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Research article

Floristic assessment and habitats of community interest in the coastal area Vilun-Rana e Hedhur

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Abstract: From the general floristic analysis, 224 taxa are reported and they represent 182 genera, 75 families and 6.17% of the total Albanian flora. Based on phytosociological relevés carried out in the study area, 9 habitats of community interest are identified, three of which represent prioritar habitats in terms of protection and conservation (Habitats' Directive 92/43/EEC). Communities with *Ephedra distachya* are unfrequent and very small in the study area's sandy dunes. They represent a unique assosation in Albania and in the Mediterranean area.

Keywords: Vilun – Rana e Hedhur, flora, Directive habitat, Albanian Coastal Area

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Introduction

Albania is a small country with a diverse relief in where hilly-mountainous landscape combines with considerable plain and coastal area. The whole country is characterized by an interesting flora, vegetation and habitats of community types, although they survive under anthropologic pressure. Many researchers have contributed to the recognition and description of these natural assets (Mullaj, 1986, 1989, 1990, 1994, 1998; Demiri, 1962; Mullaj & Ruci, 1995; Mersinllari & Hoda, 1985; Imeraj, 2007, etj.)

Supporting the continuation of these works, in this study we bring data on the floristic richness, vegetation and diversity of natural habitats of the coastal area "Vilun - Rana e Hedhur", which lies in the northern part of the Albanian Adriatic coast. It begins 2.9 km south of the Vilun Lagoon and ends at "Guri i Marka Nikës", 3 km north of the city of Shengjin. With a width of approximately 3 km, the area is represented by a sand belt with embryonic sand dunes, with a height of 2-3 m up to 8 m. At the foothill of Mount Renci, the sand dunes reach up to 80 m in height, due to strong winds. Near Shengjin, they are interrupted by a rocky coast and an afforestation area with *Pinus halepensis.* In the depressions behind the sand dunes, where the underground water level is high, patches of hydro or hygrophilous vegetation are present. This composition gives the area the appearance of a very complex, diverse and interesting mosaic, a perfect model, where the vegetation successions are clearly visible.

The dominant geological formations in "Vilun - Rana e Hedhur" are the limestone rocks over which four main soil types are formed: brown soils, alluvial soils, sandy soils and salty soils, which are distinguished by their characteristics and the different vegetation types (Gjoka et al., 2003). Due to the intrusion of seawater and the irregular rainfall regime, the surface area of saline soils and saline lagoonal basins varies greatly in the different seasons during the year (Kabo, 1990-91).

The area is characterized by a warm climate, with an average annual temperature of 15°C. The warmest months

of the year are July and August, with a temperature of 23.6°C, while the coldest month is January with 6.2°C. The maximum temperature values fluctuate from 11.0°C in January to 29.4°C in August, while the minimum ones from 2.8°C in January to 18.2°C in July. Rainfall reaches up to 1360 mm/year; about 66% of their total was registered during the cold season between October-March (Kabo, 1990-91).

Material and methods

The main study of the coastal area "Vilun - Rana e Hedhur" was carried out in 2016, in the framework of a research project financially supported by the Faculty of Natural Sciences/University of Tirana (Figure 1). The data are collected during field work and georeferenced in Garmin GPS 20x. Six field expeditions were carried out in spring, summer and autumn, along a cyclic itinerary Velipoje-Rrjoll-Rana e Hedhur and Rana e Hedhur-Rrjoll-Velipoje. Phytosociological relevés (not reflected in this paper) were carried for the study of habitats of community interest. Identification of habitats is done following the description of habitats in the Interpretation Manual of the European Union (EU, EUR.28). The human pressure activity in the natural habitats of the area, were monitored frequently in period 2016-2022.

Figure 1. Geographical position of the study area.

The collected plants were deposited in the National Herbarium (TIR), Museum of Natural Sciences, while some of them were collected alive for ex-situ conservation in the Botanical Garden. Plant identification is carried out according to the Flora of Albania vol. 1- 4, (Paparisto et al., 1988; Qosja et al., 1992, 1996; Vangjeli et al., 2000) and Flora of Europe vol. 1-5 (Tutin et al., 1964 -1980). Data on life forms and chorology for each species are based on Raunkiaer, 1934; Davis, 1965-1985; Greuter et al., 2008; Tutin et al., 1968-1980, 1993), etc. The nomenclature is updated according to "Euro+Plant Plantbase" (2006-). For the distribution of plant species in Albania, we referred to the atlases of the flora of Albania (Barina et al., 2017; Vangjeli, 2016-18). The obtained results are visually reflected in the graphs and the map of habitat distribution (Figure 3). The maps are generated from Arcmap 10.1 with \ WGS 1984 34N as coordinate system.

Results

Flora of the study area

The floristic analyses indicate the presence of 224 species (see Appendix), which belong to 182 genera and 75 families, thus constituting approximately 6.17% of the flora of Albania (Meço & Mullaj, 2015). The families with the largest number of species are Poaceae (24), Asteraceae (22), Lamiaceae (14), Fabaceae (12), Charyophyllaceae and Chenopodiaceae (9). Species/genus and species/family ratios of 1.2 and 3, respectively, result from an approximate number of species and genera and an almost three times higher number of species compared to the number of families. These indicators clearly show high values of floristic diversity, compared to the indicators of the flora of Albania, which are respectively 3.7 and 20.7. Compared to the flora of the Albanian, where the family with the largest number of species is the Asteraceae (Meço & Mullaj, 2015), we note that the Poaceae prevail in the study area.

18 species are part of the Albanian Red List (VKM, 2013), of which nine have conservation status EN A1b, five VU A1b, three VU A2b and one VU A1c (Table). We note that only nine species of the Albanian Red List have conservation status according to the IUCN. The big difference between the two lists is not only due to the fact that the Albanian Red List is a regional assessment, but also due to the serious endangerment of some species in the Albanian territory, due to the damage to their habitat. The most critical example is *Ephedra distachya* (with conservation status EN A1b) on sand dunes.

Table. Species with conservation status, according to the Albanian Red List (2013) and the IUC.

No	Species	Family	Albanian Red List, 2013	IUCN
1	*Ammophila arenaria* (L.) Link	Poaceae	EN A1b	-
2	*Butomus umbellatus* L.	Butomaceae	VU A1b	LC
3	*Cladium mariscus* (L.) Pohl	Cyperaceae	VU A1b	LC
4	*Ephedra distachya* L.	Ephedraceae	EN A1b	LC
5	*Glaucium flavum* Crantz	Papaveraceae	EN A1b	-
6	*Hypericum perforatum* L.	Hypericacea	EN A1b	-
7	*Juniperus oxycedrus* L.	Cupressaceae	VU A1b	LC
8	*Matthiola tricuspidata* (L.) R. Br.	Brassicaceae	EN A1b	-
9	*Origanum vulgare* L.	Lamiaceae	EN A1b	-
10	*Pancratium maritimum* L.	Amaryllidaceae	EN A1b	-
11	*Periploca graeca* L.	Apocynaceae	EN A1b	-
12	*Populus alba* L.	Salicaceae	VU A2b	LC
13	*Quercus ilex* L.	Fagaceae	EN A1b	LC
14	*Salvia officinalis* L.	Lamiacea	VU A1b	LC
15	*Satureja montana* L.	Lamiacea	VU A1c	-
16	*Stachys maritima* Gouan	Lamiacea	VU A1b	-
17	*Ulmus minor* Mill.	Ulmaceae	VU A2b	DD
18	*Tamarix hampeana* Boiss. & Heldr.	Tamaricaceae	Vu A2b	LC

Hemicryptophytes is the most representative biological form, with about 72 species, followed by therophytes 53 species, phanerophytes 41 species, geophytes 29 species, etc. (Figure 2, b). The relatively large number of therophytes can be explained by the fact that some habitats of the study area, such as dunes and salt marshes, reach extreme drought and salinity conditions. These habitats are populated by a large number of therophytes, which are adapted to live there and to close their life cycle before ecological conditions reach extreme values. Out of 55 species belonging to therophytes, about 30 were found in these extreme habitats.

About 27% and 23% of the flora is represented respectively by Mediterranean and Euro-Mediterranean species, expected result considering the geographical position of Vilun - Rana e Hedhur and its climatic characteristics. Cosmopolitan (12%), Paleotemperate (8%), European (7%) and Eurasian (7%) species occupy a significant percentage (Figure 2, a). The significant presence of invasive species such as: *Symphyotrichum squamatum, Amorpha fruticosa, Dittrichia viscosa* and *Oenothera biennis*, are good indicators of the anthropogenic disturbance of the area (Mullaj et al., 2007).

Graph 'c' of Figure 2 shows the number of species in bloom for each month, which matches with the data of Flora of Albania (Meço & Mullaj, 2015). Thus, even in our study area, June has the highest number of species in blooming (about 155), while the month with the smallest number is December (only 1 species). May (148) and July (147) have almost the same number of species in blooming.

In the ecological group of aquatic macrophytes, it is worth mentioning *Chara canescens*. Its distribution is limited to brackish waters and is included in the Red List of Charophyta of the Balkans, with a VU threat status (Blaženčić et al., 2006). In Albania, so far it has been reported only for this area (Zeneli & Kashta, 2016). *Gloeotrichia natans*, a cyanobacteria in the form of brown mucilaginous spherical masses, found as an epiphyte on *Ruppia cirrhosa* and *Stuckenia pectinata*, has not been previously reported for Albania.

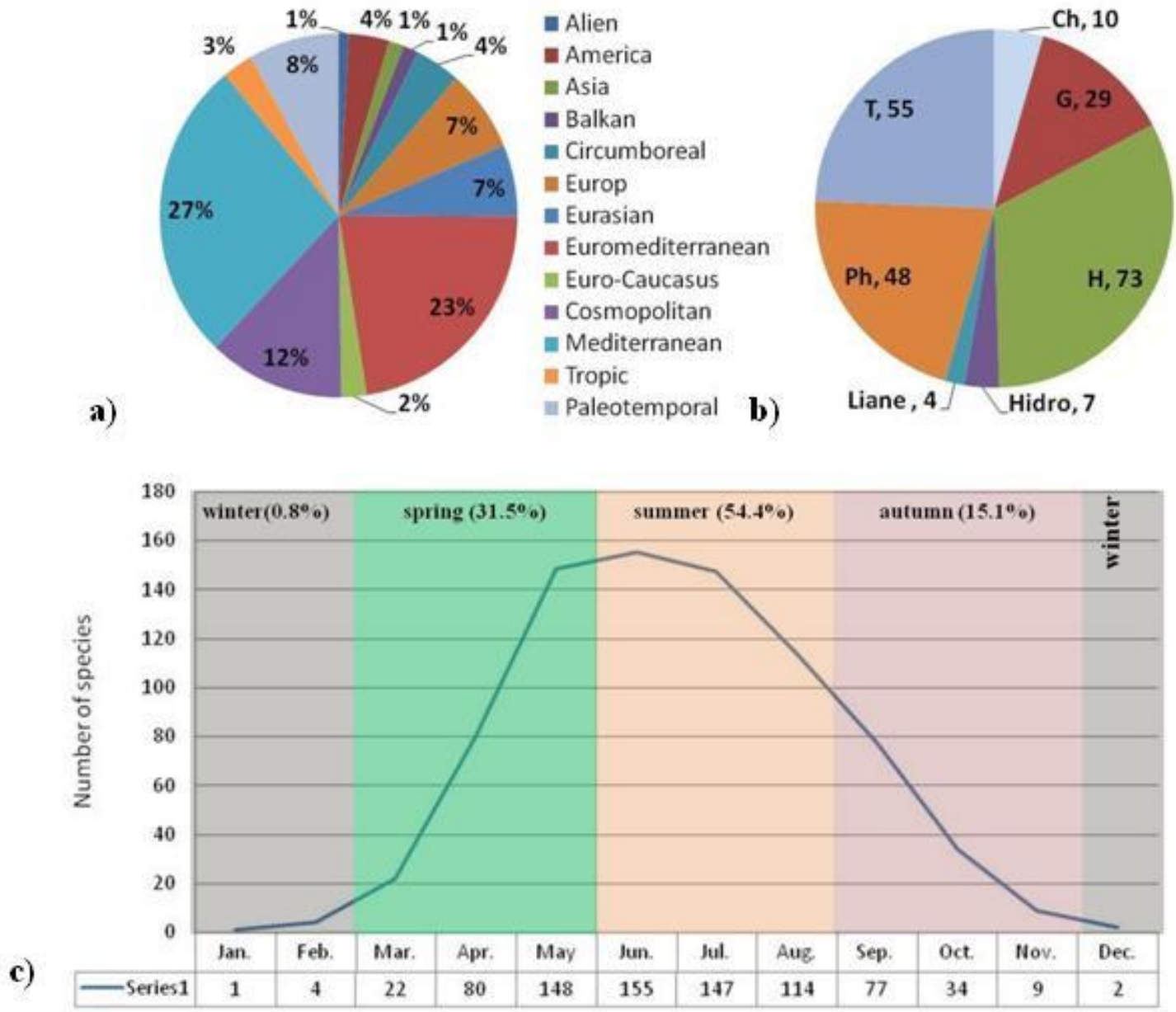

Figure 2. Data on: a) chorology; b) biological form (**H**=hemicryptophytes, **T**=therophytes, **Ph**=phanerophytes, **G**=geophytes, **Hidro**=hydrophytes); c) the flowering period and their percentage according to the seasons of the year.

Habitats Directive (92/43/EEC) of the sudy area

The variety of climatic, pedological, hydrological factors, combined with the pressure of human activity, is reflected in the variety of habitats of the study area (Figure 3), often quite fragmented:

1210 Annual vegetation of drift lines

This is the first habitat to appear immediately from the sealine, after a narrow strip with no vegetation. The characteristic and most widespread species in this sandy belt are *Cakile maritima*, *Xanthium strumarium, Salsola kali, Atriplex hastata*, *Euphorbia peplis, Elymus farctus, Euphorbia paralias*, *Eryngium maritimum*, etc. In the phytosociological classification, this community belongs to the class *Cakiletea maritimae*. The habitat has a wide distribution range throughout all the study area, but it is highly fragmented by human activity. This negative fact of habitat loss is also emphasized by Attore et al. (2012) in the study on the assessment of disturbing factors in the conservation of Mediterranean dunes.

2110 Embryonic shifting dunes

This habitat represents the first stages of dune formation, consisting of raised sand belts in the upper part of the coast, or secondary uplifts driven by the sea, with a height of 0.5-1.5 m and located at the base of high dunes (EC,

2013). In the study area, this habitat is represented by different communities of embryonic Mediterranean dunes with characteristic species: *Euphorbia paralias, Elymus farctus, Echinophora spinosa, Eryngium maritimum, Medicago marina, Pancratium maritimum,* etc. Often, some halophytic, halo-nitrophilic species, such as *Cakile maritima, Euphorbia peplis, Salsola kali*, etc., participate in the floristic composition of these communities. Sea erosion and mainly the development of tourist activity in the area are a serious risk for this type of habitat.

2130* Fixed coastal dunes with herbaceous vegetation ("grey dunes")

This primary habitat is present in areas with low human activity and where ecological conditions enable it. It is represented by stable dunes with characteristic species such as: *Ephedra distachya, Cyperus maritimus* Poir., *Cyperus capitatus, Pancratium maritimum, Cionura erecta, Medicago maritima* as well as *Teucrium polium, Satureja montana, Salvia officinalis*, which represent the most xerophilous elements of Mediterranean shrubs and can withstand the specific conditions of sand dunes. This is a very rare and almost unique case on the Albanian coast, but also in the Mediterranean, where *Salvia officinalis* has a healthy and well-stabilized population in the dunes. The presence of *E. distachya* in the dunes is a rare case that has been reported only in Greece so far (Doody, 2019). From a phytosociological point of view, the association with *E. distachya* was initially described simply as *Ephedretum distachyae* (Mullaj, 1989), but later specified as *Scabioso argenteae-Ephedretum distachyae* ass. nova hoc loco (Mullaj-unpublished material). This association is sindynamically included to the *Ammophilion* alliance (Mullaj, 1998; Dring et al., 2002), although some ecological features and species, such as *Ephedra distachya, Vulpia fasciculata*, also bring it closer to the *Crucianellion* alliance. Mullaj (1998) considers it a geographic vicariant of *Crucianelletum* of the western Mediterranean and of *Tortuleto-Scabieosum* of the northern Adriatic, as well as quite similar to *Ephedero distachyae - Silenetum subconicae* of Greece. However, the habitat is not peculiar only for its specific combination in this area of our country, but also for the presence of the endangered species such are *E. distachya, Cionura erecta*, a unique case in Albania of their presence in the floristic composition of sand dunes. After 1996, uncontrolled urban development and coastal tourism severely damaged the habitat and as result its species gradually disappeared from the beach of Golem (Mullaj, 1999). Even in our study area, in the period 2016-2022, as a result of urbanization/tourism, this species has lost more than 50% of its habitat. Currently, this type of habitat, in such a small and very fragmented area in Rana e Hedhur, represents the only location of this association in our country. Uncontrolled urban and touristic development without a farsighted strategy, seriously risk the extinction of this population as well.

2270* Wooded dunes with *Pinus pinea* and/or *Pinus pinaster*

These dunes represent a pre-climax stage, of anthropogenic origin, towards the characteristic climax of this area, which is the Mediterranean evergreen forests of the Quercetea ilicis class. The dunes were planted about 70 years ago, mainly with *Pinus halepensis* and *Pinus pinea*. The shrub layer of these forests is missing. Analyzing their floristic composition, we noticed two plant groups that represent: (i) characteristic elements of sand dunes (ii) xerothermic elements of the plant formation of Mediterranean forests and scrubs. The frequent plant species encountered in these forests are: *Pinus halepensis, Pistacia terebinthus, Phillyrea latifolia, Juniperus oxycedrus, Satureja hortensis, Teucrium polium, Ruscus aculeatus, Paliurus spina-christi*, *Punica granatum*, *Satureja montana, Salvia officinalis, Cyperus capitatus, Ephedra distachya,* etc., habitat borders with the associations of sand dunes, although in many cases this direct contact is interrupted by plant communities dominated by *Juniperus oxycedru*s subsp. *macrocarpa*.

1410 Mediterranean salt meadows (Juncetalia maritimi)

The habitat is present in depressions behind dunes with medium salinity, populated by vegetation groups belonging to the association *f* Horvatić 1934, also reported for the Viluni lagoon (Fanelli et al., 2015). Referring to this paper, the presence of the plant communities with *Juncus maritimus* and *Lippia nodiflora* are also confirmed in some depressions of the study area, mainly in its central part.

The characteristic species of this habitat are *Juncus maritimus, J. acutus, Plantago crassifolia, Puccinellia festuciformis, Artemisia caerulescens*, etc. Other accompanying species are *Lippia nodiflora, Tunica*

*saxifraga, Teucrium pollium, Paliurus spina – christi, Imperata cylindrica,*etc.

1510* Mediterranean salt steppes (Limonietalia)

The habitat is present in depressions which are highly influenced by marine waters and exposed to extreme drought in summer (EC, 2013). It occupies only a small surface in Shengjin beach in the entire study area. Plant communities are dominated by *Limonium vulgar*e. The habitat is characterized, like in majority of halophytic communities, by a low species diversity. The presence of invasive species (A*morpha fruticosa*) and cosmopolitan species (*Dittrichia viscosa, Xanthium strumarium*) indicate anthropogenic influence in this area.

2190 Humid dune slacks

In Vilun - Rana e Hedhur this habitat type is represented by depressions in the form of a series of temporary ponds with slightly salty water or depressions, dominated by *Erianthus ravennae* and *Schoenus nigricans* winter-spring, these depressions are flooded (mainly by rainwater), afterwards they turn into swamps and during August almost dried up completely (Zeneli & Kashta, 2016). Due to seawater infiltration, flooding and rainfall the habitat salinity changes. The species that populate this type of habitat (ponds or water surfaces) are *Chara canescens* Loiseleur 1810 (typical of slightly salty waters), the cyanobacterium *Gloeotrichia natans* and other aquatic macrophytes such as *Stuckenia pectinata, Ruppia cirrhosa, Scirpus littoralis, Zannichellia palustris*, etc. Other species that contribute in the habitat physiognomy are: *Saccharum ravennae, Schoenus nigricans, Imperata cylindrica, Juncus littoralis, Scirpus holoschoenus, Plantago crassifolia* etc. The habitat has a fragmentary distribution in the area. It is in the form of small patches without a clear physiognomy. From the syntaxonomic point of view, it is very difficult to classify this group, but there are citations that include it in the Plantaginion crassifolia alliance.

92D0 Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)

Riparian galleries are alsmost always fragmented and with a considerable width. The floristic composition of these communities is a mixture between hydro-hygrophilic and halophilic species. The dominance of one or the other group is always dependent on the degree of salinization. When the degree of salinization is high, *Tamarix dalmatica* is accompanied by halophilic species such as *Juncus acutus, Schoenus nigricans, Juncus littoralis, Plantago crassifolia, Psilurus incurvus*, etc., and when the salinity drops, hygro-hydrophilic species such as: *Vitex agnus castus, Saccharum ravennae, Imperata cylindrica, Periploca graeca, Scirpus holoschoenus*, etc., are dominant. In the group of hydro-hygrophilous species, it is worth mentioning the presence the insectivorous *Utricularia australis*, which is reported for the first time for the coast of Albania. This new location represent the second location *U. australis* in Albania (Barina et al., 2017).

92A0 Salix alba and Populus alba galleries

In the northern part of the study area, where the surface waters or ponds created mainly by rainfall do not dry and have low salinity, the riparian vegetation belts/forest are dominated by *Populus alba* accompanied with *Hedera helix, Malus sp*., etc. The average tree layer cover reaches 40% and height up to 25m. The shrub layer is richer in species composition, with a cover of 85% and varies 1.5 – 3.5m heigh. The dominant species are: *Carpinus orientalis, Rubus fruticosus, Crataegus monogyna, Periploca graeca, Hedera helix*, etc.

Where poplar trees have been cutted, *Carpinus orientalis* dominates the formation, while the herbaceous layer is dominated by *Hedera helix*, which forms a carpet, together with seedlings of *Populus alba, Quercus trojana, Juniperus oxycedrus, Carpinus orientalis, Fraxinus ornus* and *Crataegus monogyna*. In addition to the above species, herbaceous species such as *Brachypodium sylvatica, Equisetum arvense, Ruscus aculeatus, Brachypodium distachyon*, etc., are evident. Thus, as a whole the landscape of this part of the study area can be described by two main forest formations: 1) forests with typical Mediterranean species and 2) riparian/alluvial forests with *Populus alba* which border the area to the west and east. Among them, there are wetland/depressions, populated mainly by *Juncus sp.* and *Schoenus nigricans*. However, there are also sand dunes, all populated by *Vitex agnus-castus*, which also spread through formations with *Juncus sp.* and *S. nigricans*. It seems that the former forest area is being replaced by these species which have taken priority.

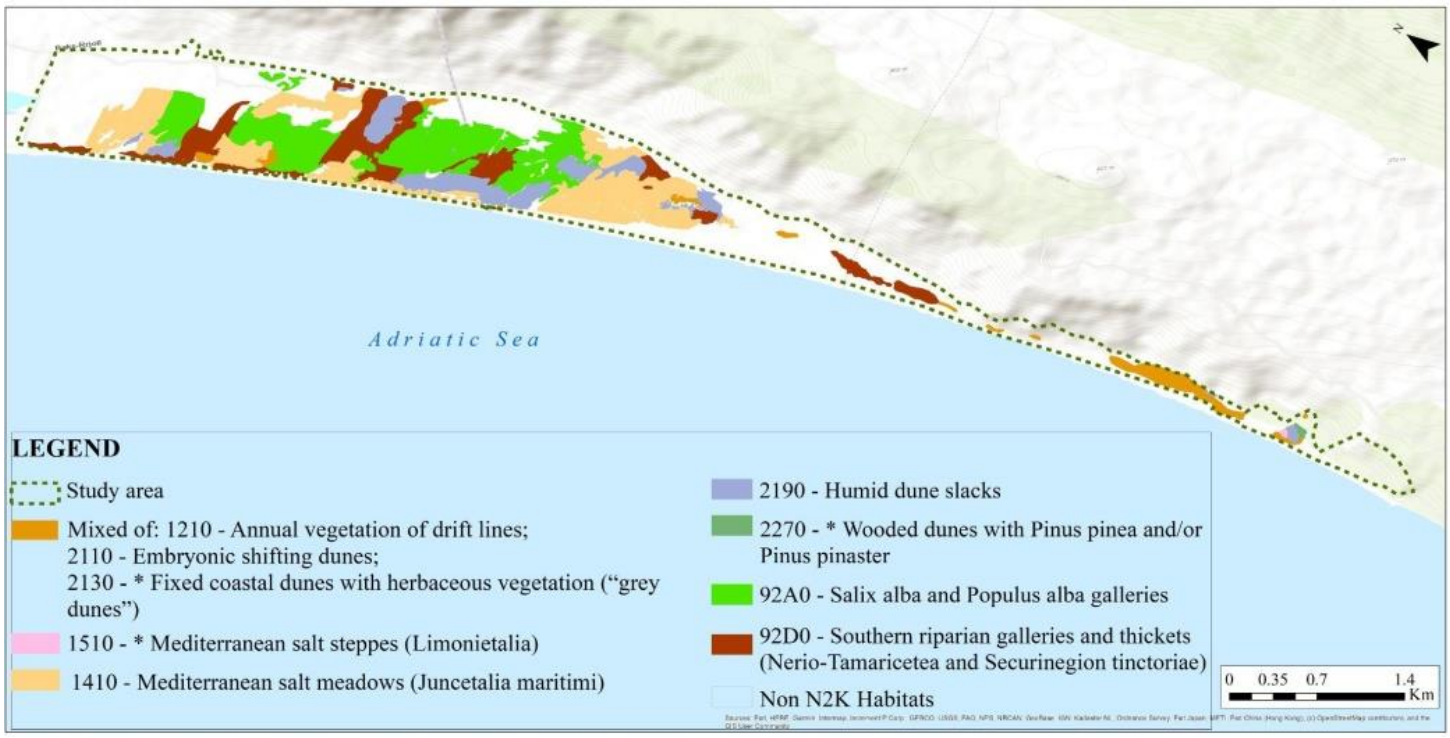

Figure 3. Map of the Annex 1 Habitats of the Vilun-Rana e Hedhun study area.

Discussion

The study results showed that the study area is composed of a high diversity of habitats of Directive (92/43/EEC) and rich in plant species, many of them endangered rare species. Location of Renci mountain, next to the sand beach, has created conditions for forming of unique dunes in the foothills of this mountain with a height of more than 80 m, making this area different from the other sandy coastal shore of Adriatic in Albania. The different typology of these sand dunes reflected even in the unique floristic composition, vegetation communities and habitat types. Being in the base of the foothill, some areas of the humid sand and not too salty are covered by *Carpinus orientalis* shrubland mixed with a few *Quercus trojana*, a vegetation community not typical for the sandy sea area in Albania, but that is dominant on the hillslope.

Nevertheless, the area is under high pressures. As in other coastal areas (Bego et al., 2013), the main threats and pressures are tourism development, erosion and illegal logging. The construction of tourist resorts, the creation of coast car parks in the sand and pedestrians walking and cars driving over the dunes populated with rare species such as *Pancratium maritimum, Ephedra distachya, Cionura erecta,* etc., threaten these species and their habitats with extinction. The dune at the foot of Mount Renci, with a height of about 80 m is unique in Albania but, due to the lack of interest of the local authorities and low sensitivity of tourists, it is turned into a sand slide for the entertainment of vacationers during the summer. This action seriously endangers this 'natural monument', promoting marine erosion and the disappearance of the entire sand belt between the sea and the Renci Mt.. Also, in recent years, the management authorities of the coast of Shëngjin allow the driving of vehicles through the dunes, from the tourist resorts to the dune of "Rana e Hedhun", giving the last blow to these habitats of international importance.

Conclusions

The study found that the flora of the coastal area of Vilun - Rana e Hedhur is composed of 224 plant species, several vegetation community and 9 Habitats of Annex 1 of Habitats Directive.

Among the plant species, 18 species are part of the Albanian Red List, while 9 species have an international conservation status (IUCN). *Ephedra distachia*, with EN A1b conservation status, is a very important species not only for the study area but also for Albania. This is because Vilun - Rana e Hedhur is the only location of the species and, as a consequence of urbanization and tourism development, it is at high risk of extinction.

3 out of 9 habitat types identified in an area of 10.52 km^2 are primary habitats (*). The habitat 2130* (Fixed coastal dunes with herbaceous vegetation, “grey dunes”) is of particular importance. In Albania it is reported only in this area with the presence of the *Ephedra distachya*, the second case in the whole Mediterranean region after the first report in dunes of northern Greece.

Based on the data given by Barina et al. (2017) we report the second location of *Utricularia australis* in Albania that represent its first location in the coastal area. Cyanobacteria were not a direct target group of the study, but *Gloeotrichia natans* Rabenhorst ex Bornet et Flahault, a cyanobacteria not reported previously for Albania, is found.

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Ethical Approval

The authors dont declare ethical approval.

Conflicts of Interest

The authors declare that have no conflict of interest.

Funding Statement

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Apendix. Vascular flora the study area, Rrjoll-Rana e Hedhur.

Species	Family	Biological form	Flowering period
Alkanna tinctoria (L.) Tausch	Boraginaceae	H	III-V
Alnus glutinosa (L.) Gaertner	Betulaceae	Ph	II-III
Amaranthus albus L.	Amaranthaceae	T	VII-X
Ambrosia maritima L.	Asteraceae	T	VI-IX
Ammophila arenaria (L.) Link	Poaceae	G	IV-V
Amorpha fruticosa L.	Fabaceae	Ph	VI-VII
Anagallis arvensis L.	Primulaceae	T	V-X
Anthemis carpatica Willd.	Asteraceae	H	VI-VIII
Anthemis chia L.	Asteraceae	T	III-V
Arabis pseudoturritis Boiss. & Heldr.	Brassicaceae	T	V-VI
Aremonia agrimonioides (L.) DC.	Rosaceae	H	V-VII
Aristolochia clematitis L.	Aristolochiaceae	G	V-VIII
Aristolochia rotunda L.	Aristolochiacea	G	IV-VI
Armeria maritima (Miller) Willd.	Plumbaginaceae	H	VI-VIII
Artemisia caerulescens L.	Asteraceae	Ch	VII-IX
Artemisia scoparia Waldst. & Kit.	Asteraceae	H	V-VIII
Arum italicum Miller	Araceae	G	IV-VI
Asparagus acutifolius L.	Liliaceae	G	V-VI
Asparagus maritimus (L.) Miller	Liliaceae	G	V-VI
Asplenium adiantum-nigrum L.	Aspleniaceae	H	V-VII
Asplenium trichomanes L.	Aspleniaceae	H	V-VII
Aster tripolium L.	Asteraceae	T/H	VIII-IX
Atriplex hastata L.	Chenopodiaceae	T	VII-IX
Atriplex tatarica L.	Chenopodiaceae	T	VII-X
Avena fatua L.	Poaceae	T	V-VII
Baldellia ranunculoides (L.) Parl.	Alismataceae	Hidro	IV-VI
Bellis perennis L.	Asteraceae	H	I-XII
Blackstonia perfoliata (L.) Hudson	Gentianaceae	T	V-IX
Brachypodium sylvaticum (Hudson) P. B.	Poaceae	H	V-VIII
Brachypodium pinnatum (L.) P. Beauv.	Poaceae	H	V-VIII
Brachypodium distachyon (L.) P. Beauv.	Poaceae	T	IV-VII
Buglossoides purpurocaerulea (L.) I.M. Joh	Boraginaceae	H	IV-VI
Bupleurum baldense Turra	Apiaceae	T	IV-VIII
Butomus umbellatus L.	Butomaceae	Hidro	IV-VI
Buxus sempervirens L.	Buxaceae	NPh	III-IV
Cakile maritima Scop.	Brassicaceae	T	IV-IX
Calamintha sylvatica Bromf.	Lamiacea	H	V-X
Calystegia soldanella (L.) R. Br.	Convolvulaceae	G	VI-VIII
Campanula versicolor Andrews	Campanulaceae	H	V-VII
Carex extensa Good.	Cyperaceae	H	V-VI
Carex divulsa Stakes in With.	Cyperaceae	H	V-VI
Carpinus orientalis Miller	Corylaceae	Ph	III-V
Celtis australis L.	Ulmaceae	Ph	III-IV
Centaurea jacea L.	Asteraceae	H	VI-VII
Centaurium erythraea Rafin.	Gentianaceae	T	V-VIII
Cerastium brachypetalum Pers.	Caryophyllaceae	T	III-VI
Ceterach officinarum DC.	Aspleniaceae	H	V-VII
Chamaemelum mixtum (L.) All.	Asteraceae	T	V-IX
Chenopodium glaucum L.	Amaranthaceae	T	VI-IX
Chondrilla juncea L.	Asteraceae	H	VI-VIII
Chrysopogon gryllus (L.) Trin.	Poaceae	H	VI-VII
Cichorium intybus L.	Asteraceae	H	V-IX
Cionura erecta (L.) Griseb.	Apocynaceae	H	VII-VIII
Cistus salvifolius L.	Cistaceae	NPh	V-VII
Cistus incanus L.	Cistaceae	NPh	V-VI
Cladium mariscus (L.) Pohl	Cyperaceae	G	V-VII
Convolvulus althaeoides L.	Convolvulaceae	H	IV-VI

Conyza canadensis (L.) Cronq.	Asteraceae	T	VI-XII
Cornus sanguinea L.	Cornaceae	Ph	V-VI
Coronilla emerus L.	Fabaceae	NPh	VII-X
Crataegus monogyna Jacq.	Rosaceae	Ph	IV-VI
Cuscuta campestris Juncher	Convolvulaceae	T	V-IX
Cyclamen hederifolium Aiton	Primulaceae	G	VIII-XI
Cynanchum acutum L.	Apocynaceae	Liane	V-VII
Cyperus capitatus Vandelli	Cyperaceae	G	V-IX
Dactylis glomerata L.	Poaceae	H	IV-VII
Daucus carota L.	Apiaceae	T/H	IV-X
Dittrichia viscosa (L.) W. Greuter	Asteraceae	H	VII-X
Dorycnium pentaphyllum Scop.	Fabaceae	H/Ch	IV-VI
Dorycnium hirsutum (L.) Ser.	Fabaceae	Ch	V-VI
Echinophora spinosa L.	Apiaceae	H	VI-IX
Echinops bannaticus Rochel ex Schrader	Asteraceae	H	VI-VIII
Echium plantagineum L.	Boraginaceae	T	III-VII
Elymus farctus (Viv.) Run. ex Melderis	Poaceae	G	IV-VI
Elymus pycnanthus (Godron) Melderis	Poaceae	G	V-VI
Ephedra distachia L.	Ephedraceae	Ph	V-VI
Ephedra foeminea Forssk.	Ephedraceae	Ph	II
Equisetum arvense L.	Equisetaceae	G	IV-VI
Erica manipuliflora Salisb.	Ericaceae	Ch/NPh	VI-X
Eryngium maritimum L.	Apiaceae	G	VI-IX
Euphorbia paralias L.	Euphorbiaceae	G	V-VIII
Euphorbia peplis L.	Euphorbiaceae	T	V-X
Ficus carica L.	Moraceae	Ph	V-VIII
Fraxinus angustifolia Vahl.	Oleaceae	Ph	IV-V
Fraxinus ornus L.	Oleaceae	Ph	IV-VI
Fumana procumbens (Dunal) Gren & Gord.	Cistaceae	Ch	V-VI
Galium mollugo L.	Rubiaceae	H	VI-VIII
Glaucium flavum Crantz	Papaveraceae	H	V-IX
Gratiola officinalis L.	Scrophulariaceae	H	VI-VIII
Halimione portulacoides (L.) Aellen	Chenopodiaceae	Ch	VII-X
Halocnemum strobilaceum (Pallas) Bieb.	Chenopodiaceae	Ch	IX-X
Hedera helix L.	Araliaceae	Liane	IX-X
Helianthemum numularium (L.) Miller	Cistaceae	Ch	V-VIII
Heliotropium curassavicum L.	Boraginaceae	Ch	VI-VIII
Herniaria hirsuta L.	Caryophyllaceae	T	VI-IX
Hordeum marinum Hudson	Poaceae	T	IV-VI
Hyparrhenia hirta (L.) Stapf in Oliver	Poaceae	H	V-X
Hypericum perforatum L.	Hypericacea	H	V-VIII
Hypochoeris radicata L.	Asteraceae	H	IV-VII
Imperata cylindrica (L.) Raeuschel	Poaceae	G	V-VII
Inula crithmoides L.	Asteraceae	Ch	VII-XI
Juncus acutus L.	Juncaceae	H	V-VII
Juncus articulatus L.	Juncaceae	G	V-VIII
Juncus bufonius L.	Juncaceae	T	V-IX
Juncus maritimus Lam.	Juncaceae	G	VI-VIII
Juncus effusus L.	Juncaceae	G	V-VII
Juniperus oxycedrus L.	Cupressaceae	Ph	IV-V
Lagurus ovatus L.	Poaceae	T	IV-VI
Limbardia crithmoides (L.) Dumort.	Asteraceae	Ch	VII-XI
Limonium oleifolium Miller	Plumbaginaceae	H	VI-VIII
Limonium vulgare Miller	Plumbaginaceae	H	VI-IX
Linum maritimum L.	Linaceae	H	V-IX
Lippia nodiflora (L.) Michx.	Verbenacea	H	VI-IX
Lolium perenne L.	Poaceae	H	IV-VIII
Lonicera caprifolium L.	Caprifoliaceae	Ph	V-VII

Lotus corniculatus L.	Fabaceae	H	V-VIII
Lycopus europaeus L.	Lamiacea	H	IV-IX
Lythrum salicaria L.	Lythraceae	H	VI-IX
Malva sylvestris L.	Malvaceae	H	V-VIII
Matthiola sinuata (L.) R. Br.	Brassicaceae	H	IV-VII
Matthiola tricuspidata (L.) R. Br.	Brassicaceae	T	IV-VII
Medicago marina L.	Fabaceae	H	III-VIII
Mentha aquatica L.	Lamiacea	H	VI-X
Mentha pulegium L.	Lamiacea	H	V-IX
Micromeria graeca (L.) Bentham	Lamiacea	Ch	V-VI
Micromeria juliana (L.) Bentham	Lamiacea	Ch	V-VI
Morus nigra L.	Moraceae	Ph	IV-V
Myrtus communis L.	Myrtaceae	Ph	VI-VII
Nigella damascena L.	Ranunculaceae	T	V-VII
Oenothera biennis L.	Onagraceae	T/H	VI-VIII
Omphalodes verna Moench	Boraginaceae	H	III-IV
Ononis spinosa L.	Fabaceae	Ch	V-IX
Origanum vulgare L.	Lamiacea	H	VI-IX
Ostrya carpinifolia Scop.	Corylaceae	Ph	IV-V
Paliurus spin-achristi Miller	Rhamnaceae	Ph	V-VI
Pallenis spinosa (L.) Cass.	Asteraceae	T/H	V-VIII
Pancratium maritimum L.	Amaryllidaceae	G	VII-IX
Papaver rhoeas L.	Papaveraceae	T	III-VII
Parapholis incurva (L.)C.E. Hubbard	Poaceae	T	IV-VI
Parapholis filiformis (Roth) C.E. Hubbard	Poaceae	T	V-VI
Parietaria officinalis L.	Urticaceae	H	V-X
Periploca graeca L.	Apocynaceae	Liane	V-VI
Petrorhagia saxifraga (L.) Link	Caryophyllaceae	H	V-IX
Petrorhagia prolifera (L.) P.W. B. & H	Caryophyllaceae	H	V-IX
Phillyrea latifolia L.	Oleaceae	Ph	IV-V
Phragmites australis (Cav.) Trin. ex Stend.	Poaceae	G	VI-X
Phytolaca americana L.	Phytolacaceae	H	VI-X
Pinus halepensis Miller	Pinaceae	Ph	IV-V
Pistacia lentiscus L.	Anacardiaceae	Ph	IV-VI
Pistacia terebinthus L.	Anacardiaceae	NPh	IV-VII
Plantago crassifolia Forskal	Plantaginaceae	H	IV-VIII
Plantago coronopus L.	Plantaginaceae	T/H	V-VIII
Plantago lanceolata L.	Plantaginaceae	H	IV-XI
Plantago major L.	Plantaginaceae	H	IV-VIII
Plumbago europaea L.	Plumbaginaceae	Ch	VI-IX
Polygonum maritimum Waldst. & kit.	Polygonaceae	H	V-IX
Populus alba L.	Salicaceae	Ph	II-IV
Portulaca oleracea L.	Portulacaceae	T	V-X
Potentilla reptans L.	Rosaceae	H	VI-VIII
Prunella vulgaris L.	Lamiacea	H	IV-X
Pseudorlaya pumilla (L.) Grande	Apiaceae	T	IV-V
Psilurus incurvus (Gouan) Schinz & Thell.	Poaceae	T	IV-VI
Psoralea bituminosa L.	Fabaceae	H	III-VI
Pteridium aqulinum (L.) Kuhn	Hypolepidiaceae	G	VI-VIII
Punica granatum L.	Punicaceae	Ph	V-VII
Pyracantha coccinea M. J. Roemer	Rosaceae	Ph	IV-V
Pyrus amygdaliformis Vill.	Rosaceae	Ph	IV-V
Quercus cerris L.	Fagaceae	Ph	IV-V
Quercus trojana Web.	Fagaceae	Ph	III-V
Quercus pubescens Willd.	Fagaceae	Ph	IV-V
Quercus ilex L.	Fagaceae	Ph	IV-V
Reichardia picroides (L.) Roth	Asteraceae	H	IV-VIII
Rubus ulmifolius Schott	Rosaceae	NPh	V-VII
Ruppia cirrhosa (Petagna) Grande	Ruppiaceae	Hidro	V-IX

Ruscus aculaetus L.	Liliaceae	Ch	II-IV
Saccharum ravennae (L.) Murray	Poaceae	H	VII-X
Salix alba L.	Salicaceae	Ph	III-IV
Salsola kali L.	Chenopodiaceae	T	VI-IX
Salsola soda L.	Chenopodiaceae	T	VII-VIII
Salvia officinalis L.	Lamiacea	Ch	III-VI
Sanguisorba minor Scop.	Rosaceae	H	VI-VIII
Satureja hortensis L.	Lamiacea	T	VI-IX
Satureja montana L.	Lamiacea	Ch	VII-IX
Scabiosa argentea L.	Dipsacaceae	H	VII-IX
Schoenus nigricans L.	Cyperaceae	H	IV-VIII
Scirpus holoschoenus L.	Cyperaceae	G	IV-VI
Scirpus litoralis Schrader	Cyperaceae	G	V-VI
Scirpus holoschoenus L.	Cyperaceae	G	IV-VI
Scolymus hispanicus L.	Asteraceae	H	VI-IX
Setaria pumila (Poiret) Schultes & fil.	Poaceae	T	VI-IX
Silene conica L.	Caryophyllaceae	T	IV-VII
Smilax aspera L.	Liliaceae	Liane	IX-XI
Solanum nigrum L.	Solanaceae	T	Ms-N
Sonchus maritimus L.	Asteraceae	H	VI-IX
Spartium junceum L.	Fabaceae	Ph	V-VI
Spergula arvensis L.	Caryophyllaceae	T	III-VII
Spergularia diandra (Guss.) Boiss.	Caryophyllaceae	T/H	III-VIII
Spergularia marina (L.) Griseb.	Caryophyllaceae	T/H	III-IX
Spergularia rubra (L.) J. & C. Presl	Caryophyllaceae	T/H	III-X
Spiranthes spiralis (L.) Chevall.	Orchidaceae	G	IX-XI
Sporobolus pungens (Schreber) Kunth	Poaceae	G	VII-VIII
Stachys maritima Gouan	Lamiacea	H	VI-IX
Stipa bromoides (L.) Doerfler	Poaceae	H	IV-VI
Stuckenia pectinata Stuckenia pectinata (L.) Börner	Potamogentaceae	Hidro	VI-VIII
Suaeda maritima (L.) Dumort.	Chenopodiaceae	T	VII-X
Suaeda vera J. F. Gmelin	Chenopodiaceae	NPh	V-X
Tamarix dalmatica Baum.	Tamaricaceae	Ph	V-VI
Tamarix hampeana Boiss. & Heldr.	Tamaricaceae	Ph	IV-V
Tamus communis L.	Dioscoreaceae	G	IV-V
Teucrium chamedrys L.	Lamiacea	Ch	V-VII
Teucrium polium L.	Lamiacea	Ch	VI-VIII
Tragus racemosus (L.) All.	Poaceae	T	VI-VIII
Trifolium angustifolium L.	Fabaceae	T	IV-VII
Trifolium stellatum L.	Fabaceae	T	IV-VI
Typha angustifolia L.	Typhaceae	G	VI-VII
Ulmus minor Mill.	Ulmaceae	Ph	II-III
Urtica dioica L.	Urticaceae	H	V-IX
Utricularia australis R.Br.	Lentibulariaceae	Hidro	VI-VIII
Verbascum sinuatum L.	Scrophulariaceae	H	V-VII
Viola odorata L.	Violaceae	H	III-VI
Vitex agnus-castus L.	Verbenacea	Ph	V-IX
Vulpia fasciculata (Forskal) Samp.	Poaceae	T	IV-VI
Xanthium strumarium L.	Asteraceae	T	VII-X
Zannichellia palustris L.	Zannichelliaceae	Hidro	IV-VII