

Data Submitted (UTC 11): 2/2/2024 1:39:45 PM

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Comments: Climate change is a major threat to the survival of old-growth forest ecosystems. In a 2015 study on climate change projections in old growth forest on Oregon's Pacific Northwest, the authors ran a dynamic global vegetation model and a landscape simulation model and found that the forest composition transitioned from evergreen-needleleaf to broadleaf trees better adapted to a warmer climate. By 2100, the authors predicted that 20-50% of the forest landscape would be of a different composition than it is today (Turner, 2015). Other studies of the Pacific Northwest old growth forest region have corroborated these findings, indicating that projected increases in temperature and changes in precipitation patterns will reduce the soil moisture available to vegetation, altering the hydrological cycle that sustains life in these forests (Turner, 2015). Old-growth forests may also experience elevated mortality associated with drought, and much of the inland region is forecasted to experience a "water-balance deficit" during the summer months (Spies, 2018). Under one particularly pessimistic model, the authors of the 2015 study found that the average forested area burned in severe wildfires, a primary driver of old growth forest habitat fragmentation, will increase by a factor of 3 to 9 (Turner, 2015). The impact of climate change and the subsequent losses of suitable habitat is forecasted to be the greatest on fragmented populations, species with narrow distributions and species with low rates of dispersal (Spies, 2018).

Frey, S. et al. 2016. "Spatial models reveal the microclimatic buffering capacity of old-growth forests." *Sci. Adv.* 2. <https://www.science.org/doi/full/10.1126/sciadv.1501392>.

Krankina, O.N., DellaSala, D.A., Leonard, J. et al. 2014. "High-Biomass Forests of the Pacific Northwest: Who Manages Them and How Much is Protected?". *Environmental Management* 54, 112-121. <https://link.springer.com/article/10.1007/s00267-014-0283-1#citeas>.

Spies, Thomas A. et al. 2019. "Twenty-five years of the Northwest Forest Plan: what have we learned?". *Frontiers in Ecology and the Environment* 17 (9): 511-520. https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/fee.2101?casa_token=L8pPhcqC3NsAAAAA%3AKdIFe8fRgSyTio6iGT50n6ANlzlyfOTihe9FmjAgahnyvgr2tRbl56GZ1YfVAIK0hd_DUqnN1FuK3Q.

Turner, D.P., Conklin, D.R. & Bolte, J.P. 2015. "Projected climate change impacts on forest land cover and land use over the Willamette River Basin, Oregon, USA." *Climatic Change* 133, 335-348. <https://link.springer.com/article/10.1007/s10584-015-1465-4#citeas>.