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CROSS-BORDER COOPERATION FOR SUSTAINABLE DEVELOPMENT AND TOURISM, THROUGH VALORIZATION OF RURAL CULTURAL HERITAGE AND CONSERVATION OF NATURAL ASSET OF AREAS WITH ANCIENT OLIVE GROVES

Characterizing Biodiversity of Ancient Olive Groves in Džidžarin

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PROJECT DELIVERABLE

Project Partner	*PP 5 Municipality of Bar, Montenegro*
Work Package	*WP T 1 Identification and conservation of landscape with ancient olive trees and orchards (AOOs)*
Deliverable Code	*DT 1.2.1*
Deliverable Title	*Characterizing Biodiversity of Ancient Olive Orchards*
Date of submission	*Period 4*
Expert	*Danka Caković, PhD*

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I Introduction

Olive grove Džidžarin is one of the largest, the most attractive and therefore one of the most valuable olive complexes at the territory of Bar municipality, few hundred meters apart from Old City of Bar.

It spreads over 70 ha, at an altitude between 65 and 250 m above sea level. Džidžarin is situated at the southern slopes of Rumija Mountain massif, in the south-eastern part of the Montenegrin coast.

This region is under the influences of mild Mediterranean climate. Mean maximum temperature is 27.8 ºC, mean minimum temperature is 4.3 ºC, while the average air temperature equals 15.6 ºC. Average annual rainfall is 1480.8 mm, while the average annual sunshine duration equals 210.6 h.

These climate conditions, primary absence of low winter temperatures and long vegetation season, favour rich vegetation development.

II Materials and methods

Inventory of flora at the olive grove was realized during the summer and autumn aspects of vegetation season.

All species of vascular plants found during the fieldwork were included in the census. Plant determination was realized in the field, while taxa that required laboratory determination have been properly placed in herbarium and determined in the laboratory, after the fieldwork.

Determination was conducted with keys usually used for inventory of Montenegrin Mediterranean flora: Flora of Croatia, Flora of Italy and Flora of Europe.

The results content the list of species which nomenclature is in accordance with MCL (Med Check List). Also, habitats that are important for environmental protection in EU countries were labelled according to the codes and names of Habitat Directive.

III Results – Analysis of flora

At the area of Džidžarin olive grove 294 species and subspecies of vascular plants were registered within this research.

Total number of plant taxa at the area is higher, but inventory was not complete, due to the fact that investigation started during the summer aspect. Therefore, the data from summer and autumn aspects were completed. Winter and spring aspects were omitted even though numerous plant species flourish during that period.

Some of the autumn species were determined according to the aboveground remains, but geophytes are missing from the list, because their living cycle is short and their above ground parts dry quickly.

Orchids *(Orchidaceae)* belong to the geophyte life form and they are protected in Montenegro, but it was not possible to register them during the summer and autumn. Completing the list of floral diversity in Džidžarin olive grove by further investigation of the flora during spring time would be very useful.

Vascular plants collected at the investigated area belong to 64 families out of which family of grasses *(Poaceae)*, with dominant in the taxonomical spectrum (41 species). After this family follow: *Asteraceae* (32 taxa), *Fabaceae* (31 taxa), *Lamiaceae* (23 taxa). This type of taxonomical spectrum is expected, considering that grasses are common species at

meadows, pastures and rocky grasslands developed in the lower floor of olive groves. Large number of *Asteraceae* and *Fabaceae* families is explained by the fact that these two families are the most present in the taxonomical spectrum of Montenegrin flora. Following plant families are represented with more than 10 species in the olive grove flora: *Apiaceae* (12), *Scrophulariaceae* (11), *Caryophyllaceae* (11).

There are three different reasons that explain flora richness in Džidžarin olive grove:

1. Warm Mediterranean climate;
2. Various types of management in different parts of the olive grove;
3. Presence of various natural habitats within the olive grove.

Warm Mediterranean climate conditions enable long lasting vegetation season, almost without interruption, thus enabling development of large number of plants with various life forms.

Different types of management within the olive grove result in presence of various habitats, enabling development of plants with different ecological needs. Some parts of the olive grove are totally neglected and there are developed stands of Mediterranean underbrush, with dense and impassable shrub floor made of: *Phyllirea media, Myrtus communis, Laurus nobilis, Pistacia lentiscus, Spartium junceum...* Due to the dense shrub floor, the floor of herbaceous plants is very poor. There are some non-mowing parts within the olive grove (Photo 1), while other

parts are mowing two times in the year: in the spring and in the autumn (Photo 2). In these zones, meadow plants are present. The olive grove is used for grazing sometimes (Photo 3).

Photo 1: Non-mowing part of the olive grove

Photo 2: Mowing part of the olive orchard

Photo 3: Grazing in the olive grove

Presence of various habitats is a result of different management, but also depends on natural characteristics of the terrain. Along with underbrush, meadows and pastures, vegetation in rocky fissures, rocky dry grasslands and small areas of wet habitats are developed. Urban areas within the olive grove result in presence of ruderal habitats. In the rocky fissures habitat from the Habitat Directive - 8210 *Calcareous rocky slopes with chasmophytic vegetation* is registered.

Habitat Directive is one of the most important documents within the environmental protection domain in EU counters. Habitats listed in this Directive are important for definition of NATURA 2000 net of protected sites in EU countres. In calcareous rocky fissures in Džidžarin followed species grow: ***Campanula austroadriatica,*** *Galium firmum, Asplenium adianthum-nigrum, Asplenium ceterach, Asplenium ruta-muraria, Dianthus ciliatus* ssp. *dalmaticus, Micromeria parviflora...*

Rocky dry grasslands are represented with the habitat 62A0 East sub-Mediterranean dry grasslands *(Scorzoneretalia villosae)* (Photo 4). This habitat is developed on the shallow, skeletal soil that is very dry and warm; calcareous rocks rise in some places from the soil.

Important plant community edificatory plants of dry grasslands *(Scorzoneretalia villosae)* are grasses: *Chrysopogon gryllus, Bromus erectus, Stipa bromoides, Stipa pennata, Koeleria splendens.* Among the grasses, at the same habitat followed species are common: *Salvia officinalis, Micromeria julijana, Micromeria parviflora, Teucrium chamaedrys, Teucrium capitatum, Satureja montana.*

Photo 4: 62A0 East sub-Mediterranean dry grasslands *(Scorzoneretalia villosae)*

There are two species that are protected with national legislation in the area of investigation: *Cyclamen hederifolium* (Photo 5) and *Spiranthes spiralis* (Photo 6).

Both species are not rare or endangered in Montenegro. They have very numerous populations. Obviously, it is expected to find more protected species within the olive grove such as elements of spring flora. Due to the period of research, those species were not included in this report. This is primarily related to the species of Orchid's family *(Orchidaceae),* which are numerous in wide surround of Džidžarin (confirmed in the previous reserach conducted by the same expert). All species of Orchid's family are protected with national legislation.

In the flora of Džidžarin, six endemic plant species that are present in the area of Balkan Peninsula only, were registered: *Asperula scutellaris,* ***Campanula austroadriatica, Galium firmum,*** *Crocus dalmaticus, Stachys menthifolia, Trifolium dalmaticum.* These species are widely distributed along the Rumija Mountain massive, where investigated olive grove is situated.

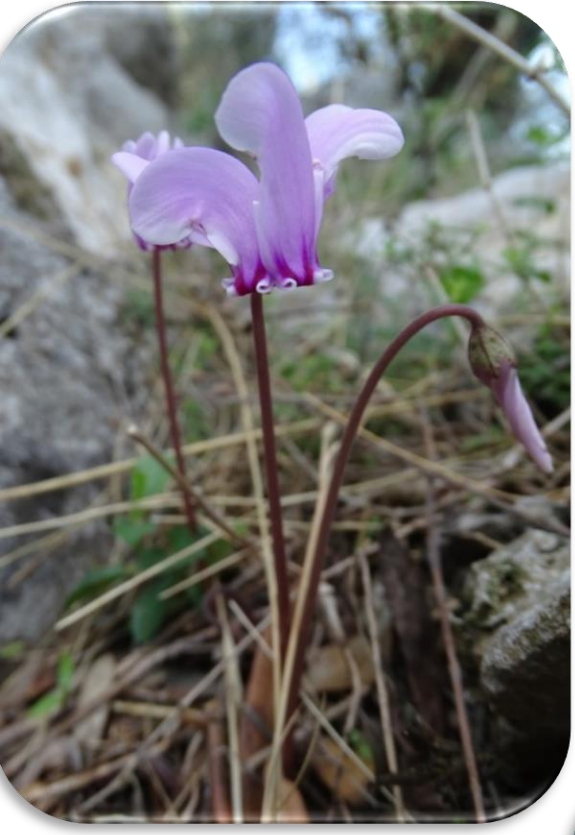

Photo 5: *Cyclamen hederifolium* (protected species)

Photo 6:
Spiranthes spiralis (protected species)

IV Results – List of flora

The list of species found during the research, supplemented with earlier collected species on the broader area of Džidžarin during the spring aspect, is presented in the following table:

Latin names of species
Acanthus spinosus L.
Acer campestre L.
Acer monspesulanum L.
Achillea millefolium L.
Acinos suaveolens (Sibth. & Sm.) G. Don
Aegilops neglecta Req. ex Bertol
Aegilops triuncialis L.
Aethionema saxatile (L.) R. Br.
Agrimonia eupatoria L.
Aira elegantissima Schur*[1]
Allium roseum L.
Althaea cannabina L.
Althaea officinalis L.
Anagallis arvensis L.
Anthemis arvensis L.
Anthoxanthum odoratum L.
Arabis turrita L.
Arabis verna (L.) R. Br.
Arenaria leptoclados (Reichenb.) Guss

[1] Species not found during the fieldworks realized in 2019, but noted within the previous investigations in the are marked with the star.

Aristolohia lutea Desf.
Aristolochia rotunda L.
Asparagus acutifolius L.
Asperula scutellaris Vis.
Asphodelus aestivus Brot.
Asplenium adianthum-nigrum L.
Asplenium ceterach L.
Asplenium ruta-muraria L.
Avena barbata L.
Avena streilis L.
Balota rupestris (Biv.) Vis.
Berteroa mutabilis (Vent.) DC.
Bituminaria bituminosa (L.) Stirton
Blackstonia perfoliata (L.) Hudson
Bellis perenis L.
Brachypodium distachyum (Torn.) Beauv.
Brachypodium sylvaticum (Huds) Beauv.
Briza maxima L.
Briza media L.
Bromus arvensis L.
Bromus erectus Hudson
Bromus hordeaceus L.
Bromus madritensis L.
Bunias erucago L.
Bupleurum baldense Turra ssp. *gussonei* (Arcangeli) Tutin
Calamintha nepeta (L.) Savi
Calepina irregularis (Asso.) Thell*
Calystegia sylvatica (Kit.) Griseb.
Campanula austroadriatica D. Lakušić & Kovačić
Campanula erinus L.

Campanula lingulata Waldst. & Kit.
Capsela bursa-pastoris (L.) Medicus
Cardus pycnocephalus L.
Carpinus orientalis Mill.
Catapodium rigidum L.
Celtis australis L.
Centaure alba L.
Centaurea calcitrapa L.
Centaurea jacea L.
Centaurea solstitialis L.
Centaurium erythraea Rafn
Cephalaria leucantha (L.) Roemer & Schultes
Cerastium glomeratum Thuill
Chaerophyllum coloratum L.
Chelianthes persica (Bory) Mett. ex Kuhn
Chondrilla juncea L.
Chrysopogon gryllus Trin.
Cichorium intybus L.
Cirsium arvense (L.) Scop
Cirsium candelabrum Griseb.
Cirsium vulgare (Savi) Ten.
Clematis flamulla L.
Clematis vitalba L.
Clinopodium vulgare L.
Colchicum autumnale L.
Colutea arborescens L.
Consolida aiacis (L.) Schur
Consolida regalis S. F. Gray
Convolvulvus arvensis L.
Convolvulvus althaeoides L. ssp. *tenuissisimus* (Sibth. & Sm.)

Stace
Convolvulvus cantabrica L.
Cornus mas L.
Cornus sanguinea L.
Crataegus monogyna Jacq.
Crocus dalmaticus Vis.*
Corydalis cava (L.) Schweigger & Koerte*
Cotinus coggygria Scop.
Crepis capillaris (L.) Wallr.
Crepis foetida L.
Crepis neglecta L.
Crepis sancta (L.) Babcock*
Cupressus sempervirens L.
Cyclamen hederifolium Aiton
Cynoglossum creticum Miller
Cymbalaria muralis P. Gaertner
Cynodon dactylon (L.) Pers
Cynosurus echinatus L.
Dactylis glomerata L. ssp. *glomerata*
Dactylis glomerata L. ssp. *hispanica*
Dasypirum villosum (L.) P. Candargy*
Daucus carota L.
Delphinium peregrinum L.
Desmazeira rigida (L.) Tutin
Dianthus carthusianorum L.
Dianthus ciliatus Guss. ssp. *dalmaticus* (Čelak.) Hayek
Digitaria sanguinalis (L.) Scop.
Dittrichia viscosa (L.) W.
Dorycnium hirsutum (L.) Ser

Dorycnium herbaceum Vill.
Echium italicum L.
Echium vulgare L.
Eleusine indica (L.) Gaertner
Ephedra campilopoda C.A.
Erodium cicutarium (L.) L'Hér.
Erygeron annuus (L.) Pers.
Erygeron canadensis L.
Eryngium amethystinum L.
Eryngium campestre L.
Euphorbia amygdaloides L.
Euphorbia helioscopia L.
Euphorbia spinosa L.
Festuca heterophylla Lam.
Festuca rupicola Heuffel
Ficus carica L.
Frangula rupestris (Scop.) Schur
Fumaria officinalis L.*
Galega officinalis L.
Galium firmum Tausch
Galium lucidum All.
Galium mollugo L.
Geranium columbinum L.
Geranium lucidum L.
Geranium mole L.
Geranium robertianum L.
Haynaldia vilosa (L.) Schur
Hedera helix L.
Helianthemum nummularium (L.) Miller ssp. *obscurum* (Čelak) J. Holu

Hieracium pilloseloides (Vill.) ssp. *bauhinii* (Schult)
Hippocrepis emerus L. (Lassen) ssp. *emeroides* (Boiss. & Spruner) Lasse
Hordeum bulbosum L.
Hordeum murinum L.
Hyparrhenia hirta (L.) Stapf
Hypericum perforatum L.
Hyosciamus albus L.*
Hypochoeris cretensis (L.) Bory & Chaub.
Hypochoeris radicata L.
Huetia cynapioides (Guss) P. W. Ball.
Juncus gerardii Loisel.
Juniperus oxycedrus L.
Kickxia commutata (Bernh. Ex Reichenb.) Fritsch
Kickxia elatine (L.) Dumort.
Kickxia spuria (L.) Dumort
Knautia arvensis (Briq) Szabó
Koeleria splendens C. Presl
Lapsana communis L.
Lathyrus aphaca L.
Lathyrus cicera L.
Laurus nobilis L.
Leontodon automnalis L.
Leontodon hispidus L.
Leontodon tuberosus L.
Ligustrum vulgare L.
Linaria pelisseriana (L.) Miller*
Linum nodiflorum L.
Linum tenuifolium L.
Lolium multiflorum Lam.

Lolium perenne L.
Lotus angustissimus L.
Lotus corniculatus L.
Lupinus micranthus Guss.
Malva sylvestris L.
Medicago arabica (L.) Hudson
Medicago minima (L.) L.
Medicago orbicularis (L.) Bartal.
Medicago sativa L.
Melissa officinalis L.
Mentha pulegium L.
Mercurialis annua L.*
Micromeria julijana (L.) Bentham
Micromeria parviflora (Vis.) Reichenb.
Minuartia mediteranea (Led.) K. Malý
Myrtus communis L.
Nigella arvensis L.
Nigella damascena L.
Oenanthe fistulosa L.
Olea europea L.
Onobrychis arenaria (Kit.) DC. ssp. *tommasinii* (Jordan)*
Onobrychis caput - galli (L.) Lam.*
Ononis spinosa L. ssp. *spinosa*
Origanum vulgare L.
Orlaya grandiflora (L.) Hoffm
Osyris alba L.
Oxalis corniculata L.
Paliurus spina christi Mill.
Pallenis spinosa (L.) Cass.

Parietaria judaica Willd
Petrorhagia prolifera (L.) P. W. Ball & Heywood
Petrorhagia saxifraga (L.) Link
Phleum pratense L.
Phlomis fruticosa L.
Phyllirea media L.
Pistacia terebrinthus L.
Pistacia lentiscus L.
Plantago arenaria Waldst. & Kit.*
Plantago lanceolata L.
Plantago major L.
Plumbago europaea L.
Poa annua L.
Poa bulbosa L.
Poa trivialis L. ssp. *Trivialis*
Poa trivialis L. ssp. *Sylvicola*
Portulaca oleracea L.*
Potentila recta L.
Potentila reptans L.*
Prunella laciniata L.
Prunella vulgaris L.
Pteridium aquilinum (L.) Kuhn
Punica granatum L.
Quercus ilex L.
Ranunculus ficaria L.
Raphanus raphanistrum L.*
Rhagadiolus stellatus (L.) Gaertner

Rhus coriaria L.
Rosa arvensis Hudson
Rosa canina L.
Rosa pimpinellifolia L.
Rosa rubiginosa L.
Rubia peregrina L.
Rubus ulmifolius L.
Rumex acetosa L.
Rumex acetosella L.
Rumex conglomeratus Murray
Ruscus acuelatus L.
Sambucus ebulus L.
Sambucus nigra L.
Sanguisorba minor Scop.
Satureja montana L.
Salvia officinalis L.
Salvia sclarea L.*
Salvia verbenaca L.
Saxifraga tridactylites L.*
Scandix pecten-veneris L.
Scirpus holoschoenus L.
Scrophularia canina L.
Scrophularia nodosa L.
Scolymus hispanicus L.
Sedum acre L.
Sedum hispanicum L.
Setaria verticillata (L.) Beauv.
Sherardia arvensis L.
Sideritis romana L. ssp. *purpurea* (Talbot & Bentham)

Heywood
Silene dichotoma Ehrh *
Silene italica (L.) Pers.
Silene latifolia Poiret ssp. *alba* (Miller) Greuter & Burde
Silene vulgaris (Moench.) Garcke
Smilax aspera L.
Sonchus asper L.
Sonchus oleraceus L.*
Spartium junceum L.
Spiranthes spiralis (L.) Chevall.
Stachys germanica L.
Stachys menthifolia Vis.
Stachys recta L.
Stipa bromoides (L.) Dörfler
Stipa pennata L.
Teucrium capitatum L.
Teucrium chamaedrys L.
Teucrium scordium L.
Thlaspi perfoliatum L.
Thymus praecox Opiz ssp. *polytrichus* (A. Kerner ex Borbás) Jalas
Tordylium apulum L.
Torilis arvensis (Hudson) Link
Torilis nodosa (L.) Gaertner
Trifolium angustifolium L.
Trifolium campestre Shreb
Trifolium dalmaticum Vis.
Trifolium lappaceum L.
Trifolium prantese L.
Trifolium repens L.

Trifolium stellatum L.
Valerianella dentata (L.) Pollich
Verbascum nigrum L. ssp. *abietinum* (Borbas) I. K. Ferguson
Verbascum sinuatum L.
Verbena officinalis L.
Veronica chamaedrys L.
Veronica serpyllifolia L.*
Vicia cracca L.
Vicia grandiflora Scop.
Vicia hirsuta (L.) S.F. Gray
Vicia sativa L. ssp. *nigra* (L.) Ehrh
Viola silvestris Lam.*
Viola reichenbachiana Jordan ex Boreau*
Vitex agnus castus L.
Umbilicus rupestris (Salisb.) Dandy

V Possibilities for Tourist valorization

Regarding rich floral diversity of olive grove Džidžarin, roundabout tours for tourists and local visitors in the olive grove might be organized. Those tours should include brief description of the interesting floral elements.

Since this olive grove covers large area, tours of different complexity levels may be organized. Short tours may include introduction with characteristic elements of flora in the vicinity of newly renovated ancient bridge and other various cultural-historical assets of the grove, while adventourous tourists interested in longer walks in the nature might circle the whole grove.

Interested and characteristic elements of flora with high potential for tourst valorization are:

1. Edificators of plants communities in the olive grove;
2. Protected species;
3. Medicinal species;
4. Plants used for cooking;
5. Endemic species.

In order to promote and enrich tourist offer of the olive grove, creation of a brochure would be very useful. The brochure should contain basic information about Montenegrin flora, data about plants found in the grove as well as photos and short descriptions of above mentioned plant species. The brochure should be created after the whole year of floristic research. Research has to include

winter, spring and early summer aspects of the flora, in order to collect detailed data about interesting and characteristic plants. This specifically refers to the family of orchids *(Orchidaceae)*, due to the fact that all of the species belonging to this family are protected by the national law. Those species flourish in the spring and were omitted from this report.

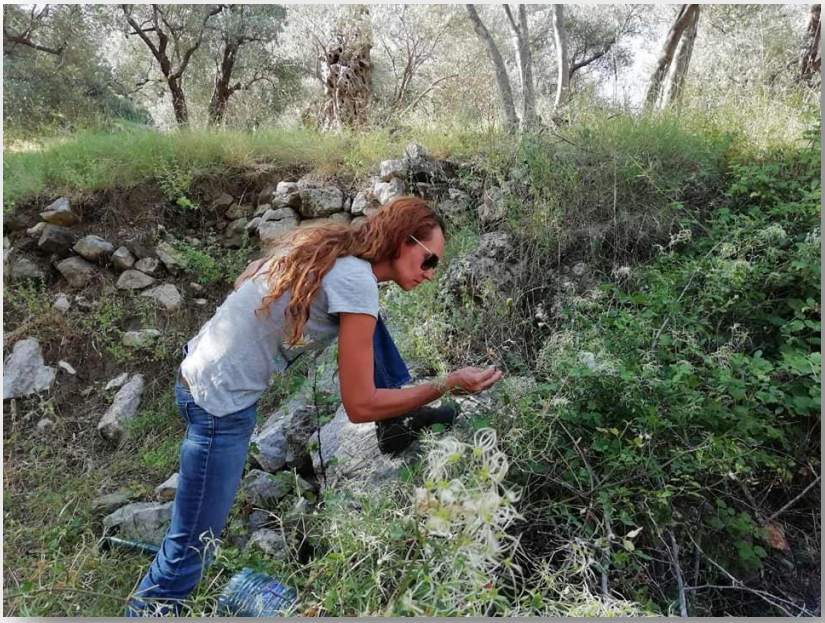

Photo 7: External expert, professor Danka Caković, research biodiversity richness in Džidžarin

VI Endangerement of Biodiversity and Potential Protective Measures

During the research of flora in the olive grove Džidžarin, negative effects of eventual anthropogenic pressures that may endanger the biodiversity were not registered.

Various manners of management, as well as extensive agronomic practices in different parts of the olive grove are favourable for development of various flora.

Additionally, in the parts of the grove that are not maintained, monitoring as well as cuting off the surplus of shrubs (to eliminate increasing of shrub layer) have to be regularly realised.

According to the abovesaid, activities for protection of biodiversity are not necessary at the moment. However, degradation and urbanisation of the area have to be prevented.

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Acknowledgments go to:
A. Živanović and M. Markoč (Municipality of Bar - Montenegro) and to all field collaborators who participated in this project and made possible this publication.

Published online by Municipality of Bar in the framework of the project "INTERREG IPA CBC ITALY-ALBANIA-MONTENEGRO PROGRAMME – **Cross-border cooperation for sustainable development of tourism, through valorisation of rural cultural heritage and conservation of natural asset of areas with ancient olive groves**

This publication has been produced with the financial assistance of the Interreg IPA CBC Italy-Albania-Montenegro Programme. The contents of this publication are the sole responsibility of Municipality of Bar and can under no circumstances be regarded as reflecting the position of the European Union and of the Interreg IPA CBC Italy-Albania-Montenegro Programme Authorities.

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