Raini Village, home of Chipko Aandolan needs to shift for its survival

A Himalayan case study of climate change, fragile ecosystem, unplanned development, and combined consequences

Raini Village, home to India's most famous forest conservation movement '*Chipko Aandolan*' is now a site too dangerous for its residents to live in. The village in Chamoli district, Uttarakhand has been in the eye of the storm, with scores of landslides and flash floods making appearances every now and then.

Recently, the statue of Gaura Devi, who had led the Chipko movement in 1973, was moved from Raini to a safer place. Expressing grief, villagers could not believe that Raini that once got global recognition for ecological consciousness now has to fight for its existence.

Villagers are yet to overcome the massive flash floods that had ravaged Raini village on February 7, 2021, following a glacier coming apart and an avalanche on the Alaknanda river. The huge mass of snow, water, boulders and silt slithered down Rishiganga, first damaging a 13 MW private hydel project and then flowing down to Dhauliganga river to swamp NTPC owned 520 MW Tapovan-Vishnugad hydropower project.

On June 14, incessant rains in the region brought back the nightmare for the villagers. The Rishiganga river had swollen due to torrential rains for three days straight, causing soil erosion from underneath the village. This led to big cracks in several houses, instilling fear among the villagers.

Reportedly, a large portion of Joshimath-Malari road beneath Raini village caved in, cutting off more than a dozen border villages of Chamoli district.

With Raini becoming vulnerable to natural disasters, locals have been seeking evacuation and have been pressing for rehabilitation to a safer place. In a bid to address this, the Uttarakhand state government had appointed a team of geologists for survey of the village, only to declare that the area was quite prone to natural disasters. The Alaknanda river has been eroding the river bank and shifting closer to the village with every incident.

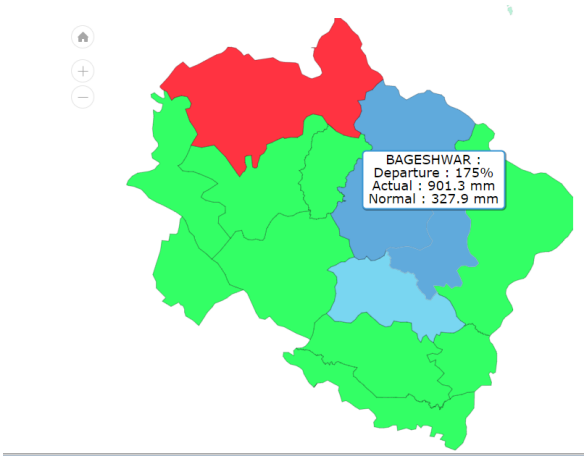
According to Nand Kishore Joshi, Disaster Management Officer, the lower areas of Raini village that house around 55 families are not fit for human settlement. These families are likely to be rehabilitated in Subhai Village.

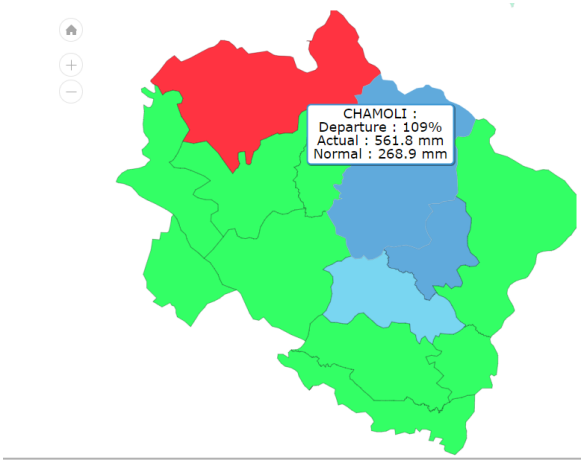
However, it is yet to ascertain whether the reason behind this is climate change or man-made destruction. Experts however agree that Raini's misfortunes are a combination of all these factors. Not just the weather, it is also the strategic location of Raini that makes it an extremely important area. Raini is located on the far reaches of the Indo-Tibetan border in Chamoli district, making it a perfect connection to border areas.

How changing climate is affecting the local weather systems in the region

There is consensus among meteorologists and geological experts that the Himalayan state is in the firing range of climate change and global warming. *According to* ***Mahesh Palawat, Meteorologist, Skymet Weather,*** *"There has been a significant rise in extreme weather events across the state, with steep rise in frequency as well as intensity of relentless rainfall, cloud burst, flash flooding, landslides, and mudslides. Deforestation has also been the major cause of these disasters."*

Chamoli and Bageshwar districts have seen torrential rains since June 1, particularly from June 9-22. Both the districts, at present, are reporting large excess rainfall. Bageshwar has recorded excess rains to the tune of 175% with a total of a whopping 901.3 mm of rain from June 1 – July 27 against the normal of 327.9 mm. Similarly, Chamoli is surplus by 109%, with 561.8 mm of rain so far in the season against the normal of 268.9 mm of rains.



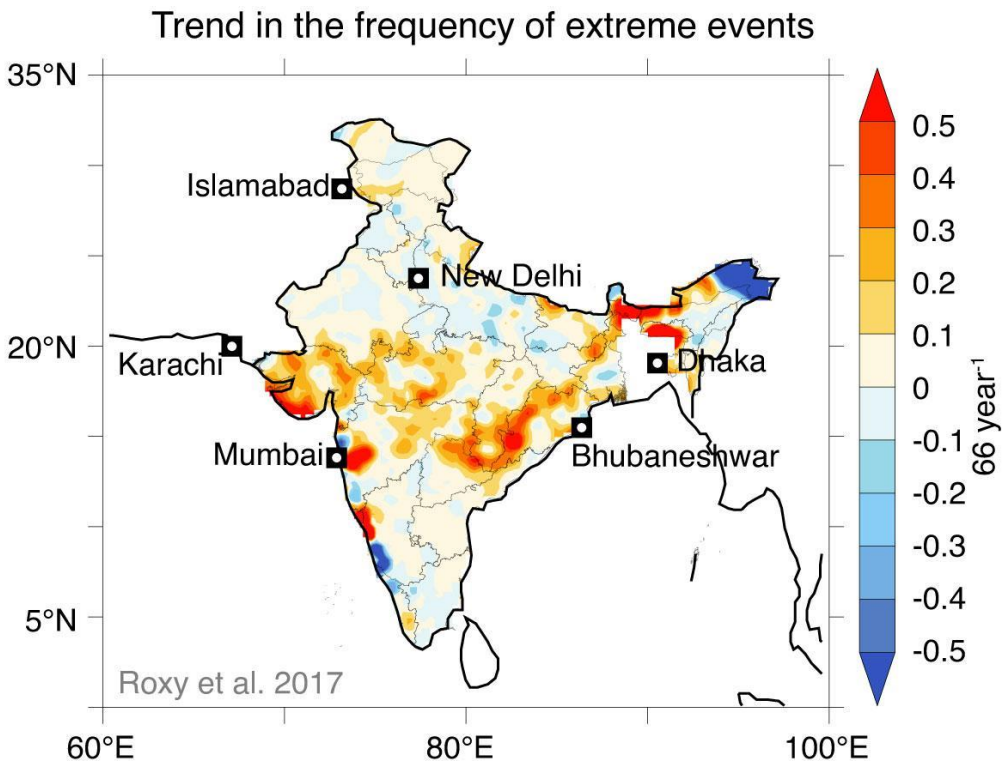


The week from June 9-15, saw large excess rains by 423%, while the latter week from June 23-30 saw humongous amounts of rain in Chamoli district making it a large surplus by 863%.

Aligning with the fact, ***Sharath Chandra, Director-Flood Forecasting & Monitoring, Central Water Commission*** *said, "Himalayan systems are very young and fragile making them unstable. The rain which was earlier recorded during the span of days now outpours within a handful of days only. This has led to an increase in incidence of flash flooding and landslides, making the region very vulnerable to natural disasters. If the landslide comes down to the river stream, it increases the chances of floods. Also, commercialization and urbanization have led to decrease in soil infiltration capacity, resulting in floods."*

Citing similar views, AVM GP Sharma, President - Meteorology and Climate Change, Skymet Weather added, *"Mountains of Uttarakhand are ecologically very fragile. On top of that, deforestation, rapid urbanisation and ever-increasing construction work has made the situation even more worse. The state is already vulnerable to natural disasters and the slightest impact of climate change or global warming can result in mass destruction. We have already started witnessing impacts of climate change in terms of extreme weather events like cloudburst, flash floods, landslides, or glacial outburst. If the rise in global temperatures remains unchecked, we would see an increase in Monsoon rainfall. To be more precise, we would see a rise in extreme weather events, which can be very dangerous for the hilly states."*

Following map also shows an increase in frequency of the extreme weather events across parts of North India and Central India.



"There has been a manifold increase in the tourist influx over the years. Roughly counting, the state used to host around 6 lakh tourists per year which has now increased to over 15 lakhs. With this, there has been an increase in vehicular pollution, river pollution, construction activities, and commercialization. Construction of hydropower projects and road widening activities have had a major impact over the region. All these factors have contributed to the increase in temperatures along with change in rainfall pattern. We now see incessant rains that go on for 2-3 days at a stretch, while several days being left high and dry. Also, during the 1980s and 90s, snowfall was a prominent feature between December 20-25 in Joshimath region. But that changed over the years, with snowfall even giving a miss to the region," ***said Atul Satti, a local environmental activist.***

The IPCC's fifth Assessment Report cycle concluded that human influence on the climate system is "clear". Since then, literature on attribution - the sub-field of climate science that looks at how (and by how much) human activities lead to climate change - has significantly expanded. Today, scientists are more certain than ever that climate change is caused by us. A recent study finds that humans have caused *all* of the warming observed since the preindustrial period, leaving no room for debate as to why the climate is changing. Since AR5, there has also been an increased focus on regional impacts, with scientists improving their models and understanding of what global climate change impacts will look like on a regional scale.

Geological impact of retreating glaciers on the region

The higher Himalayas were once home to a lot of glaciers, which have now retreated owing to global warming and climate change. Glacier is a moving mass of ice, soil and rocks and thus, it consists of lots of loose sediments. According to geologists, the retreating glaciers have left behind unlimited sediments which consist of an unstable mix of earth and rocks in the higher reaches of Himalayas. In such cases, even less rainfall is good enough to move the boulders and debris downstream. Hence, the higher Himalayan region is very unsuitable for dams and tunnels due to higher concentration of sediments.

Raini village is located at an altitude of 3,700 meters above sea levels on the upper slopes of River Rishi Ganga. With such a high gradient, the chances of soil erosion and landslides increase manifold. The gravitational impact also increases at this altitude, bringing more damage and eroding river banks. Events witnessed near Raini village in the last few months are evidence to these facts.

An expert committee appointed by the Supreme Court after the 2013 Uttarakhand disaster had strongly recommended against constructing a dam above an altitude of 2,000 meters, terming the region as a highly sensitive zone. ***Ravi Chopra, Director, People's Science Institute and Chairman of the Supreme Court appointed expert committee*** *said, "Hydropower plants have had serious implications on the river ecosystem, geological environment, forest and terrestrial biodiversity and social infrastructure. In fact, the projects in the paraglacial zone above 2,000 m height obstruct river flow and are dangerous. There is no sustainable way to develop such projects given the flouting of environmental norms and challenges with the disposal of debris, accumulated muck. The recent avalanche plus the 2013 experience show that dams in the paraglacial zone are a danger to the people below."*

The cost of unplanned development

The Himalayas are young and fragile in nature. Creating cracks and fractures in the rock which could widen in future and create a rockfall / slope failure zone. Experts believe that anthropological intervention has worsened it further. Be it development of hydropower plants, tunnels, or roads planned. The Tota Ghati example warns us that stable, hard rock dominated valley slopes, if not investigated critically for their geological fragility, lead to unprecedented slope instability having a cascading impact on the terrain. A slope failure is a phenomenon in which a slope collapses abruptly due to weakened self-retainability of the earth under the influence of rainfall or an earthquake.

Blasting in mountains not only weakens the slopes along the road, but the impulse of the explosion and vibration generated by heavy excavators possibly would have transmitted upslope. Thus, geologists strongly recommend a critical evaluation of the geological and structural stability before subjecting mountains to large-scale mechanical excavation and blasting.

Professor Y P Sundriyal, Head of Department, Geology, HNB Garhwal University *said, "Higher Himalayas, both climatically and tectonically, are highly sensitive, so much so, that at first stance construction of mega hydro-projects should be avoided. Or else they should be of small capacity. Secondly, construction of roads should be done with all scientific techniques. At present, we just see roads are being made or widened without taking proper measures such as no slope stability, lack of good quality retaining wall and rock bolting. All these measures can restrict the damage done by landslides up to some extent."*

"There is a huge gap between planning and implementation. For instance, rainfall patterns are changing, temperatures have been increasing along with extreme weather events. Policy makers should be well versed with the geology of the region. There is no denying the fact of development but hydropower plants, especially in higher Himalayas should be of less capacity. Policy and project implementation should consist of local geologists who understand the terrain well and how it responds," added ***Prof Sundriyal.***

NTPC-owned 520 MW Tapovan-Vishugad project was washed away in the February 7 massive flash floods and had suffered a loss of approx INR 1500 crores. Apart from this, state government-run

THDC India Ltd's 444 MW Pipal Koti hydel project, 400 MW Vishnuprayag project owned by Jaypee Group and Kundan Group's 130 MW Rishi Ganga project also suffered losses in the Chamoli disaster.

For a very long time, water-abundant state Uttarakhand has been trying to convert its rivers into assets. In fact, an Uttarakhand representative told the Parliamentary committee formed after the February 7 Chamoli disaster that 'Solar energy, wind energy or any other form of renewable energy is always going to be smaller. For us, as a state in the Himalayas, hydro is our main stake.' This theory has diluted environment clearance procedures and risk assessment norms for hydropower projects in the Himalayas.

Manju Menon, Senior Fellow, Centre for Policy Research said, "*The renewable energy (RE) tag is a means to create new investment opportunities in the hydro sector for financial elites and energy capital. In an effort to attract investments from the private sector that is reluctant to venture into "remote" Himalayan locations, government agencies are willing to undertake construction of "enabling infrastructure" at public cost. The Parliamentary committee report is an excellent example of the opportunistic use of RE and how the development of private hydro-finance overtakes the assessment of social and environmental risks of dams. Although the committee's report records that "geological surprises" resulting from weak Himalayan geology, "lack of technology or expertise, natural calamities like landslides, floods, and cloud bursts etc cause severe setbacks in construction schedules", the committee didn't see these as problems that require in-depth examination. Instead, the report dedicates its attention to reducing the financial risk to existing and potential dam-builders."*

*"The social and environmental risks of large dams are well-documented. Experts of Himalayan rivers have been warning about these risks for decades but unfortunately Environmental Impact Assessment (EIA) for these projects withhold or underlie this information so that projects get approved. Given all these projected risks, development and environmental policies should really not be selecting these options that put people at great risk. This is a moment for all our decision-makers in state governments, courts and Parliament to review their support for Himalayan dams," **added Manju Menon.***

Further, the latest addition in the list of risks to the region is the association of cloud bursts with forest fires. A joint study was conducted by Hemvati Nandan Bahuguna (HNB) Garhwal University and IIT Kanpur, which finds that the- "First surface measurement of variation of Cloud Condensation Nuclei (CCN) concentration over the Pristine Himalayan region of Garhwal, Uttarakhand". The study found a connection between the formation of the tiny particles, the size of a cloud droplet on which water vapor condenses leading to the formation of clouds and forest fires. The quantity of such particles called the CCNs were found to have peaks associated with forest fire events. The highest CCN concentration (3842.9 ± 2513 cm−3) values of the whole observation period were observed in May 2019. It was significantly affected by the heavy fire activities over Uttarakhand and nearby Indo-Gangetic Plain regions.

Not enough land, leaving those with least carbon footprint impacted most

Rise in these natural disasters has instilled fear among the locals of Raini village. Flash floods in February had not only wreaked havoc in terms of human and asset loss but had also interrupted the aerial highway leading to the international border. Thereafter, the Border Road Organisation (BRO) has constructed a road just above the village which they plan to further convert into a national

highway. Reportedly, the road is built on the agricultural land of Raini village, with 40 meters length and 10 meters width.

Geologists have declared the region unfit for human settlement. Owing to all these developments, villagers have been demanding permanent rehabilitation to another place where they can feel safe. Reportedly, state officials have marked Subhai village for their relocation, which is about 5 km down south from Raini. However, this would not be an easy task.

According to district officials, land is a limited commodity and thus, relocation of villages is not an easy task. *"Relocation of a bunch of people to another place also has an impact on the irrigation means, grazing and cultivation land which would then be divided among a larger number of people. Hence, we would try to relocate the affected families within a radius of 300-500 meters, so that they would not have to deal with difficulties," said* ***Nand Kishore Joshi, Disaster Management Officer, Raini Village.***

According to the rehabilitation policy of Uttarakhand state, villagers are likely to get compensation of INR 360,000 and an allocation of 100 sq ft of land. However, locals claim that the administration has not been doing enough for the people. Several locals complain about the lack of timely administrative action and that the provided land and monetary compensation are not enough to start afresh at a new place.

"Villagers have to fight a long battle for relocation. Initially, the local administration wanted us to shift to a makeshift place in a primary school but that was without our cattle. What if something happens to our cattle, who will bear the loss. Now, they have decided to relocate us to a place near Subhai village but again, as we have seen in the other cases, the place allocated to us is quite less. In addition to this, we are afraid that this decision does not remain on paper only. Monsoon is here and we are spending every night in fear whether we will be alive by tomorrow," ***said Sanju Kaparwan, a local from Raini Village.***

Hundreds of people across the state are still fighting for land, which they lost or was washed away by the river in spate, frequent landslides and incessant rainfall. In fact, social activists feel Raini has been lucky enough to witness prompt response by authorities. *"Raini is not the first village which is under discussion for relocation in the state. Scores of villages have been rehabilitated over the years. In fact, at the time of construction of Tehri Dam, at least 27 villages were forced to relocate, people from those villages are still struggling. For instance, a village named Paing which is located just above Raini was relocated to Lambri some 13-14 years ago. However, dissatisfied with the compensation and area provided, villagers keep shuttling between the two villages as per the season. They come down to Lambri village during Monsoon when risk for landslides is high but go back to Paing post the rainy season. Similar is the story of Chai Village which was rehabilitated in Marwadi Chak Pakh village in 2007,"* ***said Atul Sati.***

Thousands of villagers across the state of Uttarakhand have been waiting for their turn to get rehabilitated. Reportedly, 395 villages are identified in disaster-prone belts of 12 districts of Uttarakhand which are waiting to be shifted to safer areas. The entire process is likely to cost a whopping INR 10,000 crore. A maximum of 129 villages are in Pithoragarh district followed by 62 in Uttarkashi, 61 in Chamoli, 42 in Bageshwar, 33 in Tehri, 26 in Pauri, 14 in Rudraprayag, 10 in Champawat, 9 in Almora, 6 in Nainital, 2 in Dehradun and 1 in Udham Singh Nagar.

Security issues vs surviving disasters

Uttarakhand shares a lengthy border with neighboring countries of China and Nepal, making it a geo-politically sensitive place. While China has a 350-km boundary with Uttarakhand, Nepal shares a 275-km long border with the state. Out of the 13 districts in the state, five are border districts. China shares a border with Chamoli and Uttarkashi, whereas Nepal shares boundaries with Udham Singh Nagar and Champawat. Meanwhile Pithoragarh shares the border with both China and Nepal. The ongoing tensions and territorial disputes with neighbouring countries only add to the vulnerability of the Himalayan state and the complexity of relocating its villages, making it even more urgent to strengthen the state's infrastructure and habitability.

Raini's proximity to the border with China has increased its significance and also its vulnerability. Widening and regular repair or construction of roads near or inside the village cannot be curbed at any cost. According to officials, roads from Raini village connect with a dozen border villages in the Chamoli district. Recently, on June 14, torrential rains had caved in a major chunk of the road, disrupting contact with troops at the border.

Prof Sundriyal said, *"This matter is of prime concern and would always call for instant attention. There is no denying the fact that we need to strengthen our infrastructure keeping national security in mind. However, we need to ensure that slope stability and good quality retaining walls should be taken care of while widening the roads in such high altitudes so as to avoid landslides."*
