

Modernizing Federal Forest Management To Mitigate and Prepare for Climate Disruption:

**Science-based Recommendations to The Obama Administration in Response to The President's November 1, 2013 Executive Order:
*Preparing the United States for the Impacts of Climate Change***



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NOTE: these recommendations were developed in 2014 by the FCC when it focused solely on federal forestlands. For more information about these recommendations, please contact: info@corestcarboncoaliton.org.



Modernizing Federal Forest Management To Mitigate and Prepare For Climate Disruption

Science-based Recommendations to The Obama Administration in Response to The President's November 1, 2013 Executive Order: *Preparing the United States for the Impacts of Climate Change*

The Federal Forest Carbon Coalition (FFCC) is a first-of-a-kind consortium of national, regional, and local organizations that believe the management of federal forests must be reoriented and modernized to emphasize stabilizing the climate and preparing for climate change and other natural disturbances. FFCC members are focused on forests, biodiversity, fisheries, rivers, faith and spirituality, Native American treaty rights, youth, rural communities, and climate disruption.

In this document, the FFCC members listed on page 5 offer recommendations on the policies, programs, regulations, and practices that the Departments of Interior and Agriculture and other federal forest management agencies should adopt to meet the goals of President Obama's Climate Action Plan of June 2013, and the requirements of President Obama's Executive Order 13653, of November 1, 2013: *Preparing the United States for the Impacts of Climate Change*. The FFCC's recommendations specifically focus on the EO's dual requirements that federal agencies: a) "...complete an inventory and assessment of proposed and completed changes to their land- and water-related policies, programs, and regulations necessary to make the Nation's watersheds, natural resources, and ecosystems, and the communities and economies that depend on them, more resilient in the face of a changing climate..."; and b) "...focus on program and policy adjustments that promote the dual goals of greater climate resilience and carbon sequestration, or other reductions to the sources of climate change."

The FFCC commends President Obama for issuing the Executive Order. It is very timely because federal forests can and must play an important role in responding to the urgent needs—described in this year's reports from the U.S. National Academy of Sciences, the Intergovernmental Panel on Climate Change, and the National Climate Assessment—for (i) large and rapid reductions in greenhouse gas emissions to prevent runaway climate disruption and (ii) increased resilience to climate impacts. Federal agencies have taken some positive steps to address these needs by, for example, quantifying some carbon stocks and analyzing changes in carbon held in federal forests. However, assessing carbon is not sufficient. The agencies must quickly and definitively elevate their efforts to the scale of the climate crisis by amending existing policies, programs, and regulations and adopting new ones to reduce the sources of climate change and increase resilience to climate and other natural disturbances, as the President's Executive Order requires.

The necessity for new forest-management regimes to satisfy the requirements expressed in the President's Executive Order is also great because most of the policies, programs and regulations that shape the management of federal forests were adopted well before the risks of runaway climate change were so well understood. Consequently, many either offer little direction for how federal agencies should manage forests to minimize the release of carbon emissions and prepare for climate impacts, or promote activities that produce the opposite effects, contrary to the goals of the President's Executive Order. In addition, many of the tools used by, as well as the training and expertise of most of the personnel of federal forest management agencies, reflect conditions that existed prior to today's understanding of the climate crisis. This has led many agencies to apply timber management principles and practices to carbon management, when in fact they are very different issues that require a different mindset, goals, policies, regulations, programs, and management tools.

Similarly, many commercial, recreational, and other uses of federal forests were established before the risks of runaway climate disruption became well-known. Consequently, many uses and practices often exacerbate rather than diminish these risks. For the sake of the current and all future generations, it is essential to rapidly modernize the way federal forests are managed and utilized to reduce the profound ecological, economic, and social risks associated with uncontrolled climate disruption.

The FFCC recommendations are framed around six interrelated goals that we believe offer an appropriate set of organizing principles for modernizing federal forest management in an era of climate change, now and in the future. We believe these goals and principles are fully consistent with the suite of existing laws that govern federal forest management:

- I. Recognize carbon as a significant public resource and establish carbon and climate change-centered goals for all decisions affecting federal forest management.
- II. Maintain the existing stocks of carbon on federal forests, including carbon in live and dead materials, above and below ground.
- III. Increase the amount of carbon stored on federal forests.
- IV. Enhance, consistent with goals I, II, and III, the resilience of federal forests to climate change-related and other natural disturbances.
- V. Generate social, economic, and ecological co-benefits consistent with goals I, II, III, and IV.
- VI. Fully account for the benefits and costs of any decreases or increases in atmospheric carbon dioxide and other greenhouse gases in all forest-related policies, programs, regulations, and development proposals.

The FFCC encourages CEQ and OMB to use our recommendations to evaluate the proposals put forward by the Departments of Interior and Agriculture, and all other federal forest management agencies. Whenever an agency's proposals differ from the FFCC's recommendations, the FFCC recommends that CEQ and OMB require the agencies to produce comprehensive, transparent scientific and economic analysis demonstrating the validity of and factual basis for their alternative approach. These steps will lay a solid science-based foundation for accomplishing the President's substantive objectives of reducing the risk of runaway climate change, and will also help establish the leadership of the President and the Executive Branch globally in addressing the climate crisis.

Summary of FFCC Recommendations

The FFCC recommends that The White House and all federal forest management agencies adopt the following goals, policies, regulations, and practices:

Goal I: Recognize Carbon As A Significant Public Resource and Establish Carbon and Climate Change-Centered Goals For All Decisions Affecting Federal Forest Management.

Goal II: Maintain the Existing Stocks of Carbon on Federal Forests, Including Carbon in Live and Dead Materials, Above and Below Ground

Specific Recommendations:

- A. Permanently withdraw high-biomass forested areas nationwide from further commercial timber harvest and other development activities.
- B. Authorize commercial timber harvest and other development activities in other mature forests only when analysis shows the carbon benefits exceed the full costs over the mid-term (i.e. 20-40 years).
- C. Establish in planning rules a requirement to designate and conserve forested areas with higher than average carbon biomass.

Goal III: Increase the Amount of Carbon Stored on Federal Forests

Specific Recommendations:

- A. Prevent management activities, including but not limited to timber harvests that would reduce increases in carbon stocks on a federal forest.
- B. Increase the carbon stored on federal forests by reducing human disturbances.

Goal IV: Enhance, Consistent with Goals I, II, and III, The Resilience Of Federal Forests To Climate Change-Related and Other Natural Disturbances

Specific Recommendations:

- A. Use principles of conservation biology as the basis for increasing the resilience of federal forests, including restoration of more natural fire regimes in mesic and xeric forests, away from human habitation and infrastructure.
- B. Where needed, prioritize forest thinning in the immediate vicinity of human habitation and infrastructure and avoid thinning elsewhere unless analysis shows net carbon benefits, over the mid-term (i.e. 20-40 years).

- C. Prohibit the burning and salvage logging of dead wood in high biomass and mature forests.
- D. Place a 5-year moratorium on new leases for fracking for oil and natural gas on federal forests to allow for an assessment of hydrofracking consequences and the values at risk on our national forests.
- E. Deny proposals to extract biomass for energy or to harvest timber for wood products unless analysis shows net carbon benefits over the mid-term (i.e. 20-40 years).
- F. Significantly reduce carbon emissions generated by the use of fossil fuels in forest-related activities.

Goal V: Generate Social, Economic, and Ecological Co-Benefits Consistent With Goals I, II, III, and IV.

Specific Recommendations:

- A. Increase the supply of ecosystem services compatible with storing carbon on federal forests.
- B. Promote carbon-conservation and restoration jobs consistent with climate and ecological goals.
- C. Realign forest-related payments to local governments to reflect the direct value of storing carbon and the value of the co-benefits of other ecosystem services provided by forests.

Goal VI: Fully Account For The Benefits and Costs of Any Decreases or Increases in Atmospheric Carbon and Other Greenhouse Gasses In All Forest-related Policies, Programs, Regulations, and Practices.

Specific Recommendations:

- A. Publicly and consistently highlight the need to alter federal forest policies and management to reduce the risks of climate change.
- B. Invest in and build the capacity of federal forest management agencies to understand the science and manage for carbon storage and climate resilience.
- C. Require scientific, comprehensive, transparent analysis of the ecological, social, and economic costs of changes in carbon due to all management activities before approval.

FFCC Member Organizations Endorsing These Recommendations

Southeast Alaska Conservation Council
Natural Resources Defense Council
Interfaith Moral Action on Climate
Kids Vs. Global Warming/I Matter
Virginia Forest Watch
American Bird Conservancy
Geos Institute
Great Old Broads for Wilderness
Colorado Mountain Club
Oregon Wild
The Resource Innovation Group
National Sierra Club
Glacier Climate Action
Conservation Northwest
North Cascades Conservation Council
Klamath-Siskiyou Wildlands Center
Southern Oregon Climate Action Now
Los Padres ForestWatch
The Coast Range Association
The Tribal Environmental Policy Center
Klamath Forest Alliance
Epic-Environmental Protection Information Center
High Country Conservation Advocates
Western Watersheds Project
Center for Rural Affairs
RESTORE: The North Woods
Swan View Coalition
Umpqua Watersheds
South Umpqua Rural Community Partnership (SURCP)
Pacific Rivers Council
Mid Klamath Watershed Council
Cascadia Wildlands
Utah Rivers Council
The Clinch Coalition
Hells Canyon Preservation Council
Rock Creek Alliance
Save Our Cabinets
The Wildlife Center
Golden Eagle Audubon Society
WildEarth Guardians
Forests Forever
Sheep Mountain Alliance
San Luis Valley Ecosystem Council
Western Colorado Congress
Snowriders International
EcoFlight



Modernizing Federal Forest Management To Mitigate and Prepare For Climate Disruption

**Detailed Recommendations to The Obama Administration
From The Federal Forest Carbon Coalition**

Goal I: Recognize Carbon as a Significant Public Resource and Establish Carbon and Climate Change-Centered Goals for All Decisions Affecting Federal Forest Management.

Recent reports by the National Academy of Science, Intergovernmental Panel on Climate Change, and the U.S. Global Change Research Program make clear that climate change is already having significant impacts in the U.S., and that major rapid changes are needed to reduce the risks of runaway climate change. Because federal forests store large amounts of carbon, and managerial decisions for these forests can determine how well they continue to play this vital role, all federal forest management agencies should be required to recognize carbon as a significant public resource and adopt clear carbon and climate change-centered goals.

The FFCC therefore recommends that the Departments of Interior and Agriculture and all other federal forest management agencies adopt goals to maintain existing carbon stocks while also increasing carbon stored, especially where it is harmonious with other multiple-use objectives, such as clean water, high quality habitat for fish & wildlife, recreation, and scenic values. These goals should direct forest management agencies to do whatever is possible to harmonize carbon storage and climate resilience, resolving conflict in favor of carbon storage because uncontrollable climate change will overwhelm resilience measures while causing devastating impacts for all of humanity, now and in the future.

Goal II: Maintain the Existing Stocks of Carbon on Federal Forests, Including Carbon In Live and Dead Materials, Above and Below Ground

A. Permanently Withdraw High-Biomass Forested Areas Nationwide From Further Commercial Timber Harvest and Other Development Activities.

Runaway climate change will eventually devastate the U.S. and global economy and diminish the resilience of federal forests. To reduce these risks, quick and decisive action is needed to prevent, whenever feasible, the release of carbon into the atmosphere. Federal forests must be a core element of this action. The National Forests, alone, currently hold more than 10 billion metric tonnes of carbon. Research suggests that, if managed appropriately, the nation's terrestrial ecosystems could offset as much as 40% of these emissions.¹ While this total includes agricultural and other lands, the FFCC will limit its recommendations to federal forests.

A vital, early action needed to reduce carbon emissions is to prevent, whenever feasible, the release of stored carbon on federal forests. The largest amount of carbon on federal forests is found in high-biomass forests, as defined by Krankina et al.² Protecting high-biomass forest areas is an essential starting point for any scientifically credible forest response to the President's Executive Order 13653.

The FFCC specifically recommends that all federal forest management agencies immediately withdraw all high-biomass forests on federal lands from further commercial timber harvest, road building, post-fire logging, and other development activities. Agencies should use the definition and process described by Krankina et al. to identify these areas.³

B. Authorize Commercial Timber Harvest and Other Development Activities in Other Mature Forests Only When Analysis Shows The Carbon Benefits Exceed the Full Costs over the mid-term (i.e. 20-40 years).

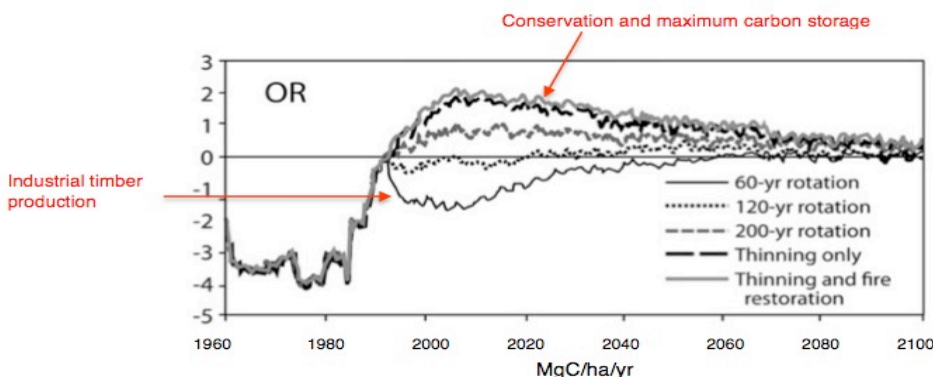
Mature forested areas, as defined by federal forest management agencies, also provide opportunities for maintaining carbon stocks on federal lands. The release of carbon from these areas must also be avoided. The FFCC therefore recommends that commercial harvest, road building, and other development activities should be avoided in moist mature forests, and authorized in other forests only after federal agencies have completed scientific, comprehensive, transparent analysis that shows that the carbon benefits of the activities substantially exceed the costs.

Two recent publications illustrate an approach for estimating the economic value of the carbon stored or emitted under forest-management alternatives. One publication estimates the social cost of carbon, i.e., the value of the economic damage that will result from the emission of one metric tonne of carbon dioxide or, conversely, the value of the damage that

will be prevented by sequestering the same amount.⁴ The mid-level estimates range from about \$33 in 2015 to \$71 in 2050 (2007 dollars).

The second publication, by forest scientists at Oregon State University, estimates the amount of carbon dioxide that would be emitted or sequestered under forest-management alternatives for federal lands managed by the Northwest Forest Plan (NWFP).⁵ This research traced carbon stores on these lands from 1960 until the adoption of the NWFP in 1993, and then projected carbon stores under five alternatives: industrial logging with 60-year rotations, logging with 120-year rotations, logging with 200-year rotations, conservation with the thinning and fire-management currently allowed by the NWFP, and conservation with current level of thinning and restoration of historical fire regimes. The researchers did not assess an alternative with no thinning. The modeling found that, through 2100, the first of the alternatives (60-year rotations) would convert the greatest amount of forest carbon to atmospheric carbon dioxide, and the last of the alternatives (thinning and fire restoration) would store the most carbon.

The graph below shows the annual results for lands in Oregon, measured in Mg of carbon per hectare per year. These results, converted to the equivalent annual metric tonnes of carbon dioxide emitted or sequestered and multiplied by the social cost of carbon for each year, can support a comparison of the carbon-related social costs, or benefits, of one alternative versus another.



Source: Krankina, et al. (2012 p. 176).

Such a comparison would provide only an initial estimate of the carbon-related costs or benefits of one alternative relative to another. Additional consideration should be given to accounting for, even if qualitatively, major sources of uncertainty in the analysis. The analysis also should transparently account for other effects, such as the value of each alternative's effects on clean water, habitat, and other co-benefits of carbon stored by federal forests, as well as for effects not included in the estimates of the social cost of carbon. These include effects, like those associated with the acidification of freshwater and seawater resulting from rising atmospheric carbon dioxide levels, that cannot be monetized with currently available information.

C. Establish in Planning Rules a Process to Classify, Designate, and Conserve Forested Areas With High Carbon Stocks.

The growing risks of runaway climate change mean that the long-term conservation of forested areas with high carbon stocks must become a top priority for federal forest management agencies.

FFCC therefore recommends that a process be initiated to incorporate into planning rules a new land use classification that leads to the designation and permanent conservation of forested areas with high carbon stocks. The FFCC also recommends that a formal process be established to define the criteria that will be used to determine such classifications and to nominate forest areas that satisfy these criteria. While the criteria are being established, the FFCC recommends using levels above regional forest biomass averages for specific forest types to determine relative significance of carbon stores because similar techniques have been used in the literature (Krankina et al. in press). ⁶

Establishing a new classification for the conservation of forested areas with high carbon stocks is consistent with both the National Forest Management Act (NFMA) and the Federal Land Policy and Management Act (FLPMA). The NFMA language (16 U.S.C. § 1603) states, for example, that "the Secretary of Agriculture shall develop and maintain on a continuing basis a comprehensive and appropriately detailed inventory of all National Forest System lands and renewable resources. This inventory shall be kept current so as to *reflect changes in conditions and identify new and emerging resources and values*" (italics added). The emergence of climate change certainly reflects new conditions and scientists have identified high-biomass forests as an incredibly important emerging resource and value.

Goal III: Increase the Amount of Carbon Stored In Federal Forests

A. Prevent management activities, including but not limited to timber harvests that would reduce increases in carbon stocks on a federal forest.

The FFCC strongly believes that federal forest management agencies must adopt policies, programs, regulations, and practices to increase carbon sequestration on federal forests through practices while *also* maintaining the existing stocks of carbon. In other words, actions to accelerate the sequestration of carbon from the atmosphere must not increase the release of carbon currently stored in the trees and soils of federal forests.

A starting point for achieving this goal is to prevent deforestation from development activities, unsustainable timber harvests, and other actions that would degrade a forest's ability to sequester and store carbon. The FFCC therefore recommends that policies, programs, and regulations be adopted to prevent deforestation resulting from road building, energy production, and other development activities, as well as the conversion of forests to pasture, or scrub lands. The FFCC opposes policies and projects that would reduce a forest's capacity to sequester and store carbon.

B. Increase the carbon stored on federal forests by reducing human disturbances.

Older forests sequester and store additional carbon as they age. Thus, increasing rotation ages and lengthening the interval between commercial timber harvests will, over time, increase carbon stored in forests. By contrast, harvesting trees in short rotations generally reduces the amount of carbon held in a forest, especially when fully accounting for the damage to soils and biodiversity often created by heavy equipment and the emissions generated by the equipment and other practices associated with commercial timber harvest.⁷

The FFCC therefore recommends that federal forest management agencies increase forest growth by reducing both the frequency and intensity of human disturbances. This will also increase the resilience of federal forests to climate and other natural disturbances by increasing the diversity of vegetation and age classifications. In addition, longer rotations will significantly enhance ecological co-benefits such as habitat diversity and cleaner supplies of water and reduced risk of landslides and flooding for downstream agricultural and urban uses.

Goal IV: Enhance, Consistent with Goals I, II, and III, The Resilience of Federal Forests to Climate Change-Related and Other Natural Disturbances.

A. Use Principles of Conservation Biology, Including Restoration of More Natural Fire Regimes in Mesic and Xeric Forests, As the Basis for Building the Resilience of Federal Forests

Conservation biology is a "mission-oriented crisis" multidisciplinary science that has developed to address the loss of biological diversity (Soulé 1986)

Climate change presents a new set of challenges for federal forests that traditional forest-management principles and practices do not adequately address. For example, respected conservation biologist Reed Noss states:

*"Among the land-use and management practices likely to maintain forest biodiversity and ecological functions during climate change are (1) representing forest types across environmental gradients in reserves; (2) protecting climatic refugia at multiple scales; (3) protecting primary forests; (4) avoiding fragmentation and providing connectivity, especially parallel to climatic gradients; (5) providing buffer zones for adjustment of reserve boundaries; (6) practicing low-intensity forestry and preventing conversion of natural forests to plantations; (7) maintaining natural fire regimes; (8) maintaining diverse gene pools; and (9) identifying and protecting functional groups and keystone species. Good forest management in a time of rapidly changing climate differs little from good forest management under more static conditions, but there is increased emphasis on protecting climatic refugia and providing connectivity."*⁸

Similarly, recommendations made by the Climate Leadership Initiative at the University of Oregon in its 2008 *Framework for Integrative Preparation Planning* include ⁹:

- *Reduce anthropogenic stress in anticipation of increased climate stress, which means less logging, less roads, less weeds, etc.*
- *In the face of uncertainty, "no regrets" decisions are preferable.*
- *Maintain diversity of native species, genes, and ecosystem composition and structure.*
- *Maintain self-organized ecosystem resilience and resistance.*
- *Maintain natural disturbance regimes such as recurrent wild fire and flood plain inundation.*
- *Maintain connectivity for wildlife interaction with food supply and migration to more suitable habitat under new climate conditions.*
- *Complementarity – this concept captures the co-benefits that climate change preparation strategies will create by improving wildlife habitat, biodiversity, water quality, carbon storage, scenic values, and other "ecosystem services."*
- *Equity should be adhered to across generations, among human communities and between human and natural systems.*

- *Humility requires recognizing that interventions to prepare ecosystems for climate change should be informed, limited, and strategic.*
- *Abundance and redundancy will spread the risks of habitat loss due to climate change spatially across landscapes.*

In many cases these principles conflict with traditional approaches to federal forest management. However, the risks of runaway climate change are large and growing. The FFCC therefore recommends that all federal forest-management agencies use the principles stated above, and other principles and strategies of conservation biology, as the basis for efforts to build the resilience of federal forests nationwide to climate change-related and other natural disturbances.

B. Where Needed, Focus Fire-Related Forest Thinning in the Immediate Vicinity of Human Habitation and Infrastructure and Avoid Thinning Elsewhere Unless Analysis Shows Net Carbon Benefits over the Mid-term (20-40 years).

The FFCC recognizes that on-going and expected future changes in climate will continue to increase the risk of disturbances, such as fire and insect infestation, or as more intense droughts and other changes in growing conditions retard the growth of or kill trees. Species distribution shifts are also likely in response to climate change over decades to centuries. In addition, the FFCC recognizes the hazards of wildfires for communities and essential built infrastructure, and that members of the public often have a visceral reaction to wildfire, especially when a fire threatens their lives or property.

However, it is important to remember that fire has in the past and continues today to play a major role in maintaining forest diversity and resilience. While recent studies have shown an increase in the onset and length of the fire season, and in the extent of wildfires in certain places, some research suggests that in most locations there is an overall deficit in wildfire compared to historical conditions.¹⁰ In addition, as climate becomes more of a top-down driver of fire behavior, thinning will become less effective and will require increasing effort over large landscapes, thereby increasing carbon emissions above the level released by even severe fire.

The FFCC therefore recommends that, as much as possible, a goal of federal forest-management agencies should be to avoid interfering with the return of more natural forest fire regimes. The FFCC also recommends that, when it is needed, forest thinning aimed at reducing the risk of wildfire be limited to the immediate vicinity of structures inhabited by people, and to critical built infrastructure where concerns about human safety and economic risk are greatest, reduced fuel loads are shown to impact the survival of structures and infrastructure, and thinning treatments can be readily maintained.

A growing body of research has raised significant questions about the need for and the carbon implications of, thinning treatments. A good summary of some of these questions is provided below. It is excerpted from “Wildland fire emissions, carbon, and climate: Seeing the forest and the trees – A cross-scale assessment of wildfire and carbon dynamics in fire-

prone, forested ecosystems” recently published in the *Journal Forest Ecology and Management* ¹¹:

“The stochastic and variable nature of fires, the relatively fine scale over which fuels treatments are implemented, and potentially high carbon costs to implement them suggest that fuel treatments are not an effective method for protecting carbon stocks at a stand level (Reinhardt et al., 2008; Reinhardt and Holsinger, 2010). For example, in fire-prone forests of the western US, because of the relative rarity of large wildfires and limited spatial scale of treatments, most treated areas will not be exposed to wildfire within the 10–25 year life expectancy of the treatment (Rhodes and Baker, 2008; Campbell et al., 2012; North et al., 2012). Further, some studies show that the difference in carbon emissions between low-severity and high-severity fire is small when scaled across an entire wildfire because consumption of fine surface fuels associated with low-severity fire occurs across broad spatial extents, while consumption of standing fuels associated with high-severity fires occurs in small patches within the larger wildfire perimeter (Campbell et al., 2012). Fuel treatments designed to reduce wildfire severity and wildfire-related carbon emissions have carbon costs in the form of fossil fuel emissions from harvesting activities, transportation of removed material, and milling waste (North et al., 2009). In addition, because probability of fire increases with time since fire, fires cannot be excluded indefinitely from fire-prone forests, and large surface and ladder fuel loads associated with long-unburned stands are more likely to result in high-severity wildfires and large carbon releases (Peterson et al., 2005; Stephens et al., 2009a). High carbon stocks resulting from fire exclusion and in-growth, particularly in forests adapted to frequent fire, are unlikely to be sustainable (Hurteau et al., 2011).

“Fires confer ecological benefits that may (e.g., nutrient release and redistribution and stimulation of plant growth, increased productivity in soil systems from decomposition of burned material, initiation of vegetation succession and forest regeneration, increased availability of resources for surviving trees) or may not (e.g., increased plant species richness, creation of critical wildlife habitat, biodiversity and heterogeneity) be directly measurable in units of carbon (Habeck and Mutch, 1973; Boerner, 1982; Delong and Tanner, 1996; Hirsch et al., 2001; Saab et al., 2004; Turner et al., 2004; Hutto, 2008; Keane et al., 2009; Schoennagel et al., 2009). In addition, suppression of wildfires in fire-prone landscapes, while initially increasing forest carbon density (Canadell and Raupach, 2008), may increase vulnerability of systems to transformation; i.e., reduce resistance (Walker et al., 2004; Briske et al., 2006; Pausas and Keeley, 2009). Because of inherent difficulties in tracking long-term benefits of treatments, recent papers have suggested that we should question not *how* forests can be managed for carbon, but *whether* they can be managed for carbon, especially using current management practices (Mitchell et al., 2009; Campbell et al., 2012; Bowman et al., 2013).”

Because scientific questions that have been raised about the degree to which forests in many regions of the nation are actually outside of their natural fire regime, and because questions have been raised about efficacy of forest thinning as a tool to reduce the risks of wildfire and associated loss of carbon, the FFCC recommends that fire-related thinning on federal forests be limited to the structure/infrastructure zone described above, with the goal of reducing the risks of fire to people, structures, and infrastructure and to areas where, and to the extent, clearly needed to preserve critical habitats or ecosystem components.

C. Prohibit The Burning and Salvage Logging of Dead Wood in High Biomass and Mature Forests

While it is often assumed that salvage logging provides ecological benefits, significant scientific questions have been raised about the efficacy of this practice. For example, it is often assumed that salvage logging focuses only on dead trees. In practice, however, salvage logging typically includes harvesting live green trees as well, which reduces carbon stored on federal lands. It is often wrongly assumed that burned or other dead trees do not store significant carbon for long periods of time. In addition, carbon emissions are generated from harvesting equipment, transportation of material, milling, and wood waste.¹² Due to the heavy equipment used, salvage logging also often damages or kills native seedlings, compacts and disturbs soils, releases sediment into streams, and produces other impacts that reduce the resilience of forests.¹³

The replanting and establishment of forest monocultures also typically follow salvage logging. This results in conditions that are less resilient to climate change-related and other natural disturbances. Complex native forests that develop naturally after disturbance are more resilient to climate change and much more biodiverse than simplified plantations.¹⁴

In addition, scientific questions have been raised about the effectiveness of salvage logging as a fuel reduction strategy because evidence indicates that it often makes forests more prone to damage in subsequent fires.¹⁵ For example, the 2014 report by the Intergovernmental Panel on Climate Change states that ¹⁶:

... [R]educing emissions from deforestation and degradation may also yield co-benefits for adaptation by maintaining biodiversity and other ecosystem goods and services, while plantations, if they reduce biological diversity may diminish adaptive capacity to climate change (e.g., (Chum et al., 2011). Primary forests tend to be more resilient to climate change and other human-induced environmental changes than secondary forests and plantations (Thompson et al., 2009). The impact of plantations on the carbon balance is dependent on the land-use system they replace, while plantation forests are often monospecies stands, they may be more vulnerable to climatic change (see IPCC WGII Chapter 4) ... Adaptation measures in return may help maintain the mitigation potential of land-use systems. For example, projects that prevent fires and restore degraded forest ecosystems also prevent release of GHGs and enhance carbon stocks (CBD and GiZ, 2011). ... Forest and biodiversity conservation, protected area formation, and mixed-species forestry-based afforestation are practices that can help to maintain or enhance carbon stocks, while also providing adaptation options to enhance resilience of forest ecosystems to climate change (Ravindranath, 2007)...

For these reasons, the FFCC recommends that salvage logging be prohibited in high-biomass forest areas, and allowed in other forests only after a comprehensive, transparent assessment shows a high likelihood that the carbon benefits of the proposed project substantially outweigh the costs. Such an outcome might be possible, for example, where salvage logging can be accomplished using horse logging or other reduced-impact techniques with low carbon emissions, and short hauls to a mill.

In addition, the FFCC recommends prohibiting the purposeful combustion of dead wood (slash burning) in high-biomass areas of federal forests.

D. Place a 5-Year Moratorium on New Leases for Fracking for Oil and Natural Gas On Federal Forests To Allow For An Assessment Of Hydrofracking Consequences And The Values At Risk On Our National Forests

The FFCC recommends that a 5-year moratorium be established on new leases and renewal of dormant leases for the purpose of fracking for oil and natural gas on federal forests to allow for an assessment of hydrofracking consequences and the values at risk on our national forests. When a lease has already been executed the FFCC recommends that every possible method be used to monitor the project and to minimize the ecological impacts to the extent possible.

Existing laws and policies provide sufficient foundation for this recommendation. U.S. Forest Service policy states that withdrawing lands from mineral leasing shall be requested only in circumstances where there are *sensitive, unique surface resources that cannot be adequately protected under current public laws and federal regulations*. For example, areas within limits of incorporated cities or wilderness areas are closed to leasing. The Federal Government's Mining and Minerals Policy of 1970 states that the Forest Service is directed to provide commodities for current and future generations while continuing to *sustain the long-term health and biodiversity of ecosystems*. The Federal Land Policy and Management Act of October 21, 1976 requires that public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and *atmospheric, water resource*, and archeological values; that, where appropriate, *will preserve and protect certain public lands in their natural condition*; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use.

The FFCC believes these requirements provide sufficient cause--and authority--to prohibit future leases for fossil fuel extraction on federal forests.

In addition, the natural gas and oil generated by fracking on federal forests constitutes only a tiny fraction of the energy used in the U.S. However, the risks to the climate, ecosystems, and biodiversity as well as the resilience of federal forests to climate related and other natural disturbances resulting from fracking are great. The Obama Administration will demonstrate its commitment to maintaining the health and resilience of federal forests and addressing the climate crisis by prohibiting new leases and the renewal of dormant leases for fracking for natural gas.

E. Deny Proposals to Extract Biomass for Energy or to Harvest Timber for Wood Products Unless Analysis Shows Net Carbon Benefits over the Mid-term (20-40 years).

The Obama Administration has voiced a great deal of support for the idea of forest biomass as a source of energy that generates fewer greenhouse gas emissions than fossil fuels while

also providing jobs and income. Similarly, claims have been made that the use of wood for construction materials leads to lower carbon emissions than the use of aluminum and steel. However, many scientific questions have been raised about the validity of both claims and both run the risk of reducing the resilience of federal forests.

The FFCC therefore recommends that scientific, comprehensive, transparent analysis of proposed biomass energy development and timber harvest projects intended to provide wood for construction be completed before any such proposals are approved. The assessments should unequivocally show that the carbon benefits of the proposed projects substantially outweigh the costs over the mid-term (i.e. 20-40 years).

In concept, harvesting and burning wood derived from certain forests as a source of energy could reduce fossil fuel emissions. Similarly, in concept, using wood in construction could lead to increased carbon stores. However, research has not substantiated these claims. To the contrary, a synthesis of research concluded that the benefits of logging forests for biomass energy or to substitute for other construction materials could be more than offset by reductions in stored forest carbon.¹⁷

In addition, the carbon benefits of biomass energy would accrue only if it actually substitutes for fossil fuels. When the regional electrical grid already contains substantial amounts of clean renewable energy (e.g. wind, solar), or when biomass energy is merely added on to energy generated by fossil fuels rather than substituting for it, the carbon benefits would be small to none.¹⁸ In addition, incentives for and investment in current, inherently inefficient wood burning technologies detracts from development of much-needed advanced clean energy sources.

The risks of runaway climate change are now so great that the White House and federal forest management agencies should take a precautionary approach and make every effort to avoid mistakes that lead to the release of more carbon from federal forests. For this reason the FFCC recommends that biomass energy proposals and timber harvest for wood product proposals be approved only if compelling evidence is provided on a case-by-case basis through comprehensive verifiable scientific assessments that the projects generate net climate and ecological benefits over 20-40 years.

F. Significantly Reduce Emissions Generated By The Use of Fossil Fuels In Forest-Related Activities

The FFCC recommends that fossil fuels used by federal forest managers, timber operators, recreational users, tourists, and others in conjunction with commercial and non-commercial activities on federal forests be substantially reduced. The combustion of fossil fuels associated with management, commercial, and noncommercial activities on federal lands contributes to climate disruption that increases the risk of large scale natural disturbances that undermine the resilience of federal forests. In addition, the greenhouse gas emissions generated by long transportation distances often associated with wood and pulp industries contribute to climate disruption and thus add greater risks to federal forests.¹⁹ The FFCC therefore believes that the social costs of carbon resulting from

management, commercial, and noncommercial activities on federal forests should be assessed through scientific, comprehensive, transparent analysis. Emissions should then be minimized by policies requiring a reduction in the use of vehicles and heavy equipment, a shift to clean, renewable fuels, the use of public transportation for recreation and other noncommercial purposes, and other similar strategies.

Goal V: Generate Social, Economic, and Ecological Benefits Consistent With the Goals I, II, III, and IV

A. Increase the Supply of Ecosystem Services Compatible with Storing Carbon on Federal Forests

*Healthy forest ecosystems are ecological life-support systems. Forests provide a full suite of goods and services that are vital to human health and livelihood, natural assets we call **ecosystem services**.²⁰*

The FFCC recommends that federal forest-management agencies acknowledge that the storage of carbon on federal forests provides multiple ecosystem services vital to human health and livelihood, and use their efforts to conserve and increase carbon stores to optimize the supply of compatible ecosystem services. Maintaining existing stocks of carbon, increasing carbon sequestration, and maintaining or enhancing the resilience of federal forests will have positive social and economic co-benefits by increasing the supply of the many critical ecosystem services associated mainly with federal forests. For example, conserving forests and forested areas with high carbon values can generate numerous co-benefits, such as habitat for wildlife, soil productivity, pollination, and clean water.²¹ Improvements in the quality of river water by protecting high biomass watersheds, for instance, can increase the value of water flowing from federal lands to communities downstream. Reforesting areas that were at one time naturally covered with trees but can be proven to not be naturally regenerating on their own can prevent erosion and reduce the risk of floods that affect ecosystems and communities downstream.

B. Promote Carbon-Conservation and Restoration Jobs Consistent With Climate and Ecological Goals

The FFCC recommends that rural economic and community development policies and programs be amended or adopted to expand and capitalize on opportunities to generate jobs and other economic benefits associated with conserving and restoring the carbon stored by federal forests. Most of these opportunities stem from the need to restore the ability of federal forests to generate the ecological, social, and economic co-benefits associated with carbon stores. These opportunities include, but are not limited to jobs associated with outdoor recreation, wildlife-viewing, fishing, tourism, stream restoration, and fisheries restoration on federal forests. The FFCC suggests that the Small Business Administration, the Economic Development Administration, and other rural development agencies investigate the possibility of using programs like the Business and Industry Guaranteed Loan Program and the Rural Economic Development Loan and Grant Program, and others, to achieve these ends.

In some cases activities that maintain existing pools of carbon, increase stored carbon, and build the resilience of federal forests to climate and other disturbances might reduce timber harvest jobs. If this occurs, the White House, Departments of Interior and

Agriculture, and all other federal forest management agencies should acknowledge that these activities generate economic and social benefits for families, businesses, and communities locally, nationally, and globally, now and in the future. Rather than continuing to support logging and associated jobs that contribute to climate disruption, programs should be established to temporarily support timber workers financially and in other ways (e.g. retraining assistance) to help them make the transition to industries and jobs that are consistent with the goals of the President's EO and the recommendations found in this document.

C. Realign Forest-Related Payments to Local Governments to Reflect the Direct Value of Storing Carbon and the Value of the Co-Benefits Of Other Ecosystem Services Provided by Forests

Local governments containing or adjacent to federal forests have, in recent years, received payments of about \$400-600 million through three programs. One entails the sharing of revenue derived from the sale of timber and other resources. The Secure Rural Schools and Community Self-Determination Act (SRS) provides money to rural counties and schools affected by declines in timber-sale revenues. Payments in Lieu of Taxes (PILT) help offset losses in property taxes due to non-taxable Federal lands within their boundaries. These payments provide a significant portion of the budget resources for many local governments, but high variability in the levels of payment, and uncertainty about whether or not they will materialize at all, can disrupt the provision of local services. The structure of the payments to counties also creates incentives for local governments and residents to call for a commodity-based approach for managing federal forests, even if the overall costs to Americans as a whole outweigh the benefits.

The FFCC therefore recommends that, if forest-related payments to counties continue, they should reflect the new emphasis on storing carbon on federal forests as well as the provision of other ecological services generated by forests. Specifically, the FFCC recommends that the Executive Branch draft and work diligently to secure the passage of legislation that would modify forest-related payments to local governments so they reflect the value of the services federal forests provide all Americans by storing carbon that if released into the atmosphere would cause harm locally, nationally (and globally) for centuries to come, and by generating the numerous other ecological co-benefits that accompany carbon storage such as habitat improvements for fisheries and other forms of biodiversity, enhanced water quality and quantity for downstream users, reduced risks of landslides and siltation, and more.

This value is large. For example, the mid-level estimate by the Interagency Working Group on the Social Cost of Carbon of the monetizable damage from the emission of carbon dioxide is about \$50 (in current dollars) per metric tonne over the next few years. This amount suggests that, if the 10 billion metric tonnes of carbon currently stored on national forests were emitted to the atmosphere, the monetizable damage would total about \$2 trillion. If even one percent of the carbon stored on federal forests were released into the

atmosphere each year the annual monetizable damage would be around \$20 billion. Managing federal forests to hold onto the stored carbon helps prevent this damage. Further advantages would materialize from managing them to store additional amounts of carbon. Moreover, this number does not reflect many types of damage from carbon dioxide emissions, such as those associated with acidification of freshwater and seawater, nor does it incorporate the value of co-benefits, such as improvements in water quality, habitat, and recreational opportunities in mature and old-growth forests.

Basing forest-related payments to counties on the value of the services all Americans receive from stored carbon and its co-benefits, would have several advantages over the current system. It would better reflect the true value of the federal forests and the importance of managing them to optimize their value. It also would provide more stable payments, insofar as the value of stored carbon and its co-benefits likely will not experience the fluctuations associated with the commodities underlying current payments.

Goal VI: Fully Account For The Benefits and Costs of Any Decreases or Increases In Atmospheric Carbon and Other Greenhouse Gasses In All Forest-related Policies, Programs, Regulations and Development Proposals.

A. Publicly and Consistently Highlight the Need to Alter Federal Forest Policies and Management To Reduce The Risks of Climate Change.

The President's Executive Order 13653 states that the federal government must focus on program and policy adjustments that promote the interlinked goals of greater climate resilience and reductions to the sources of climate change. At present, achieving these goals will be difficult because few members of the general public, community leaders, forest users, or elected officials understand the critical role that forests in general, and U.S. federal forest in particular, can and must play in regulating the climate. Even many federal forest management agencies today believe they are responsible for developing alternatives that address goals for timber, listed species, water supplies, and recreation, while only "analyzing" the effects on climate change. Many agencies do not believe they have a responsibility to reduce the sources of climate change by protecting existing stocks of carbon, or manage for other goals described in this document.

To meet the twin goals of reduce the sources of climate change and improve the nation's resilience to climate change described in President Obama's Executive Order, the FFCC therefore recommends that CEQ and all federal forest management agencies make it a top priority to continually apprise forest users, communities, elected officials, and all federal forest management agency personnel about the need to fully account for the social costs of carbon in all practices, programs, regulations and policies. In addition, a relentless education program should be instituted to let the public, commercial, and recreational interests know that many long-standing federal forest policies, programs, regulations, policies and uses must be altered to address the recommendations described in this report and respond to the climate crisis by leaving as much carbon as possible in the ground and in the foliage.

B. Invest In and Build The Capacity Of Federal Forest Management Agencies To Understand The Science And Manage For Carbon Storage and Climate Resilience

For over a century scientists have known that additional atmospheric greenhouse gasses would alter the Earth's climate. However, definitive evidence of serious human-induced climate change has emerged in just the past few decades. Consequently, the Departments of Interior and Agriculture and other federal forest management agencies are in steep learning curves about how to manage for carbon and climate disturbances. The agencies have a few scientists that truly understand carbon management. However, most agency scientists as well as management and field personnel do not have the training or expertise in this field. As a result, many federal forest management agencies are applying knowledge and

practices applicable for timber production to carbon management, as if they were the same thing. They are not, and the failure to grasp this and do what is needed to change the situation is likely to produce very serious ecological, social, and economic consequences.

The FFCC recommends that the White House make a concerted effort to build the capacity of all federal forest management agencies to thoroughly understand the issues and develop tools to conserve existing carbon stocks while increasing carbon storage and achieve the other goals described in this document.

An immediate step the Obama Administration can take is to organize scientific symposiums where federal agency scientists join with scientists from academic and non-profits with expertise in forest carbon to present and debate research with the goal of ensuring that the best and most recent science drives federal forest management. This action is urgently needed because major discrepancies exist between the science used by many federal forest agencies—as well as much of the science described in the forest chapter of the National Climate Assessment--and the scientific research on forest carbon management emerging from academic and non-profit researchers. In addition, in response to the risks of wildfire some federal agencies are proposing large-scale forest thinning projects, even though emerging scientific research indicates they are likely to be counterproductive. The Obama Administration can demonstrate its commitment to using sound science to respond to the climate crisis by rapidly convening symposiums to close the gap between the best-available science and ongoing forest management.

In the mid- and longer term, in addition to new policies, programs, and regulations, building capacity will require significant investments in new tools, substantial education and retraining to help existing agency personnel become carbon literate, and the hiring of many new employees with expertise in forest carbon conservation and management.

C. Require Scientific, Comprehensive, Transparent Analysis of the Carbon Costs of Management Activities Before Approval

Many of the recommendations described in this document include a call for comprehensive, transparent assessments of the full carbon costs and benefits of policies, programs, regulations and practices. Too often, commercial timber harvest, road building, and other development proposals as well as ill-informed restoration projects are approved because they are assumed to have little to no effect on forest carbon.

The FFCC therefore recommends that the White House, Departments of Interior and Agriculture, and other agencies adopt a precautionary policy and require, as part of NEPA and other policies, that comprehensive, transparent analysis of the full carbon costs and benefits of forest-related policies, programs, regulations, and development proposals be completed before they are approved. This analysis should compare the proposed action against others, including another without it, comprehensively account for the action's annual net effects on atmospheric carbon dioxide (or other greenhouse gases), and describe the social costs (benefits) associated with any annual increase (decrease) in

atmospheric carbon dioxide. This description should estimate the present value of the monetizable social costs and benefits of each scenario using the estimates of the Interagency Working Group on Social Cost of Carbon,²² provide a detailed, qualitative descriptions of costs and benefits that cannot be monetized, and clearly assess the risks if costs turn out to be higher than expected.

Each analysis should reflect the best available science regarding the ecological, social, and economic effects of carbon emitted from or sequestered by federal forests, select proper baseline and systems boundaries, include the social costs of carbon as determined by the Office of Management and Budget or other sources, and compare the effects “with and without” management activities such as timber harvest rather than “before or after” they are implemented (i.e. quantify not only how much carbon currently exists and how much additional carbon could be add in the absence of timber harvest and other management activities).

The economic values at stake are large. For example, the mid-level estimate of the monetizable damage from the emission of carbon dioxide is about \$50 per metric tonne over the next few years. This amount suggests that, if the 10 billion metric tonnes of carbon currently stored on national forests were emitted to the atmosphere, the monetizable damage would total about \$2 trillion. If even one tenth of the carbon held on federal forests is released into the atmosphere that damage would be in the range of \$200 billion. Managing federal forests to hold onto the stored carbon helps prevent this damage. Further advantages would materialize from managing them to store additional amounts of carbon. Moreover, this number does not reflect many types of damage from carbon dioxide emissions, such as those associated with acidification of freshwater and seawater, nor does it incorporate the value of co-benefits, such as improvements in water quality, habitat, and recreational opportunities in mature and old-growth forests.

Estimates of the monetizable social costs of carbon are available from the Interagency Working Group on Social Cost of Carbon, United States Government. 2013. *Technical Support Document: -Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis - Under Executive Order 12866*.²³ Assessments should also acknowledge the importance of social costs of carbon dioxide emissions that have not yet been monetized, such as the costs associated with acidification of freshwater and seawater.

Footnotes

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