

PROTECTION COASTAL ENVIRONMENT : GOOD PRACTICES AND EXPERIENCES (Case - study in Italy)

Ms. CHIARA VICINI

APAT

Agency for Environmental Protection and Technical Services

Contents

1. Introduction
2. Posidonia grasslands
3. Rebuilding of coastal dunes
4. The case study of *Circeo*
5. The case study of *Nova Siri Marina*
6. The case study of Po river
7. The case study of M.O.S.E. in Venice
8. The case study of Mediterranean Garden in *Vasto*
9. Conclusions

1. Introduction

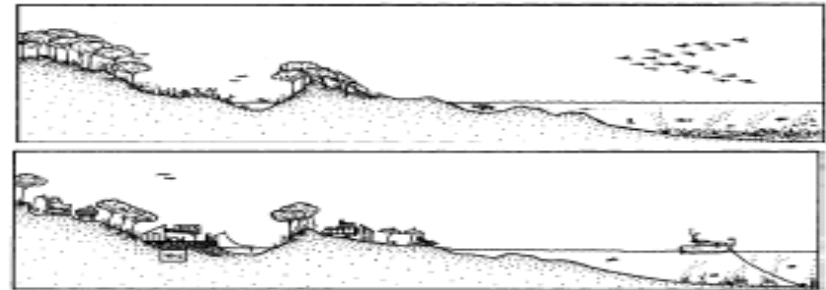
- A new model of intervention, in the last years, use a series of element to control the energy of meteo- marine pressures, and to assure an high environmental quality for the fruibility of the beach.
- In this context, the interventions of rebuilding and planting dunes, combined with reforestation of fanerogame submerged and / or re-generation of the beaches have a decisive role to protect the sea environment.

2. Posidonia Grasslands

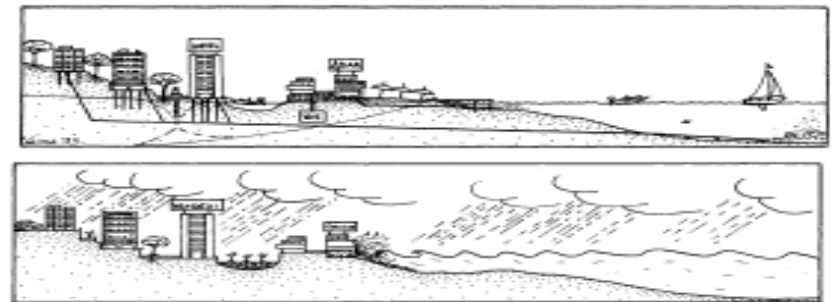
Posidonia is a *fanerogama* plant very important for marine ecosystem:

- ☐ grasslands submerged are irreplaceable site for breeding and growing of fish, shellfish and crustaceans
- ☐ produces oxygen: for every 1 square meter, until 14 liters of oxygen for a day
- ☐ protects shoreline from erosion through the reduction of the waves action

The action of Posidonia grasslands is similar to the activity of dunal vegetation: the plant roots hold the sand and reduce beach erosion



L'azione delle praterie di Posidonia è simile a quella della vegetazione che cresce sulle dune delle spiagge; le radici dei due tipi di vegetazione trattengono la sabbia



Disegni modificati da "La Posidonia Oceanica - Rivista Marittima 1995" e da "Mare è Vita - Fondazione Michelagnoli 1995" - www.fondazionemichelagnoli.it/poster

Posidonia grasslands are decreasing for the negative effects of :

Trawling

Anchorage

Port and river facilities

Industrial and urban areas pollution

Posidonia grasslands re-forestation

Reforestation of sea-bed is possible, also for wide extensions, through various techniques:

- ☐ Water soluble vases of biodegradable materials
- ☐ Insertion of plants in metal bollards

- An example of Posidonia grasslands re-planting in a Marine Park close Rome (Italy)



3. The rebuilding of coastal dunes :

- Dunes form when an obstacle, such as rock or vegetation, causes wind velocity to decrease and deposit any windblown material on the leeward side of the obstruction.
- Most dunes are not static features and slowly migrate as wind blows sand up the gently sloping windward side over the crest and down the steep leeward side. Dune migration tends to be slow but moving over of 30 meters in a year. Migration will continue until the dunes become vegetated. This can occur naturally or may be due to deliberate planting. Planting programs are established to stabilize the dunes and prevent further loss.
- In coastal areas vehicular and foot traffic can cause depletion of dune vegetation, allowing erosion to set in. This has had serious consequences along part of the northeastern seaboard of the USA and the Netherlands, where dunes protect low-lying land from inundation by the sea. Loss of life and damage to property can be considerable if the sea breaches the protective dunes.
- In Italy, rebuilding and planting of coastal dunes are fairly widespread

In the past



Re-establishment of dunes in *Sabaudia, Latina*, Italy (year 1960) - photo S. Puglisi



Dunes stabilisation by *Ammophila* planting on Libia (year 1931)



4. The case study of Circeo (1)

A case study very significant is the coastal dunal system on national park of Circeo (close Rome). The coastal dune extends itself along the coast, from the slopes of the promontory and for about 25 Km northwards to Capo Portiere. It is a geologically and vegetationally delicate area consisting in a continuous series of sandy reliefs reaching a width of 250 meters. Also in this case we can distinguish a less protected sea-side slope with a pioneer halophilic vegetation and an inner slope which is protected by the sea wind full of saltiness.

- ❑ This system have a variable high from 8 ÷ 10 meters until a maximum of 27 meters
- ❑ It is a sanding area re-establishment by vegetation, stopped in the own dynamism (accretion and erosion) by the coastal road built in 1931



The case study of Circeo (2)

From 1995 until 1998, after various analysis, are issued specific recovery and protection interventions by :

- ☐ foot baseline barrier consists of sloping *graticciata*
- ☐ chessboard barriers to protect by wind
- ☐ re-establishment and dunes stabilisation through combined consolidation, *viminate* – *graticciate* and barriers to protect by wind

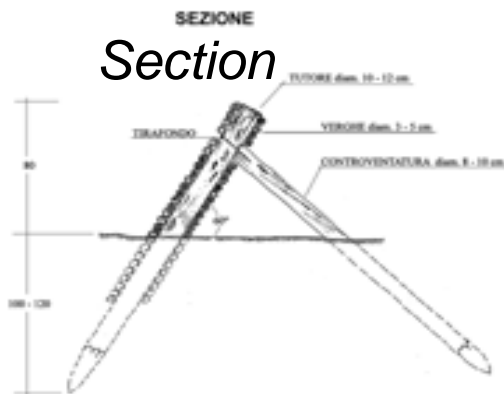
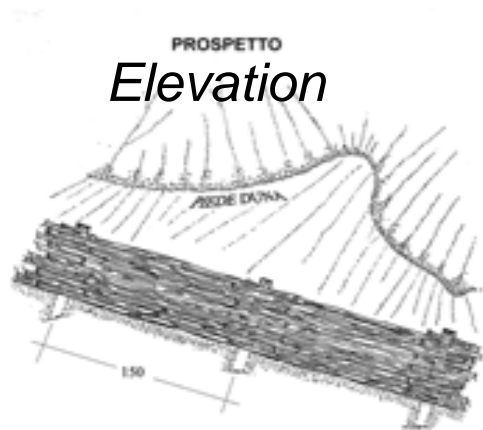


The case study of Circeo (3)

Others works:

- ☐ wooden footbridges for direct access to the beach
- ☐ wooden dissuasive fences
- ☐ pickets fence for the interdiction of private car parking on the dune
- ☐ information panels on the proper use of the dunal environment

TYPE 1: Barrier baseline in *viminata*



Protecting the dune by foot baseline barrier consists of sloping graticciata (da G. Bovina, C. Callori Di Vignale, M. Amodio *Manuale di Ingegneria Naturalistica Volume 2 - Regione Lazio 2003 modificato*)

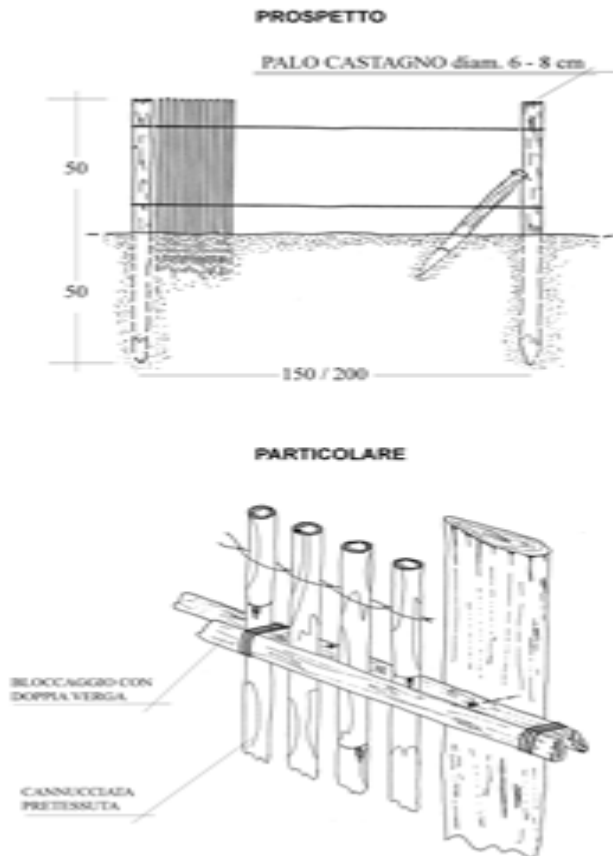


Barrier baseline immediately after execution

TYPE 2: Chessboard barriers to protect by wind

Elevation

(da G. Bovina, C. Callori Di Vignale, M. Amodio
*Manuale di Ingegneria Naturalistica Volume 2 -
Regione Lazio 2003 modificato*)



Barriers after two years (from construction)

TYPE 3: Combined consolidation

- Re-establishment and dunes stabilisation trough combined consolidation, *viminate* – *graticciate* and barriers to protect by wind
- (da G. Bovina , C. Callori Di Vignale, M. Amodio *Manuale di Ingegneria Naturalistica*

Volume 2 - Regione Lazio 2003 modificato)

Elevation



During the construction phase

5. The case study of Nova Siri Marina

Stabilisation of dunes and beaches on Nova Siri Marina (MT), an 200 squaremeters area, through planting of *Pancratiun maritimum*, on three parallel lines along the coast



Pancratiun maritimum (Photo A. Trivisani)

6. The case study of Po river(1)



Reconstruction of morphologies by dredging materials and gabions to recovery the mouth of the Po river

Reconstruction of river morphologies by using gabions (Photo G. Sauli)



Natural planting by *Salicornia* and *Arthrocnemum* (Photo G. Sauli)

The case study of Po river(2)

- ✓ This type of protection is typically carried out in order to contain the bank soil: the need for a suitable protection is met by combining different materials such as gabion gravity walls or zinc and plastic coated double twisted wire Terramesh® reinforced soil, with plant insertions.
- ✓ The use of bioengineering techniques* is based on the combination of artificial materials and plants: the artificial materials shall provide stability to the local situation thus creating the ideal condition for a natural re-greening.

* www.aipin.it

7. The case study of M.O.S.E. in Venice (1)

- ❑ The M.O.S.E. (Electromechanical Experimental Unit) was devised specifically to protect the Venice lagoon. It is made of mobile flood barriers which can isolate the lagoon from the sea when the tides are higher than the set limit of 110 cm. Such tides are expected to occur approximately 12 times a year. Additional measures have also been planned to lower the level of the more frequent tides.
- ❑ The mobile flood barriers are made of rows of flap gates positioned in the three inlets. They are “mobil” insofar as that, in normal tidal conditions, they are full of water and lie on the sea bed in their housings built into the inlet canal bed.
- ❑ To protect the flood barriers from erosion caused by events which can be triggered during manoeuvres, by natural wave motion and/or waves caused by the passage of boats, to and from the lagoon, and by the action of the tides coming in or going out of the lagoon, a rockfill protection has been planned to fix the level of the new sea bed at the various predetermined levels for the three inlets to the lagoon.

7. The case study of M.O.S.E. in Venice (2)

- A fundamental aspect for the stability of the protection is the filter function to be guaranteed the contact between the embankment and sea bed.
- Filter layer which provides the hydraulic performance to ensure the required transition, as well as being heavy enough to keep the filter on the seabed in any situation, to eliminate any instability of the seabed below the filter.
- It has to be positioned at levels varying from 13 to 18 metres below the average sea level, the Maccaferri Venice Project Consortium has developed a system for producing and launching ballasted filter mattresses that can provide the required performance level (weight and filter function).

8. The case study of Mediterranean Garden in Vasto (1)



The Mediterranean botanical garden is located on a SIC (*Site of Community Importance*) on Marina di Vasto, Abruzzo, Italy.

www.infaorg.it/index.htm

The case study of Mediterranean Garden in Vasto (2)

The project concerns:

- ☐ area delimitation by low visual impact fences
- ☐ light wooden footbridges for access to the sea
- ☐ recovery of dunal vegetation by propagation in nursery and transplant on dune
- ☐ re-naturation of area by expansion of existing wetlands
- ☐ implementing the visitor centre with recreational, museum and educational purposes

The case study of Mediterranean Garden in Vasto (3)



The Garden, hosting pavilions for educational visits, where held post-graduate courses on Landscape redesign (photo P. Cornellini)

The SIC area is compatible with tourist structures (such as campsite and hotels)



9. Conclusions

- ✓ On the basis of experiences collected through research and professional activity, It can be said that is possible protect coastal marine ecosystems by the principles of environmental restoration
- ✓ The works realised through bio-engineering methods are flexible and coherent with the environmental mechanisms
- ✓ These techniques help the natural processes of formation and stabilisation of sand deposits, slow erosive processes and contribute to the conservation of biodiversity.