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# The design of permeability raster of land cover in the Râmnicu-Vâlcea metropolitan area in order to implement the green-blue infrastructure

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## The problem

Taking into account the uncontrolled urban expansion at the level of large cities in Romania, but also the commitment made by the Romanian state regarding the achievement of the objectives of the European Green Deal, in terms of climate change, biodiversity, social conditions and economic development, the present study aims to elaborate an analysis of the connectivity of the green-blue areas at the level of the metropolitan area of the Râmnicu Vâlcea municipality in order to include the green-blue infrastructure within the documentation of urban and territorial planning.

Green infrastructure involves a planned network that provides viable solutions to urban and climate challenges through a combination of major infrastructure, ecological restoration and urban design to optimize the relationship between man and nature. The implementation of green-blue infrastructure becomes absolutely necessary in territorial planning because habitat fragmentation can increase the potential impact of climate change and cause negative phenomena such as the greenhouse effect, urban heat islands, soil erosion, landslides, etc.

Landscape connectivity is a crucial feature of green-blue infrastructure and it is a key pillar for maintaining species movement and sustaining ecological processes and functions. It is the key principle of spatial organization to ensure a better opportunity for the provision of ecosystem services, which can affect urban hydrology, mobility, recreation and cultural assets. It is considered an integral part of urban development and territorial development, and the importance of green infrastructure is relevant in protecting Europe's natural capital and integrating it into sectorial policies and financial instruments of the European Union.

The objective of the ongoing study is to implement a methodology for the operationalization, analysis, assessment and multifunctional mapping of green-blue infrastructure, and the present material presents an innovative methodology for identifying the connectivity of green-blue areas and designing green-blue infrastructure at the level of the metropolitan area of Râmnicu Vâlcea municipality.

What distinguishes the present methodology from other studies is the IT component, which represents an innovative and original model at the level of the European Union. Thus, the land cover in the studied area will be evaluated according to the characteristic values of the landscape in several categories (zero, low, moderate, high, very high). In order to evaluate the characteristics of the landscape in the studied area, we will take into account the biodiversity value, the socio-economic value, the connectivity aspects and the type of ecosystem services offered. For a more accurate assessment of the landscape, we will use the ANCPI data in accordance with the European CORINE 2018 data, and the topographic elevation of the inner city of Râmnicu Vâlcea in accordance with the European Atlas data. The IT solutions used are based on two ARCGIS tools – Gnarly Landscape Utilities and Linkage Mapper.


Study area of Râmnicu Vâlcea municipality
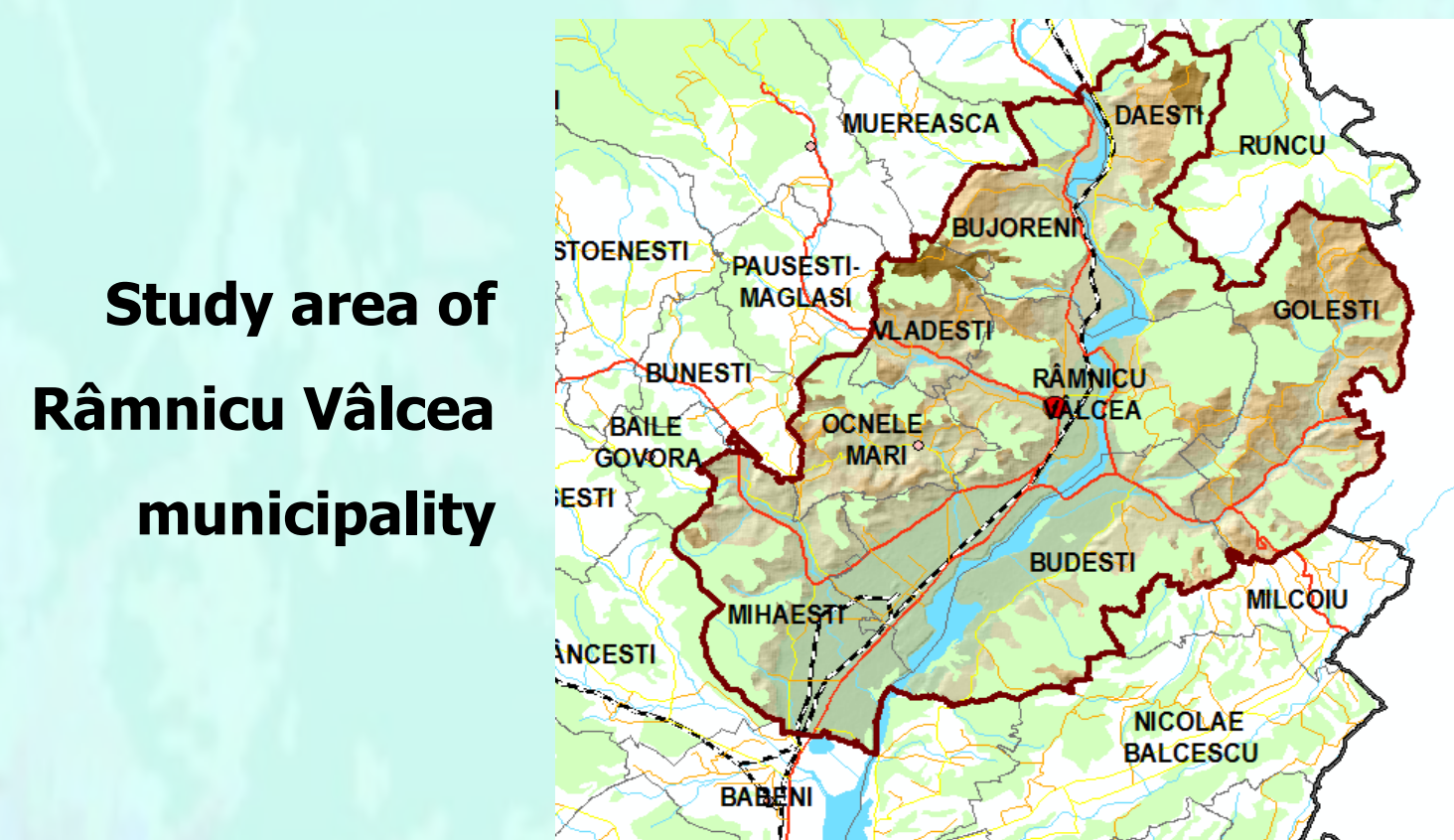
To define *the permeability* of land in studied area, we have developed an IT solution based on the ARCGIS 10.6 tool - *Gnarly Landscape Utilities*. Thus, we defined the areas with high connectivity and other areas that are barriers for the development of a the green-blue infrastructure.

To define *the connections* between areas having high landscape characteristics, we have developed an IT solution to assess the area of the green-blue infrastructure and the connections between different green elements, based on the *ARCGIS - Linkage Mapper tool*.

Such a green-blue infrastructure model requires a large amount of data and the assessment of its quality for a correct evaluation. Also, evaluation processes must be iterative in nature, so that the data systems used are able to integrate new and better performing data to improve the quality of evaluation tools.


2. Map of land use at the level of the studied area, according to the European database CORINE 2018
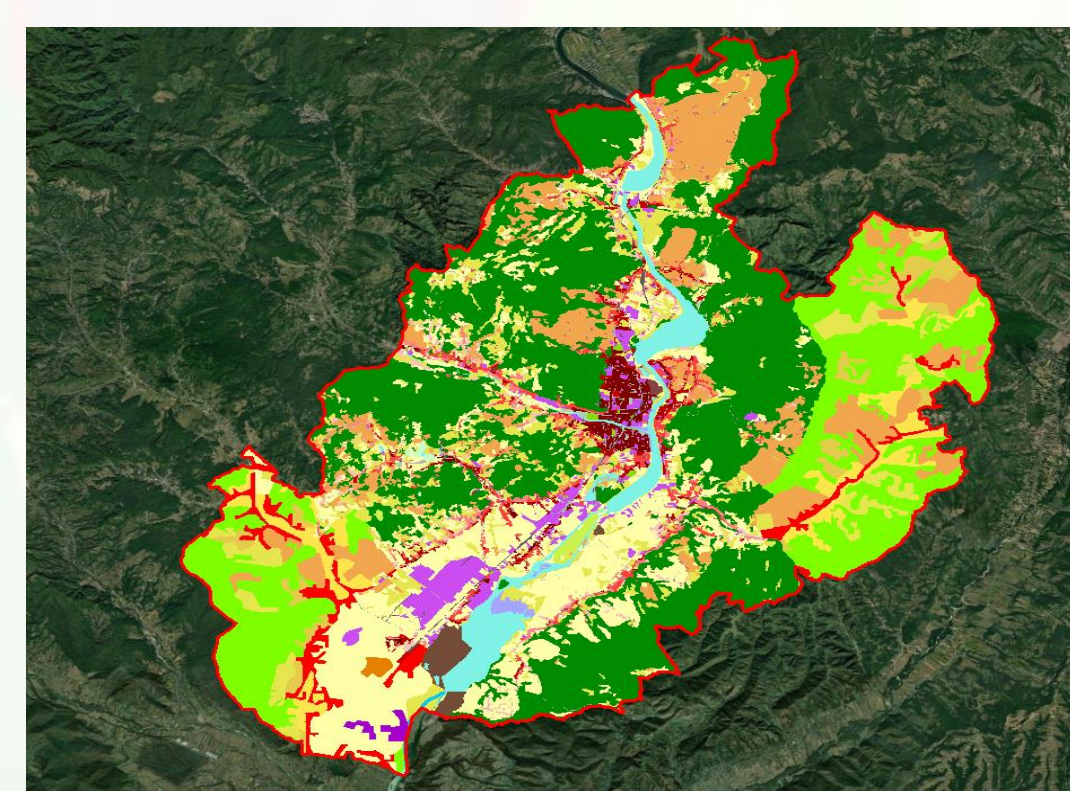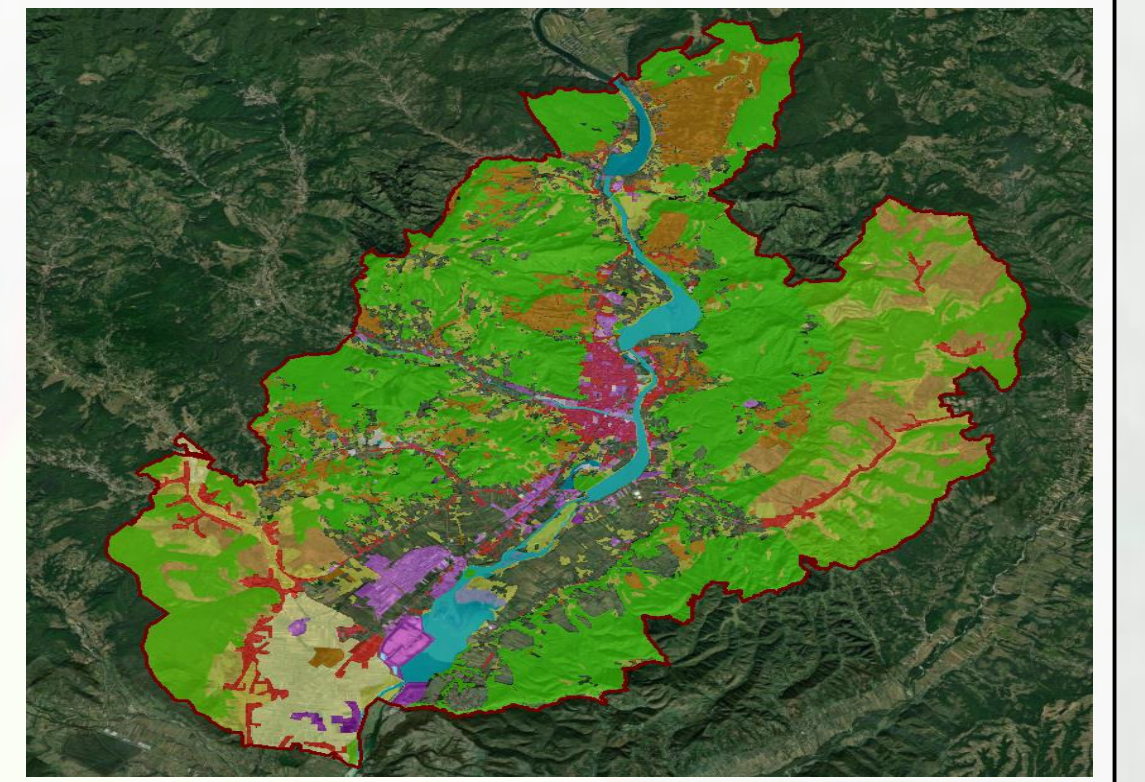

3. Study area with compatible data for land use


4. Data processing as required by the GIS script – Gnarly Landscape Utilities
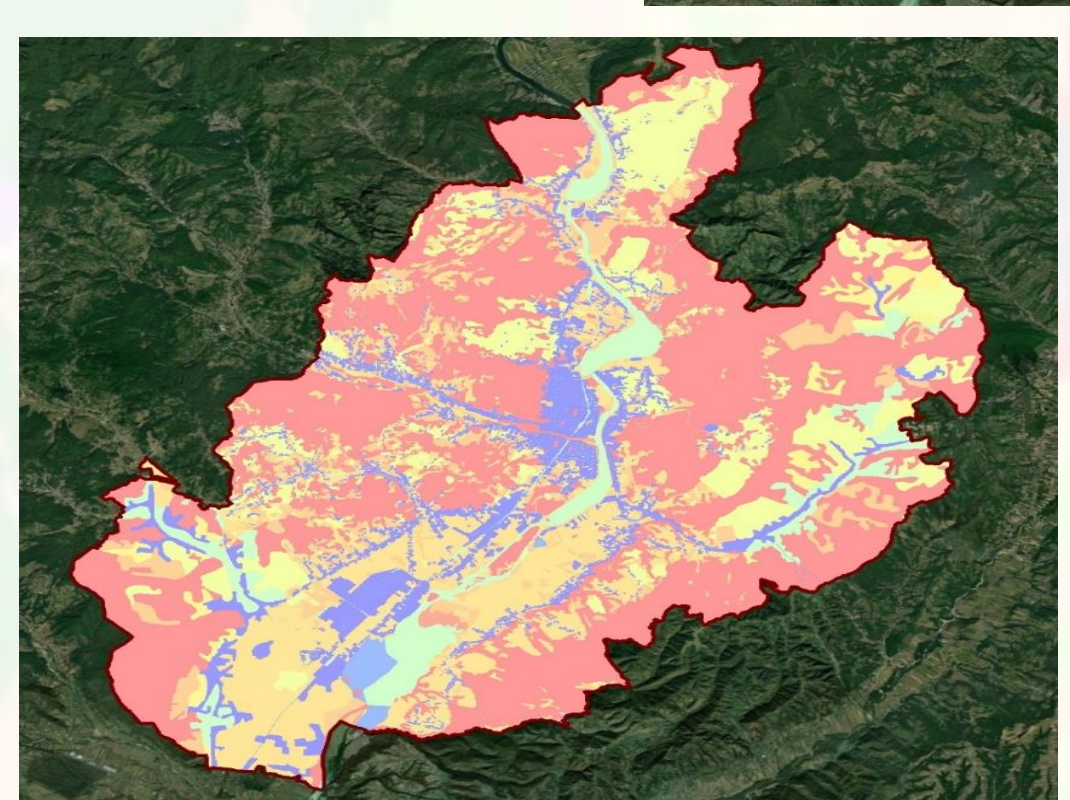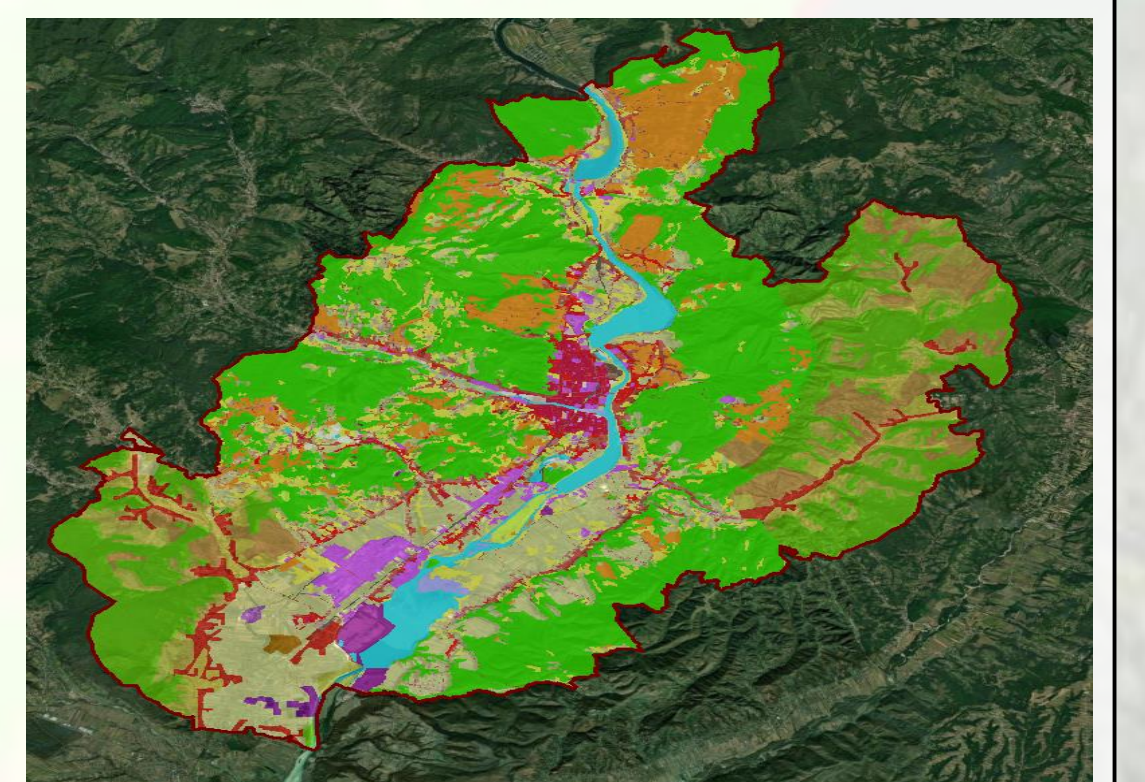

5. Raster of movement resistance through the landscape of the study area

## Methodology

The methodology is based on a data set compatible with the European databases in the field of environment and urban planning - Corine CLC and the European Urban Atlas and on two highly successful ARCGIS tools - Gnarly Landscape Utilities and Linkage Mapper. For the evaluation of the characteristics of the landscape in the studied area, we took into account the biodiversity value, the socio-economic value, the connectivity aspects and the type of ecosystem services offered.

The computer scheme in defining the landscape connectivity model of the studied area is presented as follows:
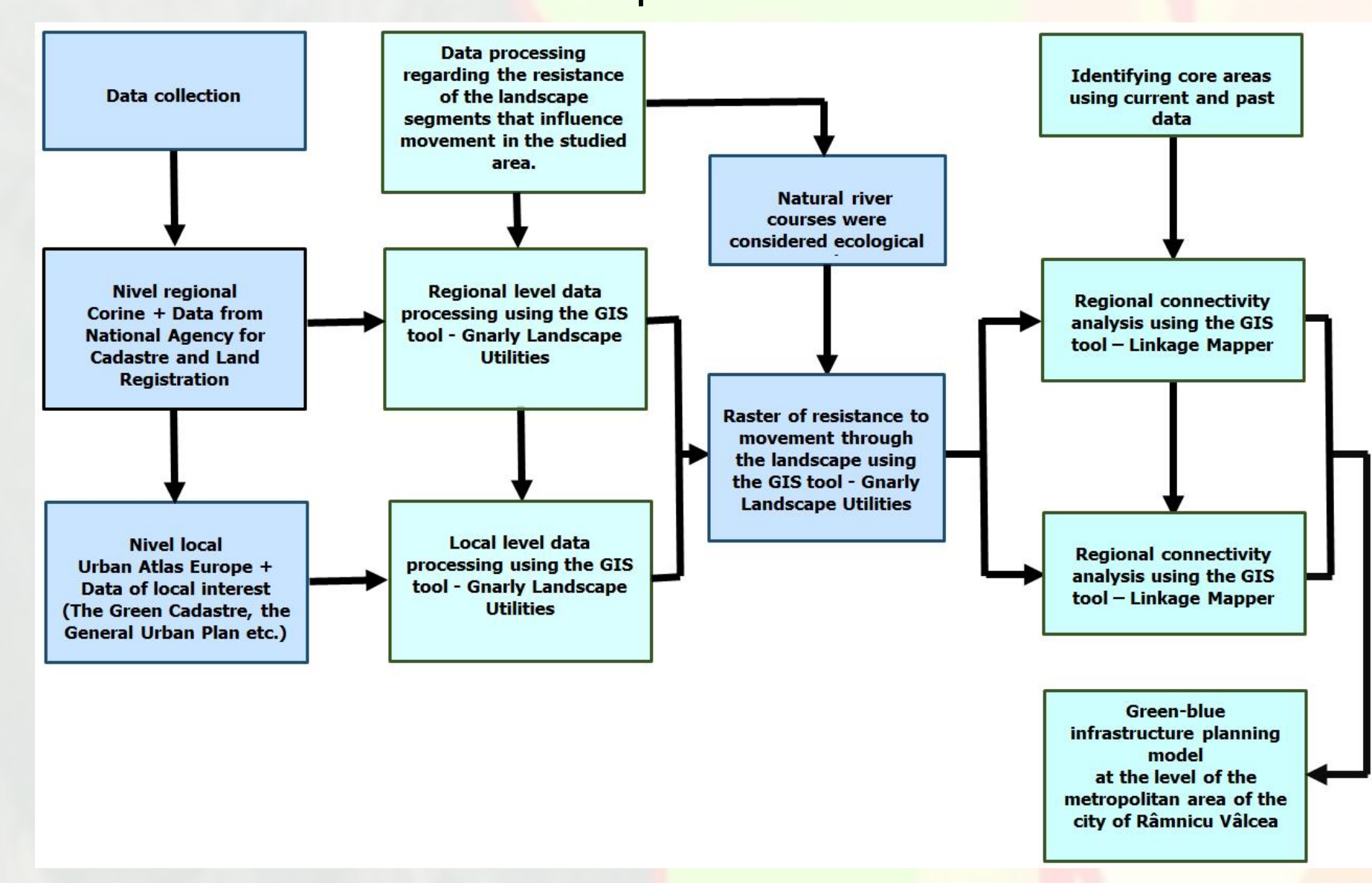


## Results

The development and implementation of the present methodology had a double purpose: firstly, it constitutes a starting point for the planning of the green-blue infrastructure at the level of the Râmnicu Vâlcea metropolitan area and secondly, it represents a model of good practice for the integration of green-blue infrastructure in urban and territorial planning.

The green infrastructure analysis model for the municipality of Râmnicu-Vâlcea is designed so that it can be used with input data for different scales, since the necessary input data are available for different quality levels. The quality of the result is based on the homogeneity and quality of the input data. The ultimate objective is to see natural and agricultural areas forming a single territorial ecological matrix, ensuring sustainability and biodiversity.

The landscape connectivity evaluation process, according to the methodology, contains the following sequences of GIS processing:
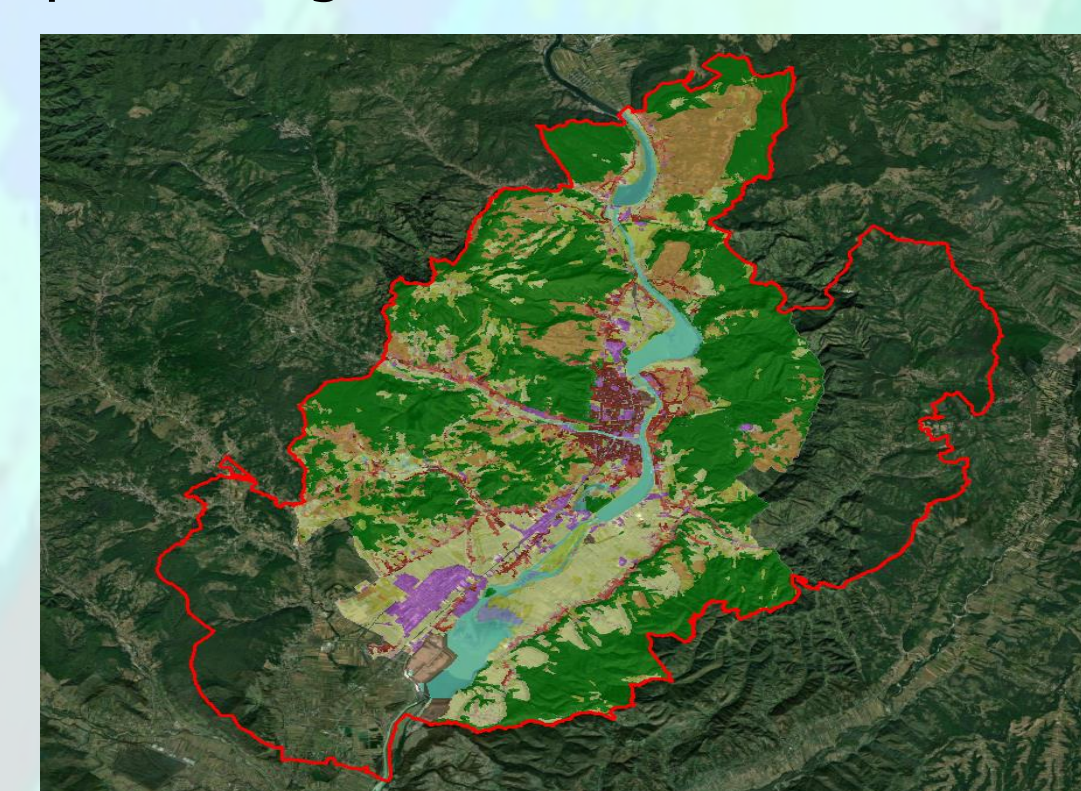

1. Land use map after processing data from the European Atlas for the studied area

## Conclusions

Obtaining the movement resistance grid through the landscape is an important milestone in the implementation of the methodology for identifying the connections of green areas in the metropolitan area of Râmnicu Vâlcea municipality. The accuracy of this resistance raster is highly dependent on the quality of the data used and the weights assigned to each land use element in the Corine 2018 and Urban Atlas databases. The weighting of landscape feature values is defined according to biodiversity value, economic value, social value, the types of ecosystem services they provide and the connectivity aspects of the landscape. In defining the final values, the specificity and history of the studied area must be taken into account, the experience of the specialists in ecology and territorial planning and last but not least the international experiences, especially guidelines for the implementation of green-blue infrastructure at the regional and local level.

The implementation of the present methodology has as final goal the protection of metropolitan territory of big cities in Romania from the intensity and dispersion of urban development by integrating the green-blue infrastructure, and the sustainable development in urban and territorial planning.

## Bibliography

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