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Longer conserved alpine forests ecosystem exhibits higher stability to climate change on the Tibetan Plateau

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Abstract:
Aims
Vegetation dynamics are simultaneously regulated by climate change and anthropogenic activities. Since the 1980s, climate has been warming on the Tibetan Plateau (TP) at a rate higher than North hemisphere average. Anthropogenic activities, including grazing, farming, and urbanization, are also influencing the alpine ecosystem on the TP. Especially, an ensemble of large engineering projects, such as power transported from west to east by State Grid, have been in operation on the TP. While studies disentangling effects of climate and anthropogenic activities interference are still lacking for the forest ecosystems on the TP. The overarching objectives of this study were to separate effects of natural climates and human interferences on forest ecosystem dynamics on the TP.
Methods
We compared vegetation activities of two typical natural reserves (Gongbu natural reserve, GNR, and Yarlung zangbo river grand canyon natural reserve, YNR) and their surroundings in southeastern Tibet (outside of the natural reserves, ONR) using long-term satellite NDVI dataset. Linear regression and partial correlation analyses were constructed for the relationship between vegetation activity and climates to evaluate the distinct climate effects on the two natural reserves.
Important Findings
The two natural reserves were established at different time, which were related to anthropogenic activities impact durations. The results showed that the annual mean NDVI fluctuated between 0.5 and 0.6 in the relatively longer reserved YNR, which was remarkably higher than those in other regions (with NDVI lower than 0.45). The vegetation vigor in the YNR showed neither a significant temporal trend nor significant relationship with climate. Nevertheless, vegetation vigor exhibited a significant increasing trend during the last three decades (0.012/decade) at the GNR. The inter-decadal analysis turned out positive relationships between vegetation vigor and annual temperature since late 1990s until early 2000s when the GNR was officially established. This study underlined the importance of considering human interference duration when assessing the relationships between vegetation dynamics and climates.