

Western Ecological Research Center

Publication Brief for Resource Managers

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Forest Seedlings and Climate

In long-lived forest trees, there is often a considerable time lag between climate change and vegetation change, with species persisting long after conditions suitable for their establishment have disappeared. Regeneration is likely a sensitive indicator of climatic change, perhaps evident in patterns of cone initiation, seed production, and seedling recruitment. This, however, is complicated by limited understanding of how current conditions control forest reproduction. In a study recently published in *Forest Ecology and Management*, USGS scientists Drs. Phil van Mantgem, Nate Stephenson, and Jon Keeley addressed these information gaps using a unique long-term data set from the Sierra Nevada of California.

The authors used permanent plot data from 1999–2003 across a broad elevational range (1,500 to 3,000 m) in the southern and central Sierra Nevada to show that conifer seedling density declined sharply with elevation (i.e., from warmer to cooler climates). This relationship held when overstory tree density was also considered. Seedling birth and death rates were also significantly higher in warmer, low-elevation forests. In contrast, seed production was not predicted by elevation and was highly variable from year to year. After a particularly abundant year of seed production, seedling densities were high only in the following year, suggesting reproduction in the Sierra Nevada may have been primarily limited by abiotic factors such as the availability of suitable sites and weather.

van Mantgem, P. J., N. L. Stephenson, and J. E. Keeley.
2006. Forest reproduction along a climatic gradient in the Sierra Nevada, California. *Forest Ecology and Management* 225:391–399.

Management Implications:

- Reproductive failures may be our earliest signal of changing forest conditions; seedling dynamics could provide a sensitive indicator of environmental changes.
- Forest reproduction did not appear to be strongly seed limited. Therefore, quick recovery from disturbance (e.g., logging, fire) may depend on favorable post-disturbance weather conditions.