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Mediation of knowledge to visitors of the Exhibition of the Tatra nature in Tatranská Lomnica

ZUZANA HOMOLOVÁ

Research centre of Tatra national park, Tatranská Lomnica; zuzahomolova@gmail.com

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Abstract: The Exhibition of the Tatra nature in Tatranská Lomnica is located in the settlement of Tatranská Lomnica on south–eastern slope of the High Tatra Mts. Originally here were spreading wet meadows with globeflower (*Trollius altissimus*). Particularity of the Botanical garden is species composition, which is corresponding to Tatra Mts. plants. Fundamentals and most important constituent of collection are the alpine species including the species and relict species. The plants are planted in 8 rockeries on granite and limestone bedrocks and mylonite imitation on the area of 3,20 hectares Focus of our garden has been highly specialized. Very important mission have been public relations. The information on the occurrence individual species, site condition and history of national park are the major education for visitors of botanical garden The aim of ETP is also discovering and observing the beauties of the Tatra nature as well as protection and preservation of precious and endangered Tatra flora species, and teaching to have an active relationship towards the Tatra nature.

Keywords: Exhibition of the Tatra nature, Tatranská Lomnica, High Tatra Mts.

Introduction

Site description and history

The Tatra Mountains is the most northern and the highest part of Carpathian mountain range. The mountain chain is oriented east-west and located almost in

the centre of Europe. Steep peaks are surrounded by large basins. This Geographical island constellation is one of the reason for unique climate with frequent extreme meterogical changes, it has notable impact on local vegetation (FLEISCHER et al. 2009). Modelling of the Tatra Mountain surface into present day shape is due to triple glaciation in nearly Quaternary. Mountains have diverse variety of plant life. They are more than 1300 species of vascular plants, about 450 mosses, 200 liverworts, 700 fungi. Flora of the High Tatras includes endemic species. Diversity of geological composition, surface relief, soil properties and climatic originality of the Tatras gave rise to fauna and flora which has special Mountain and alpine character. Above all in plant associations there is a characteristic differentiation among five vegetation degrees -submontane, mountain, subalpine, alpine, nival. Great scientific and cultural value are the plants and animals occurring only on some smaller parts of the Earth - endemits. The idea to establish botanic garden in the Tatras where the visitors have possibilities to see the Tatras vegetation is old nearly century. The idea was filled after TANAP establishment. The establishment of the Tatra National Park encouraged an intention to build up a botanical garden of the TANAP. It was suggested in accordance with the §7 Article 6 of the Decree of the body of Commissioners from October 28, 1952 as execution to the Act of the Slovak National Council Nr 11 from December 18, 1948 about Tatra National Park (KYSELOVÁ 2013). The Original intention to build up botanical garden in Štrbské Pleso was not realized, because of the financial difficulty. KYSELOVÁ (2013) mentions that construction site in Štrbské Pleso turned up as the most convenient for botanical garden. Next choice was location in Tatranská Lomnica. The construction was prepared in May 19, 1987, the construction site was handed over to the builder. The first planting on limestone rock was carried out in 1989. For public was garden was opened in July 15, 1992, with official name The exposition of the Tatra Nature. The biological project was suggested by botanists Anna Šoltésová, Rudolf Šotés and Zuzana Kyselová, and were made thanks to the first head Karol Seman.

Materials and methods

The exhibition of Tatra Nature is located in the settlement of Tatranská Lomnica on the south-eastern slope of the High Tatra Mts (49°10´04´´N and 20°17´16´´). It is located on the border of fluvogl acial cone in the altitude of 850 m asl. The total area of exhibition is 3,20ha. The climate of the area is charaterized by an average annual temperature about 5°C, in vegetation period about 11°C (**vegetation period 2015 was about 5 degrees warmer**). The warmest month is July with temperature 15, 4 °C (in 2015 17°C). Average bulk precipitation is about 770 mm, in vegetation period 575mm. Snow cover takes 167 days. (KYSELOVÁ *in* MOCHNACKÝ *ed*. 2013). Originally were spreading here globeflower (*Trollius altissimus*), and we can also observe western marsh orchid (*Dactylorhiza majalis*) and Yellow Iris (*Iris pseudacorus*). An important element of exhibition was selection of species composition, to be used for education of student, pupils and the general public in the context of the traditions of Tatra

national park and environmental education, botany and dendrology itself. More than 300 species of plants characteristic for Tatra National park are situated. Part of the garden belong to arboretum with 60 species of Tatra native trees.

Results

Public botanical gardens provide numerous social, economic, and environmental benefits. Some of these benefits include biodiversity and endangered species conservation, green space often surrounded by urbanization, educational opportunities, and improved human health and well-being (BALLANTYNE, PACKER, & HUGHES, 2008; CONNELL & MEYER, 2004; WARD, PARKER, & SHACKLETON, 2010). MAGDOL & POMEROY (2015) hypothesized that botanical gardens can be designed and managed to provide the traditional amenities (e.g., biodiversity, education) along with improving the urban environment (e.g., runoff filtration, heat island reduction).

Exposition - planting

The exposition of Tatra flora have been the first botanic exposition of such type in Slovakia. Authors of the Exposition tried to model landscape so that it reflects the shapes of Tatra relief. On a small scale the hills and valleys, grass and water areas are imitated. (MOCHNACKÝ, 1996)The location of plants is according to soil condition. Plants are planted in 8 rockeries on granite and limestone bedrock and mylonite imitation. Raised bog, fen and tall-herb floodplain vegetation are exhibited. The suitable habitats for the ecological plant groups turned up in the course of time. Fundamentals and the most important constituents of the collection are the alpine species including the endemic species and relic species. The Carpathians endemic species are e. g. *Sempervivum wettsteinii* subsp. *wettsteinii, Oxytropis carpatica*, *Leontodon pseudotaraxaci*, *Erigeron hungaricus* and *Aconitum firmum* subsp. *firmum*. The Westcarpathians endemic species are represented e. g. by *Campanula tatrae*, *Delphinium oxysepallum*, *Dianthus nitidus*, *D. praecox* subsp. *praecox*, *Saxifraga wahlenbergii* and *Pulsatilla slavica*. *Cochlearia tatrae*, *Leucanthemopsis tatrae* and *Ranunculus altitatrensis* belong to the most attractive endemic species. Admired are procumbent alpine willows. The our smallest tree is *Salix herbacea*. Decorative are *Salix reticulata*, *S. jacquiniana* and *S. kitabeliana*, which is the Carpathians endemic. Very rare is glacial relic *Ranunculus reptans.* After the glacier backdown, all over the whole district between the arctic-boreal areas and the Alps, the plant had sheltered only in a single tarn in the Tatra Mts. The cold breathing of nordic glacier forced more species to move southward and they found their shelter in the alpine zone of the Tatra Mts. Some of them are components of the garden plantation, e. g. *Dryas octopetala*, *Saxifraga cernua*, *Kobresia simpliciuscula* and *Elyna myosuroides*. *Saussurea pygmea* and *Saxifraga retusa* apart from the Tatra Mts. don't occur in Slovakia. *Aster alpinus*, *Hedysarum hedysaroides, Dianthus glacialis, Gentiana clusii, Callianthemum coriandrifolium, Campanula cochleariifolia, Lilium martagon* and others attract attention by remarkable flowers. Outstanding are fen plants: *Calla palustris,*

Gladiolus imbricatus, Iris sibirica and other, by law protected plants. The highest peaks in the subnivale zone are home for e. g. *Silene acaulis, Gentiana frigida, Saxifraga oppositifolia, Saxifraga bryoides* and *Cardaminopsis neglecta.* In the areal of botanic garden is established arboretum with the trees typical for the montane and subalpine zone. The collection is now being widen, the representatives of submontane zone are beeing planted. The geological exhibition is a part of the botanic garden. On the occasion of 50. anniversary of the Tatra National Park arose a memorable place dedicated those who propagated the ideas of the Tatra nature protection, founders of the Tatra National Park and those who introduced these ideas in the practice, Tatras important botanists and zoologists.

Exposition - research

Important duty is preservation gene pool of rare and endangered taxa of Tatra vegetation. Effort is particularly given to keep the viable populations of monotypic species and critically endangered species. The long-lasting task of the Exhibition is not only to conserve the plant gene pool but their investigation. The collection of plant includes species protected by law (100 species) and endemic species are most valuable part of collection in the garden. The collection includes 67 woody species. The garden features 14 critically endangered (*Saxifraga cernua, Salix kitaibeliana, Ranunculus reptans*), 60 endangered (*Salix helvetica, Primula farinosa, Pinguicula vulgaris*), 59 vulnerable species (*Minuartia gerardii, Oxytropis halleri, Gladiolus imbricatus*), 29 lower risk (*Gypsophila repens, Lilium martagon*, *Dianthus nitidus* subsp. *nitidus*) and 9 rare species (Fig. 1.).

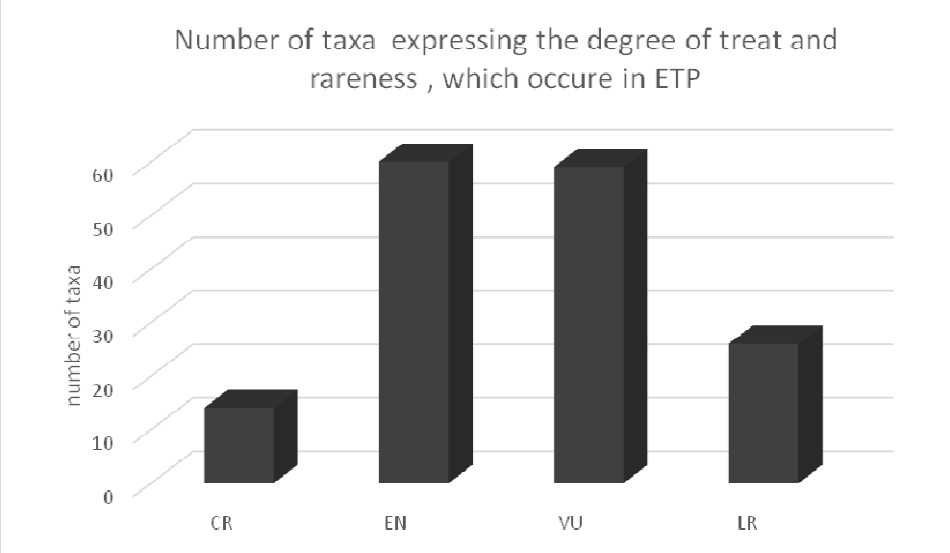

Fig. 1. Number of species expressing the degree of treat and rareness of taxa, which occur in ETP collection. VU- vulnerable, EN- endangered, CR- critically endangered, LR - lower risk

Vegetates plant blooms and fruits. The highest level of adaptation to the environment is a natural self-renew. The table shows the duration of selected species of flowering plants. Limiting factor for the flowering is, the number of sunny days, length of snow cover and rainfall. Precipitation, together with temperature are most important climatic factors that affect the successful growth and reproduction. The table 1 shows the beginning of blooming selected protected species. One of the species *Armeria alpina* which is critically endangered species occurring only in the High Tatra Mts., where is restricted in only location Furkotská dolina Valley. Species is restricted in nature to the assotiation *Silenetum norcae* and *Pediculari oederi-Festucetum versicoloris*, the accompanied is *Carex sempevirens* subsp. *sempervirens*. For example ŠKOLEK (2006) observed in 2004 the population of *Armeria alpina* was heavily flowering. 535examined clumps bore 3,067 flowers, i.e. 6 flowers per clump. Most clump (97) bore only one flower, i.e. 18% out of all studied clumps. The study indicates, that the population is thriving. To compare population of *Armeria alpine* in garden is doing very well, blooms an produces seeds and freely reproduced.

Education process – visitors load

Focus of our garden has been highly specialized. Very important mission have been public relations. The visit of botanical garden is the education. Education in the Exposition of Tatra Nature has developed parallel with construction of garden and completing its species composition. The memorable place and geological exhibition propagates ideas of the Tatra National Park. Even these place provides favourable opportunity for education. Our objective is to attract visitors to the garden, to provide education in the active relaxation. We inform public about events in the garden regularly. In 2015 promotion of garden increased in public media and number of visitors increased too (Tab. 2). The lowest attendance was recorded in 2004. The adults visit garden in July and August, students and pupil and school groups in June.

Resaerchers explored the motivations of garden visitors in Great Britain, CONNELL (2004) laid a foundation for building knowledge and understanding of reasons for visiting botanic gardens. In this study, a large portion of visitor behaviour fell into three categories: interpersonal pursuits (such as picnicking), activity based behaviour (such as photography), and contemplative activities (such as wildlife observation).

On request we performed accompany school groups and primary schools. In the lecture mainly focuses on effort to inculcate the foundations of the protection of species of flora and emphasizes the important species growing in the Tatra Mountains. Annually within the lesson of botany students from secondary forestry school visit garden. Students are educated and obtained broad spectrum of knowledge not only of the subject botany (relating to protected species) dendrology and pedology. To get better orientation, the labels of endemic and endangered species are coloured. They understand the different ecological requirements of plants and trees at the positions where they are located and which reaches its optimum growth. Great emphasis in the interpretation put on the importance of the adaptation of plants and trees for alpine conditions.

Tab. 1. Beginning of blooming selected protected species.

species /year	2004	2005	2006	2008	2009	2010	2011	2013	2014
Aconitum firmum subsp. *firmum*	14.6.	8.6.	18.6.	26.6.	23.5.	1.5.	12.6.	20.6.	14.6.
Adenophora liliifolia	25.8.	9.7.	17.7.			29.7.	19.7.	28.7.	20.7.
Andromeda polifolia	18.5.	1.5.	15.5.	26.4.	29.4.	15.5.	30.4.	1.5.	18.4.
Androsace obtusifolia			10.5.	19.5.	18.5.	22.5.	12.5.		25.5.
Armeria alpina	20.5.	20.5.	15.5.	25.5.	12.5.	31.5.	15.5.	10.5.	1.5.
Aster alpinus subsp. *serpentimontanus*	9.6.	8.6.	13.6.	29.5.	1.6.	5.6.	30.5.	6.6.	19.5.
Astragalus alpinus	12.6.	15.6.	15.6.	29.5.	26.6.	5.6.	20.5.	10.6.	10.5.
Astragalus australis	12.6.	31.5.	1.6.	25.5.	25.5.	3.6.	12.5.	20.5.	12.5.
Astragalus norvegicus	27.5.	25.5.		25.5.	10.9.	3.6.	20.5.		18.5.
Callianthemum coriandrifolium	3.5.	5.5.	10.5.	29.4.		7.5.	25.4.		14.4.
Calla palustris		27.5.		28.5.	30.5.	28.5.	1.6.	22.5.	18.6.
Campanula tatrae	20.6.	8.6.	20.6.	18.6.	20.6.	18.6.	22.6.	15.6.	5.7.
Cochlearia tatrae	7.5.	12.5.	4.5.	25.4.		6.5.			
Dactylorhiza majalis	20.5.	23.5.	20.5.	25.5.	22.5.	22.5.	20.5.	1.6.	1.5.
Delphinium elatum	11.6.	12.6.	23.6.	10.6.		1.7.	10.6.	10.7.	3.7.
Delphinium oxysepallum	10.6.	12.6.	10.6.	6.6.	28.5.	10.6.	10.6.	25.5.	31.5.
Dianthus glacialis	18.5.	23.5.	26.5.	25.5.	10.5.	28.5.	15.5.	18.5.	7.5.
Dianthus nitidus	30.5.	30.5.	28.5.	29.5.	25.5.	28.5.	1.6.	20.5.	20.5.
Dianthus praecox	15.6.	15.6.	27.6.	10.6.	12.6.	10.6.	10.6.	16.6.	1.6.
Dianthus superbus subsp. *alpestris*	21.6.	22.6.	1.7.	15.6.	15.6.	22.6.	10.6.	22.6.	18.6.
Dryas octopetala	4.5.	17.5.	15.5.	19.5.	4.5.	10.5.	1.5.	7.5.	24.4.
Erigeron hungaricus	25.5.	19.5.	28.5.	19.5.	12.5.	26.5.	21.5.	15.5.	28.4.
Erysimum hungaricum	27.5.	3.6.		24.5.		12.5.	15.5.	12.5.	28.3.
Gentiana clusii	5.5.	5.5.	8.5.	1.5.	28.4.	10.5.	27.4.	4.5.	14.4.
Gladiolus imbricatus	7.7.	10.7.	6.7.	1.7.	10.7.	6.7.	12.7.	10.7.	1.7.
Hedysarum hedysaroides	20.5.	25.5.	25.5.	15.6.	18.5.	22.5.	1.6.	20.5.	26.5.
Iris sibirica	11.6.	10.6.	20.6.	10.6.		8.6.	1.6.	10.6.	26.5.
Leontopodium alpinum	14.6.	23.6.	22.6.	4.6.	13.6.	15.6.	3.6.	3.6.	29.5.
Onobrychis montana	4.6.	1.6.	10.6.	1.6.	24.5.	3.6.	19.5.	31.5.	22.5.
Oxytropis campestris	15.6.	20.6.	20.6.			6.6.	10.6.	16.6.	16.6.
Oxytropis carpatica	30.5.	31.5.	25.5.	10.6.		15.6.	22.5.		12.6.
Oxytropis halleri	14.5.	18.5.		12.5.			20.5.	14.5.	29.4
Papaver tatricum	12.5.	17.5.	19.5.	13.5.	10.5.	15.5.	11.5.	10.5.	20.4.
Petrocallis pyrenaica	22.4.	23.4.	29.4.	20.4.	18.4.	26.4.	13.4.	28.4.	1.4.
Pinguicula vulgaris	2.6.	1.6.	15.6.			3.6.	1.6.	30.5.	26.5.
Plantago atrata subsp. *carpatica*	3.5.	5.5.	4.5.	12.5.	10.5.	18.5.	26.4.	27.4.	20.4.
Primula auricula	27.4.	1.5.	4.5.	19.4.	28.4.	23..4.	16.4.	18.4.	19.4.
Primula farinosa	5.5.	10.5.	8.5.	3.5.	7.5.	8.5.	10.5.	10.5.	11.5.
Primula halleri	3.5.	3.5.	6.5.	3.5.		30.4.	5.5.	3.5.	20.4.
Primula minima	21.4.	22.4.	24.4.		13.4.	26.4.	26.4.	24.4.	10.4.
Pritzelago alpina subsp. *alpina*	12.4.	18.4.	20.4.	15.4.	8.4.	20.4.	14.4.	27.4.	29.3.
Pulsatilla slavica	13.4.	13.4.	23.4.	4.4.	10.4.	17.4.	15.4.	24.4.	20.3.
Ranunculus alpestris	29.4.	25.4.	10.5.	5.5.	29.4.	8.5.	28.4.	4.5.	20.4.
Ranunculus altitatrensis	31.5.	6.6.	4.5.	18.5.	6.5.	22.5.	15.5.	19.5.	1.5.
Ranunculus reptans	15.6.	3.6.	12.6.	10.6.	10.6.		29.5.		22.6.
Salix alpina	25.4.	3.5.	4.5.	25.4.	18.4.	30.4.	11.4.	28.4.	1.4.
Salix retusa	10.5.	18.5.	4.5.				15.5.		
Saussurea alpina	28.6.	28.6.			18.6.	20.6.	28.6.	19.6.	4.6.
Saxifraga cernua	10.6.	30.5.	12.5.	18.6.	18.5.	22.5.	20.5.	1.6.	1.6.
Saxifraga wahlenbergii	15.4.	14.4.	15.4.		31.3.		11.4.		8.4.
Silene acaulis	29.4.	5.5.	5.5.	27.4.	26.4.	1.5.	12.5.	5.5.	8.7.
Soldanella carpatica	5.5.	20.4.	29.4.	3.5.	22.4.	20.4.	20.4.	29.4.	14.4.
Trollius altissimus	7.5.	16.5.	15.5.	12.5.		15.5.	12.5.	25.5.	1.5.

Tab. 2. Overview of number of visitors in Exposition of Tantra nature.

year/visitors	School groups	Children	Students	Adults	Seniors	SUM
2002	4523	926	639	3849	904	10841
2003	178	3093	657	3684	642	8254
2004	30	714	55	479	367	4776
2005	456	2564	314	1964	594	5436
2006	560	2903	852	2184	740	6679
2007	305	2058	549	3469	653	6729
2008	4418	259	306	1691	689	6829
2009	4633	224	270	1575	536	6753
2010	4818	279	167	1398	485	6537
2011	4054	1992	0	1948	0	7562
2012	3599	283	320	1301	759	5742
2013	3568	430	263	2238	1234	7313
2014	3511	406	224	1877	1441	6953
2015	5077	706	261	2526	3299	11 195

Department of alpine ecology of University Žilina visited garden within the field exercise of botany, who repeated the information obtained during study at term and build knowledges. Last years visited garden students from foreign universities. (University of Frankfurt and Budapest). Quite often are visits from foresters, botanists, and researches of scientific institutes. A relatively frequent often they are accompanied by visits from abroad within specialized conferences in the Tatra region.

Special attention is paid to opening weekend of parks and gardens. We offer an escort around the garden, in cooperation with forest pedagogies who offers an engaging program for children and educate them through play. We also show examples seedlings replanting and provide little guidance in plant cultivation. Major group of visitors comes to the garden for recreation rather than education. Contrary to popular garden management expectations, such research has shown that visitors may not be interested in education during their garden experience and may visit gardens to pursue other leisure activities (BALLANTYNE et al. 2008). Researchers cite the need for further studies into botanic garden visitor motivations and benefits (BALLANTYNE et al. 2008). MURRAY et al. (2007) explored the dimensions of visitor service quality and benefit attainment at an Australian botanic garden. Results indicated that there is a relationship between benefits attainment and service quality performance, and that these features can help predict visitor advocacy for botanic gardens. Additionally, benefits of improvement in physical and mental health were important to visitors. The Exhibition of the Tatra Nature is interlaced with fine gravel paths. Over marshland there are wooden paths. It is easy to walk on them even with a pram or a wheelchair. Visitors can find waterfall with supplying stone lake, new mountain path over the pine to get a better experience, and better relax.

Discusion

In a time of increasing concern about the impact of human activity upon the environment, botanic gardens are potentially well placed to inform and

encourage action against the loss of the world's plants species, and the impact that this will have upon the people and animals which rely on them. It is estimated that as many as two-thirds of the world's plant species are in danger of extinction in nature during the course of the 21st century, threatened by population growth, deforestation, habitat loss, destructive development, over consumption of resources, the spread of alien invasive species and agricultural expansion (DODD & JONES 2010).That is also why we consider as very significant existence of Exhibition of the Tatra Nature, as place where is genepool of rare and endangered taxa of the Tatra vegetation preservation. It is also place where visitors have opportunity to watch the changing flower variegation and typical woods. Lot of rare species from our botanical collection remain hidden to be seeing by visitors of TANAP, because their habitats are outlying from marked paths. Large groups of visitors are school groups. For many children is school trip to garden only one way to get information on richness of the Tatra vegetation. The status of botanical gardens as providers of education is well established. The educative offer at botanic gardens can range from academic, specialist courses to lifelong learning opportunities for school and communities groups. Many have condition for school groups, ranging from teacher-led visits to individual workshops. Nothing can remain static, and by engaging with these processes of change, botanical gardens will be better equipped to deal with their contemporary context, to the benefit of society and themselves. Botanical garden help people to understand its impact upon the environment. WARD, PARKER & SHACKLETON (2010) summarise the benefits of botanic gardens (alongside the three core functions of conservation, research and education) as providing: green and recreational space in urban areas; economic benefits from attracting tourists and visitors to a region; psychological and spiritual restoration and Redefining the Role of Botanic Gardens – towards a new social purpose. The first true botanic gardens were built in Europe as "physic gardens" as plant species were brought back from newly discovered lands. These botanic gardens served as a repository for the newly discovered botanic wealth, a place to evaluate and research newly found plant species for their economic (WARD et al. 2010) and aesthetic potential, and a place for community members to interact with these plants.

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