

LAYMAN'S REPORT

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RES MARIS



Recovering Endangered habitats in the
Capo Carbonara MARine area, Sardinia



The **RES MARIS** project aims at the conservation and recovery of marine and terrestrial ecosystems of the emerged and submerged beach system on the Site of Community Importance (SCI) ITB040020 "Isola dei Cavoli, Serpentara, Punta Molentis and Campulongu".

In particular, the project focuses on **priority habitats** 1120* "Posidonia beds (*Posidonium oceanicae*)", 2250* "Coastal dunes with *Juniperus* spp." And 2270* "Dunes with pine forests *Pinus pinea* and / or *Pinus pinaster*" of the Habitat Directive 92/43/CEE.

In these habitats, during the last decade there has been a significant increase in invasive alien species, both on land and at sea, as well as an increasing degradation of the posidonia beds due in particular to uncontrolled anchoring. Therefore, an integrated sea-land action was required with the following **specific objectives** :

- ✓ **Control/eradicate** the invasive alien species present in the priority habitats (target 5 of the "European Biodiversity Strategy to 2020");
- ✓ **Long-term protection of the three habitats** by applying best practices;
- ✓ **Reduce/control** the threat posed by unrestricted anchorage on habitat "Posidonia beds";
- ✓ **Restore** the natural development of the spontaneous vegetation in the priority habitats;
- ✓ **Restore and recover** the areas colonized by invasive species in priority habitats.
- ✓ **Raise awareness** among local community, visitors and all stakeholders about the protection and conservation of marine and land ecosystems.
- ✓ **Share** good practices on the conservation and the sustainable use of environmental resources.

SITE OF COMMUNITY IMPORTANCE

All project actions are implemented within the **Site of Community Importance (SCI) "Isola dei Cavoli, Serpentara, Punta Molentis and Campulongu"**, which is located precisely in the municipal territory of Villasimius, Province of South Sardinia. The SCI covers an area of 9,280.48 hectares (742.48 on land and 8.538 marines), and match almost entirely coinciding with the border of the **Capo Carbonara Marine Protected Area** and includes three Special Protection Areas (SPAs) "Isola di Serpentara", "Isola dei Cavoli", "Capo Carbonara and Stagno di Notteri - Punta Molentis" according to the Bird Directive 2009/147/CE.

ACTIONS

Preparatory actions: assessment of the conservation status of habitats, of the distribution of alien species and identification of the areas of intervention.

Concrete conservation actions: at sea installation of mooring equipment and habitat recovery interventions 1120*; on land collection, multiplication and reintroduction of germplasm, control / eradication of invasive alien species, restoration and renaturation of the dune vegetation in the habitats 2250* and 2270*.

Monitoring: evaluation of the effectiveness of concrete conservation actions implemented on land and at sea.

Communication and dissemination of results through website, social networking, school activities, territorial animation, video documentaries, etc.

Management and networking: to ensure compliance with times, objectives and costs.

COORDINATOR BENEFICIARY

Città Metropolitana di Cagliari (formerly Province of Cagliari)

ASSOCIATED BENEFICIARIES

Municipality of Villasimius

Capo Carbonara Marine Protected Area

University of Cagliari - Centre for the Conservation of Biodiversity (CCB), Life and Environmental Sciences Department

TECLA - Association for the local and European transregional cooperation

SUPPORTED BY

Sardinian Region Environmental Department

Federparchi, Italian Federation of Parks and Natural Reserves

Tourist hotel consortium "Villasimius per il turismo"

START DATE: 01/06/2014

END DATE: 31/05/2018

TOTAL BUDGET: € 1,510,805

EU CONTRIBUTION: € 1,121,479 (= 74.23% of the total budget)

WEBSITE: www.resmaris.eu

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All project actions are implemented in the **Municipality of Villasi-mius**, a locality that represents one of the main tourist attractions of Sardinia; its reputation and recognizability as a marine - coastal destination in fact are in continuous growth at national and international level. Its tourist offer is characterised by the quality of environmental resources, especially the coastal and marine ones, as well as for the services connected to the fruition of these assets.

What is the purpose of the RES MARIS project ?

RES MARIS aims to protect, defend and recover the priority marine habitat **Posidonia beds** (1120*) and priority land habitats **Coastal dunes with junipers** (2250*) and **Dunes with pine forests** (2270*).

CODE	NAME	SPECIES FEATURES
Habitat 1120*	Posidonia beds : "Posidonion oceanicae"	<i>Posidonia oceanica</i> is the characteristic plant of the habitat; it is an endemic species of the Mediterranean Sea and within the SCI it cover an area of about 2000 hectares, at depths ranging from a few meters to more than 40 m. This habitat is the most important and representative ecosystem in the Mediterranean Sea as it performs fundamental functions for the submerged life and for the protection from coastal erosion.
Habitat 2250*	Coastal dunes with juniper: "Coastal dunes with <i>Juniperus spp.</i> "	It is the most vulnerable wooded habitat of the coastal dune strip. It consists of community of junipers, mainly large-fruited juniper (<i>Juniperus macrocarpa</i>) and Phoenician Juniper (<i>Juniperus phoenicea ssp. turbinata</i>), accompanied by other shrub species such as mastic (<i>Pistacia lentiscus</i>) and narrow-leaved mock privet (<i>Phillyrea angustifolia</i>). This habitat has an important stabilizing function of the fixed dunes and in the ground part of the SCI it covers 7.26 hectares on 742.48 hectares.
Habitat 2270*	Wooded dunes with pines trees: "Wooded dunes with <i>Pinus pinea</i> and/or <i>Pinus pinaster</i> "	The habitat consist mainly of communities of pine trees such as the stone pine (<i>Pinus pinea</i>) and the Aleppo pine (<i>Pinus halepensis</i>) accompanied by shrubby plants such as junipers. Product of reforestation activity, it is rarely natural, nevertheless it has a great environmental naturalistic importance because it favors the growth of other plant species in the undergrowth. In the SCI it is located in the innermost part of the stable dunes of Campulongu and covers 9.29 hectares.

The aforementioned habitats are highly vulnerable and the growing anthropic pressure can cause an alteration of the habitats with consequent fragmentation and reduction and / or disappearance of the native species, thus favoring also the spread of invasive **non-native plant species**. These are non-native species introduced into the Mediterranean from bio-geographic regions.

They are frequently spread by direct human action (intentional or accidental) and in any case they constitute an important threat that can cause damage to the habitats, often causing a reduction in biodiversity.



Juniper recovery Timi Ama (Habitat 2250)

- ✓ Updating of the conservation status of priority habitats 1120 *, 2250 * and 2270 *;
- ✓ Drafting of checklist of vegetal alien species;
- ✓ Reduction diffusion / presence of alien invasive species in areas of interest;
- ✓ Drafting of new protocols of germination and multiplication on a wide-scale for selected psammophile species;
- ✓ Production of plants from the germplasm (seeds) for renaturation interventions;
- ✓ Restoration of Posidonia beds and priority dune habitats;
- ✓ Involvement of local schools in educational activities;
- ✓ Production of 10 video documentaries;
- ✓ Drafting of the online manual of best practices and guidelines for the correct use and management of the sandy coastal areas.
- ✓ Awareness-raising activities for tourists and citizens.

The project has been structured into different types of actions. The first ones are the preparatory actions (A), which allowed to update the status of knowledge of the priority habitats of the SCI, to identify targets areas of intervention and plan the concrete conservation actions (C). The latter constitute the most relevant actions and have provided for the application of protocols and solutions already tested in other similar projects, in particular for the dunes in the LIFE07NAT/IT/000519 PROVIDUNE project.

The monitoring actions (D) were aimed at evaluating the effectiveness of conservation measures.

Communication actions (E), transversal to the whole project, concerned the realization of a coordinated communication plan shared by the partners and implemented by activities and promotional and information tools, both conventional and multimedia.



ACTIONS AT SEA

The actions at sea have provided for the recovery of the the *Posidonia oceanica* beds in the degraded areas, by placing geomats on the seabed on which cuttings of *Posidonia oceanica* have been planted and through the eradication of invasive alien species, in particular *Caulerpa cylindracea*.

This activity was carried out in sectors of the Posidonia beds damaged for example by anchors and / or fishing trawling equipment, and identified on the basis of information obtained during the preparatory actions. In order to protect the habitat, mooring buoys have been positioned in order to reduce the impact of free anchorage on the habitat.

ACTIONS ON LAND

The actions on land are mainly designed to recover and restore priority habitats, remove the threat of invasive species and repopulating with native species typical of dune habitats. The seeds used to reintroduce these plants are collected in the SCI areas and then propagated in specialized nurseries.

The areas selected in the preparatory actions, after the removal of the invasive, are subjected to interventions to avoid the erosion and loss of the dunes. The first step is the sowing and the planting of the collected and propagated material, followed by the creation of naturalistic and low impact engineering structures, which favour the accumulation of sand and the redevelopment of the dunes.



COMMUNICATION ACTIONS

Communication actions include promotion and dissemination of project contents through conventional media (brochures, flyers) and multimedia (website and social network); a manual of good practices for the integrated management of the marine and coastal strip, the implementation of environmental education, as well as local outreach actions aimed to the local population and tourists.

For more information, visit the website www.resmaris.eu.



Positioning mooring buoys

As regards **actions at sea**, seabed surveys were conducted with the aid of acoustic detection techniques, associated with sea-truth activities performed by SCUBA diving and towed underwater camera. The use of these techniques and subsequent analysis of the results allowed to have an exhaustive overview of the state of conservation of the seabed and to identify areas of intervention intended for the placement of the mooring facilities for habitat protection.

To update the check-list of alien marine flora present in the habitat 1120* , non-destructive visual techniques in diving were applied and, where appropriate, non-destructive visual techniques were used by scientific divers samples were taken for subsequent laboratory analysis for the identification and quantification of alien algal species with particular attention to the invasive ones.

The information gained from the preparatory actions allowed the best evaluation for the development and planning of concrete conservation actions at sea. For habitat protection in habitat 1120* 31 fixed mooring facilities in previously identified areas were placed. The methodologies used for restoration of the natural habitat conditions in 1120* were:

- ✓ Manual removal of alien invasive species *Caulerpa cylindracea*;
- ✓ Experimental removal of *Caulerpa cylindracea* by laying 5 blackout curtains, for a total area of 150 square meters and a test period of at least 30 days;
- ✓ Planting of native plant *Posidonia oceanica*: collection of naturally undermined cuttings of *Posidonia oceanica* and their subsequent placement on geomats MAC MAT® (1.000 recolonization patches consisting of a minimum of 30 cuttings / sqm for a total area occupied by the intervention of 1.000 sqm.).

Finally, monitoring actions were carried out to evaluate the effectiveness of conservation actions. The applied methodologies are in line with those proposed by the project and widely documented in the scientific bibliography relative to the habitat 1120*.



Monitoring of invasive species

For the **land part**, both the preliminary investigation on habitats 2250* and 2270* and preparatory actions to harvesting, propagation and reintroduction of germplasm and the analysis and updating of the distribution of invasive plant species in the area and detailed mapping within the habitat 2250* and 2270* were concluded.

The cognitive investigations were carried out, both through field trips, and through the analysis of bibliographic and herbarium data and those related to the results of the **LIFE + PROVIDUNE** project. This has allowed the realization of updated floristic inventories of native species, endemic and / or of phytogeographical interest for the evaluation of the species destined for the collection, the test and the multiplication of the germoplasm.

The field surveys have also allowed, through the compilation of special "alien threats" boards, to have a detailed and updated knowledge base of the invasive plant species that threaten the priority coastal habitats and to carry out the checklist of the alien plants present in the SCI and the cartographic elaborations of invasive species in the priority habitats of the SCI with greater detail for those belonging to the genus *Carpobrotus*, *Agave* e *Acacia*.

The information derived from preparatory actions allowed the best evaluation for the development and planning of the concrete conservation actions on the ground.

For the conservation of habitats 2250* and 2270*, germplasm of 14 structural taxa was collected; among these, for 6 species completely new and never investigated before, the optimal germination protocol has been identified. The germplasm and protocols were delivered to the Forestas Agency of the Sardinia Region that, with the scientific support of UNICA-CCB, produced a number of plants equal to 31.070 units, of which over 28,000 have been used to renovate the priority habitats and those connected to them.

Controls and / or eradication of invasive non-native species have been completed in the habitats 2250* and 2270* and restoration and renaturation of the dune vegetation related to the habitats 2250* and 2270* that have affected the priority habitats , as well as public areas adjacent to or near the priority habitat areas and different private areas.

For the **control of invasive species**, the intervention was implemented not only on the **19,000 sqm** relative to priority habitats and those connected to them in a catenary succession, but also on **about 40,000 sqm** of public areas adjacent to or near the priority habitat areas with presence of non-native species invasive, very variable in terms of coverage and never more than 10%.

The **renaturation action** concerned the same areas on which we have intervened for the control of invasive species. This was achieved through naturalistic engineering interventions, **planting around 30,000 plants and sowing about 25,000 seeds**.



Eradication monitoring

The collected germplasm was monitored, through the qualitative and quantitative analysis of seed lots, and the verification of the protocols applied for the germination of the selected and harvested species.

Monitoring also involved evaluating the effectiveness of interventions in habitats 2250* Coastal dunes with junipers and 2270* Wooded dunes with Pinus pinea and/or Pinus pinaster.

In particular, monitoring was aimed at evaluating the recovery of invasive species subject to intervention through the presence of new plants or recesses and the regeneration of spontaneous vegetation through the study of indicator species.

As far as **communication and dissemination activities** are concerned, these have been coordinated and integrated into a unified communication strategy for all partners, in line with the general objectives of the project, in order to offer a unified image and constitute an easily recognizable identity. The aim of the communication strategy was to increase the general visibility of the project, through the preparation of informative material, the development of a program to disseminate the activities and results of the project, the creation of communication flows among project partners and among these and the stakeholders (citizens, businesses, local institutions of reference, environmental associations, local economic operators such as hoteliers, trade associations, tourists and local tourism operators in general). The website (www.resmaris.eu) and the social networks (Facebook, Twitter, YouTube and Instagram) were activated and digital gadgets were produced (screen saver, animated background and the APP game) produced, as well as communication materials.

Dissemination products (**Flyer on habitats and sustainable fruition, 16-page dissemination brochure, Role-playing gamebook, flyer Game for children**) have been widely distributed in the territory of Villasimius: left available at strategic points of greater attendance (Municipality, Capo Carbonara Protected Marine Area, tourist office, tourist port, environmental education center and various information points) and delivered during the summer awareness campaigns and the various events that were held during the project life.

The same materials have also been distributed to a very wide audience in the course of initiatives held in Cagliari organized by the University of Cagliari.



Brochure on habitat and sustainable use

The **information panels on the habitats** and **educational roll-ups** were also realized. The environmental information and education activities have been implemented in the schools of the territory (infancy, primary and secondary) for the school years 2015/2016, 2016/2017 and 2017/2018 with the involvement of a total of approximately **600 students**.

As for the territorial animation, two technical tables were organized with local stakeholders and a public project launch event. The campaign for the replacement of non-native species with native autochthonous species in private areas was also carried out, and the actions to raise awareness tourists for the summers in 2015, 2016 and 2017 with **about 12,000 tourists contacted**. The information and awareness campaign was based not only on the distribution of gadgets, flyers and brochures, but also on the filling in of questionnaires for a **total of 878 filled out questionnaires**.

Finally, **10 video documentaries** were produced and disseminated.

The project was also promoted through the participation of partners in various television and radio shows.

IMPACT OF THE PROJECT ON HABITATS

The environmental benefits are related to the implementation of concrete conservation actions.

With regard to **actions at sea**, placement of mooring buoys had the function to reduce the impact generated by the free berths on habitat 1120*, in particular the work of recreational boats (between 15 and 24 meters in length). The restoration of the native species *Posidonia oceanica* had, instead, the function of reducing the fragmentation of habitat 1120* through an increase of plant coverage, obtained thanks to the implantation of patches of recolonization constituted by at least 30 cuttings / sqm. In addition, in order not to undermine the structural integrity of the surrounding meadows or other donor seagrasses, only naturally undermined cuttings were collected and used for the execution of the planting intervention.

Attempts to remove the invasive alien species *Caulerpa cylindracea* have proven to be of limited efficacy over the long term. Since the threat is not eradicable, attempts have been made to limit the invasion of the seaweed as much as possible by maintaining the integrity of the habitat 1120* by strengthening the protection measures supported by actions aimed at sensitizing and sustainable use of the sea.

The positioning of the mooring buoys had a positive impact on the habitat 1120* with the reduction the pressure generated by the free anchoring. The pressure was further reduced with the addition of 11 buoys beyond the 20 foreseen by the Project. The restoring of the native species *Posidonia oceanica* has had a strongly positive impact linked to the reduction of habitat fragmentation 1120* with relative increase in the percentages of plant cover.

Furthermore, the exclusive use of naturally undermined cuttings has prevented their removal from the natural prairie, eliminating any possibility of negative impact on the habitat 1120*. The maintenance of the actions at sea undertaken in the RES MARIS project will be assured even after its end; in fact, in addition to being recognized as a marine SCI, the site is a Marine Protected Area which, among its institutional aims, pursues the protection of biodiversity and promotes monitoring activities on habitats and species.

With regard to **land actions**, the knowledge acquired with the C3 action remains available and can be replicated at any time and context; thus represent a long-term benefit for the project's habitat objects.

The collection, conservation and multiplication of germplasm activities (seeds, but also tissues, spores and pollens that represent the material capable of transmitting the hereditary characteristics of a given species) constituted a fundamental step in the field of project, aimed at achieving in the best possible way the most practical conservation actions carried out on dunal systems, both in public and private areas.

The first conservation action was the seed harvest during the ripening season. It was essential to harvest native germplasm, coming from a site compatible with those where reintroduction interventions will be carried out. This was done to increase the chances of success of recovery and re-naturalization.

Once brought to the laboratories of the **Germplasm Bank of Sardinia**, the seeds were subjected to a period of quarantine in a controlled temperature environment; they were then either cleaned, selected, scanned and weighed and counted.



Work in the germplasm bank

A part of the seeds collected was used for the execution of studies and tests such as germination tests, which led to the obtainment of the optimal germination protocol for each species.

This protocol has therefore been provided to the **Foresta Agency**, which provided for the large-scale multiplication of the species selected in the project, intended for the renaturalization of dune habitats.

With regard to the part on the ground, thanks to the conclusion of the concrete actions and the carrying out of the monitoring, we can consider the objective of controlling the invasive non-native species present in the priority habitats.

As regards the objective of encouraging the recovery of the natural dynamics of the native vegetation, thanks to the monitoring until the end of the project and during the **post-LIFE**, it will be possible to quantify the results (already visible even if in the initial phase) and verify its achievement.



www.resmaris.it - info@resmaris.it

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CITTA' METROPOLITANA DI CAGLIARI



Comune di Villasimius



VILLASIMIUS
AREA MARINA PROTETTA
CAPO CARBONARA



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