

D.5.1.1. Report on Priority issues



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1. Introduction

This report is identified on the basis of the results of the studies of WP3 “*Modelling present and future salt ingressions in Adriatic coastal*” and of WP4 “*Identifying needs and barriers in coastal aquifer management*”. The priority issues described below, can be divided in “*physical issues*” and “*management issues*”. The “*physical issues*” are related to climatic variations that induce sea level rise and variation of the fresh water and saltwater interface. The “*management issues*”, on the other hand, are related to the management of surface and underground water resources (lack or absence).

To this end, key factors for sustainable use of groundwater resources will be considered, including coordination between competing users, the dissemination of communications relating to first signs of overexploitation, the formulation of administrative and disciplinary responses in response to physical (climate-induced) and related variations, thus highlighting any regulatory and institutional deficiencies in the management of coastal aquifers.

2. Physical issue

The priority “*physical issues*” related to climatic variations in the Adriatic coastal area is the sea level rise, with consequently:

1. lowering fresh water and salt water interface,
2. retreat of the saline wedge in surface waters,
3. setback of the coast line,

The studies conducted as part of the activities of WP3 and WP4, led to the simulation of a forecast scenario resulting from phenomena related to climate change in progress, in the absence of adaptation measures.

The climate change, induce:

- Current ice melting,
- Steric component (thermo&halo).

As a consequence of the aforementioned climatic effects, it has been estimated that in 2100 there will be a sea level rise of about 80 cm (with a lower influence of Glacial Isostatic effects too).

In the figure below, is represented the growth regional high-resolution maps of sea-level rise, induced by climate change at the macro regional scale (Adriatic)

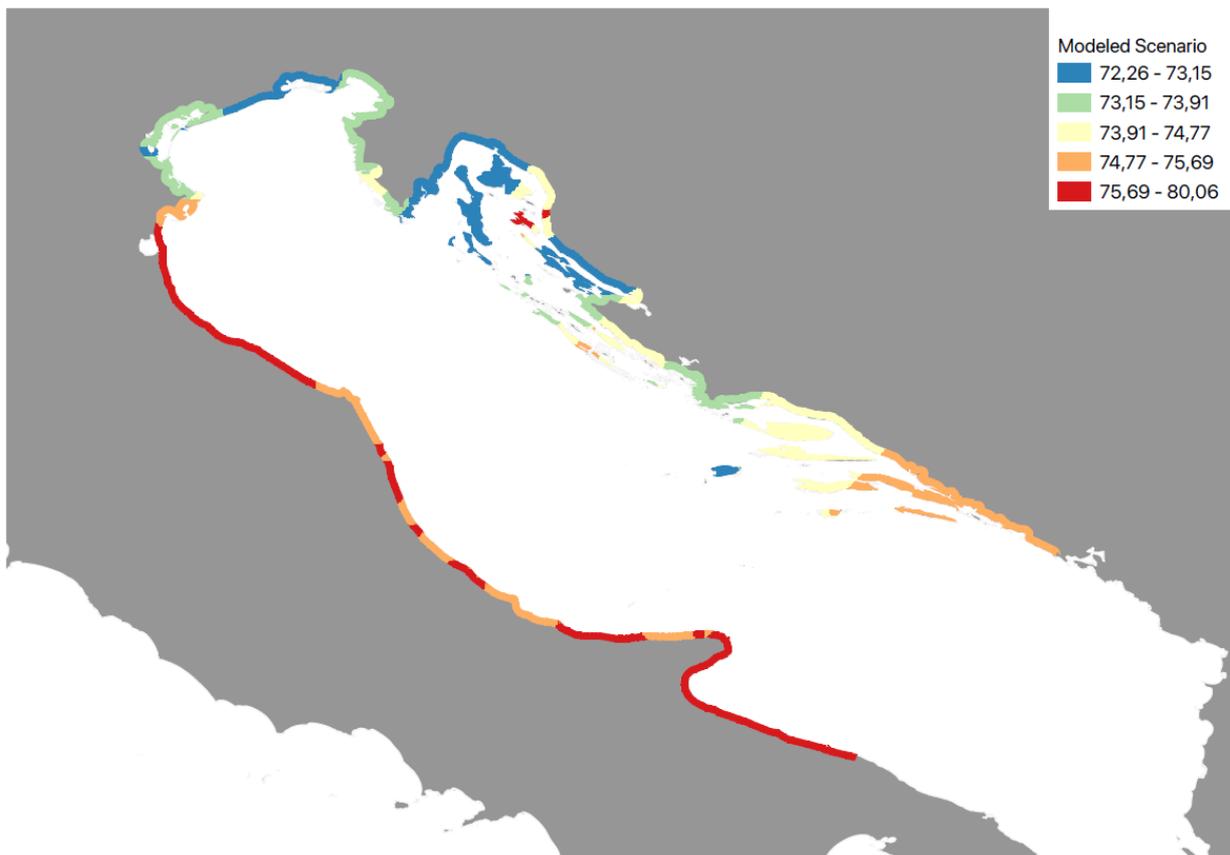


Figure 1: modeled scenario of sea-level rise induced by climate change at the macro regional scale (Adriatic)

2.1. Saline intrusion (raising of fresh water and salt water interface)

The main problem related to sea level rise that emerged from the studies is the salt intrusion. The work of WP3 aims to obtain a conceptual model for the risk assessment to salt intrusion in North Adriatic basin for future scenarios of climate change, extended to a broad area (almost 2000 km of coasts), involving three Countries (Italy, Croatia and the short portion of Slovenia facing Adriatic coast) and including a variety of geological, morphological and also socioeconomical conditions.

The model is based on future climate scenarios, accounting for sea level rise but also storm surge.

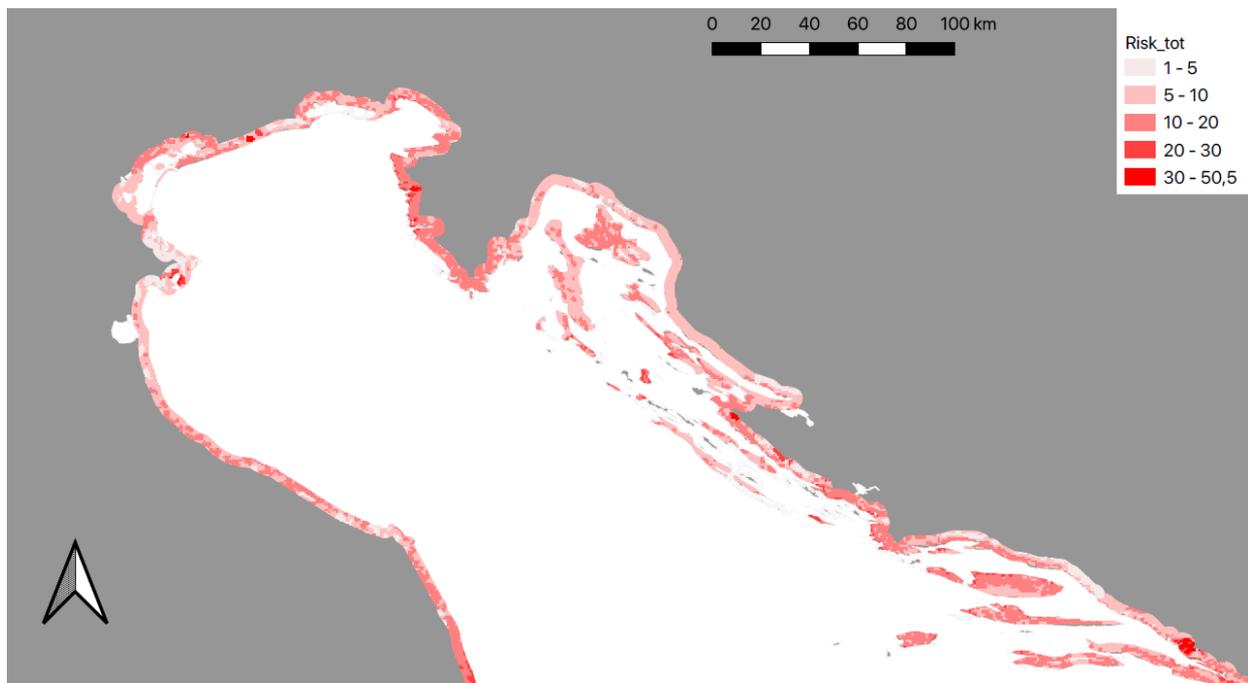


Figure 2: a map of risk to coastal salinization at the macro regional scale (Adriatic) based on future scenarios for sea level rise and the hydrological cycle

2.2. Ingression of the saline wedge in surface waters

From the monitoring carried out as part of the previous activities, it emerged that the problem of salt intrusion characterizes not only groundwater, but also important rivers or channels. They showed in fact higher EC values, which here denoted the presence of seawater ingression along the riverbed and up to almost 4 km inland from the shoreline.

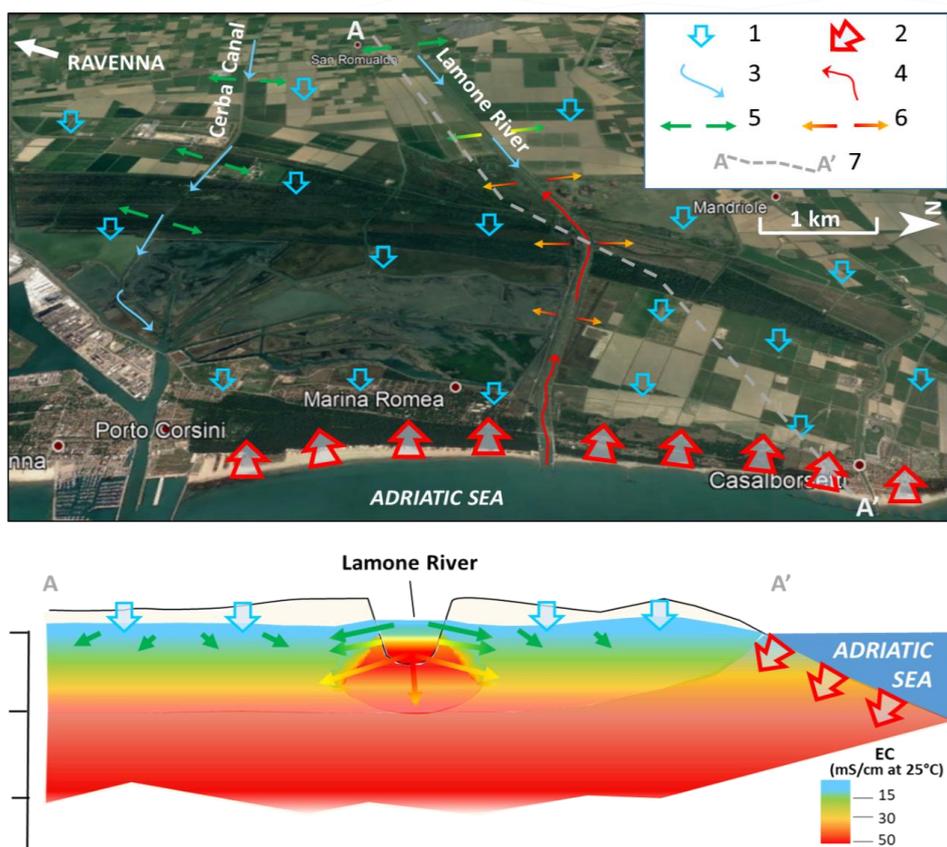
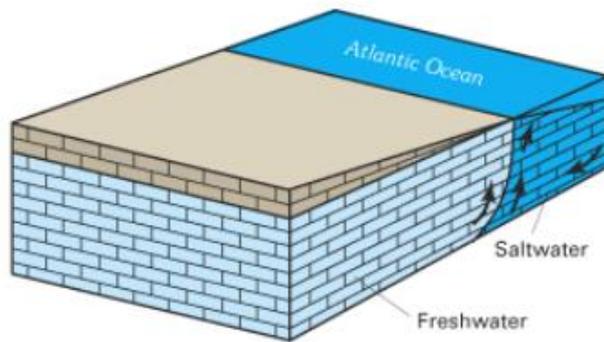
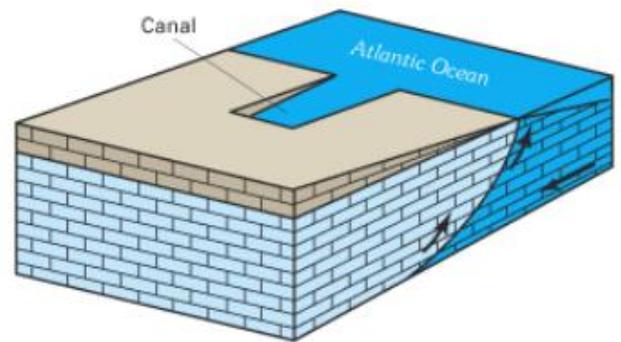


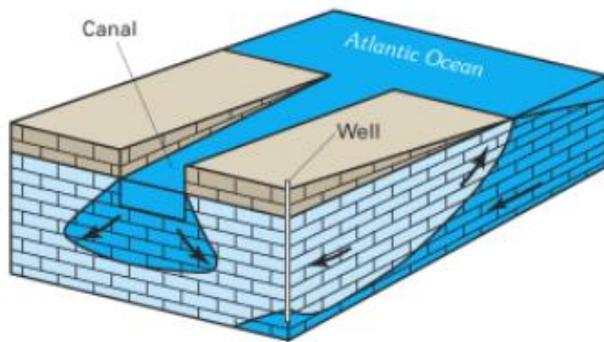
Figure 1: conceptual model in Ravenna pilot test



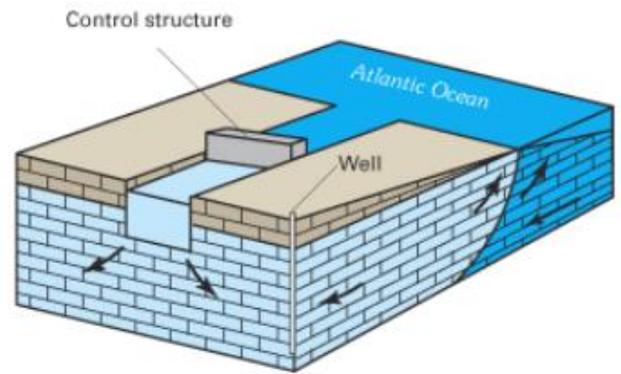
The freshwater-saltwater interface was nearly stable before coastal canals were built.



Uncontrolled tidal canals caused saltwater intrusion by lowering freshwater levels and providing open channels to the sea.



An uncontrolled canal that extended into an area of heavy pumping could convey saltwater inland to contaminate freshwater supplies.

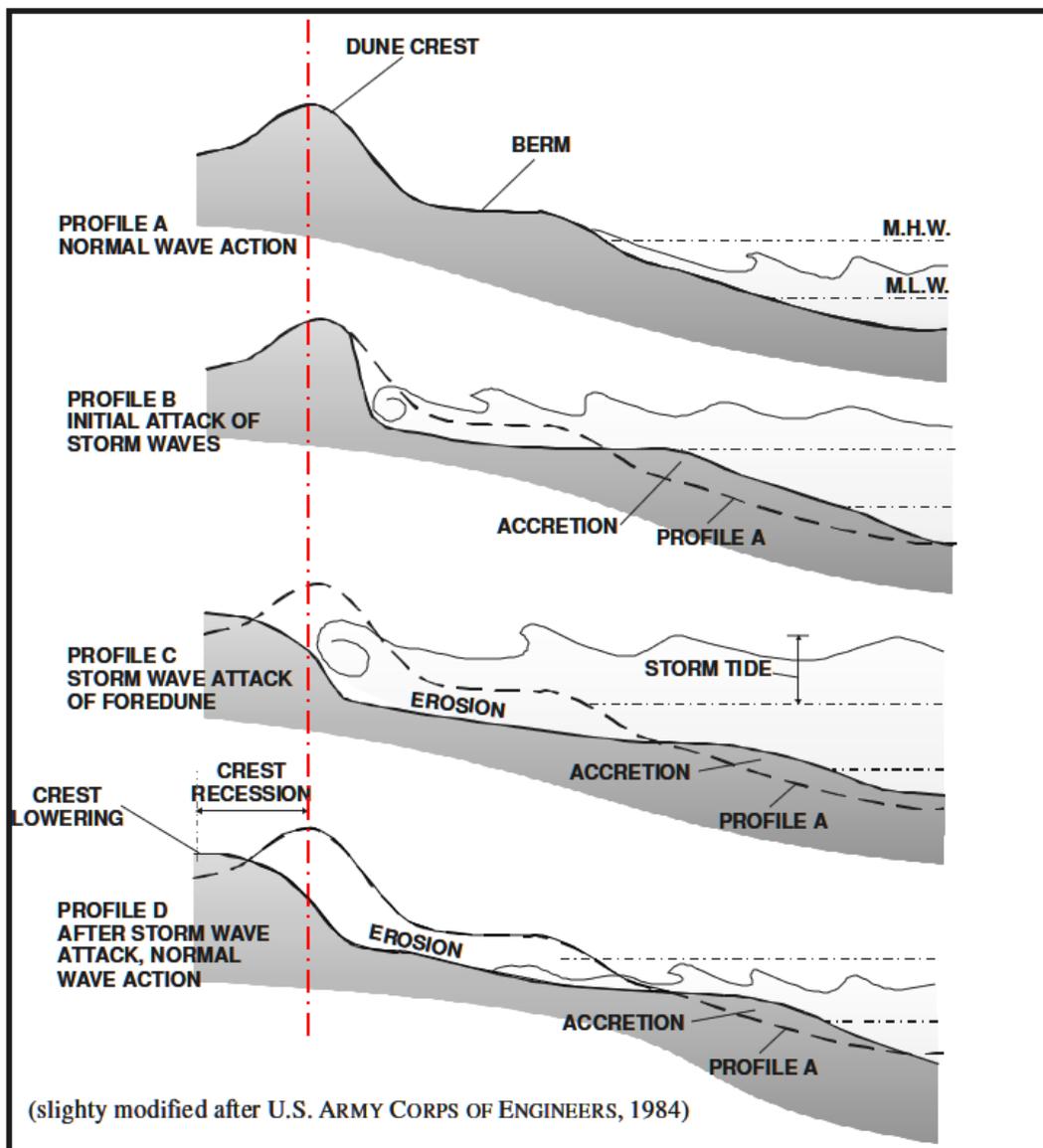


In contrast, a controlled canal provides a perennial supply of freshwater from upgradient areas to prevent saltwater intrusion and to recharge a well field.

Figure 2: scheme of control structures placed on the southeastern Florida canals to prevent inland migration of seawater, as well as to provide flood protection and artificial recharge to the aquifer (*Ground Water in Freshwater-Saltwater Environments of the Atlantic Coast* - Paul M. Barlow - 2003).

2.3. Setback of the coast line

The rise in sea level described in the scenario, together with the storm surges, will determine, in the absence of adaptation and protection measures, a progressive shoreline erosion and retreat of the coastline.



3. Management issues

Generally, about management, emerged this priority issues:

- absence of quantitative control on extraction rates by private wells;
- heterogeneous knowledge of aquifer salinization;
- lack of planning in the following areas:
 - water resource,
 - urban environment,
 - agriculture,
- Low awareness of people living along the coasts.
- Wet-zone coastal management (surface flow regulation)

3.1. Lack of quantitative control on extraction rates by private wells

The absence of a systematic quantitative control on the management of the water resource is underlined both in Italy and in Croatia as a critical point, since the exploitation of phreatic aquifer with private wells for irrigation, industrial, conditioning use is a general feature.

The lack of a fully-operative and structured system of collecting and storage of data about annual volume extracted by wells on time unit prevents the possibility to update groundwater balance estimations and evaluation of groundwater status.

The scarce knowledge on the extraction rates of water with respect to the recharging rates, makes difficult to have a reliable estimation of the renewability of the resource.

3.2. Heterogeneous knowledge of aquifer salinization

From the studies conducted, a gap emerged in the knowledge of the state of aquifer salinization. In particular, a knowledge systematic and capillary-diffused is lacking, like an integrated monitoring devices of coastal water resources, headed by coordinated control bodies, with continuously multiparameter instruments.

3.3. Lack of planning in the following areas

1. Water resource:

About water management, the priority issue is:

- the lacking of a plan of sustainable water use, that allows a schedule and an optimization of withdrawals and discharges in surface and underground waters;
- the lacking of a plan that encourage alternative water supplies for less-valuable uses

2. Urban environment

The main problems in urban area, directly linked to the physical issues, are:

- the lacking of an adaptation plan of underground structures and infrastructures within the framework of existing urbanizations,
- the regulation of the construction of structures and infrastructures within a buffer from the coast line, potentially affected by the rise in sea level and its consequences, in new urbanized areas

3. Rural and agricultural environment

Uncontrolled use of the resource in the agricultural field, without management of the

withdrawals and planning that encourage the freshwater storage and ponding.

3.4. Wet-zone coastal management (surface flow regulation)

The combined effect of climate change with the progressive increase of the mean sea level, low land elevation (often lower than mean sea level as shown in Figure 14), and deep and surface waterbody exploitation resulted in a certain fragility of the coastal zone and natural wetlands that host important biodiversity.

4. Formulation of administrative and disciplinary responses

It is necessary to update the current legislation, taking into account the need for adaptation measures to the priority issues discussed in the previous chapters, where deficient.

In particular, the responses to the aforementioned critical issues must become an integral part of the legislation and regulations on a regional / provincial / municipal scale. For example, we mention

- “Piano di Gestione Acque su scala distrettuale” (District Water Plan)
- “Piano d’Ambito” (Sub-regional Water Distribution Plane)
- “Piano regolatore” e “Regolamento edilizio comunale” (Municipal regulatory plan)

But also the main environmental law code could be integrated with specific attention to the criteria for quantitative management of groundwater bodies in coastal aquifers.

It's necessary to establish a connection between the monitoring system managed by a control room, municipal building regulations and the municipal officers.

They could put in place regulations aimed at adapting to various plans and possibly issue specific site and time ordinances in the event of an emergency emerged in the context of continuous monitoring systems, when critical thresholds are exceeded.

But especially medium to long-term strategic groundwater and land-use planning, oriented to salt intrusion in coastal aquifers is needed.