The Democratic Socialist Republic of
Sri Lanka

The Democratic Socialist Republic of Sri Lanka

STATUS OF DISASTER MANAGEMENT

Final Report for the Visiting Researcher Programe Year 2010

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I am Dinesh Hemachandra, a Geologist at National Building Research Organisation (NBRO) in Sri Lanka. I am here as a visiting researcher at Asian Disaster Reduction Center (ADRC) in Kobe.

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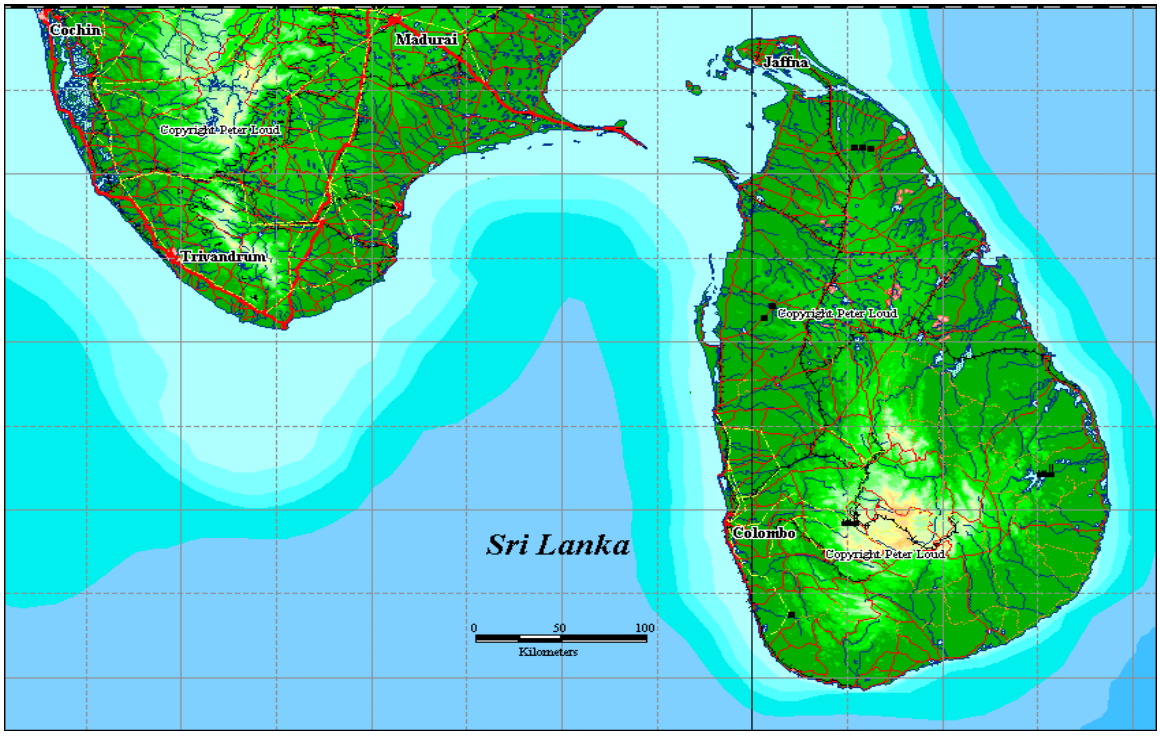
01. General Information of Sri Lanka

01.1 Background Information

Country name: **conventional long form:** **conventional short form:** **former:**	**Democratic Socialist Republic of Sri Lanka** Sri Lanka Serendib, Ceylon
Government type	Republic
Capital	Colombo; note - Sri Jayewardenepura Kotte is the legislative capital
Administrative divisions	8 provinces; Central, North Central, North Eastern, North Western, Sabaragamuwa, Southern, Uva, Western; note - North Eastern province may have been divided in two - Northern and Eastern
Independence:	4 February 1948 (from UK)
National holiday:	Independence Day, 4 February (1948)
Constitution:	adopted 16 August 1978
Legal system:	a highly complex mixture of English common law, Roman-Dutch, Muslim, Sinhalese, and customary law; has not accepted compulsory ICJ jurisdiction
Suffrage:	18 years of age; universal
Executive branch: **Head of government:**	President Mahinda Rajapaksha (since 22 December 2005); Ratnasiri Wickramasingha(since 05 Jan. 2006) is the prime minister; in Sri Lanka the president is considered to be both the chief of state and the head of the government, this is in contrast to the more common practice of dividing the roles between the president and the prime minister when both offices exist
Legislative branch:	unicameral Parliament (225 seats; members elected by popular vote on the basis of a modified proportional representation system by district to serve six-year terms)
Judicial branch:	Supreme Court; Court of Appeals; judges for both courts are appointed by the president
International organization participation:	ADRC, JICA, AsDB, C, CCC, CP, ESCAP, FAO, G-24, G-77, IAEA, IBRD, ICAO, ICC, ICFTU, ICRM, IDA, IFAD,

	IFC, IFRCS, IHO, ILO, IMF, IMO, Inmarsat, Intelsat, Interpol, IOC, IOM, ISO, ITU, NAM, OAS (observer), OPCW, PCA, SAARC, UN, UNCTAD, UNESCO, UNIDO, UNTAET, UNU, UPU, WCL, WFTU, WHO, WIPO, WMO, WToO, WTrO
Flag description:	yellow with two panels; the smaller hoist-side panel has two equal vertical bands of green (hoist side) and orange; the other panel is a large dark red rectangle with a yellow lion holding a sword, and there is a yellow bo leaf in each corner; the yellow field appears as a border that goes around the entire flag and extends between the two panels
Population Growth	1.3%
GNP at market price	Rs.1,737bn US$ 18 bn
GNP per capita	Rs.90,244 US$ 935
Languages:	Sinhala, Tamil, English
Life expectancy:	72.5 years
Infant mortality:	17 deaths/1,000 live births
Rural population:	78.9% of total
Urban population:	21.1% of total
Under age 15:	25% of total
Over age 65:	6.9% of total
Labour Force Participation Rate (percent)	48.6%
Unemployment Rate (percent)	8.3%

01.2.Geographical Information:



The democratic Socialist Republic of Sri Lanka (Formerly known as Ceylon) comprises one large island and several islet s, lying east of the southern tip of the Indian subcontinent. The maximum north- south length of (formerly known the island is 435 km. and its greatest width is 225 km. The Island (including adjacent small islands) covers a land area of 65,610 sq. km. The Bay of Bengal lies to its north and east and the Arabian Sea to its West. Sri Lanka is separated from India by the gulf of Manna and the Palk Strait, between which there lies, in very shallow water. Sri Lanka stretches from 5 dig. 55 min to 9 Dig. 42 Min. to 81 Dig.53 Min. East. Sri Lanka is headed by the Executive President. Administratively country is sub divided into nine Provincial councils, 25 districts, and 327 Divisions.

Sri Lanka's population of around 19.8 million has an urban rural mix of approximately 30% to 70 %. Ethnically 75% of population is Sinhalese. Buddhism is the main religion. Around 69% of the population are Buddhists and the rest belong to Christianity, Hinduism and Islam

Detailed Map of Sri Lanka is attached here with ***Annexure No I in PDF***

01.3. Culture of Sri Lanka

With the introduction of Buddhism, Pali works Tripitaka, Pali literature came to Ceylon and the Sinhala language was supplemented with Pali words without much difficulty for the language spoken by the people here was much similar to Pali. A vast literature in Sinhala derived influenced by Pali tripitaka. Pali commentaries and other literature brought from India and the Pali works were translated into Sinhala. With the growth of Mahayana and vast literature in Sanskrit, place of Pali was taken over Sanskrit and the Sinhala language.Really became a mixture of Pali and Sanskrit languages Sanskrit literary works as Meghaduta, Ramayana, Maharasrata were studied and their structure was followed in Sinhala prose and verse.

Aryans when they came to Ceylon brought the system of farming and irrigation but most probably not a religion nor art, architecture, sculpture, literature etc. All these were introduced with the advent of Buddhism. Monasteries and temples and other religious edifies were built first of stone

and later of brick and mortar as residences for the bhikkus huge stupas were constructed to enshrine the scared relic of the Buddha and his noble disciples. These religious edifies were embellished by a rich legacy of sculptural forms. Interior of the Viharas were decorated with images of the Buddha later with Bodhisattvas, various scenes from Buddha's life. With divinities etc. when you take all these into the account we could say that there Mahinda not only introduced noblest religion in the world but also a culture of a much advanced form. Introduction of Buddhism and arrival of Aryans to Sri Lanka not only helped socially but helped to enhanced **culture of Sri Lanka** too.

Aryans first introduced the village system government when they arrived in Lanka. According to historical sources, Vijay's followers established themselves as chiefs of villagers as indicated by the names Anuradhagama à village of Anradha, Upatissagama à village of Upatissa and so on. They chief most probably captured the adjuring villages and set themselves as rulers or rajas of the area. With the introduction of Buddhism these rulers became more humane for they were expected to rule according to the DasaRajaDhamma – 10 kingly virtues (giving, morality, liberality, straightness, gentleness, self-restriction, non-anger, non-hurtfulness, forbearance and non-opposition. At the beginning kings were not looked upon as gods but ordinary men go=given the leadership to work for the welfare of the people under him according to Buddhist principles. Thus the main duties of the Rajas were to develop agricultures by building tanks and canals to protect the people and lands from foreign invaders, plunderers, robbers etc. and also to protect the religion and build religious edifies and grant land for their upkeep.

Thus Ceylon had a culture based on self-sufficiency. There was actually the barter system prevailing in ancient Lanka. Only the kings could trade with foreigners and transact money. Farmer gave some of his products to the villages potter, smithy, traders on cloths, fancy goods etc. in exchange for pots & pans mammoth blades, axes, fancy goods etc. and as such there was no need for the ordinary man to possess money but he and his family had enough for their sustenance unlike people of the contemporary medieval Europe and England where the 8 years, 10 years old worked as slaves in the work, house, in coal mines in stables for a mere pittance..

This culture based on self sufficiency in Lanka as changed into an export – import oriental economy based on export crops as team rubber, coconut, cinchona, cinnamon, canbamousetc. with a damaging influence to sustainable agriculture which declined at a fast rate with the arrival of the Europeans – Rice was exported and the lands were handed over to the Europeans planters for a mere pittance as the farmers could not produce the “so – call deeds” for the land they cultivated for the time immemorial. Thus money became the pivotal factor upon which everything depended. Family relationships, religious practices, ancient customs receded to the background with a new culture based on money.

Classical Dances of Sri Lanka

(a) **(b)**

PhotoS (a), (b), shows the classical dancing of Sri Lanka

The origin of Sri Lankan dances goes back to immemorial times of aboriginal tribes and "yakkas" (devils). According to a Sinhalese legend, Kandyan dances originate, 2500 years ago, from a magic ritual that broke the spell on a bewitched king.

An ancient chronicle, the *Mahavamsa,* states that when the culture hero Vijeya landed in Sri Lanka (Ceylon) in 543 BCE, he heard the sounds of music and dancing from a wedding ceremony. Dance is still of paramount importance in Sri Lankan (Sinhala) arts. There are three main styles: the Kandyan dance of the hill country, known as *uda rata natum;* the low country dance of the southern plains, known as *pahatha rata natum*; and *sabaragamuwa* dance, or *sabaragamuwa natum*.

©

(d)

Photos (c), (d), shows the Kandyan dancing and kandy Perahara

Kandyan dance takes its name from Kandy, the last royal capital of Ceylon, which is situated about 72 miles (120 kilometers) from the modern capital at Colombo. This genre is today considered the classical dance of Sri Lanka. In Sanskrit terminology it is considered pure dance *(nrtta);* it features a highly developed system of *tala* (rhythm), provided by cymbals called *thalampataa*. There are five distinct types; the *ves, naiyandi, uddekki, pantheru*, and *vannams.*

- **Ves Dance.** *Ves* dance, the most popular, originated from an ancient purification ritual, the Kohomba Yakuma or Kohomba Kankariya. The dance was propitiatory, never secular, and performed only by males. The elaborate *ves* costume, particularly the headgear, is considered sacred and is believed to belong to the deity Kohomba. (See Kohomba Kankariya *and* Ves Dance.)Only toward the end of the nineteenth century were *ves* dancers first invited to perform outside the precincts of the Kankariya Temple at the annual Kandy Perahera festival. Today the elaborately costumed *ves* dancer epitomizes Kandyan dance. (See Kandy Perahera.)
- **Uddekki Dance.** *Uddekki* is a very prestigious dance. Its name comes from the *uddekki,* a small lacquered hand drum in the shape of an hourglass, about seven and half inches (18 centimeters) high, believed to have been given to people by the gods. The two drumskins are believed to have been given by the god Iswara, and the sound by Visnu; the instrument is said to have been constructed according to the instructions of Sakra and was played in the

heavenly palace of the gods. It is a very difficult instruments to play. The dancer sings as he plays, tightening the strings to obtain variations of pitch.

- **Pantheru Dance.** The *pantheruwa* is an instrument dedicated to the goddess Pattini. It resembles a tambourine (without the skin) and has small cymbals attached at intervals around its circumference. The dance is said to have originated in the days of Prince Siddhartha, who became Buddha. The gods were believed to use this instrument to celebrate victories in war, and Sinhala kings employed *pantheru* dancers to celebrate victories in the battlefield. The costume is similar to that of the *uddekki* dancer, but the *pantheru* dancer wears no beaded jacket and substitutes a silk handkerchief at the waist for the elaborate frills of the *uddekki* dancer.

Naiyandi Dance. Dancers in Naiyandi costume perform during the initial preparations of the Kohomba Kankariya festival, during the lighting of the lamps and the preparation of foods for the demons. The dancer wears a white cloth and white rurban, beadwork decorations on his chest, a waistband, rows of beads around his neck, silver chains, brass shoulder plates, anklets, and jingles. This is a graceful dance, also performed in Maha Visnu (Vishnu) and Kataragama Devales temples on ceremonial occasions.

01.4. History Information:

(e)

(f)

Photos (c), (d), shows the Kandyan dancing and kandy Perahara

Figure 01- Historical Places of Sri lanka

Recent excavations show that even during the Neolithic Age, there were food gatherers and rice cultivators in Sri Lanka. Very little is known of this period; documented history began with the arrival of the Aryans from North India. The Aryans introduced the use of iron and an advanced form of agriculture and irrigation. They also introduced the art of government. Of the Aryan settlements, Anuradhapura grew into a powerful kingdom under the rule of king Pandukabhaya. According to traditional history he is accepted as the founder of Anuradhapura.

During the reign of King Devanampiya Tissa, a descendent of Pandukabhaya, Buddhism was introduced in 247 B.C. by Arahat Mahinda, the son of Emperor Asoka of India. This is the most important event in Sri Lankan history as it set the country on the road to cultural greatness. As a new civilisation flourished Sri Lanka became rich and prosperous.

In the mid 2nd century B.C. a large part of north Sri Lanka came under the rule of an invader from South India. From the beginning of the Christian era and up to the end of the 4th century A.D. Sri Lanka was governed by an unbroken dynasty called Lambakarna, which paid great attention to the development of irrigation. A great king of this dynasty, Mahasen (3rd century A.D.) started the construction of large `tanks' or irrigation reservoirs. Another great `tank' builder was Dhatusena, who was put to death by his son Kasyapa who made Sigiriya a royal city with his fortress capital on the summit of the rock.

As a result of invasions from South India the kingdom of Anuradhapura fell by the end of the 10th century A.D. Vijayabahu 1 repulsed the invaders and established his capital at Polonnaruwa in the 11th century A.D. Other great kings of Polonnaruwa were Parakrama Bahu the Great and Nissanka Malla both of whom adorned the city with numerous buildings of architectural beauty.

Invasion was intermittent and the capital was moved constantly until the Portuguese arrived in 1505, when the chief city was established at Kotte, in the western lowlands. The Portuguese came to trade in spices but stayed to rule until 1656 in the coastal regions, as did the Dutch thereafter. Dutch rule lasted from 1656 to 1796, in which year they were displaced by the British. During this period the highland Kingdom, with its capital in Kandy, retained its independence despite repeated assaults by

foreign powers who ruled the rest of the country. In 1815 the kingdom of Kandy was ceded to the British and thus they established their rule over the whole island. Modern communications, western medical services, education in English, as well as the plantation industry (first coffee then tea, rubber and coconut) developed during British rule. By a process of peaceful, constitutional evolution, Sri Lanka won back her independence in 1948 and is now a sovereign republic, with membership in the Commonwealth of Nations and the United Nations Organisation.

01.5 Present Government Information:

01.6 Administrative Details

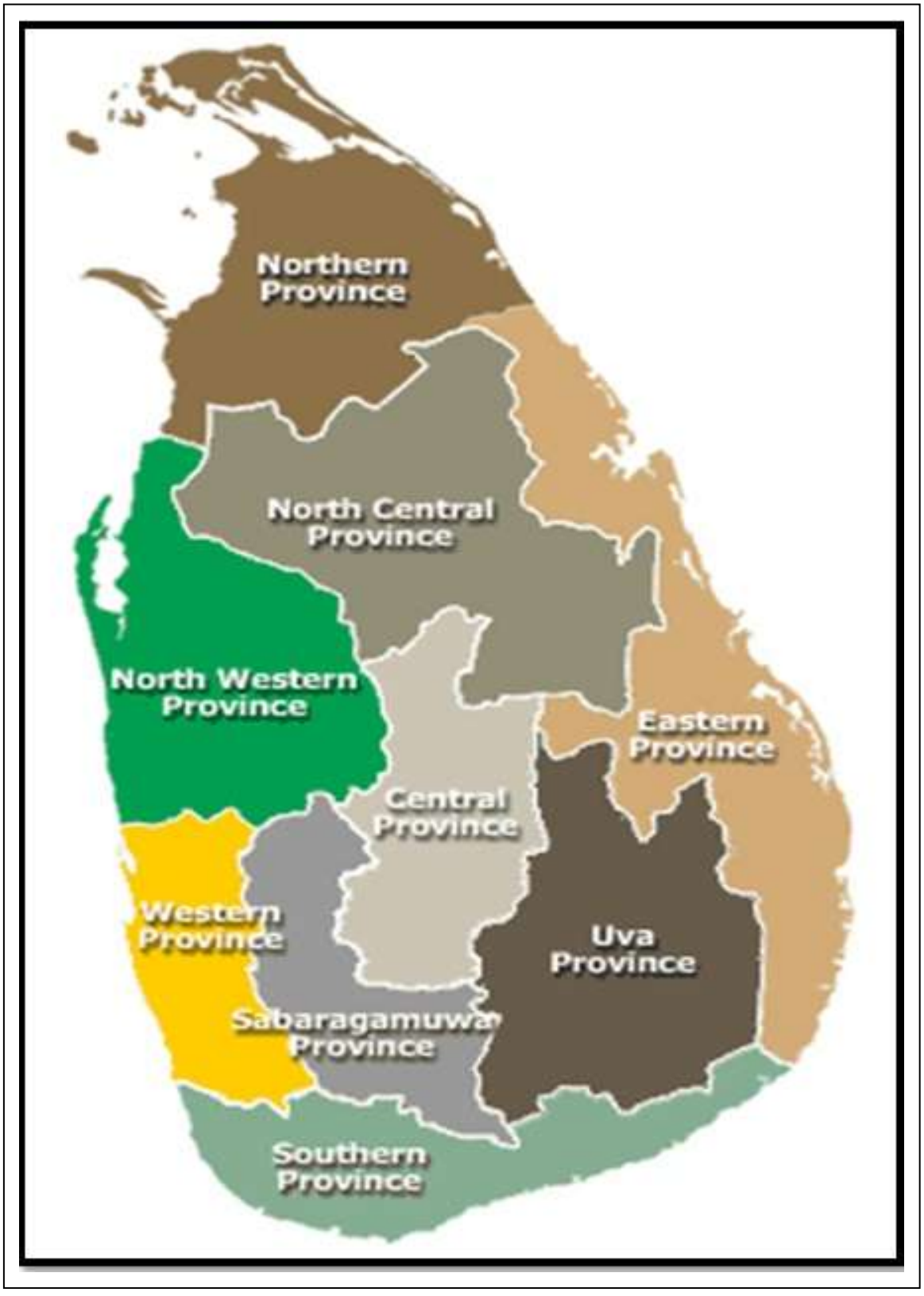


Figure 2- Administrative Boundaries (divided into 09 Province)

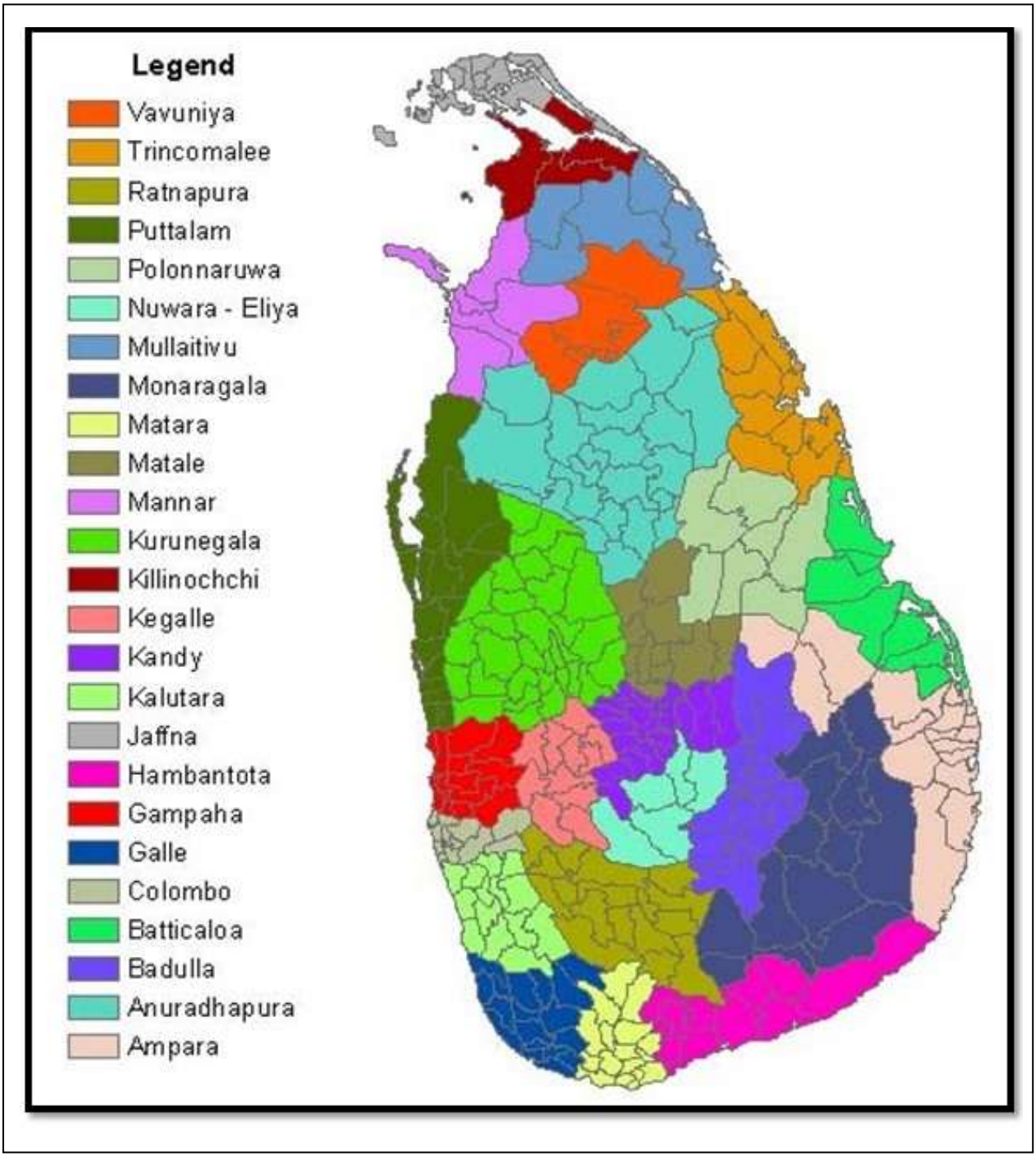


Figure 3- Districts Boundaries (divided into 25 districts)

Figure 4- Sri Lanka's population of around 2009 estimate 20 million has an urban rural mix of approximately 30% to 70 %

01.7 Sri Lanka Economy

Sri Lanka's economy is mainly agricultural, based on the production and export of tea, rubber, coconut garments, gems and minor export crops. Paddy is the main domestic crop, and rice is the staple food of the people, foreign employment and tourism play a vital role in the economy of the country.

The House holds Income Survey data 2002 reveals that during 1981-2002 the richest 20% increased by 121% where as the poorest 40 % of the income group increased only by 15.6 %.

The per capita GDP in the Western Province 1470 US$ in all other districts it is below the national average of US$ 935 Lowest per capita GDP, US$ 483 was recorded in the conflict affected areas of country. 455 of the population in the country earns below US$ 2 per day. This accounts for over 60 percent in the rural sector. In 2002 the percentage of poor households in the rural sector based on the official poverty line was 20.8 against 6.2 in the urban sector. It was 24.3 in the estate sector.

Macro economic forecast up to 2010 expect a growth of GDP at 7%-8% While the initiatives taken by the government to improve the economic infrastructure development in the country is admirable, the issues relating to economic infrastructure have to be resolved urgently to place the country in the expected high economic growth path. In 2009, the government continued its efforts to improve the social infrastructure facilities considering the importance of social infrastructure development in building a healthier society with an educated and productive labor force. The government has declared its intention to transform Sri Lanka into a Naval, Aviation, Commercial, Energy and Knowledge hub and develop the country into a strategically important economic centre in the region. With the end of nearly three decades of conflict in May 2009 and the re-integration of the Northern and Eastern provinces with the rest of the country, priority has been given to infrastructure development activities in these two provinces.

Port Services

Development of port infrastructure has been given the highest priority in recent years. Several port developmental projects were in progress in 2009.

Figure 6- Layout Plan of the Port of Hambantota

The Hambantota port was envisioned during an effort to synchronies the different aspects of port development including shipping, transshipment, ship building and bunkering and construction commenced in January 2008. It is a landmark project built inland on dry conditions and is the fi rst major port built in Sri Lanka after the Port of Colombo which was built in the 1870s. The total estimated cost of this project is US dollars 361 million and Phase I of the Hambantota Port Development Project is expected to be completed by April 2010.

Tourism sector enjoyed total earnings of US $ 384 million in 2009, an increase of 12.3 percent over 2008 making itself as the fast emerging growth industry in the economy. The number of tourist arrivals has also increased to 448,000, a 2.1 percent increase compared to 2008. Sri Lanka is eyeing 575,000 tourists with earnings of US $ 600 million for 2010. During the second half of 2009, the tourist arrivals and earnings rose by 21.5 percent and 42.5 percent respectively compared to the corresponding period of 2008.

Economic Target:

- 8% Growth in GDP by 2010
- Reduction of budget deficit from 9.9% of GDP in 2002 to 3% of GDP by 2010.
- Reduction of current account deficit and improve balance of payment.
- From 6.6 %of GDP 2002 to 0.5 % of GDP by 2010.
- An Increase of in domestic savings from 17.3 percentile to 32% of GDP by 2010.
- An Increase of investment from 28% of GDP to 35% by 2010.
- An increase of exports 39.1 % to 50.8 of GDP by 2010.
- Reduction of inflation from 6 % to 3 % by 2010.

01.8. Weather and Climate

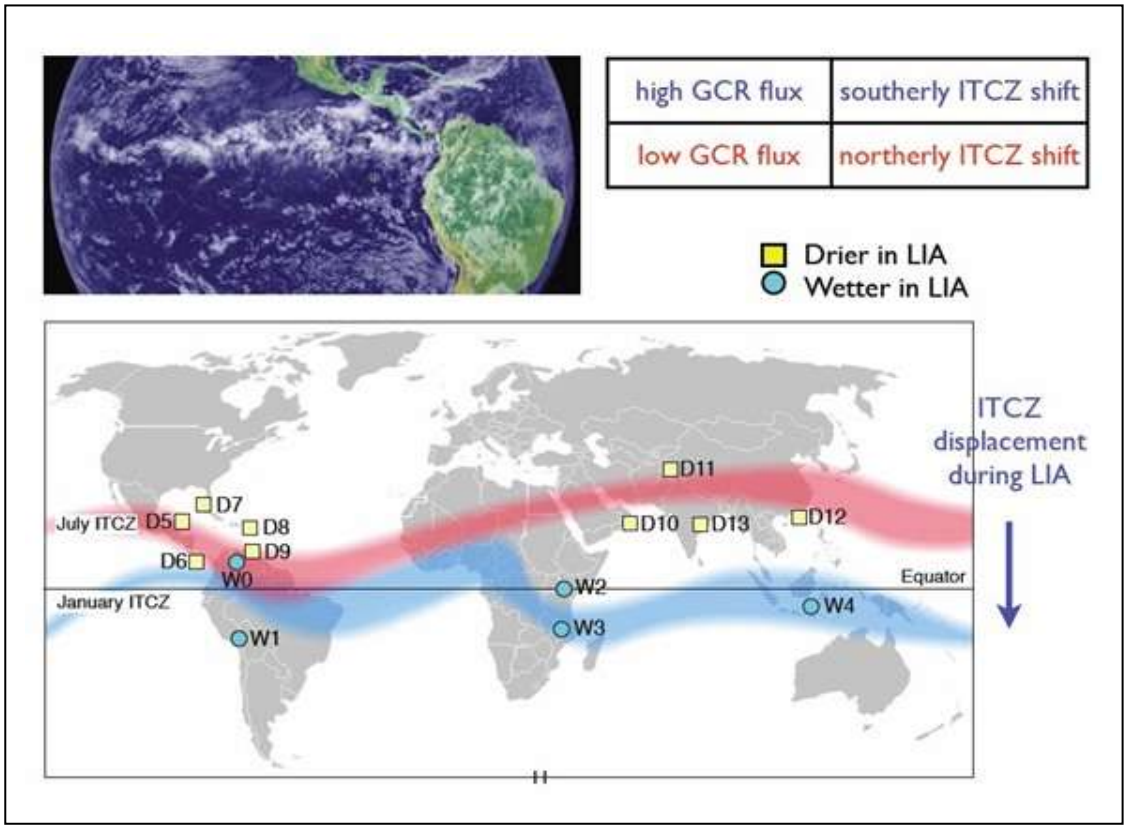


Figure 5- Sri Lanka lie on ITCZ - Map

The climate of the island is mostly governed by the metrological conditions in the Bay of Bengal. The climate of Sri Lanka can be classified as a tropical monsoonal climate marked by model seasonal rhythm rainfall of two distinguished monsoons (South west monsoon and North east monsoon.) the south west monsoon and North east monsoons are prevalent from May to September and December to February respectively. The first and second inter monsoons are prevalent from March-April and October-November respectively. The onset of monsoon is associated with a cyclonic wind circulation in the low troposphere (below 1500m). the surface winds occur when cyclonic storms cause depressions to form in the vicinity of the country. Depressions frequently occur with the onset of the monsoons.

The annual rainfall in Sri Lanka varies from 900 mm to 6,000 mm and the average annual rainfall is 1836 mm. Wet, intermediate and dry zones are classified as below.

Wet Zone - Annual rainfall above 2,200 mm

Intermediate zone. – Annual rain fall between 2,000 mm and 2,200 mm

Dry zone - annual rainfall bellow 2,000 mm

The temperature decreases with increasing altitude approximately 2 degrees C for every 300 m of elevation. The high temperatures are observed in April, May and June. And the low temperatures are observed in December, January and February. However the difference between the warmest and coldest is only between 1.5 to 4 degrees C. The annual average temperature for the country varies from 25 and 28 Degrees C. The relative humidity varies generally from 70 % during the day to 90 % at night. In the arid areas in the south west and the south east, the humidity drops to about 60%.Based on the observations made by the Irrigation department and Meteorological Department, the average annual evaporation for the Dry zone and wet zone are 1,436mm and 1,017 mm respectively.

01.8.1 Climate Change

01.8.1.1 Present and Future Perspective of Sri Lanka (source :Department of Meteorology, Colombo)

Climate Change is defined as statistically significant variation in either mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forcing or to persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC, 2001).

01.8.1.2 Rain fall change

Annual average of rainfall over Sri Lanka has been decreased by an amount of 144 millimeters, about seven percent, during 1961 to 1990 period compared to 1931 to 1960 period (Chandrapala 1997) with the standard deviation increasing from 234 to 263 millimeters. Northeast monsoon rainfall over Sri Lanka has been decreased from 1931 – 1960 to 1961-1990 periods, with an increased variability. Southwest monsoon rainfall has not shown any significant change during these two periods; however variability has been decreased during 1961-1990 compared to 1931-1960. High

variability of annual rainfall is reported at Baticaloa, Kurunegala, and Rathnapura) meteorological stations in the recent past compared to other meteorological stations. No significant trends of annual rainfall have been noticed during the last century. High variability of rainfall patterns could probably be due to global climate change with the increase of Greenhouse gases in the atmosphere.

01.8.1.3 Temperature Change

Annual mean air temperature anomalies have shown significant increasing trends during the recent few decades in Sri Lanka (Basnayake et al 2002). The rate of increase of mean air temperature for the 1961-1990 period is in the order of 0.016 0C per year (Chandrapala, 1996). Annual mean maximum air temperatures have shown increasing trends in almost all stations with the maximum rate of increase about 0.021 0C per year at Puttalam. Nighttime annual mean minimum air temperatures have also shown increasing trends with higher gradients. The maximum rate of increase of nighttime annual mean minimum air temperature is reported about 0.02 0C per year at Nuwara-Eliya.

It has been evident that increase in average annual surface temperatures across the country during recent time is largely due to the increase in nighttime minimum temperature than that of the daytime maximum temperature. This trend is similar to the global trend of rising temperature during the last century. Enhanced greenhouse effect could partly be responsible for this warming in addition to the local heat island effects caused by the rapid urbanization that has been taken place during the recent past.

01.8.1.4 Impacts due to Increased Sea Level

Being an island Sri Lanka is highly vulnerable to sea level rise with varying degree of sectoral impacts. It is highly confident that sea water intrusion to agricultural lands will be inevitable event under a changing climate which will lead to further reduction of land available for agriculture. Increased sea level rise will also exacerbate the coastal erosion giving rise some additional pressure on land available for agriculture, directly and indirectly. Also, it may reduce the quality of both drinking and irrigation water in coastal regions by disturbing the interface between fresh and brackish water. It is highly likely that sea level rise will disturb the Gyben-Herzberg lens of fresh water found underneath of Regosol in coastal regions. These fresh water lenses provide the irrigation water for intensive agriculture in those regions.

01.8.1.5 Response Strategies to Minimize the Vulnerability

Suggested Adaptation Strategies – Technical

- promote micro-irrigation (drip, sprinkler etc.).
- upland annual crop cultivation in the DZ to be transformed to perennial fruit crop cultivation

with intensive irrigation management practices wherever possible.

- crop recommendation based on the agro-ecological suitability.
- promote on-farm soil and moisture conservation.
- rain water harvesting (domestic and on-farm).
- rehabilitation of irrigation canal network.
- rehabilitation of minor tanks to operate at their design capacity.
- re-use of drainage water, if suitable.
- use of tail water recovery pits for lift irrigation.
- program to improve the water use and conveyance efficiency.
- breeding for short age varieties.
- strengthen the breeding program for.
- drought resistance.
- high temperature resistance.
- pest and disease resistance.
- salt resistance.
- effective use of long range weather forecasting for agricultural planning.

02. Natural Disasters on Sri Lanka

Photo (g) shows the December 2004 Tsunami devastation on southern coastal parts of the country.

Natural Disasters in Sri Lanka are mainly hydro-meteorological and geological phenomenal events such as floods, landslides, cyclones, tidal waves drouts and Tsunamis. Besides the country is plunging in civil strife, accidents, industrial hazards and environmental degradation as human made disasters. Natural Disasters have caused extensive damage to the people and property year after year, disrupting social and economic development endeavors. While it is experiencing human made disasters, triggering tremendous damage to people and there livelihood and exposing substantial economic losses to the country. In the last 10 years period before 2003, Sri Lanka experienced 30 major disaster events in which about 398 peoples were killed and 27.5 million people were affected. The total economic losses were estimated to be almost US$ 5.96 billion approximately. But the flood and Land slides occurred on 17 May 2003 have claimed 252 lives around 26 000 houses damaged. It is estimated that total loss to economy is around US$ 76.7 million. And the divesting Tsunami waves in 26 Dec. 2004 caused unbelievable damage to country which claimed approximately 40000 people lives and caused more than US$ 3.0 billion losses to country economy. While the natural disasters claimed such amount people's lives, man made disasters also have killed about 640000 people and 20 million people affected since 1983. (Annexure 1, shows the occurrence of Natural Disasters and allocated funds for relief and rehabilitation activities for 1981-2005)

02.1 Disasters in Sri Lanka and the History

When look back at the history of natural disasters in Sri Lanka one will be surprised to know that the island is located in a dangerous position not far away from the two fault lines, one in Indian Ocean and the other in the Bay of Bengal. The volcanic mountain named Karakatoa located in the Sunda strait near Sumatra erupted on 27th August 1887 at 10.00 am generated massive 40 meters tidal waves which killed more than 36450 people. Waves hit Pothuvil, Panama, Hambantota, and Galle in southeastern coastal towns of Sri Lanka. April 14th, 1615, a strong earthquake struck Sri Lanka unleashing widespread damage and casualties in western sections of the island, most notably in Colombo. It is thought that 200 houses collapsed. A part of the western city wall of the Colombo Fort collapsed destroyed. A bastion also collapsed and destroyed a neighboring house killing 4 persons. A stone bridge was also destroyed in the earthquake. Deep fissures opened in the earth. According to a historical text (reproduced below), flames and sulphur are said to have been emitted from these fissures. It is thought that 2000 persons were killed in and around Colombo as a result of this earthquake. The recent Tsunami originated by the undersea earthquake on the northern tip of this fault line has again hit Sri Lanka. It is incorrect to say that Sri Lanka is free from natural disasters like Cyclone, Tsunamis, Floods and Landslides etc.

The most powerful earthquake in 40 years erupted under the Indian Ocean near Sumatra on Dec. 26, 2004. It caused giant, deadly waves to crash ashore in nearly a dozen countries, killing tens of thousands. A long stretch of Sri Lanka's coast was devastated by these killer waves, with more than 40,000 dead and staggering 2.5 million people displaced. Although 1,600km from the epicenter, the waves struck with huge force and swept inland as far as 5 kilometers. Waves as high as six meters had crashed into coastal villages, sweeping away people, cars and even a train with 1700 passengers. It was the worst human disaster in Sri Lanka history. This study mainly concentrated on Tsunami. This is the major incident to create the Disaster Management Center of Sri Lanka.

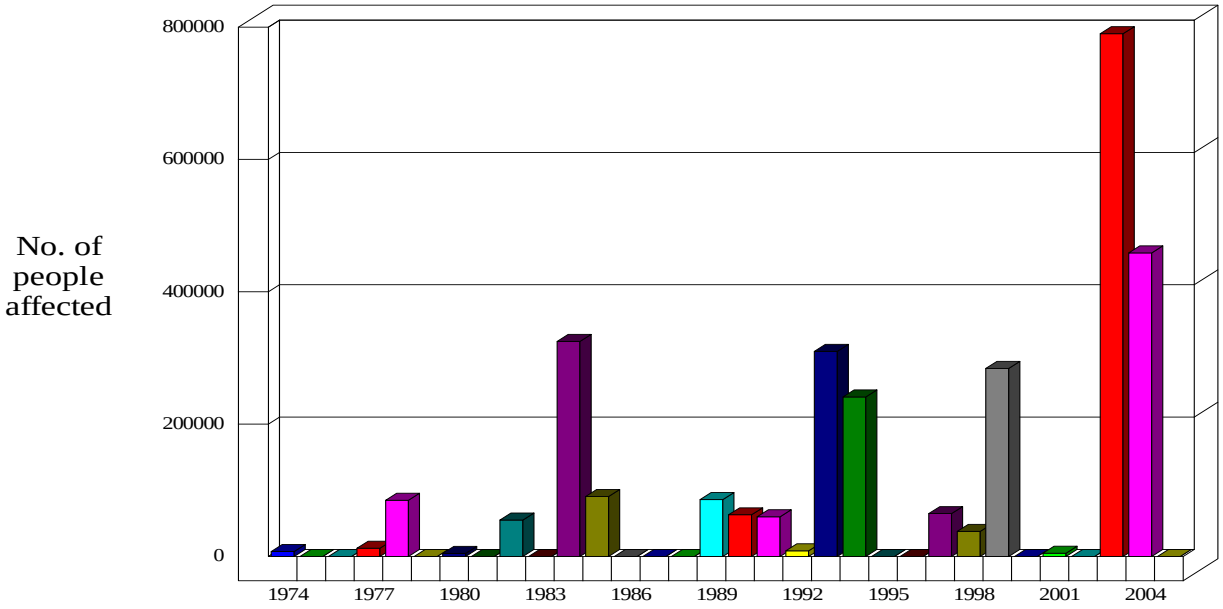
02.2 Floods

Sri Lanka is an island with a unique aerographic region which acts as the hub for the racially flowing river system. There are 103 drainage basin 80 % of this would not have water go dry every year and river basing with over 800 square km are considered as resourceful basins. Out of 103 rivers it is only 10 rivers such as Mahaweli, Kalani, Nilwala, Kalu and Gin are vulnerable to floods substantially. While heavy rainfall and run off the large volume of water from the catchments areas of rivers are the causes of much flooding, human activities such as deforestation, improper land use and absence of scientific soil conservation methods are contributing towards the increase in both frequency and impact of floods.

Despite the districts of Colombo, Gampaha, Rathnapura, Kegalle, Galle and Matara are inundating to floods during the south west monsoon, the districts of Ampara, Polonnaruwa, Trincomalee, Jaffna, and Baticoloa are subject to floods during the North east monsoons. The floods, which occurred in 1947, 1957, 1984, 1990, 1992 and 2003, were disastrous events the country ever faced.

Photo (h) shows the flood of Ratnapura 18.05 2003 (Photo from Irrigation Department)

The Graph of No. of Peoples affected by Floods from 1974-2004 (NDMC)



The Historical Floods for Colombo illustrated in *Annexure No. II*

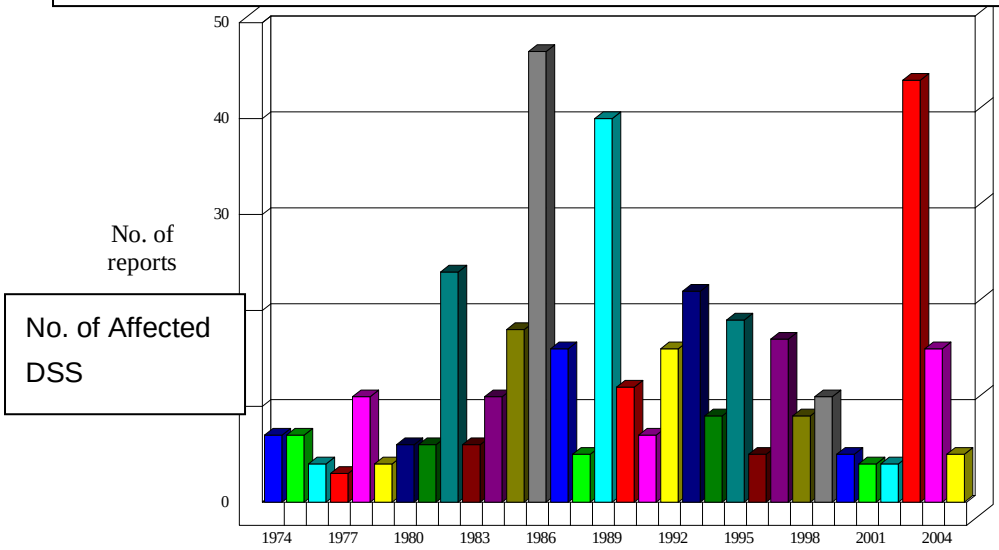
02.3 Landslides

Photo (i) shows the landslide Hapugoda-Ratnapura 2003.05.17 (Photo from NBRO)

Landslides, which are often triggered by intense heavy rains, have caused imminent damage to people and development activities of the country especially during the last two decades. Changes in land use and cropping patterns, increased demand for land that pushes settlements into unstable

areas, alterations in normal drainage flows improper slope cutting technique have caused increasing of the landslides in hilly areas substantially. It is identified that eleven districts in Central .South western, Sabaragamuwa, and Southern region covering over 12000 square kilometers land area of the country are highly vulnerable to land slides. The landslides occurred in 1989, 1993 and 2003 ever recorded hazardous events in the Disaster history of Sri Lanka have Triggered severe damage to people and property.

The Graph of No. of Divisions affected by Landslides from 1974-2004 (NDMC)

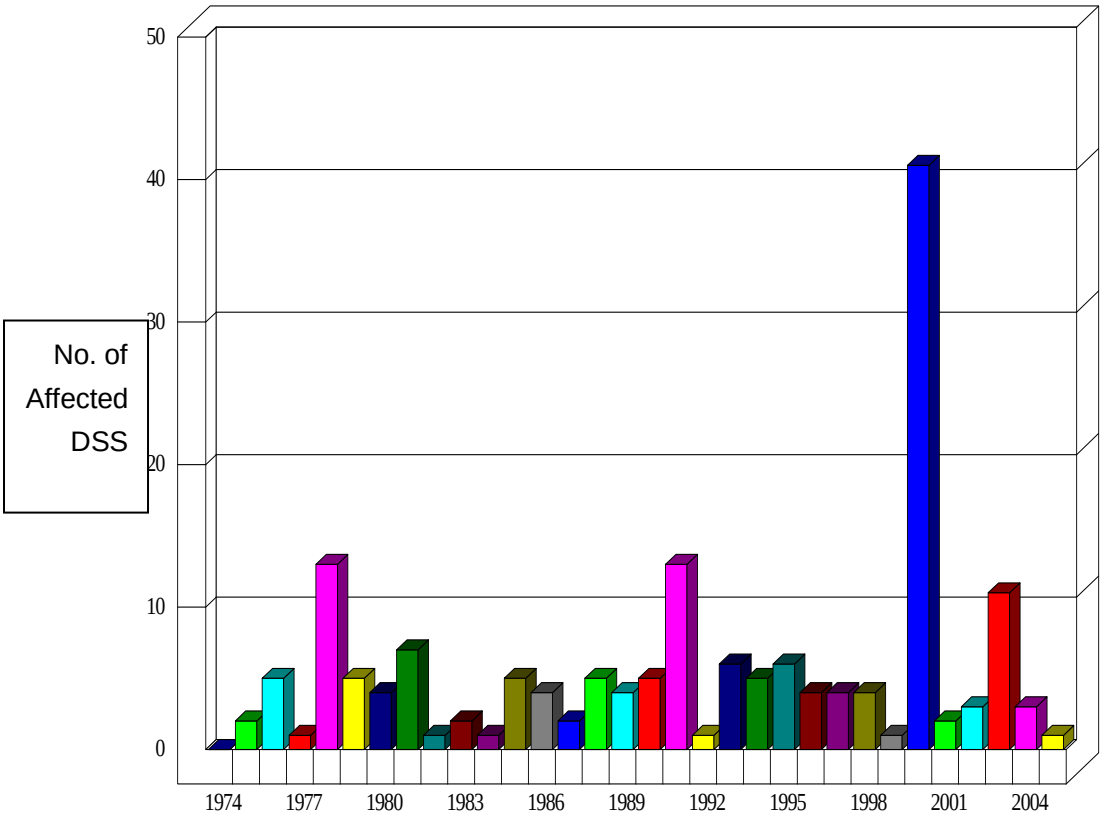


02.4.Cyclones:

The eastern, northern and north central regions are vulnerable to cyclone that occurs as a result of climatic changes of the Bay of Bengal. According to disaster history, cyclones are not frequent occurrences in the country, but high gale and wind storms accompanied with the monsoon rains have frequent caused considerable damage to the people's livelihood and environment. Few of the cyclones in the past 70 years, have caused substantial damage to the society and economy. The 1978 cyclone alone affected more than one million people, killed ,killed nearly a thousand persons, partially and completely damaged more than 250 000 houses, destroyed 90% of coconut plantation in the Batticoloa district and resulted in the government having to spent over 600 million to bring immediate relief to those affected. The cyclone occurred in December 2000, has claimed 15 lives

and damaged 77,000 houses in the districts of Trincomalee, Polonnaruwa, Anuradhapura, Matale, Vavuniya and Mannar.

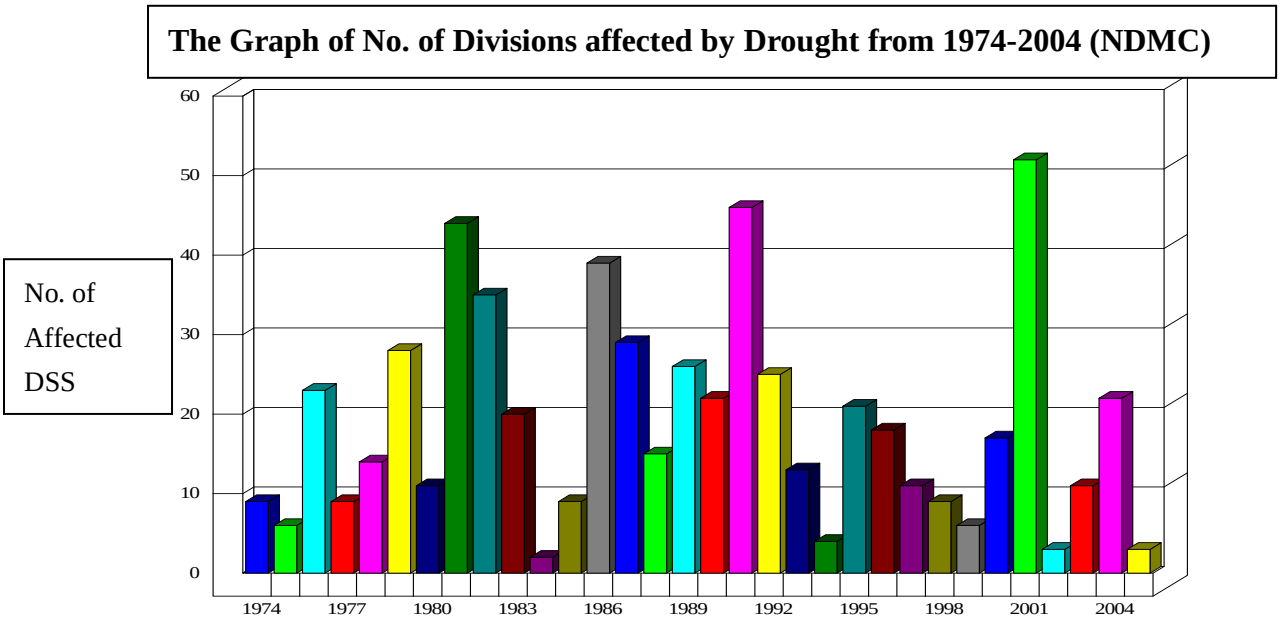
The Graph of No. of Divisions affected by cyclones from 1974-2004 (NDMC)



02.5 Droughts:

Droughts are also a frequent occurrence in Sri Lanka and every year. For short durations droughts which are local significance are experienced by the people in some parts of the country. Despite regional significance droughts occur once in every 3 or 4 years, the people and economy have hit by severe drought national significance once in 10 to 15 years consequently. Least rainfall, deforestation, improper land use and unplanned cultivation patterns are the main causes for the drought in some parts of the country. Such as North central, southern, Northwestern and eastern regions. Major droughts occurred during the period of 1953-1956, 1974-1977, 1981-1983 and 1995-

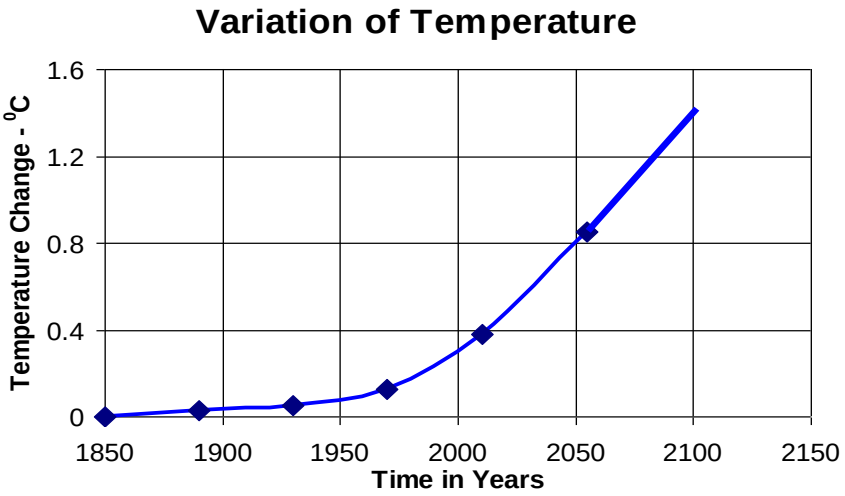
1996, causing substantial damage to the economy and plaguing development efforts of Sri Lanka. The period of 2001- 2002, 1.6 million people living in southern and north western dry zone areas were experiencing severe drought.

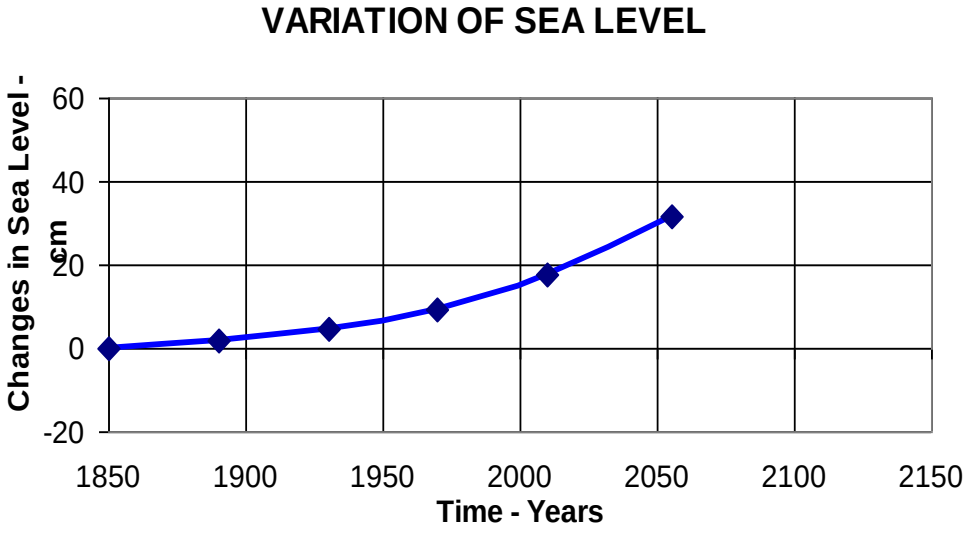


02.6. Sea Erosion:

Sri Lanka has a coastline of 1585 km. nearly 25% of the 19 million populations live along the coastal areas engaging in fisheries and tourist industries. The economic importances of the coastal areas have increased further with the rapid urbanization, the development of commercial harbours (Colombo, Galle and Tricomalee) Fishing harbours and encourage, main lines of communication (road and rail) recreational facilities and tourism. It has been estimated that over 50 – 55 % of the shore line is subjected to or threatened by coast erosion. The most critically affected areas are those between Kalpitiya in the Northwest and Matara in the South. Shoreline retreat due to sea erosion has been a severe problem in Sri Lanka resulting in damage to and loss of property and infrastructure facilities,

and development efforts.





02.7 Tsunami :

Tsunami is a rare, unpredictable and a destructive type of event. The experience of the 26th December 2004 was that the people were taken unawares. This was a disaster, the characteristics of which were not known widely. Unfortunately a historic and a well documented tsunami incident that hit Sri Lanka on 27th August 1883 was not widely known.

When the tsunami struck on 26 December people in Sri Lanka did not know what was happening. The people observing the phenomenon probably would not have known whether it is a local

occurrence in the sea or a country wide phenomenon. Many people moving to the sea shore exploring it when the sea receded stand testimony to this fact.

There was a time gap between the strike of the tsunami on Indonesia and that on Sri Lanka. Even within the country, the coast was hit by the wave at different times (East getting the first brunt, but gradually spreading to North, South and finally the West) allowing adequate time for warning if the mechanism were there.

The most important lesson learnt was that all segments of population including the community and all levels of officials must be made aware of the peculiar characteristics of tsunami. As this is a rare occurrence, it is important that the knowledge is passed on to the next generation

Table 1-Top Ten Natural Disasters From History- up to 2005

Top 10 Natural Disaster

Disaster	Date	Killed
Wave / Surge	26-Dec-2004	35,399
Wind Storm	24-Nov-1978	740
Flood	30-May-1989	325
Flood	17-May-2003	235
Wind Storm	22-Dec-1964	206
Wind Storm	25-Dec-1957	200
Slides	8-Oct-1993	65
Flood	25-Dec-1969	62
Epidemic	Nov-1987	53
Flood	24-May-1984	45

Number of people killed

Number of people affected

Disaster	Date	Affected
Drought	1987	2,200,000
Drought	1982	2,000,000
Drought	1983	1,800,000
Flood	Dec-1983	1,250,000
Wave / Surge	26-Dec-2004	1,019,306
Wind Storm	24-Nov-1978	1,005,000
Flood	25-Dec-1969	1,000,000
Drought	Aug-2001	1,000,000
Drought	Mar-1989	806,000
Flood	17-May-2003	695,000

Source : OFDA/CRED International Disaster Database / Nov-3-2005 - Data version: v05.10

(Annexure No. III) Illustrate occurrence of natural disasters and allocated funds for relief and rehabilitation activities from 1981-2005

03. Current Disaster risk management in Sri Lanka
03.1. Legal System

03. 2 *Sri Lanka Disaster Management Act No 13, of 2005*

13th May 2005 the Government of Sri Lanka has been passed the "**Sri Lanka Disaster Management Act No. 13 of 2005**" in parliament. It is the main legal base for Sri Lanka's Disaster management.

This act provides the provisions of establishment of National Council for Disaster Management (NCDM), the Disaster Management Centre (DMC) ; appointment of technical advisory committees (TAC); the preparation of Disaster Management Plan; the Declaration of a state of disaster; the Award of Compensation and for matters connected here with or incidental thereto. (***Annexure No IV-*** Sri Lanka Disaster Management act no 13-2005)

According to the provisions given by the act, 12th Nov. 2005 Her Excellency the President Chandrika Bandaranaike Kumaratunga was appointed the National disaster management council. This consists of

1 The President- Chairmen
2. The Prime Minister Vice-chairmen
3 The Leader of the opposition
4. The ministers in charge of the following subjects:
    (i) Social Welfare
    (ii) Rehabilitation and Reconstruction
    (iii) Environment,
    (iv) Home affairs,
    (v) Health
    (vi) Science and Technology
    (vii) Housing
    (viii) Coast Conservation
    (ix) Irrigation
    (x) Power
    (xi)Defense
    (xii) Police
    (xiii) Finance
    (xiv) Land
    (xv) Fisheries and aquatic resources
    (xvi) Foreign affairs
    (xvii) Water supply

(xviii) Highways
(xix) Urban Development
(xx) Education

5. The chief ministers of every provincial council

Vision:

Disaster Risk Management for safer communities and sustainable development in Sri Lanka.

The Broad Mission:

To create a culture of safety among communities and the nation at large through systematic management of natural, technological and man-made disaster risks.

03. 3 Functions of the National Council for Disaster Management (NCDM)

The following are spelled out as functions of the Council as its functions and through these provisions it will strategize the implementation mechanisms:

a. Formulate a National Policy and Programme for DM
b. Prepare and formulate the National Disaster Management Plan and the Emergency Operation Plan
c. Monitor and implement the National Disaster Management Plan and the Emergency Operation Plan
d. Facilitate emergency response, recovery, relief, rehabilitation and reconstruction in the event of a disaster
e. Take all steps to counter any disaster or impending disaster in accordance with the plans
f. Direct, coordinate and monitor activities of the Disaster Management Centre established under the provisions of this Act
g. Ensure adequate publicity to the above 2 plans
h. In the preparation of Disaster Management Plan to specify guidelines to be complied by every ministry, government department and public corporations

i. Facilitate and support local and community self reliance in the event of any potential or actual disaster

j. Promote public awareness campaigns and fund research and development in DM

k. Facilitate liaison with originations and persons pursuing hazard, vulnerability and risk reduction studies and implementing action programmes and commissioning such studies and action programmes

l. Assign functions and responsibilities to the Disaster Management Centre (DMC)

m. Initiate programmes relating to prevention and mitigation of disaster and provision of relief, rehabilitation and reconstruction

n. Appraise the Cabinet of Ministers on all relevant matters connected with any potential and actual disasters

o. Recommend the allocation of funds for DM from the relevant authorities and bodies and the Reconstruction and Rehabilitation Fund established by the relevant Act

03. 4 Functions of Disaster Management Centre (DMC)

Disaster Management Centre will be headed by a Director General and there will be Directors appointed as determined by the Council. (Proposed Organizational structure for DMC- ***Annexure No V***) The functions will be as follows:

a. Assisting the Council to prepare the National Disaster Management Plan (NDMP) and the Emergency Operation Plan and proposals for upgrading when necessary

b. Taking responsibility to implement the National Disaster Management Plan (NDMP) and the Emergency Operation Plan (EOP), and upon declaration of a state of disaster to direct and coordinate implementation of EOP

c. Ensure that Disaster Management Plans prepared by ministries, government departments and public corporations conforms to the NDMP

d. Facilitate and support local and community self reliance in the event of any potential or actual disaster

e. Based on NDMP by various ministries, government departments and public corporations, preparing and implementing programmes and plans for disaster preparedness, mitigation, prevention, relief, rehabilitation and reconstruction activities and coordinating of all organizations which implement such programmes and plans, and obtain financial assistance from the Treasury and release same to relevant regions and monitor and evaluate these activities

f. Issuing instructions and guidelines to appropriate organizations, non-governmental organizations, district secretaries and divisional secretaries on DM related activities and initiating and implementing activities with such organizations and secretaries

g. Promoting research and development programmes in relation to DM and maintaining a database on DM

h. Submitting reports to the Council as required

Technical Advisory Committees (TAC) – Provision for Technical Advisory Committees appointed by the NCDM for assisting NCDM and DMC

National Disaster Management Plan (NDMP) - Disaster Management Plans to be prepared and submitted by ministries, government departments and public corporations conforming to the NDMP before the date specified by Council; DMC to extend assistance in the preparation; DMC to submit same to Council

Declaration of a disaster

Procedure to be followed on Declaration of a disaster

Council to obtain assistance of NGOs

Duties of an appropriate organization

Award of compensation

Designation of appropriate organization - Council may designate any ministry, government department, public corporation or Disaster Management Centre (DMC) as an appropriate organization required to carry out and implement the NDMP or Emergency Operation Plan (EOP) as the case may be and generally assist the Council (published in the gazette and specifying duties, guidelines, functions etc.)

After the Presidential Election Dec.2005. Newly appointed His Excellency the President Mahinda Rajapaksha Appointed the two ministries of Disaster Management. Ministry of Disaster management and Ministry Of Disaster Relief services.

(Annexure no. VI) Illustrate the institutions and activities allocated to the Ministries.

03.5. Government Structure of Disaster Management

According to the new reforms of the ministerial levels, the government structure mainly responsible for Disaster management is centered round the District administration, Ministry of disaster Management and Ministry of disaster Relief services. These institutions will focus on Disaster relief, rehabilitation, reconstruction as well as the Disaster Prevention. Mitigation, Preparedness, Awareness and disaster early warning. In the Divisional levels Divisional secretary has an important role in disaster management. His/ her office entrusted to take all possible steps for effective relief and recovery in the aftermath of Disasters as well the preparedness activities to cope with the Disasters.

Supportive agencies:

1. National Planning department.
2. National Building Research Organisation(NBRO)
3. Irrigation Department (ID)
4. Meteorological Department (Met D)
5. Social Service Department (SSD)
6. National water supply & Drainage Board (NWSDB)
7. District and Divisional Administration.
8. Police Department and Armed forces.
9. Road Development Authority.
10. Geological survey and mines Bureau
11. International NGOO
12. NGOO

03.5.1. Institutional Roles:

National Planning Department;

The role of the Department of national planning is appraising projects and plans prepared by the line ministries, providing observations on the cabinet Memoranda with regard to Disaster preparedness

and management. Apart from above, the Department is involving preparation of poverty reduction strategies which includes a component of reducing vulnerability of poor to the natural calamities.

The Department has been involving in the preparation of rebuilding plan for the are affected by the recent Tsunami. This plan includes gross estimates of the damage caused, Programmed for immediate rehabilitation and a medium term development plan.

National Building Research Organisation (NBRO)

The NBRO is a semi-governmental body and the lead agency in Sri Lanka for all activities relating to landslides, particularly landslide risk identification and mitigation. Its programmes and activities are funded by the GoSL and its activities include:

- identification of areas prone to landslides;
- landslide hazard mapping (completed in Badulla, Nuwara Eliya, Ratnapura, Matale, Kandy and Kegalle; ongoing in Matara, Galle and Habantota);
- introduction of guidelines and engineering practices for landslide mitigation;
- training of government officials in landslide mitigation; and
- awareness creation with regard to landslide risk and vulnerability (e.g. developing studies and conducting workshops). At the national level, the NBRO coordinates with the NPPD, the Land Use Policy Planning Department (LUPPD), the Road Development Authority (RDA), the UDA, the Central Environmental Authority (CEA), Agriculture Department, the CHPB, and the NDMC. At the international level it has ongoing partnerships with the ADPC, the Indian Central Building Research Institute (CBRI), the Dutch International Institute for Geo-Information Science and Earth Observation (ITC), Care International, and the governments of Japan and Bangladesh.

Centre for Housing Planning and Building (CHPB)

The CHPB is a government institution under the Ministry of Housing and Construction Industry, and is primarily involved in natural disaster mitigation. Its activities include: > delivery of disaster mitigation training to government agencies, CBOs and NGOs;

- development of emergency management and response plans for Ratnapura and Kandy Municipal Councils, and local authorities along the Kelani River from Awisawella to Colombo;
- raise public awareness in project areas (production of printed and audiovisual materials in local language, social marketing);
- integration of DM into school curricula, Environment Impact Assessment of development projects; and
- information exchange and dissemination (development of CHPB and NBRO websites as information centres on DM). The CHPB has active working partnerships with the NBRO and the UDA, and their district-level offices as well as with local CBOs and NGOs in the implementation of CBDRM activities. Support for programme work is sourced from external agencies, such as the Office of United States Foreign Disaster Assistance (USAID/OFDA) under the ADPC's Sri Lanka Urban Disaster Mitigation Programme. It does not receive any budget from GoSL.

National Physical Planning Department (NPPD)

The NPPD is a government department under the Ministry of Urban Development and Water Supply, and is mandated to develop national and regional physical plans. The Department integrates information on natural disaster-prone areas and disaster mitigation aspects into the planning process. It works with government agencies and local governmental bodies under the Town and Country Planning Ordinance No. 13.

Urban Development Authority (UDA)

The UDA is a government agency under the Ministry of Urban Development and Water Supply, and is in charge of urban planning and sustainable urban development in the country. Its main activities include:

- integrated planning and physical development of declared urban areas; and
- formulation and implementation of development plans and urban land-use policy.

Coast Conservation Department (CCD)

The CCD is a government agency under the Ministry of Fisheries and Aquatic Resources, with the mandate to develop and implement Sri Lanka's coastal management plan, as well as to regulate and oversee all development activities in the coastal zone. The National Coastal Zone Management Plan developed in the 1980s required buildings to be set back up to 300 meters from the coast. In January 1986, the CCD implemented a comprehensive ICZM programme, with USAID support and with community participation, to address shorefront development, coastal erosion, habitat loss, and the decline of recreational and cultural sites. Mitigation efforts include coastal permits for house construction and sand mining, public education, and coastal protection works. The Coastal 2000 strategic plan takes a two track approach, including national and local levels in coastal zone resource management, and actively involving residents in the design and implementation of special area management plans.

Department of Meteorology

The Department of Meteorology has the broad mandate to provide climatic, meteorological, aviation meteorological, marine meteorological, hydro meteorological, agro meteorological and astronomical services for national needs. In the area of DRM, it is involved in early warning and awareness in Sri Lanka, and now functions as the tsunami early warning centre of Sri Lanka.

Civil Defense Organizations and Their Activities

In Sri Lanka, Civil Defense organization plays a major role in the event of disasters to protect the lives and property from such calamities as floods, landslides and cyclones. At the grassroots level, we have the Grama Niladaries to provide basic assistance with the help of civil Defense organizations. Thereafter, as mentioned above, we have Divisional level institutions called the

Divisional Secretariats headed by the Divisional Secretary, who coordinates all operational activities and the provision of emergency relief in the event of a Disaster. At the Divisional level, he coordinates all disaster functions coming under the Civil Defense organizations. At the provincial level, we have provincial level Civil Defense Committee which is chaired and coordinated by the chief Minister. On top of these arrangements, under the Passed Disaster management Act No.13. We have the Committee under the chairmanship of the His Excellency the President, to coordinate all activities regarding a disaster at the national level. The activities of the Civil Defense organizations at various levels can be summarized as follows.

Immediately after a disaster, officers are dispatched to identify and assist people as quickly as possible. Identify the seriously injured people and assist the community in organizing emergency evacuation for health treatment centres.Ensure that the police station functions immediately. The Ministry of Disaster Relief Services recently established an information system with collaboration with UNDP called DisInventar and DisConsultar to collect and disseminate data on natural and man made disasters.

We have already done substantial work in Sri Lanka in the area of mitigation. To reduce the impact of disasters, we have structural and nonstructural measures, such as legislation and incentives for people in landslide areas. (Annexure XIII) However, people are reluctant to move out of their traditional habitats though their area is prone to landslide. The Department of social services provides financial assistance to the people living in the low lying areas in the Kalutara district to build flood resistance houses. But the programme did not succeed due to the reluctance of the people to put their own resources also to implement this type of programmes. Therefore, it has become necessary to create awareness among the people living in areas prone to disaster like floods, landslides, and severe droughts to adopt themselves to disaster conditions by accepting the programme which will enable them to live without becoming disaster victims.

03.5.2 The Role of Volunteers and Non-Governmental Organizations for Disaster Preparedness and Relief

The dependence on volunteer organizations has become inevitable in disaster preparedness and relief programmes in Sri Lanka. They can respond at short notice to an emergency situation since they don't have to work through bureaucratic channels. They can bring in expertise from outside whenever necessary at very short notice. Their budgets are fairly flexible. On the other hand, they are at a disadvantage in that they do not have the necessary authority and at times the official contacts to get things done. The major advantages of the volunteers and NGOO for disaster preparedness are as follows:

- NGOO can participate with their expertise at the stage of formulation of policy and National Plans.
- NGOO could be useful in providing necessary material in disaster management such as the provision of food, drugs and clothes.
- NGOO can provide experts for training of local officials.
- They can help in the designing and production of information material to the public regarding disaster preparedness and relief.
- They can be assigned with specific roles in advance, e.g. Supply of emergency kits and first-aid kits.
- NGOO can render help in the running of refugee camps.

Consortium of Humanitarian Agencies (CHA)

Established in 1997, the CHA is an association of agencies working in and supporting humanitarian work in Sri Lanka. In the past nine years the CHA has continued to function as a network of humanitarian agencies and has developed a full-fledged secretariat with its own specific capabilities. The CHA focuses on two main roles:

- functioning as a network of like-minded organisations; and
- implementing projects on behalf of and with its members.

CHA Post-tsunami Recovery Programme (CPRP):

The programme works from the premise that the threat of tsunamis requires concerted efforts from different sectors and different actors. It wants to involve and address equally all actors involved in humanitarian assistance. These include the tsunami survivors and people in the surrounding communities, private initiatives of nationals, internationals and diaspora communities, Sri Lankan NGOs, international NGOs with a presence in the country prior to the tsunami, newly arrived international NGOs, government agencies at different levels,

Intermediate Technology Development Group (ITDG)

The ITDG is an NGO with a mandate to use appropriate technology in agriculture, transport, energy, infrastructure, and disaster preparedness and mitigation to increase the resilience of the poor. It focuses on research, advocacy, information- sharing, and demonstrations of its technology. Activities are implemented in partnership with the government and other NGOs, with funding support from DFID, the EU, and other independent trusts in the UK, and include:

- the development of district-level action plans for drought mitigation (completed in Monaragala and Puttlam districts);
- demonstrations to enhance the resilience of poor communities to climate variability (Badulla and Monaragala districts);
- capacity-building of communities through training; and
- creation of public awareness.

Oxfam

Oxfam has been supporting projects and partners in Sri Lanka since 1968. Focusing on the extreme poverty suffered by those who are affected by the long-lasting conflict in the country, Oxfam has also been working actively in the field of DM. In the response to the tsunami, Oxfam has been working in the area of building shelters, restoring livelihoods, the water supply and sanitation, and gender.

World Vision

World Vision has been working in Sri Lanka since 1977, and immediately after the tsunami the organisation was well placed to mobilise its staff across the worst-affected areas and to launch a relief programme to provide local people with life-saving food and essential items. In addition to continuing emergency relief distributions where necessary, the main sectors that the World Vision programme addresses include: shelter, child protection, improving the infrastructure, economic development, water and sanitation, health, education and the environment.

03.6. Proposed National Disaster management Plan (NDMP)

The objectives of the proposed national disaster management plan are to provide effective measures;

- For protection of life and property from effects of the Disasters.
- For maintenance and restoration of order in areas affected by Disasters.
- For provision of facilities on emergency response and recovery in the event of disasters.
- For providing leadership and initiative, to all authorities concerned.

03.6.1. Activities of the Proposed Plan

Under the proposed plan, Disaster management activities can be conveniently classified into five main areas.

- Prevention, Mitigation and preparedness
- Emergency response and relief operation
- Rehabilitation and Reconstruction
- Awareness creation and education
- Initiatives for Development opportunities.

Implementation of the NDMP will be at National, Provincial, Divisional and village levels. Concerned institutions at all levels have their Role and Responsibilities identified in the Action plan.

In the event of disasters, the emergency measures should be taken immediately, Protecting people and properties from possible disaster threat subsequently and providing assistance for protection and safeguarding the affected people. In this context, it is observed that some disaster management activities should be decentralized into the provincial, district, divisional and village level, enabling people's participation. It will be therefore suggested that the following disaster related coordinating comities be set up to upgrade local level disaster management building capacities.

- Provincial Disaster Management Coordination Committee.
- District Disaster Management coordinating committee.
- Divisional Disaster Management coordinating committee
- Village Level Disaster Management coordinating committee

04.Latest Disaster Information of Sri Lanka

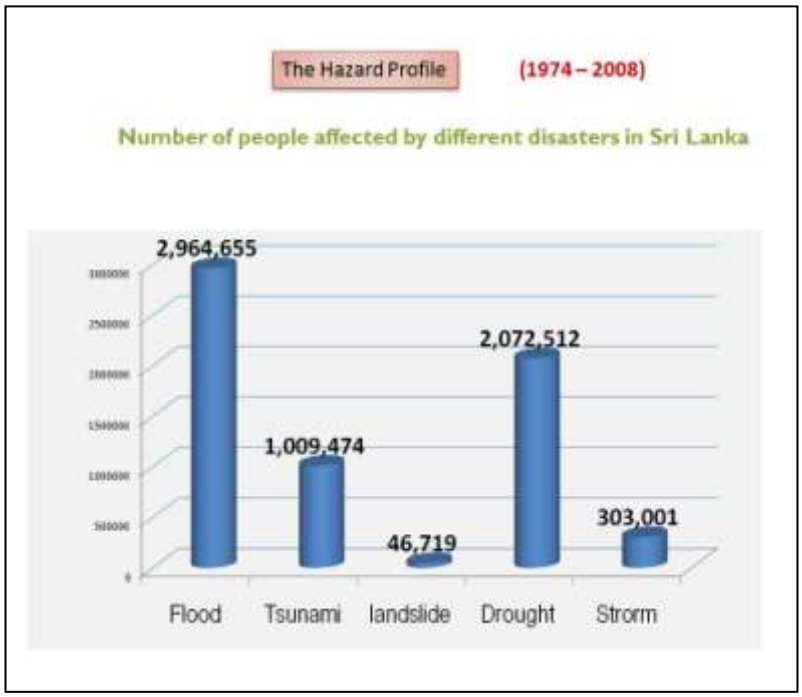


Figure 7- Disaster profile of Sri Lanka

04.1. Flood Situation Sri Lanka– May 2010

Friday, 14 May 2010, heavy monsoon rains have resulted in flash floods, high-winds, landslides, lightning and thunder storms in 13 districts in Sri Lanka including: Colombo, Gampaha, Kalutara, Ratnapura, Kegalle, Matara, Kegalle, Galle, Nuwara Eliya, Trincomalee, Puttalam, Mannar and Anuradhapura.

As of Wednesday, 19 May 2010, over **458,783** persons (104,213 families) have been affected by the heavy rains. This includes minor displacement of **9,579** people and **18** deaths. Reports indicate that 172 houses have been destroyed and another 915 damaged. The Government of Sri Lanka is responding to the crisis through local and central levels and the Navy has been deployed with their boat teams to assist with evacuations.

Some of views of disasters 2010

Photos(j), (k) are shows of flood disaster in Rathnapura and Matara district

Table 2 - Flood Situation Reports 2010 (*source from* UN OCHA *Sri Lanka*)

District	DS Divisions	Affected		Deaths Reported	Injured People	Missing People	Houses Damaged		IDP Camps			Remarks
		Families	People				Fully	Partially	No.	Families	People	
Kalutara	*Kalutara*	3523	14733				13	79				Flood - Most of the by-roads are inundated. Relief is being distributed.
	Bandaragama	386	1717									
	Matugama	129	583									
	Palindanuwara	700	1400				8	10				
	Panadura	5720	26978									
	Millaniya	460	2254	1			1	4				
	Walallawita	400	1317				3	15				
	Dodangoda	150	600									
	Beruwala	970	4907				6	31				
	Bulatsinhala	518	1292				14	1				
	Horana	64	328									
	Madurawala	997	4077				3	5				
	Ingiriya	315	1269					15				
	Agalawatta	105	300									
	Sub Total	14437	61755	1	0	0	48	160	0	0	0	
Gampaha	*Divulapitiya*	831	3382	3			5	4	2	464	960	Flood - Most of the roads are inundated. Relief is being distributed. Provided 06 motor boats from Navy for relief services.
	Attanagalla	561	2342				4	5				
	Biyagama	1768	5623					13	13	1544	4849	
	Ja Ela	5921	21842				1	19	5		750	
	Dompe	152	578				1	4				
	Gampaha	3300	11218	1			19	3	2	28	80	
	Katana	8359	34218	2								
	Kelaniya	6850	30885				2		4	672	3372	
	Mahara	734	3134					11	14	377	1335	
	Negombo	3266	13581									
	Minuwangoda	1118	4095	1								
	Wattala	10877	49076				5	7	18	665	3067	
	Sub Total	43737	179974	7	0	0	37	66	58	3750	14413	
Colombo	*Kolonnawa*	9250	50000						10		1864	Flood
	Moratuwa	3790	14700						2		95	Relief is being distributed. Provided 03 motor boats from Navy for relief services.
	Thimbirigasyaya	4250	28914									
	Ratmalana	1503	4683									
	Colombo	10553	35110						6		1854	
	Sri Jayawardanepura Kotte	2743	10358						4		617	
	Kesbewa	908	3285									
	Maharagama	750	3857									
	Seethawaka	102	542									
	Kaduwela	562	2238						1		65	
	Padukka	33	128									
	Homagama	41	139									
	Dehiwala	50	167									
	Sub Total	34535	154121	0	0	0	0	0	23	0	4495	
Kegalle	*Dehiowita*	1	3					1				Earth Slip
	Sub Total	1	3	0	0	0	0	1	0	0	0	
Rathnapura	*Kalawana*											Flood - Drowning. Relief is being distributed. 02 deaths due to electricution Due to fallen trees
	Eheliyagoda	10	46	1			3	7				
	Ayagama	48	184	2				9				
	Kolonna			1								
	Sub Total	58	230	4	0	0	3	16	0	0	0	
Kurunegala	*Pannala*	179	582		2		2	10				Flood
	Ududaddawa	22	91				1					
	Sub Total	201	673	0	2	0	3	10	0	0	0	
Galle	*Hikkaduwa*	10000	46200									Flood
	Ambalangoda	2000	9785									
	Balapitiya	3136	19437				28	76				
	Gonapinuwala	184	752				13	15				
	Akmeemana	200	1120				12	18				

	Imaduwa	18	70									
	Habaraduwa	342	1655									
	Elpitiya	114	521				2					
	Baddegama	281	1290	1			8	41				
	Weliwitiya Divithura	728	3100				11	116				
	Benthota	73	385				1	8				
	Bopepoddala	689	2634				2	15				
	Karandeniya	450	1500									
	Kadawathsathara	2036	8891				1	36				
	Niyagama	2	3									
	Sub Total	20253	97343	1	0	0	78	325	0	0	0	
Puttalam	*Dankotuwa*	88	326	2			1	5				Flood -2 Navy Boats moved to Army camp to use in an emergency Flood & Sea Erosion
	Anamaduwa			1								Elephant attack
	Wennapuwa	117	468									
	Nathandiya	1500	5223									
	Mahawewa	15	75					2				
	Madampe							3				
	Halawatha	24	115				3	21				
	Sub Total	1744	6207	3	0	0	4	31	0	0	0	
Trincomalee	*Morawewa*	212	837				17	195				Strong Wind
	Sub Total	212	837	0	0	0	17	195	0	0	0	
Matara	*Akuressa*	6	31					6				Flood
	Mulatiyana	7	45				6	1				
	Hakmana	3	15					3				
	Aturaliya	10	57				7	3				
	Matara	83	415				3	4				
	Welipitiya	8	35				6	3				
	Kirinda	2	10					2				
	Puhulwella											
	Weligama	17	70				7	10				
	Malimbada	288	1090									
	Sub Total	424	1768	0	0	0	29	32	0	0	0	
Anuradhapura	*Padaviya*			2	4							Lightning Strong Wind
	Rambewa							136				
	Kebitigollewa							8				
	Sub Total	0	0	2	4	0	0	144	0	0	0	
Nuwar Eliya	*NuwaraEliya*	1	6					2				Fire (due to shortage of electricity)
	Sub Total	1	6	0	0	0	0	2	0	0	0	
Mannar	*Mannar*	7					1	7				Mini Cyclone
	Musali							24				
	Nanaddan							26				
	Sub Total	7	0	0	0	0	1	57	0	0	0	
GRAND TOTAL		**115610**	**502917**	**18**	**6**	**0**	**220**	**1039**	**81**	**3750**	**18908**	

04.2. Landslides and rock falls occurred Nuwara Eliya district in year 2007.

Landslide incidences At Padeyapallela area – Nuwara Eliya district (12th Jan 2007)

Photo (l) shows the Damage to the house

Photo (m) shows the Damage to the Road

Photos(n) ,(o) shows the Lunugala Landslide – Passara Badulla District

Sri Lankan Landslides which are often triggered by intense heavy rains are an increasing problem due to development activities and urbanization. With the torrential rains received in year 2003, 2006 and 2007 large number of landslides and rock falls took place in Nuwara Eliya, Kandy, Badulla and Matale districts. About 440 landslides and rockfalls incidents causing eleven deaths have been reported from Nuwara Eliya district in year 2007 (NBRO, 2007). More than 2000 families had to be evacuated and proposed to resettle in safer locations due to landslide threat. Ir is noted that progress of the resettlement work are slow due to unavailability of safer locations in the hilly terrain. Landslide disasters occur with the heavy rains and affect, severely on the livelihoods and the agricultural activities which are the main lively hood of the people in these areas.

Table 3- Damages caused by the Landslides occurred from June 2004 to June 2007 in Nuwara Eliya district

DS Division	Deaths	Houses Destroyed	Houses Damaged	Affected Number	People Evacuated
Ambagamuwa	1	2	3	N/D	N/D
Nuwara Eliya	3	19	29	2001	N/D
Walapane	18	383	1004	11222	8317
Hanguranketha	4	38	269	2310	1296
Total	**26**	**442**	**1305**	**15533**	**9613**

Source: www.desinventar.lk

Table 4- Summary of Landslide Victims on 2007 landslide disaster According to the reports completed by NBRO

AGA Div.	Reported Sites	High risk Families	Medium risk Families	Total
Walapane	198	897	380	1277
Hanguranketha	52	720	312	1032

Table 5- Details of Evacuation during the past period due to landslides ((source: NBRO)

District	High risk	Medium risk	Low risk	Total
Ratnapura	947	646	259	1852
Matara	467	249	131	847
Hambantota	133	29	2	164
Kegalle	31	49	5	85
Galle	37	23	25	85
Kalutara	41	38	17	96
Nuwara Eliya	1617	692	-	2309
Total	**3273**	**1726**	**439**	**5438**

In year 2007, National Disaster Relief Services Centre has spent about Rs. 22,586,775.00 for the land slide affected people as for the relief work.

04.3 Tsunami Disaster 26th December 2004

Impacts and Response

In the early hours of the morning of Sunday 26th December 2004 a massive earthquake measuring 9.0 on the Richter scale struck the west coast of the Sumatra. The epicenter was some 30km under the seabed and 250 kilometers south-southwest of Banda Aceh. The first quake was followed by after shocks ranging from 6 to 7.3, them selves large enough to destroy thousands of lives and livelihoods. The quake triggered powerful Tsunamis reaching ten meters in height, and these moved through neighboring parts of the Indian ocean at over 500 kilometers an hour wrecking coastal areas in India, Sri Lanka, Thailand and Maldives, as well as Myanmar, Seychelles and Somalia.

This reached Sri Lanka at 8.00 in the morning local time causing extensive loss of life and destroying coastal areas. In Sri Lanka thirteen districts, including Jaffna in the north, eastern and southern coast, and part of the west coast as far north as Chilaw were struck by tsunami waves. The waves penetrated inland areas up to 500 meters in many places leaving behind few intact structures and killing or injuring ten thousands of people. Many people were swept into the sea and drowned by the strong currents, while others were trapped in buildings, busses and trains. The majority of those who lost their lives were women and children who were unable to escape the force of the water. In coastal communities houses were destroyed, fishing boats lost, bridges and roads washed out. The majority of the displaced are living in the camps or in public buildings having lost their homes and their possessions.

Table 7- Situation Reports on Tsunami - 2004

Comparison of Situation between Districts, Tsunami Disaster, Sri Lanka Update: 18/02/05 15.00 hrs

Province	District	Affected Families	Displaced Families	Displaced Persons			Deaths	Injured	Missing	Damaged Houses		No. of Camps
				In Welfare Centers	With Relatives and Friends	Total				Completely	Partial	
Northern	Jaffna	14767	10,827	7,625	33,381	**40,006**	2,640	1,647	540	6,084	1,114	12
	Killinochchi	2,297	407	0	1,603	**1,603**	560	670	0	246	-	0
	Mullaitivu	6745	6,007	11,993	10,564	**22,557**	3,000	2,590	421	5,033	424	23
Eastern	Trincomalee	30,545	30,545	14,853	69,208	**84,061**	1,078	1,328	45	4,830	3,835	34
	Batticaloa	63,717	12,494	22,002	35,047	**57,049**	2,975	2,375	346	13,530	5,839	36
	Ampara	58,729	38,866	24,179	81,648	**105,827**	10,436	6,581	161	18,886	8,651	55
Southern	Hambantota	14,069	3,334	1,803	45,195	**46,998**	4,500	434	1,341	2,303	1,744	11
	Matara	19,398	2,235	2,613	6,405	**9,018**	1,342	6,652	612	2,362	5,659	22
	Galle	24,583	23,278	2,761	119,427	**122,188**	4,248	313	527	7032	7,680	26
Western	Kalutara	9,433	7,059	2,438	32,509	**34,947**	279	401	69	2,683	3,835	12
	Colombo	9,647	8,140	5,555	29,160	**34,715**	79	64	12	3,338	2,210	28
	Gampaha	6,827	308	876	573	**1,449**	6	3	5	278	414	2
North Western	Puttlam	232	18	66	-	**66**	4	1	3	23	72	2
	Total	260,991	143,518	96,764	464,720	561484	31,147	23,059	4,082	66,678	41,477	263

Source- Ministry of Social Welfare 18-02-2005

www.cnosrilanka.org

Figure 9 – Tsunami affected districts

Figure 1. Affected DS Divisions

As of March 31st 2005 official figures indicated that more than 31,000 people in Sri Lanka were dead and approximately 4,100 remained missing (Annex I); however, theses figures may change as bodies continue to be identified, and depend upon the public health situation during relief efforts. Displaced persons estimates stand at 516,000 while the affected population is estimated between one and two million, out of a total population of approximately 19 million people. The government estimates that the number of damaged houses at more than 100,000 of which more than 60,000 have been completely destroyed. About 100,000 people are still living in relief camps, while approximately 400,000 people have moved in with friends or relatives. How ever, this number continues to decrease over time as families return to their homes to begin rebuilding.

The tsunami has affected a broad range of economic income and ethnic groups, both rich and poor. Thus it caused huge direct and indirect economic impacts on major and minor infrastructures, Livelihood options, lives and property in the country. It is important to have a soft analysis of damages on sector wise scenario.

The tsunami caused damage to the Education, Health, Housing, Fisheries, Agriculture and livestock, Livelihood, Transportation, Power, Water and Sanitation and Tourism.

- **Education**

  The tsunami caused damages to a total of 168 public schools, 4 Universities and 18 vocational/industrial training centers. The Number of students affected is 76911 where as the number of teachers affected is 3173.The total cost of the damage to the education sector according to preliminary estimates, is approximately $26 million.

- **Health**

  Damage to the Health system occurred in three primary areas: the loss of services, human resources, and damage to health related infrastructure. Following the disaster 92

local clinics, hospitals and drug stores were either destroyed or damaged. The estimated cost of the damage to the health sector is $60 million.

- **Housing**

The tsunami surge completely destroyed around 99,480 homes and partially damaged about 44,290.The completely and partially damaged houses together comprise 13 percent of the housing stock in the administration divisions along the coast. The net replacement cost for housing is estimated between $437 million to $487 million.

- **Agriculture and Livestock**

The damage to the agriculture sector is mainly confined to the destruction to standing crops in paddy and other crop fields and home gardens along the entire coastal belt and the washing away of parts of cashew and betel cultivations along the eastern coast. A total of about 2,308 hectares of paddy lands, 589 hectares of other field crops, 473 hectares of vegetable cultivation and 201 hectares of fruit crop areas were completely destroyed. The total damage to the agriculture sector is estimated to be $3 millions.

- **Fisheries**

Sea fishing has been the most severely affected sector, industry and livelihood as a result of the tsunami. About 7416 fishermen died. In addition 90,000 fishermen's families have been displaced due to the loss of housing and other household assets. More than 60 percent of the boats and fishing implements were destroyed.

Transportation – Railways/Roads

The tsunami caused damage to the southern rail corridor estimated at LKR 1.5billion.This is the most important rail corridor in Sri Lanka carrying 78,000 passengers per day and freight from the port of Galle.

The tsunami damaged sections of the national road network (Classes A and B) totals approximately 690 km in length, in addition to approximately 700 km s of provincial roads (Classes C, D, and E) and approximately 1,100 km of local government roads have been damaged. The Damage is estimated at $60 millions.

Water Supply and Sanitation

In water and sanitation sector, the tsunami disaster affected 14 districts in the Northern, Eastern and Southern provinces, mostly in the areas where dependency on wells was high. A rough estimate shows at least 12,000 wells were damaged mainly by salt-water intrusion and approximately 50,000 were abandoned.

National Response

Immediately after the disaster struck, communities and local authorities responded quickly to address immediate needs of the affected people. On December 27, President addressed the nation and promised full support to the tsunami victims and enacted the several emergency response mechanisms to expedite relief activities. In addition, a Centre for National Operations (CNO) was formed under the President's Secretariat to oversee and monitor emergency programs and liaise with relevant line ministries, NGOs, the private sector, and other organizations contributing to the relief and relief and recovery phases. Three new task forces comprising representatives of the public and private sectors were also formed under the President's Secretariat. The Task Force for Rescue and Relief (TAFOR), the Task Force for to Rebuild the Nation (TAFREN), and the Task Force for Logistics and Law and Order. At the district level, Disaster Management Authorities were appointed to coordinate local relief efforts.

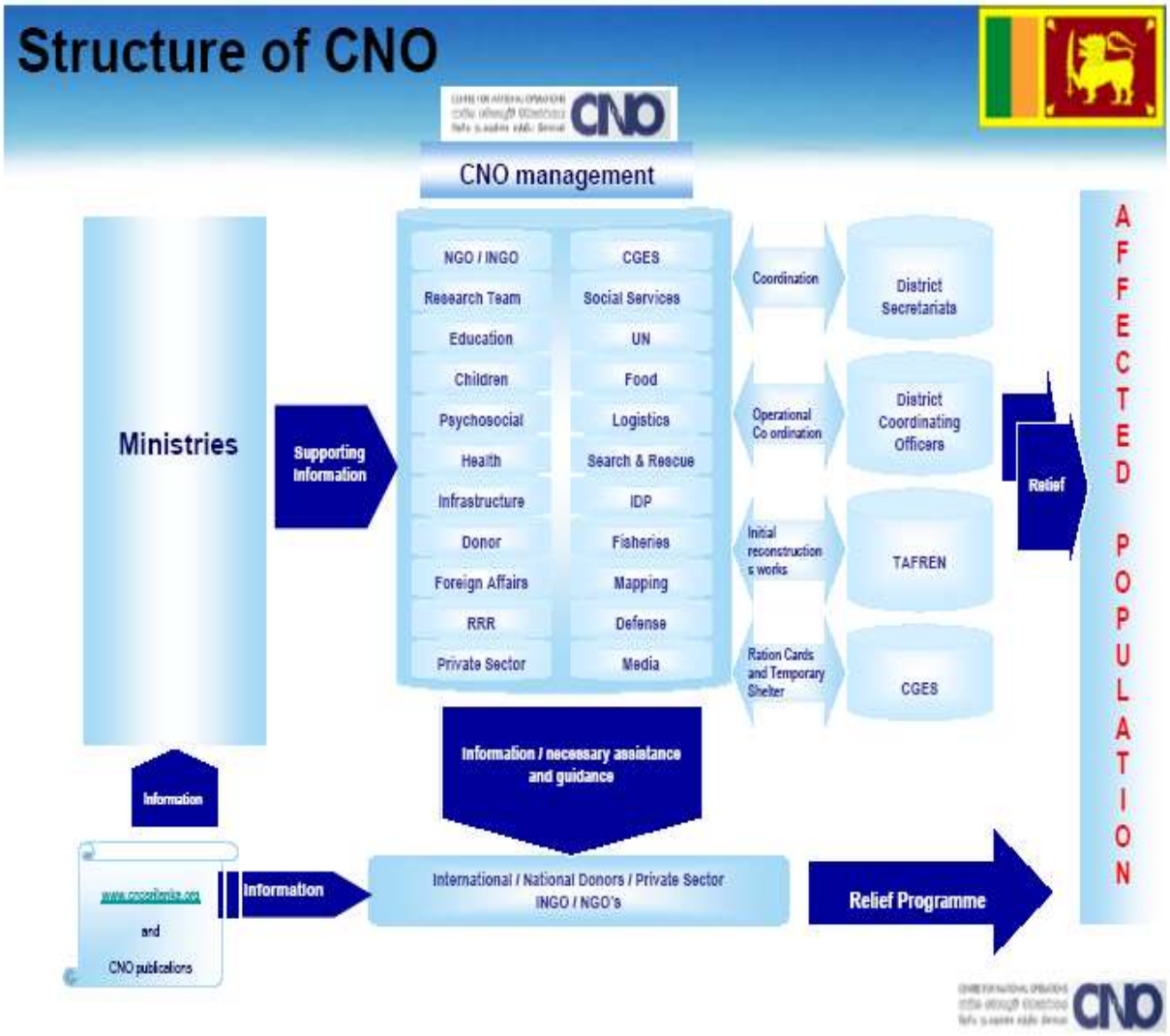


Figure 10- Structure of the CNO

Figure 11- Structure of the CNO

04.4. Flood and Land slides- May 2003

Response and Resettlement in Flood Effected Areas Following the May 2003 Floods and Landslides.

Torrential rains accompanied by heavy winds experienced in central and southwestern coastal areas of Sri Lanka on 17 th and 18 May 2003 were the heaviest since 1947. Floodwaters damaged over 20600 houses and destroyed 10,065 houses. Many buildings were submerged with power and telephone lines and sections roads and bridges being destroyed. Numerous villages were totally or partially submerged. Over 120,000 people had to be evacuated to camps. The persons either dead or missing were assessed as 252. Some of those missing were buried in land slides. The worst affected areas were the five districts of Ratnapura, Kalutara, Galle, Matara and Hambantota.

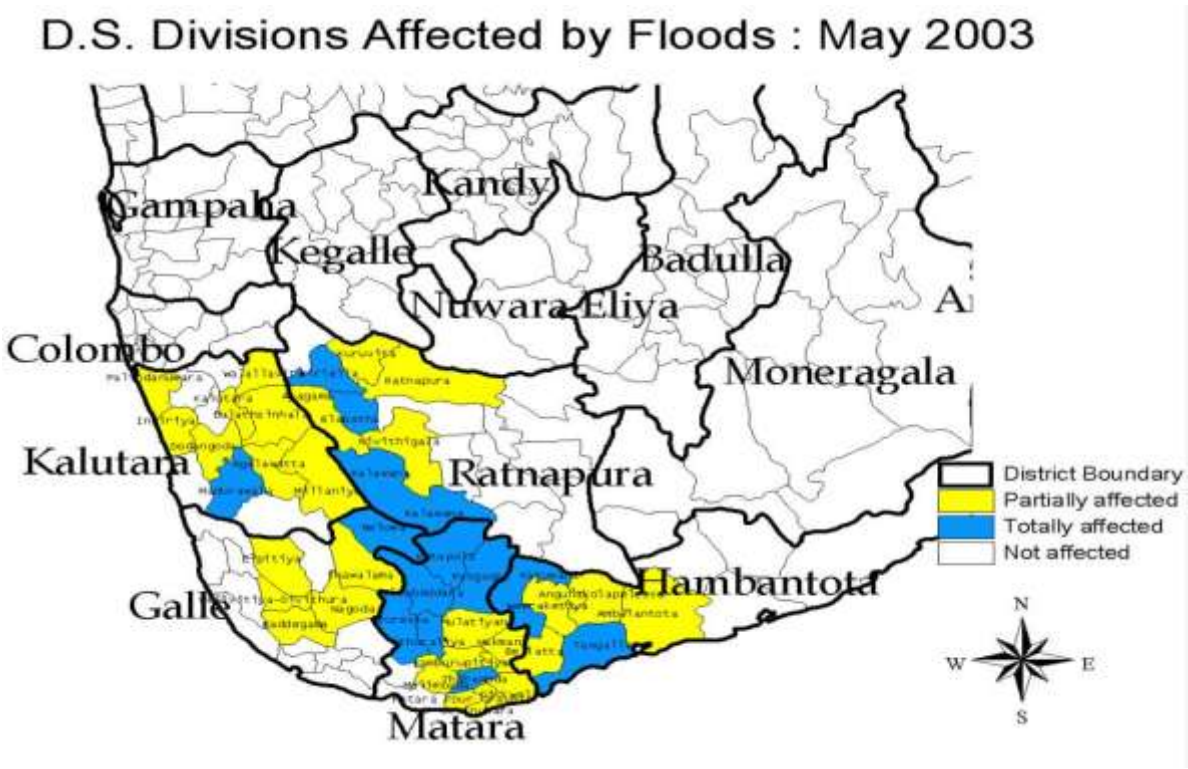


Figure 8- Flood affected areas (Source: NDMC)

The following series of activities were undertaken to manage this extreme disaster event. The immediate needs for emergency relief and reconstruction were assessed by a special team of experts and a detailed assessment of the impact of the floods was undertaken subsequently utilizing the provincial administrative set up and the district technical committees.

Table 6- Situation Report – Flood 2003

As at 06th October, 2003					
District	Affected Families	Deaths	Missing	Damaged Houses	
				Fully	Partly
Hambantota	2241	21		585	649
Kalutara	24555	11		944	2330
Galle	28173	16		1533	4037
Matara	47642	64	17	2145	7201
Ratnapura	34478	122		3668	9531
Nuwara Eliya	132	1		360	255
Grand Total	137221	235	17	9235	24003

Source; NDMC

As an immediate response 6740 wells that were flooded were cleaned and chlorinated to make them suitable for use as drinking water sources. A total of 2678 latrines were rehabilitated with assistance provided by especially by UNICEF and other voluntary organizations.

Schools Hospitals and other infrastructure facilities were rehabilitated mobilizing the assistance provided by National and International donors. Credit facilities granted by the World Bank and the Asian Development Bank were utilized for rehabilitation work in infrastructure facilities.

Assistance received by government of Sri Lanka

Assistances by	Kind of Assistance
India, Japan, Germany, Abu Dhabi, Singapore, Oman, Thailand, Malaysia, China, Japan, Israel, Pakistan, Singapore	Tents, Blankets, Plastic Sheets, Polyester Tanks, Generators, Water Purification Plants, Laboratory ,Chemicals for Water, Generators, Clothes, Kitchen Equipments, Dry Rations, Food items, Water Pumps, Medical Equipments & Medicines
International Agencies	Baby Foods, Medicines & School Kits
UN Agencies	Relief Kits, Kitchen Equipments, Etc.

Source: NDMC

UN ASSISTANCE – Around 2 Million US$

UNHCR – US$ 250,000 worth Family Packs

UNICEF – US$ 630,000 worth Non Food Relief Item

WHO – US$ 280,000 – Emergency Health Kits for Persons, Medical Equipment & Technical Support

WFP –US$ 0.16 Million Food Supplies

UNDAC – Assisting GOSL for Request for Assistance Proposal

UNDP – OCHA US$ 128,000 Co-ordination/Information & 2040 Family Packs In the Pipeline

UNDP/OCHA: 100,000 US$

FAO: Conducting Assessment leading to 400,000 US$ Technical Co-operation Project

WFP: 105,000 MT of Food

This experience gave rise to the creation of a programe for disaster preparedness and response which included the following components

• Establishment of a multi disciplinary National Disaster Operations Centre.

• Improvement in communication and information management and establishment of a resources database.

• A Geographic Information System to determine priority areas for disaster mitigation and preparedness and creation of suitable hazard maps.

• Conducting awareness creation at village, district and national levels including school children

• Capacity building for national emergency response.

The rehabilitation and reconstruction programme of damaged housing were implemented with the aim of risk reduction in building in areas vulnerable to flood and landslides. The affected families were settled in no risk areas, identified by the Scientists and Geologists.

05. Countermeasures and International commitment for Disaster Reduction in Sri Lanka

05.1.Road map for a 'Safer Sri Lanka'

Since the tsunami, there has been a renewed attempt to institutionalize a DRM framework in Sri Lanka. The consensus is that ongoing policy and legislative efforts have to be complemented by adequately identifying risks, evaluating their differential impacts, developing strategies for their management and adequately communicating the risk to all stakeholders at the community, provincial and national levels, and this has contributed towards the conceptualization of this framework. There has also been an affirmed need to address the underlying vulnerabilities with regard to strengthening local and national governance structures, emphasizing national and community-based environmental resource management, and considering the differential nature of hazards and associated vulnerabilities while formulating national action plans for poverty alleviation and infrastructure for Sri Lanka. In acknowledging these needs, the Ministry for Disaster Management has proposed a comprehensive framework

which will seek to identify and coordinate multi-stakeholder efforts in the next ten years through a holistic strategy or "Road Map" towards building a "Safer Sri Lanka". The road map is broadly focused on seven thematic components which are consistent with ongoing and past efforts in the field of DRM and development planning in Sri Lanka. The strategy proposed by the DRM framework for Sri Lanka seeks to cover the following areas:

- Policy, Institutional Mandates & Institutional Development including components such as the preparation of a national policy for DM, reviewing and formalizing mandates, identifying the capacity development needs of agencies to perform their DM functions; and including the steps to implement policies that are already in place.
- Hazard, Vulnerability and Risk Assessment, comprising activities ranging from flood simulation modelling in key river basins to the development of a vulnerability atlas for Sri

Lanka. This will enable development planning which is sensitive to multiple hazards and different kind of vulnerabilities.

- Multi-hazard Early Warning Systems, incorporating elements to generate advancements in warning for floods, cyclones, abnormal rainfall, drought and landslides, thus enabling decision-makers to take much needed action even prior to the occurrence of a disaster.
- Disaster Preparedness Planning and Response, minimizing the adverse impacts of a disaster through effective precautionary actions and timely adequate responses. Prioritized activities include the development of a national emergency preparedness and response plan and the establishment of emergency operation centers at the national, provincial and district levels.
- Disaster Mitigation and Integration into Development Planning, encompassing activities related to reducing the impact of droughts, preventing floods and landslides, and protecting against storm surges, sea and coastal flooding by incorporating disaster risk considerations into development plans.
- CBDM, involving activities that recognize the fact that communities – though affected by disasters – are also the first line of defense against them if they are well prepared. Interventions proposed include mobilising community teams, creating a local network of trained volunteers, establishing resource centres, and providing small grants to fund priority projects by community teams.
- Training, Education and Public Awareness, focusing on empowering the public with ways and means to reduce disaster losses, and including a national awareness campaign designating a “National Disaster Safety Day”, promoting disaster awareness among professionals through training and among children via the school curriculum. These components have been developed through a consultative process which has helped identify gaps, needs, priorities and strategies for further action in Sri Lanka. The strategies and priorities for particular projects have been developed by working groups comprised of multiple stakeholders, representing varied interests and capacities. The resulting conclusions and priorities for action are consistent with the requirements and responsibilities of the Sri

Lanka Disaster Management Act No. 13 of 2005, which the framework will work towards implementing over the next five to ten years. The following paragraphs provide a brief summary of the strengths and weakness of Sri Lanka's DM system.

05.2.Flood Mitigation:

The remains of ancient hydraulic civilization still functioning at its best found in the Dry Zone implemented by ancient rulers demonstrate the evidence of remarkable human effort taken to mitigate the droughts and ensure food security of the nation. Especially after the major flood in 1947 government implemented number of flood protection bunds major works was constructed to protect the city of Colombo. Structural means were also implemented in other river basins to protect cities along Kelani, Gin, Nilwala Rivers as a measure to control inundation and the consequent damages. Since then these areas were never been affected. Decisions to implement these projects were influenced by perceived destruction rather than on an economic analysis.

Flooding of Kelani Ganga has serious consequences as the outfall being near the capital of Colombo. When the flood level of Kelani Ganga is between 5 and 7 ft, the flood is defined as major flood and during the period of 1930 to 1935 both banks of the Kalani Ganga near the city of Colombo were provided with flood protection bunds. These bunds are capable of providing safety to the Colombo city for a 25 year period. However due to encroachment and poor maintenance, a complete rehabilitation of this flood protection scheme has now become urgent. The estimated cost of this work is nearly 3 billion rupees however there are no real or indicators or forecast to take a decision to make a investment of such magnitude.

The Gin Ganga flood protection scheme was launched in 1975 with the financial support from the People's Republic of China. Protection is provided against of flood of 10 years return period and an extent of 5000ha, of paddy has been protected from frequent flooding. Ten electrically driven pumping units were installed to cater to the local drainage on the protected side. High cost of

maintenance and reduced threat of floods have rendered this installation somewhat neglected, in some cases and may not be possible to run in an emergency.

The Nilwala Ganga flood protection scheme was completed in 1993 and it provides protection to 5600ha.of paddy lands with three diesel driven pumping units. Of the three stages of project implementation, only two stages were completed leaving out the last stage unattended. Even though the scheme was originally designed for flood protection, the project was launched to provide drainage facilities for low lying lands and therefore the pumps have to run everyday. Due to non completion of the third stage of the project and due to several other reasons, the scheme has not been very successful. Failure to complete the stage 3 of the project has also increased the threat of floods to Matara town.

Among the non structural flood mitigation methods, a flood forecasting system has been introduced only in the case of Kelani Ganga, Forecasting of water levels in the river is done by means of four upstream gauges and the data transmission is done with radio equipment. An organizational set up and the necessary standing orders are available to facilitate coordination among several institutions during a flood. This scheme prepared in 1968 was updated by the Irrigation Department in 1993 which can be considered as a comprehensive study to provide a detailed mitigation plan for the city of Colombo.

Ratnapura is a town in upper basin of Kalu Ganga Which is subject to frequent flooding. However due to limited travel time of the flood wave, it is not possible to warn the people. At present, there is no structural plan to mitigate flood in Kalu Ganga. Among the structural measures taken during the recent past by the Government to control floods, both Gin Ganga and Nilwala Ganga flood protection scheme can be highlighted. These two Projects are provided with safety measures against of flood of 10 years return period.

The flood protection study for Kelani Ganga was done in 1990 under DANIDA aid and this project provided the necessary computer facilities and soft ware to model Kelani Ganga. Action is being taken by the Department of Irrigation to prepare a proposal for funding by the world metrological organization to install a real-time flood forecasting system for Kelani Ganga. This will serve as a pilot Project. Flood protection schemes implemented so far has been able to minimize the loss of lives.

05.3.Land slide Mitigation:

Landslides which are often triggered by intense heavy rains are an increasing problem due to development activities and urbanization. In Sri Lanka, there are major areas in seven districts (Nuwaraeliya, Badulla, Ratnapura, Kegalle, Kandy, Matale and Kalutara) which are prone to landslide.

With the technical and financial assistance from UNDP/UNCHS Landslide Hazard Mapping in Badulla and Nuwaraeliya districts had been carried out by the National Building Research Organization (NBRO). Preparation of hazard maps for Ratnapura and Kegalle districts was completed by NBRO and the Kandy District Mapping is in progress under the Government Grant.

The main objective of the Land slide Hazard Mapping (LHMP) was to identify areas vulnerable to landslide hazard and establish good engineering practices in planning and construction through consultancy services, creation of public awareness, introduction of guidelines to ensure proper construction procedures with the ultimate aim of landslide hazard mitigation.

05.4.Transition Recovery Support to Flood and Landslides Disasters in Sri Lanka.

This is a project jointly implemented by the NDMC of the Ministry of Women Empowerment and Social welfare and the UNDP SRI LANKA. It has a component for recovery from the 2003 floods and landslide disasters which includes incorporating risk reduction measures and a component for risk reduction implemented in partnership with the national, district, divisional and village level government administration in the area of disaster risk management.

The awareness and interested generated for disaster risk mitigation in the affected districts following the May 2003 flood and landslides events were quite high. This became an invaluable opportunity for the NDMC and the UNDP Sri Lanka in partnership with the district administration to conduct lessons learnt workshops in all the five affected districts. These workshops provide a platform for relevant stakeholders from both national and district levels to revisit the disaster events and review what aspects of response and recovery had been done right and what aspects needed improvement. The workshops also led to the formulation of district disaster preparedness and response plans in the five districts and establishment of disaster management committees, in line with the draft National disaster management plan. In addition, the district administrations were mobilized to engage in preparation of divisional level plans and community contingency plans. Gradually the focus is being shifted from disaster response to disaster risk reduction by linking the vulnerability reduction and mitigation activities identified in the divisional plans with the development plans and the budgets.

Simultaneously, recognizing that NDMC at the national level is best positioned to act as a repository of disaster related information and coordinate response, the UNDP Sri Lanka is assisting NDMC setup a disaster database that will capture occurrences of all natural disasters over the last 30 years. This will provide a much needed policy tool to analyses trends and patterns of the occurrences of disasters. In addition UNDP Sri Lanka is also working with NDMC in strengthening its information coordination and dissemination capacities by training its staff and setting up its website.

05.5.Drought Mitigation:

Table Drought control projects in Kalutara districts, 2008-2009

District	Unit	Total Allocation Rs (Mn)
Kandy	50 Tanks	1.269
Hambantota	70 tanks	2.487
Kalutara	03 projects	10.7
Deraniyagala	01	10
Total		23.456

Rain Water Harvesting Project in Monaragala and Hambantota Districts

Drinking water shortage in the drought prone areas of Monaragala and Hambantota districts has become a recurring problem during drought periods for the residents of these areas. Depletion of the supply in the regular water sources during drought and the ill effects of using tube well water for drinking purpose due to the preference of hardness and soluble fluorides, subject the poor people in the area to serve hardships.

In order to mitigate such impacts of drought the NDMC has implemented a pilot project on rainwater harvesting in the most vulnerable villages of Meegaswewa, Kotiyagala, Ihalawa, Kumbukwewa in the two districts targeting 180 families with 900 beneficiaries. The basic scope of the proposal was to upgrade the roofs of houses to a suitable level to serve as catchments for rainwater and construct water tanks in the premises to store the water.

Objective of the pilot project was to test out the sustainability and wide spread application of the project concept within the capacity limitations of the participants. NDMC accordingly expected to reach out to a larger number of beneficiaries in the next phase in association with the Open University of Sri Lanka, ITDG, Divisional Secretary, the Social Services Officer, Samurdi Development Officer and Agricultural Production Assistants attached to the Divisional Secretariats.

The concept included providing technical assistant and financial grants by NDMC and the above partners to the beneficiary families to supplement the cost sharing contributions being made by them in cash and kind. A part of the local building materials and unskilled labour required came as the contribution from the beneficiary family, which was about 25% of the total cost.

05.6.Disaster Risk Information Management

A recent initiative by the UNDP Sri Lanka to assist in building a systemic historical disaster inventory that covers a 25-30 year period of disaster losses has led to the NDMC to commence an activity with the following objectives.

- To take stock of disaster information sources and existing or developing disaster information systems and inventories in Sri Lanka.
- To assess the possibility of adaptation in Sri Lanka the DisInventar methodology which has been successfully implemented in some Latin American countries and in India and Nepal.

05.7.Sri Lanka Urban Multi-hazard Disaster Mitigation Project (SLUMDMP)

In September1997 Centre for Housing Planning and Building (CHPB) was selected by the USAID for the management of the Sri Lanka Urban Multi-Hazard Disaster Mitigation Project (SLUMDMP), which is the Sri Lanka country project in a programme involving several Asian countries under the Asian Urban Disaster Mitigation Programme (AUDMP). This programme is implemented by the Asian Disaster Preparedness Center (ADPC) in Bangkok, Thailand and funded by the USAID. The Sri Lankan project is implemented by the CHPB in collaboration with the National Building Research Organization (NBRO) and the Urban Development Authority (UDA) providing the technical inputs. The project includes demonstration, training, information and networking activities related to urban disasters. Apart from the demonstration project activities involving activities related to mitigation of natural hazards in the Ratnapura MC, there is a considerable training component in the project, which is carried out by the CHPB. Disaster mitigation activities are mostly concerned with integration of natural hazard aspect in the planning process and guidelines for construction in hazard prone areas. Therefore the project involves a major training component for engineers and technical officers of local authorities, and also planners in the UDA.

The project goal: Reduced natural disaster vulnerability of urban populations, infrastructure, lifeline facilities and shelter in Sri Lanka.

The project objective: Establishment of sustainable public and private sector mechanisms for disaster mitigation in targeted urban areas of Sri Lanka

The responsibilities of National Building Research Organization (NBRO) under the Ministry of Disaster Management(DMC)

The National Building Research Organization is an institute integrated with an in-house multidisciplinary team of professionals. Those are directly involved to foster, promote and sustain Research and Development work and provide technical services to the housing, building and construction sectors, with a view to improving the quality of life when minimizing the effect of Natural and Geological disaster such as Landslides, Floods, Tsunami and Earthquake. This is the mission of organization and to achieve the above target following major services offered provided by National Building Research Organization. (Annexure 0 : NBRO 2010 Profile)

1. Consultancy service in the field of Natural disaster such as geological disaster and Hydro-metrological disaster, specially in the field of landslide disaster mitigation and slope stability measures.
2. Total consultancy service package for building project.
3. Geotechnical and foundation engineering, soil investigation and testing.
4. Testing, quality control of building materials and related research and development works.
5. Human settlement planning, design of cost effective housing.
6. Environmental monitoring and assessment of EIA, IEE for development projects.

Corporate Objectives

01. Support and maintain applied research on reducing the risk on human life, property and the environment of Sri Lanka that is being threatened by certain disasters taking place.

Goal : To become the focal point on disaster related research.

02. Assist National Disaster Management Council, Ministry for Disaster Management and Human Rights and other affiliated institutions in disaster risk reduction.

Goal : To become a contributing institution to line ministry in achieving its mission.

03. Study landslide hazards in Sri lanka in view of monitoring, prediction and prevention and mitigation.

Goal : To be the consultative body for landslide.

04. Develop and maintain scientific knowledge and information bases on natural and manmade disasters, assessment, prediction, mitigation and management in Sri Lanka especially in focused areas such as geo- hazards, hazards on air, soil & water pollution, disposal of waste including hazardous waste, pollution related epidemics and hazards related to stability of buildings and structures.

Goal :To become the line agency with institutional capacity and scientific data base.

05. Provide technical advice and solutions to state, local governments, international organizations, private institutions, commercial institutions, business organizations and to the citizens of the country, as a fee- paid service or otherwise, consultancy services on the fields that the institution has expertise, (i.e. building materials, environment, human settlements, geotechnical engineering, landslide studies and project management).

Goal :To ensure effective utilization of technical competence of staff, as individual divisions and as an institution & to generate revenue.

06. Provide quality testing services of three technical laboratories of the organization for building materials, environment & geotechnical engineering.

Internal Structure of NBRO

National Building Research Organization (NBRO) is a statutory institution coming under the purview of Ministry of Disaster Management and Human Rights. NBRO has been formed in 1984 by the merge of former Building Research Institute (BRI) of the State Engineering Corporation (SEC) and the soil Testing Laboratory of the Department of Buildings. Today the NBRO has seven divisions such as Landslide Studies and Services Division, Geotechnical Division, Building Material Division, Project Management Division, Environmental Division, Human Settlement Division, Human Resource Management Division and Finance Division. Under the supervision of Director General, these divisions are guided by directors appointed for each division. (Annexure 0 : Organization chart)

Landslide Studies and Services Division (LSSD)

Provide service to the nation by carrying out R&D for the utilization of technologically problematic areas such as low-lying, landslide-prone & derelict land for human settlements

Latest technology equipments, experience and knowledge of the staff, site offices in appropriate place are facilitated to achieve the above objectives.

LSSD carried out the following special programs in 2007 to present

1. Awareness creation and training:

The following workshops were conducted by the LSSD which were funded by various donors and institutions such as UNDP, DMC, etc. In addition, LSSD in many occasions made presentations at many workshop arranged by various organisations such as SLIDA etc.

District	No. of Workshops
Kegalle	6
Kandy	5
Matale	6
Nuwara Eliya	42
Kalutara	6
Ratnapura	5

Reduce the Landslide Risk of "Peradeniya Landslide" in Sri Lanka.

Phots show the Peradeniya Landslide occurred in 2006.Due to this failure one shop (Udaya Stores) was completely damaged .

Peradeniya town is located in the Central Province of Sri Lanka and is the gateway to the National Heritage City of Kandy. Following the heavy rainfall from 9th – 11th November 2006, a mass of soil and rock blocks detached from the upper slope of the hill at Peradeniya town on 11th November 2006 at about 21.00 hrs. One shop at the foot hill was completely destroyed and a few other shops were partly damaged. The main road towards the Kandy and Gampola from Colombo was completely blocked due to the debris of this slide. With this incident, National Building Research Organisation (NBRO) of Sri Lanka assessed the slope to prevent remaining buildings from the immediate risk of damage and issued a preliminary investigation report to the relevant authorities for immediate actions. Removal of all the debris and regrading the upper slope were the main recommendations included in the preliminary report. The main road had to close for a couple of weeks till the activities were completed. Unstable rock blocks were removed from the upper slope by blasting and earth dam was constructed at the toe region of the slope to stop any debris coming

from the upper slope. Main bus halting place had to be shifted and vehicle traffic was controlled by prohibiting to stop the vehicles on either side of the road from Peradeniya Bridge to Gannoruwa road junction.

With the requests made by the government, NBRO continued the detailed investigation to evaluate the level of hazard and to identify the required permanent mitigation measures to reduce the risk from the future slope failure to the Peradeniya Town.

Long term risk reduction measures for the potential landslide at Padiyapelella Town

Padiyapalella Town with potential landslide- 2007

With the heavy rainfall from 11th -12th January 2007, large number of landslides occurred at the parts of Central province. Especially, both of Haguranketha and Walapane divisional secretariat areas were severely affected from those landslides and number of deaths, injuries and property damages were reported. Upon the request made by GA of N'Eliya and AGA's of the above divisions, preliminary investigations were conducted by the National Building Research Organization (NBRO) during the last period. According to the findings of the above investigations, it can be concluded that areas susceptible for landslides are grater than the investigated number of landslides, which are already failed. Therefore, that was one of the reasons to identify more than thousands of families as a direct victims of landslides and NBRO advised to evacuate those families and relocate them in safer place due to impracticability of mitigation through engineered measures. But considering the level of risk and importance, that may required to apply such engineered solution in selective areas.

Due to sociological, agricultural, economical and historical importance of places as well as land demand in the area, commercial places such as towns, major roads, and other populated places such as schools and hospitals may be required to retrofit by adopting suitable mitigation measures. Padiyapelella town, Maturata town, Mahawewa LS with Kubalgamuwa Keerthibandara School and Walapane-Ragala road at Diyanilla can be noted as most suitable examples to pay our attention to reduce the existing vulnerability with adopting suitable remedial measures. But findings of those preliminary investigations were insufficient to propose suitable remedial and therefore NBRO has proposed to conduct detail investigations to evaluate the level of hazard and to identify the required measures to reduce the risk from slope instabilities to Padiyapelella town as well as other locations specified in the above.

Mahawewa , Meeriyagolla- Walapane Landslide Risk Reduction Modal Site project under Disaster Risk management (DRM) Programme

Photo shows the

Photo shows the Surveying of landslide

Photo shows the conducting awearness for school childeren

Even though landslide is a natural hazard and preventing the occurrence of it is extremely complicated, the time has come to mitigate the damage to the life and the property through introducing a disaster management policy.

Within such background, a landslide mitigation project for the Mahawewa and Kumbalgama unstable area was implemented by the National Building Research Organisation under the grant from UNDP. On January 11, 2007, due to heavy rain which unexpectedly fell on Walapane division, a landslide occurred in Mahawewa area causing a vast damage to the lives and property of the area. The awareness programmes which had been already held by the geologists of the Landslide Studies and Services Division of the National Building Research Organisation had helped the people and the students in the Keerthibandarapura school to protect their lives.

Mahawewa and Meeriyagolla areas in Kumbalgamuwa GN Division in Walapane Division have been selected as a pilot project for fulfilling the aim of landslide mitigation. At present, the project area has been mapped for its topographical and geological details. The objective of this project is to introduce a successful landslide mitigation method through controlling the surface drainage and increasing the awareness of landslides among the resident in the area.

Mapping and the mitigation work are carried out by Geologist, HML Indrathilake, Dinesh Hemachandra and Technical officer, T. Rasaroopan along with a group of junior geologists and technical officers.

The financial support of the UNDP and the coordination of the Disaster Management Centre for the successful implementation of this project is highly appreciated.

References

Sri Lankan historical data base http://www.lankalibrary.com/

Asian Disaster Reduction Center, ADRC, accessed March 2006, www.adrc.org.jp

Japan Cabinet Office web site accessed March 2006, www.cao.go.jp

Kobe city web site, accessed March 2006, www.city.kobe.go.jp

Disaster Countermeasures in Japan, a publication of the Cabinet Office, Government of Japan, January 2005

Earthquake disaster countermeasures in Japan, Earthquake countermeasures division, Prime Minister's Office, January 2005

Lessons Learned from the Great Hanshin-Awaji Earthquake, Disaster Reduction and Human Renovation Institution, January 2005, Japan

Amunugana, Sarath. Notes on Sinhala Culture, Colombo , 1980. Boers, Faubion. Theatre in the East; A Survey of Asian Dance and Drama, New York, 1956.

De Zoete, Beryl, Dance and Magic Drama in Ceylon. London, 1937, Disanayaka, Mudiyanse. Udarata santikarma saha gami natya sampradaya. Colombo 1990.

Gunasinghe, Siri, Masks of Ceylon, Colombo, 1962. Kotelawala, Sicille P.C. The Classical Dance of Sri Lanka. New York, 1974. Makulloluwa, W.B. Dances of Sri Lanka, Colombo, 1976. Molamure, Arthur. "The Outlook for Kandyan Dancing," In Some Aspects of Traditional Sinhalese Culture, edited by Ralph Pieris, Peradeniya, 1956.

Fernando, T.K. and L. Chandrapala, 1995. Climate variability in Sri Lanka – A study on Trends of air temperature, rainfall and thunder activity. Proceedings of international symposium on climate and life in Asia - Pacific, April 10-13, 1995, Brunai.

Punyawardena, B.V.R., 2002. Climate change and food security. Abstract of the paper presented at the seminar on "National Climate Change Public Awareness, Information and Outreach in Sri Lanka. Organized by the Center for Climate Change Studies, Department of Meteorology in collaboration with LIFE and TSU of IPCC working group III. December 13-14, 2002. Hotel Galadari, Colombo, Sri Lanka.

Arambepola, N.M.S.I., Bandara, R.M.S., Pallewela, P.P.D.H. (1997), Landslide Hazard Zonation Mapping and Geoenviornmental Problems Associated with the Occurrence of Landslides, Proceedings of CBRI Golden Jubilee Conference.

Bhandari, R.K., Perera, M.P.K., Weerasinghe, K.M. (1996), Application of GIS in Landslide Hazard Mapping at the NBRO, Procedings of the First GIS User Group Conference.