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# Disaster Risk Management Systems in South Asia: Natural Hazards, Vulnerability, Disaster Risk and Legislative and Institutional Frameworks

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## Abstract

The purpose of this paper is to provide an overview of the disaster risk reduction and management systems and its challenges in the countries of South Asia Region. All the member states of the South Asian Association for Regional Cooperation (SAARC) are highly prone to hydro-meteorological and geological hazards such as floods, landslides, droughts, cyclones, earthquakes, heat waves, avalanches and tsunamis. Economic vulnerability analysis shows that India, Pakistan and Bangladesh exhibit the largest losses, which is due to large exposure at risk and the high level of hazards. Poverty, exposed population and lack of preparedness can be attributed to the vulnerability to the disasters caused by natural hazards. Bangladesh and India have the highest Multiple Mortality Risk Index (MMRI) whereas Maldives and Bhutan have the least. Although Maldives has the lowest MMRI based on the past disaster losses, the country has the high risk of tsunami, floods and potential risk of sea level rise mainly due to climate change. *Urbanization, environmental degradation and lack of strong governance are exacerbating the vulnerabilities in most of the countries in South Asia. Political instability, border disputes, ineffective regional networks and climate change are triggering the hazard impacts.*

The occurrence and impact of disasters due to natural hazards are not confined to a country's political boundary. *Floods, earthquakes, forest fires and volcanoes have significant cross border impacts. Some examples of cross-border impacts of disasters include Koshi flooding in South Asia (2008), Kashmir earthquake (2005), Indian Ocean Tsunami (2004), and recurrent tropical cyclones in Bangladesh and India.* Good governance, regional stability, economic prosperity and sound environmental management are required to have minimum impacts of a disaster.

After the 2005 Kobe conference, many efforts have been initiated in line with the resilient building of the state in the SAARC region; however, there exists a huge gap in its implementation. For this, a sound disaster risk management system together with the strong coordination among the disaster risk management actors in the countries should prevail to augment the capacity building of the community and institutions and build their resilience capabilities.

**Keywords:** Disaster risks, Multiple Mortality Risk Index, South Asia.

## Introduction

South Asia[1] is home of 1.8 billion people, of which more than 70% live in poverty. Despite having tremendous natural resource base such as water, minerals, forest, productive fertile land and industrious people, this region remains underdeveloped primarily due to political instability, poor leadership, inability to utilize natural resources at optimum level, and regular occurrence of disasters. More than two thirds of the world's poor people live in Asia, and nearly half of them are in Southern Asia [1].

In the South Asia Region (SAR), Sri Lanka has the highest Human Development Index (HDI) followed by Maldives and India, where as Afghanistan and Nepal have the lowest HDI (Table 1). As the governance, poverty status, access and mobilization of resources, awareness level are among the key factors to show the vulnerability level of a country, HDI rankings can be a good indicator to reflect the coping capacity of a country to disaster risk. The comparative studies of the various elements of disaster risk management systems in South Asia have not been well documented. This paper attempts to analyse the key hazards, country level vulnerabilities and disaster risks in the region. The purpose of this paper is to provide an overview of the disaster risk reduction and management systems and its challenges in the countries of South Asia Region. The following sections analyses the key natural hazards, vulnerability and disaster risks, national policies, legal and institutional frameworks in South Asia. Natural hazards and vulnerability in South Asia South Asia is the most exposed region in the world to flooding and highly exposed to cyclones. Of the world's total population exposed to floods each year, 64 per cent of them are in the South Asia Region. Furthermore, within the developing world, South Asia is the second most exposed region to cyclones [2]. All the member states of the South Asian Association for Regional Cooperation (SAARC) are highly prone to hydro-meteorological and geological

| Country | 2000 | 2005 | 2010 | 2014 |
|---|---|---|---|---|
| Afghanistan | N.A. | N.A. | 155 | 171 (0.465) |
| Bangladesh | 146 | 139 | 129 | 142 (0.570) |
| India | 128 | 127 | 119 | 130 (0.609) |
| Maldives | 89 | 96 | 107 | 104 (0.706) |
| Pakistan | 135 | 135 | 125 | 147 (0.538) |
| Sri Lanka | 84 | 93 | 91 | 73 (0.757) |
| Bhutan | 142 | 134 | N.A. | 132 (0.605) |
| Nepal | 144 | 136 | 138 | 145 (0.548) |

Source: UNDP Human Development Report 2015.

**Table 1:** Human development index rankings of countries in South Asia.

[1]South Asia comprises Afganistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka.

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hazards such as flood, landslide, drought, cyclone, earthquake, tsunami, among others (Table 2). Drought affects Afghanistan, India, Pakistan and parts of Nepal and Sri Lanka. Floods devastate Bangladesh, India, Nepal, Pakistan and Sri Lanka. Cyclones hit Bangladesh, India and Sri Lanka. Landslides occur in mountainous regions of India, Pakistan, Nepal, Bhutan and Sri Lanka. The Maldives, Bangladesh and Sri Lanka are subject to coastal erosion and salinity intrusion [3]. Similarly, due to poor health education, awareness and health facilities, this region is also equally susceptible to epidemics. Moreover, the World Disaster Report (WDR) reveals that this region has the highest affect to killed ratio in the world [4]. Flood has been the most frequent, highly damaging and wide spread natural disaster in the region. The 2008 floods of Koshi river in Nepal and India, floods of Pakistan and India 2010 have killed thousands of people and displaced more than 3 million, and damaged billions of dollars (Table 3). There are three common types of flooding; slow onset floods, rapid onset floods and flash floods. Earthquakes, floods, landslides, cyclones, avalanche and epidemics are among the recurrent and devastating hazards in the South Asia Region. In South Asia, river flooding due to excessive rainfall is the major cause of floods. Flooding due to tsunami, cyclones and high tide are also common in the coastal areas. Floods occur when large amount of water overflows over dry land. They may result from prolonged or very heavy rainfall, severe thunderstorms, monsoon rains, or tropical cyclones. People, who live near rivers, or in low-lying coastal areas, live with the greatest threat of floods [5]. Glacier Lake Outburst Floods (GLOF), dam burst and avalanches are also common in South Asia.

There are several causes of floods; they may vary by locations and region. Some of the major causes include:

- Heavy rainfall
- Siltation of the river bed reduces the water carrying capacity of the rivers/streams
- Blockage in the drains leave to flooding of the area especially in urban areas
- Landslides blocking the flow of the streams
- Construction of dams and reservoirs
- Cyclone- storm surge
- Tsunami and other disasters
- Glacier Lake Outburst

Table 4 summarizes the relative intensity of key hazards by country. Flood hazards have dominated all the hazards in terms of frequency of occurrence and impacts.

Landslide does not constitute the major causes of deaths during disasters in South Asia. However, the ratio of death and injuries and displacement is quite high in landslide disaster events. The following are the major causes of landslides in the region:

- Geological weak materials (weathered materials, jointed or fissured materials)
- Erosion
- Intensive rainfall
- Human excavation
- Earthquake shaking
- Weak foundation

Drought has been the silent killer which has the highest impact on livelihoods, and the number of people affected among the key natural hazards. Almost all countries in South Asia region are prone to drought hazard.

Earthquake is one of the major devastating hazards in the countries

| Country | Key hazards |
|---|---|
| Afghanistan | Earthquake, drought, floods, landslides, extreme winter conditions, avalanches, sand and dust-storms, agriculture paste |
| Bangladesh | Cyclone, floods, drought, epidemic |
| Bhutan | GLOF, flash floods, landslides, earthquake, forest fire, epidemic |
| India | Flood, Earthquake, cyclone, tsunami, epidemic, landslides, forest fire |
| Maldives | Tsunami, floods, cyclone, earthquake |
| Nepal | Flood, landslides, earthquake, epidemic, GLOF, avalanche, fire |
| Pakistan | Earthquake, floods, landslides, sand-storm, drought, avalanche |
| Sri Lanka | Tsunami, floods, landslide, drought, cyclone |

Source: Asian Disaster Reduction Centre (ADRC), Annual Reports 1999, 2003, 2006).

**Table 2:** Major hazards of the South Asia Region.

| Countries/major recent disasters | Year | Persons Killed | Affected |
|---|---|---|---|
| **Afghanistan** | | | |
| Earthquake | 1998 | 4700 | 116935 |
| Earthquake | 2002 | 2500 | 56000 |
| Flood | 1991 | 728 | 108400 |
| Drought | 2000 | - | 2580000 |
| **Bangladesh** | | | |
| Cyclone | 1970 | 300000 | 20 million |
| Flood | 1974 | 1789 | 38 million |
| Flood | 1988 | 2211 | 73 million |
| Cyclone | 1991 | 138000 | 15 million |
| **Bhutan** | | | |
| Flood | 2000 | 200 | 1000 |
| Flood | 1994 | 22 | 600 |
| Windstorm | 1994 | 17 | 65000 |
| **India** | | | |
| Earthquake | 1993 | 9475 | 1 million |
| Cyclone | 1999 | 10086 | 15 million |
| Earthquake | 2001 | 13805 | 1.8 million |
| Tsunami | 2004 | 12405 | 3.5 million |
| **Maldives** | | | |
| Tsunami | 2004 | 108 | 20000 |
| **Nepal** | | | |
| Earthquake | 1934 | 9040 | 215884 |
| Earthquake | 1988 | 709 | 301016 |
| Flood | 1993 | 1048 | 553268 |
| Landslide | 2002 | 472 | 265865 |
| Earthquake | 2015 | 8831 | 8 million |
| **Pakistan** | | | |
| Earthquake | 2005 | 83000 | 5 million |
| Earthquake | 1974 | 4700 | 230500 |
| Flood | 1992 | 1300 | 12 million |
| Flood | 1998 | 1000 | 9 million |
| Flood | 2010 | 2000 | 20 million |
| **Sri Lanka** | | | |
| Tsunami | 2004 | 35399 | 1 million |
| Cyclone | 1978 | 740 | 1 million |
| Flood | 1989 | 325 | 1.2 million |
| Flood | 2003 | 235 | 695000 |

**Source:** SDMC 2009; http://saarc-sdmc.nic.in/drr_p.asp

**Table 3:** Recent disasters in the countries of the South Asia Region.

| Countries | Severity of hazards | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Flood | Landslides | Earthquakes | Tsunami | Drought | Volcanoes | Cyclones | Forest fires | Epidemics | Frost |
| Afghanistan | M | M | M | - | S | L | - | L | M | S |
| Bangladesh | S | L | L | L | S | L | S | L | M | L |
| Bhutan | L | M | M | - | M | - | - | M | M | M |
| India | S | L | M | M | M | M | S | M | M | M |
| Maldives | S | - | M | S | M | L | M | - | M | - |
| Nepal | S | M | M | - | M | - | - | M | M | M |
| Pakistan | S | L | S | L | M | L | L | L | M | L |
| Sri Lanka | M | M | L | L | M | - | L | L | L | - |

S: Severe, M: Medium, L: Low.

Source: ADPC 1991, ADB 1991, Kafle 2013.

**Table 4:** Relative intensity of hazards in the countries of South Asia.

| Date (AD) | Location | Magnitude |
|---|---|---|
| 1556 | Shanxi province (China), Nepal | 8.0 |
| Oct 11, 1737 | Calcutta (India) | - |
| 1819 | Kutch (India) | >8.0 |
| 1897 | Assam (India) | 8.7 |
| 1905 | Kangara (India) | 8.6 |
| 1934 | Bihar (India) and Nepal border | 8.4 |
| 1935 | Pakistan | 7.6 |
| June 26, 1941 | Andaman and Nicobar islands (India) | 8.1 |
| 1950 | Assam (India) | 8.7 |
| Feb 4, 1998 | Afghanistan | 6.1 |
| March 25, 2002 | Afghanistan | 5.8 |
| October 25, 2005 | Kashmir (India and Pakistan) | 7.6 |
| 25 April 2015 | Gorkha, Nepal | 7.9 |

Source: Sinval 2010, Kafle 2013, updated.

**Table 5:** Some major earthquakes in the region.

| Date (AD) | Location |
|---|---|
| 1524 | Near Dabhol, Maharashtra; |
| 2 April 1762 | Arakan Coast, Myanmar |
| 16 June 1819 | Rann of Kachchh, Gujarat |
| 31 Oct 1847 | Great Nicobar Island; |
| 31 Dec 1881 | An earthquake of 7.9 Richter scale in Car Nicobar (Pu) island; |
| 26 Aug 1883 | Explosion of the Krakatoa volcano in Indonesia caused damages in India and Sri Lanka. |
| 15153 | An 8.1 Richter scale earthquake in the Andaman archipelago; |
| 16615 | An 8.5 Richter scale earthquake at a distance of about 100 km south of Karachi; |
| 38347 | 9.3 Richter scale earthquake triggered tsunami; Banda Aceh, Indonesia; Affected coastal areas of Tamil Nadu, Kerala, Andhra Pradesh, Andaman and Nicobar Islands, Sri Lanka, Maldives. |

**Table 6:** History of tsunami in South Asia.

in South Asia. The earthquakes that happened in Gorkha (2015, Nepal), Gujarat (2001, India) and Kashmir (2005, Pakistan) are three recent examples. Most earthquakes in South Asia are tectonic in origin [6,7]. The causes of earthquakes, in general, are the following:

- Tectonic movement- earthquake can be triggered by tectonic activity along the plate boundaries and fault.
- Volcanic eruptions- earthquake can be linked to an explosive volcanic eruption.
- Human activities- Earthquake can be generated by human activities such as nuclear testing.

Three of the eight SAR countries are landlocked. However, there were 9 tsunami disasters recorded over the last 5 hundred years in the region (Tables 5 and 6).

## Vulnerability and Disaster Risk in South Asia

Urbanization, environmental degradation and lack of strong governance are exacerbating the vulnerabilities in most of the countries in South Asia [8]. Political instability, border disputes, ineffective regional networks and climate change in these countries are triggering the hazard impacts. "Economic vulnerability analysis shows that India, Pakistan and Bangladesh exhibit the largest losses, which is due to large exposure at risk and the high level of hazards. When expressing the relative economic vulnerability in terms of economic loss corresponding to 0.5 percent probability of exceedance (corresponds to 200 year return period) as a function of the GDP, Nepal ranks first followed by Bangladesh, Afghanistan, Pakistan, India, and Sri Lanka" [9].

The following are the major causes of vulnerability in South Asia:

- High population density

- Weak governance (local/urban)
- Climate change
- High rate of urbanization
- No effective local structure in place for DP/DRR
- High rate of women/youth unemployment; rampant rural poverty;
- Increased pollution and degradation of natural resources;

Spatial vulnerability is also acute in the countries in South Asia. Bangladesh is one of the most vulnerable countries in South Asia followed by India and Pakistan. Over the past 30 years, almost 300,000 people have died due to disasters caused by natural hazards in Bangladesh (Tables 7 and 8). The number of people killed per event is also the highest in the country followed by Pakistan and Sri Lanka. Poverty, exposed population and lack of preparedness can be attributed to the vulnerability to the disasters caused by natural hazards. World Bank identifies the population growth, economic expansion, urbanization and mismanaged development as the drivers of vulnerabilities in South Asia.

'The number of disasters per year has quadrupled over the past four decades in the South Asia Region. Resulting damages have accumulated to over US$25 billion in the past five years alone' [10].

In South Asia, Bangladesh has the highest Multiple Mortality Risk Index (MMRI)[2] followed by India, Pakistan and Sri Lanka. Nepal has the highest Mortality Risk Index (MRI) in landslide hazard (Figures 1 and 2).

## Afghanistan

Afghanistan is highly vulnerable to floods and earthquakes. Droughts, landslides, sandstorms and avalanches are also common in the country. Wars and civil conflicts have led to more community vulnerabilities thereby less resilience to natural disasters. In terms of Multiple Mortality Risk Index (MMRI) Afghanistan is the fifth highest in South Asia.

All the countries in the South Asia region have established nodal bodies to support disaster management activities, coordinate with other agencies to deal with disaster issues and mobilize national and international agencies and resources. 'The focal point agency is expected to play a leading role in promoting Disaster Risk Management at the national level. The agency should have authority to formulate a vision, develop national policies, allocate budgets for government organizations, demand compliance, and define actions for the organizations. For example, the agency can function as the secretariat of a DRM committee, which usually consists of ministers of concerned agencies and is chaired by the prime minister or president, and formulates national strategies and DRM plans through coordinating with line ministries and other organizations concerned' (Figure 3) [11].

## Bangladesh

Bangladesh and India have the highest MMRI whereas Maldives and Bhutan have the least. Although Maldives has the lowest MMRI based on the past disaster losses, the country has the high risk of tsunami, floods and potential risk of sea level rise due to climate change (Tables 9 and 10).

Bangladesh is highly prone to flood and cyclone. "The number of disasters related to cyclone is very high (100 out of 182; 55 percent) as compared to flood (70.38 percent). Cyclone caused more deaths (0.47 million) than flood (0.04 million). Flood affected the largest population and is the main contributor to loss (0.29 billion people and $ 12 billion). Cyclone also contributes to significant economic losses of

| Hazards | Recurring | Defining seasonality | Defined Location | Probability of early warning | Generally well known |
|---|---|---|---|---|---|
| Floods | × | × | × | × | × |
| Landslides | × | × | × | × | × |
| Drought | × | × | × | × | × |
| Cyclone | × | × | × | × | × |
| Earthquake | × | × | × | × | × |
| Tsunami | | | × | | |
| Volcanic eruptions | | | × | | |
| Forest fire | × | × | × | | × |
| Avalanche | | × | × | | |

**Table 7:** Characteristics of hazards in South Asia.

| Country | Population | Occurrence | Deaths | Total affected | Total damage (US$ '000) |
|---|---|---|---|---|---|
| Afghanistan | 3,256,4342 | 170 | 2,4007 | 9,674,938 | 600,320 |
| Bangladesh | 168,957,745 | 330 | 2,992,779 | 432,653,115 | 18,350,780 |
| Bhutan | 741,919 | 10 | 304 | 87,369 | 3,500 |
| India | 1,251,695,584 | 662 | 9,128,538 | 2,044,637,210 | 84,580,506 |
| Maldives | 393,253 | 6 | 325 | 65,559 | 506,100 |
| Nepal | 31,551,305 | 120 | 32,786 | 15,756,180 | 4,607,155 |
| Pakistan | 199,085,847 | 190 | 176,464 | 91,477,709 | 28,295,969 |
| Sri Lanka | 22,053,488 | 95 | 39,079 | 28,241,579 | 2,516,364 |
| Total | 1,707,043,483 | 1583 | 12,394,282 | 2,622,593,659 | 139,460,694 |

Source: http://emdat.be/advanced_search/index.html

**Table 8:** Impacts of disasters in South Asia (1900-2015).

[2]Multiple mortality risk was computed using (R1+R2)/2 formula. Where, R1=Absolute mortality (killed per year), R2= Relative mortality (killed per million population); Source of data: "EM-DAT: The OFDA/CRED International Disaster Database, Université catholique de Louvain, Brussels, Bel.

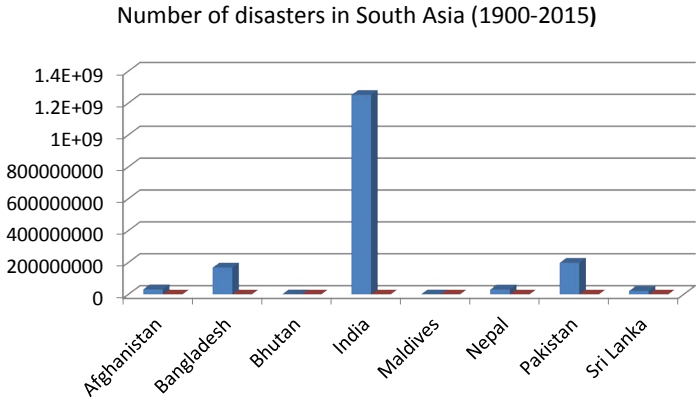


**Figure 1:** Number of disasters in South Asia.

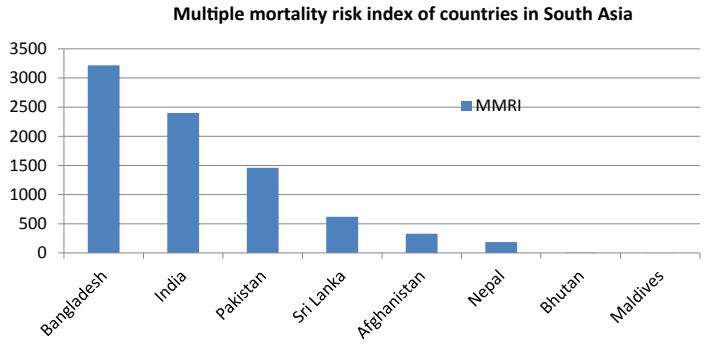


**Figure 2:** Multiple mortality risk index of countries in South Asia.


**Figure 3:** Top 11 countries for number of events (1980-2010).

the order of $ 2.9 billion". Drought is another severe natural hazard in the country causing widespread loss to livelihoods and economy. The average rainfall of the country is about 1,971 mm, which mainly occurs during the monsoon [12].

Past records have shown that Bangladesh is also prone to earthquake disasters. Bangladesh is located close to the plate boundary between the northward moving Indian plate and the Eurasian plate. Historical seismic catalogues [13] reveal that the country has witnessed earthquakes in 1664, 1828, 1852 and 1885 with Dhaka as epicentre area. During 1869-1930, five earthquakes with magnitude M≥7 have affected parts of Bangladesh.

## Bhutan

Bhutan is vulnerable from earthquake, landslides, forest fire, GLOF and drought. Landslide events are recurrent phenomena in Bhutan, especially in the eastern and southern foothill belt, where the terrain is steep and rocks underlying the soil cover are highly fractured. Contributing factors are the undercutting of slopes by high-energy rivers and streams during a period of heavy rainfall.

Climatic variations, forest fires, and flash floods are also common and frequent hazards in the country. Forest fires are a major problem for Bhutan with 72.5% of the country under forest cover. A series of fires break out in different parts of Bhutan every year, causing great loss to the kingdom- socially, economically and environmentally. The forest fire that occurred in March 2006 destroyed thousands of acres of forest. Despite all this, Bhutan is one of the few countries where forest cover is increasing. Flood both flash and riverine are common in Bhutan during summer.

| Country in the sub-region | No of hazard events (1980-2010) | Total # of people killed (1980-2010) | Average killed per year | Total # of people affected (1980-2010) | Average affected per year | Economic damage per year (US$X 1000) | # of victims (killed+affected) per year | Absolute risk (killed per year) (R1) | Relative risk (killed per million people) (R2) | Multiple mortality Risk | Rank | Multiple mortality risk class (0-10) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Afghanistan | 130 | 19,655 | 634 | 6,820,793 | 220,026 | 12,197 | 220,660 | 634 | 25.36 | 329.68 | V | 8 |
| Bangladesh | 234 | 191,836 | 6,188 | 323,480,264 | 10,434,847 | 550,726 | 10,441,035 | 6,188 | 247.52 | 3217.76 | I | 9 |
| Bhutan | 9 | 303 | 10 | 67,353 | 2,173 | 113 | 2,183 | 10 | 0.40 | 5.2 | VII | 6 |
| India | 431 | 143,039 | 4,614 | 1,521,726,127 | 49,087,940 | 1,550,446 | 49,092,554 | 4,614 | 184.56 | 2399.28 | II | 9 |
| Maldives | 4 | 102 | 3 | 53,012 | 1,710 | 16,326 | 1,713 | 3 | 0.12 | 1.56 | VIII | 6 |
| Nepal | 78 | 11,112 | 358 | 5,165,810 | 166,639 | 43,588 | 166,997 | 358 | 14.32 | 186.16 | VI | 6 |
| Pakistan | 138 | 87,053 | 2,808 | 58,098,719 | 1,874,152 | 593,639 | 1,876,960 | 2,808 | 112.32 | 1460.16 | III | 8 |
| Sri Lanka | 62 | 36,982 | 1,193 | 17,457,668 | 563,151 | 54,012 | 564,344 | 1,193 | 47.72 | 620.36 | IV | 5 |

**Table 9:** Multiple mortality risk index of countries in the South Asia Region.

| Disaster type | Occurrence | Deaths | Affected | Injured | Homeless | Total affected | Economic loss (USD '000) |
|---|---|---|---|---|---|---|---|
| Drought | 14 | 4250320 | 1061841000 | | | 1061841000 | 2441122 |
| Earthquake | 31 | 78298 | 26173179 | 220376 | 2160700 | 28554255 | 5222700 |
| Epidemic | 68 | 4543874 | 421473 | | | 421473 | |
| Extreme temperature | 56 | 17262 | | 250 | | 250 | 544000 |
| Flood | 271 | 69142 | 825262419 | 7267 | 16791000 | 842060686 | 56807188 |
| Insect infestation | 1 | | | | | | |
| Landslide | 44 | 4919 | 231300 | 531 | 3616485 | 3848316 | 54500 |
| Mass movement (dry) | 2 | 61 | | | | | |
| Storm | 173 | 164656 | 97898820 | 17665 | 9994745 | 107911230 | 19508996 |
| Wildfire | 2 | 6 | | | | | 2000 |

Source: http://www.emdat.be/advanced_search/index.html

**Table 10:** Disaster losses in India (1990-2015).

## India

In India, earthquakes, floods, cyclones, drought, tsunami, landslides, avalanches are the major hazards. Almost 85% of India's area is vulnerable to one or multiple hazards [14]. Approximately 60% of the landmass is prone to earthquakes of various intensities; over 40 million hectares is prone to floods; about 8% of the total area is prone to cyclones and 68% of the area is susceptible to drought in the country. More than 50 million people are affected by droughts annually. In the decade 1990-2000, an average of about 4,344 people lost their lives and about 30 million people were affected by disasters every year. India's long coastline of 7,516 kilometres is exposed to nearly 10 percent of the world's tropical cyclones. River flooding is an annual phenomenon in most of the big rivers. In the hilly terrain of India including the Himalayas, landslides have been a major and widely spread natural disasters that often strike life and property and occupy a position of major concern.

Forest fire, though not causing much loss to human life, is a major hazard for forest cover in the country. As per Forest Survey of India report, 50 percent of the forest cover of the country is fire prone, out of which 6.17 percent is prone to severe fire damage causing extensive loss to forest vegetation and environment.

## Maldives

The Maldives is regularly exposed to multiple natural hazards such as flood, storms, heavy rains and high waves caused by cyclones in the South Indian Ocean. In addition, the country is susceptible to oil spills and aviation related hazards. Given that the Maldives is a nation of islands, no more than two meters above sea level, the country is at particular risk from rising sea levels associated with climate change. It is important to add that the predominant dependence of the country upon the tourism and fisheries sectors enhances economic and social vulnerability to sea related hazards [15-20].

Sea level rise due to climate change threatens the entire country. Estimations are that the projected sea level rise of 0.09 m to 0.88 m is going to take place between 1990 - 2100. As three quarters of the land area of Maldives is less than a meter above mean sea level, the slightest rise in sea level will prove extremely threatening. As per an estimate, 15% land area of Male will be inundated by 2025 and 50% by 2100. For people living on low lying islands, a rise in sea levels by 50 cm could see significant portions of the islands being inundated or washed away by erosion [20].

## Nepal

Nepal faces an acute problem of recurrent natural hazards such as flood, landslides, epidemic, cold wave, and avalanche and forest fire. An inventory of past disastrous events during 1971-2006 reveals that epidemics takes the largest toll of life every year, and that landslide, flood and urban or rural fire are the principle hazards in terms of their extent and frequency of occurrence as well as the spread and intensity of physical and socio-economic impacts [21].

Nepal faces several types of natural disasters every year, the most prominent being floods including glacial lake outburst flooding (GLOF), drought, landslides, wildfires and earthquakes. Nepal ranks 11$^{th}$ in the world in terms of vulnerability to earthquakes and 30th in terms of flood risks [22]. A combination of rough topography, steep slopes, active seismic zone and intense impact of monsoon rains makes Nepal extremely vulnerable to disaster impacts.

Although the frequency of earthquakes in Nepal is low, however, the earthquakes have affected the maximum number of people among

all disasters that occurred between 1990 and 2015 (Figure 4).

## Pakistan

Pakistan is prone to a number of natural and human-induced hazards, of which landslides, flooding, earthquakes, drought, soil erosion and cyclones are the most significant. Landslides and flooding in Pakistan tend to be frequent, seasonal and localized. Although the recurrence period of earthquake in Pakistan is quite long, however once it occurs, it renders the devastating impacts on life, properties and economy. An earthquake measuring 7.6 on the Richter scale that struck the northern areas of Pakistan and India on 8 October 2005 and the subsequent hundreds of aftershocks which triggered landslides left behind scenes of almost apocalyptic devastation: dozens of communities swept away, more than 600,000 houses damaged, and 73,338 inhabitants killed, 128,000 injured and 3.5 million people were displaced in Pakistan alone.

## Sri lanka

Two-third of the coastal belts in Sri Lanka was devastated by tsunami in December 2004. More than 35,000 lives were lost, 100,000 houses were completely damaged in thirteen districts along the coastal belts. Approximately 5,000 people were missing[3]. In Sri Lanka, floods, landslides, cyclones, droughts, wind storms and coastal erosion are the main causes for natural disasters. These natural disasters have caused loss of life, and enormous damage and destruction to property. In addition to these natural disasters, the country also incurs heavy toll on account of human induced disasters such as deforestation, indiscriminate coral, sand and gem mining, and industrial hazards besides ethnic conflicts and occasional political violence in the recent past [3] (Figure 5).

Based on information available on the people affected by natural disasters during the period 1974-2004 is given in the figure above which clearly identifies floods, drought, tsunami, storm and landslides as the most common disasters in Sri Lanka

Sri Lanka disaster profile indicates that flood is a most reported disaster and causes economic damages to the island. In average around 1200 people loss their life to the natural disasters in the country. The Indian ocean Tsunami occurred on 26th December 2004 had a severe impact on Sri Lanka causing 35,399 deaths, which is more than 95% of the total deaths caused due to Natural Disaster in three decades. Huge economic loss was also caused by the Tsunami (Figure 6).

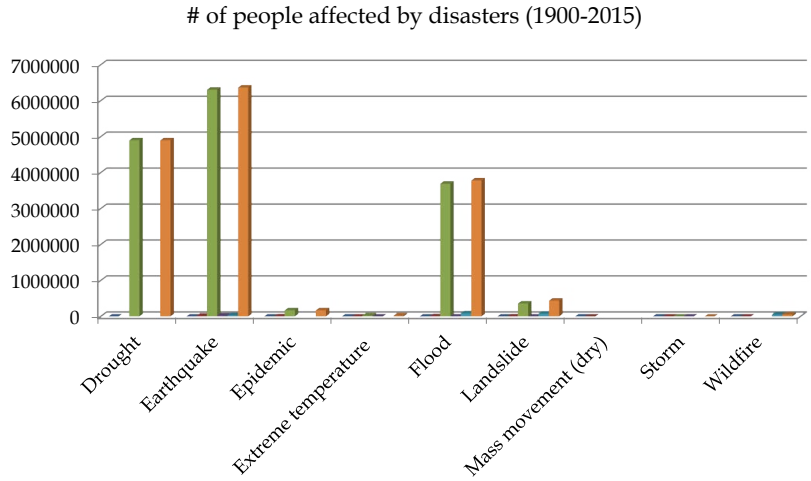


**Figure 4:** Number of people affected by disasters in Nepal (EM DAT, 2016).

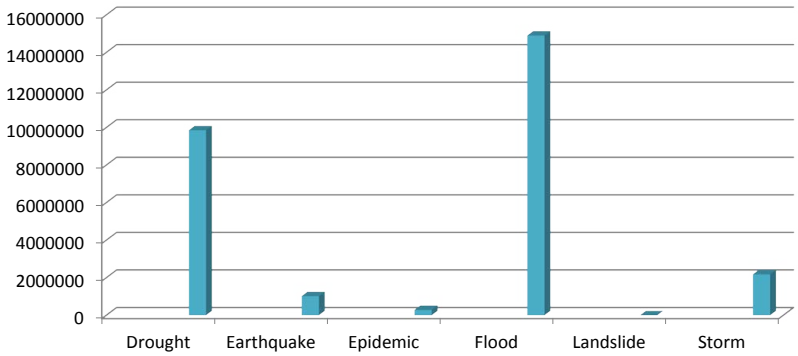


**Figure 5:** People affected by different disasters in Sri Lanka (1900-2015).

[3]Gamini, Hettiarachchi, Disaster Risk Reduction in Sri Lanka-Towards Safer Sri Lanka; Power point presentation; downloaded on 5 January 2009.

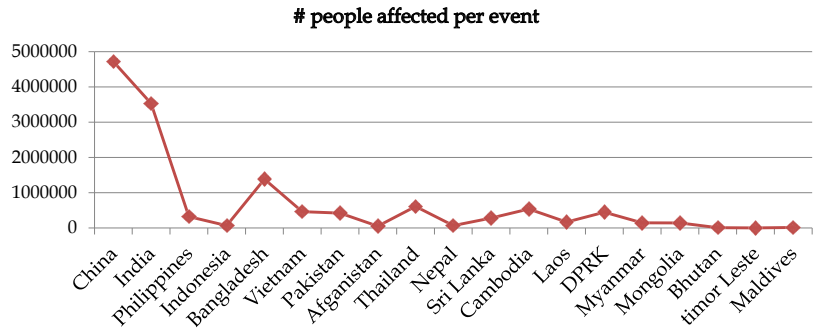


**Figure 6:** Number of people affected per event in Asia.

## Legal and Institutional Frameworks

South Asia has developed a regional road map for disaster risk reduction (DRR) and a framework for mainstreaming DRR in the development sectors in the region. In Sri Lanka and Bangladesh, separate Ministries have been established and authorities have been delegated. However, in other countries focal desks at some key Ministries have been formed and nodal organization set up. Legislative framework and institutional capacity to manage hazards have been developed in all the SAARC countries. However, the capacities of these institutions are not the same in all the countries [23-28]. India, Sri Lanka, Pakistan and Bangladesh are quite ahead in terms of capacities and networking.

In India, Nepal, Sri Lanka and Bangladesh the National Development Plan encompasses the disaster management component. The eleventh five year plan of India has given focus on mainstreaming of DRR in all development sectors and urged all Ministries to integrate DRR into the sectoral planning. Nepal is the only country in the SAARC region that has not formed National DM Commission or DM Authority yet (Tables 11 and 12). However, an authority for reconstruction for earthquakes of April 2015 has been formed in 2016.

## Key Findings and Conclusion

The key findings of the natural hazards, vulnerability and disaster risk of the counties in the South Asia Region may be summarized as follows:

- Afghanistan, Pakistan, India, Nepal, and Bangladesh, lie in very high risk zones, where seismic and hydro-meteorological hazards are active.
- Urbanization, environmental degradation and lack of strong governance are exacerbating the vulnerabilities in most of the countries in South Asia. Political instability, border disputes and ineffective regional networks in these countries are triggering the hazard impacts;
- Floods, earthquakes, wild land fires (forest fires) and volcanoes have significant cross-border impacts. Koshi river flooding (2008) in South Asia; Kashmir earthquake (2005), Bihar earthquake of 1934, Indian Ocean Tsunami, tropical cyclones in Bangladesh and India, Pakistan floods of 2010 are some examples of cross-border effects of disasters [29-32].
- Bangladesh is the most vulnerable country to natural disasters followed by India and Pakistan in South Asia.
- 'Flooding' is the most frequent and common natural hazard in Asia. Floods occur at least once a year in all the countries in South Asia. For instance, 75% of the total annual mortality due to floods is in three countries of Asia namely India, Bangladesh and China. Nine out of 10 countries on the top of Mortality Risk Index (MRI) are in Asia. Nepal, Indonesia and Philippines are in the top ten MRI for landslide risk [33].
- Disasters due to natural hazards have high impact on low and medium HDI countries. All the ten most affected countries from the natural disasters over the past 30 years belong to these two categories in Asia [34].
- Unlike in other regions, the 'number of people killed per year', 'number of people affected per year' and 'number of people killed per million inhabitants' are rising in most of the countries in South Asia. The number of hazard events and disaster impacts are increasing over the last 30 years in this sub-region. The risks are also concentrated in certain countries and locations. The change in nature of the hazard events and increased impact can be due to urbanization, climate change and environmental degradation [35].
- 'Cross-border vulnerability' is very important and highly relevant to DRR. The occurrence and impact of disasters are not confined to a country's political boundary. The earthquake of 1223 and 1934 (which killed thousands of people in India and Nepal), the Kashmir earthquake of 2005 (India and Pakistan), the Koshi flood of 2008 (India and Nepal), the Indian Ocean Tsunami of 2004 (more than 12 countries), tropical cyclones (India, Bangladesh, Sri Lanka and Maldives), and GLOF in Nepal (Impact in India, Nepal, Bangladesh and Maldives) are some examples of cross-border vulnerabilities [36,37].

The following are the some of the key challenges and constraints in the disaster risk reduction and management in the South Asia region:

- Most of the governments in the region have given priority for relief and response operations rather than disaster risk reduction.
- There are a number of sporadic community level initiatives and good practices. However, there are no proper mechanism to scale up successful initiatives;
- Insignificant and unpredictable amount of resources are available for DRR component in each key sector. Coordination has also been a challenge at all levels.
- In most of the countries, sustainable local capacity building mechanism has not yet emerged. One of the main challenges

| Country | DM Act | DM Ministry/Department | DM strategy, Roadmap, standing order; Framework | National DM Commission or Authority |
|---|---|---|---|---|
| Afghanistan | ✓ | ✓ | - | ✓ |
| Bangladesh | ✓ | ✓ | ✓ | ✓ |
| Bhutan | ✓ | - | ✓ | ✓ |
| India | ✓ | ✓ | ✓ | ✓ |
| Maldives | ✓ | ✓ | ✓ | ✓ |
| Nepal | ✓ | - | ✓ | (only for EQ) |
| Pakistan | ✓ | ✓ | ✓ | ✓ |
| Sri Lanka | ✓ | ✓ | ✓ | ✓ |

**Table 11:** Disaster management policy and institutional frameworks in SAR.

| Countries | National platform | Related Act | Institutional structure |
|---|---|---|---|
| Afghanistan | National Commission on Disaster Management | National DM Law | The Afghanistan National Disaster Management Authority (ANDMA) is the principal institution at the national level with the mandate to coordinate and manage all aspects related to disaster mitigation, preparedness, and response through its national and provincial offices. A presidential decree of May 2007 empowers ANDMA as a nodal agency responsible for coordinating all disaster related intervention in the country.<br>Afghanistan has developed key policy documents such as the Disaster Management Framework, National Strategy for Disaster Management, and National Disaster Management Plan. The National Disaster Management Commission, under the leadership of the president has been established. |
| Bangladesh | National Disaster Management Council (NDMC) | DM Act, 2012 | The government has restructured and established the Disaster Management Department as the main organ or instrument in the field for implementing and coordinating various forms of disaster management activities. Merging two organizations – the Disaster Management Bureau (established after the 1991 cyclone) and the Directorate of Relief and Rehabilitation established earlier. |
| Bhutan | Department of Disaster Management (DDM) | National DM Act | The Royal Government of Bhutan has formulated the Department of Disaster Management under the Ministry of Home and Cultural Affairs. It coordinates all disaster management activities in the country and is responsible for public awareness and disaster preparedness with special focus on vulnerable groups.<br>Has formulated documents such as National Disaster Management Act, National Disaster Management Framework, Disaster Management Rules and Regulations. |
| India | National Disaster Management Authority (chaired by Prime Minster) | DM Act 2005 | The Disaster Management Act 2005 has provided the legal and institutional framework for disaster management in India at the national, state and district levels.<br>National Institute for Disaster Management (NIDM) has been created under the Disaster Management Act, 2005 for policy advocacy, research, training, capacity building, and documentation for the holistic management of disasters as mandated by the policies and guidelines laid down by the NDMA. The General Body of the Institute is chaired by the Home Minister and has 10 Secretaries to the Government of India as Members. Vice Chairperson of the National Disaster Management Authority is the Chairman of the Governing Body. |
| Maldives | National Disaster Management Council (NDMC) | DM Act 2007 | The mission of the NDMC is to take proactive and timely measures to prevent or reduce the impact of disasters on the Maldivian people and economy through its efficient staff and collaborative efforts with National, Regional and International Agencies.<br>DM Centre has been formed to coordinate DM related activities in the country. |
| Nepal | Central Natural Disaster Relief Committee (CNDRC)<br>National Reconstruction Authority (NRA) for reconstruction of earthquake affected areas. | Disaster Relief Act 1982 | The Ministry of Home Affairs is responsible for coordinating overall disaster management activities in Nepal. The Natural Calamity Relief Act (NCRA) has provision to set up the Central Natural Disaster Relief Committee (CNDRC), Regional Natural Disaster Relief Committee (RNDRC), District Disaster Relief Committee (DNDRC) and Local Natural Disaster Relief Committee (LNDRC) to administer relief and rescue works during emergency. The Natural Disaster Relief Committees at Central and District levels are also functional. |
| Pakistan | NDMA | National Disaster Management Ordinance 2006 | Set up under Section 3 of the National Disaster Management Ordinance 2006 and is responsible for the preparation of the national planning, coordinating, mandating and implementation of the plan, lay down guidelines for preparation of disaster management plan by the different Ministries and the provincial Governments. The Chairperson of the NDMA also functions as the Ex-officio Director General of the National Disaster Management Commission which is headed by the Prime Minister and includes the leader of opposition in the National Assembly, concerned Ministers and the Chief Ministers of the provinces. |
| Sri Lanka | | DM Act 2005 | The National Council of Disaster Management (NCDM) is chaired by the President and Vice-chaired by the Prime Minister and Leader of Opposition, Ministers and provincial Chief Ministers as its Members. The Disaster Management Centre (DMC) was established in July, 2005 to implement the directives of the NCDM.<br>In July 2005 the Disaster Management Centre (DMC) was established as the implementing arm of the National Council for Disaster Management (NCDM). As mandated by the Act, the National Council for Disaster Management (NCDM), chaired by H.E. the President is the apex body for disaster management. |

**Table 12:** National focal agencies in SAARC countries.

for DRR mainstreaming is to strengthen DRR capacity at the local level to ensure implementation of DRR initiatives.

- Cross-border vulnerabilities and disaster impacts need to be considered in the regional planning. This has been neglected in the past. Floods, earthquakes, forest fire, tsunami and volcanoes have significant cross border impacts. Recent floods in Pakistan, India, Bangladesh and Nepal devastated the lives and properties in more than one country.

Formulation of appropriate and relevant policies, strategies and frameworks and their effective implementation are the prerequisites of an efficient and effective disaster management system in a country. After the 2005 Kobe conference, many efforts have been initiated in line with the resilient building of the state in the SAARC region. However, there exists a huge gap in its implementation. For this, a sound disaster risk management system together with the strong coordination among the disaster risk management actors in the countries should prevail to augment the capacity building of the community and build their resilience capabilities.

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