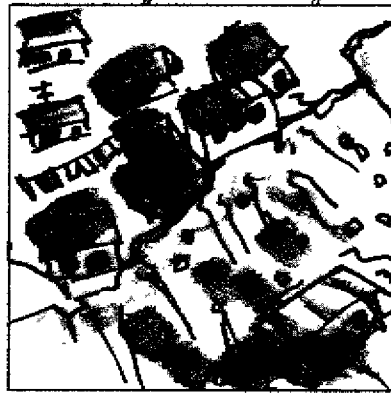


What Makes Cities Vulnerable to Disasters?



Rapid Growth and Inadequate Planning

As cities cannot always manage rapid population growth, poor people settle illegally in hazardous areas (Less hazardous areas are already occupied.) Basic services are lacking, and local governments as well as new settlers often have too many daily problems to worry about preventing disasters that may occur years later.



Ecological Imbalance

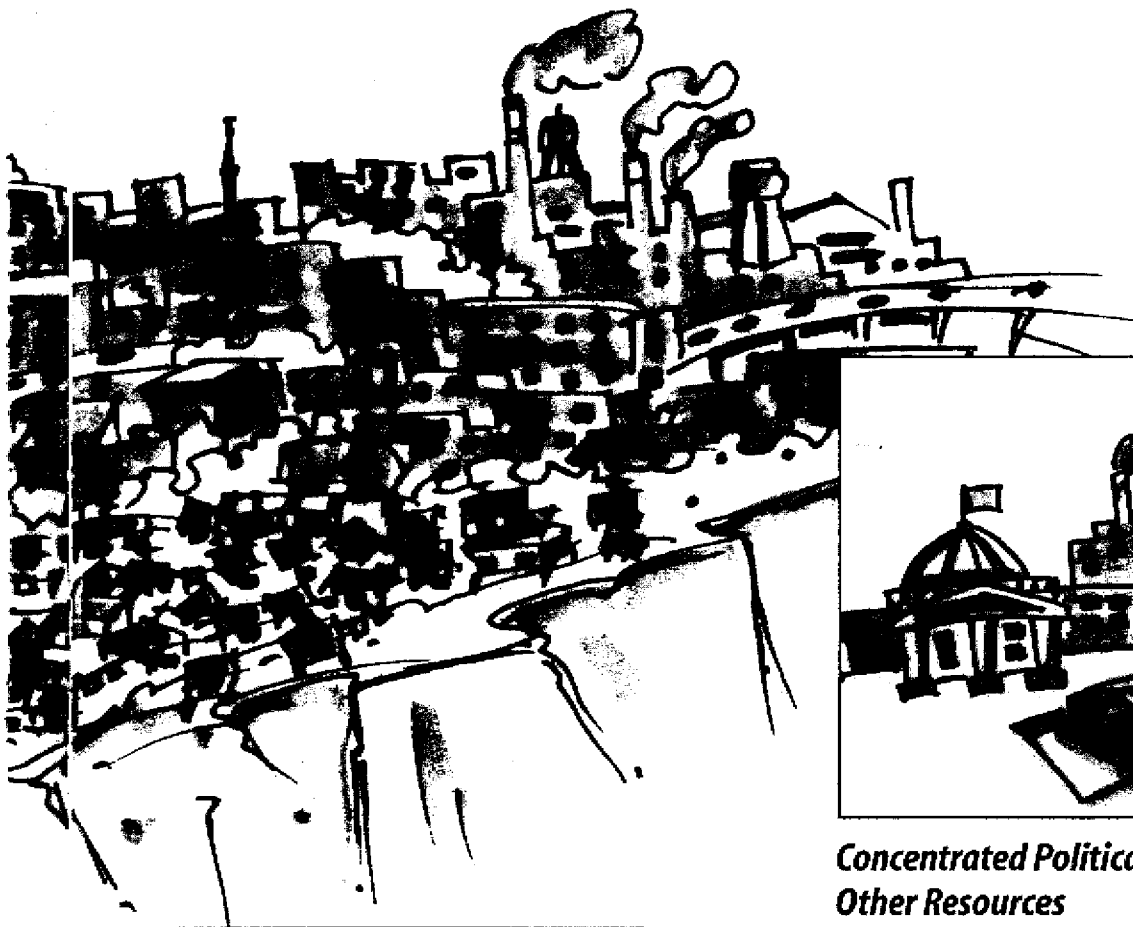
As rapid urban development changes local ecosystems, "natural" disasters can result. A shortage of appropriate drainage systems, squatter encroachments on waterways, and insufficient planning has made some cities vulnerable to flash floods. In others, deforestation has led to hillside erosion, making people vulnerable to landslides triggered by heavy rains. Overuse of groundwater resources leads to land subsidence,

making the area more vulnerable to flooding or earthquakes. The use of concrete has changed the ability of soil to absorb water, leading to flash floods.



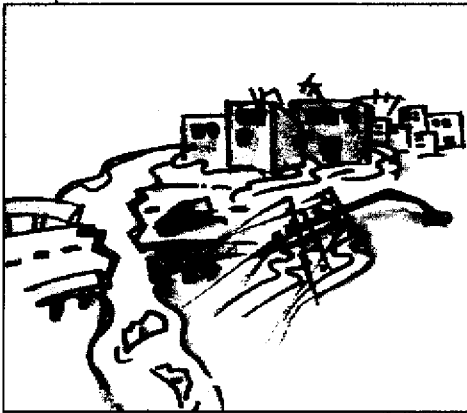
Population Density

When people are concentrated in a limited area, a natural hazard will have a greater impact than if people are dispersed. Population density in the largest cities in developing countries is high, and often higher in old parts of the city or in squatter settlements.



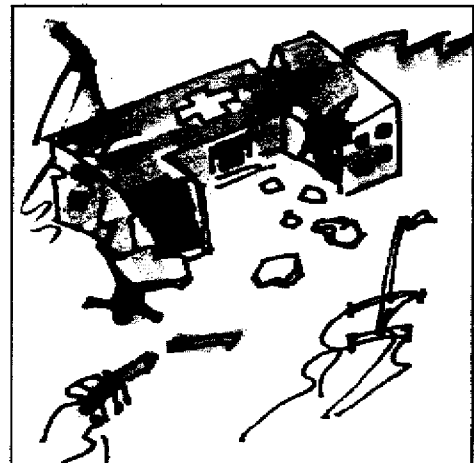
Concentrated Political, Economic and Other Resources

Too many political, industrial, financial or other resources in one urban area can have regional, national or even international repercussions. If a major earthquake were to strike Tokyo, for example, global financial markets could be affected.



Dependency on Infrastructure and Services

People in cities depend on infrastructure and public services. It is difficult for the population to meet their daily needs if the electricity is cut, bridges have collapsed, telephones don't work and water mains are broken. Essential services such as health care and firefighting are especially important after a disaster. After the Mexico City earthquake in 1985, the collapse of hospital buildings killed trained personnel, seriously hampering health services.



Inappropriate Construction

Many people die in buildings that collapse in a disaster. In earthquakes, up to 80% are killed by falling buildings. Brick buildings without a concrete frame are often dangerous in an earthquake. Wooden houses need to be strapped to their foundations so that they don't blow away in hurricane winds. Improving construction methods is usually effective in reducing casualties, and can be done at low cost.

The Urban Poor are Most Vulnerable

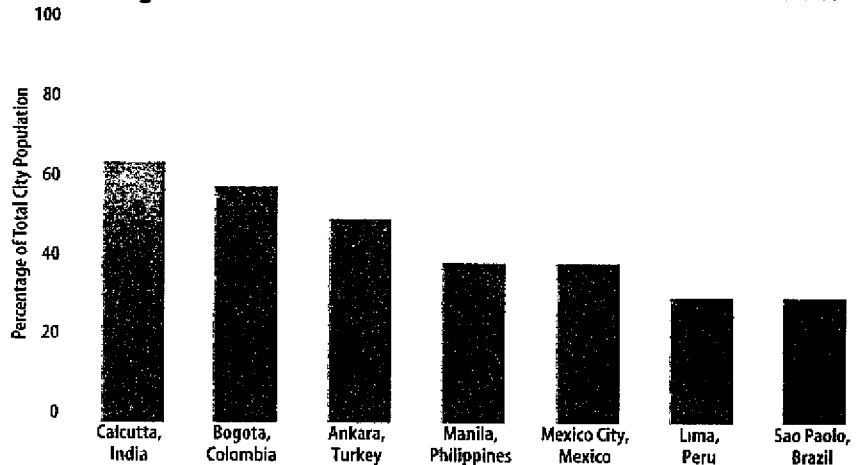
Urban disasters are selective in whom they strike hardest, and the poor are the most vulnerable. Those who can afford it avoid ravines prone to landslides following storms or earthquakes, or marshy areas and riverbanks prone to seasonal floods. As cities continue to grow exponentially, marginal land is often all that is left. The urban poor live in these areas to be near a source of income (whether they are fertile flood plains or industrial factories).

Conventional solutions for urban disaster mitigation in developed countries are not easily applicable to the urban poor. Building codes, zoning measures and urban planning techniques, for example, are difficult to enforce when people occupy land illegally. Consequently, these measures have had little impact in reducing vulnerability of the urban poor.¹

Why Focus on Informal Settlements?

- ▶ A very high percentage of people in cities in the developing world live in informal settlements (*see graph below*).
- ▶ This percentage will continue to rise. Informal settlements grow at about twice the average urban rate. They double every 5 to 7 years, while the overall urban population doubles every 12 to 15 years.²
- ▶ The urban poor rarely own their homes. Residents have little incentive to improve land they don't own.
- ▶ Governments rarely are able to provide adequate water, sanitation and other services for squatter inhabitants. They can hardly keep pace with new growth. (Istanbul, which hosted the UN "City Summit" Habitat II, is growing by about 450,000 people each year, and already has 10 million inhabitants.) Furthermore, city authorities often fear that they sanction and encourage settlements on unauthorized land by providing services.
- ▶ Many informal settlements are located in environmentally vulnerable areas: ravines, deforested hills, marshes, riverbanks and floodplains.

Percentage of Informal Settlements in Selected Disaster-Prone Cities



Sources: *Global Report on Human Settlements*, UN Center for Human Settlements, Oxford University Press, 1987, *At Risk*, P. Blaikie, T. Cannon, I. Davis, B. Wisner, Routledge, 1994

The 1976 Guatemala "Class-quake"

Twenty years later, the urban poor are still at risk

Highly vulnerable to earthquakes, floods and landslides, Guatemala City is one of the most disaster-prone areas of the country. No disaster in Guatemala is more memorable than the 1976 earthquake. The disaster killed 23,000 people. In Guatemala City, it left 1,200 dead and 90,000 homeless out of a population of 1.3 million. Twenty years later, the 1976 quake and its aftermath continue to serve as a vivid example of how disasters affect people in urban areas in unequal ways

The consequences of the 1976 earthquake on the country's social structure were profound and the inequitable nature of its damage is still evident today. Many in the poorest sectors of society have yet to recover from their losses. The quake demonstrated that vulnerability of the urban poor of Guatemala city was due to economic and political factors as much as the type of land and



Another example of the urban poor at risk to disasters: informal settlements in Manila.

buildings which were occupied.

A local journal reported at the time that "...almost all [of those affected] lived in the slum areas of the city. In this well known fault zone, houses of the rich have been built with costly anti-earthquake specifications. Most of the poorest housing, on the other hand, is in ravines or gorges which are highly susceptible to landslides whenever earth movements occur."

In the aftermath of the 1976 earthquake, many survivors left the steepest areas and resettled on safer, gentler slopes, a short

distance away, leaving the most dangerous areas unoccupied. Since then, the city's population has grown to some 2 million inhabitants. Due to accelerated population growth, a larger metropolitan area has emerged, exceeding the original boundaries of the city. As the memory of the 1976 quake fades, new generations of migrants and urban poor are willing to live in the disaster-prone areas.

Middle and high-class residential areas established in the steep terrain to the east of the city have been built to resist and mitigate the effects of natural disasters. Yet, many migrants and urban poor, in an effort to find solutions to their housing problems, often organize themselves to occupy vacant land and build in a haphazard fashion. A recent study identified 197 precarious settlements around Guatemala City, which encompass a total of 589,900 inhabitants, and include 76 sites considered highly susceptible to earthquakes, floods and landslides.⁴ Thus, 20 years later, the urban poor remain the most vulnerable targets for natural disasters.⁵

Natural/Technological Disasters: Few Plans to Meet a Growing Threat

Chernobyl and Bhopal have become shorthand to describe tragedies associated with a growing malaise of the last 50 years: technological disasters. The links between technology and natural disasters, however, are less well-known. Nevertheless, two trends are clear. On the one hand, urban natural disasters are increasingly likely to trigger technological disasters. On the other hand, technology also plays a hand in “natural” disasters, especially when development actions upset the balance of local ecosystems.

There are several examples of how natural disasters can lead to technological ones. Earthquakes may cause gas pipelines to rupture, causing major fires, as happened in the 1995 Kobe earthquake. During floods in the US Midwest in 1993, liquid gas tanks floated down the Mississippi River, posing a major technological threat. Drought and windstorms spread radioactive materials over a wide area in Russia in a 20-year period (*see box*).

There are also examples of how development practices, based on technological innovations, can lead to natural disasters. Loggers may cause deforestation, for example, leading to erosion and landslides during heavy rains. In another example, as land in cities is replaced by concrete, the ground's natural ability to absorb water declines, leading to flash floods.

These compound disasters are sometimes labelled by researchers as “na-techs” (natural/technological disasters). Na-techs are the clearest evidence of how distinctions between “natural” and “technological” disasters have become blurred, as more and more people echo the title of one well-known book *Natural Disasters – Acts of God or Acts of Man?*¹

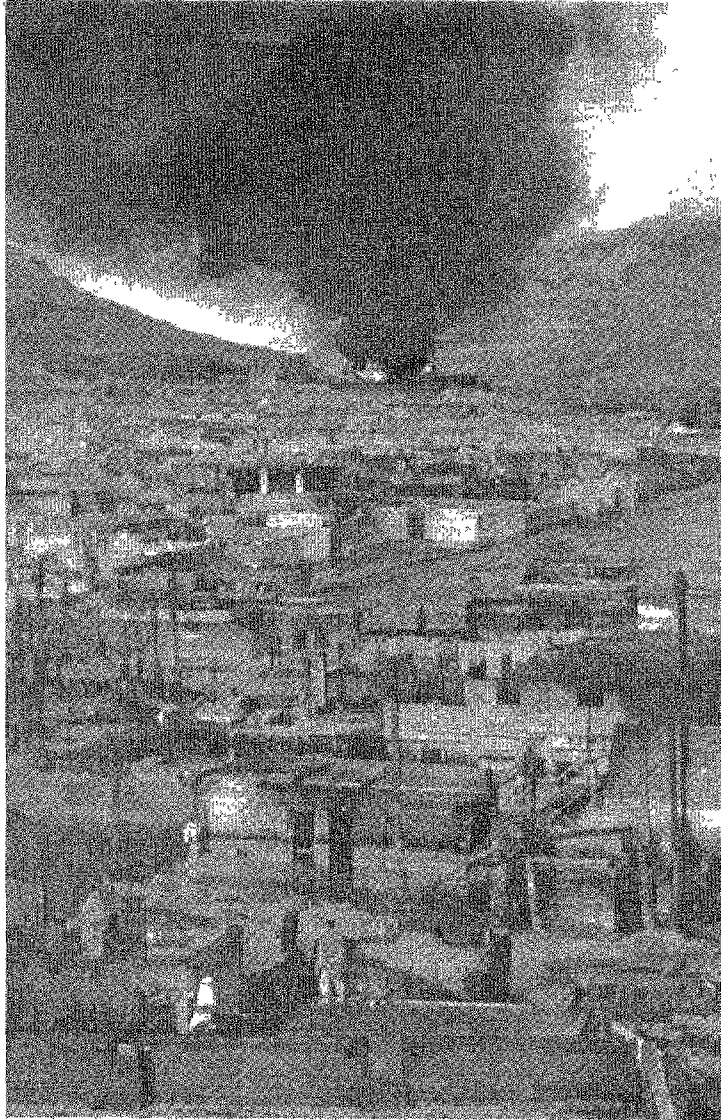
Research on the two-way relationship between natural and technological disasters is in its early stages. While more na-techs are occurring, preparations “remain cursory,” notes E. Quarantelli, a US sociologist and disaster expert.² As with the case of natural disasters, measures to reduce risks usually happen after the event. During the 1978 Sendai earthquake, for example, petroleum tanks with corroded bottoms poured oil into the adjoining bay. Within two years Japanese building codes were amended, and petroleum storage tanks are now be emptied and inspected for corrosion every five years.³

While all urban areas have technological disaster risks (more or less controlled), those most at risk to na-techs are rapidly growing cities in developing countries. Often, it is the same rapidly growing cities which are most at risk to natural disasters that are most at risk to technological disasters. With rapid industrialization, hazardous materials are accumulating in densely populated areas – usually with little attention to adequate zoning, planning and safety measures.

The question remains as to whether na-tech risks will be addressed by rapidly growing cities in developing countries, as they continue their quest for economic growth. The answers depend on city administrators and residents from those cities, but also from national and international partners. “Aid providers who usually finance...large scale payments in third-world countries do not consider disaster prevention plans as a prerequisite to funding such projects,” points out Christie Silva, an official at the Ministry for Shipping, Ports, Rehabilitation and Reconstruction in Sri Lanka. “Proper training and education in disaster preparedness is not considered important to large populations living in the vicinities of such projects. This has already caused some serious problems in developing countries that see quick industrial development as a stepping stone to Newly Industrialized Country (NIC) status.”⁴

Decoupling the link between technology and disasters is possible – but not widely practiced. Environmental impact assessments for new urban development projects infrequently assess potential natural disaster risks. Development projects in outlying areas don't always assess potential environmental effects that eventually may lead to floods, landslides or other natural disasters in adjacent urban centres.

Policy recommendations and practical techniques to make cities safer from natural disasters obviously can be extended to protect cities from na-techs. One can take many of the same concepts used for natural disaster



In a 1994 flash flood in Darinka, Egypt, oil storage tanks burst into flames

reduction (creation of emergency management committees, local public awareness programmes, hazard assessments, construction regulations, etc.) and adopt them to technological disaster reduction. For example, common sense dictates that a nuclear plant, or even an industrial plant with highly combustible materials, not be built along an earthquake fault.

How Disasters Affect Urban Areas, Large and Small

The few examples below indicate the many different ways in which major disasters affect urban areas, small and large, in every region of the world.¹ Taken collectively, these examples are representative of the range of social, health, economic, environmental, cultural and historical effects caused by recent disasters in urban areas. By no means is this a comprehensive list of major disasters in urban areas.

Spectacular disasters affecting megacities are often featured in the news. But that is only the tip of the iceberg. New evidence shows that the cumulative damage from thousands of lesser disasters may be even greater than the spectacular major disasters featured in the news.²

Megacities attract attention because of their scale – large concentrations of people, industry and government. *But all fast-growing settlements in hazardous areas are vulnerable – no matter what their size.*

Selected Recent Major Disasters in Urban Areas

(Ordered roughly by geographic region, left to right.)

1 Los Angeles (pop. 12.4 million), USA

The 1994 Northridge earthquake was the strongest to shake the region in two decades, killing only 57 but causing over \$30 billion of economic losses.

2 Mexico City (pop. 15.7 million), Mexico

A 1985 earthquake killed over 10,000 people, left tens of thousands homeless, destroyed nearly 34,000 buildings and affected 65,000 others.

3 Armero (pop. 25,000), Colombia

A 1985 volcanic eruption and mudflow rapidly buried the town and killed 21,800 – most of its inhabitants

4 Rio de Janeiro (pop. 9.9 million), Brazil

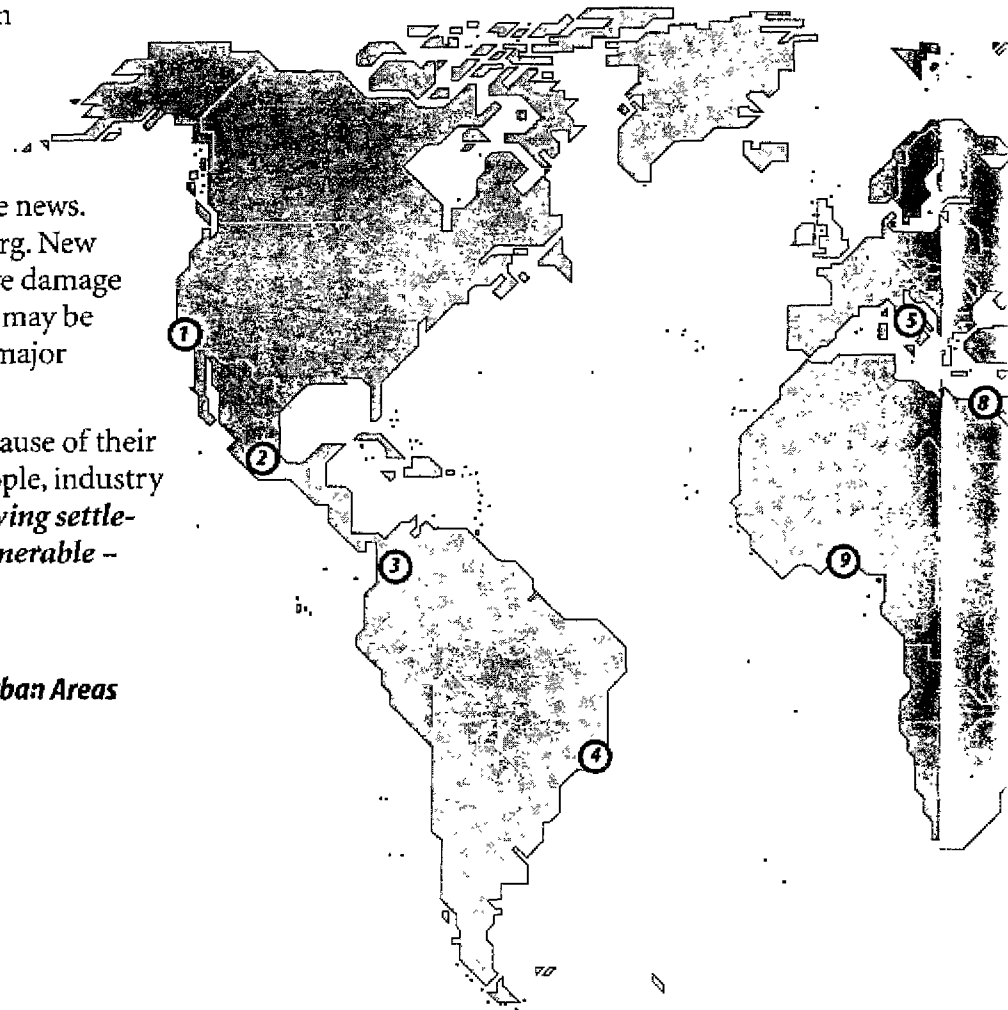
1988 floods affected nearly 20% of Rio inhabitants. Nearby cities of Petropolis and Acre also were stricken. Economic losses were just under \$1 billion. Greatest damage was to squatter settlements on unstable slopes.

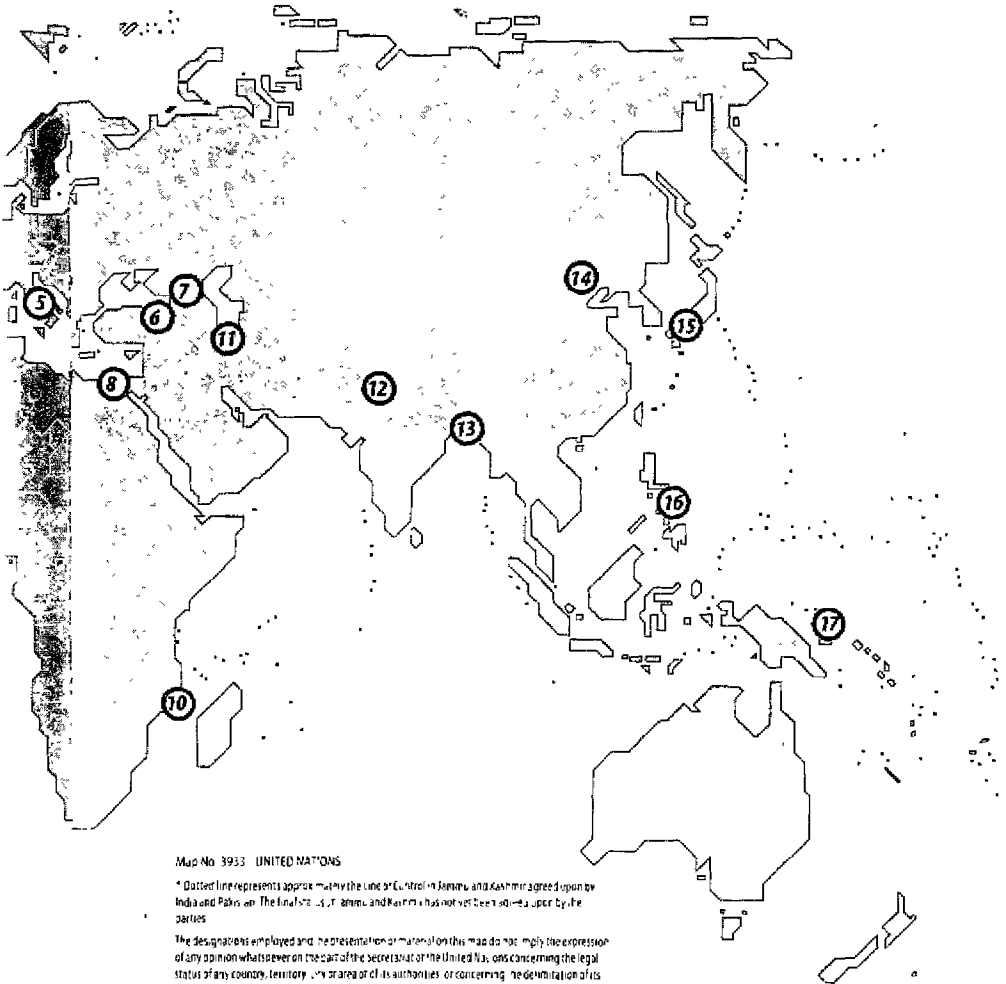
5 Naples (pop. 1,200,000), Potenza (100,000), Salerno (200,000), Avellino (60,000), Italy

The 1980 earthquake in Southern Italy killed more than 3,000 people in these and nearby cities. Dozens of historic urban centres were hit; about 75% of buildings around the epicentre were destroyed. The Pugliese aqueduct (largest freshwater distribution network in Europe) was blocked.

6 Erzincan (pop. 300,000), Turkey

The 1992 Erzincan earthquake affected 230,000, killed 547, and damaged or destroyed over 18,000 buildings





Map No. 3933 UNITED NATIONS

* Dotted line represents approximate line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been determined by the parties.

The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities or concerning the delimitation of its frontiers or boundaries.

7 Spitak (pop. 50,000), Gumri (220,000) and Vanadzor (180,000), Armenia

The 1988 Spitak earthquake killed over 25,000. New constructions (rapidly and shoddily built) were the first to collapse. Lack of water, sewage, electricity or gas caused 120,000 people to evacuate.

8 Cairo (pop. 9.7 million), Egypt

5,000 buildings were destroyed and nearly 12,000 were damaged, including historical monuments and many schools. The earthquake was perceived as "unexpected."

9 Cotonou (pop. 650,000), Benin

In the 1988 and 1991 floods, economic life stopped for a week. Floods are recurrent – 56% of houses are flooded regularly.

10 Nacala City (pop. 1.4 million), Mozambique

The 1994 cyclone Nadia destroyed 75% of homes and cut power and transport lines.

11 Manjil (25,000), Zanjan (25,400) and Rudbar (95,000), Iran

The 1990 Manjil earthquake destroyed three towns. It killed 40,000 people and left 500,000 homeless. (Rural areas affected included 1,600 villages.)

12 Uttarkashi (pop. 240,000), India

The 1991 earthquake triggered severe landslides which killed 2,000 people. About 90% of the houses in Uttarkashi collapsed.

13 Chittagong (pop. 2.4 million) and Cox's Bazaar (40,000), Bangladesh

A 1991 cyclone killed 140,000 in these cities and nearby islands.

14 Tangshan (pop. 1.8 million), China

The 1976 Tangshan earthquake killed 148,000 people and injured 81,000 in Tangshan City. 95% of houses and 80% of industrial buildings collapsed or were seriously damaged.

15 Kobe (pop. 1.5 million), Japan

The 1995 Hanshin-Awaji earthquake killed 6300 people (75% crushed/suffocated, 10% burned) and caused over \$100 billion in losses.

16 Ormoc City (pop. 45,000), Philippines

A 1991 mudflow following Tropical Storm Thelma killed 5,000 people and left nearly 46,000 homeless. Damage was \$27.7 million.

17 Rabaul (pop. 30,000), Papua New Guinea

In 1994, the Rabaul volcano erupted. Inhabitants evacuated the area rapidly, but 40% of buildings, transport and communications were damaged by ash and lava.