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# Is survival of Himalayan Cedar (*Cedrus deodara*) threatened? An evaluation based on predicted scenarios of its growth trend under future climate change

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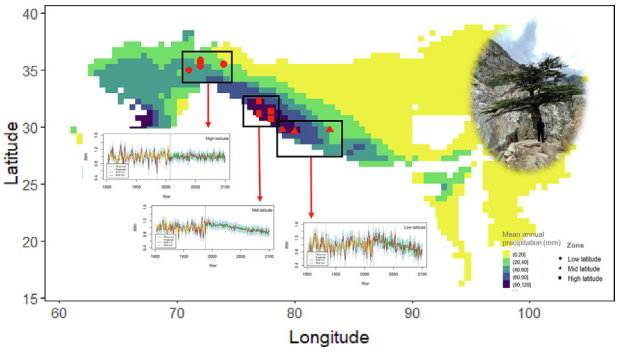
## HIGHLIGHTS

- Spring and winter season climate limits growth of Himalayan Cedar trees.
- Himalayan Cedar growing at monsoon zone would decline due to warmer winter and spring season climate in the future.
- Anomalous expansion of glaciers in the future may favor growth of the Himalayan Cedar growing at westerly dominated region.

## GRAPHICAL ABSTRACT

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## ABSTRACT

Global warming is likely to become one of the significant drivers of forest losses in the Hindu-Kush Himalaya (HKH) during the 21st century. Better understanding of how forest ecosystem will respond to global warming requires a precise knowledge of site and species specific responses to climate change. We applied dendrochronological technique to quantify and predict future growth trend of Himalayan cedar (*Cedrus deodara*), a tree of high commercial importance, and explored its spatial growth variability under two different climatic regimes from 17 deodar sites in the HKH. Of the two climate regimes, one is dominated by the monsoon rainfall and the other by the westerly disturbances. Analysis of tree ring width and climate (monthly temperature and precipitation) data reveals that the spring (March–May) temperature and precipitation affect the growth of deodar negatively and positively, respectively. We used Generalized Least Squares (GLS) regression model to forecast future growth of deodar by taking an ensemble of 40 General Circulation Models (GCMs) for emission scenarios RCP 4.5 and RCP 8.5. Predicted growth trends indicate the decline between 34 % and 38 % under RCP 4.5, and between 29 % and 32 % under RCP 8.5 scenarios, for the low and mid latitude sites. In contrast, a moderate increase in growth was observed in high latitude sites under the both climate scenarios. The study shows more drought stress to deodar trees growing in monsoon areas in mid-and low-latitude sites where less snow melt and low precipitation during the spring season are predicted to increase evapotranspiration. In comparison, in the higher latitude sites where there is a high snowfall due to western disturbances, the growth of deodar is predicted to increase. These findings may be used to take suitable migratory steps for the conservation of deodar in the HKH region.

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