

## Building resilience to natural hazards. Practices and policies on governance and mitigation in the central region of Portugal

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**ABSTRACT:** In this paper it is argued that the public and media impact of last years natural disasters in Portugal induced changes in the legal framework of civil protection and of governance policies related to natural hazards and the associated vulnerabilities.

It is shown how the new institutional and legal framework was strategically integrated by local populations in their mitigation practices, appealing to past practices and memories, but also to the new challenges posed by the building up of official emergency plans, hazards zoning and new technical instruments and practices.

In this confrontation between the national laws, the municipalities' technicians and rulings and the mundane practices of hazard preparedness and mitigation, a new public awareness emerged that allowed for a discussion of priorities, inclusion dynamics, effectiveness of the alert messages, and the production of new ways of participating in the public sphere and new dimensions to define citizenship and political belonging.

### 1 INTRODUCTION

The capacity of the local and regional communities to absorb and deal with social disturbance related to natural hazards is a part of the risk assessment equation. This organizational, individual and community competence characterizes the ability of living with uncertainty, improving self-organization and planning procedures, increasing mitigation measures, and strengthening emergency resources.

Effective disaster risk reduction is possible with the participation of people at risk and their awareness of the root causes of vulnerability (Heijmans 2004). For this awareness to develop, scientific knowledge must be accessible and integrated in the mundane lives of people at risk. The articulation of the scientific community, political actors, experts and citizens can enhance the civic epistemologies of citizens, in order to inform personal and collective decisions concerning the issues of natural and technological hazards and prevention measures (Jasanoff 2005, Miller 2005).

This can be implemented through the creation of spaces for the circulation of information and the consultation of all those who are interested in the topics of risk and vulnerability. It must incorporate all that want to contribute to the reflection on how to build a community open to uncertainty and to the design

of adequate strategies for action based on democratic consultation and participation (Callon et al., 2001, Fischer 2003, Irwin 2006, Latour & Weibel 2005, Rowe & Frewer 2005).

But, the vulnerability literature often underscores the specific and autonomous dynamics pertaining to resilience and recovery ability of local communities, families and individuals. Taking resilience as "the intrinsic capacity of a system, community or society predisposed to a shock or stress to adapt and survive by changing its non-essential attributes and rebuilding itself" (Manyena 2006), a structural and systemic approach is needed, one that goes beyond vulnerability assessment and reduction (Weichselgartner & Bertens 2000, Pelling 2003, Resilience Alliance 2005, UNISDR 2005).

Following Manyena, this entails the identification of the essential and non-essential elements of communities and building on affirmative action rather than endless risk assessments and reactions to negative events. On the other hand, project planning can learn from the resilience discourse in that it encourages us to prepare for resilience that is likely to be more than the sum of individual development activities. For effective preventive measures there is the need to mainstream resilience building through people at the centre of disaster risk reduction and recovery (Manyena 2006).

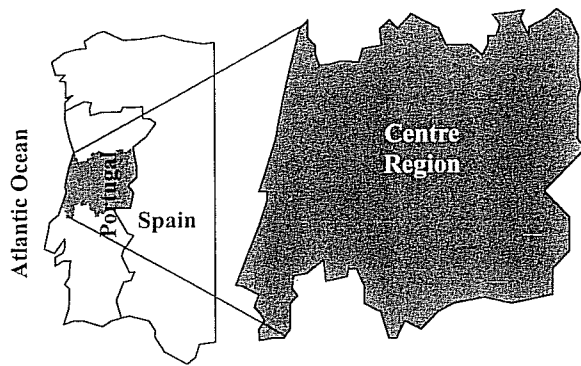


Figure 1. Location of the Central Region of Portugal.

Local practices and policies, based on the articulation with official civil protection entities, are the most effective way for building communities' resilience to natural hazards.

In Portugal, the local, municipal and regional levels of administration and the overall national organization of the mitigation resources, are the adequate scopes for prevention and for operative and emergency measures.

## 2 GENERAL CHARACTERIZATION OF THE CENTRAL REGION OF PORTUGAL

Figure 1 shows the Central Region of Portugal, which is characterized by a diverse and contrasted biophysical territory with asymmetric demographic and urban distribution.

The region has about 23671 km<sup>2</sup> of extension, from the coast line to the Spain border. It is represented by ten territorial units and 78 municipalities, with 1.783.596 inhabitants according to the 2001 census (INE 2001).

### 2.1 Physical characterization

The region presents a deep contrast between a littoral meso-cenozoic sedimentary basin and an interior area characterized by morphological and lithological complexity around its mountainous system. The climate has general Mediterranean characteristics, with an Atlantic influence on coastal areas and continental influence on the interior, especially in the summer. The region is divided in five major hydrographic basins (Tejo/Zêzere, Douro/Côa, Vouga, Mondego and Lis), with a coastline over 140km of extension, where are located the last three river mouths.

The studied area presents contrasted natural and forestall cover and land use, with a large extension of forest on the central interior and on the coastal areas, with productive agricultural lands on the littoral and

a large distribution of small agriculture proprieties. Seven protected natural areas are represented, partial or totally, on the region.

### 2.2 Social characterization

The region has a polycentric urban distribution, with a major urban concentration and infrastructural and equipment support on the littoral area.

A general continuous urban and outer urban areas, supporting industrial and commercial activities are represented on the three littoral territorial units.

In the interior units some urban areas concentrate economic activities, which generally are located on road junctions, or are based on the exploitation of a local resource.

According to the 2001 census (INE 2001), the regional urbanization rate is about 51%, with the major urban indexes concentrated in the littoral units.

Most of the population of the region is dedicated to tertiary economic activities, but with regional contrasts in the distribution of the economic activities.

The region has an ageing index of 130.8, a birth rate of 9.7%, and a mortality rate of 11.8‰. It also presents an index of illiteracy of 10.9%, which increases to the interior of the region to 15% or more (INE 2001).

### 2.3 Hazardous processes and social vulnerability

The region has a large historical record of disasters or catastrophic events and processes related with natural hazards.

Mass movements, collapses, floods, coastal erosion and sedimentation are some of the recurrent geodynamics hazardous processes, with losses and fatalities, to which is associated natural radioactivity and seismic activity.

The climatic hazards related with forestall fires, heat waves and droughts have been also producing severe social, economic and environmental damages and losses.

The representation of the natural hazard susceptibility is, however, marked by strong contrasts on the region. The forestall fires are the most recognized hazardous processes on whole of the regional area, and less incidence the flash flood and inundation events.

The analysis of the underlying dimensions of the social vulnerability index in the Central Region of Portugal reveals great heterogeneity and a relevant interactivity of the factors that condition social vulnerability in the region, even in contiguous spaces (Mendes 2007). The region is characterized by high levels of social vulnerability to natural and technological hazards. Only in two of the eleven municipalities with high social vulnerability indexes is social vulnerability related to just one conditioning factor.

Social vulnerability is highly associated with the urbanisation and industrialisation patterns of the region, being higher in the hinterlands and metropolitan zones of the main urban nodes.

In those municipalities located in the littoral, the direct contribution to an increase in social vulnerability derives from the demographic dynamics (population growth and the increase in population density) and the degradation of the lodging conditions (overcrowded households). In some of the municipalities these trends are exacerbated by the heavy economic dependence from the industrial sector and a large presence of low skilled factory workers. In other municipalities the lower resilience to natural and technological hazards are influenced by a weak entrepreneurial dynamism or an excessive specialisation in non-reproductive economic activities.

The territorialisation of the social vulnerability index, closely associated with the urbanisation and industrialisation patterns of the region, and the construction of regions of risk, elaborated by the crossing of the vulnerability index with natural and technological hazards maps, clearly shows that social vulnerability increases in the hinterlands of the main administrative urban space.

The relative polarisation of the urban structure and the inherent concentration of economic, administrative and political resources, and of a qualified working force, imply lower levels of social vulnerability in the region's main cities. These lower levels of social vulnerability also present heterogeneous patterns and influencing factors in the main cities of the Region: for Coimbra (population of around 100.000 inhabitants) and Aveiro (population of around 80.000 inhabitants) the main factor for low social vulnerability is the development dynamics; for Viseu (population around 60.000 inhabitants) it is the growth of the industrial sector; as for Leiria (population around 70.000 inhabitants), it is the above average offering of employment and the level of economic activity that reduce social vulnerability.

The strong polycentrism in the Centre Region of Portugal, the diffuse urbanisation patterns, with complimentary agricultural activities, and the model of economic development, with a strong single-sector specialisation of production activities (traditional industrial sectors and tourism) and a population and working force with low skills, induce high levels of social vulnerability.

Some mitigation structures have been implemented along the years, particularly with coastal protection structures, dams and other fluvial defences.

In the last decades we have assisted to huge investments on civil protection and emergency resources. These resources have been disseminated in all

the region, especially through the heavy equipment delivered by the national authorities to the fire combat and rescue local voluntary firefighters companies.

In the recent years, some hazardous events on the region, but also some national and global processes, with a strong public and media impact and deep losses and damages, induced changes in the national legal framework of civil protection, and of governance policies related to natural hazards and the associated vulnerabilities.

### 3 NATURAL HAZARD RECORDS FROM 2000 TO 2007 AND BACKGROUND EVENTS

In Table 1 we present the most important national/regional hazardous events, and the global significant catastrophes (according to the Munich Re data), which supported the main changes on the institutional and citizens' awareness and understanding of the impact of natural hazards.

The period in analysis shows that the global framework of the natural catastrophes is mainly represented by internal geodynamic processes or climatic events.

At the Portuguese national and regional levels, the panorama is more diversified, which reflects the heterogeneous landscape related to natural hazards.

In the national and regional contexts the flooding processes and the wildfires affecting forestall and natural areas, but also urban and outer urban areas, were the most visible. The Entre-os-Rios bridge collapse in 2001, and the Prestige marine oil split in 2002 were other hazardous events with a strong relevance on national media and increasing public attention, which appealed for new levels of security.

Coastal erosion affecting urban areas is cyclically referenced, questioning the effectiveness of the coastal structures and levels of sediment available for drift coast.

### 4 IMPROVEMENTS ON LEGAL REFERENCES AND ON MUNICIPAL MANAGEMENT AND ASSESSMENTS

In return to the general land disturbance, especially felt by the floods of the winter of 2000/2001, the enormous burned area by wildfires (about 400000ha), associated to a murderous heat wave (more than 2.000 deaths), both related to an adverse meteorological context in 2003, and the requirement of new planning instruments produced a deep change on legal references and civil protection management.

The recent political and organizational inputs and the related legal instruments, most of them produced

Table 1. Hazardous events in national, regional and global context.

Year	National and regional	Global framework
2000	Floods Drought Forestall fires Coastal erosion Mass movements	Indonesia earthquake and tsunami Northwest Pacific typhoon Mozambique flooding Alps floods and landslides Central Europe heat wave
2001	Floods Mass movements Coastal erosion	Central America earthquake India earthquake Algeria floods Afeganistan cold spell
2002	Forestall fires Flash floods	Nyirapongo vulcan eruption Afeganistam earthquake Central Europe floods Earthquake in Molisa, Italy
2003	Heat waves Drought Wildlandfires Floods Coastal erosion	Ban earthquake, Iran Algeria earthquake Europe heat wave and drought California wildlandfires
2004	Drought Wildlandfires	Morocco earthquake Flood in Hispaniola island Indian Ocean earthquake and tsunami Indian subcontinent floods
2005	Drought Heat waves Wildlandfires Coastal erosion	Sumatra earthquake Katrina hurricane and Louisiana flood Kashmir earthquake India floods
2006	Heat waves Flash floods Landslides	Indonesia earthquake Ethiopia floods India floods Central and Eastern Europe cold spell
2007	Coastal erosion Mass movements	China floods Indian subcontinent floods Asian cyclone Sidr UK floods Greek wildlandfires

after the aforementioned events, are summarized in Table 2.

Nevertheless, most of the principles and the organizational structure of risk analysis and management in Portugal were established before the events of 2000/2001 and 2003, as the law 48/98 on Spatial Planning and Urbanism, the law 113/91 on Civil Protection, the law 33/1996 on Forestall Policies and Regional Forestall Planning, but also on Special Environmental Plans, including the Protected Areas Plans, Public Water Catchments Areas Plans, Coastal Plans, and Municipal Land Use Plan, including the Local Master Plans.

However, a large number of the policy measures and the overall risk governance revealed a strong lack of clarity and a negative influence on the planning processes, specially related with disturbed land or areas with high hazard susceptibility.

The legal instruments and resources pertaining to preparedness measures and emergency services also denoted strong inadequacies on adverse situations. This assumption has produced a large debate about the available resources, the coordination measures and the authority institutional framework.

The analysis of the inputs shows a strong correlation between the political timing and the proposal of new legislative instruments and organizational designs.

A clear link can be established between some legislative and organizational instruments and previous hazardous events, specially those related with wildlandfires. These inputs related with forestall fire defence have been upgraded and evaluated in successive periods.

Some national and regional hazardous processes presented in Table 1, that resulted in fatalities and huge losses, had no concomitant upgrading in the legal framework, especially those associated with meteorological and climatic phenomena.

The general conclusion is that an important number of framework laws and national strategies were proposed, discussed and approved by the parliament and the Government, reflecting the attempt to articulate instruments and practices.

For the first time, a national map and a normative framework for hazardous natural and technological processes were produced and presented on the National Programme for Planning Policies (PNPOT, 2007).

On the regional context, and supporting the PNPOT suggestions, which stresses risk evaluation as the main parameter for the planning policies, a large characterization and cartography initiative was initiated, producing data about the geodynamic, climatic, meteorological, technological and environmental hazards. As an example of this cartographical effort, relevant for planning activities and incorporating the risk analysis dimension, we present in Figure 2 the high and very high levels of susceptibility for the Central Region of Portugal (CCDRC, 2007).

Following the review of the municipal plans, and in direct relation with hazardous processes, the local political and technical staffs have been progressively requiring new evaluations and new cartography. In Figure 3 we present the mass movements cartography of the municipality of Coimbra (Tavares & Cunha 2006), which reflected the administration reaction to the large disturb period in the 2000/2001 winter and the huge landslide processes that had as consequences enormous damages and losses.

Table 2. Recent inputs on legal, political and organizational policies.

Year	Political and organizational inputs	Legal instruments
2000 2001	Plans for the hydrographic basin	Coastal Plans, Gov. Resol. no 142/2000
2002	Legislative elections XV Government Maritime National Authority (AMN)	Decree no 44/2002 (AMN); National protected areas, Decree no 204/2002
2003	Prevention and protection policies against forestall fire (PPPAFF)	Regime for public hydric domain; Law no 16/2003; Nat Ass. Res. no 25/2003 (PPPAFF)
2004	XVI Government Municipal commission for forestall fire defense (CMDFCI) National climatic changes programme (PNAC)	Law no 14/2004 (CMDFCI) Gov. Resol. no 119/2004 (PNAC)
2005	Legislative elections XVII Government Forestall Intervention Zones (ZIF)	Water Law (Law no 58/2008); Decree no 127/2005 (ZIF)
2006	Integrated System for Protection and Response Operations (SIOPS) Proposals for the National Strategy for Coastal Zone Management Actualization of the National climatic changes programme (PNAC)	National system for forestall fire defense; Decree no 124/2006; Decree no 134/2006 (SIOPS); Civil Protection Law, Law no 27/2006; Municipal plans for forestall fire defense (PMDFCI), Jur. Leg. no 1139/2006; New regime for National Ecological Reserve, Decree No 180/2006 Gov. Resol. no 104/2006 (PNAC)
2007	Civil Protection National Authority (ANPC) Civil Protection Municipal Services (SMPC) National Strategy for Sustainable Development (ENDS) National Programme for Planning Policies (PNPOT)	Decree no 75/2007 (ANPC); Evaluation and management of flooding risk areas European Directive 2007/60/EC; Decree no 316/2007, new instruments for territorial administration; Law no 65/2007, Civil Protection Municipal Services Framework (SMPC) Gov. Resol. no 109/2007 (ENDS); Law no 58/2007 (PNPOT)

As another example, we show in Figure 4 the flooding processes and the identified critical runoff flow points on Condeixa-a-Nova municipality. This cartography is an unprecedented local instrument, and was produced for the local master plan, taking into account several flash flood problems in the area (Tavares et al., 2006).

These examples show the recent changes that occurred in the national and municipal authorities and in the defined planning instruments, implementing new rules of coordination, but also referring to local solutions to implement prevention, emergency organisation and response strategies.

The mitigation strategies of the local populations had necessarily to adapt and incorporate the new institutional alignments, where the planning practices of the municipalities became central in mobilizing,

constraining and defining the different stakeholders' roles and positioning.

In the new context there is less acceptance for the social and economic consequences of risk, and the national and local authorities must apply effective risk communication strategies to convey trust and support from the citizens.

## 5 ACTUAL AND FUTURE PRACTICES AND POLICIES

According to the regional and local case studies presented in this paper, the new institutional and legal framework has posed new challenges in the building up of official emergency plans, hazards zoning and new technical instruments and practices.

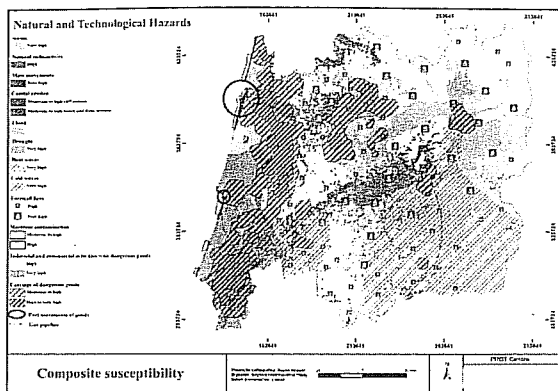


Figure 2. Composite map for higher susceptibility levels on the Central Region of Portugal.



Figure 3. Mass movement susceptibility map for Coimbra municipality.

However, it is not clear that the new policies were strategically integrated by local populations in their mitigation practices. The integration of past practices and memories with the new instruments and legal frameworks and their effectiveness in future hazardous processes has not been tested. The adequateness of the national and regional plans with the local particularities is yet to have practical results in terms of emergency planning and the implementation of structural population security measures.

In Figure 5 the strengths of the new policies are evaluated. The different grey gradients show the

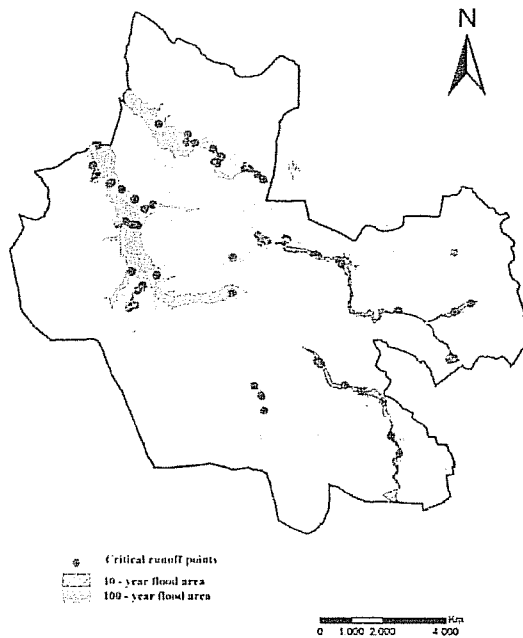


Figure 4. Flooding processes and critical runoff flow map on Condeixa-a-Nova municipality.

Principles	Extension	Objectives	Application Execution
General	Governance	Prevention	National
Sectorial	Monitoring	Reduction	Regional or county
	Planning	Mitigation	
Territorial	Infra-structuring	Alert	Inter-municipal
Process	Operation	Emergency	Municipal
	Training	Awareness	

Figure 5. Strengths of the developed policies.

instrumental importance of the general and sectorial principles which focus specifically on planning practices. These considerations show a weakness in the prospective policies, particularly on monitoring processes and components and on social resilience improvement by training and mainstreaming actions.

On the other hand, the most active objectives are related most to the mitigation aspects and the emergency resources and operative actions. The responsible organizations for the application and execution measures are mainly set at the national or municipal scales, discharging the intermediate regional level, which is essential for the optimisation of resources and for the effectiveness of the actions applied.

Figure 5 also shows the inherent weakness of the territorial and process analysis, which are the closest to mundane practices of hazard preparedness. The evaluation of the objectives of the implemented

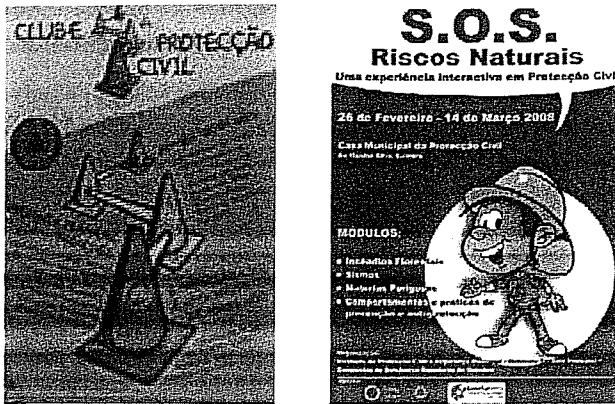


Figure 6. Examples of awareness activities for primary and lower secondary schools.

policies and practices reveals a lower emphasis on social dynamic priorities, with less attention to alert messages issuance and on public awareness actions.

The existing warning messages systems are mostly related to adverse meteorological events at a regional scale, and also to forestall fire risk.

The promotion of citizens' awareness to natural hazard problems, in order to ensure a better understanding of the processes and dynamics related to the complex dynamics of a risk society, and the associated technical training of the populations, have been neglected and remains mainly an exclusive technical and scientific domain. The idea of a technical democracy (Callon et al. 2001) in what pertains to natural hazards mitigation is still not a priority for the Portuguese civil protection authorities or for the risk regulation regimes.

The dissemination of information to the various social actors, and the increase of citizens' awareness and responsibility by the adoption of self-protection practices have been mainly concentrated on primary and lower secondary schools' population and on summer beach sensitisation actions. Figure 6 illustrates two examples of these actions directed to high-school students, namely the Civil Protection Clubs and a municipal interactive natural and technological risks exhibition.

## 6 CONCLUSIONS

In this paper we argue that the public and media impact of last years natural disasters in Portugal induced changes in the legal framework of civil protection and of governance policies related to natural hazards and the associated vulnerabilities. The ensuing reactive legislation induced a confrontation between the national laws, the municipalities' technicians and

rulings and the applied mitigation strategies. It also resulted in a new public awareness that allowed for a discussion of priorities, inclusion dynamics, effectiveness of the alert messages and the production of new ways of participating in the public sphere and new dimensions to define citizenship and political belonging.

Although the National Civil Protection Law of 2006 has subsidiarity as one of its principles and contemplates the creation of local civil protection units, the tradition and history of civil protection and the risk regulation regime in Portugal has been based on a hierarchist model (Hood *et al.* 2001). This contrasted with the increasing need for planning and mitigation measures imposed on municipalities. Also, the public pressure at the local and municipal levels demanded effective strategies of public communication and public participation in the production, implementation and evaluation of plans.

This dual process could be clearly seen at the drawing process of the Regional Programme for Planning Policies in the Central Region of Portugal (PROT-C), at which the two authors participated. At the level of recommendations we can highlight the need for the implementation of programmes and specific awareness-raising and preparation measures oriented to specific vulnerable and exposed populations to the different natural hazards. It was also emphasized the need for public disclosure of the relevant information concerning measured levels of radioactivity and other natural processes.

One of the most important suggestions is the integration of the components of hazards, social vulnerability and risk in the definition of other territorial strategies, especially in the options for rural development and agro-forestry policies, urban consolidation, public health and social care policies, tourism development, both in the interior and in the coastline, and also the road infrastructure and accessibilities.

The dissuasion of land use and occupation, abandonment and relocation of people and activities in areas characterized by high levels of susceptibility should be also taken into account. This goal of natural hazards management and assessment must be supported by clear public policies and accepted by all the concerned citizens' groups. Its governing principle must be based on cost balancing mechanisms.

One of the recommendations of the public policies involving risk governance, operational civil protection measures and training is the dissemination of activities and knowledge through in on-line platforms. All the population security and safety plans, organized by municipal, regional and national entities must be available for consultation and allow for interaction and feedback from all concerned stakeholders.

It was also our contention that the population should be informed about the anticipated location of relief and

reunification areas, in case of accidents or catastrophes, defined according to the Municipal Emergency Plan.

In municipalities with high levels of social vulnerability to natural and technological hazards the need for the effective participation of local populations, as consecrated in the Civil Protection Law, through the local town structures as agents of civil protection was stressed.

Our paper shows that the socio-economic acceptability of risk is a dynamic feature which generates, at different times, constraints or ruptures on the forms of interaction between citizens and public and private powers, and produces meanings that will shape legal framing and the definition of priorities for public policies.

The social, political and economic impacts of extreme events and the resilience of populations, clearly associated with an adequate policy of territorial planning and with effective strategies of communication and of building citizens' trust in public institutions, demand a change in the risk regulation practices and regimes that must be more egalitarian and relevant to the mundane lives of the affected persons.

The pressure of the events and the opportunities created by the new legal frameworks must allow for the production of effective prevention and population security policies, which take into account social inequalities and citizenship rights.

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