Bioindicators and Relict Vegetation Dynamics in Mediterranean Plains: The Bonassai Forest (NW Sardinia) as a Model of *Pyro spinosae–Quercetum ilicis*

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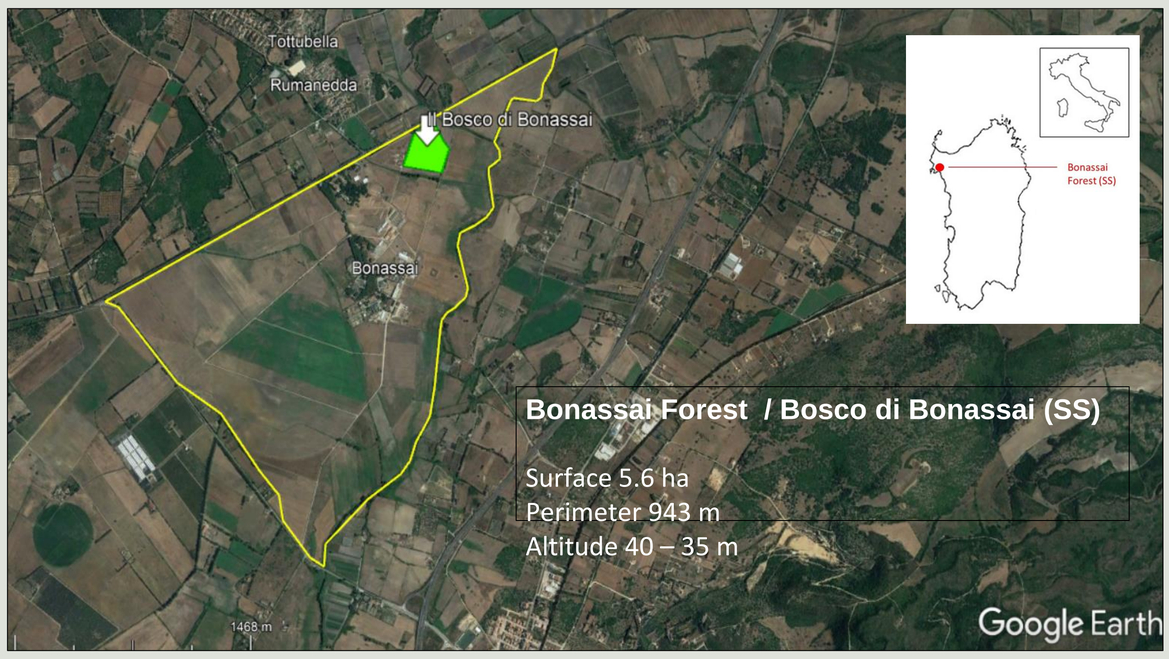
Introduction

The Bonassai Forest, located in Sassari (northern Sardinia, Italy), lies within the "*Oasi permanente di protezione faunistica e di cattura*" and the AGRIS experimental farm. This 6 hectare woodland represents one of the last remnants of the ancient vegetation that once covered the Nurra plain Classified as *Pyro spinosae Quercetum ilicis* in 2001 it is a relict ecosystem spared from historical land reclamation and agricultural clearing. The forest offers a valuable model for understanding the potential natural vegetation of Sardinian lowlands and for assessing biodiversity patterns in Mediterranean plain ecosystems. To characterize the biodiversity and ecological structure of this forest, a multidisciplinary monitoring program was conducted on vascular plants and ants, the latter used as proxies for macroarthropod diversity.

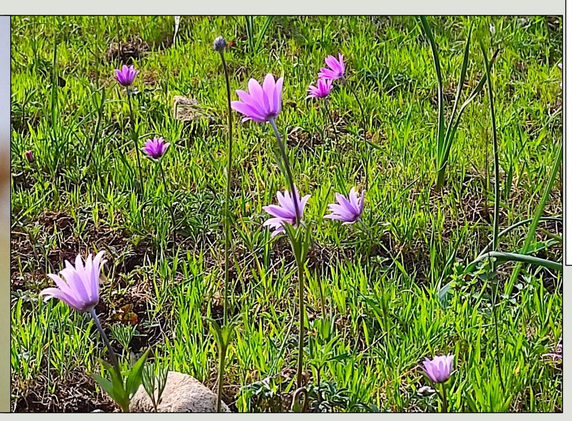


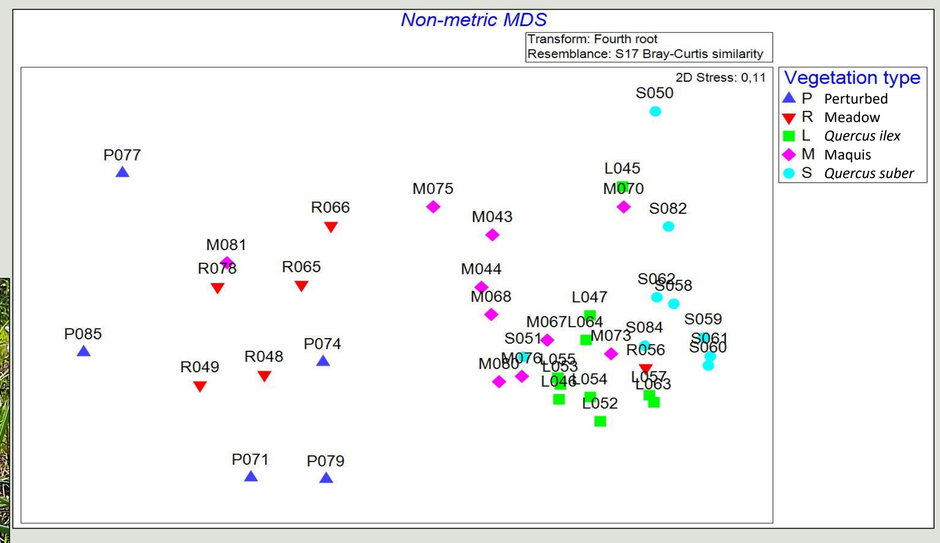
Methods

Vegetation surveys employed stratified sampling plots to analyse species composition, vertical structure, and abundance in both arboreal and shrubby layers. Four vegetation units within the Bonassai forest were identified: holm oak woodland (L), cork oak woodland (S), Mediterranean maquis (M), and clearings. The clearings were classified into three types: natural (R), disturbed (P, located along forest edges), and one shaded clearing beneath the canopy near an old ruin.
Ants were sampled using pitfall traps, following the same spatial design to allow direct comparison between plant and ant communities.
A total of 41 traps were deployed 10 in holm oak woodland, 10 in cork oak woodland, 10 in Mediterranean maquis, and 11 in clearings.
Floristic survey was conducted covering a surface of 5-m radius around each trap to quantify local plant species composition and richness.

Results

The *Pyro spinosae–Quercetum ilicis* formation is dominated by *Quercus ilex* with *Quercus suber* and *Olea europaea*, accompanied by thermophilous shrubs (*Chamaerops humilis*, *Pistacia lentiscus*, *Myrtus communis*, *Rhamnus alaternus*) and mesophilous spiny species (*Pyrus spinosa*, *Prunus spinosa*, *Crataegus monogyna*). The herbaceous layer includes Mediterranean nemoral species such as *Ambrosinia bassii*, *Narcissus obsoletus*, *Bellis sylvestris* and *Prospero obtusifolium* subsp. *intermedium*. This multi-layered structure promotes habitat heterogeneity, soil stability, and resource diversity, contributing to high ecosystem resilience.





NMDS ordination showing the clustering of pitfall samples according to similarities in composition.

Ant assemblages reflected the forest's structural complexity, indicating that vegetation architecture plays a significant role in shaping macroarthropod communities. A total of 222 botanical species were recorded. The species richness (S) of both the flora and ant assemblages varied among the five vegetation units (L, S, M, R, and P), being 40 and 7; 42 and 5; 88 and 8; 162 and 7; and 161 and 6, respectively.
Twenty-two ant species were identified, representing about 25% of the entire ant biodiversity of Sardinia. The ant assemblage is characterized by species that dominate agroecosystems and arboreal habitats, reflecting the island's mosaic of Mediterranean landscapes. Many of these species are thermophilous and well adapted to the dry, warm conditions typical of Sardinia, while others play key ecological roles in soil turnover, seed dispersal, and the maintenance of trophic interactions.

Conclusions

The Bonassai Forest constitutes a key ecological reference for Mediterranean plain forests. As the locus classicus of *Pyro spinosae–Quercetum ilicis*, it provides a model for interpreting the dynamic vegetation series of Sardinian lowlands under thermomediterranean and mesomediterranean conditions. The integration of botanical and faunal data underscores the importance of conserving the forest's multi-layered architecture to maintain biodiversity and ecological functionality. Protecting this relict woodland within the "Bonassai" reserve is essential for safeguarding regional biodiversity, sustaining ecological processes, and preserving a living witness of Sardinia's ancient lowland forests.

2nd International Symposium on Biodiversity and Ecosystem Functions under Global Change
12 – 14 November 2025
Alghero (Sardinia – Italy)