

# METHODOLOGY ON LAND SUITABILITY ANALYSIS



**FUNCTIONAL AREAS IN THE EU**

Crossing administrative boundaries for green transition and sustainable development.

## TABLE OF CONTENTS

<b>METHODOLOGY ON LAND SUITABILITY ANALYSIS .....</b>	<b>1</b>
Cadastral Data .....	1
Public Land Plots.....	1
Undevelopable Plots or Plots with Development Restrictions .....	1
Setting the Parameters for the Land Suitability Analysis .....	1
<b>Annex 1. Cadastral data for Rzeszow Functional Urban Area .....</b>	<b>3</b>
<b>Annex 2. Public Land Plots in Rzeszow Functional Urban Area .....</b>	<b>4</b>
<b>Annex 3. Undevelopable Plots and Plots with Development Restrictions .....</b>	<b>5</b>
<b>Annex 4. Example of Land Suitability Analysis in Rzeszow Functional Urban Area .....</b>	<b>6</b>
<b>Annex 5. Parameters proposed for Land Suitability Analyses for different types of developments in Rzeszow Functional Urban Area .....</b>	<b>7</b>
<b>Annex 6. Land Suitability Analysis for industrial, logistics and warehousing activities.....</b>	<b>12</b>
<b>Annex 7. Land Suitability Analysis for residential development .....</b>	<b>13</b>

## METHODOLOGY ON LAND SUITABILITY ANALYSIS

**Land Suitability Analysis is a relatively simple, but data-intensive tool that can be used for strategic and spatial planning purposes at the local and regional level.**

The methodology can be used for multiple purposes, but it is most effective in assisting strategic development decisions and zoning of land. The advantage of land suitability analysis is that it employs computing power to analyze large volumes of data and generate results that can aid human decision-making. The methodology itself is relatively simple, although it requires access to large and detailed datasets, knowledge of geographic information system tools, and basic programming capabilities. The way the methodology can be applied will be highlighted with the help of an actual example, that of the Rzeszow Functional Urban Area (RFUA) in the Podkarpackie Region, Poland.

### Cadaster Data

A full and up-to-date cadaster database for a studied area is of absolute importance for a land suitability analysis (LSA). An LSA can be run even with an incomplete cadaster database, but the result of such an analysis should be used with a lot of circumspection. Annex 1 includes, as an example, all the cadaster plot in the RFUA, along with the plots that are developed in red. One can easily see one of the negative side-effects of poor or lack of spatial planning, with the urban footprint of the RFUA expanding in an octopus like fashion along existing thoroughfares. This first layer of data also tells us what is already developed and what is, potentially, developable – although it does not provide any information on developed plots that are suitable for conversion.

### Public Land Plots

The next layer of relevant data for the LSA is the data on public land plots. This information is key as it identifies the plots/areas that may be used as strategic investment areas by local/regional public administrations. Often times, this information is not available and local/regional administrations have a poor understanding on the assets they own, which, of course, hinders their capacity to effectively and efficiently manage these assets. Annex 2 include an example with all plots that have a public administration as a majority owner.

### Undevelopable Plots or Plots with Development Restrictions

Another important layer of information includes data on undevelopable plots or plots with development restrictions. Such information could include details on floodable areas, areas with land slides, high-quality agricultural areas, natural preserves, mining areas, etc. This information is key, as it informs the LSA algorithm. For example, it is difficult to raise multi-apartment housing units on high-quality agricultural land in rural areas. One should not develop in natural preserves, and should only develop some uses in floodable areas. Similarly, one should be aware of the additional costs and safety measure required by developing in an area with landslides.

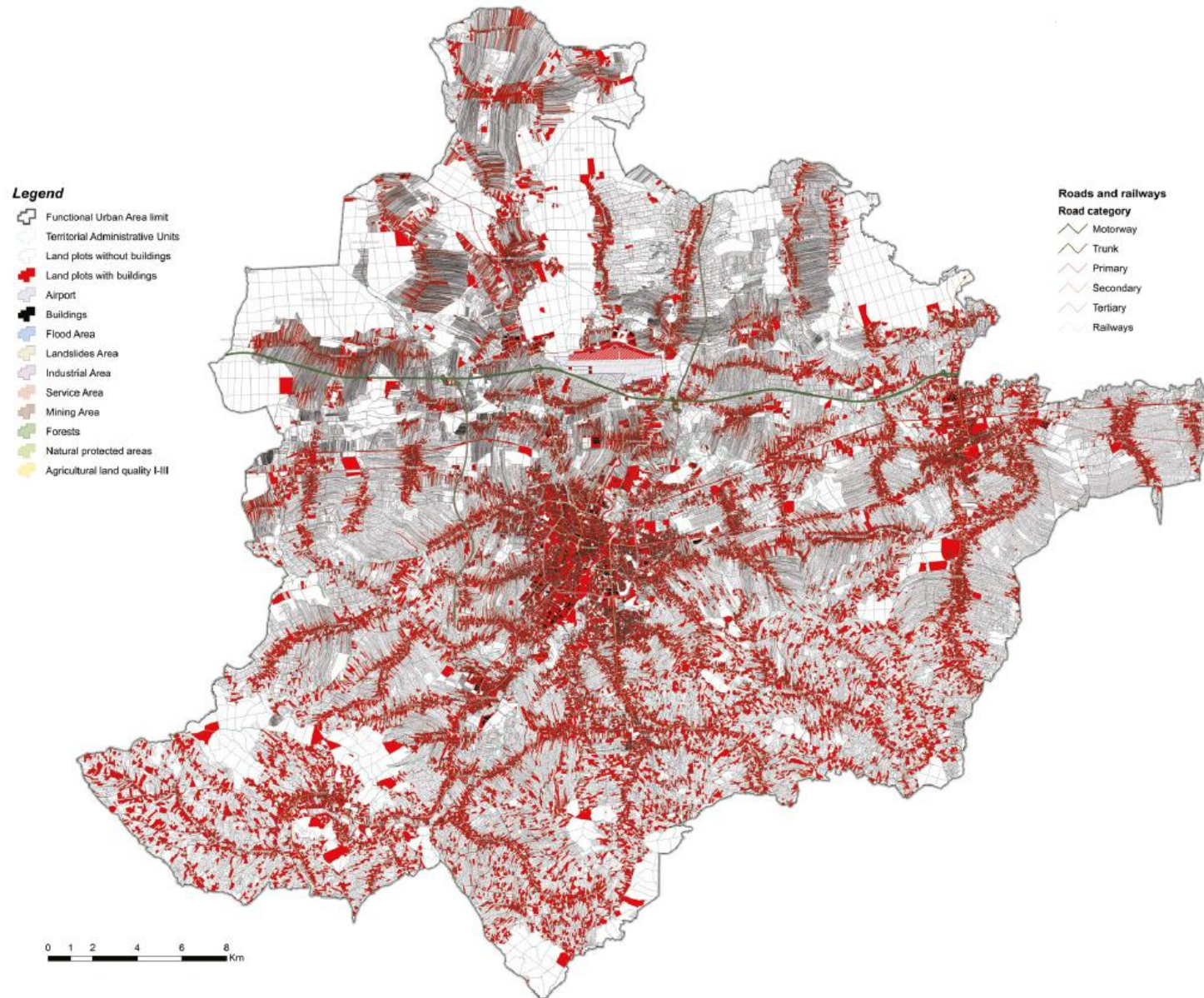
### Setting the Parameters for the Land Suitability Analysis

Once the basic information for the LAS is available, one needs to also collect information that may be used as a parameter in the LSA methodology. Annex 4 includes a simple example of a general LSA for the RFUA, which looked at parameters such as proximity to an existing road, proximity to an urban center, size of the plot, or shape of the plot. Such an analysis can be further refined, by looking at different types of developments (e.g. industrial/logistics, retail, housing, office), and by identifying different parameters for each type of

development type. Annex 5 includes detailed parameters for the following types of developments: 1) industrial, logistics and warehousing activities; 2) commercial and retail spaces; 3) office buildings and activities ; 4) housing / residential; 5) environmental; 6) tourism and recreation. These parameters can be adjusted or modified to sharpen the focus of the LSA, and additional filters could be introduced. For example, Annex 6 includes an LSA for industrial, logistics and warehousing activities, with high-quality agricultural land not being considered a restrictive criteria. Annex 7, on the other hands, includes high-quality agricultural land as a filters for the LSA on residential development.

As more data becomes available or when more detailed LSAs are needed, additional parameters can be introduced in the LSA, or existing ones could be adjusted. Once a solid baseline is created, the LSA can become a very useful tool for better informed strategic and spatial planning decisions.

## ANNEX 1. CADASTER DATA FOR RZESZOW FUNCTIONAL URBAN AREA





## ANNEX 2. PUBLIC LAND PLOTS IN RZESZOW FUNCTIONAL URBAN AREA

### Legend

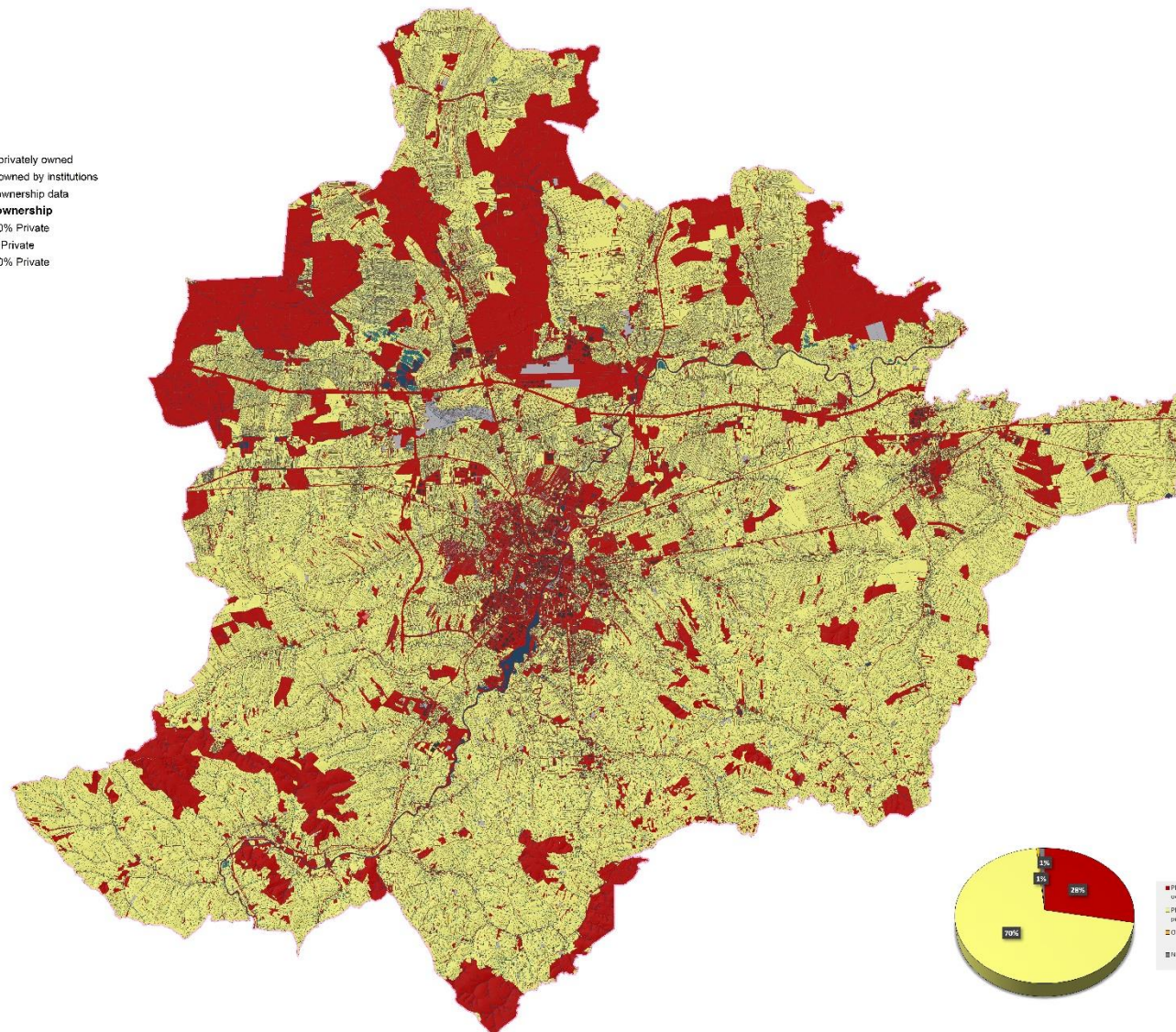
- Rzeszów FUA
- Gminas
- Buildings
- Water
- Waterway

### Cadastral data

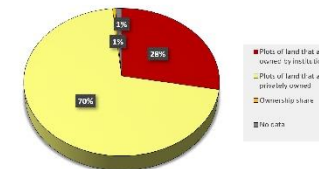
- Plots of land that are privately owned
- Plots of land that are owned by institutions
- Plots of land without ownership data

### Plots of land that share ownership

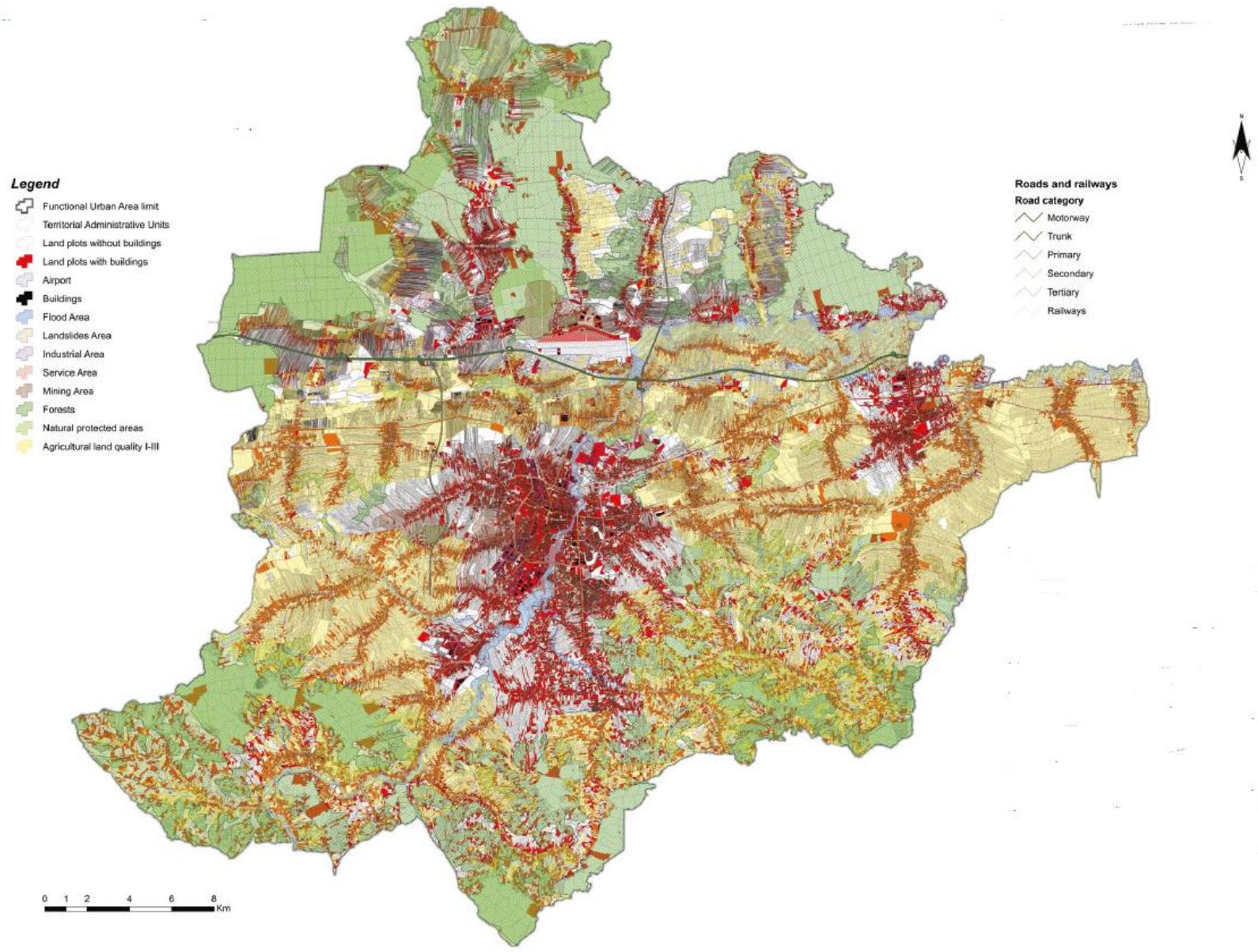
- > 50% Institution; < 50% Private
- 50% Institution - 50% Private
- < 50% Institution; > 50% Private



0 0.5 1 2 3 4 Km

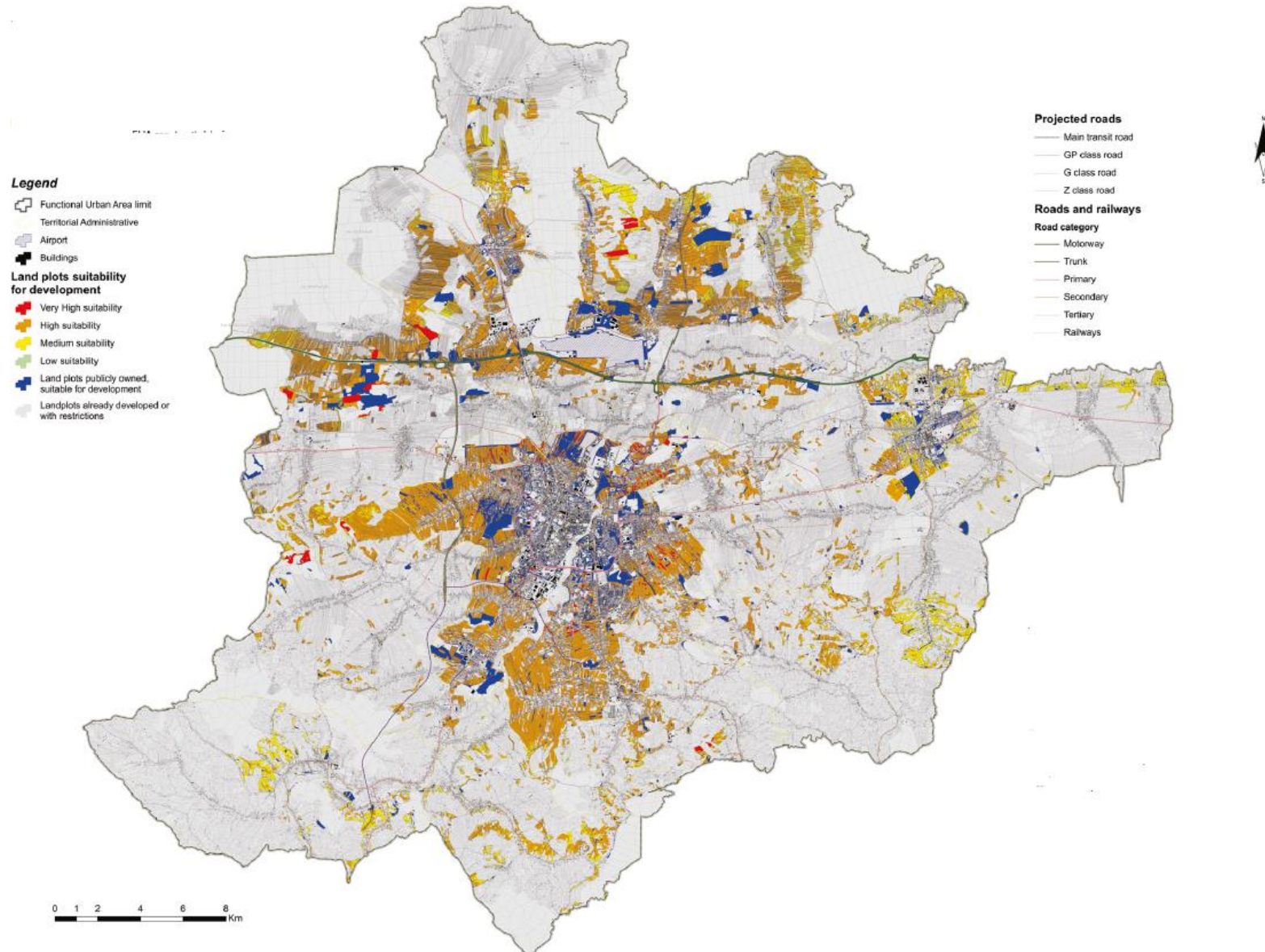


### ANNEX 3. UNDEVELOPABLE PLOTS AND PLOTS WITH DEVELOPMENT RESTRICTIONS





## ANNEX 4. EXAMPLE OF LAND SUITABILITY ANALYSIS IN RZESZOW FUNCTIONAL URBAN AREA





## ANNEX 5. PARAMETERS PROPOSED FOR LAND SUITABILITY ANALYSES FOR DIFFERENT TYPES OF DEVELOPMENTS IN RZESZOW FUNCTIONAL URBAN AREA

VERY IMPORTANT:	<i>The analyzed database (land plots) must be filtered according to: land use / coverage, restricted areas (protected areas, risk areas - floods, landslides, areas regulated by law) and areas incompatible in terms of type of development.</i>			
<b>Development potential: Industrial, logistics and warehousing activities</b>				
Parameters	Metrics	Points	Weight	Comments
Proximity to major road infrastructure	≤ 0.5 km to a motorway, ring road or national road	10	20%	
	0.5–1.5 km to a motorway, ring road or national road	6		
	>1.5 km to a motorway, ring road or national road	3		
Proximity to the airport	≤ 3 km to Rzeszow Airport	10	10%	
	3–5 km to Rzeszow Airport	6		
	> 5 km to Rzeszow Airport	3		
Proximity to an urban center	≤ 5 km to the town hall of urban localities	10	15%	
	5-15 km to the town hall of urban localities	6		
	> 15 km to town halls of urban localities	3		
Access to utilities	Plot adjacent to an urbanized area with access to utilities (electricity, water and wastewater, gas)	7-10	15%	Requires complete data on utilities infrastructure
	Plot adjacent to the urban perimeter / built-up areas	6		
	Plot in an area without utilities	3		
Plot size	≥ 10 ha	10	20%	
	2-10 ha	6		
	<2 ha	3		
Parcel Shape Index	0.75 - 1	10	10%	$Shape\ regularity\ index = 16 \times \frac{Plot\ area}{(Plot\ perimeter)^2}$
	0.5 - 0.75	6		
	0 - 0.5	3		
Proximity to a public transport station (including rail)	≤ 300 m	10	10%	Requires complete data on public transportation network
	300 m – 600 m	6		
	> 600 m	3		

			<b>100%</b>	
<b>Development potential: Commercial and retail spaces</b>				
Proximity to road infrastructure (250m)	Main road (motorway / highway / belt)	10	20%	
	Secondary roads (county road)	6		
	Tertiary roads / residential / exploitation streets (communal road / streets)	3		
	No road	1		
Proximity to the center (central point = town hall of any locality with over 5000 inhabitants)	≤ 1 km	10	25%	
	1-3 km	6		
	> 3 km	3		
Proximity to other retail spaces	≤ 500 m	10	10%	Requires data on retail spaces
	500 m – 1.5 km	6		
	> 1.5 km	3		
Proximity to a public transport station (including rail)	≤ 300 m	10	15%	Requires complete data on public transportation network
	300 m – 600 m	6		
	> 600 m	3		
Plot size	≥ 1 ha	10	20%	
	0.5 - 1 ha	6		
	< 0.5 ha	3		
Parcel Shape Index	0.75 - 1	10	10%	$Shape\ regularity\ index = 16 \times \frac{Plot\ area}{(Plot\ perimeter)^2}$
	0.5 - 0.75	6		
	0 - 0.5	3		
			<b>100%</b>	
<b>Development potential: Office buildings and activities</b>				
Proximity to road infrastructure (250m)	Main road (motorway / highway / belt, national road)	10	20%	
	Secondary roads (county road)	6		
	Tertiary roads / residential / exploitation streets (communal road / streets)	3		
	No road	1		
Proximity to an urban center	≤ 2 km to the town hall of urban localities	10	25%	
	2-5 km to the town hall of urban localities	6		

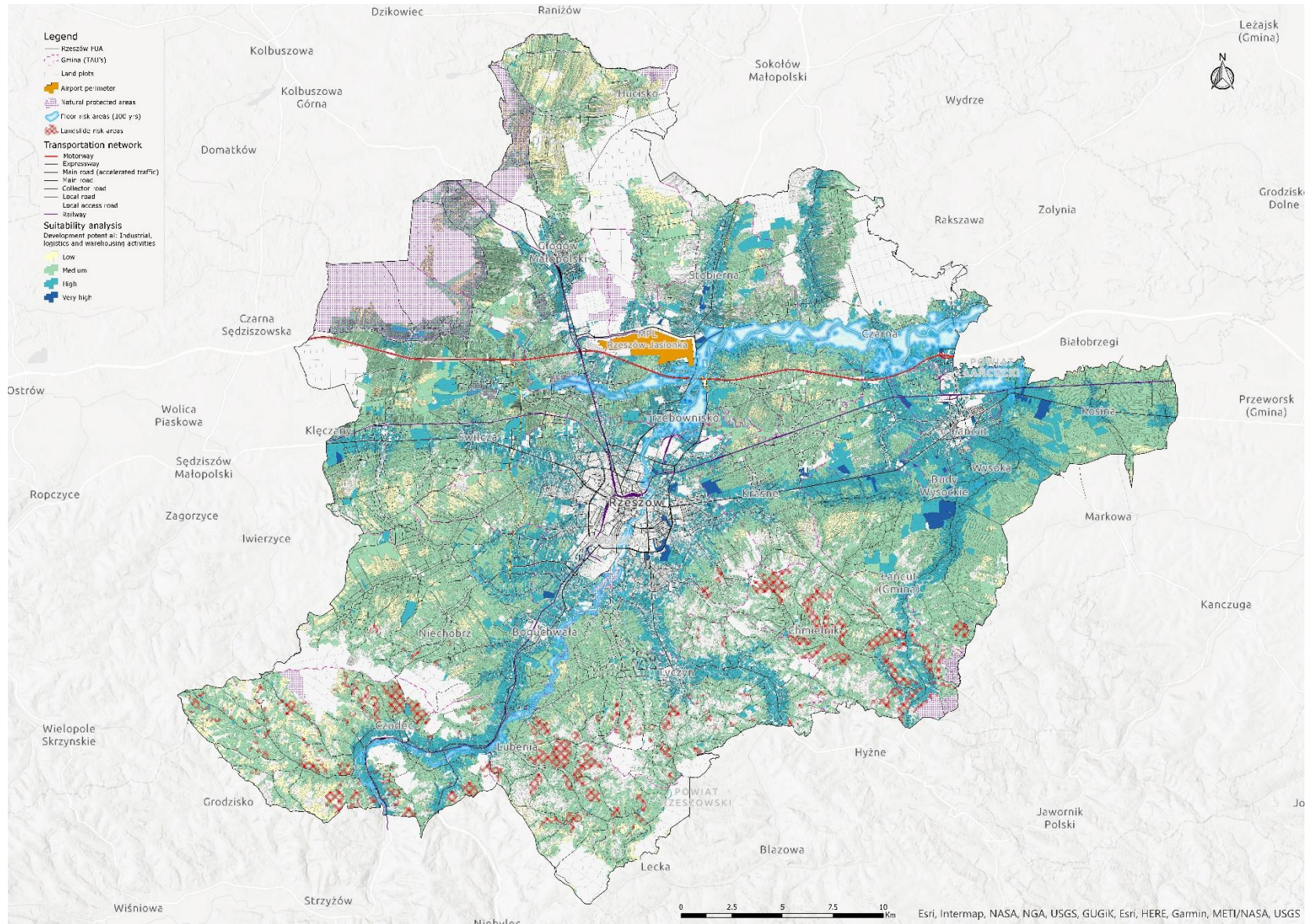
	> 5 km to town halls of urban localities	3		
Proximity to other office spaces	≤ 500 m	10	20%	Requires data on office spaces and other points of interest
	500 m – 1.5 km	6		
	> 1.5 km	3		
Proximity to a public transport station (including rail)	≤ 300 m	10	20%	Requires data on public transportation network
	300 m – 600 m	6		
	> 600 m	3		
Plot size	≥ 1 ha	10	15%	
	0.5 - 1 ha	6		
	< 0.5 ha	3		
			<b>100%</b>	
<b>Development potential: housing / residential</b>				
Proximity to an existent or planned road	≤ 1 km	10	25%	
	1-2 km	6		
	2-3 km	3		
	> 3 km	1		
Proximity to the center (central point = town hall of any locality with over 5000 inhabitants)	≤ 2 km	10	20%	
	2-5 km	6		
	> 5 km	3		
Access to utilities	Plot adjacent to an urbanized area with access to utilities (electricity, water and wastewater, gas)	7-10	25%	Requires complete data on utilities infrastructure
	Plot adjacent to the urban perimeter / built-up areas	6		
	Plot in an area without utilities	3		
Plot size	≥ 1 ha	10	15%	
	0.5 - 1 ha	6		
	< 0.5 ha	3		
Accessibility to public facilities	≤ 1 km	10	15%	Requires data on public facilities (the relevant types to be defined: e.g., kindergarten, school, healthcare, etc.)
	1-3 km	6		
	> 3 km	3		
			<b>100%</b>	



<i>Development potential: environmental</i>				
Proximity to an existent (large) protected area	≤ 1 km	10	20%	
	1-3 km	6		
	3-5 km	3		
	> 5 km	1		
Flooding area or wetlands	in	10	20%	
	adjacent	6		
	out	3		
Inside or adjacent to the blue-green corridors.	Inside green-blue corridors	10	25%	Blue-green corridors must be defined prior to the analysis
	Adjacent to the blue-green corridors	6		
	≤ 1 km to the blue-green corridors	3		
	> 1 km to the blue-green corridors	1		
Plot size (green area size)	≥ 10 ha	10	20%	
	2-10 ha	6		
	<2 ha	3		
Proximity to the center	≤ 1.5 km	10	15%	
	1.5-3 km	6		
	> 3 km	3		
			<b>100%</b>	
<i>Development potential: tourism and recreation</i>				
Proximity to (large) protected / green areas	≤ 1 km	10	25%	
	1-2 km	6		
	2-3 km	3		
	> 3 km	1		
Proximity to tourism POIs	≤ 2 km	10	20%	Requires data on tourism points of interest/ determine which POIs to be used prior to the analysis
	2-5 km	6		
	> 5 km	3		
Proximity to key transport, sport and business hubs (airport, main railway and bus station, large stadium)	≤ 2 km	10	25%	Key hubs must be defined prior to the analysis
	2-5 km	6		
	> 5 km	3		

Proximity to (large) water reservoir	≤ 1 km	10	15%	Requires data on cycling routes & walking paths
	1-3 km	6		
	> 3 km	3		
Proximity to bike cycling routes (Green Velo) and main walking paths	≤ 1 km	10	15%	
	1-3 km	6		
	> 3 km	3		
			<b>100%</b>	
<b>Resulting suitability classes:</b>				
	< 4 points – low			
	4-6 points – medium			
	6-8 points - high			
	> 8 points - very high			
<b>Optional parameters :</b>				
Slope	<5 degrees,	10	N/A	It is not a relevant indicator for most analyzes due to the topographic configuration and small elevation differences.
	5-9 degrees,	6		
	9-15 degrees,	3		
	>15 degrees.	1		
Within the RFUA ventilation corridors	Within the ventilation corridors	10	N/A	Requires a completely separate analysis on ventilation corridors
	Outside the ventilation corridors	1		
Proximity to heat islands	< 300m	10	N/A	Requires a completely separate analysis on urban heat islands
	300-500 m	6		
	> 500 m	3		
Proximity to ambient pollution hot spot	< 300m	10	N/A	Requires a completely separate analysis on ambient pollution
	300-500 m	6		
	> 500 m	3		
Projections of population growth (population density)	N/A	N/A	N/A	

## ANNEX 6. LAND SUITABILITY ANALYSIS FOR INDUSTRIAL, LOGISTICS AND WAREHOUSING ACTIVITIES





## ANNEX 7. LAND SUITABILITY ANALYSIS FOR RESIDENTIAL DEVELOPMENT

