Effect of Environmental Changes on the Shivalik and Himalayan Populations of Northern India

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ABSTRACT

Since the origin of the Shivalik and the Himalayan Mountain Ranges in India, these mountain ranges have witnessed extensive climatic fluctuations. The hill states of India, that is, Jammu and Kashmir, Himachal Pradesh, Uttarakhand, and the North-Eastern states, as well as the hilly regions of other states located within the Himalayas and the Shivalik mountains, have also been adversely affected in various eras on the planet Earth. The fossiliferous beds of these mountains unfold the story of palaeontology and palaeoecology of these regions. The uncongenial, drastic climatic conditions led to the extinction of a number of species of flora and fauna in this region. This paper highlights how recent ecological and environmental changes have affected human and animal populations, as well as the forests, in these regions. What can be done in these regions to protect the ecosystem and environment has also been indicated.

Keywords: Shivalik, Himalaya, Mountains, Ecosystem, Environment, Populations, Climatic Fluctuations

INTRODUCTION

The Himalayan Mountain Range came into existence in India between 40 and 50 million years ago and is considered one of the youngest mountain ranges in the world. The Himalayas extend from Afghanistan to Myanmar along the border of China and India. The height of these ranges is approximately 9000 metres. It includes the famous peak of Mount Everest, which is as high as 8,850 metres (29,035 feet) above sea level. The formation of the Himalayas is believed to be the result of the collision of the Eurasian and Indian Tectonic plates. [1]

The formation of the Shivalik Mountain Ranges occurred approximately 2-20 million years ago, following the formation of the Greater and Lesser Himalayas. The Shivalik ranges were formed through tectonic uplift and the accumulation of unconsolidated sediments, including sandstones, conglomerates, and siltstones, deposited by rivers flowing from the higher Himalayas. The Shivalik mountain ranges are younger and more fragile than the Himalayas. The formation and ongoing shaping of the Shivalik landscape are closely tied to tectonic activity, erosion, and sedimentation in the region. Human populations began living in the Shivalik foothills as early as 50,000 years ago, while permanent habitation in the higher Himalayas occurred around 12,600 years ago. It is evident from studies carried out in India, Nepal, Pakistan, and the Tibetan Plateau that human populations began living in the Shivalik ranges much earlier than in the Himalayas, due to the presence of snow, difficult living conditions, and oxygen deficiency at high altitudes in the Himalayas. The Shivalik and Himalayas have experienced periods of significant tectonic activity and climate change, and this trend continues to this day. Human populations are sometimes forced to migrate due to natural disasters and unsafe living conditions. [2] [3] [4]

METHODOLOGY

The present study has been carried out by studying the various incidents of cloudbursts, flash floods, landslides and other disasters incidents which have taken place in the Shivalik and Himalayan regions in the recent past.

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These occurrences have caused extensive injuries a death in Jammu & Kashmir, Himachal Pradesh and Uttarakhand States of India and also led to shifting and migration of human populations from their permanent habitations to their temporary shelters. The construction of tunnels in these mountains for passing the connecting roads through these tunnels also led to the trapping of a number of construction workers in these tunnels in the state of Uttarakhand and Himachal Pradesh. While writing this article, government data as well as published data on such incidents in the electronic and print media have been studied, analysed and cited, herein. The results obtained have been discussed in this paper.

Early Life in the Shivalik and Himalayan Mountain Ranges:

The ecosystem in the Himalayan and Shivalik hills has become more balanced and protected for human populations over time, as these populations have adapted to the environment. They have learnt the means of livelihood adapted to the climate, protection from predators, snow, and cold. There were primitive and simple ways of living for these hill tribes. They have adopted food gathering and hunting in the forests and later shifted to agriculture, horticulture, and domesticating cattle, sheep, goats, and yaks. They adopted art and craft, such as woodworking, weaving from silk and wool, and constructing their houses with wood and mud (Dhazi walled houses), paved with stones on the rooftops. The Himalayan and Shivalik populations traded through the ancient Silk Route with China, Afghanistan, and Tibet, exchanging goods such as wool, honey, mushrooms, and other art and cultural items for pulses, condiments, food items, animal bones, teeth, furs, and tusks of elephants. These populations were geographically and genetically isolated, with closed gene pools resulting from inbreeding and intermarrying within their own tribes. In some tribes, polyandry and polygyny were also practised. Until late, they were isolated from urbanization, industrialization, and modern means of transportation due to a lack of road and rail infrastructure.

Contemporary Changes and the Environment

Human Activity in the Shivalik Hills and Himalayas has increased significantly during contemporary times, especially after 1950. It has severely disturbed the ecosystem and environment of the Himalayas and the Shivaliks. The notable salient features are described here.

Constructions

There have been extensive constructions of buildings, roads, and dams, which have led to the cutting and blasting of mountains. The originality of the natural strata has been disturbed, and loose debris has filled the water channels, rivers, and gorges, leading to a change in the direction of the rivers' flow.

Deforestation

The construction activities necessitated space for construction, resulting in extensive deforestation and tree felling in various states in India, especially in the Himalayan and Shivalik regions.

Urbanization

Urbanization and industrialization encouraged the movement of populations from villages to cities, and also gave rise to extensive, haphazard constructions on the steep locations of $60\text{-}80^0$, which always remain prone to landslides and damage to the hills as well as to the constructions themselves.

Tourism

The tourism influx in the hill states is so high that during peak tourist seasons, all hotels and homestays remain packed to capacity, and traffic on the roads is so extensive that it causes road blockages and significant air and sound pollution. Tourists often disregard cleanliness and hygiene, discarding debris such as meal leftovers, empty plastic water bottles, and other containers and wrappings in open areas of the hills, thereby contributing to environmental pollution.

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Use of Heavy Machinery

The use of heavy machinery for cutting the hill strata to create roads, dams, tunnels, and other buildings causes vibrations in the earth's crust, and the strata become loose and prone to landslides during rain and snow. A similar effect is observed during blasting, which uses explosives to break rocks for tunnelling.

Effect of High Temperature and Warming

The extensive use of moving vehicles and machinery in construction has led to air pollution and warming in the hills. Deforestation has also contributed to the same. The result is the melting of glaciers, cloudbursts, flash floods, and untimely rains. This has also shifted the spells and times of snowfalls in the hills and caused unusual rains in areas where they weren't expected earlier. It has also been observed that the cutting of hillsides on the sides of the roads do not remain stable for decades and leads to road blockage due to landslides and motor vehicle accidents. The stones falling from height on the roads cause a number of accidental deaths and injuries to the travellers.

Flora and fauna

The flora and fauna in the hills have been significantly disturbed by human intervention. Wild animals have begun entering human habitats and attacking humans on roads, in forests, and in villages. These animals find their natural habitats disturbed by human presence, construction, and other activities. [5]

Natural and Manmade Disasters

Himachal Pradesh

Natural disasters have been occurring in the Himalayas and Shivalik Range for time immemorial, leading to the migration of people from various areas to safer places. The Kangra earthquake of 1905 was a glaring example in which more than 20,000 people were killed, and a large number of people were injured. Not only this, but the Himalayan and Shivalik regions primarily fall within Seismic Zone IV and Seismic Zone V, which are extensively prone to earthquakes. Haphazard constructions can lead to huge losses of lives and property.

Due to ecological imbalance and environmental changes caused by human activities in the Hills, man-made disasters have become increasingly common. A recent example is that of Himachal Pradesh state during the 2025 rainy season. The local meteorological department had issued a red alert warning of intense to very intense spells of rain at isolated places in Kangra, Chamba and Lahaul and Spiti districts on August 26, 2025. The state has witnessed 77 flash floods, 46 cloudbursts, and 81 major landslides up to that time. As of September 17, 2025, there were 46 cloudbursts, 98 flash floods, 145 major landslides, 417 people had died, 477 people suffered injuries, and 45 people were still missing. A total of 1,502 houses were fully damaged, 6,503 houses were partially damaged, and, as reported by the Press Trust of India, there was a loss of approximately ₹ 4,582 crores. Similar incidents of landslides occurred in Jammu and Kashmir and Uttarakhand due to extensive rainfall and landslides in the Hills, which swept away houses, hotels, and markets, as well as entire landmasses. It also caused damage to cultivable lands and crops in Punjab and Haryana due to floods caused by the Sutlej, Beas, Ghaggar, Markanda and Tangri rivers. There were damages to human life and property which cannot be estimated in terms of money, as human physical and psychological trauma existed among the people who had lost all their properties and had to live in shelters provided by social organizations and the government.

It is worth mentioning that the estimated age of the Himalayas ranges from 40 to 50 million years, and the Himalayan Range is considered the youngest in the world. As far as the Shivalik Range is concerned, its formation occurred during the Tertiary period, which encompasses the Miocene and Cenozoic epochs. This formation occurred approximately 2-20 million years ago, following the formation of the Greater and Lesser Himalayas. The Himalayan and Shivalik Mountains have highly fossiliferous beds, indicating that flora and fauna in these regions have always been affected by the climatic fluctuations and the folding and faulting due to seismic activities in these hills. [6] [7]

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Cloudbursts in Jammu and Kashmir- 2025

On 14th August, 2025, at least 40 persons were feared dead and more than 100 missing after a cloudburst and flash flood hit Chositi village in the Chenab Valley of the hill state Jammu and Kashmir (J&K) at least 10 houses, multiple government offices and temples were damaged.On 26th August, 2025, four persons died due to a cloudburst and flash floods in the Doda district of J&K. The districts of Kathua, Samba, Doda, Jammu, Ramban

and Kishtwar were highly affected by the extensive rain and flash floods. This was due to human intervention with the ecology and the environment of the Shivalik and the Himalayas in these part of J&K. The roads were blocked due to landslides and washed away in various regions. The human populations were moved to safer places. In J&K rains have been very extensive and unprecedented, causing swelling and floods in the rivers and damage to human life and property. Eleven persons were killed in the cloudburst and landslides in the Ramban area on 31st August 2025. [8] [9]

Cloudbursts in Uttarakhand

There have been several cloudbursts and extensive rains in Uttarakhand in the year 2025 from the months of July to October. The districts of Chamoli, Rudraprayag, Tehri and Bageshwar Bore the brunt of the natural calamity. On August 23, there has been major cloudburst and flash flood and landslides in Tharali Village. On the 5th of August 2025, there has been a flash flood in the Kheer Ganga River in Uttarkashi district, which demolished half of Dharali Village, many hotels, homestays and nearby Harsil village were destroyed, and victims got no time to escape from this area. A large number of people from this area died or went missing. Such cloudbursts are highly dangerous, which can wash away houses, roads, bridges, and land masses. In 2013, a cloudburst took place in Kedarnath, causing a disaster where over 4000 people died and several others went missing due to getting buried under debris or washed away. The forest, flora and fauna also get destroyed in such flash floods and cloudbursts. It may be mentioned that these reasons of Uttarakhand fall in the Himalayas and the Shivalik Hills. Himachal Pradesh, Jammu and Kashmir and Uttarakhand are the Hill states of India where there is extensive tourist influx and pollution being caused by human activity, which is leading to climate change and fluctuations. [10]

Supreme Court directs Himachal Pradesh to clarify disaster management measures.

The Supreme Court on September 23, 2025, directed the Himachal Pradesh government to provide comprehensive details on its disaster management plans, climate change and tourism policies, construction and industrialisation activities, mega hydroelectric projects, four-lane highways, tree felling, and pending prosecutions.

A Bench led by Justice Vikram Nath, in a *suo motu* case, observed that “humans, not nature, are responsible for continuous landslides, collapsing houses, and subsiding roads,” amid the recent landslides and flash floods devastating the State. The court, based on queries prepared by amicus curiae senior advocate K. Parameshwar, sought information on whether zoning has been done based on seismic activity, landslide susceptibility, green cover, and eco-sensitivity. It also asked whether any ecological sites prohibit industrialisation or large-scale projects. The Bench demanded details of protected areas, reserved forests, wildlife sanctuaries, national parks, and eco-sensitive zones, including notifications thereof. It further sought data on forest areas diverted for non-forest use over the past two decades and changes in tree and forest cover across districts in the last ten years. The State must also furnish statistics of permissions granted for felling over 500 trees, along with pending cases and prosecutions. Additionally, the court directed submission of details on disaster management plans, implementation measures, funds allocated and utilised over the past 20 years, and projects under the State Disaster Mitigation Fund. Information on existing and proposed State and National Highways, including the number of four-lane roads and their completion stages, must also be provided. The Himachal Pradesh government has been asked to submit all details before the next hearing on October 28, 2025. [11]

RESULTS & DISCUSSION

The Himalayas and the Shivalik Hills of India have always been fragile due to folding and faulting in the

Earth's crust. The human and other flora and fauna have always been facing challenges due to natural calamities. The human intervention in these hills for the so-called developmental activities like construction of dams, bridges, roads, and houses in an unplanned, haphazard way has been damaging the natural set-up of the strata and ecology of these mountains. The tourist influx, deforestation for construction and cultivable land, have further damaged the environment in these hills and making the human life of the hill populations vulnerable due to the shifting of the snow season, rains, cloudbursts, floods, and landslides. On September 23, 2025, the Supreme Court of India rightly showed its concern and worry on the flash floods and rains, which have caused extensive damage to the Himalayan and Shivalik ecology, environment, flora, and fauna.

The increasing disaster incidents due to reasons as stated in the preceding paragraphs of this article indicate that if human activities which are causing ecological changes, if not checked can be a cause of further damage to the Himalayan and Shivalik populations in future.

CONCLUSION

From the analysis of the foregoing discussions, it is apparent that:

1. Deforestation in the Himalayas and Shivalik Hills should be stopped.
2. There should be well-planned construction activity with minimum or no damage to the ecology and environment in these areas.
3. The cutting and blasting of strata of the hill should be in a scientific and well-planned way, with minimum force applied.
4. Heavy machinery should be sparingly used. It should be used only in situations when it is unavoidable.
5. They should be regularisation and control on the tourist (visiting population) as per the resources available.
6. These states should impart training to their various concerned departments and the public at large in disaster management.

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