



Moving Sediment Management Forward

River basin case studies

The Venice Lagoon

The Venice lagoon ecosystem is of great importance for the inhabitants of a wide area in its surroundings and it represents a unique asset for the Veneto Region. It is the largest wetland in Italy and one of the most important coastal ecosystems in the whole Mediterranean basin, with a total area of 550 km². It is densely populated (about 1 million inhabitants in a watershed of 2,000 km²) with urban settlements, extensive infrastructure (airport, rail road bridge and the lagoon sea port) and the large industrial area of Porto Marghera. However, the Venice Lagoon still maintains high biodiversity interest and unique ecological characteristics.

The morphological state and evolution of the lagoon has been under formal study since the early 1970s when special legislation to protect Venice and its lagoon came into force. Mainly as a result of the hydrodynamic processes operating (waves and currents) and the reduced input of sediment, the lagoon is currently experiencing a negative sediment balance (sediment loss of about 300,000 m³ annually), constant erosion and a loss of morphological diversity. Most lagoon channels are undergoing siltation (about 400,000 m³ annually) from sediments being eroded from shallows and salt-marshes.

The chemical quality of the sediments (intertidal areas, shallows, canals) is a function of the complex interactions between a number of factors and processes including

- present and past pollution sources,
- hydrodynamics and sediment transport,
- erosion and deposition processes,
- fishing activities,
- boat traffic,
- dredging, and
- early diagenetic processes.

There are many active sources of pollution. These include the rivers of the watershed; treated and untreated wastewater directly entering the lagoon from the industrial area of Porto Marghera and surroundings and the Venice historical centre; atmospheric fall-out; erosion of contaminated soils; and advection of contaminated ground waters from the canal embankments of Porto Marghera.

Sediment management challenges

Sediment management in the Venice Lagoon is a continuous effort. Management actions relate to marine works (defense against high tides, marinas, other infrastructures); to the maintenance of navigation and urban infrastructure; to environmental objectives where contaminated sediments are present, and to morphological protection. Sustainable sediment management principles recommend beneficial reuse of dredged sediments: this is presently

accomplished following a specific Sediment Management Protocol. New management rules are under discussion, taking into account the results of 20 years of studies and experiments and the evolution of the EU and national legislation.



Fig. 1: The Venice Lagoon

Sediment and lagoon ecosystem

It has been recognized that current management solutions affect not only habitats and biodiversity, but also the lagoon sediment budget including its resilience and adaptation capacity to external forces and pressures including climate change. Sediment management has therefore been integrated into a wider adaptive ecosystem management strategy and plan. The WFD-RBMP approved in 2010 attributes great importance to hydromorphological parameters in maintaining / reaching good ecological status and to safeguarding and enhancing biodiversity.

Sediment management measures are included in the RBMP. Highly contaminated sediments are dredged and stored in confined disposal facilities at the border of the lagoon and in the port / industrial area. According to the present Management Protocol, sediments are

beneficially reused inside the lagoon to reconstruct shallows and salt marshes only if they are classified as “A”, i.e. having chemical characteristics similar to natural background contamination levels. Discussions are ongoing to adopt different classifications which take into account chemical speciation, bio-availability and actual biological risks: this approach could allow the re-use of larger quantities of sediment inside the lagoon.

New artificial structures recreate lost habitats; they also contribute to conserving the existing habitats (improving hydrodynamics, wave climate, biological communities, etc.). Other protection measures are specifically applied to the dynamic preservation of existing morphological structures. Continuous experimentation and monitoring is being carried out in order to improve solutions and adapt both the plan and the measures.



Fig. 2: Beneficial use of dredged materials

The institutional framework

In line with the requirements of the Water Framework Directive, the competent River Basin District Authority prepared a RBMP with contributions from the Venice Water Authority (MAV), the Veneto Region (RdV) and the Ministry of Environment for territory and sea protection (MATTM).

Sediment issues are taken into account in the RBMP in the overview of pressures and impacts on the ecosystem. Particular attention is paid to hydro-morphological impacts for various reasons: the tendency towards erosion; sediment loss and the consequent impacts on submerged habitats; contamination; and various associated biological effects. The program of measures aims to reduce impacts and to improve ecological status through actions on sediments which are addressed towards:

- pollution reduction (e.g. dredging of canals in the industrial area and in the city centre of Venice; improvement of sediment quality in shallow areas);
- hydro morphological protection (protection and reconstruction of shallow areas, tidal flats and salt marches);
- sustainable use of resources (maintenance of canals for navigation and improvement of sediment quality to allow fishing and clam collection and cultivation).

Various initiatives have been undertaken or are ongoing. Sediment management is carried out at lagoon scale by the Venice Water Authority, a part of the Italian Ministry of Infrastructure. Dredging and dredged material management from Porto Marghera industrial canals has been carried out in recent years by the Port Authority. A Government Commissary was appointed to solve the social-economic-environmental crisis related to the navigational channels of the Venice Lagoon. CORILA has been founded in 1999 as a Consortium of Universities and Public research bodies under the Ministry of Education, Universities and Research (MIUR) to coordinate and manage research on the Venice Lagoon dealing with a wide range of environmental, climate change, sustainability and economic issues. CORILA is entrusted by the Venice Water Authority and the Italian Ministry of Infrastructure to produce a new Morphological Plan of the Venice Lagoon in order to properly address the effects of canal dredging, sediment movement, the conservation of salt-marshes, and the evaluation of sustainable uses for the lagoon environment.

The Venice Lagoon case study highlights some of the problems faced in managing sediments in a complex system under intense human pressure. Measures required include those in respect of:

- pollution reduction *inter alia* to deliver sediment quality improvements,
- protection of natural hydro morphological processes, including through restoration and beneficial use of dredged material,
- sustainable use of water resources.

Literature

La Gestione Dei Sedimenti Contaminati Nelle Laguna Di Venezia. Protocollo d'Intesa.

www.magisacque.it/uff_piano/rapporti_tematici/rapporto_qualita_sedimenti_2010.pdf

Links

Magistrato alle Acque di Venezia (MAV)

www.magisacque.it

Consortium for coordination of research activities concerning the Venice lagoon system (CORILA)

www.corila.it

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