

## **11. ITALY**

This country fiche provides a comprehensive overview and assessment of climate change adaptation in Italy. After detailing the vulnerability of the Italian coastal zones, the responsibility and financing for coastal protection is explained. Next, the fiche presents the relevant research activities, the coastal defence, risk reduction and adaptation plans available in Italy as well as the current and future protection and adaptation expenditure. The persons contacted and sources of information used are listed at the end.

### **11.1. VULNERABILITY OF ITALY'S COASTAL ZONES TO CLIMATE CHANGE**

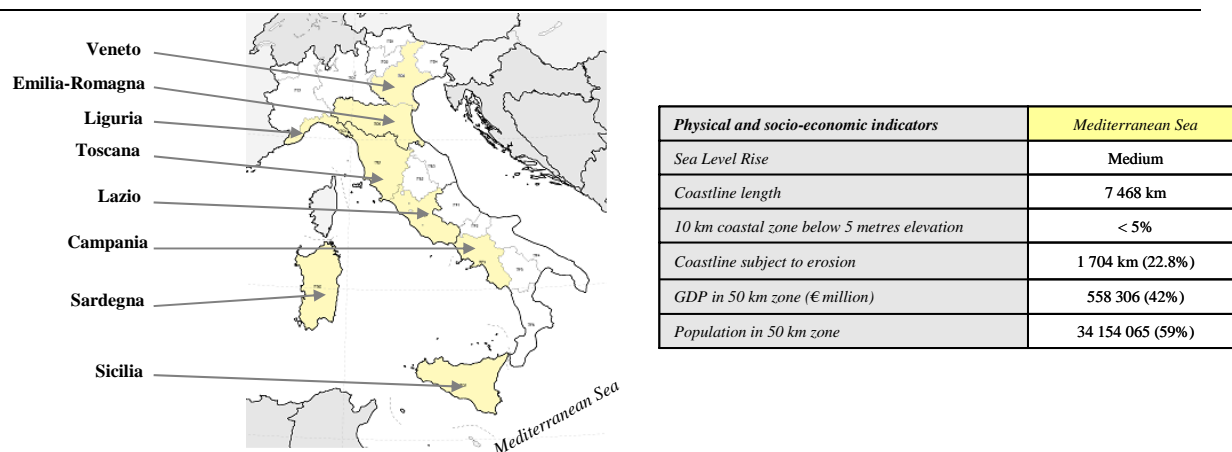
Italy is located in southern Europe and borders the Mediterranean Sea. The country consists of the Italian peninsula and the two largest islands in the Mediterranean, Sicily and Sardinia. The total coastline measures 7 468 km. The country has 21 regions of which 15 are coastal regions.

The following paragraphs discuss the main climate change risks for the coastal zones of Italy. Flooding poses the greatest risk to the country's low-lying coastal zones.

#### ***a/ Flooding and erosion***

Coastal geological types vary along the Italian coastline, including both rocky coasts and low-lying sandy beaches. The latter are most at risk of SLR, coastal flooding and erosion. In this respect, the most vulnerable areas are the coasts of Toscana, the Tevere mouth (Lazio), the southern part of Lazio, the Volturno estuary and the coast south of Salerno (particularly in Cilento) in Campania and Sicily. The Northern Adriatic basin is particularly at risk due to the presence of the Po delta (Emilia-Romagna) and the Venice lagoon (Veneto). In this area, the coastline is rarely more than 2 meters wide and due to subsidence various zones presently lie below sea level. Besides these geographical factors, socio-economic characteristics also make the coastal zones of Italy quite vulnerable as the Italian seashore is home to many residential as well as industrial sites. *Figure 11-1* illustrates the most vulnerable coastal regions in terms of flooding together with the main physical and socio-economic indicators of Italy's coastal zones.

**Figure 11-1: Most vulnerable coastal regions of Italy in terms of flooding and an overview of the main physical and socio-economic indicators of the Italian coastal zones**



Source: Policy Research based on EEA, 2006, *The changing faces of Europe's coastal areas* (for Sea Level Rise and 10 km coastal zone below 5 metres elevation); European Commission (EuroSION study), 2004, *Living with coastal erosion in Europe: Sediment and space for sustainability* (for coastline length and coastline subject to erosion); Eurostat 2004 (for GDP and population in 50 km zone)

**b/ Freshwater shortage**

The impact of climate change on freshwater provision in Italy is twofold. First of all, precipitation is rapidly decreasing affecting both ground- and surface water in Italy and longer and more intense periods of drought can be observed. As a result desertification is becoming a problem, not only for the islands Sicily and Sardinia and the southern regions, but also for the northern areas of Italy. Furthermore, water use is steadily increasing throughout the country. In addition, saltwater intrusion into coastal freshwater beds will have an adverse impact on both agriculture and freshwater supply. In this regard negative effects are anticipated at a local scale in southern Italy.

After the Italian National Conference on Climate Change, held in September 2007, the Ministry of Environment, Land and Sea proposed measures to counteract potential freshwater shortage such as a sound water pricing policy, better drought risk management and the promotion of water saving. Furthermore, it was concluded that the implementation of the Water Framework Directive<sup>1</sup> must be given absolute priority.

**c/ Loss of coastal eco-systems**

Desertification has also a negative impact for coastal eco-systems such as wetlands, which are widely present in the coastal zones of Italy. Degradation of these areas is exacerbated by other climate-related effects such as erosion, salinisation and potentially increased run-offs caused by floods.

<sup>1</sup> Directive 2000/60/EC of 23 October 2000 on establishing a framework in the field of water policy.

In 1999 a National Action Programme to Combat Drought and Desertification was approved by the government of Italy, which provided a set of actions to reduce the vulnerability to desertification and to adapt to climate change<sup>2</sup>. Furthermore, one of the conclusions of the Italian National Conference on Climate Change was to give top priority to the implementation of the Habitat Directive<sup>3</sup> with the aim of protecting important eco-systems and biodiversity in general.

## **11.2. RESPONSIBILITY AND FINANCING FOR COASTAL PROTECTION AND CLIMATE ADAPTATION**

In Italy, the organisation and administration of coastal defence is the responsibility of the 15 coastal regions. National authorities have only a limited role in coastal defence since the regions organise coastal protection policies and adaptation measures independently. The main responsibility of the national government is to provide policy guidance and financial support.

At national level the *Ministry of Environment, Land and Sea* and the *Institute for Environmental Protection and Research (ISPRA)* are the main actors involved. Together they are responsible for providing a national framework with regard to the protection of the environment of which the coast is an important element. The *Directorate of Life Quality* of the Ministry of Environment, Land and Sea is involved in the provision of freshwater at national level.

The actual responsibility for coastal protection is situated mainly at sub-national level. In first instance the regions but also provinces and municipalities are assigned to deal with coastal planning, protection and management. Within each of the regions the division of responsibilities is different. For example in Lazio, the regional government takes full responsibility while in other regions such as Liguria the responsibility has been transferred to the municipalities.

Funding of coastal protection works is mainly sought at national and EU level. Several regions apply for EU funding through the Structural Funds, while others have an agreement with the Ministry of Environment, Land and Sea. Landowners have to contribute for maintenance activities such as beach nourishments or the restoration of infrastructure.

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<sup>2</sup> Examples of actions include additional training and research programmes with regard to better soil protection, sustainable management of water resources and land restoration.

<sup>3</sup> Council Directive 92/43/EEC of 21 May 1992 on nature conservation.

### **11.3. RESEARCH INTO ITALY'S VULNERABILITY TO CLIMATE CHANGE AND CLIMATE CHANGE SCENARIOS**

Research with regard to climate change and climate change scenarios is rather limited in Italy. The main actor involved is the Euro-Mediterranean Centre for Climate Change, *Centro Euro-Mediterraneo per I Cambiamenti Climatic (CMCC)*.

CMCC is an Italian research consortium consisting of various Italian public and private research institutions and is financially supported by the Italian Ministry for Environment, the Ministry for Education, University and Research and the Ministry for Economy. The main activities of CMCC concentrate on numerical simulations and the development of climate scenarios as well as impact studies. CMCC uses simulations to conduct studies on the impact of climate change for the economy, agriculture, the sea, coastal zones and eco-systems, as well as health.

*Impact on Soil and Coast (ISC)* is the division of CMCC responsible for research with regard to the coastal zones. The general objective of this research unit consists in establishing a set of methodologies and tools for the analysis and management of climate change risks and impacts on coastal areas. The ultimate goal is to support decision-making processes and coastal management plans as well as to facilitate the implementation of adaptation measures in accordance with the most recent Integrated Coastal Zone Management (ICZM) principles.

### **11.4. COASTAL DEFENCE, RISK REDUCTION AND ADAPTATION PLANS IN RELATION TO CLIMATE CHANGE**

As coastal protection is the responsibility of the regions, no coastal defence plans exist at national level. The national government is responsible for the overall framework with regard to climate change adaptation and is therefore undertaking preparatory actions to develop a National Adaptation Strategy for Italy.

#### ***a/ Actions taken at national level***

In Italy no national strategy with regard to climate change or climate change adaption exists at the moment. However, preparatory actions to develop a *National Adaptation Strategy* have already started, although these are still at a very early stage.

In September 2007, the Ministry for Environment, Land and Sea organised a *National Conference on Climate Change* which helped to draw a first set of recommendations on adaptation measures and to stimulate the development of a National Adaptation Strategy, which would include issues relevant to coastal zones. The conference was preceded by some preparatory workshops focusing on the most critical situations such as desertification, erosion and coastal flood-risk.

The main result of this conference was a call for the preparation of national, regional and local adaptation strategies. The ministry mentioned that in order to achieve this goal it is essential for ISPRA to be appointed as the central authority to coordinate climate change research and adaptation activities. Furthermore, the ministry outlined 13 actions for sustainable adaptation, with the ambition to achieve these within the following three years. The actions related to coastal zones focus on<sup>4</sup>:

- Start wide research activities about the major critical issues linked to the impacts of climate change and prepare a yearly report on the monitoring of climate change and its effects;
- Adjust water resource management to climate change (e.g. avoid exploitation of waterbeds in the neighbourhood of wetlands of high natural value);
- Provide actions for sustainable management of marine resources, start mechanisms for the development of sustainable fishing and coordinate actions to safeguard eco-systems;
- Develop a more efficient early warning system in areas at higher risk of floods and landslides;
- Protect the Italian coasts by adjusting urban area regulations, re-think port infrastructures and transport networks and restore the coastal dunes and wetlands.

In addition, the recently published ICZM document by the Ministry of Environment, Land and Sea states that from now on it is prohibited to build in the first 100 m from the coastline<sup>5</sup>.

***b/ Actions taken at sub-national level***

Italy has 21 regions of which 15 are located along the coast. Five regions are vulnerable to climate change in terms of flooding, erosion and extreme weather events and as a result are more advanced in coastal protection. These regions are discussed in the following paragraphs. Venice is the only region that takes a climate scenario indicator, namely SLR, into account when developing and implementing coastal protection measures.

***Venice***

Venice, a city of the region Veneto situated on the east coast of Italy, is one of the most vulnerable parts of the country with regard to flooding and extreme weather events. The city is located along the Venice lagoon, the largest wetland of the Mediterranean Sea. The total surface area of the lagoon is about 550 km<sup>2</sup> of which 420 km<sup>2</sup> is directly subject to the sea tides. In this area, high tides have increased in terms of frequency and intensity due to the low elevation, a rise in sea level as well as a reduction in land level (subsidence). As a result, the area of Venice is losing land to the sea.

After the major catastrophic event in November 1966 when Venice was completely submerged under a metre of water, the safeguarding of Venice was accepted by the government as a national commitment and the Parliament passed a specific law for it in 1984. The law is the responsibility of

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<sup>4</sup> Ministry for the Environment, Land and Sea, 2007, *Fourth national communication under the United Nations framework convention on climate change*.

<sup>5</sup> In addition a law exists which stipulates building restrictions in the first 300 m from the coastline.

the state and is being implemented by the Venice Water Authority of the Ministry of Infrastructure and Transport, through the Consorzio Venezia Nuova. The Consorzio Venezia Nuova, which consists of a group of Italian and local construction companies is in charge of implementing protection measures.

To carry out the measures aimed at safeguarding Venice and its lagoon, the Venice Water Authority and the Consorzio Venezia Nuova have drawn up and implemented a *General Plan of Interventions* of which the cost is sustained by the government. The plan includes defences from sea storms and high water (e.g. beach nourishments, restoration of dunes, raising low-lying parts of urban areas) as well as environmental protection defences (e.g. the protection of eroding salt marshes).

A separate project, called the *MOSE-project*, has been set up to be able to temporarily separate the sea from the lagoon during high tides. In order to do this, a system of mobile barriers is under development at the three lagoon inlets (Lido, Malamocco and Chioggia). The construction consists of 78 mobile steel barriers that will be activated during exceptionally high tides. They will lie on the seabed most of the time, but will be filled with air to create a dam when Venice is threatened. The defence structure has been designed to cope with an increase of up to 60 cm in sea level. Construction works started in 2003 and the completion is scheduled for 2012.

### ***Lazio***

The region of Lazio, situated on the western coast of Italy, is especially vulnerable to coastal flooding and erosion because of the many low-lying areas and the socio-economic activities taking place there. In this area the regional government is responsible for carrying out protection works while the municipalities are assigned to maintain the beaches.

The region of Lazio is regarded as one of the forerunners with respect to coastal defence and indirectly to climate change adaptation as the region establishes a new coastal protection programme every 3 years. To defend its coastal zones Lazio opts for the use of soft measures and mainly uses beach nourishments to protect its coastal zones. Currently, measures are implemented under the *Regional Framework Programme for Soil and Coastal Defence (2008-2010)*. About 20% of the programme will be financed by the Ministry of Environment, Land and Sea.

### ***Campania***

The region of Campania, also situated on the western coast of Italy, is especially vulnerable to flooding and erosion due to rapid urbanisation over the last decades and the growth of the coastal cities which has taken place in recent years. In contrast with Lazio, the region of Campania does not have a protection programme and measures are mainly decided upon ad-hoc.

Most actions undertaken in Campania aim to reduce the rate of erosion. These actions are funded by the national government as well as the EU Structural Funds. Over the period 2007-2013 the aim is to reduce erosion along 16% of the coastline.

Furthermore the region of Campania is also developing a real-time wave monitoring network to support civil protection decisions during extreme weather events. The system transfers data collected at the remote monitoring stations into concrete information that provides an assessment of the actual critical conditions for possible floods or landslides.

### ***Toscana***

The region of Toscana, situated on the western coast of Italy, is particularly vulnerable to flooding and erosion because of its sandy beaches. In this region the regional government has transferred the responsibility for the design, realisation and maintenance of coastal defences to the provincial administrations. The municipalities are responsible for the management of the maritime domain. The regional government remains responsible for programming and planning coastal defence strategies and the coordination of the regional ICZM plan in accordance with the other institutional actors involved (river basin authorities, provinces and municipalities).

A process of technical changes in beach management has recently taken place in Toscana, transferring from hard engineering techniques to softer defence strategies (e.g. beach nourishments, dune restoration). The corresponding policy development is now based on decentralisation of political responsibilities, and centres on the request for more sustainable defence strategies. The main measures used to combat erosion of the sandy beaches are beach nourishments, dune restoration and submerged groins. The measures are funded from the regional as well as the national funds. In addition, Toscana performs research for the creation of a coastal zone database and the use of continental shelf sand, gravel deposits and reservoirs for beach nourishments.

### ***Emilia-Romagna***

The region of Emilia-Romagna is situated on the east coast of Italy and is particularly vulnerable to flooding and erosion because of its many low-lying sandy beaches.

A first Regional Act concerning coastal protection was issued in 1979. In 1983 the first Coastal Plan was approved and a monitoring network was set up for surveying the subsidence of the coastal land and shoreline movements. A second Coastal Plan was established in 1995 which was followed by two Coastal Status Reports in 2000 and 2007. In early 2000 the process for the creation of a GIS-based Coastal Information System started which is now being used as the basis for studies, monitoring and planning in the field of coastal protection.

To protect the coastal zones of Emilia-Romagna existing rock defence structures such as detached breakwaters and groins are maintained on a yearly basis and beaches are nourished every few years.

In 2002 and 2007 two large-scale beach nourishment interventions took place using off-shore sub-marine sand deposits. The measures are financed from national, regional as well as local funds.

#### **11.5. PAST, PRESENT AND FUTURE ADAPTATION EXPENDITURE**

In Italy, the coastal protection and adaptation expenditure to protect against flooding and erosion is usually co-financed by the state, but the contribution differs greatly from region to region. In 2008, the total expenditure amounted to €380.37 million, including the expenditure for the Italian regions more advanced in coastal protection. Over the period 1998-2015, the expenditure to protect the Italian coastal zones from flooding and erosion will have totalled over €4.6 billion. The MOSE-project in Venice accounts for more than 90% of the total amount spent in Italy.

More detailed information on the past, present and future adaptation expenditure can be found in *Table 11-1*.



**Table 11-1: Expenditure to protect against flooding and erosion (in € million)**

Year	CAPITAL & MAINTENANCE EXPENDITURE					INDIRECT EXPENDITURE	HOT-SPOT PROTECTION	TOTAL
	Toscana (mainly soft protection measures)*	Campania**	Lazio (80% beach nourishments)***	Veneto****	Emilia-Romagna*****	Toscana*****	MOSE-project in Venice*****	
1998	1.20	1.14	8.00	n.a.	1.50	0.40		12.24
1999	1.20	1.14	8.00	n.a.	1.50	0.40		12.24
2000	1.20	1.14	8.00	n.a.	8.75	0.40		19.49
2001	1.20	1.14	8.00	n.a.	8.75	0.40		19.49
2002	1.20	1.14	8.00	n.a.	8.75	0.40	276.00	295.49
2003	11.11	1.14	8.00	n.a.	8.75	0.95	276.00	305.95
2004	11.11	1.14	8.00	n.a.	8.75	0.95	276.00	305.95
2005	11.11	1.14	8.00	n.a.	8.75	0.95	276.00	305.95
2006	11.11	1.14	8.00	n.a.	8.75	0.95	276.00	305.95
2007	11.11	1.14	8.00	n.a.	8.75	0.95	276.00	305.95
2008	11.11	1.14	16.67	n.a.	1.50	0.95	276.00	307.37
2009	11.11	7.25	16.67	n.a.	1.50	0.95	756.00	793.48
2010	11.11	7.25	16.67	n.a.	1.50	0.95	756.00	793.48
2011	11.11	8.30	7.50	n.a.	1.50	0.95	756.00	785.36
2012	<5	8.30	7.50	n.a.	1.50	<1		23.30
2013	<5	8.30	7.50	n.a.	1.50	<1		23.30
2014	<5	8.30	7.50	n.a.	1.50	<1		23.30
2015	<5	8.30	7.50	n.a.	1.50	<1		23.30
<b>TOTAL</b>	125.99	68.54	167.51	n.a.	85.00	14.55	4200	<b>4661.59</b>
			447.04					

\* Expenditure provided by the region Toscana for the period 1998-2002 and 2003-2011 and equally split over the years by Policy Research; in Toscana capital and maintenance expenditures were funded by the national government up to 2002, as from 2003 the region finances 100% of these expenditures; the expenditure for the period 2012-2015 was estimated by Policy Research based on stakeholders' information that the expenditure will be far less than during the previous period

\*\* Expenditure provided by the region Campania and equally split over the years by Policy research; for the region of Campania the amount includes the annual expenditure for the reduction of erosion financed by the national government and the development of a sea-wave monitoring system in the period 2009-2010 for an amount of € 1.5 million financed by the region

\*\*\* Expenditure provided by the region Lazio for the period 1998-2007, 2008-2010 and 2011-2015 and equally split over the years by Policy research; in Lazio the national government finances about 20% of the maintenance and capital expenditures

\*\*\*\* An official request for the annual expenditure related to the General Plan of Interventions has been sent to the Venice Water Authority, but unfortunately has been left unanswered

\*\*\*\*\* Expenditure provided by the region Emilia-Romagna for the period 2000-2007 and equally split over the years by Policy research; the yearly expenditure for 2008-2015 is estimated by the Directorate General Environment, Soil and Coast Protection to be around € 1-1.5 million with the possibility of an additional budget of around € 15 million for a third large beach nourishment intervention (the € 15 million has not been attributed yet and is therefore not incorporated in the table)

\*\*\*\*\* Expenditure provided by the region Toscana for the period 1998-2002 and 2003-2011 and equally split over the years by Policy Research; the expenditure includes the monitoring of the effectiveness of coastal restoration projects during the period 2003-2011 funded by the region, the expenditure on the research into the implementation of a coastal zone database over the period 1998-2011 which is funded 20% by the national government up to 2002 and entirely by the region as of 2003, and research into the use of continental shelf sand, gravel deposits and reservoirs for beach nourishments financed by the region; expenditure for the period 2012-2015 estimated by Policy research based on the information that the indirect expenditure will be comparable to the previous years

\*\*\*\*\* Expenditure estimated by Policy research based on the information that in 2008 46% of the work had been completed out of a total project cost of € 4.2 billion

## **11.6. PERSONS CONTACTED AND SOURCES OF INFORMATION USED**

### **11.6.1. PERSONS CONTACTED**

<b>Name</b>	<b>Organisation</b>
<i>Albertazzi, Carlo</i>	Regione Emilia-Romagna - Directorate General Environment, Soil and Coast Protection
<i>Biafore, Mauro</i>	Regional Functional Centre, Campanian Civil Protection
<i>Castellari, Sergio</i>	Centro Euro-Mediterraneo per I Cambiamenti Climatici
<i>Chirico, Giovanni Battista</i>	Regional Functional Centre, Campanian Civil Protection
<i>Cipriani, Luigi</i>	Regione Toscana - D.G. Territorial and Environmental Policies
<i>Corsini, Stefano</i>	ISPRA
<i>De Pol, Francesca</i>	Consorzio Venezia Nuova
<i>Gentilella, Matteo</i>	Regional Functional Centre, Campanian Civil Protection
<i>Giannattasio, Maurizio</i>	Regional Functional Centre, Campanian Civil Protection
<i>Lupino, Paolo</i>	Regione Lazio, Gestione Aree Naturali Marine Protette
<i>Massini, Giovanni</i>	Regione Toscana
<i>Mayerle, Giampietro</i>	Venice Water Authority
<i>Montenaro, Oliviero</i>	Ministry of Environment, Land and Sea
<i>Napoli, Francesca</i>	Regional Functional Centre, Campanian Civil Protection

### **11.6.2. SOURCES OF INFORMATION USED**

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- [www.salve.it](http://www.salve.it), Venice Water Authority of the Ministry of Infrastructure and Transport