

PARTICULARITIES AND THREATS ON THE BIODIVERSITY FROM CROATIA

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Abstract

Because it has a specific geographic position and it's situated at the crossroads of several bio-geographical regions and as a result of its ecological characteristics, the climate and geo-morphological conditions, Croatia is one of the wealthiest countries from Europe concerning the biodiversity. The great variety of the territory, maritime and underground habitats has determined the existence of numerous species and subspecies, including a significant number of endemic species. Although the climate of Croatia has a great value, many of its components are threatened. The most important threats of wild species are losing the habitats and the degradation. Because of its shape and its position in Europe, Croatia has very rich landscape diversity. Croatia contains significant populations of many species that are threatened at the European level. These are connected to preserved large areas of their habitats. Vast mountain beech and fir forests are rich in bear, wolf and lynx populations. Large wetland complexes with alluvial forests are important breeding, the migration and wintering sites for European water birds and for wetland birds nesting in forests. The wealth of marine biodiversity, in combination with the immense diversity of islands and cliffs with endemic life forms, gives the Croatian coastal area international significance.

Key words: Natural protected area, Biodiversity, National park, Habitat, Endemic species.

JEL: Classification: Q26.

1. INTRODUCTION

The protected areas represent the main component of national and international strategies concerning the preservation/protection sustained by the governments and specialized organisms.

The remarkable importance which nature, the environment has on life and human existence is reflected in the preoccupation to its preservation. More than that, the intensive exploitation of some resources, registered in the last 70 years and according to the imminent exhaustion of some of them, the increase of the number of animal and plant species or even human communities threatened to disappear have led to the creation of some necessary oasis in order to protect them.

The protected areas are the most efficient preservation means for the biodiversity and in a general context to the environment and its natural and atrophic components.

The realization of the preservation objective has materialized along time by constituting protected areas and creating some systems, first national and then international systems of protected areas in order to improve the administration methods of these areas and to disseminate the experience concerning their organization and government.

The protected areas are important in special to maintain the biodiversity of the ecosystems, species and genetic variations which form the diversity of life. They preserve complex and in continuous change models of ecosystems, they represent a first measure to protect the big and small species from disappearing, save the genetic diversity, wild and cultural diversity

of many important crops from the world and also assure a vital reservoir for the plants and animals used in medicine.

Together with these practical benefits, the protected areas improve the quality of the human life, especially as recreation locations.

Croatia is located in the heart of Europe on the beautiful Adriatic coast bordering Italy, Slovenia and Hungary. Croatia is a country of more than 1185 islands, islets and reefs, most uninhabited and preserved, perfect for eco-tourism. In 1999, Croatia won three international awards for the cleanest waters in the Mediterranean.

Almost 10 percent of the country is protected as part of a national park or preserve.

Unfortunately, there isn't a complex inventory of the biodiversity from Croatia, especially of the invertebrate species. New species and subspecies are discovered every year. The number of known species (species and subspecies) in Croatia is almost 38,000, although it is assumed that the number of species is much higher – from 50,000 to more than 100,000 (Fourth National Report of the Republic of Croatia to the Convention on Biological Diversity the Republic of Croatia, 2009, p. 11).

During the last five year period in Croatia, 199 new species of land invertebrates, 205 species of freshwater invertebrates and 20 species of marine invertebrates have been registered and 3 new species of freshwater fish have been described. This indicates that the actual biological diversity of Croatia is much higher than present day data indicate. In 2005 a new species of endemic fish has been discovered in the Nereva Delta in Norin River. These elements reinforce

the fact that the biodiversity from Croatia is much bigger than it is presented in the current data.

One of the reasons for which in Croatia we meet a great number of endemic species, especially the glacial relicts, is that this area was affected in a small measure by the glaciations. The main centers of endemic species of flora are the mountains Biokovo and Velebit meanwhile the endemic species of fauna is more representative for the underground environments (the invertebrates from the caves), islands (lizards, snails) and calcareous rivers of the Adrian Basin.

On the other hand Croatia owns significant populations of the species that are threatened at a European level. These are connected to the vast protected areas and their habitats. The vast forests of beeches and firs are rich in population of bears, wolves and lynxes. The large humid areas with alluvial forests represent a proper area for procreation, migration and hibernation for many of the water birds from the Continent as well as for the special birds such as the white eagle with tale, the black stork and the small crying eagle.

On the *Red List of Threatened Species*, analysed on groups (vertebrate, butterflies, snakes, caves fauna, vascular plants and mushrooms) we meet 1131 species. All these species are strict protected by the Law for the wilderness protection which was issued in January 2006. This settlement divides the interest species for preservation into protected and strictly protected according to the relevant international legislation - The Convention from, The Directives for habitats and birds (Biodiversity of Croatia, 2008).

The purpose of this paper is analysing the degree of conservation of biodiversity and identifying the main threats to protected areas in Croatia.

2. SPECIFIC ELEMENTS OF THE NATURAL PROTECTED AREAS FROM CROATIA

According to the existing data, in present the flora from Croatia has 8582 species, the number being estimated at almost 10000 species. The proportion of the plant species places *Croatia as one of the richest three countries from Europe concerning its flora* (together with Slovakia and Albany). 5.65% from the known plant species are endemic species.

With 101 mammals species from which 90 are local, *Croatia is one of the eight countries from Europe with a great variety of mammals*. The mountain areas are covered with vast forestry complexes and they represent the habitat of all the three biggest European carnivorous (bear, wolf and lynx). *The bird's species from Croatia is one of the richest from Europe*.

The forests from Croatia cover a surface of 2,490,000 ha which represents 37% from the territory while the thick forests cover 37% from the territory.

Karst geology represents 46% from the land area of Croatia. Approximately *7000 caves and pits* are known in Croatia and the number is expected to grow during the new discoveries.

According to the Law for the natural protection from Croatia (2005), the natural protected areas are divided in 9 categories. In present there are 444 natural protected areas which cover a surface of 5124, 80 km², which represent 9.05% from the total surface of the country. The biggest percentage as territorial cover has the national and nature parks. Therefore, there are two strict reservations, 8 national parks and 10 nature parks to which was added the 11th nature park, Lastovo Archipelago, in designation process. Also, there are several sits from other categories which are in declaration process.

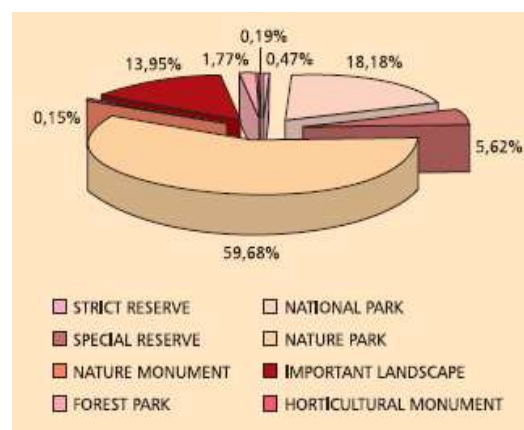


Figure 1 - The typology of natural protected areas from Croatia

Source: *Biodiversity of Croatia, State Institute for Nature Protection, Ministry of Culture, Republic of Croatia, Zagreb, 2008, p.38*

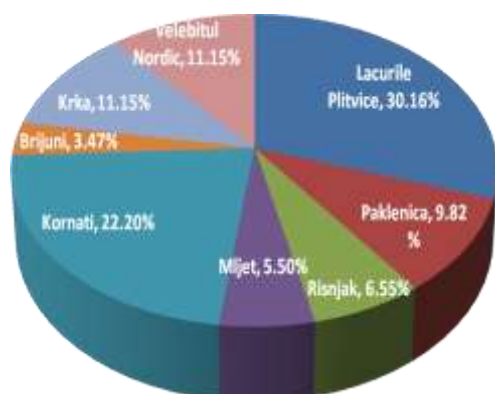
Three of the eight national parks of Croatia (Kornati, Brijuni and Mljet) are insular, being characterized by a wealthy marine life. In exchange, the national parks North Velebit, Risnjak and Paklenica are mountain areas characterized with a particular relief, numerous limestone's and rocks, plains situated at high altitudes and large forestry complexes. The diversity of the habitats in combination with the geographical isolation has led to the development of specific vegetation with many endemic species.

The Plitvic Lakes, the eldest national park from Croatia and also the largest (Table 1) and Krka are characterized by a unique calcareous, hydrological and morphology, travertine barriers, lakes and waterfalls.

Table 1 - National parks from Croatia

National parks	Area (ha)	Percentage (%)
Lacurile Plitvice	29,482	30.16
Paklenica	9,600	9.82
Risnjak	6,400	6.55
Mljet	5,375	5.50
Kornati	21,700	22.20
Brijuni	3,395	3.47
Krka	10,900	11.15
Velebitul Nordic	10,900	11.15
Total	97,752	100

Source: Processing of the Biodiversity of Croatia, State Institute for Nature Protection, Ministry of Culture, Republic of Croatia, Zagreb, 2008, p.38

**Figure 2 - The percentage distribution of the national parks surface from Croatia**

Six of the nature Croatian parks cover mountain areas (Medvednica, Žumberak-Samoborsko Gorje, Učka, Biokovo, Velebit and Papuk).

The nature parks Kopački rit and Lonjsko polje are large flooded areas which belong to the Panonic Plain and each of them include special ornithological reservations. The rivers and the flooded areas that surround these areas represent the cause of the existing habitats that are very special and also of a great variety of wild life, especially the bird species.

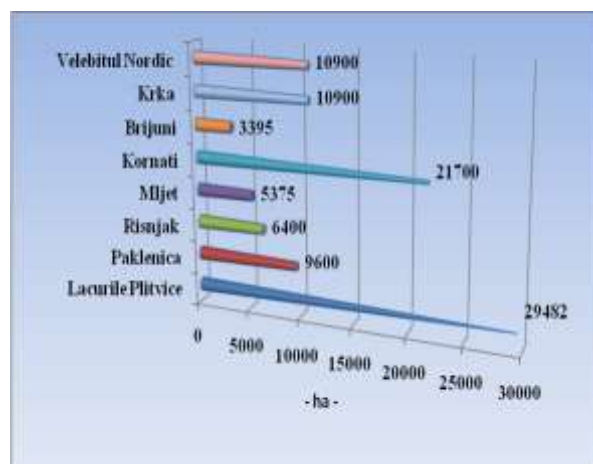
The natural park Vransko, next to Zadar Coast, is the largest natural lake from Croatia and it's important for the procreation and hibernation of the birds.

Table 2 - Nature parks from Croatia

Nature parks	Area (ha)	Percentage (%)
Kopački rit	23,894	5.80
Medvenica	22,826	5.53
Velebit	200,000	48.48
Biokovo	19,550	4.74
Telašćica	7,050	1.71
Lonjsko Polje	50,600	12.27
Papuk	33,600	8.15
Učka	16,000	3.88
Lacul Vransko	5,700	1.38
Žumberak-Samoborsko Gorje	33,300	8.06
Total	412,520	100

Source: processing of the Biodiversity of Croatia, State Institute for Nature Protection, Ministry of Culture, Republic of Croatia, Zagreb, 2008, p.38

The Nature Park Velebit (200,000 ha) is the largest natural protected area from Croatia (Table 2) which, together with the North Velebit and the national park Paklenica represent almost 40% from the protected territory of Croatia Republic.

**Figure 3 - The surface of nature parks from Croatia****Table 3 - Natural sites of international importance from Croatia**

Site name	International designation	Area (ha)	Percentage (%)
Plitvice Lakes National Park	UNESCO World Natural Heritage List	29,482	9.34
Velebit Mountain Nature Park	UNESCO MAB Site	200,000	63.38
Lonjsko polje Nature Park	Ramsar Site	50,560	16.02
Kopački rit Nature Park	Ramsar Site	23,400	7.42
Neretva Delta (proposed nature park)	Ramsar Site	11,500	3.64
Crna Mlaka fishponds ornithological reserve	Ramsar Site	625	0.20
Total		315,567	100

Source: Processing of the Biodiversity of Croatia, State Institute for Nature Protection, Ministry of Culture, Republic of Croatia, Zagreb, 2008, p.38

Several natural protected areas from Croatia are known internationally because of their exceptional biological value and landscapes diversity. Therefore the national park Plitvic Lakes is on the list of the Natural World Patrimony UNESCO, meanwhile the Mountain Velebit which belongs to the natural park Velebit, Paklenica and the national park North Velebit

are declared Reservations of the Biosphere. The natural parks Kopački rit and Lonjsko polje together with the ornitological special reservation Crna Mlaka and Neretva Delta are on the list of Humid Areas of International Importance under the Ramsar Convention.

Table 4 - Natural protected areas from Croatia

Category	Number of areas	Total area (ha)	Purpose	Level of protection
Strict reserve	2	2,395.35	Protection of overall biological diversity, scientific research	Protected by the Government, managed by county
National park	8	93,181.48	Protection of biological diversity, scientific research, tourism, recreation, education	State
Special reserve	79	28,796.5	Protection of biological diversity focusing on a specific component (forests, plant communities, fauna, hydrology etc.)	Protected by the Government, managed by county
Nature park	10	305,864.38	Protection of biological and landscape diversity, sustainable, development, tourism and recreation	State
Regional park	0	0	Protection of biological and landscape diversity, sustainable, development, tourism and recreation	County
Natural monument	103	761.79	Protection of a representative element of nature or small site, scientific research	County
Important landscape	69	71,467.08	Protection of landscape diversity, sustainable development, tourism and recreation	County
Park forest	38	9,051.95	Tourism and recreation, protection of landscape diversity	County
Horticultural monument	135	961.82	Protection of cultural heritage and landscape diversity, tourism and recreation, education	County
Total	444	512,480.35		

Source: *Biodiversity of Croatia, State Institute for Nature Protection, Ministry of Culture, Republic of Croatia, Zagreb, 2008, p.39*

The eldest natural protected area from Croatia is Arboretumul Opeka from Varazdinska district, protected since 1947 and integrated in the category of architecture monument of the park.

In Croatia, the *National Ecological Network* is defined by the Law concerning the natural protection since 2005 and includes areas of great ecological importance connected by corridors. It is organized to national and international level (international conventions, Directives of the European Union, Red List at a national level) to assure the survival on long term of the habitats and the threatened species. According to the mechanism of the Habitats Directive, the Croatian law stipulates the fact that there are parts of the ecological network that can be protected by declaring them natural protected areas, by implementing the management plans or the nature mechanism of impact on any intervention of threat of the area and respecting the preservation objectives.

The National Ecological Network represents a first step in the preparation process of NATURA 2000 network, the proposal being a part of the adhesion process of Croatia to the European Union.

Table 5 - The Ecological Network from Croatia

Category	Land (km ²)	%	Sea (km ²)	%	Total (km ²)
International core areas	7767	13.8	4280	13.5	12047
National core areas	5491	9.7	109	0.4	5600
Corridors	4903	8.7	8515	26.9	13418
Buffer zones	6510	11.5	9188	29.0	15698
Total ecological network	24671	43.6	22092	69.8	46763
Outside ecological network	31944	56.4	9552	30.2	41496
Total	56615	100	31644	100	88259

Source: *Biodiversity of Croatia, State Institute for Nature Protection, Ministry of Culture, Republic of Croatia, Zagreb, 2008, p.41*

National and international core areas represent the result of the combination of the following sites:

- All national and nature parks (large protected areas, important for preservation of biodiversity);
- All special reserves, existing and declared in the physical plans;
- Important areas for birds listed in Annex I of the Birds Directive;
- Important areas for other species threatened at the international (NATURA 2000) or national level (Red List): bats, dolphins, mushrooms, endemic species etc.;
- Representative part of the total area covered in habitat types threatened at the international (NATURA 2000) or national level.

Corridors have been created as follows:

- All large rivers with a surrounding belt of 100 or 50 meters;
- Forest corridors from between forest core areas;
- Migratory route of birds across the Adriatic Sea;
- Coastal marine waters important for sea turtles and dolphins.

Buffer areas have been created to surround the core areas. Some **restoration areas** have been created in order to ecologically reconstruct some areas.

3. THE MAIN THREATS ON THE BIODIVERSITY FROM CROATIA

There is a great pressure concerning the conversion of the natural habitats into construction areas or lands destined to intensive agriculture. More than that, the fragmentation of the habitats is caused by the construction of roads or other traffic corridors. Next to these threats the excessive exploitation such as hunting, fishing, forestry, intensive agriculture, water, soil and air pollution also represent major risks.

Also, in present, the *Mediterranean Sea* is the most threatened sea of the world and according to a study its flora and fauna are in danger of disappearance. During the research there were examined 20 oceans and none of them is facing with such major problems like Mediterranean Sea. The degradation of the habitats, the excessive fishing, the pollution and the increase of the invasive species, together with the global warming are just some of the problems which the Mediterranean is facing.

The pollution has decimated many essential habitats for the marine diversity, including the water grasslands and the reefs of corals. The excessive fishing represents a great danger for the biodiversity, a phenomenon that will register an intensive increase in the next ten years.

A major particularity of the Mediterranean Sea is given by the important presence of invasive species, a crucial factor which will continue to modify the biodiversity of this sea. These hexogen species, whose

names have grown in the last decades, have arrived in Mediterranean Sea at the board of ships – in the water used as ballast – through the Channel Suez and Gibraltar Gorge.

Other species, such as the molluscs and Japanese shells have been voluntary introduced in Mediterranean Sea with the development of aquaculture. The experts say that the global warming will accentuate even more this phenomenon.

In the experts opinion this phenomenon will represent with no doubt a new threat for the biodiversity but at the same time a new source of wealth in certain areas.

There is a need to organize the prevention of unwanted introductions of alien species at the national level, to recognize and evaluate the level of their impacts on native biological diversity, and to define and implement actions to reduce these threats. Several actions in this regard have already been taken. The State Institute for Nature Protection has initiated a project of invasive plant species inventory in cooperation with competent scientists.

Throughout history, man has altered nature by adapting certain species to his needs through breeding and selecting specific properties. Such domesticated animals and plants also represent a part of biodiversity. Over thousands of years, numerous domesticated species have adapted to man-made habitats, developing “local” varieties of cultivated plants and “ecotypes” of domesticated animals. The protection of biodiversity implies keeping records of indigenous sorts of cultivated plants and breeds of domesticated animals in individual countries and their conservation. These sorts and breeds, adapted to the local climate, are more resistant to disease and often very well incorporated into the surrounding nature and landscape. Due to the great efforts and knowledge of numerous generations invested into their creation, they also represent national cultural heritage.

The main causes of threats to forests in Croatia include: pollution of air, soil and water (fir is the most affected species), change in water regimes due to water management activities in lowland forests (common oak forests are threatened) as well as construction of roads through large forest complexes.

Underground habitats and species are extremely vulnerable and threatened by external influence. Quarrying and road building, pollution of ground waters, disturbance of animals by lighting in caves open for public and over collecting of underground fauna by amateurs are among the main causes of threat.

Accelerated urbanization and expansion of settlements along the Adriatic coast have a negative effect on preservation of landscape diversity. A strong seacoast expansion trend is noted on the Adriatic coast. Negative changes occurred in rural areas too, mainly due to depopulation, abandonment of traditional ways of land management (expansion of forest vegetation and its spreading over grassland

areas), illegal and uncontrolled construction of mainly holiday houses, but also because of the physical plans with guidelines which did not respect natural environmental characteristics and traditional activities. Level of threat to biodiversity of individual landscape units is also not known, although generally speaking, lowland and coastal landscapes and their biodiversity are undoubtedly among the most endangered. ***The main threats to landscape diversity in Croatia are:***

- Uneven, uniform, and environmentally asynchronous urbanization;
- Huge infrastructure interventions;
- Roads;
- Energy facilities (power plants, accumulations, power lines, pipelines, etc.);
- Water management structures (flow regulation, canals, accumulations retentions, embankments etc.);
- Melioration, condensations, monocultures, destruction of groves, tree alleys and hedgerows;
- Unplanned, environmentally and architecturally inappropriate and inadequate building of housing, holiday and tourist facilities at prominent locations of landscape, and in particular;
- Undefined institutional framework for landscape conservation;
- Lack of specialists for this area;
- Insufficient coordination and cooperation among various government and local administration bodies.

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A significant increase and development of tourist capacities and activities and a large concentration of people often endanger valuable habitats and sensitive ecosystems as well as plants and animals species. Due to the fact that Croatian coast and islands are still oriented to the mass tourism, the pressure on national areas, especially national and nature parks which are situated near the coast and on the islands has been increased.

4. CONCLUSIONS

In conclusion, a great diversity of habitats is distributed between the plains, mountain and coast areas of Croatia. The variety of the geomorphologic forms permits a tridimensional distribution of the habitats, in this way contributing to the wealth of the habitats. It is exceptional to find such a diversity of habitats in a small country like Croatia. Many categories of habitats are specific to Croatia, such as calcareous habitats or stones and rocks.

As other countries of the world Croatia also developed a national classification of habitats with the purpose of promoting the diversity of its habitats and some specific characteristics as the marine ones.

Biodiversity in Croatia analysed through this article is based on the movement of tourist flows to the major tourist destinations in Europe and the world at a rate much higher than anthropic resources.