

CO2 PACMAN

COoperation and CO-designing PArtnership for ClIMate Neutrality

3rd Rooting Lab - Elba and Florence
Portoferraio, 11th February 2025





CO2 PACMAN

Interreg
Euro-MED



Co-funded by
the European Union

Posidonia oceanica, a mediterranean blue carbon ecosystems

Antonio Melley

Environmental Protection Agency of Tuscany (ARPAT)





CO2 PACMAN

Interreg
Euro-MED



Co-funded by
the European Union



The Blue carbon

Blue Carbon is the carbon stored in coastal and marine ecosystems in the form of biomass and sediments and, although the plant biomass in the ocean is 20 times lower than the Earth's biomass, it absorbs almost the same annual carbon quantity of terrestrial plant organisms.

Marine prairies store about 50% of the totale carbon buried in marine sediments and they are 10 times more efficient that temperate forests and 50 times that the tropical ones, constituting reservoirs of organic carbon higher than those stored by terrestrial forest ecosystems.

In the Mediterranean Sea this function is carried out mainly by the Posidonia meadows, a higher plant endemic to this basin and protected by Berna Convection, Barcelona Convection and Habitat Directive.

The organic matter stored in the sediments of Posidonia meadows represents between 11 and 42% of the CO₂ emissions produced by Mediterranean countries since the beginning of the Industrial Revolution.

A. Melley (ARPAT): *Posidonia oceanica*, a mediterranean blue carbon ecosystems



CO2 PACMAN

Interreg
Euro-MED



Co-funded by
the European Union



Ecosystem services by *P. oceanica* prairies

- 1) Biodiversity: about 25% of the total Mediterranean species live in the *Posidonia* meadows, but they occupy less than 1% of its seabed; prairies can host around 350 species per hectare and they are very important nursery areas for many fishes, also species of commercial interest;
- 2) Coastal stability: *Posidonia* meadows are able to trap sediment (more transparent coastal water) and to attenuate wave energy, preventing coastal erosion, also thanks to the masses of leaves washed up on the beaches (banquettes);
- 3) Energy: primary production of *P. oceanica* builds high plant biomass, which is largely exported (dead leaves) both towards the sandy coastline (food for microfauna) and in depths up to 50-100 m, where photosynthesis is highly reduced;
- 4) Oxygen production: it is estimated that one square metre of *Posidonia oceanica* meadow can generate up to 20 litres of oxygen per day
- 5) Carbon sequestration: prairies can fix more than 1000 t C/ha per year and they store (dead mats, sediments and leaves) up to 15 t C/ha per year;

A. Melley (ARPAT): *Posidonia oceanica*, a mediterranean blue carbon ecosystems



CO2 PACMAN

Interreg
Euro-MED



Co-funded by
the European Union

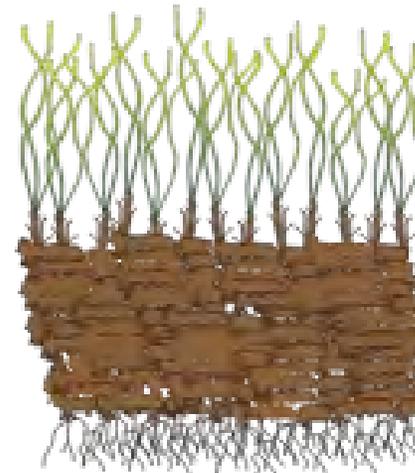


Biodiversity and nursery area



Protection of the sandy coasts

Banquette



Dead Mats



A. Melley (ARPAT): *Posidonia oceanica*, a mediterranean blue carbon ecosystems



CO2 PACMAN

Interreg
Euro-MED



Co-funded by
the European Union



The main impact factors on *P. oceanica* meadows are:

- 1) The decrease in sunlight penetration caused by increasing water turbidity and by changes in solid transport and sedimentary flows, due to coastline alterations (construction and expansion of ports, piers, barriers, cliffs, etc.) and/or an increase in maritime traffic;
- 2) Mechanical covering and removal (anchoring, trawling): e.g. a 50m yacht can destroy up to 1500 m² of this seagrass per anchor cycle and a Folding anchor tears over 5 bundles of *P. oceanica* at a time in the anchorages of small boats;
- 3) Contamination of marine waters (urban and industrial waste)
- 4) Competition with alien species and overgrazing by urchins and herbivorous fish (caused by fishing for their predators)





CO2 PACMAN

Interreg
Euro-MED



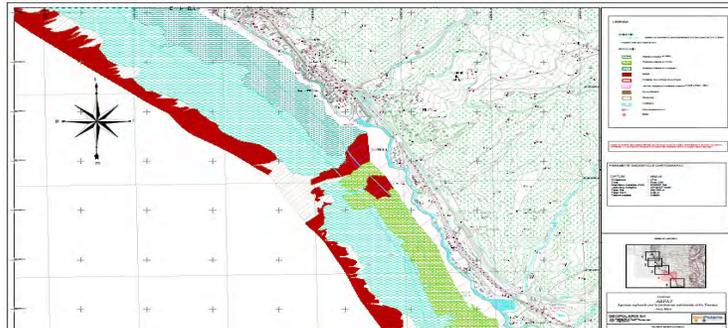
Co-funded by
the European Union



Marine ecosystems monitoring by ARPAT

Every year ARPAT (the Environmental Protection Agency of Tuscany) monitors some of the most important posidonia meadows along the coasts of Tuscany, both through measurements, sampling and analyzes carried out by its underwater operators and through the use of instrumentation.

In particular, Multibeam, Side Scan Sonar and ROV are used for Posidonia meadows extension mapping and for identifying upper and lower limits.



These activities are absolutely essential to evaluate the impacts and estimate any damage in terms of extension and ecological quality of the prairies.

A. Melley (ARPAT): *Posidonia oceanica*, a mediterranean blue carbon ecosystems



CO2 PACMAN

Interreg
Euro-MED



Co-funded by
the European Union



For example, the alteration of the coast in front of the city of Livorno, caused by the construction of the hydraulic works (Navicelli canal and Arno spillway canal) and port infrastructures (Medici port and current industrial and commercial port), as well as the increase in maritime traffic connected to them, has led to a progressive move away from the coastline and deepening of the upper limit of the meadows, so much so that an overall loss of area between the "dead matte" (pink areas in the map) and/or "degraded meadows" (blue areas) by over 7.5 km².

The loss of this prairie surface now represents a lack of carbon sequestration of over 10.000 tons every year.



A. Melley (ARPAT): *Posidonia oceanica*, a mediterranean blue carbon ecosystems

CO2 PACMAN



Thank you!



+39 331 1414267



a.melley@arpat.toscana.it



<http://www.arpat.toscana.it/>



Via G. Marradi, 114, Livorno (LI) - Italy

**A special
thanks to
Marina Pulcini
(ISPRA) and
Life Project
SEAFORREST
LIFE
(<https://www.seaforestlife.eu>)**

A. Melley (ARPAT): *Posidonia oceanica*, a mediterranean blue carbon ecosystems