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Hierarchical analysis of the threats for Species of Community Interest in the Iron Gates Natural Park, Romania

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Abstract

Threats to biodiversity are diverse and the management of these threats is a major research direction in the conservation of biological diversity. Determining the status of a species is essential in identifying those in danger of becoming extinct and also to establish conservation priorities.
For the management of all types of threats that manifest themselves for certain species of community interest in the Iron Gates Natural Park, we must first understand their causes and effects.
Conservationists are increasingly interested in determining threats to biological communities, this being an important part of territorial and environmental planning strategies. The analysis undertaken for some geographical areas showed that the most important threats are the socio-economic and demographic variables, the fragmentation, destruction and degradation of habitats through various practices, the introduction of non-native species, illegal hunting or overfishing. In this context, for elaborating sustainable patterns of habitat management we must analyze and prioritize the threats that we are dealing with.
The method requires an inventory of the main threats in the Iron Gates Natural Park, the threats for certain Species of Community Interest (*Tulipa hungarica, Colchicum arenarium, Pulsatilla grandis*). We have also applied a method used by WWF in order to achieve a hierarchy of the main threats and to establish logical and efficient actions that can be locally applicable.

Keywords: *threat, threat ranking, Species of Community Interest, biological diversity, habitat management, Iron Gates Natural Park, Romania*

Rezumat. Ierarhizarea ameninţărilor la adresa speciilor de interes comunitar în cadrul Parcului Natural Porţile de Fier, România

Ameninţările la adresa biodiversităţii sunt diverse şi managementul lor reprezintă o direcţie majoră de cercetare în conservarea diversităţii biologice. Evaluarea statutului de conservare necesită estimarea riscului extincţiei unei specii şi ajută în stabilirea priorităţilor de conservare.
Managementul tuturor tipurilor de ameninţări la adresa anumitor specii de interes comunitar in cadrul Parcului Natural *Porţile de Fier* reclamă înţelegerea în primul rând a cauzelor şi efectelor acestora.
Conservaţionistii sunt din ce în ce mai interesaţi în determinarea ameninţărilor la adresa comunităţilor biologice care se constituie în o parte importantă a strategiilor de planificare a teritoriului şi mediului. Analizele întreprinse în diferite spaţii geografice au arătat că cele mai importante ameninţări sunt variabilele socio-economice şi demografice, fragmentarea, degradarea şi distrugerea habitatelor prin diferite practici, speciile invazive, vânătoarea ilegală sau pescuitul intensiv. În acest sens, în elaborarea de modele de dezvoltare durabilă pentru managementul habitatelor se impun a fi analizate şi prioritizate tipurile de ameninţări identificate.
Metodologia utilizată în demersul nostru a presupus în primul rând inventarierea principalelor ameninţări din cadrul Parcului Natural *Porţile de Fier* pentru câteva specii de interes comunitar (*Tulipa hungarica – Lalaeaua Cazanelor, Colchicum arenarium - Brânduşa, Pulsatilla grandis – Dediţel mare*). La aceasta s-a adăugat aplicarea unei metode de analiză folosită de WWF pentru ierarhizarea ameninţărilor cu scopul stabilirii acelor acţiuni logice şi eficiente ce pot fi aplicate la nivel local

Cuvinte-cheie: *ameninţare, evaluarea ameninţărilor, specii de interes comunitar, diversitate biologică, managementul habitatelor, Parcul Natural Porţile de Fier, România*

Introduction

An important aspect of protected areas management is the monitoring of key components of biological diversity (eg: the water level in ponds, the number of individuals belonging to rare and threatened plant species, the density of grass, shrubs and trees, data referring to the arrival and departure of migratory species, etc).

The basic methods include recording standard observations, supervision of key elements, taking

pictures and interviews with visitors of the protected area (Primack et al, 2008).

The management of protected areas must also take into account the factors that threaten biological diversity. These include a series of threats such as exotic species, destruction, degradation or fragmentation of habitats or human activities (Primack, 2008). Even well-managed protected areas can deal with air and water pollution, acid rain, climate change that may affect natural communities and contribute to the growth, the decrease and even the extinction of some species.

In some countries the most serious threats to protected areas come from government policies responsible for their management (Haslett et al. 2010). Large development projects (road networks, bridges, dams), exploitation activities (deforestation) or extraction (oil, natural gas) and policies that come into conflict with the management objectives can threaten biodiversity in protected areas.

Some major causes for the extinction of the species are habitat destruction and degradation and overexploitation (Diamond, 1989). Another example of the classification of the threats can start from the destruction and degradation of ecosystems, the decline or destruction of some species, pollution and transport infrastructure (Salafsky et al., 2002).

After managing threats in Eastern Australia, Auld and Keith (2009) propose a simple classification into five types of threats. These include the major threats of destruction and fragmentation of habitat and climate changes, threats that are directly related to natural hazards (eg: fires, floods, landslides, etc.), threats related to reduced functionality of biological interactions (eg. due to invasion of exotic species) and overexploitation that affects specific groups of plant and animal species.

Habitat disturbance, overexploitation, poaching, pollution, invasive species, disease, sub-optimal protected areas design represents only a few of the threats that affect Romania's protected areas network. (Primack et al, 2008; Ioja et al, 2010; Baldwin, 2010)

Although nationally threatened and endemic species are important conservation targets, some results indicate that reserve networks that are focused only on these species may not be sufficient to preserve all the species diversity in a country (Bonn et al., 2002; Grammont, Cuaron, 2006).

To manage all types of threats, we need first to understand the causes and the effects combined with adaptive management strategies for amelioration (Auldt and Keith, 2009).

Conservationists are increasingly interested in determining the threat status of ecological communities as a key part of their planning efforts. (Nicholson et al., 2009). Conservation managers can take multiple actions to conserve threatened species but sometimes they are facing with restricted funding and they are forced to eliminate some projects (Hayward, 2009).

The aim of our study is to develop a method that could help the local authorities in the management and prioritization of the threats for the species of Community interest present in the Iron Gates Natural Park using as a starting point a WWF method (Threat Ranking) and two case studies.

Study area

Iron Gates Natural Park (1156 km^2) is located in the South West Romania over Caraş-Severin County (11 administrative units) and Mehedinţi County (9 administrative units). It can be considered one of the regions with the greatest diversity of ecosystems, landscapes and species in Romania. Iron Gates Natural Park is a Transboundary Ramsar Site bordering the Republic of Serbia along the course of the Danube River (Fig. 1).

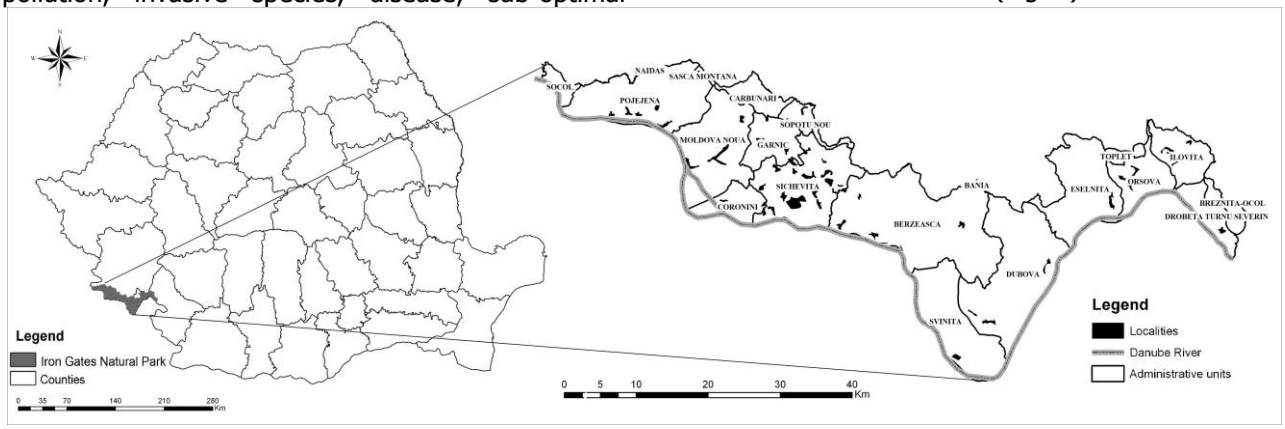


Fig. 1: – Location of the study area

It is not the number of the species, but their importance to science that counts. In the Iron Gates Natural Park, there are **1668** floristic taxons (only superior plants), out of which **28** are endemic. The diversity of the plant associations is also high, being identified **171** plant associations, out of which **26** are endemic for Romania and **21** have community value (Mataca, 2005). The number of endemic elements completes the large diversity of phytogeographic elements. According to several authors, the endemic species number in the park varies from **28** to **33** elements. Among those are: *Pinus nigra ssp. banatica, Minuartia cataractarum, Prangos carinata, Stipa danubialis, Tulipa hungarica, Dianthus banaticus, Dianthus spiculifolius, Campanula crassipes.*

From the species with community value, eight are enlisted in the 1st Annex of The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention): *Tulipa hungarica*, *Stipa danubialis*, *Salvinia natans, Colchicum arenarium, Pulsatilla grandis, Typha shuttleworthii, Campanula abietina* and *Eleocharis carniolica*. The elements of valuable genofound are: *Tulipa hungarica, Pinus nigra ssp. banatica, Cachrys ferulacea, Stipa danubialis, Paeonia banatica* (RNP Romsilva – Iron Gates Natural Park Administration, 2011).

Data and methods

Habitat affinities and data for the species that we used in our analysis were determined primarily from literature review.Threat ranking is a method used by WWF in the WWF Standards of Project and Programme Management that shows the degree to which each direct threat affects the biodiversity target at a given site (WWF, 2007). The method consists in identifying a set of criteria, apply them to the direct threats so that the conservation action can be directed where they are most needed. This method can help teams prioritize and locate actions when they are dealing with more than one threat in a conservation area or region.To do a threat ranking, it is important to be clear about the main threats in that natural area and what biodiversity targets they are affecting. In a threat ranking, we have to evaluate each direct threat and its impact on the biodiversity targets it is affecting. We have chosen two methods to do this evaluation: the *absolutely* and *relatively method*.

The first step is to determine the criteria against which the threats at the site will be ranked. Taking the example given by WWF we can consider the criteria of **scope**, **severity, urgency** and **irreversibility**. The criteria of scope and severity are used in both methods while urgency is used in the *Relative Threat Ranking* and irreversibility in the *Absolute Threat Ranking*.

Criteria used in evaluation

There are some factors to consider in ranking threats. We can include here the **scope** (Table 1) that refers to the area affected by the threat within 10 years under current circumstances, the **severity** (Table 2) dealing with the impact of the threats, the **irreversibility** (Table 3), which targets the recovery that may happen if possible meaning that a given threat can be undone and the targets affected by the threat restored, if the threat is stopped and the **urgency** that shows the importance of taking immediate action to deal with a threat. There should be a thorough evaluation and examination of the threats based on the targets we are pursuing.

The most important criteria for rankings are *scope* and *severity* that taken together will give us the magnitude of the threat. For this reason, the recommendation given by WWF is to double-weight them and those threats with the highest number will be considered the biggest threats in the site for the analysed targets. We will have different scales depending on the model we use (eg. 1-11 for the Relative Threat Ranking System; 1-4 for the Absolute Threat Ranking System).

Categories of threat according to the IUCN model

A variety of threats are impacting on the Species and Habitats of Community Interest around the world and as shown above, there exist many classifications. To better understand the threatening processes and the assessment of threats for each species, we used a standardized list (IUCN Threats Classification Scheme) of major threats (Fig.2).

Most species and biological communities are faced with two or more categories of threats that could accelerate the process of extinction and make the conservation efforts difficult. Using this standardized list and the methods used by WWF in the WWF Standards of Project and Programme Management, we tried to develop a method that would facilitate the analysis of threats and the conservation actions that have to be taken further.

Relative Threat Ranking System method adapted from Margoluis and Salafsky (1998, 2001) compares all the direct threats overall for the site, not target-by-target. For this method, we used all the 11 threats from the IUCN Threats Classification Scheme as a direct threat and we ranked them relative to one another. So, because there are 11 threats, the highest ranked threat in any criteria will get 11 points and the lowest ranked threat will get 1 point (Table 4).

Table 1 Scale classification for *scope* criteria

Scale	Classification	Definition
4	Very high	the threat is likely to affect the target across all or most (71-100%) of the population
3	High	the threat is likely to affect the target across much (31-70%) of the population
2	Medium	the threat is likely to affect the target across some (11-30%) of the population
1	Low	the threat is likely to affect the target across a small proportion (1-10%) of the population

Source: Resources for Implementing the WWF Project & Programme Standards

Table 2 Scale classification for *severity* criteria

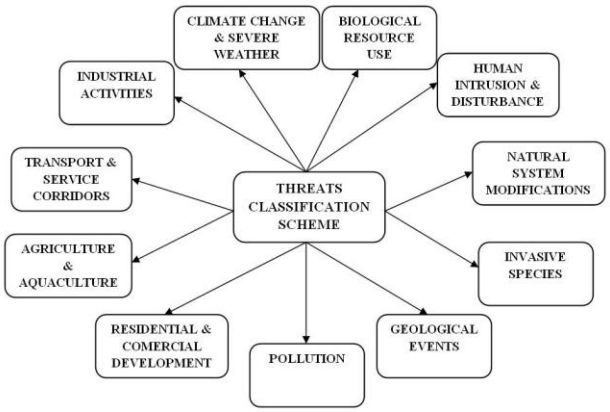
Scale	Classification	Definition
4	Very high	within the scope, the threat is likely to destroy, eliminate or reduce the population by 71-100% in the next 10 years
3	High	within the scope, the threat is likely to seriously reduce the population by 31-70% in the next 10 years
2	Medium	within the scope, the threat is likely to moderately reduce the population by 11-30% in the next 10 years
1	Low	within the scope, the threat is likely to slightly reduce the population by 1-10% in the next 10 years

Source: Resources for Implementing the WWF Project & Programme Standards

Table 3 Scale classification for *irreversibility* criteria

Scale	Classification	Definition
4	Very high	the effects of the threat cannot be reversed, it's unlikely the target can be restored and will take more that 100 years to do it
3	High	the effects of the threat can be reversed and the target restored within 21-100 years
2	Medium	the effects of the threat can be reversed and the target restored within 6-100 years
1	Low	the effects of the threat are easily reversible and the target restored within 0-5 years

Source: Resources for Implementing the WWF Project & Programme Standards



Source: www.iucnredlist.org

Fig. 2: IUCN Threat Classification Scheme

RESULTS AND DISCUSSIONS

Relative Threat Ranking System

Given the fact that we are analyzing one of the largest protected areas in Romania, we must consider all types of threat given by IUCN. This analysis indicates that we can split the threats into 4 categories depending on the level of classification and their aggressiveness, from very high to low threats. The most aggressive threats for the whole protected area are the *industrial activities, human intrusions and disturbances* and *pollution*.

Industrial activities in the Iron Gates Natural Park are represented by the exploitation of various natural resources. The storage of tailings resulted from mining is made in mine dumps, the one from Moldova Nouă being the largest mine dump in the country. Tailings represent an external cost of mining because no one is taking adequate measures to make tailing areas environmentally safe after closure.

Being a rural area with 11 communes and 3 towns (Moldova Nouă, Drobeta Turnu Severin and Orşova) and low living standards, the main occupation is animal husbandry and subsistence agriculture. The lack of septic tanks in the area has direct consequences on the environment. Therefore the waste waters from domestic activities are being discharged directly into the surface waters or into the ground. Also, there is no gas supply network or heating network and wood is the main source of heating.

Agriculture and aquaculture, biological resource use and *invasive species* form another group of threats almost with the same level of importance and urgency to be dealt with.

Uncontrolled commercial fishing, sport fishing and especially poaching fish (using electricity, monofilament nets etc.) represents a permanent threat to aquatic ecosystems, especially wetlands habitats in the western part of the Iron Gates Natural Park.

Table 4 Relative Threat Ranking System

Direct threat	Scope	Severity	Urgency	Total	Classification
Residential & commercial development	6	5	5	**16**	Medium
Agriculture & aquaculture	11	4	6	**21**	High
Industrial activities	7	11	11	**29**	Very High
Transport & service corridors	4	3	4	**11**	Medium
Biological resource use	8	6	8	**22**	High
Human intrusion & disturbance	9	7	10	**26**	Very High
Natural system modifications	3	10	3	**16**	Medium
Invasive species	5	9	9	**23**	High
Pollution	10	8	7	**25**	Very High
Geological events	2	1	2	**5**	Low
Climate change & severe weather	1	2	1	**4**	Low
TOTAL	66	66	66		

Being a rural area, farmers focus on growing enough food to feed themselves and their families. People tend to use large quantities of natural resources and transform large areas of natural habitats into agricultural land and built-up areas.

All types of hunting or poaching led to adversely affect certain species, and if these activities are not controlled, more and more of these species will become extinct. Poaching has different effects, but the biggest impact is represented by species extinction at global, regional or local level. Poaching was also associated with the effect of the spread of diseases from animals to human and vice versa.

Population growth will lead to overexploitation of resources. In rural areas, because of low living standards, no one thinks of biodiversity conservation. Thus, low standards of living will eventually lead to deterioration of the natural environment (Primack et al., 2008, Primack, 2008).

Invasive species can be considered one of the main causes of biodiversity loss due to their role in competition and hybridization (Goudie, 2006)

In the medium classification we included: *residential and commercial development, transportation and service corridors* and *natural system modification*. Currently they do not represent an urgent problem at the level of the entire protected area but mostly at local level. Without a long term management strategy they could easily pass into a higher threat category.

In this category, the chaotic development of tourism infrastructure and uncontrolled tourism are a negative phenomenon with repercussions on the natural diversity and landscape. Construction of secondary homes on the shore of the Danube is a direct threat to biodiversity mainly due to direct discharge of the waste waters into the Danube.

Some studies provide us with only partial support for the idea that the areas with high human population density coincide with areas of high species richness (Araujo, 2003).

On a global scale, Kerr and Currie (1995) found that population density is the factor most closely related to endangered species of birds, although the number of threatened mammal species is more closely related to GNP per capita (Lenzen et al., 2008).

Besides the phenomenon of destruction of habitat, fragmentation occurs through construction of paths, roads or railways, extension of agricultural land or urban sprawl. Habitat fragmentation is the process by which a large area of a given habitat is divided into two or more fragments (Pătroescu et al., 2007b). Another cause of fragmentation could be the development of tourism infrastructure that could increase the density of transport network. At the transportation policy level, it is very important to guarantee the permeability of highways for fauna, given that the roads and a high volume of traffic generally have an important barrier effect (Clevenger and Wierzchowski, 2006; Gurrutxaga et al., 2010).

From the habitat fragmentation phenomenon that causes the border effect we can highlight other threats such as increased fire, microclimate change, increased vulnerability to invasive species, exposure to disease etc (Primack et al, 2008).

The last category of threats includes *geological events, climate change* and *severe weather.* Regarding the geological events, the Iron Gates Natural Park is not close to a seismic area so there is little seismic activity. According to the European Environment Agency, the indicators used to analyze climate changes do not show significant changes in the area.

Absolute Threat Ranking System

After the example given by WWF Project & Programme Standards (2007) we consider the criteria of **scope**, **severity** and **irreversibility** for the Absolute Threat Ranking System (compares all the direct threats target-by-target.).

In the example below we used the three criteria to evaluate seven direct threats across three targets. In this analysis we chose seven direct threats and not eleven, like in the previous example, because the scale of analysis is smaller and the threats are local applicable. Each threat is rated using the criteria and a 4 point scale.

Because we are dealing with a large protected area we need to apply measures against different types of threats so, a more detailed and focused analysis on the habitats or species will give us a better view of the measures we will have to take at regional or local level.

Given the presence of several endemic elements in the Iron Gates Natural Park (eg: *Tulipa hungarica, Stipa danubialis, Colchicum arenarium, Pulsatilla grandis, Campanula abietina, Eleocharis carniolica* etc.) we have chosen a more detailed analysis for three plants from this list based on the existing studies and available IUCN data. Because we are dealing with species in this example, we have changed the column of direct threats with specific threats that can affect either one or all three plants.

In Romania, there are over 1000 mature individuals of *Tulipa hungarica*, on the southern slopes of Iron Gates (IUCN, 2012). It grows in open mixed deciduous forests, shrubs and steep stony limestone slopes. *Tulipa hungarica* is threatened by collecting for local gardening.

For *Colchicum arenarium* one of the main threats is forestry management and plantation of *Pinus sylvestris* and *Pinus nigra* (Patroescu et al., 2007a).

Pulsatilla grandis is threatened by modification of cultivation practices, invasive species such as *Robinia pseudoacacia* and burning, either accidentally from recreational activities or deliberately to remove dry grass and shrubs to prepare pasture land. Urbanization is a minor threat as is agriculture and the use of fertilizers.

Another threat that can characterize many species is the collection of the plants. Cultivated species from the *Pulsatilla vulgaris* group are often planted in gardens (Table 5).

This example shows that the method can be applied in the analysis of large habitats using a standardized list but also for specific targets as species using specific threats.

Table 5 Absolute Threat Ranking System for Species of Community Interest

DIRECT THREATS	TARGET: *Tulipa hungarica*					TARGET: *Colchicum arenarium*					TARGET: *Pulsatilla grandis*					Site ranking	
	S1	S2	I	Total	Classification	S1	S2	I	Total	Classification	S1	S2	I	Total	Classification	Total	Classification
Collection of the plants	2	2	2	**10**	Low	-	-	-	-	-	1	1	1	**5**	Low	**15**	Medium
Forestry management	-	-	-	-	-	4	3	3	**17**	High	-	-	-	-	-	**17**	High
Plantation of *Pinus Sylvestris* or *Pinus nigra*	-	-	-	-	-	3	3	3	**15**	Medium	-	-	-	-	-	**15**	Medium
Modification of agriculture practices	-	-	-	-	-	-	-	-	-	-	4	4	3	**19**	High	**19**	High
Presence of invasive species	-	-	-	-	-	3	2	3	**13**	Medium	3	3	2	**14**	Medium	**27**	Very high
Burning	-	-	-	-	-	-	-	-	-	-	2	1	1	**7**	Low	**7**	Low
Agriculture or use of fertilizers	-	-	-	-	-	-	-	-	-	-	1	1	2	**6**	Low	**6**	Low

S1 = Scope; S2 = Severity; I = Irreversibility; Total = 2 x (Scope + Severity) + Irreversibility

Source: Processed after The IUCN Red List of Threatened Species

Conclusion

Threat ranking can be considered an important tool in the conservation management. This way we can prioritize which species most urgently require action to prevent extinction. The administration of a protected area can then allocate the budget according to these priorities.

Starting from identifying the presence of IUCN categories of threat and relating it with the *Relative Ranking* values and *Absolute Ranking* values we found the following for ***Iron Gates Natural Park***:

a) The threats for the entire protected area resulted from the Relative Threat Ranking System are: **industrial activities, anthropic disturbances** and **pollution**;

b) The local threats resulted from the Absolute Threat Ranking System for some species (*Tulipa hungarica, Colchicum arenarium, Pulsatilla grandis*) that we are interested in are: **presence of invasive species, inappropriate forestry management, some changes in agricultural practices** and for some species the **collection of the plants** either for commercial use or for gardening;

c) The main activities that require immediate actions to reduce or remediate their effects on Species and Habitats of Community Interest from Iron Gates Natural Park are: **industrial activities, anthropic disturbances, the presence of invasive species**, and the **collection of the plants**.

Both methods require a good knowledge of threats and how they affect the species taken in the analysis so that they could be correctly ranked. Comparing the two methods, the Absolute Threat Ranking System is more realistic, based on field observations and allows us to establish more logical and efficient actions that can be local applicable.

The limitation of this approach is that different people might use different criteria or apply them differently so in the end we can obtain different results. In order to use the right method for a particular site, we must be aware of the benefits and limitations of each method.

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