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MAPPING OF ECOSYSTEMS IN MALA PLANINA MT, BULGARIA

BORISLAV G. GRIGOROV * & ASSEN I. ASSENOV

*Faculty of Geology and Geography, University of Sofia “St. Kliment Ohridski”, 15 Tzar
Osvoboditel Blvd., 1504 Sofia, Bulgaria*

Abstract. The main aim of the current study is to differentiate and analyze types of ecosystems in Mala planina Mt. The investigation is based on the typology of the Working Group for Mapping and Assessment on Ecosystems and their Services (MAES), following Action 5 of the EU Biodiversity strategy requiring member states to map and assess the state of ecosystems and their services in their own territories. The provided methodological framework for mapping of ecosystems is for the continental scale of Europe and it is applied to the local scale of a Bulgarian mountain. The map of the ecosystems in Mala planina Mt based on the MAES typology is created on the basis of information from CORINE Land Cover 2012 dataset. All other ecosystem types of terrestrial category except wetlands, heathland and shrub are presented in a different areal pattern. Grassland, woodland and forest are the most widely distributed ecosystem types of level 2, while urban, cropland and sparsely vegetated areas are randomly distributed.

Key words: ecosystem type, CORINE Land Cover, MAES

** corresponding author:* B. G. Grigorov-Faculty of Geology and Geography, University of Sofia “St. Kliment Ohridski”, 15 Tzar Osvoboditel Blvd., 1504 Sofia, Bulgaria; borislav.g.grigorov@gmail.com

INTRODUCTION

We live in the decade of biodiversity. When the 10th meeting of the Conference of the Parties to the Convention on Biological Diversity was held in Nagoya, Japan, almost seven years ago in October 2010, a Strategic plan for Biodiversity 2011 2020 (CBD & UNEP 2010), which is of a global importance, was discussed. The Aichi Biodiversity Targets (CBD & UNEP 2010) were also agreed by governments. The constantly raising awareness regarding the significance of biodiversity and ecosystem preservation led to development of EU Biodiversity Strategy, aiming to fight against the loss of biodiversity and ecosystem services in the European Union (http://ec.europa.eu/environment/nature/biodiversity/strategy/index_en.htm). Many tasks were designed, and one of them was applied by the Working Group for Mapping and Assessment on Ecosystems and their Services (MAES), following Action 5 of the EU Biodiversity strategy. The member states of European Union were required to map and assess the status of the ecosystems and their services in their own territories. The economic importance and value of these services have to be assessed as well. The first and the second technical reports (Maes et al. 2013, 2014) provided a coherent analytical framework and indicators that member states are obliged to apply to mapping and assessment of biodiversity, ecosystem condition and ecosystem services.

Nedkov et al. (2017) proved the applicability of the mapping of the ecosystems in Bulgaria (as a member country of EU) based on MAES typology. The present paper is aimed on differentiation and analysis of different types of ecosystems in Mala planina Mt based on the same typology.

MATERIALS AND METHODS

The aim of the study is to differentiate and analyze different types of ecosystems in Mala planina Mt. The studied area is located in the western part of the country, going to the north of the capital city Sofia. The boundaries of Mala planina Mt are discussed by Grigorov & Assenov (2015). The investigation of the ecosystems in the area is based on the MAES typology (<http://biodiversity.europa.eu/maes/typology-of-ecosystems>) which consists of three major ecosystem categories: terrestrial, fresh water and marine, marked as level 1, and these three categories are subdivided into ecosystem types for mapping and assessment at level 2. This subdivision, in particular, is the basis of the investigation of ecosystems in Mala planina Mt. The terrestrial category is subdivided into seven ecosystem types at level 2: urban, cropland, grassland, woodland and forest, heathland and shrub, sparsely vegetated land and wetland. Considering the geographic characteristics of the studied area, the other two major categories at level 1 may be omitted.

The CORINE Land Cover 2012 dataset was a free download from the Executive Environment Agency website (<http://eea.government.bg/bg/projects/>

korine-14/kzp-danni-clc-data). It corresponds directly to MAES' ecosystem types at level 2 (Maes et al. 2013). The information concerning the territory of Mala planina Mt was extracted from the dataset and modified for the purpose of investigation. The mountainous territory consists of 15 CORINE Land Cover classes at level 3 (**Fig. 1**). They are as follows: discontinuous urban fabric, industrial or commercial units, mineral extraction sites, non-irrigated arable land, fruit trees and berry plantations, pastures, complex cultivation pat-tems, land principally

Fig. 1. CORINE Land Cover 2012 dataset for Mala planina Mt.

occupied by agriculture with significant areas of natural vegetation, broad-leaved forest, coniferous forest, mixed forest, natural grassland, transitional woodland/ shrub, bare rock, sparsely vegetated areas. As far as the territory of Mala planina is concerned, apart from wetlands and heathland and shrub, all other five types of the terrestrial category are represented in the investigated area. The map of the ecosystems in Mala planina Mt was created by the use of ArcGIS 10 software product by establishing the correspondence between the presented CORINE Land Cover classes

at level 3 with the proposed ecosystem types at level 2.

RESULTS

The total area covered by the mountain is 351.3 km². Five ecosystem types of level 2 (MAES typology) are represented in Mala planina (**Fig. 2**). 164.9 km² or 46,9 % of the territory is covered by the woodland and forest ecosystem type. This is the most widely spread ecosystem type in the studied area. Among the EUNIS habitats, the largest territories of this ecosystem type are covered by: Moesio Danubian thermophilous oak forests (G1.768), Dacio-Moesian hornbeam forests (G1.A322), Moesian white oak woods (G1.7372) and Balkan Range neutrophile beech forests (G1.6932). The dominant species in the current ecosystem type

Fig. 2. Ecosystem types of Mala Planina according to MAES typology.

are *Quercus dalechampii* Ten., *Quercus cerris* L., *Quercus frainetto* Ten., *Fagus sylvatica* L., *Carpinus betulus* L., *Acer pseudoplatanus* L., *Fraxinus excelsior* L., *Fraxinus ornus* L., *Quercus pubescens* Willd. and *Carpinus orientalis* Mill. Middle European dry-slope limestone beech forests (G1.661), Dacio-Moesian ash-alder woods (G1.2116), Eastern European poplar-willow forests (G1.1112), Deciduous

exotic *Quercus* plantations (G1.C2) and *Robinia* plantations (G1.C3), dominated by *Alnus glutinosa* (L.) Gaertn., *Robinia pseudoacacia* L., *Quercus rubra* L., *Salix*

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purpurea L. occupy more limited territories. Woodlands and forests are located mainly in the eastern part of Mala planina Mt and their highest density is in remote areas, where the influence of the anthropogenic factor is weaker. The ridge Kamuka which in fact represents the western part of Mala planina Mt, lacks widely dispersed woodland and forest areas with the exception of few oak forests in the coombs to the south.

Croplands occupy the second place as an ecosystem type in Mala Planina, as far as covered area is concerned. They share 24,7% of the whole territory, or ca. 87.1 km². Croplands are situated to the north, where Mala planina Mt is divided from the Chepun Mt, especially near the villages of Tsruklevtsi, Vasilovtsi, Malo Malovo, Rayanovtsi and Golemo Malovo. This is a flat territory, where different kinds of crops, such as wheat, maize and a variety of vegetables are grown. Other wide croplands are situated on the lands of villages at the central part of Mala planina Mt - Drumsha, Drenovo and Chibaovtsi. There is also a band of croplands to the south, where the downward movement of Mala Planina slopes gently transforms in the flatland of Sofia valley (Sofiysko pole) - ranging from the village of Bogoyovtsi to the village of Kutina. The other cropland areas in the investigated territory have fragmented distribution. A part of them can be seen near the gorge of Iskur River (Iskursko defile) surrounding the town Novi Iskur and the villages Vlado Trichkov, Lukovo and Tompson. However, the steep slopes of Mala planina to the east prevent development of vast cropland areas. Another fragmented band of croplands is observed to the north, near Iskretska River's valley. This part of the mountain is also characterized by steep slopes with a significant denivelation and the few cropland areas cover the territories of villages Buchin prohod, Zavidovtsi, Iskrets and Svidnya, as well as the area of Svoje town.

Grassland ecosystems are at the third place by territorial coverage in Mala planina (62.2 km² of the mountain, or 17,7%.) The vastest territories covered by this type of vegetation are located to the west from the ridge Kamuka. Among the EUNIS habitats, Moesio-Carpathian steppes (E1.222), Moesio-Carpathian meadow-steppes (E1.234), Helleno-Balkan *Satureja montana* steppes (E1.21), Low and medium altitude hay meadows (E2.2), *Molinia caerulea* meadows and related communities (E3.51) and Balkan Range calcicolous chasmophyte communities (H3.2A13) cover the largest territories of this ecosystem type. The dominant species are: *Festuca valesiaca* Schleich, ex Gaudin, *F. stajanovii* (Acht.) Kozuharov, *F. dalmatica* (Hack.) K. Richt., *F. rupicola* Heuff, *Dichanthium ischaemum* (L.) Roberty, *Chrysopogon gryllus* (L.) Trin., *Poa pratensis* s.l., *Briza media* L., *Thymus* spp., *Dactylis glomerata* L. and *Molinia caerulea* (L.) Moench. Apart from the ridge Kamuka, there are also fragmented grassland ecosystems - in the triangle of Gradets, Balsha and Dragovisthitsa to the south, near the villages of Chibaovtsi, Tsarichina, Drenovo and Buchin prohod to the

north.

The ecosystem type of sparsely vegetated areas covers 23.7 km² or 6,8% of Mala planina. These ecosystems are located in the central and southern parts of the

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ridge Kamuka, between the villages of Ponor and Bezden, as well as near Vlado Trichkov village. Apart from forest and grassland, shrub vegetation is also formed here. The EUNIS habitats are Moesian oriental hornbeam thickets (F3.2431) and Moesian lilac thickets (F3.2432), dominated by the species of *Carpinus orientalis* Mill., *Rosa canina* L., *Crataegus monogyna* Jacq. and *Syringa vulgaris* L.

The urban areas occupy 3,9 % of the mountain (13,4 km²) territory. Two towns (Svoge and Novi Iskur), larger villages (Iskrets, Svidnya, Gradets, Chibavtsi, Drumsha) and a few smaller villages (such as Rayanovtsi, Malo Malovo, Vasilovtsi, Tseretsel) are situated in Mala planina. An important characteristic of the mountain is the presence of enormous number of villas, cottages and huts, adding more weight to the anthropogenic influence, typical for urban areas. It is essential to stress that the urban ecosystem type in level 2 of MAES typology do not always cover all parts of a particular village. Based on the fragmentation in the distribution of secluded villas in the outer layers of a village, there are sections that are not included in the urban ecosystem category, but in one of the other types. There are villages, which do not fall in this category at all, following their scattered character (*e.g.* Tseretsel and Tsarichina villages).

CONCLUSION

The typology of Working Group for Mapping and Assessment on Ecosystems and their Services (MAES) is a direct result from European Union challenge - each member state to map and assess the state of ecosystems and the services they provide in their own territory. This study is based on the application of this approach on a small scale: to a mountainous territory of Bulgaria, Mala planina, in particular. There twelve ecosystem types based on EUNIS habitat classification were identified. Five of the seven ecosystem types in level 2 (terrestrial major category in MAES typology) are represented in the studied area, with the exception of wetlands and heathland and shrub.

Using a map, based on CORINE Land Cover 2012 dataset, for the territory of Mala planina, a new map is generated, comprising the ecosystem types in MAES typology. The largest area of the mountain (46,9 % of its territory) is occupied by the woodland and forest ecosystem type, while the smallest area (3,9%) belongs to the urban type. The typical plant species for a mountain range at these latitudes dominate in the described ecosystem types. They play an important role for the presence and health of ecosystems in Mala planina Mt. The grassland ecosystem type takes up to 17,7% of the mountain area, while it is also an integral part of the sparsely vegetated areas. The croplands are the other integral type of ecosystem in Mala planina, covering

over 87 km².

The current investigation, along with the work of Nedkov et al. (2017) can be used as a base for other studies, concerning the application of MAES typology for ecosystems in Bulgaria. The present study shows promising results and it can

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be used as an example for more comprehensive and elaborate future investigations of ecosystems diversity in Mala planina and in the Western Balkans.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interests regarding the publication of this article.

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