Forests synchronize their growth in response to climate change

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Sampling of a centenary Scots pine with Pressler auger, Navarredonda de Gredos, Spain. Credit: Mar Génova

A new study, with the participation of UPM, has revealed a growing synchrony in ring-width patterns of trees in response to global warming.

A multidisciplinary research team consisting of Russian and Spanish researchers, with the participation of a female researcher from School of Forestry Engineering and Natural Resources at Universidad Politécnica de Madrid (UPM), has assessed the tree-ring width patterns of diverse conifer species in Spain and Siberia. This study shows the existence of an increase of spatial synchrony of ring width patterns in both regions. These findings are a warning of the global warming impact on forest ecosystems at subcontinent scale.

Forests play a key role in the carbon balance of terrestrial ecosystems. One of the main uncertainties in global change predictions lies in on how the spatiotemporal dynamics of forest productivity will be affected by global warming. Fortunately, we have registers of an indicator for biological responses to climate change impact: the sequence of tree-ring dating.

The concept of spatial synchrony in tree growth refers to the extent of coincident changes in ring-width patterns among geographically disjunct tree populations. As Mar Génova, the UPM female researcher, explained: "We aimed to verify whether this phenomenon was local or rather extended over large regions at subcontinent scale". With this purpose, two very contrasting terrestrial ecosystems were selected: "the extremely cold continental taiga of Siberia and the comparatively warm and dry Mediterranean montane forests". A total of 93 growth-ring chronologies of six different conifer species were used: 45 chronologies from central Siberia and 48 of diverse Iberian mountain systems.

In order to manage this huge volume of data, a new methodological framework was developed. This method is able to deal with large sets of ring width sequences that date back several centuries ago. These new methods have allowed researchers to show the synchrony among growth patterns in coniferous forests whose main limiting factor is cold, in the case of taiga, and drought, in the case of Mediterranean forests.

This unprecedented coherence at a large geographical scale in a recent past indicates that the growth synchrony among disjunt forests by almost 1000 km is quite similar to the trees inhabiting in a same forest mass.

This more synchronous growth of forests caused by the global warming is a global phenomenon too, but the particular mechanisms involved in every case are regionally dependents.

Particularly, these mechanisms are related to the increased drought stress at the end of spring in Spain and with greater impact of year to year fluctuations of summer temperatures in Siberia. Besides, all this is related to an earlier start of wood formation, which has been proved to be induced by a warmer climate.

The synchrony increase on the tree-ring width can be useful to establish climatic thresholds for tree survival as well as anticipating local and regional forest decay events.

More information: Tatiana A. Shestakova et al. Forests synchronize their growth in contrasting Eurasian regions in response to climate warming, *Proceedings of the National Academy of Sciences* (2016). DOI: 10.1073/pnas.1514717113

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