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A horizontal banner at the top of the page features a map of Europe. The map is divided into numerous small, irregular regions, each filled with a different color. The colors transition from dark red on the left (representing Western Europe) through orange and yellow in the center (representing Central Europe) to light green on the right (representing Eastern Europe).

ESPON-TITAN Territorial Impacts of Natural Disasters

Applied Research

**Final Report – Case Studies Report
Po River Basin (Italy)**

June 2021

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Case Study Report

ESPON-TITAN Territorial Impacts of Natural Disasters

Po river basin, Lombardy Region
(Italy)

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Abbreviations

AIPO	Agenzia Interregionale Po – Po Interregional Agency
ARPA	Agenzia Regionale Protezione Ambiente – Regional Agency Environment Protection
CP	Civil Protection
D. Lgs.	Decreto Legislativo – Legislative Decree
DdARACC	Documento di Azione Regionale per l’Adattamento ai Cambiamenti Climatici
DG	Direzione Generale
DRM	Disaster Risk Management
EU	European Union
FLA	Fondazione Lombardia per l’Ambiente – Lombardy Foundation for Environment
GDP	Gross Domestic Product
l.r.	Legge - Law
NRM	Natural Risk Management
PAI	Hydrogeological plan
PEAR	Regional Environmental Energy Program
PGRA	Flood risk management plan
PNACC	National Adaptation Plan
PNIEC	National Action Plan for Energy
PREAC	Regional Energy, Environment and Climate Plan
PRIM	Integrated Regional Program for Risk Mitigation of Lombardy
PTCP	Provincial Territorial Coordination Plan
RaSDa	Raccolta Schede Danni, Damages Form collection
RTP	Regional Territorial Plan
SPL	Spatial Planning Law
SNACC	National Climate Change Adaptation Strategy
VAS	Valuazione Ambientale Strategica – Environment Strategic Assessment
VIA	Valutazione di Impatto Ambientale - Environment Impact Assessment

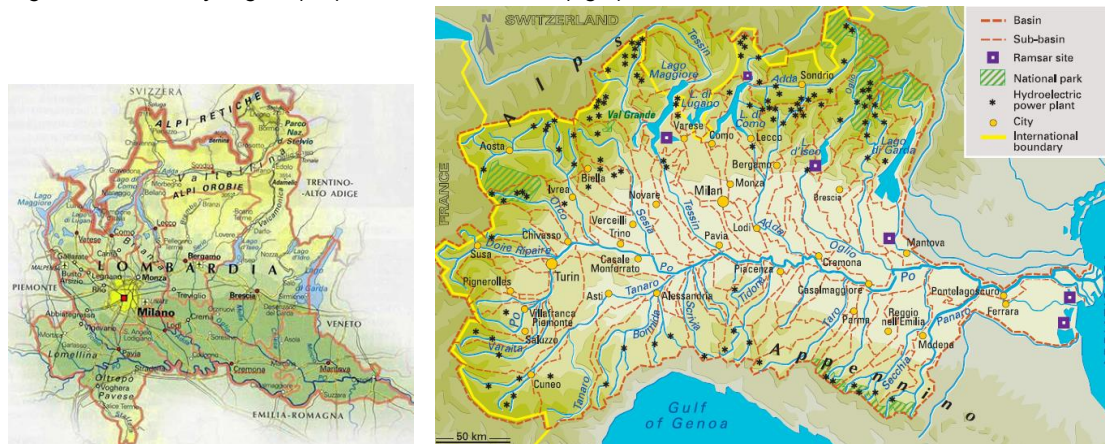
1 Introduction

The case study presents the experience of Lombardy region in the broader territorial context of the Po river basin, here the basin being represented as the most suitable unit for the implementation of organic actions aimed at the protection of the territory and the naturalistic safeguarding of waterways (law 183/89-Law¹). This area is affected by all the typologies of natural hazards included in ESPON-TITAN, counting with a large amount of available data; besides, the responsible government formulated a sound and coherent set of policy instruments and measures with a strong cooperation². Thus, an interesting example to be analysed as a case study, from the decision-making perspective.

1.1 Geographic, economic and demographic characterization

The transnational territory of the Po river basin includes 7 Italian regions – although only four of them are crossed by the main river – besides one Swiss Canton (Ticino), with a total surface of around 71.000 km² and almost 16 million inhabitants. The focus of the analysis is the part of the Po river basin comprehended by the Lombardy region, that includes 11 Provinces, the Metropolitan city of Milano and sums 1.506 municipalities.

Figure 1. Lombardy region (left) and Po River Basin (right)



Source: *Water in a changing world*, UN (<https://unesdoc.unesco.org/ark:/48223/pf0000181993.page=405>)

Lombardy Region is located in northern Italy. Its territory has an extension of 23.000 km² and accounts for 10 million inhabitants. According to the regional spatial planning, it comprehends 6 territorial systems:

- the **mountain area**, Alps and Appennines, where the main cities are in the valleys;
- the **transition area**, highly populated and industrialized;

¹ <http://www.adbve.it/Documenti/legge18389.htm>

² The following measures refer to the “second generation” related to the Po basin modern approach to DRM, that was implemented after Valtellina disaster occurred in 1987.

- the **metropolitan area**, including Milan and the main cities, mostly on flat or hilly land, like Varese, Como, Lecco, Bergamo, Brescia;
- the **big lakes** (Maggiore, Como, Iseo, Garda);
- the **irrigated plain**, with its intensive agriculture and food industry;
- the **upper dry flat or hilly land** and the **main rivers**.

Regarding economics, the Lombardy production system is currently one of the most developed in Italy and Europe. At the end of 2013, there were approximately 815 thousands of active businesses (around 8,3 businesses/100 inhabitants). Micro and small businesses are the basis of the production fabric of the Region, representing over 99% of Lombard enterprises. The Lombardy productive system has always been manufacture-oriented. GDP amounts to EUR 380 billion, which in term of GDP pro capita is EUR 38.000. In terms of research institutions, Lombardy has a first-class R&D Infrastructure (13 Universities and 12 national Research Council Institutes). The Region has been renowned as an outstanding centre of creative and cultural industries in Europe (third place among European regions), with a component of knowledge-intensive services.

2 Main characteristics of the administrative structure and planning system

2.1 Brief introduction to the administrative structure

Italy presents four administrative levels with territorial relevance: State, Regions, provinces and municipalities, being the first two with some degree of legislative power. According to their role in terms of policies, there are three possible situations: **State competence** (the legislative power is at the national level. Regions can only apply and specify state legislation); **State-Regional shared competence** (both State and Regions have legislative power in a particular topic. Usually, state legislation represents a general framework, complemented and detailed by regional normative); **Regional** (the legislative power is at the regional level).

Provinces and municipalities have correspondent administrative competencies. Related to them are the Metropolitan cities, with the same competencies as provinces, added by specific exclusive competencies for metropolitan areas.

Through the direct election system of politicians, the Statal, regional, and municipal configure their governments. For the provinces and metropolitan cities, the system is based on the municipality council's election. Besides, the Italian Constitution allows som (articular Regions statute (like Valle d'Aosta), and Autonomous Provinces (like Trento and Bolzano) with a wider range of primary associated competencies, such as water and disaster risk management (DRM), and thus adding complexity to the governance model.

The main policy areas relevant for DRM are three: environment protection, where the statal level has the responsibility; spatial planning, where Regions have decision power on content, and, since 1998, Civil Protection, with shared competencies (national and local bodies). Besides this formal administrative division, other institutions participate in the DRM with different roles in the coordination-cooperation process, such as Po river basin Authority, ARPA, FLA, AIPO, and other voluntary bodies.

2.2 Brief introduction to the planning system

In the Lombardy region, the spatial planning system also has three levels: regional, provincial and municipal; the structure of the plans and the knowledge involved are defined by Regional Law 12/2005³. All public documents, through a regional geographic information platform, have their standard corresponding legend and associated metadata.

Plans are approved by the corresponding Council, under the condition of previous evaluation of coherence with the upper level. The regional level evaluates the province and some municipal propositions, according to some environment and landscape criteria. The remaining municipalities are evaluated directly by the responsible province.

³ https://www.bosettiegatti.eu/info/norme/lombardia/2005_012.htm

3 Hazard profile and economic impacts of natural disasters in the Po river basin

As previously indicated, in 1987 heavy spots of rain lasted for days, slopes collapsed, amounts of debris choked the streams, one landslide (around 40 million m³ of rock) destroyed more than 3 km of the valley, including villages, infrastructure, and fields. The impact was huge, and the event had worldwide resonance: 52 people died, an investment of EUR 894 million (equivalent to EUR 2,1 billion present value) for immediate damage recovery, and the development of a reconstruction plan (EUR 1,2 billion).

Generally, and following the six territorial systems previously identified according to the RTP, it is possible to find the following hazards:

- In the **mountain areas**: Landslides, avalanches, flood, debris flow, rock falls;
- In the **lakes**: rockfalls, landslides, flood, debris flow;
- In the **upper plain and hills**: small landslides, local floods;
- In the **metropolitan area**: pluvial flood due to soil impermeabilization, local floods from main or second-tier rivers;
- In the **irrigated plain**: local pluvial floods, floods in the area of influence of the main rivers;
- In the **areas of the main rivers**: floods, locally rare landslides from river valley scarp.

As expected, there is no coincidence between administrative boundaries and territorial distribution of the risks. All landslides, floods, storms, and severe weather events are region wide, therefore, most provinces are affected by of them. The last major **flood events** in Lombardy occurred in 2014 (Po river and Lombardy rivers flood), 2016 (Po river flood), 2018 (Vaia storm, all along with Northern and Central Italy), 2019 (June event). **Seismic events** are, by contrast, more located but also quite harmful, with two main events having occurred in the last 16 years (2004 in Garda Lake, 5,2 million; 2012 in Mantova area, approximately 6,0 million). However, in Lombardy the minor events are more frequent, happening annually. For them, the Region defines a budget for urgent interventions, carried out by the regional territorial departments or by municipalities (under Regional level supervision). In Lombardy, the procedure follows the following steps:

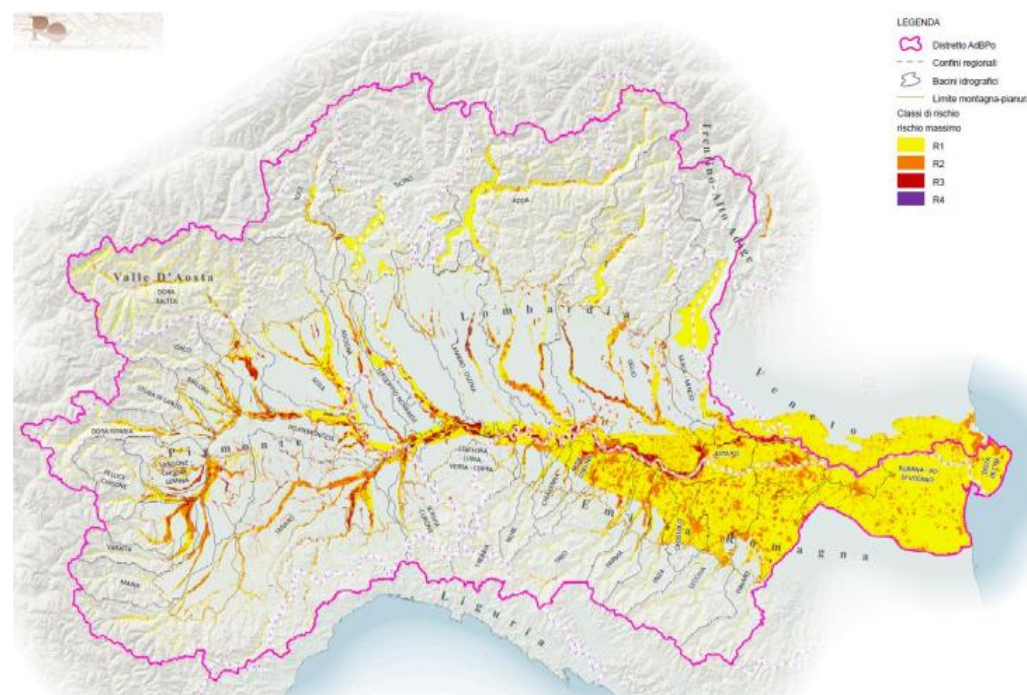
- Towns/cities and other bodies (Province, Region itself) send – in 7 days starting from the last day of the event – their first assessment (events occurred, estimated economic impact), through a dedicated system (RaSDa);
- Region verifies the forms, also throughout specific field surveys, making more accurate assessments;
- the data, together with an analysis of technical aspects (for instance, weather conditions), are sent – in case of main events – to Prime Minister – Civil Protection Department – , together with a specific request for the national level of emergency declaration.

Beyond the evaluation of the risk, there is a possibility to ask for damage reimbursement. For instance, in the case of **storms** are relevant, especially for agriculture; strong wind and hail are the main problems. The Agriculture Department is responsible for damage reimbursement and prevention measures, in particular protection for the most valuable crops, like fruit and vineyards. Including the European level with correspondent funds plays a relevant role.

Beyond the main events, the process to evaluate particular short-term consequences, as a fundamental part of Civil Protection Italian system (even as estimated value) to get the funds provided by the regional government, follows a coherent sequence. The regional government allocates funds (the national Civil Protection law states that the Region can utilize administrative emergency instruments to face the emergency), and it is possible to request a state emergency situation (National or EU funding, administrative emergency mechanisms).

Floods and landslides interact with each other and for this reason, it is difficult to separate the associated impacts. Besides, debris flow is a frequent phenomenon, especially in the mountain territorial system, i.e. Alps and Appennini areas. In this sense, it is important to consider the asymmetry of the Alpine chain, of which the Italian slopes are the steepest ones.

Figure 2. Flood risk in Lombardy region



Source:

https://ec.europa.eu/regional_policy/rest/cms/upload/21102020_111125_presentation_adriana.pdf

4 Disaster Risk Management in the Po river basin

4.1 General remarks

The first generation of policies and instruments (between 1990 and 2000) included both laws and decrees by State and Lombardy Region, for specific aspects such as risk assessment, mitigation works, or maintenance. Since 2000, both State and the Region decided to reorganize the legislative framework, integrating those different aspects. Nowadays, the normative in prevention and mitigation present two legislative decrees:

D. Lgs. 152/2006 – Norme in materia ambientale (Environmental act)⁴. This normative absorb the previous 183/89 Law for soil defense, and includes natural risk prevention, soil protection, and risk mitigation standards.

D. Lgs. 2 January 2018, n.1 – Codice della Protezione Civile (Civil Protection Code)⁵. This normative replace the Law 24 February 1992, n.225: Istituzione del Servizio Nazionale della Protezione Civile (Creation of the Protection national system), created after some natural disasters (especially the Irpinia earthquake in 1980). Its main principles are still valid in the current normative which are:

- Civil Protection activities are not confined to emergency management in case of an event, but include prevision/prediction and prevention/preparedness actions and restoring normal life conditions. The system covers the whole cycle of emergency management, focusing on prevention/preparedness activities.
- Events decline according to a size and coordination model which classifies events in categories, starting from events at town scale (one body involved through a typical mechanisms), to province/regional scale (more bodies involved, which implies more coordination through typical mechanisms), to State scale (national coordination of territorial bodies, with extraordinary measures).

The Civil Protection Code also includes some main changes: (i) the Mayor, President of the metropolitan area, President of the Region, and Prime Minister are set as the CP authorities, and City Town halls are technical bodies. There is a clear definition of the responsibility chain, starting from the level nearest to affected people (Mayor); moreover, the law states the existence of authorities and operational bodies; (ii) it establishes that extraordinary measures should be activated at the regional level (according to their legal procedures).

⁴https://www.isprambiente.gov.it/it/garante_aia_ilva/normativa/normativa-ambientale/Dlgs_152_06_TestoUnicoAmbientale.pdf

⁵http://www.protezionecivile.gov.it/amministrazione-trasparente/provvedimenti/dettaglio/-/asset_publisher/default/content/decreto-legislativo-n-1-del-2-gennaio-2018-codice-della-protezione-civile

This national law is related to the decentralization process, as it delegates more competencies to the regional level. In this context, the Lombardy region developed its own normative:

- I.r. 11 March 2005 #12 – (*Legge per il Governo del Territorio*) - Spatial planning law: It includes the obligation to carry out geological, hydrogeological, and seismic hazard analyses in preparation for every level of urban planning;
- I.r. 15 March 2016 #4 – (*Revisione della normativa Regionale in materia di difesa del suolo, di prevenzione e mitigazione del rischio idrogeologico e di gestione dei corsi d'acqua*)⁶. – Regional law on soil protection, hydrogeological risk prevention, and mitigation, river and stream management. It is a coherent basis for regional policies on natural risk prevention and management;
- I.r. 22 May 2004 #16 – (*Testo Unico delle disposizioni regionali in materia di Protezione Civile*)⁷ Regional Code of Civil Protection: It is a translation of the national law on a regional basis, with two fundamental aspects: both regional and provincial presidents are recognized as local Civil Protection authorities, although the creation of the "Crisis State" figure for emergencies is done at the regional level. This code, issued in 2018, recognizes the importance of the regional level and the need for regional states, with administrative and economic procedures. In this context, the regional laws on soil protection, hydrogeological risk prevention, and mitigation, river and stream management (I.r. 11 March 2005 #12 and I.r. 15 March 2016 #4) set the following policies and instruments:
 - An integrated knowledge system, based on a public geographic platform where local authorities upload their maps and data as part of the administrative process;
 - Structural works for risk mitigation including flood containment, slope stabilization, protection for houses, and infrastructure;
 - A regional monitoring system that keeps under control the main landslides and rivers connected with alert functionalities;
 - It states that maintenance is crucial, divided into three aspects: structural works; riverbeds and banks; slopes, and woods. In this line, traditional agricultural practices were, and still are, quite effective in risk mitigation.

According to the regional spatial planning, it is an obligation to carry out geological, hydrogeological, and seismic hazard analyses in preparation for every level of urban planning. In this context, Civil Protection plans (at all levels) consider hazards, scenarios, and actions to mitigate the consequences in case of an event. As a consequence, CP planning relates to the local, provincial, regional, and State levels.

For instance, the Region has to perform CP planning about dams and earthquakes. The documents designed by different levels should be consistent in terms of scenarios (considering the scale of the plans).

⁶<http://normelombardia.consiglio.regione.lombardia.it/NormeLombardia/Accessibile/main.aspx?iddoc=lr02016031500004&view=showsum>

⁷<http://normelombardia.consiglio.regione.lombardia.it/NormeLombardia/Accessibile/main.aspx?view=showdoc&iddoc=lr002004052200016>

4.2 Competent institutions in risk prevention

In this case study, the competent institutions in risk prevention (territorial planning), soil protection, and DRM are the following:

Po river basin Authority: Develops the basin plan and its excerpts, including natural risks (landslides, avalanches, floods). Those are the PAI and the PGRA (art.7 Directive 2007/ 60 / EC)⁸ and builds up intervention programs.

Lombardy Region: Works together with the Basin Authority editing the Basin Plan, promotes and carries out studies aimed at updating the Plan. Through Lombardy Geoportal (based on INSPIRE directive), geographic information about the natural hazards of the Basin Plan cartography (and other studies) is available. Defines the priority interventions for soil protection in its regional planning tool (RTP) and formulates, in collaboration with local authorities and hydraulic authorities, proposals for intervention programs (construction of new works and maintenance of existing works) for financing with state funds; draws up and finances intervention programs with its resources; approves intervention projects which he draws upon his own or with the support of local authorities. It carries out the hydraulic police service on its network or through local authorities (AIPO, Consorzi di Bonifica). Following the rules of the Basin Plan, it elaborates and approves the legislation in the urban planning sector. It also carries out Hydraulic police activities for the main rivers and streams).

Provinces and the Metropolitan City of Milano: In their planning tool (PTCP) they can deepen their knowledge on the types of instability that characterize their territory (for instance, sink-holes for the territory of the Province of Monza and Brianza; landslides for the territory of the Province of Varese).

Municipalities: They conduct studies aimed to identify the areas with geological, hydrogeological, hydraulic, and local seismic hazards. Urban planning tools include these studies. Based on the same studies, they also formulate and update the civil protection emergency plans. Municipal studies are validated by the Lombardy Region and contribute to updating the Basin Plans. They also perform hydraulic police activities on their hydrographic network and are contracting authority for the implementation of soil defense works through agreements stipulated with the Lombardy Region.

ARPA: It contributes to the construction and updating of the cognitive framework; in particular, it builds and updates the maps related to avalanche areas. It also designs and manages meteorological, hydrological, hydraulic monitoring networks on 43 large landslides. It provides scientific support to other authorities and, in particular, concerning natural hazards (floods), it provides the reference values necessary for civil protection activities (preparation for events and emergency management).

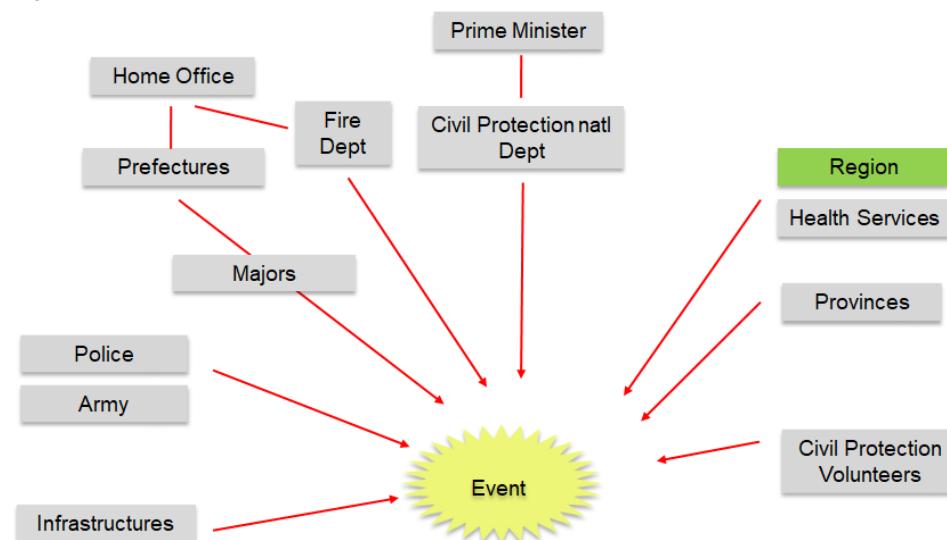
⁸ <https://www.eea.europa.eu/policy-documents/directive-2007-60-ec-of>

FLA: It is a non-profit scientific foundation established in 1986 by the Lombardy Regional Council. Its objective is to develop research and training activities for the protection of the environment from anthropogenic pressures, with particular attention to climate change and mitigation and adaptation strategies related to these risks. It transfers knowledge from the research and development sectors to the Public Administration through the development of cognitive and management tools to support the governance of the territory.

AIPO: It is responsible for mitigation works, flood management, river maintenance for the Po and its main affluents (on the remaining main waterways, this activity is performed by the Region).

Voluntary bodies: They are free associations supported and equipped with public funds. They are very active in case of emergency, integrating and supporting the public bodies.

Figure 3. Competent institutions in risk prevention



Source:
https://ec.europa.eu/regional_policy/rest/cms/upload/21102020_111125_presentation_adriana.pdf

4.3 Risk assessment and management on the regional level

In the Civil Protection Italian system, it is fundamental to evaluate, even as estimated value, the economic consequences of an event, as the regional government allocates funds (the national CP law states that the Region can utilize administrative emergency instruments to face the emergency). It is also possible to make a request for a state emergency level (with national or EU funding and administrative emergency mechanisms).

Lombardy Region promotes cognitive actions as surveys and studies aimed at identifying areas subject to hazards due to various natural phenomena (description of those actions are available through the Lombardy Geoportal):

- Flood hazard maps are constructed both considering areas affected by past flood events and based on hydraulic models that estimate areas potentially affected by floods for different return times adjacent to rivers, streams and lakes;
- Landslide hazard maps identify areas of an active landslide (currently in motion), quiescent (inactive for more than a year but believed to be reactivated) or stabilized (not expected to be reactivated);
- Avalanche hazard maps represent the areas affected by avalanches that occurred in the past and those potentially exposed to avalanche hazard (due to slope exposure, altitude);
- Seismic hazard maps represent the basic hazard (on which the seismic classification of municipalities in classes from 1 to 4 is based) and the local seismic hazard (site seismic effects), which highlight the areas that can give rise to amplification or instability phenomena (subsidence, liquefaction, landslides).

All maps are at scale 1:10.000-1:25.000, each of them representing a single hazard. Moreover, in the Lombardy Geoportal it is also possible to overlay all the maps to have an overview of the dangers affecting an area. Furthermore, the Territorial Certificate service is available in the Lombardy Geoportal which, by examining a point or an area, it extracts the information from all levels (cognitive and diagnostic) and provides a downloadable identity card with the list of all the factors of attention, as well as numerous physical data of the site.

As part of the PRIM, multi-hazard maps of the hydrogeological hazard were developed. The regional territory has been divided into cells of 20m x 20m and 1km x 1km. Each cell is associated with a hydrogeological hazard index (for landslides, floods, or avalanches) which varies from 0 to 10 and defines the criticality level of the cell concerning the regional average which is set by definition = 1.

In the PRIM context, multi-risk maps (hydrogeological risk) are built through the overlay of multi-hazard maps and potential targets (buildings, infrastructures, land-use). As for the hazard maps, the regional territory has been divided into cells of 20m x 20m and 1km x 1km, each of them associated with a hydrogeological risk index that varies from 0 to 10 and defines the criticality level of the cell for the regional average which is set by definition = 1. The PRIM contains a mapping not only of the hydrogeological and seismic risk, but also of other risks such as forest fires, road accidents, accidents at work, industrial, meteorological, and an integrated assessment of all risks, including spatial representations of the dominant one.

It is compulsory by the regional law 12/2005 that urban plans at the local scale (municipalities, provinces) are preceded by an analysis of the natural hazards, so that they are correctly addressed in urban projects. These analyses help to update the hazard maps built at the regional level. As a consequence, spatial planning at the regional and local level is based on previous natural risk assessment. A similar methodology for flood, landslide, and avalanche risk, is set based on hazard mapping, risk synthesis, and feasibility map. A specific methodology is dedicated to seismic risk based on micro zoning. Since those maps influence land-use, they are built at a very detailed local scale.

At the regional level, there is a department responsible for risk assessment and management; its main tasks are: (i) cooperate to the basin plan; (ii) define rules and guidelines for risk assessment, mitigation works, and civil protection; and (iii) programming and coordinating the implementation of the policies. Regional Territorial Departments, located in each Province, are responsible for the main rivers and streams, emergency intervention, and support the local administrations in their tasks. At the province level, the organization can be different, especially after the Del Rio law that cut their competencies and budget. At the municipality level, the same office responsible for spatial planning is in charge of risk maps, and the task is externalized to professionals.

Sectorial planning benefits from the existing risk maps, which are quite complete and detailed. In Italy, sectorial plans are subject to a process of an Environmental Strategic Assessment (VAS) where the potential impacts, including risk aspects, are evaluated.

The risk assessment process is conducted by public entities. The analyses of natural hazards that are an integral part of urban plans, are subjected to participatory processes in which all stakeholders can make observations.

In the plan implementation phase, each infrastructure project depends on a detailed technical regulation, prescribing the specific assessments to be performed, including risk evaluation and protection measures.

Spatial planning at different municipal, provincial, regional, and basin scales has competencies in prevention by setting constraints that do not allow building in highly dangerous areas. It also has competences in reducing the vulnerability of buildings, as the plan regulations can provide for coupled building interventions, and in reducing the vulnerability of buildings.

The protection objectives for natural hazards (landslides, avalanches, floods) are defined in the basin plans, which are incorporated in the planning tools at a more local level.

5 Climate Change Adaptation in the Po river basin

5.1 General remarks

Beyond the national level (National legal framework: SNACC, 2015⁹; PNACC, 2017¹⁰; PNIEC, 2018-), and in agreement to it, in order to face the effects of climate change, the Lombardy Region presents the following normatives:

- Regional Climate Change Adaptation Strategy of Lombardy Region (Strategia Regionale di Adattamento ai Cambiamenti Climatici della Lombardia¹¹), elaborated in collaboration with Fondazione Lombardia per l'Ambiente, was adopted by Giunta di Regione Lombardia December, 12, 2014;
- Regional Action Plan for Adaptation to Climate Change (Documento di Azione della Lombardia sull'Adattamento ai Cambiamenti Climatici¹²), elaborated in collaboration with Fondazione Lombardia per l'Ambiente, was adopted by Giunta di Regione Lombardia December, 19, 2016;
- Regional Council, in addition to the initiatives already planned or in progress, even those implemented, focuses on identifying strategies and paths to obtain medium and long-term results (2030 and 2050). The reduction of climate-altering pollutants constitutes a concrete action to lead the decrease over the years.

The definition of PREAC is in progress, and it updates and enriches the PEAR with targets for 2030 and a long-term vision, and which also addresses the content contained in the PNIEC, the Integrated National Plan for Energy and Climate adopted by the State in early 2020.

Besides strategies and plans, Lombardy region has developed a community engagement/education initiative, launching an information campaign on climate change, focused on the description of its impacts at the regional scale and the adaptation policies implemented by the regional authorities, including actions that can be performed by social actors or private citizens. As a result, there is a publication entitled “Il clima cambia: cosa possiamo fare insieme?” (*Climate is changing: what can we do together?*).

The school for the environment, organized by the Regional Environment Protection Agency includes a specific module about climate change. In particular, the Course on Climate Change tries to highlight the scientific basis of climate change, the international agreements and

⁹ https://www.minambiente.it/sites/default/files/archivio/allegati/clima/documento_SNAC.pdf

¹⁰ https://www.minambiente.it/sites/default/files/archivio_immagini/adattamenti_climatici/documento_pna_cc_luglio_2017.pdf

¹¹ <https://www.regione.lombardia.it/wps/portal/istituzionale/HP/DettaglioRedazionale/servizi-e-informazioni/cittadini/Tutela-ambientale/Qualita-dell-aria/adattamento-al-cambiamento-climatico-verso-una-strategia-regionale/adattamento-al-cambiamento-climatico-la-strategia-regionale>

¹² https://www.regione.lombardia.it/wps/wcm/connect/946249ce-87c4-4c39-88f9-5eab3a264f14/Documento+Azione+Adattamento+RL_9dic.pdf?MOD=AJPERES&CACHEID=946249ce-87c4-4c39-88f9-5eab3a264f14

national and regional commitments, the mitigation and adaptation scenarios, with a view on the role of local communities.

Lombardy Region is a member of The Climate Group Network, and one of its commitments is to annually monitor the implementation of climate change measures under The Compact of States & Region. In particular, chapter 5 on climate risks and adaptation actions of the Lombardy CDP States and Regions questionnaire, is focused on climate change adaptation. The last monitoring report was submitted on July 29, 2020. Moreover, during the implementation phase of the Regional Action Plan for Adaptation to Climate Change (DdARACC), it will be possible to evaluate and monitor the implementation of selected adaptation measures.

5.2 Climate change impact assessments

Regarding the development of the new PREAC, a great contribution to this path comes from the activity that the Region is carrying out in the context of the Observatory for the circular economy and the energy transition, set up to guarantee an open and intersectoral approach to the regional action on two strategic areas: energy transition and circular economy.

All the actors (universities and research centres, business associations, local authorities, environmental associations, trade unions associations and associations of financial institutions) contribute to the framework of knowledge, limits, barriers, and opportunities to support the political choices in a highly participatory process for identifying the measures to be implemented.

5.3 Climate change impact management

There are different instruments and plans to promote the climate change adaptation in Lombardy Region, aimed at including specific measures designed for new planning of areas that are most affected by the climate change drivers, such as increase in temperatures and changes in seasonal precipitation patterns (with particular attention to mountain areas).

In the frame of spatial planning, the revision and update of RTP – to be finalized by 2020 and to be approved by Consiglio Regionale in 2021 – contains a specific pillar dedicated to resilience and climate change adaptation: PILASTRO 3. Resilienza, sicurezza e governo integrato delle risorse. One of the aims is the target of zero net land consumption by 2050, considering the territorial vulnerability to climate change impacts.

More specific objectives of the Plan are the reduction of soil impermeabilization, the quality of agricultural soils, re-naturalization of disused and degraded areas, and the increase of natural areas, to improve carbon storage, biodiversity, quality, and availability of water system.

Moreover, the Regional Landscape Plan¹³, currently under revision, is going to produce new cartography that highlights areas of high landscape and ecological value, based on the indicator Habitat Quality. This tool provides a map of the spatial distribution of regional biodiversity versus the risks and threats connected to climate change.

The climate change issue is integrated into several regional planning instruments related to different sectoral policies.

The definition of the new PREAC is in progress, and it will update and enrich the PEAR with targets for 2030 and a long-term vision, which takes into consideration the addresses contained in the PNIEC, the Integrated National Plan for Energy and Climate adopted by the State in early 2020.

The Lombardy Regional Plan for Air Quality¹⁴ presents several actions aimed at increasing air quality through progressive reduction of pollutant emission considering the effect of climate change on the formation and deposition of climate-dependent air pollutants.

The Water Protection Plan¹⁵ is aimed at regulating water resources in Lombardy Region through the planning of the qualitative and quantitative protection of water. Several measures are planned and, in part, implemented with co-benefits for climate and water management.

Rural Development Plan of Lombardy Region¹⁶ includes incentives for farmers to implement agricultural practices with low environmental impacts, promoting sustainable use of resources and conservation of animal and plant biodiversity. One of the Measures of the Plan is aimed at financing sustainable agricultural practices of conservative agriculture focused on the increase of carbon storage potential of the agricultural soils to go into a sustainable and climate-proof agriculture.

Related to the previous rural policies, and to promote the protection and valorisation of multifunctional forest ecosystem services, DG Agriculture is implementing forests management plans aimed at the promotion, planning, and monitoring of the forests of Lombardy Region. Furthermore, intervention plans have been designed aimed at the

¹³<https://www.regione.lombardia.it/wps/portal/istituzionale/HP/DettaglioRedazionale/servizi-e-informazioni/Enti-e-Operatori/territorio/paesaggio/piano-paesaggistico-regionale/piano-paesaggistico-regionale>

¹⁴

<https://www.regione.lombardia.it/wps/portal/istituzionale/HP/DettaglioRedazionale/istituzione/direzioni-generalidi/direzione-generale-ambiente-e-clima/piano-regionale-interventi-qualita-aria-pria#:~:text=Il%20Piano%20Regionale%20degli%20Interventi,della%20salute%20e%20dell'ambiente.>

¹⁵<https://www.regione.lombardia.it/wps/portal/istituzionale/HP/DettaglioRedazionale/servizi-e-informazioni/Enti-e-Operatori/territorio/governo-delle-acque/piano-tutela-acque-pta-2016/piano-tutela-acque-pta-2016>

¹⁶[https://www.regione.lombardia.it/wps/portal/istituzionale/HP/DettaglioServizio/servizi-e-informazioni/Imprese/Imprese-agricole/programma-di-sviluppo-rurale-psr/psr-2014-2020/psr-2014-2020#:~:text=Il%20PSR%20\(Programma%20di%20Sviluppo,imprenditori%20agricoli%20e%20forestali%20lombardi.](https://www.regione.lombardia.it/wps/portal/istituzionale/HP/DettaglioServizio/servizi-e-informazioni/Imprese/Imprese-agricole/programma-di-sviluppo-rurale-psr/psr-2014-2020/psr-2014-2020#:~:text=Il%20PSR%20(Programma%20di%20Sviluppo,imprenditori%20agricoli%20e%20forestali%20lombardi.)

sustainable management and protection of forest habitats and biodiversity, utilizing the funds of the regional Rural Development Plan of Lombardy and other national funds.

Besides plans and strategies, the Lombardy Region presents some financial instruments, mainly focused on green areas at both regional and superregional levels.

From the European level, ecological connectivity and biodiversity protection, the current LIFE IP project GESTIRE 2020 addressed to Lombardy Region as its main beneficiary, including an action related to monitoring and containing invasive unfamiliar species whose diffusion is influenced by climate change. Priority has been given to strengthening ecological connectivity inside and between Natura 2000 sites.

From the regional level, Lombardy has established the Fund for Green Areas with the Regional Law 12/2005. This financial instrument is aimed at compensating for environmental loss due to soil consumption and transformation. Private bodies who apply for permission for soil transformation is charged with a tax that will constitute the economic resources invested by the fund. Interventions financed by the Fund have the following objectives: (i) build up the regional ecological network; (ii) improve connections between regional forests; (iii) add value to rural areas with the improvement of their ecological value; (iv) implement the indications listed in the Regional Territorial Plan and the Regional Landscape Plan.

Besides, it presents some initiatives to change the functioning of some economic sectors like tourism, trying to develop a new and innovative business model with new sporting practices and facilities as an idea to facilitate the adaptation of the tourism sector to the new climatic scenarios.

6 Vertical and horizontal cooperation system in DRM and CCA in the Po river basin

Strong vertical cooperation is fundamental for the success in risk management; the system is quite complex since every actor plays different roles in the specific policies.

First, the Po river basin includes, even if partially, seven different Regions, with different specific laws. They all participate in the District Authority, where common rules and goals are discussed and approved. A second aspect is the relevance of the local level; to assess the risk, very detailed data are necessary, based on models, analysis, studies apt to identify the areas affected by natural hazards and the targets potentially affected by them; only at such scale, the risk maps can have a legal effect on the land-use. As mentioned, Lombardy includes 11 provinces, the metropolitan city of Milano, 1.506 municipalities – some of them smaller than 100 inhabitants. For this reason, in mountain areas an intermediate administrative level, as the Mountain Community, is necessary in terms of providing services; this level is very active in risk prevention. A similar function presents the irrigation consortia in the low-land areas. Beyond the initiatives to ensure the irrigation of the plain (through a complex network of canals), the consortia develop initiatives related to the prevention of hydraulic risk and drought.

In the planning sphere, the process includes hazard and risk maps. Therefore, coordination is unavoidable. About the role of data and information, and the relation with maps and their impact on land-use planning, it is necessary to focus on the information flow; the first maps at basin level were produced based on an inventory of the main risks through data collection, interviews, then refined through models for the landslides and rivers. The second generation is based on new studies, but also the results from the local maps. In this way, the local level takes advantage of a coherent vision at the basin or sub-basin scale, and the general level is the synthesis of more detailed data.

The civil protection system is based on subsidiarity principles: upper levels are activated in case of need (and request) from lower levels. In case of an event, upper levels act when local resources cannot face emergency tasks, or when the size of the emergency is regional or national.

According to this participatory philosophy, a wider consultation process is currently ongoing, involving local authorities and the stakeholders in the elaboration and revision of the regional spatial planning. Also, the air quality plan includes information campaigns that have been organized aimed at raising citizen awareness and engaging social and economic stakeholders in the implementation of several measures. Special attention has been given to climate change mitigation measures based on the reduction of greenhouse emissions in the mobility, agriculture, civil heating sectors. Also, meetings with territorial offices of the Lombardy Region are organized to raise awareness of local stakeholders on the issues of biodiversity and the importance of ecological connections related to the LIFE Project.

Besides, in these participatory activities, civil protection presents a preparedness phase that includes planning activities (2018 Code: article 2, clause 4). According to this article, the idea of preparedness supposes:

- Information, and spreading of civil protection culture among citizens (mainly students);
- Drills and training activities (also with the population).

This represents a response to a traditional recommendation that has never been fully carried on (apart from the involvement of technical bodies such as fire brigades, always part of the process of emergency management procedures-making). The code of civil protection and the coordination processes realized at the regional level should improve the situation.

The coordination between spatial planning and climate change policies is ensured through the mentioned Environment Strategic Assessment process, which is performed in every general or sectoral planning, and has specific participation tools, similar to those used in the Environment Impact Assessment.

Climate change impact assessment is a new tool, and the risk management policies in Lombardy have been in place for a long time; currently, this aspect is not yet considered, except for the scenarios used for hazard evaluation. It is also fundamental to the principle of connection between risk management activities and environmental planning. Of course, the impact of this principle is yet to be seen (to this day, coordination between regular use of the environment and risk management is not so easy and present).

For structural mitigation works, the involvement of professionals, enterprises, and universities is crucial. Assuming responsibility for the project, tendering and bringing into reality this complex works have two main effects to municipalities: on one side, since the technical complexity is a big challenge, accompanying measures may be set in place, especially through the Regional Territorial Departments; on the other side, it can involve a larger number of experts who develop new solutions and methodologies, improving the quality and effectiveness of interventions.

7 Lessons learned

The first key lesson we can learn from Lombardy experience is that prevention has a relevant cost, although is worth it; in fact, climate change is causing more and more intense events, and anthropic pressure becomes harder, after population and economic activities growth, but the damages are less than in the past.

The second lesson is that risk can be mitigated, although not eliminated; residual risk should be accepted and managed through sound preparation and disaster management measures.

The third lesson is that mitigation and prevention are processes, including a whole toolbox of measures, and that the targets are not reached once and forever – constant maintenance is needed.

The fourth is that people matter in the context of emergency management. In the framework of well-known procedures, informal decisions and checks help the system to cope and manage all the different aspects.

The **strengths** of this model are:

- Active coordination of actions at the basin scale, including interregional and State-Regions cooperation. Now, Regions play a strategic role in DRM, but natural phenomena do not care about administrative borders; the model for the cooperation between Regions for water uses and risk management faces the main challenges that are also present in transnational cooperation for bigger basins: downstream transfer of impacts, different legislation, need for common, interoperable information and prevision models.
- The legal obligation for risk assessment is directly included in the legal frame for spatial planning. Risk maps are integrated with the planning process, and their absence invalidates the plan itself; similarly, the geological and risk evaluation is included in the project process for public and private buildings and infrastructures.
- The focus is set on the local scale in different phases of the process. For risk assessment, this is the scale where the direct impact on land-use regulation is ensured. Moreover, in an emergency, local authorities are the first on the spot and can ask for regional and state help if needed.
- Legal obligation alone is not so effective if the local authorities are left alone with this complex task. Strong support and accompanying measures from the regional level build the other pillars: financial support, guidelines, knowledge dissemination, terms of reference for tendering, etc.
- A common geographic information platform, which updating is part of the planning process, allows to build on knowledge in a circular process, from local to regional and basin-scale and again to local – a constant exchange allows to refine the models.
- In the past, interventions on river and slopes were managed by a single body called Genio Civile. The new model opens to a plurality of actors, benefitting from their innovation capacity. In this context, professionals, universities, and enterprises, are constantly developing new solutions and new skills to the benefit of all.

The **weaknesses** of this model can be seen as critical points that need attention and as areas for future development:

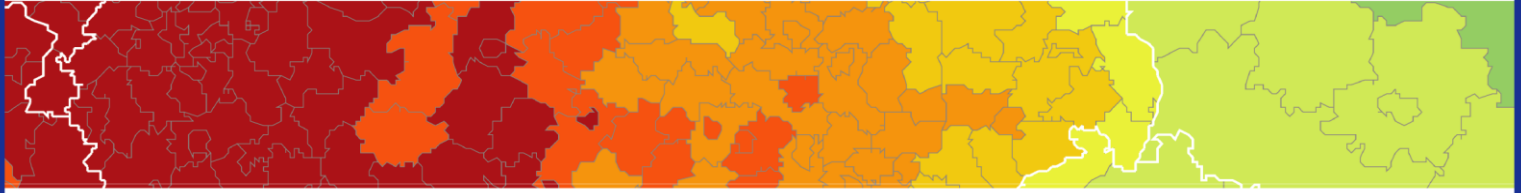
- the increased load on local authorities, whose staff is often too small. At this point, professionals and universities step in, and project activities are externalized. In this line, the regional government should make more effort in training for local administrators and officers. This is partially solved through accompanying measures, although still needs attention.
- the increasing need for funds for maintenance. One solution, already in place, is a dedicated tax in the form of fees for the use of land and water in river areas.
- the great number of existing buildings in risk areas due to the urban spread in the sixties and seventies of the last century, corresponding to the economic and population boom. Possible solutions are gradual delocalization, insurance, or urban regeneration.

The main elements that can be extracted from this experience are:

- Investing in prevention pays back, but the results are not so visible as the best proof of its effectiveness is that nothing serious happens. In Lombardy, consciousness arises from a main tragic event; other countries that may be less affected could learn from this experience.
- Risk cannot be reduced to zero and recovery funds will be always needed, but Europe should consider adding an objective on risk prevention to cohesion policies.
- Administrative or state borders are transparent for natural phenomena. Every action, to be effective, should be based on physical territorial units like river basins, where the effects are transferred downstream by the river itself. Both water and sediment flow are relevant.
- Policies for risk management cannot remain sectorial, but should be integrated with spatial planning and development programs.
- Sharing information and knowledge is one of the main assets. This is one area in which the European level could give a relevant contribution by setting common standards for data and facilitating the exchange of experiences.
- A sound strategy for risk management, to be successful, should involve all the relevant actors, facilitate innovation, and identify clear responsibility and roles.
- Risk maps, to be effective, need to be very detailed, based on sound analyses and models, and their impact on land-use.

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