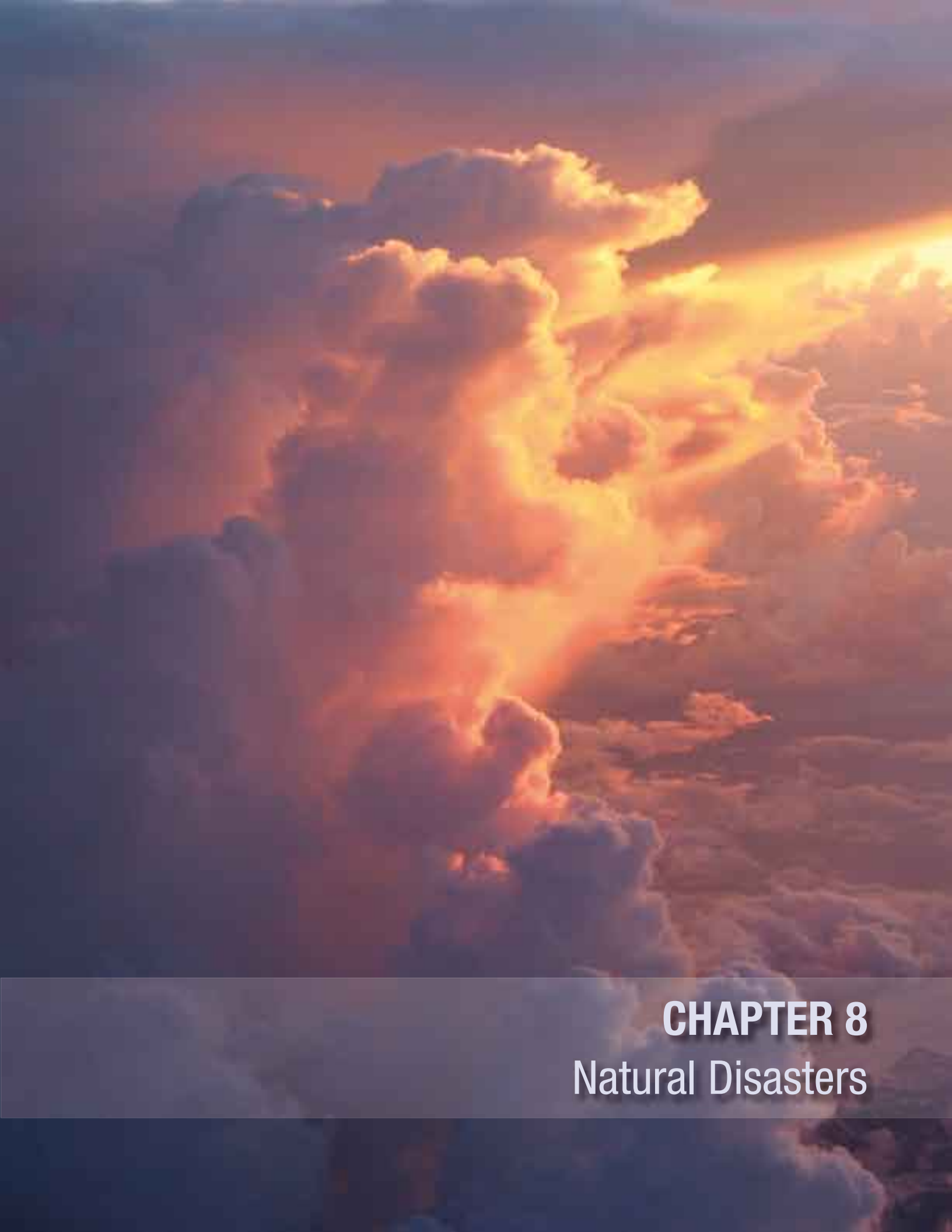

CHAPTER 8
Natural Disasters

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Toll of Natural Disasters

South Asia is extremely vulnerable to natural disasters, with more than 900 events reported since 1970 alone. Between 1990 and 2008, more than 750 million people—50 percent of the population in the region—were affected by at least one natural disaster, leaving almost 230,000 deaths and about US$45 billion in damages (Table 8.1).

The toll of natural disasters is high and rising. Since 1970, the number of reported natural disasters in the region has been rising steadily (Figure 8.1). Figure 8.2 shows the principal hazard risks in the region and the distribution of the "hotspots" where they are most likely to be encountered. These hotspots occupy a significant portion of the geographic territory, with several parts being susceptible to more than one type of

Table 8.1 Reported Natural Disaster Impacts in South Asia (1990–2008)

Country	Population[56] ('000)	Deaths ('000)	People Affected ('000)	Population Affected (%)[57]	Damage (US$millions)
Afghanistan	22,615	6.1	5,410	23.9	69,060
Bangladesh	143,990	155.3	145,713	101.2	12,984,000
Bhutan	602	0.2	66	11.0	3,500
India	1,071,608	53.4	885,244	82.6	25,743,100
Maldives	279	0.0	2	0.7	500,100
Nepal	25,278	4.6	2,796	11.1	245,100
Pakistan	162,662	9.4	27,943	17.2	3,573,054
Sri Lanka	19,258	0.5	6,331	32.9	1,670,070
Total	**1,368,327**	**229.5**	**1,073,504**	**78.5**	**44,787,984**

Source: Emergency Events Database (EM-DAT: The OFDA/CRED International Disaster Database) (http://www.em-dat.net) and United Nations World Population Prospects (http://esa.un.org)

[55] Authors in alphabetical order: Siet Meijer, Christophe Pusch, and Ranu Sinha.

[56] United Nations World Population Prospects, http://esa.un.org.

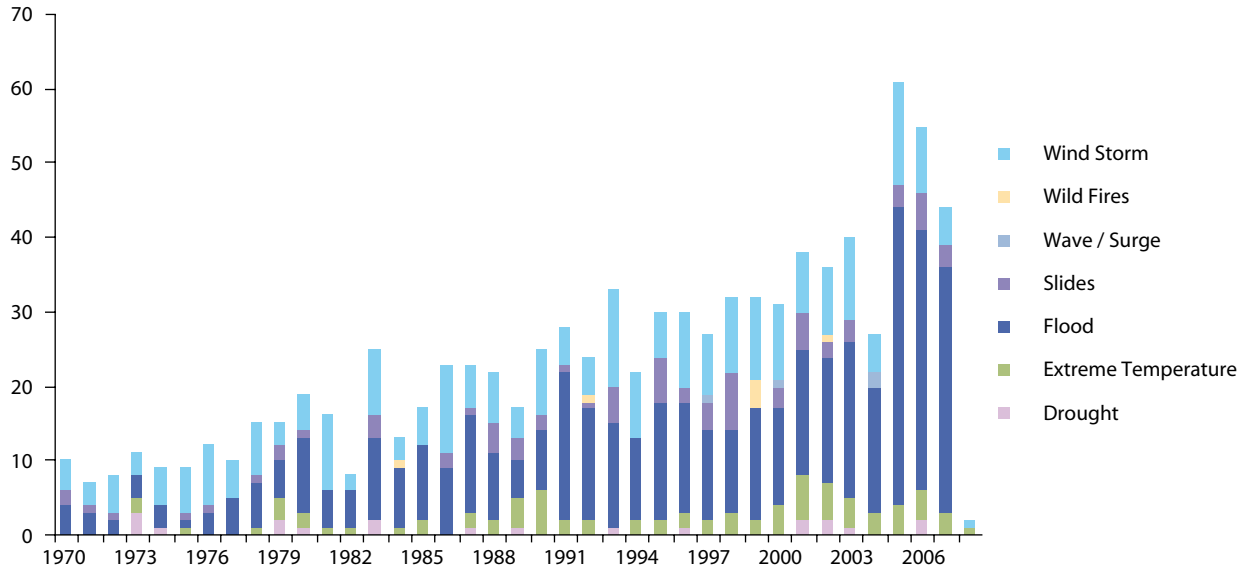
[57] Because this is the total number of people affected over 18 years, percentage affected as a proportion of average population over this time can be higher than 100 percent, since it indicates multiple exposures to disasters.

climate-related hazard. With a coastline of 12,000 kilometers as well as low-lying lands and many islands, the region is highly vulnerable to cyclones, storm surges, and sea-level rise. As shown in Figure 8.2, significant portions of Bangladesh, India, Nepal, and Sri Lanka are prone to flooding. In the 1970–2008 period, floods accounted for 50 percent of the total number of events reported, while droughts accounted for 2 percent (Figure 8.1). Nevertheless, droughts affected more than 50 percent of the total number of affected people.[58] Droughts normally occur as a consequence of rainfall deficiency and low air humidity. The arid and semi-arid regions of Afghanistan, India, and Pakistan experience significant drought. Though droughts seldom result in structural damage, they generally extend over a larger geographic area than damages from other natural hazards (American Meteorological Society 2003).

Global warming has been correlated with an upward trend in the destructive potential of hurricanes (Emanuel 2005). The eastern coast cyclones originate in the Bay of Bengal, the Andaman Sea, and the South China Sea and move toward the coasts of West Bengal, Orissa, and Andhra Pradesh, eastern and north central parts of Sri Lanka, and the coastal areas of Bangladesh. Recently, observed trends in the intensity of tropical cyclones—Cyclone Yemyin, for example, affected 2.5 million people in the southern provinces of Pakistan alone.—There is a possibility that the region may face an even stormier future This prospect might be partially shaped by an increase in sea-surface temperature resulting from climate change.

The areas and populations that face the highest risk from natural disasters are located in Bangladesh and Nepal (Table 8.2). However, with 436 events since the 1950s and almost 2 billion people (cumulative) affected during this period, it is India that has suffered the most extensive damage. Population growth and increased infrastructure density in disaster-prone areas only exacerbate this risk.

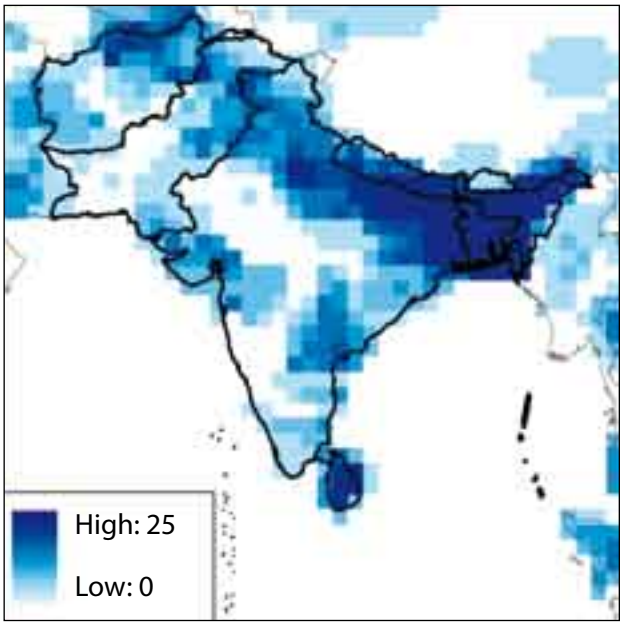
Figure 8.1 Numbers of Reported Disasters in South Asia by Disaster Type (1970–2008)



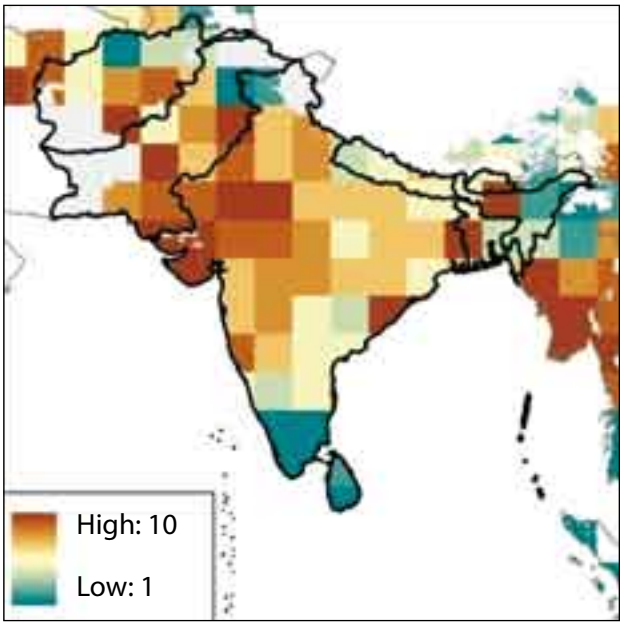
Source: Emergency Events Database (EM-DAT: The OFDA/CRED International Disaster Database) (http//www.em-dat.net).

[58] Emergency Events Database (EM-DAT: The OFDA/CRED International Disaster Database) (http://www.em-dat.net).

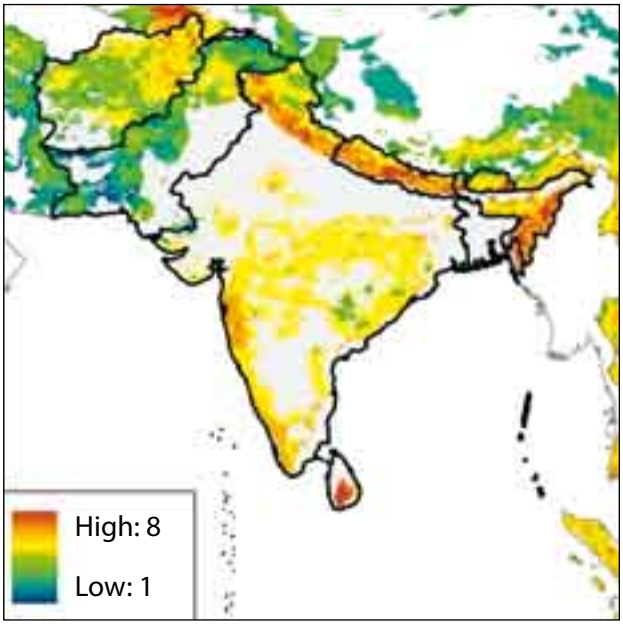
Figure 8.2 Distribution of Hazard Risk Hotspots in South Asia



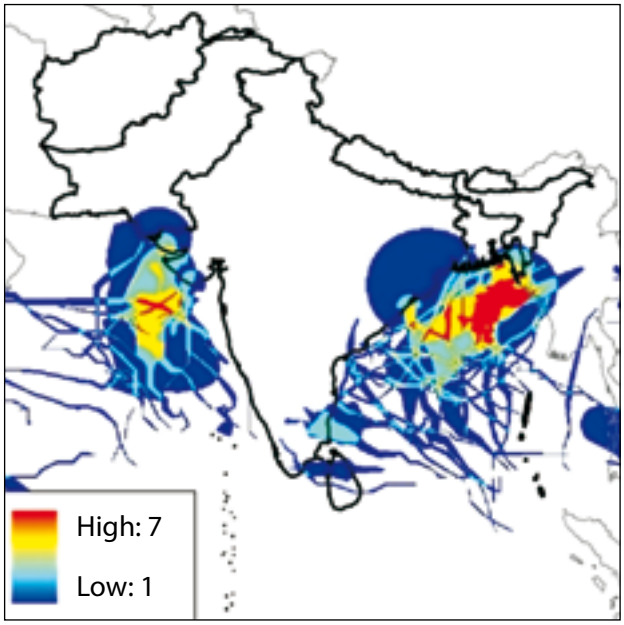
Map 1: Flood frequency index[59]



Map 2: Drought frequency index[60]



Map 3: Slides frequency index[61]



Map 4: Cyclone frequency index[62]

Source: Reproduced/modified from Dilley et al. 2005

[59] Maps 1–4 display the South Asia region with hazards data that are derived from a global source, reproduced/modified from Dilley et al. 2005.

[60] Ibid.

[61] Ibid.

[62] Ibid.

Table 8.2 Countries at Relatively High Mortality Risk from Multiple Hazards[a]

Global Rank	Country	Total Area at Risk (%)	Population in Risk Areas (%)
1	Bangladesh	97.1	97.7
2	Nepal	80.2	97.4
31	Bhutan	31.3	60.8
48	Pakistan	22.8	49.6
50	Afghanistan	7.2	46.0
71	India	21.9	27.2

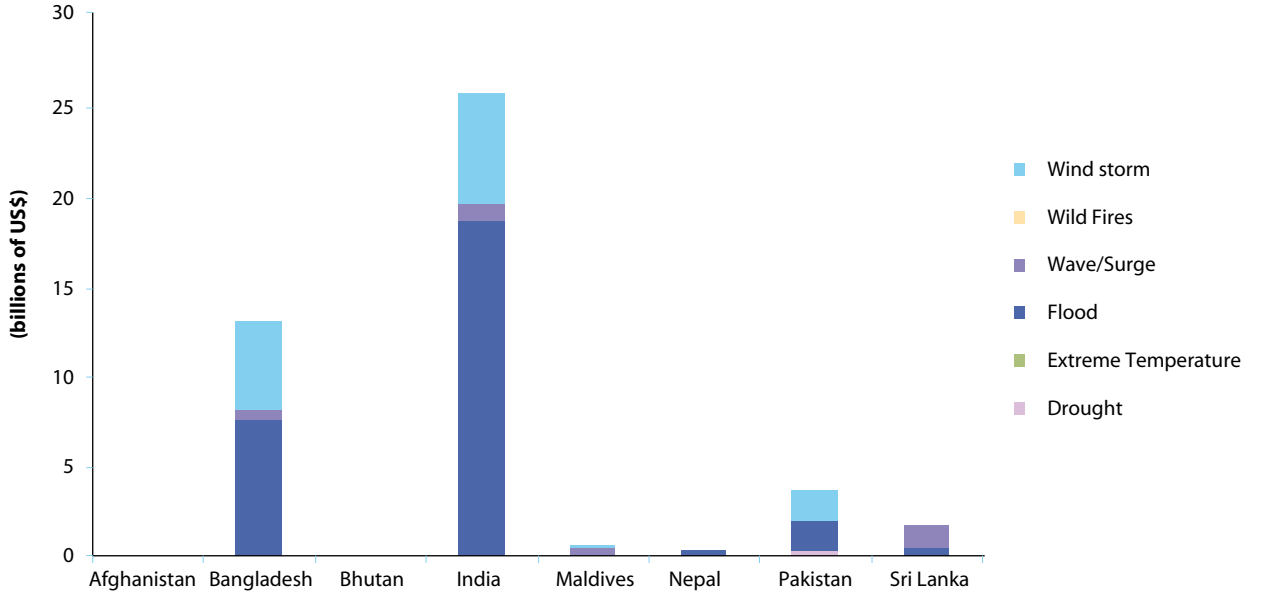
Source: World Bank 2005

a. Hazards include earthquakes.

Figure 8.3 shows the Emergency Events Database–reported costs of damage in South Asia by country and type of disaster in the period 1990–2008.[63] Floods account for the majority of damages (measured by cost), followed by windstorms. Large distributional differences are present within each country. The impact of the 2007 cyclone Sidr on the Bangladesh economy was estimated to be a modest 2.8 percent of GDP, but at a local scale several districts were much more severely affected. There are also indirect effects of floods, such as the degradation of agricultural lands and the consequent decline in their productivity, long after the floods have receded that add to the toll of natural disasters.

With climate change and rising population densities, damage and exposure to natural disasters is set to increase. Since the region shares common geological formations and river basins, natural hazards transcend national boundaries. Heavy rainfall and the high silt load of water bodies cause recurrent floods over large areas, often transboundary in nature. The floods in Bangladesh and India, for example, have their origins in Bhutan and Nepal.

Figure 8.3 Reported Costs of Damage in South Asia by Country and Disaster Type (1990–2008)



Source: Emergency Events Database (EM-DAT: The OFDA/CRED International Disaster Database) (http://www.em-dat.net).

[63] Emergency Events Database (EM-DAT: The OFDA/CRED International Disaster Database), http://www.em-dat.net.

Fiscal Impact of Disasters

Relief measures and their financing may not be sustainable in the not-so-distant future. The damages caused by natural disasters are exerting more and more pressure on development opportunities. Public expenditure is placed under stress by the repeated need for relief work in vulnerable areas. In India for instance, the direct losses from natural disasters amount to up to 2 percent of India's GDP and up to 12 percent of central government revenues (World Bank 2003). Several state governments spend significantly more on relief and damages than on their rural development programs. In the state of Maharashtra, a single drought in 2003 and a flood in 2005 consumed more of the budget (Rs 175 billion[64]) than the entire planned expenditure (Rs 152 billion) on irrigation, agriculture, and rural development for the 2002–2007 period (World Bank 2007). Oxfam (2008) estimates that between 2 and 6 percent of South Asia's GDP is lost to disasters every year.

Governments usually respond to natural disasters only in their aftermath. This is largely due to both limited fiscal resources and a lack of economic incentives to engage in disaster-mitigation strategies. Many countries depend on emergency aid and on easily available reconstruction funds from international development organizations to alleviate the impacts of disasters. This dependence can adversely affect the need for proactive disaster management. Many development programs already experience a reduction in their effectiveness. Though relief programs can be strengthened and will continue to remain a key source of aid to countries suffering from extreme natural disaster events, in the long term there is a clear fiscal and development need to strengthen climate resilience by addressing the root causes of vulnerability (World Bank 2007).

Response to the Natural Hazards Threat: From Relief to Resilience

Economic losses and loss of life from natural disasters can be reduced through a systematic approach to planning and preparation. Some South Asian countries have recently adopted disaster-management plans that focus on prevention and preparedness rather than on relief and response. Several countries have begun to develop national-level disaster-management legislation and to institutionalize national disaster-management frameworks that engage district- and state-level authorities in action planning to improve resilience to natural disasters (Box 8.1).

Recognizing these needs of the region, the World Bank has begun to engage in high-priority risk mitigation activities and to provide support for the mainstreaming of disaster-risk practices

Box 8.1 India and Bangladesh: National Disaster Management Frameworks

In India, the National Disaster Management Framework (August 2004) sets out policy parameters and provides guidelines on institutional mechanisms, disaster prevention strategy, early warning systems, disaster mitigation, preparedness and response, and human resource development.

Bangladesh has improved its ability to manage disaster risks, in particular floods and cyclones, after the cyclone of 1991 that claimed nearly 140,000 lives. This has been the result of a gradual shift from a response-based approach to one that incorporates elements of greater emergency preparedness and risk mitigation.

Pakistan has prepared a National Disaster Risk Management Framework, operational since March 2007, which serves as a vision and provides guidelines to coordinate responses across sectors and stakeholders.

[64] Indian rupees.

into the overall development agenda of client governments. Various programs and projects have been developed, such as the establishment of the new Global Facility for Disaster Reduction and Recovery, which provides annual grants of about US$4 million for the countries in the region to mainstream risk mitigation into the development process.

Strategic coordination between the disaster-risk-management and the climate-change agendas is of high importance. Many of the impacts associated with climate change alter the risk profile of existing hazards, such as floods, droughts, cyclones, and other extreme weather-related events. Adaptation measures can benefit from the practical experience in disaster management. When dealing with climate-change risks, it is important to recognize the existing vulnerability to climate variability. Enhancing the ability of local communities to manage current natural hazard risks will help improve their capacity to prepare for and respond to future climatic changes. In this context, the disaster-risk-mitigation and climate-adaptation agendas require an integrated approach.

Maintenance of risk-mitigation investments is critical for many protective infrastructures but is often overlooked. It has become increasingly apparent that expensive disaster-prevention infrastructure often fails due to lack of maintenance. Reasons for this include a shortage of human resources available for maintenance tasks, inadequate levels of training in maintenance management, and a lack of beneficiary ownership and accountability.

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The high concentration of risk also suggests that mechanisms are needed to either finance or transfer the financial risks of catastrophic events. How to fund the necessary response is always a key question for disaster-affected countries. There is a clear need in most cases for immediate funds that might be covered by contingency funding. The World Bank has already supported such initiatives in Colombia, Mexico, and Turkey, and similar mechanisms may be applicable to the countries of South Asia.

Key elements of the framework proposed to deal with these issues include the following:

a. Disaster-funding approaches are needed that encourage *ex ante* mitigation efforts (i.e., risk management) as well as reinforce *ex post* response capacity (i.e., coping mechanisms).

b. Three basic and interlinked building blocks:

- A formal institutional structure (disaster-management agency) to guide, support, and fund mitigation efforts and response capacity enhancement, particularly with respect to critical infrastructure and the poor.
- A national capacity to offer catastrophe insurance to better-off households and small business owners. Where insurance markets are undeveloped, this may take the form of a separately managed catastrophe pool, possibly backed by international capital (e.g., reinsurance and catastrophe bonds).

- A "visibility filter" whereby decision makers can be shown to be responding to all affected households after a catastrophe. This will often take the form of a low-interest loan facility for reconstruction costs, including the cost of any postdisaster mitigation requirements and modest relief grants.

c. Techniques are needed to identify gaps between *ex post* resource availability and postdisaster financing needs (particularly for those countries and states with concentrated and vulnerable exposures). Modern technology can enable these to be identified and appropriate ex ante funding strategies developed.

d. *Ex ante* funding mechanisms will need to be designed explicitly to support the three building blocks listed above. World Bank contingent credit and reinsurance funding instruments have already taken on this role in a number of countries subject to earthquake risk.

Role of the World Bank

The World Bank is strongly promoting a proactive and strategic approach to natural disaster risk management in the South Asia region by supporting the establishment of effective disaster risk management systems. The Bank's proposed disaster risk management framework is based on five basic pillars:

a. **Risk identification and assessment:** What is the country's hazard exposure? What are the economic and social losses? What is the probability of loss exceedance? Where is the risk concentrated?

b. **Risk mitigation:** What structural and nonstructural measures are suitable and affordable to mitigate physical damage? What are the priorities for intervention, considering risk to lives, livelihoods, and the need for emergency facilities? How best can these measures be financed and sustained?

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c. **Emergency preparedness:** Is the country sufficiently prepared to respond to emergency situations, organizationally and technically? Does the existing coordination and response mechanism function under stress? How efficiently are public, nongovernmental, bilateral, and international aid institutions integrated in the emergency response system?

d. **Catastrophe risk financing or transfer:** What is the country's financial capacity to absorb catastrophic events? Is there a funding gap? What are the most suitable financial instruments with which to address the funding gap?

e. **Institutional capacity building:** What is the country's capacity to manage risk at different levels of government? Is an institutional framework and coordination mechanism in place that allows strategic planning and decision making at the central, regional, and

local levels? Are technical, social, and economic considerations integrated adequately in the investment decision process?

The increasing frequency and intensity of natural events pose a significant threat to development and may challenge the prospects for achieving the Millennium Development Goals. The increase in surface-sea temperature due to climate change is likely to intensify tropical cyclones and hurricanes. It is imperative that the region improves disaster preparedness in order to save lives, but also that it promotes adaptation to climate-change risks. Both disaster risk reduction and climate-change adaptation have to be integrated into national planning strategies.

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