

Western Ecological Research Center

Publication Brief for Resource Managers

Release:

August 2005

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Tree Populations, Present and Future

It's tough to make predictions, especially about the future.

-- attributed to Yogi Berra

Is it reasonable to base management decisions on expected future population trends? Population viability analyses often inform conservation policy and strategies, but at the heart of these analyses are models which extrapolate relatively short-term demographic data often decades into the future. Are these projections meaningful in terms of future population size and dynamics? In a study recently published in the *Journal of Ecology*, USGS scientists Drs. Phil van Mantgem and Nate Stephenson addressed these questions for forest trees using a unique long-term data set from the Sierra Nevada of California.

Van Mantgem and Stephenson used demographic data from six coniferous tree species, encompassing 16,673 trees in 15 permanent plots, to create 17 separate simple matrix population models based on stem size. Using these models they determined differences between projected trends from initial 5-year records and observed data during two subsequent 5-year time steps. Total population sizes were strongly predicted by model projections, although population dynamics were dominated by carryover from the previous 5-year time step (i.e., there were few cases of recruitment or death). Fractional changes to overall population sizes were less well predicted. Model projections were also able to predict short-term rates of survival, growth and recruitment. Mortality frequencies were not well predicted.

Their results suggest that simple models can accurately project future short-term changes for at least some tree populations because demographic rates appear to be relatively stable over time. However, not all populations were well predicted and these simple models would

Management Implications:

- Tree population size was well predicted by simple models, although relatively little change was observed over the 15-year study period.
- Short-term predictions of population-level frequencies of tree survival, growth, and recruitment were much more accurate than mortality frequencies.
- Forest tree demographic rates appeared to be relatively stable in the absence of disturbance.

likely become more inaccurate over longer projection intervals. The predictive ability of these models would also be limited by disturbance, such as fire, or other events that destabilize demographic rates (e.g., pathogen outbreaks).

van Mantgem, P. J., and N. L. Stephenson. 2005. The accuracy of matrix population model projections for coniferous trees in the Sierra Nevada. Journal of Ecology 93:737-747.