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Flash Floods in Himachal Pradesh: Man-Made Disaster or a Natural Calamity

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Abstract

Almost every year monsoon is the time when a lot of disasters take place in some form or another in various places across the Himalayan regions.Earthquakes varying in harshness, floods or flash floods, and glacial lake outbursts are common among other menace.Cloudbursts that are unexpected and violent rainfall, followed by flash floods,are generally reported in the monsoon season. The most disasters in American history have caused more than a billion dollars in damage. According to NOAA and India, by 2023, 23 disasters had cost more than $57 billion and killed at least 253 people. El Nino climate change increases natural disasters in vulnerable areas, exacerbating a devastating climate problem. 2023 India witnessed floods, landslides, Raigarh, and Thathri subsidence incidents in Himachal, Nagpur. The mixture of the monsoon gush and moisture from the Mediterranean Sea brought by the western disturbance led to widespread flooding and landslides. Climate change also played a vital role, as increasing temperatures in the atmosphere's moisture-holding volume led to more intense rainfall conditions. The incident of flash floods, especially in small river valleys, is one of the most dreaded reactions of major cloudbursts, landslides, or glacial lake outbursts.

Keywords: *- calamity, rhythm, cloudburst, landslides, rainfall,consequences, floods*

1.Introduction

The spectacular, snow-covered Himalayas and the stunning surroundings of Himachal Pradesh draw in millions of people worldwide each year. Himachal Pradesh is one of the most frequently visited tourist areas in India. The mountain state, on the other hand, is now subject to a never-ending cycle of landslides, cloudbursts, and flash floods. The cloudburst events, which led to flash floods and landslides, were the cause of significant damage to the state's infrastructure. In fact, according to a report on the risk of landslides by the state government of Himachal Pradesh, all 77 blocks in the form, which contain over 18,577 villages, are currently threatened by landslides. 1 Since the arrival of monsoon, flash floods, cloudbursts, and landslides have disturbed Himachal Pradesh's typical pattern of life. Three spells of torrential rain and rain-related events have claimed hundreds of lives over the state. At the end of the week, August 12-13, 2023, while the government was during its restoration and aid attempt, several cloudbursts took place in the region. These cloudbursts resulted in the throwing away of large volumes of water in a short period, leading up to the floods. These cloudbursts caused flash floods and landslides that destroyed homes and infrastructure, resulting in a significant loss of life. The floods and landslides caused unexpected damage to infrastructure and property, along with roads, bridges, and houses. Also, crops were damaged, and reports of livestock losses emerged [1-4].

According to media reports, more than seven hundred roads have been closed in the state due to heavy rains. Official sources verified that since the morning of the stormy season, 367 people have been killed, over 340 are injured, and around 40 people are missing. The disaster has led to the destruction of over 12,000 houses, out of

which 2,200 have been destroyed. As numerous as 729 roads were closed in the state and several areas were without electricity as 2,897 power mills were damaged. The Kullu region of Himachal led to the collapse of a row of structures, leaving hundreds of trippers stranded in relief camps as landslides blocked the road to Mandi. Fierce heavy rains have also led to numerous flash floods and downpours in Himachal since July. From submerging roads and causing business dislocation to entering people's houses- the flood tide waters have caused massive loss of properties [2-4].

It is projected that 7,000 crore rupees' worth of damage has been inflicted on public structures in Himachal Pradesh. There are around 1,400 inaccessible roads, in addition to hundreds of drinking water systems and power force lines. In several regions of the state, road obstructions have resulted in shortages of critical items such as food, vegetables, milk, and meat, among other things. Landslides have blocked an estimated 950 roads, one of which is the Chandigarh-Manali National Highway. As a result of this, state transport motorcars have been dismantled on approximately 2,100 routes, and citizens have been left stranded [5].

1.1. What are Flash Floods?

Sudden rises in water levels can occur at any time, but flash floods typically occur during or immediately after intense rainfall. In most cases, fewer than six hours pass between the occurrence of the rainfall and when the flood tide is at its highest point. These are very localised phenomena that last for only a brief period and have a very high peak. The situation with the flood tide grows worse when there are obstructions in the drainage lines or encroachments blocking the natural flow of water into the area. Heavy rain coupled with a severe downpour, hurricane, tropical storm, or melt water running over ice wastes or snowfields might be the origin of this phenomenon. Mudslides and flash cataracts are two different types of natural disasters that can occur simultaneously [6].

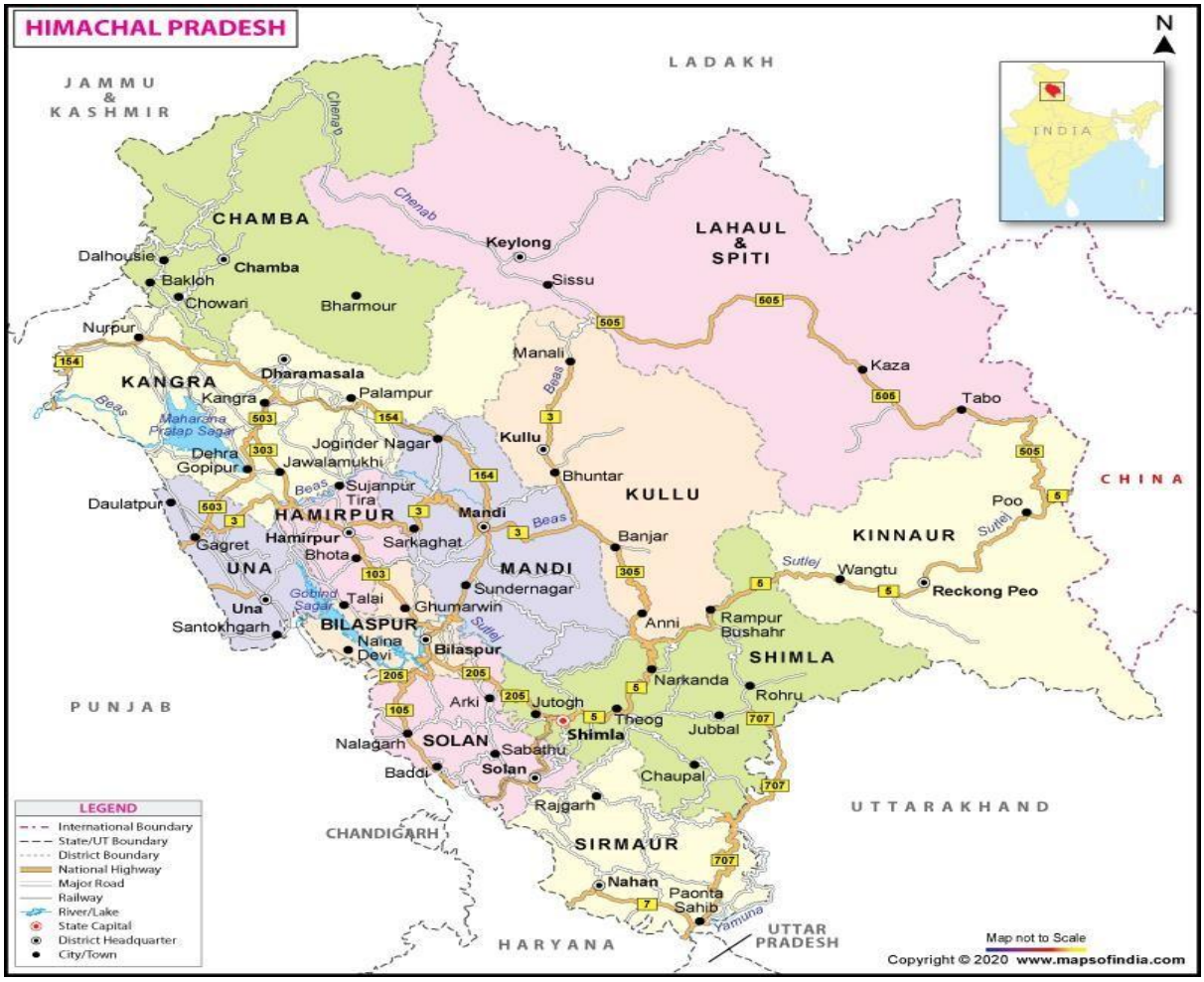
2.Background Information On Himachal Pradesh's History

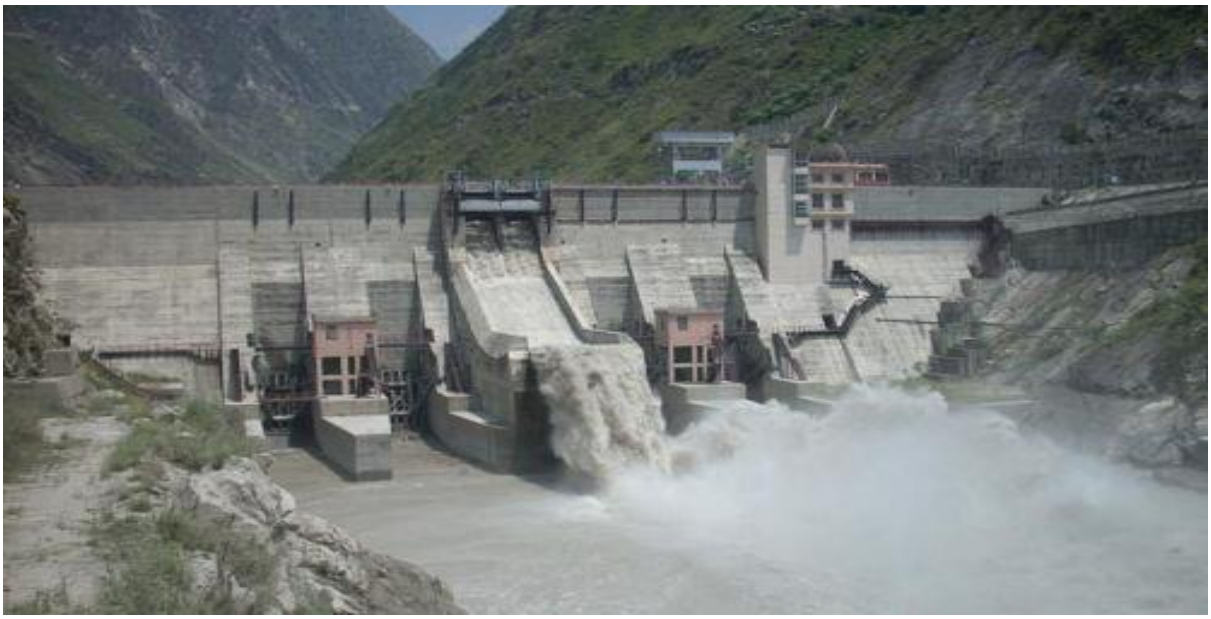
The Indian state of Himachal Pradesh is in the western part of the Himalayas, in an area that is home to some of the most stunning natural scenery in the world. The region is home to snow-capped mountains, deep canyons, densely forested valleys, expansive lakes, and terraced fields and streams. In its original form, the name of the state refers to the region in which it is located: It derives from the Sanskrit term him, which means "snow," and the other word, a cal, which means "slopes," and the definition of Pradesh is "state." Himachal means "snowy slopes," and it derives from these words. This stunning state is also known as "Dev Bhoomi," which translates to "Land of Gods" and "Goddess," and "Veer Bhoomi," which means "Land of the Brave." Both of these names pertain to the same place [7].

The Indian state of Himachal Pradesh is distinguished from by its abundant supply of numerous rivers and streams that flow year-round across its many valleys. The most significant contributors to the economy of the state are the agricultural sector, the horticultural industry, hydropower facilities, and the tourism business. As of 2016, 99.5% of houses in the mountainous state had access to electrical power, making it virtually wholly electrified. In 2016, the state was recognised as India's second state to be free of public urination and faces. According to the findings of the CMS-India Corruption Study in 2017, Himachal Pradesh is the least corrupt state in all of India [8].

3.Perspective On The Geography Of Himachal Pradesh

Himachal Pradesh is a state in the northern section of India in the Western Himalayas. It is one of the thirteen states formally recognised as mountain states and is distinguished by a mountainous environment that includes a considerable amount of peaks and a wide-ranging system of rivers. Himachal Pradesh is the most northern state in India. To the north, it shares its border with the union territories of Jammu and Kashmir and Ladakh. To the west, it borders the state of Punjab; to the southwest, it connects the state of Haryana; to the southeast, it borders Uttarakhand; and to the south, it has a tiny border with the state of Uttar Pradesh. Furthermore, in addition, there is a shared international border connecting this state and the Tibet Autonomous Region in China, which is located to the east [7,8,9].





Himachal Pradesh is a state in the western Himalayas that is located between the geographic centres of 30°22' North and 33°12' North in latitude and 75°47' East and 79°04' East in longitude. The state is characterized by its rugged terrain and occupies a total area of 55,673 square kilometres (21,495 square miles). Although the Dhaula Dhar and Pir-Panjal10 ranges of the lower Himalayas and their valleys compose much of the state's core

regions, the Zanskar range is in the northeastern section of the state and the vast Himalayan range is located between the eastern and northern parts of the state. The Shiwalik Mountains, often known as the outside Himalayas, are in the southwestern and southern parts of Himachal Pradesh. At an elevation of 6,816 meters above mean sea level, Reo Purgyil is the mountain peak that is the tallest in Himachal Pradesh [9-11].

The climate of Himachal Pradesh is highly variable as a direct result of the vast elevational differences that exist throughout the state. The weather in the southern regions is hot and humid subtropical, but the climate in the northern and eastern mountain sections is cold, alpine, and glacial. The climate changes as you get further north and east. Even though parts of the state like Lahaul and Spite are known for their low temperatures and lack of precipitation, the state's winter capital is in Dharamsala, which is known for its very copious rainfall. There are generally three distinct seasons in Himachal Pradesh: summer, winter, and the rainy season. Temperatures typically range from 28 to 32 degrees Celsius (82 to 90 degrees Fahrenheit) throughout the summer, which begins in the middle of April and lasts until the end of June in most parts of the world.12 Late November marked the beginning of winter, which lasted until about the middle of March. The alpine regions are the ones most likely to receive snowfall. Nearly all of India's states are experiencing climate change as as a direct consequence of pollution's influence. Himachal Pradesh is now the only state in India that does not permit cigarette usage, because of initiatives made by state and local governments to reduce and eliminate pollution. As a result, traditional chulhas are no longer used for cooking in any part of the state [11,12].

Both rivers and glaciers contribute to Himachal Pradesh's drainage system, which explains why the state is so mountainous. Rivers that originate in the Himalayas cut over the entire mountain range. Together, the Indus and Ganges basins receive their water supply from Himachal Pradesh13. The Chandra Bhaga, also known as the Chenab, the Ravi, the Beas, and the Sutlej rivers, and the Yamuna River are the state's primary drainage systems. These rivers never go away since they get their water supply from snow and rain. They are shielded from danger by a substantial cover of the surrounding natural flora. Himachal Pradesh is the source of three of the five rivers that make up the Punjab, and four of those rivers run through the state. The mountain ranges of this state create a labyrinth of valleys that the rivers that run through them go through. The Satluj River enters the state around Shipki La, which results in the formation of the Satluj Valley. Similarly, the Spiti and Baspa Valleys are the result of the river's two of its most significant tributaries in the state of Himachal Pradesh.14 The Beas River flows through the Kullu Valley as well as the Kangra Valley; its tributary, the Parvati River, is responsible for the formation of the Parvati Valley. The Chenab River, which was formed by the confluence of the Chandra and the Bhaga Rivers, shapes a significant portion of the northern regions of Lahaul and Pangi, and the Ravi River primarily flows through Chamba. Located in the southeast, the Pabbar and Giri rivers are both considered to be tributaries of the Yamuna basin [11- 15].

3.1.A catastrophe caused by humans in Himachal Pradesh.

Due to its location on the Himalayas, the youngest and most fragile mountain range in the world, the state of Himachal Pradesh is especially vulnerable to dangerous situations and natural disasters. It is very evident that it is not appropriate to attribute earthquakes, cloudbursts, flash floods, and landslides to the forces of nature in this scenario. It is the incident or, at the very most, the danger that may be natural. Disasters are not natural in and of themselves. All disasters are the result of human activity [16].

4.A Few Examples Are Given Below:

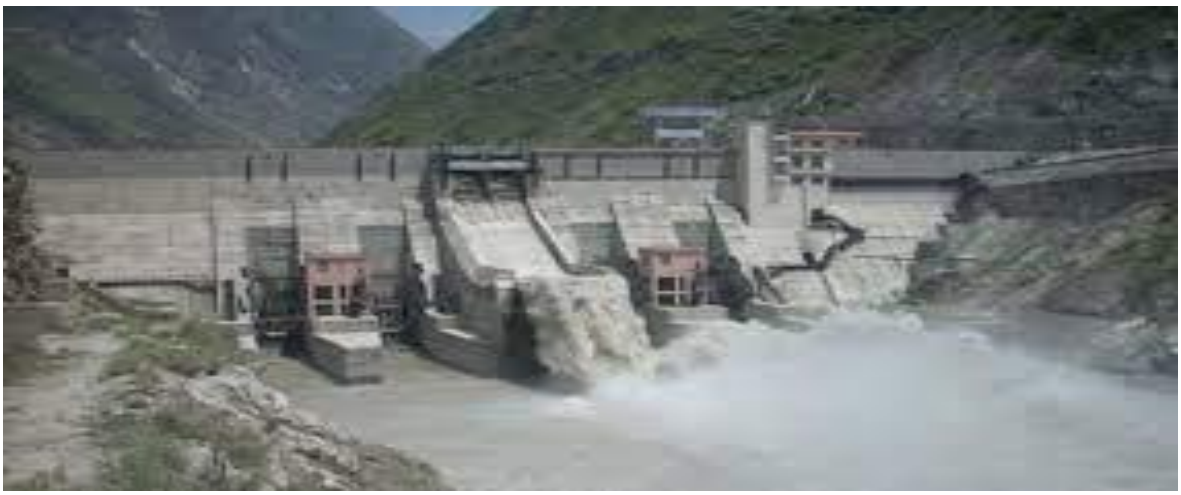
The part that debris and unscientific slope cutting play in these man-made disasters Various Catastrophes.During road expansion projects, unscientific slope cutting and trash disposal into the Beas and Sutlej rivers have contributed to the situation by raising water levels and flooding riverbank areas. For example, because of the recent flooding in Himachal Pradesh's Kullu and Mandi districts, the river Beas has taken a different path in some areas of those districts. Several cities in Himachal Pradesh, including Shimla, Dharamshala, Manali, and Mandi, have had house collapses and landslides as a direct result of unregulated building projects that violate local construction laws. One building that serves as a good illustration of this is the Himachal High Court building. It has 11 floors, which is far higher than the National Green Tribunal's proposed maximum of 2.5 stories [15-17].

4.1. The melting of glaciers can cause enormous damage.

The Himalayan Rivers, which used to only flood when snow melted, have become unpredictable because of road development and hydropower plant construction in the region. The melting of the ice creates glacial lakes and natural dams, both of which have the potential to fail and cause flooding further down the valley. As a result of a flash flood, the soil, boulders, and debris left behind by retreating glaciers cause extensive damage in populated lowlands that are already vulnerable due to the blasting of mountain slopes and the removal of trees for highways and hydropower projects [17].

4.2. Uncontrolled Construction of the Hydropower Projects

The unregulated building of these hydropower plants, which have practically turned Mountain Rivers into simple streams, is one of the primary factors for the terrible effects of floods in the mountain region. These floods have caused a lot of damage in the mountain region. The redirection of water through tunnels and the disposal of dredged material along riverbeds both contribute to an increase in the impact during times of intense precipitation or cloudbursts.



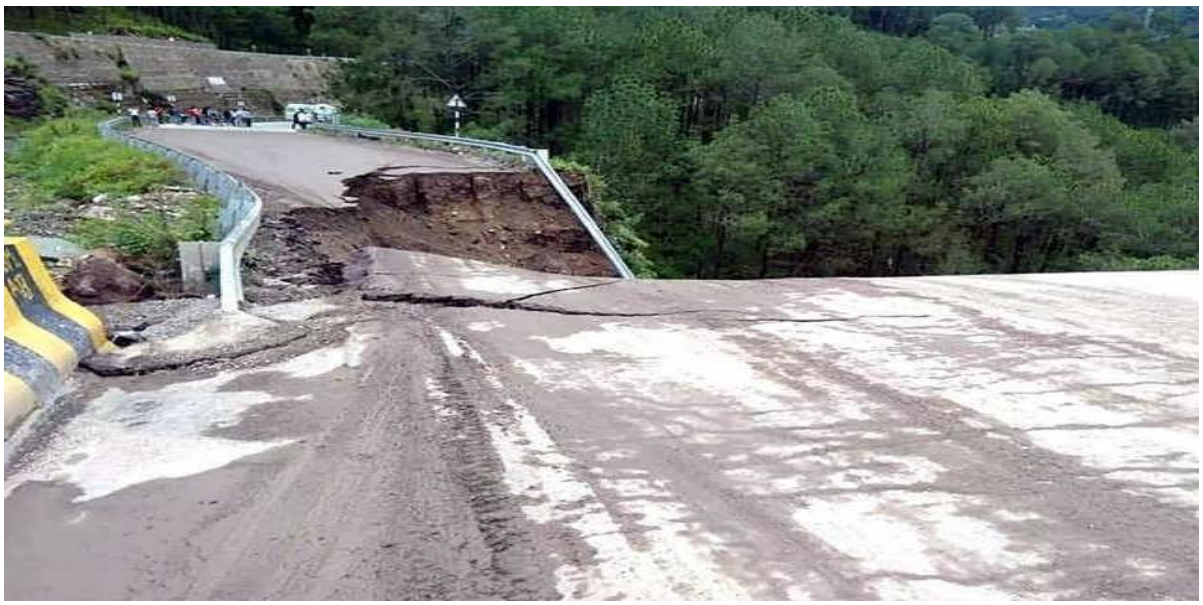
NathpaJhakri Hydroelectric Project in Himachal Pradesh (https://ejatlas.org/conflict/nathpa-jhakri-hydroelectric-project-hp-india)[18]

Improper disposal of mud not only produces a favorable condition for landslides during the rainy season but also block river valleys with massive sediments dumped by humans, leading to water diversion, overflow, and thus floods.Parvati, Beas, Sutlej, and other rivers are the instance of affected rivers. Long tunnels work or commissioned on the Sutlej River leading to ecosystem damage. At present, there are 168 hydropower projects in operation, producing 10,848 MW of electricity. Looking forward, it is projected that by 2030, 1,088 hydropower projects will be commissioned to harness 22,640 MW of energy. This rush in hydropower projects raises concerns about the inevitability of impending destruction in the region [17,18].

4.3. Upsetting natural balance

In the opinion of the Himachal Pradesh State of the Environment Report (2022), mountain ranges are highly sensitive to natural disasters, and evolution over the years has increase the problem by upsetting the natural balance of different physical processes. The reports mentioned that the increased pressure on the mountain ranges has contributed in some amount to environmental problems such as landslides, land subsidence, removal of vegetation and soil decrease. Approximately 58.36% of land is subjected to huge soil erosion, most of which is situated in the Himalayas, and Himachal Pradesh, which forms part of the Western Himalayas, is environmentally breakable and ecologically vulnerable[18-19].

4.4. How Tourism and Road Expansion Leads to Damage to the Environment?



https://economictimes.indiatimes.com/news/india/heavy-rains-and-cloudburst-damages-kalka-shimla-highway-in-solan/traffic-movements-disrupted/slideshow/93523870.cms?from=mdr [20]

4.5.Kalka-Shimla Highway in Solan

Tourism-driven, the continual expansion of roads has resulted in the transition of two-lane roads into four-lane streets, avoiding the necessity of conducting geological studies. The construction of a road that cut vertically through mountains resulted in landslides and caused damage to already existing roads with even moderate rainfall. The situation was even worse during periods of intense precipitation or flooding. In mountainous regions, there were first roads that were terraced and curved, which provided some level of security and safety against landslides. However, vertical roads are more prone to landslides and erosion than their curved and terraced predecessors [21].

5. Impact Of Cement Plants On The Environment

Enormous cement plant establishment and vast mountain cutting have altered land use patterns, decreased the land's water absorption capacity, and gave contributed to flash floods during rainfall.

Jaypee Group Cement Plant, Darlaghat, Solan (http://jalindia.com/gallery-cement.html) [22].

Enormous cement plants in districts like Bilaspur, Solan, Chamba causing crucial land use changes. The cement plants alter the natural landscape, and the removal of vegetation lowers the land's capacity to absorb water since it reduces the amount of vegetation cover [18-21].

5.1.How Shifts in Crop Patterns Contributed to the Degradation of the Environment

There has been a significant shift not only in landholdings but also in production. A significant increase in the number of farmers favoring cash crop production over conventional grain agriculture is visible today. Because of the easily decomposable nature of these crops, this move may pave the way for the delivery of these crops to markets in an extremely short amount of time. Roads are being rapidly built as a reaction to this requirement, but the process does not consider the necessary land cutting and gradient requirements, and it also does not create the appropriate drains or sites designated for dumping muck [3,16].

6. Methods To Reduce The Risk Of Flooding And Landslides[23-27].

Both flash floods and landslides are impossible to foresee in advance. There is always a loud and peculiar sound that accompanies flash floods and landslides when they occur. If very large rocks collide with one another and trees break, the result is a sound that is exceptionally thunderous and may be heard from quite a distance. An overflow of water that typically submerges the dry land is what we refer to as a flood. The most common type of natural disaster is the one that accounts for most fatalities across the world. A flash flood not only has an impact and widespread impact on the people, but it also has an impact and widespread consequences on the environment and the economy [23-27].

6.1.Improve Current Flood Detection and Warning Systems

During times of flash flooding, it would be beneficial to have a better flood warning system that would give people additional time to prepare and act. It also has the potential to save further lives by issuing a timely warning [22].

6.2.Build your structures higher than the floodplains.

To protect against the risk of flooding, you should construct a building that is at least one meter above the ground. It was necessary to reinforce traditional defenses with more cutting-edge strategies to reduce the likelihood of further catastrophes [25].

6.3. Restore Rivers to their Natural Courses

Many river courses have undergone historical rerouting to make them more navigable. Remaining rivers that have had their natural curves straightened out can have their length increased by reintroducing the curves, which in turn can delay the flow of floodwaters and lessen the impact of floods farther downstream [25,26].

6.3. Rehabilitate Rivers and Ensure Drainage is Clear

Restoring rivers and maintaining clean drainage can help prevent flooding. The fundamental reality is that the rivers will be restored to their natural state and that the drainages will be clean. It is possible to exercise control over the flow of water, so mitigating the risk of potential harm [24-27].

6.4. Add Flood Barriers

Install flood barriers to prevent further flooding. In addition to that, it has the capability of containing water and preventing damage to property. In high-hazard locations, the Environment Agency deploys a wide variety of temporary or "demountable" protective measures. When the water level drops, these can be entirely severed from one another. Increasing the degree of protection offered by permanent flood defenses by incorporating temporary flood barriers, such as higher embankments, is one possibility. The danger of flooding and the frequency of its occurrence have increased, which means that the use of passive flood defense must be the only feasible long-term option [27].

7. Conclusion

The recent floods have critically impacted healthcare facilities in Himachal Pradesh. Thousands of people have been dislocated from their homes, and a lot of have been injured or killed. These heavy rains resulted in common flooding, landslides, and significant destruction to infrastructure, including roads, bridges, and power lines. The flash floods in Himachal Pradesh demonstrate the reaction of both climate change and human-induced development. It calls for a comprehensive approach that considers sustainable development actions, empowers local communities, and prioritizes environmental conservation to protect lives and benefits in the region.

8.Conflict: The authors declare no conflict of interest.

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