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# The assessment of Floristic Diversity in Narta (Albania)

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**Abstract**

Narta Ecosystem is considered as one of the most important area in Albania based on the high biodiversity values and the number of habitat found there. The natural ecosystem of Narta is characterized by a rich diversity of habitats as lagoon area, delta of Vjosa river, salt marshes, sand dunes, pine forest, islet of Zverneci. The relations between these various types of habitats are of great ecological importance. The studies for this area have shown the importance of the area related to the interesting and specific flora [1]. In many cases the relations between these various types of habitats is of great ecological importance. On the ecological point of view, they form a pathway for dispersion and migration of plant and animal species. All these plant species make up a great national asset with economic and scientific values. Some of them are extremely rare, some others have scientific values, most of them make up widely used economic groups such as the medicinal, aromatic, industrial alimentary and decorative plants [3, 4]. Many species of this area are found in the RED Book of Albania. There are 2 endemic species of orchids. There are 9 flora species, which are considered as rare for Narta. There are 24 different species in different level of threatening scale.

**Keywords**: salt marshes; sand dunes; RED book; orchids; threaten.

## 1. Introduction

From the physic–geographical point of view the Narta area belongs to the Myzeqeja of Vlora Region. It includes the area from the Vjosa Mouth till Triport Cape. The whole area from the Vjosa Mouth, including Bishan-Novosela-Cerkovina-Panaja–Narta–Triport Cape and Adriatic Costa cover a total surface about 15 000 ha, is characterized by the dominance of the coastal, alluvial plain, which lies along the low sandy coasts, often interrupted from the hill massifs of Dajlani (47 m) and Pllaka (81 m).

It is bordered in the north by Vjosa River, includes Zhuka lagoon, agricultural area of Akernia, Narta lagoon and saltpans up to Zverrneci hills in the south. In the east the area is limited by Panaja hills while in the west occurs the Adriatic Sea. Narta is a wetland complex composed by many different habitats including different types of habitats, where the most important are: Narta Lagoon, Vjosa Mouth, Salt marshes of Zhuka-Gryke Pishe, Sand dune, Mediterranean pine forest, Old flow of Vjosa and mud sand flats of the Dajlan-Zvernec – Triport.Cape zone. Referring to the whole Narta Lagoon area, only the northern site of Poro has the status of Natural Managed Reserve..

## 2. Material and Methods

A total of 33 phytosociological relevés were made in the period between 2016 and 2018. The vegetation relevés were made and elaborated according to the standard procedures of the Braun Blanquet methods of phytosociology (Zurich Montpellier), (Braun-Blanquet 1964) [2]. The standard keys for determination of plants and nomenclature of plant species were used Flora of Albania, [8, 9]. For syntaxonomic nomenclature of the higher levels of classification (class, order and alliance) we followed [1, 7, 8]. Species cover-abundance values we followed the Braun Blanquet scale.

## 3. Results and Discussion

### *3.1. Aquatic vegetation.*

These plant communities cover considerable surfaces in the bottoms of the Narta Lagoon (***Ruppietum cirrhosae, Zosteretum noltii***). The main species, which participate in forming of the so-called "*Aquatic Bed* "of the Narta Lagoon are ***Zostera noltii*** and ***Ruppia cirrhosa***. ***Zostera noltii*** is more widely distributed community in this lagoon, giving the physiognomy the "Aquatic Bed "and covering 30-40 % of the total surface of the mudded bottoms of this lagoon. These species, together with the ecological groups of the accompanied species (mainly algae) represent for the Narta Lagoon one of the most important biocenosis [10]. The greatest threat to the "*Aquatic bed* "comes from the industrial installations for salt production in the surroundings [11, 12]. As it was mentioned before, the marshy area was transformed in salt production fields by reclamation.

### *3.2. Sandy dunes vegetation.*

Extensive dunes occur along the coastline of Narta area from the delta of Vjosa river up to the Old Beach of Vlora. This region is known for some of the largest dunes of Albania, "Zverneci hills "; which altitude varies from 1-2 m to 4-5 m. The sandy belt along the coastline is completely bare of vegetation to a length sometimes extending up to 30 m. The lack of vegetation in this belt is a result of the active life of different animals, mainly crustacean species. After the first belt from the sea shoreline, the Phanerogamy vegetation appears in mudded belt, at the sandy belt area, which is already washed away by the considerable amounts of salt as a result of rainwaters [11]. Pioneer species, ***Cakile maritima, Xanthium strumarium subsp. italicum, Salsola kali*****,** isolated at the first part of this belt, become more frequent when leaving the coastline. The vegetation of this sandy belt belongs to the pioneer association ***Cakilo-Xanthietum italici***. Gradually, going away from the coastline and as the altitude of sandy dunes is increasing; the physiognomy of vegetation is composed by species as ***Ammophila arenaria subsp arundinaceae*****,** ***Elymus farctus*****,** ***Echinophora spinosa*** etc. On sand dunes, these species are considered as important dune building plants. ***Ammophila arenaria subsp. arundinacea*** represents the characteristic specie of the association ***Ammophiletum***. The degradation of sandy dunes and formation of depressions is accompanied by a different vegetation, dominated mainly by ***Sporobolus punges***, characteristic specie of the association ***Sporoboletum***. ***Ammophiletum*** association constitutes the last most evolved phase of the vegetation of sandy dunes or the borderline between dune vegetation and the Mediterranean pine forests. These forests occupy a considerable part of the Narta area, extending parallel with dune systems of this area. These forests are relatively of a young age, cultivated (30-40 years ago) recently in order to stabilize the sandy dunes and protect the agricultural lands. The physiognomy of this formation is composed by the species ***Pinus maritima, P. pinea, P. pinaster*** (tall ligneous trees, the height of 10 year trees is about 5-7 m and the cover about 70-80% of total area). The shrub layer is represented by typical Mediterranean species such as ***Pistacia lentiscus, Erica manipuliflora, Myrtus communis*** etc, characteristic species of the **C*lass Quercetea ilicis***. (covering 40-50 % of total area, shrub < 2 m). At the Soda forest, the shrub layer is totally absent. The reason is a very high density of woody layer. These forests appear to be quite damaged in many sectors especially at old beach of Vlora. A special interest in this formation represent the presence of the endemic species such as ***Orchis albanica*** *Goelz & Reinhard* as well as a hybrid form ***Orchis x paparisti***. Between these plant communities (sandy dunes vegetation and Mediterranean Pine forests), there are some cultivated belts, dominated by some introduced species such as ***Acacia saligna*** (a large part of this belt was burned last year, near of Vjosa delta river), ***Agave americana*** (about 200 m at Zverneci beach)

### *3.3. Salt Marshes Vegetation*

This vegetation is distributed widely in the natural ecosystems of Narta. Salt marshes and their associated plant communities are found extensively around the coastline of Narta Lagoon, in southern part of Vjosa river (mostly near the delta of Vjosa river or estuary), in both side's inlets canals which connect the Lagoon with Adriatic Sea. Large areas of salt marshes vegetation are found also in depressions behinds sand dunes and alluvial plain (Panaja region). Salt marshes and their complex, and often highly productive mosaic habitats support large populations of migrating and wintering waterfowl, which is should be considered as the most obvious reason for

their conservation interest. Salt marshes content of number of plant communities in different level of tolerance to sea floods. Species composition of these plant communities, is relatively simple with only a few species able to tolerate the stressful environmental conditions. Some of the species occurred in this area, such as ***Salicornia spp., Arthrocnemum spp., Salsola soda, Limonium spp***., are oftenly present in mono specific stands. However, as the number of tides covering the marshes has been reduced while their level has increased, the species composition becomes increasingly more complex and variable [5]. Furthermore, there are mosaics of different community types found within a small area. The distribution of the plant communities does not follow a linear scheme compared to that found in sandy dunes vegetation. In the recent years the salinity level increased due to the extensive erosion and lost of the depressions. The plant communities of the class ***Thero- Salicornietea*** and ***Juncetea maritimi*** cover a large surface in these stations. These communities, whit dominant species as ***Arthrocnemum fruticosum, A. perenne, A. glaucum, salicornia europea, Salsola soda, Juncus acutus, Juncus maritimus, Inula crithmoides, Limonium vulgare, Artemisia coerulescens, Halimione portucaloides,*** are distributed widely in the saltmarshes of the Narta area. The cover of vegetation in these stations is generally high (70-80 % of the total surface). The association ***Schoeno- Erianthetum*** dominated by ***Erianthus ravennae*****,** ***Schoenus nigricans*** etc (vegetation cover 50-60 %) occurs in large flat areas of sand zones behind Pine forests. In smaller area (on sandy and muddy flats), there are also found the associations ***Holoschoenetum romani,*** dominated by ***Scirpus holoschoenus***, ***Schoeno-Plantaginetum crassifoliae***, dominated by ***Plantago crassifolia*****,** ***Schoenus nigricans*****,** etc. (vegetation cover: 30-40 %) and ***Vitici-Tamaricetum dalmaticae***, dominated by ***Tamarix dalmatica***.

*3.4. The Hydro – Hygrophilic Vegetation.*

This vegetation type is spread mainly along the flow of Vjosa river, on the banks of the different channels, etc. The main species, participating in the forming of the hydro - hydrophilic vegetation are Phragmites australis, Typha angustifolia, T. latifolia, Scirpus lacustris, S. maritimus and Salix spp. The communities dominated by Phragmites australis are distinguished for a wider ecological tolerance to be increased level of the salinity in this area. Their distribution is quite fragmented and does not play any visible role in the general plant physiognomy of the natural ecosystem of Narta. The plant communities dominated by the species mentioned above are: Phragmitetum communis, Typhetum angustifoliae and latifoliae, Scirpetum lacustris, Bolboschoenetum maritimi, Salicetum albae – fragilis albanicum. This plant community belong to the class Phragmitetea and Salicetea purpureae. (vegetation cover about 70 –80 %). They often have the monophytic tendencies without any visible role in the general plant physiognomy of the natural ecosystem of Narta.

*3.5. Endemic species*

The understanding of pure sense of "Endemism" includes those species that are geographically distributed only inside of the study area. Endemism is generally related with geographical isolation and this is not the case for fauna species occurring in Narta site area. Although the flora of this area represents a high level of endemism. There are 2 endemic species of orchids:

***Orchis albanica*** Goelz & Reinhard.

***Orchis x paparisti*** Goelz & Reinhard

**Albanian orchid (Alb: Salepi Shqiptar)** Fam. *Orchidaceae* - Salepore. Endemic species for Albania, perennial, 18-20 cm high, flowers in white, pink to violet color, flowering period April – May. It occurs in Pishe Poro (Narta area) and in the Soda forest (Vlora).

*3.6. Rare species*

Rare species are generally ones of the categories of endangered species, since being rare means being under certain risk of stochastic events such as harsh climate, competition with other animals or human induced actions. A sudden change could seriously put this category of species under the survival question. In our case, we would understand with "Rare Species", only those that are considered as rare species in local and national geographical level. There are nine flora species, which are considered as rare for Narta Lagoon. The following list gives the scientific names of those species:

***Ephedra distachya*** L.

***Marsilea quadrifolia*** L.
***Narcissus poeticus*** L
***Nymphaea alba*** L.
**Nuphar lutea** (L). Sibth. & Sm.
***Nymphoides peltata*** O. Kuntze.
***Baldellia ranunculoides*** (L.) Parl.
***Desmazeria marina*** (L.) Drude.
***Pancratium maritimum*** L.
***Ephedra distachya,*** Fam. ***Ephedraceae***. Shrub up to 0.5 m. A northwest Mediterranean species with red fruits with two seeds. Flowering period May - June; Fructification: June - July. It is occurred in rocky areas and sandy dunes of Vjosa river delta up to Treport – Vlore. It is also used as medicine plant thus the number has been decreased considerably especially in the sandy dunes areas du to the recent overexploitation by the local population.
***Marsilea quadrifolia*** L. (Alb: Marsilie), Fam. ***Marsileaceae***. Perennial, flowering period July–Sept.. It occurs in pond with stagnative waters and wetland areas.
***Nuphar lutea*** (L). Sibth. & Sm. (Alb: Lekoi i verdhe) Fam. ***Nymphaeaceae***. Perennial, floating leaves, while the sank ones in heart shape. Flowers in yellow color flowering above the water level. Flowering period May - August. It occurs in fresh water ponds of old river Poro-Narte. European – Asian species. It is used for decoration purposes as well as medicine plant.
***Nymphaea alba*** L. (Alb: Lekoi i bardhe) Fam. ***Nymphaeaceae:*** Perennial with big white flowers. Flowering period April - October. It occurs in fresh water ponds of old river Poro-Narte. European – Asian species. It is used for decoration purposes as well as medicine plant.
***Desmazeria marina*** (L.) Drude. (Alb. Desmazere-bregdetare) Fam. ***Graminaceae***.
Herbaceus plant. Flowering period April - May. It is found in dry areas along the coastline of Vjose-Treport. Mediterranean – Atlantic species.
***Pancratium maritimum*** L. (Alb. Zambaku i detit) Fam. ***Amarylidaceae***.
Herbaceous perennial plant with bulb. Long leaves. White flowers in umbrella shape. Flowering period July – September. It is found in sandy areas of the coastline from Vjosa river delta up to "Plazhi i vjeter" Vlora. Steno-mediterranean species. It is found in area with high level of human activity especially in beach areas, thus this plant became a rare species.

***Threatened species***

Regarding to flora species, there are 24 different species in different level of threatening scale, among which the two endemic species of Fam. ***Orchidaceae***.
Oak, ***Quercus robur,*** (Fam. *Fagaceae*- Ahore), Evropean – Caucasian species, is included among the other species at the list of threatened species to be extinct (Ex). This species has very commonly distributed in the Narta area establishing massive forest areas. Nowadays, it is almost extinct from the Narta area. There are only a few individuals near by Poro forest. Thus, the immediate protection measures are necessary.
List of flora species and the threatening status, is presented in the following table:

**Table 1.** List of endangered flora species in Narta area

| No. | Latin Name | Threatened status according to IUCN |
|---|---|---|
| 1 | ***Agrimonia eupatoria*** L. | **E** |
| 2 | ***Anacamptis pyramydalis*** (L.) Rich. | **E** |
| 3 | ***Ammophila arenaria*** (L.) Lb. | **E** |
| 4 | ***Baldellia ranunculoides*** (L.) Parl | **V** |
| 5 | ***Butomus umbellatus*** L. | **V** |
| 6 | ***Cladium mariscus*** (L.) Pol. | **V** |
| 7 | ***Desmazeria marina*** (L.) Drude. | **E** |
| 8 | ***Elymus farctus*** P.B. | **E** |
| 9 | ***Ephedra distachya*** L. | **E** |

| | | |
|---|---|---|
| 10 | ***Hydrocotile vulgaris*** L. | **E** |
| 11 | ***Hypericum perforatum*** L. | **E** |
| 12 | ***Marsilea quadrifolia*** L. | **V** |
| 13 | ***Nymphaea alba*** L. | **V** |
| 14 | ***Nuphar lutea*** (L). Sibth.& Sm. | **V** |
| 15 | ***Nymphoides peltata*** O.Kuntze. | **V** |
| 16 | ***Orchis albanica*** Goelz & Reinhard. | **E** |
| 17 | ***Orchis x paparisti*** Goelz & Reinhard | **E** |
| 18 | ***Orchis coriophora*** L | **E** |
| 19 | ***Origanum vulgare*** L. | **E** |
| 20 | ***Pancratium maritimum*** L. | **E** |
| 21 | ***Quercus robur*** L. | **Ex?** |
| 22 | ***Serapias lingua*** L. | **E** |
| 23 | ***Spiranthes spiralis*** Koch. | **E** |
| 24 | ***Stachys maritima*** L. | **E** |

*3.7. Ecological interest of Narta area*

The natural ecosystems of in many cases Narta site are characterized by: a rich diversity of habitats: estuaries, lagoons, river delta, tidal mud flats, salt marshes, sand dunes and beaches, Zverneci island, cliffs and the pine forest, where different kinds of combinations and qualities occurs. In most of the cases the relations between the various types of habitats are of great ecological importance. In addition, many of the above mentioned habitats are specific to Narta site and cannot be found anywhere else. In the ecological point of view, they represent a natural "biocorridor" for dispersion of plant species. Salt marshes are characterized by very specific plant species, especially dominated by the succulent species. In pine forest, two endemic plant species are found: ***Orchis albanica*** and ***Orchis x paparisti***. Many rare and endangered plant species occur inside the Zverneci islet, in the southern part of the Lagoon, covered by evergreen forest of ***Cupressus sempervirens***, a unique forest in Albania.

*3.8. Sensitivity of different habitats*

The diversity of habitats is the specific characteristic of this area explaining the high species richness. The most important key habitats are situated in the half western part of the site. This includes western part of Narta lagoon, Zverneci island and the small water reservoirs next to it, Pishe-Poro Nature Reserve, Lake of Kallenga, Gryka Plain, Grykpisha Plain, Dellenja Plain, old river bed of Vjosa, downstream and estuary of Vjosa River, the littoral belt of sand dunes, and the most western part of the salty land next to Pishe-Poro Reserve.

A variety of natural and semi-natural habitats (estuarine, riverine, lacustrine and palustrine) are still well preserved there. They are offering critical important habitats (reproduction, shelter and hunting place) for all threatened species. The small water reservoir in the south of Zverneci Island provides an important freshwater source and hunting place for a number of species, particularly for bats. Water habitats are very important for water snakes, ***N. natrix*** and ***N. tessellata,*** water turtles as ***E. orbicularis*** and ***M. caspica.*** The wetland type of habitats as well as those ones with fresh water present in this area (canals, small ponds, wetlands and rivers) are of crucial importance for the living conditions of all amphibian species, serving as feeding, reproduction, escape and hiding from predators, etc.

Nowadays. the sensitivity level of all these habitats is very high, because they actually represent only a small portion of the former natural habitats range extended throughout the site until the beginning of the last century. Therefore, putting them under an appropriate protection and management scheme is a priority objective of the management plan of the site.

*3.9. Lagoons*

It is the predominant and more sensitive habitat in Narta site. It is composed by Narta lagoon, Zhuka lagoon. They offer good habitats for wintering birds, but there are not suitable sites for nesting of water birds.

***Narta Lagoon***

It is a shallow eutrophicated lagoon. It suffers from (i) pollution and (ii) partial drought periods.
(i) Pollution: The pollution composition is of organic and non-organic base. The organic pollution is considerably increased by discharge of sewage waters of Vlora City and Narta village in the southern-eastern part of the lagoon. Furthermore, the canal brings also other type of pollutants as solid wastes (plastic containers, sacks, bottles), pesticide and insecticide containers, etc. Industrial inorganic pollution needs further verification, but it used to be a major problem in the past. An abandoned PVC factory left toxic wastes in a basin situated the southern part of the complex, divided with the lagoon by a dike. (*During the expert's field trips, birds were using the basin for feeding and roosting, showing thus a lesser concentration of pollutants*). On the other hand, a considerable amount of waste is discharged into the seawaters. It is most likely that some amount of waste enters into the lagoon through the communication channels. An evaluation of pollutants in the basin and the lagoon is a point of particular concern.
(ii) The lagoon is linked to the sea via two channels. Sedimentation is rather strong and channels are often filled up with sand. Their maintenance is done by private enterprises dealing with fisheries. When the channels are closed the lagoon suffers drought periods. This process speeds up due to salt industry intervention, which during summer takes water from the lagoon. Its intervention could be rather disastrous to the lagoon during the period, when the channels are closed, bringing the water levels in their lowest levels. In summer of 1995, due to the closure of channels and Salinas intervention, more than 50% of the lagoon surface was totally dry causing high levels of eutrophication and massive death of fish stock. But the real impact of the Salinas industry and the local agriculture needs to be further investigated by hydrological studies.

## 5. Conclusions

Based on the data provided above, we can conclude that although strongly modified by human activities, Narta Protected Landscape is still char- acterized by a high diversity of community types. Our data shows that this diversity is related not to the richness of the flora, that is not exceptional for a Mediterra- nean area, but to a complex interaction between morphological and geological features. In turn, this complexity determined the presence of many species found in the RED Book of Albania, 2 endemic species, and some other rare and threaten. Besides the importance of the area on national and to some extend international level, the data about species composition, population numbers and its changes over time are having considerable gaps of information. It results mainly by the lack of expeditions and monitoring programs at this area.

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