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USAGE OF PLANTS IN SIMULATING OF BIOTOPE OF CAUCASIAN BLACK GROUSE (*TETRAO MLOKOSIEWICSI*)

Simulation of biotope of *Tetrao mlokosiewiczi* ex situ has been realized on the basis of field investigations of the habitats (incl. studies on plant diversity) of the Caucasian Black Grouse in Armenia. The main elements of 3 types of vegetation characteristic for the bird species (thickets of *Rhododendron caucasicum*, grove of *Betula litwinowii* and sparse growth of *Quercus macranthera*) have been reproduced in the biotope.

Մանվելյան Կ. Ա. Բույսերի օգտագործումը կովկասյան մարեհավի (*Tetrao mlokosiewiczi*) բիոտոպի մոդելավորման մեջ: Հայաստանում Կովկասյան մարեհավի ապրելավայրի եւ բույսերի տեսակային բազմազանության դաշտային հեղափոխությունների արդյունքում իրականացվել է այդ թռչունի բիոտոպի մոդելավորումը ex situ: Բիոտոպում վերարտադրվել են կովկասյան մարեհավին հարուկ բուսականության երեք տիպերի (*Rhododendron caucasicum*-ի մացառուտներ, *Betula litwinowii* պուրակ եւ *Quercus macranthera*-ի նոսր անտառ) հիմնական տարրերը:

Манвелян К. А. Использование растений при моделировании биотопа кавказского тетерева (*Tetrao mlokosiewiczi*). На основе результатов полевых исследований местообитаний кавказского тетерева в Армении с изучением видового разнообразия растений осуществлено моделирование биотопы данного вида ex situ. В биотопе воспроизведены основные элементы трех типов растительности, характерных для проживания кавказского тетерева (заросли *Rhododendron caucasicum*, роща из *Betula litwinowii* и редколесье из *Quercus macranthera*).

Introduction.

The Caucasian Black Grouse (CBG) (*Tetrao mlokosiewiczi*) is considered as endangered and is included in the Red List of Armenia and other countries of the Caucasus (Ayrumyan, 1987).

Grouse species are known as indicators of habitat health that combined with their attractiveness to people, can make grouse suitable flagship species to promote the conservation of habitats and biodiversity. Habitat loss and fragmentation due to the human land use are considered among the most important threats to the species today (McGowan, Garson, 1995). Other frequently identified threats include small population size, predation, poaching and human disturbance.

The population of the CBG in Armenia occurs in two separate areas: the northern population being concentrated on Pambak, Tsakhkunyats, Bazoom mountain ranges and mt. Aailer; and the southern population in Zangezur, Bargushat and Meghri mountain ranges (Adamian, Klem, 1999).

The current approaches to grouse conservation include legislation, protected areas, monitoring, habitat management, captive breeding, re-introduction, predator control, reduction of human disturbance, and education. Captive management of grouse is justified because this species is declining in most of the subalpine areas, at the edge of its distribution area and there is a great need to raise public awareness by displaying the birds in captivity.

The goal of the project was simulating the Caucasian Black Grouse habitat for further maintainance of captive population of the species in the Armenian Centre for Biodiversity Conservation (ACBC).

The main objectives of the project were:

To investigate the habitats of CBG in Armenia.

To simulate a habitat of CBG maintaining in the ACBC.

Background

One of the main objectives of the Armenian National Strategy for Biodiversity Conservation is the establishment

of centres for animal and plant species ex situ conservation and reintroduction to native habitats (Biodiversity Strategy and Action Plan of Armenia, 1999). For this purpose the Armenian Centre for Biodiversity Conservation was established in 1994 in the Yerevan Botanical Garden (Institute of Botany of National Academy of Sciences).

Since then, the collection of 350 plant species (130 rare and endangered) and 30 animal species (18 rare and endangered) has been created that is displayed in 10 enclosures (models of biotopes). The rest of the collection of plants and animals (mainly exotic species) are displayed in terrariums and in the central gallery of the ACBC.

The Centre was officially opened for visitors in 1998, since then it has become a favourable place to visit for many people (including school pupils and university students). The display of plants and animals in the biotope models simulate conditions as close as possible to natural conditions, which is very important for animals and visitors needs. A number of endangered species of plants (11) and animals (4) bred at the ACBC have been reintroduced to the native habitats.

So, to make it possible to maintain Caucasian black grouse in captivity, taking into account the fact that it would be the first attempt to keep the species in captivity, the investigations were divided into two stages: in situ and ex situ.

Investigations in situ

The main objective was to study different habitats of CBG (vegetation, landscape, threats etc) which would allow to simulate a biotope of the species in captivity.

The first stage of field trips was connected with the investigation of the habitats of CBG in the northern population. Field investigations were carried out in different areas within the northern population: in the Pambak mountain range (Mt. Arkhashan), the Tsakhkunyats mountain range (Mt. Aghveran) and Pambak mountain range (Mt. Qoshakar).

The habitat of Mt. Arkhashan is about 4 km long and 1 km wide (located at 40°40'99" N and 44°40'06" E and at the altitudes of 1,800–2,800 m, covered by forest and sub alpine vegetation). This habitat is rather popular with people and is often used for ornithological tours. There are two farms near the site, which cause disturbance (grazing of sheep and cattle, sheep-dogs, hay-harvest etc.). The population size of CBG is about 14–17 and the main threat is from predation (foxes, weasels, wolves, birds of prey, sheepdogs) and overgrazing. The distinctive feature of this habitat is thickets of rhododendron (*Rhododendron caucasicum*).

The Mt. Aghveran site is about 2.5 km long and 0.8 km wide, located at 40°30'61" N and 044°33'60" E and at the altitudes of 1,950–2,750 m, covered by forest and subalpine vegetation. The population size of CBG is about 17–20 and the main threats are poaching and habitat loss (due to deforestation and overgrazing). The distinctive feature of this habitat is grove of birch (*Betula litwinowii*).

The habitat of Mt. Qoshakar is about 3 km long and 1.2 km wide, located at 40°48'20" N and 044°41'08" and altitudes of 1800–2700 m, covered by forest and sub alpine vegetation. The population size of CBG is about 12–15 and the main threat is poaching. The distinctive feature is thickets of rhododendron (*Rhododendron caucasicum*).

The second stage of field trips was connected with investigation of the habitats of CBG in the southern population in the Zangezur mountain range (mountain north-west and south-east slopes along the Kajarants and Vokhchi rivers).

In comparison with the area of northern habitats with a great influence of the anthropogenous factor because of large density of the population, this area is sparsely populated. The altitude is 2000–3100 m and size of the habitat is 3 km², with a population size of 8–10 birds. The main threat is predation (wolves, birds of prey, foxes) and the characteristic features are sparse growth of Caucasian Oak (*Quercus macranthera*).

Plants were collected during the field trips for identification and floristic assessment of the habitats. The main plant species growing in the habitats of CBG in Armenia are: *Acer campestre*, *Aconitum nasutum*, *Alchemilla* sp., *Allium jajlae*, *A. schoenoprasum*, *A. szovitsii*, *A. vineale*, *Arabis christiani*, *Asperula molluginoides*, *A. odorata*, *Aster alpinus*, *Astragalus aureus*, *A. falcatus*, *A. glycyphylloides*, *A. polygala*, *A. uraniolimneus*, *Astrantia maxima*, *Asyneuma amplexicaule*, *A. campanuloides*, *A. rigidum*, *Berberis iberica*, *B. vulgaris*, *Betonica macrantha*, *Betula litwinowii*, *Bryonia dioica*, *Bupleurum polyphyllum*, *Campanula glomerata*, *C. tridentata*, *Carpinus betulus*, *Cerastium szovitsii*, *Coronilla varia*, *Coloneaster integrimus*, *C. obovata*, *Crataegus pontica*, *Cystopteris fragilis*, *Dactylorhiza merovensis*, *Daphne glomerata*, *D. mezereum*, *Delphinium freynii*, *D. linearilobum*, *D. szovitsianum*, *Dianthus armeria*, *D. orientalis*, *D. raddeanus*, *D. ruprechtii*, *Dracocephalum ruyschiana*, *Dryopteris filix-mas*, *Epilobium hirsutum*, *Euphorbia squamosa*, *Euphrasia pectinata*, *Fagus orientalis*, *Fragaria viridis*, *Fraxinus excelsior*, *Gagea anisanthos*, *Galium aparine*, *Gentiana septemfida*, *G. verna* ssp. *pontica*, *Geranium platypetalum*, *Herniaria glabra*, *Juniperus depressa*, *Hordeum bulbosum*, *Hypericum alpestre*, *Juniperus oblonga*, *Linaria* sp., *Linum hypericifolia*, *Lonicera caucasica*, *Lotus corniculatus*, *Minuartia caucasica*, *M. oreina*, *Onobrychis bungei*, *Onosma microcarpa*, *Orchis mascula*, *Origanum vulgare*, *Padus racemosa*, *Papaver orientale*, *P. persicum*, *Pedicularis crassirostris*, *Pisum sativum*, *Polygonatum orientale*, *Polygonum alpinum*, *P. carneum*, *Polypodium vulgare*, *Potentilla pimpinelloides*, *Poterium polygonum*, *Primula auriculata*, *Pyrus salicifolia*, *P. syriaca*, *Quercus araxina*, *Q. macranthera*, *Ranunculus caucasicus*, *Rhododendron caucasicum*, *Rhynchocoris orientalis*, *Ribes biebersteinii*, *Rosa canina*, *R. spinosissima*, *Rubus idaeus*, *R. saxatilis*, *Rumex acetosa*, *Salix carpea*, *Saxifraga cartelaginea*, *S. juniperifolia*, *Scabiosa caucasica*, *Scutellaria orientalis*, *Sedum pallidum*, *S. pilosum*, *Semprevivum globiferum*, *Sibbaldia parviflora*, *Silene compacta*, *S. multifida*, *Sorbus aucuparia*, *S. dualis*, *S. graeca*, *S. subfusca*, *S. torminalis*, *Symphytum asperum*, *Thalictrum foetidum*, *T. minus*, *Theucrium chamaedrys*, *Thlaspi arvense*, *Trifolium canescens*, *T. trichocephalum*, *Thymus kotshyanus*, *Vaccinium myrtillus*, *Valeriana alliariaefolia*, *Viburnum lantana*, *Vicia sativa*, *V. variegata*, *Ziziphora biebersteinii*.

Common features for all habitats in Northern and Southern Armenia are rock streams ("chingils": these stones are in the habitats as a result of soil erosion covering areas from 20 m² to 1000 m²). Such conglomerations of stones exist in all investigated habitats and are used by the birds as a hiding place. The strongest threats to the species are predation, habitat loss and fragmentation (due to deforestation and overgrazing) and poaching.

Plants play very important role for grouses as feeding and hiding sources. Plants are the principal food, the species taken varying according to season and among different-age birds. Principal winter foods are the buds and catkins of

birches (*Betula litwinowii*), needles and berries of juniper (*Juniperus depressa*), fruits of dog rose (*Rosa canina*), and shoots and buds of willow (*Salix carpea*). Green leaves and shoots are more important in spring, but increased use of animal prey prior to breeding, as occurs in other grouse, is unknown. From late May, they consume stalks, flowers, unripe seeds and pods of alpine vegetation. In early August they mainly take ripe seeds of alpine plants, and from mid-August throughout autumn, berries of *Ribes*, *Rubus*, *Vaccinium*, and seeds of alpine plants are taken. Eating buds, needles, berries, suckers grouses move from brush to brush (*Rhododendron*, or *Juniperus*). In *Betula* groves, they also prefer to feed from the snow surface. The snowless spots near the rocks, where the snow is blew down by the wind, and where the leaves of whortleberries are uncovered, also are not left without attention.

Investigations *ex situ*

The main objective was to simulate a habitat of CBG in designing an enclosure in the ACBC. The design of a successful exhibit for captive wild animals is a complex and challenging task. Different types of enclosures as well as barriers are used in modern zoos (Design Consortium Ltd., 1990, Stevens, 1992, Harrison, 1998). Enclosure design for animals in the ACBC is based on a principle of naturalism (Andersen, 1989), through creation of biotopes that correspond to the species' habitat landscape and plants (in accordance with mission statement of the ACBC).

When designing new enclosures for CBG the following requirements was taken into account: captive data, geographic origin, habitat (including plants species), behavioural characteristics, activity cycle, social characteristics, feeding and dietary needs, reproduction, medical needs, associated species (for mixed exhibits), exhibition location, public requirements, research and education opportunities (Sausman, 1982).

The enclosure was built with exposition to the north covering the territory about 150 m².

Underground and up ground watering were established to provide the corresponding moisture (as it is in the native habitat). Soil for the model was brought from Mt. Arkhashan to fit the plants' growth. Rock streams of stones were set up to provide hiding places for the birds.

The enclosure is covered by net providing safety for the birds from birds of prey.

36 species of plants (7 of them are endangered (Gabrielyan, 1990) from different natural habitats of CBG were introduced to the enclosure (model of biotope): *Acer campestre*, *Alchemilla* sp., *Allium szovitsii*, *Berberis iberica*, *B. vulgaris*, *Betula litwinowii*, *Crataegus pontica*, *Daphne glomerata*, *D. mezereum*, *Dryopteris filix-mas*, *Fagus orientalis*, *Gentiana verna* ssp. *pontica*, *Juniperus depressa*, *Hordeum bulbosum*, *Hypericum alpestre*, *Juniperus oblonga*, *Lonicera caucasica*, *Orchis mascula*, *Papaver orientale*, *Pyrus salicifolia*, *P. syriaca*, *Quercus araxina*, *Q. macranthera*, *Rhododendron caucasicum*, *Rhynchocoris orientalis*, *Ribes orientale*, *Rosa canina*, *R. spinosissima*, *Rubus idaeus*, *Salix carpea*, *Sibbaldia parviflora*, *Sorbus aucuparia*, *S. torminalis*, *S. roopiana*, *Thymus kotschyanus*, *Vaccinium myrtillus*, *Viburnum lantana*.

The model of biotope provides the Caucasian grouse with the same type of vegetations that exist in the species' original habitats and therefore provides the birds with shelter and with a natural source of food. Seeds and nuts of the following plants are provided in corresponding season: *Betula*

litwinowii, *Juniperus depressa*, *Quercus macranthera*, *Rosa canina*, *Rubus idaeus*, *Sorbus aucuparia* etc.

Conclusions:

1. The habitats of CBG differ from each other by the main type of vegetation:
 - The distinctive feature of the habitats in Pambak mountain range is thickets of rhododendron (*Rhododendron caucasicum*).
 - The distinctive feature of the habitats in Tsakhkunyats mountain range is grove of birch (*Betula litwinowii*).
 - The distinctive feature of the habitats in the Zangezur mountain range is sparse growth of Caucasian Oak (*Quercus macranthera*).
2. Common features for all habitats in Northern and Southern Armenia are rock streams which are used by the birds as a hiding place.
3. The strongest threats to the species are predation, habitat loss and fragmentation (due to deforestation, overgrazing) and poaching.
4. Enclosure design for animals in the ACBC is based on a principle of naturalism through simulating of biotopes that correspond to the species' habitat landscape and plants. This approach was developed in designing of the bird and plant display that uses aspects of human behaviour to draw visitors to respect animals, plants and habitats.
5. Functions of plants in the enclosure: creating microclimates; screening; decorating; feeding; supplementing food; defining spaces; occupying the birds; building nests; educating visitors.

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ПОВЕДЕНИЕ ПЕРВОЦВЕТОВ (*PRIMULA* L.) В УСЛОВИЯХ КУЛЬТУРЫ

Изучены особенности поведения первоцветов в условиях культуры и их адаптивный потенциал. Установлена зависимость поведения интродуцентов как от их морфологических особенностей, так и от метеорологических условий и агротехники возделывания. По результатам фенологических наблюдений выявлены оптимальные условия для использования перспективных видов первоцветов в культурных сообществах растений в условиях Еревана. Обработка фенологических показателей позволила выделить три группы интродуцируемых первоцветов по срокам и продолжительности цветения.

Մարտիրոսյան Լ. Յու. Գարնամաղիկների (*Primula* L.) վարքագիծը մշակութային պայմաններում: Ուսումնասիրվել են գարնամաղիկների վարքի առանձնահատկությունները մշակութային պայմաններում, նրանց հարմարողական ընդունակությունները: Հաստատվել է ինտրոդուցենտների վարքի կախվածությունը թե՛ նրանց մորթիոգիական առանձնահատկություններից եւ թե՛ օդերևութաբանական պայմաններից եւ մշակման ագրոտեխնիկայից: Հստ ֆենոլոգիկական արդյունքների բացահայտվել են բույսերի մշակուկի համակցություններում գարնամաղիկների նպարակային փոփոխության օգրագործման օգրիմալ պայմանները: Ֆենոլոգիական ցուցանիշների մշակումը թույլ փոխ ներդրվող գարնամաղիկները ըստ ծաղկման ժամկետի եւ փոխողական բաժանել երեք խմբի:

Martirosyan L. Y. Behaviour of primroses (*Primula* L.) in culture. The peculiarities of primroses behavior in culture and their adaptive abilities have been studied. Behaviour dependence of the introduced species on their morphological peculiarities, meteorological conditions and agrotechnics has been established. As a result of phenological observations the optimal conditions for use of perspective primrose species in cultivated communities of plants have been revealed. Treatment of the phenological indicators allowed to separate three groups of the introduced primroses according to the blossom terms and duration.

Онтогенез особи любого биологического вида складывается из последовательно сменяющихся этапов и фаз. Простой цикл жизни растения представляет собой развитие от семени до семени, то есть перехода от эмбриональной стадии роста к стадии зрелости. У многолетних растений главный, или большой, жизненный цикл (от зарождения до отмирания) усложняется наличием малых или годовых циклов. В первый год жизни у травянистого многолетника, как правило, образуются только вегетативные побеги. Со второго года жизни или с одного из последующих годов у многолетнего травянистого растения формируется более сложная побеговая система, которая может быть дифференцирована на вегетативные и генеративные побеги или вегетативные и смешанные, то есть генеративно-вегетативные (Серебряков, 1962). Есть и третий вариант, когда все побеги смешанные. Для *Primula* характерен второй вариант, то есть наличие как вегетативных, так и генеративно-вегетативных побегов (Лозина-Лозинская, 1952). По окончании вегетационного сезона все побеги отмирают, при этом генеративные или смешанные успевают за сезон пройти цикл от цветения до плодоношения. На надземной части растения (в зависимости от его типа) за вегетационный цикл успевает сформироваться почка возобновления будущего года. У корневищных трав они могут быть апикальными или пазушными. У *Primula* апикальная почка – генеративно-вегетативная, а пазушная – вегетативная, развивающаяся в вегетативный побег, на котором в последствии также закладывается апикальная и пазушная почки.

Эти циклы развития – временные промежутки, в течение которых они осуществляются во многом зависят от параметров внешней среды: температурных показателей, влажности, инсоляции и других. Следовательно наблюдение за поведением интродуцентов, их развитием в новых для них условиях обитания, что составляет суть фенологических наблюдений, является обязательным условием успешной интродукции. Именно эти данные позво-