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PAPER

CLASSIFICATION OF HABITAT UNITS OF THE NUROTA STATE RESERVE ACCORDING TO THE IUCN HABITAT CLASSIFICATION SCHEME

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Abstract

The article analyzes the ecosystems of the Nuratau State Nature Reserve according to the IUCN Habitat Classification Scheme. Based on a global habitat map with 100 m spatial resolution, eight habitat types were identified, and it was shown that the Grassland – Temperate class occupies the largest share of the area. Field observations demonstrated that some globally mapped units are not actually present in the reserve, while others occupy such small areas that they do not appear on the global habitat map. The study emphasizes the need to complement global data with local field observations.

Key words: IUCN Habitat Classification Scheme, Nuratau State Nature Reserve, natural ecosystems, habitat units, global habitat map, GIS, temperate grasslands, arable land, remote sensing.

Introduction

In the classification of natural ecosystems, the Habitat Classification developed by the IUCN harmonizes the various approaches used in different countries and regions on the basis of a single scientific criterion and makes it possible to divide natural areas into standard categories according to their ecological, biogeographical and structural characteristics. The habitat classification and the International Ecosystem Typology are two complementary, but in terms of their purpose and scale of application distinct, systems: the former is intended to standardize habitat units at the species level (in Red List assessments and habitat maps), while the latter serves to classify the world's ecosystems (forests, deserts,

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marine, urban, etc.) into global types based on their composition, function and ecological processes [iucnredlist.org, 2025; Lumbierres et al., 2021]. The habitat classification scheme provides a global spatial characterization of terrestrial habitats based on the best available worldwide datasets on land cover, climate, and land use [Jung et al., 2020]. The most recently published scheme consists of three hierarchical levels: at the first level, 16 major habitat groups are recognized; at the second level, 119 more specific habitat units are identified; and the third level reflects regionally specific habitat types. The assignment of each species to these classes is regulated according to global standardized criteria [Habitats Classification Scheme, 2012; Brooks, 2019].

At the same time, the habitat classification offers an important information basis for the planning of protected areas (nature reserves, national parks, biosphere reserves, etc.), for optimizing protected area networks, and for identifying priority territories.

The standardized nature of the classification greatly facilitates the comparison of remote-sensing data, geospatial information and field observations obtained in different years, the tracking of dynamic changes over time, and the monitoring of the impacts of climate change and anthropogenic pressures on ecosystems.

This has been implemented by overlaying the best available information on land cover, climate and other ancillary data sources using simple map algebra. The resulting map describes the global distribution of Level 1 and Level 2 habitat units as defined by the IUCN classification scheme for the year 2015. The classes on this global map have been validated using independent, spatially explicit calculations. This represents the first attempt to map the IUCN Habitat Classification units at the global scale [Jung et al., 2020].

Reseach method

In assessing the habitat units of the Nuratau State Nature Reserve, the global Habitat Classification Scheme (version 3.1) developed by the IUCN and the associated Global IUCN Habitat Classification (Level 2) digital map were used as the principal sources. This map, produced by Jung and co-authors, was generated at an approximate spatial resolution of 100 m based on an intersection of the best available global datasets on land cover, climate, and land use, and it reflects the global distribution of Level 1 and Level 2 habitat units.

First, the digital version of this global map (at the Level 2 detail) was loaded into a GIS environment. At the same time, the official administrative boundary of the Nuratau State Nature Reserve was prepared in the form of a polygon. At the next stage, by applying the "clip" operation, only the part of the global IUCN Habitat Classification map corresponding to the study area was extracted. In this way, for the territory of the Nuratau State Nature Reserve, the Level 2 habitat classes (habitat units) identified by the IUCN were generated as a separate data layer.

Based on the Level 2 codes and class names stored in each pixel, a list of the various habitat units occurring within the reserve was compiled. Using GIS software, the area of polygons belonging to each class was calculated, expressed in square kilometers, and their percentage share relative to the total area was determined. The results were summarized in tables and diagrams, and the area distribution, proportional relationships, and the role of different habitat units in the landscape structure of the reserve were comparatively analyzed.

The data from the global IUCN Habitat Classification map were compared with regional and topographic maps, as well as with field observations conducted throughout 2025. During this comparison, the composition and boundaries of individual classes in the real landscape and their correspondence with micro landscapes were assessed. As a result, some units that were generalized on the global map were refined under local conditions, while habitats with very small areas or those located in transition zones were recorded separately and, where necessary, reinterpreted.

Results. As the object of the study, the territory of the Nuratau State Nature Reserve was analysed in terms of its distribution according to the IUCN habitat classification. According to the analysis based on the digital data on IUCN habitat categories, a total of eight different habitat units were identified within the study area at the Level 2 of the classification (six Level 2 units and, in addition, the Level 1 units Rocky areas and Wetlands (inland)) (Tab. 1).

Table 1

Habitat units of Nuratau State Nature Reserve

IUCN Habitat Classification Scheme (version 3.1)	
Level of Classification	
1	2
1. Forest and Woodland	
	1.1. Forest – Temperate
3. Shrubland	
	3.4. Shrubland – Temperate
	3.5. Shrubland – Subtropical/tropical dry
4. Grassland	
	4.4. Grassland – Temperate
4. Wetlands (inland)	
	5.11. Wetlands (inland) – Alpine wetlands (inc. temporary waters from snowmelt)
6. Rocky areas (e.g., inland cliffs, mountain peaks)	
14. Artificial –Terrestrial	
	14.1 Arable Land

The analysis of area indicators calculated for the territory of the Nuratau State Nature Reserve based on the global IUCN Habitat Classification (Level 2) map showed that the landscape structure of the reserve is characterized primarily by the predominance of temperate grasslands. The Grassland – Temperate class covers an area of 370.7 km² and accounts for approximately 97 percent of the total area of all habitat classes distinguished according to the IUCN (Fig. 1). Such a high share indicates that the vegetation cover of the Nuratau Reserve consists mainly of low-growing xerophytic grassland types adapted to semi-desert conditions, and that the zonal landscape features of the region have been aggregated into a single class in the global classification.

Taking second place is the Shrubland – Subtropical/Tropical dry class, which, with an area of 7.8 km², accounts for about 2 percent of the total area classified. Shrublands are usually located in transition zones between grasslands and other landscape elements (such as steep slopes and rocky sites) and perform an important ecosystem function by limiting soil erosion, retaining moisture, and providing shelter and food resources for small mammals, birds, and insects.

Although the remaining classes occupy very small areas, they represent important structural components that contribute to the ecological mosaic of the landscape. Arable Land covers 2.3 km², accounting for about 0.6 percent of the territory, and reflects traces of unregulated anthropogenic activity within the reserve and its buffer zone. The Rocky Areas class occupies 0.4 km² (about 0.1 percent) and represents areas with steep slopes and shallow soil layers; although such rocky habitats may appear "low resource," they serve as important concentration points for xerophytic and endemic species. The Shrubland – Temperate class covers around 0.2 km² and constitutes less than 0.1 percent of the total area, yet it records patches of temperate climate shrub vegetation and increases the ecological diversity of transition zones.

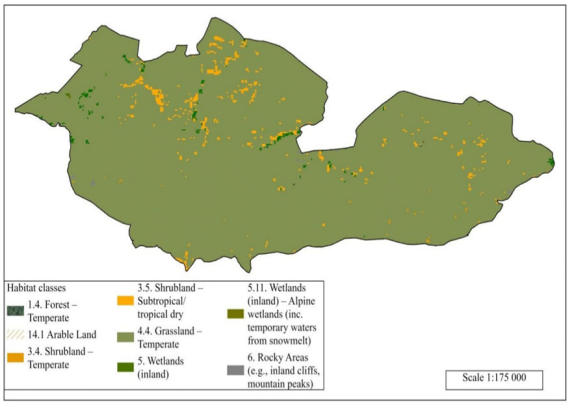

Figure 1. IUCN Habitat units of the Nuratau State Nature Reserve (Level 2, ~100 m resolution)

Water dependent habitats also occupy a limited area. The Wetlands (inland) class covers 0.5 km², corresponding to about 0.1 percent of the total territory, while the Wetlands (inland) – Alpine wetlands (incl. temporary waters from snowmelt) class occupies 0.2 km² and accounts for less than 0.1percent. (Fig. 2).

Overall, the analysis of these area values and proportions shows that, at the scale of the global IUCN classification, temperate grasslands are absolutely dominant in the Nuratau State Nature Reserve, while shrublands, rocky areas, arable land and water dependent environments, despite occupying very limited areas, appear as locally important habitats that play a key role in maintaining biodiversity and ecosystem services.

The field surveys and desk based analyses conducted throughout 2025 made it possible to directly verify and compare the information derived from the IUCN Habitat Classification (Level 2) global map under the specific conditions of the Nuratau Reserve. As a result of this comparative assessment, it was found that, in several cases, the area values calculated from the global map differ considerably from the actual situation, and some classes are not characteristic of the study area at all. In particular, the classes Shrubland – Subtropical/Tropical dry and Wetlands (inland) – Alpine wetlands (including temporary waters from snowmelt), which appear in the global dataset, were not confirmed during

field observations and by high resolution (10 m) classification results in the reserve, indicating that such habitats do not occur in practice. At the same time, several local habitat types that are either absent or insufficiently represented in the global classification—such as micro scale rocky complexes, semi desert grasslands, spring oases and others—were recorded.

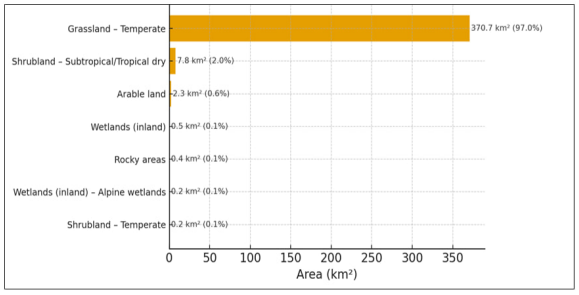

Figure 2. Area and proportion of IUCN Level 2 habitat units in the Nuratau State Nature Reserve (global 100 m habitat map).

The discrepancy observed between the datasets is primarily explained by the fact that the global IUCN Habitat Classification map was produced at an approximate spatial resolution of 100 meters and applies a single generalized approach for the entire Earth. At such a coarse spatial scale, micro landscapes, steep slopes, lithological structures, narrowly fragmented wetlands and water bodies, as well as poorly defined transition zones, are often aggregated into a single class. As a result, several pixels may represent environments that are spectrally similar but ecologically and biogeographically completely different; consequently, certain classes - such as tropical dry shrublands or alpine wetlands - may be applied to the Nuratau landscape inappropriately.

Conclusion

In this study, the natural ecosystems of Central Uzbekistan were comprehensively examined using the Nuratau State Nature Reserve as a case study, based on the IUCN Habitat Classification Scheme (version 3.1), and global and local scale datasets were comparatively analyzed. First, the global IUCN Habitat Classification (Level 2) map, developed by Jung and co authors with an approximate spatial resolution of 100 m, was clipped to the territory of the Nuratau Reserve in a GIS environment, and the areal distribution of the main habitat classes was determined. At this stage, the absolute dominance of the Grassland – Temperate class, as well as the formal presence of several other classes (including Shrubland – Subtropical/Tropical dry, Wetlands (inland) – Alpine wetlands, etc.), was identified.

However, the fieldwork and desk based analyses carried out throughout 2025 clearly demonstrated that the accuracy of the global map is limited under local conditions. In particular, it was revealed that classes such as Shrubland – Subtropical/Tropical dry and Alpine wetlands do not actually occur in the reserve. Conversely, several local habitat types that had been generalized in the global model—such as extensive rocky habitat complexes, spring oases, semi desert grasslands and low productivity rangelands—were found to be present. This inconsistency is primarily explained by the fact that the IUCN map was generated at a global scale and at a pixel size of 100 m, which forces multiple distinct environments to be aggregated into a single class in mosaic foothill landscapes.

Overall, the study demonstrates that global IUCN Habitat Classification maps provide a convenient and standardized platform for preliminary assessment and comparative analysis of protected areas. Nevertheless, when making management and planning decisions at the local scale, these maps must be complemented and refined using high resolution remote sensing data and extensive field observations.

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