	Jóźwin	Konin	Poland	0.457281
6	6	Polygon	Jóźwin	Konin	Poland	0.149674

Figure 3.48 Visualization of the vector layer suitable_PV_Jozwin within the ArcGIS environment, from the **Konin RES.gdb** geodatabase.



	OBJECTID *	Shape *	Mine	Region	Country	Area
1	1	Polygon	Jóźwin	Konin	Poland	0.017612
2	2	Polygon	Jóźwin	Konin	Poland	0.025345
3	3	Polygon	Jóźwin	Konin	Poland	0.0511
4	4	Polygon	Jóźwin	Konin	Poland	0.047863
5	5	Polygon	Jóźwin	Konin	Poland	0.018326
6	6	Polygon	Jóźwin	Konin	Poland	0.016949
7	7	Polygon	Jóźwin	Konin	Poland	0.045224
8	8	Polygon	Jóźwin	Konin	Poland	0.009101
9	9	Polygon	Jóźwin	Konin	Poland	1.68011
10	10	Polygon	Jóźwin	Konin	Poland	0.034858
11	11	Polygon	Jóźwin	Konin	Poland	0.41211
12	12	Polygon	Jóźwin	Konin	Poland	0.239211
13	13	Polygon	Jóźwin	Konin	Poland	0.121527
14	14	Polygon	Jóźwin	Konin	Poland	0.127998

Figure 3.49 Visualization of the vector layer suitable_WP_Jozwin within the ArcGIS environment, from the **Konin RES.gdb** geodatabase.



	OBJECTID *	Shape *	Mine	Region	Country	Area
1	1	Polygon	Jóźwin	Konin	Poland	0.043387
2	2	Polygon	Jóźwin	Konin	Poland	1.583754
3	3	Polygon	Jóźwin	Konin	Poland	0.017297
4	4	Polygon	Jóźwin	Konin	Poland	0.034013
5	5	Polygon	Jóźwin	Konin	Poland	0.362564
6	6	Polygon	Jóźwin	Konin	Poland	0.025345
7	7	Polygon	Jóźwin	Konin	Poland	0.047863

Figure 3.50 Visualization of the vector layer overlapped_RES_Jozwin within the ArcGIS environment, from the **Konin RES.gdb** geodatabase.

4. CONLCUSION AND OUTLOOK

This document provides an overview of the visualized inventory of the platform that aims to help the stakeholders and the local authorities regarding the reclamation and the development of the presented open-pit mines. Particularly, the visualization of Tasks 2.1 and & 2.2 providing information about the legislation of each country (Figure 4.1) (Greece, Poland, Germany) and the existing best practices (Figure 4.2).

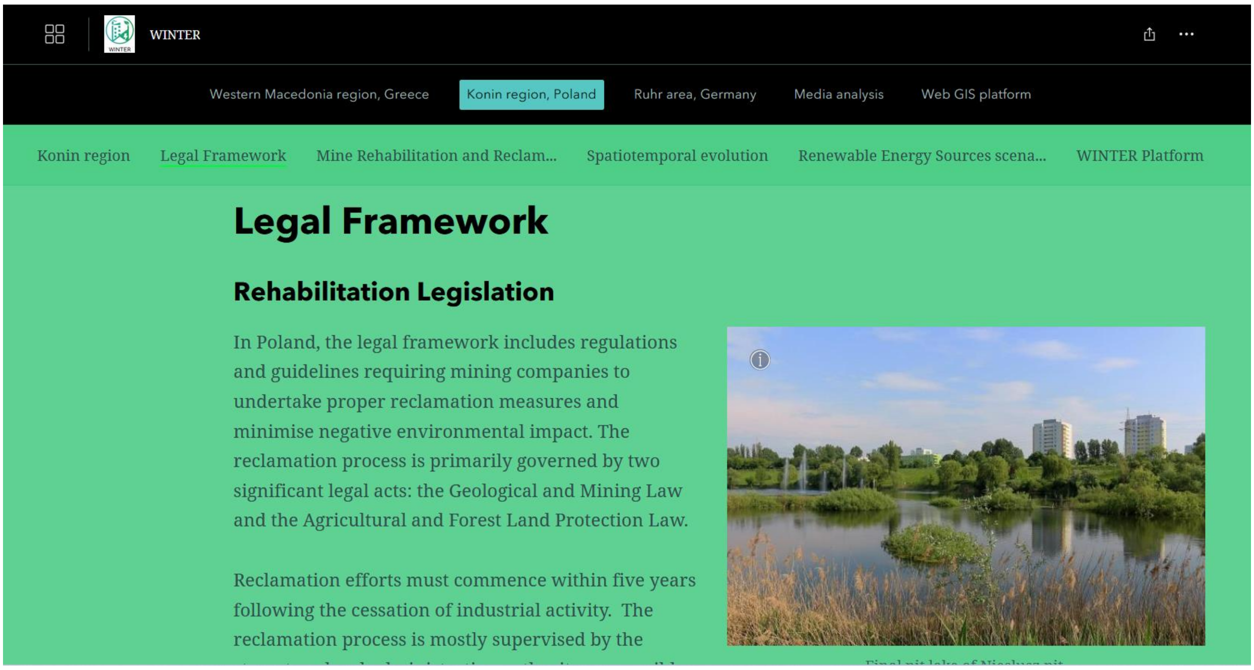


Figure 4.1 A screenshot of descriptive text presenting the legal framework of Polish region regarding the rehabilitation legislation.

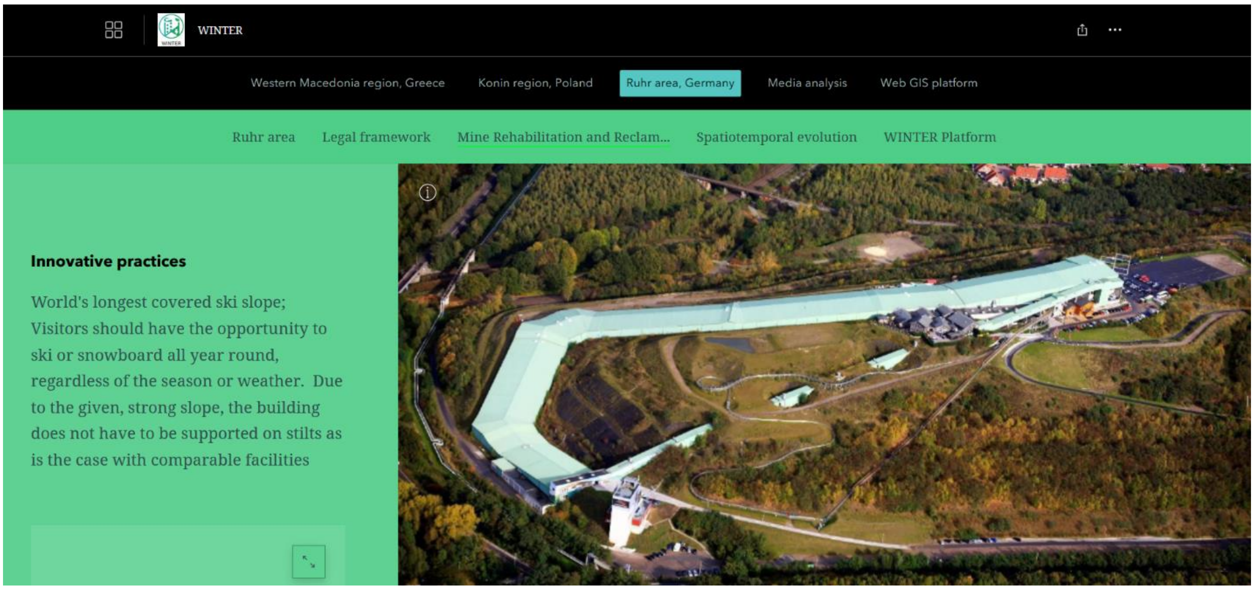


Figure 4.2 A screenshot of interactive narrative texts, accompanied by images, highlighting the best practices of the reclamation process in the Ruhr area.

The development of WINTER database will focus on updating and expanding the capabilities of the Web interactive platform developed under Deliverable 4.1. This will involve the integration of new datasets, particularly from WP 3, which are expected to bring the socioeconomic aspect of the three regions of the project (Western Maceodnia, Konin, Rurh) regarding the Green transition and the delignitization. Additionally, there will be an effort to improve the user's experience on the platform (Figure 4.3). Particularly, the future work will focus to continually updating the existing datasets to illustrate the latest developments in WebGIS functionalities. This includes the refining of the tools visualization ensuring the platform remains a cutting-edge tool for spatial analysis and decision-making that can be effectively used by stakeholders, and the general public. Lastly, a User's Guide in the form of a storymap will be created to illustrate the capabilities of the platform, securing an easy navigation for users within the platform.

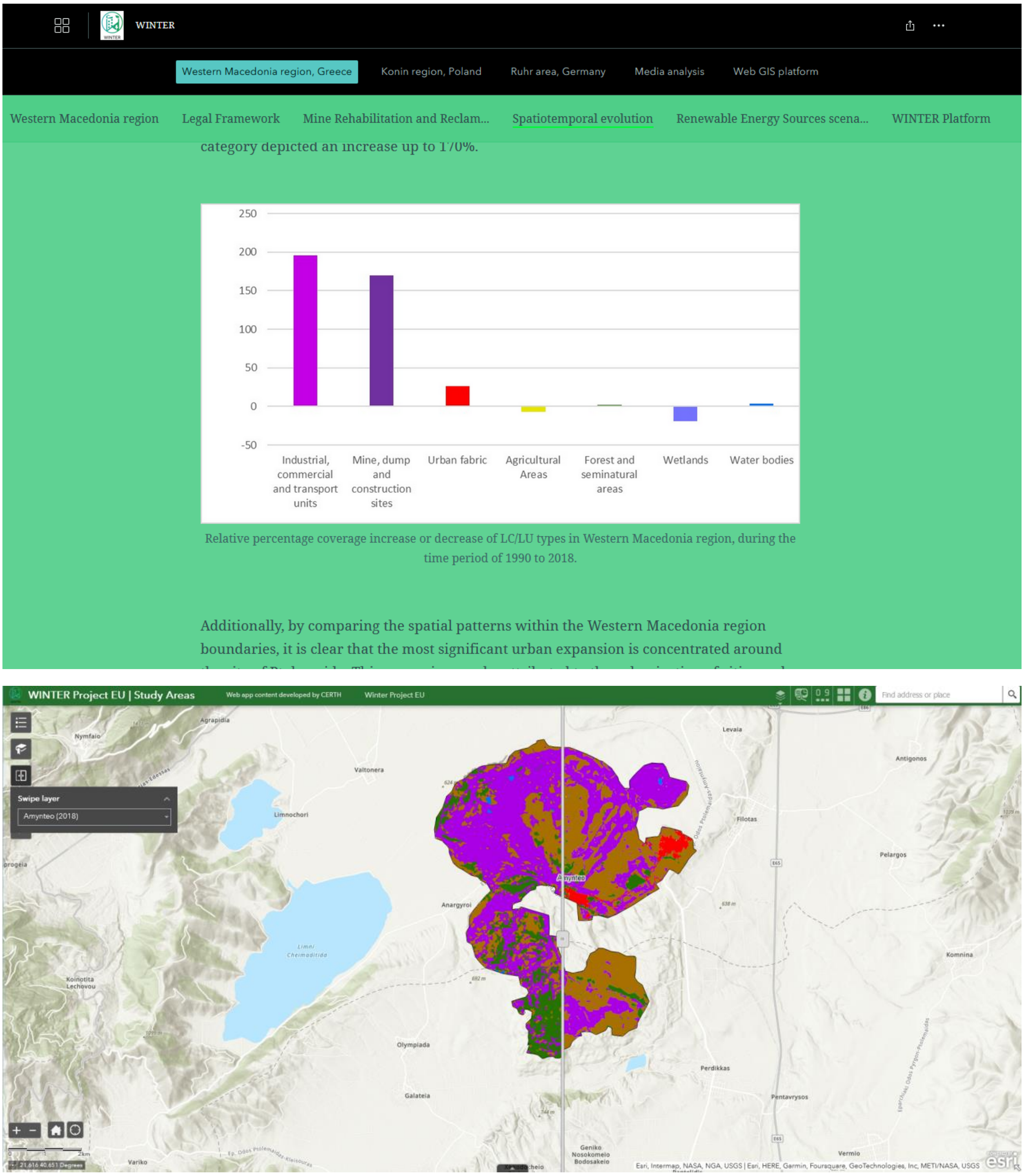


Figure 4.3 WINTER storytelling interface illustrating the spatiotemrpoal evolution of Amynteo open-pit mine using interactive diagrams (top) and WebGIS layout of the WINTER platform (bottom).

5. REFERENCES

CLC. Copernicus Land Monitoring Service. (2018). Available online: https://land.copernicus.eu/pan-european/corine-land-cover/clc2018 (accessed on 12 May 2023).

Environmental Systems Research Institute. (2023). ArcGIS Desktop: Release 10.8.2 [Windows software].

Environmental Systems Research Institute. (2023). ArcGIS Online. Available at: https://www.arcgis.com/index.html# (accessed on 15 October 2023).

Environmental Systems Research Institute. (2023). ArcGIS Pro: Release [3.2.0] [Windows software].

Global Wind Atlas v 3.3 (https://globalwindatlas.info , accessed on 30 July 2023)

Global Solar Atlas v 2.8 (https://globalsolaratlas.info , accessed on 30 July 2023)

Krassakis, P.; Karavias, A.; Nomikou, P.; Karantzalos, K.; Koukouzas, N.; Kazana, S.; Parcharidis, I. Geospatial Intelligence and Machine Learning Technique for Urban Mapping in Coastal Regions of South Aegean Volcanic Arc Islands. Geomatics 2022, 2, 297-322. https://doi.org/10.3390/geomatics2030017.

Laurence Hawker, Jeffrey Neal (2021): FABDEM V1-0. https://doi.org/10.5523/bris.25wfy0f9ukoge2gs7a5mqpq2j7