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Grasslands, forests and glaciers decreased in the Kedarnath-Joshimath region over 3 decades

Glacial decrease in Kedarnath and the surrounding region can be attributed to increase in surface radiative temperature & runoff, shows study

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▣ The sinking town of Joshimath has been witnessing panic and anger as locals protest the cracks in the area. Photo: Twitter/ DM Chamoli.

The incidences of homes cracking in [Joshimath town of Uttarakhand](#) have been attributed to massive infrastructural projects such as National Thermal Power Corporation (NTPC)'s The Tapovan-Vishnugad Hydropower Project and the Helang Bypass.

However, researchers at Hemvati Nandan Bahuguna Garhwal University in Srinagar, Uttarakhand, identified other potential contributing factors to regional disasters, particularly in the Uttarakhand region of the northwest Himalayas. They highlighted three reasons: Reducing green cover, decreasing glacial area and increasing radiative surface temperature.

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The researchers compared the satellite data of land use and cover over 30 years (1991-2020) to track the spatio-temporal changes over these years.

Two hot spots, namely the Kedarnath-Joshimath region and the Tehri Hydroelectric power plant's waterbody region, were identified as having relatively more changes in land use/land cover pattern.

The researchers stated in their 2022 preprint study:

The Kedarnath-Joshimath region is noted to experience a relatively more decrease of grasslands, dense forests, and glaciers, primarily attributed to the relatively high surface radiative temperature from 1991 to 2021, growing population, tourism, and subsequent infrastructure development.

"In view of frequent extreme climatic-geomorphic events, temporally increasing population and tourist pressure, and temporally changing climatic conditions, it is vital to identify hotspots having dominant changes in land use/land cover to understand the possible source of potential disasters," they added.

Uttarkashi, Rudraprayag, Tehri, Chamoli and Pithoragarh were the five hilly districts included in the study area, covering a total area of 28,856 square kilometres (sq km).

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The study had two main findings about forest cover:

In 1991, nearly 4,316 sq km was the total extent of the moderately dense forest area captured via satellite imagery. In 2020, it decreased to around 3,856 sq km and 10.6 per cent of this was observed between 2001 and 2011.

In 1991, approximately 6,418 sq km was the total dense forest area. In 2020, it decreased to about 6,073 sq km. Of this, a 5.3 per cent decrease mostly occurred from 2011-2020.

"Such decreasing pattern is attributed to tourist influx, population rise, associated job opportunities, and subsequent increased demand of built-up area in Kedarnath-Joshimath region and Tehri HEP (hydro electric project)," the researchers explained.

Such a decrease in the forest cover, along with frequent forest fires, not only alters the carbon sink budget in the region but also affects the local climate, they added.

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"These reductions in forest cover are considerable because barren land leads to disasters like forest fires and increases debris flow," said Vipin Kumar Saini, one of the study's authors.

There is no direct correlation between land subsidence and decreasing forest cover. But the former is more related to how humans use the land for inhabitation, added Saini, who is also an assistant professor in the School of Environment and Natural Resources at Doon University.

Even grasslands decreased over the study period. The total area went from around 3,479 sq km in 1991 to nearly 3,332 sq km in 2020 and reduced far less in comparison to forested areas studied. Here again, the reduction was noted, especially in the Kedarnath-Joshimath region. The upstream Kali valley also witnessed a decrease in grasslands.

“Various studies have noted the decrease in grasslands owing to climate change and resultant temperature increase because higher temperature induces a shift in plant species towards higher altitudes, resulting in reduced species richness and altered species composition and resultant less productivity,” the researchers said.

Glacier loss

The Uttarakhand region comprises 968 of the 9,775 glaciers in India, according to another study. The total glaciated area in the state decreased from about 2,153 sq km in 1991 to approximately 2,069 sq km in 2020.

A relatively higher decrease is noted in the Kedarnath-Badrinath region, the study stated.

“The glacial decrease in the Kedarnath and surrounding region might be attributed to the increase in surface radiative temperature and runoff during the years 1991-2021,” the researchers said.

“Our satellite measurements with the help of NASA showed us that the increase in radiative temperature due to global and regional factors, resulted in increased surface run-off due to snow-melt. These enhance the possibility of changing climate influence,” Saini told *Down To Earth*.

While the green cover was reduced due to various factors, the built-up area correspondingly increased by 49.4 per cent. The waterbody area also increased by 66.6 per cent due to the construction of the Tehri Dam and Hydro Power Plant, the tallest (260.5 m) hydropower dam in India.

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