7_М_Резюме на дисертацията на английски език

Spatial analyses and high-mountain ecosystem condition and services assessment in Rila Mountains

Environmental changes as a result of climate change become an important part of the public awareness. Environmental science as an instrument of the social processes is considered to be the tool to understand and assess the influence of climate change on the ecosystems as the main functional unit of nature. It is necessary to both identify the nature components sensitive to these changes, and assess the effects on their functions and the goods and services provided to the society that are related to them. For the purposes of the current study, a "High-mountain ecosystem" (HME) was defined via structural and functional criteria. It is located in the South-western parts of Rila National park in Rila Mountain. The aim of the current research is to assess the structural and functional condition of the selected study area, including determining condition dynamics as a result of key climate parameter changes and their influence on the provision capacity of the studied area to provide ecosystem services. To achieve the goal, remote sensing approach, climate data, Copernicus' expert products and GIS technology were applied to a 42 years period.

Data fusion approach of integration of different data sources was applied when we studied the influence of the local climate changes on the structure and functions of the defined HME. For the needs of the current dissertation methods were developed including remote sensing based on vegetation indices (NDVI, NDWI and NDGI). The resulting prevalence of positive NDVI values (NDVI> 0) throughout the entire study period was interpreted as an indication of good functional condition. The obtained results were confirmed using NDWI and NDGI.

The dynamics of the spatial distribution of the main structural components of the HME was established and cross-verification was conducted for both the expert products of Copernicus and forestry database, showing high correlation between them. It was confirmed that the applied methodological approach of using heterogeneous data is adaptive and well applicable for data processing, fusion, statistical analysis and their common interpretation. Geo-spatial identification of the main and sub-components (forests) was conducted. Trends of changes in the spatial extent and functioning of the studied HME as well as trends of changes in the local climate conditions were established. The trend towards acceleration of the HME response to the climate change found by some authors (Cannone et al., 2008, Vitasse et al., 2022) was confirmed to be traceable via constant monitoring of the relevant systems thanks to the new series of Copernicus expert products (High Resolution Layers). In addition, new potential indicators were developed to be included in the Methodological framework. They are suitable for monitoring the climate change effect on the terrestrial ecosystems by means of remote sensing.

Expert-based approach was applied in selection and assessment of three cultural ecosystem services and in the assessment of the HME's capacity to provide them.

The results and discussion of the research carried out are published and presented in the fallowing articles as well as in Annex 1

- 1. Katrandzhiev, K.; Gocheva, K.; Bratanova-Doncheva, S. Whole System Data Integration for Condition Assessments of Climate Change Impacts: An Example in High-Mountain Ecosystems in Rila (Bulgaria). Diversity 2022, 14, 240.
- 2. Katrandzhiev, K. APPLICATION OF REMOTE SENSING FOR HIGH MOUNTAIN ECOSYSTEM CONDITION ASSESSMENT (SOUTH WEST RILA MOUNTAIN BULGARIA). Ecological Engineering and Environment Protection 2018, No 2, p.35-40.
- 3. Katrandzhiev, K. and Bratanova-Doncheva, S. Spatial Distribution of High-Mountain Ecosystems— Application of Remote Sensing and GIS: A Case Study in South-Western Rila Mountains (Bulgaria). Silva Balcanica 2019, 20, 3, 57–69.
- 4. Annex 1 an article prepared for submission, with the working title: "Data Fusion for Ecosystem Services Assessment: a Case Study in Bulgarian South-western Rila Mountains".