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Patterns of Treeline Rise with Climate Change Across Western North America from the 1980s to Present

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Previous research has shown that (1) treelines are shifting upward in elevation on high mountain peaks worldwide, and (2) the rate of the upward shift appears to have increased markedly in recent decades. Because treeline shift is a process manifested over broad scales of space and time, a particular challenge has been that of obtaining a broad-enough view of patterns of treeline shift to permit inferences about geographic and environmental patterns. What is more, intensive studies of treelines have been concentrated in North Temperate regions, such that little information is available about treeline shift patterns in the Tropics. We have attempted to broaden this viewpoint by means of analysis of long time series of vegetation indices derived from Landsat imagery obtained and analyzed via Google Earth Engine for the 1980s to present. We sampled vegetation indices at points spaced every 100 m along 100 km transects radiating out from 120 high peaks across western North America (Canada to Central America); considerable data preparation was necessary, including ending transects <2 km into closed forest, identifying current treelines via reference to Google Earth imagery, and consideration only of up to <1 km above treeline. Patterns that emerged were—as is well known—that treelines are generally higher at lower latitudes, but also that magnitude of treeline shifts is nonrandomly distributed with respect to latitude, location with respect to coastlines, and size of the mountain mass within which the peak is located. Although analyses are continuing at the time of preparation of this abstract, this analysis offers a broadscale view of treeline shifts over a period of almost 40 years, and over a geographic span of more than 40° of latitude.