Growing the Role of US Forests in the Climate Movement

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Why Forest Science and Forestry Need to Engage the Climate Movement

Throughout America’s history, grassroots movements have played a significant role in shaping how we govern ourselves as a people. The US civil rights movement of the 1960s is the preeminent example, and a watershed moment for our nation.

In fact, the US civil rights movement is perhaps the most referenced case for how a shift in the collective consciousness of the masses transformed how society functions. Up to now, a similar movement to address climate change—a threat that promises to impact the health and welfare of every person and ecosystem on the planet—has largely failed to result in a shift in collective consciousness similar to that which occurred during the civil rights movement. There are now signs of such a grassroots change beginning to take root.

On September 21, 2014, more than 400,000 people took to the streets of New York City and more than 160 other cities worldwide to participate in the People’s Climate March. In what is probably the largest environmental protest in history, the march was timed for just before a UN Climate Summit. Many conservation groups rightfully used the occasion to advocate for the role of reducing deforestation and forest degradation in the tropics. Yet, as these groups marched through midtown Manhattan alongside so many other Americans, a focus on the fate of the forest carbon in their own country was noticeably absent. Surely American forests are a central issue for conservation groups, so why are they not also of focus for the broader climate movement?

Conservation of tropical forests is of course a crucial strategy in mitigating the worst effects of climate change; however, the role of temperate forests in the US must not be overlooked. Roughly a third of greenhouse gas (GHG) emissions now in the atmosphere are attributed to land use change. The remaining two-thirds come from

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According to a report released recently by the National Audubon Society, climate change is “likely to so alter the bird population of North America that about half of the approximately 650 species will be driven to smaller spaces or forced to find new places to live, feed and breed over the next 65 years.” If they do not they could become extinct. The world as a whole has lost half of its wildlife in the past 40 years, according to authoritative research compiled by the World Wildlife Fund, the Zoological Society of London, and several other organizations. This follows the publication earlier this year of Elizabeth Kolbert’s book *The Sixth Extinction*, an attempt to raise public awareness of an ongoing mass extinction that has been evident to scientists for at least the past decade.
“America’s greatest idea,” as Ken Burns characterized the creation of national parks and other protected areas, prompted others around the world to take stock of declining wildlife populations, from western Europe to the plains of Africa, and take actions aimed at reversing these trends. Clearly unsustainable patterns of natural resource exploitation spawned entirely new areas of natural and social science focused on understanding the complex web of ecological relationships in the natural world, and expanding the production of renewable resources to stay ahead of the needs of a growing—and increasingly consumptive—human population worldwide. Advances in agriculture and forestry greatly increased the land’s productivity for food, shelter, and renewable energy. The new field of resource economics posited that free markets, the laws of supply and demand, and new technologies would temper resource scarcities and ensure that production and consumption would always be roughly in equilibrium.

And yet…after more than a century of concerted effort in conservation science, policy and management techniques, we find that populations of other animal species around the world have plummeted by half in less than the last fifty years. How else to describe this magnitude of loss over such a short period of time in the history of life on Earth? This is not just the loss of rare, sensitive, and local species—as bad as that is—but a precipitous drop in the populations of robust species that heretofore have been able to co-exist in a world dominated by human influences.

So here is a question for the social scientists: How should we interpret so passive a public response to the finding that we are already several decades into a global mass extinction on the order of the one that ended the era of the dinosaurs? Perhaps it is not that people don’t care, but that they are overwhelmed by the enormity of the challenge and the apparent lack of any realistic solutions. Or perhaps many have concluded that, while certainly tragic, these trends in the natural world don’t really matter, particularly as humanity becomes increasingly an urban species. For most of us, especially in the US, life is good; we may never have noticed these declines in wildlife populations had they not been discerned by watchful scientists.

Besides, this isn’t the first time something like this has happened. There were five previous extinctions, after all. The planet survived and here we are today, perhaps even the beneficiaries of the cataclysmic events that gave mammals a shot at ecological dominance. Might we actually benefit from the current mass extinction as well, technologically rendered immune to the forces that are decimating the populations of so many other species? It may be worth considering that humanity was not around to survive any of those previous extinctions, and the higher order species that were present at the time did not fare nearly as well as microbes and bacteria.

The reality is that humanity is a highly adaptable and opportunistic species, and we will adapt as best we can to the global environmental changes that we helped put in motion, and now cannot stop. We are betting heavily that it will be at least a survivable world, notwithstanding the disappearance of so many other life forms.

I have a book, Animals of the World, that was given to me as a child. Its rich color illustrations of strange and exotic beasts drew me to its pages time and time again. I will pass this book along to my first grandchild, born this past summer, in hopes that in her own lifetime she too will still have a chance to experience this rich diversity of life—that the exotic beasts on these pages will not have become something akin to what the saber-toothed tiger and woolly mammoth were to my generation’s childhood.

More than half the world’s population is now urban and increasingly distant from natural systems. But environmental change that has eliminated half the world’s wildlife in a mere four decades cannot help but have significant implications for the future of humanity as well. Creating a broader understanding of the connections between healthy natural systems and the health and well-being of human societies may be the most critical mission of conservation in this century.

— Al Sample

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the combustion of fossil fuels since the early 1900s. Over time, deforestation globally shifted from the temperate forests of North America and Europe to the tropical forests in Southeast Asia and Latin America. Ironically, it was that movement to fossil fuels away from wasteful uses of fuelwood and extensive clearing for agriculture that allowed forest carbon stocks of North America and Europe to recover.

However, forest regrowth in the US has recovered only about a third of the carbon released to the atmosphere from land use change occurring between 1700 and 1935. Forests are naturally a long-term proposition binding generation to generation. Indeed, when it comes to US forest carbon, the choices we make now with regard to repairing the damages of the past will dictate the course of our future.

An Uncertain Future for US Forest Carbon

When considering net primary productivity, timber harvest removals, and forest disturbance, US forests are on the balance serving as a substantial net carbon sink accumulating approximately 200 million metric tons of carbon annually. This storage is equivalent to approximately 10% of net CO₂ emissions from all US sources. While debated in conservation circles, the National Climate Assessment cites an additional 77.6 million metric tons of carbon being stored in harvested wood products each year, which is equivalent to approximately 4% of net CO₂ emissions from all sources. So in all, the forest sector is assumed to currently serve as a net carbon sink in which the equivalent of 14% of annual CO₂ emissions of the US economy are being stored.

Forest carbon stocks have increased rapidly since the 1940s, but recent years find this trend line slowing, if not leveling off. If events of the past are indeed the prologue for the future there is no guarantee that we will be able to maintain the nation’s forest carbon sink and we should expect substantial carbon flux in the coming decades. In fact, the most recent national forecast for US forests, the 2010 Resource Planning Act (RPA) assessment, suggests a return to our forests being a net source of carbon release to the atmosphere. How can this be possible and what can we do to bend this curve?

As projected, each plausible RPA scenario suggests that US forests will change from being a net sink to a significant source of carbon emissions by 2030, with annual net carbon emissions from forests increasing to 40–80 million metric tons by 2050. From a climate forcing perspective this would be like adding as many as 86 additional 600 MW coal plants to the US electric power grid. Given the battles fought over new fossil fuel power plants, this potential fate of US forest carbon stocks should be alarming to climate activists, but the issue is rarely looked at this way.

While previous long-range RPA projections of forest growth and loss have been shown to have significant margins of error relative to subsequent measurements of forest growth and carbon storage, emerging science on the effects of climate change on net carbon storage in forests, coupled with observed trends in the scale and severity of urban development, wildfires, insect infestations, and drought related forest die-off, would seem to indicate that these long-range RPA scenarios at least correctly identify the trends.

Declining Trends in Forest Carbon

In the last decade or so, the US has been losing forest and open space at an estimated average rate of about four acres per minute. If trends in the US
continue unabated, increases in urban development are expected to expand by 41% by 2060, with most of this development occurring at the expense of forests. Forests lost to development in the southeastern US alone, a region that has tremendous natural forest carbon sequestration capacity, are projected to be as much as 9.7 million acres by 2050—a land area about twice the size of New Jersey. Urban growth projections in other forested regions, the Puget Sound for instance, are expected to result in significant loss of carbon storage.

When forests are cut, the direct impact is not only a pulse of emissions and the ensuing loss of sequestration capacity, but also often the addition of secondary emissions from new buildings replacing forests. These secondary emissions are not captured in estimates of net forest carbon flux, meaning that the effects of land use change are significantly larger when the carbon footprint of the built environment replacing natural carbon sinks is considered. Going forward, better integration of regional urban planning and strategies to conserve working forests around cities will be fundamental as it is these specific geographies where forest carbon will continue to be lost.

In addition to forest conversion, degraded forest conditions should rightly be viewed as a carbon concern too. For instance, western forests represent 20–40% of US terrestrial carbon sequestration capacity. Opinions vary widely on what management approaches should be taken across this massive land area.

The wet forests of the Pacific Coast offer globally superior carbon storage rates, with old growth forests in the Pacific Northwest storing nearly 250 metric tons of carbon per acre. Much attention is being paid to incentivizing longer rotation forestry in the coniferous forests of the Pacific Coast as a means to remove more carbon from the atmosphere and store it in standing forests. Strategies vary across landownership types, from the integration of carbon into National Forest plan revision processes, to engaging large acreage private landowners in carbon offset projects through the California carbon market. New types of incentives also need to emerge to promote carbon storage and land retention within the family forest landowner demographic.

In the Interior West, high intensity crown fires and large-scale insect infestations are becoming increasingly significant factors in the regional terrestrial carbon balance. The scale and frequency of disturbance events is being driven in part by an over-accumulation of small trees. The USDA Forest Service has estimated that across this region, from Idaho and Montana south to Arizona and New Mexico, forests are experiencing significant fire regime departure due to overstocking of at least 1.5 billion cubic feet of excess tree growth per year. From a carbon management perspective, this translates to as much as 9 million metric tons of additional forest carbon being added annually to already unstable carbon pools.

These forest conditions are expected to contribute more CO₂ to the atmosphere. In fact, between 2001 and 2008, carbon emissions from fires on western rangelands and forests in effect cancelled out nearly 12% of the carbon sequestered in those same ecosystems. Looking forward, when combined with losses in sequestration capacity, direct emissions from wildfires are projected to counter as much as 27–43% of net carbon sequestration by terrestrial ecosystems across the West by 2050. This trend is unfolding before our eyes.

In the western US over the last 30 years, the average area burned in large fires (i.e. those greater than 1,000 acres)
has increased to about 1 million acres per year. The last 10 years have seen more than 60 “mega-fires” of greater than 100,000 acres across the West, many of them high-severity stand-replacing fires. Unsurprisingly, climate change is playing a role here. In what appears to be the new normal, the western fire season has increased in length by more than two and a half months since the 1980s. Warmer springs and earlier snow melt are drying out western interior forests, increasing the risk of wildfire related emissions.

Going forward, under future climate change scenarios for the period of 2041–2050, the annual area of land burned by wildfires in the West is projected to increase by 31–66% as compared to 2001–2008, a period which itself had already seen increased wildfire activity. A growing percentage of these fires will likely be high-severity stand-replacing crown fires.

Some suggest this is an expected reconfiguration of western forests in response to 100 years of fire suppression, while others see a more nuanced story linked to the effects of climate change. Whatever the cause, we need to learn to live with fire and identify strategies for reducing negative impacts to forest ecosystems, human communities, and the climate.

We also need to consider the loss of carbon storage after large fires. Recent studies find that in parts of the West, the types of ecosystems returning after severe disturbance events are not always the same as existed before. Forests in parts of the Southwest, for instance, are transitioning toward grass and shrub systems with inherently less capacity to store carbon. In fact, between the late 1990s and 2010 nearly 20% of the forest area of the Southwest experienced tree killing wildfires, bark beetle infestations, and related mortality from drought stress. Given trends in fire activity and intensity, it appears that the success of reforestation efforts post-fire are now, and perhaps greater than in any time prior, a controlling variable in the functional ability of the land to store carbon. Scientists and managers take heed.

Altered fire regimes are not the only way in which the forest carbon to climate change feedback loop is being expressed. Rather, all manner of disturbance appears to be at least somewhat induced by climate change. For instance, the mountain pine beetle epidemic in western Canada occurring on a land area the size of Missouri has transitioned much of British Columbia’s forests from being a small net carbon sink to a large net carbon source. In the worst year of the infestation by this endemic insect, the carbon impacts are estimated to be equivalent to approximately 75% of the annual direct forest fire emissions from all of Canada during 1959–1999.

Federal Policy and Management of Forest Carbon

Policies will need to recognize variation in regional forest types and conditions. Conserving the vast reservoir of carbon currently stored in US forests, and increasing the near-term rate of carbon storage where possible, is not a one-size-fits-all proposition. Forest species, ages, soils, fire risks, vulnerabilities to natural disturbance, and decomposition rates vary widely from the rain forests of the Pacific Northwest, to the pine flats of the South, to the boreal forests of the Lake States and New England. Each must be understood for its own potential, and for the specific ways in which forest managers and conservationists can adjust their methods to achieve this potential.

Across the forest regions of the US, management actions for optimal forest carbon management vary widely, from encouraging the development of late successional characteristics that promote dense accumulations of biomass, to strategies focused on reducing the amount of standing biomass. This will inherently involve tradeoffs between competing values. For instance, in the longleaf pine forests of the Southeast, restoring optimal savannah habitat for the red-cockaded woodpecker involves reducing forest biomass through mechanical thinning and frequent prescribed burning, which has been found to reduce forest carbon stocks by as much as 22% as compared to passive management.

The relationship between climate change and forest carbon is exceedingly complex and the scientific community is just now beginning to develop a robust understanding of these issues. Policy is not waiting for science to catch up. There are a number of proposals under consideration by federal and state agencies regarding the management of forests to enhance or maintain carbon storage. Many of these policy initiatives are presented within the context of reducing net carbon emissions across the entire economy. The objectives of these proposals include maintaining existing reserves of stored carbon in live forest biomass; minimizing carbon emissions associated with forest loss, degradation, and disturbances; and identification of optimal forest management regimes for various regional forest types.

At the same time, there is an active discourse on “resilience” occurring within the natural resource management world. As defined by a 2013 executive order, resilience is “the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions.” Much of this resilience dialogue is centered on the need for stabilizing forest carbon pools and identifying the management actions that may do so.

Building on this Executive Order, the interagency Council on Climate Change Preparedness and Resilience has prepared a report detailing several actions needed to promote the resilience of the US forest carbon estate. As reported, these include: improving inventory, assessment, projections, and monitoring of carbon sinks via integration of remote
sensing with the USDA Forest Service’s Forest Inventory and Analysis (FIA) and the USDA Natural Resources Inventory (NRI) to regularly and accurately detect changes in terrestrial carbon stocks; developing estimates of baseline carbon stock and trends using methods consistent with those developed by the International Panel on Climate Change (IPCC); and promoting forest conservation and restoration through initiatives such as the Forest Legacy Program, the Land and Water Conservation Fund, and the Collaborative Forest Landscape Restoration Program, but also by stimulating “complementary markets for sustainably harvested wood products,” such as efforts to create a boom in multi-story wood construction as a means to creating long-term stable pools of biocarbon within the cities of the future. These high level goals, as valid as they may be, presently lack transparent strategic plans to catalyze those capable of making real progress toward the goals by working at the interface of government and the private sector. Without leadership, little progress will be made.

**Conclusion**

As a society, we face difficult choices regarding what steps to take to positively affect the stability of carbon stocks in our forest sector. These steps cannot be taken on the basis of conjecture, conventional wisdom, or wishful thinking. We need to get this right the first time; science has a significant role to play and is absolutely necessary for identifying optimal forest sector strategies. Moreover, we need to quickly enhance the way in which scientific knowledge informs natural resource management, as the implications of climate change for the US forest carbon sink are already playing out. As a first step, a process is needed to identify the low hanging fruit for forest carbon management in each region of the country to identify:

- Opportunities for reforestation and afforestation. For instance, the failed Waxman-Markey climate and energy legislation identified a hypothetical goal of storing nearly 1 billion metric tons of CO2 via tree planting that would require 105 and 455 million acres of afforestation. Who owns these lands, at what expense, what financial mechanisms are used, and how such forest banks are maintained are all essential questions for such a policy.

- Priorities for restoration treatments in fire adapted ecosystems. With emissions from disturbance projected to increase, the costs and benefits of measures that may reduce risk of losing stored carbon need to be weighed along with myriad other variables. Mechanisms to finance and reduce the cost of such activities are sorely needed.

- Market-based incentives to encourage carbon storage through long-rotation forestry. Incentives need to flexibly account for variations in forest ownership demographics. An appropriate balance between robust protocols for carbon measurement and practice-based approaches should be considered.

- Methods of more effectively integrating regional urban planning efforts with strategies that conserve working forests. Substantial amounts of carbon are being lost through conversion of forests at the fringes of expanding cities. Networks of individuals and institutions in the conservation and planning worlds need to target these buffer areas and prioritize them for conservation.

Through the process of identifying near-term priorities and opportunities, it will be vital that science continues to inform policymaking and peels away motivations not otherwise grounded in evidence. Such science is thus not a feel good gesture or academic exercise, but rather an essential act of the democratic process. The choices we make, from the woods of the forester to the desk of the policy maker, affect the nature of future carbon fluctuations.

Finally, science must also interface with the growing climate change social movement if forest sector strategies are to be given serious consideration by society at large. During the civil rights movement there was a collective realization that significant social change was needed and that this would ultimately improve the lives of all Americans. However, it was a strong and consistent desire for changes expressed across society which created the political will necessary to pass
Civil Rights legislation. Similar momentum is needed to enact transformational climate policy. Strategies for maintaining the US forest carbon sink and minimizing its transition to becoming a net source of emissions must be as clear as possible in order to engage the growing climate change movement.

If we are to avoid a truly life-altering climate change future, greenhouse gas emissions will need to be aggressively reduced in the next 25 years. Reducing the carbon intensity of the energy, materials, and food we consume is paramount but maintaining, and where possible expanding the US forest carbon sink is just as important. The forest sector must nudge the American people toward the realization that the fate of our forests warrants equal airtime to calls for the divestment from fossil fuels, ending tropical deforestation, and other statements emblazoned on the signs of climate activists marching through the streets of Manhattan. This will only happen with greater consensus within the forest sector itself. Without a commitment to a transparent and non-politicized dialogue, the US forest sector will remain at the fringes of the climate movement.

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Saving the Sink: Conserving Stored Carbon on Private Forest Lands

Will Price

The carbon stored and sequestered in forests in the United States has for most of the last century masked the atmospheric implications of economic growth. Pre-colonial forests were cleared and then mostly recovered just as a fossil fuel-intensive economy reached full throttle. This forest recovery depended on an exodus from the countryside to cities where industrialization was centered. Cities then sprouted suburbs on surrounding agricultural lands. These historical changes in landcover are well-documented, as are the changes in our forest carbon sink over time. The evolution in land use still continues, as there now is little arable farmland that will be so easily abandoned. In fact, over the last two decades forests have become the growth zone for population centers throughout the US.

Over time this trend will both accelerate and slow in correlation with national GDP and housing, but will not abate for some decades. By 2050 urbanized land may expand by 73% to 98%, and exurban/suburban areas by 15% to 20%. The character of this change—the paving and perforation of forests across the landscape—eliminates and impairs habitat and degrades water quality. It also irrevocably reduces the extent and future potential of our forest carbon sink.

The forest carbon sink is sequestration and storage of carbon in forest ecosystems. The scientific literature on carbon storage and flux in the US has exploded in recent years, and with it different estimates of how much carbon is stored in US forests and what will happen to it over time. The oft-cited figure is that US forests absorb around 16% of the country’s annual fossil fuel CO₂ emissions. This essential service provided by forests is ever more important considering the increase in national CO₂ emissions. For the first six months of 2014, CO₂ emissions were higher than emissions for the same periods in 2013 (+3%) and 2012 (+6%), with only the transportation sector holding the line (EIA 2014). We cannot afford to have emissions continue to rise in direct proportion to economic growth.

We also can not afford a reversal of fortune in forest carbon stores. The “forest account” is a critical component of the national total, and we can still affect whether today’s forests will, over the next 100 years, be a net source or a net sink. A useful way to think of this question is to treat forestlands as the principal that accrues interest as the forest grows—much the same way as timber investors have thought of forests all along. Within the construct of climate mitigation this concept became controversial with the publication of the “Manomet Study,” creating substantial debate on the notion of “carbon debt.” Timber removals are a withdrawal on the principal, which as...
long as the land regenerates, will grow back over time. With conversion of forest to houses and towns, the principal declines as well as potential future interest. So how rich is our stockpile of forest carbon? Are we withdrawing or depositing and for what purposes?

The latest Resources Planning Act Assessment shows that going forward an increasingly greater share of the “forest carbon pool” will be in the slowly decaying (releasing CO₂) pool of harvested wood products and not in in the forest. While in prior years we have gained actual forestland, in some regions we have begun to lose acres, yet the total carbon in the forest sector still increases nationally because remaining forests still grow and there continues to be carbon stored in buildings throughout the country. From a carbon perspective this could be the equivalent of a bubble, a “carbon bubble.” By sometime between 2030 and 2040 the bubble will burst, and from that time forward the forestlands in the US will give up more carbon to the atmosphere than they absorb.

The most complex and contentious part of our growing understanding of carbon dynamics is what happens to carbon in wood that is taken out of forests. The prevailing science shows that carbon in buildings stays out of the air for many years and substitutes for more polluting building materials. Wood burned for energy can also substitute for more polluting sources of energy, but in most cases will only begin to reduce atmospheric CO₂ many years from now since burning wood immediately moves carbon from the forest to the air. It takes decades until the balance of exchange is a net reduction in atmospheric CO₂, but how many decades is still debated. Accelerating wood utilization strategies is favored by many policymakers and scientists, including the Intergovernmental Panel on Climate Change. The idea is that over the long term more use of wood could have climate benefits, but all scenarios suggest that this intensification of wood use will reduce the carbon stored on the land in the short run. This tradeoff emphasizes the need to protect the principal, to retain forestlands in whatever way we can.

So what is happening to the principal? The present consensus seems to be that on private forestlands there was more carbon on the land by around the year 2000 than there was at any time over the last 100 years, and carbon is still accumulating from year to year. The story of what is happening right now to the actual area of privately owned forestlands (58% of US forests) is a little murkier. There is no such thing as real time data on forestcover, and recent studies use different methods or draw data from different periods (e.g. the heyday of housing starts in the 1990’s and early 2000’s, or the subsequent economic recession.) Also, different assessments variously define “forest” and the implications of forestry—e.g. as a disturbance that leaves bare land vs. a harvest that moves carbon to another “pool”, such as building material. Reconciling the implications of different modeling and accounting approaches is crucial to understanding what is actually happening on the land.

A study of global forest cover loss from a few years ago ranks the US among the countries that are losing forest the fastest—6% between 2000 and 2005. But this is based on satellite data that just looks at bare land, a lot of which has been harvested and will soon again be forests. These findings are echoed by the USGS Land Cover Trends project, which looks at exchanges between different kinds of landcover. This kind of information helps reveal the highly regionalized character of forest loss and gain, with a net deficit of eastern forest occurring from 1973 to 2000 (-4.1%, or -0.15% each year). Last year, a remarkable study carried out by the World Resources Institute, University of Maryland, and Google shed light on forest “turnover,” showing that the US South has some of the fastest cycles of harvest and regrowth in the world—with a portion of the forest being lost to development in each cycle. The same pattern occurs throughout the Mid-Atlantic and into the Northeast, albeit with trees growing back more slowly further north. The studies that look at shifts in landcover (e.g. farms to forest, forest to cities, fields to neighborhoods, etc.) may prove particularly important for devising regional strategies to keep the land forested.

The charge is clear for all organizations that work to conserve forests: protect US forest carbon sinks and reduce emissions resulting from forest loss, change, and management. The (continued on pg. 12)
Prioritizing Conservation for Ecological Resilience

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“Landscapes and seascapes are changing rapidly... altering some regions so much that their mix of plant and animal life will become almost unrecognizable.” Despite this blunt appraisal from the National Climate Assessment, many of us still have trouble grasping just how much things have changed, and will continue to change, even if we successfully tackle our societies’ addiction to fossil fuels.

About ten years ago, the Wilburforce Foundation recognized that our purpose, to preserve the North American West’s irreplaceable diversity of wildlife, land and water, was fundamentally at risk from a changing climate. We realized we needed to shift where we worked and how we worked in order to ensure that conservation gains were resilient in the face of ongoing change.

The Wilburforce Foundation has focused on two avenues in the realm of climate adaptation. First, we support conservation groups and partners to act on what we know now. Groups like EcoAdapt excel at helping groups think through how their goals are vulnerable to climate change, and what actions they can take.

Second, we invest in science to improve our understanding of how rapidly and significantly ecosystems are changing, and where and how we can best mitigate that change. Better information on where to prioritize conservation efforts to maximize resilience is one of the most common requests for assistance we receive. To address this key need, we support AdaptWest (adaptwest.databasin.org), a climate adaptation conservation planning database for western North America. The AdaptWest team is conducting a comprehensive comparison and synthesis of the many available approaches to adaptation, applying those approaches to the majority of western North America, and developing a spatial database from the results of these analyses.

Change can carry with it a sense of loss. One of my favorite childhood places, the hike up to Jack Meadow in the Oregon Cascades, was transformed by a severe fire, exacerbated by drought. It was hard the year following the fire to see the forest I’d loved as a child and the pond where my cousins and I chased tadpoles now a landscape of charred trunks and blackened soil. In my more recent visits to Jack Meadow, I’ve seen the bear grass flowering in swaths of white as the burned areas are recolonized by wildflowers, insects, and birds. Natural systems have an amazing capacity for adaptation, as seen in the unexpectedly rapid ecological recovery following the eruption of Mt. Saint Helens, or the historical ebb and flow of species tracking glacial expansion and retreat.

While a natural reaction to the scale and scope of climate impacts is hopelessness, it is important to remember that “action is the antidote to despair.” I am continually inspired by the work of Wilburforce’s grantees and partners, who are tackling these problems with passion, dedication, and innovation. It is incredibly transformative for us all to realize how much we can do, even given the scope of the changes ahead, with the tools we have to hand already.
The US has been slow to consider actions of this kind—California being the notable exception. In 2010, when the US Congress came within a few votes of passing a Senate version of the House’s American Clean Energy and Security Act, there were expectations that a cap and trade regime would emerge in the US, harnessing carbon markets to reduce emissions. In the proposed legislation, the EPA could allow regulated entities (the energy sector) to meet their emissions cap by purchasing credits generated outside the energy sector, including emissions reductions resulting from forest planting, management, and protection.

Many involved in forestry were giddy at the prospect of this new source of revenue. At the same time there was also criticism of the House version of the bill, contending that forest offset provisions were not stringent enough and would at the end of the day let CO2 leak back into the atmosphere. In fact, recent modeling suggests that the leakage rates for carbon offsets are perhaps more significant than previously imagined. This research shows that in North America delayed harvest becomes wood removed elsewhere—wood supply being very inelastic and the leakage adjustments included in offset protocols perhaps being too modest.

Four years after the last serious attempt to create a national carbon market, there is only one regulated emissions trading system in the US that has led to private forestland protection. In 2014, California’s Air Resources Board (CARB) issued the first forest offset credits under California’s compliance protocol. These were issued to the Yurok Tribe in Northern California, which had been working for several years with a private firm to inventory, model, and register carbon credits. All told there are 366,894 acres in ten forest projects that are now credited, or nearly so, within the CARB system.

Voluntary credits for forest projects in the US are also being sold, 58,185 acres of which are registered with the Verified Carbon Standard. This cumulative total of less than half a million acres, while a notable accomplishment, will have to grow quickly to catch up with the rate of forest loss.

Many of the projects registered for carbon credits have been developed by conservation organizations, but these are a small fraction of the forestlands they have conserved over the last few decades. As of 2010, national, state, and local land trusts had protected 47 million acres—at a rate that has accelerated over the years. Other than the 316 million acres of forest conserved on public lands, this has been perhaps the most reliable strategy to protect forests. The land trusts’ ongoing campaigns and creativity will be essential to safeguarding the carbon sink on private lands.

A popular goal among conservationists is “no net loss of forests.” This is much easier said than done as it immediately pits forests against every other land use to which forests may be shifting. Forests will have to reclaim land now in farms, towns, golf courses, and other land uses—each of which has a constituency. Only one state in the US has successfully launched a no net loss policy, in the form of Maryland’s Forest Preservation Act of 2013. The legislation is unique in the US. It adds a number of measures to complement and strengthen Maryland’s pioneering Forest Conservation Act, which requires developers to work with counties to offset the removal of forests. Other mechanisms include offsite mitigation for highway projects and a host of incentives for private landowners. The combination of measures introduced in Maryland promises the emergence of new and innovative ways to work with landowners. It also directly influences land use such that the carbon sink will be protected.

Few states will muster the political support to follow Maryland’s lead, though more should try. Also, few states, even those northeastern states that joined the Regional Greenhouse
Gas Initiative, will have offset revenue available to landowners. Moreover, one of the lessons from California may be that the stringent requirements for the highest-value offsets may be unacceptable to the majority of landowners who steward the US carbon sink. For them we need to deploy additional strategies, which do more than encourage faster growth and better use of forest carbon—at the end of day these strategies need to save the principal by reducing forest loss. Senator Stabenow of Michigan introduced a conservation program title to the Clean Energy Partnerships Act of 200920 that would have provided “supplemental incentives” for private landowners. While the bill was not passed by the Senate, it suggested a model for investing in the carbon sink at a large scale. The model was similar to a concept developed by the Pinchot Institute, the US Forest Service, and members of the Forest Climate Working Group.21 In essence, the idea is to sharpen the focus and improve the outcome of federal landowner assistance programs, or, introduce a new program altogether. Such a program would need to secure and grow the carbon sink in the forest, not just through 2030, but through 2100 and beyond.

Ideas of many kinds are under consideration, with supporting science and institutions capable of delivering them in cooperation with federal, state, and local government. They need to be evaluated from the perspective of what they can do to safeguard the forest carbon sink on private lands over the long term. We then need to apply strategies on the ground at a scale that matters, and get serious about saving the private forest carbon estate.

Will Price is Director of Conservation Programs at the Pinchot Institute in Princeton, NJ. The author appreciates the editorial contributions of Dr. John Gunn of SIG-NAL.

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The recent agreement between President Obama and his counterpart President Xi Jinping to substantially reduce the greenhouse-gas emissions in the world’s two largest economies raises the heat on all other countries to take climate change more seriously. This comes on the heels of more than 400,000 people who poured out into the streets of New York City in September for the People’s Climate March prior to the United Nation’s Climate Summit. At the Summit, heads of state, industry titans, movie stars, and people from all walks of life took to the floor of the United Nation’s General Assembly and made passionate pleas for climate sanity. One of the more hopeful outcomes is the New York Declaration on Forests & Action Agenda, which sets an ambitious goal to halt the loss of natural forests by 2030, starting by halving the rate of global deforestation by the year 2020, and restoring an additional 350 million hectares (865 million acres, or five times the size of Texas) of degraded forest landscapes by improving governance and mobilizing the required financing.

The US-China GHG emission reduction targets are sure to bring a renewed focus on reducing deforestation and restoring degraded landscapes by planting trees as two of the most cost-effective solutions available to mitigate climate change while also producing other environmental, livelihood, and security benefits for local families and their communities.

Forests play a vital role in the Earth’s climate as a vast sponge that continuously absorbs a substantial amount of carbon from the atmosphere through photosynthesis. But forests are also a source of roughly one fifth of global carbon emissions from the conversion of forests to agriculture and urban sprawl. The emissions from deforestation are equal to that from all the cars, trucks, trains, planes and ships in the world—many of which are moving consumer goods that contain palm oil, soy, beef, leather, pulp, paper and other wood commodities produced at the expense of illegal forest clearing.

What separates the New York Declaration on Forests from past manifestos is the rainbow coalition of supporters—over 30 countries (including the US), 40 multi-national companies, as well as a number of well-known indigenous peoples and civil society organizations. Cargill—America’s largest agricultural commodity processor—made a commitment to extend its “deforestation-free” pledge on palm oil and soy to cover every commodity processed by the company. This groundswell of commitments to address the age-old challenge of deforestation, and its more recently recognized pivotal role in climate change, is encouraging. But this stands in stark contrast to the impasse between the world’s major economies—notably the US, China, European Union and India—to agree on how deep and fast to curb fossil fuel emissions driving climate change and transition to a low-carbon energy future. However, conservation of forests has emerged as a critical step that all parties can agree on, particularly in the tropics where we lose 13 million hectares of forest every year—or 36 football fields of forest every minute.

Forests are important to the US Climate Action Plan, which after the agreement with China, increases the US target to reduce greenhouse gas emissions by 26–28 percent below 2005 levels by the year 2020. The total amount of carbon stored in forest lands and wood products (such as homes and furniture) equals roughly 25 years worth of total US greenhouse gas emissions. It is estimated that our forests and wood products have absorbed about 16 percent of total annual US emissions from the burning of fossil fuels over the past two decades. The amount of carbon...
Forests play a vital role in the Earth’s climate as a vast sponge that continuously absorbs a substantial amount of carbon from the atmosphere.

stored in wood products alone is roughly the same as the annual US emissions from more than eighteen 500 MW coal fired power plants. Forests are also an important source of plant-based material to produce energy; this bioenergy currently comprises about 28% of the US renewable energy supply. The projected potential for forest bioenergy ranges from 3% to 5% of total current US energy consumption. Looking forward, US forests have the potential to capture and store a maximum of 225 million tons of additional carbon per year through to the beginning of the next century. However, this vast carbon sink could also become a significant source of emissions if not managed wisely. More than half of US forests are threatened by wildfires, urban development, invasive species, insects and disease. These risks may also be exacerbated by significant changes in species composition and productivity due to changes in temperature and rainfall patterns as a result of climate change. The Forest-Climate Working Group representing a broad cross-section of the US forest sector—landowner, industry, conservation, wildlife, carbon finance, and forestry organizations—produced a 6-step action plan for the nation’s forests in support of the US Climate Action Plan:

1. Provide sound data and science; prioritize information and tools to continue development of climate-informed strategies.
2. Promote forest products; strengthen markets for wood over less environmentally friendly materials.
3. Restore and manage private forests; support private land owners to implement management practices and increase preparedness.
4. Retain existing forests; prevent forests from being developed through the encouragement of permanent protection, carbon storage incentives, and strong forest product markets.
5. Develop landscape-scale conservation approaches; encourage collaboration to view forests as systems instead of individual disjointed properties.
6. Increase urban forests; promote programs that support increasing the urban forest canopy.

The families and individuals who own close to 60 percent of the US forests will be critical to realizing this potential; they will need to reap the benefits for providing this public environmental service and be insured against the risks. If we can make this vision for the world’s forests a reality, then we may be able to bring many more in step with the march for climate justice.

Bruce Cabarle is President of Concentric Sustainability Solutions, LLC in Falls Church, VA. Tom Martin is the President & CEO of the American Forest Foundation in Washington, DC.

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A Monumental Forest Restoration Opportunity

Char Miller

The San Gabriel Mountains are Southern California’s spectacular foreground and dramatic backdrop; they occupy a pivotal place in the Southern Californian imagination, past and present. On October 10, 2014, a sun-drenched and smoggy day, President Obama underscored their local centrality when he designated a portion of the Angeles National Forest as the San Gabriel Mountains National Monument.¹

To its promoters, the switch in nomenclature is critical. They believe that the nearly 350,000-acre national monument will generate additional dollars that will enable the U.S. Forest Service to enhance the visitor experience. That it needs enhancing is without doubt. Trees and rock faces are tagged and trash is strewn across meadows, scenic areas, and river banks; sodden diapers clogging the east and west fork of the San Gabriel River, whose headwaters lie within this rugged mountain range, are too-common sight. Pomona College geologist Jade Star Lackey likens this devastation to a desecration. “On field trips we commonly go off the beaten path in search of outcrops, only to find ravines filled with trash and bullet-riddled appliances,” Lackey told The Student Life, newspaper of the Claremont Colleges (institutions that routinely use images of the snow-capped San Gabriels for admissions brochures and press releases). “We often pull up to a favorite outcrop that we’ve used for years to teach important geologic concepts like cross-cutting relations, only to find that it’s covered with graffiti.”²

Cleaning up this distressed landscape will be costly. But the key question is whether the necessary funds will be forthcoming. I doubt it. With the Republican Party in control of the House appropriations process, gaining additional public moneys will be difficult for all national forests, parks and refuges, let alone a new National Monument. At least in the short run, those who hope for more robust budgets will be disappointed.

Some of that disappointment may be mitigated by an increase in philanthropic dollars. In conjunction with the President’s designation, for example, the National Forest Foundation (NFF) announced the creation of a new $3 million fund for the national monument. Since the 2009 Station Fire, which torched more than 160,000 acres on the Angeles, the NFF has been active in underwriting restoration projects in the Big Tujunga Canyon and other burned-over sites. The goal then was to rehabilitate damaged riparian corridors, replant the headwaters to protect against erosion and boost the forest’s capacity to sequester carbon, while rebuilding recreational opportunities in the forest.

That work is ongoing but the NFF, which Congress chartered in 1990 to support the Forest Service’s land management efforts, has taken on a new role with the announcement of the National Monument. Its San Gabriel Fund will help jump-start rehabilitation of those acres most battered by the annual influx of more than three million visitors. “This designation provides an exciting opportunity for the Forest Service and Los Angeles’ business and civic communities to provide residents and visitors with improved conditions to enjoy their public lands,” observed NFF president Bill Possiel. The fund will deepen “our commitment to long-term stewardship with community-based partners and to connecting Los Angeles County’s diverse residents to the National Monument.”³
That social good may be difficult achieve, however, given that the mon-
ument, for all its size, is not as large or as comprehensive as originally
intended. Its first iteration called for it to absorb the whole of the San Gabriel
range, stretching from the Cajon Pass on the east (through which I-15 cuts)
to Newhall Pass on the west (through which CA-14 runs into the Mojave
Desert). The logic was driven by geographic realities and management
needs. By pulling together the entire Angeles National Forest and that por-
tion of the range the San Bernardino National Forest stewards, the National
Monument would streamline administration, making for more efficient and
effective governance.

That plan made perfect sense on paper, but not in the imperfect politi-
cal arena. Supervisors of San Bernardino County, responding to
mountain community residents opposed to what they decried as a “fed-
eral land grab”—the irony is delicious, given that by definition a National
Forest is also federal—unanimously opposed the designation. The Obama
Administration responded by shrinking the monument so that its eastern
boundary (as it had with the Angeles NF) runs in tandem with the Los Angeles-San Bernardino County line. However understandable, this decision will hamper efforts to manage recrea-
tion, wilderness, and endangered species in a more unified fashion across
the range.

Those managerial efforts will be fur-
ther complicated by the troubling fact
that the San Gabriel Mountains
National Monument does not include all of the Angeles National Forest,
either. Although it is not yet clear what the administrative structure will be
for the monument inside a National Forest, the inevitable overlapping authorities will not bring clarity to decision-making processes or streamline procedures, which is one of the issues that the mon-
ument’s proponents hoped to resolve through the original designation.

None of these difficulties—potential and predictable—undercuts the San Gabriels Mountains’ claim to National Monument status. They are more than
worthy of this acclaim for reasons natu-
ral and human—not all of which are benign. “The San Gabriels, in their state
of tectonic youth, are rising as rapidly as any range on earth,” John McPhee
observed in The Control of Nature. “Their loose iminical slopes flout the
tolerance of the angle of repose. Rising straight up out of the megalopolis, they
stand ten thousand feet above the

nearby sea, and they are not kidding
with this city. Shedding, spalling, self-
destructing, they are disintegrating at a
rate that is also among the fastest in the
world. The phalanxed communities of Los Angeles have pushed themselves
hard against these mountains, an aggres-
sion that requires a deep defense budget to contend with the results.”

These very dangers of uplift and sloughing off add to this range’s
uniqueness: when rain falls on their loose soils, the resulting debris flows are
beyond treacherous; in August, a freak
monsoonal storm dropped four inches
on rain on the Mt. Baldy watershed,
setting loose a churning torrent of rock, gravel, trees, and soil that killed one
man, smashed houses, and gouged out
roads. These same terrain, under
scorching sun and fanned by furious
Santa Ana winds, can funnel firestorms
down slope and canyon to incinerate
broad swaths of these stiff-folded
mountains. Fascinating and terrifying,
the San Gabriels are one of a kind.

They are home as well to some unusual geological features—the
shape-shifting San Andreas Fault, for one—and a rich biodiversity consist-
tent with Mediterranean ecozones that cover but three percent of the earth’s
surface. More than 80 percent of the forest is covered in chaparral (a “bristly
mane,” is how John Muir described it after hiking there in the 1870s), a habi-
tat that contains upwards of 300 species of plants endemic to this
region. Its streams, creeks, and springs sustain such threatened or endangered
species as the yellow-legged frog and
arroyo chub, while Nelson’s bighorn
sheep occupy portions of the moun-
tains’ windswept high ground; sailing
overhead are California Condors.

These iconic natural features are
matched by the mountains’ remarkable human history, which dates back
12,000 years. Native people used the
foothills, ridges, and canyons for food,
clothing, and shelter. They hunted
animals, increased the food supply for ani-
mals, and support the development of
material used in construction and med-
icine.” Central to their cosmology, the San Gabriel Mountains were also their
source of life.

The San Gabriels proved as rich
for the Europeans—ranching and
agriculture made use of rain and
snowmelt that flowed downhill: there
would have been no citrus production
in Southern California without these
remarkable mountains and the alluvial
fans that spread out from their
canyons. The same can be said for
recreation. The San Gabriels were the
stimulus to the so-called Great Hiking
Era of the late 19th and early 20th
century. Hundreds of thousands of
Angelenos took streetcars to trailheads
in the foothills, and then trekked up
Mt. Wilson and Mt. Baldy, and slept
in the lodges that catered to their
needs, blazing a trail for the more than
three million people today who splash
in the San Gabriel River, rest within a shady oak grove, or camp out in the Sheep Mountain Wilderness.

We can continue to commune with nature whether the landscape is called the Angeles National Forest or the San Gabriel Mountains National Monument. And maybe that’s the point: the lands are more important than the name we give them. Yet its new status as a monument perhaps gives us an unparalleled opportunity in this climate-changed era to repair these lands so that they will do what they have always done—sustain the human and biotic communities that depend on them.

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1 Of the new monument’s 346,179 acres, the vast majority is from the Angeles National Forest (342,177) and a sliver (4,002) from the adjacent San Bernardino National Forest.


CONTINUING THE PINCHOT LEGACY

“The conservation of natural resources is the basis, and the only permanent basis, of national success. There are other conditions, but this one lies at the foundation.”
— Gifford Pinchot

The Pinchot Institute depends on the support of individuals who believe in practical, action-oriented solutions like those undertaken by Gifford Pinchot. Help us continue the Pinchot Legacy by returning the enclosed envelope or making your tax-deductible contribution online.

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In Memoriam: Richard L. Snyder 1940–2014

Former Pinchot Institute board member Richard Snyder passed away on November 14 after an accidental fall at his home in Milford, Pennsylvania. Dick served as Pinchot Institute board member and Treasurer 1998–2004, and was a continuing contributor to the Institute’s work in his native Pennsylvania, at Grey Towers National Historic Site, and across the country. Having retired from the corporate world and New York City, he was committed to his adopted community in Milford, the home of Grey Towers and birthplace of the Pinchot Institute. He was a natural at building coalitions and working partnerships, and fostering a sense of community that went beyond the bounds of simple geography. From his CFO days, Dick had a clear sense of organization and finance, and the improvements he brought about during his time on the board are a lasting legacy of his service. Dick was a warm and gracious human being who made the world a better place, in his community and with every life he touched.
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**Book Review**

**Living Wild**

Char Miller

**Wilderburbs: Communities on Nature’s Edge**

By Lincoln Bramwell, with foreword by William Cronon

University of Washington Press, 2014. 344 pp. $34.95.

Roger Kennedy, former director of the National Park Service, called the phenomenon “sprawling into danger.” Most federal land-management agencies use the clunky term “wildland-urban interface” to identify the terrain into which millions of Americans have set up house since the mid-20th century—their teeming presence has deeply complicated the stewardship of our national forests, grasslands, parks, and refuges. But what does it mean to live on the metropolitan edge, within this apparently dangerous interface?

A series of unsettling answers to that question emerge in Lincoln Bramwell’s marvelous new book, *Wilderburbs: Communities on Nature’s Edge* (University of Washington Press, 2014). Key to its claims is Bramwell’s coining of the term Wilderburbs to define this contested landscape. These “clusters of homes on mountain slopes and ridges that lay within commuting distance of cities and town centers” come with a set of inherent tensions. For even as well-heeled residents have flocked to wild settings on the outskirts of Albuquerque, Denver, Salt Lake City, or San Francisco, reveling in the natural beauty outside their plate-glass windows, luxuriating in their abodes’ upscale amenities, and banking on a steady increase in their property values, these developments have disrupted the very landscapes their residents have rushed to embrace. Their lives have been disrupted in turn.

Bramwell, the US Forest Service’s Chief Historian, gained an inkling of this story’s complexity while fighting fires across the west for the better part of the 1990s. At the beginning of his time on the line, firefighting strategies were relatively straightforward—he and his colleagues would “hike up behind the blaze and try to coax like cowpokes on a cattle drive up to the top of the ridge, hill, or mountainside so it could run out of fuel.” But as more and more subdivisions were built into these high and remote grounds, popping up “like mushrooms after a nice soaking rain,” firefighting tactics shifted. They did so because “the public urged fire officials to drop us into the fire’s path to make heroic stands in front of insured and evacuated houses.”

Intensifying the firefighters’ peril is what appears to be a new cultural response to nature itself. Wilderburbs are nestled into the surrounding, fire-adapted ecosystems to enhance homeowners’ encounter with the wild. Yet their love of this land (and their privileged place in it) also sparked some odd behaviors. Including the time that a homeowner yelled at a chainsaw wielding Bramwell to stop clearing a defensible perimeter around her house as a wildfire blew close. However flammable the bushes that had become entangled with her shake-shingle roof and eaves, they represented nature, her nature. She could not give up that vision even if it meant losing her home.

This was not a unique occurrence, and one of the best aspects of Wilderburbs is the careful way it weaves together site-specific details with the larger patterns that these particulars reveal. Framed around four case studies—Foresta, California; Colorado’s Burland Ranchettes; Utah’s Snyderville Basin; and Paa-Ko Communities in New Mexico—Bramwell explores the emblematic issues these developments evoke. Despite differences in how they were constructed, for example, these subdivisions rearranged land-use patterns in their home counties. Fifty years ago, rural economies had revolved around ranching, farming, and/or the extraction of natural resources such as timber and minerals. The arrival of wilderburbs and their occupants signaled a significant shift to a service economy built around tourism and housing starts.
These new residential environs reflect as well the increased pressures that a growing population can have on local water supplies. Given that much of the American west is arid, the creation of water-intensive subdivisions has had a worrying impact on groundwater supplies, made all the more worrisome given how a changing climate is expected to decrease levels of precipitation across the 21st century. If there is not enough water to flush toilets, run dishwaters, or irrigate lawns, the allure of the wilderurb will diminish considerably.

Then there are the close encounters with endemic flora and fauna. People may have moved into the wild, but they are not always thrilled when bears upend their garbage cans, take a cool dip in their pools, or ransack kitchens. Coyotes no doubt are cute, but should your cat or Chihuahua go missing, then their eradication suddenly seems like a good idea. Moose seem sacred right up until that moment when your car collides with one of those rock-solid quadrupeds. The increase in calls to county and state wildlife departments to remove these and other large mammals from their habitat reflects the tension that exists between the idealized natural world wilderburbs’ promote and the much more messy reality their inhabitants occupy.

Fire brings these contradictions and paradoxes into sharp focus, and Bramwell’s chapter on this subject is compelling. Even as it sketches out the familiar story of the evolution of firefighting on western public lands, it builds an important case for the decided impact that wilderburbs have had on how fires start, why and when they are fought, and at what price. These communities have also become media sensations, and their precarious siting frames our imagination of fire’s place in the land: every conflagration’s news cycle comes replete with breathtaking images of swirling flames sweeping toward McMansions crowing ridgelines, valiant if weary firefighters, Pulaskis in hand, battling these infernos, and the charred aftermath—smoldering structures, torched vehicles, blackened dreams.

Bramwell, drawing on his insights as a firefighter and historian, troubles this hyped narration. “People want to live in a wilderness,” he observes, “yet they do not want a truly dynamic ecosystem that constantly changes through natural processes such as fire.” As these residents have learned, often reluctantly and sometimes only partially, is that what they desire is in constant negotiation with what nature allows, how it responds, and what it takes. That’s a life lesson for us all, wherever we live.

Char Miller, a University Fellow of the Pinchot Institute, is the W.M. Keck Professor of Environmental Analysis at Pomona College in Claremont, CA.

Dr. Patrick Bixler, University Fellow at the Pinchot Institute, recently relocated to Eugene, Oregon to join the faculty of the Ecosystem Workforce Program in the Institute for the Sustainable Environment at the University of Oregon. As Faculty Research Scientist, he will focus on the intersection of ecology, economy, and governance across a range of issues relevant to forest disturbance and western public lands management. Of particular concern will be community and collaborative responses to mountain pine beetle outbreaks in the context of climate change, and local consequences of wildfire suppression policies and strategies in large wildfires. Patrick intends to offer courses in Environmental Policy, Planning, and Management as well as Society and Environment. He will be continuing his affiliation with the Pinchot Institute as a University Fellow, working with Brian Kittler, Western Regional Director, on an analysis of the USFS Collaborative Forest Landscape Restoration Program. Patrick can be reached at pbixler@pinchot.org.
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