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Sandy Dunes Vegetation in Narta

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Abstract

Extensive dunes occur on exposed coastline of Narta area from Vjosa mouth till Old Beach of Vlora. This region in particular has some of the largest dunes anywhere in Albania, with one of the largest expanses at " Zverneci hills ".

The sandy belt along the coastline is completely bare of vegetation to a length sometimes extending up to 30 m.

The Phanerogamic vegetation appears after this nudded belt, in a sandy belt already washed away by the considerable amounts of salt as a result of rain waters.

Pioneer species *Cakile maritima, Xanthium strumarium subsp. italicum, Salsola kali*, at the beginning isolated 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 high of sandy dunes is increased, the physiognomy of vegetation is imparted by the species *Ammophila arenaria subs parundinaceae, Elymu sfarctus, Echinophora spinosa* etc. 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 are relatively going, cultivated (30-40y ago) recently in order to stabilize the sandy dunes and protect the agricultural lands.

The physiognomy of this formation is imparted by the species *Pinus maritima, P.pinea, P. pinaster* .The shrub layer is represented by typical Mediterranean species such as *Pistacia lentiscus, Erica manipuliflora, Myrtus communis*etc, characteristic species of the *Class Quercetea ilicis*. At the soda forest the shrub layer totally absents. The reason is a very high density of woody layer. These forests appear also very danger in many sectors (old beach of Vlora. Special interest in this formation present the endemic species such as *Orchis albanica Goelz&Reinhard* as well as a hybrid form *Orchis x paparisti*.

Keywords: Sandy dunes, Phanerogamy, Mediterranean pine forests, Endemic species.

1. Introduction

The studies mentioned above, even current data reflect, that the Narta area is a very important zone, especially by the presence of special flora and a diversity of habitats. The flora and vegetation of this area is very interesting. It is very rich in plant 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 value and most of them make up widely used economic groups such as the medicinal, aromatic, industrial alimentary and decorative plants.

The aim of this study was to describe the basic types of vegetation in this area, and to show global importance of area of Narta and needs for their effective protection.

2. Material and Methods

The vegetation of the Narta area analyzed based on relevés follow the phytosociological method of Zurich-Montpellier school (Braun-Blanquet, 1932, 1964) This analysis conducted with the support of Flora of Albania (Paparisto et al.,1984-2000) and Flora Europaea (Tutin et al., 1964-1980). The nomenclature followed is Paparisto et al.,1984-2000. Number, size, distribution pattern of the stations and transects depend on the size and heterogeneity or diversity of habitats situated in the area of Narta, as well as on the bio-ecological

characteristics of the species or group of species. The GPS used to tell the exact location of stations or transects. The relevés were stored into the TURBOVEG database program (Hennekens&Schaminée 2001). The results of the classification were given in a vegetation table.

3. Results and Discussion

Our phytosociological research in the area Narta has recorded 10 associations. Sintaxonomical review is presented

1. CAKILETEA MARITIMAE Tüxen&Preising ex Br.-Bl. &Tüxen 1952

Euphorbietalia peplis Tx.ex Oberd. 1949

Euphorbion peplis Tx. ex Oberd. 1952

2. Cakilo - Xanthietum strumarii(Beg. 1941) Pign. 1958

Medicagini marinae-Ammophiletum australis Br.-Bl. 1921 corr. F. Prieto & T.E. Díaz 1991

3. ARTHROCNEMETEA Br.- Bl. et Tx. 1943 corr. Bol. 1957

Arthrocnemetalia fruticosi Br.-Bl. 1931 corr. Bol. 1957

Arthrocnemion fruticosi Br.-Bl. 1931 em. Riv. Mart. et al. 1980

4. Puccinellio festuciformis-Arthrocnemetum fruticosi (Br.-Bl. 1928) Géhu 1976(= Salicornietum fruticosaeBr.-Bl. 1928)

5. Limonietalia Br.-Bl. & O. Bolòs 1957

Limonion angustifolii Br.-Bl. (1933) 1934

Limonio-Artemisietum coerulescentis Horvatić (1933) 1934

6. JUNCETEA MARITIMI Br.-Bl. 1952 em. Beeft ink 1965

Juncetalia maritimi Br.-Bl. 1931 Juncion maritimi Br.-Bl. 1931

Juncetum maritimo-acuti Horvatic 1934

7. Populetalia albae Br.-Bl. ex Tchou 1948

Populiona lbae (Br. Bl. 1931) Tchou 1948

Populetum albae (Br. Bl. 1931) Tchou 1948

Table 1. Assoc *Cakilo-Xanthietum strumarii* Beguinot 1941, Pign. 1953

Numberofreveals	1	2	3	4	5	6	**Dominance**
Distance from the sea (m)	30	30	50	50	30	30	
Relevessurphace (m^2)	25	25	25	36	36	50	
Abundance (%)	25	15	20	20	25	25	
Abundance-Dominance	**A-D**	**A-D**	**A-D**	**A-D**	**A-D**	**A-D**	
Main sp of assoc.							
*Cakile maritima*Scop.	1.1	2.2	2.2	1.1	1.1	1.1	V
*Xanthium italicum*Mor.	2.2	2.2	1.1	1.1	1.1	1.1	V
Species of Cl. Cakiletea							
Salsola kali L.	1.1	1.1	1.1	-	1.1	1.1	V
*Euphorbia peplis*L.	1.1	-	2.2	1.1	-	1.1	IV
*Polygonum maritimum*L.	-	-	1.1	1.1	1.1	-	III
Species of Cl. Ammophiletea							
*Euphorbia paralias*L.	2.2	1.1	1.1	1.1	1.1	1.1	V
Elymus farctus(L.) P.Beauv.	-	-	1.1	2.2	1.1	1.1	IV
*Eryngium maritimum*L.	-	1.1	1.1	1.1	-	2.2	IV
*Echinophora spinosa*L.	1.1	1.1	1.1	-	1.1	2.2	IV
Convolvulus soldanella L.	1.1	1.1	-	-	1.1	+	IV
Sporoboluspungens(Schreber)Kunth	1.1	-	1.1	-	1.1	-	III
Others							
*Inulacrithmoides*L.	1.1	1.1	-	1.1	-	1.1	IV
*Lagurusovatus*L.	-	-	-	-	+	1.1	II
Cuscutasp	-	-	+	-	-	+	II

Table 2. Assoc*Cakilo-Xanthietumstrumarii* Beguinot 1941, Pign. 1953

Nr. of releves.	1	2	3	4	5	Prania
Releves surphace. (m2)	10	20	30	60	50	
Dominance. (%)	70	80	60	90	90	
Abundance-Dominance	A-D	A-D	A-D	A-D	A-D	
Main species.						
Arthrocnemum fruticosum (L.)Moq.	4.4	3.3	4.4	3.3	3.3	V
*Puccinellia festuciformis (*Host.) Parl	1.1	1.1	1.1	+	1.1	V
Sp. *Arthrocnemetea, Arthrocnemetalia and Arthrocnemion*						
Limonium vulgare Miller	1.1	1.1	1.1	+	1.1	V
Inula crithmoides L.	+	-	+	+	+	V
Halimione portulacoides (L.) Aellen	1.1	+	-	+	-	IV
Artemisia coerulescens L.	1.1	-	1.1	+	+	IV
Arthrocnemum glaucum (Delile) Ung.-Sterng.	+	+	1.1	-	+	IV
Sp. of Cl. Juncetea maritimi						
Juncus maritimus Lam.	+	+	-	+	1.1	IV
Juncus acutus L.	1.1	1.1	-	+	-	III
Suaeda maritima (L.) Dumort	-	+	+	+	-	III
Parapholis incurva L	-	+	+	-	-	II
Plantago crassifolia L.	+	-	-	+	-	II
Plantago coronopus L.	-	-	-	+	+	II
Salsola soda L	-	+	-	-	-	I
Sp. of Cl. Phragmito - Magnocaricetea						
Phragmites australis(Cav.) Trin &Stendel	-	+	+	-	+	III
Others						
Tamarix dalmatica Baum	+	+	+	+	1.1	V
Dittrichia viscosa L.	+	+	+	-	1.1	IV

Table 3. Assoc. *Limonio-Artemisietumcoerulescentis*Horvatic (1933) 1934

Nr. of releves.	1	2	3	4	5	6	Prania
Relevessurphace. (m2)	25	25	25	36	36	50	
Dominance (%)	25	15	20	20	25	25	
Abundance-Dominance	A-D	A-D	A-D	A-D	A-D	A-D	
Main species ofassosiacion							
Limonium vulgare Miller	4.4	4.4	5.5	3.3	5.5	5.5	V
*Artemisia coerulescens*L.	1.1	+	1.1	+	+	1.1	V
Sp. *Arthrocnemetea, Arthrocnemetalia*							
Limonium vulgare Miller	1.1	1.1	1.1	+	1.1	+	V
Inula crithmoides L.	+	-	+	+	+	1.1	V
Halimione portulacoides (L.) Aellen	1.1	+	-	+	-	1.1	IV
Artemisia coerulescens L.	1.1	-	1.1	+	+	+	IV
Arthrocnemum glaucum (Delile) Ung.-Sterng.	+	+	1.1	-	+	+	IV
Salicornia europaea L.	-	1.1	+	-	-	-	II
Suaeda maritima (L.)Dumort	+	-	-	+	-	-	II
Astertripolium L.	-	+	-	+	-	-	II
Salsola soda L	-	+	-	-	-		I
Sp.of Cl. Juncetea maritimi							
*Juncus maritimus*Lam.	+	+	-	+	1.1	-	III
Juncus acutus L.	1.1	1.1	-	+	-	+	III
Parapholis incurva L	-	+	+	-	-	+	III
Plantago crassifolia Forscal.	+	-	-	+	-	-	II
Plantago coronopus L.	-	-	-	+	+	-	II
Tamarix hampeana Boiss & Heldr	+	-	-	-	-	+	II
Sp. of Cl. Phragmito - Magnocaricetea							
Phragmites australis(Cav.) Trin. &Stendel	+	+	+	-	+	1.1	V
Scirpus maritimus L.	+	+	+	+	1.1	-	V
Tamarix dalmatica Baum	-	+	+	+	-	+	IV
Other							

Dittrichia viscosa L.	+	+	+	-	1.1		IV

Table 4. Associacion *Juncetummaritimo-acuti* Horvatič 1934

Nr. of releves.	1	2	3	4	5	6	7	**Dominance**
Releves surphace. (m2)	50	50	50	50	50	50	50	
Dominance. (%)	50	50	50	60	40	50	50	
Abundance-Dominance	A-D	A-D	A-D	A-D	A-D	A-D	A-D	
Main species ofasoc.								
Juncus acutus L.	2.2	2.2	1.1	3.3	1.1	2.2	2.2	V
Juncus maritimus Lam.	1.1	1.1	3.3	1.1	2.2	1.1	1.1	V
Sp. of Cl. Junceteamaritimi								
Scirpus holoschoenus L.	1.1	-	+	+	1.1	+	+	V
Tamarix dalmatica Baum	1.1	+	+	+	+	+	-	V
Plantago crassifolia Forscal	+	-	+	+	+	-	-	III
Plantago coronopus L.	-	+	+	-	+	-	+	III
Parapholis incurva(L.) C.E.Hubb.	+	+	-	+	+	-	-	III
Agropyron pungens (Pers.) R. & S.	-	+	+	-	-	+	+	III
Blackstonia perfoliata (L.) Huds	+	+		+	-	-	-	II
Limonium oleifolium Miller	-	+	+	-	-	-	+	II
Cynanchum acutum L.	+	-	+	-	+	-	-	II
Tamarix hampeana Boiss&Heldr	+	+	-	-	-	-	+	II
Juncus subulatus Forschal	-	+	-	+	-	+	-	II
Polypogon monspeliensis L.Desf	-	-	+	-	-	-	+	II
Aster tripolium L.	-	-	-	-	-	+	+	II
Aeluropus littoralis (Gouan)Parl.		+	-	-	-	+	-	II
Elymus pycnanthus Godron	+	-	-	-	+	-	-	II
Linum maritimum L.	-	-	-	+	-	-	-	I
Triglochin bulbosa L	-	-	-	-	-	-	+	I
Sp. of Cl. Arthrocnemetea								
Inula crithmoides L.	-	1.1	-	+	+	+	1.1	IV
Arthrocnemum fruticosum Moq	1.1	-	+	+	-	1.1	+	IV
Limonium vulgare Miller	1.1	-	+	+	+	-	+	IV
Artemisia coerulescens L.	+	-	+	+	+	-	-	III
Puccinellia festuciformis (Host.)Parl	+	+	+	-	-	+	+	III
Halimione portulacoides (L.) Aellen	-	-	+	+	-	+	+	III
Suaeda maritima (L.) Dumort	+	+	-	-	-	-	+	II
Arthrocnemum perenne Millex.Moss	-	-	+	-	-	-	+	II
Arthrocnemum glaucum Delile	-	-	+	-	-	-	+	II
Sp. of Order. Phragmitetalia								
*Phragmitesaustralis (*Cav.) Trin. &Stendel	1.1	1.1	1.1	+	-	1.1	+	V
Scirpus maritimus L.	1.1	-	+	+	-	1.1	+	IV
Equisetum ramosissimum L.	+	-	+	+	+	1.1	-	IV
Scirpus lacustris L.	1.1	-	+	+	+	-	+	IV
Chenopodium album L.	-	-	+	+	-	+	+	III
Foeniculum vulgare Miller	-	-	+	-	-	-	+	II
Piptatherum miliaceum(L.) Cosson	+	-	-	-	+	-	-	II
Sorghum halepense(L.) Pers	-	+	-	-	+	-	-	II
Phalaris arundinacea L.	-	-	-	+	-	+	-	II
Typha angustifolia L.	-	-	-	-	-	+	+	II
Others								
Dittrichia viscosa L.	1.1	-	-	+	-	1.1	+	III
Cynodon dactylon L.	+	+	+	-	-	-	+	III
Melilotus alba Medic.	-	+	-	+	+	+	-	III
*Vitexagnuscastus*L.	-	-	-	-	+	+	-	II
Daucus gutattus L.	+	-	-	-	-	-	+	II
Xanthium strumarium L.	-	-	+	+	-	-	-	II
Hordeum murinum L.	-	+	+	-	-	-	-	II

Potentilla reptans L.	-	-	-	+	+	-	-	II
Aster squamatus L.	+	-	-	-	-	+	-	II
Plantago lanceolata L.	-	-	-	-	-	+	+	II
Ononis variegata L.	-	-	+	+	-	-	-	II
Trifolium pratense L.	-	-	+	+	-	-	-	II
Calystegia sepium (L.) R.. Br	+	-	-	-	-	-	-	I
Arundo donax L.	-	-	+	-	-	-	-	I
Samolus valerandi L.	-	+	-	-	-	-	-	I
Lythrum salicaria L.	-	-	-	+	-	-	-	I
*Lotust enuis*W.&K.	+	-	-	-	-	-	-	I

8. FraxinionangustifoliaePedrotti 1970

Alnoglutinosae–Fraxinetumoxycarpae (Br. Bl. 1915) Tchou 1946.

9. QUERCETEA ILICIS Br. Bl. 1947

Pistacio lentisci – Rhamnetalia alaterni Rivas – Martinez 1975

Juniperion turbinatae Rivas – Martinez 1975 corr. 1987

Pistacio lentisci-Juniperetum macrocarpae Caneva, De Marco e Mossa (1981)

Quercionilicis (Br. Bl. 1936) Riv. Martinez 1975

10. Pinetumhalepensis-pineae prov.

Pinus maritima, P.pinea, P. pinaster

The presence of a dune system is result of factors, which determine the morphology of a sandy coast: abundant detritus depositing of fluvial or marine origin and presence of strong dominant winds. Moreover, the vegetation present in the area have to be considered as determining factor, since it has, due to its radical apparatus, a fundamental role in the consolidation and in the growth of the dune's height.

Perennial plants as a biological type dominate in floristic complexes, though in some cases (mainly on the beaches) the dominants are pioneer annual plants (*Cakile maritima, Salsola kali or Euphorbia peplis*). Analyzing the transversal profile of a dune (Uslu&Géhu 1990), starting from the shoreline, where the waves break, and continuing towards the inner part of the shore, one can observe a sequence of vegetation clusters which determine various habitats and various stages of growth of the dune's sandbar. In accordance with the specified definition of psammophytic vegetation succession dynamics and stages of dune formation, the following parts of the dune complexes have been evidenced: The higher parts of the beaches with pioneer vegetation Embryonic dunes Shifting dunes Pioneer vegetation on the higher parts of the beaches. The first vegetation clusters, found along the shore, find location at a distance from the sea, which safeguards them from the action of the wave-motion, and where sea storms may reach them only in rare cases. This association represents the first stages of development of littoral psammophytic vegetation in the higher beach places. Despite the poor floristic composition, the total abundance of the species is often very low. Pioneer plants are so called because they are the first plants capable of colonizing this type of hostile environment. The hostility is caused by strong thermal *Pinetum Pistacio lentisci – Juniperetum macrocarpae Medicagini marina – Ammophiletum australis, Euphorbio paraliae, Agropyretum Eryngio-Sporoboletum virginici, Cakilo – Xanthietum strumarii*.

Stabile dunes with, *Juniperusmacrocarpa* and *Pinuspinaster, P. halepensis, P. pinea*. White mediterranean dunes with *Amophylaarenaria* changes, poorness of water and finally, because of the variable saline content. The most representative plants among them are *Cakile maritima, Salsola kali, Inula crithmoides* and *Xanthium strumarium.*

Embryonic dunes.

Gradually going away from the coast line and as the height of sandy dunes is increased, the physiognomy of vegetation is imparted by the species *Eryngium maritimum, Euphorbia paralias, Echinophora spinosa, Elymus farctus, Cyperus capitatus, Sporobolu spungens*, that pertain to a more evolved phase of psammophytic

vegetation and from the beaches to the embryonic dunes. This type of vegetation represents a stable "potential" of the sandy banks. The discussed vegetation, in most of the cases, is under human impact determined by the developing tourism, intensive usage and intensive erosion. An obvious result of human impact is the expansive distribution of *Xanthium strumarium subsp. italicum* in the highest beach places and the embryonic dunes. The species was introduced from America and is perfectly adapted in these areas. Shifting dune vegetation. The increase of dune height is accompanied as well with the gradual change of the physiognomy of this vegetation. The highest dunes are colonized by the big tufts of *Ammophila arenaria* which grow especially on the crest of the dunes. This species is the real builder of the dunes. The presence of this species is an important factor in impeding the movement of sand quantities pushed away by the sea winds towards the continent. From this type of vegetation there are noticed two evaluative lines: Retro dune or degradation of sandy dunes and the formation of depressions. The end of depressions is closer to the level of salted ground waters. The ground becomes wetter and different vegetation grows from that of dunes, dominated by *Erianthus ravennae, Scirpus holoschoenus, Schoenus nigricans and Plantago coronopus.*

Mediterranean pine forest: These forests occupy a considerable part of the area distributed mainly on sandy dunes. In generally, they represent relatively young forests, cultivated recently in order to stabilize the sandy dunes and protect the agricultural lands. The physiognomy of this formation is imparted by the species *Pinus halepensis* and *Pinus pinea*. The shrubby layer is represented by typical Mediterranean species. The most spread shrubs in this formation are *Myrtus communis, Juniperus oxycedrus subsp. macrocarpa, Erica manipuliflora* and *Pistacia lentiscus*.. These forests constitute the last most evolved phase of the vegetation of sandy dunes.

On the Narta area, salt marshes are one of the most prevalent habitats around the coastline of Narta Lagoon. Plant species diversity is low, since the flora must be tolerant of salt and anoxic mud substrate. The most common salt marsh plants in Narta area is glasswort (*Salicornia europaea*), which have worldwide distribution. Glasswort is often the first plants to take hold in a mudflat and begin it's ecological succession into a salt marsh. Their shoots lift the main flow of the tide above the mud surface while their roots spread into the substrate and stabilize the sticky mud and carry oxygen into it so that other plants can establish themselves as well. Plants such as sea lavender (*Limonium vulgare*), Spiny rush (*Juncus acutus*) and Sea rush (*Juncus maritimus*) grow once the mud has been vegetated by the pioneer species. The *Salicornia europaea* (pioneer marsh communities) takes place in the space of just a few months between summer and early autumn. Following this layer is a wetland of sea-lavenders (*Limonium vulgare*), saltmarsh-grass (*Puccinellia festuciformis*), perennial glasswort (*Arthrocnemum fruticosum*) and *Halimione portulacoides*. These plants are tolerant of being covered by salt water for long periods. The development of the lower marsh communities is marked by the increasing diversity which follows the arrival of a range of new species. The next stage is the development of the plant communities dominated by Spiny rush (*Juncus acutus*) and Sea rush (*Juncus maritimus*) that cover a large surface in this area. In lagoon stretches enjoying similar conditions, a dense population of sea club-rush (*Bolboschoenus maritimus*) settles instead of the plant communities dominated by Spiny rush.

The development of the salt marshes in terms of plant species and communities is also accompanied by developments in the soil structure and micro-flora. These developments involve the establishment of populations of bacteria and fungi which are involved in biogeochemical processes controlling the breakdown of organic matter and the cycling of plant nutrients. Fresh waters vegetation.

The riparian forests, or alluvial forests, generally are those wooded areas suited to moist soils that cover both the river banks and the areas which are periodically submerged by flooding.

These forests occupy a considerable part of the Narta area. The dominant species of this wood are: the bay-oak (*Quercus robur*), common alder (*Alnus glutinosa*), ash (*Fraxinus angustifolia*), the white poplar (*Populus alba*), the elm (*Ulmus minor*), white willow (*Salix alba*) and the privet (*Ligustrum vulgare*). The area of riparian forests (typical for the region) is declining. The other riparian forests dominated by species such as *Alnu sglutinosa, Fraxinus angustifolia, Quercus ilex* and *Populus alba* can be found fragmentally. The relatively modest density of the vegetation is due to human pressure exerted on the area; building embankments, and poplar fields have greatly changed the original landscape.

This riparian forests includes several types:

1.*Riparian mixed forests.* - Mixed forests of *Quercus robur, Ulmus minor, Alnus glutinosa, Fraxinusangustifolia* are most distributed. The soil may be well drained between inundations or remain wet liable to flooding during regular rising of water level. The undergrowth is well developed.

2. *Riparian common alder forests*. – *Alnus glutinosa* type of riparian forest which require constant soil moisture throughout the year. Tree layer is dominated by *Alnusglutinosa* and rarely accompanied by *Populusnigra, Salix alba.*

3. *Riparian willow formations*. - The various species of willows, especially white willow (*Salix alba*).

- Another interesting association developed with high vitality in humidity and inundate environments in this belt is the one with White Poplar (*Populus alba*). Forest physiognomy is determined by White Poplar. In low humidity environment White Poplar are presented by weak development and very oft en cannot upper the shrubs level.

Formations of *Tamarix spp*., including *Tamarix dalmatica, Tamarix hampeana*, wet areas of fresh water and saline habitats of the Narta area. The relatively modest density of the vegetation is due to human pressure exerted on the area. All types occur on heavy soils (generally rich in alluvial deposits) periodically inundated by the annual rise of the river level, but otherwise well-drained and aerated during low-water.

4. Recomandations

The relations between these various types of habitats is of great ecological importance.

The importance of this area is illustrated by the fact that many of the threatened plant species in the Red Book of Albania occur in this area.

In general, the natural ecosystem of Narta can be seen as an essential part of Europe's natural heritage.

The most important environmental problems along the Narta area include:

- Development of tourism.

Today, the scale of this process is most extensive in Old beach of Vlora. Habitat loss is probably the most important effect. A number of coastal plant species are now believed to have become extinct due to total destruction of their habitats, especially sand beaches and dune areas

- Urban development.

Urbanization is a major space consuming process, still continuing in Soda forest.

- Intensification of traditional use.

Ecological values can be affected seriously by stronger forms of intensification on fishery and water culture, hunting, agriculture, production of salt, etc.

- Reclamation of land and cultivation.

In the past, reclamation was carried out on a large scale in this area.

As elsewhere in coastal region of Albania even in Narta area, forestation with maritime pines (*Pinus maritima, Pinu spinaster* and *Pinus pinea*), has had a major impact on much of the dune landscape throughout the area.

5. References

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