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The flora of mount Dagnak as a part of CWR (Caucasus Wildlife Refuge)

Abstract

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The unique protected area CWR (Caucasus Wildlife Refuge), working at the crossroads of wildlife protection, environmental education, and sustainable development, engaging rural populations in the sustainable development of their communities presented in this article. Protection of that habitat are extremely desirable not only to prevent extinctions and maintaining biodiversity but to provide a special opportunities for study and research. Data on the flora of the mountain ridge Dagnak was collected several years. The descriptions of taxa and landscapes are given.

Key words: plant biodiversity, protected areas, endemism, Armenia.

Caucasus Wildlife Refuge (CWR)

To conserve unique and endemic biodiversity of the region, FPWC established Caucasus Wildlife Refuge (CWR), as a Privately Protected Area (PPA) with a surface of 30,000 ha on Y2010, which is a crucial habitat for a range of endangered species, as well as part of wildlife migration corridor in the southern Armenia, in the Ararat and Vayots Dzor regions of Armenia. It is an important part of the Caucasus biodiversity hotspot. It includes the southern important areas of the country that form an ecological connectivity corridor for endangered wildlife stretching along the border of Khosrov Forest State Nature Reserve.

The overall objective of FPWC's Caucasus Wildlife Refuge is to contribute to efficient biodiversity protection in Armenia by improving the protection of flora and fauna in the reserve's previously unsustainably managed buffer zones and wildlife migration corridors.

The CWR includes several lands from different communities with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area.

The territories of the CWR are registered in World Database of Protected Areas (WDPA), as well as at the National Strategy plan for the Key Biodiversity Areas (KBA).

According to IUCN PA categorization system, the CWR matches to the Category VI: Protected area with sustainable use of natural resources, protected areas that conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems.

CWR lands are also included in Khosrov Reserve Important Bird Area (according to BirdLife International) protecting 15 species of birds:

<http://datazone.birdlife.org/site/factsheet/khosrov-reserve-iba-armenia/details>
and Khosrov Forest Emerald Site (according to the Bern Convention).

The Khosrov Forest State Reserve conservation has been far from satisfactory with lack of resources, knowledge and proper management, examples being the intensive logging during the 90s and the forest fire in Y2017. The absence of control on poaching and absence of regulations on human-wildlife conflicts are other big gaps in the Ararat and Vayots Dzor regions. Land leasing of huge territories for private hunting grounds has been a growing issue all over the country, including part of the Urts Mountains close to CWR, threatening the national populations of large mammals like Bezoar goats and Armenian mouflon.

Improving conditions for wildlife in CWR, as it has been proven by camera trapping and rangers monitoring, is even more important in this national context. Bigger herds of Bezoar goats feeling secure in CWR attract large carnivores, including the Leopard. All four species of European vultures find important sources of food in CWR and nest within the boundaries or nearby. Some of the oldest *Juniperus* forest stands in Armenia are located in CWR.

The Caucasus Wildlife Refuge is the first project of this type in the entire South Caucasus. FPWC maintains a permanently manned ranger station in the area (all rangers are employed from the communities), which is sufficiently equipped to protect the territory against any negative human impact.

The FPWC cooperates with the World Land Trust (WLT) within the framework of Keepers of the Wild project. The rangers working on the front line of conservation are patrolling the CWR area at a 24/7 regime. Rangers protect reserves from illegal activity such as poaching and logging. They act as direct links to local communities; building trust, changing attitudes and finding practical solutions, as well as monitoring the animals by applying the newest technologies.

Starting from Y2013 the FPWC rangers spotted 5 individuals of Caucasian Leopards via trap cameras in the area of the CWR, which was not spotted in the Central Armenia for 40 years.

Flora of Dagnak Mountain Range

Asymmetric Dagnak Range included in Caucasus Wildlife Refuge (Fig. 1) covers mount Dagnak from base (1200 m) to the summit (2800 m) and is characterized by diversity and complexity of the topography, lithological composition of rocks and a variety of climatic conditions. Dagnak Mountain is located between the Urtz Range – the most

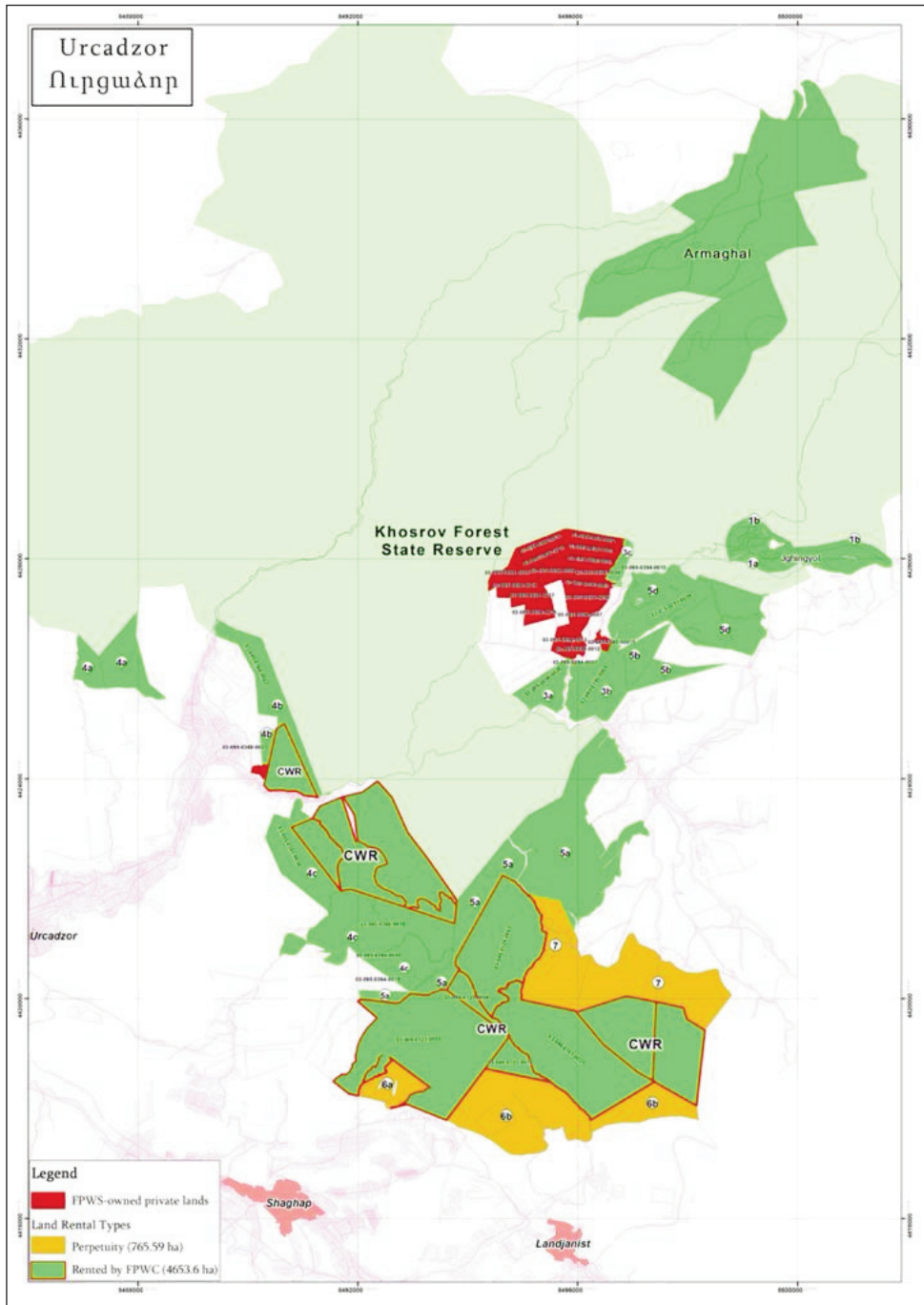


Fig. 1. Map of Asymmetric Dagnak Range included in Caucasus Wildlife Refuge covers mount Dagnak.

interesting from a botanical point of view, birth place of Armenian moufflon – and the Khosrov Forest Reserve, and serves as a bridge between them. The climate is dry and continental, with high summer temperatures reaching c. 38°C and severe winters with significant snowfall and low temperatures down to -25°C. The flora of mount Dagnak as well as neighboring Urtz Range and all Khosrov Forest Reserve is extremely rich in species and strongly influenced by the Iranian flora (Grossgejm 1916, 1949; Tahtadžjan & Fedorov 1972). A characteristic feature of this region is an abundance of mountain xerophytes, i.e. plants of arid habitats. It is important to note that it is just at the foothills and the lower-mountain zone, on these dry barren slopes that look like a lifeless desert, that grows the vast majority of wild useful plants of Armenia.

The vegetation of Dagnak, as in all this region is very mosaic connected with the diversity of relief as well as soil and climatic conditions. The vertical zonation results in an interchange of different types of vegetation starting from the 700-900 m above sea level (Ararat valley) up to the altitudes of mountainous meadow belt (2500-2800 m).

It is generally believed that the semi-desert vegetation in Armenia is distributed at an altitude of 600-1200 m. Above 1200 m to 1800 m there are growing mountain steppes, and 1800 m to 2200 m meadow-steppes. Subalpine and alpine belt 2200-3600 m covered by meadows and turf. At the same time, wetland vegetation, rocky and skeleton vegetation, not confined to a certain height can be seen.

Vegetation of Dagnak Mountain Range is distributed in three belts. The first occupies the lowlands and foothills from 1200 m to 1500 m and is covered with a wormwood semi-desert (*Artemisia fragrans* Willd.), and community of phryganoid xerophytic formations of shrubs and semi shrubs, often spiny and thornless representatives of the genus *Astragalus* (*A. aureus* Willd., *A. microcephalus* Willd. and others), as well as cushion forms of the genera *Acantholimon* and huge cushion of *Onobrychis cornuta* (L.) Desv. (Fig. 2), beautiful during flowering.

Wormwood semidesert, is the most common and most vulnerable formation of Armenia, as it is situated at an altitude of 800 m to 1400 (1500) m, which is used for cultivation or plantation of the vineyards, fruit gardens and orchards. As it has been mentioned, the main component of wormwood semi-desert is a low-growing shrub with small grayish narrow-splitted densely pubescent leaves and a strong smell of camphor. Only in the late autumn the wormwood will be covered with small yellowish or reddish flowers. However, often monotonous gray wormwood is animated with beautiful dark red velvety flowers of *Phelypaea tournefortii* Desf. (Fig. 3a), parasite on the roots of the *Artemisia* and *Tanacetum*. This charming parasite with a subtle pleasant smell is endemic of Armenian Highlands and is one of the interesting examples of the close co-evolution between flowers and certain insects. In the central part of the lower lip of the flower there are two dark bumps with amazing accuracy mimicking the abdomen of the female beetle and lure males, thanks to which flower pollination takes place.

Besides wormwood annual herbaceous plants dominate in the semi-deserts. In winter and early spring, the whole desert is covered with bluegrass *Poa bulbosa* L. and therefore it is used as a winter pasture. In early spring there are tiny plants - ephemers (*Ceratocephala falcata* (L.) Cramer (Fig. 3c), *Erophila verna* (L.) Besser, *Carex stenophylloides* V. I. Krecz., *Roemeria hybrida* (L.) DC. (Fig. 3b) and others). At the



Fig. 2. View of Dagnak Mountain Range, in detail the species *Onobrychis cornuta* (L.) Desv.

same time there shows up a variety of bulbs ephemeroïds: pale pink Armenian snow-drop *Merendera trigyna* (Steven ex Adam) Stapf with a strong smell of honey; a little tulip (*Tulipa polychrome* Stapf) the flowers of which are white-pink-yellow inside and pink-purple outside; green, white and golden yellow stars of different species of the genus *Ornithogalum* and *Gagea*. Somewhat later the beauty of the wormwood semi-desert, endemic to Armenia *Iris elegantissima* Sosn. (Fig. 5e) blossom with huge exquisite creamy brownish-wine flowers that resemble exotic butterflies at a distance. They are interesting also because they offer “bed and breakfast” to bees and other insects. The stigmatic branches of these irises are bent outwards so that they form a sort of tunnel in which the air temperature is 4°C higher than that of surrounding air. In our mountainous country with its sharp, continental climate and cool nights, in April-May when this iris flowers a difference of 4°C is much felt! A way into the “shelter” is signposted by a black velvety blotch. Sometimes *I. elegantissima* enriches the steppe zone, both on mount Dagnak and Urtz Range. Obligatory element of wormwood semi-deserts are capers *Capparis herbacea* Willd. (Fig. 3d) - spiny shrub with long prostrate branches and large beautiful very fragrant white flowers. Interestingly, these beautiful flowers bloom in the evening for the night and close on the next morning. The main pollinators are nocturnal insects and bats. Buds and fruits of *C. herbacea* are widely used in national cuisine.

Later in June here can also be found two beautiful endemic cornflowers - lilac-pink, large, honey-flavored *Amberboa moschata* (L.) DC. (Fig. 3e), and *Amberboa sosnovskyi*



Fig. 3. Representative elements of wormwood semidesert: a) *Phelypaea tournefortii* Desf.; b) *Roemeria hybrida* (L.) DC.; c) *Ceratocephala falcata* (L.) Cramer; d) *Capparis herbacea* Willd.; e) *Amberboa moschata* (L.) DC.; f) *Myosotis alpestris* F. W. Schmidt; g) *Corydalis seisumsiana* Lidén; h) *Papaver macrostomum* Boiss. & A. Huet.

Iljin (Fig. 4c), bright blue *Centaurea depressa* M. Bieb., different kinds of poppy (*Papaver macrostomum* Boiss. & A. Huet (Fig. 3h), *Papaver commutatum* Fisch. & C. A. Mey., *Papaver arenarium* (L.) DC. (Fig. 4b) which make the semi-desert landscape more vivid.

The middle and upper mountain belt (1200-2200 m) are characterised by various kinds of steppe, meadow-steppes vegetation, shrub steppes and thorny cushion (tragacanth) vegetation. Steppe vegetation in Armenia is most common and occupies an extensive area with a mixture of feather grass: *Stipa arabica* Trin. & Rupr., *S. holosericea* Trin., *S. tirsia* Steven, there are many herbs as well here: the endemic *Tomanthea daralaghezica* (Fomin) Takht. (Fig. 4d) with dark wine purple flowers, *T. aucheri* DC., bright pink *Silene compacta* Fisch., violet *Vicia variegata* Willd., different species of *Trifolium*, *Pisum elatius* M. Bieb., which is a direct wild progenitor of domestic pea and many others. Particularly beautiful is the steppe during the flowering of perennial poppy, *Papaver lasiothrix* Fedde (Fig. 4a), with huge flowers in large groups aflame everywhere.

Shrub steppes and open forests consists of prickly almonds *Amygdalus fenzliana* (Fritsch) Lipsky (Fig. 4g) and buckthorn *Rhamnus pallasii* Fisch. & C. A. Mey. On the screes and among the debris and in crevices of rocks are found wild cherries: *Cerasus incana* (Pall.) Spach, *C. mahaleb* (L.) Mill., barberry *Berberis vulgaris* L. (Fig. 4e), *Spiraea hypericifolia* L. (Fig. 5b), *Ephedra procera* C. A. Mey., etc. Here grows a lot of essential-oil highly fragrant species, such as the representatives of genera *Salvia*, *Thymus*, *Ziziphora*, *Stachys*, etc. Sparse Juniper woodlands occur on the steep northern slopes of Dagnak mount. Tertiary relic *Juniperus polycarpus* K. Koch. mixed with some deciduous shrubs and trees. Among them are species of wild pears: a polymorphic, ornamental with beautiful silvery pubescent leaves *Pyrus salicifolia* Pall., local endemics *P. tamamschjanae* Fed. and *P. sosnovskii* Fed., wild apple *Malus orientalis* L. (Fig. 4f), decorative rowan-trees with simple leaves and bright red fruit: *Sorbus graeca* (Spach) Lodd. ex Schauer, *S. kuznetzovii* Zinserl., *S. persica* Hadl., *S. luristanica* (Bornm.) Schön.-Tem., recently found, species of hawthorn *Crataegus orientalis* M. Bieb., *C. pontica* K. Koch as endangered species included in new Red Data Book etc., honeysuckle *Lonicera iberica* M. Bieb., *Cotoneaster integerrimus* Medik., *C. racemiflorus* (Desf.) K. Koch, different species of the genus *Rosa*, maple *Acer iberica* M. Bieb. (Fig. 5a) and others. Occasionally there can be found *Juniperus oblonga* M. Bieb. and *J. hemisphaerica* J. & C. Presl.

Tragacanth steppe, which are formed on the eroded slopes on the site of the old mountain steppes characterized by the fact that the usual steppe vegetation is mixed with spiny astragals and species of the genus *Acantholimon*, *Onobrychis cornuta* (cushion plant formation). In general cushion growth form is an excellent device to reduce evaporation, especially intense in strong winds. Low growth cushions removes them from the strong currents of air and richly-developed root system makes it possible to maintain stability against strong wind gusts. Strong and rigid leaf thorns and prickles prevents cushion from being eaten by animals. They often serve as a protection for the more delicate plants such as tulips, bluebells, fritillary and others. In the spring, when the huge cushions of *Onobrychis* covered with dense all shades of pink, rarely white flowers, the steppe is fascinating for its unusual beauty.

Towards the top of mount Dagnak, the steppe changes to meadow - steppes with the elements of tall subalpine vegetation: *Delphinium freynii* Conrath, *Hordeum bulbosum* L., *Scrophularia orientalis* L., *Symphytum asperum* Lepech., *Echium rubrum* Forssk.,



Fig. 4. Representative elements of wormwood semi-deserts: a) *Papaver lasiothrix* Fedde; b) *Papaver arenarium* (L.) DC.; c) *Amberboa sosnovskyi* Iljin; d) *Tomanthea daralaghezica* (Fomin) Takht.; e) *Berberis vulgaris* L.; f) *Malus orientalis* L.; g) *Amygdalus fenzliana* (Fritsch) Lipsky.



Fig. 5. Representative elements of wormwood semi-deserts: a) *Acer iberica* M. Bieb.; b) *Spiraea hypericifolia* L.; c) *Gypsophyla aretioides* Boiss.; d) *Tulipa julia* K. Koch.; e) *Iris elegantissima* Sosn.; f) *Fritillaria hajastanica* Gabrieljan.

Papaver orientale L., *P. bracteatum* Lindl. etc. In the late spring - early summer there is a very beautiful riot of colors thanks to the abundance of flowering plants: flaming *Tulipa julia* K. Koch. (Fig. 5d), *Fritillaria hajastanica* Gabrieljan (Fig. 5f), different species of golden buttercup (*Ranunculus*), sky-blue forget-me-not *Myosotis alpestris* F. W. Schmidt (Fig. 3f), azure *Ixiolirion tataricum* (Pall.) Herb. & Traub. and many others.

The very top of mount Dagnak consists of piles of rocks, among which on them and in their hidden crevices were found the recently discovered *Gypsophyla aretioides* Boiss. (Fig. 5c), *Corydalis seisumsiana* Lidén (Fig. 3g) is one described as new for the science, and rare Iranian species *Aethionema salmasium* Boiss.. The plateau near the summit with a breathtaking view of Mount Ararat, is covered with a multi-colored carpet of all kinds of geophytes (*Muscari*, *Bellevalia*, *Gagea*, *Tulipa*), scattered among the cushion-shaped *Onobrychis cornuta*.

Discussion and Conclusions

In Armenia, the system of the protected areas comprises national parks, natural reserves and special areas (Table 1). Among them, there are four national parks, about twenty natural reserves and three special areas. Within the latter, the VPC is comprised, a private area of about 30,000 hectares rich in biodiversity.

Table 1. Prospectus of the protected areas established in Armenia.

National Parks

Arevik National Park

Sevan National Park

Arpi National Park

Dilijan National Park

Natural Reserves

Akhnabat Yew - Tree Grove (Forest)

Aragats Alpine

Arjatkhlendi

Arzakan and Meghradzor

Banksi Pine -Tree

Banx Pine - Tree

Boghakar

Eghegnadzor

Gandzakar (Verin Aghdan)

Getik

Goravan Sandlands

Goris

Gyulagarak Pine - Tree

Ijevan

Jermuk Mineral Waters

JermukForest

Margahovit
Sev Lich
Vordan Karmir

Special Areas

Erebuni
Khosrov Forest
Shikahogh

Within the special areas, CWR (Caucasus Wildlife Refuge) is comprised, an area of about 30000 hectares falling within the Khosrov Forest. Mount Dagnak is a meaningful part of this special area, home - as already seen - of a rich and diverse flora that is characterized by a high rate of endemism. On the base of these characteristics or its high plant biodiversity, the Mount Dagnak area may well figure among the European IPA (Important Plant Areas).

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