Civil Protection in Italy

Basic Training in Civil Protection

Law n. 92/2019 on the Introduction of Civic Education
in the National Education Programme

PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
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Civil Protection in Italy

Introduction to the English version of the book

This book is the English version of an Italian text entitled "Civil Protection in Italy - Institutional Textbook for School Teachers", published online on 14 August 2020. It was conceived as a tool for all school teachers who, following the Law n. 92 of 19/8/2019 and beginning from the 2020-21 School Year, are required to include in the national education program the subject of Civil Protection to be taught as part of the compulsory course of Civil Education. The text was designed to provide teachers, who work with students from 6 to 19 years old, with a wide range of detailed subjects, including historical, technical, scientific, operational and policy-making topics.

The scope and depth of this work make this textbook a very rich and useful source of information that could definitely be appreciated and shared with a wider audience, besides Italian teachers. It represents, in fact, an organized and in-depth description of the National Civil Protection Service that operates on Disaster Risk Reduction (DRR) in Italy and of the risks it deals with.

It has been translated in the English language in consideration and hope that it may be of interest to the European and international DRR community. Decision 1313/2013/EU, concerning the European Civil Protection Mechanism, has among its objectives that of achieving a high level of protection against disasters by preventing or reducing their potential effects, by fostering a culture of prevention, and that of increasing public awareness and preparedness for disasters. The European Commission itself is called upon, with a view to prevention, to support Member States in increasing public awareness, information and education. Similarly, enhancing public awareness of risks and preventing disasters through educational measures are among the principles of the Sendai Framework for Disaster Risk Reduction (SFDRR 2015-2030).

It is hoped that, within this framework of unity of purpose, this English version of the book can contribute also outside Italy to DRR and to an effective increase in community resilience.

Fabrizio Curcio

FOREWORD

Giuseppe Conte
Prime Minister

Risk reduction has become an important and urgent topic in recent years, not only in terms of scientific debate, but also of conscious and necessary action at all government levels, from local to global. And Italy has always been and remains a true laboratory for every possible type of risk.

Italy is the European Country with the highest number of active volcanoes, many of which fortunately quiescent. The subsoil of the entire national territory hosts, at depth, numerous seismogenic faults. Their destructive effects are linked to the high seismic vulnerability of the built environment, with its rich monumental, historical and infrastructural heritage, mainly built in remote eras when very few seismic techniques were applied.

A Country characterized by an enormous number of landslides affecting hilly and mountainous areas, lacking adequate forestation and with terrains that suffered a long-term neglect and absence of regular maintenance, which in the past was ensured by the work of active citizens operating in the primary sector, even in highly impervious areas. Also the hydraulic risk has been historically present with sudden potent overflowing of rivers and streams and consequent floods.

By contrast, the prolonged periods without rainfall and with extreme high temperatures are among the causes, along with irresponsible or criminal human behavior, of devastating high intensity forest fires which, despite our skilled response capacities and the significant deployment of means ready to extinguish such fires, cause increasing substantial damage to our territory.

Without forgetting the devastation, always possible, caused by tsunamis and the continuous and progressive erosion of our coasts.

To these types of natural risk we must add the wide range of man-made risks that occur both in the form of accidents, and due to the consequences of an extremely rapid economic development neglectful of its devastating effects on the territory and on coastal/marine ecosystems. Also for these types of risk, the full awareness of the effects of development, which have determined a significant concentration of the population in urban areas together with the growth of a complex industrial system, was only achieved when the natural balances had already suffered damaging effects that are difficult to reverse.

Scientific knowledge of the reality in which we live along with our, even recent, experience, also have helped draw attention to a set of new risks that we must necessarily take into account, such as the deterioration of the materials used, the durability of which we erroneously once confided in, to build structures and infrastructures after the war until this day.

The Covid-19 health crisis has also shown how the possible impact of certain risks can cross over any geographical or administrative boundary. This emergency has emphasized the need to be prepared also for the occurrence of low probability and high impact disasters, as required by the European civil protection legislation. These are crises that cannot be overcome alone, but in a coordinated joint effort and synergistic way. A shared strategy, however, must be prepared in ordinary time, because it is very difficult to develop it while the emergency is ongoing.

As per disaster risk reduction, Italy has implemented a series of different policies. Since the 1980s, our Country has equipped itself with a civil protection system that involves all the government bodies, universities and scientific research institutes, and all the human resources available to face risks together, to preventively mitigate their impact and to learn to deal with emergencies related to them as quickly and effectively as possible.

Along with the developing civil protection system, our Country has grappled with structural and non-structural policies to reduce the existing risks. This activity was implemented through a timely and constant revision of the legislation regulating industrial production, transport, prevention and the management of man-made risks, the management of risks related to hydrogeological basins, the classification of seismic areas. This has led to the implementation of modern policies to prevent disasters, resulting, for example, in an intense and widespread production of civil protection plans, both at municipal level and for particularly exposed areas, such as the Vesuvius and Phlegraean Fields, or, after the past devastating earthquakes, in reconstruction programs that follow the 'building back better' strategy, pursued by Italy ever since the 1960s.

During my mandate as Prime Minister of Italy, I can say that I have gained a deeper awareness of how important and essential it is to promote and disseminate the knowledge of risks and ways to reduce their impact to the national population. In this context, an initiative has sprung from a joint effort of the Ministry of Education and the Civil Protection Department, involving the entire national education system, that is schools of all levels and degrees, according to an articulated modular education program aimed at teaching the best behaviors to adopt to ensure the maximum possible safety with respect to the risks present in the diverse territories of our Country.

And this is also the context of this textbook on the Italian civil protection available nationwide to all school teachers. It is an extensive piece of work, rich in information and data provided by an institutional and competent source, such as the Civil Protection Department under the Presidency of the Council of Ministers. I am sure that this text will spark new didactic initiatives for teachers of all levels, but also become an invaluable source of knowledge for all those who want to further understand how our National Civil Protection Service works, and perhaps even participate in it actively according to the many possible options: with their work, adopting self-protection techniques, or operating as a civil protection volunteer.

PREAMBLE

Lucia Azzolina
Minister of Education

This textbook, which could become a useful teaching aid available to our school teachers to increase their knowledge of the National Civil Protection Service in Italy, is being released at a very delicate moment for Italian schools.

We have just concluded a very special school year, severely compromised by the Covid-19 pandemic. Children and their parents, teachers and all school staff members and personnel throughout the Country have faced an unprecedented period of crisis, marked by a deep concern for the health conditions and hard work of many loved ones, as well as didactic, technical and relational complexities. It is an ongoing challenge with many critical issues, which in my opinion we have a good chance of overcoming, drawing lessons for the future.

A period, unlike many others, in which an emergency has entered directly in the homes and lives of all Italian citizens and of the entire world population, affecting us directly and individually.

Fear has forced us to become familiar with the concepts of hazard and probability; a time to take decisions in a context of scientific uncertainty, to chase the “calculated risk”; on a new journey with the decisive support of the civil protection on our side. The challenge was to learn directly "on the field", so to speak, proving the essential and irreplaceable value of this Public Service!

Now a new school year is about to begin, and while we have not completely gotten rid of this Covid-19 health emergency that still haunts us, we cannot afford to let our guard drop against all the other many risks that trouble our beautiful Country.

But starting from this school year, the entry of Civil Education as a compulsory subject in the schools, as per Law n. 92 of 19/8/2019, will allow students of all ages to learn about and increase their knowledge of the risks faced by our Country and the great work of prevention and mitigation entrusted to the National Civil Protection Service.

In fact, the three main concepts that constitute the pillars of the aforementioned law include "Sustainable development, environmental education, knowledge and protection of heritage and territory" to which health education, environmental protection, food safety, all areas of competence of the National Civil Protection Service, can be traced.

In launching this latest educational innovation and taking into account the pandemic period in which we are still fully immersed, this text could be of great support to school teachers in planning didactic units that will allow students to become familiar with the National Civil Protection Service and the strategic functions entrusted to it.

The text covers a wide range of topics, from historical to scientific, from social to regulatory. All teachers will find, among the many aspects covered, topics and affinities related to their own teaching methods, the content of their teachings, the school sector specific requirements and the region in which they operate, and their students’ particular field of interest.

The book also provides a series of images, photos, tables, links and bibliographical references to enrich the educational offer to teaching staff and to allow an in-depth study of elements of specific interest. Further contents will be added over time through a series of Dossier linked to this text; the first one can only be dedicated to the current Covid-19 emergency.

Students are interested and sensitive to these topics, as they are accustomed to hear about such events every day on Television, in newspapers and social media. It will therefore be easier for them to learn the concepts of prevention, self-protection, mutual solidarity and participatory sharing of sustainable choices, which are the basis of a good civil protection system and of the consolidation of a less vulnerable and more resilient community.

INTRODUCTION

Angelo Borrelli
Head of the Civil Protection Department

The growing need for citizens to be aware of the risks of civil protection starting from the younger generations, and the need to promote prevention choices and self-protection behavior codes, to reduce risks and increase the resilience of communities, are among the main reasons for this text. To this aspect it must be added that: «The civil protection body, which provides information to the public opinion about the forecast, the extent or nature of feared hazardous events for public safety, exercises a concrete operational function of prevention and protection, and to do this it is required to adapt the content of public communication to an optimal level as per transparency and scientific accuracy of the information disseminated, and to adapt the communication language to standards of clarity, objective understanding and unequivocal statements» (Cass., sec. IV, sent. 19 November 2015, n. 12478/16).

Furthermore, in January 2018, with the issue of Legislative Decree n. 1/2018 – Civil Protection Code, under art. 2, paragraph 4, letter e), among the activities of civil protection, the following was included for the first time: «dissemination of knowledge and culture of civil protection, also with the involvement of educational institutions, in order to promote resilience of communities and the adoption of aware behaviors and measures of self-protection by citizens».

Based on these needs, on 13 October 2018, the Civil Protection Department under the Presidency of the Council of Ministers and the former Ministry of Education, University and Research signed a Memorandum of Understanding to promote strategic and integrated action on safety issues to increase the "resilience of communities" through a profound action of dissemination of the culture of civil protection. To this end, the Department and the Ministry took steps to establish a virtuous path for a synergic and cohesive institutional action, developing the project called "Culture is... civil protection" aimed primarily at:

1) the activation of a complex cultural process through the active involvement of school staff, managers and teachers, for the elaboration of the National Training Program, necessarily participated and shared between the local administrations and the central government;

2) the future building of suitable civil protection organizational structures within the school world, aimed at ensuring educational continuity in all conditions of crisis and emergency;

3) the production of official reference texts and documents, to support school staff in the dissemination of the basic concepts of civil protection, in schools of all levels and universities.

Furthermore, Law n. 92/2019, which re-introduces the school course of "Civic Education" among the mandatory subjects of the ministerial programs, has provided, among the skills to be developed and the learning objectives, for the basic training on civil protection.

In support of the objectives set out above, this volume has been drafted as an institutional textbook on which the teaching of civil protection issues is outlined within the new Civic Education course.

This textbook contains a wide range of information on civil protection, provided by an official source such as the Civil Protection Department under the Presidency of the Council of Ministers. From this text, depending on the school level, the training level, the territory in which it operates and the local cultural sensitivity to the subject, teachers can draw useful information for their didactic work on civil protection.

Furthermore, the text provides a precise reference also to those who want to further understand the concepts of their specific field of interest beginning from institutional information, which is essential to be able to provide a consistent and effective support to the National Training Program in civil protection.

Civil protection is in fact a living matter, called from time to time to face new situations, new emergencies, new challenges abiding by its primary mission, that is to «protect life, physical integrity, property, settlements, animals and the environment from damage or the danger of damage resulting from natural disasters or deriving from human activity». This is why a textbook on the function of civil protection can not be static and still, as it needs to be progressively integrated, through specific Dossiers, with updates on risk forecasting and prevention and lessons learned from the latest emergency experiences, such as the most recent Covid-19 pandemic.

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1

WHAT IS CIVIL PROTECTION

According to art. 1 of Legislative Decree n. 1/2018 – Civil Protection Code:

«The National Civil Protection Service [...] defined as a public utility service, is the system that performs the civil protection function consisting of the set of skills and activities aimed at protecting life, physical integrity, property, settlements, animals and the environment from damage or danger of damage resulting from disasters of natural origin or deriving from human activity».

By civil protection we mean, therefore, both the structures and the activities put in place to protect life, integrity and the property of people, the environment and the territory from all risks deriving from disastrous events through actions of forecasting, prevention, emergency management and emergency overcoming.

The complex legislation, as we will see in constant evolution, has developed a civil protection system named the "National Civil Protection Service", not centralized but widespread with a multi-level organizational structure: the system is based on the constitutional principle of subsidiarity (Italian Constitution, art. 118) which from the first level, the Mayor, rises to the provincial or regional level up to the national level.

One of the objectives of this text is to bring out the systemic dimension of civil protection. This also means that each of us, both professionally and as single citizens, participate in the National Civil Protection Service. In this sense, civil protection is a right and a duty for everyone. It is certainly a right – and therefore it is the duty of the institutions to give priority to civil protection issues – but it is also a duty for the citizen, who has the obligation to know the risks to which his/her territory is subject and to adopt appropriate behavior. This way a group of citizens can be transformed into a resilient community.

The growing need for safety in today's society must therefore be associated with a greater awareness of the importance of choices, including personal ones, which can increase or reduce one's risk conditions: the connection between correct behavior and mitigation of risks is extremely relevant, as it is between previous choices and subsequent effects. This reflection starts from what is established by the Civil Protection Code:

«The Components of the National Service, within their respective powers, provide citizens with information on risk scenarios and on the organization of civil protection services in their territory, also in order to allow them to adopt self-protection measures in emergency situations [...]» (Legislative Decree n. 1/2018, art. 31, paragraph 2).

In this first chapter we will provide an excursus between the terms that are used when talking about risks and civil protection activities. Some terms are simply typical words spoken everday, such as "crisis" or "disaster". Others are found both in daily speech and in civil protection legislation, such as "catastrophe" or "calamitous event", or may have a more scientific connotation, such as "probability" or "monitoring". In the following chapters we will enter more deeply into the technical-scientific and operational aspects.

It is very common to hear phrases like: "There is an emergency at home, I forgot to buy milk and we need it to feed our little boy". Just as it would appear as a catastrophe, in the eyes of parents, to receive a bad report card for the poor performance of their child at school.

Going through a "crisis" is a state that is part of everyone's life; very often we question ourselves over a dilemma on a choice or decision to make. We are in a state of crisis, for example, when we have to decide which school our children should attend or what brand and model of a new car to buy. Or, again, when we have an overload of commitments or things to do, at home or at work; concerns or worries that do not allow us to live and operate peacefully or in a state of tranquillity.

The word "vulnerability" is a more sophisticated but frequently used term, which in common speech is more often associated to a social or psychological state: it is often said that "that group of people is vulnerable in case of..." or that "our children are vulnerable to...".

"Prevention is better than treatment" is an affirmation repeated endlessly by our family practicioners when prescribing a therapy, while recommending an appropriate diet and increased physical activity. The same way it is wiser to prepare for the winter season in a country house by stocking up on firewood to prepare and protect ourselves from the cold.

In technical language, as is appropriate for this publication, we will try to give each word its correct definition, with the aim to provide school teachers with clearly defined points of reference to explain topics related to the vast universe of civil protection to their students. The definitions contained in this volume, reported analytically in the Simplified Glossary, are from qualified public sources that you can find by clicking at the link.

Technical language helps us to better understand the risks and consequently to take preventive actions under normal conditions. In an emergency situation, the appropriate use of terms is essential to calibrate the actions necessary to effectively manage any case: the operational response will in fact depend on the description of the scenario given by its reporter, the person relating the event from the emergency site.The ability to communicate and reliability of the reports given depend on the terms used to describe the disaster event in course.

The word **crisis** means a condition of trouble in the life of an individual or a group of individuals, a situation perceived as complex and destabilizing. It implies the possibility of the start of a hazardous process, of which neither time and space, nor levels of intensity can be well defined. A crisis may not be evident and requires a competent analysis before being recognized. There are at least four characteristics inherent in a crisis that are of interest in our context:

- an unexpected condition;
- an unusual or non-routine event or series of events;
- a situation that creates a condition of uncertainty;
- a situation that creates a threat, real or perceived.

Photo 1. Castelluccio di Norcia, Perugia, 2016. Collapses caused by the 30 October earthquake.

Emergency is a term used to describe an unexpected condition which, from a management point of view, requires decisions and extraordinary measures to be adopted often immediately. A state of emergency needs to be "declared" or ordered by an authority, the same that has the right to close the emergency state when the crisis is over.

From a civil protection point of view, an event causes an emergency condition if, for example, it:

- poses a threat to life, health, property or the environment;
- has already caused loss of life, damage to health, property or the environment;
- the two situations just described are imminent and, even if they have not yet occurred, the probability of their occurrence is high.

Many emergencies require urgent interventions to prevent the situation from becoming worse, although, sometimes, the damage is already irreparable and intervention is mainly aimed at the rescue and assistance of the affected population.

Photo 2. Dimaro, Trento, 2018. Building damage caused by an ecceptional wave of bad weather.

The terms **catastrophe** (from the Greek idiom: reversal or tilting over) and **disaster** (prefix *dis*, which has a pejorative value, and *astrum*, which indicates the influence on events once attributed to the stars) indicate events that have produced particular effects and severe consequences. We often refer to catastrophes and disasters even if there has not yet been a quantification of the extent of the damage that justifies the use of this term. Disasters or catastrophes involve direct or indirect effects on individuals and the environment, in relation to the different levels of vulnerability. The latter term, as will be seen below, is declined in different ways depending on the perspective in which it is used.

The UNDRR-United Nations Office for Disaster Risk Reduction defines the **risk** in terms potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time. It is a probabilistic estimate that takes into account **hazard**, **vulnerability** and **exposure**, as well as the **capacity** to cope with the phenomenon (see Focus 1 and Simplified Glossary).

DEFINITION AND ASSESSMENT OF RISK

The United Nations' definition of risk (see Simplified Glossary) can be summarized by the following general equation:

R = f (H, E, V, C)

R refers to the **risk** that assets/goods are exposed to in the area of interest, expressed in terms of probability or frequency of occurrence of predefined consequences (also for the definitions of H, E, V, C see Simplified Glossary).
f stands for function of (risk is a function of...).
H referes to the **hazard** of the area of interest: as it increases, the risk also increases.
E refers to the **exposure** in the area of interest: as it increases, the risk also increases.
V refers to the **vulnerability** of the exposed goods: as it increases, the risk also increases.
C refers to the **response capacity** of those exposed and of the civil protection system: as it increases, the risk decreases.

This way to define risk is very broad, both because it can bereferred to any type of hazard, and because for a given type of hazard there is not a single risk assessment. In fact, it can be referred to different elements exposed to it (people, buildings, transport infrastructures, cultural heritage, industrial systems, entire communities, etc.) and quantified through different metrics (severity of damage, restoration costs, number of victims, indirect costs for interruption of economic activities, impact on social communities, impact on the landscape, etc.). Furthermore, risk can refer to a single scenario event or to all the events that may occur, with their relative probability of occurrence, in a given period of time (1, 10, 50, 100 years and so on), in a specific geographical area (village, city, region, etc.).

If an hazardous event occurs that can be associated with a certain degree of probability or frequency of occurrence (see Focus 11) – such as an earthquake of a given magnitude with a given epicenter or a landslide or a flood in a specific geographical area – different questions can be answered by making a risk assessment, for example:

Focus 1

- how many victims are expected?
- how many homeless people will have to be sheltered in tents or provisional accomodation structures?
- what will be the damage to cultural heritage and churches?
- what will be the costs of restoring damaged buildings?
- what will be the costs to compensate the losses suffered by the interruption of production activities?

These questions can refer to a small village, a city, a region or to the whole national territory. Moreover, it is necessary to distinguish if the reference is made to a single scenario event or to all possible events of that type impacting an area under assessment in a predetermined time span, for example a year or a hundred years.

Photo 3. Amatrice, Rieti, 2016. Teams engaged in search and rescue activities after the 24 August earthquake.

For this reason, when it comes to risk assessment, it is necessary to have a clear understanding of the purpose of the analysis, and therefore how danger is expressed (scenario or hazard), which exposed elements are taken into account (residential buildings, infrastructures, cultural heritage, etc.), the quantity and metrics to adopt to carry out the assessment and represent its final result.

The issue becomes considerably more complicated in case of a multi-hazard/multi-risk assessment, if various hazards are simultaneously taken into account (earthquakes, landslides, extreme weather events, etc.).

These hazards can be considered either independently, combining them with their probability of occurrence, or taking into account the interactions that determine domino or cascading effects (for example an earthquake that causes a landslide or a tsunami). Multi-hazard/multi-risk assessment is often very complex, to the point that rigorous probabilistic approaches cannot be adopted and simplified procedures must be used.

The definition of risk implies the concept of possibility or potentiality. There is no certainty that the phenomenon will occur, nor that it will have a particular intensity or that it will cause certain consequences, and this uncertainty is represented by the probability of occurrence.

Among the risks considered by the civil protection system there are also those deriving from human activity, that is man made, unlike what regards the WHO-World Health Organization, which refers only to natural phenomena.

Therefore, to realistically assess a risk, it is not enough to know its hazard component, but it is also necessary to accurately estimate the exposure factor, i.e. the lives and assets present in the territory that may be affected by an event and their vulnerability with respect to the events taken into consideration (see Focus 1). The ability to cope with a dangerous event, then, allows you to reduce vulnerability and/or exposure (if I have an emergency kit, I am less vulnerable; if the area is evacuated, exposure to that risk is greatly reduced) hence the risk in general, or the impact of a specific event.

Photo 4. Amatrice, Rieti, 2016. Collapses caused by the 24 August earthquake.

It is useful to note that individual people do not necessarily share the same perceptions of the meaning and underlying causes of different risks.

According to the definition provided by UNDRR, **vulnerability** (see Simplified Glossary) describes the conditions that make individuals, communities, assets or systems more susceptible to the impact of different hazards. A similar concept is expressed by the WHO-World Health Organization, which defines it as the degree to which a socio-economic system is sensitive or resilient to the impact of natural risks and related technological and environmental disasters.

The vulnerability level of a community is determined by a combination of different factors, including the condition of the building stock and the infrastructures, awareness of the hazards, organization of public administration, management of public order, organization of skills in all fields of disaster management. Poverty, for example, is one of the main causes of social vulnerability in many parts of the world.

It is evident that the vulnerability referred to communities or socio-economic systems is a very complex and articulated concept, difficult to quantify. For this

reason, a distinction is often made between physical and social vulnerability, referring the first one to buildings and infrastructures, the second one to communities. Further distinctions can be made for the various subjects exposed to hazard (economic system, social relations system, etc.). However, it is clear that if the physical vulnerability is very low there will be no, or very limited, damage to buildings and infrastructure, for example due to earthquakes, hurricanes or other natural events. Other is obviously if these are epidemics or other health emergencies, cyber attacks or events whose impact does not derive from damage to physical structures.

Photo 5. Villa Sant'Angelo, L'Aquila, 2009. Teams engaged in search and rescue activities following the 6 April earthquake.

Many causes of vulnerability therefore lie in several factors. Examples can include poor design, construction or maintenance of buildings and infrastructure, inadequate protection of socio-economic resources, lack of public information and awareness, limited skills of risk recognition and prevention measures, poor environmental management. Vulnerability can vary significantly within a community and over time.

Risk management includes civil protection activities that are widely covered in this text: forecasting, prevention, emergency and overcoming the emergency. According to UNDRR, risk management is the application of policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses. It corresponds, therefore, to a systematic approach and the practice of managing uncertainty to minimize potential damage and loss.

The forecasting of an event or risk corresponds to the evaluation of what will happen (phenomena and/or consequences) and how this will evolve on the basis of data, information, models and hypotheses available, affected by a degree of uncertainty. The Legislative Decree n. 1/2018 defines **forecasting** as the set of civil protection activities aimed at the identification and the study of possible risk scenarios, for civil protection alerting and planning needs (see Simplified Glossary).

For the purpose of an effective prevention and mitigation, risks need to be duly assessed. **Risk assessment** is defined by UNDRR as a qualitative or quantitative study to determine the nature and extent of the risk considered by analyzing the potential hazards and assessing the existing conditions of exposure and vulnerability, which together could harm people, property, services, livelihoods and the environment by which they depend (see Focus 1 and Simplified Glossary). The effectiveness of the reaction capabilities that can be activated to deal with possible risk scenarios must also be considered.

The Civil Protection Code defines **prevention** as the set of activities of structural and non-structural nature (for example, the seismic upgrading of school buildings and the realization of civil protection plans, respectively) aimed at avoiding or reducing the possibility of consequential damage to calamitous events, also on the basis of forecasting activities (see Simplified Glossary).

Response to any disaster will prove much more effective by benefiting from a strong prevention, which also includes **preparedness**. Prevention includes the knowledge and skills developed by institutions, communities and individuals to respond to events in order to effectively anticipate the impact of ongoing, probable or imminent events. Preventive action aims to build the necessary skills needed to manage all types of emergencies and achieve an orderly transition to response and a lasting recovery. Preparedness is based on a solid risk analysis and includes activities such as civil protection planning, storage and preservation of equipment and supplies, development of coordination procedures, evacuation and public information, associated with training and field exercises. It also benefits from efficient early warning systems, that is the set of capabilities needed to promptly generate and disseminate information of an imminent danger to allow individuals, communities and organizations under threat to prepare and act appropriately and in a timely manner to reduce the possibility of damage or loss.

An alarm system aimed at individuals necessarily includes some key elements: knowledge of the risks, monitoring, analysis and forecast of the hazards and of the calamitous events, communication or dissemination of warnings and alerts and local capacity to respond to messages.

End-to-end alarm system is an expression used to emphasize that these systems must extend to the entire cycle of evolution of the phenomenon in progress, starting from its detection and ending with the behavior of a community prepared to respond adequately.

1. What is civil protection

The risk management cycle (see Chapter 6) also takes place through **emergency response** in case of a catastrophic event, i.e. the provision of emergency services and assistance to the population in the immediate term, during and immediately after a disaster, in order to safeguard lives, public and private safety, reduce the impact on health and on the territory, guarantee public security and meet the basic subsistence needs of those affected. Disaster response (or disaster relief), initially focused on relief, then on assistance to the population, deals mainly with immediate and short-term needs.

The response phase is followed by the post emegency recovery phase. The two phases are not physically divided. Some response actions, such as the provision of temporary housing and the supply of water, can also extend to the overcoming phase.

Through forecasting and prevention actions first, and then management and response, civil protection systems tend to what is called "zero risk", i.e. zero mortality, zero damage, and negative effects completely eliminated in relation to a specific type of risk. However, as we will technically see in Chapter 5, experience teaches that the impacts of important hazards can almost never be completely cancelled: this is an ideal objective, generally unattainable (see Focus 1). But the severity of the effects can be substantially diminished by various strategies and actions that make up the so-called damage mitigation. The **mitigation** therefore refers to the reduction or limitation of the

Photo 6. Amatrice, Rieti, 2016. Search and rescue activities after the 24 August earthquake.

negative impacts of the hazards and related disasters, compatibly with the available resources.

Consequent to the basic impossibility of reducing to zero a given risk, there is the need to define what is an **acceptable risk**, that is, the level of potential losses that a society or a community considers acceptable, taking into account existing social, economic, political, cultural, technical and environmental conditions (see Simplified Glossary). It is evident that the acceptable risk is suitable for very heterogeneous and subjective assessments and possible disputes, because it exposes those who have established the level of "acceptability" to important responsibilities. They have to justify in what capacity and according to what criteria, whether professional or ethical, or moral, a level of risk has been established that is deemed acceptable but entails by definition a possible harm to people or the environment.

Photo 7. L'Aquila, 2009. Setting up an area for the population assistance.

For some years, the international community has also introduced the term **resilience** in the context of risk management, which means the ability of a system, community or society exposed to a hazard, to resist, absorb and recover from the effects of a calamitous event in a timely and efficient manner, including through the conservation and restoration of functions and of its essential basic structures (see Simplified Glossary). It is the ability to "withdraw from" or "absorb in an elastic way" a shock. The resilience of a community with respect to potential events deriving from risk conditions is determined by the degree of resources, tangible and intangible, available within the community and by the ability to organize itself both before and during periods of need.

Not all emergencies arise from natural phenomena, such as earthquakes, volcanic eruptions, floods, hurricanes, landslides, etc. Emergencies, even serious ones, are often caused by man: technological disasters, air, naval, road or railway accidents, terrorist attacks, humanitarian crises due to conflicts and political or religious tensions, etc. It is necessary, then, to keep in mind that, although

emergencies present numerous difficulties and facets, there are simpler and more complex ones. Simplicity can be referred, for example, to a disastrous event caused by a single phenomenon such as an earthquake, a flood or a human accident. The complexity of an emergency, instead, can be connected to the occurrence of cascade or domino effects that aggravate the impact on the environment and on the population of events triggered by natural causes. The catastrophe of the Fukushima nuclear power plant, in Japan (see Chapter 8), is an emblematic example of a domino effect, considering that a magnitude 9 earthquake triggered a tsunami wave that damaged a nuclear power plant, built in an area at high risk and with insufficient precautions to protect the system in the case of a seismic event of that intensity. Hence the radioactive cloud leak and consequent environmental catastrophe. The impact on the territory and on the population was very strong, with victims and damage caused first by the earthquake, then by the tsunami, finally by the radiation from the damaged plant, the effects of which are still evident and will remain so for a long time to come. It can be said that in Fukushima the "worst case scenario" occurred. To the effects of the earthquake additional subsequent events were set off, linked to the tsunami wave and human activity, transforming a simple emergency into a complex one.

Speaking of complex emergencies, we must also consider the cases in which emergencies occur in areas of the planet where the population’s resilience is greatly reduced due to situations of conflict or political-military instability.The interaction between conflicts and natural disasters is not uncommon when a natural emergency, such as an earthquake, occurs in a Country or area affected by conflict or political unrest. This aspect affects the European Civil Protection Mechanism – in which Italy operates – when it is called to offer aid and assistance to Countries afflicted by disaster (see Chapter 7).

In the context of definitions it is important to mention two expressions: perfect storm and black swan, now used in universal language to describe highly improbable or totally unthinkable situations (Junger, 2000; Taleb, 2008). By **perfect storm** we mean an event, also known in human memory, which can be imagined, based on knowledge of previous events and their effects. However, it represents a highly unlikely situation triggered by the concurrence of a series of unlikely factors. A **black swan** event, on the other hand, is an occurrence of which we have no historical memory, we have no knowledge, we do not imagine or know its characteristics and it is not contemplated among the possibilities provided by the interpretative models of reality available: it is therefore very difficult to imagine such an event and its consequences.

The terms "highly improbable" and "unthinkable" refer to those situations which have a very low probability of occurring; however, if they occur, these events can have a devastating impact on the population and the environment. So what is "highly unlikely" in terms of natural disasters? An event that is not remembered in human memory or that is remembered only through traditions reported by ancient texts, narrations, novels. An event is unlikely because human memory is linked to a "legend" rather than to scientific data, because the last event described dates back to many hundreds and in some cases thousands of years, or because the traces are found only in archaeological or geological records if any at all.

In general, for these types of High Impact Low Probability (HILP) risks, it was not considered a priority to invest resources to prepare civil protection plans or prevention activities. Today, however, also due to the unfavorable influence of climate change on floods and fires in Europe, the new European legislation explicitly mentions the HILPs, with respect to which Member States are asked to explain the priority prevention and preparedness measures in their risk assessments (Decision (EU) 2019/420).

In recent years we have witnessed some major disasters that can be traced back to the perfect storm concept: the earthquake and tsunami of Southeast Asia in 2004, the aforementioned Fukushima disaster, the hurricane Katrina. Disasters different in type and cause, but which also have similarities, if we consider that these are events that, theoretically, could have been foreseen and for which much could have been done to reduce their impact on the population and the environment. And it is precisely around this last consideration that the debate of those involved in safety and civil protection revolves. The attacks on the Twin Towers of 11 September 2001 instead opened a cage of black swans of terrorist origin.

These are different situations that have taken the whole planet by surprise, shocked by the scale of such disasters, the number of victims, the complexity of the events, which have shown how much, for these hazards, civil protection systems and institutional systems of States or international organizations are still unprepared. In particular, a point to be strengthened is the ability to adequately share the information available from different components of the same system. On elements of this type, one should learn to work better, to reduce their devastating impact or completely prevent the catastrophic consequences that, however, in some cases have occurred.

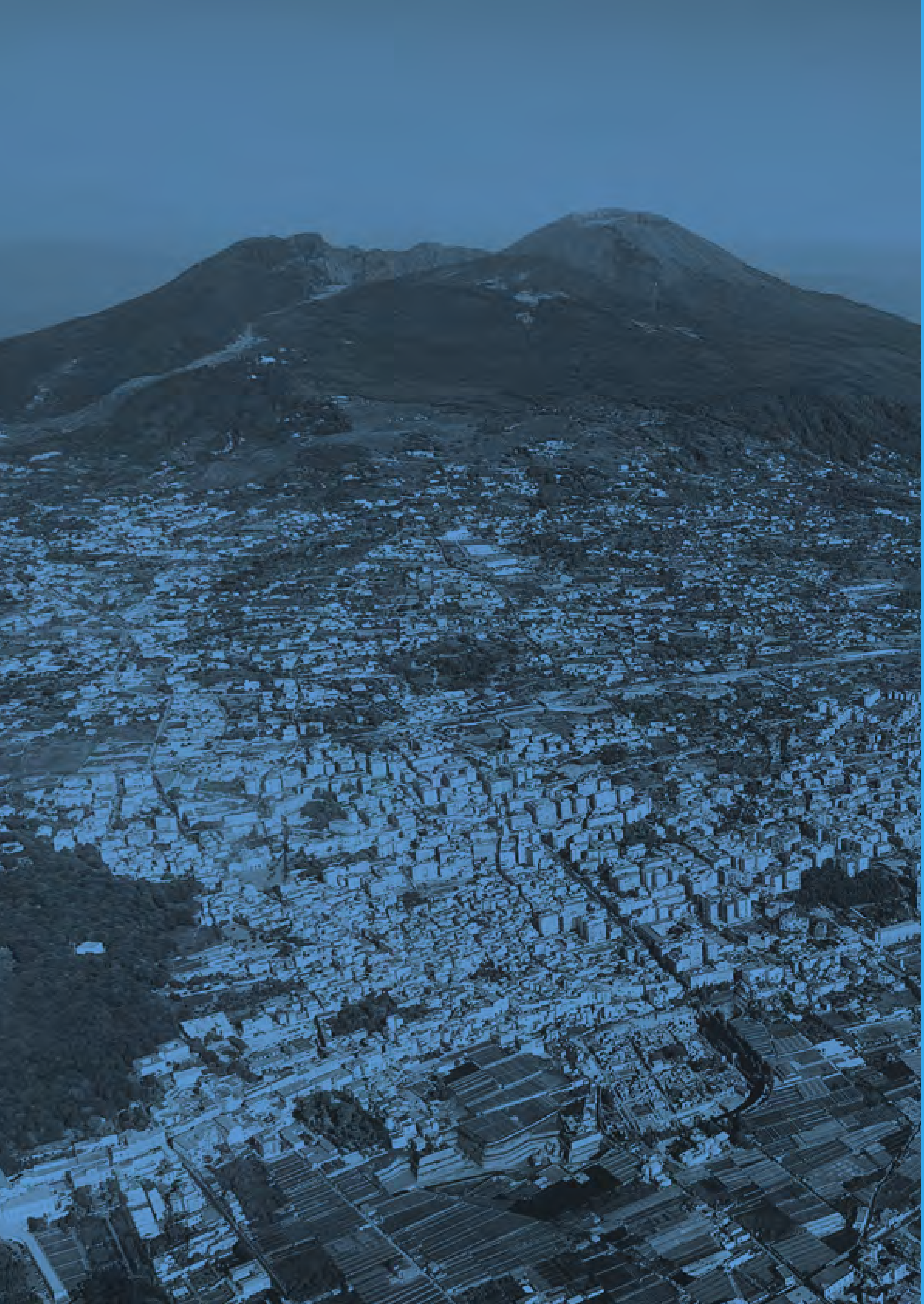
In this sense, civil protection organizations and activities of prevention and planning must have structured procedures but at the same time flexible enough

to allow to provide an answer as adequate as possible even to unforeseen, unpredictable or unexpected events.

This text is divided in nine chapters. After the introduction (Chapter 1), which ends here, the next chapter deals with the fragility of the Italian territory with respect to the various risks of civil protection (Chapter 2). It is followed by a story of the evolution of civil protection regulations through the events that have affected Italy up to the legislation currently in force (Chapter 3). We then proceed to an accurate description of the civil protection system's organization (Chapter 4), of the many risks affecting our territory (Chapter 5) and of the activities of the management cycle of such risks (Chapter 6). The text then explores the relationship with international civil protection organizations (Chapter 7) and describes a few interventions carried out by the civil protection system in Italy and worldwide (Chapter 8). Finally, the role of citizens is addressed, both as individuals and organized in voluntary civil protection associations (Chapter 9).

Finally, since civil protection is a matter of constant updating and evolution, individual Dossiers are expected to be progressively updated and added, which, although in the form of separate files, are to be considered an integral part of this text, and will be published whenever relevant topics, such as news in matters of risk and multi-risk, management of significant emergencies and so on, have reached maturity for their treatment also in the educational field.

Photo 8. Fukushima (Japan), 2015. Debris collection operations four years after the earthquake and subsequent tsunami.



2

ITALY'S FRAGILITY

Among the countries most prone to natural disasters, Italy is unfortunately at the top of the list for the numerous and frequent phenomena that have struck and continue to affect its territory. Volcanic eruptions, earthquakes, landslides, floods, storm surges: Italy has historically been hit by a series of disasters that have caused significant social and economic damage, many victims and huge costs for the Country. As previously mentioned, calamity, catastrophe, disaster are all terms that describe, sometimes with different nuances, deeply impacting situations with significant consequences on man, his goods and his activities. However, it must be remembered that natural phenomena become calamities when they affect urbanized territories or in any case when the exposure degree, defined in the previous chapter, is not zero. Furthermore, the very presence of man can be considered one of the determining factors for many disasters that have affected, over the years, different parts of the world, leading the effects of natural events to extreme levels: for example, through the territory's transformation processes in terms of land-use and non-use, many times due to underestimation and errors made in the past and, above all, in the recent past.

Today as never before, the present risks and characteristics of territories are known and it is essential to become more aware of such risks. The activity of the civil protection system, in this sense, is fundamental to foster the growth of knowledge: information on existing risks must help define intervention priorities and reorient the choices made by the local governing administrations to allow for a more balanced and regimented use.

Our Country is geologically young and in constant evolution.The landscape of Italy being so varied, from the rugged mountains of the Apennines to the steep Alps, from the gentle morphology of the hills, which characterize most of the Italian territory, to the jagged coasts and sandy beaches, is the result of phenomena constantly altering the Earth's crust.

Landslides, floods, earthquakes, eruptions are natural events linked to the recent geological evolution our Country's territory, but too often these events turn into disasters due to human activities. On the one hand, these activities upset the balance of nature through the degradation of pastures and forests, the abandonment of mountain areas and hills, the excavation activities in the beds of waterways to extract inert material for construction purposes, the occupation of flood expansion areas around rivers, the waterproofing of large areas of land. On the other hand, the same activities concentrate a large number of people in hazardous areas, for example in the proximity of active volcanos, in flood-prone plains, and in vulnerable man-made environments, such as in the outskirts of large cities, whereby increasing the exposure of human lives and property to possible catastrophic events.

In Italy the population went from 13 million inhabitants in the 1700s, mostly concentrated in rural areas, to about 33 million at the end of the 19th century, when in fact the urbanization process began, up to the current 60 million.

Photo 9. Vesuvius, Naples, 2006.The image of the volcano from above shows a strongly urbanized and densely populated area.

From Italy's Unification to present day, the population has more than doubled and this has led more and more often to subtract land areas from the woods to turn them into agricultural land or to meet the growing demand for timber by cities and industries.The population has concentrated in urban areas, with the consequence of an increase of occupation of potentially risky areas. Urbanization and the increased demand for water for different uses has changed the river system, altering, among other things, the balance between surface water and groundwater.

In this context, the impact of natural disasters over the years has increased significantly, not only in Italy but in all industrialized countries. The fragility and vulnerability of the territory interacted with the man-made environment, causing an imbalance in the areas exposed to hazards that too often has lead to tragic consequences.

► 2.1 Earthquakes

Compared to other natural events, earthquakes are a particular phenomenon. A seismic event is a very rapid oscillatory movement of the ground that occurs without notice and has a variable duration, in Italy from a few to a few tens of seconds, rarely minutes. This brief intense motion impacts heavily on constructions, sometimes damaging them to the point of collapse, with consequences that – in terms of victims, economic damage and affected population – can be dramatic affecting even very large areas.

Focus 2

BASIC INFORMATION ON EARTHQUAKES

Seismic shaking is a rapid movement of the ground caused by an earthquake, characterized by strong accelerations that determine horizontal and vertical pushing (inertia forces) on buildings and on anything on the ground subject to such shaking, so as to cause damage or even collapse. In common language we often speak of sussultatory and undulatory earthquakes, as categories of shaking characterized by vertical or horizontal movements, respectively. In reality this distinction is not correct since all earthquakes, or rather all seismic shakes, are characterized simultaneously by vertical and horizontal components.

Dozens of earthquakes occur on Italian territory on a daily basis. Most of them are not perceived by people, but are only recorded by the most sensitive measuring instruments. Earthquakes, especially the strongest ones, also cause effects on the natural environment such as landslides, liquefactions and surface ruptures, etc. (co-seismic effects).

Earthquakes are generated by complex mechanisms that involve the lithosphere, i.e. the solid layer that characterizes the surface of the planet for a few tens of kilometers of thickness. The lithosphere is made up of **tectonic plates** that move, wedge and press against each other. The plate motion determines, at depth, conditions of stress and accumulation of energy. When the stress exceeds the resistance limit, the rocks break and slide along the fault surfaces, starting from a point at depth called the **hypocenter**, corresponding to the **epicenter** placed at surface on its vertical. Part of the accumulated energy that is released as a result of the break travels through the Earth in the form of **seismic waves**. As they reach the surface, they give rise to the shaking of the ground, that is, to what is perceived as an earthquake.

Two totally different kinds of measure are used to measure an earthquake: magnitude and intensity.

The **magnitude** measures the earthquake in its entirety, expressing indirectly, but with a good approximation, the energy released. There are several measures of magnitude. The best known are the **local magnitude** (Ml), or Richter magnitude, by Charles Francis Richter who developed it in 1935, and the **moment magnitude** (Mw), developed in the 70s by Hiroo Kanamori, whose measure provides a better correlation with the total energy released. It should be noted that they correspond each other quite well for values at least up to magnitude 6, and both are on a logarithmic scale: a passage from one degree to the next implies a 31.6 greater quantity of energy released. For example, the 1980 Irpinia-Basilicata earthquake of Mw 6.8 released more than 30 times the energy released by the 2012 Emilia earthquake of Mw 5.8. The highest magnitude that occurred in Italy, during the 1693 Eastern Sicily earthquake, is estimated at 7.3. The highest reported magnitude worldwide is 9.5, recorded in the 1960 Chile earthquake.

The **intensity** provides a measure of the shaking produced by the earthquake at a specific point on the Earth's surface. It is therefore a local measure and changes according to the site in which it is assessed or measured, depending on the distance from the epicenter and the possible effects of local amplification. Therefore, different intensity values will be associated with the same earthquake. The oldest intensity measure is the macroseismic intensity.

Macroseismic intensity is based on the effects that an earthquake produces on people (perception), on buildings (damage of different level, until collapse, in the various types of buildings) and on the environment (landslides, cracks in the ground, etc.) and it refers to a scale on 12 degrees of intensity. The most widely used macroseismic scales derive from the **Mercalli Scale**, which the homonymous Italian scholar developed in the early 1900s, then perfected by Cancani and Sieberg. Today the most used macroseismic scales in Europe are the MCS (Mercalli Cancani Sieberg) and the EMS (European Macroseismic Scale). The 12 degrees of the different scales are mostly comparable, with some differences especially in the higher degrees.

Photo 10. L'Aquila, 2009. Detail of building damaged by the 6 April earthquake.

Focus 2

With the spread of ground motion measuring instruments, particularly **accelerometers**, i.e. instruments that measure ground acceleration continuously, according to the three components – North-South, East-West and vertical – the intensity measurements of the shaking that are mostly used today for engineering purposes are those referred to the instrumental measurement of the ground motion parameters (on this issue, see the National Accelerometric Network). In particular, the best known are the maximum **acceleration** (PGA-Peak Ground Acceleration), the maximum **velocity** (PGV-Peak Ground Velocity) and the maximum **displacement** (PGD-Peak Ground Displacement), measured during seismic motion at the specific spot on the ground surface where the instrument is positioned. Other more sophisticated intensity measures, aimed at obtaining a better correlation with the effects on buildings, derive from mathematical processing of the recordings.

It should be noted that, as per the above stated, the measures of magnitude and intensity are not comparable with each other and that, on the contrary, different intensities correspond to a same magnitude, depending on the place where the intensity is assessed or measured.

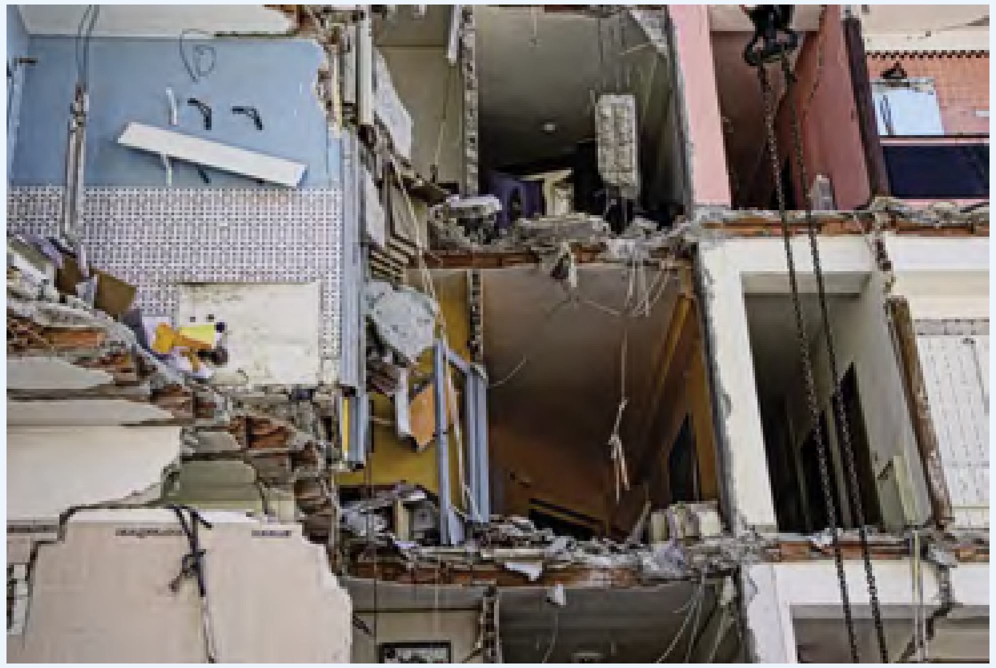


Photo 11. L'Aquila, 2009. Facade of a building destroyed by the 6 April earthquake.

Italy is a highly seismic Country. Over the past thousand years, it has been affected by about 3,000 earthquakes that have caused damage corresponding to a degree of the MCS-Mercalli Cancani Sieberg scale higher than V (quite strong) or VI (strong), of which about 300 equal to or greater than VIII (ruinous) or IX (destructive).

YEAR	MONTH	DAY	EPICENTRAL AREA	Mw	VICTIMS DUE TO THE SEQUENCE
1905	09	08	Central Calabria	6.95	557
1908	12	28	Messina Straits	7.10	80.000
1915	01	13	Marsica	7.08	32.610
1919	06	29	Mugello	6.38	100
1920	09	07	Garfagnana	6.53	171
1930	07	23	Irpinia	6.67	1404
1968	01	15	Belìce Valley	6.41	231
1976	05	06	Friuli	6.45	978
1980	11	23	Irpinia-Basilicata	6.81	2735
2009	04	06	L'Aquila	6.29	309
2016	10	30	Valnerina	6.61	299

Table 1. Earthquakes that have affected Italy from 1900 to today with magnitude Mw equal to or greater than 6.29. The data on earthquakes are taken from the CPTI15 catalog (Rovida et al., 2019), the number of victims from the CFTI5Med Catalog (Guidoboni et al., 2018; 2019) and from Dolce and Di Bucci (2017; 2018).

In the twentieth century Italy was hit by at least nine earthquakes (without considering the aftershocks) with a magnitude equal to or greater than 6.3, with effects between the X (completely destructive) and the XI (catastrophic) degree of intensity MCS and a number of victims more than 100 thousand overall (see Table 1).

In the ten years between 2009 and 2018 alone, as many as five earthquakes reached or exceeded moment magnitude 6.0 and 13 moment magnitude 5.5 (Rovida et al., 2019). We will discuss a few of these in the next chapters.

Earthquakes that produce even only minor damage historically concern the entire national territory, apart from Sardinia. If, on the other hand, events of magnitude greater than 5.7 are considered, there is no historical memory of them in Piedmont, Valle d'Aosta, Lombardy and South Tyrol, part of the Tyrrhenian coast from Versilia to Volturno, along the Adriatic coast south of Ancona (excluding Gargano promontory) and Salento.

The highest seismic activity is concentrated in the Central and Southern part of the peninsula, along the Apennine ridge (Val di Magra, Mugello, Tiber Valley, Val Nerina, Aquilano, Fucino, Liri Valley, Benevento, Irpinia, Val d'Agri), in Calabria and Sicily, and in some Northern areas, including Friuli-Venezia Giulia, Veneto and part of Western Liguria, as shown in Figure 1.

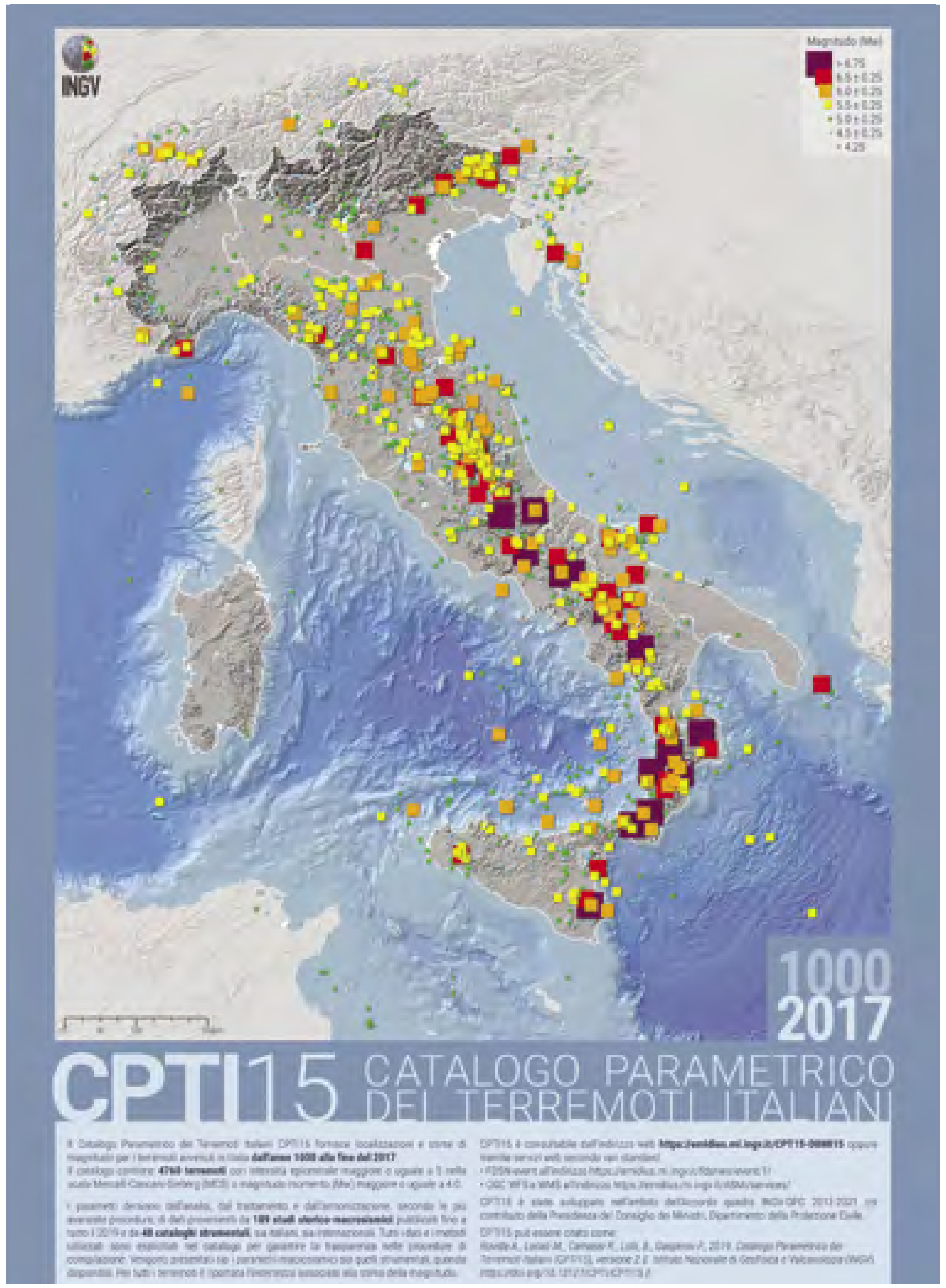


Figure 1. Earthquakes occurred in Italy from the year 1000 to 2017 and listed in the CPTI15 Catalogue. Source: INGV-National Institute of Geophysics and Volcanology.

The territory of Central and Southern Italy, in particular, has been hit by some of the strongest and most destructive events recorded by historical memory. In the Central Apennines, for example, the earthquakes of 1349 and 1703 caused extensive damage to the affected areas. The most recent are the earthquake that hit L'Aquila on 6 April 2009, reaching magnitude Mw 6.3 and intensity of the IX-X degree of the MCS scale, and the 2016-17 seismic sequence of Central Italy, with two earthquakes of magnitude Mw equal to 6.2 and 6.6 and effects corresponding to the XI degree of the MCS scale (Rovida et al., 2019).

In the Southern Apennines, Irpinia, over the centuries, has seen some of the most catastrophic earthquakes in Italian seismic history, until the last one of 23 November 1980 which left deep scars, still easily recognizable in the area.

In Calabria and Sicily the consequences of earthquakes such as those of 1693, 1783 and 1908 – the latter being one of the strongest ever recorded in Italy, with magnitude 7.1 (see also Chapter 3) – are of historical importance, having profoundly influenced the society, economy and culture of the areas involved.

Seismicity, as mentioned above, is a characteristic of the territory that cannot be changed, being due to the geological and geodynamic evolution of our Country. However, it is possible to prevent the effects of an earthquake by acting on the other components that determine seismic risk, i.e. vulnerability, exposure and capacity (see Focus 1 and Chapter 5).

► 2.2 Tsunamis

The Mediterranean Sea is exposed to the danger of tsunamis, a Japanese term that literally means "port wave", due to the high seismicity of submerged territories, the steep slopes of some seabeds and the presence of numerous active volcanoes, both emerged and submerged. Since the Italian coasts are often densely populated and rich in infrastructure, the consequent risk is very high.

Photo 12. Jacques Chereau, “Le célebre, pour les vaisseaux autre fois si dangereux détroit de faro di Messina”, 1784. Fantasy representation of the tsunami in the Messina Straits occurred on 5 February 1783.

Focus 3

BASIC INFORMATION ON TSUNAMIS

Tsunami is a series of sea waves produced by the rapid movement of a large mass of water. At open sea, waves propagate very quickly covering large distances with almost imperceptible heights, even less than one meter, but with wavelengths (distance between one wave and the next) that can reach a few tens of kilometers. Upon approaching the coast, the speed of waves decreases while their height increases rapidly, even up to tens of meters. The first wave may not be the largest and several minutes may pass between the arrival of the next wave and the one after.

The main causes of tsunamis are strong earthquakes with an epicenter in the sea or near the coast. Tsunamis can also be generated by underwater or coastal landslides, by volcanic activity underwater or near the coast and, much more rarely, by meteorites that fall into the sea. In all cases, tsunamis are generated by the movement of a large mass of water produced: in the event of an earthquake, by the rapid dislocation of the seabed in correspondence with a seismogenic fault; in the event of a landslide, by the rapid movement of unstable ground; in the event of meteorite, from its sudden entry into the water.

Along the coasts, tsunamis manifest themselves as a rapid rise of the sea level or as a real wall of water that falls on the coasts, causing a flood. Sometimes there is an initial and sudden withdrawal of the sea water leaving ports and beaches dry.

Tsunami waves have much more force than storm surges and are able to penetrate inland even for several hundred meters (even kilometers, if the coast is very low), dragging everything they find along the way: vehicles, boats, trees, reservoirs and other materials, greatly increasing their destructive potential.

Many things are known about tsunamis, but nobody is able to predict when and where they will occur, because it is not possible to forecast the events that cause them (earthquakes, landslides, volcanic eruptions, meteorites). However, if the triggering event, in particular an earthquake at sea, can be identified at an early stage, it is possible to make a rapid assessment on the possible trigger of the tsunami. Through simulation models, a rapid forecast can be made, albeit with wide margins of uncertainty, of what the affected coastline and the height of the wave potentially arriving on the coast may be.

On the basis of these assessments, an early warning can be launched, counting on the fact that, since the time of the trigger of the tsunami to the moment the wave reaches the coast, from several minutes to hours may pass, in relation to the distance between the point of trigger of the tsunami and the stretch of coast of interest. Obviously the alert will be all the more effective the longer the time between the trigger and the arrival of the tsunami, and the shorter the time of acquisition and processing of the signal and issuance of the alert.

The use of monitoring networks, the study of past events and the wave propagation models allow us to reduce the tsunami risk. This knowledge contributes to improving the planning of the territory, to carrying out interventions for the safety of the areas at risk as well as to drawing up civil protection plans. Being aware and prepared is the best way to prevent and reduce the consequences of tsunamis (see the information material of the"Io Non Rischio"-I Don't Take Risks national civil protection Campaign).

Photo 13. 2017. Emergency signage for tsunami risk.

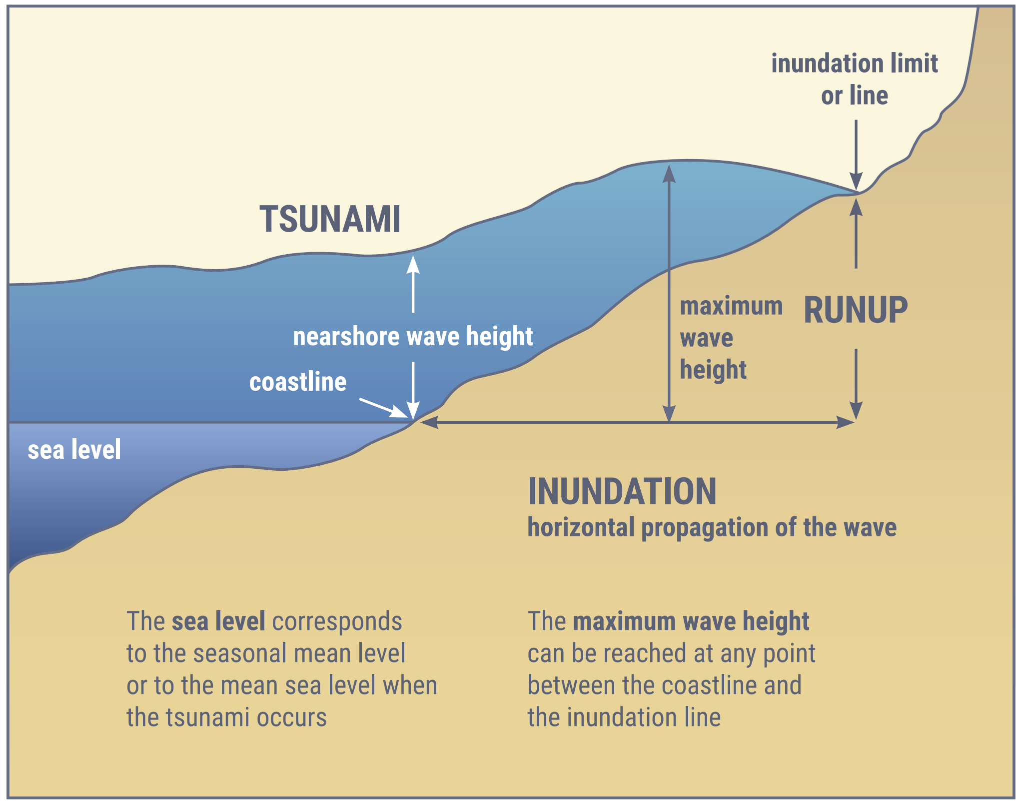


Figure 2. Nomenclature for tsunamis. Height above sea level (a.s.l.) means the amplitude of the wave caused by the tsunami in proximity of the coast, and referred to the sea level in the absence of tsunami. The impact of a tsunami wave on the coast produces the rise of the level of sea and the invasion of the coastal belt. The extent of the rising water level, understood as the maximum topographic elevation touched by water, is called "runup". The width of the submerged coastal strip is called "inundation".

In the last thousand years, dozens of tsunamis have been documented along the Italian coast, luckily only few of them were destructive.

For the most recent Italian tsunamis (1627, 1693, 1783, 1887, 1908), historical sources report the amount of destruction they caused (Maramai et al., 2014). The most affected coastal areas were those of Southern Italy (Eastern Sicily, Calabria, Puglia and the Aeolian archipelago).

However, minor tsunamis also occurred along the Ligurian, Tyrrhenian and Adriatic coasts. It must also be considered that the Italian coasts can be reached by tsunamis generated in areas of the Mediterranean far from our Country, for example following a strong earthquake in the waters of the eastern Mediterranean or along the Algerian coast.

The most recent event hit the Aeolian Islands and was caused by a landslide that developed along the side of the Stromboli volcano during the strong eruption of 2002, with a maximum wave height of 10 meters. Fortunately, the event took place in the winter, during a rainy day, and did not cause victims due to the absence of people on the beaches.

► 2.3 Volcanic activity

In Italy volcanism owes its origin to a wide range of geological processes that involve the entire Mediterranean area and are connected to the Euro-Asian and African tectonic plates that converge with each other. The most evident results of this convergence are earthquakes and volcanic activity in the southern Tyrrhenian Sea and Sicily (Figure 3).

Italy, after Iceland, is the Country with the largest number of active volcanoes in Europe and is one of the first Countries in the world by number of inhabitants exposed to volcanic risk.

Volcanoes can be classified as extinct or active. The latter can be divided, in turn, into quiescent or with persistent activity. Even volcanoes that have not shown activity for many centuries can in fact be active.

Figure 3. Map of the volcanoes in Italy: in orange the volcanoes considered active, in light blue the underwater volcanoes (regardless of their state of activity).

Volcanoes that have been historically recorded to erupt over 10,000 years ago are by definition extinct. Among these are the Salina, Amiata, Vulsini, Cimini, Vico, Sabatini, Pontine Islands, Roccamonfina and Vulture volcanoes.

Quiescent volcanoes are active volcanoes that have erupted over the past 10,000 years and are currently in a resting phase. According to a more rigorous definition, volcanoes whose current rest time is less than the longest rest period previously recorded are considered quiescent. The ones in this state are: Colli Albani, Phlegraean Fields, Ischia, Vesuvio, Lipari, Vulcano, Panarea and Pantelleria. Not all quiescent volcanoes present the same level of risk, both because of the hazard of the expected phenomena and because of the higher concentration of population and goods at risk. In addition, some have phenomena of secondary volcanism – such as soil degassing, fumaroles – which in the ordinary can still induce risk situations.

Photo 14. Stromboli, Messina, 2012. Eruption.

Volcanoes with persistent activity are the ones in a constant eruption state or with eruptions separated by short rest periods, that is months or a few years. These are Etna and Stromboli, which erupt frequently and which are in open conduit conditions.

Volcanic activity in Italy is also present in the submerged areas of the Tyrrhenian Sea and the Sicilian Channel. Some submarine volcanoes are still active while others, now extinct, are real underwater mountains.

Active or potentially active volcanoes are located in Southern Italy and present different levels of hazard. Etna and Stromboli erupt frequently and, since they are in open conduit conditions, they present a limited risk with very short-term precursor signals. The other volcanoes, in particular Vesuvius, Phlegraean Fields and Vulcano, have a very low eruptive frequency and currently obstructed ducts. In this case, the assessment of their hazard level is more complex, because the intensity of future eruptions must be forecast based on the eruptive history of each volcano – which has generally evolved for many thousands of years and of which there are no recent experiences – and with monitoring systems that allow to calibrate the hazard thresholds of the measured parameters.

BASIC INFORMATION ON VOLCANOES

Volcanic phenomena. It is important to understand that when we talk about volcanic risk, we are actually referring to a wide variety of very different hazardous phenomena. To name a few: lava flows, pyroclastic flows, mud flows (lahar), emission and fall of pyroclastic materials of different sizes and weight (bombs, slags, pumices, lapilli, ashes), soil degassing.

Each of these phenomena has very different characteristics and requires very specific civil protection planning and mitigation measures. In addition to the aforementioned phenomena, there are a number of other phenomena that may accompany or be induced by volcanic activity, including earthquakes, fires, landslides and tsunamis. Volcanic risk management is therefore actually the management of several possible risks.

Classification of eruptions. For volcanoes there is no scale of magnitude or intensity like those used for earthquakes, but there are several characteristics that can help in classifying eruptions.

A first classification distinguishes volcanic eruptions into effusive or explosive. The former are characterized by low explosiveness and by emissions of fluid and degassed magma that flows along the sides of the volcano. In the latter, magma fragments into shreds of various sizes, which are expelled violently from the volcano, along with a large amount of gas.

Explosive eruptions can be classified by combining quantitative data, such as volume of products emitted, fragmentation of magma and height of the eruptive column, through the Volcanic Explosivity Index (VEI), an empirical index that classifies the energy of explosive eruptions with values ranging from 0 to 8.

Another possible classification of eruptions, of qualitative kind, distinguishes them using the terms Hawaiian, Surtseyan, Strombolian, Vulcanian, Plinian, Ultraplinian, etc., which represent eruptive typologies typical of different volcanoes in the world with gradually increasing explosiveness, determined by the different chemical composition of magma, the gas content and the interaction with water.

Eccentric eruptions. Even in volcanoes with a typical cone shape, eruptions do not always occur from the summit crater. In fact, in its ascent to the surface, magma can intrude into the rocks by opening different routes that deviate from the central duct and then reach the surface on the sides of the volcanic edifice, giving rise to new fractures and eruptive vents and to lateral or eccentric eruptions, and forming the so-called adventive cones. A typical example is represented by Etna. The possibility of lateral eruptions must be kept in mind in the presence of inhabited areas on the slopes of the volcano.

Calderas. A caldera is a large sub-circular depression that can reach a diameter of many kilometers. It is produced by the collapse of a more or less large part of a pre-existing volcanic edifice due to the emptying of the magma chamber following a large eruption.

Photo 15. Solfatara di Pozzuoli, Naples, 2012. The Solfatara di Pozzuoli is one of the many eruptive centres that form the Phlegraean Fields.

Italy has sophisticated monitoring and surveillance systems, operating on the main volcanoes, based on the detection of chemical and physical parameters that allow to determine the variations of their state of activity and therefore to estimate the probability of their eruption. The surveillance of active volcanoes provides the scientific evidence necessary to adopt safety measures capable of significantly reducing the harmful consequences of eruptive activity on people. This monitoring activity is particularly important for two quiescent volcanoes, Vesuvius and Phlegraean Fields, which in the past have experienced very violent eruptions, that have marked the history of our Country. For example, the eruption of Vesuvius in 79 AD, which occurred after about three centuries of inactivity, represents one of the most powerful and destructive events in history and was defined as "Plinian" in memory of the description that Pliny the Younger handed down to us. The eruption was catastrophic for Pompeii, Herculaneum and Stabia.

After the eruption of 79 AD countless Strombolian and effusive eruptions occurred that led to the gradual construction of the Vesuvian Great Cone and the placement of lava flows on the Southern and Western sides of the volcanic edifice. Since then, the eruptive activity has experienced two important rest periods, followed in both cases by explosive events of great energy, such as the eruption of 472 and that of 1631, of sub-Plinian nature. During the latter, the whole range of countries between the inhabited area of Pollena in the North and that of Torre Annunziata in the South-West was devastated having been reached by pyroclastic flows that killed over 4 thousand people.

In the period between 1631 and 1906, the date on which one of the two major events of the last century occurred, Vesuvius showed an almost continuous Strombolian activity, associated with effusive activity. The 1906 event was characterized by explosive and effusive activity of varying intensity and caused numerous deaths and injuries due to the collapse of roofs following the accumulation of ashes.

The most recent eruption of 1944 closes a period of more or less continuous activity with an open duct. The event, characterized by effusive and explosive activity, caused the death of 21 people due to the collapse of the roofs, the almost total destruction of the villages of San Sebastiano, Massa di Somma and Terzigno and the evacuation of 14 thousand people. Scholars believe that this eruption marked the end of an open duct period and the beginning of an obstructed duct, quiescence period. In fact, from 1944 to today, Vesuvius has produced only fumarolic activity and moderate energy seismic swarms, without ground deformation or significant variations of the physical and chemical parameters of the system.

As per the Phlegraean Fields, the last eruption occurred in 1538, although among the minor eruptions of the entire eruptive history of this volcanic complex, and it interrupted a quiescence period of about 3 thousand years and, within a few days, it gave rise to the approximately 130 meters high cone of Monte Nuovo. Since then, the activity in the Phlegraean Fields has been characterized by phenomena of bradyseism, as well as fumarolic and hydrothermal activity located in the Solfatara area.The eruptive history of the Phlegraean Fields prior to 1538 is dominated by the eruptions of the Ignimbrite Campana (40 thousand years ago) and of the Neapolitan Yellow Tuff (12 thousand years ago). These events were so impactful that the volumes of magma produced and the speed with which they were emitted caused collapses and originated a caldera. For this reason the shape of the area is that of a semicircle bordered by numerous volcanic cones and craters.

As far as Etna is concerned, the activity of greatest concern is that represented by the lateral eruptions, which occur on the sides of the volcano (see Focus 4) and which, during the twentieth century, occurred on average every 3-4 years. They affect in particular the Southern and Eastern side, where the crops (citrus, vines, olive trees, almond trees) reach up to about 1500 meters above sea level and the villages reach 900 meters above sea level. Furthermore, over the centuries more recent, explosive eruptions of moderate energy and lava effusions have occurred with a certain frequency, fed both from the summit craters of the volcano and from lateral vents. These eruptions have repeatedly hit the urban areas that are located on the slopes of Etna, in particular with the accumulation of large quantities of ash.

► 2.4 Landslides, floods and extreme weather events

For civil protection purposes, hydrogeological risk includes phenomena ranging from landslides to coastal erosion, subsidence and avalanche risks, while hydraulic risk refers more specifically to the flood risk. These risks are characterised by the fact that the main driver is given by adverse weather conditions, i.e. the occurrence of meterological events of particular intensity that are capable of constituting a hazard, which is associated with the risk of damage, even serious, to property or persons. Other drivers may be earthquakes of significant intensity which can trigger landslides and liquefaction phenomena, or the breakage and damage of hydraulic works – dams, embankments, etc. – which can cause floods (see Focus 5).

Photo 16. Vibo Valentia, 2006. A car flooded by mud due to a flood.

BASIC INFORMATION ON LANDSLIDES AND FLOODS

A **landslide** is a movement of a mass of rock, soil or debris along a slope. The causes that predispose and determine these destabilization processes are manifold, complex and often combined with each other. In addition to the amount of water, or melted snow, deforestation and fires also cause landslides: in the wooded slopes, in fact, the roots of the trees consolidate the soil and absorb excess water. The Alpine and Apennine territories of the Country, but also the coastal areas, are generally exposed to the risk of landslides due to the nature of the rocks and the dip of the slope, which can cause some instability. Furthermore, climatic characteristics and the annual distribution of rainfall contribute to increasing the vulnerability of the territory. Landslides can also be triggered by earthquakes, volcanic activities and human activity.The intense transformation of territories by human activities, often without criteria and respect for the environment (construction of buildings or roads at the foot of a slope or halfway up the slope, ski runs, etc.), can cause ground failure.

Landslides present different hazard conditions depending on the mass and speed of the landslide body. There are low hazard landslides, since they are characterized by a reduced mass and a constant and low speed over long periods. Others, however, present a higher hazard since they suddenly increase in speed and are characterized by a conspicuous mass.

Floods consist of the temporary flooding of an area where normally there is no water. The flooding of these areas can be caused by rivers, streams, canals, lakes and, for coastal areas, by the sea.

Floods originates mainly from rainfall, which can affect the flow of rivers, streams, canals and sewage networks, whose waters are not contained by the banks and pour into the surrounding area causing damage to the territory. However, it is possible that floods can occur even with little or no rainfall, for example due to the breakdown of a hydraulic work such as an embankment.

The most significant relatively recent floods that hit Italy were those of the Arno river (1966) and Po (1951, 1994 and 2000). However, there are fre-

Focus 5

quent floods that occur in small river basins, due to intense and localized rainfall that is difficult to forecast. These basins are characterized by overflows that develop in just a few hours and which can cause high hazard floods, often capable of causing victims and damage to the environment and seriously compromise the economic growth of the affected areas. In general, heavy rainfall has more serious effects in urban centers, not only because of the concentration of people, structures and infrastructures, but because in these environments the action of man has often changed the territory without respecting its balance.

Floods are natural phenomena, however among the causes of the increase in their frequency are the high anthropization and widespread waterproofing of the territory which, preventing the infiltration of rain into the soil, increases the quantities and the speed of water flow to the rivers. The lack of maintenance and clearing of debris of the rivers, and the presence of vegetation obstructing the ordinary flow of water, are other important causal factors.

Photo 17. Rome, 2012. Flood of Lazio countryside.

Very heavy (intense) or abundant (prolonged) rains, combined with the particular conditions that characterize a territory, can contribute to causing a landslide or a flood; that is technically what we refer to as hydrogeological or hydraulic risk. On the other hand, heavy snowfalls in the mountains, followed by particular temperature conditions and/or winds at high altitudes, in certain situations of land morphology and exposure of the slopes, can give rise to movement of large masses of snow – the avalanches – that descend more or less rapidly downstream, with the risk of hitting people or affecting roads and houses. Avalanches result from sudden loss of stability of the snow present on a slope and subsequent sliding downward towards the valley of the portion of snow affected by the fracture. The detachment can be spontaneous or caused by human intervention.

Furthermore, other risks connected with atmospheric events derive from the occurrence of meteorological phenomena capable of directly causing damage to things or people. In particular, the phenomena to pay more attention to are storms, tornadoes, winds, fog and snow/frosts.

Among the natural factors that predispose the territory to hydrogeological instabilities are the geological and geomorphological conformation, characterized by a complex orography, and mainly small hydrographic basins, which have extremely rapid response timelapses to precipitations. The time that elapses between the onset of the rain and the onset of the flood in the water course can therefore be very short. Localized and intense meteorological events, combined with these characteristics of the territory, can give rise to violent phenomena, characterized by even very rapid kinematics, such as mud or debris flows and flashfloods.

Hydrogeological risk is also strongly influenced by human action.The population density, the progressive urbanization and consequent waterproofing of large areas, the abandonment of mountain areas, the unauthorized construction in landslide and flood hazard areas, deforestation, the use of agricultural techniques that are not environmentally friendly and the lack of or poor maintenance of the slopes and waterways have aggravated the conditions of instability and further highlighted the fragility of the Italian territory, increasing its exposure to phenomena and, consequently, the risk.

With just 21% of the territory consisting of plains, against 40% consisting of hills and 39% of mountains, often in the presence of clayey soils, Italy holds one of the worst records for landslide risk compared to other European countries

2. Italy's fragility

and of the world. The landslide and flood hazard areas have been delimited throughout Italy by the District Basin Authorities, public bodies that deal with spatial planning through the preparation of the PAI-Hydrogeological Plans and PGRA-Flood Risk Management Plans.

Based on these perimeters, the ISPRA-Institute for Environmental Protection and Research has created a "national mosaic" of hazard areas. As per landslides, these areas are classified into five hazard classes: very high (H4), high (H3), medium (H2), moderate (H1) and attention zones (AA). Overall, the landslide hazard zones, including the warning zones, cover 59,981 km^2, equal to 19.9% of the entire national territory. The areas affected by the highest hazard classes (H4 and H3) cover 25,410 km^2, equal to 8.4% of the national territory.

With regard to floods, the mosaic was made considering three hazard scenarios:

- a scenario with a high probability of occurrence, in which floods are frequent, with a return period of 20-50 years;
- a scenario with medium probability of floods occurrence, with a return period of between 100 and 200 years;
- a scenario with a low probability of occurrence, which considers "extreme" flood events (on the probability of occurrence see Focus 11).

The areas with high flood probability in Italy cover 12,405 km^2 (4.1% of the national territory), areas with medium flood probability 25,398 km^2 (8.4% of the national territory), and low hazard areas 32,961 km^2 (10.9% of the national territory), for a total of 70,764 km^2, 23.4% of the entire Country. It must be said that the most likely events are also the least severe, that is those expected to do less damage.

The numbers just listed show that much of the Italian territory is exposed to hydrogeological and hydraulic risks. The data tell us that 7,275, out of about 8,000, are the Italian municipalities affected by the risk of landslides and/or floods. 16.6% of the national territory is classified as very hazardous, and 1.28 million inhabitants are exposed to landslide risk and more than 6 million to flood risk. The regions where a greater number of inhabitants are exposed to landslides and floods are Emilia-Romagna, Tuscany, Campania, Lombardy, Veneto and Liguria (Figure 4).

As per avalanches, the knowledge tools available for archiving past phenomena and planning are the avalanche land registers and monographic maps. Created by the Forestry Carabinieri, by the Alpine Troops Command and by the Regions and Autonomous Provinces, the land registers and cartographies represent a fundamental tool for documenting avalanches. In addition to these, there is also the CLPV-Probable Avalanche Location Map. It is a thematic map that reports the "avalanche zones", identified with on-the-spot inspections and investigations based on evidence and archive data, or through analyses of the territorial and environmental parameters that distinguish an avalanche area, mainly derived from the analysis of stereoscopic aerial photographs. From 2015 to 2018, in just four years, over 300 victims were recorded due to avalanches.

In the twentieth century, due to hydrogeological emergencies, Italy has had a record of more than 12 thousand victims, 350 thousand homeless, tens of thousands of damaged houses, as well as countless collapses of bridges and hundreds of kilometers of damaged roads and railways.

Among the most catastrophic events (see Table 2), we should recall a few major historical floods: Polesine (1951), Salerno (1954), Florence (1966), Genoa (1970), Piedmont (1994), as well as some landslides followed by a flood, such as the tragedies of Vajont (1963) and Val di Stava (1985).

MAIN HISTORICAL FLOODS

YEAR	AFFECTED AREA	VICTIMS
1951	Polesine	about 100
1954	Salerno	318
1966	Florence	53
1970	Genoa	43
1994	Piedmont	79

DISASTERS CHARACTERISED BY LANDSLIDE-INDUCED FLOODS

YEAR	AFFECTED AREA	VICTIMS
1963	Vajont	1917
1985	Val di Stava	268
1987	Valtellina	61

Table 2. Examples of primary floods and floods triggered by landslides.

Furthermore, since 2009 (see Table 3), the most significant events that should be mentioned are those that occurred in Giampilieri (Messina), on 1 October 2009; in La Spezia area (Liguria) and in Lunigiana (Tuscany), on 25 and 26 October 2011; in Genoa, on 4 November 2011; in the Grosseto area (Tuscany), on 12 November 2012; in Sardinia, on 17 and 18 November 2013; in Rigopiano (Abruzzo), on 18 January 2017; in Livorno (Tuscany), on 9 and 10 September 2017; in the Raganello Gorges (Calabria), on 8 August 2018.

DATE	PHENOMENON	AFFECTED AREA	VICTIMS
1/10/2009	mudflows	Giampilieri (Sicily)	31
25-26/10/2011	flood	La Spezia area (Liguria) and Lunigiana (Tuscany)	13
4/11/2011	flood by the Ferreggiano river	Genoa	6
12/11/2012	floods and landslides	Grosseto area (Tuscany)	5
17-18/11/2013	flood by the Flumendosa and Cedrino rivers	Sardinia	17
18/1/2017	avalanches*	Rigopiano (Abruzzo)	29
9-10/9/2017	flood	Livorno (Tuscany)	8
20/8/2018	flood	Raganello Gorges (Calabria)	10

** in conjunction with the seismic sequence of Central Italy and heavy snowfalls*

Table 3. Main hydrogeological and hydraulic events occurred from 2009 to 2018 in Italy.

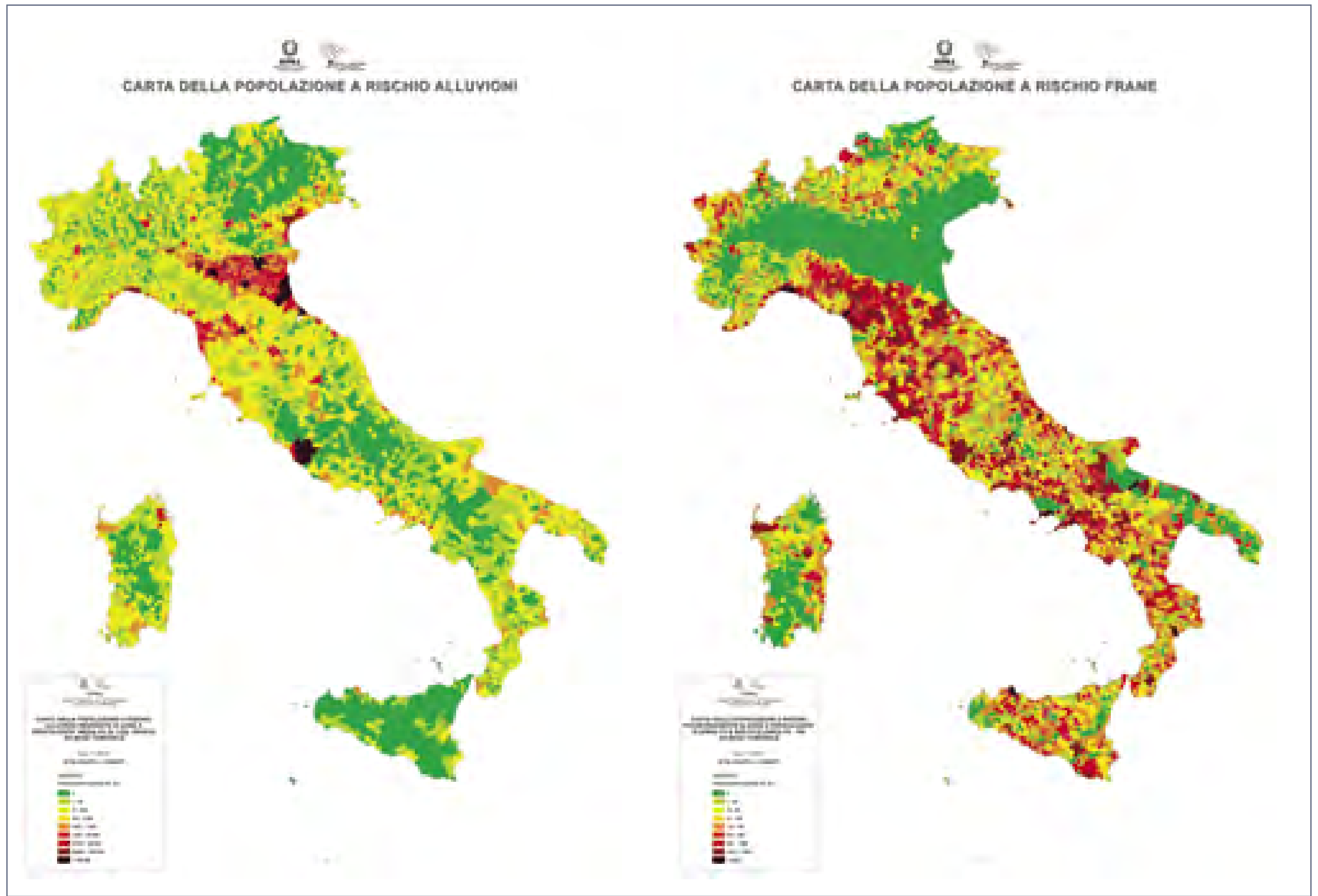


Figure 4. Population exposed to landslides and floods. Source: ISPRA-Institute for Environmental Protection and Research.

► 2.5 Water deficit

Over the past twenty years, Italy has faced an increasing number of droughts and water crises. The causes of water crises are not only natural, but above all of anthropogenic origin: infrastructure backwardness, heavy losses to distribution networks, high withdrawals, significant waste, etc. (see Figures 5 and 6).

BASIC INFORMATION ON WATER CRISES

Water crises occur when there is an imbalance between the demands of the users and the actual availability of water, both due to drought, pollution or incorrect management of power sources, and due to shortage in the water systems. Such crises determine severe limitations not only in the drinking sector, but also in the agricultural and industrial sectors.

According to the European Directive 2000/60/CE, water use must be sustainable and based on the protection of long-term use of available water resources, and must ensure that all needs are met at an acceptable level, including that of maintaining flow rates and water levels compatible with the health of ecosystems and the quality of natural environments.

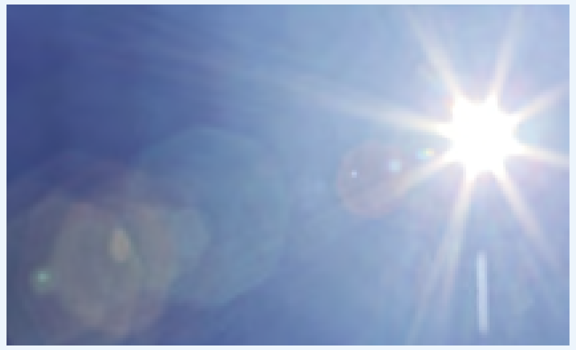


Photo 18. Rome, 2011. Heat waves are extreme weather conditions that occur during the summer season, characterized by high temperatures.

The sustainable use of water must be based on shared and exhaustive information bases, necessary for the programming of resources and to ensure the best possible balance between the availability of resources and the needs for different uses.

Italy is one of the potentially richest water countries. The average volume of rainfall is estimated at around 300 billion cubic meters per year and the average annual precipitation is around 900 millimeters.

The factors that predispose the water deficit situations are manifold and often combined with each other. In addition to the main one, i.e. the occurrence of weather-climatic situations characterized by a generalized decrease in precipitation, it is also necessary to take into account the high consumption and waste, including the inadequacy of the distribution networks, which in Italy records an average water loss of the order of 30%. Climate change could also aggravate the situation, as the possible combination of the increase in temperatures and irregular rainfall can produce an increase in withdrawals for agriculture, energy production and drinking water.

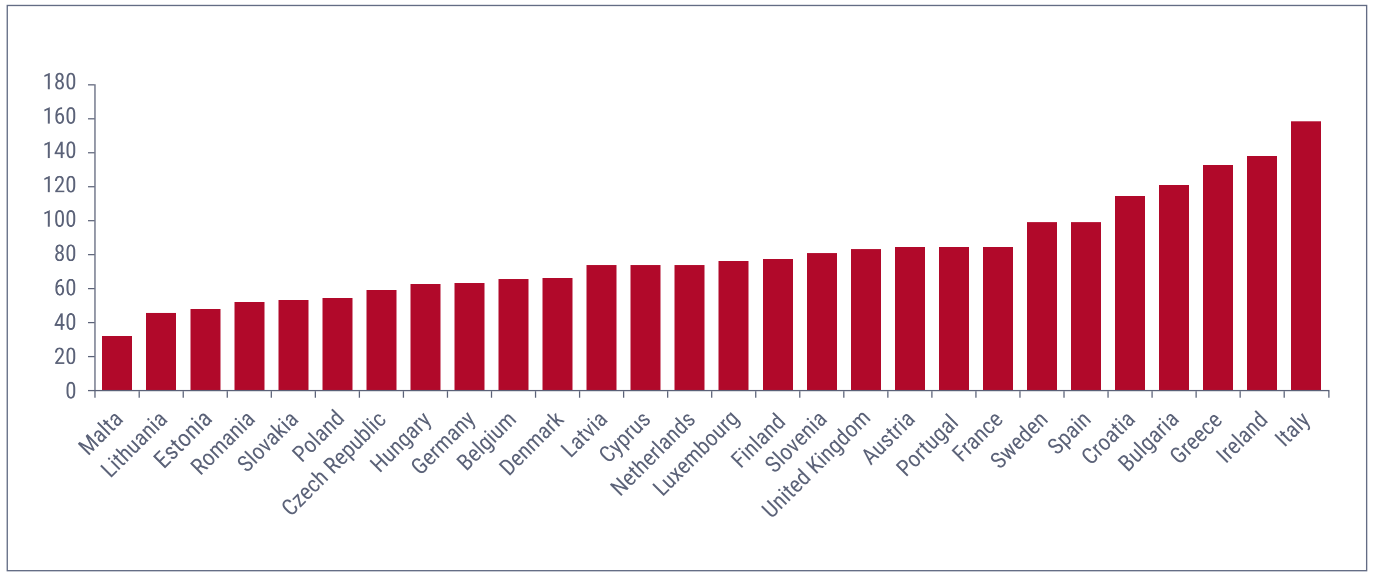


Figure 5. Drinking water withdrawals in the 28 EU Countries in cubic meters per inhabitant. Year 2015. Source: ISTAT-National Institute of Statistics, Census of water for civil use, compilation on Eurostat-Statistical office of the European Union data.

Figure 6. Percentage and linear total losses in the regional capital municipalities. Percentage values on volumes fed into the network and daily cubic meters per kilometer of network. Source: ISTAT-National Institute of Statistics, Census of water for civil use.

In the last twenty years drought and water crises have not only affected the South, which has always been exposed to the risk of drought for climatic reasons, but also the regions of Central and Northern Italy, causing serious damage to agriculture and the manufacturing industry, with an impact also on civil uses. The water crises of 2003, 2006, 2007 and 2017 affected the

Po river basin, the most densely populated and industrialized area. The water crisis of 2017 also affected some regions of Central Italy (Lazio, Umbria, Marche). It is interesting to note that the water crisis in the Marche is an example of aggravation of a phenomenon, since the 2016 earthquake had diverted the course of some rivers, thus depriving the territory of the water resource. At the beginning of 2018, another water crisis hit the Palermo area in Sicily.

Several very important water crises, especially over the years 1988-1990, 2003, 2006, 2007, 2012, 2017, have had serious consequences. Just to cite an example relating to economic aspects, we can say that, regarding the appropriations for the crises approved in 2017 for the Lazio, Umbria and Emilia-Romagna regions, as well as for the Province of Pesaro-Urbino, the total amount was 43,250,000 euros, against a request of less than 650 million euros, therefore with a percentage of about 7%.

Photo 19. Sicily, 2006. Drought.

Although a debate on the causes of climate change is beyond the scope of this text, it is worth mentioning how climate change will likely exacerbate the problems arising from the water deficit, as it may cause an increase in withdrawals for agriculture, energy production and drinking water. The water deficit could in fact be linked to a combination of the increase in temperatures combined with decreasing and irregular rainfall.

The assessment of droughts and water crises is based on a complex set of methodologies, mainly referring to the continuous monitoring of strategic indicators, i.e. hydrometeorological variables (rainfall, temperatures, etc.) and water availability indices (volumes stored in surface reservoirs, groundwater levels, river flows, outflows from reservoirs, snow reserves, etc.). In this context, the integration of local and scientific knowledge in support of drought monitoring is very useful in supporting drought management.

► 2.6 Forest fires

In the Mediterranean area, all European Countries are affected, in a different way, by the problem of forest fires. In 2017 Italy was one of the five most affected European States together with Spain, Greece, Portugal and France (Figure 7).

In 2018, forest fires affected not only the Mediterranean Countries, but also Northern European Countries such as Sweden and the United Kingdom. It is likely that these phenomena are also linked to ongoing climate change.

In general, Italy is characterized by a climate and vegetation that vary from North to South. These differences directly affect the distribution of forest fires throughout the territory. Due to the distribution of rains during the year, forest fires are mostly located in the Alpine region in winter (in particular in the North-Western Alps), while in summer they are mainly concentrated in the Mediterranean region (Southern Italy and major islands). In Liguria (North-Western Italy) fires occur both in summer and in winter with the same frequency.

It should be noted that only 1% of forest fires can be traced back to exclusively natural causes (Figure 8). Most of the fires are in fact related to responsibilities attributable to human neglect or criminal behaviour, where there is a specific criminal objective to be pursued through the fire, or arson, that is, related to incorrect behavior, distractions, disrespect for the surrounding environment (a cigarette butt thrown out of a running car or a barbecue lit near a wooded area, perhaps on a very windy day during the drought season).

PERCENTAGE OF LAND AREA BURNED IN SOUTHERN EUROPE MEMBER STATES

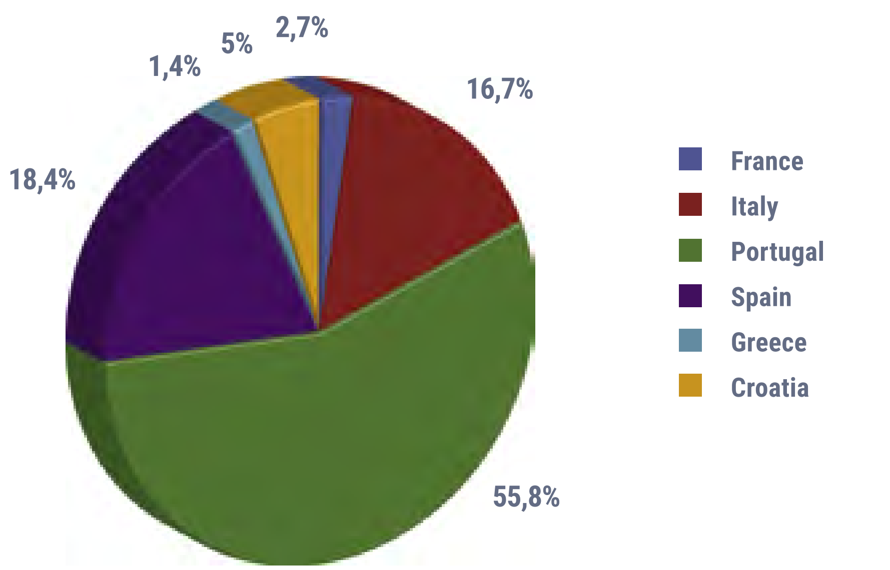


Figure 7. Percentage of land area burned in 2017 in Southern European Member States. Source: JRC-*Joint Research Centre, "Forest Firest in Europe, Middle East and North Africa 2017"*.

Photo 20. Sardinia, 2020. Forest fire.

CAUSES OF FOREST FIRES

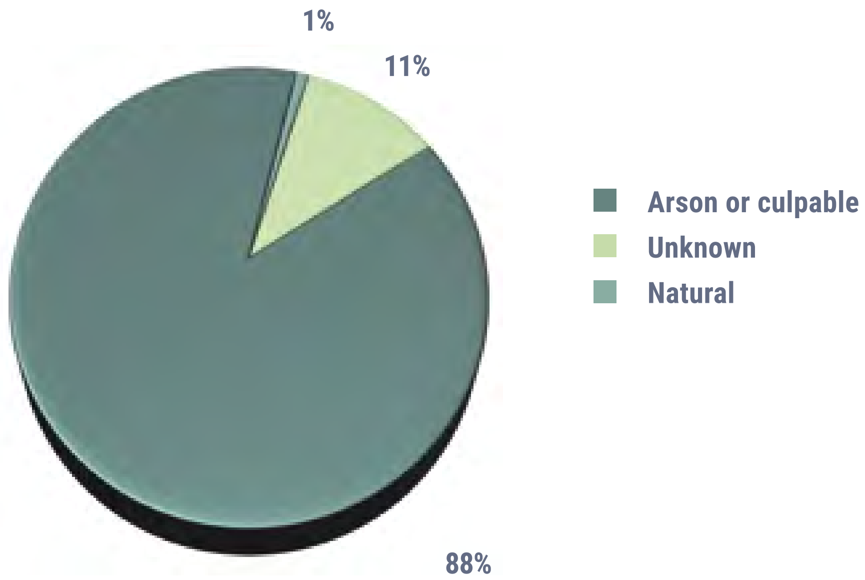


Figure 8. Causes of forest fires in percentage terms in 2010. Source: State Forestry Corps.

BASIC INFORMATION ON FOREST FIRES

A forest fire is «a fire that tends to spread over wooded, bushy areas, cultivated or uncultivated land, or on pastures near these areas, including any man-made structures within the aforementioned areas» (Law n. 353/2000, art. 2).

There are three main types of fire, based on how a fire originates and spreads:

1. Underground fires that burn below the layer of fallen leaves on the ground, penetrate a few centimeters underground and advance also burning the roots of the trees until they reach the surface;
2. Grazing fires, which burn the litter, herbs, bushes and shrubs;
3. Canopy fires, which spread from one crown of trees to another helped by the wind and are the most difficult to control.

When a fire, originating from combustible vegetation, affects areas bordering urban-rural areas, it is called interface fire, which can originate either near a settlement (for example due to the burning of plant residues or ignition of fires during recreational activities in urban or peri-urban parks, etc.), or as a proper forest fire, and then to affect the interface areas.

The consequences of forest fires can be direct, when they cause the loss of animal and plant heritage, or indirect, when they cause damage related to the function of forests, such as drought, desertification and various forms of hydrogeological instability.

To reduce the risk of forest fire, it is necessary to ensure every possible prevention activity that aims, with respect to the forest heritage, landscape and environmental assets, on the one hand at the reduction of the fuel mass available for the ignition and the spread of forest fires, on the other hand at the creation of protection strips around tourist settlements and residential areas, as well as industrial plants and strategic or particularly sensitive infrastructures, so that any risk resulting from the occurrence and/or approach of a fire front is reduced.

The correct and effective organization of the surveillance service of the whole territory and of the areas considered most at risk is also very important.

In Italy, from 2000 to 2018, approximately 122 thousand fires have been recorded, burning about 740 thousand hectares of forest, a surface that can easily be doubled if we also consider the "non-forest" areas, for a total of 700 thousand hectares (Source: the Carabinieri Corps). In our Country, the threat of fires is not limited to wooded areas, but extends also to agricultural areas and urban-forest interface areas, especially those where maintenance failed. In fact, the agricultural and rural areas, from the 50s of the last century to today, have been gradually abandoned, both in regions with a complex topography, where the mechanization of agriculture is unfavorable, and in the major islands and in the South of Italy, due to socio-economic changes.

► 2.7 A reflection

The images of places destroyed by earthquakes, the spectacular lava flows that threaten the countries on the slopes of Etna, the aerial shots of cities and countryside inundated by the flooding of rivers are too often associated with events whose consequences seem inevitable and are accepted with a sense of fatalism and resignation. In reality, the severity of the effects is the result of the interaction between a natural event, in terms of recurrence and predictability, and the artificial environment created by man. It can therefore be misleading to call these events "natural disasters", placing man's responsibility in the background, who often built and occupied particularly fragile and vulnerable areas of the territory. Therefore the risk of suffering serious damage, as a consequence of the natural occurrence of calamitous events, can be reduced essentially by acting on the man-made environment, establishing a new balance between man and nature. However, risk awareness by citizens and the growth of a culture of prevention is crucial to achieve this.

It is important to improve the civil protection system's intervention capacity in its broadest sense, including risk forecasting and prevention (risk assessment and reduction strategies, monitoring systems, identification and delimitation of areas at risk, etc.), emergency management and the overcoming of the emergency phase. But in the long term it is structural prevention which, more than other interventions, is crucial in reducing risks. To achieve this objective many are the subjects who must operate in ordinary, normal time, to create favorable, continuous and constant conditions, for this prevention work to take place in the quantity and quality needed to produce a real and effective reduction of risks. In fact the lack or limitation of structural prevention actions also makes non-structural prevention actions that are typical of civil protection activities less effective, and intervention in emergencies, inevitably faced by our Country, much more difficult.

3

A HISTORY OF EVENTS AND LAWS

3. A history of events and laws

The history of Italian civil protection has spanned throughout the entire last century. In Italy the concept and consequent definition of "protection of citizens" emerged at a particular time thanks to the perception of two levels of awareness: becoming a nation after centuries of political and economic division that prevented a consistent government policy across the whole territory, and being a Country exposed to all kinds of risks, both natural and man-made.

Governments are forced to acknowledge the consequences of natural disasters and how they can affect the future of communities and even change the social and economic fabric of territories, sometimes even irreversibly. In such cases, State attitude evolves throughout the course of time, according to the different political experiences and the driving force exerted by the progress of technology.

Several critical historical events should be considered, starting from Italy's unification, when the State's approach toward major issues such as the safeguard of people's lives gradually changed towards more modern forms of relations between public institutions and citizens.

► 3.1 The beginnings

After the unification of Italy (1861), the new Government had to deal with natural disasters and their social and economic effects almost immediately. The approach chosen by the State was mostly a liberal one, which implied that people did not receive special help in times of great need. Therefore, the individual had to operate autonomously in relation to the territory and its disasters. State intervention was expected and, when appropriate, it was guaranteed after the disaster, but aid from the State was conceived in an almost charitable form, exclusively for the needy, and consisted of limited material resources and assistance to the population.

Consistent prevention or protection actions were not taken into consideration at all, nor were recovery and reconstruction following a disaster. A clear example of this approach is the response to a disaster in the summer of 1895, in an intervention at the Chamber of Deputies by the Treasury Minister of the time, Sidney Sonnino. It took place just a few months after the earthquake of magnitude 6.1 and maximum intensity IX MCS that hit the region of Calabria in November 1894, when the Parliament was discussing the possibility of providing a stronger support to those territories, so severely affected. The liberal politics of Sonnino prevented him from conceiving State's emergency interventions to support the population, also due to the possible excessive burden on the State treasury resources. His words deserve to be recalled in our text:

«In a Country like ours, where unfortunately calamities, like earthquakes and floods, occur almost regularly, both here and there... the State cannot directly make up for the damage with public money, which is then painfully demanded to taxpayers; it cannot provide for all the misfortunes and losses that come from force majeure. The State must restrict its intervention to a few cases: to provide first aid operating alongside the local authorities in some way, by sending troops, authorities, and even funds directly on site. Then, it can intervene for the poorer classes, helping them to repair their hovels, but cannot come to the aid of the bourgeois classes in the same way...»[1] (Bevilacqua, 1996).

Photo 21. The devastating effects of the earthquake of 28 December 1908 in the city of Messina.

Therefore, the liberal State resolved to leave the citizens on their own to solve their problems, above all those that were not included in specific established political-economic programming. The impact of some major earthquakes between 1903 and 1915 modified the direction and attitude of the State towards natural disasters and their consequences. At the beginning of the 20th century, some laws, following a good number of natural catastrophes, began to lay down regulations regarding floods and earthquakes. In 1904, watercourses and their maintenance regulations were disciplined. After the Calabrian-Messina earthquake of 1908, the seismic classification of the territory and a first anti-seismic regulation for buildings was introduced, to be applied only in classified areas (Figure 14). The latter earthquake, together with the consequent tsunami, had caused about 80 thousand deaths. First aid to the population came from the English and Russian naval teams, while in some villages of the Calabrian coast and inland help arrived after days, and in some cases weeks.

The Marsica earthquake of 13 January 1915, also known as the Avezzano earthquake, affected the entire area of Marsica in Abruzzo and the Liri Valley in Lazio, causing more than 32 thousand deaths. The catastrophic quake occurred a

[1] *«In un Paese come il nostro dove purtroppo disastri del genere, come terremoti, inondazioni, avvengono quasi a periodi regolari, sia qua sia là… lo Stato non può supplire direttamente ai danni col danaro pubblico, che si strappa poi penosamente ai contribuenti; non può provvedere a tutte le disgrazie e le perdite che provengono da forza maggiore. Lo Stato si deve restringere ad alcuni casi: a dare insieme con le autorità locali i primi soccorsi in qualunque maniera, inviando sul luogo truppe, autorità, e anche denaro. Poi può sovvenire alle classi più povere, aiutandole a riparare ai loro tuguri, ma non può sotto questa forma venire in aiuto alle classi borghesi...».*

few months before Italy entered the First World War in May 1915, which greatly affected the army's stay in the epicentral region. The military units involved in the relief operations were called to the front abandoning the territory and the population hit by the earthquake.

For the few young survivors, the possibility of being exempted from the call to arms to take part in the Great War soon faded. Over 2 thousand young Marsican soldiers lost their lives on the front, along the Isonzo river and in the Carso region.

After the Avezzano earthquake, the Government tried to remedy its shortcomings by introducing more timely and adequate interventions. With the Royal Decree-Law n. 1915 of 1919, an attempt was made to organize an earthquake intervention system founded on the "assumption" made in Rome of the degree potentially reached by the shock in the affected area. The responsible competent body called to intervene was attributed to the Minister of Public Works as the responsible authority, on the spot, for the management and coordination of rescue and relief services and all civil, military and local authorities. During the fascist regime, pursuant to Royal Decree-Law n. 2389 of 1926, a real emergency operational organization was created: the Minister of Public Works left Rome on a specially prepared train, which was deployed near the disaster site, to establish a decentralized operational center of the Government.

Photo 22. The collapses caused by the earthquake of 23 July 1930 in a village in the Vulture area, in the North of Basilicata.

The seismic emergency of Vulture and Alta Irpinia in 1930 caused 1404 victims, and it was managed also providing for the reconstruction of houses by implementing anti-seismic techniques and urbanization works: sewers, cesspools, and aqueducts. Under the supervision of the League of Nations, worried of any potential propaganda, the rescue and reconstruction intervention was then overtaken by the Minister of Public Works, Araldo di Crollalanza. In a few months,

he created thousands of reinforced concrete houses. Also, the State intervened directly on less damaged buildings, by repairing them as soon as possible to ensure prompt shelter for a suitable number of families, saving the considerable cost of security shoring. Substantial rebuilding started immediately, three days after the earthquake, with the clear intent to go directly "from the tent to the house", aimed at avoiding the cold winter typical of that area in wooden barracks (at that time, the earthquake victims of 1908 and 1915 were still in barracks). The construction began with 4 thousand "temporary anti-seismic houses" in reinforced concrete and masonry, which were delivered between late October and early November 1930, in just three months. In the report of the activities at the end of October, there were also 7 thousand private repairs, 2 thousand and 5 hundred demolished buildings, and 4,818 shorings. Thus accommodation was provided to about 50 thousand people in a very short time, while the tents were quickly removed.

However, the one adopted in 1930 remained a model based on experience of pure emergency rescue, which had nothing to do with the protection of citizens, if not in the anti-seismic reconstruction implemented in post-emergency phase.

In 1935, the need felt by the Government to deploy relief interventions in a congruous way throughout the territory led to the suppression of the municipal bodies of firefighters, which existed only in Northern Italy, and the distribution of services on a provincial basis, to ensure promptness and consistency of deployment everywhere. Law n. 1570/1941 completed the work with the nationalization of Italy's Fire Brigade. World War II ended up enhancing more and more the model of emergency rescue, due to the war's frequent bombings which required the continuous collection of dead bodies and wounded.

After the war, the Country's efforts and attention turned to a new approach focused on positive growth, well-being, recovery of illiteracy, reclaiming and protection of some fundamental rights of Italians who came out of the war. The safety and security of citizens seemed to be overshadowed, also because disasters did not occur with particular frequency. Although, the two main events faced in this period were massive catastrophes that had a lot to do with the patchy culture of prevention existing in Italy at the time.

In 1951 the entire Polesine area between Ferrara and Rovigo was flooded by the flood of Po, which, due to errors of preventive hydraulic assessment and the failure to timely intervene to divert water courses, created 180 thousand homeless and severe social and economic consequences.

3. A history of events and laws

Photo 23. The Polesine flood in Veneto, November 1951.

Photo 24. The Vajont disaster, 9 October 1963.

In 1963 on the border between Friuli and Veneto, in an artificial hydroelectric basin created from a dam on the Vajont stream, a vast landslide fell from the mountain above, Monte Toc: sinking into the lake, the landslide caused a violent displacement of the reservoir water, forcefully flooding over its banks and sweeping over two villages along the slope. But the devastating event occurred when it overtopped the dam with unprecedented speed and force, leading to the destruction of the inhabited villages on the valley floor and, in particular, the one of Longarone, that was flooded and destroyed. The victims of the disaster amounted to 1917. Rescue operations, entrusted to a general of the army, were conducted in according to the relief methods in place at that historical time, provided by law, i.e., the use of the State's operational structures. The very morning after the disaster, along with the Fire Brigade and the Red Cross from Friuli and Veneto, thousands of army soldiers were sent to the disaster site, in particular the Alpine Corps, who could only collect and count the dead.

However, the two disasters did not change the legislator's priorities, which were still concentrated on the ability to intervene as fast as possible and with an adequate number of relief operators. At the same time, there were still no initiatives aimed at taking preventive actions. After all, the debate on prevention is subsequent and connected to the increasing availability of data and information. Back then, the availability of mass communication tools was limited and the press releases and media information focused on the culture of moral strength of the Italians and the post-war reconstruction capacity, which were fundamental values at the time, during a period of socio-economic recovery.

► 3.2 The 1966 Florence flood and the 1968 Belìce earthquake

For a new radical change in terms of the national regulatory system, a rapid sequence of disasters that shook the Country had to occur which clearly pointed out the critical aspects of our rescue/relief operations. In November 1966, a major flood hit the city of Florence: the event had great international resonance for the impact on the immense cultural and artistic heritage of the Medici Renaissance city, compromised by the severe flooding of the Arno river that left the citizens of Florence shocked and unprepared.

The whole world was mobilized to save the treasures of Italian culture and, alongside international aid, the new-born public television documented the birth of a phenomenon that would change once and for all the fate of civil protection: "the mud angels", or "*angeli del fango*", according to reporter Giovanni Grazzini, a journalist of the "*Corriere della Sera*". All those young volunteers from all over Italy and from abroad, solely moved by their spiritual and passionate determination to save the Florentine artistic and cultural assets at risk, handed over the winning project of civil protection volunteering to an enlightened legislator.

Photo 25. The Florence flood disaster of 4 November 1966.

The echo of Florence's devastating flood had not yet died when, just over a year later, in January 1968, a 6.4 magnitude earthquake struck the Belìce area, in Western Sicily. Even compared to previous disasters, the tragic event, in the eyes of all Italians, served to point out the many and deep organizational gaps in the national civil protection system, through public TV, the most effective new popular media communication tool that helped to direct the public's opinion on the efficiency of the institutional machine.

In Belìce, relief efforts were poorly organized and arrived late. Such a situation continued over the following months, so much that the departure of families from the area was favoured: they were given a one-way train ticket for abroad or even airline tickets to Australia, North and South America. The effects of this decision had severe repercussions that lasted for decades.

The operational structures of the State started off the relief operations, although with evident difficulties.

The day before the major earthquake a swarm of minor shocks had occurred, after which the Prefect and Police Chief had already presided over the area. These shocks had already caused damage to the local buildings in a state of decay and forced a part of the population to abandon the towns. As a preventive measure, the local administrative elections scheduled for that Sunday were postponed. Also, some railway wagons were brought in from Trapani to welcome the elderly and sick people, with coaches and field kitchens that distributed hot food and drinks during the night. A mobile public security relief convoy was dispatched on the area along with a mobile relief convoy from the Fire Brigade, which were even partially affected by the collapses caused by the first strong shocks.

The strongest shock occurred on 15 January in the heart of the night at 3:01 am local time. As all communications were interrupted, the news of the disaster was given from a police car radio on the site. Despite the presence of these resources on the spot, however, after the destructive shock the system was unable to get activated effectively. The relief convoys arrived late, the news was confusing, the first relief operations were chaotic. A few inhabited centers remained entirely isolated because they could not be reached.

Photo 26. Damage caused by the earthquake that, on the night between 14 and 15 January 1968, hit the Belìce valley in Western Sicily.

The total number of casualties reported was 231. Initially the homeless people in the area of the so-called "crater" were about 98 thousand, then in the following period the number decreased to 25-30 thousand. Tent camps were set up to immediately provide shelter to the displaced people.

At the time, from the point of view of emergency management, no civil protection model based on a simplified coordination existed (the last experience, the 1966 Florence flood, by formal admission of the Government at Parliament had proven totally ineffective in the emergency logistics coordination). The 1926 law still applied, but in a different context of administrative and accountability checks, typical of the organization of the State that emerged from the war. Indeed getting the machine off the ground had proven to be very difficult. A week after the earthquake, the overall situation saw over 13 thousand people hosted in alternative housing and almost 14 thousand in tent camps: considering the winter season, it was a rather difficult logistical choice for the population. In a center like Gibellina – eventually abandoned – the only access roads were invaded and blocked by rubble: firemen began removal operations and entered the city center only with a limited number of vehicles.

Photo 27. Relief coordination operations in Gibellina after the 1968 earthquake that hit the Belìce valley in Western Sicily.

The Ministry of Public Works allocated the first funding and ordered the deployment of ministerial technical experts of the Ministry and the State Civil Engineering for inspections. An attempt was made to conclude the first phase by placing the population in temporary prefabricated buildings, passed down in history as the "barracks" of Belìce[2]. With the Law n. 241/1968, the State resolved to adopt a centralized approach, believing it was possible to manage the reconstruction directly from Rome. That would have been the last experience of this type, since afterwards, with the establishment of the Regions, Governments preferred to decentralize the main reconstruction functions to the Regions and local bodies.

The reconstruction took a very long time and was characterized above all by the controversial decision to abandon the old centers and rebuild them in another area[3]. After bitter protests, often led by priests, like Don Riboldi, or intellectuals, like Danilo Dolci (who in 1970 started the first free radio in Italy to report about the situation of the slums), the Mayors obtained a law that delegated the management of reconstruction interventions to the municipalities. The reconstruction process in Belìce dragged on for years with the endless presence of residual barracks. It was declared completed not before the end of the nineties, about 30 years after the event, although still in 2010, 42 years after the earthquake, acts have been made by the Sicilian Regional Council for the completion of reconstruction of the earthquake areas.

2 *Technical times for the supply of the barracks were set from a minimum of 20 days to a maximum of 40 days, at a price (about 40 thousand Lira per square meter) corresponding to the cost of building a brick house at the time. On January 18, the State Civil Engineering, i.e. the building Authority, began the operations of leveling the areas and many barracks were started fairly quickly thanks to public and private donations: the IRI-Institute for Industrial Reconstruction gave the availability of an adequate number of steel barracks, while NATO-North Atlantic Treaty Organization, by paying only transport costs by ship (which in the end however was considerable), provided the ones used in the Korean War.*

3 *A symbolic role in this event was played by the Municipality of Gibellina, one of the most affected countries: the old inhabited center was abandoned, demolished with dynamite and then covered by the "Cretto" designed by Alberto Burri, while the new center (Gibellina la Nuova) was rebuilt 18 kilometers downstream thanks to the contribution of architects and nationally and internationally renowned artists. Montevago was also demolished to the ground and rebuilt in another area.*

► 3.3 The 1976 Friuli earthquake

With regard to the improvement and evolution of the response system to the severe disasters that hit Italy, even in the awareness that there is no single intervention model suitable for all cases, the case of Friuli in 1976 indeed represents a positive one, which was then studied and analyzed very carefully to identify the strengths that could improve our system in future emergencies. But essentially Friuli represents the first involvement in the political-institutional scene of Giuseppe Zamberletti, who will introduce a radical change in the operational perspective of the system.

The Friuli seismic sequence was characterized by two main shocks which occurred more than four months apart. On 6 May 1976, at 21:00, a shock of magnitude 6.5 struck large areas of Friuli, between the provinces of Udine and Pordenone. The municipalities most affected were Gemona, Venzone, Bordano, Artegna, Buia, Osoppo and Forgaria. The casualties were 978 in total, the homeless about 189 thousand (Guidoboni and Valensise, 2011).

Photo 28. Rescue teams at work following the earthquake in Friuli on 6 May 1976.

The arrival of relief operators and resources was very rapid, as about 18 Army battalions were located for entirely different reasons in North-Eastern Italy and the barracks which had suffered minor damage promptly mobilized their military forces to bring relief to the population.

On the morning of 7 May, Prime Minister Moro and the Minister of Interior Cossiga arrived on the disaster site and urgently decided to entrust the role of Extraordinary Commissioner for the emergency to the Undersecretary of Interior, Mr. Giuseppe Zamberletti.

4 *The reason for entrusting the delicate task to Zamberletti was not the result of an extemporaneous choice, nor even a purely institutional one. Indeed, it is true that the politician from Varese was at that time the Undersecretary responsible for the Fire Brigade, but he was above all the rapporteur of the first law approved by the Parliament that dealt with civil protection, the Law n. 996/1970 - Rules on rescue and assistance to populations affected by disasters, and therefore he was considered to be, in that phase, the most experienced politician to manage disaster interventions.*

Although the presence of the military guaranteed a fair number of men the situation was chaotic; all requests passed through the Commissioner's office, hosted in the Prefecture of Udine. Zamberletti then decided to create local coordination centers, also at the Municipality level, and put army officers alongside the Mayors in the area. Things quickly began to work fairly well, and the acute crisis was overcome in three months, after which Zamberletti resigned from the mandate.

With regards to the functioning of relief operations, the factors that positively influenced the action in Friuli, compared to Belìce, were different and can be briefly summarized as follows:

- conspicuous military presence in the area;
- good communication and road system network;
- presence of hotels on the coast and consequent immediate availability of numerous beds to assist the population (strategy replicated also in the earthquakes of 2009 and 2016-17).

Immediately after the main shock, the homeless found refuge in rail cars, in tent camps and in caravans. After the first emergency, the communities strived to regroup. The Friulians launched the slogan "from tents to homes", hoping to rebuild or repair their homes soon, even if urban planning problems and the high number of displaced people made it difficult to implement this project. Upon completion of the relief operations, the first resettlement was an urgent matter: the warm season was about to end soon, and tents would not be good enough.

With that slogan, the Friuli citizens hoped to soon be able to rebuild or repair their homes. As per the intermediate period, they built prefabricated houses to be used during the transitional phase. The Friuli Region firmly believed in that motto and, proudly, took on themselves the burden of such an enterprise. There was no awareness at the time of something that in seismic risk is now known to everyone: when the choice of reconstruction concerns repair or reconstruction of existing houses (with the evocative, but technically not always appropriate, concept of "where it was and how it was"), the time needed cannot be short, and reconstruction can never last less than 10-12 years, in consideration of urban planning and safety problems, cultural heritage, the high number of displaced persons, technical difficulties in operating in historical centers, administrative burdens caused by often fragmented properties, the need for services and the lack of local building companies available. Around the end of summer, the situation was still stuck on the choice of areas to be expropriated and occupied and the weather was starting to get worse.

From July onwards, with the end of Zamberletti's commissioning role, the Friuli Region, which had taken over the reconstruction task, was unable to start the planned light prefabrication of about 9,000 homes. As regards repairs, during the summer, only those undertaken by the Alpine Corps involved in the emergency were guaranteed. By the end of summer, the prefabricated buildings were not ready.

So even before the new main shock of September, that made events plummet, evacuation from the earthquake zones appeared necessary and inevitable by the end of August: it seemed reckless to stay in tents with the start of the cold season, and in many cases the construction of temporary prefabricated buildings needed to start right in the areas occupied by the tent camps.

Between 11 and 12 September, new shocks caused further collapses, also involving rebuilt property. At that point, the transfer of displaced families away from the epicentral area was organized to protect people from new risks, and to allow a faster deployment of operations. Prefecture officials were instructed to take immediate contacts with institutions and trade organizations on the coast to check hotel accommodation availability. Obviously, a classic and repetitive scenario emerged as soon as the transfer option was decided; people showed significant resistance to move, fearing an exodus and definitive departure from their homes.

Photo 29. Rescue teams at work following the Friuli earthquake.

The 6.0 magnitude main shock on 15 September, causing further damage and another halt to the restoration to normal conditions, persuaded the displaced population, and even Zamberletti, who had been urgently reappointed Commissioner after the September events, to opt for moving to seaside resorts along the coast. It was not just the new shock to convince people to leave the tents and move to the coast for four or five months, i.e. the estimated construction time needed to complete the prefabricated buildings; the area's bad weather conditions with the advent of winter did the rest. Cold and rain definitively discouraged the resistance of the tough and tenacious citizens of Friuli, and finally the exodus happened with the helpful collaboration of the Mayors. Hospitality was guaranteed in an orderly and not random way, thanks to the Commissioner's staff, the assistance of the hosting municipalities and local volunteering. The short distance allowed commuting for those ready to pick up their business activities, but also for the farmers and workers, so as not to feel destabilized and cut off from their places of origin.The evacuated population amounted to about 30 thousand and were accommodated in five seaside resorts and in a mountain resort (Geipel, 1979). The displacement plan from the affected areas and the hospitality plan in seaside resorts lasted until April 1977. In the meantime, the temporary housing solution in prefabricated buildings was underway, partly under the responsibility of the Region and by the Commissioner himself, while a building recovery plan for houses that had suffered minor damage was being drafted.

Photo 30. The devastating effects of the Friuli earthquake.

The reconstruction period then began which, from a legislative point of view, was characterized by a substantial decentralization of responsibilities in favor of the Region and local bodies; but first and foremost in favor of the Municipalities: it was a novelty in the field of reconstruction management, as the Regions had only been established a few years earlier and Friuli-Venezia Giulia also enjoyed the privileges of a Special Statute Region. In five years, half of the homeless people were already granted definitive accommodation (39 thousand out of 80 thousand). In 1985 the homeless people still hosted in prefabricated homes were approximately 20 thousand. The reconstruction had therefore gone fast enough, favored by the decentralization of decisions that enhanced the municipal level, which proposed ideas and decisions appreciated and backed by the local population, and set up the reconstruction process based on the "do it yourself" principle. Furthermore, the relatively homogeneous territory of the region allowed for better planning management.

► 3.4 The 1980 Campania-Basilicata earthquake

Around 19:35 in the evening of 23 November 1980, a very long shock lasting over one minute, with magnitude 6.8, destroyed 36 villages between Campania and Basilicata, resulting in 2,735 dead and 8,850 injured. The disaster, gigantic in its proportions, struck with particular violence above the entire territory of Irpinia, which was totally annihilated after the subsequent shocks of the seismic sequence: many houses, bridges and viaducts were destroyed, and a number of landslides were reported throughout the affected area. The whole of Italy was mobilized, moving like never before to assist the populations so gravely hit, including from abroad. Almost 500 billion Lira were collected in a short time from across the border.

Photo 31. The Irpinia earthquake of 23 November 1980 struck Central Campania and Central-Northern Basilicata.

Unfortunately, an unforgotten failure of the Irpinia affair is to be attributed to the initial delay of relief operations, caused by the severity of the shock and congestion of the road system, as well by the uncertainty of the disaster site and its epicenter, i.e. the most severely hit area, in consideration of the fact that at the time the Country relied on a seismic network at an early stage, therefore with few seismic stations. Many dead remained under the collapsed roofs of their poor mountain homes for days on end. The chaotic situation with respect to roles and responsibilities resulted in the most vehemently expressed condemnation by any other President of the Italian Republic against the State's ineffectiveness. The words of President Sandro Pertini caused the removal of the Prefect of Avellino and resignation of the Minister of Interior of the time, Virginio Rognoni. The organizational failure was caused first of all by the erroneous assessment of the earthquake's epicenter in Basilicata,


IL MATTINO
CRESCE IN MANIERA CATASTROFICA IL NUMERO DEI MORTI (SONO 10.000?) E DEI RIMASTI SENZA TETTO (250.000?)
FATE PRESTO
per salvare chi è ancora vivo
per aiutare chi non ha più nulla

Photo 32. The title of the newspaper "Il Mattino" on 26 November 1980, three days after the tragic earthquake in Campania-Basilicata.

which suggested to the Ministry of Interior to dispatch the relief convoys to one of the least affected areas. Furthermore, the poor and severely damaged road network, in addition to the winter weather, made things worse. Last but not least, the fact that the main strength of intervention, i.e. Armed Forces, were in part lined up to the North of the Po river, and therefore to brought them quickly to the South, with all the necessary logistics, proved to be a time-consuming and titanic feat.

With the appointment of an Extraordinary Commissioner, once again Zamberletti, and with the exponential use of vehicles and men from the Armed Forces, the relief operations coordination quickly improved. The commitment of men and means deployed by the State was impressive, unlike ever before: in early December, ten days after the earthquake, the total military forces amounted to over 38 thousand men, including about a thousand foreign armies. Almost 4,000 vehicles circulated throughout the area: the army alone had 2,500 transport vehicles, of which 1,950 were from operational units and 550 from transport units. Overall, over 2 million Army food rations were used, 6,200 tons of food, 10,200 tents, equal to approximately 200 thousand beds, 349 thousand blankets, 22,500 sleeping bags, over 50 thousand tons of various materials. The organizational model of intervention, even in its administrative aspect, copied with intelligent modifications the Friuli model, which had proved substantially efficient.

Photo 33. The collapses of houses caused by the 1980 Campania-Basilicata earthquake.

► 3.5 The birth of modern civil protection

The errors and inefficiencies of the first intervention phases in Campania had changed the scenario. As Zamberletti said, «when the President of the Republic arrived in Irpinia, the Government had not convened yet to appoint the Extraordinary Commissioner, which happened shortly after.The citizens on the premises of disaster saw the authorities' convoys following the President and thought they were the emergency relief convoy. Therefore, Pertini was badly received by the people upon arrival on the disaster site. And he was not used to it...» (Interview with Giuseppe Zamberletti of 5 November 2016). This experience convinced the President of the Republic that the time had come to break away from the past and create a new institutional body to keep up with the times and ensure the protection and safety of the population.

Another historical event that took place only six months after the earthquake, in Vermicino, in the neighbourhood of Rome, helped further strengthen President Pertini's convictions. On that occasion, the President had decided to preside over the recovery of a child, Alfredino Rampi, who had fallen into an artesian well, tens of meters underground, and whose rescue attempt was followed on live Television with great participation and apprehension by the whole Country. The failing result of that operation, without the hoped-for "miracle" by the rescuers, led him to firmly request that the Government immediately prepare for the establishment of an organized civil protection.

Photo 34. Operations for the rescue of little Alfredino Rampi, fallen into a well near Rome on 10 June 1981.

To do this, a few days later, during the establishment phase of a new Government, an innovative figure was identified, that of "High Commissioner, with the rank of Minister, in charge of preparing the organizational tools of the new civil protection". In order to exercise that delicate role, Giuseppe Zamberletti was appointed to be able to commit himself entirely to such a task, with the objective of transforming into a system what had been so clearly realized by him and implemented on the field, when faced with the responsibility of responding to the two great earthquakes. It was in June 1981. The following year, the High Commissioner was elevated to the rank of Minister.

Thus, under the guidance of Zamberletti, the Civil Protection Department was officially established in 1982, with which the civil protection matter was placed directly under the highest government figure, the President of the Council of Ministers, who delegated this task to a Minister without portfolio. That same year, the Government presented the first organic civil protection law, established according to the new more inclusive concept, namely that of the National Civil Protection Service.

The law's course in time has been rather winding and troubled, lasting ten years, and managed to see the light thanks to the personal trust that the Country and the Parliament had placed in Zamberletti. However, it was a matter of regulating "states of emergency", a term which, for reasons related to the context and the Cold War, evoked political ghosts especially for the parliamentary opposition. The bill in fact also spoke of risks "linked to human activity", and their related "prevention": this term, in that context, seemed to refer to a possible state of police. The situation was somewhat resolved by mediation of the text, oriented toward a greater decentralization of the responsible intervention functions, involving more the local bodies and in particular the Mayors, and thus an almost unanimous approval was finally reached. Law n. 225/1992 became the first exhaustive civil protection law.

Photo 35. A 2011 image of Giuseppe Zamberletti, the founding father of modern Italian civil protection.

Until then, the reference standard for civil protection interventions was represented by the first articles of Law n. 996/1970, constituting the first legislative text on civil protection together with its implementing regulation, adopted after a decade (Presidential Decree n. 66/1981). Law n. 996/1970 had the merit of defining the concept of natural disaster for the first time as «the occurrence of events involving serious damage or danger of damage to the safety of people and property, which by their nature or extent must be faced through the use of extraordinary technical means».The law also contained a first attempt to involve all interested bodies. The direction and coordination was in fact handed over from the Ministry of Public Works to the Minister of the Interior to whom, «in agreement with the other civil and military administrations of the State, and through the contribution of all local and institutional public bodies», the organization of civil protection was entrusted and the provision of emergency relief and assistance services for the affected populations. Moreover, the inter-ministerial civil protection Committee was set up. The appointment of a Commissioner for emergencies was also envisaged, as a responsible figure in charge of directing and coordinating the relief operations on the site of the disaster, while the CAPI-Emergency Assistance Centers were created for the assistance of the population.

Finally, for the first time the civil protection volunteering activity was recognized and the related training and equipment entrusted to the CNVVF-National Fire Brigade. However, although attempts were already being made to affirm the concept of civil protection as a coordination body of various subjects, identifying their tasks and interventions, the mechanism outlined by Law n. 996/1970 failed, both because its execution regulation was approved after 11 years, and due to the evolution of the events described above.

Photo 36. The flood of Versilia, in Tuscany, 19 June 1996.

The new Law n. 225/1992 broadened its scope beyond the concept of civil protection as a mere initiative of effective public assistance, in favor of a wider all round view of "protection of citizens".The relief phase was in fact framed as the third one of a cycle of four activities, starting from the forecast of risks of the territory and continuing with a number of prevention activities. Relief, understood as a moment of response to the critical phase of emergencies, is not even conclusive of the cycle of activities, since it is followed by a fourth phase, the emergency overcoming phase that includes a series interventions needed to ensure the return to normal activities, with which acceptable living conditions after a catastrophe can be quickly restored.
Law n. 225/1992 brought three fundamental intuitions to the cultural scenario of the sector, which are still today at the basis of the civil protection system:

1. the awareness that an effective civil protection system – which the law defines as the "National Civil Protection Service" – must pre-exist prior to the event and cannot be improvised in an emergency context, on the basis of news coming from an affected area;
2. the need for a civil protection presidium previously identified and localized in all Italian Municipalities, which, according to the principle of subsidiarity, are responsibly called to operate every day for the safety of their citizens;
3. the understanding that, in order to guarantee the necessary intervention capacity in case of emergency events, especially the most serious ones, it is necessary to involve organized volunteering.

This latter intuition proved particularly successful also following the cancellation of the compulsory military service.

The new system designed by Law n. 225/1992 found its first application on the occasion of the most important disasters of the nineties: the 1996 Versilia flood was the first, followed immediately by the earthquake of Umbria and Marche in 1997 and by the mud flows of Sarno and Quindici of 1998 (see Chapter 8). Those experiences of emergency coordination characterized a period of great labour and normative reflection, in which the Parliament decided to have the centralized State take a significant step backwards by conveying sovereignty to regional and local powers, which for some years had been growing in importance and efficiency. The direct election of the Mayor, as well as the assignment to the Municipalities and Regions of autonomous powers of taxation on citizens, convinced the legislator that it was time to decentralize a non-secondary part of technical and administrative functions hither to exercised directly by the State through its territorial ramifications. The whole system of competences was thus revised with a view to "administrative federalism", on the basis of the principles of **subsidiarity** and **integration**, so as to bring the solution of problems closer to communities and their citizens. This happened through the so-called Bassanini Laws and their Legislative Decrees of implementation, which filled modern territorial bodies with new objectives, but also with stringent responsibilities.

With regard to civil protection, with one of these decrees, Legislative Decree n. 112/1998, a large part of the functions were decentralized and distributed among the local bodies, while the main functions of direction, promotion and coordination already attributed by Law n. 225/1992, as well as urgent technical assistance and the use of air fleets to extinguish forest fires, were maintained at the head of

Photo 37. Houses destroyed in Versilia by the flood of 1996.

the State. In summary, civil protection was considered a matter of mixed competence. The Regions and local bodies were entrusted with all the functions except for the tasks of "national relevance for the civil protection system".

The path to decentralization ended with the reform of Title V of the Constitution (Constitutional Law n. 3/2001), in which for the first time the Constitutional Charter expressly deals with civil protection matter, inserting it among the matters with concurrent legislation, and therefore also of regional competence (within the fundamental principles dictated by the framework laws). This means that the Regions have the right to build and regulate their regional civil protection systems, though within a general framework of guidelines established by the State.

Photo 38. The earthquake of 26 September 1997 in Umbria and Marche. The seismic sequence lasted a few months, with significant damage to the cultural and artistic heritage.

In the civil protection system, decentralization represented an epochal turning point, which immediately highlighted the need for a reorganization that would make it more effective and efficient under these new conditions.

A first attempt at reorganization occurred with Legislative Decree n. 300/1999, which established a Civil Protection Agency, in order to bring the activity of the Presidency of the Council of Ministers back to its traditional direction and coordination functions, eliminating the more purely operational ones. The entire structure of the civil protection system was revolutionized: instead of the Prime Minister and the Civil Protection Department, the Minister of the Interior, with political-administrative and control functions, and the Civil Protection Agency, with technical-operational and scientific tasks, were placed at the top of the system. The functions of the Civil Protection Department were transferred to the Agency.

This vision, however, was soon abandoned. With the Law n. 401/2001, the State's civil protection competences were brought back directly under the President of the Council of Ministers, the newly created Civil Protection Agency was abolished and the Civil Protection Department was restored within the Prime Minister's office, with the tasks of the President corresponding to those already identified by Law n. 225/1992 and Legislative Decree n. 112/1998. A State-Regions-Local Authorities Joint Committee was also established within the Prime Minister's Office.

Photo 39. Damage to housing caused by the earthquake in Umbria and Marche.

One of the novelties of the Law n. 401/2001 was the introduction, in the context of civil protection, of the so-called "major events". The declaration of a major event, as well as that of a state of emergency, involved the use of the power of ordinance. With the entry into force of Law n. 27/2012, the legislation concerning major events was however changed and, since then, their management has not been included as part of the civil protection competences.

In 2012, twenty years after its birth, a new reform of the National Civil Protection Service was launched. With Decree-Law n. 59/2012, converted into Law n. 100/2012, the civil protection activities were brought back to the original core of competences defined by Law n. 225/1992, mainly aimed at dealing with disasters and making interventions in emergency management more incisive. The role of direction and coordination of the Civil Protection Department of the activities of the various Components and Operational Structures of the National Service was reiterated.

Law n. 100/2012 touched on, among others, some key issues for the whole system: the classification of disaster events, civil protection activities, the declaration of a state of emergency and the power of ordinance. In this sense, the law redefined the first phase of the emergency, placing more emphasis on the **time factor**. The extraordinary means and powers to deal with the calamities had to be used for limited and predefined temporal interventions, the state of emergency could also be declared "in the imminence" and not only "upon the occurrence" of the calamitous event, and was expected, from the outset – another important step of the law – the identification of the competent administration that, on an ordinary basis, would have continued the activities once the state of emergency expired. It was established that the civil protection ordinances necessary to carry out the interventions to counter and overcome the emergency were normally issued by the Head of the Civil Protection Department and no longer by the President of the Council of Ministers, and their "domains of application", for the first time, were defined by law.

Photo 40. The landslide of Sarno, in the province of Salerno, in May 1998.

For the first decade of the third millennium, in this context of change, the progressive construction of the new regional systems went hand in hand with the implementation and refinement of the mechanisms provided for by Law n. 225/1992, with particular regard to that of the agreements between the State and the Regions for the resolution and revocation of the state of emergency, for the issue of ordinances needed to proceed with the implementation of emergency interventions or to favour the return to normal living conditions in areas affected by disastrous events or, again, for the issue of the directives by the President of the Council of Ministers.

In the meantime, segments of the National Service were growing and developing, which day after day felt the need to be regulated in an ever more stringent way: from the alerting system of the Functional Centers, to the varied world of civil protection volunteering, to the technical legislation on anti-seismic building, to the new fundamental functions – prescriptive for Municipalities – linked to planning, up to the issue of public information regarding disasters and risk prevention.

It is on the basis of these needs that Law n. 225/1992 found an adaptation and broadening of scope through Legislative Decree n. 1/2018, which the State Council resolved to define as "Civil Protection Code" due to the organic nature and completeness of the matter dealt with. In the current legislative text, we find the greatest technical-scientific, organizational and operational achievements of the last decades, taking advantage of the advancement of studies and research, not only in the technological and communications field, but also of those deriving from a deeper cultural knowledge and legal frameworks on safety issues. The fundamental conceptual system, which still shows all its modernity, remains linked to the cycle of the four phases that characterized the vision of Law n. 225/1992.

Photo 41. Sarno landslide of May 1998.

4 ORGANIZATION OF THE NATIONAL CIVIL PROTECTION SERVICE

The National Civil Protection Service, which pursuant to Legislative Decree n. 1/2018 – Civil Protection Code constitutes a **public utility service**, is the system that performs the **civil protection function**, whose purpose is to protect life, physical integrity, property, settlements, animals and the environment from damage or the danger of damage resulting from natural or man-made disasters.

In addition to the national and local civil protection Authorities, the Components (art. 4), the Operational Structures, national and regional (art. 13, paragraph 1), and the contributing subjects identified in the Civil Protection Code (art. 13, paragraph 2) are part of the Service. This plurality of institutional and non-institutional actors constitutes a system which operates under the national coordination of the Civil Protection Department of the Presidency of the Council of Ministers.

Photo 42. «We have many uniforms but only one soul. Civil protection belongs to each one of us and works with and for everybody» is the slogan of a commercial on Italian civil protection created by the Civil Protection Department in 2004.

Civil protection, it is important to emphasize, is not in fact a task assigned to a single administration, but a function attributed to a whole complex system. All its components participate, each according to well outlined skills, in the various activities of the cycle of risk management (see Chapter 6). A very broad and heterogeneous set which requires strong action determined by a multi-level coordination system, both territorial and related to the specific areas of competences. Guidance and coordination are keywords for understanding the system's operation.

As seen in Chapter 3, the current organization of the civil protection system arises from a series of experiences resulting from calamitous events that have interested and interest our Country. They have brought out the importance of a continuous improvement to better combine needs with the fundamental resources available in the various phases of civil protection activities: risk forecasting, prevention and mitigation, emergency management and emergency overcoming.

In particular, for the purposes of organizing civil protection interventions, emergency events[5], deriving from natural or man-made disasters, are classified into three types referring to management capacity, following the principle of vertical subsidiarity[6]. In that sense, just in case of calamitous events, the most immediate and direct intervention to assist the population must be guaranteed by the nearest and closest institutions – that is Municipalities – and, where the available resources and response capacities in the area are not sufficient to cope with the situation due to the intensity or extent of the event, higher institutions can intervene, up to national ones (Figure 9).

[5] *Those situations deriving from the consequences of calamitous phenomena and their effects related to the risks referred to in art. 16 of the Civil Protection Code that determine a dangerous situation for the population and that can occur with different intensity.*

Emergencies of type a) are those that can be addressed through the interventions and measures put in place at the local level, that is, Municipalities. The emergency events that, by their nature or extent, require the coordinated intervention of multiple Bodies or Administrations are defined as **type b)** and are managed at the local level by the individual Regions, or as emergencies of **type c)** when the resources available in the area are not sufficient and adequate, and therefore immediate intervention by the national level of the civil protection system is needed. In the latter case, the Council of Ministers approves the state of national emergency, which allows the deployment of extraordinary means, powers and/or human or financial resources for a given period of time, for a specific territory and for a specific disaster. In case of type b) events, also the Regions can declare a state of emergency.

The **National Civil Protection Service** operates at local, regional and central level. The State intervenes only where and when local authorities are unable to cope with the emergency (vertical subsidiarity).

TYPES OF EMERGENCIES
A - Local
B - Provincial or regional
C - National or international

PRINCIPLE OF SUBSIDIARITY

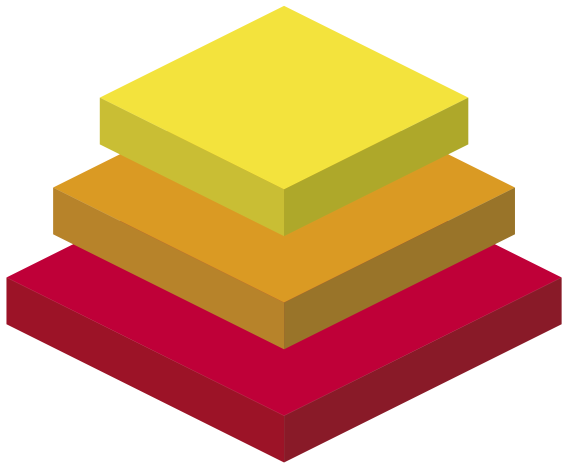


Figure 9. According to the Civil Protection Code, emergencies can be of type A, B or C. The first two types can be faced through ordinary or extraordinary management, at the local level. Type C emergencies must instead be faced with extraordinary means and powers at national level.

[6] *Constitutional Law n. 3/2001 amended art. 118 of the Constitution by introducing the principles of subsidiarity, differentiation and adequacy, which refer to the distribution of administrative functions between the State, Regions and local Authorities, as well as art. 117 of the Constitution, inserting the matter of civil protection among those of concurrent legislation. In general, the principle of vertical subsidiarity requires that public functions are carried out by the administrative level closest to citizens, and that the territorially higher level intervenes only where it is able to carry them out better than the lower level.*

The civil protection function, as anticipated and as will be better illustrated in the next chapters, is not limited to emergency management only, but includes also risk forecasting and prevention activities that need continually to be further developed and updated also due to technological evolution and the development of scientific knowledge, as well as the overcoming of emergencies phase, understood as the restoration of normal living conditions for the populations and territories affected by calamitous events.

The competences of the civil protection system are extremely varied and regard a wide range of fields, as well as multileveled, including public Administrations, central and territorial, public and private Bodies, the Scientific Community, businesses and private Companies that perform functions in support of the civil protection system, up to single citizens or organized in associations.

As mentioned, the Civil Protection Code clearly identifies the subjects that make up the National Civil Protection Service distinguishing them in **Components** – i.e. State, Regions and Autonomous Provinces, local Authorities – and **Operational Structures**, consisting of Firefighters, Armed Forces, Police Forces, the Scientific Community, the National Health Service, the civil protection Voluntary service, the National System for the Protection of the Environment, management structures of meteorological services at national level, the central and peripherals boards of the Ministry of Cultural Heritage and Cultural Activities (see Focus 8).The Code also explicitly provides that professional Orders and Colleges and any other company, public and private, that performs useful functions for civil protection purposes, contribute to civil protection activities (**contributing subjects**).

Photo 43. Rome, 2019.The Operational Committee at the Headquarters of the Civil Protection Department for the national exercise "Exe Flegrei 2019". Representatives of the Components, Operational Structures and subjects contributing to the purposes of civil protection sit at the Committee table.

The guiding functions are entrusted to the Civil Protection Authorities, in relation to their respective areas of government: the President of the Council

of Ministers, the Prefects, the Presidents of the Regions and Autonomous Provinces of Trento and Bolzano, the Mayors and metropolitan Mayors.

The President of the Council of Ministers determines civil protection policies at national level providing the guidelines for the development, in a coordinated fashion, of civil protection activities in order to ensure their unity in compliance of the peculiarities of the territories. To this end, it makes use of the Civil Protection Department of the Presidency of the Council of Ministers, which coordinates the intervention of the National Service in major emergency situations envisaged or in progress. The Department is also responsible for the preparation and implementation of national plans and national relief programs, as well as for coordinating the activities for the emergency overcoming phase, including the general direction of training activities in civil protection and the promotion of studies and research on forecasting and risk prevention, as well as the participation of the National Service to the European Union's civil protection policies. The Prefects, who perform the function of representing the Government on the territory, on events that involve the area of their competence take on the unitary direction of emergency services in liaison with the President of the Region, in particular by ensuring and coordinating the intervention of the State structures present in the provincial territory. The Presidents of the Regions and the Autonomous Provinces of Trento and Bolzano as well as the Mayors, being local civil protection authorities, exercise supervisory functions over the integrated and coordinated conduct of civil protection activities by the structures belonging to the respective Administrations, and are responsible for the organization of their structures in order to ensure the exercise of civil protection functions.

The functions of the Regions and Autonomous Provinces, of the Metropolitan Cities and of the Municipalities mainly concern forecasting and prevention activities, civil protection planning, the organization of technical, operational and administrative activities to deal with calamitous events, among which the organization of Decentralized Functional Centers (see Simplified Glossary) and regional and provincial Operating Rooms, as well as the implementation of the necessary interventions needed to overcome the emergency.

At municipal level, civil protection functions are also aimed at adopting measures to safeguard public and private safety, the implementation of first aid and information to the population on natural and man-made risk scenarios and on the related civil protection planning activities.

OPERATIONAL STRUCTURES OF CIVIL PROTECTION

Among the Operational Structures, the role of the **National Fire Brigade** certainly deserves to be discussed, being the only Structure that is also a Component of the National Civil Protection Service; the Code defines it as "fundamental" and it is endowed with all the skills for the immediate rescue response to the population in every type of emergency event. The Fire Brigade, in fact, is constantly committed – at any time, every day of the year – toward the institutional task of **emergency technical rescue**, ready to intervene to protect the safety of people when there is an imminent or ongoing danger[7]. In case of civil protection events, the intervention of the National Fire Brigade is immediate, by virtue of its widespread presence across the entire national territory and the promptness of activation at all times, allowing it to ensure – thanks to technical skills and professionalism even with high specialistic expertise – the direction and implementation of emergency rescue technical interventions in conjunction with the other Components and Structures involved.

The **Armed Forces** contribute to civil protection activities[8] by carrying out specific tasks, in particular, in circumstances of public calamity and in other cases of extraordinary necessity and urgency. The Italian Army, the Navy, the Air Force and the Carabinieri Corps provide in fact – thanks to technical skills, tools and the means available – their contribution and technical-operational support to other national and territorial Administrations for activities aimed at the protection of human life and search and rescue of the population. This is also done through technical activities such as the preparation of civil protection areas, the demolition of buildings, the removal of rubble, the restoration of the functionality of infrastructures – in particular mobility – or of transport by military ground, air or naval means.

The State Police, in its various divisions and specialties, the aforementioned Carabinieri Corps, which also has functions of public order, the Financial Police and the Penitentiary Police are the State **Police Forces** and contribute to civil protection activities according to their own skills and specificities. The national Police Forces, but also the local and regional Police Forces, participate in civil protection interventions in any situation that involves the safety and security of people, each according to their professional, logistical, instrumental and staffing possibilities in reference especially to the management of public order and road network.

The **National Health Service**, aimed at guaranteeing health care, in other words the safeguarding of citizens' health, is divided into different levels of responsibility and government: the State, through the Ministry of Health and various national bodies and institutions, such as the National Institute of Health or the Zooprophylactic Institutes; the Regions, with exclusive competence in the regulation and organization of services and activities intended for the protection of health through Local Health Authorities and Hospital Companies.

[7] *The National Fire Brigade must be kept separate from the Fire Department at the Ministry of the Interior, with which the Prefect is connected for the purpose of exchanging information flows.*

[8] *As provided also in the Legislative Decree n. 66/2010-Military order code: art. 15 (Attributions of the Ministry of Defense), paragraph 2; art. 89 (Tasks of the Armed Forces), paragraph 3; art. 92 (Further tasks of the Armed Forces), paragraphs 1 and 2.*

Focus 8

PROTEZIONE CIVILE
Presidenza del Consiglio dei Ministri
Dipartimento della Protezione Civile

- National Fire Brigade
- State Police
- Penitentiary Police
- Financial Police
- Carabinieri
- Italian Army
- Navy
- Harbour and Coast Authorities
- Air Force
- Relevant research bodies and national institutes
- National Institute of Geophysics and Volcanology
- National Council of Research
- National Health Service facilities
- Italian Red Cross
- National volunteering organizations
- National Alpine and Speleological Corps
- National Environmental Protection System
- Management structures of meteorological services at national level
- Professional orders and colleges
- Public or private subjects, organizations, companies that perform useful functions for civil protection purposes

Figure 10. The Operational Structures of the National Civil Protection Service.

Focus **8**

The **SNPA-National Environmental Protection System** participates in the civil protection system with mainly prevention and monitoring activities to protect the environment and human health. It is a network system involving the 21 ARPA-Regional Agencies for the Environmental Protection and APPA-Provincial Agencies for the Environmental Protection, and the ISPRA-Institute for Environmental Protection and Research, with fundamental environmental monitoring tasks, also in terms of monitoring the state of the environment and the pollution factors, through targeted research and technical-scientific support activities of national and regional Administrations and Bodies. The National Environmental Protection System is active in environmental emergencies with controls and monitoring. The protection of the environment is also a civil protection activity aimed at reducing risks and, therefore, it is itself a form of prevention.

In addition, the **central and peripherals boards of the Ministry of Cultural Heritage and Tourism Activities** recently became a part of the national Operational Structures as experts in management activities for the safety and protection of cultural heritage in case of emergencies deriving from natural disasters (Legislative Decree n. 4/2020).

All Operational Structures participate to the different phases of risk management. Some relevant activities carried out for each of these phases are shown.

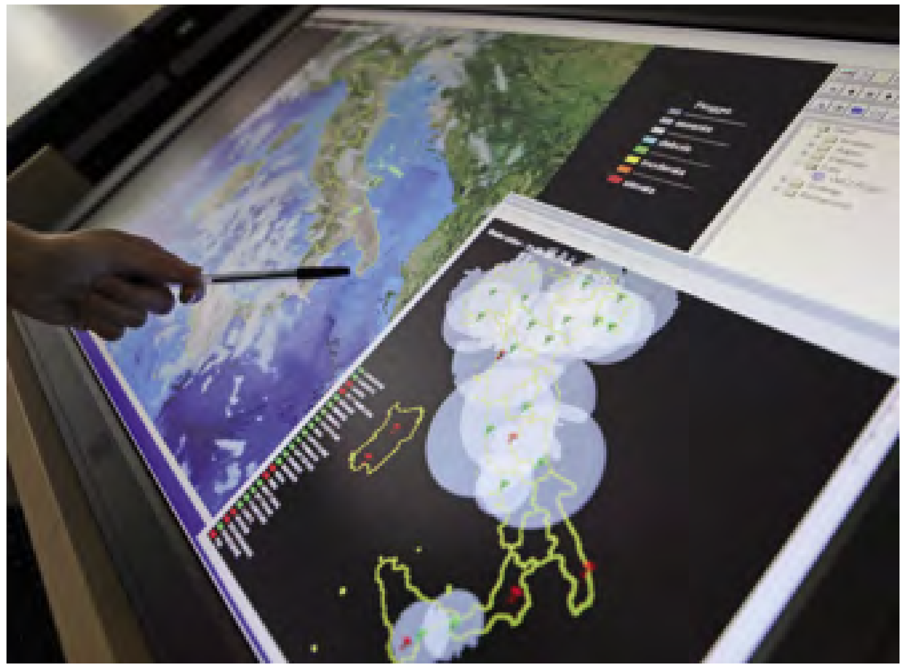
In the **forecasting** and **prevention** phases, in addition to the specific and peculiar activities of the Scientific Community (see Focus 9), we should recall the structures in charge of managing meteorological services at national level, with particular reference to the role played by the Armed Forces, which participate in meteorological forecasting activities also through the issuing of related periodic bulletins on avalanche risk and exchange of information and data on climatology. In addition, ISPRA is part of the SiAM-National Warning System for Tsunamis generated by earthquakes, as owner of the National Tide Gauge Network and related data. This network consists of tide gauges, positioned mainly in the ports, which have the function of confirming, where possible, the impact in real time of tsunami waves along the different stretches of coast, following tsunami events. The CROSS-Remote Operation Center for Medical Aid Operations is part of the civil protection planning activities, in particular for coordination of health interventions. To deal with the event in the early hours, an Operation Center is activated and located outside the territory of the affected Region. It is picked among the "118" emergency health service operation centers already operating in other Regions and eligible to play the role of support to national coordination activities of health resources for the purpose of emergency medical assistance.

Police Forces also play a role in the planning activities. In particular, they are involved in national planning for the volcanic risk of the Vesuvius and Phlegraean Fields, preparing the adoption of measures to ensure the possible displacement of the population at risk, priority mobility to the rescue system, access control to areas and control of evacuated areas.

In the **emergency management** phase, each Operational Structure is called to intervene by readily providing competent contribution with an essential operational link to effective rescue and assistance to population.

In the **post-emergency** civil protection activity, again the National Fire Brigade plays an important role, both for the first structural checks and assessments of buildings following seismic events and ground failure, and for securing unsafe parts or the delimitation of the areas of the territory to be closed off, due to the risk of even partial collapses, in particular in case of earthquakes. For the recovery of normal living conditions and to support economic and productive activities, the contribution of the National Health Service can be relevant for issues of public hygiene and zootechnics, the latter with particular evidence where the emergency affects rural territories with presence of farms and livestock.

Within the Operational Structures of civil protection, finally, we should mention the Technical-Scientific Community with their Competence Centers, the civil protection organized Volunteering system, the Italian Red Cross Association and the National Alpine and Speleological Rescue Corps, treated in the text in other Focuses.



As part of the civil protection Operational Structures (see Focus 8, Figure 10), the role of the Scientific Community should be highlighted as it provides, mainly through the Competence Centers, technical-scientific services for civil protection purposes both in ordinary time and in emergency (see Focus 9).
The contribution of the National Commission for the Forecasting and Prevention of Major Risks is also fundamental, it in fact constitutes the technical-scientific advisory body of the Civil Protection Department (Legislative Decree n. 1/2018, art. 20). The commission, often referred to simply as the Major Risks Commission, provides technical-scientific opinions on questions and topics posed by the Head of the Civil Protection Department in relation to the various types and potential risk situations, imminent or ongoing, or even proposals to update or improve assessment, forecasting and prevention skills with respect to civil protection risks. The contributions of the Competence Centers and the Major Risks Commission are fundamental for implementing the strategies for forecasting and preventing civil protection risks and for the management, from a technical-scientific point of view, of emergencies.

Photos 44, 45. Rome, 2016. Monitoring of radar network data in the Central Functional Centre of the Civil Protection Department. The radar platform is one of the products implemented on the basis of a consolidated research activity of the national and international Scientific Community, as well as of the experiences of similar regional structures and Competence Centres.

COMPETENCE CENTRES

Art. 21 of the Legislative Decree n. 1/2018 deals with the Civil Protection Competence Centers and states that, within the Scientific Community and in line with the risks of civil protection (see Chapters 2 and 5), «research bodies and institutes, consortia and university structures which are owners and make available knowledge and provide research and innovation products that can be integrated in civil protection activities, can be included among the Competence Centers». They provide services, information, data and technical-scientific contributions and elaborations in specific areas. These centers include research Institutions and Universities, but also State Administrations, Agencies and Basin Authorities. The Competence Centers currently recognized are very numerous. The complete list is available on the official website of the Civil Protection Department.

The activities carried out by the Scientific Community, even in the form of Competence Centers, pursuant to art. 19 of the Code, can be traced back to four types:

a) ordinary and operational activities, which include, among other things, monitoring and surveillance of events, the development of databases and other useful activities, for the management of emergencies and forecasting and risk prevention, that provide products of immediate use. It is natural to imagine these activities applied to civil protection risks;

b) testing activities preparatory to the activities described in point a) and production of scientific contributions and summaries of existing and useful research for this purpose. A typical field of action in this respect is represented by the development of hazard and risk models and scenarios, for example related to seismic, tsunami, volcanic or flood phenomena;

c) targeted research aimed at preparing products useful for risk management [...] and to the study of the related scenarios. Competence Centers have often played a coordinating role in this type of activity by collecting contributions of a much larger Scientific Community than that represented by the Centres themselves;

d) collaboration in activities related to the preparation of technical legislation on the topics of civil protection. For example, by contributing to the preparation of the technical parts of Directives issued by the President of the Council of Ministers or Decrees by the Head of the Civil Protection Department.

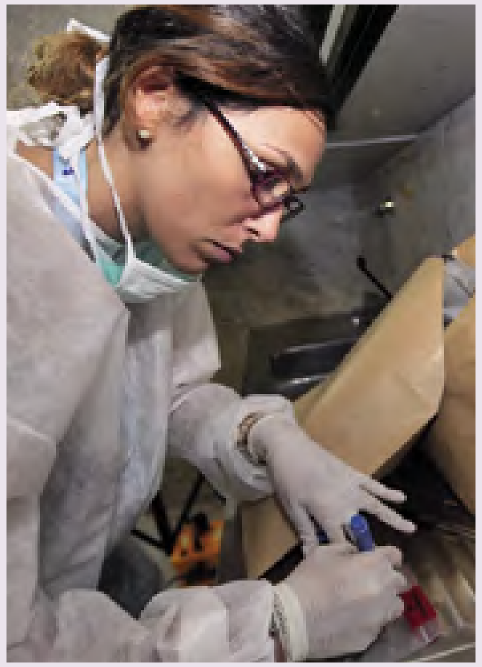


Photo 46. Salerno, 2013. Laboratory technician involved in an international civil protection exercise.

The organization described, implemented in civil protection for more than a decade, is aimed at channelling scientific activities of civil protection interest toward concrete results and products beginning from targeted research (point c) and, through a phase of experimentation and procedural refinement (point b), reaching their peak in the operational phase (point a). Moreover, the technical-scientific contribution to the drafting of regulations and documents, an activity that the Scientific Community has always provided in a longstanding fruitful collaboration, is recognized explicitly (point d).

The same Competence Centers are often involved in emergency activities, during which risk or residual risk assessments, definitions of impact scenarios and monitoring of ongoing phenomena need to be carried out.

In addition to the contribution to research activity applied to the civil protection topics and activities, the Competence Centers, each for the subjects and risks they are called to contribute to the system, participate in the training activities of the operators of civil protection and information dissemination to citizens, with the aim of promoting the adoption of aware behavior and self-protection measures, as well as to provide information to the population on risk scenarios and on the good practices to be adopted. Furthermore, very often the Competence Centers contribute to information campaigns and exercise activities related to emergency planning implemented at national level, promoted by the Civil Protection Department.

As mentioned, individual and associated citizens are also part of the National Service who, also by making their skills available, actively support civil protection activities. Professional Orders and Colleges and their respective National Councils, also through agreements with public administrations, provide a valuable contribution both in knowledge and in terms of technical and operational skills, particularly in the field of prevention and emergency management. Like, for example, the support provided by professional technical experts following seismic events to detect damage and assess usability of buildings, a fundamental activity to guarantee on the one hand the safety of the populations in an affected territory, on the other hand the information necessary for the assessment of the type of civil protection actions to be implemented, both during the emergency management phase and in the subsequent reconstruction activities.

In addition, a contribution is provided by national bodies, institutions and agencies with relevant civil protection functions, along with businesses, corporations and private companies. As an example, we should recall essential services supplier companies (energy, water, landline and mobile network providers) or infrastructure mobility services (road system, railways, ports, airports), both in terms of network management and in terms of distribution (Focus 10).

Finally, the individual citizen has a leading role in civil protection activities. The growing sensitivity to the hazards of one's own territory, associated with an ever-increasing need for individual and collective safety, requires an active participation of citizens in risk prevention activities, particularly in civil protection planning, and in the management of emergency events. In this perspective, as we will also see in Chapter 9, it is increasingly necessary to spread the civil protection culture, based on risk awareness and knowledge of the most appropriate behaviors in order to react at best.

Photo 47. Bologna, 2012. Engineers involved in detecting damage and usability of buildings after the 20 May earthquake.

PARTICIPATION OF PRIVATE COMPANIES IN CIVIL PROTECTION ACTIVITIES

The Civil Protection Code provides the contribution to civil protection activities of, among others, «companies, enterprises and other public or private organizations that perform functions useful for civil protection purposes» (art. 13, paragraph 2).

A fundamental and specific function is carried out, in civil protection activities, by the companies that provide and guarantee mobility and essential services. In this sense, both in the civil protection planning phase and in the emergency management phase, mobility infrastructure operators (road, railway, port and airport) and the companies that manage the distribution and supply of services such as electricity, gas, telecommunications, and water are involved and are an integral part of the system. This involvement takes place both at local and at national level. Even in the civil protection Operational Committee (see Focus 16), in fact, the representatives of the main service companies are present and effectively called to intervene, both for emergency activities and for national planning activities, including exercises.

For an effective intervention in the case of an emergency, the operational procedures aimed at improving the exchange of information both between the operators of national mobility infrastructures and between those in charge of essential services, including landline and mobile telephone operators, are defined during

Photo 48. Rieti, Lazio, 2016. ENEL technicians, civil protection volunteers and Civil Protection Department officials involved in the restoration of electricity after the earthquake.

Photo 49. Pescara del Tronto, Ascoli Piceno, 2016. Mobility infrastructure restoration intervention following hydrogeological events triggered by the Central Italy earthquake.

the planning phase. The related activation procedures are also defined.

In emergency situations, foreseen or in progress, the involvement of the operators of national mobility infrastructure and essential services, including the landline and mobile telephone operators, is needed to ensure the continuity or restoration of the functionality of the infrastructures of the various services, both for the affected population and for the effectiveness of emergency management operations. These subjects are called upon to support the identification of the routes and access points to the affected areas, due to the influx of rescuers and the removal of the population exposed from the areas at risk, and to guarantee the relief operators access and operability of the Coordination Centers in the emergency areas. In this regard, the intervention priorities must be defined and, if necessary, access of the companies' intervention teams must be granted and facilitated for the assessments and the rapid restoration of service networks, also to avoid any domino effects: it is easy to think, for example, of the consequences of the lack of electricity in an area already affected by disaster, also due to the multiple interdependencies that link energy to networks and to many urban and territorial services (heating, lighting, medical assistance, etc.), or to the damage to roads and infrastructure following landslides triggered by earthquakes. Immediate intervention is evidently indispensable for the restoration of normal conditions and, above all, for the rescue of the population hit by disaster.

5 CIVIL PROTECTION RISKS

The risks that civil protection deals with are those defined in art. 16 of Legislative Decree n. 1/2018: seismic, volcanic, of tsunami, hydraulic, hydrogeological, of adverse weather phenomena, of water deficit and of forest fires, and are those with respect to which the Country suffers the greatest or most recurrent fragilities (see Chapter 2). Then there are other risks, for example the industrial or the environmental one, on which the intervention of civil protection can be carried out, without prejudice to the competences of the ordinarily appointed subjects and the consequent activities.

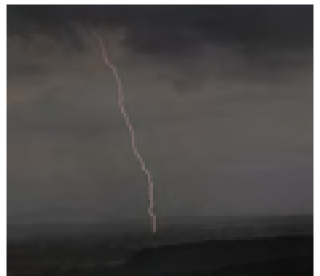

EARTHQUAKES


VOLCANOES


TSUNAMIS


FLOODS


LANDSLIDES


ADVERSE WEATHER


WATER DEFICIT


FOREST FIRES

Photos 50-57. The main civil protection risks according to the Legislative Decree n. 1/2018 – Civil Protection Code (art. 16, paragraph 1).

The UNDRR-United Nations Office for Disaster Risk Reduction describes the risks by referring to potential victims, injured, damaged or destroyed property that may occur in a given place and in a specific period of time (see Simplified Glossary). As already said, these risks can be assessed in probabilistic terms as a function of the hazard, exposure, vulnerability and coping capacity (see Focus 1).

UNDRR
UN Office for Disaster Risk Reduction

PROBABILITY, FREQUENCY, AVERAGE RETURN PERIOD

The forecasting of natural phenomena that can cause disasters is always affected by considerable uncertainty. In nature it is practically never possible to predict the occurrence of an event, among those of civil protection interest, specifying exactly its intensity, the place and the day and time when it will take place. For this reason, to describe the hazard associated with a certain type of phenomenon (for example earthquakes, floods, volcanic eruptions), we use as far as possible probabilistic assessments deriving from more or less sophisticated and complex models, which can be based, in part or in all, on historical statistics and/or on mathematical models linked to a physical interpretation of the phenomena and their genesis.

Probabilistic hazard can be expressed using the concept of **probability of occurrence**, **frequency of occurrence** and **(average) return period**, however referring to an event of given intensity in a certain time interval and in a certain place.

As a first approximation, the three ways of expressing hazard are equivalent. For example, seismic hazard is often expressed with reference to the probability of occurrence in 50 years (typically 2%, 5%, 10%, etc.). By fixing the hypothesis that the occurrence of a strong earthquake does not condition (neither positively nor negatively) the occurrence of other strong earthquakes in the years, decades and centuries following, to a certain probability corresponds a specific return period. For example, a 10% probability in 50 years corresponds to a return period of 475 years for that earthquake, and a frequency of approximately 0.002 events/year (i.e. 1/475).

It is necessary to further understand the return period concept, which is sometimes mistakenly attributed a deterministic meaning. For example, if the return period of an event (earthquake, flood, etc.) of a certain intensity in a certain place is 100 years, it does not mean that this event will re-occur on time in the same place exactly after 100 years. It is actually more appropriate to talk about the average return period. Having a sufficiently long time series, the average return period could be correctly assessed by dividing the observation time interval, for example 1000 years, by the number of times the event occurred with that particular intensity in the same place of interest, for example 10 times: the average re-

Photo 58. Concordia sulla Secchia, Modena, 2012. Damage caused by the 20 May earthquake.

turn period would then be 1000/10 = 100 years and the frequency equal to 1/100 = 0.01.

The fundamental hypothesis on the basis of which we can speak of the average return period and frequency of occurrence, and therefore establish a correspondence also with the probability of occurrence referring to any observation interval, is that the temporal succession of events is governed by a so-called stationary process, i.e. that the conditions that determine the occurrence of the event do not change over time (or at least in the observation time interval of interest). If the process is not stationary, for example because the occurrence of an event affects that of subsequent events or because the mechanisms generating the event change over time (as in the case of climate change), the problem can no longer be simplified by resorting to the concepts of average return period or frequency of occurrence, but it is necessary to resort to distinct probabilities of occurrence in the coming years (e.g. 5, 10, 20, 50 years).

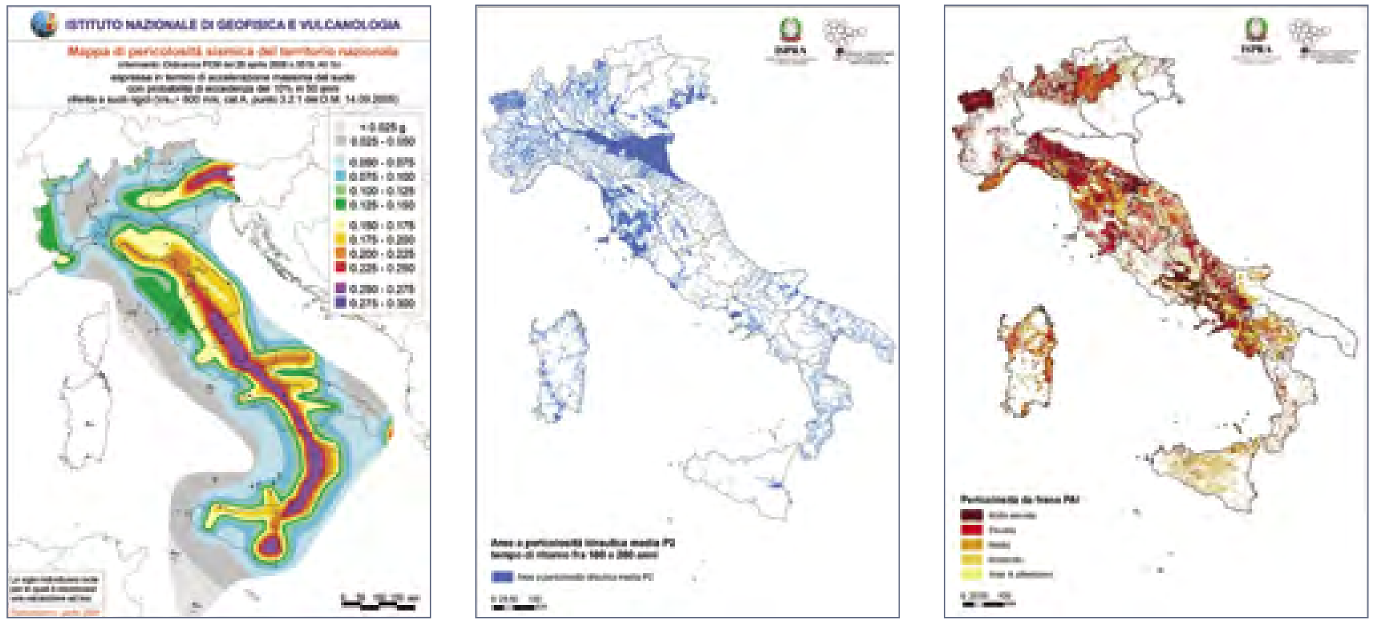
► 5.1 Hazard

In summary, the hazard describes, when possible in a quantitative and probabilistic way, the occurrence of phenomena of certain scale and intensity (regardless of the consequences they can determine) that occur in a certain time interval and in a specific area (see Figure 11).

To calculate the probability of occurrence of phenomena of interest, more or less complex mathematical models are used. The simplest and most direct way, when you have a lot of historical data, is to apply statistical models and evaluate the average return periods of a given phenomenon (see Focus 11). The catalogs of past events allow to evaluate the number of times a phenomenon of a certain intensity has affected a specific geographical area of the territory in a certain time interval, so as to define how frequent these phenomena are in that particular territory and what their average return period is. For a fixed period of time, the greater the number of historical data available, the greater the reliability in defining the return period.

However, it should be noted that not all phenomena repeat at more or less regular intervals over time. For some it is reasonable to assume, for simplicity of calculation, that this happens (for example, major earthquakes in the long run), for others this is not possible. For example, hazardous phenomena related to climate change, such as violent thunderstorms, are varying their return period, which can become progressively shorter or longer depending on the phenomenon considered.

Figure 11. Examples of hazard maps related to earthquakes, floods and landslides. The seismic hazard map identifies the intensity, expressed in terms of maximum ground acceleration on the surface (net of possible amplification effects that depend on the specific conditions of the subsoil) which is 10% likely to be overcome by earthquakes that can occur in 50 years, i.e.,with an average return period of 475 years. The flood hazard map is probabilistic and identifies areas that can be flooded with different return periods. The landslide hazard map provides a classification according to a qualitative scale (from "attention" to "very high hazard") that can be associated with approximate probability values.



The probabilistic assessment method highlights the uncertainty inherent in the definition of the concept of hazard. If in the memory of that territory an event of a certain intensity has occurred only once or there is not even a trace of it, there is extreme uncertainty, if not impossibility, in defining a return period[7]. This does not mean that that phenomenon, with that intensity, is not possible in that territory. Therefore, if there are no sufficiently extensive event histories over time, such as to include an adequate number of events of the intensity under analysis, it is necessary to resort to more sophisticated models, which take advantage of some intrinsic properties of the hazard under analysis (seismic, volcanic, of flood, landslide, etc.) to be able to extrapolate from previously occurred events in the past the probabilities of those that could occur in the future (see Focus 11).

SEISMIC HAZARD

SEISMIC ZONE	ACCELERATION WITH EXCEEDENCE PROBABILITY 10% IN 50 YEARS
1	ag > 0.25 (ag = gravity acceleration)
2	0.15 < ag ≤ 0.25
3	0.05 < ag ≤ 0.15
4	ag ≤ 0.05

Subdivision of seismic zones in relation to peak acceleration on rigid soil (Ordinance of the President of the Council of Ministers N. 3519/2006)

HYDRAULIC HAZARD

FLOOD hazard scenarios

a) rare floods of extreme intensity: return period up to 500 years after the event (**low probability**);
b) infrequent floods: return period between 100 and 200 years (**intermediate probability**);
c) frequent floods: return period between 20 and 50 years (**high probability**).

Legislative Decree n. 49/2010-Implementation of Directive 2007/60/EC on the assessment and management of flood risks

VOLCANIC HAZARD

Reference scenario for the Vesuvius: sub-plinian eruption with **exceeding probability 5%**

Red zone exposed to pyroclastic flows
Yellow zone exposed to ash fallout (about 30 cm)

[7] *That's a key point. Before the availability of instrumental measurements of natural events, one could only rely on historical narrative, as well as, in some cases, on archaeological or geological evidence. And the fact that an event is not reported doesn't mean it did not happen. Since when phenomena have been measured with instruments (such as seismometers for earthquakes, hydrometers for river levels, rain gauges for rainfall) our ability to define probabilities of occurrence have increased dramatically. Unfortunately, however, we do not yet measure all phenomena. For example, we do not measure all landslides and avalanches.*

5. Civil protection risks

As regards seismic hazard, whose assessment is made using complex modeling studies for which knowledge of past earthquakes is only one of the constituent elements, a measure that is used to describe the ground shaking caused by an earthquake is the maximum acceleration that affects the ground during the shock (see Focus 2). Therefore, in the seismic hazard maps, accelerations are assessed for each point of a very dense grid covering the whole national territory, net of possible amplifications due to the geological and morphological characteristics of the site, which have different exceedance probabilities in 50 years. In particular, the best known map is the one relating to a 10% probability in 50 years[8], equivalent to a return period of 475 years (Figure 11).

Figure 12 (page 96). Three different ways of expressing hazard. The seismic classification in Italy identifies four zones by setting three thresholds of intensity of the shaking, expressed in terms of maximum ground acceleration (see Focus 2), as represented in the seismic hazard map relating to 475 years of return period (10% probability in 50 years). The hydraulic hazard classifies the event scenarios by referring to three different return periods, 500, 100-200, and 20-50 years. The volcanic hazard outlines reference scenarios, on which civil protection actions are based, by identifying areas subject to the most damaging volcanic phenomena and identifying one scenario that will not be overcome in 95% of the eruptions that may occur.

Based on these accelerations, the Italian Building Code (NTC, 2018) establishes the levels of seismic resistance of buildings to be built or strengthened. Based on the same hazard map, the territory is divided into four seismic zones, with decreasing hazard levels from zone 1 to zone 4 (Figure 13). The division into zones has only a technical-administrative value, above all to establish the type of control over projects in a seismic zone.

If the seismicity of a territory, and therefore its seismic hazard, is not modifiable by man, the seismic vulnerability of buildings can instead be significantly reduced. To this end, starting from the Calabrian-Messina earthquake of 1908, the State intervened by progressively classifying the territory in seismic areas based mainly on the intensity and frequency of past earthquakes, providing for specific rules for the design of buildings in these areas. As we have seen, the entire Italian territory is characterized by a diversified seismic hazard, with respect to which anti-seismic design/construction rules are in force to reduce the consequences of earthquakes on newly designed buildings. However, the toughest challenge is to reduce the vulnerability of existing buildings, infrastructure and building stock. We should also stress that even if the first anti-seismic regulations and the first seismic classification of Italy's territory date back to 1909, the whole national territory was formally classified as seismic as recently as in 2003 (Ordinance of the President of the Council of Ministers n. 3274/2003) and, therefore, only after that date anti-seismic regulations were applied throughout the national territory (Figure 13).

[8] *50 years is the time order conventionally assumed to be the nominal life of an ordinary building. This obviously does not mean that the construction, at the end of this period, should be decommissioned immediately, but rather that it requires special attention in relation to possible deterioration of materials and changes in regulations and conditions of use, and may have to be subject to re-assessment, extraordinary maintenance or, if at all, be decommissioned.*

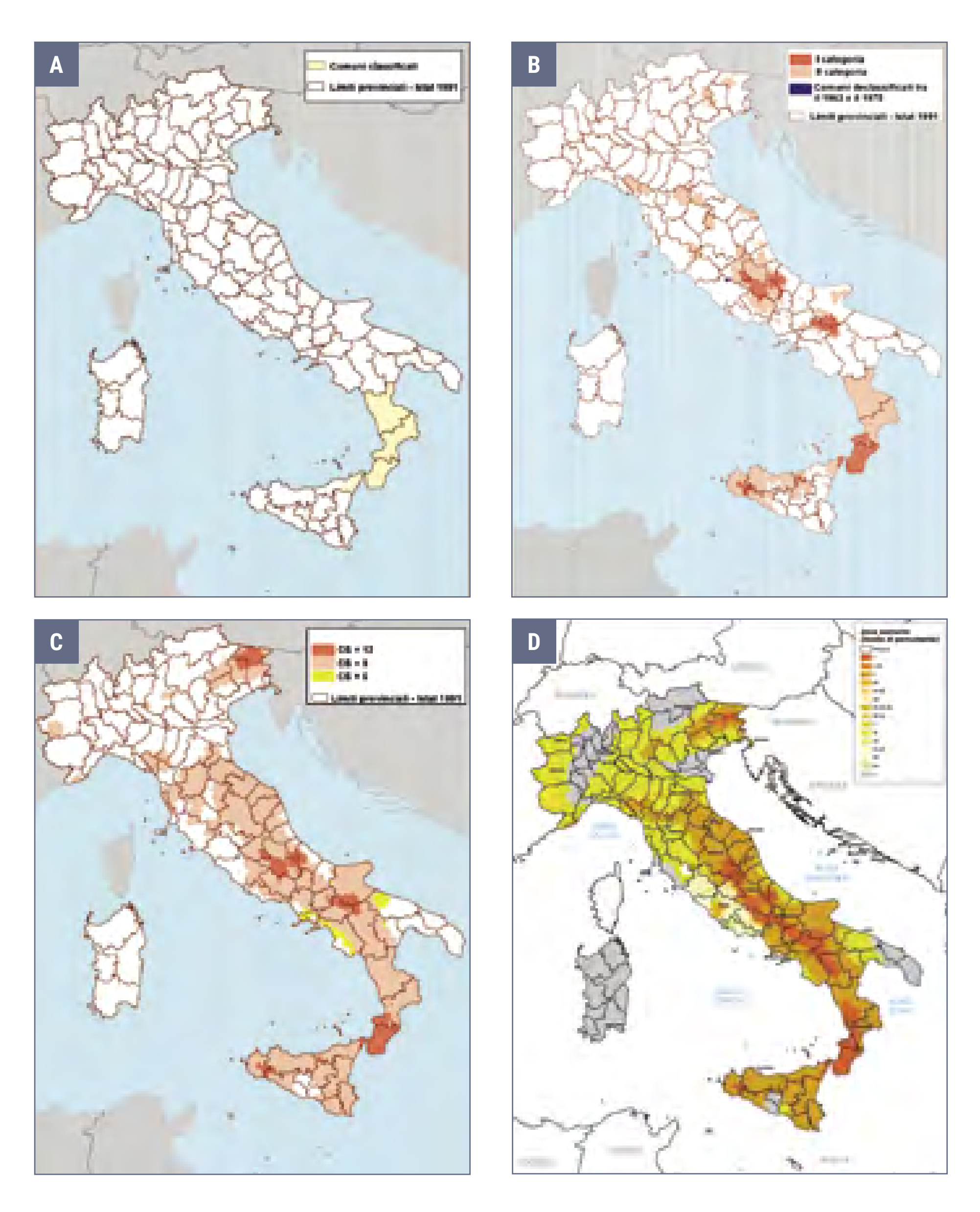


Figure 13. Seismic classification maps of the national territory. **A.** First classification, of 1909, issued after the Calabrian-Messina earthquake of 1908, in which a single category was provided. **B.** Classification in force since 1975; the map clearly shows how the zones are classified as seismic, in two categories, after the occurrence of individual earthquakes since 1900, such as the Avezzano earthquake of 1915 or the Irpinia event in 1930. **C.** Classification according to three seismic categories, in force after 1984, in which for the first time knowledge of historical earthquakes and in general of seismic hazard was taken into account. **D.** Seismic classification currently in force, updated to January 31, 2020; the whole territory is classified into four main seismic zones.

Much of the built territory, from the last century and even earlier, was therefore built prior to the obligation to apply any seismic regulation or building restrictions and this makes the Country's seismic vulnerability quite high. Huge investments and rational risk reduction strategies are therefore required, based on accurate risk assessments (Figure 17) and cost-benefit analyses to optimize the use of future investments in seismic prevention.

In the case of volcanic hazard, there are several measures and information that can help in classifying eruptions. A classification of volcanic eruptions is obtained from the combination of quantitative data (such as volume of products emitted, fragmentation of magma and height of the eruptive column) and/or

from qualitative observations (see Focus 4). Even in the case of volcanic eruptions, the reference scenario for civil protection activities must be assessed in terms of probability. For example, by checking the historical records of volcanoes – as in the case of Vesuvius or the Phlegraean Fields – these report on strombolian, subplinian or even plinian activities (see Focus 4). However, the set of events classifiable as subplinian and strombolian corresponds to 95% of those that have occurred; therefore, it can be estimated that, provided there is an eruptive event, the probability that it is of subplinian or strombolian type is 95%. The actions of the civil protection system, in this case, were therefore calibrated against a subplinian scenario. A plinian eruption is always possible, but has a much lower probability of occurrence, equal to 5%.

It should be emphasized that, as opposed to seismic hazard, the probability of occurrence of certain types of volcanic eruption does not refer to a predefined time interval (for example 50 years), but to the condition that the event does occur (conditional probability). For example, in the case of the civil protection plan for the Vesuvius, a subplinian eruptive scenario such as the one occurred in 1631 was taken as a reference. In defining a volcanic hazard scenario, in addition to the eruptive history of the volcano, other factors are also taken into consideration, related for example to the current state of the volcano (such as the amount of magma available for the next eruption, whose volumes are estimated by volcanologists through sophisticated methods of investigation of the magma chamber in the subsoil); computerized simulations are also carried out through elaborate numerical models, which allow to identify the area that can be invaded by pyroclastic flows (Red Zone) or affected by significant ash fallout (Yellow Zone). Even in these cases, the uncertainties of knowledge and modeling of the phenomena necessarily lead to the adoption of probabilistic assessments.

As per flood hazard scenarios, the return periods to be taken into account are dictated by the Floods Directive (Directive 2007/60/EC), which defines floods with return period of 500 years as of low probability, those with return period between 100 and 200 years of intermediate probability, and those with a return period between 20 and 50 years as frequent. The related perimeter of areas that can be flooded is important for territorial planning, as it determines restrictions for the transformation of the territory, for example for the construction of new structures and infrastructures or for changes to the existing building stock. Floods that occur more recurrently often are considered more dangerous, even if of smaller "magnitude". The fragility of the territory, also due to its ever increasing anthropization as well as climate changes, that entail the intensification of extreme and localized phenomena, is taken into account. Therefore, the management of the alert system (see Focus 13) and the issuance of alerts is referred to pluvio-hydrometric threshold systems based on return periods of less than 20-50 years. It should be noted that the calculation of return period (see Focus 11) takes into account the various uncertainties inherent in the statistical analysis. Therefore, for example, the city of Genoa has recently been hit by a series of events which, on the basis of the time intervals available, have more than one hundred year return period, but which, if referred to the last 10 years, have much lower return periods.

Here are some examples:

- flood event of the Arno river basin, 4 November 1966. It caused 35 victims. A return period of the order of 200 years has been assessed;
- flood event of the Po river basin, 6 November 1994. It affected the territory of the provinces of Cuneo, Asti and Alessandria in Piedmont, causing 70 victims. A return period of the order of 200 years has been assessed;
- flood event in the Veneto Region, 31 October-2 November 2010. It caused extensive damage, mainly due to bank failures, two victims and one missing person. A return period of the order of 50 years has been assessed;
- flood event of the Tiber river basin, 11-12 November 2012. It affected the Paglia river and the city of Orvieto, and caused extensive damage but no casualties, as it occurred in the early hours of the day. A return period greater than 200 years has been assessed.

► 5.2 Exposure

With regard to exposure (see Focus 1 and Simplified Glossary), in the area considered by the scenario of the prefigured event or in the territory considered in the hazard maps, the exposed property or assets are usually expressed in terms of numbers (people present, buildings, etc.) or economic value, where possible, or in terms of other quantities better correlated to the economic value (volume or total area for buildings, etc.). Figure 14 shows, for example, the number of people residing in Italy in the various areas subject to seismic, volcanic, landslide or flood hazards. These are statistical data derived from the ISTAT-National Institute of Statistics censuses, referring to resident citizens,

5. Civil protection risks

and therefore characterized by uncertainty if you look at the number of people actually present in those areas at the time considered. The census data are in fact significant at the macroscale, because they follow an evolution connected to the updating of the ISTAT data and do not take into account, for example, the daily and seasonal fluctuations. Consider the case of the population exposed to volcanic risk on the island of Stromboli in Figure 14, where, unlike the other figures shown, the exposure in the middle of summer is highlighted, with about 5 thousand people, compared to the exposure in the winter, when only the resident population would be counted.

It should be noted that exposure is strongly correlated to the concept of soil consumption (see Figure 15) and therefore to the government of the territory responsible for regulating the urbanization of new areas, which must take into account the hazard of these areas to avoid increasing the risk by increasing exposure.

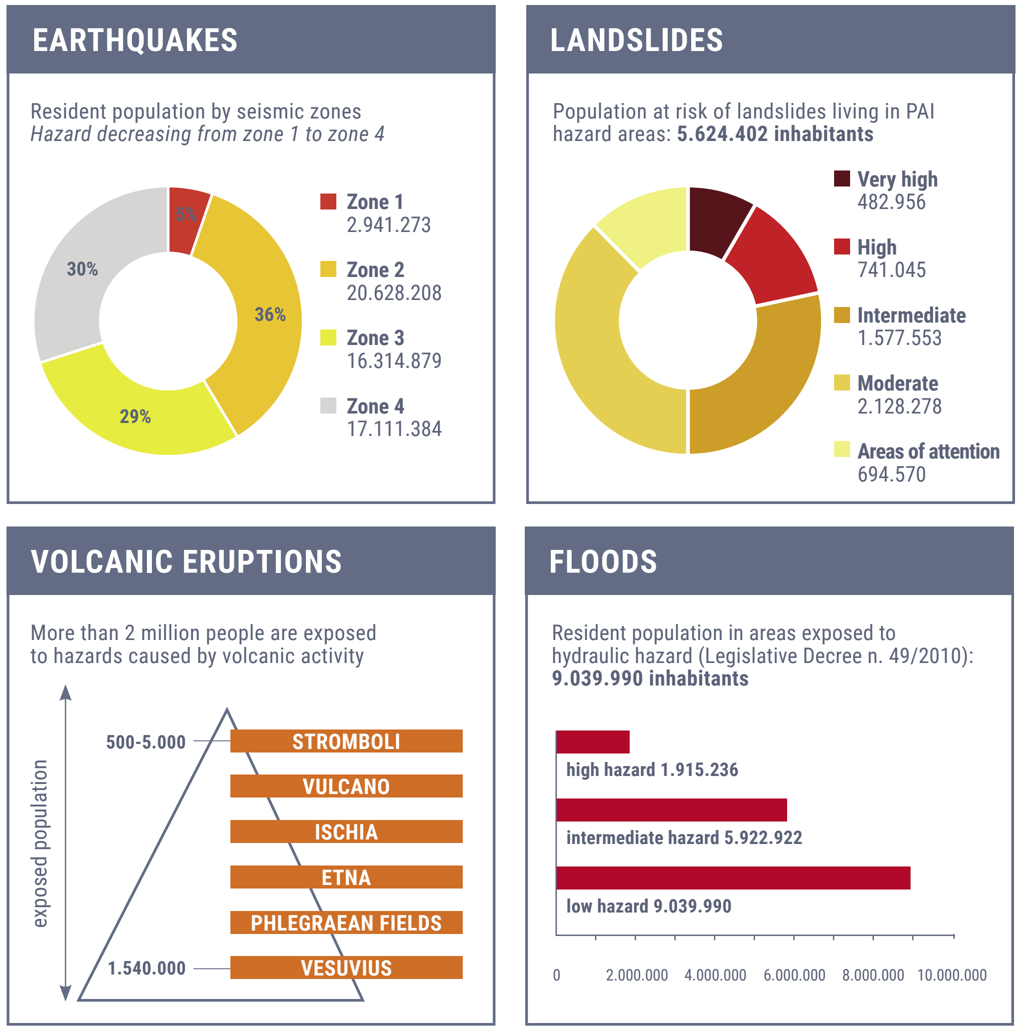


Figure 14. Population residing in areas exposed to the hazard of earthquakes, landslides, volcanic eruptions and floods. In many cases the different hazards coexist, even if the corresponding phenomena rarely occur simultaneously or at close intervals. Sources (from left to right): earthquakes, National Institute of Statistics 2001; landslides, Institute for Environmental Protection and Research 2018; volcanic eruptions, Civil Protection Department 2018; floods, Institute for Environmental Protection and Research 2015.

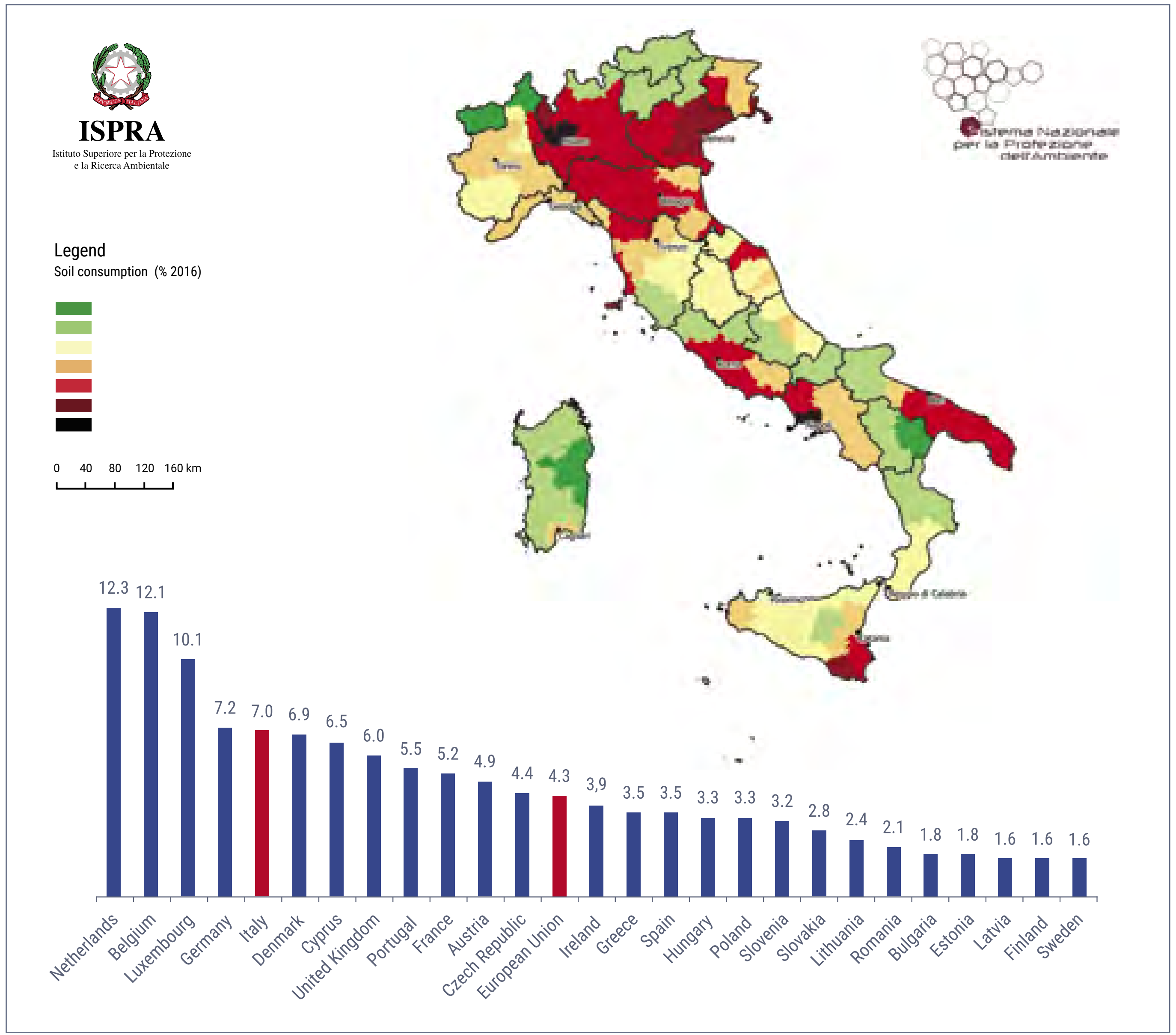


Figure 15. Soil consumption in percent in European Countries for the year 2016. Source: Institute for Environmental Protection and Research.

Some risks are aggravated by the consumption of soil which increases the hazard levels, as for example, by creating roofs and asphalt surfaces, new soil surfaces are waterproofed which, in case of hydraulic and hydrogeological hazards, cause a decrease in the water absorbed by the same and, consequently, an increase in the flow and speed of the water that flows into the natural drainage network.

► 5.3 Vulnerability

The concept of vulnerability, which represents the third risk factor (see Focus 1 and Simplified Glossary), is extremely broad and diversified in relation to the objectives to be achieved with the specific risk assessment.

If, for example, the risk assessment is aimed at determining the cost of restoring damaged buildings, it is essential to know, in addition to the number and value of the exposed elements (buildings, infrastructures, etc.), also their physical vulnerability, that is their propensity to be damaged or destroyed by a certain hazard. If, on the other hand, the objective is to estimate the number of victims expected for a given event or for the hazardous conditions of a certain area in relation to the events (of different intensity and probability of occurrence) that may occur, then it is necessary to consider, in addition to human exposure, also the vulnerability of people. If the objective is to produce a broader economic assessment, for example also referring to losses due to the interruption or impairment of economic activities, i.e. the so-called indirect losses, it is necessary to know, among other things, also the vulnerability of these activities compared to the physical damage caused by the events to the buildings, infrastructures and plants or with respect to the event itself.

In any case, many of the risk assessments have as a first step a forecast (probabilistic) of physical damage to exposed property hosting people, goods, economic activities (buildings of various types) or that allows the various activities to be carried out (infrastructures of different type). Obviously this does not apply when the hazardous phenomenon directly affects people (e.g. a pandemic), assets (e.g. flooding of a historical archive) and activities (e.g. a water crisis impacting on agricultural activities), and therefore their damage is not directly related to the damage of assets.

Referring more closely to physical vulnerability, that is, the proneness of the elements exposed to be damaged or destroyed by a given event, it can be easily understood how the intrinsic vulnerability of the exposed element differs according to the hazard considered (earthquake, landslide, flood, etc.).

If that element (a house, a bridge, etc.) is able to resist to the impact caused by a natural event without damage or with minor damage, then it is considered less vulnerable. If, on the other hand, the element hit is incapable of resisting and can be damaged or even collapse, then it is considered partly or very vulnerable. Physical vulnerability can be quantified by means of appropriate experimental investigations, analysis of building monitoring data (see the Seismic Observatory of Structures) and/or numerical assessments on the exposed element considered, or, when dealing with sets of elements of the same type, through statistical processing of damage data from past events (Dolce et al., 2019).

Physical vulnerability is also associated with individual and social vulnerability that depends on different characteristics, for example physical, psychological, cultural, economic and environmental, specific to both the individual and the community considered: usually a calamity that affects a territory, in addition to causing victims and injuries, affects people's habits and everyday life, their social network and relational and cultural references, as well as economic activities, i.e. employment opportunities, and can thus favor the depopulation of a territory, even more if that area was already in a state of socio-economic decline.

In this context, the reflection currently underway in the world of civil protection is how to take into account individual and social vulnerability, paying particular attention to those social groups which, given certain hazardous conditions, may be more vulnerable than the rest of the population (for example, foreigners who do not understand the information in Italian) without leaving anyone behind (following the "leave no one behind" approach).

It is interesting to note that some risks are not, as they say, gender neutral but affect males and females differently, also varying according to different age groups and different countries of the world. For example, while in economically developing countries females are generally more exposed to risks, in particular to floods, the same is not true for more developed countries, such as Italy, where statistics say that males are more vulnerable to landslides and floods, and rather significantly too (Salvati et al., 2018). In all parts of the world, the reasons for the difference essentially lie in the culture of different communities, in their social structure, as well as in the different propensity to risk of males and females, well known in behavioral sciences.

Photo 59. Vibo Valentia, 2006. House damaged by a flood.

EARTHQUAKE
Ischia, Naples, 2017

FOREST FIRE
Peschici, Foggia, 2007

TSUNAMI
Stromboli, Messina, 2009

LANDSLIDE
Cerzeto, Cosenza, 2005

VOLCANIC ERUPTION
Etna, Catania, 2002

FLOOD
Grosseto, 2012

Photos 60-65. Examples of damage related to physical vulnerability.

Individual and social vulnerability can be mitigated by the capacity of a community to prepare, resist and react to a disaster (Figure 16). As the capacity increases, the risk is therefore reduced, both in the immediate and in the long term, and capacity grows and is strengthened by putting in place structural and non-structural civil protection prevention activities. Among the latter, training and information dissemination to citizens, as well as their active participation and involvement in the implementation of prevention measures are extremely important. But no less relevant is the ability, at all levels of the public administration, to plan and manage emergencies, guaranteeing the continuity of the administrative function and of the fundamental economic and social functions of a community.

Figure 16. Examples of civil protection non-structural prevention measures that contribute to enhance the capacity (C). Source: Civil Protection Department.

C increases with:

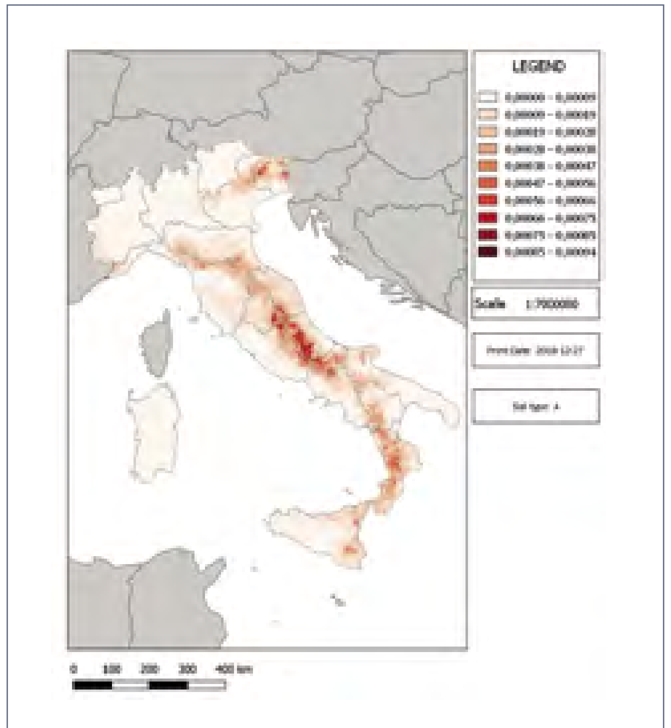
- Risk and criticality assessment
- Strengthening the sense of community
- Training
- Dissemination of knowledge and culture of civil protection
- Alerting
- Learning from others
- Information to the population on risk scenarios and related rules of conduct
- Involvement of citizens
- Planning
- Knowledge of exposure and vulnerability
- Data sharing
- Link between civil protection planning and territorial planning
- Public education and awareness

Figure 17. Seismic risk map in Italy. Probability of occurrence in one year of damage level D5 (partial or total collapse) of the residential building stock (taken from the National Risk Assessment, 2018). This seismic risk map is an example of risk assessment consistent with its probabilistic definition (see Focus 1).

► 5.4 Risk

In principle, a quantitative risk assessment would be necessary, measured in probabilistic terms, by adopting metrics that allow to compare different types of risk (for example, the number of expected victims per year) related to the same territory.

Often, however, this is not possible, because risk assessment suffers from an intrinsic difficulty, linked both to the determination of the individual parameters necessary for its assessment, with higher or lower levels of uncertainty (see Focus 15), and to the combination of these parameters, which further increases the degree of uncertainty of the risk estimate. Added to this, the more general difficulty of quantitatively assessing socio-economic vulnerability and capacity.



Only for some risks a quantitative assessment of the effects of the hazard is possible, even only on buildings and infrastructures and, indirectly, on people. This is true for seismic risk (see Figure 13) and the same direction is being taken for the tsunami risk. In these cases, it is possible to make estimates of the likely economic and human losses and to develop optimized risk reduction strategies based on a quantitative comparison. For hazards

and risks such as earthquakes and tsunamis, there are quantitative analyses on a national and even supranational scale (see the GEM-Global Earthquake Model Foundation program and the European project TSUMAPS-TSUnami Hazard MAPS for the NEAM Region).

The national-level qualitative risk assessment, represented by maps, is made starting from the concept that the risk is greater the more likely the event is to happen and the greater is the extent of the expected damage. Setting up a risk matrix may help (Figure 18), dividing the probability and severity into a descriptive grid of the expected event. By modulating these parameters in the grid, it is possible to qualitatively define the risk class to which that territory, at that time and for that risk scenario, belongs.

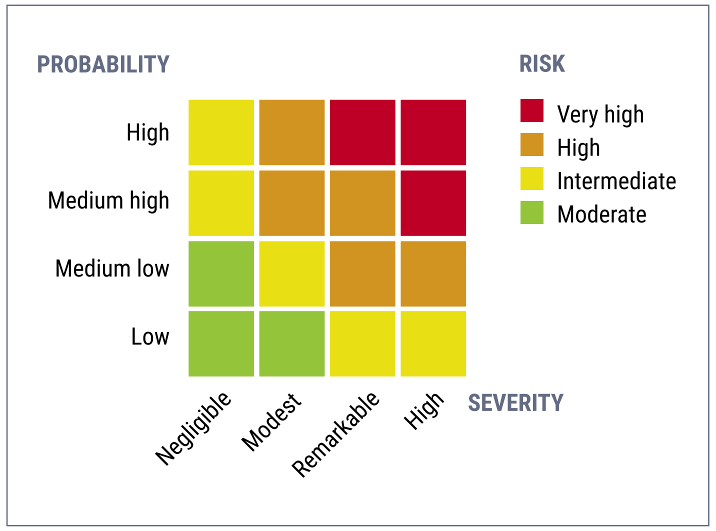
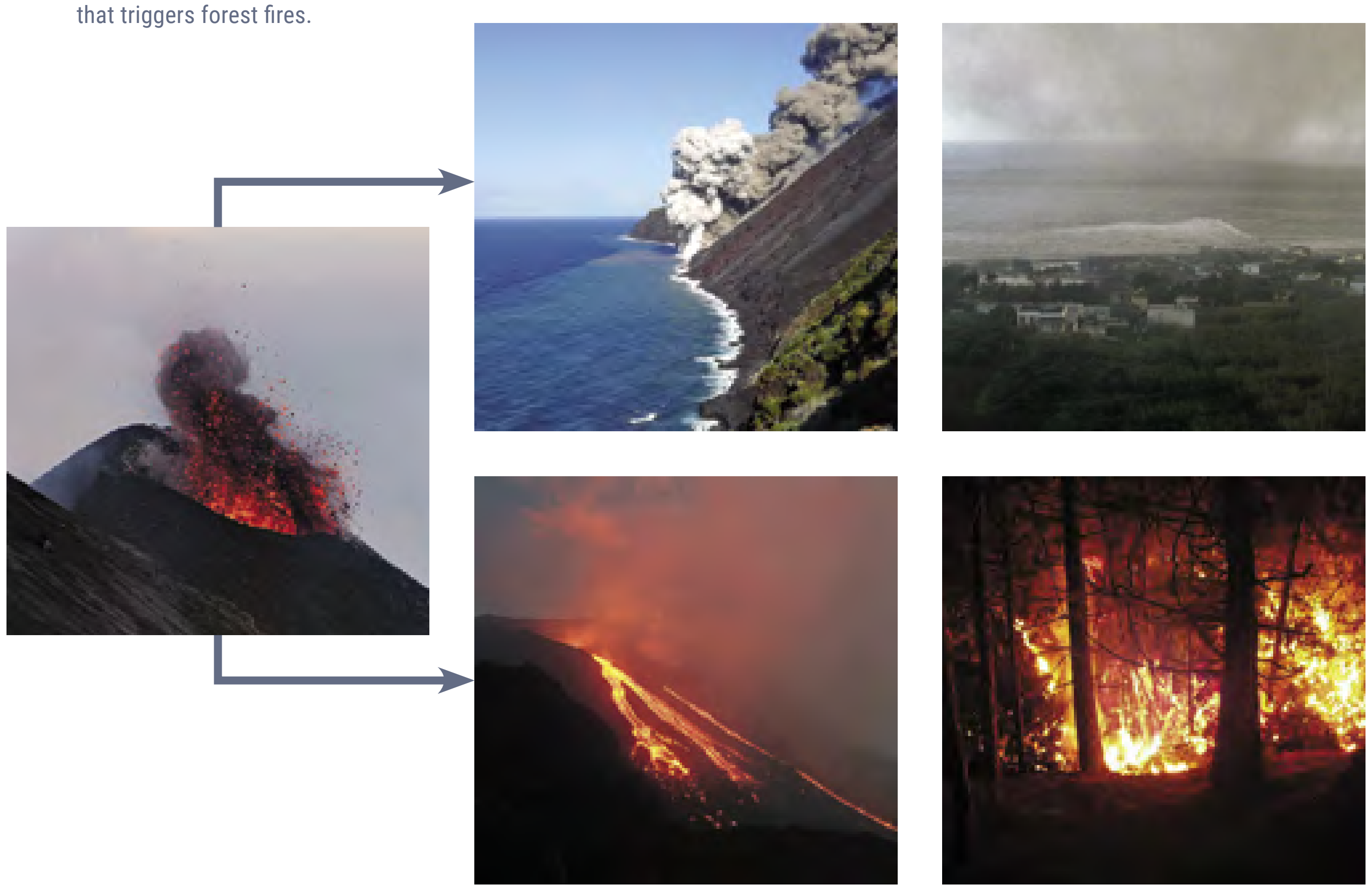


Figure 18. Example of a matrix for qualitative risk assessment. The zero risk is not included in this graph because it would correspond to a null probability of the event on the y-axis.

One aspect must be clarified: in our territory there are no, or rare, conditions in which the hazard, vulnerability and exposure are zero. Therefore, based on its definition, the risk cannot be zero. To have this result, in fact, in the risk equation at least one of the hazard, exposure or vulnerability parameters should be equal to zero (capacity is not decisive for canceling the risk). This implies that, when actions or strategies (or slogans) pledging "zero risk" are proposed, one must be aware that, in reality, there will always be a residual amount of risk to live with, which is why both risk reduction and capacity and resilience increase are important and complementary activities (see Simplified Glossary).

Very often the risk assessment of a given area requires taking into account several types of hazard and risk at the same time, carrying out so-called "multi-hazard" and "multi-risk" assessments. If the catalogs of calamitous events affecting a particular area tell us, for example, of a territory that may be subject to floods, earthquakes or volcanic eruptions, then all these categories of risk have to be considered, taking into account that they may occur simultaneously, or in a short time sequence, while the consequences of the first event have not yet subsided.

The assessment of the so-called "multi-hazard risk" can be very complex. Even more complex is the risk assessment when events occur according to a temporal succession, sometimes very short, because they depend upon each other – the so-called "cascade effect" – or because they are induced by a common triggering cause. For example, there can be an earthquake that triggers the landslide of a slope, which in turn obstructs a stream, creating an additional flood risk. Other examples can be represented by the case of a volcanic eruption that causes the collapse of a slope of the volcano into the sea, and the latter in turn causes a tsunami, as happened in Stromboli in 2002. Or, again, by a lava flow or a pyroclastic eruption that triggers forest fires, as occurred in Stromboli in 2019. In the cascade effects, the presence of technological accidents is frequent: as for example the case of the Tohoku earthquake in Japan, which caused a tsunami which, in turn, determined the nuclear accident in Fukushima. When a natural event triggers a technological disaster, we speak of NATECH-NAtural hazard triggering TECHnological disasters.



Photos 66-70. Examples of cascading effects. Upward arrow: a volcanic eruption leads to the collapse of a side of the volcano in the sea that generates a tsunami. Downward arrow: a volcanic eruption produces a lava flow that triggers forest fires.

We have seen how climate change affects the possibility of quantitatively estimating some risks, compromising the validity of the stationary hypothesis of the occurrence of events and making it difficult to adopt the average return periods – and consequently the frequency of occurrence – in the evaluation

of the hazard (see Focus 11). For example, it can cause major changes in the precipitation regime. The events that have occurred in recent years indicate that intense and localized rains are increasingly frequent, as well as other phenomenologies such as tornadoes or cases of exceptional hydrometeors which, at times, can also take the form of hailstones of a more or less coarse size. These types of phenomena, due to their very nature, are difficult to predict.

Photos 71, 72. Example of extreme weather event and resulting damage. The frequency of occurrence of this kind of event is changed by ongoing climate change.

► 5.5 Predictability and forecasts

What has been stated thus far on risk assessment leads us to tackle another far-reaching matter: the predictability of calamitous events, an issue strictly connected to the possibility of promptly alerting the authorities and the population through early warning systems, so as to mitigate the effects of events that may occur in the near future.

Some natural phenomena can be predicted with precision, accuracy and surprisingly large advance: think, for example, of the eclipses of the Sun or Moon, whose details can be predicted with perspectives of tens or hundreds of years. However, most natural catastrophic phenomena associated with civil protection risks have a very different behavior which depends on the non-linear progression of various factors which are not fully known and therefore a precise prediction of where, when and with what intensity they will occur is very difficult, if hardly possible.

In the case of earthquakes, as already seen, forecast assessments are basically related to the hazard of the territory (Figure 1). They are therefore probabilistic and essentially long-term (tens-hundreds of years) and are mainly based on statistical data, therefore on the knowledge of the seismicity that has historically affected our Country, as well as on geological knowledge (for example, the seismotectonic setting of the different parts of the territory). We know which areas are affected by a high seismic hazard, due to the frequency and intensity of earthquakes, and therefore where a new seismic event of high intensity is more likely to occur, but it is not possible to establish precisely the exact time and place in which it will occur and its magnitude. Probabilistic forecasting allows to identify hazardous areas and to classify them according to the probability of strong earthquakes and the frequency with which we can expect them.

An alternative way to predict earthquakes would be to rely on knowledge and monitoring of precursor phenomena. However, the numerous researches conducted around the world for many decades have yielded disappointing and contradictory results so far (Hough, 2013). In fact, no precursor of those studied occurs regularly and exclusively before a major earthquake; this is why research is moving towards observation and the simultaneous measurement of several elements deemed potentially diagnostic, collecting and analyzing data series with a rigorous experimental approach based on transparency and reproducibility of methodologies and results. In this regard, it is worth recalling that Legislative Decree n. 1/2018 – Civil Protection Code describes the knowledge and scientific products that can be integrated into civil protection activities as those that «have reached a level of maturity and consensus recognized by the Scientific Community according to the practices in use».

Among the civil protection risks, the volcanic one is often considered a "foreseeable" risk, because it is believed that the phenomena predicting the rise of magma towards the surface can be recognized and measured, for this reason they are called "precursors" (earthquakes, fractures of the ground, deformations of the volcanic edifice, variations in gas emissions and temperatures of fluids, etc.). This is a simplification which, however, does not take into account the complexity and extreme variability of volcanic phenomenologies and the difficulty in evaluating and interpreting them. In fact, it is more appropriate to consider precursor phenomena only as indicators of an ongoing process. If properly and adequately studied, analyzed and monitored, they can give an idea of the state of activity of the volcano and its possible evolutions, allowing to identify any anomalies. For this reason, some of these parameters are measured through networks of instrumental stations installed on active volcanoes, or observed with other methodologies, for example through data acquired by satellite or with overflights or, more simply, with direct field visits. However, even if these phenomena are studied and monitored punctually, it is not possible to predict with certainty, also due to the peculiarities that characterize each volcano, when and how a volcanic eruption can occur. In the current state of knowledge, therefore, no deterministic form of prediction is possible.

In Italy there are volcanoes, such as Etna and Stromboli, which are open duct vulcanoes and often give rise to eruptions, but there are also obstructed duct volcanoes, such as Vesuvius and Phlegraean Fields, which have not had eruptions for some time. In the era of instrumental monitoring, there has never been an eruption of these last volcanoes that allows to calibrate the signals currently monitored, while for open duct volcanoes we have great availability of data and generally better interpretative ability, although still affected by considerable uncertainties.

Photo 73. Eruption of the Stromboli volcano, 2011.

Photo 74. Eruption of Etna, 2002.

For most flood events, the precursor phenomenon is usually rain, but floods can occur even in the absence or with low rainfall, for example due to the rapid melting of snow or damage to hydraulic works, such as the breaking of an embankment. In the case of rain occurrence, the forecast of the event is linked to that of precipitation, the predictability of which is much higher proportionally to the wider their spatial extent (which usually corresponds also to a certain duration of the phenomenon) and, conversely, it is reduced when the phenomenon takes place on local scales, which typically also correspond to a short duration (but not necessarily a low intensity, actually).

Photo 75. Flood in Lazio, 2012.

Photo 76. Flood in La Spezia area and in Lunigiana, 2011.

The forecast of floods depends, among other things, on the size of the river basins: the larger the watercourse, where the size of the watercourse is directly related to the distance from the mouth and the size of the upstream river basin, the greater will be the forecasting capacity, in particular towards the mouth (however, the forecasting capacity upstream remains lower). In large basins, such as those of the Po or Tiber rivers, persistent and widespread rains are necessary over the entire basin or part of it to form a flood, and the water level

5. Civil protection risks

of the main river rises slowly, with times ranging from several hours to several days. In this case, the evolution of the phenomenon can be followed through hydraulic monitoring – for example by measuring the level of the river in several points – and hydrological and hydraulic models, based on digital terrain models, are used to understand how rainwater converges to valley areas, and which areas will be occupied by the waters and at what times.

In the case of small basins, response times are instead of the order of a few hours or less, and stormy phenomena are sufficient for a rapid rise in the hydrometric levels. These floods are difficult to predict or unpredictable, as the forecast uncertainty of storm phenomena is associated with that of the behavior of small basins, influenced by factors such as erosion, solid transport, landslides and obstructions, which are not easily modeled.

As regards landslides, the causes that predispose and determine them are manifold, complex and often combined with each other. In addition to the amount of water fallen, or melted snow, which is usually the trigger for a landslide phenomenon, deforestation and fires also have an important effect: in wooded slope areas, in fact, the roots of the trees consolidate the soil and absorb excess water. It is therefore complex to define precursors of landslides and the related thresholds, intended both as the amount of rain capable of triggering the landslide movement, and as displacements/deformations of the soil, the exceeding levels of which could determine the collapse of unstable masses. Landslides can also be triggered by earthquakes (seismoinduced landslides) or by volcanic eruptions.

The forecasting of landslides also depends on their typology. If we refer to a single landslide that is monitored, the so-called slow landslides can be forecast with less uncertainty and with more or less long notice times, especially those that give precursor signals that allow carrying out civil protection actions. If it is not possible today to predict exactly where, when and with what intensity a given landslide will occur, there are probabilistic models for forecasting landslides that link the amount of rain (measured, estimated or expected) to the possible triggering of the phenomenon in a certain area. Warning systems are based on these models at different geographical scales, from the local scale, to the regional or river basin scale, up to the national scale (Guzzetti et al., 2020). Each area at risk has specific characteristics, for which specific analyses are required. In the case of situations that involve a particularly high risk, for example unstable slopes that loom over urbanized elements (mobility infrastructures, inhabited centers, etc.), specific studies and assessments must be carried out on the landslide area and monitoring systems must be installed.

Forecasting an avalanche is not easy and this is because the release of an avalanche is often not preceded by a precursor phenomenon, or at least by an evident precursor.

Photo 77. The Montaguto landslide: this is a slow flow that has reactivated since the beginning of 2006 (the image refers to the year 2011, before the start of the safety works).

Photo 78. Sarno mud flow in May 1998.

When avalanches are caused by the sudden loss of stability of the snow deposited along a slope, factors such as the weight of the fresh snow or a thermal rise can trigger it. When the detachment is caused by human intervention, the trigger can be accidental or programmed. Accidental triggering occurs when those who find themselves on foot or on skis along a snow-covered slope involuntarily cause, with their own weight or cutting the snowpack, the release of the avalanche. In Italy, the programmed trigger occurs mainly in skiing areas, when the snowy slopes considered dangerous are cleared with the aid of explosives.

In the two cases, the causes of triggering avalanches are different, but always referable to the loss of internal equilibrium of the snow mass, for example due to a decrease in cohesion, which determines its detachment. The long stay of a layer of snow on the surface, the heating of the air, the action of the wind and rainfall affect detachment.

A correct assessment and forecast of avalanche risk scenarios and their short-term evolution cannot be separated from an accurate analysis of the hazard scenarios (type, nature and intensity of avalanches), from specific and detailed observations and measures carried out in the field and the evaluation of the effects on the ground of the expected avalanches.

The snow and avalanche Bulletin issued by Meteomont constitutes an irreplaceable support tool, as it provides a synthetic picture of the degree of snow cover, the conditions of stability of the snowpack, the avalanche activity in progress, the avalanche hazard and the evolution in the time of all the above factors.

To forecast possible water crises, some indicators are monitored, such as hydrometeorological variables (rainfall, temperatures, etc.) and water availability indices (volumes stored in surface reservoirs, groundwater levels, river flows, outflows from reservoirs, snow reserves, etc.). In addition, since 2007, the Group for the monthly and seasonal climate forecast on a synoptic scale has been operating. It is a group of high technical profile established following the water crisis that hit the Regions of Central-Northern Italy in 2007.

In order to preserve and manage the national water heritage in the most appropriate way, it is necessary to implement a prudent and rational management of water resources, a reduction of consumption and of the vulnerability of water resource distribution systems. For such measures to be effective, it is necessary to resort to participatory forms of governance of resources due to the complexity of the framework for withdrawals and uses. To this end, Observatories on water uses have been set up in each of the national District Basin Authorities, as decision support structures in which the main interested public and private actors participate (relevant Ministries, Regions, Autonomous Provinces, Civil Protection Department, trade Associations, research Bodies and Institutes). Municipalities can participate in case of significant critical issues.

For forest fires, only elements prone to ignition and propagation can be forecast, i.e. the triggering and spreading circumstances, the fuel conditions, the possible presence of dry vegetation and soil moisture. On the other hand, external trigger causes, that can be the strike of lightning, if natural, or the action, voluntary or involuntary, of man, are not predictable in any way. As already reported in Chapter 2, if human action is involuntary, due to irresponsible and careless behaviors, not aimed voluntarily at causing damage, we speak of "culpable" fire. When the action is voluntary, that is, fire ignited voluntarily with the intention to harm the forest and the environment, that is what we refer to as “arson".

The national legislative framework on forest fires (Law n. 353/2000) defines the actions and responsibilities of the various Administrations involved. The main actors are the Regions, which have full responsibility for fire prepredness, prevention and fire fighting activities. The Civil Protection Department is responsible for ensuring coordination of the State air fleet in support of the Regions which, in the shutdown activities, operate with the use of land resources and the aircraft that make up the regional fleets.

The forecasting activity is focused on assessing the conditions predisposing fires well in advance, to alert the regional forest fire and civil protection systems, as well as the Country's suppliers and infrastructure operators.

There are predictive models which, using different variables (weather and climatic conditions, the state of vegetation, physical conditions and land use, morphology and organization of the territory), support the drafting of a susceptibility bulletin for triggering and spreading fires useful for bringing out critical situations in the area, modulating alert levels and preparing the use of personnel and equipment in forest fire fighting. In this regard, the Civil Protection Department daily guarantees the forecast of susceptibility conditions to the triggering and propagation of forest fires through the national forecast Bulletin of fire hazard.

The forecasts contained in the bulletin refer to a provincial scale, estimating the average value of the trigger susceptibility which is divided into three levels (low, medium, high), over a period of time useful for the next 24 hours, and in trend for the next 48 hours.

Many Regions issue a bulletin for forest fires in more detail, such as to allow a more targeted and useful assessment to strengthen surveillance in the area, to activate the various alert levels and to organize extinguishing activities for any fires.

Prevention activities consist of fielding actions aimed at reducing the causes and potential ignition of fire, actions aimed at mitigating damages, training and information activities aimed at the population and trade associations to promote the adoption of rules of environmental protection behavior. The annual census of Municipalities plays a fundamental role in prevention activities, through land register of the stands covered by the fire in the last five years, to place constraints on such stands as required by law (Law n. 353/2000, art. 10, paragraph 2), and through the drafting of civil protection plans for forest fires.

Finally, the active fight against forest fires includes all reconnaissance, surveillance, sighting, alarm and extinguishing activities with ground vehicles and airplanes. Each Region plans these activities within its own regional plan of forecasting, prevention and active fight against forest fires, a reference tool for all activities in the regional territory.

6

THE RISK MANAGEMENT CYCLE AND CIVIL PROTECTION ACTIVITIES

The management of civil protection risks includes a succession of activities of different nature, schematically divided and traced back to four phases that make up a single cycle, in which the development of each phase influences the actions of the next in a continuous manner. The phases of the risk management cycle are: forecasting, prevention, emergency management and emergency overcoming (Figure 19).

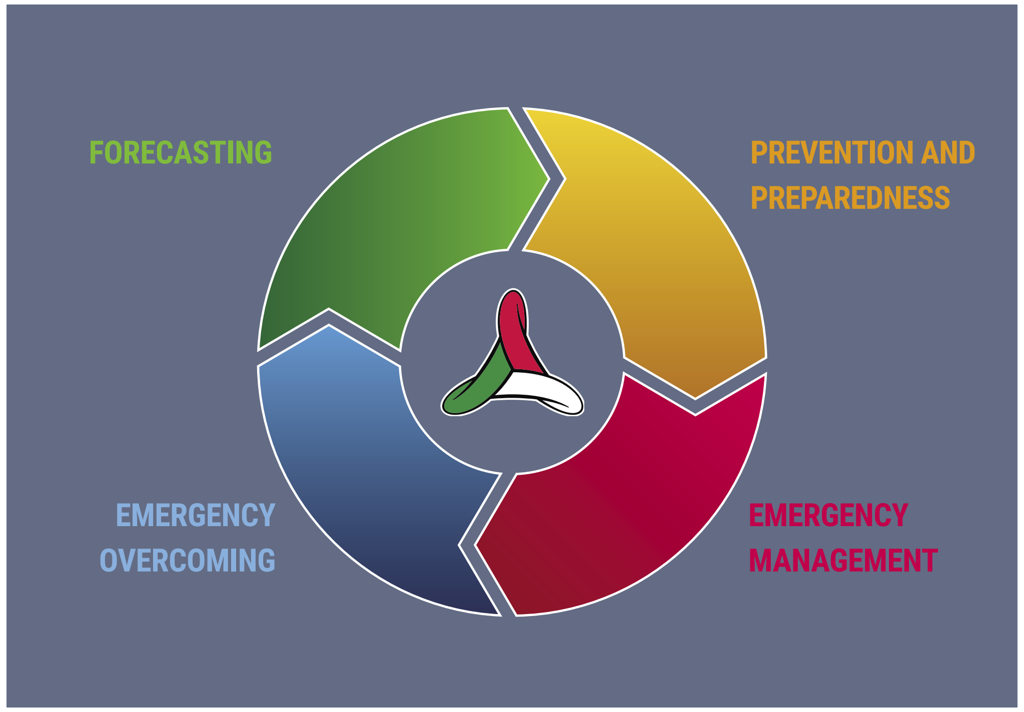


Figure 19. Risk management cycle. Forecasting: identification and study of possible risk scenarios. Prevention and Preparedness: measures aimed at risk reduction. Emergency management: integrated and coordinated set of measures and interventions for assistance and rescue. Emergency overcoming: removal of obstacles to the resumption of normal living conditions.

In many cases, there is also an additional phase dedicated to reconstruction, which however does not fall under the responsibility and competence of the civil protection but rather of the regional and local governments. It is therefore carried out by the competent Bodies and Administrations on an ordinary basis, in case an extraordinary Commissioner is not appointed, as happened, for example, after the earthquakes that hit Central Italy, the island of Ischia, Molise and Sicily between 2016 and 2019.

► 6.1 Forecasting

In the risk management cycle, the forecasting phase concerns all the activities aimed at identifying and studying the possible risk models and impact scenarios. In particular, the scenarios constitute the knowledge base for the National Civil Protection Service's warning alert activities related to risks for which notice is possible, and for the preparation of civil protection planning at the various territorial levels for all risks.

Forecasting a catastrophic phenomenon means defining, in probabilistic terms, where, when and with what intensity it could occur, and therefore identifying possible event scenarios and their impact: for example, in the case of flood risk, defining an event scenario in a given territory involves identifying floodable areas, as well as the related frequency and intensity. We therefore speak of scenarios because a potentially dangerous event, in progress or expected, evolves dynamically and causes different damages depending on its impacting sites and how many exposed and vulnerable elements are present on those sites.

We have seen that forecasting activity, intended as an assessment of a specific risk, in a certain area and in a certain period of time, is carried out using historical and geological information, the results of empirical and/or mathematical models as well as direct knowledge of the criticalities of the territory.

However, forecasting activities are also carried out "in real time", that is, in progress or nearing the event, with the possible support of precursors and their monitoring. In these cases, the expected event and the related effects on the territory can be announced and, during the event, its veracity and severity can be verified through monitoring and surveillance. Pre-announcement allows the National Civil Protection Service to be activated in advance, making it possible to implement the mitigation actions of the effects determined by the event, by implementing the contrast measures provided for in the civil protection plans. When citizens are reached with this pre-announcement activity, so that they can implement self-protection behaviors, the result is also an increase in the capacity and a therefore higher resilience of the communities.

► 6.2. Prevention

Prevention activities are manifold and are implemented by the Components and Operational Structures of the National Service at the various territorial levels. Risk reduction is obtained, in fact, through the implementation of both structural and non-structural prevention actions, also carried out in an integrated form, aimed at avoiding or reducing the possibility of damage resulting from calamitous events, also on the basis of the knowledge acquired as a result of the forecasting activities (see Simplified Glossary). **Structural prevention measures** are real works (retention basins, embankments and canalizations, seismic retrofitting of buildings, etc.) and ordinary and extraordinary maintenance actions on the territory. These activities are implemented by the competent Administrations, which have the resources to finance intervention programs in their own jurisdiction. In this context it is necessary to promote a link between civil protection planning and territorial planning, in order to make the planning decisions of the territory consistent with the needs of sustainability and risk reduction.

In this regard, "passive" **non-structural prevention measures** include the application and updating of technical regulations, with particular regard to urban planning regulations, which govern the transformation of the territory, and building codes, which affect the safety of structures and infrastructures taking into account the type and level of risk to which that territory is exposed. The adoption of measures that favor the activation of insurance coverage also by private individuals constitutes a preventive measure.

Then there are also "active" non-structural measures, such as the preparation of civil protection plans at different territorial levels by the Authorities and the Operational Structures of civil protection, the training of civil protection operators – from public employees to representatives of public and private companies who carry out civil protection tasks, up to volunteers – the dissemination of knowledge and of the culture of civil protection and the information to the population on risk scenarios, related rules of conduct and civil protection planning. Exercises and other training activities are further prevention measures that also provide for the involvement of the communities, and are carried out in order to test planning, system operations and support the dissemination of knowledge.

Photo 79. Chieti, 2018. Volunteers meet citizens in the square to promote the good civil protection practices that are the object of the "I Don't Take Risks" campaign.

CIVIL PROTECTION EXERCISES

Exercises are part of a training programme designed to verify the activities and measures provided for in civil protection plans, developed according to the risks present in the area. During these initiatives, in particular, the organizational model and methods of intervention are tested, and civil protection operators are trained to be prepared in the event of an emergency. Furthermore, such exercises promote information activities for the population on the risks and contents of the plans.

The preparation of exercises is an important training moment. On the basis of the objectives identified, the planning of the exercise activities requires the active involvement of the various subjects who also operate in an emergency, the mutual knowledge of everyone's skills, the in-depth analysis of what is foreseen in the plans and what will be necessary to put in place in a coordinated manner in case of a real event. Exercise activities therefore represent a test of the flows of communications and operating procedures of the civil protection system and, in some cases, also provide for the direct participation of the population. Exercises are also essential in the longer term to report in the planning phases what emerged from the assessment of the activities and operational measures tested during the exercise phase.

Photo 80. Poggioreale Antica, Trapani, 2019. International exercise "Modex Sicily 2019" on seismic risk.

Exercises, as well as civil protection plans, can be carried out at different territorial levels: local, regional, national or international. In the latter case, not only civil protection plans are tested, but also the activation and international support procedures, in particular at European level, and the interoperability between the Operational Structures of different Countries.

In these contexts, the role of volunteers assumes great importance for the actions concretely implemented on the territory (mobilization of teams) and to support the activities of information to the population and the operations of the civil protection coordination centers.

In October 2019, an important national-level exercise was held in the Phlegraean Fields to test civil protection planning for volcanic risk. The exercise involved the Municipalities of the Red Zone, the Prefecture of Naples, the Campania Region, some Competence Centers of the Civil Protection Department (National Institute of Geophysics and Volcanology, Study Center for Hydrogeological, Volcanic and Seismic Engineering-Laboratory of Urban and Territorial Planning "Raffaele d'Ambrosio" and National Research Council-Institute for Electromagnetic Sensing of the Environment), the Major Risks Commission and the Regions and Autonomous Provinces twinned with the Municipalities of the Red Zone. Operational Structures and contributing subjects of the National Service also participated in the exercise activities.

The scenario simulated a change in monitoring parameters and the occurrence of phenomena such as to determine a change in the alert level of the volcano from yellow to orange, up to an imminent eruption state, i.e. a red alert level, with the activation of the operational phases foreseen in the plan, including a test on the evacuation, with the participation of part of the population from the Municipalities of the Red Zone.

The exercise also provided for the communication campaign "I Don't Take Risks", focused on volcanic risk and specifically relating to the Phlegraean Fields (see Chapter 9).

Photo 81. Naples, 2019. Civil protection volunteers involved in the national exercise "Exe Flegrei 2019".

It is evident that in many cases structural and non-structural prevention activities are carried out in association. As an example, in the area of non-structural prevention, areas affected by landslides can have extremely varied characteristics and it is often necessary to carry out specific studies. In particular, on the landslide slopes that loom over urbanized elements (mobility infrastructures, urban centers, etc.) and which therefore underlie a particularly high risk, non-structural civil protection measures are often implemented, such as specific studies and analyses on the landslide area, implementation of systems for the monitoring activity and, if possible, for the early warning. These systems are regulated in the civil protection plans. In fact, for the purposes of prevention, it is necessary to define the precursor phenomena and the relative thresholds to which the actions to be taken are connected. Thresholds are intended both as the amount of rain capable of triggering the landslide movement, and as displacements/deformations of the ground, beyond which the collapse of unstable masses could occur. At the same time, structural risk mitigation interventions are often planned and carried out, assessed on the basis of the types of expected phenomena, such as drainage of rainwater, arrangement of the slopes with planting or positioning of protections, retaining walls, anchoring, micropiles, injections of concrete, rockfall nets, *spritz-beton* layers, etc.

Even in the case of floods, it is possible to reduce the risks of negative consequences both through structural interventions such as embankments, reservoirs, draining channels, artificial canals cutting meanders, and through non-structural interventions, such as safeguard rules on areas at risk, the alert system and emergency plans. In particular, an efficient alert system based on forecasting models connected to a monitoring network is essential to alert regional and local institutional authorities as early as possible. It reduces people's exposure to events and limits damage to the territory through the implementation of prevention measures in real time (Figure 20). These include the activities of the hydraulic territorial control and the regulation of outflows of the reservoirs present in the basin for the flood lamination.

The frequency of episodes of hydrogeological instability which, as we saw in Chapter 2, caused the loss of human lives and significant material damage, imposes a prevention policy that includes both structural and non-structural activities. These have to be carried out in an integrated manner with the aim of reducing the impact of calamitous events, making it sustainable with the social and economic reality of the Country, also in consideration of current or expected climate, environmental and socio-economic changes.

Among the non-structural civil protection prevention activities, in case of risks for which a pre-announcement is possible, the alerting activity of the National Civil Protection Service is fundamental for the protection of the population (see Focus 13).

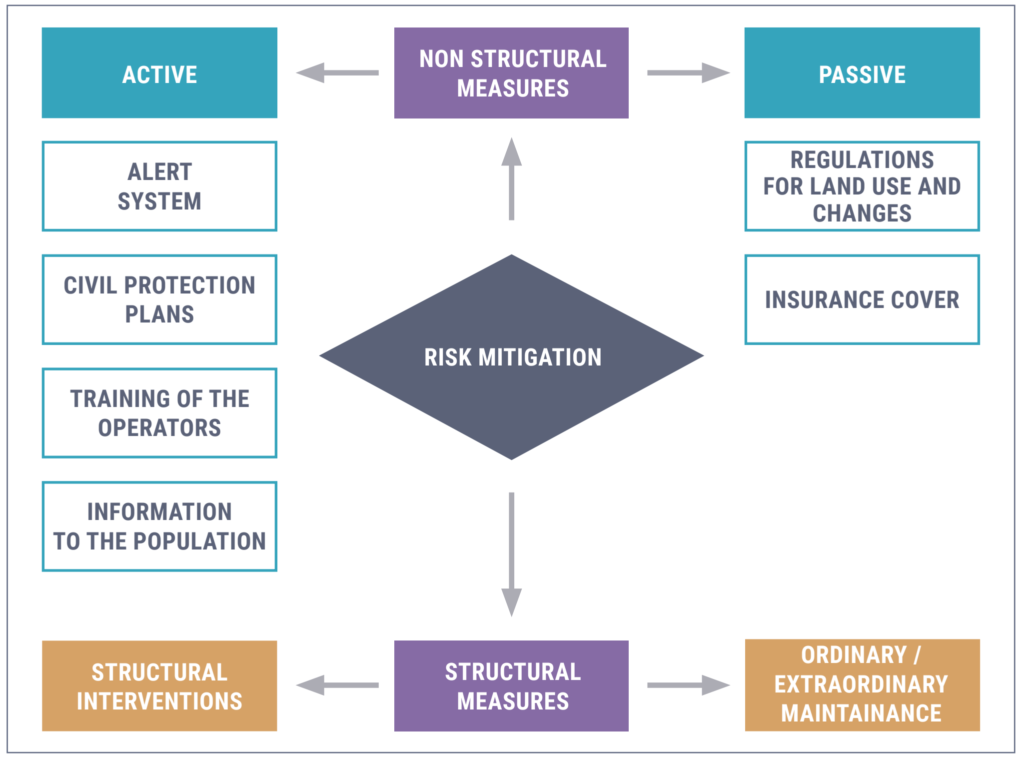


Figure 20. Example of risk mitigation measures, referred to hydrogeological and hydraulic risk. Active prevention measures are under the responsibility of the civil protection system, which participates in passive ones.

As per meteorological, hydraulic and hydrogeological risks, the Italian alert system is made up of the network of Functional Centers (see Focus 13) responsible for issuing Warnings of adverse weather conditions and Bulletins/Alerts of hydrogeological and hydraulic criticalities. On the basis of the **criticality levels** expressed in the hydrogeological and hydraulic criticality Bulletins and highlighted in the regional criticality Warnings, the Presidents of the Regions and Autonomous Provinces establish the different **alert levels** for the territory. The alert levels, uniform on the national territory and ordered by increasing severity degrees, are: yellow, orange and red alert. The civil protection authorities operating in the area match the **operational phases** (attention, pre-alarm and alarm) with the alert levels. The operational phases have to be activated according to the civil protection plans. In particular, the Municipality, depending on the alert received, activates the most appropriate operational phase to field the resources necessary to face the expected or ongoing event in its territory, also by informing its citizens, who have, in turn, the duty to implement self-protection behaviors.

As regards water crises, the series of important cases that occurred since the late 1980s prompted Italy to adopt a proactive approach to the problem, rather

than reactive. Instead of carrying out an intervention only after a crisis, as a reaction to what happened, the proactive approach is based on the identification and preparation of preventive measures and interventions before reaching a critical situation. In this context, accurate and real-time monitoring of the hydrometric variables and available water resources is extremely important. These data are also fundamental for the planning tools provided for by Italian legislation, adopted in transposition of Directive 2000/60/EC – Framework Directive in the field of water policy, such as for example the Water Protection Plans and the Water Balance Plans. In fact, the Legislative Decree n. 152/2006, which implemented the Directive, divided the national territory into eight **river basin districts** and provided for the drafting of a **management plan** for each district, attributing its competence to the River Basin District Authorities.

Another important step for a new governance of water was the establishment, in July 2016, of the Observatories of water uses, promoted by the Ministry of the Environment and the Protection of the Territory and the Sea. They are decision support structures in which the main stakeholders are involved, public and private, with the aim of creating a shared system of real-time monitoring of the water balance and forecasting drought conditions, using best practices and the most appropriate technologies at sustainable costs. Observatories of water uses contribute to the Water Management Plans.

For the management of water crises that lead to a declaration of a state of emergency, measures are put in place to manage the available water resources, with changes in the intended use and in any case guaranteeing safe drinking purposes. Urgent interventions are also arranged to reduce the effects of the water emergency and measures to reduce the vulnerability of the supply systems.

Photo 82. Rome, 2014. Monitoring and surveillance activities in the Central Functional Center, in the operational headquarters of the Civil Protection Department.

Focus **13**

THE ALERT SYSTEM

The alert system is a set of procedures and activities, based on the probabilistic forecast of an event and its possible effects, that activates the National Civil Protection Service in order to implement non-structural prevention measures aimed primarily at safeguarding human life.

The management of the national alert system is ensured by the Civil Protection Department and by the Regions and Autonomous Provinces and is, therefore, a State-Regions distributed system that makes Regions and Autonomous Provinces the key players.

An example of a national alert system is the one for hydrogeological and hydraulic risk, defined by the Directive of the President of the Council of Ministers of 27 February 2004, containing the "Operational guidelines for the organizational and functional management of the national and regional alert system for hydrogeological and hydraulic risks, for civil protection purposes".

The management of the system is guaranteed by the network of Functional Centers, subjects that carry out real-time forecasting, monitoring and surveillance of events and assessments of the consequent effects on the territory. The network of Functional Centers is constituted by a CFC-Central Functional Center, at the Civil Protection Department, and by CFD-Decentralized Functional Centers, at the Regions and the Autonomous Provinces.

Each Functional Center has the task of collecting and sharing with the entire network of Centers a series of data and information from different technological platforms and from a dense network of sensors located throughout the Country. Specifically: data collected by weather-hydro-pluviometric networks, by the national meteorological radar network and by the various satellite platforms available for Earth observation; hydrological, geological, geomorphological and territorial data deriving from the landslide monitoring system; meteorological, hydrological modeling, hydrogeological and hydraulic modeling.

Starting from these data and models, the Functional Centers carry out the forecasting activity by processing expected probabilistic scenarios and, on this basis, issue Bulletins and Warnings. They report both the evolution of expected and/or ongoing phenomena, and the criticality levels (type, diffusion and severity of landslides and floods) assessed for the area under their jurisdiction. It is the job of the Regions and the Autonomous Provinces to issue alerts for local civil protection systems, while it is up to the Mayors to activate the Civil Protection Plans, inform citizens of risk situations and decide the actions to be taken to protect the population (Figure 21).

The monitoring and surveillance phase just described has the purpose, through the collection, concentration and sharing of data, as well as through non-instrumental information obtained locally, to make information available on the evolution of the event in progress. To this end, the monitoring and surveillance activities are supplemented by non-instrumental surveillance activities in the area. Surveillance takes place through territorial safeguards, promoted and organized at regional, provincial and municipal level, to find information locally on the actual evolution of the event and communicate it to the network of Functional Centers and to the various competent subjects through the regional operating rooms.

Unlike the classic and generic weather forecast released through the media and addressed to a general public – in which terms like "perturbed weather", "light rain", "heavy showers", "intense winds" are used – the weather forecasts developed by the Functional Centers are information addressed to those who are responsible for the assessment of the impacts of the weather event and to translate these elements in states of alert and operational decisions. Therefore, these forecasts must as far as possible, and compatibly with the uncertainty of the forecast, be accurate, reliable and in detail with respect to the probable timing, location and quantification of expected phenomena.

In 2019, new tools were made available in the field of forecasting and warning for the civil protection system, thanks to the introduction of two new institutes: the ItaliaMeteo Agency, a national structure capable of providing integrated information on the meteorological and climatic changes of our Country, which will be based in Bologna, designated as the seat of the new data center of the European Weather Center for medium-term forecasts; the IT-alert system (see Focus 23), which will make it possible to reach all the population present in a specific territory with a message on mobile phones, in view of a disastrous event.

A further example of a warning system is SiAM, for tsunamis generated by earthquakes (see also Chapter 2).

Within this system, the INGV-National Institute of Gephysics and Volcanology – which operates through the CAT-Tsunami Alert Center – has the task of assessing the possibility that an earthquake of magnitude equal to or greater than 5.5, with an epicenter at sea or near the coast, could generate a tsunami, also estimating the arrival times of the waves along the different stretches of coast. The tidal data provided by ISPRA-Institute for Environmental Protection and Research allow you to record any waves and to confirm or not the formation of the tidal wave. On these bases, the Civil Protection Department spreads the alert to activate, in the shortest possible time, the National Civil Protection Service, from central to local level.

Figure 21. The network of Functional Centers issues Bulletins and Warnings reporting both the evolution of weather phenomena and the criticality levels expected in the area.

With respect to tsunamis, since 2005 Italy has participated in the international warning system for tsunami risk in the North-East Atlantic, Mediterranean and related Seas (NEAMTWS), under the coordination of the UNESCO IOC-Intergovernmental Oceanographic Commission. This is a system similar to the one active in the Pacific, Caribbean and Indian Ocean areas, where early warning systems are already present, with the difference, extremely relevant in terms of civil protection, that in a relatively small sea such as the Mediterranean Sea the arrival times of the waves are very short and this reduces the time available to alert the population.

In 2017, the SiAM-National Warning System for Tsunamis generated by earthquakes was established by a Directive of the President of the Council of Ministers. It includes three institutions: the INGV-National Institute of Geophysics and Volcanology, which operates through the CAT-Tsunami Alert Center, the ISPRA-Institute for Environmental Protection and Research and the Civil Protection Department. On 15 November 2018, the dispositions addressed by the Head of the Civil Protection Department to the Components and Operational Structures of the National Service were published in the Official Journal of the Italian Republic for the updating of the civil protection plans for tsunami risk.

Depending on the limited arrival times of the waves in the event of a tsunami in the Mediterranean, SiAM has provided for the use of a centralized system capable of simultaneously activating the various institutions of the National Civil Protection Service to issue the alerts. With this in mind, the Civil Protection Department has developed a technological platform for the exchange of information capable of simultaneously distributing alert messages to the various institutions up to the local level.

An alert system, however, works well if, in ordinary times, a plan has been put in place to explain what to do in case of alert, and if everyone is familiar with the plan as well as the behaviour codes to adopt.
To identify the coastal areas at risk of tsunami useful for draw-

Figure 22. Tsunami hazard induced by seismic events, for recurrence period 2500 years and maximum expected inundation height (MIH) in meters.

ing up civil protection plans, SiAM used a probabilistic model of seismically induced tsunami hazard developed by INGV as part of the European TSU-MAPS-NEAM project. Based on a hazard map elaborated in this model and relating to a return period of 2500 years (Figure 22), ISPRA has mapped the flood areas of potential tsunamis with reference to the orange and red alert levels. On the basis of this model, the alert zones established are available to the coastal Municipalities in order to prepare their civil protection plans (Figure 23).

The most effective planning for the protection of the population on the coasts is undoubtedly the municipal one, which must be elaborated using this cartography. The orange alert level indicates that the coasts could be hit by a tsunami wave with a height above sea level of less than 0.5 meters and/or a runup of less than 1 meter. The red alert level indicates that the coasts could be hit by a tsunami with a height above sea level higher than 0.5 meters and/or a runup greater than 1 meter (Chapter 2, Figure 2).

Civil protection planning is a non-structural prevention activity that increases responsiveness. Planning does not just mean organizing the action of civil protection operators to intervene in an emergency. The plan, according to the Italian regulations, is a tool that serves to increase risk awareness in ordinary time, to organize the pooling of resources, to build skills and professionalism, and to guarantee the link between different Administrations and Bodies. A civil protection plan is therefore not only the set of operational intervention procedures, but also the tool through which to define the organization of the structure needed to carry out civil protection activities: from forecasting to prevention, from emergency management to its overcoming.

Civil protection planning is a system activity, to be carried out jointly between all the territorial Administrations and the relevant Bodies, whether public or private, in charge of preparedness and emergency management. As well as emergency management, planning is a team effort, built with the contribution, in terms of capacity and resources, of all the Bodies and Administrations. Among all the civil protection activities, emergency planning and management are those that most require sharing and connection between all the Components of the National Civil Protection Service and, as far as possible, the participation of the communities.

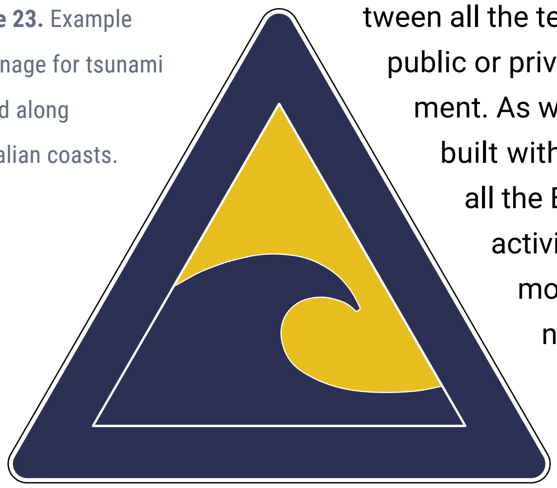


Figure 23. Example of signage for tsunami hazard along the Italian coasts.

CIVIL PROTECTION PLANNING AT NATIONAL LEVEL: THE EXAMPLE OF THE VESUVIUS PLAN

Civil protection planning is an activity that affects all territorial levels. At national level, National Plans and National Rescue Programs are prepared for the management of events that may require the intervention of the entire National Civil Protection Service.

The **National Rescue Programs** contain the intervention model for the organization of the operational response in the event or in view of national disasters where it is not possible to identify a specific reference scenario. This is the case of the seismic risk (Directive of the President of the Council of Ministers of 14 February 2014), for which it is not possible to define in advance neither the instant of the occurrence of the seismic event for which it is planned, nor the connected location and magnitude.

A **National Plan**, on the other hand, in addition to describing the potentially affected territory, identifies the event scenario, the monitoring of the precursor phenomena of the event and the specific measures and operating procedures to be implemented: this is the case, among others, of the Vesuvius volcanic risk national plan, which must be drawn up from all the National Service and therefore constitutes an example of collaboration and link between the State, Region and local Authorities and, at each territorial level, between all public and private subjects who contribute to the activities.

The Vesuvius is among the most monitored volcanoes in the world, as eruptions are often preceded by precursor phenomena (see Chapter 5). The monitoring of these phenomena is fundamental to define the state of activity of the volcano and therefore the level of alert, on the basis of which the operational measures to be implemented are identified in the civil protection plan.

The Vesuvius volcanic risk plan is therefore national and is prepared by the Civil Protection Department and the Campania Region, with the Prefectures and Municipalities concerned, the other Regions and Autonomous Provinces, the Scientific Community, the civil protection Operational Structures and other contributing subjects (Legislative Decree n. 1/2018, art.s 4 and 13).

The Scientific Community, in addition to defining the reference scenario, carries out continuous monitoring of the volcano, in particular through the

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Photo 83. Vesuvius, Naples, 2006. The crater.

Vesuvian Observatory of the National Institute of Geophysics and Volcanology which, based on the monitored parameters and any ongoing phenomena, proposes the variation of the alert levels that describe the state of the volcano. The change in level alert is also declared in consideration of the opinion of the Major Risks Commission (Legislative Decree n. 1/2018, art. 20).

The consequent actions that must be taken by the National Service are defined in the operational phases (attention, pre-alarm and alarm) provided for in the civil protection planning. The general intervention strategy, defined in the plan, provides for the division of the risk area into planning zones, as well as intervention methods, which basically consist in the removal of the inhabitants of the Municipalities at greatest risk and in the twinning with the other Italian Regions.

The Red Zone of the Vesuvius, where about 670 thousand people live, is the area exposed both to the invasion of pyroclastic flows, which, due to the high temperature and speed, is considered the most dangerous phenomenon for people, and to the collapse of homes due to the excessive ash load on the roofs and terraces (see Chapter 5, Figure 12). 25 Municipalities of the Provinces of Naples (24 Municipalities) and Salerno (one Municipality) are part of the Red Zone. For this area, the only safeguard measure is the removal of the population before the start of the eruption. People can decide whether to find accommodation independently outside the risk areas or take advantage of the temporary solutions offered by the State and the Region or Autonomous Province twinned with their Municipality.

National planning also identified another risk area, called the Yellow Zone, which includes the area exposed only to the hazard of lapilli and volcanic ash fallout. For the Yellow Zone, the removal of the population and the measures for their safety must be assessed while the event is in progress, based on the direction of the winds and the extent of the eruption.

The role of local civil protection structures is fundamental in this planning: the main task of the Municipalities is to assist and inform the population and, in this sense, to survey the population present in their territories, and to prepare and keep the municipal planning up to date, with particular reference to the organization of the removal of the population from the municipal area. The Prefectures must plan the coordinated set of activities aimed at ensuring public order and safety in the different operational phases. The Region takes steps to ensure support to local Authorities and to prepare the planning for the removal of the population from the Red Zone. To this end, the Campania Region – with the contribution of the various regional structures responsible for the matter, as well as the Provinces – evaluates and plans, based on the assessment of existing infrastructures and vehicles, activities and measures to be implemented for the evacuation of the population from the Red Zone.

The other Regions and Autonomous Provinces, which are twinned with the 25 Municipalities of the Red Zone, plan the reception on their territory of possibly evacuated citizens.

All the Operational Structures and the civil protection contributing subjects draw up sector plans that must guarantee coordinated response by the civil protection system in the various operational phases, and the integration and harmonization of the actions of the various Administrations and Bodies to achieve the general objectives. An example of sector planning is that for the safeguarding of cultural heritage assets in the Red Zone which, where possible, provides for the safety of real estate, such as the archaeological site of Pompei, and the relocation of mobile works of art.

The Civil Protection Department is in charge of the coordination of planning activities to ensure the consistency of the actions defined in the overall plan strategy.

This is the reason why the civil protection plan needs to foresee and plan consistent procedures and terminologies, shared and at the same time suitable for different territorial realities. The plans must be continuously updated in relation to the development of the territorial structure and changes in the expected scenarios. In addition, a plan must be flexible enough to be used in all emergencies, including unexpected ones. Furthermore, civil protection planning must necessarily be coordinated with the wider management and rehabilitation planning of the territory, within the context of a general vision of governance of the territory itself.

Photo 84. Lucca, 2012.
Civil protection planning activity.

All Administrations at different territorial levels must plan. Italian regulations provide for plans at municipal, optimal context, provincial, regional and national level. The concept of optimal context is a novelty recently introduced by the Civil Protection Code with the aim of establishing, on a geographic level and on a provincial basis, areas of organization of civil protection structures capable of optimizing resources and improving the efficiency of civil protection measures. Unless catastrophic events are so severe to cancel the territory's ability to react, the first response to an emergency, whatever the nature of the event that generates it and the extent of its effects, must in fact be guaranteed by the local civil protection structure. The other plans must provide, according to the subsidiarity principle, for methods to support the activities put in place by the Municipalities in case of events of particular intensity and extent.

In a plan, at the various territorial levels, the definition of operational strategies cannot be missing. They allow for: the organization of the structure for the performance of all civil protection activities (see Chapter 4); the ways to guarantee the activation and the connection for the information exchange between the various actors of the National Civil Protection Service and the definition of communication flows; the methods of periodic updating and revision of the plan and to guarantee information to the population, also during the event. In case of events that can be forecast, such as floods and partly tsunamis, the plan must also include the warning system of the structure and, according to the alerts issued, provide for increasing activations of the civil protection structure articulated in the operational phases of attention, pre-alarm and alarm, expected and defined in the civil protection plan of the various territorial levels (municipal, optimal context, provincial, regional and national). In particular, in each operational phase, a given degree of activation of the civil protection structure is provided, which allows to implement the necessary measures and contrast actions defined in the plan itself.

6. The risk management cycle and civil protection activities

Civil protection exercises are organized to test the effectiveness of a plan: simulations aimed at verifying the alert, activation and intervention procedures within the emergency coordination and management system, but also to make the population know both the risk to which it is exposed, and the intervention measures foreseen by the planning (see Focus 12).

In order for civil protection planning to reduce the impact of events, citizens, alone or in an associated form, must be aware not only of the risks of their territory, and adopt correct rules of self-protection, but also of the organizational methods of the structure of civil protection, in ordinary and emergency conditions. Therefore, citizenship participation in civil protection activities in general, and planning in particular, is increasingly necessary. In fact, a participatory plan allows to spread the culture of civil protection and to guarantee adequate behaviors and self-protection actions by citizens. Described in a plan, at the various territorial levels there must therefore be the set of actions to be implemented to ensure an effective response in the event of an emergency. The plan is therefore the best "vision", drawn up in the ordinary, compared to an emergency situation that creates inconvenience and damage to the population and the environment. Far from being a mere formal exercise, the civil protection plan constitutes the reference system, that is, the organization of the civil protection structures which must respond to a vast set of emergency situations (also not foreseen in the plan itself).

► 6.3. Emergency management

Emergency management is the integrated and coordinated set of measures and interventions aimed at ensuring relief and assistance to populations and animals affected by disasters and the reduction of their impact, including through the implementation of undeferrable and urgent interventions, the use of simplified procedures and information dissemination to the population. The nodal

Photo 85. L'Aquila, 2009. The DiComaC set up in the Barracks of the Finance Police in Coppito after the 6 April earthquake.

points of any emergency management are the activity and organization of **coordination centres** at various territorial levels. The coordination centres represent the physical place where the civil protection system carries out in a coordinated and structured way all emergency management and response operations. They are the seat of the operational coordination of activities and see the active and joint participation of Administrations and public and private Bodies, which contribute to the management of emergencies, each with their own expertise.

The activation of these centers determines a change in the working methodology: if in ordinary time each Administration operates autonomously, in emergency, to pursue the objective of protection and safeguard of the population, the Administrations work together organizing themselves by functions and objectives to pursue. This working method is carried out through the "support functions" system, as defined in the civil protection plans. The support functions represent the basic organization of each coordination center at all territorial levels (municipal, optimal context, provincial, regional, national) and are defined as specific areas of activity, functional to guarantee the choral management of the emergency context[9]. The coordination centers implement the provisions of the civil protection plans, in which operating procedures are defined and shared to optimize alerting and activation of intervention capacity by the National Service. The goal of each center is therefore to coordinate and link civil protection activities, and this is achieved through the organization of an effective flow of communications between the subjects which contribute to the management of the emergency, in order to ensure the circulation of information and the implementation of the measures.

[9] *Examples of support functions are: the health function, to which the Region, the Local Health Authorities, the "118", etc., contribute, or the mobility function, made up of Companies and Administrations that deal with the road network and mobility infrastructures. The support functions vary according to the capacities and organisation of the Authorities responsible for the plans. A reference regarding the support functions at national level can be found in the National Seismic Risk Rescue Programme (Directive of the President of the Council of Ministers of 14 February 2014).*

An example of a support function is the "essential services" function, which can be activated in the operational centers of the various territorial levels. This function has the objective of guaranteeing the functionality and, if necessary, the restoration of essential services (energy, gas, water, telephony, etc.), often interconnected with each other and of great importance for carrying out emergency activities. This function sees the joint participation of representatives of the services operators themselves, who work in coordination for the resolution of problems that may occur. In addition, within the coordination center, each function connects with the other functions to implement activities and pursue common objectives, as well as with similar functions activated in the other coordination centers of upper or lower territorial levels.

In the event of a nationally coordinated emergency, the entire coordination chain can be activated, adapting the provisions of the planning to the needs dictated by the local context and the specific emergency event. For example, in the seismic emergencies of the last ten years that have seen the activation of DiComaC-Command and Control Center, the national coordination center (see Focus 16), in Emilia-Romagna, Lombardy and Veneto in 2012 and in Central Italy in 2016, this structure of the Civil Protection Department and of the involved Regions coordinated the activities of the coordination centers at territorial (regional and/or provincial) and local level (municipal operational centers).

Based on the scale of an emergency situation, the various levels of coordination are activated according to the principle of subsidiarity (see Chapter 4), in order to support and integrate the response of the local system.

Photo 86. Rieti, 2016. The DiComaC set up after the 24 August earthquake.

Focus **15**

DECISION-MAKING IN UNCERTAINTY AND RESPONSIBILITY

How can risk be measured? In the first instance, expected human losses can be measured in terms of the number of victims and injuries in a certain area and for a specific period of time. Direct and indirect costs are typically, although roughly, measured in terms of monetary value, as is normally the case in the insurance industry. Defining these numbers not only allows one to quantitatively express the risk for a certain area in a given period of time, but also to make decisions: for example, plan the strategies for the prevention and mitigation of that risk, the correct allocation and distribution of resources available (often limited) for the various risk reduction policies, monitor and evaluate these strategies over time. However, quantifying these indicators is rather difficult. In fact, all the components of any risk (see Focus 1) are an expression of the level of knowledge reached (and therefore also of that not yet achieved) by scientific research in the relevant fields of interest. This uncertainty, which characterizes both the risk and its components, in general terms can be seen as consisting of two parts: aleatoric uncertainty and epistemic uncertainty.

Aleatoric or statistical uncertainty is the expression of the unknown and, in general, unknowable and non-modelable aspects, which can vary when the same experiment is repeated (such as when throwing a dice).

Epistemic or systematic uncertainty, on the other hand, relates to the fact that not all the elements that would contribute to an assessment, an experiment or an estimate, are known. It is therefore a measure of how much is known and not known of the subject one is dealing with. By acquiring new information and evidence, and integrating them into the analyses, the epistemic uncertainty that accompanies their results may eventually be reduced.

In turn, this degree of certainty/uncertainty will change the overall level of risk assessment, thus influencing the starting point for any protection or prevention action (Di Bucci & Savadori, 2018). This aspect is very important: scientific knowledge has well-recognized limits, which obviously evolve with time, but which are always present and must be taken into consideration at all times. This implies that although the information provided by the Scientific Community to decision-makers is intrinsically affected by uncertainties, the decision must be made in any case, managing this uncertain information (Dolce & Di Bucci, 2014; 2015; Guzzetti, 2015; 2018).

Decision-makers must have a reasonable idea of what the degree of uncertainty of the information available is (Di Bucci & Dolce, 2019). It should be underlined how the impact has a double face, one in case the "expected" event does not happen, the other instead consequent to its occurrence, with the different nuances and scales connected to the intensity of the event actually occurred. In the first case, the decision will have "easily" quantifiable economic and social consequences (for example, the decision to close schools in case of unfavorable weather forecasts or the decision to evacuate an area affected by a possible volcanic eruption where there are important precursory signs, or, in the long term, the decision to invest a certain fraction of GDP-Gross Domestic Product for a structural prevention program on a specific area with high seismic and/or hydrogeological hazards). In the event that the "expected" catastrophic phenomenon takes place, instead, the economic and social costs are offset by the lesser consequences, also economic and social, determined by the decision taken to reduce or mitigate the risk (for example, lower human losses in the event of a flood, volcanic eruption, strong earthquake in the area considered).

Photo 87. Rome, 2014. Monitoring and surveillance activities in the Central Functional Center.

The answer to decision-makers on which scientists are currently working, apart from providing scientific information on the event, the hazard or the risk, concerns just how uncertain this information could be and consists of a quantitative measure of this uncertainty. Since the latter is closely linked to the concept of randomness – or rather, probability, in more technical terms – scientists are working to quantitatively describe the risks in terms of probability of occurrence. This probability in turn is characterized by the relative uncertainty of evaluation.

Photo 88. Rome, 2010. The operational room (Sala Situazione Italia, Italy's Situation Room) in the operational headquarters of the Civil Protection Department.

On a national level, constant surveillance of the territory is ensured by the SSI-Italy's Situation Room of the Civil Protection Department, which operates on a 24/7 basis and is composed of representatives of the various Operational Structures of the system. The SSI has the task of following the emergencies, planned or in progress on national territory, and to alert and activate the various Components and Operational Structures of the National Civil Protection Service that contribute to their management. This task is carried out through the constant connection with the national operating rooms of the institutional rescue and/or public utility forces, with those of the Regions and the Autonomous Provinces, with the Territorial Offices of the Government-Prefectures, as well as with the monitoring central structures of the Bodies and Administrations that manage the networks and service infrastructures.

In case of emergencies of particular intensity followed by the SSI, the civil protection system is activated by convening the civil protection Operational Committee, the highest strategic body in which representatives of the Bodies and Administrations that are part of the National Civil Protection Service are called to participate in the decision-making process.

Photo 89. Rome, 2012. The civil protection Operational Committee, convened to coordinate interventions during a severe weather emergency.

THE CIVIL PROTECTION OPERATIONAL COMMITTEE

Upon the occurrence or in the imminence of a national event, of natural origin or caused by human activity, that by scale and characteristics has an impact on the population and the environment or on the normal course of life of the local community, the Head of the Civil Protection Department convenes the Operational Committee, which operates under the Prime Minister's Office and meets at the Civil Protection Department headquarters. The Operational Committee ensures the coordination of all interventions by the Components and Operational Structures of the National Civil Protection Service, defines the intervention strategy on the basis of the characteristics of the event, the needs, the resources available at national level and those already used, guaranteeing unitary management activities.

The Committee is regulated by art. 14 of Legislative Decree n. 1/2018, while its constitution and functioning are defined by a Decree of the President of the Council of Ministers. It is chaired by the Head of the Civil Protection Department and is composed of representatives of the Department, of each of the Components – State, Regions, Autonomous Provinces and local Authorities (Legislative Decree n. 1/2018, art. 4) – and the Operational Structures of the National Civil Protection Service: National Fire Brigade, Armed Forces, Police Forces, Research Bodies and Institutes, National Institute of Geophysics and Volcanology, National Research Council, National Health Service facilities, National Volunteering Organizations, Italian Red Cross, National Alpine and Speleological Corps, National Environmental Protection System, essential services operators, management structures of meteorological services at national level, designated by the respective Ministers or by the heads of the structures to which they belong (Legislative Decree n. 1/2018, art. 13).

The Operational Committee is a modern representation of the civil protection system, embodying the concept of inclusion of the various components and multidisciplinary nature of the emergency response action and close coordination. It is an effective decision-making instrument, since it allows for a proper institutional setting conducive to decisions and their immediate implementation in complex situations, to ensure the most effective assistance to the population of the affected territories.

Photo 90. Rome, 2020. Meeting of the civil protection Operational Committee.

The convening of the Committee takes into account the characteristics of the emergency event in order to fully identify further Administrations, national or local Authorities, Companies and Bodies whose participation is needed (Extended Committee). The Committee is therefore not a rigid structure, but it adapts to different emergency situations by including an assorted variety of public and private subjects of interest.

The representatives who sit at the table of the Operational Committee ensure the implementation of all the necessary response operations established in compliance with their skills and procedures. In the event of national emergencies, the Committee is convened a few minutes or shortly after the outbreak of the event.

The Operational Committee remains active, depending on the situation, from a few hours to a few days (for example, in the case of the seismic sequence of Central Italy in 2016, the Committee was kept operational for five days). Subsequently, the coordination action is guaranteed through the Crisis Unit of the Civil Protection Department or, in the need for coordination closer to the territory affected, by the on-site establishment of the DiComaC-Command and Control Center. DiComaC represents the national coordination center directly in the area affected by the emergency event and includes representatives of the various Operational Structures and Components involved in emergency management. Following the earthquake in Central Italy, DiComaC was activated in Rieti. Finally, the Operational Committee can be convened also on the occasion of international and national exercises, and for the sharing of national civil protection planning activities and strategies.

Focus 16

LIST OF PARTICIPANTS

Participants in the civil protection Operational Committee: Head, Deputy Head and Operational Director of the Civil Protection Department, CNVVF-National Fire Brigade, PS-State Police, Penitentiary Police Corps, Regions, UPI-Union of the Provinces of Italy, ANCI-National Association of Italian Municipalities, National Volunteering Organizations, CNSAS-National Alpine and Speleological Rescue Corps,Viabilità Italia, ANAS-National Road Authority, Italian State Railways Group, COI-Chief Operating Command of the Interforce, Carabinieri Corps, Harbour and Coast Authorities, Finance Police, CRI-Italian Red Cross, INGV-National Institute of Geophysics and Volcanology, CNR-National Research Council, ISPRA-Institute for Environmental Protection and Research, ENEA-National Agency for new technologies, energy and sustainable economic development, Ministry of Health, MIBACT-Ministry of Cultural Heritage and Activities and Tourism, Bank of Italy, Italian Mail Service, RAI/Public Utility, TIM, Vodafone, Wind Tre, AISCAT-Italian Association of Motorway and Tunnel Concession Companies, ASPI-Motorways for Italy, ENAV-National Body for Flight Assistance, ENAC-National Civil Aviation Authority, ENI-National Hydrocarbons Body, SNAM-National Gas Pipeline Company, GSE-Energy Services Operator, TERNA-National Electricity Network, ENEL-National Body for Electricity, General Directorate for Dams and water and electricity infrastructures, MEF-Ministry of Economy and Finance, MISE-Ministry of Economic Development, MAECI-Ministry of Foreign Affairs, etc.

The regulatory instruments provided by the Civil Protection Code to support the territories affected by events of exceptional seriousness that can compromise life, physical integrity or primary assets, are the state of mobilization and the state of emergency.

The **state of mobilization** was included for the first time in the 2018 Code, replacing the "state of compromise of primary interests" required by Law n. 225/1992, in order to promptly intervene. It is adopted by Decree of the President of the Council of Ministers even for a still imminent forecast event, at the request of the Region concerned, and allows for the coordinated intervention of mobile convoys from other Regions and organized civil protection volunteering. The mobilization therefore has the purpose of ensuring the timely intervention of the National Civil Protection Service in order to limit the impact of the events expected or in progress. It allows for an effective support to the affected area, where the available resources are not sufficient and adequate, mainly in the activities of rescue and assistance to the population, even if the calamitous event is not expected to cause damage that requires the declaration of a national emergency. The declaration of a state of emergency may follow a state of mobilization. In the absence of this, the mobilization is closed and, by order of the Head of the Civil Protection Department, the contributions to cover the financial costs incurred by the mobilized Components and Operating Structures are assigned.

Photo 91. Rome, 2020. Meeting of the civil protection Operational Committee.

When natural disasters occurr or are about to occur, as well as events related to human activity that by scale and intensity require immediate intervention implemented through extraordinary means and powers, the **state of national emergency** is declared and deliberated by the Council of Ministers on the basis of expeditious assessments made by the Civil Protection Department in conjunction with the Regions involved.

The deliberation defines the duration (maximum 12 months, with possible extension of another 12 months), the territory affected by the emergency and the necessary resources, both for the start of rescue and assistance to the population, and for the implementation of the more urgent interventions to carry out, such as the restoration of public services and strategic infrastructures.

TEMPORARY HOUSING SOLUTIONS

Catastrophic events, in particular earthquakes, floods, landslides, often have a strong impact on buildings, causing damage and collapses, so as to make them uninhabitable for even long times. The problem therefore arises immediately of housing, in safe and, as far as possible, comfortable conditions, families who cannot continue to live in their homes.

The choice of temporary housing solutions adopted in the most recent emergencies arose from the number of people remained outside their homes, from thousands to tens of thousands in case of destructive earthquakes, the geographical characteristics of the territory and the duration of the unsafe conditions of their homes.

In the short term – in the order of days, weeks, up to a few months – temporary accommodation typically refers to tents and tented campsites, containers, reception centers in secure and safe structures, managed by local civil protection or voluntary organizations, or hotels, possibly in the vicinity of the territories affected by the event. Possible solutions also include the CAS-Contribution for Autonomous Accommodation (a sum roughly amounting to 200-300 euros per person/month), with which a family can independently find accommodation for rent or be hosted by family relatives or friends. Obviously accommodations in tents, typical of the initial phase of assistance to the population, especially after an earthquake, present critical issues related to the climatic conditions of the period and the place where the disaster occurred, thus the use of tents is minimized, where possible.

Temporary housing for the population in the medium and long term is an issue that arises particularly in case of destructive earthquakes, which cause serious damage over a very large territory, often involving tens of thousands of buildings. In these cases, the big problem of relocation of the evacuated population in sufficiently comfortable and stable housing solutions needs to be solved to allow people who cannot return to their homes to resume their normal living conditions before the recovery and restoration of their homes is completed. Such works, as well as those of reconstruction, usually take several years, sometimes more than a decade. In fact, due to the technical complexity of the design and execution of the recontruction or demolition works – especially in historical contexts, i.e. old towns featuring aggregated buildings and often subject to landscape and cultural heritage protection restrictions – there is the need to follow well-defined administrative and control procedures, indispensable for the protection of public interest, since the financing is almost totally charged to the State.

Medium-long term temporary housing arrangements must guarantee the assisted population to stay in the territory of origin, if possible in the vicinity of their damaged home, to preserve the social network and not create favorable conditions for the depopulation of the affected areas. This situation is very frequent in Italy, where the areas with the highest seismic hazard are usually mountainous areas with limited economic development and already subject to progressive depopulation.

The medium-long term solutions, for families who have not chosen the CAS or have not found rental accommodation, adopted in recent decades, can be summarized as follows (Dolce & Di Bucci, 2017):

1) Container modules. Generally uncomfortable, even if air-conditioned, and often inadequate in size, but quick to install. They were adopted, for example, after the earthquake in Umbria and Marche in 1997. After a few years, following the protests of the inhabitants, they were replaced by mostly wooden houses, of the type described below. After the 2012 Emilia earthquake, the container modules were used until the completion of the reconstruction.

2) Prefabricated or rapidly built houses. Often in wood, with one or two floors at most, single-family, two-family or arranged in a row plan, with decidedly superior comfort standards compared to containers and a duration of at least a decade.The MAPs-Temporary Housing Modules belong to this category, implemented after the 2009 earthquake in Abruzzo, as well as the SAE-Emergency Housing Solutions, adopted after the Central Italy earthquake in 2016.

3) CASE Project-Antiseismic Sustainable Eco-friendly Complexes (Costruttori for C.A.S.E., 2010). Adopted only for the Municipality of L'Aquila after the 2009 earthquake, with characteristics of comfort, durability and architectural and structural quality similar to that of new buildings

fabricated in ordinary times. It is 185 buildings of three floors, each with about 25 apartments, built on a reinforced concrete platform equipped with seismic isolation, capable of hosting a total of about 15 thousand people, in 19 different settlements, each formed by a number of buildings between 4 and 25. The choice to implement the CASE Project stemmed from several needs, including: the need to minimize the areas occupied by temporary housing, the need to ensure conditions of comfort for those who would have stayed there for several years, the possibility of subsequently reusing temporary houses for other purposes (for example, to host non-resident university students). The CASE Project was also an example of rapid construction: the first apartments were delivered less than six months after the earthquake and the last ones after ten months. Despite the high standard and the architectural-structural quality, the CASE Project has always been thought of as a temporary housing solution for those who had temporarily lost their homes, pending the return to their restored or rebuilt homes.

Photo 92. L'Aquila, 2009. House built within the framework of the CASE Project-Antiseismic Sustainable Eco-friendly Complexes.

Two problems that often condition the rapid realization of provisional housing. On the one hand, there is the determination of the number of families and the housing size, which can only take place upon assessment of the safety and usability of the buildings affected by the earthquake and the choice of families evacuated between CAS and temporary accommodation. On the other hand, there is the identification of the areas on which to build the settlements, in compliance with the required technical specifications and urban planning, as well as minimizing infrastructuring costs (roads, water, gas, sewers).

Subsequently, on the basis of technical assessments and evaluation of the actual impact of the event on the territory and on the activities and businesses affected, additional resources can be allocated to overcome the emergency, therefore to remove obstacles to a rapid recovery of normal living and working conditions, restore essential services and reduce the residual risk in the affected areas (see Simplified Glossary). For the management of such operations, a **delegated Commissioner** is appointed by the Head of the Civil Protection Department, in charge of coordinating the interventions and measures to be implemented. The choice of the Commissioner falls, most of the time, on the head of the Regional Civil Protection Service or on a representative of the Public Administration who is responsible for the actions to be implemented in ordinary conditions (not in emergency), such as the President of the Region concerned or the Mayor of the affected Municipality, and on whose territory relief operations must be implemented. In any case, the Mayors of the affected territories are usually identified as implementing subjects of the interventions by the delegated Commissioner. At the end of the state of emergency, the person responsible for the ordinary course of action is identified, again by ordinance of the Head of the Civil Protection Department, who replaces the Commissioner for continuation and completion of emergency recovery interventions, if not yet completed during the state of emergency.

Photos 93-96. Solutions for the shelter of the population in the Central Italy earthquake emergency. From left: Amatrice, 2016. Campsites / Camerino, 2016. Container modules / Amatrice, 2016. Provisional school modules / Norcia, 2017. Prefabricated temporary houses.

6. The risk management cycle and civil protection activities

► 6.4 Emergency overcoming phase

Emergency overcoming consists, as we have seen, in the coordinated implementation of the measures aimed at removing obstacles to the recovery of normal living and working conditions, the restoration of essential services and the reduction of the residual risk in the areas affected by the disaster events.

Photo 97. Amatrice, 2016. Restoration interventions on the "Tre Occhi" bridge damaged by the earthquake.

Until the expiry of the national state of emergency, the delegated Commissioner works in "extraordinary regime" to carry out the necessary interventions to overcome the emergency. For this purpose, the civil protection ordinances can provide for derogations from current legislation, with the exception of fundamental rules such as the Constitution, the general principles of the legal system and the provisions deriving from belonging to the European Union (Treaties, Regulations, Directives). The emergency management activity is regulated and monitored through the tools identified in the **civil protection ordinances**, with which, among other things, as mentioned, the delegate Commissioner is appointed and his duties specified. The following are also defined: the derogatory regime valid for the duration of the state of emergency, the discipline of assistance to the population (see Focus 17), the methods for carrying out the interventions and any other specific measures.

The delegate Commissioner also carries out a survey of the necessary interventions and economic resources (needs) for the restoration of damaged public and private structures and infrastructures, and for the restoration of damages suffered by the population, economic and productive activities, cultural heritage and building stock. Following this recognition of needs, additional financial resources can be provided at the request for the granting of contributions and forms of compensation in favor of damaged public, private subjects and economic and productive activities.

In general, the financial resources for the management and overcoming of national emergencies are made available by the State, but are often also integrated with funds from the Regions and local Authorities concerned and, in case of major emergencies, from financial resources allocated through the European Union Solidarity Fund (see Focus 18 and Table 4).

All interventions, including structural ones, carried out during the state of emergency must be in line with the urban and territorial planning, as well as with the programs of protection and rehabilitation of the territory implemented in the ordinary, in order to contribute to the development of the territory and the achievement of the general economic objectives and social development, environmental protection and balance.

Photos 98, 99. Amatrice, 2016. Installation of a bailey bridge in Retrosi, to restore the road network.

THE EUROPEAN UNION SOLIDARITY FUND

In response to the serious disasters that have affected several European countries over the years, the European Union has set up a special fund called "solidarity" which intervenes, at the request of the affected Country, to integrate the efforts of Governments and cover part of the public costs incurred in the emergency phase.

Specifically, the EUSF-European Union Solidarity Fund was established by the Council Regulation (EC) n. 2012/2002 of 11 November 2002 after the severe floods that had devastated central Europe in the summer of that year. Since its inception, it has been used 80 times to deal with various catastrophes, including earthquakes, floods, forest fires, storms and droughts. To date, over 5 billion euros have been allocated to support 24 European countries. Among these, for the numerous emergencies, especially of seismic nature, Italy was by far the largest beneficiary of this Fund.

The EUSF can be activated as much for "major national level disasters", like the Central Italy earthquake of 2016 and other major earthquakes, and for "regional natural disasters". In both situations, the possibility of activating the Fund depends on the amount of damages and losses suffered. In the first case, the Fund can be activated if the natural disaster causes damage for a value equal to or higher than, for Italy, 3.5 billion euros. The second case concerns those disasters which in the regulation are referred to as regional natural disasters, i.e. natural disasters whose estimated direct damage is below the aforementioned threshold. The regulation clarifies that «a 'regional natural disaster' means any natural disaster resulting, in a region at NUTS level 2 of an eligible State [for Italy this territory corresponds to a Region], in direct damage in excess of 1,5 % of that region's gross domestic product (GDP)». The reference thresholds for each Italian region are indicated annually by the DG REGIO-Directorate General for Regional and Urban Policy of the European Commission. Where the natural disaster concerns several Regions, the threshold shall be applied to the average GDP of those Regions weighted according to the share of total damage in each Region. Since the establishment of the European Union Solidarity Fund, the Civil Protection Department has ensured coordination action on a national scale in order to guarantee access to this fund quickly and on time and in close collaboration with European institutions.

6. The risk management cycle and civil protection activities

Table 4. EUSF interventions since 2002[10]

Last update 18 November 2019. Source: European Commission

BENEFICIARY STATE	OCCURRENCE	NATURE OF DISASTER	CATEGORY	DAMAGE	EUSF AID	TOTAL EUSF AID
				million €	*million €**	*million €*
AUSTRIA	August 2002	Floods	major	2 900	134	
	August 2005	Floods (Tyrol, Vorarlberg)	regional	592	14.8	
	November 2012	Floods (Lavamünd)	neighbouring Country	10	0.240	
	May 2013	Floods	neighbouring Country	866	21.7	
	October 2018	Floods	neighbouring Country	326	8.2	**178.94**
BULGARIA	May 2005	Floods	major	222	9.7	
	August 2005	Floods	major	237	10.6	
	June 2014	Floods	major	311	10.5	
	July 2014	Summer floods	regional	79	2	
	January 2015	Severe winter conditions	major	243	6.4	
	October 2017	Floods (Burgas)	regional	90	2.3	**41.5**
CROATIA	May 2010	Floods	neighbouring Country	153	3.8	
	September 2010	Floods	neighbouring Country	47	1.2	
	October 2012	Floods	neighbouring Country	12	0.287	
	January 2014	Ice and floods	major	292	8.6	
	May 2014	Floods	major	298	8.9	**22.8**
CYPRUS	April 2008	Drought	major	165	7.6	
	June 2016	Drought and fires	major	181	7.3	**14.9**
CZECH REPUBLIC	August 2002	Floods	major	2 300	129	
	May 2010	Floods	neighbouring Country	205	5.1	
	August 2010	Floods	regional	437	10.9	
	June 2013	Floods	neighbouring Country	637	15.9	**160.9**
ESTONIA	January 2005	Storm	major	48	1.3	**1.3**
FRANCE	September 2002	Floods (Gard)	regional	835	21	
	December 2003	Floods (Vallée du Rhône)	regional	785	19.6	
	February 2007	Cyclone Gamède (la Réunion)	regional	211	5.3	
	August 2007	Hurricane Dean (Martinique)	regional	509	12.8	
	January 2009	Storm Klaus	major	3 806	109.4	
	February 2010	Storm Xynthia	regional	1 425	35.6	
	September 2017	Hurricanes Irma and Maria	regional	1 956	48.9	**252.6**
GERMANY	August 2002	Floods	major	9 100	444	
	January 2007	Storm Kyrill	major	4 750	166.9	
	May 2013	Floods	major	8 154	360.5	
	May 2016	Floods (Lower Bavaria)	regional	1 259	31.5	**1002.9**
GREECE	March 2006	Floods (Evros)	regional	372	9.3	
	August 2007	Forest fires	major	2 118	89.8	
	January 2014	Earthquakes (Kefalonia)	regional	147	3.7	
	February 2015	Floods (Evros and Central Greece)	regional	395.9	9.9	
	November 2015	Earthquake (Lefkada)	regional	66.1	1.6	
	June 2017	Earthquake (Lesbos)	regional	54.4	1.4	
	July 2017	Earthquake (Kos)	regional	101	2.5	
	February 2019	Severe weather (Crete)	regional	182	4.6**	**122.8**
HUNGARY	April 2006	Floods	major	519	15.1	
	May 2010	Floods	major	719	22.5	**37.6**
IRELAND	November 2009	Floods	regional	521	13	**13**

[10] *EU Solidarity Fund applications approved = Communication adopted*
* *rounded figures; ** budget procedure ongoing*

BENEFICIARY STATE	OCCURRENCE	NATURE OF DISASTER	CATEGORY	DAMAGE	EUSF AID	TOTAL EUSF AID
				million €	*million €**	*million €*
ITALY	October 2002	Earthquake (Molise)	regional	1 558	30.8	
	October 2002	Eruption of Volcano Etna (Sicily)	regional	894	16.8	
	April 2009	Earthquake (Abruzzo)	major	10 212	493.8	
	October 2010	Floods (Veneto)	regional	676	16.9	
	October 2011	Floods (Liguria and Tuscany)	regional	723	18.1	
	May 2012	Earthquakes (Emilia-Romagna)	major	13 274	670.2	
	November 2013	Floods (Sardinia)	regional	652	16.3	
	October 2014	Floods	regional	2 241	56	
	Aug 2016-Jan 2017	Earthquakes	major	21 879	1 196.8	
	October 2018	Floods	major	6 630.3	277.2	**2 792.9**
LATVIA	January 2005	Storm	major	193 9.5	9.5	
	August 2017	Floods	major	380.5	17.7	**27.2**
LITHUANIA	January 2005	Storm	neighbouring Country	15	0.4	
	October 2017	Floods	major	408	16.9	**17.3**
MALTA	September 2003	Storm and floods	major	30	0.96	**0.96**
POLAND	May 2010	Floods	major	2 994	105.6	
	August 2017	Storm	regional	491	12.3	**117.9**
PORTUGAL	July 2003	Forest fires	major	1 228	48.5	
	February 2010	Floods and landslides (Madeira)	major	1 080	31.3	
	August 2016	Forest fires (Madeira)	regional	157	3.9	
	June-October 2017	Forest fires	major	1 458	50.7	**134.4**

BENEFICIARY STATE	OCCURRENCE	NATURE OF DISASTER	CATEGORY	DAMAGE	EUSF AID	TOTAL EUSF AID
				million €	*million €**	*million €*
ROMANIA	April 2005	Spring floods	major	489	18.8	
	July 2005	Summer floods	major	1 050	52.4	
	July 2008	Floods	regional	471	11.8	
	June 2010	Floods	major	876	25.0	
	August 2012	Drought and forest fires	major	807	2.5[2]	
	April 2014	Spring floods	neighbouring Country	168	4.2	
	July 2014	Summer floods	regional	172	4.3	
	June-August 2018	Summer floods	regional	327.7	8.2	**127.2**
SERBIA	May 2014	Floods	major	1 105	60.2	**60.2**
SLOVAKIA	November 2004	Storm (Tatras)	major	203	5.7	
	May 2010	Floods	major	561	20.4	**26.1**
SLOVENIA	September 2007	Floods	major	233	8.3	
	September 2010	Floods	major	251	7.5	
	October 2012	Floods	major	360	14.1	
	January 2014	Ice storm	major	429	18.4	**48.3**
SPAIN	November 2003	Oil spill (Prestige)	regional	436	8.6	
	August 2003	Forest fires (Portugal border)	neighbouring Country	53	1.3	
	May 2011	Earthquake (Lorca)	regional	843	21.1	
	October 2017	Fores fires	neighbouring Country	129	3.2	**34.2**
SWEDEN	January 2005	Storm Gudrun	major	2 297	81.7	**81.7**
UNITED KINGDOM	June 2007	Floods	major	4 612	162.3	
	December 2015	Floods	regional	2 412	60.3	**222.6**

GRAND TOTAL OF EUSF AID APPROVED SINCE 2002 — 5 535.6 MILLION €

7

RELATIONS WITH EUROPE AND INTERNATIONAL BODIES

► 7.1 The Union Civil Protection Mechanism

When in Brussels, on rue Joseph II n. 79, by looking up you will notice the 24/7 lit up office windows, 365 days a year: it is the seat of the ERCC-Emergency Response Coordination Center of the European Union that is constantly operational. Just 20 years ago, the issue of disaster risk was connected with environmental risk, without any distinction. The European Commission dealt with humanitarian emergencies outside Europe through an office that financed non-governmental organizations or international organizations but had never dealt directly with protecting European citizens from possible disasters.

The case of the Erika oil tanker that sank in the Bay of Biscay in 1999, causing a major spill of hydrocarbons on the French coast and with a great media impact, highlighted the importance of a system allowing for mutual aid between European Countries in emergency, facilitated by the European Commission. This experience fostered a profound debate among the Member States and European Institutions on how to organize a system that would combine sensitivity and administrative traditions of different Countries on such a delicate issue. The most active Countries on this matter were the Southern European States, whose territory is more exposed to several major risks. Italy, France, Spain, Portugal and Greece, that more than others are confronted with the management of risks and emergencies, have always supported the need for an expert approach to risks and possible emergencies, and have pledged to stress the importance of this matter and the need for European Institutions to deal with these issues in a dedicated and joint way.

Photo 100. Brussels, 2018. The European Civil Protection Forum, biannual event on European civil protection cooperation.

Italian civil protection started to cooperate with the other Member States of the former European Community in the 1980s, in response to the numerous natural and environmental disasters that the European continent was called to face[11]. This first form of European cooperation continued with the adoption of resolutions that initiated a progressive sharing of experiences and an organized training course for civil protection experts from the various States.

[11] *On the evolution of civil protection cooperation within the European Union, see Silvestri (2012).*

In the following years, this cooperation increased particularly in the field of prevention, in the context of the study and analysis of the causes of disasters, as well as in that of preparedness, including the strengthening of volunteering, today a primary element of the Italian National Civil Protection Service, the realization of public awareness campaigns for the promotion of self-protection measures against disasters and the establishment of a platform for the exchange of information in real time between the operating rooms of the various Countries, to be used especially in the case of an emergency (the current CECIS, which will be discussed further).

The constant process of consolidating cooperation in the field of civil protection led, in 2001, to the creation of a real European Civil Protection Mechanism through a formal legislative act, the Council Decision n. 2001/792/EC.

Photo 101. L'Aquila, 2009. European expert involved in assessing the usability of buildings damaged by the 6 April earthquake.

With the Lisbon Treaty of 2009, the matter became more important and was regulated under a dedicated Title. The importance achieved by the system at European Union level also reverberates in its organization: the competence moved from the DG-ENV-Directorate-General for the Environment of the European Commission to the renamed DG ECHO-Directorate-General for Humanitarian Aid and Civil Protection. The 2001 Decision is reviewed in 2007, 2013 and again in 2019.

The Decision reflects the evolution of a system which, from 2001 to today, has contributed to improving cooperation between the Member States and facilitated greater coordination. The European Civil Protection Mechanism, which has now become the Union Mechanism following the 2013 reform, by recognizing the primary responsibility of the Member States for the safety and protection of people, the environment and socio-economic context of a territory, promotes at the same time solidarity among the Countries, in line with the Lisbon Treaty[12].

[12] *TEU-Treaty on European Union, art. 3, paragraph 1: «The Union's aim is to promote peace, its values and the well-being of its peoples»; Article 3, paragraph 3: «[the Union] shall promote economic, social and territorial cohesion, and solidarity among Member States».*

Finding a meeting point between different political and administrative visions of many Countries is not a simple task, especially when the topic is risk management, which sees the Countries of the Union exposed to hazards of different nature and entity. If for example we consider the seismic risk, it is a hazard that mainly affects the Union's Southern Countries. Nonetheless, an agreement has always been reached between the different needs and legitimate expectations, considering that protecting the well-being and safety of people's lives is a common universal objective that will rarely raise any doubts, vetoes or impositions.

What is the Union Civil Protection Mechanism today? It is not easy to concisely reply to a question of this scope, considering the long journey made thus far. It is a system, a network of Member States' civil protection Authorities that collaborate in the various phases of risk management, from prevention and preparedness to emergency response. It is therefore a network between States facilitated by the European Commission: this means that the pooled resources are national resources, to which the European Institutions contribute economically. Each State participates in the Mechanism under the coordination of its own Authority of national civil protection, which for Italy is the Civil Protection Department under the Prime Minister's Office.

But beyond Europe, every Country in the world, in addition to the United Nations and relevant international organizations, in the event of a catastrophe or even in its imminence, can request assistance from Europe through the Union Mechanism. Every request and offer of assistance is conveyed through the ERCC-Emergency Response Coordination Center referred to at the beginning, located in Brussels at DG-ECHO, which uses a protected IT platform for communication with and between the participating States (in addition to the European Union Countries, Norway is also part of it, Iceland, Serbia, Montenegro, North Macedonia and Turkey) called, as mentioned, CECIS-Common Emergency Communication and Information System.

In order to ensure the best possible coordination between teams and experts from so many States, in the last 20 years it has been necessary to define a common language, based on standards and training courses shared by all participating Countries; it has been a long journey, made up of training courses, exercises, study projects, exchange of experiences and emergency collaborations. These elements have contributed to making it possible, today, for teams from different countries to work together in a coordinated and effective way. It wasn't just about creating a common language between people of different

geographical origin, but also of different training: firefighters, medical doctors, architects, engineers, geologists, volunteers and many others, being the civil protection responsible for many complex subjects that require the contribution of different skills.

The objective of making different skills and organizational structures work together is common to almost all European civil protections and it is thanks to this shared vision that the Mechanism has been able to overcome differences between Countries and fields of competence.

In its early years, the Mechanism went through stalls and rapid accelerations due to the outbreak of emergencies. The latter helped to overcome the initial resistance that some had on the opportunity to structure themselves to manage certain types of phenomena. A good example would be to recall what recently occurred in Sweden. The traditional resistance of Scandinavian Countries to enhancing their firefighting air fleets changed radically when in 2017 Northern Europe was severely hit by forest fires (see Chapter 8).

Photo 102. Unawatuna (Sri Lanka), 2004. The Advanced Medical Post set up by the the Civil Protection Department in the South of the Country a few days following the tsunami.

Since its establishment in 2001, the European Union Civil Protection Mechanism has been activated more than 300 times, in many cases with the contribution of Italy, offering help and relief to Countries affected by serious emergencies and populations in need of assistance. The Mechanism's operations can range from sending teams of experts to support the affected Country addressing a specific problem (for example, sending oil pollution experts to the Bahamas in 2019), or sending technical resources to face situations of hazard out of control (for example, with the dispatch of Canadair fleets to promptly support forest fire operations), up to complex operations thanks to the deployment of teams and equipment to respond to global catastrophic events (for example, the 2010 Haiti earthquake, in which the Union Mechanism intervened with the contribution of 25 Countries).

Our Country has played a leading role for the success of the Mechanism. Italian resources have intervened in international emergencies, under the coordination of the Civil Protection Department, since the very establishment of the Mechanism, providing support and assistance to various Countries in the European region, both in the fight against forest fires that have affected several Mediterranean Countries over the years such as Greece, France or Croatia, as well as to other less recurring emergencies, such as the flood in Bulgaria in 2012 or in Bosnia and Herzegovina and Serbia in 2014. It has also intervened at global level in many parts of the world, from Southeast Asia, hit in 2004 by a devastating tsunami, to Florida (USA), affected by the terrible flood caused by hurricane Katrina in 2005, to the Haiti emergency in 2010, Nepal in 2015, Ecuador in 2016, Iraq in 2017 and Albania in 2019, or even when the Idai cyclone hit Mozambique with devastating effects in 2019 (see Chapter 8). But Italy has also made use of the support of the Mechanism to deal with particularly critical phases on its own territory, for example the forest fires of 2017.

The solidarity approach inherent in the current Mechanism Decision is also reflected in the change of the name from “voluntary Pool” introduced as a novelty in 2013, to “European Civil Protection Pool”: these are "pre-committed" civil protection resources in ordinary time by States and made available to the Commission in the event of an international emergency. As evidence of the high level of interoperability, the pool also provides for the availability, through the States, of existing resources at regional and local level.

Photo 103. Dandagaun (Nepal), 2015. The Italian team of the Civil Protection Department brings aid in an area hit by the 25 April earthquake.

This evolution shows on the one hand the will of the European Union to increase its autonomous capacity to intervene in emergency contexts, on the other that of the Member States to make available, in the name and for the benefit of the European Union, the excellence of their resources in the field of civil protection intervention.

The current Mechanism was recently strengthened by the Decision of the European Union 2019/420 through the establishment of RescEU: a set of resources acquired by the Member States and mobilized by the Commission «to respond to overwhelming situations as a last resort where existing capacities at national level and those pre-committed by Member States to the European Civil Protection Pool are not, in the circumstances, able to ensure an effective response to various kinds of disasters». It is a real "additional reserve" made up of supplementary resources, suitable to face the most recurrent catastrophes. A tool that is added and used once the pool of available resources is used up. In other words, RescEU will be activated to offer support to the already deployed means available at national level and to those pre-committed by the States within the aforementioned European Civil Protection Pool.

7. Relations with Europe and International Bodies

Photo 104. Beira (Mozambique), 2019. The second level Advanced Medical Post set up by the Civil Protection Department near the Beira hospital, seriously damaged by cyclone Idai.

The same Decision also envisages that training and knowledge sharing be enhanced. The Commission is responsible for setting up a "Union Civil Protection Knowledge Network" made up of actors and institutions involved in civil protection and disaster management, including centers of excellence, universities and researchers, forming it together with the European Commission, designed to implement activities relating to training, exercises, lessons learned and the dissemination of knowledge.

In conclusion, it can be said that the issues of prevention and preparedness play a pivotal role in the effective response to natural and man-made disasters, always guided by the spirit of solidarity and the desire for mutual support between the Member States.

► 7.2 International Bodies

Moving on a global scale, Italy, through the Civil Protection Department, has long started a fruitful collaboration with the United Nations, in particular with the specific UNDRR-United Nations office for Disaster Risk Reduction (formerly UNISDR), responsible for supporting the implementation of the Sendai Framework (see Legislative framework of reference).

The Sendai Framework for Disaster Risk Reduction 2015-2030 was adopted on 18 March 2015 on the occasion of the Third World Conference of the United Nations and is the tool that succeeds the Hyogo Framework for Action 2005 -2015.

The Hyogo Framework first and following Sendai are initiatives of the United Nations to reduce the number of victims and people affected by disasters worldwide, in consideration of the fact that these numbers are increasing instead of decreasing. This is due both to the disasters themselves, which are becoming increasingly frequent and destructive mainly due to climate change, and to the increase in vulnerability and exposure, such as stated in Chapter 5.

Photo 105. Durres (Albania), 2019. An Italian team engaged in search and rescue activities in Albania after the 26 November earthquake.

The Sendai Framework aims to: improve understanding of disaster risk in all its implications and scales that include exposure, vulnerability and hazard; strengthen disaster risk governance, including national Platforms for disaster risk reduction; identify responsibilities for risk management; "build back better" after an emergency, reducing the conditions of vulnerability compared to those before the disaster; favor the identification of interested parties and their respective roles; mobilize investments with specific attention to risk, also to avoid creating new risks; promoting the resilience of health infrastructures, cultural heritage and workplaces; stimulate international cooperation and global partnerships, including through economic support and loans from international financial institutions (see Figure 24).

As regards individual Countries, the risk reduction strategy envisaged by the Sendai Framework encourages the establishment of government coordination forums, represented by the most important players at national and local level, such as national and local Platforms for disaster risk reduction, and the identification of national focal points, designated as coordinators of all the institutions that, within the Country, can contribute to the implementation of the strategy itself. It is suggested to Governments that these mechanisms are solidly included in institutional reference frameworks, with the assignment of clear responsibilities to specific authorities in order, in particular, to identify the risks of sectoral and intersectoral disasters and to build risk awareness and

knowledge through the sharing and dissemination of non-sensitive information and data concerning the risks themselves, helping to draw up specific reports at local and national level and to coordinate public awareness campaigns on the subject. These responsibilities must be established through laws, regulations, standards and procedures.

Figure 24. Outcome, goal, priorities and targets of the Sendai Framework for Disaster Risk Reduction 2015-2030.

Photo 106. Rome, 2018. The European Forum for Disaster Risk Reduction, organized by the Civil Protection Department and promoted by the UNISDR-United Nations office for Disaster Risk Reduction, took place in Rome from 21 to 23 November 2018.

Due to the rationale underlying the organization of the National Civil Protection Service in Italy, of which the Civil Protection Department carries out the direction and coordination function, the latter also represents the focal point at national level for the implementation of the Sendai Framework, given that the management and reduction of disaster risks are a priority for the purpose of safeguarding the population, the socio-economic stability and prosperity of a Country like Italy, subject to numerous natural risks.

Italy also has its own national platform. The National Platform for Disaster Risk Reduction was established by the Prime Minister's Decree n. 66/2008, identifying the coordinating role in the Civil Protection Department[13].

The Platform acts as a forum for inter-sectoral coordination of risk reduction policies and programs at both ministerial and territorial level, through the representatives of local Authorities, and has launched the definition of a national strategy for reducing disaster risks, as set out by the Sendai Framework. For the sake of completeness, it is worth highlighting that the latter also falls within the broader 2030 Agenda for Sustainable Development and related Goals (Figure 25).

[13] *The Platform is composed of representatives of regional and State Administrations competent in the matter, as well as representatives of local authorities: Civil Protection Department, Department for Regional Affairs and Autonomies, Ministry of Foreign Affairs and International Cooperation, Italian Agency for Development Cooperation, Ministry of Defence, Ministry of the Interior, Ministry of Economy and Finance, Ministry of Economic Development, Ministry of Infrastructure and Transport, Ministry of Environment, Land and Sea Protection, Ministry of Health, Ministry of Education, University and Research, Ministry of Cultural Heritage and Tourism, Ministry of Agriculture, Food and Forestry, National Council of Civil Protection Voluntary Organizations and also one representative for the Regions, one for the Union of Italian Provinces and one for the National Association of Italian Municipalities.*

In fact, Sendai's goals coincide in many respects with the Sustainable Development ones, in particular with regard to Goal 1 (End poverty in all its forms), 11 (Make cities inclusive, safe, resilient and sustainable) and 13 (Take urgent action to combat climate change and its impacts).

Recent activities, in collaboration with UNDRR, include the Italian presidency of the European Forum on Disaster Risk Reduction in 2018, which represents the intermediate level between the State level of the National Platforms and the international level of the Global Platform. Also significant is the promotion of the World Campaign for Resilient Cities, "Making cities resilient", with the involvement of the ANCI-National Association of Italian Municipalities, aimed at raising awareness of Mayors, the first civil protection Authorities, to disaster prevention policies.

Figure 25. Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate change, environmental degradation, peace and justice. The 17 Goals are all interconnected, and in order to leave no one behind, it is important that we achieve them all by 2030 (Resolution of the United Nations General Assembly 70/1 of 25 September 2015).

The Italian experience gained in the disaster management and reduction sector is an example of good practice for many Countries and organizations, which look to Italy as an important reference case. The Civil Protection Department promotes the system in the context of projects and technical assistance activities with Third Countries to strengthen institutional capacities in risk reduction and prevention and planning emergency measures, mainly in the areas of the Western Balkans, North Africa and the Middle East. The commitment to support these initiatives is particularly fruitful with a view to facilitating dialogue between central Administrations, strengthening cohesion with the territory and stimulating a greater culture of civil protection and risk reduction.

8

CIVIL PROTECTION INTERVENTIONS IN ITALY AND WORLDWIDE

The previous Chapters have provided a general overview of the Italian civil protection system by examining the hazards, the risks, the methods of intervention, the framework of competences, and by retracing the history of disasters that affected our Country.

Interventions in response to the many disasters that have struck the Italian territory were described and analyzed (see Chapter 3), starting with the catastrophic earthquake of Calabria and Messina in 1908 up to the 1980 devastating earthquake in Irpinia. The latter launched a series of initiatives and considerations that gave rise to the current national civil protection. From Irpinia to today, there have been many interventions implemented by the national civil protection system following catastrophic events. A non-exhaustive list, which, however, gives a clear picture of the risk situation of our Country, can be found in Table 5, while Table 6 shows the main interventions carried out abroad. We will analyze some of them, grouping them by type of intervention.

As already seen in Chapter 6, the management of an emergency is almost always articulated in immediate relief to safeguard human lives, by the provision of shelter areas for those who are left homeless, and the restoration of infrastructure operability as well as reducing the residual risk until the resumption of acceptable living conditions.

The time required varies from weeks to years.

Table 5. Civil protection interventions in Italy.

YEAR	PLACE OF EMERGENCY	KIND OF EVENT
1983-1984	Pozzuoli – Campania	Volcanic crisis – Bradisism
1984	San Donato Val di Comino – Lazio	Earthquake
1985	Tesero – Autonomous Province of Trento	Hydrogeological event – Landslide
1987	Valtellina – Lombardy	Hydrogeological event – Landslide
1991-1992	Etna – Sicily	Volcanic crisis
1994	Po river – Piedmont	Flood
1996	Versilia – Tuscany	Flood
1996	Crotone – Calabria	Flood
1997	Umbria and Marche	Earthquake
1998	Sarno, Quindici, Bracigliano – Campania	Hydrogeological event – Mud flows
2000	Soverato – Calabria	Flood
2000	Northern Italy	Flood
2001	Etna – Sicily	Volcanic crisis
2002	San Giuliano di Puglia – Molise	Earthquake
2002	Macugnaga – Piedmont	Hydrogeological event – Ephemeral lake
2002	Etna, Santa Venerina – Sicily	Volcanic crisis
2002-2003	Stromboli island – Sicily	Volcanic crisis
2003	Italy	Health emergency – SARS
2003	Italy	Energy crisis – Black out
2005	Cerzeto – Calabria	Hydrogeological event – Landslide
2005	Vatican City and Rome – Lazio	Major event – Pope John Paul II funeral and Pope Benedict I election
2006	Campania	Waste emergency
2006	Vibo Valentia – Calabria	Hydrogeological event – Flood
2007	Puglia and Sicily	Forest fire emergency
2007	Stromboli island – Sicily	Volcanic crisis
2008	Tiber river, Rome – Lazio	Hydrogeological event -- Removal of stranded boat under Sant'Angelo bridge
2009	Abruzzo	Earthquake
2009	Viareggio – Tuscany	Railway accident
2009	Giampilieri – Sicily	Hydrogeological event
2010	Montaguto – Campania	Hydrogeological event – Landslide
2011	Italy	Uncontrolled return of the satellite RoSat
2011	Italy	Uncontrolled return of the satellite UARS-Upper Atmosphere Research Satellite
2011	Genoa and Cinque Terre – Liguria	Hydrogeological event – Flood
2011	Italy	Humanitarian emergency – North Africa
2012	Italy	Hydrogeological event – Snow
2012	Emilia-Romagna, Lombardy, Veneto	Earthquake
2012-2015	Giglio island – Tuscany	Shipwreck and removal of Costa Concordia
2013	Olbia – Sardinia	Hydrogeological event – Flood
2014	Liguria	Hydrogeological event – Flood
2014	Vicenza – Veneto	War device defusing
2015	Benevento – Campania	Hydrogeological event – Flood
2015	Messina – Sicily	Water crisis
2016	Sicily	Forest fire emergency
2016	Corato – Puglia	Railway accident
2016-2017	Lazio, Umbria, Marche and Abruzzo	Earthquake
2017	Rigopiano – Abruzzo	Hydrogeological event – Avalanche
2017	Ischia island – Campania	Earthquake
2017	Livorno – Tuscany	Hydrogeological event – Flood
2018	Central Italy	Hydrogeological event – Snow
2018	Italy	Uncontrolled return of the space station Tiangong 1
2018	Genoa – Liguria	Collapse of Morandi Viaduct
2018	Northern-Central Italy	Hydrogeological event – Bad weather
2018	Etna – Sicily	Earthquake
2019	Stromboli island – Sicily	Volcanic crisis
2019	Italy	Bad weather
2019	Italy	Bad weather

8. Civil protection interventions in Italy and worldwide

YEAR	PLACE OF EMERGENCY	KIND OF EVENT
1986	El Salvador	Earthquake
1988	Armenia	Earthquake
1999	Albania	Intervention "Missione Arcobaleno"
1999	Turkey	Earthquake
2003	Pacific Ocean, off Galapagos islands	Uncontrolled return of the satellite Beppo-SAX
2004	Beslan – North Ossetia	Humanitarian intervention
2004-2005	Southeast Asia	Tsunami
2005	Pakistan	Earthquake
2005	Florida and Louisiana – USA	Hurricane Katrina
2005-2006	South Sudan	Humanitarian intervention
2006	Indonesia	Volcanic crisis
2006	Lebanon	Humanitarian intervention
2008	Sichuan – China	Earthquake
2010	Haiti	Earthquake and Cholera
2010	Chile	Earthquake
2011	Japan	Earthquake
2013	Philippines	Typhoon Haiyan
2015	Nepal	Earthquake
2016	Ecuador	Earthquake
2017	Iran and Iraq	Earthquake
2017	Albania	Hydrogeological event – Flood
2019	Mozambique	Cyclone Idai
2019	Albania	Earthquake

Table 6. Italian civil protection interventions in the world.

There have been too many lost lives, incalculable damage to property, to the economy, to infrastructure and the environment. Shaped by multiple catastrophes, the National Civil Protection Service operates between two opposite extremes: on one side, a difficult run-up to securing the territory, on the other, a recognized ability to manage the first emergency phase, carried out thanks to the joint effort of the various Components and Operational Structures of the system. In between, the unceasing ongoing non-structural prevention.

The list of events that have marked our history (see Tables 5 and 6) must be read using different interpretation keys: from the diverse regulatory and legislative frameworks in force at the time of the event's outbreak, to the peculiarities arising while an event's management is underway, up to the technical solutions and/or regulatory measures that resulted.

After 1980, there has been a progressive modification of the civil protection

regulatory framework, passing through the reform of Title V of the Constitution until the new Civil Protection Code currently in force. The first represented an unprecedented change that had a significant impact also on emergency response procedures, by determining a strong decentralized approach in favor of the Regions and Autonomous Provinces. The Code, on the other hand, responds to the need to keep up with a constantly changing context.

Returning to the events, some of them – similarly to the Irpinia earthquake or the one in Friuli, the Seveso accident, the Florence flood – have strongly influenced an awareness increase and the subsequent adoption of important implementation measures (see the Sarno event). Others, due to the peculiarity of the emergency faced, helped introduce different forms of management suggested by the complex and particular challenges that emerged (see the San Giuliano di Puglia earthquake, the Costa Concordia shipwreck, the earthquakes in Abruzzo and in Central Italy).

For example, following the hydro-geological disaster of Sarno, which caused the death of 160 people in 1998, the hydrogeological monitoring and alert system was planned and implemented, which today has become the cornerstone of civil protection procedures with regard to weather-hydro risks (see Chapter 6 and Focus 13).

Four years later, in the fall of 2002, the first of two major earthquake shocks (magnitude MI 5.7) caused the collapse of the "Francesco Jovine" school in San Giuliano di Puglia, in Molise. The earthquake killed 30 people, including 27 children and a teacher. Despite the moderate magnitude, the earthquake caused the collapse of the school structure that was evidently very vulnerable.

Photo 107. San Giuliano di Puglia, Campobasso, 2002. Collapses caused by the earthquake of 31 October.

That tragedy gave rise to an important reform season of the Country's seismic hazard mapping system and the approval of regulations and related funding for the progressive seismic upgrading of existing buildings and infrastructure works of strategic interest for civil protection purposes and/or relevant for the consequences of their collapse (including school buildings).

The San Giuliano school was rebuilt with innovative techniques and, above all, in compliance with anti-seismic structural measures: the so-called seismic isolation was used, a technique that guarantees almost total protection even in case of very strong earthquakes.

Photo 108. San Giuliano di Puglia, Campobasso, 2008. The "Francesco Jovine" school rebuilt with anti-seismic techniques.

Further actions followed tragic events, contributing to mark a step forward for the civil protection system and, more generally, for the choices related to risk reduction. For example, in the aftermath of the Abruzzo earthquake in 2009, 965 million euros were allocated for seismic prevention, which made it possible to tackle structural and non-structural prevention in an integrated manner (see Focus 19) starting, among other things, the systematic realization of Seismic Microzonation in all Italian Municipalities with higher seismic hazard.

Photo 109. San Giuliano di Puglia, Campobasso, 2008. Interiors of the rebuilt school.

THE NATIONAL PLAN FOR SEISMIC PREVENTION

Article 11 of Law n. 77/2009, converted from Decree-Law n. 39/2009 for reconstruction activities in Abruzzo, provided for the allocation of a fund of 965 million euros, spread over seven years, for the prevention of seismic risk throughout the national territory.

The management of the Plan was entrusted to the Civil Protection Department through the involvement of the Regional Administrations, responsible for the implementation of prevention programs in their territories (Dolce, 2012). A total of seven ordinances have been issued since 2010, relating to as many years: Ordinances by the President of the Council of Ministers n. 3907/2010 and n. 4007/2012 (relating to the years 2010 and 2011) and the Ordinances by the Head of the Civil Protection Department n. 52/2013, n. 171/2014, n. 293/2015, n. 344/2016 and n. 532/2018 (relating to the years 2012, 2013, 2014, 2015, 2016).

For each year, the allocation of resources between the Regions was carried out through Decrees of the Head of the Civil Protection Department, in proportion to a seismic risk index assessed for each Region.

The Plan was aimed at the following non-structural (for about 10% of the fund) and structural prevention activities, overall aimed at reducing seismic risk and increasing the resilience of the territory and the emergency management system:

a) Seismic Microzonation studies, to define the areas subject to seismic shaking amplifications and/or permanent deformations of the ground in the event of an earthquake, and analysis of the Emergency Limit Condition, to verify the capacity of the structures and road infrastructures essential to the implementation of civil protection plans to adequately resist earthquakes. These are non-structural prevention activities to support local government and emergency planning;

b) measures to reduce vulnerability (local strengthening, seismic upgrading, demolition/reconstruction) of public buildings and infrastructure works of strategic interest for civil protection purposes and/or relevant for the consequences of their possible collapse;

c) measures to reduce vulnerability (local strengthening, seismic upgrading, demolition/reconstruction) of private buildings for residential use and for production activities;

d) other urgent and non-delayable interventions for the seismic risk mitigation reserved for infrastructures of strategic interest in the event of an emergency (such as bridges or viaducts).

With reference to what has been implemented to date, the following considerations emerge:

• the planned strategy is achieving, with the direct participation of the Regions, the expected results. So far, it has launched some virtuous processes to be taken into account for the future;

• the Regions have legislated to incorporate the Seismic Microzonation studies and the analysis of the Emergency Limit Condition into the planning, defining the co-financing regime provided for by the implementing ordinances. At the end of the program implementation, approximately 3,500 Municipalities (out of approximately 8,000 in total), i.e. those with the highest seismic hazard, will be provided with Seismic Microzonation studies and analysis of the Emergency Limit Condition;

• the Regions were called upon to draw up a schedule of interventions on public buildings and strategic infrastructures which made it possible to define a first picture of the needs in their territories, necessary to appropriately address any future resources;

• a large participation by citizens was recorded for access to financing on private buildings;

• the awareness process across the Country regarding the upgrading of public assets has made it possible to intervene on a significant number of buildings and infrastructure works (around 1200), strategic or relevant, subject to seismic upgrading or demolition and reconstruction;

• the conditions for managing emergencies have improved through the aforementioned securing of a first stock of strategic buildings in the various Regions;

• there was a wide involvement of the professional Orders and their members, primarily Geologists, who recognized in the initiative a moment of cultural growth and participation in a process of improvement of knowledge aimed at mitigating seismic risk at the local level;

• the Civil Protection Department carried out an effective monitoring action on the interventions promoted by the Plan also through the development of IT platforms prepared ad hoc. The results of this monitoring activity are published regularly on the website of the Civil Protection Department.

Photo 110. Ischia, Naples, 2017. Teams engaged in search and rescue activities after the earthquake of 21 August.

Overall, the emergency response capacity of the civil protection system is today considered effective in terms of activation times, skills of operators, availability of means and structures and coordination system. The list stresses how what led to such a synergic and strong system was become an absolute necessity, and not just a virtuous process. An inclusive and multidisciplinary system, based on a robust legislative and experiential framework, that more than any other directed the ability to respond effectively and efficiently to emergencies and to impose itself in prevention actions.

The action of the National Fire Brigade as well as the National Health System, Police Forces and Armed Forces, like all the other Operational Structures, is absolutely compatible with the needs. Regions and local Authorities over the years have developed skills, professionalism and the means necessary to cope with crisis situations.

The network of Competence Centers of the Civil Protection Department and the Country's entire research system allow for an adaptation of our activities to the fastest development of research and science.

The world of volunteering also benefited greatly by the system thanks to the development of an important network of skills and professionalism, distributed evenly throughout the Country. These great human and material resources allow us to carry out timely operations which, although can only partially reduce the number of victims, allow however to rescue the survivors and limit as much as possible the damaging effects of the event.

Despite their often tragic evolution, emergencies are an opportunity for the National Civil Protection Service which, on the basis of direct experiences, continues to improve its capacities and resilience, in the attempt to correct weak points and, above all, to focus on issues that compared to other priorities were once perceived only in the background. It is in this perspective that we will revisit some events.

► 8.1 Climate change and related risks

In the summer of 2002, the high temperatures of the period caused part of the Monte Rosa glacier to melt and form an "ephemeral" lake. The spectacle of a lake inside a glacier was undoubtedly fascinating, but it was also evidently dangerous, because the walls that contained it were made of ice and subject to melting. They could therefore collapse, pouring a huge mass of water and debris downstream, where the town of Macugnaga would have been swept away, with evident consequences.

Photo 111. Trento, 2018. Damage to vegetation caused by an exceptional wave of bad weather.

To avoid a disaster, which to civil protection experts immediately evoked the memory of the Vajont dam disaster, an urgent intervention was carried out to drain the lake. The complex operation was implemented by transporting powerful pumps with a helicopter. A difficult undertaking and with considerable risks, never carried out before, which however turned out to be successful: the lake was emptied and the potential collapse avoided.

In the summer of 2019, seventeen years later, we witnessed the detachment of a block of the Mont Blanc glacier which, along the slopes of the Grand Jorasses, keeps gliding at a speed of 20-30 centimeters per day. The huge mass of ice has been monitored 24 hours a day for years, and prevention actions have been taken, making the area safe by closing a road downstream the block being detached. The arrival of the cold season slows down its movement, but it can regain strength once the winter period is over. Nothing can be done to stop this phenomenon. The only action possible today is to implement all precautions and interventions for the protection of the population.

It is highly probable that these phenomena are related to "climate change", linked to global warming of the Earth. From the point of view of a civil protection operator, the actions to be taken regard all those activities aimed at reducing the exposure of people to potential risks. Emptying a lake and securing the area below the sliding ice block are examples of possible actions.

Photo 112. Trento, 2018. Damage to homes caused by an exceptional wave of bad weather.

All interventions implemented following catastrophic hurricanes, which affect large areas of Countries, also very far apart from each other, represent other important relief operations conducted by the Civil Protection Department, that has operated from time to time in agreement with local Authorities by sending its support in terms of emergency health facilities (field hospitals), goods, specialized personnel and consumable goods.

Interventions of this type (Table 6) were implemented after hurricane Katrina that hit New Orleans in 2005, after hurricane Haiyan that struck the Philippines in 2014, and hurricane Idai that hit East Africa and in particular Mozambique in 2019. Three very different realities, both geographically and in terms of socio-economic contexts but with a common denominator represented by the terrible storms of water and devastating wind causing casualties and destruction over large territories of the three Countries. Another common element to the three disasters was the difficulty on the part of local civil protection Authorities to estimate accurately the extent of the impact that such destructive hurricanes would have on the affected areas. Resident populations were not evacuated and the number of victims was therefore considerably high.

To date scientific knowledge can do very little to reduce the power of hurricanes, however highly specialized computing systems that are capable of modelling their potential route and satellite systems able to accurately follow their path do exist, providing important information on the strength and therefore on the possible damage that the impact of the storm could have on the ground. An effective preventive action is implemented by evacuation of the population from the affected areas or its sheltering in appropriate facilities, which still remains the best solution to reduce the number of victims. Moreover, there are devices to protect houses and reduce their vulnerability (for example by hermetically closing windows with sturdy protections).

However, it is certain that the three Countries mentioned, in the aftermath of these terrible catastrophes, have implemented more adequate civil protection policies. In the United States, the FEMA-Federal Emercency Management Agency has been substantially reorganized and enhanced, following a thorough investigation conducted by the American Senate that detected delays and responsibilities in the relief operations. In the Philippines a reorganization of the national civil protection system was initiated, due to the delays with which central Authorities intervened to safeguard the population, similarly to what happened in Mozambique. The organizational and procedural changes helped reduce the number of victims in the following hurricanes that hit those Countries, where in fact preventive action was promptly implemented.

Italy is not a Country historically affected by phenomena such as the devastating hurricanes that occur annually in the Caribbean or Far East. Yet, between October and November 2018, the Vaia storm broke down across 15 Regions of our Country with rain and wind that in some areas of Northern Italy reached the speed of 190 kilometers per hour. It is estimated that 13 million trees were blown down by the winds. In all the Regions affected, buildings, ports, bridges, roads were destroyed with estimated damage of over 6.2 billion euros.

The meteo-alert system adopted by the National Civil Protection Service reached all the areas concerned and the local Authorities promptly provided for the closure of schools, parks and public areas, spreading useful indications and instructions to reduce exposure to the dangers deriving from the storm.

Photo 113. Orebro (Sweden), 2018. The Canadair crew planning the firefighting mission.

At this point it seems appropriate to discuss forest fire fighting activities (see also Chapters 2 and 5), an emergency response capacity that has greatly developed in our Country over the past years in terms of the containment capacity of the phenomenon. The problem occurs cyclically throughout the Country, coinciding with particularly critical seasons due to the lack of rainfall, high temperatures and rising winds, likely the effect of climate change. The summer seasons of 2007, 2013 and 2017 were emblematic cases for the effort required. A story that has seen the development of a strong culture of prevention and repression of illicit activities and careless behaviors that cause forest fires, as well as the organization of an efficient emergency apparatus. The Italian one is the most important firefighting fleet of planes and helicopters on the whole European territory; it makes use of the skills of the National Fire Brigade and the Carabinieri Forestry Department (former Forestry Corps), in addition to many volunteer groups that, over the years, have achieved a significant intervention capacity to support institutional operators.

Photo 114. Stockholm (Sweden), 2018. Italian Canadair involved in extinguishing forest fires near the Swedish capital.

Thanks to these skills, in response to the Government's request for help from the European Union, the Italian crews also operate abroad through the activation of the Union Civil Protection Mechanism. For example, during 2018 they operated in Sweden as part of the Buffer-IT project, a European Union instrument created to respond promptly and effectively to emergencies that occur within the EU or on outside the Union borders, by sharing the resources of the Member States. Italy participated with two Canadairs in two missions, in June and July, to respond to the severe emergency caused by the numerous and extensive forest fires that affected Sweden in those months. The Swedish Authorities subsequently thanked the Italian Government for the support offered and coordinated by the Civil Protection Department.

In the summer of 2018, a significant number of fires occurred not only in Sweden, but also in Norway, Finland and Russia, and beyond the Arctic Circle. Much of the Northern hemisphere experienced an unusually warm climate that favoured the outbreak of wildfires throughout the area. Some scientists say that because of climate change, the Arctic and other areas once immune to fire could become more vulnerable. The areas affected by fires have such characteristics that allow forests and peat bogs to develop rather large carbon deposits. When such dense carbon ecosystems experience dryness and heat, even a minor source of ignition, be it lightning or a cigarette, is enough to generate devastating fires.

► 8.2 Earthquakes: continuity of educational, economic and administrative activities

In Italy the different seismic emergencies have required different response approaches and ways of assisting the population. On 6 April 2009, an earthquake of moment magnitude 6.3 struck the region of Abruzzo and its regional capital, the city of L'Aquila: 309 victims and around 67 thousand people left without safe homes that had to be assisted immediately the first weeks following the disaster. Overall, almost 6,000 tents with related services were set up in the reception areas, and thousands of people were transferred to hotels on the Adriatic coast (Dolce & Di Bucci, 2015).

In L'Aquila, urgent and essential decisions were made to assist the population affected by the earthquake (see Focus 17), also taking into account that this city of culture is an academic center for thousands of students. This vocation of the

Photo 115. Amatrice, 2016. MUSP-Temporary School Modules built after the earthquake in the town of San Cipriano by the Civil Protection of the Autonomous Province of Trento.

city has determined actions in support of educational continuity, guaranteeing students, against the impact of such a catastrophic event, the possibility to continue their studies safely, avoiding their transfer to distant areas, which could have possibly caused also a permanent abandonment of the territories affected by the event. To this end, barely damaged schools were quickly restored by intervening on the damaged parts with repair and strengthening operations, while for the most damaged or collapsed schools, prefabricated buildings – i.e. the so-called MUSP-Temporary School Modules – were built in a very short time, so that educational continuity could be guaranteed (Dolce, 2010). The significant damage suffered by cultural heritage sites and assets of the area also required particular effort and care to ensure the recovery of artistic assets, a joint effort still alive in the memory of Italian communities after disasters like the 1966 flood that hit Florence, or the collapse of the vaults of the Basilica of San Francesco d'Assisi in 1997. Firefighters from the National Fire Brigade, technical experts from the Ministry of Cultural Heritage and a great number of specialized volunteers worked effortlessly to recover everything possible from the rubble and to store it safely and put in the hands of competent restoration experts for the damaged art works and cultural heritage assets to return to their original form.

Three years later, on 20 and 29 May 2012, two earthquakes of moment magnitude 6.1 and 5.9 respectively affected Emilia-Romagna: 26 victims and a devastating impact on that Region's prosperous economy, with significant damage to the food and technology industries of the area. In this case, in addition to the usual actions in favour of the population hit by disaster, particular attention was paid to the economic and production continuity of the affected areas.

On 24 August 2016, the Amatrice-Norcia-Visso seismic sequence began with the first major shock, with moment magnitude 6.2, which saw Amatrice among the epicentral Municipalities and touched a very high number of small cities of art and villages in Central Italy. Also in this case a high number of victims was recorded: 299 deaths and thousands of displaced people. The strongest shock

in the sequence, with moment magnitude 6.6, was recorded on October 30, 2016, with no further casualties. Subsequently, on 18 January 2017, four earthquakes of moment magnitude ranging between 5.2 and 5.7 occurred on the same day. Assistance to the population was guaranteed with the usual promptness by the civil protection system, although complicated by a sequence of shocks that saw a new and powerful earthquake only two months after the first violent shock.

Educational and economic continuity were priority objectives sought by the system, in addition to the need to guarantee administrative continuity, i.e. the support to the Municipalities, in particular to those small and located in disadvantaged areas that had seen the earthquake determine a complete halt to main municipal administrative services, essential for social life.

To ensure school continuity, the civil protection system has the option to intervene in different ways, with provisional school modules and, in coordination with the Ministry of Instruction, by providing for the safety of some school buildings for the continuation of activities, as well as by implementing measures for the transfer of students and to restore connected services. Administrative continuity, on the other hand, thanks to a solidarity approach among Municipalities, is ensured by sending staff from the Municipalities not affected by the events to support the Municipalities in need.

Earthquakes, however, are not an Italian exclusive, but sadly quite frequent in many parts of the world. Our civil protection system is structured to bring relief and support to every corner of the Country as well as abroad. Over the years, numerous civil protection interventions have supported catastrophic earthquakes that occurred far from Italy. From disasters in Yerevan in Armenia, Izmit in Turkey, Boumerdes in Morocco, to Algeria, Bam in Iran, Pakistani Kasmir, Port au Prince in Haiti, Talca in Chile, Katmandu in Nepal, or Durres in Albania, the Italian civil protection system stood out for the timeliness of humanitarian aid, the appropriateness of the actions taken and the skills and effort of our experts sent on the spot to support the local Authorities. Search and rescue activities, including technical, field hospitals, campsites, community kitchens, construction of prefabricated structures: these are the main operations carried out by Italian experts, providing for complex logistics carried out mostly by air, given the distances and the need to act in a timely and effective way.

Photo 116. Amatrice, 2016. Inauguration of Temporary School Modules for over 200 students of Amatrice, Accumoli and bordering districts.

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► 8.3 Tsunamis

In December 2002 a large landslide along the slope of the Stromboli volcano, triggered by an important intrusion of magma, produced a tsunami with a run-up of 10 meters (see Focus 3). Fortunately, the tsunami occurred in the middle of winter and the absence of tourists on the beach helped greatly reduce its potential effects and risk for people.

Photo 117. Karaitivu (Sri Lanka), 2007. Inauguration of a school complex built by the Civil Protection Department in the South-East of the Country with Italian donations for the victims of the 2004 tsunami.

A tsunami of quite different dimensions occurred following the very strong earthquake that hit at sea, in the Indian Ocean on 26 December 2004, also known as the Sumatra-Andaman or Banda Aceh earthquake (magnitude 9.1). The devastating tsunami, with waves up to 40 meters high, hit Thailand, Sri Lanka, the Maldives islands, up to the coast of Somalia. The victims were estimated at around 230,000, although definite numbers are in fact impossible to obtain because in many areas affected by the tsunami the resident population census was not accurate or even available.

Rescue aircrafts were immediately dispatched by the Civil Protection Department with a load of humanitarian aid and teams of technical experts specialized in rescue operations. Hundreds of Italian and European tourists were repatriated with the flights made available by Alitalia and campsites and field hospitals were set up in numerous points on the island of Sri Lanka, one of the most affected areas by the tsunami.

The generous donation of the Italians through solidarity text messages made it possible to raise almost 60 million euros, which were then invested for the building of hospitals, schools, new homes for displaced persons and in the creation of credit lines, especially dedicated to widowed women with children who wanted to start small businesses.

► 8.4 Man-made risks

The Civil Protection Department's mandate does not concern only earthquakes, volcanic eruptions, landslides and floods. A large number of interventions have been carried out over the years following technological disasters or crises related to human activity. Some, decidedly unusual, could be considered rare events and we believe it is worth discussing them.

On 28 September 2003, in the heart of darkness at 3:00 a.m., during a storm over Swiss territory, a tree fell on a high voltage power line that supplied electricity to Italy, interrupting its supply. The overload of the network caused the sudden interruption of the electricity flow which, due to a so-called "domino effect", caused a total blackout in the Country (with the exception of Sardinia, connected to Corsica).

The power outage, which initially was attributed to a terrorist attack, activated a national civil protection plan with the convening of the civil protection Operational Committee. Upon exclusion of an act of terrorism, which greatly facilitated the following course of interventions, response operations aimed above all at guaranteeing the supply of electricity to healthcare facilities and essential services.

Photos 118, 119. The satellite images of Italy before and during the 2003 blackout (on 27 September at 22:00 on the left, on 28 September at 3:00 on the right).

The fact that the blackout occurred the night between Friday and Saturday made rescue operations easier because of the reduced energy demand in the whole Country. The event, however, highlighted the extreme fragility of the national power supply system, one of the most strategic services for the Country's security. It also highlighted the limited emergency preparedness of many crucial facilities, such as hospitals: they have the obligation to install and maintain alternative energy systems which, on

that occasion, proved to be totally out of order in many cases, due to lack of maintenance and care. A non-secondary aspect of the emergency was also discovering a large number of people who live in their homes with life-saving medical equipment that run on electricity (automatic ventilators and other equipment). Also this type of emergency pointed out the lack of preparedness of families and people in general in the event of such crisis situations.

The return of satellites to Earth is rather frequent event, although not stressed much by the media. In the spring of 2003, the return of an Italian first generation satellite, therefore entirely lacking guidance tools for returning to the atmosphere, became a very alerting issue in the Country. Beppo-SAX, as the satellite was called in the name of a famous Italian astrophysicist, Giuseppe Occhialini, would have returned to the atmosphere in a space on the Earth's surface between 4 degrees North and 4 degrees South of latitude with respect to the Equator.

Over 200 million people live in that strip of land and some important capitals, including Jakarta in Indonesia, are very near. The absence of nuclear power plants or particularly critical industrial plants in the potentially risky area facilitated the preparatory actions for the possible emergency, which could have affected the Countries located in the area described by the Italian Space Agency as a likely landing area.

Photo 120. Rome, 2018. The Technical Scientific Committee for the uncontrolled return of the Chinese space station Tiangong-1 gathered in the operational headquarters of the Civil Protection Department.

For many weeks, thanks to our diplomatic representations, constant activities of information exchange and preparation for the possible new emergency were carried out by alerting the local civil protection systems. An emergency team was ready to leave Italy in case of arising problems for the resident populations. The satellite returned to Earth on 29 April 2003, falling into the Pacific Ocean, off the Galapagos islands.

Lastly, on Easter night in 2018, the civil protection Operational Committee met to monitor the return of the Chinese space station Tiangong-1, which was supposed to crash on Earth on Easter morning, according to the latest estimates,

at 11:26 Italian time. The uncontrolled return could have led to the fall of some debris also on Italian territory, with a probability that seemed to increase, even if rather low in absolute values, up to 0.2%.

Photo 121. Beslan (Ossetia), 2004. The Number One School after the terrorist attack.

On the morning of 14 April 2002, the Libyan leader Gaddafi called the Italian Prime Minister, asking for help for serious damage that had occurred at one of the main petrochemical plants in the Gulf of Sirte. During ordinary maintenance work, a worker had involuntarily generated a spark at the top of one of the silos containing ethylene. A large flame was released from the contact point and risked detonating the entire silos that contained tens of thousands of tons of ethylene. The explosion would have affected other silos containing the same material and other petroleum products, and could have caused catastrophic damage to the area's ecosystem. Few hours after the request for aid, a team of experts went on the site thanks to an aircraft of the Presidency of the Council of Ministers and, after a careful inspection of the accident site and a consultation that lasted the whole night with Italian engineering experts, who suggested the most appropriate measures to contain the damage, the Libyan Fire Brigade managed to put the plant under control.

Once again, a request arrived from the Head of the Russian Civil Protection Department to the Italian Government on the evening of 3 September 2004 and was followed by a memorable Italian humanitarian aid intervention. Urgent medical aid was requested to be sent to Vladikavkaz, North Ossetia, where a group of terrorists occupied Beslan's Number One School, taking all the students hostage in the school gym with parents and teachers on the first day of school. The Moscow Government did not accept any of the conditions proposed by the terrorists and decided to proceed by armed intervention. The military action and the violent reaction by the terrorists resulted in 331 victims, including many children, and many hundreds of wounded, mostly burned.

The request received from Moscow was mainly for pediatric drugs and, in particular, burn treatment medication. Also, an aircraft was made available by the

Photo 122. Vladikavkaz (Ossezia), 2004. Interior of the pediatric psychophysical rehabilitation center created by the Civil Protection Department thanks to donations from the Italians.

Prime Minister to carry the requested material, quickly recovered during the night by the most important hospitals of Central Italy. The plane landed at 6:00 am, the morning after the request had been made, and the drugs were immediately delivered to the local health services treating the patients.

The shocking tragedy of Beslan deeply affected the public opinion of our Country and a fundraising campaign was organized on the same model later adopted for the 2004 tsunami. The funds raised were allocated for the creation of a psychophysical rehabilitation center for children in the area. Our Country's humanitarian intervention continued for a few months, leading to the inauguration of a functional health facility thanks to Italy's donations.

On the night of 13 January 2012, an incorrect maneuver by the Costa Concordia cruise ship near the Giglio island resulted in the wreck of the huge cruise liner ship due to the collision against the rock formation known as "le Scole", in proximity of the island. The shipwreck caused the death of 32 people (Fabi, 2012). An unimaginable disaster, a very high number of victims, the 300 meters long capsized ship tilted on the starboard side remained as a relic just a few hundred meters from the port, potentially causing severe and irreparable damage to the environment, in case of an oil spill mixed with the other substances contained in the tanks and in the Costa Concordia at sea. After the search and rescue operations carried out by over 4 thousand people and the search for the missing

Photo 123. Giglio island, Tuscany, 2012. Technical experts at work in the shipwreck area of the Costa Concordia cruise ship.

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persons, months of incessant work began, in which many technical experts and volunteers of the civil protection system were involved to move the ship back to the waterline and then tow it to the port of Genoa for demolition (see Focus 20).

Photo 124. Giglio island, Tuscany, 2012. Men and means engaged in search and rescue operations after the Concordia shipwreck.

The complexity of this particular crisis required the declaration of the state of emergency and the assignment of response coordination to the Civil Protection Department, whose management lasted about two and a half years and was characterized by the following issues:

- the rare, large and complex scenario, characterized by strong inter-dependencies and the need to activate skills related to the range of different disciplines and competences;
- the complexity of underwater research operations; the urgency of environmental remediation and the extraordinary ship removal project; the monitoring of the ship;
- the strong connection between all the different actors involved in the emergency and the level of interaction between public and private subjects.

THE COSTA CONCORDIA CRUISE LINER SHIPWRECK: TECHNICAL OPERATIONS

The Costa cruise ship Concordia, with 4,229 passengers and crew members on board, was shipwrecked near the shores of Giglio island on 13 January 2012. 32 people died. From the very first days of the emergency, activities aimed at removing the wreck began. The ship removal plan was implemented starting in summer 2012 and ended with the transport of Concordia to the port of Genoa on 27 July 2014. The following are the main phases of this technical activity.

The **fuel recovery plan** or "debunkering" was the first step in the operations leading to the final removal of Concordia and is part of the measures implemented to protect the environment. The technical intervention focused on the withdrawal of the fuel present in the 15 tanks and in the engine room and was divided into two phases: drilling and flanging the tanks and pumping the fuel (defueling). A total of 2,042.5 m^3 of hydrocarbons were sucked up.

The **plan for the recovery of materials and waste** was carried out on the basis of a project for the management and disposal of the waste that were inside the ship or on the seabed and provided for three areas of intervention: the collection, disposal and transport of floating and bulky material; the collection and disposal of black water; the collection and disposal of chemicals and oils. Before the start of the ship's rotation operations, wastewater, floating materials were recovered, and caretaking activities were carried out for the clearing of the seabed from materials and objects discarded from the ship.

Ship removal operations began with the selection of the best project. The Costa Cruises company established a Technical Committee, providing for the technical indications for the removal of the hull. On 1 February 2012, these indications were sent to ten companies specialized in the sector.

On 21 April 2012 the Costa Cruises company officially declared that the tender for the removal of the wreckage was awarded to the Italian-American consortium formed by the Italian Micoperi and the American Titan Salvage.The project selected was the one that best met the main requirements: complete removal of the wreck, least possible risk, least possible environmental impact, protection of tourism and economic activities on the Giglio island and maximum safety during the interventions. The project foresaw a first phase of anchoring and stabilization of the wreck, followed by the construction of a false support seabed. Subsequently, it was planned to install airtight tanks, called sponsons, on the emerged side of the ship. Once these operations were completed, the ship was ready to be rotated. At the end of this step, sponsons were also installed on the previously sunken starboard side. With all 30 sponsons in order, the ship was finally ready for re-floating and transfer to the port where to be disposed of.

The **preparatory operations for the rotation of the ship**, or parbuckling, began in the summer of 2012. In November 2012 the anchorage and stabilization of the wreckage were completed. In summer 2013, the false seabed was prepared and eleven sponsons were installed on the left side (sea side). In July 2013, the suction operations of the waters inside the ship also began, one of the measures envisaged to limit the pollution caused by any spills.

The **parbuckling** started on 16 September 2013 at 9:00 am and ended successfully after 19 hours of work. The Concordia, back to an upright position, was placed on six underwater steel platforms, positioned so as to create a stable base for the wreck. The safety operations ended in December and the ship was thus

Photo 125. Giglio island, Tuscany, 2012. Preparation of the area for ship removal operations.

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ready to face winter and its possible extreme weather conditions.

The **ship's refloating** began with the installation of the 15 sponsons on the starboard side, the previously sunken side, and the remaining four on the left side, starting from April until 3 July 2014. The 30 sponsons, initially filled with water, were gradually emptied during the re-floating phase, providing the necessary thrust to make the hull re-float.

Re-floating was divided into four phases: partial re-floating and displacement of the wreck 30 meters East; connection and tensioning of the last chains and cables and placing in the final position of the sponsons on the starboard side; real buoyancy, with the expulsion of the water from the sponsons, one bridge at a time, until reaching the final position; the conclusive departure maneuver towards the port of Genoa.

During the refloating operations, sea waters were constantly monitored by the Regional Environmental Protection Agency of Tuscany and by the Institute for Environmental Protection and Research. The Civil Protection Department also activated satellite monitoring to check the quality of the sea, and the Harbor Master's Office set up an aircraft with infrared cameras to identify any hydrocarbon pollution around the wreck. The wreck was finally towed to the port of Genoa to be definitively demolished following a special waste management and recovery plan of the different materials. Once the removal was complete, seabed cleaning operations and restoration of the marine flora began.

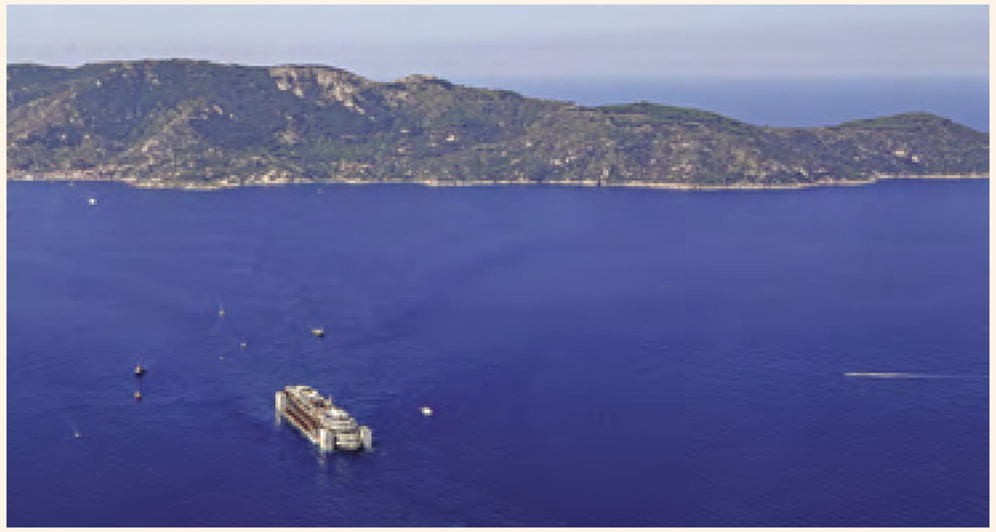

Photo 126. Giglio island, Tuscany, 2014. The refloating of the Costa Concordia ship.

The collapse of the so-called Morandi bridge, i.e. the "Polcevera" viaduct, that took place in Genoa on 14 August 2018, has undoubtedly launched a new phase of attention to large infrastructures created by man. Apart from specialists, there was generally no perception of the vulnerability of these infrastructures, or of the deterioration to which reinforced concrete is subject. The collapse of the bridge, built by the Società Condotte after the 1967 project by Eng. Riccardo Morandi, highlighted the fact that all human works are subject to degradation, especially if stimulated by external agents such as salt or vibrations due to intense traffic. That bridge, considered futuristic at the time, was designed according to the legislation of the time to support a much lower traffic load, which increased significantly over the years, besides the possible degradation of the building materials over time. The accident caused 43 victims and a severe impact on the mobility of the area, an aspect of crucial importance for a port city like Genoa, which has always been a strategic center for the transit of products, goods and people in Italy and Europe. Moreover, the bridge operated as the main motorway connection toward the West coast and the border with France. The collapse of the bridge, which also determined the need to evacuate, and then partially demolish, many buildings in its vicinity, causing losses and suffering for many families, provoked severe damage to the economy of the whole Country.

Photo 127. Rome, 2018. The civil protection Operational Committee met at the headquarters of the Department to coordinate interventions following the collapse of the viaduct on the A10 motorway in Genoa.

The intervention of the civil protection system, well represented by the exemplary work of the Fire Brigade, was decidedly complex: it included the recovery and identification of the victims, safety operations to secure the areas at risk, assistance to the families of the victims and the hundreds of people forced to leave their homes located in the vicinity of the bridge. The removal of rubble from the Polcevera stream was an operation carried out with particular urgency, to avoid possible flooding of the water course, due to the rains of the imminent fall season. This experience has shown once again how fragile our infrastructures are and how much attention the competent institutions must devote to the monitoring and maintenance of the entire road network and strategic infrastructure of the Country.

9

CIVIL PROTECTION VOLUNTEERING AND CITIZENS PARTICIPATION

The inseparable bond between citizenship and civil protection stems from a basic assumption: every citizen is an integral part of the National Civil Protection Service.

This last statement is necessary to fully understand and analyze the historical and cultural motivations underlying, over centuries, the solidarity principles of volunteering and mutual aid in our Country, in Europe and in the world, where the Italian model of civil protection volunteering, that became over time equal to the institutional Structures and Components, today is even studied in other Countries and increasingly considered a reference social model.

One of the Italian Constitution's founding principles, together with the inviolability of human rights, is to ensure a social coexistence built on the value of solidarity, setting as ultimate goal "the full development of the human person".

The principle of solidarity is also included within the prerogatives of the European Union, which aims at safeguarding and promoting the well-being of European citizens through the fulfillment of economic, political and social obligations by the governments of the Member States of the Union.

► 9.1 Civil protection volunteering

Volunteering has deep rooted traditions in Italy, like the Catholic one, linked to the work of evangelization by the Church founded on the concept of Christian pietas, still deeply present in Italy and in the world, as well as the secular work ethic and socialist traditions that spread in the nineteenth century following the industrial revolution.

The "Third Sector", which in Italy refers to the solidarity association world, has millions of operators, mainly volunteers, who carry out every day their meritorious activities with unremitting efforts to support Institutions, Bodies and public and private Companies (see Focus 22). In fact, one in eight Italians dedicate their free time to solidarity and volunteering activities, intercepting the need to "do social work" inherent in every citizen.

Among this huge amount of people dedicated to voluntary activities, an important part carries out activities related to civil protection, ensuring the widest participation of civil protection volunteer organizations in forecasting, prevention, mitigation and rescue activities, prior to or in the course of natural disasters, catastrophes or other emergency events.

SPEECH BY ITALIAN PRESIDENT CARLO AZEGLIO CIAMPI AWARDING THE FIRST GOLD MEDAL TO THE CIVIL PROTECTION (15 JULY 2004)

«Mr. Prime Minister, Distinguished Guests,

if we take a look at this most honorable audience, we can spot many different uniforms, belonging to the Fire Brigade, the Armed Forces, the Police Forces, the Red Cross, the faces of many volunteers and of many different Administrations joined together by a single life project: offering their service to the Italian people even in times of extreme difficulty and suffering, moments when the need for protection, support and help is at its highest peak.

This is the sense of a Civil Protection to which today we award the Gold Medal of Civil Merit and through it, symbolically, to each of its more than 25 Components, a medal of the Republic that has long matured in the hearts and minds of the Italian people. The Italians have seen the men and women that make up the Civil Protection at work in Italy and abroad, committed in small and large relief operations following earthquakes, floods, forest fires, volcanic eruptions, hydrological emergencies.

Civil Protection is a complex system made up of many different Components held together by a project and an innovative organizational model. In it I see almost a metaphor of the modern State that becomes more flexible and articulated, without losing however its unitary design: an intense feeling, which all of us Italians recognize in the National three colored flag fluttering across the sky of Rome, the capital city of Italy; a profound unity that comes from our history, responding to the needs of its citizens. We believe in it, stand by it and will defend it in all ways, under all circumstances.

I personally felt the sincere gratitude of the Italians from Stromboli, the day the citizens of that island proudly set foot in their homes again; I witnessed with deep emotion the heartbreaking images of the ancient city of Bam in Iran, where our mission had the honor of coordinating the entire presence of the European Union; other images come from Morocco, Algeria, France and many other places.

In view of all this, I was honoured to accept the proposal of the Prime Minister to grant this decoration, which mentions, in particular, the noble work carried out by the Civil Protection on the occasion of the major natural disasters that affected our Country in 2002.

Photo 128. Rome, 2004. The President of the Republic awards the Gold Medal of Civil Merit to the Civil Protection.

In this context, an attentive and participatory role was played by volunteering which, I will never stop repeating and firmly reaffirming, is the best training ground for young people to become aware and active citizens. It is important that the suspension of the military service does not cancel the national civil service which has proved to be an effective tool granting training, solid commitment and the values of a republican education.

Looking at a wider context, I recommend developing joint initiatives between Member Countries of the European Union with commitment and enthusiasm. We can rightly boast that we have been able to create a real Italian model that has become a reference for many other European Countries.

I am pleased to recall the ceremony with which the French Government a few weeks ago honored the flag of the Italian Civil Protection Department for the relief given following the events that hit the South of France last year.

It is with great satisfaction that I learned that a few days ago, in anticipation of the summer emergencies, an agreement was signed with France for the joint use of the Italian and French air fleets promoting their mutual assistance in the event of forest fires: it is the realization of an initiative that I had proposed many years ago without success.

I wish to renew to all the operators of the Civil Protection the most sincere and deeply felt gratitude and to express, once again, on behalf of all Italians, feelings of recognition and admiration for the service they perform for the good and safety of all of us.

Viva l'Italia».

In 2004, in his speech on the occasion of the award ceremony of the first of the four Gold Medals of Civil Merit and Civil Value assigned to the Civil Protection Department (see Focus 21), former President of the Italian Republic Carlo Azeglio Ciampi defined civil protection as a "service" paid to the community and to the entire Country system. The concept of "public service" was therefore expressed as necessarily connected to a legal recognition of the same: it should therefore be understood as a service that can be disciplined by law, not only as a simple aspiration of the community, but as a primary need to be met through legislative action:

CIVIL PROTECTION = PUBLIC SERVICE = PRIMARY NEED

In fact, in a morphologically varied and articulated territory like the Italian one, the disasters that affect it and generate crises and emergencies directly connected to natural, anthropic and social phenomena, have historically favored a strong vocation for voluntary action, which has always been a valid support to civil protection authorities. Ever since the past, both spontaneous forces and those attributable to public institutions have been organized to provide the necessary relief to save human lives, to alleviate the suffering of the sick and injured, to grant safe shelter to those who have lost their homes, to distribute food and clothing, to restore the ways and means of communication, in short, to try to bring the affected populations back to new normal living conditions.

► 9.2 Historical notes on civil protection volunteering in Italy

The first testimony of volunteering in our Country is represented by the "Misericordie" (literally "Mercies") Confraternities of Italy. The first "Arciconfraternita della Misericordia" was established in Florence in 1244 and numerous other Confraternities arose from it, often playing a leading role on the religious and civil level.

The concept of "giving" and "acting" for one's fellow citizens in a structured way therefore dates back to about 800 years ago. Significant, still valid even in a secular perspective, the words of gratitude the association addressed to those who carried out voluntary work: "May God reward you", a way of saying that emphasizes the sense of free and anonymous voluntary service of its constituent members, who did not expect any compensation for their help.

From the second half of the 1900s organized volunteering and, in particular, civil protection volunteering, took shape and became a fundamental player operating in the national scene. From the initial impulses of a spontaneous voluntary service up to the so called "angeli del fango" (the mud angels), who intervened in great numbers and will power during the 1966 Florence flood (see Chapter 3), a lengthy and tortuous path started toward the shaping of an absolutely productive and effective civic participation.

Photo 129. Paganica, L'Aquila, 2009. Dog units engaged in the search for missing persons after the 6 April main shock.

The long road since that far away November 1966 has been marked by the constant growth of awareness on the issue of protecting and safeguarding the territory in which we live, that needs care as well as to be defended and protected, through concrete and constant daily interventions. That memorable experience, characterized by the enthusiasm and total dedication of thousands of young people hastened to work tirelessly and selflessly to save priceless goods, is still remembered today also for the chaotic disorganization and lack of coordination. From that, the full awareness of the absolute need to better organize voluntary work emerged for those citizens willing to take part in relief efforts. It was understood that, to avoid that they could become a problem rather than a solution, volunteers should be prepared in advance, trained and equipped. For this reason, 1966 is remembered as the birth year of civil protection volunteering, organized and trained, that operates today with competence, effectiveness and in complete safety.

However, it was with the institution of the National Civil Protection Service (Law n. 225/1992) that the culture of civil protection became widespread and developed, no longer perceived only as a rescue activity but, above all, as a forecasting and prevention activity, also strengthening and enhancing the role of modern volunteering, organized to support municipal, regional and national civil protection levels.

Even more important, within our national context, is the role played by civil protection volunteering after Italy suspended compulsory military service, on 30 June 2005. Just think of how many specialized resources, in terms of men

9. Civil protection volunteering and citizens participation

Photo 130. San Demetrio Ne' Vestini, L'Aquila, 2009. Civil protection volunteers setting up a shelter area for the population.

and means, the Armed Forces could guarantee to the National Civil Protection Service. After the military service reform, civil protection volunteering took on a strategic role in support of the other institutional operational structures and today it is able to ensure professional skills and human resources ready to answer multiple needs.

The Italian civil protection volunteering is free: no civil protection volunteer receives an economic contribution or any remuneration for the activities carried out. A forward-looking rule allows volunteers, who belong to authorized organizations and who are mobilized in compliance with the system's regulations, to take leave from their workplace to operate voluntarily in case of emergency. This regulation provides that the employer may request reimbursement of the salary remuneration referred to the period of absence from work of the volunteer (art.s 39 and 40 of Legislative Decree n. 1/2018). The gratuitousness of volunteers' commitment remains therefore a founding principle of the system and a key aspect of the entire mechanism.

Photo 131. Vibo Valentia, 2006. Civil protection volunteers activated following a flood.

Intervention in emergency situations requires preparation, training and Personal Protective Equipment (PPE), as well as specific equipment and suitable means, which the volunteering organizations make available to their members and other institutional actors.

The role of volunteering within the system has developed considerably in all areas of civil protection, broadening its scope beyond just rescue and assistance operations to the population, but also in the areas of prevention, such as in civil protection planning activities or in the dissemination of knowledge activities. In this regard, among the ordinary activities carried out by volunteers in their territories, we should mention also the spreading of knowledge on risks and the teaching of good practices of civil protection carried out through participation in the "Io Non Rischio" (I Don't Take Risks) national communication campaign. The fundamental contribution to forecasting and prevention is one of the reasons why volunteering has increasingly become an irreplaceable component of our Country's civil protection system.

Thanks to the training, preparation and special skills acquired, civil protection volunteers are also involved and employed in emergencies and exercises abroad, both within the European Union and internationally. For example, the contribution of health teams sent on mission to Sri Lanka, Haiti, Nepal and, more recently, to Mozambique and Albania, was fundamental (see Chapter 8, Table 6).

Photo 132. Rome, 2020. Civil protection volunteers in environmental risk training activities.

To be preapred and ready to face these emergencies abroad, the volunteers, already highly specialized in their field of intervention, followed specific training courses in the European context and, with the support of the Civil Protection Department, adapted their health structures to WHO-World Health Organization requirements and UCPM-Union Civil Protection Mechanism parameters. Numerous organizations, operating in sectors other than healthcare, are preparing to set up modules, and therefore human and material resources that meet the established standards, that can be implemented abroad.

Another important international activity is the participation of volunteering organizations in European projects aimed at strengthening volunteering and civil protection in other Countries, creating partnerships that prove to be resourceful and productive even after the end of the projects themselves. Through partnership with other institutions and organizations, both European and of Third Countries, these projects offer a fruitful ground for comparison and deeper understanding of the different systems through fruitful exchanges of experts, skills, values and knowledge.

ORGANIZED CIVIL PROTECTION VOLUNTEERING

It is estimated that volunteers from the Third Sector – as the volunteering world in Italy is referred to – are around six and a half million.

Civil protection volunteering is implemented through **Voluntary Organizations** that must be registered:

- in the **Central List** that counts more than 800 thousand volunteers registered in 57 national associations, including their local sections, and organizations of particular relevance and scale at national level;
- in one of the **Territorial Lists** of the 21 Regions and Autonomous Provinces, which gather and coordinate all the volunteers of local Associations and of the municipal, inter-municipal and provincial Groups.

Civil protection volunteering is now an important component of the National Civil Protection Service, ensuring knowledge of the territory, tools and availability to carry out activities in support of the community and for the common good:

«To contribute to the promotion of effective responses to the needs of people and communities benefiting from its action in a personal, spontaneous, free and non-profit way, not even indirectly, and exclusively for the purpose of solidarity but to participate, with passion and commitment, in a free and organized force that contributes to improving everyone's life» (Decree Legislative n. 1/2018).

As an example, during the Central Italy earthquake emergency management in 2016-2017, 11 thousand volunteers managed 43 shelter camps assisting more than 31 thousand people from 131 Municipalities involved.

Photo 133. Rome, 2012. Volunteers in exercise activity.

Photo 134. Poggioreale Antica, Trapani, 2018. Volunteers of civil protection in an exercise for the safeguard of cultural heritage in case of disaster.

The Italian civil protection volunteering model is also an example for its organizational structure that covers all territorial and responsibility levels. From the municipal groups, directly under the municipal Administrations of reference in support of the various activities needed during the preparation phase and management of local emergencies, to the provincial organizations pertaining to regional Administrations, up to those of national scale: volunteering can meet emerging needs at any institutional, organizational and professional level. A fundamental characteristic of volunteering is its stable structure: volunteers are not improvised, it is necessary to be prepared, trained and equipped so as not to put one's own life or the safety of others at risk, as well as to protect the goods on which volunteers intervene.

Photo 135. Viterbo, 2019. Civil protection volunteers in the square for the "Io Non Rischio" (I Don't Take Risks) campaign.

LAST MILE INFRASTRUCTURE: IT-ALERT

IT-alert is an infrastructure system that, with alert or information messages, can simultaneously reach the owners of devices connected to the mobile telecommunication network of a specific geographical area.

It is a system already operational in several European and non-European countries, a great step forward in alerting and disseminating information on risks to the population, allowing for the consequent self-protection actions in risk areas. In fact, this system makes it possible to directly cover the so-called "last mile" of the national alert system, i.e. direct communication to individual citizens of possible imminent hazards.

The technology behind this infrastructure is the cell-broadcast one – different from text messages or social networks – where the same message is sent simultaneously to millions of users, through telephone cells (geographical areas that receive the signal from a telephone antenna of a mobile communications operator), through an independent separate channel from those used for telephone calls and data transmission.

Once the alerted area has been identified, for example because potentially affected by a tsunami or an incoming severe storm, the telephone cells within this area are automatically identified and the alert message is sent to all the devices that at that time are within the selected cells.

The message that this infrastructure can convey is alphanumeric and consists of 93 characters. Therefore, maps or drawings/graphs cannot be sent. However, you can send multiple messages in succession to provide more information about the event and the behaviors to adopt.

IT-alert operates, in the experimental phase, only for phenomena that can be forecast. In particular, it can provide alerts regarding: meteorological events that may involve large areas, based on 6-12 hour forecasts; storms in progress identified by the national radar network, in relation to their possible movements in the following minutes; tsunamis induced by earthquakes, the pre-announcement of which is based on the detection of earthquakes under the seabed; volcanic eruptions, some of which can be anticipated by precursor phenomena in terms of a few minutes.

As mentioned, the alert messages can precede the dangerous event by a few hours or a few minutes. It may also happen that the message arrives after the event itself, when the notice time is too short, as in the case of tsunamis generated by earthquakes near the Italian coast. In the case of very tight deadlines, forecasting the occurrence of an event in a specific location cannot be subjected to analysis and/or check by an operator: the manual verification process would take too long and would make the alert useless. For this reason, the process of forecasting possible events that are the object of alert messages, particularly those that have a few minutes' notice, must be automated and made completely independent of human intervention.

IT-alert will also be an app for smartphones or tablets to offer important and updated news related to risk alerting. Citizens can, among other things, consult there the civil protection plan of their Municipality. To achieve this, work is underway to create a cartographic portal containing the National Catalog of municipal civil protection plans; however, the plans must be aligned to adequate standards, both in planning and in mapping representation. The ability to quickly consult the civil protection plan of the Municipality of interest is a significant aid to citizens allowing for each person to adopt the most appropriate self-protection measures.

An important aspect to keep in mind when using IT-alert messaging is linked to the uncertainties in the information transmitted. If the event has not occurred exactly in the place where it was forecast at the scheduled time and with an intensity that justifies an alarm, the citizen might be led to believe that the forecast was incorrect, while the inaccuracy was caused by the uncertainties of the system as a whole, both related to forecasting and linked to the operating mode of the technological infrastructure.

In summary, it is possible that some of the alerts received are perceived by the individual citizen as false alerts, because the announced phenomenon did not occur exactly in the place where the user was located or because it occurred with a lower intensity than needed to justify an alert. This could happen regardless of whether the phenomenon may have occurred with the maximum intensity expected in other places still within the alerted area. All this must be clear so that self-protection measures linked to the IT-alert message system are adopted even in the event of repeated apparent false alerts.

► 9.3 Self-protection measures

Self-protection measures are the correct behaviors that citizens must follow to prevent or reduce the damage that could derive from risk situations.

The Civil Protection Code provides for the active participation of citizens in civil protection activities in art. 31, stating the importance of initiatives aimed at increasing the resilience of communities, promoting citizens' participation in civil protection planning and dissemination of civil protection information and culture.

An important and innovative concept is expressed in the same article. On the one hand, it recognizes the citizens' right to be informed, establishing that the Components of the National Service must provide them with information on the risk scenarios and on the organization of the civil protection services present on their territory, also to allow them to adopt self-protection measures in emergency situations. On the other hand, it states that citizens have «the duty to comply with the provisions issued by civil protection authorities in accordance with the provisions of the planning tools». Therefore, also citizens, as part of the civil protection system, play a very important role in risk mitigation.

Enhancing communication to the population is therefore a strategic objective of both the Civil Protection Department and the Components and Operational Structures of the system.

Civil protection good practices and alert systems are pillars of communication to citizens, which the Department also conveys through social media, i.e. Facebook, Twitter, Youtube and Flickr.

Finally, an important boost to communication activities and citizens involvement comes from the institution of the Civil Protection Week (see Focus 24), which is linked to the International Day for Disaster Risk Reduction established on 13 October by the United Nations. The Civil Protection Week will be repeated every year with the intent of further incentivating the participation of communities, citizens and above all students, who are the best recipients for the dissemination and implementation of a new contemporary civil protection based on a participatory approach, without borders.

THE CIVIL PROTECTION WEEK

SETTIMANA NAZIONALE DELLA PROTEZIONE CIVILE

As per Directive issued by the President of the Council of Ministers of 1 April 2019, the "National Civil Protection Week" has been established to take place on an annual basis in the week including 13 October, the same day the "International Day for Disaster Risk Reduction" is celebrated as declared by the United Nations.

The annual appointment of the Week represents an important moment in which numerous information and awareness raising activities on civil protection issues are carried out.

On this occasion, the Civil Protection Department plans and coordinates a series of initiatives with the direct involvement of all the Components and Operational Structures of the National Civil Protection Service. In this sense, since the first edition of the Week, conferences, training days, exercises and other events are held involving the Scientific Community, volunteers and the professional and business sector, as well as Prefectures and municipal Administrations, including the world of education, schools and universities.

During the Week, the National Conference of Civil Protection Authorities is held in the presence of the President of the Council of Ministers and represents an important event during which the common strategic lines of action are shared and consolidated at institutional level.

Photo 136. The speech by the President of the Council of Ministers during the first National Conference of Civil Protection Authorities.

Photo 137. Rome, 2019. Speech by the Head of the Civil Protection Department during the first National Conference of Civil Protection Authorities.

The main purpose of the Week is to encourage citizens to acquire greater awareness of natural and man made risks, in particular of their territory, by promoting the necessary actions to develop more widespread self-protection practices. In fact, given the significant increase in risk exposure factors of the current historical context, the need to increase and develop basic civil protection knowledge in every sector of society has strongly emerged, both in order to learn and enhance the correct behavior to adopt in case of emergency and, more in general, to spread the culture of prevention and resilience.

In this perspective, the role of schools, as well as that of the economics and private entreprise, is fundamental to effectively achieve the protection of life, physical integrity, property, settlements, animals and the environment against the «damage or danger of damage resulting from disasters of natural origin or deriving from human activity» (as stated in Legislative Decree n. 1/2018, art. 1, paragraph 1), also considering the current climate changes.

In fact, schools along with the academic and scientific world will increasingly be called upon to contribute significantly to the events focused on knowledge exchange and in-depth analysis during the Week, with the aim of training young people in the fields of civil protection and above all in prevention; an enriching experience for the younger generations of students who will be the citizens and leaders of Tomorrow.

Simplified Glossary

This glossary was compiled using as primary source the Legislative Decree n. 1/2018 – Civil Protection Code. Where the term was missing in the above mentioned source, reference was made to the document prepared by the United Nations office for Disaster Risk Reduction: "Terminology on Disaster Risk Reduction". Sometimes both definitions have been given for the same term, where one is slightly different from one another or one completes the other. In addition, some specific definitions are taken from the institutional website of the Civil Protection Department.
With respect to the Italian version of the text, this glossary is simplified, due to the idiomatic use of some words that lose their original meaning in the English translation.

Capacity. The combination of all the strengths, attributes and resources available within an organization, community or society to manage and reduce disaster risks and strengthen resilience.
Annotation: Capacity may include infrastructure, institutions, human knowledge and skills, and collective attributes such as social relationships, leadership and management.
Coping capacity is the ability of people, organizations and systems, using available skills and resources, to manage adverse conditions, risk or disasters. The capacity to cope requires continuing awareness, resources and good management, both in normal times as well as during disasters or adverse conditions. Coping capacities contribute to the reduction of disaster risks.
Source: Prevention Web

Central and Decentralized Functional Center. The network of Functional Centers consists of the Central Functional Center, at the Civil Protection Department, and the Decentralized Functional Centers in the Regions and the Autonomous Provinces. Every Functional Center performs forecasting, monitoring and surveillance in real time of meteorological phenomena with the consequent evaluation of the expected effects on people and things in a specific territory, contributing, together with the Civil Protection Department and Regions, to the management of the national alert system.
Each Functional Center has the task of collecting and sharing with the entire network of Centers a series of data and information from various technological platforms and from a dense network of sensors located throughout the Country. In particular:
- the data collected by weather-hydropluviometric networks, by the national weather radar network and by the different satellite platforms available for earth observation;
- the hydrological, geological, geomorphological territorial data and those deriving from the landslide monitoring system;
- meteorological, hydrological, hydrogeological and hydraulic models.

On the basis of these data and models, the Functional Centers elaborate the expected probabilistic scenarios, also through the use of forecast models of the effects on the territory. Based on these assessments, the Functional Centers issue bulletins and warnings, which report both the evolution of the phenomena and the expected criticality levels on the territory.
The Central Functional Center is located at the operational Headquarters of the Civil Protection Department, and it is through it that the the Department, together with the Regions, guarantees the coordination of the national alert system.
Furthermore, consistently with the principle of subsidiarity, in cases where the Decentralized Functional Centers are not active or are temporarily inoperative, the Central Functional Center performs all the operational tasks assigned to them.
Source: Civil Protection Department

Civil protection Ordinance. The President of the Council of Ministers, for the achievement of the purposes of the National Service, holds the powers of ordinance in the field of civil protection, which are exercised, unless otherwise established [...], through the Head of the Civil Protection Department, and determines the civil protection policies for the promotion and coordination of the activities of central and peripheral State Administrations, Regions, metropolitan Cities, Provinces, Municipalities, national and territorial public Bodies and any other public or private institution and organization present on the national territory.
Source: Civil Protection Code

Civil protection planning. Civil protection planning at the various territorial levels is a non-structural prevention activity, based on forecasting and, in particular, identifying the scenarios referred to in art. 2, paragraph 2 [of the Civil Protection Code], aimed at:
a) the definition of operational strategies and the intervention model containing the organization of the structures for carrying out, in coordinated form, the civil protection activities and operational response for the management of expected or ongoing disaster events, ensuring the effectiveness of functions to be performed with particular regard to people in conditions of social fragility and with disabilities, in relation to the optimal contexts referred to in art. 11, paragraph 3 [of the Civil Protection Code], defined on a provincial and municipal basis, the latter also in aggregate form;
b) to ensure the necessary information connection with the structures responsible for alerting the National Service;
c) the definition of the flows of communication between the Components and Operational Structures of the National Service concerned;
d) the definition of the mechanisms and procedures for the revision and updating of the planning, for the organization of exercises and for the related information to the population, to be ensured also during the event.
Source: Civil Protection Code

Contingency planning. A management process that analyses disaster risks and establishes arrangements in advance to enable timely, effective and appropriate responses.
Annotation: Contingency planning results in organized and coordinated courses of action with clearly identified institutional roles and resources, information processes and operational arrangements for specific actors at times of need. Based on scenarios of possible emergency conditions or hazardous events, it allows key actors to envision, anticipate and solve problems that can arise during disasters. Contingency planning is an important part of overall preparedness. Contingency plans need to be regularly updated and exercised.
Source: Prevention Web

Critical infrastructure. The physical structures, facilities, networks and other assets which provide services that are essential to the social and economic functioning of a community or society.
Source: Prevention Web

Disaster. A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts.
Annotations: The effect of the disaster can be immediate and localized, but is often widespread and could last for a long period of time. The effect may test or exceed the capacity of a community or society to cope using its own resources, and therefore may require assistance from external sources, which could include neighbouring jurisdictions, or those at the national or international levels.
Disaster damage occurs during and immediately after the disaster. This is usually measured in physical units (e.g., square meters of housing, kilometres of roads, etc.), and describes the total or partial destruction of physical assets, the disruption of basic services and damages to sources of livelihood in the affected area.
Source: Prevention Web

Disaster impact. The total effect, including negative effects (e.g., economic losses) and positive effects (e.g., economic gains), of a hazardous

Simplified Glossary

event or a disaster. The term includes economic, human and environmental impacts, and may include death, injuries, disease and other negative effects on human physical, mental and social well-being.
Source: Prevention Web

Disaster risk. The potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity.
Annotation: The definition of disaster risk reflects the concept of hazardous events and disasters as the outcome of continuously present conditions of risk. Disaster risk comprises different types of potential losses which are often difficult to quantify. Nevertheless, with knowledge of the prevailing hazards and the patterns of population and socioeconomic development, disaster risks can be assessed and mapped, in broad terms at least.
It is important to consider the social and economic contexts in which disaster risks occur and that people do not necessarily share the same perceptions of risk and their underlying risk factors.
Acceptable risk, or tolerable risk, is therefore an important subterm; the extent to which a disaster risk is deemed acceptable or tolerable depends on existing social, economic, political, cultural, technical and environmental conditions. In engineering terms, acceptable risk is also used to assess and define the structural and non-structural measures that are needed in order to reduce possible harm to people, property, services and systems to a chosen tolerated level, according to codes or "accepted practice" which are based on known probabilities of hazards and other factors.
Residual risk is the disaster risk that remains even when effective disaster risk reduction measures are in place, and for which emergency response and recovery capacities must be maintained. The presence of residual risk implies a continuing need to develop and support effective capacities for emergency services, preparedness, response and recovery, together with socioeconomic policies such as safety nets and risk transfer mechanisms, as part of a holistic approach.
Source: Prevention Web

Disaster risk assessment. A qualitative or quantitative approach to determine the nature and extent of disaster risk by analysing potential hazards and evaluating existing conditions of exposure and vulnerability that together could harm people, property, services, livelihoods and the environment on which they depend.
Annotation: Disaster risk assessments include: the identification of hazards; a review of the technical characteristics of hazards such as their location, intensity, frequency and probability; the analysis of exposure and vulnerability, including the physical, social, health, environmental and economic dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities with respect to likely risk scenarios.
Source: Prevention Web

Disaster risk management. It is the application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses.
Annotation: Disaster risk management actions can be distinguished between prospective disaster risk management, corrective disaster risk management and compensatory disaster risk management, also called residual risk management.
Prospective disaster risk management activities address and seek to avoid the development of new or increased disaster risks. They focus on addressing disaster risks that may develop in future if disaster risk reduction policies are not put in place. Examples are better land-use planning or disaster-resistant water supply systems.
Corrective disaster risk management activities address and seek to remove or reduce disaster risks which are already present and which need to be managed and reduced now. Examples are the retrofitting of critical infrastructure or the relocation of exposed populations or assets.
Source: Prevention Web

Economic loss. Total economic impact that consists of direct economic loss and indirect economic loss.
Direct economic loss: the monetary value of total or partial destruction of physical assets existing in the affected area. Direct economic loss is nearly equivalent to physical damage.
Indirect economic loss: a decline in economic value added as a consequence of direct economic loss and/or human and environmental impacts.
Annotations: Examples of physical assets that are the basis for calculating direct economic loss include homes, schools, hospitals, commercial and governmental buildings, transport, energy, telecommunications infrastructures and other infrastructure; business assets and industrial plants; and production such as crops, livestock and production infrastructure. They may also encompass environmental assets and cultural heritage.
Direct economic losses usually happen during the event or within the first few hours after the event and are often assessed soon after the event to estimate recovery cost and claim insurance payments. These are tangible and relatively easy to measure.
Indirect economic loss includes microeconomic impacts (e.g., revenue declines owing to business interruption), mesoeconomic impacts (e.g., revenue declines owing to impacts on natural assets, interruptions to supply chains or temporary unemployment) and macroeconomic impacts (e.g., price increases, increases in government debt, negative impact on stock market prices and decline in GDP). Indirect losses can occur inside or outside of the hazard area and often have a time lag. As a result they may be intangible or difficult to measure.
Source: Prevention Web

Emergency. It is sometimes used interchangeably with the term disaster, as, for example, in the context of biological and technological hazards or health emergencies, which, however, can also relate to hazardous events that do not cause severe disruption of the functioning of a community or society.
Source: Prevention Web

Emergency management. The integrated and coordinated set of measures and interventions aimed at ensuring relief and assistance to populations and animals affected by disasters and the reduction of their impact, also through the implementation of undeferrable and urgent interventions and the use of simplified procedures, and the related information activity for the population.
Source: Civil Protection Code

Emergency overcoming. Coordinated implementation of measures aimed at removing obstacles to the recovery of normal living and working conditions, to restore essential services and to reduce the residual risk in areas affected by disasters, as well as the recognition of needs for the restoration of damaged public and private structures and infrastructures, as well as damage suffered by economic and production activities, cultural heritage and building stock, in addition to the setting up of the first interventions and measures to face such needs.
Source: Civil Protection Code

Event scenario. The evolution in space and time of the only prefigured event, expected and/or in progress, despite its completeness and complexity.
Source: Civil Protection Department

Exposure. The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas.
Annotation: Measures of exposure can include the number of people or types of assets in an area. These can be combined with the specific vulnerability and capacity of the exposed elements to any particular hazard to estimate the quantitative risks associated with that hazard in the area of interest.
Source: Prevention Web

Forecasting. The set of activities, also carried out with the contribution of subjects with scientific, technical and administrative skills, aimed at identifying and studying, even dynamically, the possible risk scenarios, for the alerting needs of the National Service, where possible, and of civil protection planning.
Source: Civil Protection Code

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Hazard. A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation.
Annotations: Hazards may be natural, anthropogenic or socionatural in origin. Natural hazards are predominantly associated with natural processes and phenomena. Anthropogenic hazards, or human-induced hazards, are induced entirely or predominantly by human activities and choices. This term does not include the occurrence or risk of armed conflicts and other situations of social instability or tension which are subject to international humanitarian law and national legislation. Several hazards are socionatural, in that they are associated with a combination of natural and anthropogenic factors, including environmental degradation and climate change.
Hazards may be single, sequential or combined in their origin and effects. Each hazard is characterized by its location, intensity or magnitude, frequency and probability. Biological hazards are also defined by their infectiousness or toxicity, or other characteristics of the pathogen such as dose-response, incubation period, case fatality rate and estimation of the pathogen for transmission.
Multi-hazard means (1) the selection of multiple major hazards that the Country faces, and (2) the specific contexts where hazardous events may occur simultaneously, cascadingly or cumulatively over time, and taking into account the potential interrelated effects.
Hazards include (as mentioned in the Sendai Framework for Disaster Risk Reduction 2015-2030, and listed in alphabetical order) biological, environmental, geological, hydrometeorological and technological processes and phenomena.
Biological hazards are of organic origin or conveyed by biological vectors, including pathogenic microorganisms, toxins and bioactive substances. Examples are bacteria, viruses or parasites, as well as venomous wildlife and insects, poisonous plants and mosquitoes carrying disease-causing agents.
Environmental hazards may include chemical, natural and biological hazards. They can be created by environmental degradation or physical or chemical pollution in the air, water and soil. However, many of the processes and phenomena that fall into this category may be termed drivers of hazard and risk rather than hazards in themselves, such as soil degradation, deforestation, loss of biodiversity, salinization and sea-level rise.
Geological or geophysical hazards originate from internal earth processes. Examples are earthquakes, volcanic activity and emissions, and related geophysical processes such as mass movements, landslides, rockslides, surface collapses and debris or mud flows. Hydrometeorological factors are important contributors to some of these processes. Tsunamis are difficult to categorize: although they are triggered by undersea earthquakes and other geological events, they essentially become an oceanic process that is manifested as a coastal water-related hazard.
Hydrometeorological hazards are of atmospheric, hydrological or oceanographic origin. Examples are tropical cyclones (also known as typhoons and hurricanes); floods, including flash floods; drought; heatwaves and cold spells; and coastal storm surges. Hydrometeorological conditions may also be a factor in other hazards such as landslides, wildland fires, locust plagues, epidemics and in the transport and dispersal of toxic substances and volcanic eruption material.
Technological hazards originate from technological or industrial conditions, dangerous procedures, infrastructure failures or specific human activities. Examples include industrial pollution, nuclear radiation, toxic wastes, dam failures, transport accidents, factory explosions, fires and chemical spills. Technological hazards also may arise directly as a result of the impacts of a natural hazard event.
Source: Prevention Web

Mitigation. The lessening or minimizing of the adverse impacts of a hazardous event.
Annotation: The adverse impacts of hazards, in particular natural hazards, often cannot be prevented fully, but their scale or severity can be substantially lessened by various strategies and actions. Mitigation measures include engineering techniques and hazard-resistant construction as well as improved environmental and social policies and public awareness. It should be noted that, in climate change policy, “mitigation” is defined differently, and is the term used for the reduction of greenhouse gas emissions that are the source of climate change.
Source: Prevention Web

Non-structural (civil protection) prevention. Non-structural prevention activities of civil protection are those concerning:
a) the alert of the National [Civil Protection] Service, organized into pre-announcement activities in probabilistic terms, where possible and on the basis of available knowledge, monitoring and surveillance in real time of events and of the consequent evolution of risk scenarios;
b) the civil protection planning, as ruled by art. 18 [of the Civil Protection Code];
c) the training and acquisition of additional professional skills of the operators of the National Service;
d) the application and updating of the technical regulations of interest;
e) the dissemination of knowledge and culture of civil protection, also with the involvement of educational institutions, in order to promote the resilience of communities and the adoption of aware behaviors and self-protection measures by citizens;
f) the information to the population on risk scenarios and related rules of conduct, as well as on civil protection planning;
g) the promotion and organization of exercises and other activities related to training and training courses, also with the involvement of the communities, on the national territory in order to promote integrated and participated practice of the civil protection function;
h) the activities referred to in this paragraph carried out abroad, bilaterally, or within the framework of Italy's participation in the European Union and international organizations, in order to promote the integrated and participatory practice of the civil protection function;
i) the activities aimed at ensuring the link between the planning of civil protection and territorial planning and administrative procedures for the management of the territory for the aspects of competence of the various Components.
Source: Civil Protection Code

Preparedness. The knowledge and capacities developed by governments, response and recovery organizations, communities and individuals to effectively anticipate, respond to and recover from the impacts of likely, imminent or current disasters.
Annotation: Preparedness action is carried out within the context of disaster risk management and aims to build the capacities needed to efficiently manage all types of emergencies and achieve orderly transitions from response to sustained recovery.
Preparedness is based on a sound analysis of disaster risks and good linkages with early warning systems, and includes such activities as contingency planning, the stockpiling of equipment and supplies, the development of arrangements for coordination, evacuation and public information, and associated training and field exercises. These must be supported by formal institutional, legal and budgetary capacities. The related term “readiness” describes the ability to quickly and appropriately respond when required.
A preparedness plan establishes arrangements in advance to enable timely, effective and appropriate responses to specific potential hazardous events or emerging disaster situations that might threaten society or the environment.
Source: Prevention Web

Prevention. Activities and measures to avoid existing and new disaster risks.
Annotations: Prevention (i.e., disaster prevention) expresses the concept and intention to completely avoid potential adverse impacts of hazardous events. While certain disaster risks cannot be eliminated, prevention aims at reducing vulnerability and exposure in such contexts where, as a result, the risk of disaster is removed. Examples include dams or embankments that eliminate flood risks, land-use regulations that do

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not permit any settlement in high-risk zones, seismic engineering designs that ensure the survival and function of a critical building in any likely earthquake and immunization against vaccine-preventable diseases. Prevention measures can also be taken during or after a hazardous event or disaster to prevent secondary hazards or their consequences, such as measures to prevent the contamination of water.
Source: Prevention Web

Prevention. The set of structural and non-structural activities, also carried out in an integrated form, aimed at avoiding or reducing the possibility of damage resulting from calamitous events also on the basis of the knowledge acquired as a result of the forecasting activities.
Source: Civil Protection Code

Resilience. The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management.
Source: Prevention Web

Risk scenario. The evolution in space and time of the event and its effects, that is, the distribution of the estimated exposed and their vulnerability also following contrast actions.
Source: Civil Protection Department

Structural and non-structural measures. Structural measures are any physical construction to reduce or avoid possible impacts of hazards, or the application of engineering techniques or technology to achieve hazard resistance and resilience in structures or systems. Non-structural measures are measures not involving physical construction which use knowledge, practice or agreement to reduce disaster risks and impacts, in particular through policies and laws, public awareness raising, training and education.
Annotation: Common structural measures for disaster risk reduction include dams, flood levees, ocean wave barriers, earthquake-resistant construction and evacuation shelters. Common non-structural measures include building codes, land-use planning laws and their enforcement, research and assessment, information resources and public awareness programmes. Note that in civil and structural engineering, the term "structural" is used in a more restricted sense to mean just the load-bearing structure, and other parts such as wall cladding and interior fittings are termed "non-structural".
Source: Prevention Web

Vulnerability. The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.
Annotation: For positive factors which increase the ability of people to cope with hazards, see also the definitions of "Capacity" and "Coping capacity".
Source: Prevention Web

Bibliographical references

AA.VV. (2019) – Manuale per i volontari della campagna di comunicazione nazionale "Io Non Rischio". http://iononrischio.protezionecivile.it/wp-content/uploads/2019/02/manuale_selezione_formatori.pdf

Ambrosetti S., Campopiano F., Carpiniello C., Conte C., Duro A., Tafilaj Z. (2019) – Il ruolo del Dipartimento della protezione civile nel ciclo di gestione delle crisi idriche. In: Note tecniche su crisi idriche, siccità e servizio idrico integrato, ISBN 978-88-998-7903-7, Utilitalia, Roma.

Bertuccioli P. (2006) – Il governo delle piene nell'ambito del sistema di allertamento nazionale per il rischio idraulico (Direttiva 27 febbraio 2004). Atti I Giornata di lavoro SAFE (Sviluppo di un Ambiente Fluviale Ecosostenibile) – Infrastrutture – Parma, 7 giugno 2006.

Bevilacqua P. (1996) – Tra natura e storia. Ambiente, economie, risorse in Italia. Donzelli Editore, 224 pp.

Blöschl G., Hall, J. Parajka, J. Perdigão, R.A.P. Merz, B., Arheimer B., Aronica G.T., Bilibashi A., Bonacci O., Borga M., Čanjevac I., Castellarin A., Chirico G.B., Claps P., Fiala K., Frolova N., Gorbachova L., Gül A., Hannaford J., Harrigan S., Kireeva M., Kiss A., Kjeldsen T.R., Kohnová S., Koskela J.J., Ledvinka O., Macdonald N., Mavrova-Guirguinova M., Mediero L., Merz R., Molnar P., Montanari A., Murphy C., Osuch M., Ovcharuk V., Radevski I., Rogger M., Salinas J.L., Sauquet E., Šraj M., Szolgay J., Viglione A., Volpi E., Wilson D., Zaimi K., Živković N. (2017) – Changing climate shifts timing of European floods. Science, 357, 588-590. https://doi.org/10.1126/science.aan2506

Ciampalini A., Raspini F., Bianchini S., Frodella W., Bardi F., Lagomarsino D., Di Traglia F., Moretti S., Proietti C., Pagliara P., Onori R., Corazza A., Duro A., Basile G., Casagli N. (2015) – Remote sensing as tool for development of landslide databases: The case of the Messina Province (Italy) geodatabase. Geomorphology, 249, 103-118.

Ciampalini A., Raspini F., Bianchini S., Frodella W., Bardi F., Lagomarsino D., Di Traglia F., Moretti S., Proietti C., Pagliara P., Onori R., Corazza A., Duro A., Basile G., Casagli N. (2015) – The landslide geodatabase of the Messina Province: A tool in the civil protection emergency cycle. Rendiconti Online Società Geologica Italiana, 35, 70-73. DOI: 10.3301/ROL.2015.66.

Costruttori for C.A.S.E. (Eds.), L'Aquila (2010) – Il Progetto C.A.S.E., IUSS Press, 431 pp.

Di Bucci D. & Dolce M. (2019) – La scienza nel processo decisionale di protezione civile per la gestione dei rischi. In: Amato A., Flora G. & Valbonesi C. (Eds.), Scienza, diritto e processo penale nell'era del rischio. Chapter X, 201-218. G. Giappichelli Editore.

Di Bucci D. & Savadori L. (2018) – Defining the acceptable level of risk for civil protection purposes: a behavioral perspective on the decision process. Natural Hazards, 90, 293-324. https://doi.org/10.1007/s11069-017-3046-5

Documento sulla Valutazione Nazionale dei Rischi-National Risk Assessment (2018). https://www.protezionecivile.gov.it/en/notizia/the-national-risk-assessment-document-is-online

Dolce M. (2010) – Emergency and Post-Emergency Management of the Abruzzi Earthquake, Theme-leader lecture. 14th European Conference on Earthquake Engineering, Ohrid, Macedonia, 3-8 Settembre 2010. In M. Garevski, A. Ansal (Eds.), Earthquake Engineering in Europe, Springer. DOI 10.1007/978-90-481-9544-2_19.

Bibliographical references

Dolce M. (2012) – The Italian National Seismic Prevention Program, Proc. of 15th World Conference on Earthquake Engineering, September 2012, Lisboa, Portugal, Invited Lecture.

Dolce M. & Di Bucci D. (2014) - Risk management: roles and responsibilities in the decision-making process. In: Silvia Peppoloni & Max Wyss (Eds.), Geoethics: Ethical Challenges and Case Studies in Earth Science. Section IV: Communication with the Public, Officials and the Media. Chapter 18, 211-221. Elsevier. Publication Date: November 18, 2014 | ISBN-10: 0127999353 | ISBN-13: 978-0127999357 | Edition: 1.

Dolce M. & Di Bucci D. (2015) – Civil Protection Achievements and Critical Issues in Seismology and Earthquake Engineering Research. In: A. Ansal (Ed.), Perspectives on European Earthquake Engineering and Seismology, Volume 2. Springer series "Geotechnical, Geological and Earthquake Engineering", 39, Chapter 2, 21-58. DOI 10.1007/978-3-319-16964-4_2.

Dolce M. & Di Bucci D. (2017) – Comparing recent Italian earthquakes. Bulletin of Earthquake Engineering, 15 (2), 497-533. Special Issue: Post-earthquake assessment. https://doi.org/doi: 10.1007/s10518-015-9773-7. Published online: 23.05.2015. https://rdcu.be/7vct

Dolce M. & Di Bucci D. (2018) – The 2016-17 Central Apennines seismic sequence: analogies and differences with recent Italian earthquakes. In: K. Pitilakis (Ed.), Recent Advances in Earthquake Engineering in Europe. 16th European Conference on Earthquake Engineering-Thessaloniki 2018. Springer series "Geotechnical, Geological and Earthquake Engineering", 46, Chapter 26, 603-638. ISBN 978-3-319-75740-7. Chapter DOI: 10.1007/978-3-319-75741-4_26.

Dolce M., Speranza E., Giordano F., Borzi B., Bocchi F., Conte C., Di Meo A., Faravelli M., Pascale V. (2019) –Observed damage database of past Italian earthquakes: the Da.D.O. WebGIS. Bollettino di Geofisica Teorica ed Applicata, 60 (2), 141-164. DOI 10.4430/bgta0254. http://www3.ogs.trieste.it/bgta/pdf/bgta0254_Dolce.pdf

Duro A. (2016) – La prevenzione del rischio idraulico: interventi strutturali e non strutturali. In: AA.VV., Note tecniche su alluvioni e servizi idrici integrati, ISBN 978-88-998-7900-6, 40-41, Utilitalia, Roma.

Fabi D., Ed. (2012) – Il naufragio della Costa Concordia. Sintesi di aspetti di gestione dell'emergenza. Dipartimento della Protezione Civile, 52 pp. https://www.protezionecivile.gov.it/en/pubblicazione/costa-concordia-shipwreck-summary-emergency-response-management

Geipel R. (1979) – Friuli: aspetti sociogeografici di una catastrofe sismica. Franco Angeli ed., 192 pp.

Giordan D., Allasia P., Manconi A., Baldo M., Santangelo M., Cardinali M., Corazza A., Albanese V., Lollino G., Guzzetti F. (2013) – Morphological and kinematic evolution of a large earthflow: The Montaguto landslide, Southern Italy. Geomorphology, 187, 61–79. https://doi.org/10.1016/j.geomorph.2012.12.035

Guidoboni E., Ferrari G., Mariotti D., Comastri A., Tarabusi G., Sgattoni G., Valensise G. (2018) – CFTI5Med, Catalogo dei Forti Terremoti in Italia (461 a.C.-1997) e nell'area Mediterranea (760 a.C.-1500). Istituto Nazionale di Geofisica e Vulcanologia (INGV). DOI: https://doi.org/10.6092/ingv.it-cfti5

Guidoboni E., Ferrari G., Tarabusi G., Sgattoni G., Comastri A., Mariotti D., Ciuccarelli C., Bianchi M.G., Valensise G. (2019) – CFTI5Med, the new release of the catalogue of strong earthquakes in Italy and in the Mediterranean area. Scientific Data 6, Article number: 80. DOI: https://www.nature.com/articles/s41597-019-0091-9

Guidoboni E. & Valensise G. (2011) – Il peso economico e sociale dei disastri sismici in Italia negli ultimi 150 anni. Bononia University Press, 550 pp. ISBN: 978-88-7395-683-9.

Guerriero L., Revellino P., Coe J.A., Focareta M., Grelle G., Albanese V., Corazza A., Guadagno F.M. (2013) – Multi-temporal Maps of the Montaguto Earth Flow in Southern Italy from 1954 to 2010. Journal of Maps, 9 (1), 135-145.

Guzzetti F. (2015) – Forecasting natural hazards, performance of scientists, ethics, and the need for transparency. Toxicological & Environmental Chemistry, 98, 1043–1059. https://doi.org/10.1080/02772248.2015.1030664

Guzzetti F. (2018) – Rischi naturali: l'urgenza di una scienza nuova, in: Caporale C., Maffei L., Marchis V., de Martin J.C. (Eds.), Europa: Le sfide della scienza, Europa. Istituto della Enciclopedia Italiana, Roma, 127–133.

Guzzetti F., Gariano S.L., Peruccacci S., Brunetti M.T., Marchesini I., Rossi M., Melillo M. (2020) – Geographical landslide early warning systems. Earth-Science Reviews, 200, 102973. https://doi.org/10.1016/j.earscirev.2019.102973

Hallegatte S., Green C., Nicholls R.J., Corfee-Morlot J. (2013a) – Future flood losses in major coastal cities. Nature, 3, 802–806. https://doi.org/10.1038/nclimate1979

Hallegatte S., Green C., Nicholls R.J., Corfee-Morlot J. (2013b) – Advanced flood risk analysis required. Nature, 3, 1004-1005. https://doi.org/10.1038/nclimate2053

Hanson B. (2005) – Learning from Natural Disasters. Science, 308, 1125-1125. https://doi.org/10.1126/science.308.5725.1125

Hough S.E. (2013) – Prevedere l'imprevedibile-La tumultuosa scienza della previsione dei terremoti (Translation by Margheriti L., Lucente F.P.). Springer Verlag, 293 pp., Italia.

Junger S. (2000) – La tempesta perfetta. Rizzoli Ed., 288 pp.

Kundzewicz Z.W., Kanae S., Senevirarne S.I., Handmer, J., Nicholls N., Peduzzi P., Mechler R., Bouwer L.M., Arnell N., Mach K., Muir-Wood R., Brakenridge G.R., Kron W., Benito G., Honda Y., Takahashi K., Sherstyukov B. (2014) – Flood risk and climate change: global and regional perspectives. Hydrological Sciences Journal, 59, 1-28. https://doi.org/10.1080/02626667.2013.857411

Kundzewicz Z.W., Pińskwar I., Brakenridge G.R. (2013) – Large floods in Europe, 1985-2009. Hydrological Sciences Journal, 58, 1-7. https://doi.org/10.1080/02626667.2012.745082

Bibliographical references

Maramai A., Brizuela B., Graziani L. (2014) – The Euro-Mediterranean Tsunami Catalogue. Annals of Geophysics, 57, 4, 2014, S0435. DOI:10.4401/ag-6437.

Pagliara P. (2004) – Rischio idrogeologico e idraulico: le novità sul sistema di allertamento. Il Sole 24 ore-Ambiente e sicurezza n. 9, 18 maggio 2004, pagg. IV-VII.

Pagliara P., Bertuccioli P., Campione E., Duro A., Pupillo S. (2014) – Previsione, prevenzione, gestione e mitigazione delle crisi idriche: l'esperienza del Dipartimento della protezione civile. Atti Ecomondo 2014 (su DVD-ROM). ISBN: 978-88-916-0850-5.

Papale P. (2018) – Global time-size distribution of volcanic eruptions on Earth. Scientific Reports, 8. https://doi.org/10.1038/s41598-018-25286-y

Papale P. & Marzocchi W. (2019) – Volcanic threats to global society. Science, 363, 1275-1276. https://doi.org/10.1126/science.aaw7201

Poljanšek K., Marín Ferrer M., De Groeve T., Clark I., Eds. (2017) – Science for disaster risk management 2017: knowing better and losing less. EUR 28034 EN, Publications Office of the European Union, Luxembourg, 551 pp. https://ec.europa.eu/jrc/en/publication/science-disaster-risk-management-2017-knowing-better-and-losing-less

Risoluzione dell'Assemblea Generale delle Nazioni Unite 70/1 del 25 settembre 2015 – Transforming our world: the 2030 Agenda for Sustainable Development.

Rossi M., Guzzetti F., Salvati P., Donnini M., Napolitano E., Bianchi C. (2019) – A predictive model of societal landslide risk in Italy. Earth-Science Reviews, 196, 102849. https://doi.org/10.1016/j.earscirev.2019.04.021

Rovida A., Locati M., Camassi R., Lolli, B., Gasperini P. (2019) – Catalogo Parametrico dei Terremoti Italiani (CPTI15), versione 2.0. Istituto Nazionale di Geofisica e Vulcanologia (INGV). https://doi.org/10.13127/CPTI/CPTI15.2

Salvati P., Petrucci O., Rossi M., Bianchi C., Pasqua A.A., Guzzetti F. (2018) – Gender, age and circumstances analysis of flood and landslide fatalities in Italy. Science of the Total Environment, 610-611, 867-879. https://doi.org/10.1016/j.scitotenv.2017.08.064

Salvati P., Bianchi C., Fiorucci F., Giostrella P., Marchesini I., Guzzetti F. (2014) – Perception of flood and landslide risk in Italy: a preliminary analysis. Natural Hazards and Earth System Sciences, 14, 2589-2603. https://doi.org/10.5194/nhess-14-2589-2014

Salvati P., Bianchi C., Rossi M., Guzzetti F. (2010) – Societal landslide and flood risk in Italy. Natural Hazards and Earth System Sciences, 10, 465-483. https://doi.org/10.5194/nhess-10-465-2010

Sheffield J. & Wood E.F. (2007) – Projected changes in drought occurrence under future global warming from multi-model, multi-scenario, IPCC AR4 simulations. Climate Dynamics, 31, 79-105. https://doi.org/10.1007/s00382-007-0340-z

Bibliographical references

Silvestri V. (2012) – Commento all'art 196 TFUE. In: Curti Gialdino C. (Ed.), Codice dell'Unione Europea operativo, TUE e TFUE commentati articolo per articolo, con la Carta dei diritti fondamentali dell'Unione Europea. Edizioni giuridiche Simone, Napoli, 2012, 2560 pp.

Taleb N.N. (2007) – The Black Swan: The Impact of the Higly Improbable, Random House, 366 pp. ISBN 978-1400063512.

United Nations (2016) – Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. https://www.undrr.org/publication/report-open-ended-intergovernmental-expert-working-group-indicators-and-terminology

United Nations Office for Disaster Risk Reduction (2015) – Sendai Framework for Disaster Risk Reduction 2015-2030. 37 pp. https://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf

Legislative framework of reference

Building Code NTC 2018 – Decree of the Ministry of Infrastructure and Transport of 17 January 2018-Update of the "Technical Standards for Construction".

Decision n. 1313/2013/EU – Decision n. 1313/2018/EU of the European Parliament and of the Council of 17 December 2013 on a Union Civil Protection Mechanism.

Decision (EU) n. 2019/420 – Decision (EU) 2019/420 of the European Parliament and of the Council of 13 March 2019 amending Decision no. 1313/2013 / EU on a Union Civil Protection Mechanism.

Directive 2000/60/EC – Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

Directive 2007/60/EC – Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 relating on the assessment and management of flood risks.

Directive of the President of the Council of Ministers of 14 January 2014 – National relief program for seismic risk.

Directive of the President of the Council of Ministers of 27 February 2004 – Operational guidelines for the organizational and functional management of the national, state and regional alert system for hydrogeological and hydraulic risk for civil protection purposes.

Directive of the President of the Council of Ministers of 1 April 2019 – Establishment of the National Civil Protection Week.

Law n. 1570/1941 – New rules for the organization of fire services.

Law n. 241/1968 – Conversion into law, with amendments, of the Decree-Law of 27 February 1968, n. 79, concerning further interventions and provisions for the reconstruction and economic recovery of the Municipalities of Sicily affected by the earthquakes of January 1968.

Law n. 996/1970 – Rules on rescue and assistance to populations affected by disasters-civil protection.

Law n. 353/2000 – Framework law on forest fires.

Law n. 92/2019 – Introduction of school teaching of civic education.

Legislative Decree n. 152/2006 – Environmental standards.

Legislative Decree n. 49/2010 – Implementation of Directive 2007/60/EC relating to the assessment and management of flood risks.

Legislative Decree n. 1/2018 – Civil Protection Code.

Legislative Decree n. 4/2020 – Supplementary and corrective provisions of the Legislative Decree 2 January 2018, n. 1, bearing: "Civil Protection Code".

Ordinance of the President of the Council of Ministers n. 3519/2006 – General criteria for the identification of seismic zones and for the formation and updating of the lists of the same zones.

Royal Decree-Law n. 1915/1919 - Organization of first aid services in the event of earthquake.

Royal Decree-Law n. 2389/1926 - Provisions for first aid services in the event of earthquake or other disasters.

Building Code NTC 2018 – Decree of the Ministry of Infrastructure and Transport of 17 January 2018-Update of the "Technical Standards for Construction".

Main Webography

AISCAT-Italian Association of Motorway and Tunnel Concession Companies

ANAS-National Road Authority

ANCI-National Association of Italian Municipalities

ANPAS-National Association of Public Assistance

Campagna Io Non Rischio-I Don't Take Risks-Campaign

CIMA (Research Foundation)-International Center for Environmental Monitoring

CNVVF-National Fire Brigade

CNR-National Research Council

DG ECHO-Directorate General for European Civil Protection and Humanitarian Aid Operations

DG REGIO-Directorate General for Regional and Urban Policy

DPC-Civil Protection Department

EMS-European Macroseismic Scale

ENEL-National Body for Electricity

ENI-National Hydrocarbons Body

ERCC-Emergency Response Coordination Centre

EUROSTAT-Statistical office of the European Union

FEMA-Federal Emergency Management Agency

GEM-Global Earthquake Model

INGV-National Institute of Geophysics and Volcanology

ISPRA-Institute for Environmental Protection and Research

Main Webography

ISTAT-National Institute of Statistics

JRC-Joint Research Centre

NEAMTWS-North-Eastern Atlantic, Mediterranean and connected seas Tsunami Warning System

ReLUIS-Network of University Laboratories of Seismic Engineering

SICURO+-Risk Communication Information System

SiAM-National Warning System for Tsunamis generated by earthquakes

SNAM-National Gas Pipeline Society

SNPA-National Environmental Protection System

SNPC-National Civil Protection Service

TERNA-National Electricity Network

TSUMAPS-NEAM-TSUnami hazard MAPS for the NEAM region

UNDRR-United Nations office for Disaster Risk Reduction

WHO-World Health Organization

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