Biomorphological analysis and occurrence of plant species in the central area of the Way carbon polygon

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Abstract. When studying the biodiversity of regional flora, various floristic studies are carried out. An important role is played by the analysis of plant life forms. Life forms of plants are one of the main characteristics that make it possible to assess the current state of the flora and are an important indicator for assessing the study of the biodiversity of a floristic object. This article provides a biomorphological analysis and occurrence of plant species at the central site of the WAY CARBON carbon test site (in the vicinity of the village of Khoy, Venedo district, Chechen Republic). The analysis is based on the processing of herbarium materials and field observations of the authors.

1 Introduction

The central site of the carbon training ground “WAY CARBON” of the Chechen State University named after A.A. Kadyrov is located in the Khoisko-Makazhoisk (Cheberloisk) basin in the Venedo region at altitudes of 1500-1900 m above sea level. Orographically, the polygon is located in the Khoisko-Makazhoisk (Cheberloisk) basin, the wings of which represent the ridge in the north. Kashkerlam (the highest point is the city of the same name Kashkerlam, maximum height 2806.9 m) and ridge. Kerket (heights up to 2391.0 m), in the west – ridge. Baskhoylam (with the peak of the same name, Baskhoylam, 2594.2 m) and ridge. Hindoylam (with the highest point of the same name, Hindoylam, 2658.2 m), in the south – ridge. Abdalzabazul (the highest point of the mountain of the same name is 2604.8 m), in the east are the spurs of the Andean ridge (the highest point is the city of Azal, 2657.9 m). The highest point of this area is the city of Kashkerlam (2806.9 m), the lowest point is at the place where the Ansalta River breaks out of the basin (the height of the edge is 1331.0 m). The amplitude of the terrain height fluctuation is 1475.9 m. The area of the basin is 205 km2 [1].

From 1330-1400 m above sea level up to 2000-2500 m the subalpine belt has boundaries, and on the northern slopes both boundaries are reduced, on the southern slopes they are raised. This is predominantly a meadow belt, although in some places there are birch forests in the depressions of the relief, and on the upper border of the forest there are thicketts of Rhododendron luteum, formed as a result of excessive grazing and

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deforestation. Along with meadows and shrubs, tall grass dominated by Heracleum mantegazzianum and Cephalaria gigantea, as well as semi-weedy species Rumex alpinus, Verathrum lobelianum, and species of the genus Cirsium, are common in the lower part of the belt. Among the meadow cenoses, forb-grass groups predominate. The dominant species are Festuca varia, Bromopsis variegata, Phleum montanum, Carex tristis. Forbs include Inula orientalis, Scabiosa caucasica, Gentiana septemfida, Bistorta carnea, Anemonastrum fasciculatum, Trifolium pretense, etc. [3,4].

2 Research Methodology

The material for the work is based on field research and observations of the authors. Route-geobotanical, route-floristic methods were used. The floristic composition and spectrum of life forms were studied during 2022-2023 years by collecting vascular plants. The purpose of this study is to study the biomorphological structure of the flora of vascular plants of the central site of the WAY CARBON carbon test site in the vicinity of the village of Khoy, Vedeno district of the Chechen Republic.

To achieve the set goals, the following tasks were solved: studying the distribution of higher plant species in the study area in accordance with the system of life forms of K. Raunkier. The object of this study is the flora of the surroundings of the village of Khoy, Vedeno district of the Chechen Republic.

The subject of the study is the life forms of plants that make up the biomorphological structure of the flora of the object under study, and their analysis; identification of species that occur commonly, scatteredly, rarely, very rarely. The plant species included in this study number 100 species, selected at the central site of the WAY CARBON carbon test site in the vicinity of the village of Khoy, Vedeno district of the Chechen Republic. This study includes data on the occurrence of the studied species.

3 Results and Discussions

According to information obtained during the study, a total of 100 taxa of vascular plants (species and subspecies) belonging to 33 families grow wild in the study area.

The family Asteraceae (Comnositae) has 16 species each, which is 16%. The second place is occupied by the families Fabaceae, Gentianaceae, Lamiaceae include 7 species, which is 7%. In third place are representatives of the family Apiaceae, Primulaceae includes 5 species (5%). Seven families have two species each, which is 2%. 12 families contain one species each (1%).

For botanical and geographical analysis, the system of life forms proposed by the Danish botanist K. Raunkier is used. K. Raunkier's system for dividing life forms is based on one feature - differences in plant adaptation to surviving unfavorable seasons, that is, the location of buds or shoot tips during unfavorable times of the year.

A life form is the result of a plant’s long-term adaptation to local conditions of existence, expressed in its external appearance [1]. The most suitable system for biomorphological analysis is the system of “biological types” by K. Raunkier [9].

Life forms have a significant difference from ecological groups, since they reflect the adaptation of plants not to any one environmental factor, but to a historically formed complex of factors.

The biomorphological spectrum of plant species at the central site of the carbon polygon “WAY CARBON” is presented in Table 1.
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The biomorphological spectrum of plant species at the central site of the carbon polygon "WAY CARBON" is presented in Table 1.

<table>
<thead>
<tr>
<th>BIOMORPHA</th>
<th>Hk</th>
<th>T</th>
<th>K</th>
<th>Ch</th>
<th>Phmg</th>
<th>Phm</th>
</tr>
</thead>
<tbody>
<tr>
<td>hemicryptophytes</td>
<td>80</td>
<td>4</td>
<td>8</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>therophytes</td>
<td>80</td>
<td>4</td>
<td>8</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

There are 3 species of megaphanerophytes (3%): Pinus sosnowskyi Nakai (P. hamata (Stev.) Sosn.; P. kochiana Klotzsch) – Sosnowsky Pine, Ostrya carpinifolia Scop. – Common hop hornbeam, Thymus nummularius Bieb. - Thyme coin.

![Fig. 1. Megaphanerophytes of the Carboniferous polygon.](image1.png)

There is 1 species of microphanerophytes (1%): Salix caprea L. – Goat willow

There are 4 species of chamaphytes (4%): Teucrium polium L. – White Dubrovnik, Thymus caucasicus Willd. – Caucasian thyme, Th. collinus Bieb. – Ch. Kholmovoy, Th.. daghestanicus Klok.et Shost. – Ch. Dagestansky [7].


There are 8 species of cryptophytes (8%): Gladiolus tenuis Bieb. (G. apterus Klok.) – Thin skrewer, Lilium monadelphum Bieb. – Lily, Fritillaria collina Adams (F. ophioglossifolia Freyn et Sint.; F. lutea Bieb.) – Hill hazel grouse, Muscaria neglectum Guss. (M. muscarimi Medik.; M. racemosum (L.) Mill.) – Unnoticed mouse hyacinth, Dactylorhiza incarnata (L.) Soo (Orchis latifolia L.) – Orchis purpurea Huds. – Purple orchis, O. simia Lam. – I am a monkey, Primula cordifolia Rupr. – Primrose cordifolia [7].

Therophytes 4 species (4%): Nonea rosea (Bieb.) Link – Pink nonea, Draba nemorosa L. – Coppice grouse, Rhinanthus minor L. (R. nigricans Meinsh.) – Small rattle, Rh/ orientalis (L.) Benth. – X. eastern [7].

The biological spectrum of Raunkiera’s vegetation is presented in Figure 2.
Fig. 2. Biomorphological analysis of plant species in the central area of the WAY CARBON carbon test site.

Understanding patterns of species occurrence and distribution within a study area and across a species’ range can help prioritize plant monitoring. An analysis of the occurrence of species relative to the central site of the WAY CARBON carbon test site was carried out.

Species that occur usually, scatteredly, rarely, very rarely were identified in order to determine their habitats. Rare plant species have ecological value and may be rare due to their life cycle.

Roads and trails can spread invasive species into rare species habitats and negatively impact rare plant recruitment and conservation.


Rare (Raro) are 7 species (7%): *Dactylorhiza incarnate* (L.) Soo (Orchis latifolia L.) – *Dactylorhiza incarnate* (L.) Soo (Orchis latifolia L.) – *Ostrya carpinifolia* Scop. – Common hop hornbeam, *Sedum stoloniferum* S.G. Gmel. – *Sedum, Thymus collinus* Bieb. – Ch Kholmovoy, Th. daghestanicus Klok.et Shost. (77g. mashukensis Klok.) – Ch. Dagestan, *Galium mollugo* – Soft bedstraw [7].

Very rarely (Rarissimo) there are 4 species (4%): *Orchis purpurea* Huds. – Purple orchis, *Centaurea cheiranthifolia* Ledeber. – Cornflower, *Scorzonera filifolia* Boiss. – Threadleaf goat, *Dianthus arenarius* L. – Sandy carnation [7].

Some species of rare plants found in areas of the carbon polygon are presented in Fig. 3.
Fig. 3. Rare plant species in areas of the carbon polygon.

Table 2. Occurrence of plant species in the central area of the WAY CARBON carbon polygon.

<table>
<thead>
<tr>
<th>No</th>
<th>Occurrence</th>
<th>Number of species</th>
<th>% of total number of species</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Soc. – dominates</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>PL – usually</td>
<td>57</td>
<td>57</td>
</tr>
<tr>
<td>3.</td>
<td>Sp. – absent-mindedly</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>4.</td>
<td>Raro – rare</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>5.</td>
<td>Rs. - very rarely</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Fig. 4. Percentage distribution of the occurrence of plant species in the central area of the WAY CARBON carbon polygon.

4 Conclusions

Hemicryptophytes are represented by 80 (80%) species, cryptophytes by 8 species (8%), therophytes by 4 species (4%), chamephytes by 4 species (4%), megaphanerophytes by 3 species (3%) and microphanerophytes by 1 (1%). The largest number of species are found usually (57 species), scattered (32 species), 7 species are rare, 4 species are very rare.
Acknowledgments

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