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## **Himalayan Tsunami: Disaster Natural But Damage Man-Made**

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### **ABSTRACT:**

*Uttarakhand the hill state in the Himalayan range is so far the worst hit by the extreme rains that struck northern India on June 16-17 this year. Heavy rainfall has wreaked havoc on the region because of the fragile nature of the Himalayan range and poor soil stability in its steep slopes. But it is human-induced factors that have compounded the scale of the disaster. The indiscriminate cutting of mountain slopes for construction of buildings had resulted in filling of the flood plains. Unabated expansion of hydro-power projects and construction of roads to accommodate ever-increasing tourism, especially religious tourism, are major causes for the unprecedented scale of devastation. Every year, Uttarakhand's Garhwal region receives pilgrims in thousands for Chhota Char Dham Yatra—Gangotri, Yamunotri, Kedarnath and Badrinath. It also receives heavy rains and suffers floods. But the loss the region has suffered this time is horrifying. Even though it cannot be said that this particular Himalayan Tsunami is caused by climate change, the link to this event and the growing trend of intense and extreme rain events is clear and undisputable. Climate change is caused by fossil fuel use and emissions, needed for economic growth. So, this disaster is natural but damage is man-made.*

**Key Words:** *Devastation, Himalayan Tsunami Unabated, Religious Tourism, Unprecedented*

### **INTRODUCTION:**

Uttarakhand the hill state in the Himalayan region is known as Devbhoomi, or the abode of the Gods, sacred to Hindus, Buddhists and Sikhs alike (Semwal, 2010). The source of the most sacred river in India, the Ganga and its biggest tributary, the Yamuna lies in the region

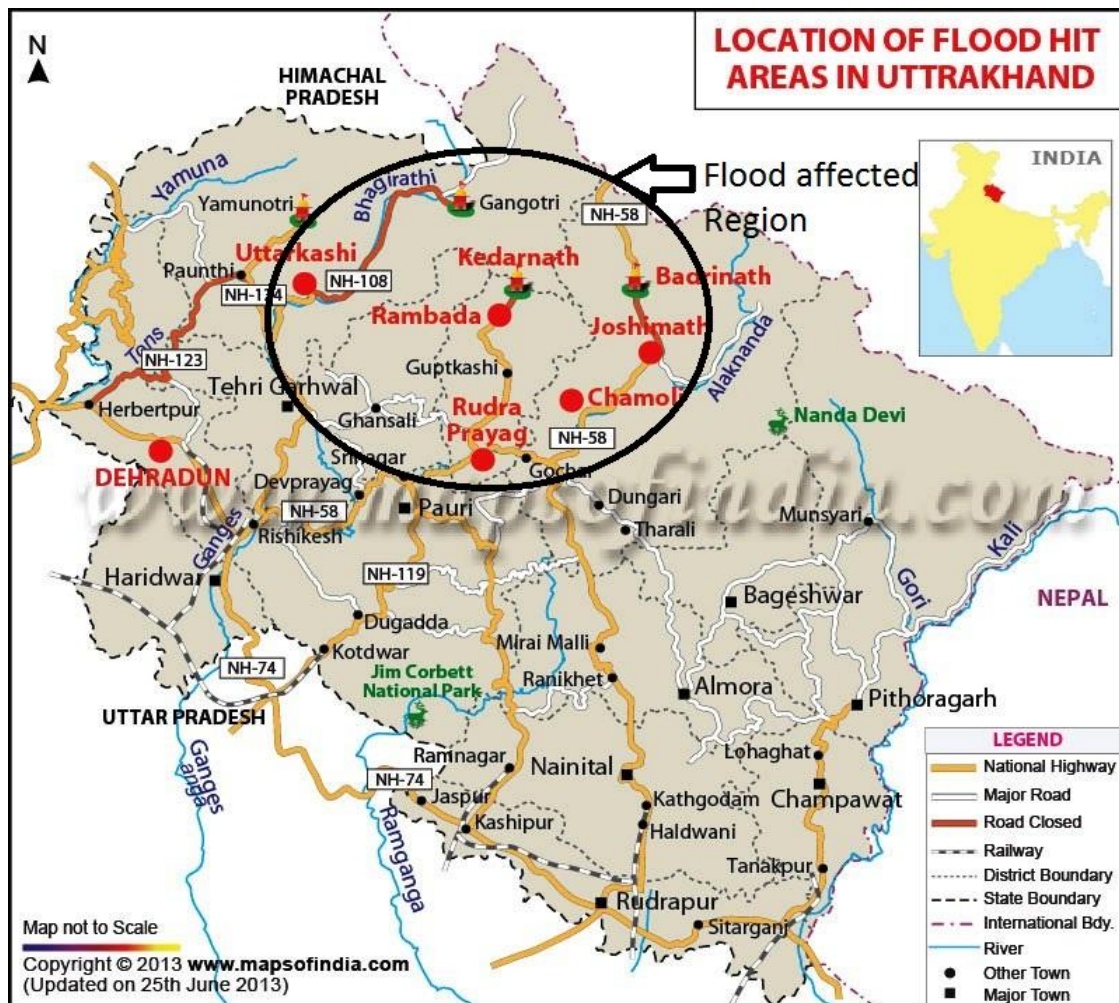
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called Gangotri and Yamunotri. This is in West Garhwal, but between that and the Eastern most Garhwal glacier of Pindar lies the source of rivers such as Mandakini, Alaknanda, Bal Ganga and Bhilangana. The holy temples of Badrinath and Kedarnath, together with Surkandadevi, Budha Kedar, Hemkund Sahib, etc., are all a part of Devbhoomi. The Jyotirling at Kedarnath was the northern most dham of Adi Sankara. It is the ambition of every Hindu and every Sikh to make a pilgrimage to Devbhoomi before he or she dies (Buch, 2013).

Ever since Uttarakhand was created in 2000, the state government, be it of the Congress or the BJP, has been working with one agenda-exploit natural resources of water, forests and minerals to develop infrastructure, without caring for its consequences on nature. The development is triggered mostly by the deluge of pilgrims who visit the holy places in the state annually for *Chhota Char Dham Yatra*—Gangotri, Yamunotri, Kedarnath and Badrinath. In the past decade, the number of tourists has risen by 155 per cent as per the state's tourism department data shows. Last year, 28.4 million tourists visited the state between May and November. The state's population is 14 million. There is hardly any place to accommodate the visitors. A survey done by the Indian Council for Research on International Economic Relations in 2006 states that there is an average of 102.5 hotels per million tourists in the state. Shortage of dwelling units has led to mushrooming of illegal structures, some right on the riverbanks. The state government's 2000 notification to prohibit construction within 200 metres from the riverbanks was not adhered to. In 2011, a local resident of Roorkee, filed a public interest litigation in the Uttarakhand High Court and identified several illegal structures along the banks of the Ganga, Song, Bhagirathi, Alaknanda and the Mandakini. The two member bench comprising Chief Justice of Hon'ble High Court ordered the state government to demolish all structures along the banks. But the state government did not act. Floods have brought down hundreds of small hotels on the riverbanks. The main indicator of a thriving real estate business is the Himalayas itself, hollowed down for boulders, pebbles, sand and gravel. Statistics of the forest department show that between 2000 and 2010, as many as 3,903.24 hectares forestland was diverted for mining projects (Singh, 2013).

**Uttarakhand Tragedy:**

From 16 to 17 June 2013, the state of Uttarakhand and adjoining area received heavy rainfall, which was about 375 percent more than the benchmark rainfall during a normal monsoon. This caused the melting of Chorabari Glacier at the height of 3800 metres, and eruption of the Mandakini River which led to heavy floods near Gobindghat, Kedar Dome, Rudraprayag district of Uttarakhand, Himachal Pradesh and Western Nepal, and acute rainfall in other nearby regions of Delhi, Haryana, Uttar Pradesh and some parts of Tibet (see Map).



Following are the major questions of inquiry which are required to answer in this study:

1. What are the main causes of this disaster?
2. Why the impact of the disaster multiplies?
3. What we have learnt from this disaster?
4. What measures should be taken to reduce the impact of such disaster in future?
5. What should be the developmental strategy for this region in future?

### **MAIN CAUSES OF THE HIMALAYAN TSUNAMI:**

Many theories and explanations for the disaster have surfaced in the aftermath of the floods in the state. Now clearer satellite images of the upstream and downstream areas of the Kedar valley that have emerged are enabling a clearer understanding of the scientific and environmental reasons for the tragedy in the state:

#### **1. Formation of Small Lake:**

The Kedarnath town and the glacier above are 3 km apart. As there is no automatic weather station there, the data has been collected from satellite. There is evidence that a small lake was formed during the rains above Kedarnath town. The lake must have lasted for a short duration. It was a 100 square hectare lake which contained 10 million litre of water. The water that collected in the lake came down along with the water from the glacier.

#### **2. Massive Landslide:**

It is believed that a massive landslide occurred upstream in the north-east region of the Kedar valley. Heavy rainfall occurred at the same time formed a small lake in the north-west of the valley. The debris from the landslide and water from the lake travelled down the slope, channelled into the glacier, and came down to Kedarnath town.

#### **3. Heavy Rainfall and Cloudburst leads to Flash flood**

There was rainfall of 120 mm in 24 hours before the flash flood of June 16 at Kedarnath. The lake burst due to a breach in the blockade that formed its boundary. Coupled with heavy rain in the area, this caused flash flood. It is because of the lake that there was excessive stream run-off and a third channel was formed.

**Table**

**District wise rainfall trends in Uttarakhand from 2008 to 2012**

Years	Chamoli		Rudraprayag		Uttarkashi	
	R/F*	% departure from LPA#	R/F*	% departure from LPA#	R/F*	% departure from LPA#
2008	163.8	59	148.9	-30	298.3	98
2009	32.2	-69	17.8	-92	197.3	31
2010	121.8	18	166.6	-21	189.9	26
2011	170.5	57	369.6	70	363.7	146
2012	41.1	-62	95.4	-56	45.6	-69

*\*Rainfall*  
*#Long Period Average*

The data shown in the above table reveals that in 2011 Uttarkashi received 146 per cent excess rainfall compared to the long period average (LPA). The corresponding figures for 2010, 2009 and 2008 are 26 per cent, 31 per cent and 98 per cent. Chamoli received 57 per cent excess rainfall in June in 2011, 18 per cent in 2010 and 59 per cent in 2008. Rudraprayag also received a deficit rainfall in 2008, 2009, 2010 and 2012, but the year 2011 witnessed excess rainfall of 70 per cent (Singh, 2013).

**4. Impact of Climate Change:**

Unprecedented glacier melting caused by warming global temperatures has spawned an increase in massive water surges known as "Himalayan Tsunami" that are causing vast destruction in the Himalayas. Surface air temperatures in the Indian Himalayas have increased by one degree Celsius in the past decade. The phenomenon known as Glacial Lake

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Outburst Floods (GLOFS) "are capable of releasing billions of cubic meters of glacial water, stored for decades, in a few short hours, or even in a matter of minutes and virtually without warning to those living downstream. As the average global temperature continues to rise, a combination of "rapidly melting Himalayan glaciers," extreme rainfall, and unpredictable seismic events are causing the GLOFS in which massive waves of water suddenly charge down mountains and wipe out entire villages and communities (Chamberlain, 2013)

#### **5. Construction of Roads and Hydro Projects destabilising mountains:**

The Himalaya is the youngest fold mountain range of the world; it will remain steady if not tampered with much. But the huge expansion of roads and transport is bringing the mountains in Uttarakhand down. It's a major destabilising factor for a mountain and it is a new phenomenon for the Himalaya.

The Ganga in the upper reaches has been an engineer's playground. According to the website of Uttarakhand Jal Vidyut Nigam Limited, 45 hydropower projects with a total capacity of 3,164 MW are operational in Uttarakhand, and around 199 big and small projects are proposed or under way in the state. In the Alaknanda-Bhagirathi (tributaries of the Ganga) basin alone, which is said to be most impacted, 69 hydropower projects with a total capacity of 9,000 MW are under way, according to the high level Inter-Ministerial Group (IMG) formed by the Union Ministry of Environment and Forests to consider matters relating to environmental flows and hydropower projects on the Ganga and its tributaries. The report was prepared in April 2013. These projects would modify the key tributaries through diversions to tunnels or reservoirs. As per the report, implementation of all 69 projects would affect 81 per cent of the Bhagirathi and 65 per cent of River Alaknanda (Basu et. al. (2013).

#### **OTHER CAUSES BEHIND THE TRAGEDY:**

- Indiscriminate construction of Roads and Hydro Electric Power projects weakens the slopes, forebode disaster in Uttarakhand.

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- Wide scale deforestation has been done due to developmental projects. To compensate this loss only 12 per cent afforestation achieved so far.
  - Projects under way do not take into account ecological impact on the Himalaya and the rivers.
  - The incidence of landslides have become more frequently now at the cost of infrastructure development.
  - No check on the flow of pilgrims in the name of *Char Dham Yatra* in a month, without assessing the carrying capacity and its adverse impact.
  - Himalayas have already seen increase in temperature that is 2-3 times higher than the average global temperature rise of 0.9° C. These climate change impacts include greater frequency of high intensity rainfall, including cloud bursts that can also increase the potential of landslides and flash floods.

#### **DEVASTATING EFFECTS OF THE HIMALAYAN TSUNAMI:**

The terrible magnitude of nature's fury in Uttarakhand unfolded on 16 -17 June 2013 has caused thousands of people missing with fears that the numbers may go up substantially as large parts remained cut off for many days while hundreds of houses and buildings lay in ruins. The total of 5,748 people missing after devastating floods in the state has been presumed dead by the State Govt.

#### **Kedarnath Temple and adjoining Valley- The Most Affected Region:**

Although the Kedarnath temple withstood the severity of the floods, the temple complex and surrounding areas were destroyed by the flood, resulting in the death of several thousands of pilgrims and local people. All the shops and hotels were destroyed and all roads were broken. Number of people took shelter inside the temple for hours together, until Indian army airlifted them to safer places.



Chorabari glacier was the epicentre of this Himalayan Tsunami. The glacier lies on the slope of the 6,940- metre Kedarnath peak of the Himalaya. The glacier is 7 km in length, its basin area is 38 sq km and the ice cover is 5.9 sq km. It has two snouts—one is the source of the Mandakini (at 3,865 metres) and the other becomes the Chorabari Lake (at 3,835 metres). People recall that on June 16 the lake exploded when clouds burst over it. The lake is 6 km from the temple upstream the Alaknanda. Ensuing rains cut off the hilly districts of Uttarkashi, Rudraprayag, Chamoli and Pithoragarh from the mainland and battered the land till it crumbled.

The raging Bhagirathi, Alaknanda and Mandakini have swollen like never before and swept away whatever came in their way. Official figures shows that as many as 2,052 houses have been wiped out, 147 bridges have collapsed and 1,307 roads destroyed. The upper reaches of Uttarakhand look as if the region has travelled a hundred years back in time.

The Gangotri and Yamunotri highways are damaged at several places. The rivers have damaged the 36-km stretch from Uttarkashi to Bhatwari at six places. Higher up, roads are damaged due to landslides. The stretch of road between Matli to Maneri in Uttarkashi is so



badly damaged that it could not be making functional for many months. Three drinking water projects have got washed away in Garur block, while 71 streams and 40 canals have been damaged. As per preliminary estimates of the Uttarakhand Govt. the disaster has cost ₹ 50,000 crore in infrastructural loss. Uttarakhand Jal Vidyut Nigam Limited has suffered loss of ₹ 77 crore apart from the ₹ 50 crore lost in power generation.



*Landslide in lower Rudraprayag destroyed a road, making relief work difficult (Photo: SOUMIK MUKHERJEE / CSE)*

#### **IMPACT ASSESSMENT BY ISRO:**

Satellite images from the ISRO reveal that rivers Mandakini, Alaknanda, Bhilangana, flowing through Uttarakhand, were overflowing 4-5 times wider than their normal width, triggering the massive flash floods and subsequent landslides that ripped through the state killing thousands, a damage analysis said. The analysis conducted by ODR Collaborative shows that undercutting and river bank erosion reactivated several old landslides in the area and also caused new ones.

“With glacial debris, massive landslides and river cutting along the length of the river, lot of sediments were deposited on the river beds, thus raising the water level. Satellite images indicate that wherever there is confluence of two rivers, there is more damage like Sonprayag, Karnaprayag and Rudraprayag,” the analysis said (The New Indian Express, 23<sup>rd</sup> Aug., 2013).

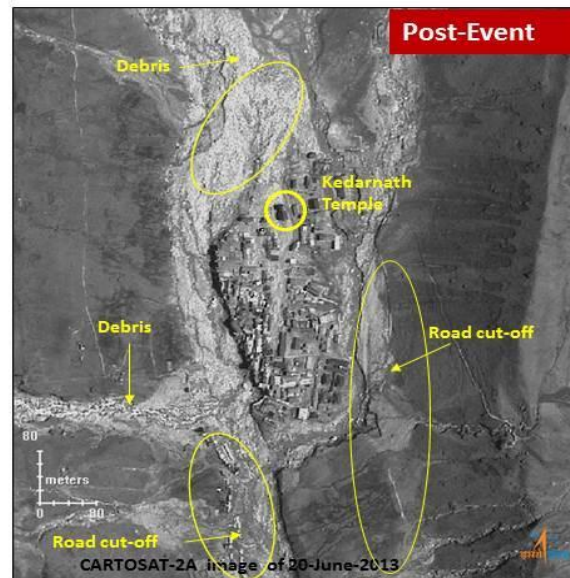
It said the indiscriminate cutting of mountain slopes for construction of buildings had resulted in filling of the flood plains, increasing vulnerability. The satellite images clearly capture this process at flash flood hit Sunargaon and Sonprayag.

“Construction of roads in certain areas, particularly along the same face of the mountain slopes has added to instability of the slope, causing landslides. Roads and bridges are badly affected because of undercutting of river banks and landslides,” the analysis stated. The report also indicated loss of lives due to unchecked expansion of settlements in flood plains, unstable slopes and landslide prone areas (Ibid, 2013).

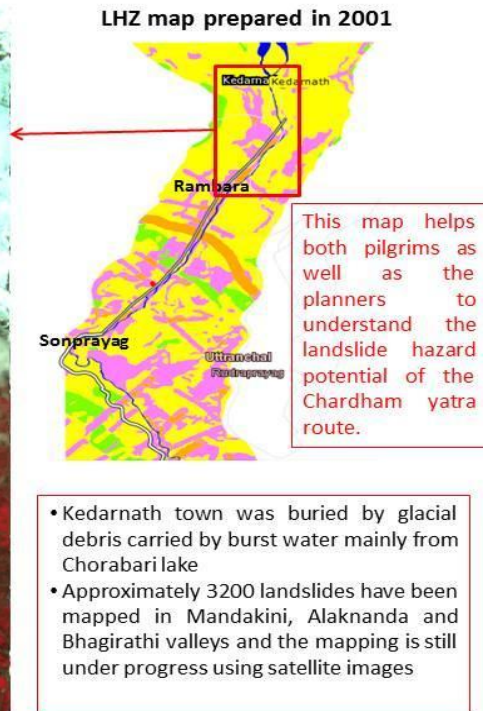
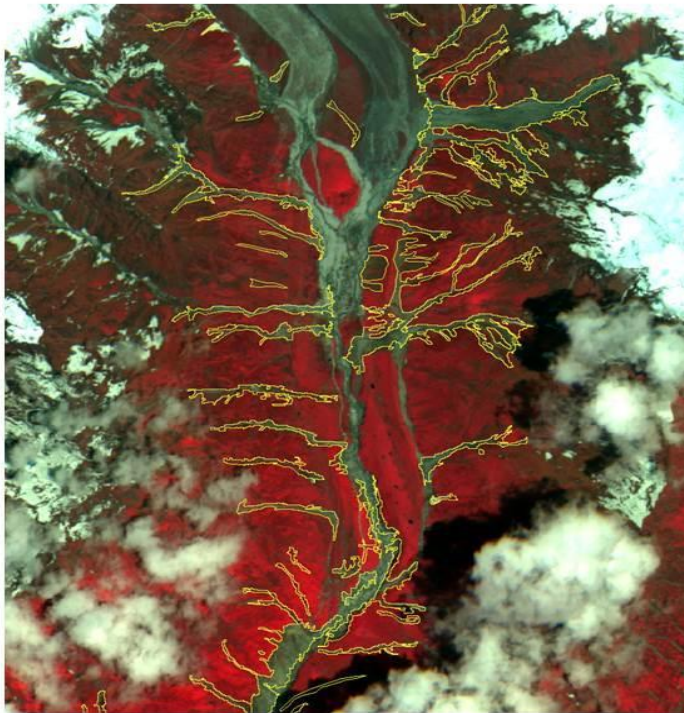


### Uttarakhand Floods– Damage to Kedarnath nrsc

- Information Provided – Flood Inundation, Damaged Roads, Landslides
- Observation Period – June, 17 to till date
- Information Dissemination – NDEM – VPN, Bhuvan Portal



## Landslide Inventory



### GOVERNMENT FAILURE:

The tragedy of Char Dham was waiting to happen. The cloudburst and subsequent impact was simply the proximate cause. Uttarakhand has witnessed man-made disasters and natural calamities in four of the past seven years. It's an active seismic zone, prone to earthquakes. It's prone to landslides, given its riverine topography, avalanches and hailstorms. The state is nestled in India's ecologically fragile zone and is the hub of temple tourism. Outcome of fate, of uncontrolled events, Government action—rather, its lack—is frequently the cause of aggravation of consequences. The tragedy at Uttarakhand is about the fury of nature. It's the causative; the consequences though are aggravated by sloth, complicity, criminal negligence. That a nation that can send a spacecraft to the moon couldn't reach to Kedarnath for four days and provide relief to the survivors that a week after the tragedy Indians didn't know how many perished proves the state of disaster risk management. Neither the topography nor the cultural context can be changed. But the risks can be better managed, if Govt. remained vigilant and seriously acted upon the forecasting issued by the meteorological department.

### **DEVELOPMENTAL STRATEGY IN FUTURE:**

The recent events in Uttarakhand have shown, more than ever, that we need a development strategy for the Himalayas that takes into account the vulnerability of the region and the need for environment protection. There is no doubt that the region needs economic growth. But this development cannot come at the cost of the environment. It will only make the already risk-prone and ecologically fragile region more vulnerable and development more “deadly”. We also know that climate change will exacerbate the vulnerability of this already fragile ecosystem.

Most importantly, we need to think about a pan-Himalayan strategy so that states can evolve common policies and not follow the race to the bottom. It is also clear that these strategies will have to be based on the region’s natural resources—forests, water, biodiversity, organic and speciality foods, nature tourism—but will need to address the specific threats so that growth does not come at the cost of the environment. Let's explore the different sectors and the questions that need to be discussed and resolved (Basu, S. et. al. (2013).

### **LESSONS LEARNT FROM THE UTTARAKHAND TRAGEDY:**

- Govt. must ensure credible environmental and social impact assessment of all activities including all dams and all hydropower projects of above 1 MW capacity, such assessments should also include how the projects can increase the disaster potential of the area, how they will affect the adaptation capacity of the local people in the context of climate change, how the projects themselves would be affected in changing climate, among other aspects. **Currently, we do not have credible environmental and social impact assessment for any project.**
- Govt. must ensure credible environmental compliance mechanism in place for each project in which local people have a key role. **Today we have NO credible environmental compliance in place.**

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- No projects should be cleared until and unless there is credible cumulative impact assessment for all projects in any river basin and sub basin, which includes carrying capacity study. **None of this was done in Uttarakhand.**
  - An urgent review of under construction and under planning projects should be taken up, stop projects awaiting such a review. The review should include various environment and river governance policies.
  - Certain rivers and certain high risk zones should be declared as no project areas in each basin.
  - In any case, there should be at least 5 km of free flowing rivers between any two projects. At least 50% of river flows in lean season and at least 30% of river flows in monsoon season. This should be applicable for all projects, including existing and under construction projects.
  - Govt. must put in place system of early warning, forecasting and dissemination for all kinds of disasters, particularly those related to rainfall and landslides. It is technologically feasible to predict even cloud bursts at least 3 hours in advance. A **Doppler Radar System** was sanctioned for Uttarakhand since 2008 that would have enabled, but due to lack of coordination between NDMA, IMD and Uttarakhand government, **this was not in place.**
  - Put in place a clearly defined monitoring system in place that will give prompt report of actual rainfall events even as the event starts so that the downstream area people and administration can be alerted. **This again was absent in Uttarakhand.**
  - Protection and conservation of rivers, riverbeds and flood plains, including aquatic biodiversity.
  - Encroachment of riverbeds and floodplains should not be allowed.
  - Prepare clearly defined space for rivers, have river regulation zone in place and remove all illegal encroachments in river beds and flood plains in a time bound manner urgently through legislative, followed by executive action.
  - Unsustainable mining of riverbeds should not be allowed.

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