

# Mapping the ancient olive trees and identification of best conservation practices in Džidžarin plantation

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**INTRODUCTION and OBJECTIVES:** Džidžarin olive orchard is located in Municipality of Bar, southern Montenegro. The experimental study area is approximately 5 km away from the Adriatic Sea and it has the following coordinates - 42°09'N, 19°14'E. The olive orchard is placed at the steep base of Rumija mountain having the elevation between 75 m and 275 m above sea level. The total surface area of this olive complex equals to 68.3 ha (52.65 ha valuable for tourist valorization). The main goal of this research was to identify best agronomic practices in the area and to create maps containing geo-referenced millennial olive trees and cultural-historical assets located within the olive groves, in order to contribute to the promotion of sustainable agri-tourism development and to valorize natural landscapes.

**MATERIALS and METHODS:** Experimental field work in this area consisted of two sets of activities. The first set, aimed to identify best agronomic practices of the area, covered surveying local olive growers about ordinary practices followed by their on-field validation, daily meteorological data monitoring, soil profile opening and sampling, soil laboratory analysis, soil moisture control, irrigation implementation testing and olive yield prediction in irrigated and rainfed conditions. Furthermore, second set of activities encompassed identification of the oldest olive trees, selection of cultural-historical objects with high agri-tourism potential, as well as their geo-referencing and maps compilation.

**RESULTS:** Daily weather data [average air temperature (°C), minimum air temperature (°C), maximum air temperature (°C), rainfall amount (mm), sunshine duration (hours), average relative humidity (%), average wind speed (m/s), maximum wind speed (m/s) and wind direction] were collected regularly from the nearest meteorological station. While average daily temperature was equal to 17.9°C, the extreme minimum was recorded in January (-0.1°C) and the extreme maximum in June (36.2°C). The total sum of precipitation during the experimental period (from January to September 2019) equalled 605.5 mm, distributed within 65 events.

According to the national soil classification system, the subtype of the examined soil is *Eutric cambisol on phlich* (Figure 1). Soil processes that were recorded during sampling are initiation of gleization and lessivage (starting from B<sub>h</sub> horizon), indicating leaching of clay particles to deeper horizons, where poor drainage conditions started to occur due to waterlogging and reduction properties. Due to terrain configuration, surface irrigation supply would not be suitable for this site, and certain traditional water harvesting techniques may be taken into consideration. However, it was noted that irrigation introduction had a positive impact on olive yield.

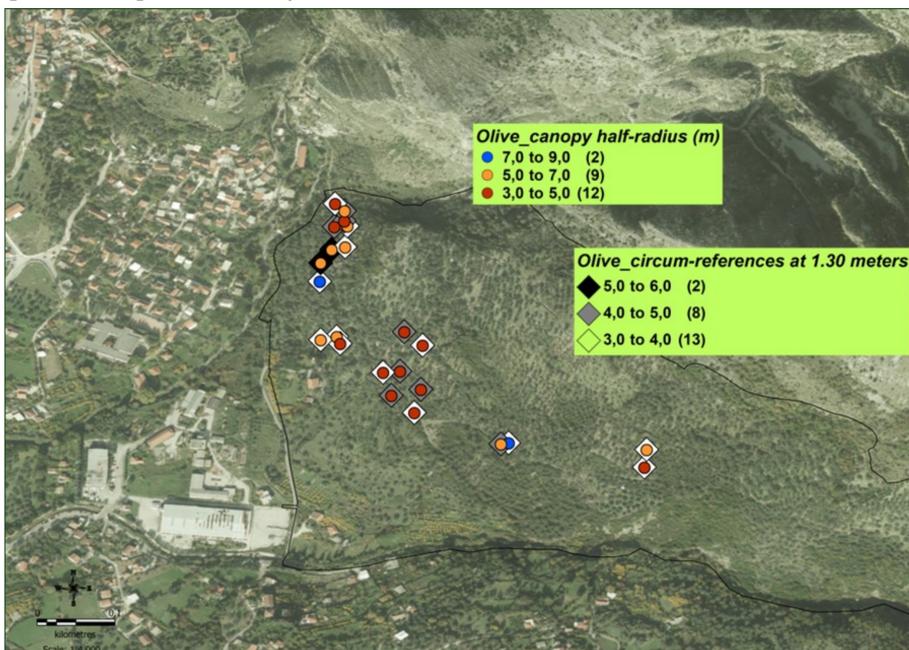


Figure 2: Geo-referenced ancient olive trees in Džidžarin olive orchard

Figure 3 represents the final topographic map of the experimental area that comprehends identified millennial olive trees, cultural-historical assets of high agri-tourism potential, such as remains of St. Urban's church, old mill, newly renovated bridge, fountains, skin tannery traces, as well as plotted public and private passable and impassable roads and ancient trail. Final orthophoto map is available as well.

**CONCLUSIONS:** Džidžarin olive orchard has a tremendous potential for agri-tourism development with immeasurable agronomic, touristic and cultural treasures. Results of this research should be used in further implementation for creation of local development plans and community maps, with constant upgrade of maps available in GIS. In order to develop sustainable tourist activities in this area, certain weaknesses should be removed (eliminate dump/landfill, repair fountains, set labels and guideposts, include local craft and souvenir offer, remove bushes, repair the roads etc.).

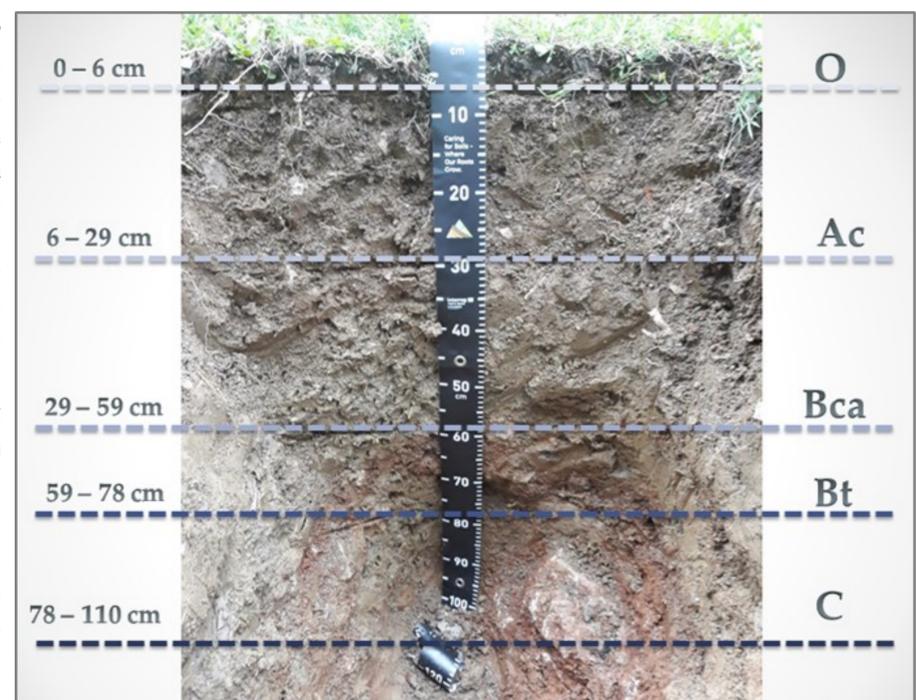


Figure 1: Experimental soil profile with distinguished horizons — *Eutric cambisol on phlich*

Figure 1 represents five soil horizons: organic (O), mineral topsoil horizon with accumulation of decomposed organic matter (Ac), illuvial horizon high in carbonates (B<sub>ca</sub>), illuvial horizon with high clay content (B<sub>t</sub>) and bedrock (C).

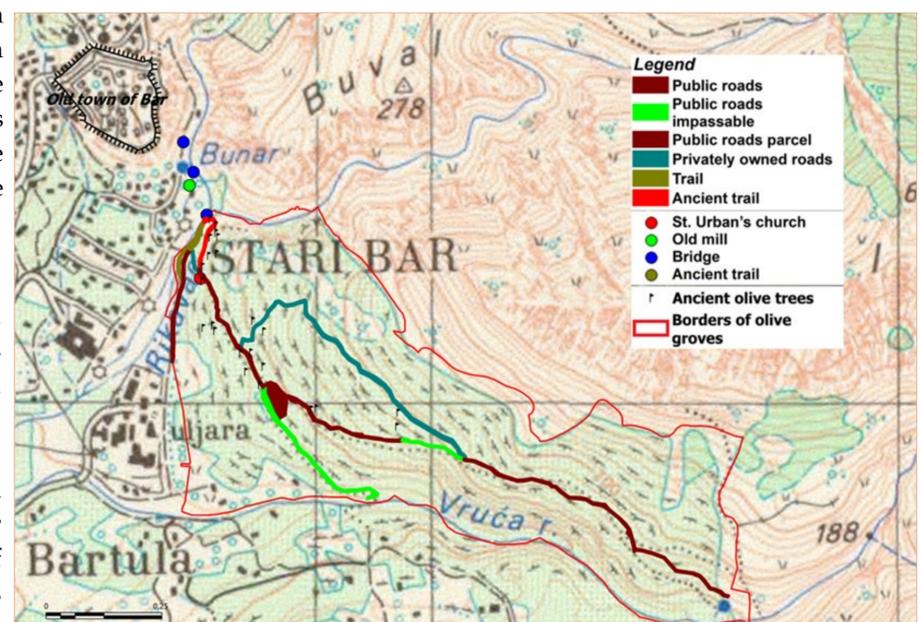


Figure 3: Map of ancient olive trees and cultural-historical assets in Džidžarin olive orchard