

Spatial analysis of land degradation sensitivity in Romania using the multi-criteria MEDALUS methodology – Scientific report 2018 –

According to its **general objective**, the present project's aim is to perform a static multicriteria analysis of land susceptibility (sensitivity) to degradation in Romania, based on the MEDALUS (*Mediterranean Desertification and Land Use*) methodology, well-established internationally, starting from the premise that land degradation is one of the most important environmental perturbations our country is currently facing.

Additionally, as described in the funding application, the project's **concrete objectives** are:

- identifying/purchasing all geographic data sets (pedological, climatic, hydrological, biotical) deemed necessary for the MEDALUS model, in accordance with the regional/national specificities of this environmental process;
- processing the data as the main biophysical indexes that represent the main causes of land degradation and obtaining a final index of land susceptibility to degradation;
- countrywide mapping/statistically analyzing lands with different degrees of sensitivity to this process, based on the final index of land susceptibility to degradation;
- validating the final sensitivity model using field investigations;
- promoting the importance of a multicriteria/interdisciplinary analysis of this environmental issue in the national scientific and political spheres by disseminating the project's results.

Therefore, in accordance with the workplan and Gantt diagram included in the funding application, **during the project's first six months, the first objective was met**, i.e. identifying/purchasing geographical data sets, necessary for applying the MEDALUS model theoretically (in accordance with the original international methodology) and particularly (in accordance with Romania's regional conditions). More specifically, in order to analyze land susceptibility to degradation nationally, this first phase entailed completing the theoretical documentation on the main environmental criteria that control land degradation, i.e. climate, soil, vegetation, water resources and land management. The documentation process was aimed at the five main indexes through which the land degradation potential is assessed – Climate Quality Index (CQI), Soil Quality Index (SQI), Vegetation Quality Index (VQI), Water Resource Quality Index (WRQI) and Land Use Quality Index (LUQI), while the data

acquisition process aimed to collect the parameters and sub-indexes that describe the state of the climate, soil, vegetation, water resources and land use, in accordance with the MEDALUS methodological diagram.

In concrete terms, in the present project, the **ICC** was obtained for Romania by processing five geographic parameters, three of which belong to the MEDALUS methodology (*precipitation, climatic aridity and slopes*), while the remaining two (*rainfall erosivity and wind speed*) were added because they are relevant for the state of lands in Romania as they can be used for estimating hydric and wind erosion. The data was purchased from the following data sources: *WorldClim* – <http://worldclim.org/> (*rainfall*), *Consortium for Spatial Information* – <http://www.cgiar-csi.org/> (*climatic aridity*), *EU-DEM – Digital Elevation Model* (2013 version) – <http://www.eea.europa.eu/> (for obtaining the *slopes* parameter), *European Soil Data Centre* – <http://esdac.jrc.ec.europa.eu/> (*rainfall erosivity*) and *National Climatic Data Center* – <http://www.ncdc.noaa.gov/> (*wind speed*).

ICS was obtained by integrating eight sub-indexes, six of which belong to the MEDALUS framework (*texture, parent material, soil skeleton, slope, soil depth and drainage*), while two were added (*salinization and alkalization*) due to the fact that certain outer-Carpathian areas are vulnerable to salinization and alkalization processes that can significantly influence the state of lands in certain sectors. All data was sourced from the *Romanian Soil Map*, 1:200,000 scale (based on mapped data of pedological records held by the *Research Institute for Pedology and Agrochemistry*), except for the slope (which was extracted from the *Digital elevation model*).

ICV was obtained by processing four parameters that are specific to the method (*fire risk, protection to erosion, resistance to drought and soil cover degree*), which were extracted based on information featured in the *CORINE Land Cover* database (2012 edition), available at <http://www.eea.europa.eu/>. The same source was also used for obtaining the **ICGT** (using the sub-indexes *agricultural intensity* and *agricultural policies*), foreseen in the original methodology.

In order to improve the methodology in accordance with our country's land degradation conditions, the project integrated a first-ever new relevant indicator, **ICRA**, which was obtained by integrating two parameters – *hydrographic density* (processed based on the hydrographic network mapped from the *Romanian Water Registry Atlas*) and *groundwater level depth* (gleization data extracted from the *Romanian Soil Map*), which are relevant for assessing the lands' biological productivity, based on the quantitative analysis of water resources.

Finally, all five indexes were obtained as raster data and will be processed in their final form (using the spatial analysis software ArcGIS 10.1) for obtaining the *Index of Land Susceptibility to Degradation*, which will feature eight sensitivity classes, consistent with the MEDALUS framework. **Essentially, during the first six months of activity, three activities** (1.1. Detailed theoretical documentation, based on international specialized literature, of the overall application procedure of the MEDALUS methodology; 1.2. Identification of necessary datasets as input for applying the methodology; 1.3. Acquisition of datasets from online databases and specialized Romanian institutions) **were completed, as foreseen in the workplan (first objective) and in the Gantt diagram**, described in detail in the initial project proposal.

In terms of **deliverables obtained**, they consist of:

- a paper submitted for publication to a red zone journal (Catena), the topic of which (analysis of land degradation in arid environments – *drylands*, both in Romania, and in Europe and globally) is directly connected to the present project's theme;
- two papers published in a red zone journal (Journal of Cleaner Production), the topics of which (analysis of solar and wind resources in arid environments, where land degradation occurs at an accelerated rate, as well as in non-arid environments) are indirectly connected to the present project's theme;
- presentation of synthesized results on the expansion (over the past decades) of arid environments and land degradation conditions nationally, continentally and globally, at an international conference held in Iași City, Romania.

Moreover, an important result obtained during this first assessment phase consists of a website that features up-to-date information on the project's stages and delivered results.