CHAPTER SIX

GIS IN THE VULNERABILITY ASSESSMENT AND RECOVERY PROCESS IN A COMMUNITY WITH ELDERLY AND DISABLED PEOPLE AFTER A DISASTER

Mapping the locations, facilities and social networks around elderly and disabled people could be useful to increase resilience in a community and undertake an efficient recovery process in developed and developing countries. A Geographic Information System (GIS) is a useful tool to carry out this process. This chapter looks at how GIS can be used to assess the vulnerability of elderly and disabled people before a disaster, and to monitor their condition during the recovery period. GIS allows users to geo-reference the location of these groups, creating spatial information that can be overlaid with the information on hazard-prone areas. In this way it is possible to develop a plan to assess the vulnerability of elderly and disabled people, and based on this assessment construct a pre-impact recovery plan in the light of the requirements and social networks of elderly and disabled people.

Definitions

The elderly are impolitely defined in the dictionaries as old people with physical and/or mental limitations. In general terms, an elder person is considered as aged sixty or above, without significant differences between developed and developing countries.

According to the World Health Organization (WHO), "disabilities" is a broad term, which involves "impairments, activity limitations, and participation restrictions."[1] *Impairment* is a difficulty in body function or structure; an *activity limitation* is related to the problem of carrying out tasks or actions; and *participation restriction* is a difficulty experienced by individuals in being involved in life situations. In conclusion, it is an interaction problem between the characteristics of the person's body and

the features of the society in which he or she lives.[2] The *International Classification of Impairments, Disabilities and Handicaps* (ICIDH) developed by the WHO identifies nine domains which can be affected: learning and applying knowledge, general tasks and demands, communication, mobility, self-care, domestic life, interpersonal interactions and relationships, major life areas and community, social and civic life. Some countries adopted the ICIDH to assess the condition of disabled people;[3] instead the European community uses questions on *Activities of Daily Living* (ADL) and evaluation tools like the *Katz index* in its assessment.[4]

Background

According to the UN, in 2000 there were 590 million people older than seventy with an estimation of 1,100 million in 2025, which represent an increase of 224 percent compared to the number in 1975;[5] Bockel even predicts 2 billion elderly people in 2050.[6]

According to the World Bank, 8 percent of the population in the world is around sixty-five or above.[7] The average percentage of population aged sixty-five and above reveals an increasing tendency over the last fifty years, as can be seen in Figure 6.1.

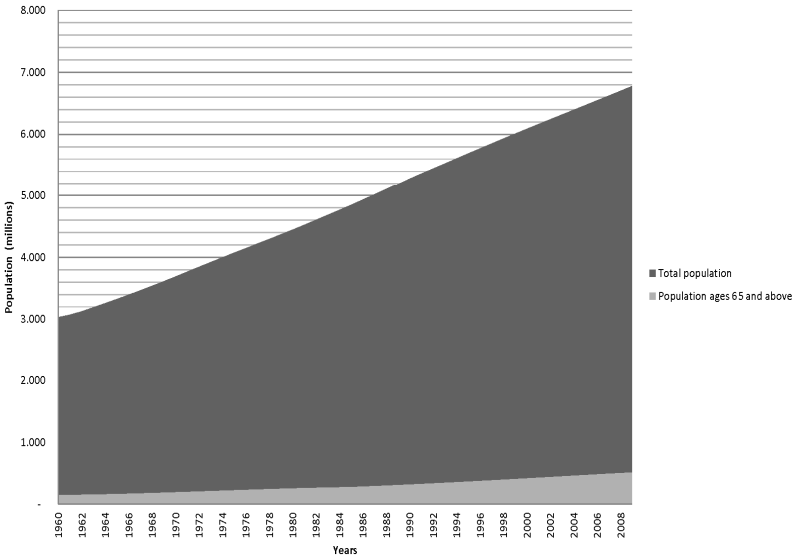


Figure 6.1 Comparison of Growth Trend between World Population and Elderly Population (Age Sixty-Five and Above) in the Period 1960–2009.[8]

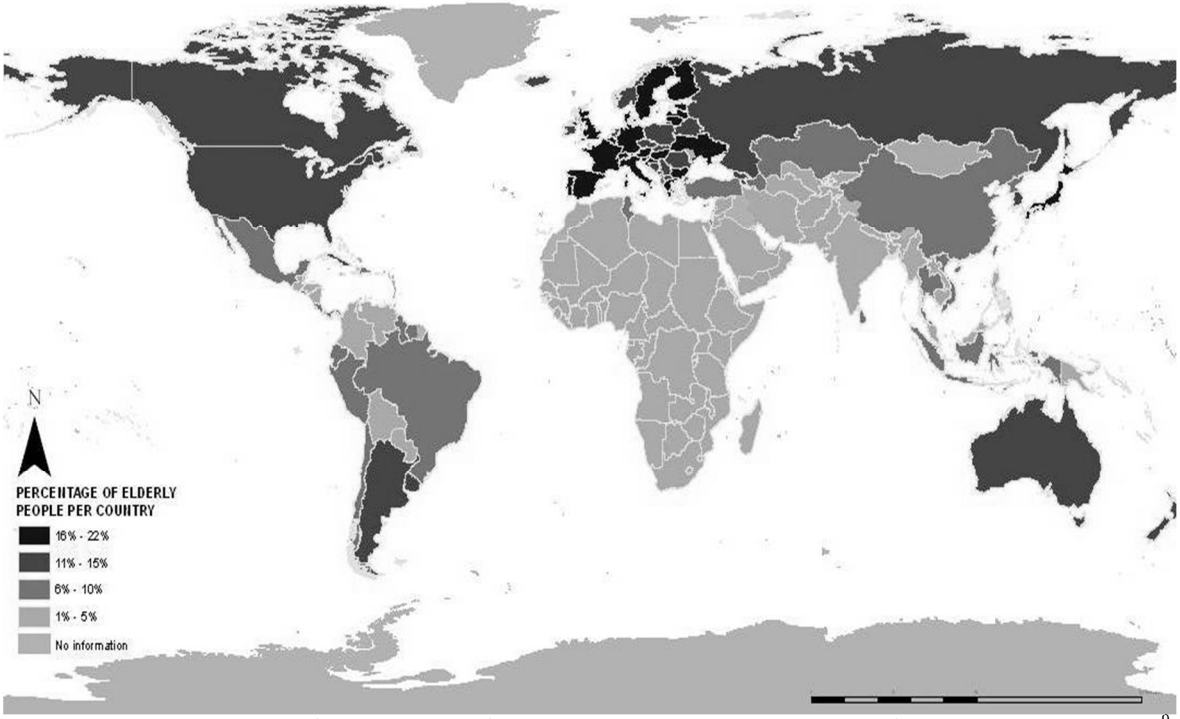


Figure 6.2 Spatial Distribution of the Percentage of People Aged Sixty-Five and Above (% of total) per Country in 2009.[9]

Table 6.1 Percentage of Elders per Countries in the World in 2009.[10]

Countries	%
Japan	22
Germany; Italy.	20
Greece; Portugal; Sweden.	18
Austria; Belgium; Bulgaria; Croatia; Estonia; Finland; France; Latvia; Spain; Switzerland.	17
Denmark; Hungary; Lithuania; Slovenia; Ukraine; United Kingdom.	16
Channel Islands; Czech Republic; Norway; Romania; the Netherlands.	15
Australia; Belarus; Bosnia and Herzegovina; Canada; Georgia; Luxembourg; Malta; Serbia; Puerto Rico; Uruguay.	14
Cyprus; Hong Kong SAR, China; Montenegro; New Zealand; Poland; Russian Federation; United States; Virgin Islands (U.S.).	13
Cuba; Iceland; Macedonia, FYR; Slovak Republic.	12
Armenia; Argentina; Ireland; Republic of Korea; Moldova.	11
Albania; Barbados; Israel; D.P.R. of Korea; Netherlands Antilles; Singapore.	10
Aruba; Chile.	9
China; Jamaica; Thailand.	8
Azerbaijan; Brazil; Ecuador; El Salvador; Kazakhstan; Grenada; Guam; Lebanon; Mauritius; Macao SAR, China; New Caledonia; Panama; Sri Lanka; St. Lucia; St. Vincent and the Grenadines; the Bahamas; Trinidad and Tobago; Tunisia.	7
Costa Rica; Dominican Republic; Indonesia; French Polynesia; Guyana; Mexico; Peru; Suriname; Turkey; Tonga; Vietnam.	6
Algeria, Arab Rep.; Bolivia; Bhutan; Colombia; Egypt; Fiji; Iran, Islamic Rep. of; India; Lesotho; Nicaragua; Malaysia; Morocco; Myanmar; Paraguay; Samoa; R. B. de Venezuela.	5
Bangladesh; Belize; Cameroon; Cape Verde; Central African Republic; Congo; Cote d'Ivoire; Gabon; Ghana; Guatemala; Haiti; Honduras; Jordan; Libya; Maldives; Micronesia, Fed. States of; Lao P.D.R., Namibia; Nepal; Mongolia; Pakistan; Philippines, Rep.; Botswana; Sao Tome and Principe; South Africa;; Tajikistan; Togo; Turkmenistan; Uzbekistan; Zimbabwe.	4
Benin; Brunei Darussalam; Burundi; Cambodia; Comoros; Chad; Dem. Rep. of Congo; Djibouti; Ethiopia; Equatorial Guinea; Guinea-Bissau; Kenya; Liberia; Guinea; Iraq; Nigeria; Madagascar; Malawi; Mauritania; Mayotte; Mozambique; Oman; Saudi Arabia; Syrian Arab Republic; Solomon Islands; Somalia; Swaziland; Tanzania; the Gambia; Sudan;Timor-Leste; Uganda; Vanuatu; West Bank and Gaza; Zambia.	3
Afghanistan; Angola; Bahrain; Burkina Faso; Eritrea; Kuwait; Mali; Niger; Papua New Guinea; Rwanda; Senegal; Sierra Leone, Rep. of; Yemen.	2
Qatar; United Arab Emirates.	1

The spatial representation of the data is shown in Figure 6.2 and Table 6.1, representing the percentage of elders in every country in the world for 2009.

The explanation of this distribution can be found in the quality of life, where populations in developed countries have longer life expectancies at birth; whereas people in developing countries—due to health conditions (malnutrition, maternal mortality, illness without treatment, access to health facilities etc.), education and sanitary conditions, internal conflicts and disasters—have a shorter life expectancy. In 2009, countries such as Bangladesh, China, Colombia, India and Indonesia with a low average of elders (between 4 and 13 percent) were highlighted in the Mortality Risk Index (MRI) as the countries in which people are most at risk of dying due to earthquakes, floods, tropical cyclones and landslides;[11] this may be an explanation as to why the percentage of elders is significantly lower in these countries. The spatial distribution of disastrous events registered for the year 2009 is depicted in Figure 6.3.

While information on age distribution throughout the world is available, data about population with disabilities is not. This may be due to the difference in approach to disability in individual states and the application of different criteria to assess disability. It may also be because disabled people are sometimes hidden or excluded. The WHO established that around 7 to 10 percent of people in the world have some kind of disability.[12]

Vulnerability, Disasters and Recovery

There is a deep attachment that people have to a place, due to experience, memory and intention, which is called *topophilia*;[13] it is assumed that this feeling is more common in elderly and physically (and/or mentally) challenged people due to their dependence on the social networks and the facilities around places where they live. Even in normal living conditions, the elderly and disabled—in some cases dependent adults or children—suffer the most due to inadequate facilities, and this is made worse after disasters. These groups of people are heavily dependent on social networks, which are usually broken as a consequence of disasters.

Disasters have been defined as a serious disruption of a community or system in a given spatial area, causing widespread losses which exceed the ability of the affected systems or community to cope with using its own resources. It results from the combination of hazards, conditions of

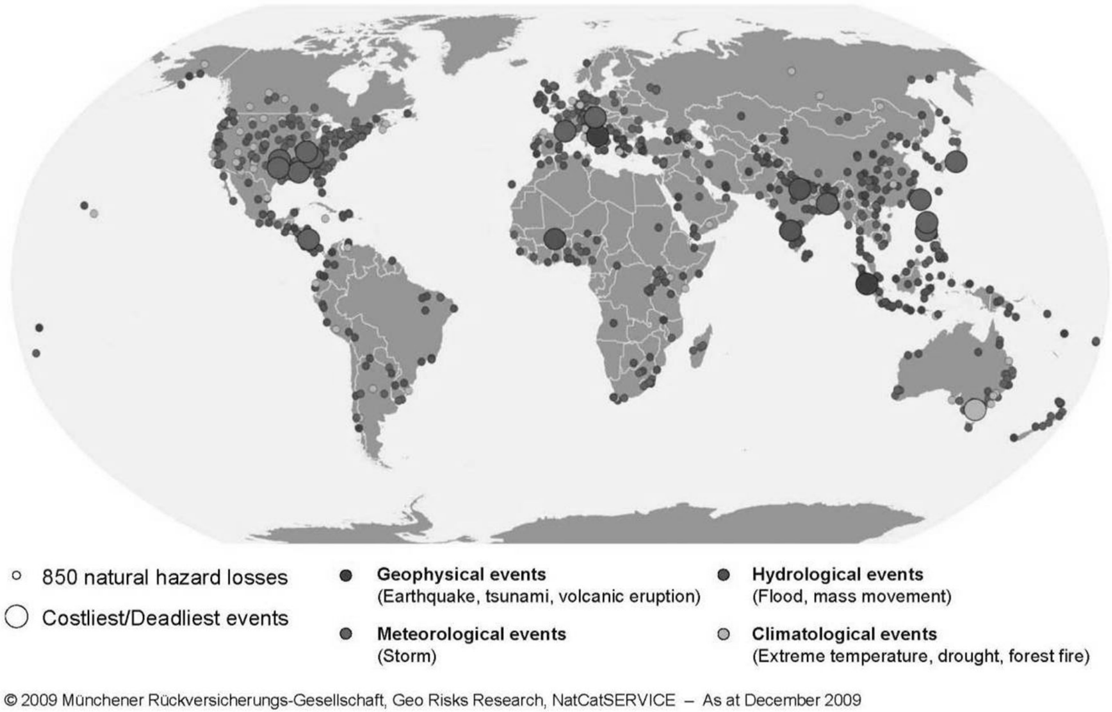


Figure 6.3 Spatial Distribution of Disaster Events Registered in 2009.[14]

vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk.[15]

Hazards are defined as potentially damaging events, phenomena or human activities that may have a negative impact on cultural, economic, environmental, institutional, physical or social assets. These could be geophysical hazards such as earthquakes, tsunamis, volcanic eruptions; meteorological or hydro-meteorological hazards like storms or floods; climatological hazards such as heat waves, droughts or forest fires; environmental hazards such as pollution, epidemics like AIDS or the different influenza viruses; technological hazards such as industrial accidents (fires, leaks, explosions and spills); and conflicts like war or terrorism.

Vulnerability is the degree of susceptibility and resilience of exposed elements to hazards; this degree changes according to physical or mental condition, socio-economic status, education level, gender, age, and sometimes also political and/or religious affiliation.[16] The causal factors of vulnerability are basically of three kinds: first, exposure, defined as the elements of society and environment that might be affected by a hazard; second, susceptibility or the predisposition to be affected due to the level of fragilities of human settlements, disadvantageous conditions and relative weaknesses in the physical, ecological, social, economic, cultural and institutional dimensions; and third, lack of resilience or the limitation of resources, and the incapacity to adapt and respond to the impact of the events.[17]

This chapter will concentrate on the susceptibility in the social dimension in which the topics of age and physical or mental conditions are described. Wisner uses the term “social vulnerability” and mentions several approaches: demographic, taxonomic, situational, contextual and proactive.[18] Here the taxonomic approach is used, which is focused on the vulnerability of social groups regarding the scale of casualties, injury, loss and disruption during the emergency, and the degree of difficulty, success or failure in the process of recovery.[19]

Age is one of the generally accepted characteristics that influences social vulnerability.[20] Physical and mental conditions are also significant factors, especially after disasters when everyone is struggling to survive or to help their relatives. Morrow distinguishes the groups of “the elderly, particularly frail elderly” and “the physically or mentally disabled” among others as the kind of categories identified in the vulnerability inventory undertaken in coastal Florida.[21] Author Ben Wisner quotes Y. F. Aysan, who considers eight types of vulnerability and elderly and disabled people fit into one or more than one of these categories, such as

> lack of access to resources (material/economic vulnerability), information and knowledge (educational vulnerability), limited access to power and representation (political or institutional vulnerability), or weak individuals (physical vulnerability).[22]

Those at the extremes of the age spectrum (the elderly and children) and the population with special needs have increased social vulnerability. It is therefore essential to develop different mechanisms for them to cope with the post-disaster period, because they need additional support and because they are a minority. They are usually invisible within the community and hence are ignored in the recovery period.[23] All elderly and disabled people are considered, per se, to be vulnerable groups in the community, but Wisner draws attention to diverse under-appreciated groups such as the elderly monolingual Russian immigrants in West Hollywood, who might experience increased social vulnerability to the effects of an extreme event.[24]

As Chang points out, defining recovery is essential.[25] She identifies three possible definitions of recovery: a) reaching the conditions existent before the event; b) reaching the state that would have been attained "without" the disaster; and c) reaching a new stable state. Each of these definitions is valid and all of them reflect different cases and recovery processes, taking into account the pre-existent conditions of vulnerability.

Several authors have developed classifications for post-disaster or recovery phases. The Kates and Pijawka model identifies four stages: emergency, restoration, replacement/reconstruction and developmental reconstruction.[26] Bowden, Haas and Kates proposed a model of disaster recovery activity, also divided into four periods: emergency, restoration, reconstruction I and reconstruction II.[27] Other authors identify different phases: assessment, planning, reconstruction and post-completion. Karatani and Hayashi, studying the case of Kobe, Japan, suggest four phases: phase 0, before an earthquake; phase I, related to confusion; phase II, emergency; and phase III, related to recovery.[28] These phases are not necessarily sequential: they can overlap because their boundaries are fuzzy and they evolve differently in every case. Finally, the United Nations Development Program (UNDP) has divided the time after an event into four phases: relief, early recovery, recovery and development.[29] The integration of the different approaches to classification of recovery after a disaster is depicted in Figure 6.4.

Post-disaster activities are focused on implementing the assessment framework to determine priorities.[30] This explains why the response and recovery, rehabilitation/reconstruction are all part of the strategy of disaster risk management.[31]

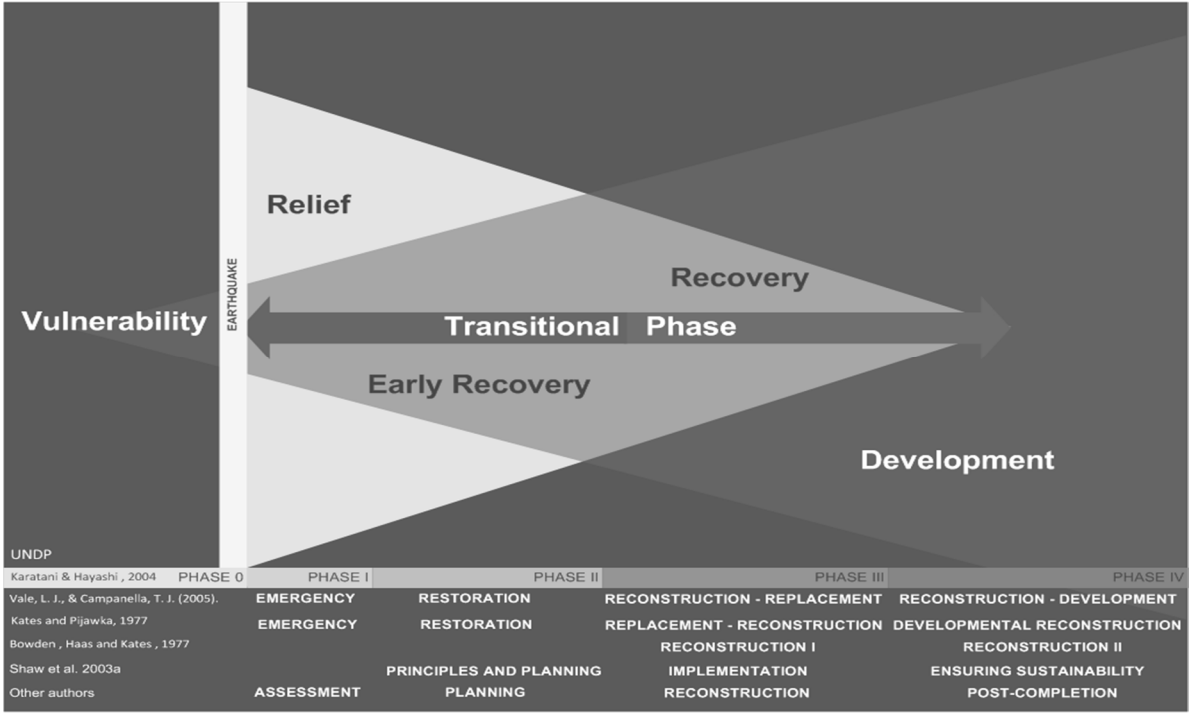


Figure 6.4 Adapted Graph Comparing the Classification by Different Authors of the Recovery Phases after a Disaster.[32]

The assessment of the recovery process should be done using indicators. Indicators are qualitative or quantitative measures resulting from systematic observation which describe characteristics of certain phenomena and allow assessment.[33] Karatani and Hayashi developed a recovery index (RI) in which the recovery of infrastructure is the basic issue in the recovery process and the main tool to encourage the reconstruction of the victim's life.[34] In this sense, life reconstruction represented in "housing, social network, livelihood, mind and body, disaster preparedness, government response and land use management" is considered something additional. The same authors only include vital statistics (live births, deaths, marriages, divorces, etc.) and public livelihood aid (millions of Yen), using people, total of expenditure on aid, livelihood, housing, educational and medical care as indicators in the social domain of their RI.[35] Beniya, on the other hand, proposes a RI in which one of the fields is "population" besides "housing, manufacturing, retailing, office and tourism."[36] Finally, in a more recent publication, Chang formulates a RI in which "population recovery" is considered first, then "business recovery" and "economic recovery".[37]

Case Studies

Kobe Earthquake. One of the most frequently cited cases, in which an earthquake affected mainly elderly people who additionally belonged to the low-income population living in the inner city, was the 1995 Kobe earthquake in Japan.[38] In Kobe, a group of elderly people who had lived in the downtown area were relocated to temporary shelters, which posed a threat to community links. The people experienced problems adjusting within a new cluster of people in the temporary shelters and the construction of social networks was slow. While younger people had positive opinions, elderly victims had a lot of concerns with regard to their future, possibly due to topophilia and the loss of the social networks they had developed prior to the earthquake.[39]

Shaw and Goda select as a case study the Nishi Suma Area of Kobe (shown in Figure 6.5) due to its high proportion of elderly people and children;[40] in this area, the community created a welfare network initially called *Nishi Suma Danran* (later shortened to just *Danran*) to provide sustainable services for the community. Danran was concentrated on three main activities:

> community mutual support system; formulation of the plaza project to continue a variety of activities; and a community network system.[42]

Figure 6.5 The Location of the Nishi Suma Area in Kobe, Japan. Image ©2010 Google, DigitalGlobe, Digital EarthTechnology, GeoEye.[41]

The community mutual support system consisted of welfare services paid for by the users, non-paid voluntary services and education activities focused on tackling community problems. The *home work assist service* included cleaning, nursing, chatting, gardening, cooking, shopping and accompanying elderly people to the hospital. In this way, it was possible to generate jobs to attend to the needs of the 5,000 elderly people in the Nishi Suma area. The *plaza project* was concentrated on the management of the *Inaba salon*, which operated as a meeting place not only for the aged and handicapped but also for working and non-working mothers.

This case is a good example of developmental reconstruction because it produced positive changes in Japanese society with the encouragement of voluntary non-governmental activities and the enhancement of the social networks.[43] It also enhanced relations between these organizations and the government.

It may be that one of the reasons for the creation of Danran is its focus on the care of elders, because of the significant importance and respect that elderly people are accorded in Eastern cultures, where they are considered the main advisors due to their experience. There is probably a correlation between this cultural attitude towards the elderly and the fact that Japan has the highest percentage of elders in the world at the moment.

The 1995 Chicago Heat Wave. Elders represent 13 percent of the total population of the U.S., a percentage which has been increasing since 1960. In 1995 a heat wave in Chicago created severe problems for the elderly population (Figure 6.6). At the time, elderly women with limited incomes and mobility problems refused to move to shelters, in spite of the fact that they could not afford air conditioning and they were afraid to open the windows due to fear of thieves.[44]

Semenza et al. carried out a study in this field, looking at the increase in hospital admissions with heat-related diagnoses.[45] In their research they found that there was an increase of 11 percent in hospital admissions during this period; 35 percent of the patients were people aged sixty-five and above. In most cases the problems were caused by dehydration, heat stroke and heat exhaustion. The researchers identified vulnerability conditions and susceptible populations in those who had underlying or co-morbid medical conditions such as diabetes mellitus, heart failure, alcoholism, and other kinds of cardiovascular, respiratory, endocrine, liver and kidney diseases. It was found that people with degenerative diseases of the central nervous system such as Parkinson's disease and Alzheimer's disease were also susceptible, as they were not able to take care of themselves by drinking enough water.

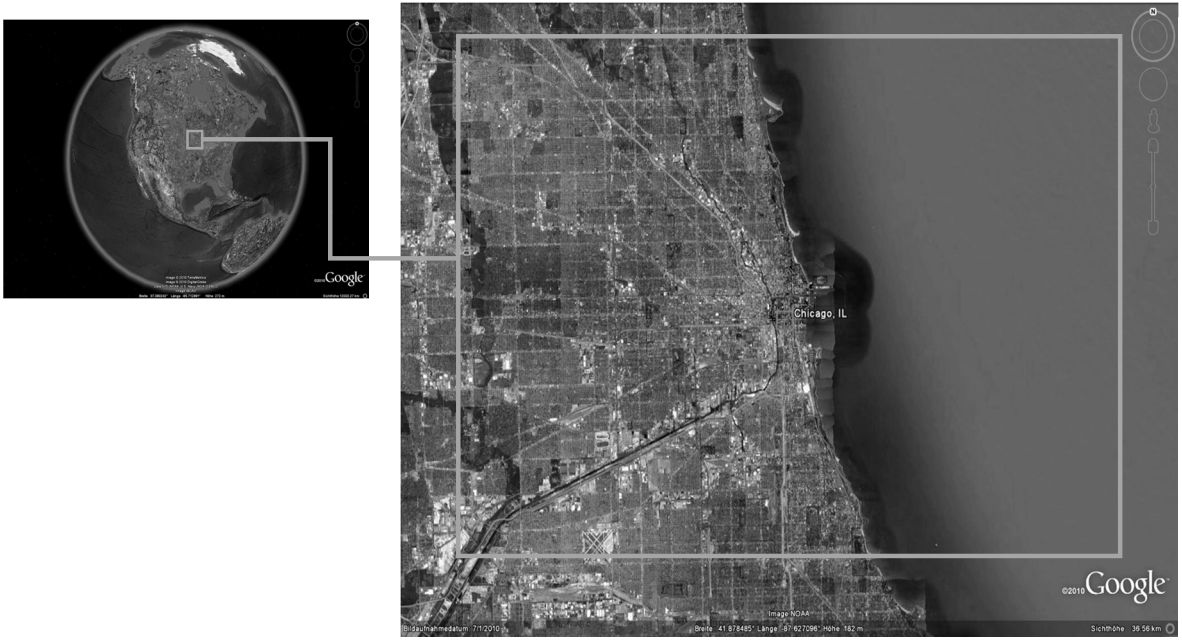


Figure 6.6 The Location of Chicago, Illinois, USA. Image (Left) ©2010 Google, TerraMetrica, DigitalGlobe; Image (Right) ©2010 Google, NOAA.[46]

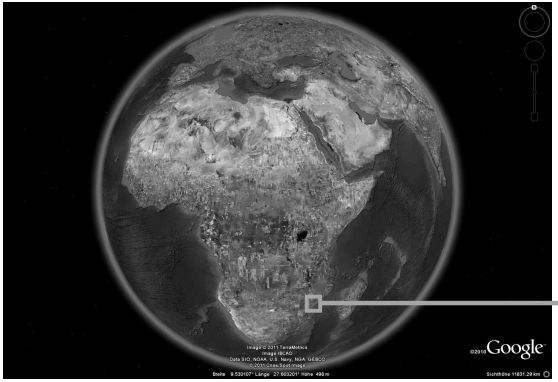
Another susceptible condition among elders arose from the dysfunction of their thirst sensation and physiological changes which made them more vulnerable to dehydration and less resilient to hot weather. These observations are consistent with those of Klinenberg,[47] which showed that socioeconomic status was also an important vulnerability factor.

Later, another study about heat-related mortality during 1999 was undertaken by Naughton et al. in the same area.[48] The heat wave was the second most deadly of the decade. The study showed that 53 percent of the patients were aged above sixty-five years. Semenza et al. also found that cardiac disease or psychiatric illness such as depression, developmental delay and schizophrenia made elderly people more likely to die during heat waves.[49] Other vulnerability indicators found by this study were social isolation (living alone or not leaving home daily), living on the top floor, and having an annual income below $10,000, findings similar to those in the other studies.[50]

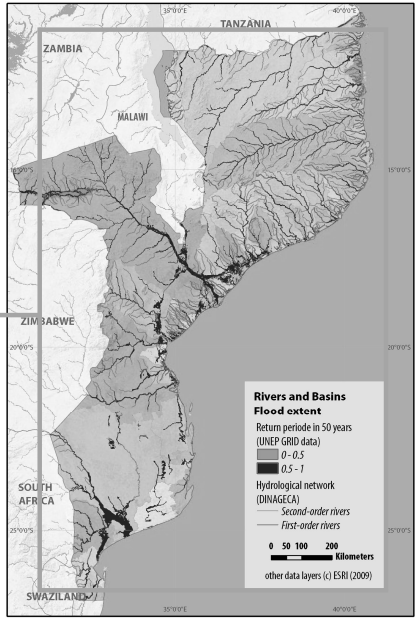
The most effective measures to improve the resilience of elderly people include having air conditioning, participating in group activities, sharing time with pets and taking additional showers and baths during heat waves. Other measures such as fans or visiting cooling centers were found not to be significantly effective. The conclusions of this study show that it is important to enhance the social networks around elders, making face-to-face assessments of their health status and disseminating educational messages to them about the two most serious types of heat-related illness: heat exhaustion and heatstroke.[51]

Floods in Mozambique. From 1999 to 2000, Mozambique (Figure 6.7) was affected by the highest rainfall rates since 1951. This caused massive floods in the center and the south of the country, affecting over a million people.[52]

Matsimbe points out that although the government asked for international assistance, the social networks (neighborhood, friendship, kinship, church, etc.) in Búzi played a key role as first responders when the floods struck.[53] The fishermen lent their small boats to evacuate people, especially elders and other vulnerable people such as women and children, to bring them to safer places where they could receive more assistance later. Nevertheless, elders had to struggle to get food and resources from relief agencies. Sometimes they faced physical violence



a) The Location of Mozambique.



b) Rivers and basins flood extent in Mozambique.

Figure 6.7 Mozambique. Image (Left) ©2011 Google, TerraMetrica, IRCAD.[54]

because of the lack of coordination with authorities in the provisional accommodation centers.

It is important to stress that the actions described above during the relief efforts demonstrate on one hand the strength of the existing social networks, and on the other hand the awareness of the needs of the most vulnerable population, which is also important during recovery.

Mozambique presents one of the lowest percentage of elders among their total population (3 percent), but the elderly are respected in the community, as was demonstrated by the research carried out by Kienberger (2010) (see below).[55] The author mentions that in the participatory exercise to delineate the risk areas, the final decision was taken by the elders and the community head; the reason for doing so is their knowledge and experience with past flood events.

Floods in Salzburg. Austria, like most of the countries in Europe, has a significant percentage of elderly people in its population (17 percent). The demographic statistics shown in Figure 6.8 indicate that the proportion has been increasing over the past forty-nine years. The Salzach River has flooded the city of Salzburg in 1571, 1789, 1899, 1920 and most recently in 2003, causing considerable damage to the city and the province. Kienberger, Lang, & Zeil,[56] in their paper *Spatial Vulnerability Units—Expert-Based Spatial Modeling of Socio-Economic Vulnerability in the Salzach Catchment* (2009), considered population age as one of the indicative variables for assessing vulnerability in the case of floods. Different weights were allocated to three groups: people younger than twenty years, people between twenty-one and eighty years, and finally people older than eighty-one years. A team of experts ranging from practitioners (government and NGO members) to academics were asked to allocate scores to each group, taking into account their relative importance and contribution to the vulnerability level of the city in the event of floods. The outcome of the vulnerability modeling is plotted in an analytical 3-D view (Figure 6.9).

A brainstorm session was carried out to select the indicators to assess the vulnerability in the same case study area, but this time for the MOVE project. MOVE project is a project to create a continued and updated approach for the assessment of vulnerability to natural hazards in Europe.

On this occasion the variable of age was again considered as a possible indicator of susceptibility in the social dimension, but this time the intervals were different: population aged five and below, between six and fifteen years old, sixteen and sixty-five years old, sixty-six and eighty-five years old, and finally population aged eighty-five and above. Additionally, the variable of disabilities among the population was

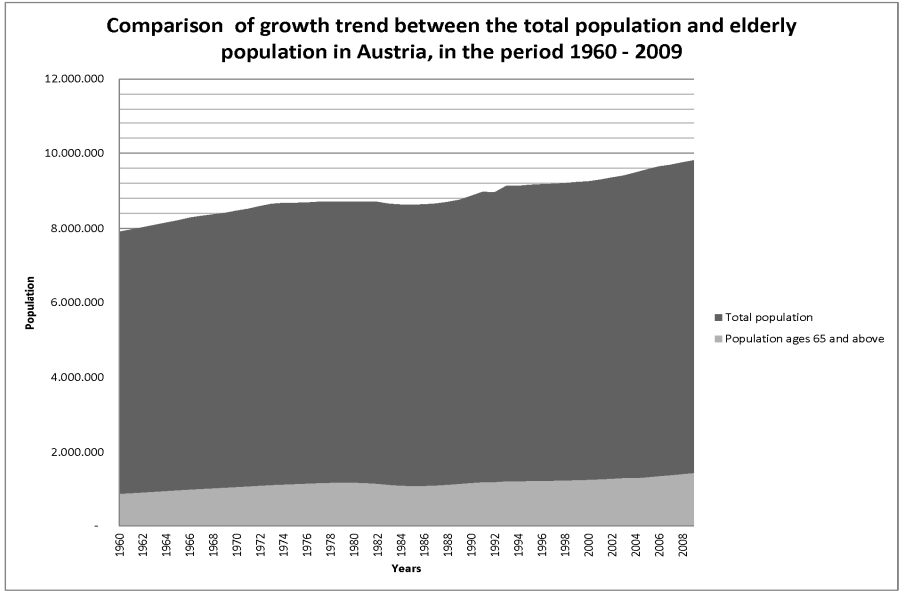
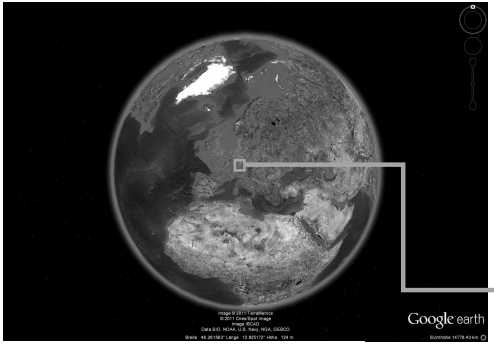
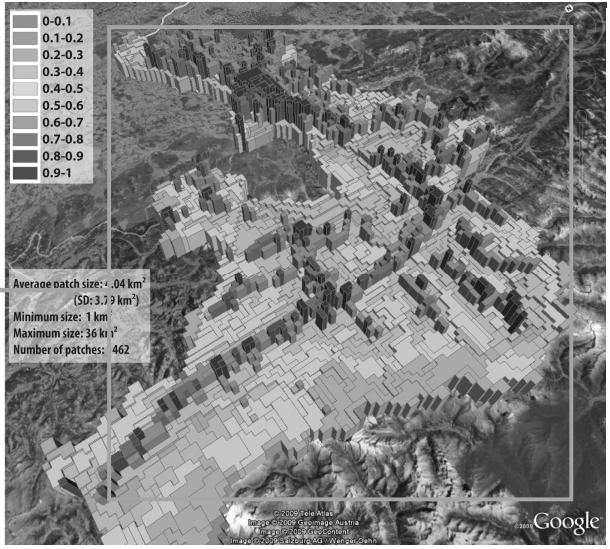


Figure 6.8 A Comparison of Growth Trends between the Total Population and Elderly Population (Age Sixty-Five and Above) in Austria.[57]

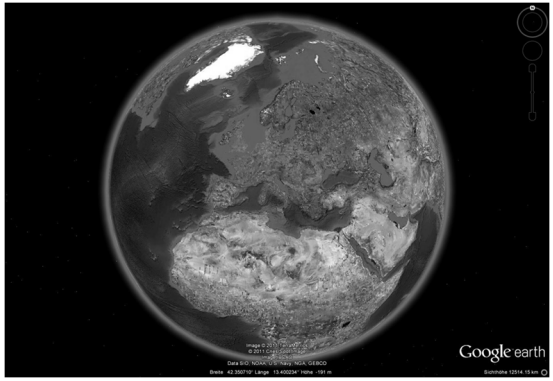


a) The location of Salzburg.

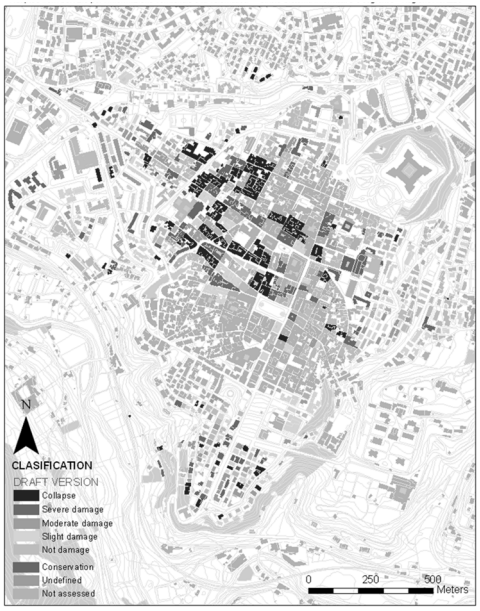


b) Visualization of Vulnerability Units (Height Reflects the Vulnerability Index).

Figure 6.9 Salzburg. Image (Left) ©2011 Google, TerraMetrics, Cnes/Spot Image, IBCAO; Image (Right) ©2009 Google, TeleAtlas, Geoimage Austria, GeoContent, Salzburg AG/Wenger Oehn.[58]



a) The location of L'Aquila.



b) Degree of damage and its spatial pattern in L'Aquila (Italy) after the earthquake.

Figure 6.10 L'Aquila. Image (Left) ©2011 Google, TerraMetrics, Cnes/Spot Image, IBCAO.[59]

considered as an element to be included in the index as an indicator of susceptibility in the social dimension.

L'Aquila Earthquake. Among European countries, Italy and Germany have the highest proportion of elders in their populations (20 percent). L'Aquila is the capital of the Abruzzo region and of the province of L'Aquila, located in the center of Italy. On April 6, 2009, a 5.0 earthquake shook the city of L'Aquila, resulting in 308 deaths and 1,500 injuries (202 of them serious);[60] 60,000 buildings were damaged and 67,500 people were left homeless. The location of L'Aquila and the process of extracting the damage indicators are detailed in Figure 6.10.

The casualties were mainly women aged between twenty to twenty-nine years and over seventy. The management of the recovery process in L'Aquila has been widely criticized. The decision to evacuate the city center, relocating people without considering the impact of breaking their social networks; the use of expensive devices (seismic or base isolation systems for new buildings which enable them to survive a potentially devastating seismic impact); the building of housing complexes not connected to wastewater treatment or in conservation areas in places far from the city center and without any urban facilities or amenities—all of these aspects of the management of the recovery process have been criticized.[61]

Nevertheless, there have been some positive elements relating to elderly and physically and/or mentally challenged people and these can be regarded as good indicators of development in the social dimension. The law allowed the city government to make specific rental agreements to supply housing within a maximum limit of 250,000 Euros per year during a period of three years in favor of families under social or economic difficulties or disability conditions.[62] The government also allocated financial support (200 Euros per person) for households living in the earthquake area who were willing to host one- or two-person households (singles, elderly, couples or single parents), in order to facilitate their proximity to the communities/municipalities where they lived before the earthquake. The main condition was that both parties (those providing lodging and those needing lodging) had their residence in the surroundings of the affected area. Furthermore, the German embassy allocated financial support to build the "Casa Onna", which would be not only the headquarters of several social organizations but would also accommodate a center for the elderly and have an auditorium for events.[63] Finally, the University of Florence is going to undertake a research project: Integrated Health, Social and Economic Impacts of Extreme Events: Evidence, Methods and Tools (MICRODIS), with the aim of studying the

epidemiological, social and economic effects of the earthquake that struck the city of L'Aquila. The project will review the health and well-being of survivors in the period of twenty months after the earthquake (especially victims living in temporary shelters),[64] and it is expected that the topic of elderly and disabled people will be addressed.

Rebuilding Communities

In the response or relief period, elderly and disabled people are considered as a multi-priority group (MPG),[65] *low mobility groups or potential evacuees without* vehicles,[66] because they are physically and sometimes mentally challenged people.

In the recovery phase, vulnerable groups can reduce the degree of resilience in a community affected by a disaster due to their need for care, irrespective of injury or otherwise.[67] Elderly and disabled people usually have constraints upon, or concerns about, their mobility. They also frequently have particular requirements with regard to medicines, therapies, controlled environments or protection that make their survival more difficult in the relief period. O'Donnell, Smart and Ramalingam claim that these groups are usually overlooked after a disaster and the needs of their households are frequently forgotten, or temporarily put on hold during disaster recovery and response.[68] The first priority in the response or relief period is to save their lives; in the early recovery and development phase, the focus is on how to take care of them. Local people usually provide all the life-saving actions and initial emergency support such as blankets, transport, medicines and labor.[69] Shaw and Goda (2004) and O'Donnell, Smart, & Ramalingam (2009) observe that "pre-existing community-based organization (CBOs) helped fill the gap between government support and people's immediate and long-term needs."[70] Community assistance as a coping strategy was also relevant in the recovery process for Kobe's elderly.

It is very important to develop resilience conditions around elders and disabled people to enable them to reconnect with their social network for a quick recovery. Recovery plans should be based on a profound knowledge of the community and its context.[71] Social capital is essential to encourage members of the community to share in collective recovery action, and to support government investment in risk reduction and disaster recovery.[72]

Matsimbe asserts that it is necessary to involve all the community members, including the elderly and those disabled who have less severe impairments, and take into account local cognitive factors to formulate long-term rehabilitation processes, planning and recovery programs, as

well as to build and support social networks.[73] The aim is to reduce levels of vulnerability, avoid pre-disaster conditions and ensure that decision-making is not divorced from local level reality.

The attention to elderly and disabled people should rely on social capital, understood as community-based skills, programs and local networks, because it can produce positive results with respect to "client satisfaction, more rapid disbursement and local empowerment";[74] it does however require enormous investment of time and human resources.

Additionally, the World Bank has observed that social networks encourage people and "should be considered in all the stages of the response."[75] Such social networks can range from links to relatives sending remittances to complex membership of organizations. The risk of undermining social networks is one reason why moving people to temporary camps may not be a good idea. Awareness of the value of social capital is one reason why communities are reluctant to relocate after a disaster. One example of a quick recovery was the case of the Yogyakarta earthquake in 2006, which was attributed in part to the fact that existing community social structures were intact.[76]

Cosgrave says that the agencies in charge of the emergency response should analyze relief and recovery policies to establish their impacts according to the different age groups and the physical and mental conditions of people.[77] Recovery is not neutral and the interventions in this phase could increase, reinforce or reduce the inequalities. To reduce inequalities, it is necessary that agencies pay attention to issues of social protection. Governments usually have plans to dispatch relief and quickly mobilize resources, but they usually are not adequate enough to accommodate the special needs of the elderly and disabled population who need more attention and care.

The Use of GIS in Disaster Management

Pre-disaster activities are concentrated on preparedness. These include maintaining a risk register, having a preparedness plan and establishing an early warning monitoring system.[78] It is necessary to include indicator data regarding the condition of elders and disabled in the vulnerability assessments in these systems, in order to incorporate their requirements into a city's emergency plan, because these special needs populations are usually unrepresented in disaster GIS as a result.[79]

In this sense, it is important to work with data about the size of population, age, classification and degree of disability, according to the ICIDH, ADL or *Katz Index*; daily requirements (where do these people

spend time?) and their local social networks; this data will allow the spatial pattern of their social condition to be identified.[80] Aid is appropriate only if it meets the needs of the affected population. For that reason, it is necessary to consult people before and during the emergency stage. It is also necessary to take into account issues such as spatial data acquisition and integration, interoperability, distribute computing, dynamic representation of physical and human processes, scale, spatial analysis and uncertainty as part of the technical concerns related to the implementation of Spatial Decision Support Systems (SDSS).[81]

During any disaster and during an emergency response, the most important criterion is to reach the people as quickly as possible; hence, it is very important to devise and plan response systems based on location and accessibility. Ramsey et al. (2001) observe the use of GPS (for coordinates) jointly with GIS and remote sensing data to undertake a quick damage estimation, information which can be useful in deciding where to look for injured and casualties.[82] It is essential to work with geospatial indicators that allow emergency response planners to estimate the risk condition of this population based on their location and the location of the physical networks, e.g., roads, hospitals, special schools etc., and social networks such as relatives, friends or people in charge of their care.

Responsible organizations could track ongoing needs and gaps in emergency services across these groups by using extensive assessment and by collecting disaggregated data.[83] Nowadays, GIS links geographic information with descriptive information, making it possible to do various geographic analyses, such as combining layers of information about where things are with non-spatial data and attributes about those things. This technology enables government officials to allocate priorities, consider alternative options and reach efficient solutions. GIS is useful to map locations and needs, and to identify gaps and shortfalls in services. GIS could be used to identify optimal locations with willing providers to make available additional services to help people in more effective ways: for instance, GIS can show the importance that elders attach to different elements in the landscape, such as forests or parks, connecting qualitative and quantitative data in a geographic context.[84]

GIS can georeference these individuals and overlay this spatial information with information about land use, hazard-prone areas, transportation routes for potential evacuation,[85] conditions of buildings, and closeness and accessibility to hospitals or specialized care centers. After such a spatial analysis, it is possible to consider the scenario of their requirements and the situation of their social networks. It is necessary to meet the different requirements of elderly and disabled people to

understand their vulnerabilities and respond effectively to their special needs after a disaster.[86]

It is essential to know how to support these vulnerable communities after disasters.[87] It is therefore necessary to locate elderly and disabled people in order to assign special attention to these areas in the emergency response plans. The assessment of existing support networks will improve the understanding of the support lost due to the casualties among their social networks.

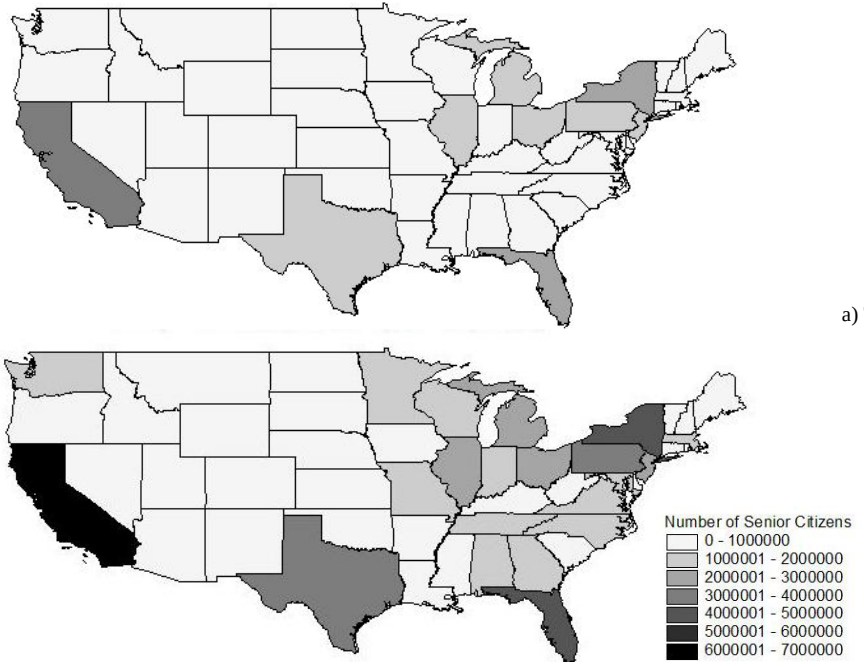
Steinberg and Steinberg describe the example of a local senior citizens' center: this organization is in charge of providing food to elders who are shut-ins in a city.[88] Hence, it is necessary to have answers to the following questions: how many people are provided with this service, how does the center plan the food distribution efforts, where are the sponsors of this organization, at what time there are traffic jams around the areas served by the center, and what can the senior center do to avoid problems with the traffic and the older adults? With this information, GIS can document the success of the organization, taking into account its particular spatial context and using it as a model for institutions with similar goals.

Steinberg and Steinberg put forward another advantage of using GIS for data classification as an analytical tool to conduct research regarding elders.[89] In Figure 6.13, they compare the results of looking at the retired population in the U.S. according to two different definitions of "elders": the Social Security definition of seniors as aged sixty-five and older, and the American Association of Retired Persons (AARP), which defines seniors as fifty and older.

Conclusions

Future research could usefully analyze the spatial correlation between hazard-prone areas and the location of elderly and disabled people. This would allow agencies to focus attention on this minority group and to reduce their vulnerability. During the preparedness phase, spatial analysis using GIS could be helpful in planning action to provide for this population and to include them in the recovery processes with greater accuracy.

Disaster managers should have some technical GIS education and training, in order that they will be aware of the spatial analytical capabilities of GIS and hence change the conception that GIS only provides maps.[90] The use of GIS and remote sensing in emergency response goes from the position of logistical support and resources for the Urban Search and Rescue (USAR) teams and preliminary damage



a) The Social Security definition.

b) the American Association of Retired Persons (AARP) definition.

Figure 6.11 Number of Senior Citizens in the United States. A comparison of maps showing the number of senior citizens in the lower 48 United States according a) the Social Security definition and b) the American Association of Retired Persons (AARP) definition. These maps are based on the raw number of individuals in 1990 census data.[91]

assessments, to maps depicting the availability of services (water, electricity, telephone, subway, roads).[92] During early recovery, recovery and development, GIS and remote-sensing capabilities are necessary to monitor the advance of the process both physically and in the social and economic dimensions with the use of proxy indicators. In order that first responders and disaster managers or decision makers use the full potential of GIS, it is necessary to have an understandable user interface and the willingness to adopt new technologies.[93]

Possible actions for agencies in the preparedness phase include empowering communities by training them in first aid and/or (light level) search and rescue, and the implementation of evacuations plans. Cosgrave, like other authors, claims that community disaster preparedness is important because most survivors are rescued by people close to them such as relatives, friends or neighbors (social networks) rather than organized rescue teams.[94]

As Wisner says, it is necessary to study and understand how elderly and disabled people as well as the poor, working-class people, ethnic minorities, youth and children can be encouraged to work in the development process with local knowledge of their cultural environment.[95] These groups have often been referred to as "ignorant", "superstitious", "uneducated" or "incapable" but they, including elderly people, can be essential in bottom-up approaches in a development process to identify issues, priorities, potentials, problems and appropriate solutions.[96]

The post-disaster phase offers some opportunities for promoting social change, but response planning should be based on the reality of the affected country.[97] If some agencies have taken the opportunity in the post-disaster phase to promote girls' schooling and women's access to medical care in countries like Pakistan,[98] why not take similar opportunities to improve the conditions of elderly and disabled people after the event? Using their knowledge and following not only their recommendations but also suggestions from people around them in a community-based recovery process could considerably improve the recovery process. The improvement in the condition of elders and physically and mentally challenged people will be a real indicator of development after a disaster if standards do not just return to the pre-existent state but are raised so that their susceptibility, and hence their vulnerability, is reduced.

The key is community-based activities and organizations, because these allow people to express real needs and priorities, making it easier to understand problems and respond to emergencies quickly;[99] however, it is

important to address the duality between efficiency and effectiveness in a participatory process.

Post-disaster policies aimed at sustainable redevelopment should be equipped with an analysis of the components of vulnerabilities that comprise an indicator system and how these can be most effectively influenced during both the short-term and the long-term phases.[100] With the latest mapping technologies backed by efficient data-handling procedures like GIS, these tasks could be more feasible, accessible and manageable.

It is imperative to have standardized data available about physically and/or mentally challenged people in the world in order to be able to include them with equity in vulnerability assessment and in recovery plans. One of the cross-cutting issues in local level recovery programs is not only to ensure the participation of elderly and people with disabilities, but also to promote their fundamental human rights.[101] The UNDP policy on early recovery stresses the importance of respect in monitoring the integration of cross-cutting issues into early recovery planning and programming (UNDP, 2008).[102]

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