CLIMATE AND HEALTH COUNTRY PROFILE

ITALY

World Health Organization

United Nations
Framework Convention on
Climate Change

OVERVIEW

Italy, located in the middle of the Mediterranean basin, is comprised of a continental northern sector, a peninsular central-southern sector, two large islands (Sardegna and Sicilia) and various archipelagos and minor islands. Italy has a heterogeneous climate which leads to differences in the immediate risks posed by climate change throughout the country.

Climate change impacts are already exacerbating existing infrastructural deficiencies, post-industrial pollution phenomena and the intrinsic hydro-geological and seismic vulnerability of the country. Rising temperatures, coastal erosion, flooding and drought may lead to water scarcity (6 out of 20 regions called on the government to declare a state of emergency due to water stress in 2017). Water stress could also lead to a reduction in agricultural production, higher risk of forest fires, increased desertification and could threaten economic progress. In addition, climate change impacts air quality, particularly in urban settings, and may lead to changes in the spatial distribution of flora and fauna which degrades biodiversity.

Furthermore, there is a concrete risk of the re-emergence of previously endemic agents (such as tick-borne encephalities, Lyme disease, Mediterranean spotted fever and West Nile fever), or the arrival of tropical communicable diseases, such as dengue, chikungunya, Zika, Crimean-Congo fever, or Rift Valley fever and diseases occurring in animals, including, Bluetongue disease and lumpy skin disease. Protection strategies have been strengthened, but the risk is increasing. Italy is also impacted by population movements. There are approximately 5 million immigrants residing in Italy, which represents about 8.4% of the total resident population. Of this total, there are about 150,000 refugees [1], most of which are economic migrants moving from areas of drought and desertification.

OPPORTUNITIES FOR ACTION

In Italy, the Ministry for the Environment Land and Sea is carrying out activities on climate change at the national level. In 2015, Italy adopted the National Adaptation Strategy to climate change (NAS) with the aim to give a common path, at national level, to deal with the impacts of climate change on natural systems and socio-economic sectors. The Ministry for the Environment is currently working for the implementation of the NAS through the development of the National Adaptation Plan to climate change (NAP). It updates background information about the impacts of climate change and outlines possible adaptation actions for specific sectors, including the health sector. Specific cooperation projects driven by the Ministry of Health are being implemented in parallel to strengthen adaptive and preventative measures to cope with environmental health and climate change-related hazards. These include:

1) Adaptation

- Evaluation of existing national information systems on climate and health.
- Estimation of the costs of the impacts of climate change on health.

2) National Policy Implementation

- Strengthening of the efforts to raise awareness and capacity building to deal with the impacts of climate change on health.
- Strengthening of multilevel governance on the issue of climate change and health, with the aim to ensure coherence between national, regional and local planning.

DEMOGRAPHIC ESTIMATES	
Population (2017) [1]	60,579,000
Population growth rate (2017) [1]	0%
Population living in urban areas (2017) [2]	69.3%
Population age average, years (2017) [3]	44.9
Population 65 years or over (2017) [3]	22,3%
Life expectancy at birth, years (2017) [4]	80,6 (males), 85,1 (females)
ECONOMIC AND DEVELOPMENT INDICATORS	
GDP per capita (current US$, 2016) [5]	30,527 USD
Total expenditure on health as % of GDP (2014) [6]	9.3%
Average annual HDI growth, 2010–2015 (%) [7]	0.34

* For references please see page 16.

1 CURRENT AND FUTURE CLIMATE HAZARDS

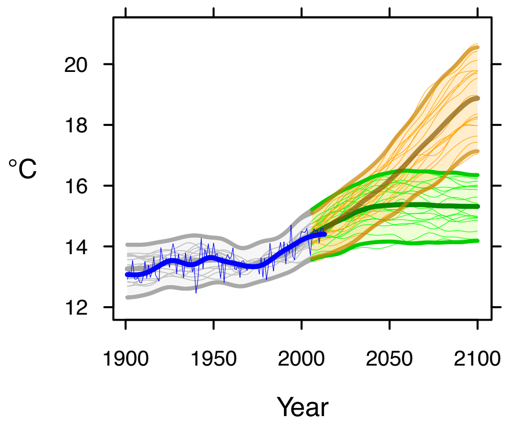
Due to climate change, many climate hazards and extreme weather events, such as heat waves, heavy rainfall and droughts, could become more frequent and more intense in many parts of the world.

Outlined here are country–specific projections up to the year 2100 for climate hazards under a 'business as usual' high emissions scenario compared to projections under a 'two-degree' scenario with rapidly decreasing global emissions. Most hazards caused by climate change will persist for many centuries.

COUNTRY-SPECIFIC CLIMATE HAZARD PROJECTIONS

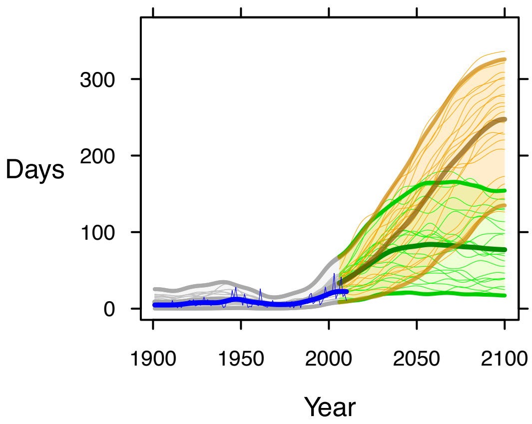
The model projections below present climate hazards under a high emissions scenario, Representative Concentration Pathway 8.5 [RCP8.5] (in orange) and a low emissions scenario, [RCP2.6] (in green).[1] The text boxes describe the projected changes averaged across about 20 models (thick line). The figures also show each model individually as well as the 90% model range (shaded) as a measure of uncertainty and, where available, the annual and smoothed observed record (in blue).[2,3]

MEAN ANNUAL TEMPERATURE



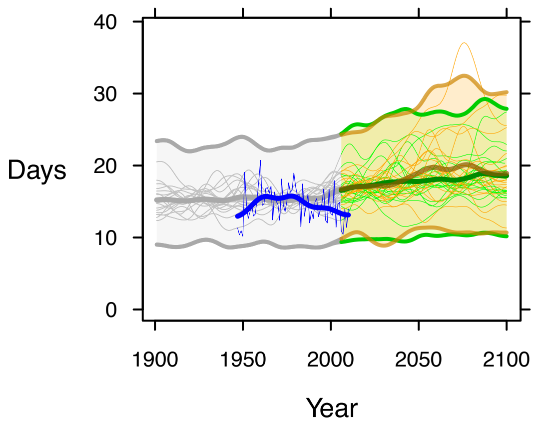
Under a high emissions scenario, mean annual temperature is projected to rise by about 5.1°C on average from 1990 to 2100. If global emissions decrease rapidly, the temperature rise is limited to about 1.6°C.

DAYS OF WARM SPELL ('HEAT WAVES')



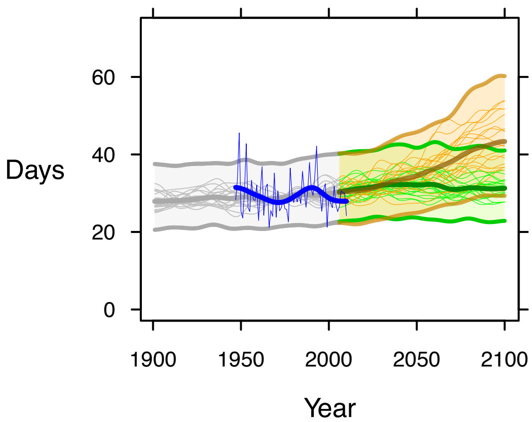
Under a high emissions scenario, the number of days of warm spell [4] is projected to increase from about 10 days in 1990 to about 250 days on average in 2100. If global emissions decrease rapidly, the days of warm spell are limited to about 75 on average.

DAYS WITH EXTREME RAINFALL ('FLOOD RISK')



Under a high emissions scenario, the number of days with very heavy precipitation (20 mm or more) could increase by about 4 days on average from 1990 to 2100, increasing the risk of floods. Some models indicate increases outside the range of historical variability, implying even greater risk. If global emissions decrease rapidly, the risk is slightly reduced.

CONSECUTIVE DRY DAYS ('DROUGHT')



Under a high emissions scenario, the longest dry spell is indicated to increase from an average of about 30 days to just under 45 days, with continuing large year-to-year variability. If global emissions decrease rapidly, there is little change in the length of dry spells.

* For references please see page 16.

2 CURRENT AND FUTURE HEALTH RISKS DUE TO CLIMATE CHANGE

Human health is profoundly affected by weather and climate. Climate change threatens to exacerbate today's health problems – deaths from extreme weather events, cardiovascular and respiratory diseases, infectious diseases and malnutrition – whilst undermining water and food supplies, infrastructure, health systems and social protection systems.

HEAT-RELATED MORTALITY

In the international context, Italy has the highest heat-related effects on daily mortality considering both hot temperatures (from 90th to 99th percentile, 4 degrees on average) and overall summer temperatures (from minimum mortality temperature (MMT) to 99th percentile) (1). However, there is heterogeneity among Italian cities both in the heat effect and in the MMT. Heat effects are greater in larger urban areas (Turin, Milan, Bologna, Florence, Rome, Naples) and a progressive increase in MMT levels can be observed from North to South of Italy and throughout summer, thus accounting for local climate and population physiological adaptation. A decreasing trend in heat related mortality risk was observed in Italian cities after the introduction of the national heat prevention plan. In particular, the reduction was shown for extreme temperatures when warnings were issued and prevention measures were activated (2). The increase in frequency and intensity of heat waves together with population ageing will have a significant impact on health in the future. Summer 2015 was associated with a 13% increase in deaths attributable to heat among the population aged 65+ (3).

Fig 2.1. Pooled relative risks for the association of hot temperatures with deaths cumulated over lags of 0–21 days in 12 countries/regions

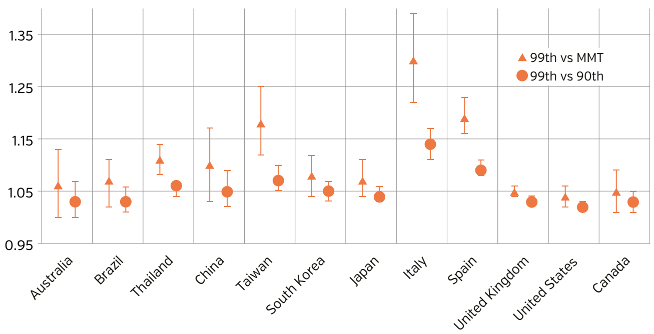


Figure adapted from: Guo, Yuming, et al. "Global variation in the effects of ambient temperature on mortality: a systematic evaluation." *Epidemiology* (Cambridge, Mass.) 25.6 (2014): 781.

KEY IMPLICATIONS FOR HEALTH

The greatest contribution in terms of heat-related effects is in terms of cardiovascular and respiratory diseases on both fatal and non-fatal outcomes. High risk subgroups more susceptible to the effect of heat comprise the elderly, individuals living alone, residents of low-income neighborhoods, those affected by chronic diseases such as diabetes, COPD, mental diseases, neurological diseases, or those taking medications for these diseases (4). Seasonal exposures, such as cold spells, air pollution and circulation of respiratory viruses, in particular influenza, also have an impact on heat susceptible subjects and influence summer mortality (3).

STRATEGY FOR PREVENTION OF HEAT-RELATED EFFECTS IN ITALY

Since 2004, the Department of Civil Protection and the Ministry of Health, have implemented a national program for the prevention of heat health effects focused on the elderly and including all regional capitals and cities with more than 200,000 inhabitants (5). Starting from the largest urban areas, the program was gradually extended to all regions, and to date, has reached national coverage, to include 34 major cities and 93% of urban residents aged 65 years and over.

The national program includes the following core components in line with WHO guidelines (6):

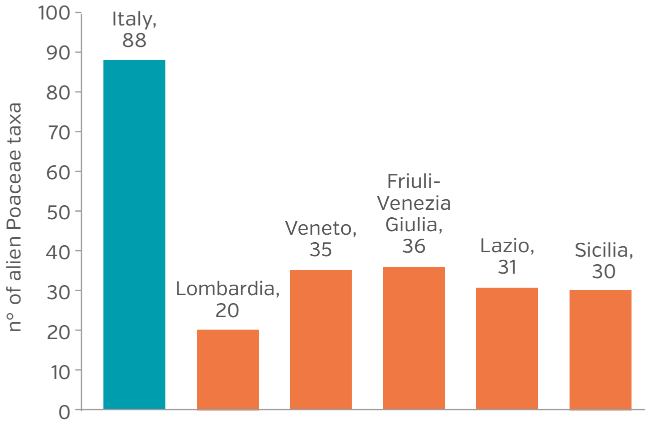
- identification of lead body;
- city-specific warning systems;
- national prevention guidelines and information campaign (7);
- preparedness and emergency response for health and social care systems;
- registries for the identification of susceptible subgroups;
- local prevention plans targeted to susceptible subgroups during heat waves a rapid "real time" mortality and morbidity surveillance;
- evaluation of warning systems and prevention programs introduced.

* For references please see page 16.

ECOSYSTEM BIODIVERSITY

The Italian vascular flora consists of 6,711 species, divided into 1,267 genera and 196 families [1]. As Italy extends from the Alps to the Mediterranean Basin, it hosts about half of the European vascular flora. At a national scale the non-native (alien) flora consists of 1023 species and subspecies (13.4% of the Italian flora), divided into 103 archaeophytes (introduced before the year 1492) and 920 neophytes (introduced after 1492) [2]. As far as allergenic flora is concerned in Italy the family with the highest number of taxa is Poaceae (535 species, of which 88 are non-native to Italy). At a regional scale Lombardia, Friuli-Venezia Giulia, Veneto, Lazio and Sicilia host the highest number of alien taxa of Poaceae (see Fig 2.2); in recent years a strong increase of these taxa was detected for Toscana and Sardegna. Other families including many allergenic and alien species are *Asteraceae* and *Amaranthaceae.*

Fig. 2.2. Number of alien Poaceae taxa [1,2,3]



KEY IMPLICATIONS FOR HEALTH

The future climatic scenario with less precipitation and higher temperatures is expected to cause an increase of annual anemophilous and/or anemochorous plants, many of them are alien and allergenic, with a distribution in a wider elevation belt than the actual, occupying a hypothetical range from the sea level up to 1,000–1,200 m a.s.l. The expected increase in occurrence of allergenic species would cause health impacts with allergopathies.

Strategy

The following strategic actions are defined:

- To promote a management of green areas (especially in urban areas) aimed at cleaning and, where possible, the eradication of allergenic species;
- To define strict guidelines for private green areas to limit the diffusion of allergenic plants.

CLIMATE CHANGE AND MIGRATION

Italy has been facing high numbers of migrant and refugee arrivals in the past few years through the Mediterranean route. UNHCR estimates that 129,000 people arrived by sea to the European shores in 2017 (as of 12 September) [4]. In 2016, 181,000 people arrived to the Italian shores via the Mediterranean Sea, and the figure has already reached over 93,000 as of July 2017 [5]. It is possible that climate change effects on subsistence economies in Sub-Saharan Africa will also push increasing numbers of people not only to move across borders, but also to cross the sea to reach Europe and Italy specifically. Nevertheless, with the available data it would be impossible to attribute exact numbers of arrivals to climate change-driven intercontinental migration.

Italy is putting in place an extraordinary response in terms of rescue operations in the sea and migration management inland. Sicilian point-of-entry locations are receiving regular arrivals of refugees and migrants. Local authorities in Italy are currently managing the public health challenges related to migration. However, increasing pressures require a strengthening of key areas such as emergency preparedness and response, inter-ministerial coordination and aspects of the existing health information system. In this context the new national guidelines on health controls at the point of entry and in the welcoming centres (hot-spots) will be a powerful tool in the hands of the health personnel [6].

The implementation of the Health 2020 policy framework and the national SDG strategy supports attention to migrant and refugee health based on improvable whole-of-society approaches. Addressing migrants' health needs is crucial to tackle broader inequalities, taking into account the social determinants of health in all policies. Moreover the 2030 agenda for SDGs, despite the local challenges, leads the way to answer global issues such as the inclusion of the migrant population.

Under high emissions climate change scenarios, predictions indicate that climate-driven migration will happen and will be very clearly identifiable in the Mediterranean area, with tens of millions of people at a time displaced by extreme weather events, and many millions more displaced by climate processes like desertification, salinization of agricultural land and sea level rise [7].

* For references please see page 16.

INFECTIOUS AND VECTOR-BORNE DISEASES

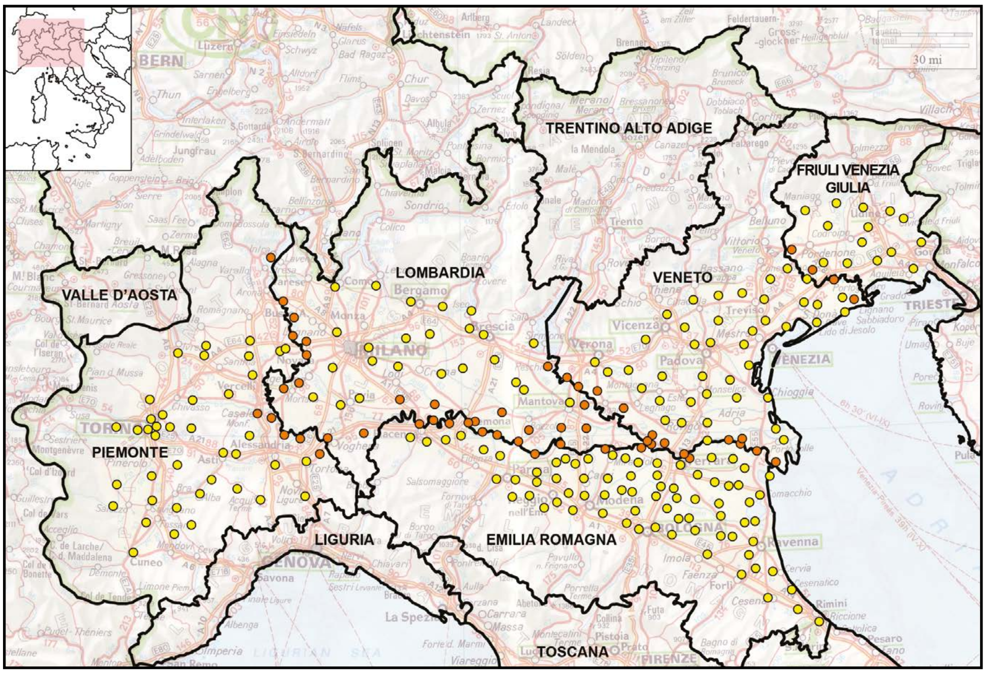
Mosquito-borne diseases (MBDs) are spreading worldwide, including in temperate regions, due to the impact of climate change, the increase in human travel and commercialization, and other factors such as urbanization and land-use changes [1,2]. Several emerging mosquito-borne outbreaks reported recently in the Mediterranean basin were caused by viruses mainly belonging to the family Togaviridae (Chikungunya virus) and to the Flavivirus genus as West Nile virus (WNV) and Usutu virus (USUV) transmitted by Culex sp. or Dengue virus and Zika virus (ZIKV), transmitted by *Aedes* sp. In 2007, a Chikungunya (CHIK) outbreak occurred in the Emilia-Romagna region of Italy [3,4,5]. Another outbreak caused by this tropical virus occurred in the summer of 2017 [6].

Likewise, an increasing number of outbreaks of West Nile disease, with occurrences of human cases, have been reported since 2008, mainly in the North Eastern regions of the country [7].

KEY SURVEILLANCE STRATEGIES

Mosquito-based surveillance is a key component of the response to emerging vector-borne disease outbreaks. First, the surveillance of mosquito populations allows to identify which species are present in an area as well as their relative abundance. This is of utmost importance because different species can have different vector competence or susceptibility to insecticides. Second, mosquito-based surveillance allows the early detection of pathogens before cases of disease are reported in animals and/or humans. The early detection of pathogens might be considered a mainstay in most surveillance programs for arboviruses [8].

Fig. 2.3. The surveillance network in Northern Italy of West Nile Disease [9]. Yellow circles: sites of entomological surveillance. Orange circles: inter-regional sites of entomological surveillance.



STRATEGY FOR VECTOR-BORNE DISEASE CONTROL IN ITALY

A surveillance network has been adopted in Northern Italy aimed at developing a system that allows the monitoring of mosquito species as well as the early detection of viruses in vectors before the occurrence of human cases permitting the application of national plan procedures for blood screening. This surveillance system was able to detect and monitor the occurrence of both autochtonous and introduced mosquito vectors, such as *Aedes albopictus* and the more recently introduced *Ae. japonicus and Ae. koreicus*. Moreover, the surveillance system allowed to detect WNV and USUV in mosquitoes before cases were reported in birds and humans in Emilia Romagna, Lombardia, and Piemonte [8–14]. Likewise, in the course of small-scale preliminary screening in 2012, Japanese encephalitis virus (JEV) was detected for the first time in Europe in a mosquito pool collected in Emilia Romagna: no cases of disease were reported, but the event raised important health issues nonetheless [15]. Considering the emergence of other flaviviruses in which humans could be the reservoir (such as the recent ZIKA infection in South America) and the World Health Organization (WHO) call to European countries to implement entomological surveillance for virus spread prevention [16], the mosquito-based surveillance system, integrated with human and animal surveillance, will provide strong data which may inform public health authorities to set up effective preparedness and control strategies.

* For references please see page 16.

WATER RESOURCES AND HEALTH

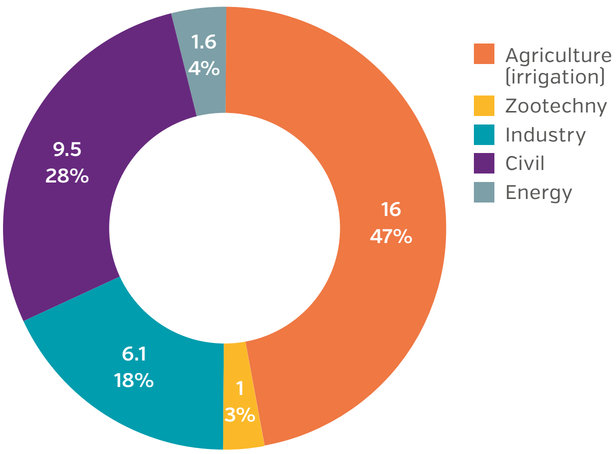
Italy is using, on average, between 30% and 35% of its renewable water resources, and is therefore considered a medium-high water stressed country. Data from the decade 2001-2010 indicate a 6% increase in the use of renewable water resources as compared with the previous 30-year period (1971-2001) (1), and this positive trend is confirmed by recent figures from 2011-2015.

Water scarcity is occurring in Italy, particularly in southern areas and inlands, with critical peaks in summer seasons due to low rainfall combined with increasing demand, from higher population density in coastal areas, and increasing demand for agriculture and animal husbandry [2]. Dramatic reductions of water availability is also a concern in northern Italian regions because of deglaciation of Alpine glaciers (the most important freshwater reservoir in Europe). The loss of ice mass has almost doubled over the last 35 years due to the increase of summer temperatures and the reduction of winter precipitation at high altitudes [3].

The future scenario related to climate change, with less precipitation and higher temperatures (see figures 2.6 and 2.7) is exacerbating water scarcity phenomena in the already affected regions; more frequent occurrence of aquifer over-exploitation, reduction of water availability and drought phenomena are expected to have severe consequences on water access (quantity and continuity of supply), and quality (e.g., turbidity for drinking water reservoirs), also affecting food production, forestry, energy and tourism [1]. Droughts and extreme temperatures are exacerbating the water crisis with 6/20 Italian regions calling for a "state of emergency" in the summer of 2017.

A general warming of maximum temperature is expected by EURO-CORDEX high resolution simulations [Figure 2.6] [2–4].

Fig. 2.4. Water volumes (billions of cubic meters) abstracted from aquifers to be destined to different human uses



Source: ISS elaboration on data "ISTAT - Censimento delle acque per uso civile, 2012."

* For references please see page 16.

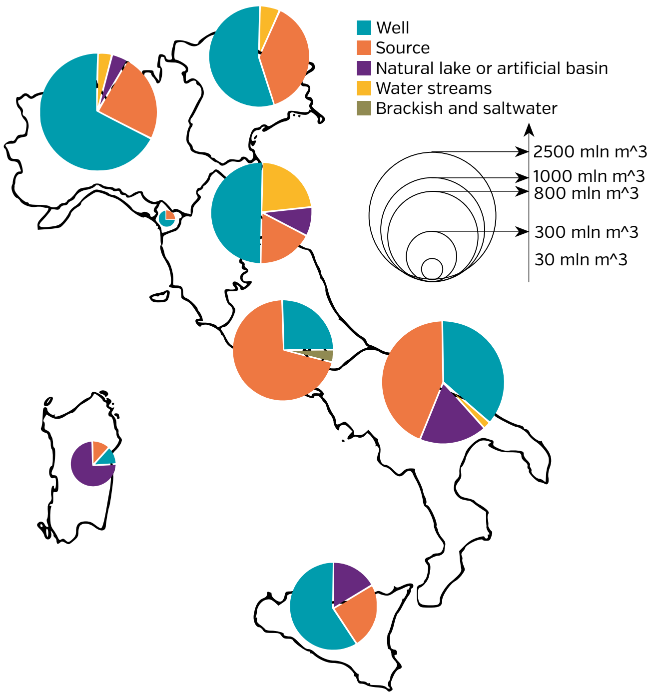
KEY IMPLICATIONS FOR HEALTH

Water scarcity and water pollution can have direct and sometimes severe consequences for health.

Decreases in mean precipitation, together with over-exploitation of water resources and lack of adequate management, investments and practices, are resulting in challenges to ensure water availability and safely managed water supply in several Italian regions.

Aquatic ecosystems and groundwater resources may also be seriously impacted resulting in; insufficient water level in rivers and lakes, intrusion of salt-water into aquifers, increased frequency and severity of water quality deficiencies with possible health impacts (non communicable and communicable diseases) due to algal blooms, lower potential of dilution of pollutants in aquifers and bio-accumulation of contaminants in the aquatic food chain. An increased risk of diseases caused by lack of water for human consumption, sanitation and hygiene could be envisaged in circumstances of extreme water crises.

Fig 2.5. Water volumes (billions of cubic meters) abstracted from aquifers to be destined to human consumption



Source: ISS elaboration on data "ISTAT - Censimento delle acque per uso civile, 2012."

Fig. 2.6 and Fig 2.7. EURO-CORDEX high resolution simulations showing an expected general warming of maximum temperature, light for RCP2.6 (in green) and more accentuated for RCP8.5 (in yellow) scenario (Fig. 2.6). No substantial variations are expected for annual total precipitation (Fig. 2.7). Also reported are: historical reference period data (in grey), average climatic projection (thick line) and 90% model range giving a measurement of uncertainty (shaded area). Plots are obtained using using 5 years running mean.

Fig 2.6. Mean Annual Maximum Temperature

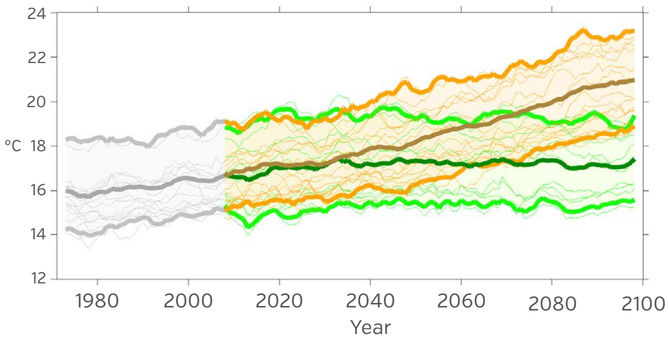
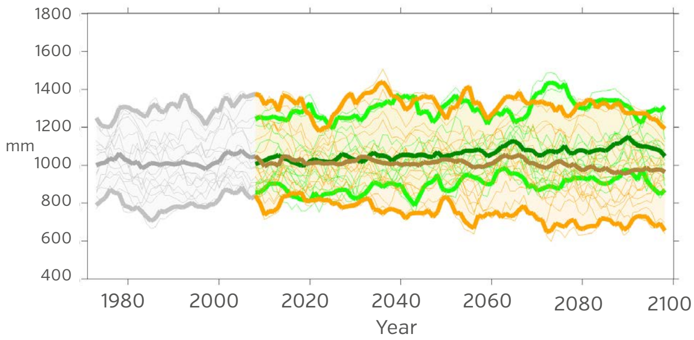


Fig 2.7. Annual Total Precipitation



There is growing concern on the effects of climate change in the marine environment, as for the increasing of surface temperatures, intensification of the deepest stratification of water masses, causing changes in the inter-relationships between deep and coastal environments, alteration of biogeochemical cycles, variability and instability of marine ecosystems, with risks from alien species, changes in the distribution and effects of contaminants and their impacts, increasing of sea level. These impacts, combined with strong anthropogenic pressures, have consequences that are difficult to predict on social and health risks related to the exposure and use of the seas in our country, taking also into account that, with over 8,000 km of coastline, basic economic resources derive from the sea (approx. 2.7% of GDP), especially for the most disadvantaged areas.

WATER RESOURCE STRATEGY IN ITALY

To cope with the challenging scenario of water quality and quantity depletion, Italy is strengthening a strategic vision for the water sector, with national policy supporting regional and local authorities in managing water resources and surveying water quality. However, any development within the water supply and sanitation sector have to cope with serious problems of inadequacy and aging of drinking and wastewater infrastructures.

The following strategic actions are defined:

- to promote natural water conservation, reclaimed water reuse, investments in renovation of water networks and infrastructure, by development of a holistic water policy, and strategy to aggregate the fragmentized surveillance authorities and water management companies, also by using economic instruments, such as water pricing;
- to promote water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity in short- medium- and long-term, and by also adopting advanced technologies such as desalination.
- to strengthen capacity building regarding climate adaptation in water management, especially regarding flood and drought controlling;
- to promote cross-sectoral, regional and national policies to increase resilience of water supply, treatment, storage and delivery systems as well as sanitation systems, by ensuring adequate knowledge and implementation of hygiene practices;
- to support the adoption and implementation of risk based approach in water and sanitation sector (i.e., water safety plans [5], sanitation safety plans), including waterborne diseases risk assessment and management, early warning systems based on forecasts of pathogen distributions, identification and monitoring of legacy and emerging chemical contaminants;
- to support modelling and monitoring of biogenic harmful substances, including algal blooms and toxin production in the aquatic environment [6–8];
- to support the development and up-scaling of technologies and methods to ensure safe and affordable drinking water in sufficient quality and quantity (e.g., desalination technologies for contingency water supply) [9].

* For references please see page 16.

CLIMATE CHANGE AND FOOD SAFETY AND SECURITY

Climate change is likely to have both direct and indirect impacts on food safety and food security. It can cause or intensify food (and feed) safety problems during all phases of production and supply. However, the interactions between climate change and food safety are very complex because of the many associated uncertainties. Climate change might alter both microbiological and chemical risks to food safety. Food and water-borne diseases are caused by the ingestion of bacteria, viruses, parasites or chemicals, in food or water, and they can have severe effects on health. This is the case especially in developing countries where food- and waterborne diarrheal disease kills an estimated 2 million people annually. However, climate change can threaten food safety even in European Countries (1). Examples include:

Microbiological food contamination, foodborne diseases and waterborne diseases

Waterborne and foodborne enteric pathogens, such as Salmonella spp., Campylobacter jejuni, E. coli, Shigella spp., Vibrio spp., Norovirus, Giardia and Cryptosporidium, show typical seasonal patterns. This suggests that climate change could play a role in changing the incidence of many foodborne diseases. 3821 cases of salmonellosis, 1041 of campylobacteriosis, and 153 of listeriosis were reported in Italy in 2015 in the last joint EFSA/ECDC report (2). Extreme climatic events such as flood can influence the incidence of foodborne diseases because of their impact on the infrastructures, the environment and the ecology of microorganisms. An association between water-borne diseases such as leptospirosis (3), salmonellosis and infectious diarrhea and flood events seems to exist in Italy (4).

Mycotoxins

Mycotoxins, produced by toxigenic moulds affecting crops, are one of the most investigated and paradigmatic example of the potential impact of climate change on food safety and security. The production of mycotoxins is greatly influenced by environmental factors, such as temperature, humidity and drought. Until a few years ago, aflatoxins, among the most harmful mycotoxins, were not a matter of concern in Europe. However, 2003 and 2012 will be remembered in Italy and southern Europe, respectively, because of the alarming contamination in maize. Models aimed at predicting aflatoxin contamination in maize and wheat crops in Europe over the next 100 years indicate Italy will be one of the most heavily affected countries [5] (See Fig 2.8.)

Environmental contaminants and chemical residues in the food chain

There are many pathways through which climate change may impact environmental contamination and chemical hazards in foods. Contamination of agricultural and pastureland soil with PCBs and dioxins have been associated with extreme climate events, particularly with the inland floods. Soil contamination can result from the mobilization of river sediments or contaminated terrestrial sites such as industrial sites, landfills and sewage treatment plants and the subsequently deposition of chemicals on the flooded areas (6).

Fig. 2.8. Risk maps for aflatoxin contamination in maize at harvest in 3 different climate scenarios, present, +2 °C, +5 °C. Mean daily data used as input result from 100-year run of the predictive model AFLAmaize in 2254 geo-referenced points throughout Europe, in the 3 scenarios. The scale 0–200 refers to the aflatoxin risk index (AFI), output from the predictive model; increasing the (present (a), +2ÆC (b), +5ÆC (c)) number, the risk of contamination increases.