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Natural Disaster Management in the Brazilian Amazon: An Analysis of the States of Acre, Amazonas and Pará

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1. Introduction

For many years, the Amazon region of Brazil has been considered to be territory immune from the threat of serious natural disasters. However, in recent years, extreme natural events, increasingly more recurrent and intense, have manifested both in rural and urban areas in the region. Consequently, this territory has been exposed to the impacts of several technological and natural hazards, mostly associated with droughts, floods, and fires and soil, fluvial, and coastal erosion.

A disaster is associated with natural hazardous frequency, recurrence, and magnitude with regard to the exposed population and infrastructures' vulnerability. In the Brazilian Amazon, these disasters negatively impact a region whose development already presents many unresolved problems, with particular regard to the economic and environmental activities of the most vulnerable people (e.g., the poor in urban areas and subsistence farming communities). It is expected that the situation will worsen, considering the forecasted scenarios of more prevalent and more intense use of the forests and the increasing occupation of the cities, as well as the intensification of climate change in the Amazon region. In this sense, a big challenge corresponding to the response to these scenarios is to develop and implement risk management policies, strategies, and measures that can address the regional peculiarities.

In Brazil, most of the natural disaster historical record, the academic researches, and the risk management strategies and measures are focused on the most densely populated and developed regions of the country – the Northeast, the South, and the Southeast. The scarce studies associated with this issue in the Amazon region are neither integrated nor systematic and are poorly disseminated within and outside of Brazil (Marcelino et al., 2006; Leal and Souza, 2011). Brown et al. (2001) describe and analyze the unique case study of governmental responses to natural disasters (drought and forest fires) in the Amazon region, in particular with the set up of a "situation room" in order to facilitate the flow of information and coordinate among government institutions on the extreme events of 2005 and 2010 (Lewis et al., 2011; Marengo et al., 2011; Brown et al., 2006).

This book chapter aims to describe and analyze the particularities of risk management in the Amazon region, principally in the states of Acre, Amazon, and Pará. In this way, considering the possibility of understanding to what the natural risk management really integrates the governmental policies, this research seeks answers to the following key questions: What are the rules that drive risk management in Brazil and particularly in the Amazon region? Who is responsible for executing the projects and programs and for implementing and enforcing the laws that drive risk management in the Amazon region? What financial resources are available for risk management in the Amazon region of Brazil?

2. Some initial considerations

Considering the different variables that correspond to the risk management issues in the Amazon region, some initial reflections should be established in order to develop better studies and analyses.

The Brazilian Amazon region is a heterogeneous territory divided into 6 states and 310 municipalities. According to the Brazilian Institute of Geography and Census (IBGE, 2011), the Amazon region occupies an area of 3.575.951 km², representing approximately 40% of Brazil and, its population of 14.481.009 inhabitants an 8% of the total population of the country. Although the intense activities natural resources exploration, yet 62% of the area maintain its forest original cover, and around 20% is already impacted. Many of the forests and traditional villages are protected by conservation units (around 390) and indigenous

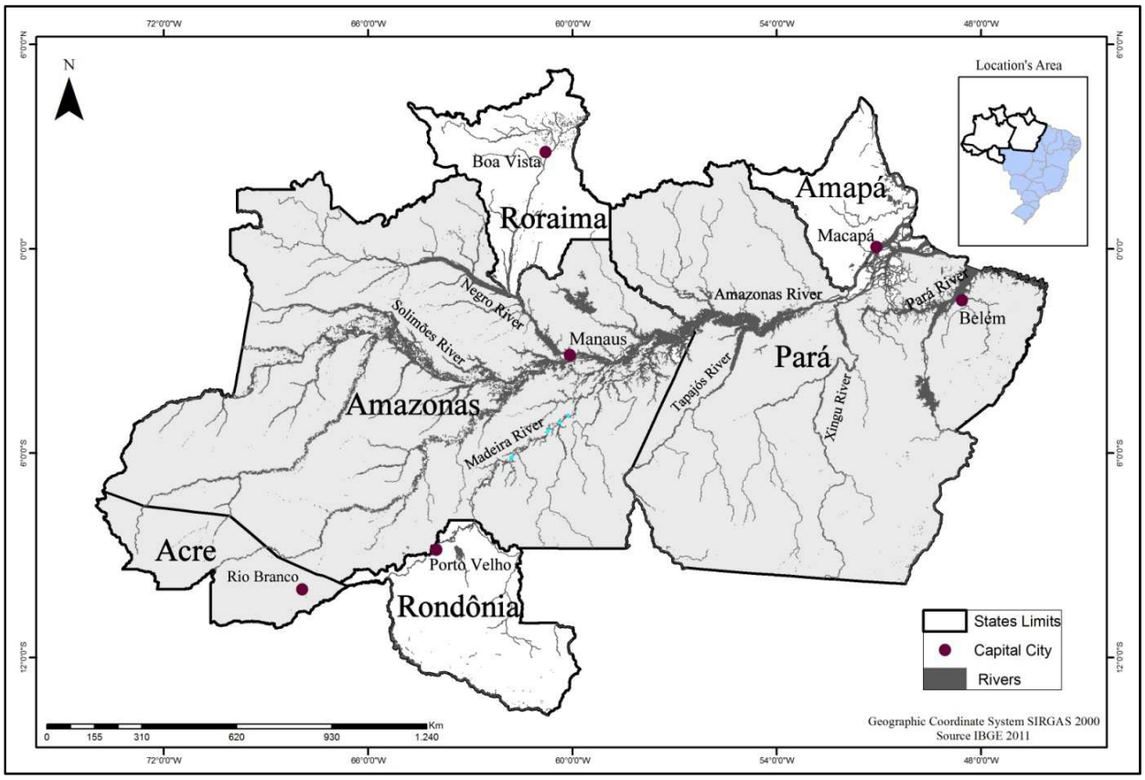


Fig. 1. The Amazon region of Brazil. The study area is concentrated in the states of Acre, Amazonas and Pará (highlighted).

reservations covering almost 30% of the territory of the region. Along with its forests and biodiversity, the region concentrates enormous mineral resources and it has become, since the 1980s, in the latest agricultural frontier of Brazil (figure 1).

The main risks in the Amazon region are caused by natural and social hazards, with the technological hazards in a few urban areas (e.g., Barcarena, Belém and Manaus). Among the first, floods and drought of the main rivers are described with recurrent consequences in urban areas (e.g., Rio Branco, Manaus), in the Western region of the State of Acre and small towns at the margins of the Amazonas, Tocantins and Xingu Rivers. To a lesser extent, strong whirlwind, localized processes of fluvial erosion, and seismicity reflection of Andean tectonic conditions also could be depicted. Social risks are mainly related to the extensive and intense process of deforestation. Natural or social forests burning risk shows the simultaneous loss of biodiversity and infrastructure in areas of close proximity to road systems (Szlafsztein, 2003; Eger and Aquino, 2006; Maia et al., 2008) (figure 2).



Fig. 2. Population living in natural risk prone areas in urban areas of the Amazon region. Left - Mass movement in Novo Repartimento (state of Pará), and right – Flood in Parauapebas (state of Pará).

Since the time of colonialism, the Amazon region has been a territory where both government-incentivized and spontaneous migrations have been justified mainly by geopolitical theories of "territorial occupation" as well as by mining of the region's natural resources (e.g., forests and minerals) (Rodrigues et al., 2009). This exploit has supported much of the growth of the different regions of Brazil, leaving a series of issues still unresolved with regard to the Amazon region development and, as a consequence, a growing social vulnerability to natural hazards.

This is very evident in certain areas of the Amazon region. The existence of large "demographic empty spaces" (e.g., population density in Amazonas State is 2 inhab./km^2) concentrates the majority of natural disaster records in regional metropolitan areas (e.g., Belem and Manaus), which are home to around 70% of the State's total population (IBGE, 2011). This population, looking for a better life condition, migrates from rural areas and quickly and disorderly occupies marginal areas that lack basic urban services (e.g., sanitation) and are naturally hazard prone (Padoch et al., 2008).

Some socioeconomic characteristics can be used as indicators of the difficult living conditions that intensify population vulnerability in urban areas of the Amazon region. More than 80% of the municipalities present a life expectancy and a rent per capita underneath the national average, and near 50% of the states have more than 65% of its municipalities showing an alphabetization index greater than the Brazilian average. In the Amazon region predominates the inexistence of collecting nets of sanitary sewers, and when collected, they are poorly treated. The variables of house quality in the region also indicate many problems, considering its constructive precariousness, the absence of bathrooms, the density of inhabitants per residence, and the access to electric energy (PNUD, IDHS/PUC minas, UFPA 2007; Freitas and Giatti, 2009).

Risk management, from the point of view of academic and governmental action, has been focused in the Southeast (where mass movements and urban floods are common) and Northeast regions (where chronic drought is an issue). In the Amazon region, the described causes of extreme natural events as well as the disaster response strategies and measures are clearly influenced by cultural and religious aspects.

Finally, a clear legal definition of the government's responsibilities (Federal, State and Municipal) and the trend of the strengthening of the local powers were established in the Federal Constitution of 1988 (Lobo, 1988). However, there are enormous difficulties associated with plainly separating the policies and actions of the various levels of government in the Amazon region.

3. The risk management legal framework in the Amazon region

Brazilian environmental legislation is profuse and detailed, showing a constant evolution since the 1980s. In the Brazilian legal system, the supreme norm since 1988 has been the Federal Constitution. However, the states and municipalities have authority, albeit limited, to organize and govern themselves by their own constitutions and laws (Bastos and Martins, 1997). Often, in order to complement the risk management legal framework at the state level, it is necessary to observe some of the main legislative acts at the federal level.

Issue	STATES		
	ACRE	**AMAZONAS**	**PARA**
Sustainable Development	Law 1117/94 - Environmental Policy	Law 2985/05 - State Council of Environment	Law 6213/99 - Executive Secretary of Urban and regional Development
	Decree 2027/00 – State council forsustainable rural development		Law 6345/00 - Fund for the sustainable development of the State
	Law 1460/02 - Traditional and small agricultures communities support program		Law 5887/95, 6671/04, 6745/05 - Environmental State Policy
	Law 1478/03 - Institute for Forest Protection		Law 7026/07 – Organization of the State Secretary of Science, Technology and Environment
	Law 1492/03 - Indigenous state council, Fund for indigenous development		
	Law 1693/05 - Agro forestry center program		
Territorial Zoning	Decree 265/93 - Agro ecologic and Economic – Zoning Program	Law Mai 2007 - State System of Conservation Units	Law 6506/02 – Methodology for the Ecologic and Economic Zoning
	Decree 503/99; 1904/07 - State Program of Ecologic and Economic Zoning		
	Law 1373/01 - State Institute of Land		Law 6745/05 - Ecologic and Economic Macro-zoning of the State
	Law 1426/01 and 1548/04 - State System of Conservation Units, State Forest Council and Fund		
Risk Management	Decree 507/98 - Committee to Combat and Prevent the Forest Fires		Law 5731/92 – Organize the Firefighters Corps Decree 3036/98 - Create the Committee to Combat and Prevent the Forest Fires
Climate Change	Law 2808 /10 – State System of Environmental Services (SISA)	*Law 3135/07 – State Policy of Climate Change, Environmental Conservation and Sustainable Development*	
Water Resources	Law 1500/03; 1596/04 - State Policy of water resources and create the State System of Water Resources Management	Law 2712/01; 2940/04 - State System of Water Resources Management	Law 5630/90 – Norms for the preservation of the water resources
			Law 6381/01 – State Policy of water resources and create the State System of Water Resources Management

Table 1. Main regulatory instruments at the State of Acre, Amazonas and Pará related with Sustainable Development, Territorial Zoning, Risk Management, Climate Change and Water Resources issues. Source: http://www4.planalto.gov.br/legislacao

The constitutions establish that the three levels have joint competence, among other things, regarding environment protection and preservation, in harmony with sustainable development. Only the constitutions specifically refer to the actions and responsibilities in the case of calamities; other legal instruments do not or only poorly consider risk management as a key element in the contexts of land use and water resources regulation, sustainable development, and climate change. Noteworthy is the wide range of legal instruments, which indirectly assist to mitigate the current risk impacts and/or prevent the potential ones, reducing vulnerability factors (table 1).

The Federal Constitution guarantees, as one of the so-called "social rights," the protection of life and patrimony, in the face of the possibility of natural disasters. Also it determines that is competence of the federal government to "plan and to promote permanent defense against the public calamities, especially droughts and floods," and to "legislate on territorial defense, aerospace defense, marine defense, *civil defense* and national mobilization" (Brasil, 1991).

The State has the responsibility of providing public security and social protection in order to, among other things, supply relief and assistance to the population in case of calamities. The police and the military firefighter's corps are the institutions that share the following tasks: the preservation and restoration of public order; forest fire prevention and fighting; and the planning, coordination and implementation of civil defense activities.

The declaration of calamity situations allows the government to hire works, provide services, and make purchases and disposals without the due bidding process, opening extraordinary loans to meet urgent and unforeseeable expenses, to occupy and to use temporarily public/private goods and services and, in a particular case, transfer the capital city of Acre.

In cases of imminent and serious risk to human life or important infrastructures, the government is authorized to determine whether emergency measures and activities may be reduced or restricted in the affected areas during a critical period. In Pará, it prohibited the installation of energy power units and human settlements in tectonically active and ecologically fragile regions, mass movement or flood-prone areas, and landfill areas with material harmful to public health.

It should be noted that many legal aspects, not analyzed here, integrate a range of legal instruments which, although not acting directly on risk management, assist to reduce the current and/or potential risks, mainly the vulnerability factors.

Territory planning policies are established as instruments of vulnerabilities reduction. The state's systems of conservation units are implemented in order to contribute to the maintenance, restoration, and protection of biodiversity and hydrological processes; sustainable development promotion; the improvement of the local population's quality of life; environmental services assessment; and GHG storage. On the other hand, the states establish the Ecological Economic Zoning (EEZ). The EEZ is a strategic instrument of territorial planning and management, whose procedure and criteria consider physical, biotic and socio-economic potential and limitations of the landscape and guide public policies focused on sustainable socio-economic development and the promotion of the population's well being.

The water resources policy in the three States aims to ensure the water resources availability through integrated and rational exploitation and the reforestation and protection of the river basins. In particular, it has the purpose of promoting the prevention of and providing protection against extreme hydrological events, defining flood prone areas, as well as creating and operating hydro-meteorological monitoring and early warning systems. It stands out in this policy that in critical situations of drought and flood, the priority is water consumption by human and domestic animals, and to that effect, it is possible to definitively or temporarily suspend, restrict or revoke the right of groundwater use.

Policies on climate change exist only in the states of Acre and Amazonas. They aim to identify and inventory GHG emissions; stimulate regional models of sustainable development; promote and regulate clean development mechanisms and environmental education; establish certification seals; mitigate the adverse effects of climate change; establish new conservation units, and particularly, set up indicators that identify areas of high vulnerability to climate change.

4. The risk management institutional framework in the Amazon region

Successful risk management depends on the integrated action of various governmental institutions and society (Raschky, 2008). The Federative Republic of Brazil is formed by the indissoluble union of States, Municipalities and the Federal District, and the government is divided into independent but complementary legislature, judiciary, and executive powers.

Considering the remarkable breadth of emergency response to natural disasters, the preservation or prompt re-establishment of public order or social peace threatened by major natural disasters is described as one of the several responsibilities of the Executive power. However, it is possible to act in anticipation, to avoid a generation of new vulnerabilities or hazards (preventive measures) and to reduce the existing ones (mitigation measures).

The description and analysis of the institutional framework concentrate on the direct administration ministries and secretariats in Brazil, particularly in the states of the Amazon region.

At the federal level, most of the programs linked to risk management are implemented by the following ministries: Science and Technology (Inter-ministerial Commission of Global Climate Change); Agriculture (Agricultural Zoning for Climate Risk); Agrarian Development, National Integration (prevention, preparedness and response to emergencies and disasters); Cities (municipal master plans); Environment, Water Resources, and Amazonia (protected conservation units) and the institutions that comprise the National System of Civil Defense (SINDEC).

The SINDEC (Federal Decrees 97274/88, 895/93, 5375/05, 7257/10) is regulated through a multi-level structure, in which each level has its own objectives and activities. The SINDEC has to plan and promote the permanent defense against natural or man-made disasters, to act in disaster situation, to prevent or minimize damages, to help and to attend to affected populations and to recover areas. Actions after a disaster at SINDEC begin following

governmental approval and declaration of Emergency Situation (the legal recognition of the existence of an abnormal condition caused by a disaster with tolerable damage to the community) or a State of Public Calamity (declared when the disaster has caused serious damage to the community, affecting the safety and life of the population) (Cerri Neto, 2007).

Figure 3 describes the complex schema established by the SINDEC that allows the recognition of an "Emergency Situation" or a "Public Calamity State" at different governmental levels. At the local level, the Municipal Commission of Civil Defense (COMDEC) or in its absence, the population, after a field recognition in the affected areas sends the "Disasters Notification - Preliminary Report" (NOPRED) to the Municipal Prefect's knowledge. After studying the severity of the region, the prefect can decree an "Emergency Situation" or a "Public Calamity State" in the region. This municipal decree only has significance if the Governor of the state homologates it. In order for this to happen, the affected municipality should send the governor, within 12 hours, the NOPRED and the

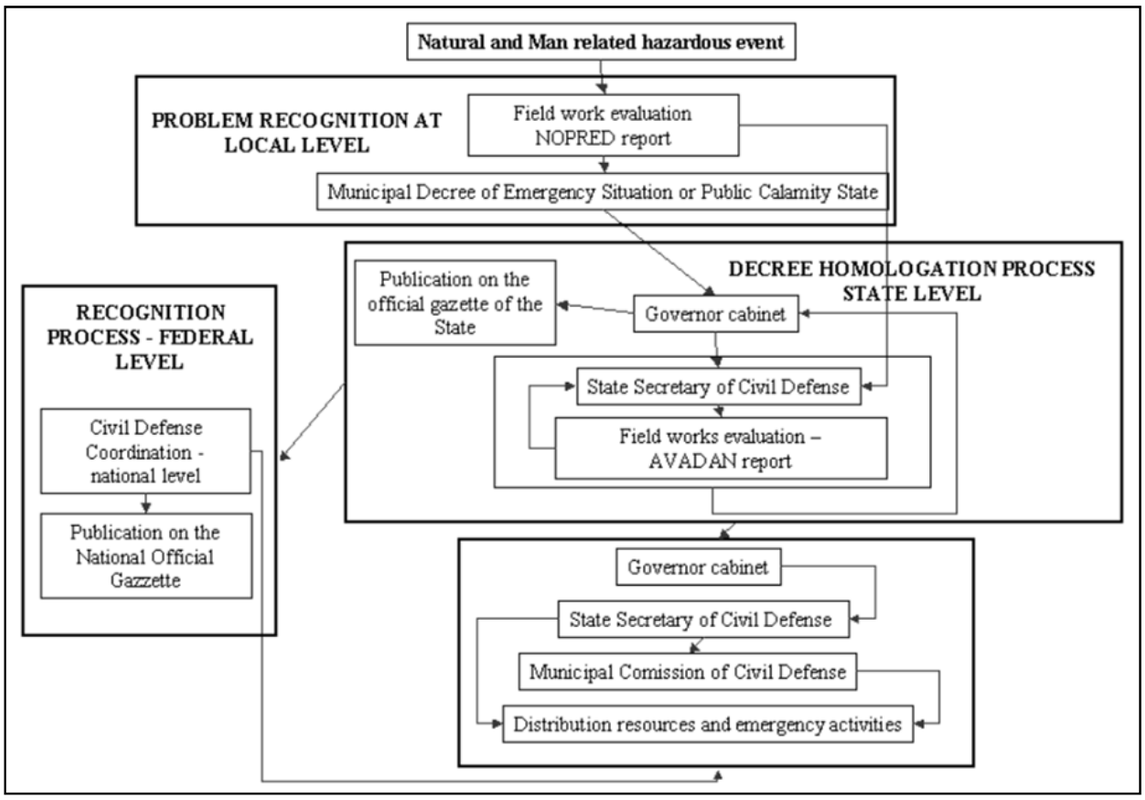


Fig. 3. Schematic diagram indicating the proceeding form of SINDEC once a natural or man-made disaster happens (modified from Szlafsztein, 2003).

"Emergency Situation" or the "Public Calamity State" decrees. The Governor then instructs the Civil Defense Coordination of the State (CEDEC) to check the damages described in the municipal ordinance. Within five days, the "Impact Assessment Report" (AVADAN) has to indicate the severity of the situation and to advise the Governor on the issue of homologation. Given the severity, the ordinance is published in the Official Gazette of the State (Szlafsztein, 2003).

The States' Civil Defense Systems have similar structures to those described with regard to SINDEC. As a result, many of the institutional goals and responsibilities at the federal level can be relatively easily assigned to similar institutions at the state and municipal levels.

This paper considers that the institutional structure for risk management encompasses all agencies or institutions related to the prevention, mitigation and response, applied research and risk monitoring. In Brazil, these functions are dispersed among various institutions. In this sense, the institutional structures of the states governments are classified according to the type of relationship to risk management (thematic, temporal, skills and activities) (table 2). The information presented is the result of a comparison with the structure of SINDEC, data obtained during visits to some of the institutions, and the interviews.

Type of Relation	Class	Description
Thematic	Direct	The objectives of the programs, projects and institutional actions have a direct and/or explicit link with risk management
	Non-Direct	The objectives of the programs, projects and institutional actions do not have a direct and/or explicit link with risk management
	Non-Existent	Non-existent: no clear relationship with risk management
Temporal	Before the Disaster	Prevention, Mitigation
	After the Disaster	Emergency response and rehabilitation
Capabilities and Activities	Survey of Basic Information and Diagnostic	Survey of environmental, historical disaster, natural hazards, and vulnerability information
	Formulation and Approval	Develop, propose and approve the plans, policies, and risk management strategies
	Implementation and Control	Implement and ensure the effectiveness of proposed actions

Table 2. Proposed classification of the state's institutional structure according to the type of risk management relationship.

A simple analysis of the type/degree of the relationship of the various components of the institutional State's structures (41 Acre, 35 Amazonas, 66 Pará) indicate that most of them have some relationship with risk management. In particular, there is a large proportion of institutions that have or say they have, a direct relationship in the States of Amazonas and Acre (Figure 4). Considering the temporal relationship with respect to the occurrence of a hazardous event (Figure 5), the predominance of activities performed after the occurrence of the disaster (sometimes the same institution has, or says to have activities before and after the event) stands out. The government institutions have been classified according to their

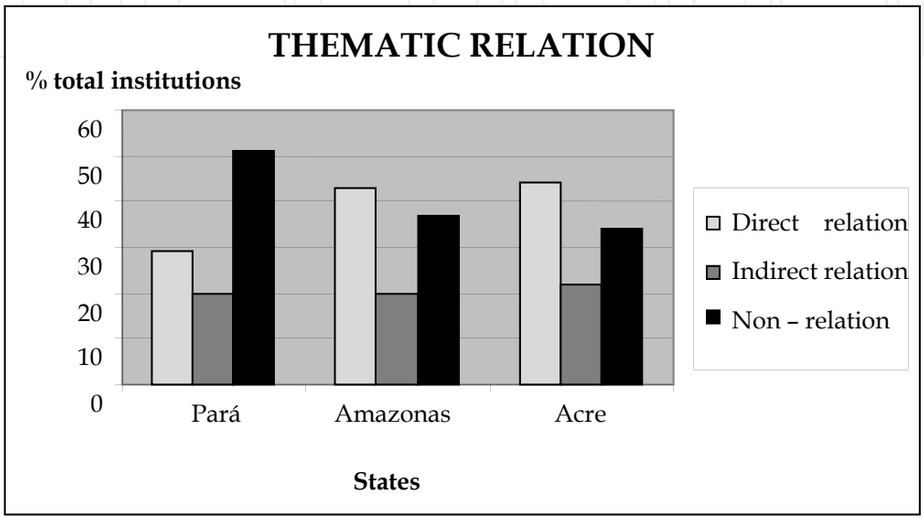


Fig. 4. Classification of government institutions in the States of Amazonas, Acre and Pará according to their relation with the risk management process.

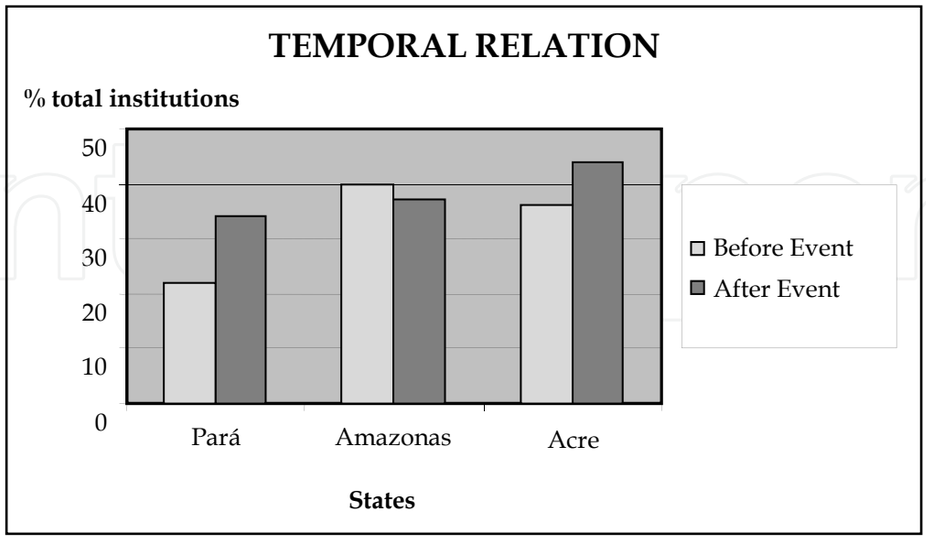


Fig. 5. Classification of government institutions in the States of Amazonas, Acre, and Pará according to their temporal relation to the occurrence of the disaster in the risk management process.

competences and activities in the risk management process (sometimes the same institution has, or claims to have more than one activity in the risk management process). *Surveys of basic information and diagnostic* are the activities less mentioned and the *implementation and control of policies and strategies* the most pointed out (Figure 6).

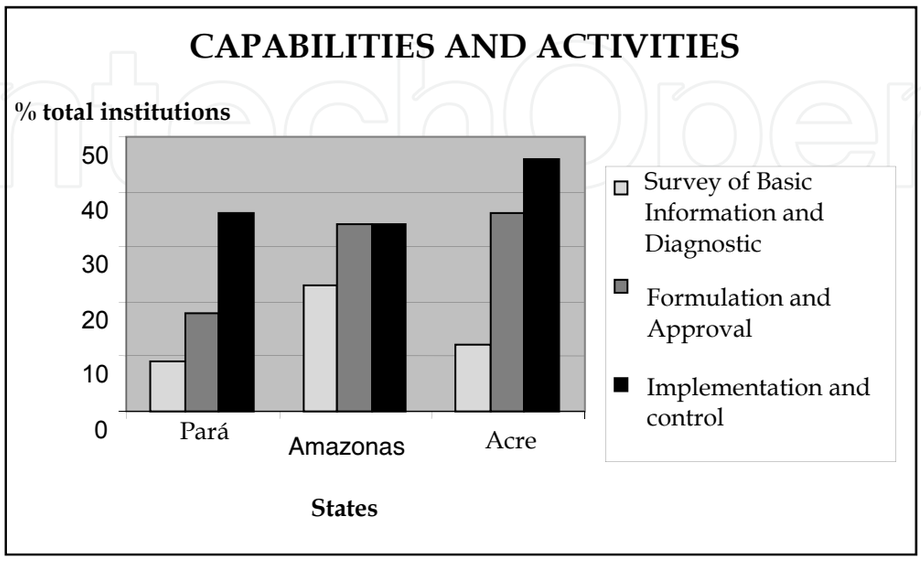


Fig. 6. Classification of government institutions in the States of Amazonas, Acre and Pará according to their capabilities and activities in the risk management process.

5. The risk management financial framework in the Amazon region

The review of the financial framework in order to know the financial capacity of the institutions in charge of risk management actions describes and analyzes the proportion of resources, their availability, and the mechanism procedures for the execution of prevention, mitigation emergency response activities (Ghesquiere and Mahul, 2010).

Government funding, particularly of the Union, in the case of emergency and disaster situations has been highlighted in all of the constitutions, since the 1891 Constitution of Brazil.

Since 1969, a Special Fund for Public Disasters (FUNCAP) has existed at the federal level in order to support reconstruction actions in areas affected by the disaster. The States set up special environmental funds for the implementation of their environmental policy. Amazonas established (a) *The climate change, environmental conservation and sustainable development fund* for combating poverty and encouraging the reduction of deforestation; the management of public forests and conservation units; reforestation and recovery of degraded areas; climate change and environmental research, education and technical training and support for sustainable production chains; and (b) *The water resources fund* to finance state water resources policies through, among other means, the implementation of programs concerning protection against dangerous and critical events and by supporting the operation and expansion of a hydro-meteorological network and water quality monitoring. The *Housing fund* in Acre was established to ensure the implementation of

programs regarding the construction and improvement of low-income population housing and the removal of residents from risk prone areas.

The scarce or nonexistent monetary resources in the funds require the concentration of the financing for the implementation of governmental risk management policies, strategies and measures in ordinary and extraordinary budgets at the federal and state levels. The ordinary budgets of the Environment secretary and the fire department do not exceed 1% of the general state budgets, and typically do not use more than 70% of this value (Brasil, 2011). An extraordinary budget is created only to meet urgent and unforeseeable expenses, such as those arising from public calamity.

However, these resources are not sufficient to achieve of their goals. Consequently, it is frequently necessary to find other funding sources to complement the risk management activities. Among these additional sources are those that: (1) seek to decrease the possibility of a public calamity; (2) share the costs among affected people through insurance contracts, and finally, (3) allow the delegation of emergency assistance tasks to non-governmental organizations and other institutions.

With regard to the first group, a detailed analysis of the state budget shows the allocation of financial resources for the structural measures of risk management (e.g., actions against drought through irrigation works and water storage or the construction of flood control measures) and the non-structural measures (e.g., development in space and atmosphere science and in data collection satellites, the deployment of state groups and the modernization of the systems for monitoring climate and hydrology, and the impacts of climate change and vulnerability).

Concerning the second group, private insurance has been revealed as a valid financial alternative, which may be appropriate and effective for the treatment of natural risk, limiting the support of assistance and recovery actions to the people affected and insurance institutions. In Brazil, the National System of Private Insurance (Decree Law 73/66) is composed of several types of coverage. One of them is the protection against the impacts arising from natural dangerous events called “Multirisk.” This is a special coverage that already includes different and, sometimes, new types of insurance, such as the protection of buildings and their contents against "external" source damages (e.g., natural floods hazards, earthquakes and seismicity, high winds and storms) (Funenseg, 1998).

Concerning third group, the emergency assistance from national and international non-governmental organizations, focuses (i) on the collection of funds in cash and supplies, as well as (ii) on emergency assistance for affected populations (Strömberg, 2007). Many of these institutions, even those of foreign origin, have shown outstanding performance in the country and receive financial assistance from uni/multilateral cooperation agencies (e.g., United States of America – USAID, UN Office for the Coordination of Humanitarian Affairs – OCHA; United Nations Disaster Assessment and Coordination - UNDAC) and religious organizations (e.g., Red Cross).

Table 3 summarizes the various aspects of financing risk management policies and actions in Brazil and in the Amazonian states and an analysis of the beneficial and limiting factors of these mechanisms, considering the legal and institutional framework.

Framework	Mechanisms for financing risk management	Beneficial factors	Limiting factors
Legal	Reserve funds (emergency resources)	Incipient spreading at the state and municipal levels. Quick availability of resources	Having no financial resources. Unknown among risk managers
	Ordinary budgets for disaster prevention and attention	The constitutional requirement for supporting the Civil Defense System	Scarce budgetary resources and non-application of the resources
	Extraordinary budgets for disaster prevention and attention	The constitutional requirement for emergency response in case of a public calamity	High dependence on external factors, such as economic and political context
	Insurance, Reinsurance	Form of social distribution for the response and rehabilitation costs	Lack of major market broadcast. Little culture of forecasting and prevention. Low local population socioeconomic development
	Aid (local, national, international)	Affected population quickly accessesthe financial and material resources for relief	High dependence on external factors, such as economic and political environment
Institutional	Federal Government	The largest ordinary and extraordinary budgets for risk management	Available only with the approval of a great rating of the emergency and calamity states
	State Government	Moderate ordinary and extraordinary budgets for risk management	Available only with the approval of at least a moderate rating of the emergency and calamity states
	Municipal Government	Proximity to the areas and populations affected	Few or no budgetary risk management resources
	Countries and multilateral organizations	Available resources and their own mechanisms for risk management financing	Complex administrative procedures for the receipt of aid
	NGOs		Complex processes for the receipt of aid. Social and political distrust

Table 3. Beneficial and limiting factors of the existing mechanisms for financing risk management at the state level in the Amazon region.

6. Decision making suggestions

Managers and qualified technical staff from the various secretaries and institutions at the state level (Table 4) were interviewed. They were asked the following main questions: What is your institution's participation in the risk management activities, with particular considerations to the prevention, response, and mitigation steps? What are the main challenges (e.g., institutional, technical, budgetary, and regulatory) facing the state and preventing a better risk management performance? What importance do you assign to the territorial planning, water resources management, and climate change aspects in the risk management of natural disasters? How are they implemented by your institution?

ISSUE	STATE'S INSTITUTIONS		
	ACRE	AMAZONAS	PARÁ
Environment	Environment Institute of Acre (IMAC); State Secretary of Environment (SEMA)	Environment Protection Institute (IPAAM); State Secretary of Environment and Sustainable Development (SDS)	State Secretary of Environment (SEMA)
Civil Protection	State Civil Defense Coordination		
Development Planning	State Secretary of Economic Sustainable Planning and Development (SEPLANDS)	Sustainable Development Agency of Amazonas (ADS)	State Secretary of Strategic Projects (SEPE)
Economy		State Secretary of Economic Planning and Development (SEPLAN)	State Secretary of Planning and Budget (SEPOF)

Table 4. The institutions visited in order to interview managers and technical staff.

The answers given by the managers of the institutions of the state governments were classified into the following two groups: *problems faced* and *solutions implemented in risk management*.

The challenges and obstacles of the risk management in the states of the Amazon region include the following:

a. *Lack of natural risk perception:* Risks have always been considered to be elements of natural origin, and society was regarded to have no influence on their causes or in the mitigation of their impacts. State governments clearly still do not understand that it is an important cross-cutting issue across policies and actions, nor do they comprehend its direct influence on the regional sustainable development.
b. *The diminutive importance of the global climate change issue:* Global climate change is still not considered to be a priority issue on the government's agendas. When considered, its role as a potential generator of opportunities (e.g., carbon market) is highlighted and not the impacts and consequences of these changes, nor its function as a key element in the present and future development models.
c. *New territorial management projects*: Territorial management, on the various levels, is extremely new yet already has quantifiable results and an easy interpretation and use by government and society. Also, it generally does not incorporate the theme of natural hazards in its conception nor its methodology.

d. *The importance of Civil Defense in risk management coordination:* Risk management currently presents a significant lack of inter-institutional coordination within the government and with NGOs. The role of the Civil Defense is considered to be a priority when risk management instigates actions as part of an emergency response after a disaster. However, this institution does not actively participate in the coordination, elaboration and implementation of prevention actions related to environmental management and spatial organization.
e. *Scarce resources:* The state's budget allocations both directly and indirectly regarding risk management are scarce; furthermore most of the programs and actions depend on financing by international cooperation and from federal government transfers. This situation creates remarkable degree of risk management vulnerability as seen in the threat of temporal discontinuity, the states' acceptance of strategies and activities not adapted to a local reality, few and/or not well functioning structures, and disinterested or uninformed administrators and staff.
f. *Lack of risk data and information:* The state does not have systematic or available information, including representative maps (in both quantity and quality), with respect to risks issues (hazard and vulnerability).
g. *Institutional problems:* A deficient number or poorly structured government institutions related to environment and civil defense issues have been installed outside the capital cities causing (i) the increased oversight of local activities by central bodies, (ii) the concentration of risk management activities and the responsibility of these bodies being based in metropolitan regions and (iii) mitigation activities being made a greater priority than planning and prevention.

The following are among the currently implemented solutions in risk management in the states of the Amazon region:

a. *On the development model:* Since 2000, the states of the region have intended to gradually transform the natural resource extractive practices and income concentration into a still incipient policy of prioritizing natural resources processing and greater income distribution. This change is one of the best ways to decrease the vulnerability of the population.
b. *On the state policy on climate change:* The states of the Amazon region were some of the first in Brazil to established a law addressing climate change issues, introducing, among other things, financial mechanisms (e.g., State climate fund, environmental conservation, sustainable development and forest grant programs), educational programs on climate and environmental monitoring and protection, as well as research centers and discussion (State climate change center).
c. *On institutional structure:* In the Secretaries of the Environment, some changes are related to the establishment of new departments overseeing climate change issues have been seen, as well as an increase in the number of planning issues activities (prevention and preparation), and the delegation of the responsibilities of fiscalization, monitoring, and licensing in other institutions.
d. *On the partnerships:* The Civil Defense department has begun the process of establishing and strengthening partnerships (Geological Service, Universities, Remote sensing research institutes, etc.) that are considered strategic, mainly in order to increase the availability of information and the implementation of the capacity building process.

7. Final considerations

The Amazon region presents a new frontier for natural disaster issues. Larger and more frequent hazards (natural, technological, and social), better record, the dissemination of journalistic information and more in-depth scientific studies are occurring simultaneously alongside a rapid population increase, demographic concentrations in a few metropolitan areas, the occupation of risk-prone areas, unwise land use practices, low socioeconomic development indices, and the uncertainties of the effects of global climate change in the region.

Given the results, the final considerations are presented and discussed here, along with the main challenges to be faced by risk management offices in the coming years in the Amazon region.

One of the main challenges is to keep the natural risks issue on the agendas of both mainstream society and the governments independent of the occurrence of a major natural disaster. When large magnitude events do occur, they permeate formal and informal communication channels that could be used also in “normal” situations.

On the other hand, it is essential to strengthen the strategies and activities to be undertaken before the occurrence of a disaster in the Amazon. There is a general recognition of the importance of the prevention and the preparation processes for risk management. However, in practice, most actions focus on the so-called "response" to the disaster. The climate policy of the State of Amazonas (law 07/3135) is the only one to refer to the principles of Prevention (adoption of measures that help to prevent climate change) and Precautionary (procedures that, even in the absence of scientific certainty, predict damage, as a guarantee against potential risks).

Transforming issues from emergency and security policies to include prevention is not an easy task, especially in the Amazon region, where:

a. The broad risk management concept is not yet fully understood by all public managers, with a great discrepancy of ideas between the states and the secretariats of each of those states;
b. The risk management issue is not considered by the governments to be a priority in the creation of social and economic development policies, possibly on the basis of considering the greater "visibility" of other governmental policies and measures, the unpredictability of disaster occurrence, the poor prevention culture existing in society, and the non-existence of success indicators for evaluation and presentation of risk management strategies and actions;
c. Civil defense public employees do not feel motivated to be proactive due to their low salaries and, sometimes, precarious working conditions (e.g., few employees, overseeing of several activities), limiting the response to demands received;
d. There is not "pressure" for carrying out prevention activities because the society recognizes disasters as cultural and religious events and, at a high frequency, turns them into landscape "chronic” issues. In many opportunities, society is adapted or resigned to the impacts. On the other hand, the outage or delays in socioeconomic development of large rural areas of the Amazon region because of the occurrence of disasters, particularly in riverside communities of flood-prone areas, do not have a

large impact on (macro) state development indices or are translated into social pressure (NGOs, journalism, etc.); and

e. In large urban areas, the risk issue is of greater visibility. However, its complexity lies in the many and various stakeholders and the absence of a public authority in certain (dangerous) regions making the implementation, monitoring and enforcement of the law difficult.

The state constitutions specifically refer to actions and responsibilities in case of calamities. However, the states' environmental legislation does not or only poorly considers the various types of risks and their management as decisive factors in the classification and organization of land use and water resources. Moreover, most of the state laws have not been regulated, despite having been adopted long ago. Regulated or not, there is also an enormous difficulty of implementing them, possibly due to a lack of coordination between government agencies, a lack of resources (financial and human) and infrastructure, political and economic pressures, and a cultural norm of people only accepting the rules when they agree with them or benefit from them.

The risk management institutional framework in states of the Amazon region shows no characteristics unique from other governance processes (e.g., reduced budgets, scarce qualified personnel, the overlay or "gaps" of responsibilities and tasks, programs lacking continuity). In particular, risk management seeks an institutional structure of high technical level, including multidisciplinary approaches and working methods, and with administrative flexibility and autonomy for decision-making.

However in the Amazon region another institutional framework is observed. Several institutions express enthusiastic interest with respect to risk issues and recognize different degrees of relationship to them. But supported by the power delegation established in the State and Federal constitutions, they associate the responsibility of risk management within the governmental structure to the civil defense coordination. In this sense, improving and strengthening the existing structures of civil defense and other government bodies to actually incorporate in risk management is believed necessary.

To strengthen the governmental structures of civil defense, the following are proposed:

a. Train employees on issues related to the consequences of climate change and the planning of prevention, mitigation and adaptation measures.
b. Encourage the understanding of the risks with regard to climate change scenarios through the production of knowledge in several themes and in particular geographic regions that are still not very well known.
c. Redefine the relationship of subordination of the State Civil Defense departments to the Military Firefighters Corps. This relationship enables a binding budget dependency, the existence of rigid structures and institutional regulations, a common association made by society concerning the goals of civil and the purpose of the Fire Department, limitations on the employment of "civil" technical staff in the corps, and non-participation in environmental and territorial planning projects.

The States have the legal autonomy to determine their territorial planning and their own security. However, up to the present time, the federal Government becomes a key element, considering the lack of resources and information at State level and the numerous exclusive

federal. Currently, risk management in the states cannot be made without coordination on the federal scale.

There is no need to devise new mechanism in order to implement risk management at municipal level: they already exist. On the one hand, the Civil Defense system already has created numerous municipal departments but not yet in all municipalities, since its creation and maintenance depend largely on political desire and the municipal financial resources. What is seen in those that are already created is that few are structured and many lack staff and/or equipment, are temporary, and only develop emergency responses at the time of the disaster. On the other hand, the municipal government needs to strengthen its institutions and take on the responsibilities of elaborating and implementing territorial zoning in order, for example, to have the capacity to supervise and monitor of land occupation.

As the liaison with the federal level, a municipal risk management must be considered. The large territory, the temporary or permanent difficulties accessing some distant regions from large urban centers, and the lack of financial resources and qualified personnel have become major obstacles to the states' successful risk management.

The knowledge of the environment (physical, biological, socioeconomic, political, etc.) is one of the most important inputs for the management of the environment, the territory and the risk. However, in the Amazon region, primary data gathering, systemization, and dissemination provision are still very incipient. Much has been advanced in recent years on spatial low-resolution scales, but huge territories and themes still have not been analyzed either by the Academy, governmental bodies or NGOs. In this sense, in order to generate knowledge to support decision-making, the following are proposed: (a) encourage and strengthen the institutional partnerships of the civil defense agencies with others organizations that can collaborate with information, data processing, personnel and technical infrastructure, and (b) create a scientific research institute to look into risk management issues in the Amazon region, as referenced in the Center for Disasters Studies and Research (Federal University of Santa Catarina) in Florianopolis (SC) and the National Institute of Spatial Research (INPE) in Santa Maria (RS), both in the southern region of Brazil.

One of the most important obstacles to risks management is the lack of mechanisms for receiving and spending financial resources in situations of *imminent* risk. Establishing action, strategies and measures (and the associated resources costs) with respect to an event that may or may not happen is very difficult for the government. For this reason, the government must establish subsidies that allow for decision-making, with should include, among other things, a better definition (conceptual and temporal) of the risk situations of imminent hazard and high levels of vulnerability of a population or infrastructure concerning a particular threat, and the peculiarities of regional diversity.

The mechanisms to financing risk management activities, at all levels, prove the status quo for the release of financial resources after the occurrence of the disaster, particularly to assist the relief efforts of the affected communities. Scarce resources lead to numerous strategies and measures that depend on numerous factors to be employed (e.g., economic and political circumstances at the national and international levels, the goodwill of donors, the subjective assessment of disaster severity and other existing priorities). Extraordinary credits clearly represent a lack of foresight by the authority's complacency with the inevitable economic

and administrative benefits of the approval of emergency situations and Public Calamity States. As a result, it is believed to be necessary to create mechanisms that would definitely strengthen and modify already existing funds (e.g., new sources of money, such as the lottery), as well as create new ones (e.g., states' and municipal funds). All these proposals seek to "break a vicious circle" (Calamity – "desperate" demand of resources for emergency assistance – lack of resources and the consequent deficiency in prevention activities – new calamity).

After analyzing this risk management scenario in the Amazon, it is believed that many of the changes and propositions can possibly be applied in so far as a clear tendency to strengthen the process of popular participation and instrument of social control over the projects and their actions can be seen in the region.

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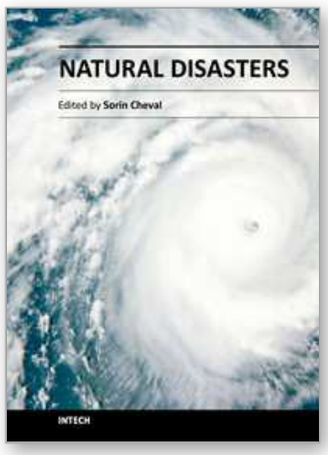
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The crossroads between a more and more populated human communities and their changing environment pose different challenges than ever before. Therefore, any attempt to identify and deliver possible solutions is more than welcome. The book Natural Disasters addresses the needs of various users, interested in a better understanding of hazards and their more efficient management. It is a scientific enterprise tackling a variety of natural hazards potentially deriving into disasters, i.e. tropical storms, avalanches, coastal floods. The case studies presented cover different geographical areas, and they comprise mechanisms for being transferred to other spots and circumstances. Hopefully, the book will be beneficial to those who invest their efforts in building communities resilient to natural disasters.

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