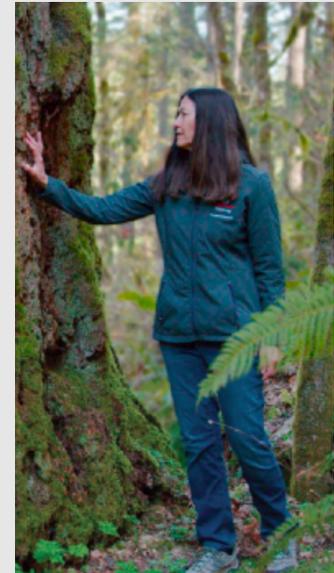


# Natural Climate Solutions to Mitigate and Adapt to Climate Change

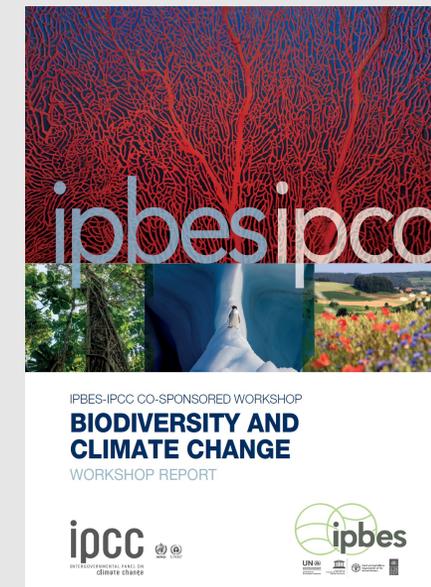
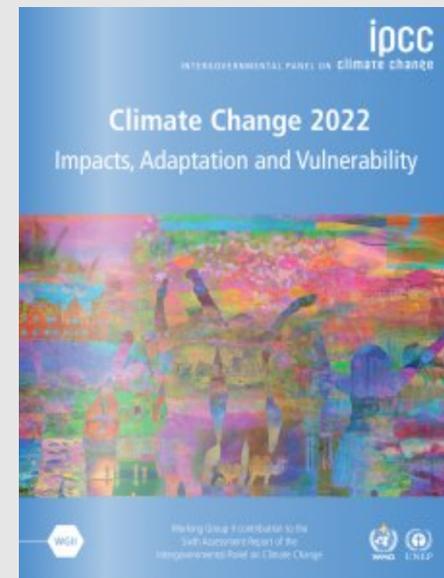
Beverly Law

Professor Emeritus of Global Change Biology  
& Terrestrial Systems Science  
Oregon State University



# Global Scientific Consensus

- **The next 10 to 30 years** are a critical window for climate action, when *severe ecological disruption* is expected to accelerate (IPCC 2018, 2021)
- It requires effective conservation of **30 to 50% of Earth's land**, freshwater and ocean areas, *including current near-natural ecosystems* (IPCC 2022)



# Mature and old forests accumulate and store the greatest amount of carbon over time

Conserving them is the most effective forest-related climate mitigation strategy.

Converting mature and old forests to young forests results in significant loss of total carbon stores, even when wood products are considered.

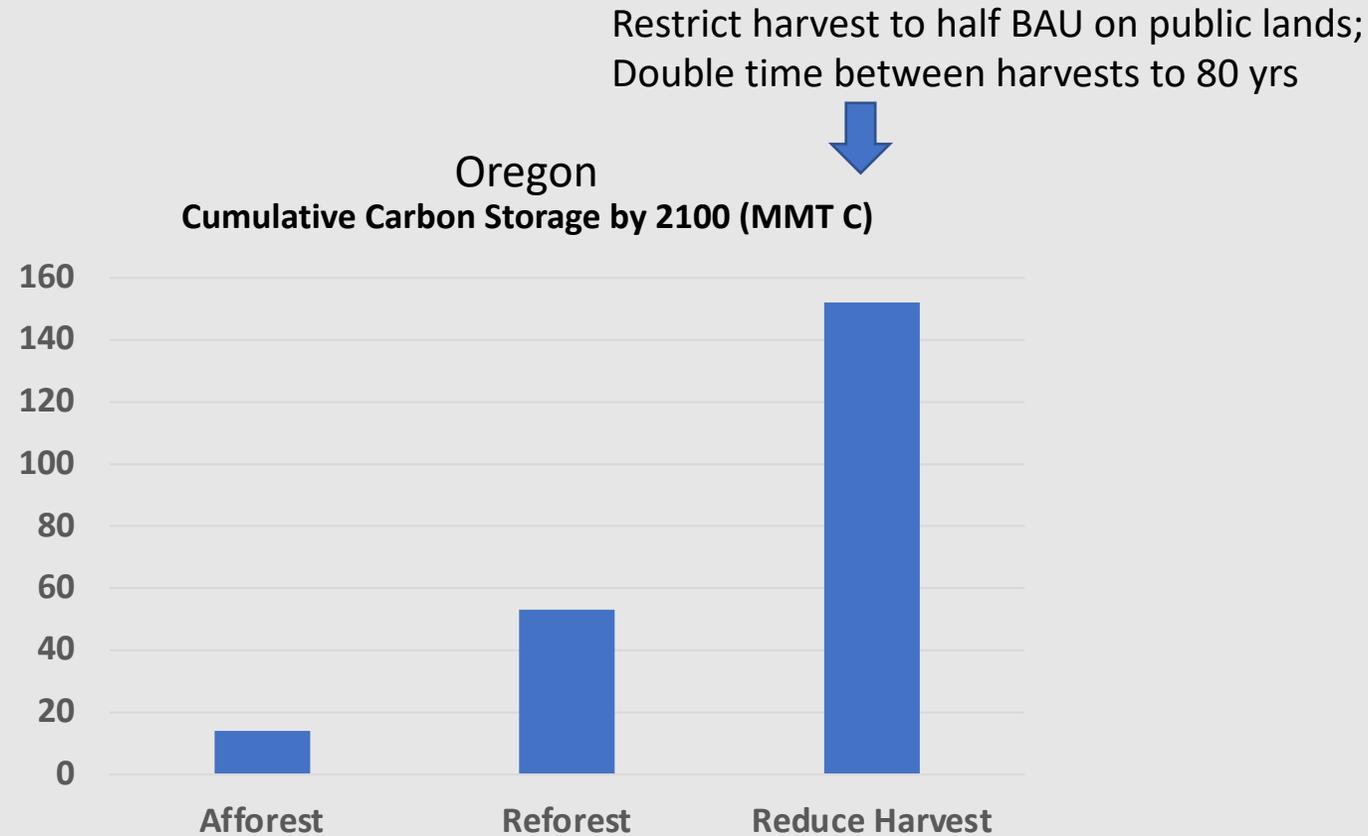
Big trees matter:  
On 6 National Forests, large trees account for 3% of the trees but stored 42% of the tree carbon.

[Law et al. *Land* 2022;  
Law et al. *Proc. Nat. Acad. Sci.* 2018;  
Mildrexler et al. *Front. Forest Glob. Chang.* 2019;  
Luyssaert et al. *Nature* 2008]

(Photo: W Cascades, Bev Law)

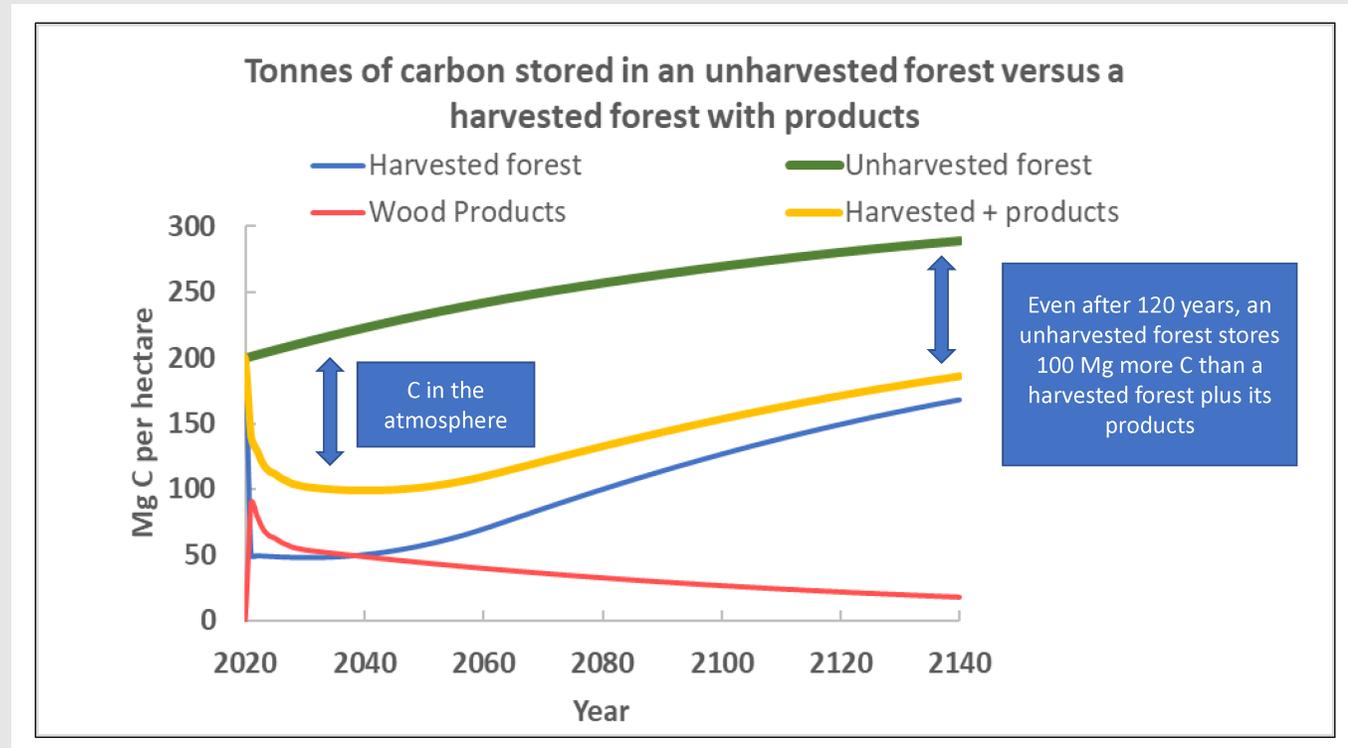


# Reducing harvest can triple cumulative carbon storage by 2100 compared with other strategies



# Comparison of carbon stored in unharvested forest vs harvest forest plus its products

Converting mature and old forests to young forests results in a significant loss of total carbon stores, even when wood products are considered



[Law, B.E., W.M. Moomaw, T.W. Hudiburg, W.H. Schlesinger, J.D. Stermann, G.M. Woodwell. 2022. Creating strategic reserves to protect forest carbon and reduce biodiversity losses in the United States. *Land*, 11, 721;  
Hudiburg et al. 2019. Meeting GHG reduction targets requires accounting for all forest sector emissions. *Environ. Res. Lett.*]

# Co-benefits of protecting mature and old forests

- Cooler interiors for sensitive species and those needing time to migrate and adapt
- Vital habitat structure and complexity for aquatic and terrestrial species
- Store and gradually release water

[Law & Schlesinger, The Hill. Why mature and old forests are so important for climate mitigation and adaptation; Law et al. 2022; Kim et al. 2022. Global Change Biology. Forest microclimate and structure mediate trends in breeding bird populations]

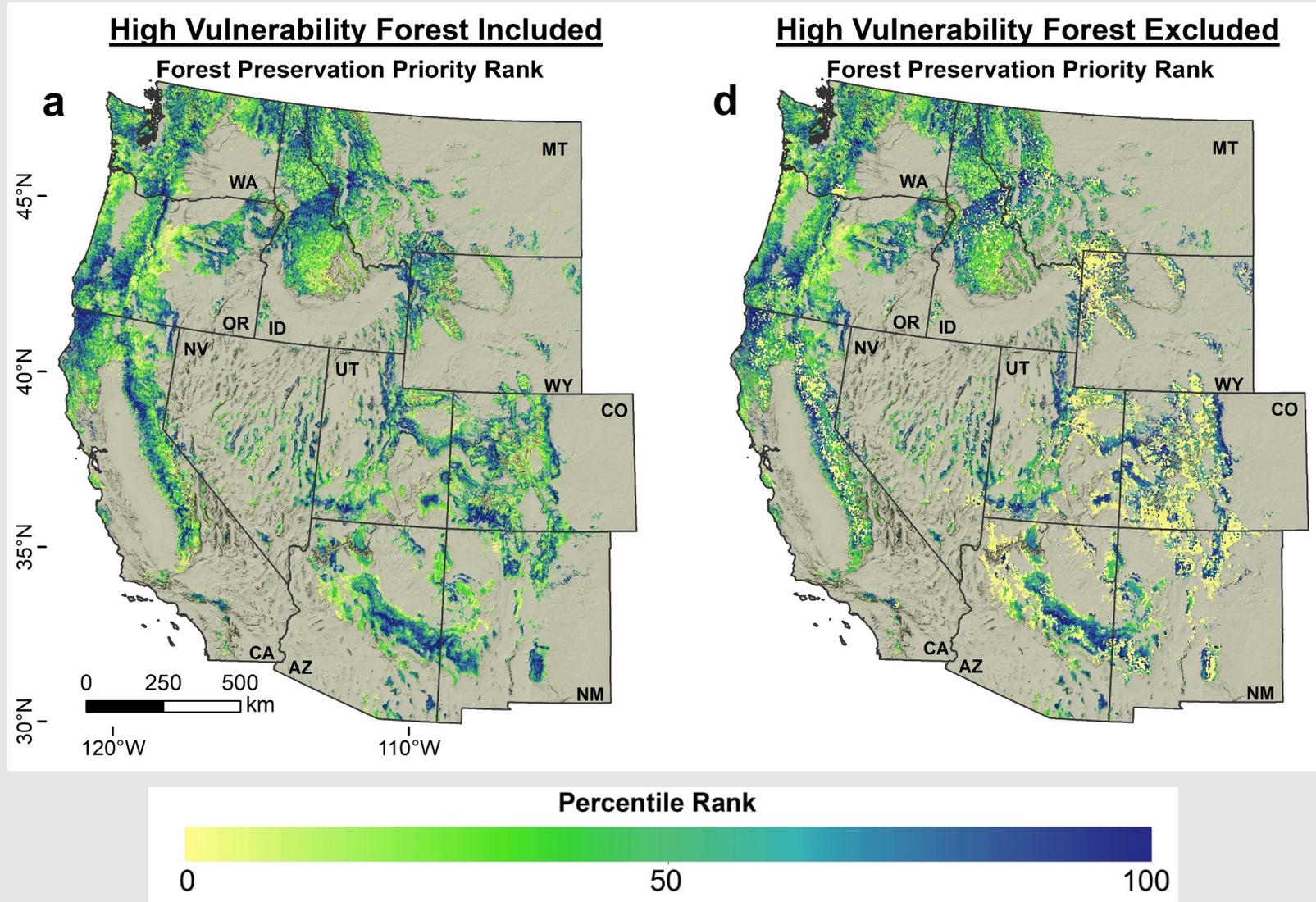
(Photo: Whale Cr., Tom Kloster)



# Natural Climate Solutions:

## High priority areas for preservation of carbon, water, and biodiversity in the Western US

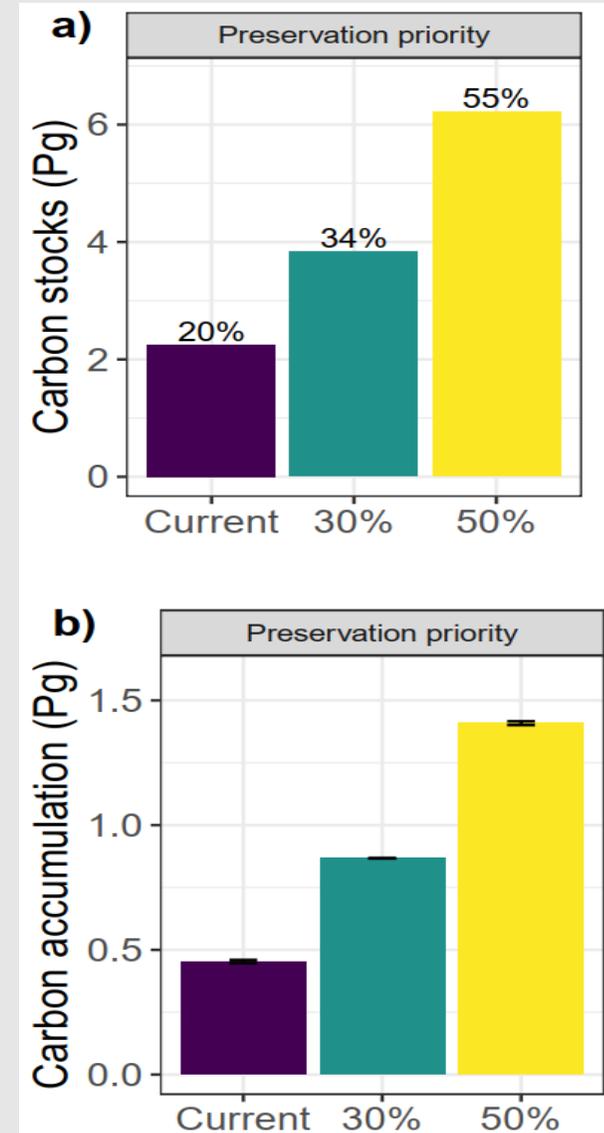
- ~65% of high priority areas is on federal forestlands if meet 2050 targets
- Public lands can more readily ensure permanence of protection



[Law et al. 2021. Nature Comm. Earth & Environ. Strategic forest reserves...]

# Protected carbon stocks and accumulation could triple by 2050 in W US

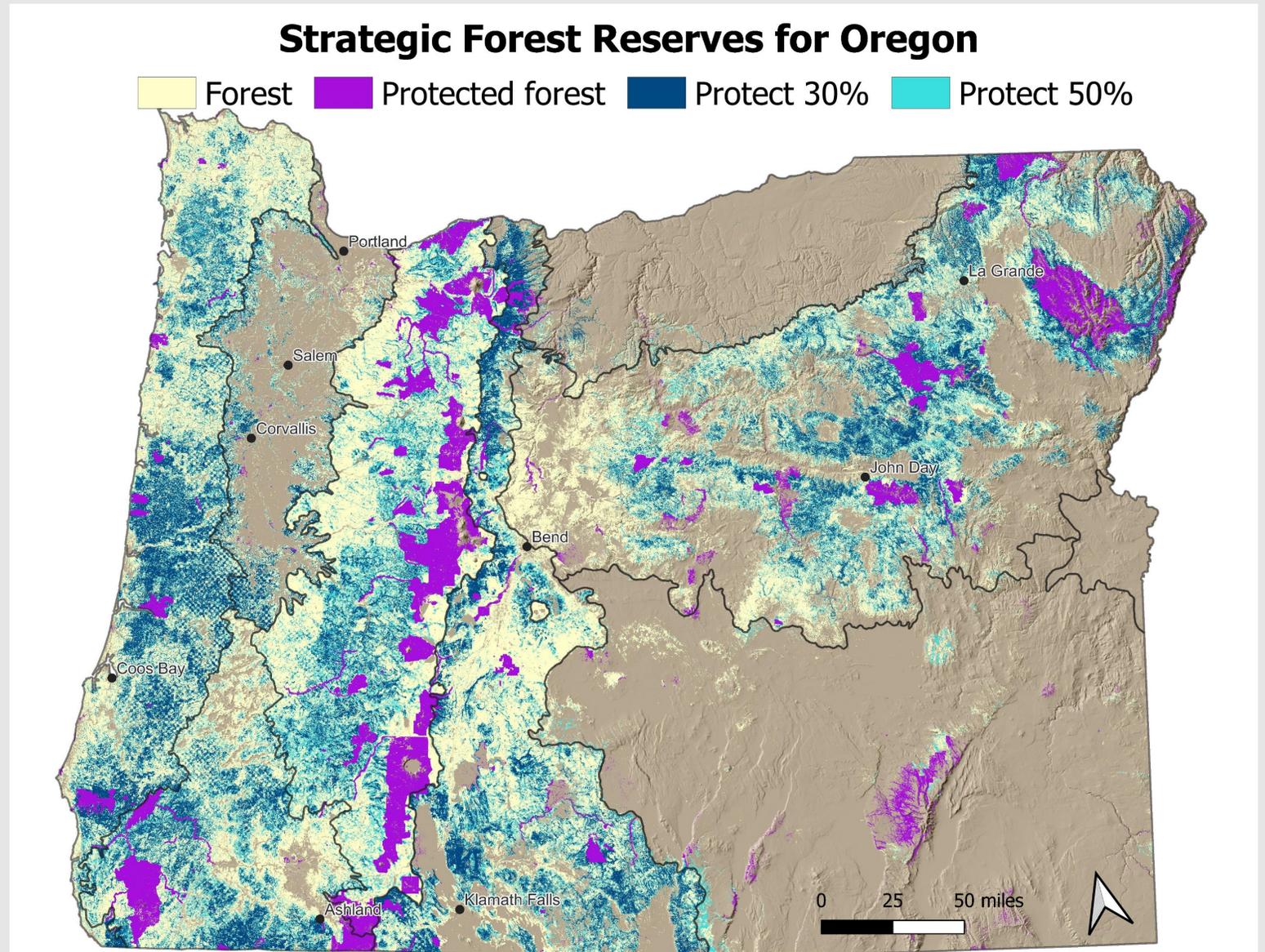
- Currently only 20% of carbon stocks are protected.
- Protecting 55% of carbon stocks by 2050 would nearly triple protected stocks and accumulation compared to current levels.



# Oregon areas with highest carbon density, biodiversity, and resilience

OR has the most total forest area and aboveground carbon density in the W US, but only 10% are protect.

Protected carbon stocks could increase by 4-6x by 2050



Habitat for vertebrate species would increase significantly if targets are met with the high preservation priority areas

Protected habitat of T&E species habitat could increase from current 8-12% to >60% by 2050

Similar increases for ~1,700 vertebrate and tree species.



# Forests account for most of Oregon's surface drinking water source area

Protected source area would increase from current 9% to 48% by 2050 if the high priority areas for carbon, biodiversity and resilience are protected.



# 13 agencies in USGCRP are charged with producing first ever assessment report on the condition of nature in the US

Tracking changes in forest carbon and biodiversity requires more frequent measurements, reporting, and verification for assessments.

“The essential metric for climate mitigation is the amount of carbon stored per acre in aboveground live and dead biomass. For purposes of carbon conservation, because mature and older forests accumulate and store the greatest amount of carbon over time, they could be defined as those with relatively high carbon per unit of ground area, *sensu* Law et al., 2021, among stands of similar species composition within an ecoregion (so delimited as to account for major soil and climate influences).”

[Law, B.E. et al. 2022. *Frontiers in Forests and Global Change*; Scientists Letter by W. Schlesinger & B.E. Law response to RFI: measurements to define mature and old forests, signed by lead scientists]

