

## UAV monitoring of the spread of *Juniperus macrocarpa* on the dunes of NW Tuscany

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*Juniperus macrocarpa* Sm. is a shrub or small tree typical of stable dunes and cliffs in the Mediterranean region (1). The species is diagnostic, constant, and dominant of EUNIS habitat N1B with a VU (vulnerable) status (2). Although not considered an entity at risk, its distribution and habitat in Tuscany show a great discontinuity, due to high anthropic pressure and/or erosion. Here *J. macrocarpa* in some areas has almost vanished due to erosion, in others, it is threatened by tourist pressure, in others still, instead, is expanding. In this survey, we report data related to the fast spread of juniper observed in Marina di Vecchiano (PI), a sandy coast in the north part of the MSRM Regional Park. In this area, *J. macrocarpa* is spreading from the internal consolidated dune to the foredune. For the investigation, an area of about 100 large and 300 m depth and with relatively stable shoreline dynamics in the last 10 years, was chosen. Since 2010 the beach in front of the mobile dune has been protected. This embryonic belt has been quickly colonized by the typical pioneer species of the shifting dunes but also by juniper. For monitoring, the use of high-resolution orthophotos (20 cm pixels) (years 2016, 2019) and UAV technology with 0.7 cm pixel resolution photos (years 2021, 2022, 2023) were added to the ground control. The surveys were carried out along 5 transects 10 meters wide and deep for the entire length of the dune sector. This was separated into 5 belts: embryonic + mobile dune (A), consolidated grassland (B), consolidated juniper (C), and consolidated mixed wood (D) (Fig.1).



Fig.1. Overlapping of the different orthophotography layers (2016-2023) and identification of juniper (yellow dot = new specimens; green polygons = pre-existing specimens).

UAV has proven to be a useful and powerful tool in remote tracking. The first results show a fast colonization of the juniper in A belt. Before the protection of this stretch of beach, only species typical of shifting dunes could be found. Since 2016, the first juniper seedlings appeared, and, in this belt, the population increased by 400 %. This increase is reduced by passing to the inner belts (B= 120%; C=16.6%; D= 9,1 %). This dynamics of colonization, even if conforming with the pioneer behavior of *J. macrocarpa*, does not seem in line with the initial constraints of the species in thermo-Mediterranean environments (strong summer aridity and strong insolation). The coastal environment of northern Tuscany (Meso-Mediterranean) can probably mitigate the aforementioned limiting factors.

- 1) E. von Raab-Straube (2014+) Gymnospermae In Euro+Med Plantbase - the information resource for Euro-Mediterranean plant diversity. – Published at <http://www.europlusmed.org> [accessed 15/05/23].
- 2) M. Chytrý et al. (2020) Applied Vegetation Science, DOI: 10.1111/avsc.12519