THE VALUES OF OLDER TREES AND FORESTS

Protecting mature and old growth trees and forests will help the U.S. mitigate and adapt to climate change. Co-benefits of these trees and forests include:

- storing and sequestering atmospheric carbon for long periods of time;
- safeguarding biodiversity and being climate refugia;
- reducing flood and erosion risk as precipitation patterns change;
- increasing availability of drinking water for communities struggling with drought impacts; and
- possessing features that are more resistant to fire.

Below is a summary of some of the science that has been published on these topics.

OLDER TREES AND FORESTS STORE AND SEQUESTER TREMENDOUS AMOUNTS OF CARBON.

- On the scale of an individual tree, research increasingly indicates that the rate of carbon accumulation will continue to rise as the tree grows older and larger.[1] As a recent study concluded: "[L]arge, old trees do not act simply as senescent carbon reservoirs but actively fix large amounts of carbon compared to smaller trees; at the extreme, a single big tree can add the same amount of carbon to the forest within a year as is contained in an entire mid-sized tree."[2]
- Although carbon dynamics operate differently in stands of trees, the rate of carbon accumulation generally remains robust well into a stand's lifespan.[3]
- Older trees and forests can store their accumulated carbon for centuries. As a healthy tree ages and continues to absorb carbon, the absolute amount of its stored carbon increases,[4] and even dead, older trees can hold onto their stored carbon for decades—or centuries—as they slowly decay on the forest floor.[5]
- Reforestation, afforestation, lengthened harvest cycles on private lands, and restricting harvest on public lands increased net ecosystem carbon balance by 56% by 2100, with the latter two actions contributing the most.[6]
- High-productivity, low-vulnerability forests in the western US have the potential to sequester up to 5,450 Tg CO2 equivalent (1,485 Tg C) by 2099, which is up to 20% of the global mitigation potential previously identified for all temperate and boreal forests, or up to ~6 yr of current regional fossil fuel emissions.[7]

OLDER FORESTS AND TREES HELP COUNTER THE BIODIVERSITY CRISIS.

- Forests and trees tend to develop structural complexity as they age (more hollows in trees, more snags and downed logs in forests, for example). This complexity fosters biodiversity[8] and can particularly support species that have specific habitat needs.[9] For instance, older forests and trees in the West provide critical habitat for wildlife, such as pileated woodpeckers and bears.[10] And large diameter snags play a key role in supporting wildlife in Arizona.[11]
- Forest resilience and adaptive capacity increase with increasing plant species richness,[12] suggesting that preserving mature forest ecosystems would provide an added buffer against potential ecosystem transformation to future climate change.
- Protecting mature forest ecosystems also creates co-benefits for adaptation to climate change for people and nature, such as higher genetic, species, and ecosystem diversities, resilience to climate extremes, and increased water availability.[13]
- The habitat connectivity provided by large, contiguous forest areas spanning environmental gradients, such as latitude, altitude, rainfall or temperature, maximize the potential for key processes such as gene flow and genetic adaptation to play out, while also allowing species to track shifting climates.[14]

INTACT FORESTS REDUCE THE RISK OF FLOODING, EROSION, AND LANDSLIDES.

- Intact forests have a positive effect on the redistribution of runoff, stabilize water table levels and retain soil moisture by altering soil permeability. These processes interact with physiography to regulate the flow across the land surface and help stabilize slopes, prevent water and wind erosion, and regulate the transport of nutrients and sediments.[15]
- A Forest Service survey of Oregon's Clackamas Watershed found that out of 254 mudslides, almost 75 percent occurred in areas that were logged or roaded. After the winter storms of 1995-96, the Forest Service found that 70 percent of Idaho's 422 landslides were linked to logging roads.[16]

INTACT, OLDER FORESTS PROTECT DRINKING WATER ACROSS THE U.S.

- Across the United States, National Forests are the largest source of drinking water.[17]
- Streamflow was 50% lower in a 40–43-yr-old plantation relative to 110-yr-old forest. Summer low flow deficits persisted over six or more months of each year. Contemporary forestry practices produced persistent, large summer low flow deficits.[18]
- Analysis of 60-year records of daily streamflow from eight paired-basin experiments in the Pacific Northwest of the United States (Oregon) revealed that the conversion of old-growth forest to Douglas-fir plantations had a major effect on summer streamflow.[19]

OLDER TREES ARE OFTEN BETTER ABLE TO WITHSTAND AND RECOVER FROM WILDFIRES.

- Older trees often possess features that make them more resistant to fire than younger trees, such as the thicker bark that comes with increasing age and size,[20] and lower branch self-pruning in some species that limits fire crown spread.[21]

ENDNOTES

1. Stephenson et al. 2014, Kohl et al. 2017, Sillett et al. 2010, Xu et al. 2012
2. Stephenson, et al. 2014
3. He et al. 2012, Law et al. 2003, Keeton et al. 2011
4. Xu et al. 2012, Pregitzer et al. 2003, Mildrexler et al. 2020
5. Lutz et al. 2021, Stenzel et al. 2019
6. Law et al. 2018
7. Buotte et al. 2019
8. Moomaw et al 2019, Donato et al 2012, Bunnell et al 2002, Pan et al 2018, FEMAT 1993, Kauffman et al. 2007, Ducey et al. 2013.
9. Franklin 1992, Linnell et al 2017, Schwartz et al 2013.
10. Bull et al. 1997, McClelland & McClelland 1999
11. Chambers & Mast 2005
12. Morin et al. 2018, Watson et al. 2018
13. Law et al, 2021, Watson et al. 2016
14. Watson et al. 2016
15. Watson et. al, DellaSala et al. 2011, Creed et al. 2016, Moomaw et al. 2019
16. Sierra Club 2020
17. Furniss et al. 2010
18. Segura et al. 2020
19. Perry et al. 2016
20. Agee 1993, Zald and Dunn 2018
21. Schwilk and Ackerly 2001