New planning instruments for the environmental restoring and sustainable development of coastal areas: the case of the wide Venice lagoon area

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SUMMARY

1. The European framework for maritime and marine policies

2. Safeguarding of Venice and its Lagoon

3. The new Morphological Plan for the Venice Lagoon
1 - The European framework for maritime and marine policies
Seas and coasts play a leading role in economic growth of Europe. However, sustainable development of the marine environment is a prerequisite for economic efficiency of activities related to it.

...Marine Spatial planning will play an important role!
The EU Integrated Maritime Policy

On 10 October 2007, the Commission presented an Action Plan (SEC(2007)1278/ 2) to the European Parliament, the Council, the Economic and Social Committee and the Committee of Regions on maritime policy for the European Union. This Action Plan issued together with a so-called "Blue Book" -COM 2007(575) is the result of one year of consultations following the Green Paper. The Action Plan sets out a series of actions that the European Commission has proposed to undertake as a first step towards the implementation of a new integrated maritime policy for the European Union.

The Water Framework Directive 2000/60/EC requires that surface freshwater and groundwater bodies should achieve good ecological status by 2015. The combined implementation of the two Directives will bridge the gap between environmental protection of inland waters and the open seas.

(a) preparation:

(i) an initial assessment, to be completed by 15 July 2012 of the current environmental status of the waters concerned and the environmental impact of human activities thereon, in accordance with Article 8;

(ii) a determination, to be established by 15 July 2012 of good environmental status for the waters concerned, in accordance with Article 9(1);

(iii) establishment, by 15 July 2012 of a series of environmental targets and associated indicators, in accordance with Article 10(1);

(iv) establishment and implementation, by 15 July 2014 except where otherwise specified in the relevant Community legislation, of a monitoring programme for ongoing assessment and regular updating of targets, in accordance with Article 11(1);

(b) programme of measures:

(i) development, by 2015 at the latest, of a programme of measures designed to achieve or maintain good environmental status, in accordance with Article 13(1), (2) and (3);

(ii) entry into operation of the programme provided for in point (i), by 2016 at the latest, in accordance with Article 13(10).
The conceptual basis: the ecosystem approach

In all European legislation, it is becoming clearer that the ecosystem approach is proposed as the main conceptual instrument to implement a real sustainable development and to the effective protection of the environment. (e.g. Habitat Directive 92/43/EEC, Water Framework Directive 2000/60/EC, Integrated Coastal Zone Management Recommendation 2002/413/EC, Marine Strategy Directive 2008/56/EC)

It is based on concepts such as:

- “favorable status of conservation”
- “good ecological status”.

It should be applied to all areas, including coastal seas, territorial waters, exclusive economic zones or equivalent ones.
Strategic Environmental Assessment (SEA)

The European SEA Directive (2001/42/EC) requires in any territorial plan design:

- To consider the different environmental consequences and alternatives
- To implement a participatory approach, which is more than a public consultation
Venice is placed almost at the top North of the Adriatic sea, and experiences the tide with the largest excursion in the Mediterranean (1m).
Location: 45°10’ N 12°40’ E, Length: ab. **51km**, Width: ab. **12km**, Perimeter: **157km**.

Total surface: **540km²**, of which 8% land above sea level (littorals, reclaimed areas, islands, embankments) and 92% “water system”: channels (11,9%), shallows, mud flats and salt marshes (80,1%).

Channels and open waters (depth >150cm): **66km²**.

Shallow (depth between 150 e 40 cm): **243km²**.

Mud flats (inertial areas between –0.40 and +0.24 on the m.s.l.): **98km²**.

Salt marshes (areas higher than +0.24m, but flooded by high tide): **11km²**.

Embanked fish farms: **92km²**.

Islands: **29km²**.
In the XIV century, the lagoon of Venice was different from today:

- large rivers flowing into the lagoon
- 5 - 8 unstable inlets
- large extension of marshes
- tendency of tidal flats to become silted

risk of infilling of the lagoon
The survival of Venice (commercial, military and even physical) was put in jeopardy by the siltation of the lagoon. From the XIV to the XVIII century great care was taken by the *Serenissima Repubblica* to defend its lagoon “against sea, rivers and man”.
Around the XIX century the political decadence of Venice brought to a halt the interventions in the lagoon

Over the past 150 years, by contrast, the lagoon was subject again to large modifications
Porto Marghera and the pollution
Biodiversity
Lagoon fishing

50,000 tons/year *Tapes philippinarum* (peak)
(75 million Euro, 2000-3000 fishermen)

3,400 tons/yr other fishing (market data)

1,500 tons/yr in the lagoon, fish farming excluded
Tourism: love without borders

- **Almost 20 million** visitors per year (nights spent)
- More than **30 million** including the sea-resorts of the province.
- Population of historical centre: **60,000** (i.e. **21,9 million** nights spent per year)
An example of global change effect: the sea level rise (SLR). Venice as a world test-case city.
Italy’s Special Law for Venice (1973)

- Venice: Italy’s national interest
- Almost 10 billion Euro in 30 years already spent
- To reach hydraulic equilibrium
- To preserve environment from pollution
- To reinforce socio-economic vitality
- To safeguard the architectural patrimony
- Different levels of administration involved (State, Region, Municipality)
3 – The new Morphological Plan for the Venice Lagoon
The erosion of lagoon morphology

1810

2000
MAIN CAUSES AND EFFECTS OF MORPHOLOGICAL DEGRADATION

**Causes**
- Relative sea level rise (subsidence and eustatism)
- River mouth diversion (occurred in 1500-1700)
- Modification of inlets (occurred around 1900)
- Navigation artificial channels dredging (1920-1960)

**Effects**
- Unbalance of sediment input-export: 0.2-2 million m$^3$ per year
- Need to dredge internal channels for navigation
- Loss of intertidal habitats/biodiversity

(A more flat and uniform lagoon > a marine bay)
FORCING AND OBSERVED/EXPECTED EVOLUTION
Reduced supply of river sediments and increased flows of sediments to sea

(IMAGE, 2008)
A rapid phenomenon

The erosion of the intertidal and subtidal areas (salt marshes, mud flats and shallows) leads to the loss of habitat diversity and biodiversity.
The salt marshes are essential for lagoon life and biodiversity:

- Salt marshes are coastal wetlands rich in marine life. They occur in the zone between low and high tides.
- Hidden in salt marsh plants are animals in various stages of life. Young fish often find here a nursery, where it is easy to find food.
- During the winter season, more than 100,000 seawater birds homed in the lagoon, and many species find their home here all over the year.
Waves

They are generated

a) by wind - energy related to:
   • the free space without obstacles (*wind fetch*)
   • the bottom deep

b) by motor boats (in the canals)- energy related to:
   • the speed of the boat
   • the nautical characteristics of the boat

Boats are used for
- Public transport of people
- Transport of goods
- Fishing boat
- Pleasure boat
POSSIBLE INTERVENTIONS (some of them already undergoing)

• Re-construction of lagoon morphology (sediments is a scarce resource): in the past 20 years 1190 ha of salt marshes and of mudflat have been reconstructed, using suitable sediment coming from of about 168 km of channel dredging. Islands’ borders have been restored, too.
• Limit to sediment export (e.g. use of the tide barriers, channels modifications, etc)
• Increase of sediment input (problem pollution)
• Regulation of uses (e.g. speed and size limits for ships, restricted area for navigation, urban plans, fishing areas, port, etc)
Paradigmatic case

Nature, landscape and cultural heritage conservation

Impossible any self-regulation of the system (zero-option policy), due to:

- Natural processes already compromised
- Presence of no-market goods of large importance
- Complex cause-effect relationships at subsystem level

Social dimension ("city status" for Venice)

Pressures affected by the status of the target

"Pure" pressures, interrelated

Port Industry Transport

Target
**Jurisdiction on the Venice Lagoon**

**Italian model**

To the **State**: “Protection of the environment, of ecosystems and cultural heritage”

**To the Regions**: the “govern of the territory” and “valorisation of environmental and cultural heritage”, but fundamental principles to the State

**Special legislation for Venice**: the State responsible for the physical defense and environment restoration, the Region for depollution, the Municipalities for urban maintenance and social re-vitalization
UPCOMING DISTRICT PLANNING - PTCP
THE ACTIONS
GOVERNANCE

9 MUNICIPALITIES
2 DISTRICTS
1 REGION

THE POLICIES
GOVERNANCE

108 MUNICIPALITIES
4 DISTRICTS
1 REGION
THE SEA STRATEGIC ENVIRONMENTAL ASSESSMENT PROCEDURE

**Screening**
investigation whether the plan or programme falls under the SEA legislation

**Scoping**
defining the boundaries of investigation, assessment and assumptions required

**Documentation of the state of the environment**
effectively a *baseline* on which to base judgments

**Determination of the likely (non-marginal) environmental impacts**
usually in terms of “direction of changes” rather than exact figures

**Informing and consulting the public**
Influencing *Decision taking* based on the assessment

**Monitoring of the effects**
The New Integrated Morphological Plan

In May 2007, the Venice Water Authority (MAV) entrusted CORILA to produce within 36 months a new Morphological Plan of the Lagoon.

The main **aims** are to properly address the interventions (canals dredging, sediments supply and movement, regulations of uses) to the restoration of lagoon morphology, preserving habitat and biodiversity and considering the sustainable economic activities.

A wide **group** of experts in various disciplines from Universities and research centers has been organized into seven Operative Units, with specific tasks assigned.

**NOT ONLY PLANNERS, but:** Ecologists, Biologists, Chemists, Engineers, Geologists, Economists and Planners
The activities

The work has several packages. Already done:

- the status-of-the-art of the knowledge (habitat conservation, pollution presence and treatment, sediment transport and morphology evolution, present economic activities and their possible evolution, cost/effectiveness of the interventions)
- the reconstruction of the present lagoon status, identifying the main cause-effect relationships
- the selection of a first wide set of indicators for each discipline
- the setting-up of idro-morphological and ecological mathematical models
- The “coherence matrix” of the present plans (urban, env., port, Natura 2000, etc)
Mathematical models of ecological functioning

Key elements

1. **BIOGEOCHEMICAL MODELS**
2. **ABIOTIC FACTORS**
   - **VARIAZIONI BATIMETRICHE**
   - **FISICI**
     - granulometria, tessitura sedimento
   - **CHIMICI**
     - salinità, torbidità, nutrienti
   - **IDRODINAMICI**
     - tempo residenza, velocità corrente al fondo
3. **BIOTIC COMPONENTS**
   - PLANCTON, BENTHOS, NECTON, AVIFAUNA
   - **fitobenthos, zoobenthos**
4. **HABITAT LAGUNARI**
   - CLASSIFICAZIONE, ZONAZIONE
5. **MODELLI RETE TROFICA**

**INTERVENTI MORFOLOGICI**

**MODELLI HABITAT SUITABILITY**
Lagoon habitats classification and zonation by communities data analysis (macrofitobenthos, macrozoobenthos and necton) and these others environmental parameters: bathymetry, granulometry, residence time, salinity, turbidity, dissolved oxygen.

The habitats are the base for models study.
### Activity line C: ecological objective

**SELECTED INDICATORS FOR LAGOON COMMUNITIES and ECOTOXICOLOGICAL**

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<td>PLANCTON</td>
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<td>ZOO BENTHOS</td>
<td>DIVERSITY</td>
<td>N. TOT TAXA</td>
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<td>SPECIE ESOTICHE</td>
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<td>STATUS</td>
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<td>TROPHISM</td>
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<td>N. TAXA PISCIVORI</td>
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<td>ECOTOXICOLOGICAL</td>
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Chemical pollution aspects

Distribution of sampling sites
Definition of indicators describing state and dynamic of natural and anthropic lagoon environment

Water and sediments

organic: •IPA •PCB

inorganic: •As •Cd •Cr •Hg •Ni •Pb •Cu •Zn

New analytic approach: chemical speciation

aerosol

Chemical species: •benzo(a)pirene •SO$_2$ •NO$_X$

PM$_{10}$ e PM$_{2.5}$

elements: •As •Cd •Hg •Ni •Pb
The result: an “optimum” Plan

• Different SCENARIOS, with internal coherence, for a restored lagoon looking forward 20-30 years will be provided, on the basis of with a restricted number of INDICATORS

• The participation process will involve Public Administrations and general public

• An “optimum” scenario, with a measured consensus index, will be proposed for adoption (May 2010)

• The overall direct cost for the interventions could be evaluated in some hundreds of million of Euro
The Morphological Plan of the Venice Lagoon is an innovative tool, in line with recent EU legislation. Its objective is to harmonize the strong demand of economic development of the city of Venice with the highest degree of naturalness and fragility characterizing the lagoon in which Venice is inserted. This Plan is going to be elaborated as an instrument of integrated planning and represents a great opportunity to effectively bind the terrestrial component with marine environment.