

International Journal of Mass Emergencies and Disasters
March 2014, Vol. 32, No. 1, pp. 26–42.

**A Geographical Approach to Disaster Management: Analyzing Vulnerability in
Relation to Decision And Intervention Resources In Lima And Callao**

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This article describes a geographical approach to disaster management for a major earthquake in Lima and Callao, Peru by examining the interface between hazard (and vulnerability) research and disaster research. It invites reflection on the spatial and territorial dimensions of crises by analyzing the specification and location of decision and intervention resources. In view of the fragmented politico-administrative organization in this metropolitan area, the location of these resources shows a center/periphery type of spatial disparity, which questions if local jurisdictions can manage this type of event and underlines the necessity to rethink the management of territory in disasters.

Keywords: Geographical analysis; vulnerability analysis, disaster preparedness, disaster response

Introduction

Lima and Callao form a metropolis of nine million inhabitants marked by poverty and many urban management problems. As the major urban area of Peru, it contains one third of the population of the country, most important government agencies, banks and large companies' headquarters, and half of the Peruvian economy. This urban area has

experienced earthquakes and tsunamis that claimed many lives in 1746, 1940, and 1974. The IGP (Peruvian Geophysical Institute) now considers that the probability of another major earthquake generating a tsunami has increased (Tavera and Bernal 2005). A recently developed scenario for a magnitude M_w 8.0 earthquake estimated 50,000 deaths and 680,000 injuries in Lima and Callao (PREDES 2009). In this context, Peru's low level of preparedness to face an earthquake was recently revealed in the 2007 Pisco earthquake. The failures of emergency plans were clearly visible; in particular, there was lack of coordination and knowledge about emergency management resources, as well as an insufficiency of emergency resources to meet disaster demands (D'Ercole et al. 2007; INDECI 2009). The diagnosis of the management of the Pisco earthquake raised concern and put Lima and Callao's disaster preparedness on the agenda of Peruvian authorities and international organizations. In order to limit the consequences of such a disaster, it is essential to strengthen emergency management capacities and ensure that the authorities and the population are prepared.

Among the efforts undertaken to improve disaster preparedness in Lima and Callao, an important project, "*Preparación ante Desastre Sísmico y/o Tsunami y Recuperación Temprana en Lima y Callao*" was implemented for the INDECI (*Instituto Nacional de Defensa Civil—Peruvian Civil Defense Institute*) in 2009-2011. This project was financed by the Office of Humanitarian Aid of the European Commission (ECHO) and run by the UNDP (United Nations Development Program). One part of this project aimed at identifying and mapping emergency management resources so as to create a decision-making tool for the implementation of prevention and preparation initiatives, but also to manage a potential disaster—"Sistema de Información Geográfico y análisis de recursos esenciales para la respuesta y recuperación temprana ante la ocurrencia de un sismo y/o tsunami en el área metropolitana de Lima y Callao".

The IRD (Institut de Recherche pour le Développement—Institute of Research for Development), in association with the Italian non-governmental organization COOPI (Cooperazione Internazionale) built a georeferenced database of emergency management resources (SIRAD—*Sistema de Información sobre Recursos para la Atención de Desastres* [Information System of Resources for Disaster Management], see D'Ercole et al., 2011). This geographical information system (GIS) has been used within the framework of a scientific approach to better understand the vulnerability of large urban areas by investigating the spatial and territorial dimensions of emergency management.

This paper aims at showing the importance of a geographical approach to emergency management by conducting an analysis of disaster decision-making and intervention resources. First, it presents the general problem of spatial dimensions of emergency management as compared to the approaches of social sciences. Second, the method used to build the database incorporates the identification of decision makers and intervention actors and their resources. Third, the results reveal predictable dysfunctions linked to the territorial imbroglio of decision-makers and the spatial concentration of intervention

resources. This article shows how the understanding of spatial and territorial dimensions contributes to improving disaster preparedness.

Spatial Dimensions for Emergency Management

In a large urban area, a major disaster such as a major earthquake involves unmistakably spatial dimensions. Specifically, direct damage of residential, commercial, and industrial structures, as well as vital infrastructure networks and areas of economic activity, is bound to modify the distribution of population, goods, activities and flows throughout the impact area. It implies, for example, the desertion of residences that have been destroyed, as well as businesses whose economic activities have been interrupted by damage to major transit routes. Moreover, to bring help to the population and restore services and urban networks, emergency management itself implies the intervention of new actors and triggers unusual ways of action and specific goals from the public authorities that may transform the flows and relocate the centers of territories. For example, government headquarters, which are usually located in city centers, might be relocated to new locations—as happened in Haiti, where these facilities were moved to the Port-au-Prince airport after the 2010 earthquake.

A major earthquake also entails new areas of population concentration, in particular towards official and spontaneous shelter areas, as well as new spots of formal and informal economic activity near them. In parallel, there are changed flows of persons, materials, and goods that are initially brought by aid organizations and later by the urban network recovery system. New management territories appear, different from the usual ones, that correspond to the operational territories of new actors. For instance, a non-governmental organization (NGO) or a military unit might have an operational area that partially or completely overlaps the areas of multiple local or regional political jurisdictions. However, the response to major disasters in large urban areas is typically complicated by the loss of spatial references within the impact area. Nonetheless, emergency management must consider spaces and territories to broaden the field of risk prevention and improve disaster preparedness.

There has been a substantial amount of research regarding emergency management in the social sciences—particularly sociology, political science, anthropology, and communication. However, the geography of spaces in emergency management is still in its early stages. Spatial dimensions are sometimes mentioned in scientific analyses and feedback from emergency responders (Gilbert 2005; Lagadec 2007) but they have rarely been the topic of specific research projects.

Cutter (2003) underlines the difficult use of geographical data by administrators and emergency managers, in spite of the development of increasingly useful tools and the availability of data. Although the complexity of cities is recognized as a factor of vulnerability (Pelling, 2003; Pigeon, 2007; IFRC, 2010), little research has directly

tackled the management of a major disaster in a large urban area. Researchers usually focus on organizations and not on territories or, if they do address geographical areas, they do so on a very local scale following a *community based* logic (Birkmann 2006; Wisner et al. 2007). If spatial dimensions are fundamental in risk studies which—according to Curtis and Mills (2010)—would justify the use of GIS, they are rarely used for research regarding crises.

The present study is based on two approaches to risk and disaster (NRC 2006). *Hazard research* makes up the first approach, along the same lines as Gilbert White's work that began in the 1940s based on the study of hazards, their characteristics and impacts, and population vulnerability. This research focuses on the prevention and mitigation of risks, with geography as an important aspect. These studies sometimes emphasize the physical and socioeconomic conditions that may lead to an emergency (Cardona 2005; Cutter et al. 2000; Weichselgartner 2001), but emergency management is rarely considered as a research topic in this context.

The second line of research has been exemplified by sociologists such as Quarantelli, Dynes, and their students in the United States since the 1950s. Research on disasters focuses on people's behavior during a disaster and is based on analysis of emergencies, disasters, and catastrophes. These researchers tackle the capacity of societies to face new crises, in particular through the analysis of emergency management systems, organizational efficiency, and crisis dynamics (Alexander 2005; Boin and 't Hart 2010; Lagadec 2003; Quarantelli 2009). This research has been widely used to improve disaster preparedness, which stood out as a priority for international policies regarding disasters and risk management (Revet 2011).

Disaster preparedness still focuses today on technical topics such as early warning systems, evacuation plans, and emergency communications, following the hypothesis that a better understanding of the relations between the events (hazards) and their impacts can provide more effective measures of preparedness and response (NRC 2006). However, this way of thinking and the lack of consideration of essential social problems, such as poverty and disparities, limit the effectiveness of emergency management. This was seen during the Hurricane Katrina disaster, where emergency management was only planned from a technical point of view (Lakoff 2006).

We would like to contribute to development of research on disaster preparedness through a major focus on the spatial dimensions of emergency management. This initiative goes further than conventional approaches to hazards and their impacts; it takes into account socio-spatial structuring problems and identifies practical elements regarding the vulnerabilities and the emergency management capacities of a large urban area.

The research undertaken by the IRD in Lima, in line with the work conducted in Quito (D'Ercole and Metzger 2004) enabled an examination of the geography of emergencies. It is based on the hypothesis that there are at least two general areas of

concern for emergency management. On one hand, there are areas in need of rescue (i.e., those directly impacted by the disaster) and, on the other hand, there are areas where emergency management resources are located (i.e., those that have decision making and intervention resources for emergency response and recovery)—see D’Ercole and Metzger (2009). The management of a disaster consists, in practical terms, of establishing an effective relationship between areas that have needs created by the disaster and areas that have the resources to respond to those needs.

Identifying Vulnerabilities

Identifying problems linked to the location of emergency management resources in disaster-stricken areas is a first approach to the spatial dimensions of emergency management. Two types of vulnerabilities can be tackled if we consider the spatial dimensions of emergency management. The first question concerns vulnerabilities due to the spatial distribution of resources. Specifically, where are the emergency resources located? How are they distributed within the jurisdiction in relation to the vulnerable areas? How far must these resources travel to reach the areas that need them? How usable are the communication channels between the vulnerable areas and the resource areas? The second question concerns the degree of resource dependence of vulnerable areas. In other words, what is the availability of emergency management resources inside the most vulnerable areas, taking into account potential accessibility problems?

This problem also allows us to identify two types of areas, a distinction that is particularly useful for disaster preparedness. The first of these is the impact area in which there are critical needs—that is, the areas undergoing great difficulties, not only because of their own vulnerability (e.g., socioeconomic, institutional, accessibility), but also because of their limited access to emergency management resources that may be recognized a priori. The second type of area comprises territories whose emergency management is made easier because of their relative autonomy and because they have sufficient human and material resources to maintain their own emergency management capacity.

This type of analysis enables us to shed light on territories that are more or less vulnerable according to their capacity for emergency management. Each one of these vulnerabilities is a challenge for civil protection measures and for the authorities in charge of emergency management. Most of them relate to the usual social and spatial inequalities of big cities.

Method: Building a Georeferenced Database for Decision and Intervention Resources

A spatial analysis of emergency management is based on the development of a georeferenced database. This database contains geographic information concerning (1) the areas in need of rescue and (2) the areas containing emergency management resources. For the first type of area—areas in need of rescue—we decided to consider the most obviously vulnerable areas, thus the most likely to be affected. These are areas that have population concentrations that are strongly exposed to hazards (e.g., areas that are highly susceptible to seismic shaking or easily flooded by a tsunami) and that also present accessibility difficulties. These spatial dimensions are also linked to social dimensions, such as urban disparities in socioeconomic vulnerability (Finch, Emrich and Cutter 2010).

Emergency management resources are useful, perhaps indispensable, elements in the management of emergencies that are recognizable and located within the territory being analyzed. These include disaster decision and intervention centers; medical facilities; water, food, and energy supply; roads and other transportation facilities; telecommunications infrastructure; potential areas for shelters; humanitarian aid stockpiles, etc. In practical terms, decision and intervention activities imply the allocation of material resources—such as people, facilities, equipment, vehicles, and other materials that are located in the area.

Activities, Decision-Makers and Intervention Actors

To identify emergency-relevant resources, we first need to formulate the specific purposes of disaster decisions and interventions. We can distinguish four important objectives in a major earthquake disaster—evaluation of damage and casualties; maintenance of law and order; management of national and international humanitarian aid, including the management of shelters; and debris clearance and building stabilization.

The resources necessary for the effective realization of these objectives in the field imply decision-making at the *strategic level* and material capacities of intervention at the *tactical/operational level* (Boin and 't Hart 2010). The distinction between decision and intervention is not always easy to make, since the intervention actors generally arrange their own modalities of decision-making. Some of them participate by right in the decision-making process within civil defense committees. In general, the number of decision-makers remains relatively limited in comparison to the number of intervention actors (emergency response organizations), who are much more numerous.

According to Boin and 't Hart (2010), whose work is based on the typology of Dynes (1970), the emergency response organizations can be classified into four categories. These are *established organizations*, for example, fire brigades; *extending organizations*

that act once the first shock has passed and insure a return to normal functioning (e.g., administrations, not specific to emergency management); *expanding organizations* related specifically to emergency management that only act when the local capacities are overwhelmed (e.g., the Red Cross); and *emergent organizations* such as *ad hoc* committees and victims' associations.

Frequently, disaster preparedness only takes into account the first type of actors—the ones that function in routine emergencies. “The Dynes typology makes it clear that the quality of disaster preparedness and response within any community depends on much more than the structure and performance of the established (type one) organisations, eg, the fire agencies.” (Boin and ‘t Hart 2010:364). Beyond these established organizations, the identification of emergency management resources allows other actors to be considered, such as *extending organizations* and *expanding organizations*.

Identifying emergency management resources implies projecting oneself into a new situation that is different from the usual functioning of the urban system. These emergency resources can be determined using quantitative criteria (e.g., health facilities according to the number of beds), qualitative criteria (health facilities with particularly useful departments in case of an emergency, such as the Severe Burns Patients Department), or spatial criteria (health facilities not so important quantitatively or qualitatively but serving a vast area). Data regarding emergency resources can exist in a formal and localized way (e.g., in emergency management programs or in official files in municipalities or ministries). Other data must be created from field work and conversations with the emergency managers to obtain their knowledge about the emergency resources. This is especially true for those resources that may need to be discussed (e.g., informally identified shelters). Critiques of responses to past emergencies also constitute an important source of information.

The *decision field* includes all of the activities of coordination, information exchange, and decision-making among public authorities, between these public authorities and other emergency management actors (from public and private institutions), and between public authorities and the impact area population. These decision actors have legal authority that enables them to give orders and mobilize other actors, particularly intervention actors. In Peru, the statutory system of the Civil Defense¹ appoints the decision makers that manage disasters at each jurisdictional level. The basic principles are the same in all cases—proximity and subsidiarity. In theory, the local scale, closer to the population and to its needs, is the first to intervene. Once all the resources at this scale are overwhelmed, higher government levels intervene.

Peru's disaster decision system is based on the country's four political levels—districts, provinces, regions (or departments) and national government. Each political level has its own Civil Defense Committee chaired by the highest executive authority (the Mayor of the district, the mayor of the province, the president of the region, and the

President of the Republic²) and is responsible for managing the disaster response. At the provincial and regional scales, we also find a national government representative.

All actors, whether public or private, institutional or associative, participate in these Civil Defense Committees³. In theory, local committees are the first to decide how to manage the disaster, by evaluating needs and allocating necessary resources. In practical terms, the material resources of the decision process identified in the database are the premises of the various acting institutions (i.e. the places that gather a set of resources allowing decision-making—staff, data, means of telecommunication, meeting rooms, etc.)

The *intervention field* includes all the actions of human and material resources to reach emergency response objectives, which means undertaking action in the field by providing a tangible response to the needs created by the disaster. Consequently, the intervention actors are emergency responders who have practical action capacities and who act directly while in the field (e.g., fire brigades). Other intervention resources are facilities, vehicles, equipment, materials, and supplies.

An Important Distinction: Identifying The Major Resources

All emergency resources do not have the same importance. Defining strategic resources for emergency management implies tackling the geographical scale. Indeed, different elements make up the resources needed on a metropolitan scale or on a district scale. As a simple example, a town hall can be a very important resource at a district scale because it can be used as a shelter or a decision center. However, it has no particular importance on an urban area scale. Useful elements for emergency management are thus multiple and scattered throughout the metropolitan area. Beyond the identification and location of all resources that can be mobilized for response to routine emergencies, it is crucial to identify resources available for a major disaster—those that will be part of the disaster response at the metropolitan scale.

With regards to the metropolitan scale, we can identify a limited number of vital resources for the whole territory. National public authorities, local governments, fire brigades, and police forces are considered essential resources, both for their major role in decision making and for their direct participation in field intervention. Quantitative and qualitative criteria are also taken into account; some resources take on a strategic importance due to their role, specificity, or shortage—especially if there is no alternative (e.g., an international airport).

Results: Vulnerabilities Resulting From the Spatial and Territorial Organization of Decision and Intervention Resources in an Emergency

The Territorial Complexity of the Decision Making Process

As indicated in Figure 1, the jurisdictional boundaries at each political level in the metropolitan area of Lima and Callao are particularly complex. This territory is divided in two regions (Lima and Callao), two provinces (the Metropolitan Municipality of Lima, MML and the Constitutional Province of Callao), and 49 districts (43 for Lima and six for Callao), which totals 54 different jurisdictions. Moreover, provinces and regions have identical territories and, even though their authorities differ, they are not well defined, especially for emergency management.

Apparently, there is no Civil Defense Committee for the urban area of Lima and Callao as a whole. Furthermore, in a disaster, the concentration of the national government buildings, the population, the major economic and social actors, the activities and the infrastructure of the capital city immediately affect the country as a whole. This means that emergency management is fragmented into four politico-institutional levels and 54 different committees, each one being entitled to make a decision and act on the whole or only a part of the territory.

Regarding decision-making, Peru's Civil Defense Institute followed a rational politico-administrative logic by deciding to have uniformity in the territories. However, this decision ignores the distinctive characteristics of these jurisdictions and the reality of their relations. Indeed, districts differ in their social composition as well as their economic, demographic and political weight—which draws affinities or hostilities among them. For various reasons, some actors have privileged relations with certain districts and, similarly, some districts have privileged relations with the provincial, regional, or national governments. These relations do not follow the logic of meeting the most urgent needs (interpersonal, community, follower or vote-catching relations) and can short-circuit planned decision chains. However, the contrary can happen; the central government can use local contacts to mobilize specific resources.

The civil defense system has established a committee, made of the most diverse actors with the decision-making process, according to the functioning of the jurisdictions in normal situations. The real capacities of the committee regarding decision making and intervention were not carefully examined beforehand. The system does not take into account the spatial specificities of Lima and disregards relations, interweaving, and interdependences among the jurisdictions in this metropolitan area. It also ignores these jurisdictions' differentiated needs arising from differences in geographical size, hazard exposure, and social vulnerability of different population segments. Worse, the system does not take into account certain key actors' real capacities for emergency management decision and action that allow them to bypass the civil defense committees if they decide to respond to an emergency as fast as possible according to their own interests. The

multiplicity of actors and their relationships makes it difficult to act in a coordinated and effective way, especially in a disaster that would imply deficient resources and urgent action entailing the definition of priorities by the civil defense committees.

Figure 1. Political and Administrative Organization of the Lima-Callao Conurbation



Another difficulty is the existence of actor-specific jurisdictions, each of which has its own logic. Emergency management is organized according to political jurisdictions, yet the civil defense system is such that each district's resources seem available to its local civil defense committee alone. This principle became obvious during emergency drills and reveals the importance of the spatial distribution of needs with respect to resources within a territory. The fact that strategic resources are managed by superior, metropolitan or national levels requires consideration of the political level of decision.⁴

Ordinary and Extraordinary Resources For Emergency Management

Some disaster resources are maintained by actors who participate in the management of their jurisdictions' routine emergencies. These actors are local administrations, fire brigades, and police forces that respond to minor events such as fires and highway accidents. These routine emergencies do not challenge jurisdictions' normal functioning because the institutions in charge of responding to them usually have sufficient resources within their boundaries. That is, emergency demands correspond to the intervention scale of each actor. However, disaster demands require mobilizing extraordinary resources. INDECI, the core of the Peruvian civil defense system, is a leading asset for disaster response. Among the specific intervention resources to be found during a disaster, there are armed forces that have resources to maintain law and order as well as support humanitarian aid and early recovery. There are also groups for specialized aid, such as urban search and rescue teams. Moreover, with 120 first aid workers (for a total of 365 listed), fire brigades represent Lima's main specialized intervention forces, in addition to other groups of emergency responders such as the national police force, the Municipality of Lima, NGOs, and the Peruvian Red Cross.

During a disaster, managing humanitarian aid depends mainly on external resources, namely the Humanitarian Network (Red Humanitaria), overseen by the UN OCHA (Office for the Coordination of Humanitarian Affairs). Constituted by approximately thirty members, this network includes bilateral cooperation agencies and international organizations (United Nations agencies), national and international NGOs, and associations such as the Red Cross. The harbor and airport facilities, the large storage areas of the INDECI, PRONAA (National Program of Supply in Food), and the Peruvian Red Cross also constitute crucial intervention resources for the reception, storage and distribution of humanitarian aid. Areas for constructing temporary shelters and disposing debris are other examples of specific emergency management resources. However, debris removal is a resource that does not exist during normal operations and, moreover, since solid waste disposal capacity is already insufficient in normal times, other areas must be adapted to this function.

The territories of the intervention resources organizations must distinguish between resources that are usually mobilized for routine emergencies and those resources that are specifically for disasters. In the first case, the operational territory of the resources (i.e., a

local jurisdiction) already exists before the disaster; it is the local governments, fire brigades, and police forces. However, in the case of disaster-specific resources, territories do not preexist because their actors are constituted by civil defense committees only when a disaster strikes.

Spatial Disparities and Intervention Resources

A spatial analysis of emergency management is based on decision and intervention resources instead of the civil defense system's organization chart. This shift in focus allows us to take a fresh look at the organization of the civil defense system. Indeed, the spatial distribution of the material resources in the field inevitably influences the effectiveness of the emergency response, especially the proximity of intervention resources to disaster-stricken areas and, thus, the speed with which disaster assistance can be provided.

We can make a preliminary estimate of the effectiveness of "proximate resources" (i.e., those that need to be delivered rapidly to be effective) from the analysis of their locations throughout the territory in relation to the most vulnerable geographical areas and population segments. The cartography of intervention resources in Lima and Callao highlights two poles of concentration within a relatively homogeneous territorial coverage. The first pole is located in the central part of Callao, whereas the other pole is located between the historic center and the modern city of Lima. Police forces (spread across more than 100 police stations) show a good coverage of the metropolitan territory, which makes them key actors for rapid intervention. However, municipal security officers (resource members of the local government) are more numerous in the wealthy districts of the central area.

As for fire brigades, if they are present in the majority of districts, they concentrate around three poles—the center of Callao, an axis between the historic center and the modern city of Lima, and finally between Surquillo and the North of Chorrillos (Figure 2). This concentration of resources objectively indicates a greater capacity for intervention in the central areas of the city, but also reveals the existence of highly deprived peripheral areas. The lack of intervention resources in these areas would be worsened if they were to be isolated after the destruction of access roads. A prime example is the district of San Juan de Lurigancho, which is the most populated urban area of Lima with nearly one million inhabitants. Indeed, even though the logic of upper level support is part of the program of the Civil Defense Institute, accessibility problems in the field may jeopardize the capacity to bring help from other sectors. In a major earthquake, the systematic spatial disparities of Lima and Callao will come out in the relief operations of the Civil Defense Institute.

Conclusions

Decision-making and field intervention are the core areas of emergency management that arise from the organization chart of the Civil Defense Institute. Beyond the functioning problems of the civil defense committees, the practical implementation of an emergency response is based on decision makers' mobilization of resources that are unevenly distributed throughout the metropolitan area. The diagnosis produced from the identification and the location of decision and intervention resources sheds light on the potential for systemic failures and underlines the contribution of geography to the understanding of emergencies.

The diagnosis highlights the specifics of the territory, the insufficiency of some resources, and their uneven distribution within the territory. The most vulnerable areas of Lima and Callao are generally poor and relatively inaccessible peripheral neighborhoods. There, the presence of public authorities is marginal and the lack of resources foretells obstacles to managing an effective emergency response. Emergency management resources are mainly located in central areas, far from potential needs.

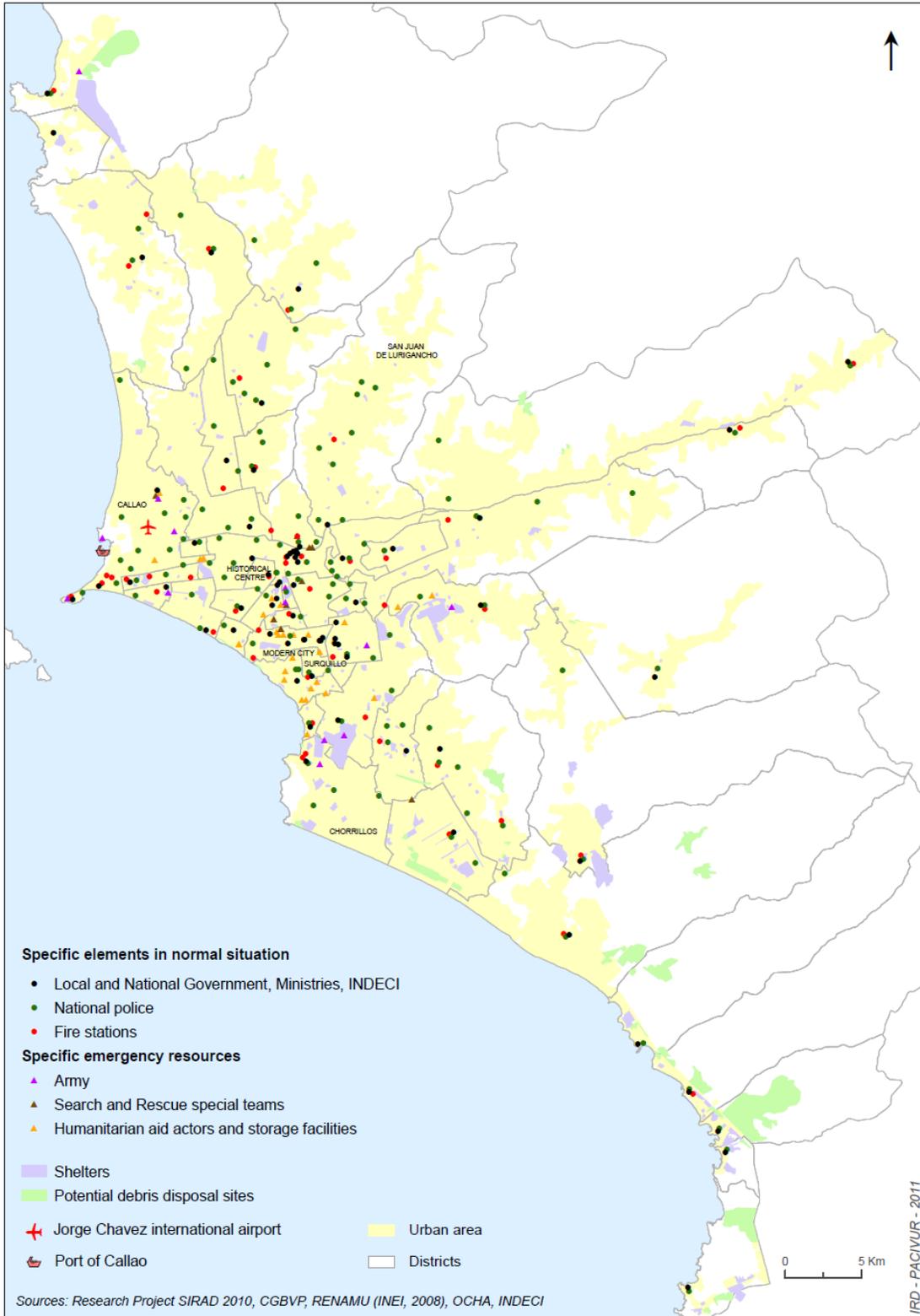
This research also shows an imbroglio of decision makers and predictable difficulties of resource management and mobilization, because of the number of jurisdictions and management scales. The complexity of the political-administrative division in Lima and Callao foretells a major difficulty in terms of decision making. Furthermore, public or private actors who have emergency management resources may act independently, which questions the efficiency of the decisions that are likely to be taken by civil defense committees.

The emergency management strategy for this territory was developed according to the territorial scales of political decision in *normal* situations. Each resource corresponds to a scale and to one or more decision makers, each with its own hierarchy and autonomy. Yet, the management scale of a resource does not necessarily correspond to its political-administrative level. Resources are not necessarily managed (nor can they even be mobilized) by the decision maker in charge of a given jurisdiction. In other words, the most adequate management scale can vary according to the type of resource.

Certain resources can be managed at a metropolitan scale (e.g., the main highways, telecommunications, hospitals). Others can—at least partly—be managed at a local scale (alternative water supply, shelters, first aid and debris disposal sites) to optimize the response to the affected population's needs and the restoration of infrastructure in time and space. The spatial dimensions of emergency management require thinking about a new territorial organization adapted to the disaster and based on the autonomy of local jurisdictions in allocating emergency management resources.

The lack of knowledge regarding available resources and their locations, as well as the fact that spatial dimensions of emergency management are not taken into account, foretell great vulnerabilities in case of a major earthquake. To optimize the management

Figure 2. Essential Decision And Intervention Resources for Emergencies in Lima and Callao



of such disasters, decision makers must have a global vision of the territory's needs and know what resources are available and where they are located. The effectiveness and efficiency of emergency response depends on (political administrative) decision scales, on the decision makers' knowledge, and on the location of emergency response resources.

Knowing what resources are available is thus necessary to coordinate and prioritize emergency response interventions, as well as to avoid their concentration in specific areas and omission in others. It would be useful if emergency plans included an inventory of the locations of emergency response resources that would specify which actors can authorize their use. It is relevant and necessary to identify the available resources at every political-administrative level of government, and to know which ones can be mobilized at other scales, either by pooling them (e.g., exchanged between districts) or according to hierarchy (dispatched from the national to the local level). A geo-referenced database of the main emergency response resources is therefore a precious asset for effective emergency management. Thus, the analysis of the spatial and territorial dimensions of emergencies would enable planners to identify preparedness actions that can remedy the predictable weaknesses of emergency management. In this perspective, disaster preparedness is a public action field linked to the preventive planning of risks.

Notes

- 1 The Sistema Nacional de Gestión del Riesgo de Desastre (SINAGERD) was established in 2011 to replace the Sistema Nacional de Defensa Civil (SINADECI) resulting from a 1972 law.
- 2 In the past, the National Civil Defense Committee was chaired in theory by the President of the Council of Ministers. The management of the 2007 Pisco earthquake showed that the authority of the President of the Republic, the holder of the legitimacy stemming from the direct universal suffrage, was imperative. This de facto situation was registered in the most recent law; the Head of State chairs the National Council of Risk of Disaster Management and the Prime Minister manages the technical secretarial department.
- 3 Each local committee (district) gathers the persons in charge of each municipal sector (e.g., security, urban development, health, education); the highest-graded military officer of the district; and the highest-ranked persons of the national police force, fire brigades, universities, churches, public and private firms located in the district, NGOs, and recognized social organizations—especially those stemming from governmental programs (*Club de madres, Vaso de leche, Comedores populares*)—and other actors designated by the Mayor.
- 4 It is the case of the international airport situated in the Callao region, but also of heliports, communication antennas, water stations, warehouses, industrial bulks, as

well as other facilities such as vital networks. During a November 2010 emergency drill, the President of the Callao Region, as President of the Disaster and Emergency Services Committee, decided to transfer flights from the international airport to the Las Palmas military base. This decision had repercussions on the whole capital city and country, and should have been made by the highest national executive authorities instead of the regional committee.

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