Inequality is normal: Dominance of the big trees

May 8 2018

Large-diameter trees in the Douglas-fir/western hemlock forest of Winder River, Washinton, USA Credit: James Lutz/Utah State University

The top 1% of the forest has been sharing some vital information with researchers. Ninety-eight scientists and thousands of field staff have concluded the largest study undertaken to date with the Smithsonian Forest Global Earth Observatory (ForestGEO), and what they have found will have profound implications toward ecological theories and carbon storage in forests. Rather than examining tree species diversity in temperate and tropical ecosystems, this global study emphasized forest structure over a vast scale. Using large forest plots from 21 countries and territories, Utah State researchers found that, on average, the largest 1% of trees in mature and older forests comprised 50% of forest biomass worldwide. Furthermore, the amount of carbon that forests can sequester depends mostly on the abundance of big trees. The size of the largest trees was found to be even more important to forest biomass than high densities of small and medium trees. Lead author Jim Lutz, Assistant Professor at Utah State University said, "Big trees provide functions that cannot be duplicated by small or medium-sized trees. They provide unique habitat, strongly influence the forest around them, and store large amounts of carbon."

This study has shown that the structure of the forest is as important to consider as species diversity - the largest trees follow their own set of rules. Using 48 of the large forest dynamics plots from around the world coordinated by the Smithsonian ForestGEO Program, scientists were able to examine the variability of forest structure on a consistent basis. Co-author Dan Johnson, Research Associate at Utah State University said, "Having a worldwide group of scientists following the same methods offers us unique opportunities to explore forests at a global scale. This is a really wonderful group of scientists united by a passion for deepening our understanding of forests."

Tropical forests are well known to typically have many more species than temperate forests. However, this study found that temperate forests have higher structural complexity, both in terms of different tree sizes

within an area and also between adjacent areas of forest. Co-lead author Tucker Furniss, PhD student at Utah State University said, "The distribution of big trees has not been well explained by theory. Our results emphasize the importance of considering these rare, but disproportionately important ecosystem elements. We clearly need more applied and theoretical research on these important big trees."

The researchers also found that the largest trees are representatives of the more common tree species. The ability of some trees in any given forest to reach very large sizes relative to the other trees and concentrate resources seems to be a global phenomenon. "Big trees are special." Continued Lutz. "They take a long time to regrow if they are eliminated from a forest. Making sure that we conserve some big trees in forests can promote and maintain all the benefits that forests provide to us."

Large-diameter trees in the sugar pine/white fir forest of Yosemite National Park, California, USA Credit: James Lutz/Utah State University

More information: James A. Lutz et al, Global importance of large-diameter trees, *Global Ecology and Biogeography* (2018). DOI: 10.1111/geb.12747

Provided by Utah State University