2015 Flood in Tamil Nadu, India
Disaster-induced displacement
Magdalena Szynkowska

Introduction

"Most of the people who were affected by the flood were marginalized people. They will probably remain on the margins of society, maybe not the same margins, but different ones, because the local government of the city has no willingnes of changing the situation."

Nityanand Jayaraman, social activist and journalist

In early 2015, the Internal Displacement Monitoring Center published a report entitled, "Risk of disaster-induced displacement in South Asia" in which they attempted to assess the risk of displacement due to natural disasters in eight countries of South Asia. In this report, India was ranked as the country with the highest quantity of potentially displaced people over the next ten years as a consequence of natural hazards. The research indicated that in India, disaster-induced displacement is a problem relevant for both urban and rural areas and that "urban Indians' vulnerability to hazards is very high due to rapid urban growth, unplanned development, and the large numbers of people without access to adequate housing, water, health, and sanitation" (IDMC, 2015).[1]
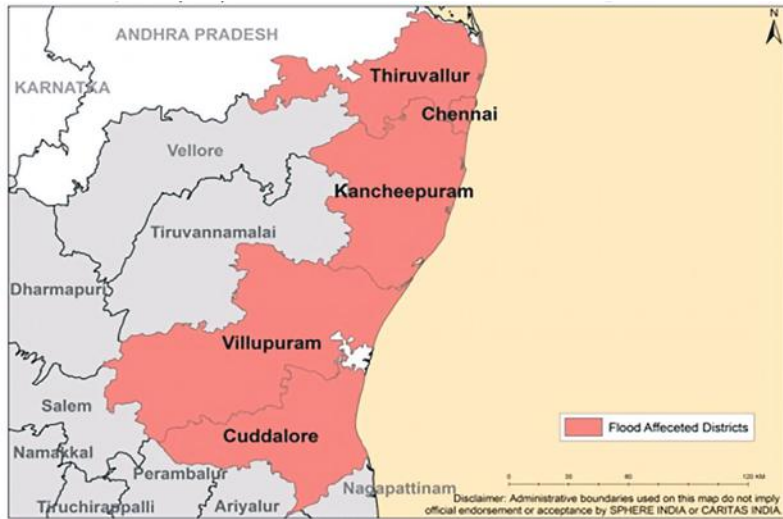
Eight months later, record-breaking rainfalls during monsoon season produced floods that devastated the southern part of India, affecting nearly three million of people and claiming 354 human lives (OXFAM, 2016).

As Chennai, the capital city of the Indian State Tamil Nadu, was drowning, world leaders discussed the impact of climate change and negotiated an agreement to limit the rise in worldwide temperature during the 2015 United Nations Conference on Climate Change in Paris. The situation in Chennai was echoed at the conference in a statement made by Laurent Fabius, French Foreign Minister and Chair of Global Negotiations, who said, "the unprecedented magnitude of the flooding confirms yet again that we no longer have time; we must take concrete and urgent action against climate disruption" (The Economic Times, Dec 2016).

The aim of this paper is to present how extreme weather conditions attributed to the strongest-ever El Niño phenomenon and high temperatures in the Indian Ocean together with environmental degradation caused by rapid urbanization and the unpreparedness of India's cities for extreme weather events caused the deaths of more than 300 people and massive human

---

[1] Read more: Internally Displaced Monitoring Center (2015) The risk of disaster-induced displacement in South Asia: http://www.internal-displacement.org/assets/publications/images/2015/201504-ap-south-asia-disaster-induced-displacement-risk-en.pdf

Illustration 1. Tamil Nadu- flood affected districts.

Source: Sphere India, 2016

displacement (The Floodlist News, Dec. 2016). In parallel, the research demonstrates that the population that has suffered the greatest impact from disaster is the most vulnerable part of the community. The majority of the affected population migrated in the past to the urban areas of Tamil Nadu in the search of better economic opportunities and a higher standard of living.

The paper focuses on events occurring in the Tamil Nadu state, with special attention given to its capital city, Chennai. The rainfall from the end of October until the end of December has caused the displacement of 1.8 million people in the Tamil Nadu and southern Andhra Pradesh (IDMC, 2016). There has been severe damage to farm livelihoods, with at least 382,000 hectares of agricultural crops affected across the State (Sphere India, 2015).

The first part of the paper describes the events that occurred during the last two months of 2015 in Tamil Nadu. It focuses on the damage produced by the flood and emphasizes the population displacement along with an example of a "trapped population"[2] that has been particularly affected by flooding and

---

[2] Trapped populations is defined as "Populations who do not migrate, yet are situated in areas under threat, [...] at risk of becoming 'trapped' [or having to stay behind], where they will be more vulnerable to environmental shocks and impoverishment." This applies in particular to poorer households who may not have the resources to move and whose livelihoods are affected by environmental change (MECLEP,2014).

neglected by the government in a relief operation (NCDHR, SASY 2015). In the next section, the research provides an analysis of the causes of the flood, and finally, it presents the aftermath of the disaster and policy implications.

This research is based on variety of sources, mainly secondary literature resources, including NGO reports, studies, news articles, online media and on various interviews undertaken with journalists and a social activist. Due to lack of access to official authorities, the report does not include any perspective of local governmental bodies.

Flood in Tamil Nadu

Geographical Characteristics of the Region

Tamil Nadu is the eleventh-largest state in India by area and the sixth-most populous. It has a coastline of about 1,076 km (669 mi), making it the country's second-longest coastline. The capital of Tamil Nadu is Chennai, which is the fourth-largest city and fourth-most populous metropolitan area (with a size of 1,189 sq km). The Chennai Metropolitan area consists of eight districts, including the Chennai city district. It is bounded by Bay of Benegal on the east and Andra Pradesh state in the north. It is characterized as a low-lying area, called a "pancake city," with its average elevation estimated at 6.7 meters above sea level (Chennai District., n.d.). There are two main rivers intersecting the district, the Cooum and Adyar. Both of them are nearly stagnant and do not carry enough water to sustain communities, except during rainy seasons (Chennai District, n.d).

The Monsoon Season With Extreme Weather Conditions

The flood in Tamil Nadu resulted from the heavy precipitation brought on by a low-pressure system during the annual northeast monsoon of 2015. The winter monsoon contributes annually up to 30 percent of total rainfall in the south of India (The Indian Express, Dec 2015). However, this time, the region had been affected by three spells of heavy rainfalls that caused flooding.

The first period of intensive rainfalls took place on the 8th and 9th of November. The second spell of heavy showers lasted three days; it started on the 15th and ended on 17th of November. Throughout November, Chennai, capital of state, received almost 1,200mm of rainfall, which was a 329 percent increase from average November rainfall measurements and

the highest observed measurement in the last 100 years (Down to earth, Jan 2016). However, the most affected area by the first two spells of rain was Cuddalore district. It is located in the proximity of water bodies that breached after reaching its capacity, affecting nearby communities and damaging a number of homes, infrastructure, and crops. The third spell of rain took place in the beginning of December and had a devastating impact on Chennai and other parts of the northern Tamil Nadu, such as Kancheepuram, Thiruvallur, Villupuram, and Cuddalore. On 1st of December, over the course of 12 hours, the amount of rain received by Chennai was estimated to be 272mm, while the average amount of rainfall received during the whole month is approximately 191mm. It was the wettest December day in the history of the city.

December 1St: The Day When Chennai Got Inundated

The unexpected weather conditions led to situation where, on the morning of December 1st, houses situated in the small location of southern Chennai-Jafferkhanpet began to submerge. By five o'clock am, almost 80% of the city was covered by four meters of water. This situation carried on for the next three days, producing massive destruction and death.

A series of events and man-made errors aggravated this catastrophic outcome. One of the direct causes of the Chennai flooding that affected part of the city was a release of water from the Chembarambakkam reservoir by the Tamil Nadu administration (Centre for Science and Environment, 2016). Chennai's reservoirs reached their full capacity due to unforeseen amounts of rain throughout the month of November. The continuous rain led the main reservoir and water source in Chennai, Chembarambakkam to reach its limit on December 1st. The Adyar River originates from Chembarambakkam Lake. Under the threat of breach in the boundary of the reservoir, the discharge was increased from its normal level, 900 cusec (regular flow in terms of cubic feet per second), to more than three times that limit. This exceeded the capacity of Adyar's channel to carry water and led to the inundation of an area of more than 4 kilometers surrounding it. When the released water reached already-waterlogged Chennai, it produced a major flood (The Indian Express, Dec 2015).

Failures In Disaster Management

Since the Indian Ocean Tsunami in 2004, the Indian government has worked on improving early warning systems in order to build resilience to natural disasters.

An important milestone in Indian disaster management was establishing the National Disaster Management Authority in 2015. It is an agency responsible for policy creation and coordination with the State Disaster Management Authorities (SDMA) and for "ensuring timely and effective response to disaster" (NDMA, n.d.). The first board meeting of State Disaster Management Authorities in Tamil Nadu was held in 2012 when the initial steps have been taken to implement disaster prevention and management activities with accordance to state and national disaster management authorities (The Hindu, May 2012). Furthermore, coastal districts set up wireless-linked public address system to inform local communities how to behave during the crisis and improve early warning (ACAPS, 2015).

As regards the November-December 2015 floods, government had issued warnings about heavy rainfall to state authorities over 48 hours before disaster. However, the analysis conducted by the Union Ministry of Earth Sciences outlined that the reaction of Tamil Nadu authorities was too slow what deepened the negative effects of the disaster (*The Economic Times*, Feb 2016).

According to Nityanand Jayaraman, a journalist and a social activist:" local government didn't warn people early enough and didn't offer a speedy response, hence good evacuation plan in the face of the crisis. Both of the instruments were lacking and if both of them were better implemented, more lives, livelihoods and properties could have been saved" (Interview, May 2016).

Evacuation And Other Relief Operations

The Government of India officially declared Chennai a National Disaster zone on December 2nd (India Today, Dec 2015). Nevertheless, throughout November, continuous rainfalls caused inundation in low-lying parts of Chennai and resulted in the evacuation of thousands of people from their households and the suspension of classes in schools and colleges across various districts of Tamil Nadu (The New Indian Express, Nov 2015). Dhanya Rajendran, a journalist who covered the events for The News Minute, declared, "In fact, there were two floods in Chennai: one in November, one in December. A lot of households and other buildings in Chennai are on the shore of the lakes and the rivers, so naturally all of these places were affected. However, in the beginning of December we saw almost every single area in the Chennai getting flooded" (Interview, Apr 2016).

By November 17th, relief operations in Chennai consisted primarily of deployment of the Indian Air Force to help the affected population, together with establishing relief camps and distributing food packets. Local government indicated that, by that time, more than 5,300 people had been rescued from flooded areas (Hindustan Times, Nov 2015). The Indian Coast Guard and other divisions of the Armed Forces were carrying out rescue and relief operations on November 20th in Kancheepuram and airdropping 5,000 kg of supplies (Business Standard, Nov 2015). On the other hand, in Cuddolore, a region suffering from lack of power and drinking water, water was supplied to village pachayats[3] with tanker lorries. "While 40 medical camps were functioning in the district, 121 special camps had been held for cattle stock. Through 70 relief camps, 58,000 food packets have been distributed" (The New Indian Express, Nov 2015).

The rainfall at the beginning of December caused inundation in 40% of the Chennai's districts (The Indian Express, Dec 2015). The rain and subsequent overflow of the Adyar River and Cooum River produced severe flooding and large-scale evacuations in the city and surrounding areas, as well as significant damage to homes and farm fields. Additionally, it generated a cut-off of road access in some districts, making it difficult to reach affected areas. 432 relief camps opened in three highly affected districts outside of Chennai city, with approximately 72,000 people evacuated to the camps. The government carried out evacuations in other damaged areas (Sphere India, 2015). After the declaration of Chennai as a disaster zone, National Disaster Response Force was involved in the rescue operations in the city. Nevertheless, the relief response was uncoordinated in the northern part of Chennai, obligating the population to evacuate on their own (The Hindu, Dec 2015). The impressions of Dhanya Rajendran are as follows: "There was no proper evacuation plan, it looked like the government assumed that the rain should stop and people didn't expect that this amount of water would come... People were caught completely unaware of the threat; some people were stranded inside their houses and could not come out. In fact, by the time, the army and air force reached out; chaos already reigned in the city" (Interview, Apr 2016).

The lack of coordination by the rescue service led the population to offer help to those most in need. Abishek Venkat, a student from Chennai, describes the situation as follows: "We had thousands of people stranded on their terraces with no access to food or water. This is where the city came to life at a time of distress. Thousands volunteered and packed food

---

[3] Pachayat refers to the village level governing body.

packets and clothing kits for the people in need. Selfless volunteers swam across buildings to give these kits to the ones suffering. It was wonderful to see people from all kinds of families caste and social status to come together to do something to help the suffering people" (Interview, Apr 2016).

Table 1. State highlights the damage produced by flood.

Chennai Urban- Total population: 4.646.732	
Affected population	More than 6 M
Houses affected	More than 1,5 M
Thiruvallur District-Total Population: 3.728.104	
Affected population	Approx. 175.000
Houses affected	More than 51.000
Total no. of households	946.949
Total no. of families who lost their houses (fully damaged)	6.964
Total number of livestock lost	2.218
Crop damaged (ha)	24.870
Land submerged in water (ha)	15.000
Kancheepuram District -Total Population: 3.998.252	
Affected population	More than 1 M
Houses affected	More than 190.000
Cuddalore district- Total population: 2605914	
Affected population	More than 600.000
Houses affected	More than 90.000
Blocks affected	11 blocks affected out of 13
Total no. of huts	5409
Huts damage	Fully damage-837
	Partially damage- 2487
Villupuram District- Total Population: 3458873	
Population affected	More than 80.000
Houses affected	Approx. 20.000
Blocks affected	22
Deaths	56
House damage	Fully-971 (as per information received from local NGO)
	Partially-15204
Cattle died	2442
Crops damaged	3661- Agriculture
	1548- Horticulture
Irrigation tanks damaged	263
Supply channel damaged	208

Source: Sphere India, 2015

By December 5th, the rainfall was less intense and relief operations had escalated. Already, more than 1,100,000 citizens had been rescued and transferred to safer places and thousands were allocated to temporary houses in relief camps across the city and in neighboring districts. "On the relief front, government efforts were supplemented by thousands of volunteers of NGOs and well-meaning individuals flooding Chennai with food packets, drinking water, clothes, blankets, and medicines" (Hindustan Times, Dec 2015).

A Joint Detailed Need Assessment report prepared by Sphere India indicates that the humanitarian assistance provided in Tamil Nadu was offered to approximately 1.7 million people who had been temporarily housed in 6,605 flood relief camps in Chennai, Cuddalore, Thiruvallur and Kancheepuram Districts. In addition, "600 boats had been mobilized for relief operations. 12.29 million food packets were distributed, 26,270 medical camps organized and 2.56 million persons treated in those camps. In addition, 97 mobile medical units were pressed into service through which 49,329 people benefited" (Sphere India, 2015). The same report assessed the damage in five districts of Tamil Nadu based on information received during coordination meetings from members of Sphere India (see table 1).

Relief operations were completed by December 19th (The Hindu, Dec 2015).

Migration Patterns And Disaster-Induced Displacement

Previously Economic Migrants, Now Disaster-Displaced Population.

Rapid growth of urban areas in the region of Tamil Nadu was accompanied by an increase in the population living in either slum or squatter settlements. The majority of slums are located on the edge of the rivers, along railway tracks and in low-lying areas, what augments the risk exposure of flooding. The slum dwellers of Chennai and other rural areas that constructed their houses on the shore of various water bodies such as rivers and lakes were the most impacted by the heavy rains and wind occurred in the end of 2015. Nityanand Jayaraman indicates that, "in terms of displacement, people who were the worst affected, are people who migrated previously to the city in the search of livelihood or other economic benefits. These are people who are generally considered marginalized... Those marginalized people tend to live on the margins of society, on the margins of roads, on the margins of rivers, on the margins of lakes and margins of the sea and these are the places who got the most affected during the floods" (Interview, May 2016).

The Census of India conducted in 2001 showed that 20.02% of the total population of selected 63 municipal towns in Tamil Nadu region lived in slums. Additionally, a survey carried out by Tamil Nadu Slum Clearance Board (TNSCL) demonstrates an increase of 51,85 % in the number of slums in Chennai from 2001 to 2014 and estimates more than 1 million slum dwellers as for 2014 (TNSCL, 2015).

The location of the majority of slums was on or around waterways such as the Adyar and Cooum rivers. Other common characteristics of slums in Chennai include open defecation areas, lack of sewage drainage systems, lack of garbage collection processes, and a common ignorance of environmental problems (Kumaran, 2012).

The economic migration of populations from rural areas to Chennai is influenced by its size (the fourth-largest city in India) and importance as a port. Additionally, Chennai has experienced accelerated commercial and industrial growth over the past several decades due to the development of the outsourcing information technology sector that enabled services in the region. Chennai, in terms of investment, was the top destination for domestic migrants in 2007 (Kumaran, 2012).

A study conducted by K. Vinayakam and S.P. Pekar analyzed additional factors that contributed to rural-urban migration in Tamil Nadu. This paper investigated the socio-economic characteristics of migrants in Chennai and the results indicate that the factors contributing to rural-to-urban migration include, "less employment opportunities, low wages, drought, lack of basic amenities, landlessness in rural areas and in urban areas more employment opportunities, higher income, better wages, better facilities activities as pull factors towards the rural to urban migration." Nityanand points out that another reason for rural-to-urban migration within the Tamil Nadu region is an agricultural distress. "India is going through a very bad span of drought, so there are people leaving from once fertile areas to nearby cities in search of jobs. These are farmers or agricultural workers who leave their place because of the lack of water or for a variety of other reasons" (Interview, May 2016).

Tamil Nadu Slum Clearance Board in the report " Slum free city plan of action-Chennai Corporation" outlines further causes of slums' formation in Chennai like: low-income level and low paying capacity of the migrants, proximity of the houses to source of employment—high transportation cost and absence of comprehensive development planning (TNSCL, 2015).

The extent of the disaster that took place during November and December 2015 in Tamil Nadu was a product of unauthorized construction of house-holds along water bodies and their exposure to flood-related events. "The

communities living in slums, who were mostly rural migrants, decided to construct their homes on the river bed, because the local authorities offered them no other choice", comments Nityanand (Interview, May 2016).

A report prepared by Oxfam concludes that the overall destruction caused by the flood totaled 117,000 huts across Tamil Nadu. "Mud huts with thatch roofs have been severely affected in the floods. Walls have melted away, the flooring made of mud remained damp and sludgy weeks after the floods. Households have lost their utensils, stoves, clothes, and other belongings in the flood. Debris from the floods around the settlements in some rural areas has affected the mobility of residents. Stagnant water and debris from the floods have become a health risk for the communities living in the flood-affected areas" (Oxfam, Mar 2016).

Dalits- Trapped Population

The Dalits population located in the Cuddalore district was the most affected by flooding and at the same time, the most neglected by government in relief operations in Tamil Nadu (Hindutimes, Dec 2015). The name "Dalits" invokes a former "untouchable" caste in Indian society, a low status in the Hindu caste system, which in the past was dedicated to occupations regarded as unclean and despised (Judge, 2012).

Till the date, Dalits face discrimination and largely remain landless. Dalit population accounts for 21 percent of the total population in the Tamil Nadu and for one forth of all households. A study showed that 92% of Dalits in rural areas of Tamil Nadu were landless (The Times of India, May 2016). Furthermore, this part of society is considered as "unable to migrate to cities as a result of the lack of education and resources." (The Hindu, July 2015).

The National Campaign on Dalit Human Rights (NCDHR) and the Social Awareness Society of Youth (SASY) held a survey in Cuddalore in November after the first span of rainfalls in which they polled 1,500 households in the area. Of this total, more than 40 percent were Dalits. The results of the survey presented that 95 percent of damaged houses, 92 percent of livestock lost, and 86 percent of crops lost belonged to Dalits in the area[4] (NCDHR, SASY, 2015).

---

[4] Read more: Tsunami to 2015 floods " No respite for dalits in disaster response, Tamil Nadu" Report of Initial Findings from immediate needs Assesment and Monitoring response towards Affected Dalit Communities http://www.ncdhr.org.in/publications/Report%20of%20Initial%20Findings%20from%20Immediate%20Needs%20Assessment%20and%20Monitoring%20Responses%20towards%20Affected%20Dalit%20Communities.pdf

Dalits' households are mostly located in low-lying areas, either on the edge of or close to the river, which makes them more vulnerable to destruction caused by floods, cyclones and other type of natural disasters. In addition, the socio-economic condition of these village people is very low. The report outlines that water washed away the poorly constructed mud houses. Of the "1,026 mud houses that collapsed in Cuddelore, 971 belonged to Dalits, and of the 311 concrete houses that were damaged, 305 belonged to Dalits." In response to the disaster, a medical camp was established in a nearby village, Alamelumangapuram. However, the Dalit population didn't use the help offered in the camp for fear of violence and discrimination since it was located in a higher caste community, outlined the report.

The paper informs that people were not warned about the arrival of flooding by neither local authorities nor other officials. The houses belonging to the Dalit population were constructed from mud and thatch and were quickly washed away by the water and those who lost their houses looked for shelter in the concrete houses within their neighborhoods. Others, who struggled to live in their deteriorated houses, used all material available, including clothing items, to cover and reconstruct walls around house. The media reported that no officials paid a visit to the villages. As the report shows, "the major problem of this village is health and sanitation, there were no provisions of distributing any sanitation material in village; no health camps have been organized. The village is located almost 5-6 km away from the main road; therefore it's very difficult for villager to access any public transport. The schools and public health centers are also more than 5 km away for villagers to access in an immediate need. Most of the people of the Dalit community in this village worked as laborers in the farmland of the dominant community where males are getting wages of 300 R.s per day and females are getting 100 R.s per day as laborers. But due to this flood, they have lost that only source of income; they are not able to go for their jobs" (NCDHR, SASY, 2015).

Nityanand, who visited Cuddalore after the flood, shares the opinion that the Dalit population was left out of the process and has faced discrimination. He claims that part of the "systemic discrimination in Indian society is represented by the infrastructure, where unintentional discrimination happens. As the effect, the Dalit villages or hamlets have always been further away from the roads than the upper cast villages are, and when relief trucks come, they have to pass the upper cast villages (...) within the Dalit colony, the households located on the streets far away from main street didn't receive any help, so there was a discrimination within the discriminated population" (Interview, May 2016).

Due to lack of access to official authorities, it wasn't possible to include a perspective of local governmental bodies.

The Causes Of The Flood

Climate Change

The phenomenon of El Niño[5] is cited as one of the primary contributors to the record-breaking rainfall in Tamil Nadu. It is described by The National Oceanic and Atmospheric Administration (NOAA) as "the large-scale ocean-atmosphere climate interaction linked to a periodic warming in sea surface temperatures across the central and east-central Equatorial Pacific" (NOAA, n.d). El Niño phenomenon increases the possibility of extreme weather conditions like flooding. However, the Center for Science and Environment in India indicated that further investigation is needed in order to attribute a direct link between the Chennai disaster and climate change, notwithstanding, "climate change-induced unnaturally heavy rains might have exacerbated the problem manifold" adding that existent scientific studies on climate do establish the possibility of a connection (CSE India, Dec. 2015).

Rapid And Unplanned Urbanization

Tamil Nadu is classified as the first on share of urban population among large states in India and third on absolute urban population. As per estimates of 2011 census, approximated urban population of Tamil Nadu accounts for 34.9 million, what means that 48.45% of its population lives in the cities. The level of urbanization in Tamil Nadu has increased by 4 percentage points from 44.04% in 2001 to 48.45% in 2011 (CSE, 2016). The main cause of rapid urbanization, as mentioned previously in the research, is migration of people from rural areas in search of economic opportunities and the presence of industrial estates in all districts (The Hindu, July 2015). The most urbanized city in the state is Chennai Metropolitan Area. The average rate of population growth of the city is a 25% increase each decade, a rate that has caused a dramatic loss of green areas, water bodies, and drainage systems. Collectively, these losses have weakened the natural protection system of the city in the face of flooding (Arunprakash et al., 2014).

---

[5] The word "El niño" means "the child" in Spanish.

Environmental Damage Caused By Rapid Urbanization

The importance of water bodies is frequently underestimated, however, lakes and wetlands are significant component of an urban ecosystem. They provide social, economic and environmental benefits. They are simultaneously sources of drinking water and home to biodiversity, and they supply humans with fuel, food, recreation, and employment. Additionally, wetlands act as a sponge, absorbing rainfall and controlling its flow into stream and rivers, which prevents the disastrous consequences of flooding.[6] (CSE, 2016). The function of water bodies in the modern context is even more critical as cities face the challenge of rapid increase in urban population and lack of appropriate urban planning. Among the most important hydrological effects of urbanization, we can distinguish: (1) increased water demand, often exceeding the available natural resources; (2) increased wastewater, burdening rivers and lakes and endangering the ecology; (3) increased peak flow; (4) reduced infiltration and (5) reduced groundwater recharge, increased use of groundwater, and diminishing base flow of streams (Gupta, Nair, 2011).

The Center for Science and Environment in India published a report on the state of India's urban water bodies, where they outline that for the past 20 years urban water bodies have been victims of unplanned urbanization in India. Among the threats to water bodies posed by the rapid growth of urban areas are "encroachment, disposal of sewage, groundwater decline leading to fall in the level of lake, unplanned tourism, and the absence of an administrative framework" (CSE, 2016).

The Center for Environmental and Water Resource Engineering, IIT Madras determined that the Chennai Region contained approximately 650 water bodies in the 1980s, however, only small portion of these remain (Srivathsan and Lakshimi, 2011). In addition, 19 major lakes have decreased in size over the past two decades by almost 50%, from a total of 1,130 hectares (ha) in the 1980s to nearly 645 ha in early 2000s. The smaller size of water bodies leads to a reduction in their storage capacity CSE, 2016).

The magnitude of flooding in Tamil Nadu at the end of 2015 was due to a decrease in the area of water bodies, which served as a natural drainage system for the region and a sink for the city of Chennai. The Pallikarni marshland, located 20 km from Chennai, has for a long time acted as a natural sponge absorbing the rainfall. However, due to the decrease in its size during the December floods, the marshland could do little. As a result

---

[6] Read more: WWF (2016) The wonder of wetlands: http://wwf.panda.org/about_our_earth/about_freshwater/intro/

Figure 1. Loss of water bodies due to urbanization in India
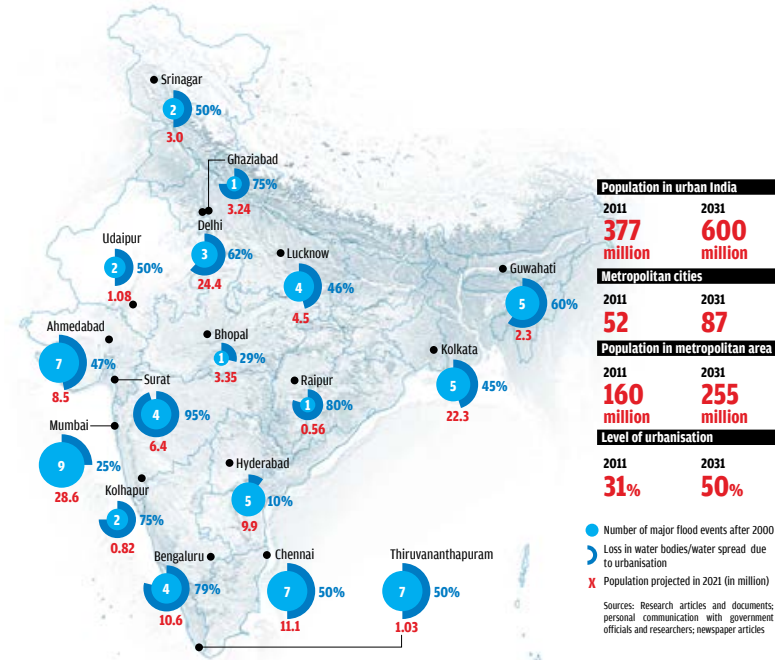
Source: CSE (2016) State of India's urban water bodies

of unplanned and rapid urbanization, the area of marshland is used now as a waste disposal site and also contains several residential and commercial projects. Another part of it has been assigned to government projects including the Mass Rapid Transport System of the Ministry of Railways, the National Institute of Ocean Technology, the Chennai Corporation, and the Centre for Wind Energy Technology (CSE, 2016).

Another really important issue of rapid urbanization in Tamil Nadu is the lack of garbage management. There has been an increase in use of non-degradable garbage like plastic which has led to clogged waterways, channels, and rivers and reduced the capacity to drain the rainwater, effectively producing flooding.

The Aftermath Of The Flood And Policy Implications

The political reaction to the massive destruction and support offered by authorities was focused mainly on post disaster response. As the

consequences of devastation caused by flooding fall principally on the slum dwellers and necessitate their relocation, the Tamil Nadu state government initiated a slum clearance program on December 29th, 2015. This program focuses on a massive clearance of encroachments along the Adyar River and holds the promise to provide alternative accommodation to families who lost their homes during the flooding events (The Hindu, Dec 2015). By March of 2016, first 4,044 housing units were inaugurated in order to resettle families who had lived in illegally encroaching construction regions and had been cleared away by the city corporation (The Times of India, Mar 2016). The government offered as well a monetary compensation to each family that lost their house in the floods and to those who lost their crops.

However, the lesson learnt from the events occurred in Tamil Nadu by the end of 2015 proved the importance of pre-disaster activities and the need of changing the region's urban governance approach to disaster management. A significant improvement is required in the areas of disaster preparedness—how to respond to natural hazards and mitigation—how to minimize its effect. It includes, among others, the effective early warning systems, preparedness plans, and emergency exercises together with public education and vulnerability analysis. An effective disaster risk reduction initiative should also involve actions related to climate change mitigation, which outcomes might be already observed in the region and that it is likely to produce, more frequently and with increasing magnitude, extreme events including floods, droughts and tropical cyclones.

Another urgent policy initiative is required in the field of urban planning and regulations related to environmental degradation. The negative effects of increase in urban population should be mitigated by strategic city planning, that satisfies the housing demand and other infrastructural, social and economic requirements of new inhabitants including drainage and sewage systems, transport and health services and so forth. In terms of environmental degradation, authorities with the help of other stakeholders should enforce regulations related to building codes and prohibit construction on existing water bodies. The growing awareness and political action is also required in the field of environmental restoration and preservation.

Conclusion

Over the last twenty years, the Indian southern state of Tamil Nadu has been affected multiple times by natural disasters like floods, cyclones and earthquakes. However, during the last two months of 2015, unexpected

weather conditions together with other inter-related determinants produced flooding that caused 354 fatalities, heavy damages to livelihoods and displacement of 1,8 million people.

The November-December 2015 floods demonstrated many complex linkages between human vulnerability and exposure to risk in the context of a changing climate and environmental degradation and supported the hypothesis of the Internal Displacement Monitoring Center about exposure of urban population in India to disaster-induced displacement caused by rapid growth and unplanned development.

The present study shows that the causes of flooding were multiple, and not only due to extreme weather conditions originating in the strongest-ever El Niño, but also emerged from environmental degradation generated by rapid growth of urban areas and unplanned development. Among the most important consequences of rapid urbanization faced by Tamil Nadu was a decrease in the area occupied by bodies of water, which served as natural drainage systems for the region. It may also be attributed to inadequate drainage systems and increase in garbage generation that clogged the waterways and reduced rainwater drainage capacities. However, poor disaster management and the series of man-made mistakes exacerbated the negative effects of flooding.

This natural disaster demonstrated as well that the part of the community with the lowest social-economic status, in majority previous economic and environmental migrants, who live in slums, is the part of the population with the highest exposure to negative impacts of natural disaster and therefore the most displacement-prone part of society.

Unquestionably, the Tamil Nadu 2015 floods showed that a comprehensive policy package is required in areas of disaster risk management with special attention to pre-disaster responses together with regulations to address urban planning and the environmental degradation. The better understanding of risks and effective disaster management of all active stakeholders is crucial to reduce the vulnerability of communities, build regional resilience and achieve sustainable development.

BIBLIOGRAPHY

REPORTS

ACAPS (2015, Nov 15) India: Floods in Tamil Nadu, Briefing Note, Retrieved from: http://www.acaps.org/sites/acaps/files/products/files/b-acaps-start-bn-india-floods-in-tamil-nadu-15-nov-2015.pdf

CENTER FOR SCIENCE AND ENVIRONMENT (2016) State of India's Urban Water Bodies. Why urban India floods, A Down to Earth Publication.

INTERNAL DISPLACEMENT MONITORING CENTER (2015) Risk of disaster-induced displacement in South Asia, Geneva.

INTERNAL DISPLACEMENT MONITORING CENTER (2016). Annual report 2015, Geneva.

OXFAM (2016 Mar 2) Oxfam Situation Report Number: 15 (Tamil Nadu cyclone 2015).

SPHERE INDIA (2015) Joint Needs Assessment Report Tamil Nadu Floods-2015.

Retrieved from: http://reliefweb.int/sites/reliefweb.int/files/resources/jna-report-tamilnadu-december-2015.pdf

NCDHR, SASY (2015) Tsunami to 2015 floods " No respite for dalits in disaster response, Tamil Nadu" Report of Initial Findings from immediate needs Assesment and Monitoring response towards Affected Dalit Communities.

ARTICLES AND BOOKS

CHANDRAMOULI, DR.C (2003) Slums In Chennai: A Profile in Martin J. Bunch, V. Madha Suresh and T. Vasantha Kumaran, eds., Proceedings of the Third International Conference on Environment and Health, Chennai, India, 15-17 December, 2003. Chennai: Department of Geography, University of Madras and Faculty of Environmental Studies, York University. Pages 82-88.

GUPTA A.K., NAIR S.S., (2011) Urban floods in Bangalore and Chennai: risk management challenges and lessons for sustainable urban ecology, CURRENT SCIENCE, VOL. 100, NO. 11, 10 JUNE 2011.

INTERNATIONAL ORGANIZATION FOR MIGRATION (2014) Migration, Environment and Climate Change: Evidence for Policy (MECLEP) Glossary, Geneva

JUDGE P.S. (2012) Between Exclusion and Exclusivity: Dalits in Contemporary India, Polish sociological review, number 178, pages 265-279.

KUMARAN T., VASANTHA; S.D., RAJESWARI; N., ANNAMMADEVI; J., NANDHINI; (2012) Community Engagement in Chennai Slums A Reflection from the Field; Internationales Asien Forum. International Quarterly for Asian Studies.

VINAYAKAM K., SEKAR S.P. (2012) A Study on Characteristics (Socio-Economic) Of Migrants In Chennai City, IOSR Journal Of Humanities And Social Science.

PRESS ARTICLES

BUSINESS STANDARD (2015, Nov 20) Indian Air Force (IAF) Winds up Relief and Rescue Operations in Flood Hit Tamil Nadu and Andhra Pradesh, Retrieved from: http://www.

business-standard.com/article/government-press-release/indian-air-force-iaf-winds-up-relief-and-rescue-operations-in-115112001064_1.html

CSE India (2015, Dec 3) Chennai in crisis, Retrieved from: http://www.cseindia.org/content/cse-press-note-chennai-crisis

Down to earth (2016, Jan 15) Chennai apart, Retrieved from: http://www.downtoearth.org.in/news/chennai-apart-52265

Floodlist News (2015, Nov 16) India-Tamil Nadu Floods Continue as Death Toll Rises, Retrieved from: http://floodlist.com/asia/india-tamil-nadu-floods-continue-as-death-toll-rises

Floodlist News (2015, Dec 11) The Cost of the Tamil Nadu Floods—347 Lives, 3 Billion Dollars. Retrieved from: http://floodlist.com/asia/cost-tamil-nadu-floods-347-lives-3-billion-dollars

Hindustan Times (2015, Nov 17) Rain batters Tamil Nadu: Rs 500cr relief announced, IAF in action, Retrieved from: http://www.hindustantimes.com/india/rain-batters-tn-jaya-announces-rs-500cr-relief-iaf-in-action/story-RQIQUQzbTUIk7QTcVYRuEN.html

Hindustan Times (2015, Dec 6) Ex-gratia for Tamil Nadu flood victims; focus shifts to relief work, Retrieved from: http://www.hindustantimes.com/india/ex-gratia-relief-for-tamil-nadu-floods-victims-receding-water-brings-trouble/story-809qDsfxZL2176olpu2jfN.html

Hindustan Times (2015, Dec 7) Dalits suffered more than others in flood-hit Cuddalore: Report, Retrieved from: http://www.hindustantimes.com/india/dalits-suffered-more-than-others-in-flood-hit-cuddalore-report/story-TQfazyjyzWfD2tUjZ6qJyM.html

India Today (2015, Dec 2) Chennai declared disaster zone, airport to remain shut till December 6, Retrieved from: http://indiatoday.intoday.in/story/chennai-rains-crisis-may-worsen-as-more-heavy-showers-predicted/1/536708.html

Raghavan, T.C.A. Sharad (2015, Jan 15) Linking urban India to drive growth, Livemint. Retrieved from: http://www.livemint.com/Opinion/VZ2ZW6DSRqTj7PIxbVLcIK/Linking-urban-India-to-drive-growth.html

The Economic Times (2015, Dec 5) Chennai floods echo at Paris climate meet.

India Times, Retrived from: http://economictimes.indiatimes.com/articleshow/50049602.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

The Economic Times (2016, Feb 2) Tamil Nadu response to flood was slow, says central analysis, Retrieved from: http://economictimes.indiatimes.com/news/politics-and-nation/tamil-nadu-response-to-flood-was-slow-says-central-analysis/articleshow/50814594.cms

The Hindu (2012, May 31) District Disaster Management Authority holds its first sitting, Retrieved from: http://www.thehindu.com/todays-paper/tp-national/tp-tamilnadu/district-disaster-management-authority-holds-its-first-sitting/article3475160.ece

The Hindu (2015, July 5) What drives urbanisation in Tamil Nadu, Retrieved from: http://www.thehindu.com/news/national/tamil-nadu/what-drives-urbanisation-in-tamil-nadu/article7386961.ece

The Hindu (2015, Dec 3) Thousands of residents flee north Chennai ,Retrieved from: http://www.thehindu.com/news/national/tamil-nadu/chennai-floods-latest-updates-relief-rescue-operation-underway-imd-predicts-more-rains/article7944477.ece

The Hindu (2015, Dec 30) Corpn. to spend Rs. 110 crore on road restoration. Retrieved from: http://www.thehindu.com/news/cities/chennai/chennai-rains-chennai-corporation-to-spend-rs-110-crores-on-road-restoration/article8044455.ece

The Hindu (2015, Dec 30) Removal of huts along Adyar river begins, Retrieved from: http://www.thehindu.com/news/cities/chennai/removal-of-huts-along-adyar-river-begins/article8043536.ece?ref=relatedNews

THE INDIAN EXPRESS (2015, Dec 14) Chennai floods: The day city went under, who did what—and who did not, Retrieved from: http://indianexpress.com/article/india/india-news-india/chennai-floods-the-day-city-went-under-who-did-what-and-who-did-not/

THE INDIAN EXPRESS (2015, December 4) Why Chennai is seeing its worst floods, The Indian Express. Retrieved from: http://indianexpress.com/article/india/india-news-india/chennai-floods-rains-jayalalithaa-imd-reasons-rescue-news-updates/

THE NEW INDIAN EXPRESS (2015, Nov 17) The Day Chennai Drowned: City Experiences 'Sunk Monday', Retrieved from: http://www.newindianexpress.com/cities/chennai/The-Day-Chennai-Drowned-City-Experiences-Sunk-Monday/2015/11/17/article3131878.ece?service=print

THE TIMES OF INDIA (2016, May 4) Mind the Dalit-OBC gap in TN, Retrieved from: http://timesofindia.indiatimes.com/elections-2016/tamil-nadu-elections-2016/news/Mind-the-Dalit-OBC-gap-in-TN/articleshow/52103820.cms

THE TIMES OF INDIA (2016, Mar 1) Jayalalithaa opens 4,044 Slum Clearance Board tenements, Retrieved from: http://timesofindia.indiatimes.com/city/chennai/Jayalalithaa-opens-4044-Slum-Clearance-Board-tenements/articleshow/51207135.cms

WEB PAGES

CHENNAI DISTRICT, Retrieved from: http://www.chennai.tn.nic.in/

WWF GLOBAL, Retrieved from: http://wwf.panda.org/about_our_earth/about_freshwater/intro/

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION. What are El Niño and La Niña? Retrieved from: http://oceanservice.noaa.gov/facts/ninonina.html

NATIONAL DISASTER MANAGEMENT AUTHORITY GOVERNMENT OF INDIA, Functions and Responsabilities, Retrieved from: http://www.ndma.gov.in/en/about-ndma/roles-responsibilities.html

GLOBAL GIVING, FLOOD DISASTER RESPONSE AT TAMIL NADU, S. INDIA, Retrieved from: https://www.globalgiving.org/projects/flood-disaster-response-at-tamil-nadu-s-india/

INTERVIEWS

ABISHEK VENKAT (2016, Apr 26) Student.

DHANYA RAJENDRAN (2016, Apr 12) Journalist.

NITYANAND JAYARAMAN (2016 May 9) Journalist, Social activist.