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Long-term assessment of ecological restoration activities in desertification prone Mediterranean areas: a study case from Sicily

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Introduction

The Nature Reserve “*Macalube di Aragona*” (Agrigento Province) is a small protected area of inner Sicily with great environmental value and high biological diversity. It is managed by Legambiente, a national environmental association which, supported by the University of Palermo, has launched several restoration projects within various Sicilian reserves. The Reserve has been established to protect a peculiar geological phenomenon, the so-called sedimentary volcanism, and hosts habitats and plant species of high interest. In the past decades intensive farming and grazing, along with wildfires, triggered the significant reduction and fragmentation of native habitats, the extinction of some plant species and the high increase of the desertification risk (see the red colour in the map on the left).

In this context, the Macalife project (LIFE04 NAT/IT/000182) for the “Preservation and extension of priority habitats damaged from agriculture activity” has been launched in 2004.

Interventions

Interventions were addressed to restore native habitats following the principles of ecological restoration. Accordingly, differently from the classical approach, consisting in the use of pines as preparatory species, native herbs, shrubs and trees were selected and used in the plantations carried out during the project.

The main aim of the interventions was to restore the most important plant communities corresponding to several habitats of community interest according to 92/43 EU Directive, i.e. the Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea* (6220) (perennial xerophilous *Lygeum* grassland), the halo-nitrophilous scrubs of the *Pegano-Salsoletea* (1430), and to improve the conservation status of some endemic and endangered plant species like *Tripolium sorrentinoi* (= *Aster sorrentinii*), featured among the priority plant species of the above-mentioned Directive.

All the target species were propagated in local nurseries, using seeds exclusively collected from individuals occurring on site, and some woody plants were also inoculated with symbiotic microorganisms (plant growth-promoting bacteria and mycorrhizal fungi).

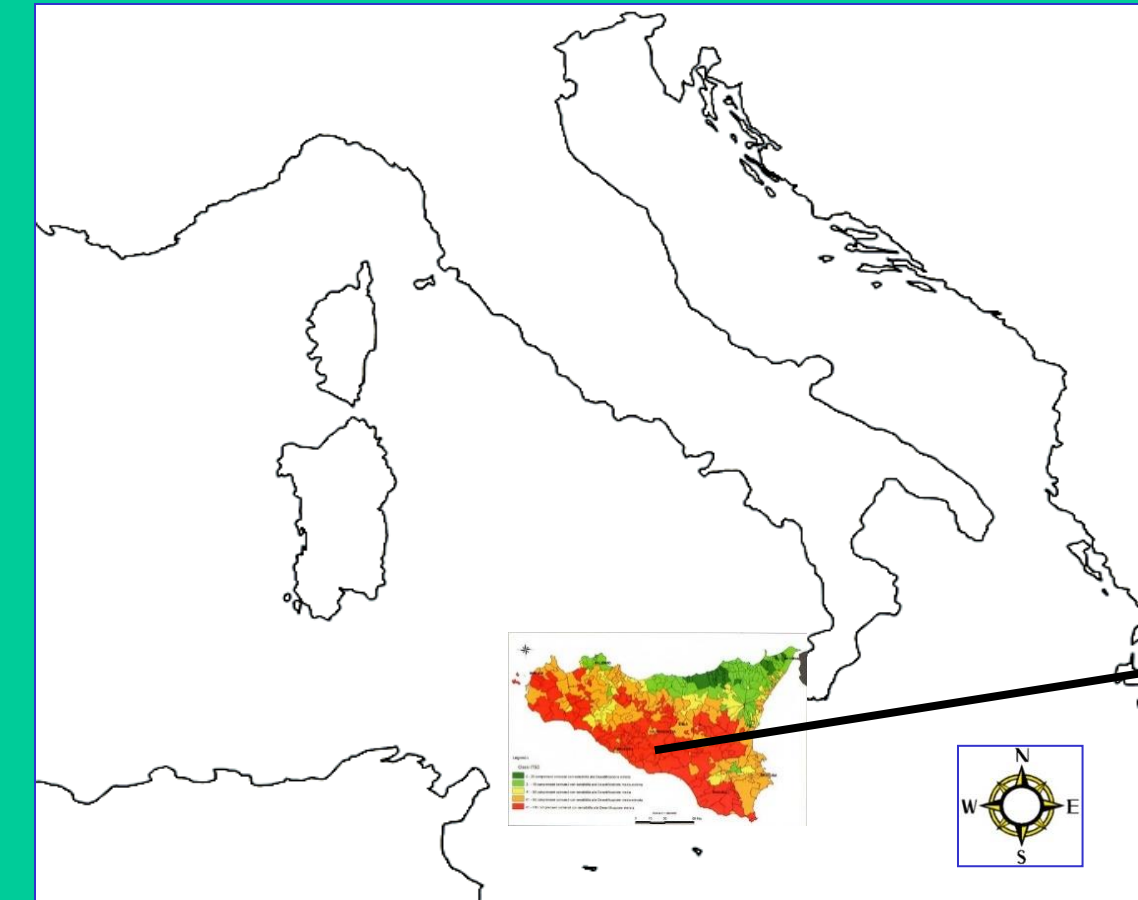
Here we report the results of monitoring activities conducted more than a decade after the last monitoring.

Results

- Significant increase in the area covered by *Lygeum spartum* grasslands, that play a crucial role in protecting native biodiversity as well as representing a strong barrier against soil erosion;
- Full establishment of *Tripolium sorrentinoi* population, now covering about 700 m² throughout the protected site;
- Halo-nitrophilous scrubs with *Salsola vermiculata*, *Salsola oppositifolia* and *Suaeda vera* are steadily spreading;
- The establishment of *Tamarix* individuals are allowing the recovery of hygrophilous thicket nuclei along the banks of the local temporary ponds.

Conclusions

- The interventions of ecological restoration carried out in the protected site have proven the importance to directly use native species to restore Mediterranean biotopes and habitats of particular scientific and conservation interest
- The very promising results from long-term monitoring activities suggest that the use of local plant germplasm and proper propagation techniques are allowing the restoration of Mediterranean habitats under desertification threat
- The good results in terms of plant growth and establishment after fungal or bacterial inoculation in most of the propagated species have proven the considerable importance of belowground symbiotic relationships, a too often overlooked topic in forestation and ecological restoration activities.



The “Macalube of Aragona” nature reserve is localized in southern Sicily, in areas prone to high desertification risk



The interventions carried out in the past promoted the restoration of native habitats and the reduction of soil erosion processes. Planting was performed using plant material collected in the site and propagated through a local nursery.



A map detail showing the remarkable increase in the cover of *Lygeum* grasslands in the last twenty years



A new nucleus of *Tripolium sorrentinoi* observed during the field surveys carried out during summer 2022.



The restoration of native habitats and the construction of perches have positively influenced also the biodiversity of local vertebrate fauna



Key results of the project have been the restoration of *Lygeum* grassland and the remarkable increase of the local populations of *Tripolium sorrentinoi* and many orchid species.

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