

Climate Change Alters Distribution of Whitebark Pine (*Pinus albicaulis*) With Respect to Land Management Status: Are there Implications for Adaptation?

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INTRODUCTION AND METHODS

Climate-based predictions of species distributions provide information for understanding impacts of climate change. However, species distribution models do not include land management zones as input. Improving understanding of geographic shifts will require consideration of management zones where certain activities could facilitate or impede responses to climate change. For instance, assisted migration to overcome dispersal barriers could be challenged in areas designated for “untrammeled” character (e.g., wilderness). Alternatively, large tracts of land with uninterrupted disturbance regimes may offer opportunities for disturbance-facilitated establishment of species into new areas. We focused on current and future distributions of whitebark pine (*Pinus albicaulis*), a keystone species of treeline. Current and future “climate space” of whitebark pine were overlaid onto ecoregions and land management zones. We also used different thresholds of predicted presence to assess the sensitivity of patterns to varying levels of confidence.

RESULTS AND CONCLUSIONS

Geographic distribution of viable “climate space” for whitebark pine is predicted to contract 86 percent by 2060 across the western United States based on our most inclusive confidence estimate. As climate change reduces the total area of viable habitat, distribution of whitebark pine in designated wilderness is expected to nearly double. The U.S. Department of Agriculture, Forest Service climate model predicts that whitebark pine range occurring within wilderness boundaries will increase from 38 percent in 2010 to 62 percent by 2060. Climate adaptation and restoration strategies need to consider the influence of land management zones as species shift in response to climate change. From our analysis, we developed a simple conceptual model that managers could use when deciding what level of active restoration to perform in protected areas set aside to sustain “untrammeled” conditions. We discuss our results in the context of ongoing and predicted whitebark pine decline, climate change, restoration, and wilderness character.

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