

To: Rep. Kathy Castor, Chair, House Select Committee on the Climate Crisis  
Rep. Frank Pallone, Chair, House Energy and Commerce Committee  
Rep. Raúl Grijalva, Chair, House Natural Resources Committee  
Rep. Collin Peterson, Chair, House Agriculture Committee  
Sen. Lisa Murkowski, Chair, Senate Committee on Energy and Natural Resources  
Sen. John Barrasso, Chair, Senate Committee on Environment and Public Works  
From: Scientists concerned about climate and biodiversity impact of logging  
Date: 13 May 2020

Dear Members of Congress,

As forest and climate change scientists and experts, we are writing to urge you to oppose legislative proposals that would promote logging and wood consumption, ostensibly as a natural climate change solution, based on claims that these represent an effective carbon storage approach, or claims that biomass logging, and incinerating trees for energy, represents renewable, carbon-neutral energy.

We find no scientific evidence to support increased logging to store more carbon in wood products, such as dimensional lumber or cross-laminated timber (CLT) for tall buildings, as a natural climate solution. The growing consensus of scientific findings is that, to effectively mitigate the worst impacts of climate change, we must not only move beyond fossil fuel consumption but must also substantially *increase* protection of our native forests in order to absorb more CO<sub>2</sub> from the atmosphere and store more, not less, carbon in our forests (Depro et al. 2008, Harris et al. 2016, Woodwell 2016, Erb et al. 2018, IPCC 2018, Law et al. 2018, Harmon 2019, Moomaw et al. 2019).

Furthermore, the scientific evidence does not support the burning of wood in place of fossil fuels as a climate solution. Current science finds that burning trees for energy produces even more CO<sub>2</sub> than burning coal, for equal electricity produced (Sterman et al. 2018), and the considerable accumulated carbon debt from the delay in growing a replacement forest is not made up by planting trees or wood substitution (noted below). We need to increase growing forests to more rapidly close the gap between emissions and removal of CO<sub>2</sub> by forests, while we simultaneously lower emissions from our energy, industrial and agricultural sectors.

In your deliberations on this serious climate change issue, we encourage you to consider the following:

- The logging and wood products industries suggest that most of the carbon in trees that are logged and removed from forests will simply be stored in CLT and other wood products for buildings instead of being stored in forest ecosystems. However, this is clearly incorrect. Up to 40% of the harvested material does not become forest products and is burned or decomposes quickly, and a majority of manufacturing waste is burned for heat. One study found that 65% of the carbon from Oregon forests logged over the past 115 years remains in the atmosphere, and just 19% is stored in long-lived products. The remainder is in landfills (Hudiburg et al. 2019).
- Logging in U.S. forests emits 617 million tons of CO<sub>2</sub> annually (Harris et al. 2016). Further, logging involves transportation of trucks and machinery across long distances between the forest and the mill. For every ton of carbon emitted from logging, an additional 17.2% (106 million tons of CO<sub>2</sub>) is emitted from fossil fuel consumption to support transportation, extraction, and processing of wood (Ingerson 2007). In fact, annual CO<sub>2</sub> emissions from logging in U.S. forests are comparable to yearly U.S. emissions from the residential and commercial sectors combined (<https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks>). The

cumulative climate change impact of logging in the U.S. is even higher, since logging causes substantial reductions in carbon sequestration and storage potential in forests due to soil compaction and nutrient removal, and these combined impacts can often reduce forest carbon storage potential by 30% or more (e.g., Elliott et al. 1996, Walmsley et al. 2009).

- The wood products industry claims that substituting wood for concrete and steel reduces the overall carbon footprint of buildings. However, this claim has been refuted by more recent analyses that reveal forest industries have been using unrealistic and erroneous assumptions in their models, overestimating the long-term mitigation benefits of substitution by 2 to 100-fold (Law et al. 2018, Harmon 2019). The climate impact of wood is even worse if the reduced forest carbon sequestration and storage caused by nutrient loss and soil compaction from logging is included, as discussed above.

In countless public communications, and at numerous Congressional hearings, industry representatives have advocated for increased logging in the context of reducing wildland fire and related emissions. While small-tree thinning can reduce fire intensity when coupled with burning of slash debris (e.g., Perry et al. 2004, Strom and Fulé 2007) under very limited conditions, recent evidence shows intensive forest management characterized by young trees and homogenized fuels burn at higher severity (Zald & Dunn 2018). Further, the extremely low probability (less than 1%, Schoennagel et al. 2017) of thinned sites encountering a fire where thinning has occurred limits the effectiveness of such activities to forested areas near homes. Troublingly, to make thinning operations economically attractive to logging companies, commercial logging of larger, more fire-resistant trees often occurs across large areas.

Importantly, mechanical thinning results in a substantial net loss of forest carbon storage, and a net increase in carbon emissions that can substantially exceed those of wildfire emissions (Hudiburg et al. 2013, Campbell et al. 2012). Reduced forest protections and increased logging tend to make wildland fires burn *more* intensely (Bradley et al. 2016). This can also occur with commercial thinning, where mature trees are removed (Cruz et al. 2008, Cruz et al. 2014). As an example, logging in U.S. forests emits 10 times more carbon than fire and native insects combined (Harris et al. 2016). And, unlike logging, fire cycles nutrients and helps increase new forest growth.

We are hopeful that a new and more scientifically sound direction will be considered by Members that emphasizes increased forest protections, and a shift away from consumption of wood products and forest biomass energy, to help mitigate the climate crisis. We believe having a dialogue now would be productive, and we could help members of your Committees to be more effective in achieving the conservation and climate change goals that we share. We look forward to hearing from you and are available to provide additional scientific sources and serve as a resource for your Committees as you consider policy proposals on the climate crisis.

Sincerely,

***Lead Signatories***

*\* Affiliations listed for identification purposes only*

William R. Moomaw, Ph.D.  
Emeritus Professor  
The Fletcher School and Co-director Global  
Development and Environment Institute  
Tufts University  
Medford, MA, USA

Chad T. Hanson, Ph.D.  
Forest Ecologist  
Earth Island Institute  
Berkeley, CA, USA

Dominick A. DellaSala, Ph.D.  
Chief Scientist  
Geos Institute  
Ashland, OR, USA

George M. Woodwell, Ph.D., Founder  
Woods Hole Research Center  
Falmouth, MA

James E. Hansen, Ph.D.  
Director, Program in Climate Science,  
Awareness and Solutions  
Earth Institute, Columbia University  
New York, NY

William H. Schlesinger, Ph.D.  
James B. Duke Professor of Biogeochemistry  
Dean (Em.) the School of the Env., Duke Univ.  
President (Em.), the Cary Inst. of Eco. Studies  
Millbrook, NY

Michael E. Mann, Ph.D.  
Distinguished Professor  
Director, Earth System Science Center (ESSC)  
The Pennsylvania State University  
University Park, Pennsylvania

Peter H. Raven, Ph.D.  
President Emeritus, Missouri Botanical Garden  
George Engelmann Professor of Botany Emeritus,  
Washington University in St. Louis  
St. Louis, MO

Thomas Lovejoy, Ph.D.  
Professor, Environmental Science and Policy  
George Mason University  
Fairfax City, VA  
Senior Fellow, United Nations Foundation

Anne H. Ehrlich, Ph.D.  
Center for Conservation Biology  
Stanford University  
Palo Alto, CA

Paul R. Ehrlich, Ph.D., Professor Emeritus, Biology  
Stanford University  
President, Center for Conservation Biology  
Palo Alto, CA

William Ripple, Ph.D.  
Distinguished Professor of Ecology  
Oregon State University  
Corvallis, OR

Beverly Law, Ph.D., Professor Emeritus, Global  
Change Bio. and Terrestrial Systems Science  
Department of Forest Ecosystems & Society  
Oregon State University  
Corvallis, OR

Mark E. Harmon, Ph.D., Professor Emeritus  
Department of Forest Ecosystems & Society  
Oregon State University  
Corvallis, OR

Tara Hudiburg, Ph.D., Associate Professor  
Dept. of Forest, Rangeland, and Fire Sciences  
University of Idaho  
Moscow, ID

Scott Goetz, Ph.D., Professor, Carbon Cycle Science  
Northern Arizona University  
Science Lead, NASA Arctic Boreal  
Vulnerability Experiment  
Flagstaff, AZ

Michael Dorsey, Ph.D., M.F.S., M.A.  
M.F.S., Yale University, School of Forestry  
M.A., The Johns Hopkins Univ., Anthropology  
Ph.D., University of Michigan, School for  
Environment and Sustainability

Philip B. Duffy, Ph.D.  
President and Executive Director  
Woods Hole Research Center  
Falmouth, MA

Jennifer R. Marlon, Ph.D.  
Research Scientist & Lecturer  
Yale Program on Climate Change Communication  
Yale School of Forestry & Environmental Studies  
New Haven, CT

Richard A. Birdsey, Ph.D.  
Senior Scientist, Woods Hole Research Center  
Falmouth, MA  
Volunteer, U.S. Forest Service

Reed Noss, Ph.D.  
President and Chief Scientist  
Florida Institute for Conservation Science  
Chuluota, Florida

Wayne S. Walker, Ph.D.  
Carbon Program Director  
Woods Hole Research Center  
Falmouth, MA

Richard A. Houghton, Ph.D.  
Senior Scientist, George M. Woodwell Chair for  
Global Ecology at Woods Hole Research Center  
Falmouth, MA

Susan M. Natali, Ph.D.  
Arctic Program Director  
Woods Hole Research Center  
Falmouth, MA

Jennifer Francis, Ph.D.  
Senior Scientist  
Woods Hole Research Center  
Falmouth, MA

Susan A. Masino, Ph.D.  
Vernon Roosa Professor of Applied Science  
Trinity College  
Charles Bullard Fellow (2018-2019)  
Hartford, CT

Mary S. Booth, Ph.D., Director  
Partnership for Policy Integrity  
Pelham, MA

Stuart Pimm, Ph.D.  
Doris Duke Chair of Conservation  
Duke University  
Durham, NC

Juliette N. Rooney-Varga, Ph.D.  
Director, Climate Change Initiative  
Assoc. Prof., Environmental Science  
University of Massachusetts  
Lowell, MA

Barry R. Noon, Ph.D.  
Emeritus Professor  
Colorado State University  
Fort Collins, CO

Scott Denning, Ph.D.  
Monfort Professor of Atmospheric Science  
Colorado State University  
Fort Collins, CO

John Sterman, Ph.D.  
Professor and Director  
MIT Systems Dynamics Group  
Sloan School of Management  
Massachusetts Institute of Technology  
Cambridge, MA

Lori S. Siegel, Ph.D.  
P.E., Senior Modeler  
Climate Interactive  
Upper Valley, NH

Margaret (Meg) Lowman, Ph.D.  
Director, TREE Foundation  
National Geographic Explorer  
Adjunct Professor, Arizona State University  
Research Professor, Universiti Sains Malaysia

James N. Galloway, Ph.D.  
Sidman P. Poole Professor  
Environmental Sciences  
University of Virginia  
Charlottesville, Virginia

William L. Baker, Ph.D.  
Program in Ecology/Department of Geography  
University of Wyoming  
Laramie, WY

Eric Chivian, M.D.  
Founder and Former Director, Center for Health  
and the Global Environment  
Harvard Medical School  
Boston, Massachusetts

Cathy Whitlock, Ph.D.  
Regents Professor in Earth Sciences &  
Fellow of the Montana Institute on Ecosystems  
Montana State University  
Bozeman, MT

Derek E. Lee, Ph.D.  
Associate Research Professor  
Penn State University  
University Park, PA

Monica Bond, Ph.D.  
Principal Scientist  
Wild Nature Institute  
Concord, NH

John Talberth, Ph.D.  
President and Senior Economist  
Center for Sustainable Economy  
Portland, OR

Ernie Niemi, President  
Natural Resource Economics  
Eugene, OR

### ***Additional Signers***

R.W. Abrams, Ph.D.  
Principal Ecologist  
Dru Associates, Inc.  
Glen Cove, New York

Nektaria Adaktilou-Landenberger, Ph.D.  
Science & Management Specialist, WVLT, and  
Service Assistant Professor  
West Virginia Univ. / West Virginia Land Trust  
Morgantown, West Virginia

Ileene Anderson, M.S.  
Senior Scientist  
Center for Biological Diversity  
Los Angeles, California

William Anderson, Ph.D.  
Professor Emeritus  
Grice Marine Biological laboratory  
Charleston, South Carolina

Warren Aney, M.S.  
Senior Wildlife Ecologist  
Oregon Chapter The Wildlife Society  
Portland, Oregon

Gregory H. Aplet, Ph.D.  
Senior Science Director  
The Wilderness Society  
Denver, Colorado

Dennis C. Odion, Ph.D. (posthumous)  
Vegetation Ecologist<sup>[SEP]</sup>  
Earth Research Institute<sup>[SEP]</sup>  
University of California, Santa Barbara

Rosemary Sherriff, Ph.D., Professor  
Geography, Environment & Spatial Analysis  
Faculty, Environmental Studies Program  
Faculty, Forest & Wildland Sciences Graduate  
Program  
Humboldt State University, Arcata, CA

A. Z. Andis Arietta, M.S.  
Ph.D. Candidate  
Yale University  
New Haven, Connecticut

William Armbruster, Ph.D.  
Senior Research Scientist  
University of Alaska  
Fairbanks, Alaska

Henry Art, Ph.D.  
Emeritus Professor of Biology  
Director Center for Environmental Studies  
Williams College  
Williamstown, Massachusetts

Peter Bahls, M.S.  
Executive Director/Conservation Biologist  
Northwest Watershed Institute  
Port Townsend, Washington

Bryant Baker, M.S.  
Conservation Director  
Los Padres ForestWatch  
Santa Barbara, CA

Jesse Barber, Ph.D.  
Associate Professor  
Boise State University  
Boise, Idaho

Constance Dustin Becker, Ph.D.  
Co-Director  
Life Net Nature  
Willcox, Arizona

Craig Benkman, Ph.D., Professor  
University of Wyoming  
Laramie, Wyoming  
Robert L. Beschta, Ph.D., Professor Emeritus  
Forest Ecosystems and Society  
Oregon State University  
Corvallis, Oregon

Leslie Bishop, Ph.D.  
Emerita Professor of Biology  
Earlham College  
Nashville, Indiana

Scott Black, M.S.  
Executive Director  
Xerces Society for Invertebrate Conservation  
Portland, Oregon

Brian Bodenbender, Ph.D.  
Professor of Geological and Env.Science  
Hope College  
Holland, Michigan

Elizabeth Borer, Ph.D.  
Professor  
University of Minnesota  
Saint Paul, Minnesota

John Bowman, Ph.D.  
Professor  
Monash University  
Melbourne, Australia

Buma Buma, Ph.D.  
Assistant Professor  
University of Colorado, Denver  
Denver, Colorado

Philip Cafaro, Ph.D.  
Professor of Environmental Ethics  
Colorado State University  
Fort Collins, Colorado

Ken Carloni, Ph.D.  
Professor Emeritus  
Umpqua Community College  
Roseburg, Oregon

Kai Chan, Ph.D.  
Professor  
University of British Columbia  
Vancouver, British Columbia

Donald Charles, Ph.D.  
Senior Scientist  
Academy of Natural Sciences of Drexel Univ.  
Philadelphia, Pennsylvania

Tonja Chi, M.S.  
Wildlife Ecologist  
Campbell, California

Joseph Cook, Ph.D.  
Regents Prof. of Biology, Curator of Mammals  
University of New Mexico  
Albuquerque, New Mexico

Patrick Crist, Ph.D.  
Principal  
PlanIt Forward  
Broomfield, Colorado

Sam Davis, Ph.D.  
Conservation Scientist  
Dogwood Alliance  
Asheville, North Carolina

John M. DeCicco, Ph.D.  
Research Professor  
University of Michigan Energy Institute  
Ann Arbor, Michigan

Alan Dickman, Ph.D.  
Professor Emeritus  
University of Oregon  
Eugene, Oregon

Craig Downer, Ph.D.  
Wildlife Ecologist  
Andean Tapir Fund  
Minden, Nevada

Tom Dudley, Ph.D.  
Research Biologist  
University of California  
Santa Barbara, California

Mary Edwards, Ph.D.  
Professor  
University of Southampton  
Southampton, United Kingdom

Jerry Estberg, Ph.D.  
Professor Emeritus  
University of San Diego  
Port Angeles, Washington

Jonathan Evans, Ph.D.  
Professor of Biology  
University of the South  
Sewanee, Tennessee

Daniel Fisher, Ph.D., Professor  
University of Michigan  
Ann Arbor, Michigan

Johannes Foufopoulos, Ph.D.  
Associate Professor  
University of Michigan  
Ann Arbor, Michigan

Janet Franklin, Ph.D.  
Distinguished Professor  
University of California  
Riverside, California

Jerry Freilich, Ph.D., Chief of Research  
Olympic National Park (retired)  
Bend, Oregon

Lee Frelich, Ph.D.  
Director, Center for Forest Ecology  
University of Minnesota  
St. Paul, Minnesota

Christopher Frissell, Ph.D.  
Principal Scientist  
Frissell & Raven Hydrobiological and  
Landscape Sci.  
Polson, Montana

Evan Frost, M.S.  
Terrestrial Ecologist  
Wildwood Consulting LLC  
Ashland, Oregon

Dana Furgerson, M.S.  
Retired teacher  
Eugene, Oregon

Carol Garrett, Ph.D.  
Retired, Conservation Ecologist  
The Nature Conservancy  
Yreka, California

Daniel Gavin, Ph.D.  
Professor  
University of Oregon  
Eugene, Oregon

Janet Gehring, Ph.D.  
Associate Professor  
Bradley University  
Peoria, Illinois

Robert Good, D.V.M., M.S.  
Epidemiologist  
USDA  
Wellsville, Kansas

Steven Green, Ph.D.  
Emeritus Professor  
University of Miami  
Coral Gables, Florida

Gregory F. Grether, Ph.D.  
Professor  
University of California Los Angeles  
Los Angeles, California

Simon Gunner, M.S.  
Botanist  
Olofson Environmental, Inc.  
Berkeley, California

James G. Hallett, Ph.D.  
Chair, Society for Ecological Restoration  
Washington, District of Columbia

Richard W. Halsey, M.S.<sup>[SEP]</sup>  
The California Chaparral Institute  
Escondido, California

Debora Hammond, Ph.D.  
Professor Emerita, Environmental Studies  
Sonoma State University  
Cotati, California

John Harte, Ph.D.  
Professor of Ecosystem Sciences  
UC Berkeley  
Berkeley, California

Susanna Hecht, Ph.D., Professor  
University of California  
Los Angeles, California

Betsy Herbert, Ph.D.  
Environmental scientist & freelance writer  
Betsyherbert.com  
Corvallis, Oregon

Karen Holl, Ph.D.  
Professor of Environmental Studies  
University of California Santa Cruz  
Santa Cruz, California

Richard T. Holmes, Ph.D.  
Emeritus Professor of Biology  
Dartmouth College  
Hanover, New Hampshire

Elizabeth Horvath, M.S.  
Associate Professor, Biology  
Westmont College  
Santa Barbara, California

Malcolm Hunter, Ph.D., Professor  
University of Maine  
Orono, Maine

Mark Hunter, Ph.D.  
Earl E. Werner Distinguished Univ. Professor  
Henry A. Gleason Collegiate Professor  
University of Michigan  
Ann Arbor, Michigan

Richard Hutto, Ph.D., Professor Emeritus, Biology  
and Wildlife Biology  
Division of Biological Sciences  
University of Montana  
Missoula, Montana

Inés Ibáñez, Ph.D.  
Associate Professor  
School for Environment and Sustainability  
University of Michigan  
Ann Arbor, Michigan

Marc Imlay, Ph.D.  
Natural Places Chair, Sierra Club  
Bryans Road, Maryland

Alice Imlay, Ph.D.  
Natural Places Chair, Sierra Club  
Bryans Road, Maryland

Timothy Ingalsbee, Ph.D., Executive Director  
Firefighters United for Safety, Ethics, and Ecology  
(FUSEE)  
Eugene, Oregon

Anne Jacopetti, M.A.  
Retired Educator/Teacher  
350 Sonoma Steering Committee  
Santa Rosa, California

Karl Jarvis, Ph.D., Lecturer  
Southern Utah University  
Cedar City, Utah

Mitchell Johns, Ph.D.  
Professor of Crop and Soil Science  
California State University  
Chico, California

Jacob Kann, Ph.D.  
Aquatic Ecologist  
Aquatic Ecosystem Sciences LLC  
Ashland, Oregon

David Kanter, Ph.D.  
Assistant Professor of Environmental Studies  
New York University  
Vice-Chair International Nitrogen Initiative  
New York, New York

James Karr, Ph.D.  
Professor Emeritus  
University of Washington  
Sequim, Washington

Maya Khosla, M.S.  
Wildlife Biologist  
Rohnert Park, CA

Bruce Kirchoff, Ph.D.  
Professor  
University of North Carolina at Greensboro  
Greensboro, North Carolina

Rick Landenberger, Ph.D.  
Science & Management Specialist & Asst.Prof.  
West Virginia Univ. / West Virginia Land Trust  
Morgantown, West Virginia

Marc Lapin, Ph.D.  
Assoc. Lab Prof. & College Lands Ecologist  
Middlebury College  
Middlebury, Vermont

Prggy Lemaux, Ph.D.  
Faculty  
UC Berkeley  
Berkeley, California



Alan Levine, Director  
Coast Action Group  
Santa Rosa, California

Gene E. Likens, Ph.D.  
President and Dist. Senior Scientist, Emeritus  
Cary Institute of Ecosystem Studies  
Millbrook, New York

Jay Lininger, M.S.  
Principal Scientist  
Pyrolysis LLC  
Talent, Oregon

Frank Logiudice, M.S.  
Senior Instructor  
University of Central Florida  
Orlando, Florida

Chris Maser, M.S.  
Social-environmental Sustainability  
Corvallis, Oregon

Carl McDaniel, Ph.D.  
Professor Emeritus (Rensselaer)  
Visiting Professor Oberlin  
Rensselaer and Oberlin College  
Oberlin, Ohio

John McLaughlin, Ph.D.  
Associate Professor  
Western Washington University  
Bellingham, Washington

Fergus Mclean, B.S.  
Retired forester  
Dexter, Oregon

Gary Meffe, Ph.D.  
Conservation Biologist, retired  
University of Florida  
Gainesville, Florida

Douglas Meikle, Ph.D., Professor of Biology  
Miami University  
Oxford, Ohio

Vicky Meretsky, Ph.D.  
Prof., O'Neill School of Public & Env. Affairs  
Indiana University  
Bloomington, Indiana

Amy Moas, Ph.D.  
Greenpeace USA  
Oakland, California

Terri Moon, M.S.  
Rohnert Park, California

John Morse, Ph.D.  
Professor Emeritus  
Clemson University  
Clemson, South Carolina

Ellen Moyer, Ph.D., P.E., Principal  
Greenenvironment, LLC  
Montgomery, Massachusetts

Rob Mrowka, M.S.  
Senior Scientist, Retired  
Machias, New York

John Mull, Ph.D.  
Professor of Zoology  
Weber State University  
Ogden, Utah

Pete Murphy, Ph.D.  
Distinguished Professor Emeritus  
Michigan State University  
East Lansing, Michigan

Dennis Murphy, Ph.D.  
Emeritus Rearch Professor  
University of Nevada  
Reno, Nevada

K. Greg Murray, Ph.D.  
T. Elliot Weier Professor of Plant Science  
Hope College  
Holland, Michigan

James Murray, Ph.D.  
Retired Ecological Geneticist  
University of Virginia  
Charlottesville, Virginia

Phil Myers, Ph.D.  
Professor Emeritus  
University of Michigan  
Ann Arbor, Michigan

Knute Nadelhoffer, Ph.D.  
Professor, Dept. of Ecology & Evolutionary Biology  
and Director, UM Biological Station  
University of Michigan  
Ann Arbor, Michigan

Charles R. Neal, B.S.  
Ecologist  
USDA (retired)  
Cody, Wyoming

Robert Norman, Ph.D.  
Lebanon, New Hampshire

Richard Nyhof, Ph.D.  
Professor Emeritus  
Calvin University  
Grand Rapids, Michigan

Gordon Orians, Ph.D.  
Professor Emeritus  
University of Washington  
Seattle, Washington

Gustav Paulay, Ph.D.  
Curator & Professor  
University of Florida  
Gainesville, Florida

Timothy Pearce, Ph.D.  
Biologist  
Carnegie Museum of Natural History  
Pittsburgh, Pennsylvania

Barbara Peckarsky, Ph.D.  
Honorary Fellow and Adjunct Professor  
University of Wisconsin - Madison  
Madison, Wisconsin

Michael Pelizzari, Ph.D.  
Astrophysicist, retired  
Xero Carbon  
Milpitas, California

Esther Peters, Ph.D.  
Associate Prof., Env. Science and Policy  
George Mason University  
Fairfax, Virginia

Roger A Powell, Ph.D.  
Professor Emeritus, Dept. of Applied Ecology  
North Carolina State Univ.  
Raleigh, North Carolina

Thomas Power, Ph.D.  
Professor Emeritus  
Univ. of Montana  
Missoula, Montana

James Quinn, Ph.D.  
Professor Emeritus  
Rutgers University  
New Brunswick, New Jersey

John Ratti, Ph.D.  
Professor and Research Scientist, Retired  
University of Idaho  
New Meadows, Idaho

Barbara Reynolds, Ph.D.  
Professor Emeritus  
UNCA  
Asheville, North Carolina

Fred M. Rhoades, Ph.D.  
Research Associate, Biology Department  
Western Washington University  
Bellingham, Washington

Dina Roberts, Ph.D., Professor  
CIEE Global Institute  
Vancouver, Washington

Terry Root, Ph.D.  
Professor Emeritus  
Stanford University  
Stanford, California

Daniel Rosenberg, Ph.D.  
Oregon Wildlife Institute  
Corvallis, Oregon

Edwin Royce, Ph.D., Research Scientist (Retired)  
Department of Plant Sciences  
University of California at Davis  
Davis, California

Matthew Rubino, M.S.  
Research Scholar  
North Carolina State University  
Raleigh, North Carolina

Will Russell, Ph.D.  
Professor  
San Jose State University  
San Jose, California

Robin Salter, Ph.D.  
Professor Emeritus  
Oberlin College  
Oberlin, Ohio

Melissa Savage, Ph.D.  
Assistant Professor Emeritus  
University of California Los Angeles  
Los Angeles, New Mexico

Carol Savonen, M.S.  
Assistant Professor Emeritus  
Oregon State University  
Philomath, Oregon

Paul Schaeffer, Ph.D., Associate Professor  
Miami University  
Oxford, Ohio

Rae Schnapp, Ph.D.  
Conservation Director  
Indiana Forest Alliance  
Indianapolis, Indiana

John Schoen, Ph.D.  
Wildlife Ecologist  
Anchorage, Alaska

Tania Schoennagel, Ph.D.  
Research Scientist  
University of Colorado  
Boulder, Colorado

Kathy Schwager, M.S., Ecologist  
Yaphank, New York

Dave Seaborg, M.S., President  
World Rainforest Fund  
Walnut Creek, California

Mark Shapley, Ph.D.  
Research Associate  
National Lacustrine Core Facility  
Minneapolis, Minnesota

Steve Sheffield, Ph.D.  
Professor of Biology  
Bowie State University  
Bowie, Maryland

Diana Six, Ph.D.  
Professor, Forest Entomology and Ecology  
University of Montana  
Missoula, Montana

Ann Sloat, Ph.D.  
University of Hawaii  
Oahu, Hawaii

Winston Smith, Ph.D.  
Principal Research Scientist  
Institute of Arctic Biology, University of Alaska  
Juneau, Alaska

Copley Smoak, M.S.  
Volunteer  
Conservancy of SW Florida  
Naples, Florida

Stefan Sommer, Ph.D.  
Director of Education  
MPCER, Northern Arizona University  
Flagstaff, Arizona

Michael Soule, Ph.D.  
Professor Emeritus  
University of California  
Paonia, Colorado

Wayne Spencer, Ph.D.  
Chief Scientist  
Conservation Biology Institute  
San Diego, California

Trygve Steen, Ph.D.  
Professor, Env. Science and Management  
Portland State University  
Portland, Oregon

Richard Steiner, M.S.  
Conservation Biologist  
Oasis Earth  
Anchorage, Alaska

James Strittholt, Ph.D., President  
Conservation Biology Institute  
Corvallis, Oregon

Michael Swift, Ph.D.  
Assistant Professor Emeritus  
St. Olaf College  
Northfield, Minnesota

Alexandra Syphard, Ph.D.  
Chief scientist, Sage Insurance  
Conservation Biology Institute  
San Diego State University  
San Diego, California

John Terborgh, Ph.D.  
Professor Emeritus  
Duke University  
Durham, North Carolina

Stephen Tettelbach, Ph.D.  
Professor Emeritus of Biology  
Long Island University  
Brookville, New York

Pepper Trail, Ph.D., Ornithologist  
Ashland, Oregon

Vicki Tripoli, Ph.D., Retired  
Moorpark, California

Walter Tschinkel, Ph.D.  
Professor Emeritus  
Florida State University  
Tallahassee, Florida

Anna Tyler, Ph.D.  
Research Scientist  
The Jackson Laboratory  
Bar Harbor, Maine

Rick Van de Poll, Ph.D., Principal  
Ecosystem Management Consultants  
Center Sandwich, New Hampshire

John Vickery, M.S.  
Natural Areas Specialist  
Denver, Colorado

David Wake, Ph.D.  
Prof. of the Grad. School in Integrative Biology  
University of California  
Berkeley, California

Don Waller, Ph.D.  
J.T. Curtis Professor of Botany, retired  
Univ. of Wisconsin - Madison  
Madison, Wisconsin

David Whitacre, Ph.D.  
Instructor, Biology and Statistics  
Treasure Valley Math and Science Center  
Boise, Idaho

Norris Williams, Ph.D., Curator Emeritus  
Florida Museum of Natural History  
Gainesville, Florida

Shaye Wolf, Ph.D.  
Climate Science Director  
Center for Biological Diversity  
Oakland, California

David Wood, Ph.D.  
Professor of the Graduate School  
UC Berkeley  
Berkeley, California

George Wuerthner, M.S.  
Researcher/writer  
Public Lands Media  
Bend, Oregon

## References

- Bradley, C.M. C.T. Hanson, and D.A. DellaSala. 2016. Does increased forest protection correspond to higher fire severity in frequent-fire forests of the western USA? *Ecosphere* 7: article e01492.
- Campbell, J.L., M.E. Harmon, and S.R. Mitchell. 2012. Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions? *Frontiers in Ecology and Environment* 10: 83-90.
- Cruz, M.G., M.E. Alexander, and J.E. Dam. 2014. Using modeled surface and crown fire behavior characteristics to evaluate fuel treatment effectiveness: a caution. *Forest Science* 60: 1000-1004.
- Cruz, M.G., M.E. Alexander, and P.A.M. Fernandes. 2008. Development of a model system to predict wildfire behavior in pine plantations. *Australian Forestry* 71: 113-121.
- Depro, B.M., et al. 2008. Public land, timber harvests, and climate mitigation: Quantifying carbon sequestration potential on U.S. public timberlands. *Forest Ecology and Management* 255: 1122-1134.
- Elliot, W.J., et al. 1996. The effects of forest management on erosion and soil productivity. Symposium on Soil Quality and Erosion Interaction. July 7, 1996, Keystone, CO.

- Erb, K.H., et al. 2018. Unexpectedly large impact of forest management and grazing on global vegetation biomass. *Nature* 553: 73-76.
- EPA. 2017. Inventory of US Greenhouse Gas Emissions and Sinks: 1990–2016 (Washington, DC: Environmental Protection Agency).
- Harris, N.L., et al. 2016. Attribution of net carbon change by disturbance type across forest lands of the conterminous United States. *Carbon Balance Management* 11: Article 24.
- Harmon, M.E., et al. 1996. Modeling carbon stores in OR and WA forest products: 1900-1992. *Climatic Change* 33: 21- 50.
- Harmon, M.E. 2019. Have product substitution carbon benefits been overestimated? A sensitivity analysis of key assumptions. *Environmental Research Letters* 14: Article 065008.
- Hudiburg, T.W., et al. 2013. Interactive effects of environmental change and management strategies on regional forest carbon emissions. *Environmental Science and Technology* 47: 13132-13140.
- Hudiburg, T.W., Beverly E. Law, William R. Moomaw, Mark E. Harmon, and Jeffrey E. Stenzel. 2019. Meeting GHG reduction targets requires accounting for all forest sector emissions. *Environmental Research Letters* 14: Article 095005.
- Ingerson, A. 2007. U.S. forest carbon and climate change. The Wilderness Society, Washington, D.C.
- IPCC. 2018. United Nations Intergovernmental Panel on Climate Change, Report SR1.5, Summary for Policymakers, p. 19.
- Law, B.E., et al. 2018. Land use strategies to mitigate climate change in carbon dense temperate forests. *Proceedings of the National Academy of Sciences of the United States of America* 115: 3663-3668.
- Moomaw W.R, Masino S.A. and Faison E.K..2019. Intact Forests in the United States: Proforestation Mitigates Climate Change and Serves the Greatest Good. *Frontiers in Forests and Global Change* 2: Article 27.
- Perry, D.A., et al. 2004. Forest structure and fire susceptibility in volcanic landscapes of the eastern High Cascades, Oregon. *Conservation Biology* 18: 913-926.
- Schoennagel, T., et al. 2017. Adapt to more wildfire in western North American forests as climate changes. *Proceedings of the National Academy of Sciences of the USA* 114: 4582–4590.
- Sterman, J.D., L. Siegel, and J.N. Rooney-Varga. 2018. Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy. *Environmental Research Letters* 13: Article 015007.
- Strom, B.A., and P.Z. Fulé. 2007. Pre-wildfire fuel treatments affect long-term ponderosa pine forest dynamics. *International Journal of Wildland Fire* 6: 128-138.
- Walmsley, J.D., et al. 2009. Whole tree harvesting can reduce second rotation forest productivity. *Forest Ecology and Management* 257: 1104-1111.
- Woodwell, G.M. 2016. *A World to Live In: An Ecologist's Vision for a Plundered Planet*. MIT Press, Cambridge, MA.
- Zald, H.S.J., and C.J. Dunn. 2018. Severe fire weather and intensive forest management increase fire severity in a multi-ownership landscape. *Ecological Applications* 28:1068-1080. doi: 10.1002/eap.1710.