Prioritizing Forest Protection Efforts in Oregon

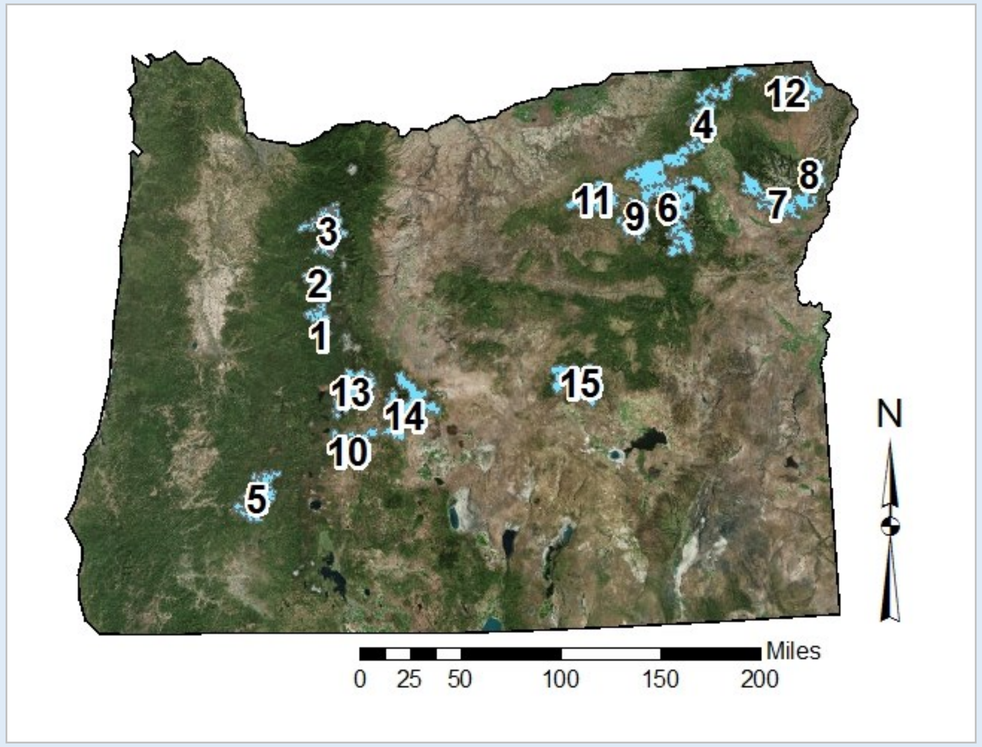
Patrick Milne

Tufts University

Introduction

Although current news about deforestation primarily focuses on developing and rapidly growing countries like Brazil, Indonesia, and China, deforestation remains a serious ecological problem in the United States. Between 1630 and 1907, forest coverage shrank from 46% to 34% of the United States' land area.[1] This number has remained approximately steady over the last 110 years, but little of this forest has been left untouched. Only 6% of the nation's forests are undisturbed "old growth" forests greater than 175 years old, and 55% have been regrown in the last 50 years.[1] The main driver of this is the American timber industry, which takes a cyclic approach, clearing the trees in an area then giving them time to regrow before being felled again. Over time, the regular cycles of clearing and regrowth can harm the fertility of the area through increased erosion, nutrient stripping, and soil compaction.[2,3] Clearcutting has other ecological impacts as well, including loss of biodiversity, as the area is usually restocked with a single type of tree, and clogging of rivers with eroded sediment.[3] In order to prevent long-term degradation and eventual loss of viability as forested land, high-risk areas should be converted from clearcutting logging methods to more sustainable practices, or in severe cases should be retired from logging altogether and protected as a wildlife or recreation area.

Oregon, a coastal state with great diversity of ecosystems, has one of the highest rates of deforestation in the United States. The state is mountainous, with the Cascade Range running north-south through the middle. With prevailing winds and moist air originating in the Pacific Ocean to the west, the Cascades create a rain shadow, making the western third of the state extremely rainy and the central and eastern regions far drier. For this reason, the densest forests are found in the west near the coast, and the timber industry is most active here. Logging is a common economic activity across the state, however, with large amounts of land held in both public and private ownership devoted to forestry.



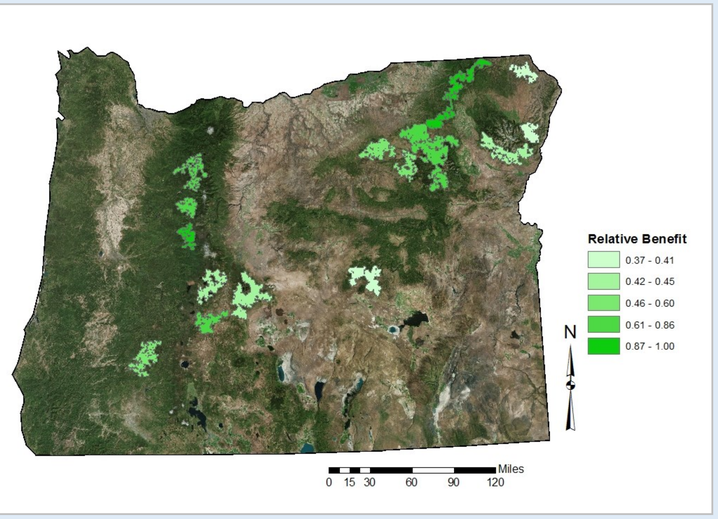
Cumulative ranking of forest protection considering degradation vulnerability and ecological benefits.

Results

The figure at left ranks the at-risk areas for protection considering both risk and reward; 1 is the highest priority, 15 the lowest. The regions on the western edge of the Cascade Mountains received the highest priority because they have both high risk for degradation and high reward if preserved. This is likely a result of the rain shadow in the Pacific Northwest that causes the western edge of the Cascades to receive very high amounts of precipitation, which increases both the rate of erosion (high risk) and the trees' growth rate (high value). The next-highest priority areas are generally clustered in the northeast corner of the state, possibly due to the mountains creating high slope and the presence of the gray wolf in this area. Oregon's central region has low priority, likely due to the relatively flat slope and lack of rainfall from the Cascades' rain shadow lowering productivity. Based on this analysis, the areas that should be the focus of reforestation and protection efforts are conveniently the closest ones to where the majority of people live, along the Pacific coast.

Conclusion

This analysis represents an overview of the most significant factors in forest protection. The weighting of the value factors was relatively arbitrary, and only a few of the true benefits of undisturbed forest were analyzed. A more in-depth analysis would account for many more endangered species, including invertebrates and plants, as well as attempt to quantify the suitability of protected or reforested habitat for these species. The impacts of sediment runoff on aquatic ecosystems could also be analyzed, utilizing the erosion value in both the risk and reward sections. Finally, the ecological and societal value of protecting these habitats needs to be compared to the economic value being derived from the areas by the timber industry and the feasibility of purchasing and protecting the land to determine which areas can reasonably be reserved for environmental protection.

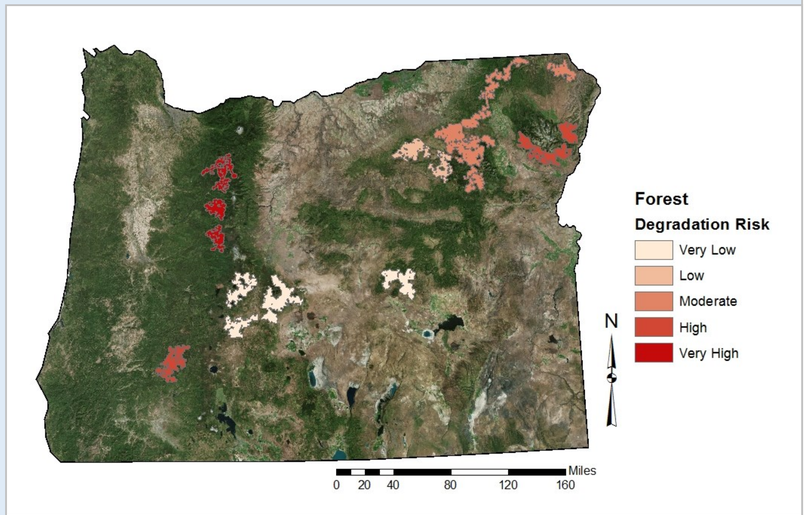


Relative benefits of forest protection in each site based on three value parameters.

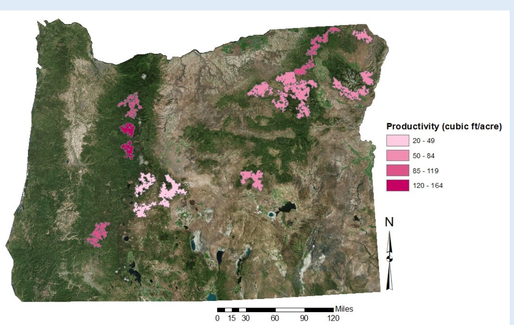
Methods

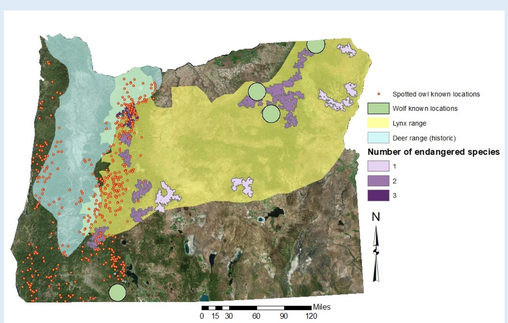
The analysis measured two parameters: the risk of ecological degradation if an area is continually clearcut and the environmental and social rewards of protecting it as healthy habitat. Areas of publicly and privately owned timber land being clearcut were grouped with a buffer range of 1000m, and the 15 largest continuous areas were analyzed. Degradation risk in each area was quantified using the USDA's Universal Soil Loss Equation (USLE),[4] although the farming-specific terms were ignored, so the analysis was based only on slope, precipitation, and soil erodibility. These factors were obtained in raster form and multiplied according to the USLE, and the product raster was averaged over each clearcutting area using a zonal analysis.

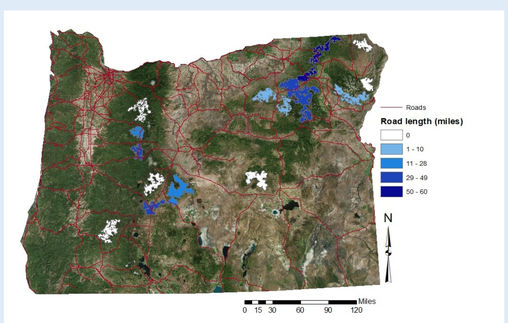
Three factors were analyzed to calculate each at-risk zones' potential value as productive forest. First, the area's growth rate, measured by logging companies, was used as a measure of how quickly it could be reestablished and how much carbon dioxide it could pull from the atmosphere to counteract climate change. Second was its ability to act as habitat for four endangered species— the spotted owl, gray wolf, Canadian lynx, and Columbian white-tailed deer— through intersection with their current or historical ranges. Finally, the length of roads running through the zone was used as a measure of how easily it could be replanted if necessary and how accessible it would be as a recreational area for hiking and camping. These three values were summed in each region with equal weight, then this sum was normalized to give each area's relative value as natural habitat.



Potential for land degradation through erosion using the USDA's total soil loss equation.







Quantification of the three value parameters— forest productivity, endangered species habitat, and length of roads contained— for the fifteen forest sites studied.

References

Citations

1: U.S. Forest Facts and Historical Trends. Washington, D.C.?: U.S. Dept. of Agriculture, Forest Service, 2001. US Forest Service. Web.

2: "When Is Clearcutting the Right Choice?" *Clearcutting*. Oregon Forest Resources Institute, n.d. Web. 27 Apr. 2017.

3: Bierman, Paul. "Clearcutting and Erosion in New England - the Photographic and Stratigraphic Record." *Vignette Collection*. University of Vermont, 15 Nov. 2016. Web. 27 Apr. 2017.

4: " Universal Soil Loss Equation (USLE)." *Universal Soil Loss Equation (USLE)*. Purdue University, n.d. Web. 27 Apr. 2017.

Data sources

"CWTD_GIS_Layers." *ArcGIS REST Services Directory.*

"Download National Datasets." *USDA: Forest Service.*

"Order by State." *United States Department of Agriculture*.

"Oregon_Wolf_Open_Data." *ArcGIS REST Services Directory.*

"Oregon_Canada_Lynx." *ArcGIS REST Services Directory.*

"spottedOwlPopCenters." *ArcGIS REST Services Directory.*

"30-yr Normal Precipitation: Annual." *PRISM Climate*