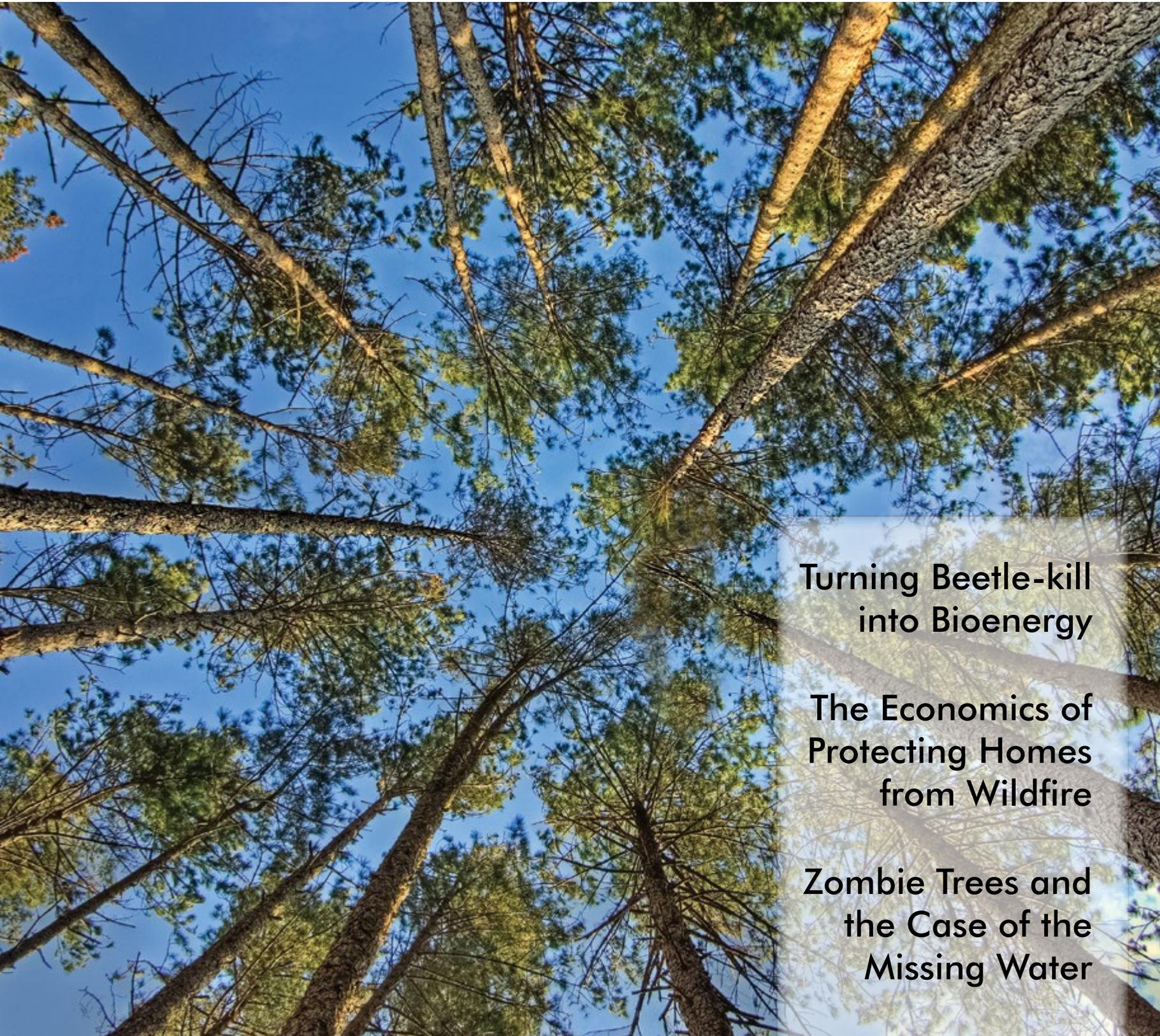


Western Confluence

Summer 2014 Issue 02

NATURAL RESOURCE SCIENCE AND MANAGEMENT IN THE WEST



**Turning Beetle-kill
into Bioenergy**

**The Economics of
Protecting Homes
from Wildfire**

**Zombie Trees and
the Case of the
Missing Water**

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EDITOR'S NOTE

By Emilene Ostlind

The forests that cloak mountainsides are one of the defining ecosystems of the western US. Recent big bark beetle outbreaks and wildfires raise questions about how forests are changing and how we should respond.

Forests rely on disturbances to open the canopy and clear the way for new, young trees. Over millennia, forests evolved with insects and disease, drought and wildfire, temperature swings and water availability. Today, human activities like logging, road building, and fire suppression, as well as natural disturbances like insects, pathogens, and storms, constantly shape forests.

Temperature is a major driver behind three big natural forest disturbances: drought, bark beetles, and wildfire. When a region warms up, even if precipitation stays the same, more water evaporates from soil and transpires from plants, drying out trees.¹ Warmer spring weather, earlier snowmelt, and longer summers also dry out vegetation and create conditions conducive to wildfires.² And warmer winters allow insects, fungi, and pathogens to survive better, reproduce faster, and more easily kill dry, weak trees.³ A spell of warm years has driven the recent big wildfire seasons and beetle outbreaks. No one expects temperatures in the western US to cool off anytime soon,⁴ so what might forests look like 50 or 100 years from now?

Making such predictions requires understanding how current disturbances compare to those of the past, how forests respond to disturbances, and what disturbances might be like in the future. Ecologists map historic forest responses to shifts in temperature and build models that take into account factors such as soil and vegetation types, moisture, temperature, and more.⁵ They test these models by measuring whether they can accurately demonstrate known conditions, over, for example, the last century, and then use the models to simulate future forest behavior.

Several models that map forests in the coming century show continued warm temps exacerbating disturbances, leading to declining tree cover, especially in the southwest and northern Rocky Mountains.⁶ One model estimates that shrub and grassland ecosystems will replace forests over about 15% of the West,⁷ while another study predicts that the suitable climate range for 130 tree species throughout North America on average will decrease by 12% and shift north by 435 miles by 2100.⁸ Still another found that, at least in some regions, tree populations are not yet migrating northward, but rather, are growing and dying faster at the southern ends of their ranges where climates are warmer and wetter.⁹

Forests are changing. They will never again look to us the way they did in, say, 1980. These changes have implications for anyone who relies on forests for timber or rangelands, drinking water or carbon sequestration, recreation or scenic vistas. How we adapt as our forests transform will be one of the great challenges of the coming decades. The articles in this issue of *Western Confluence* illustrate some possible responses and hopefully will trigger new thinking about ways we might adjust to our changing world.

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Beetle-kill Fuels



BIOENERGY

CAN INNOVATIONS TURN A ROCKY MOUNTAIN DISASTER INTO A CLEAN ENERGY OPPORTUNITY?

Photos and text by Kelly Hatton

On a morning in early March, I ride with Cody Neff, owner of West Range Reclamation (WRR), in his truck from Frisco, Colorado, to the company's nearby worksite in the White River National Forest. Light is just starting to reach over the high snow-covered slopes surrounding Frisco, but Neff is awake and ready to talk. He tells me that originally it was a love of cattle, not forests, that brought him west to the University of Wyoming, where he studied rangeland ecology while raising beef on a piece of leased land outside Laramie. Now, fifteen years later, he's running a fifty-employee company and supervising forestry projects on Colorado's Front Range and in Wyoming's Medicine Bow National Forest. It's a position he didn't necessarily imagine for himself, but one that he has taken on with enthusiasm.

Neff and wife, Stephanie—who Neff credits for his success—started WRR in 2001. They saw a need for what Neff calls responsible and beneficial rangeland and forest management.

From behind the steering wheel, Neff interrupts himself to point out areas on the slopes where the company has completed projects. As he steers up the rough road, he takes phone calls, fields questions, and jots notes for himself on the pad of paper nested in the truck's console.

When we turn off the main highway and bump slowly along the

temporary dirt road that winds up the mountain, Neff points out tightly packed, small-diameter lodgepole pine as illustrative of the problems of this forest. The stands of thin trees are all the same species, the same age, and all are competing for the same resources, susceptible to the same pests. These stands are an easy target for bark beetles. Out the passenger window, I see the impact. Dead trees stand like skeletons among the green.

At the road's end, the forest opens into a clearing where a fleet of machinery cuts, hauls, and chips

trees marked by the Forest Service for removal. Neff hands me a hardhat and a neon vest to put on before we walk over to the semi parked on the edge of the clearing.

He directs me to the ladder on the side of the truck's trailer and I climb up. The view from the top offers a panorama of the forest: the distant slopes show cleared patches from other recent forestry projects, while the surrounding dense forest is dotted with dead trees left in the wake of the bark beetle. On the acre of land directly below me,

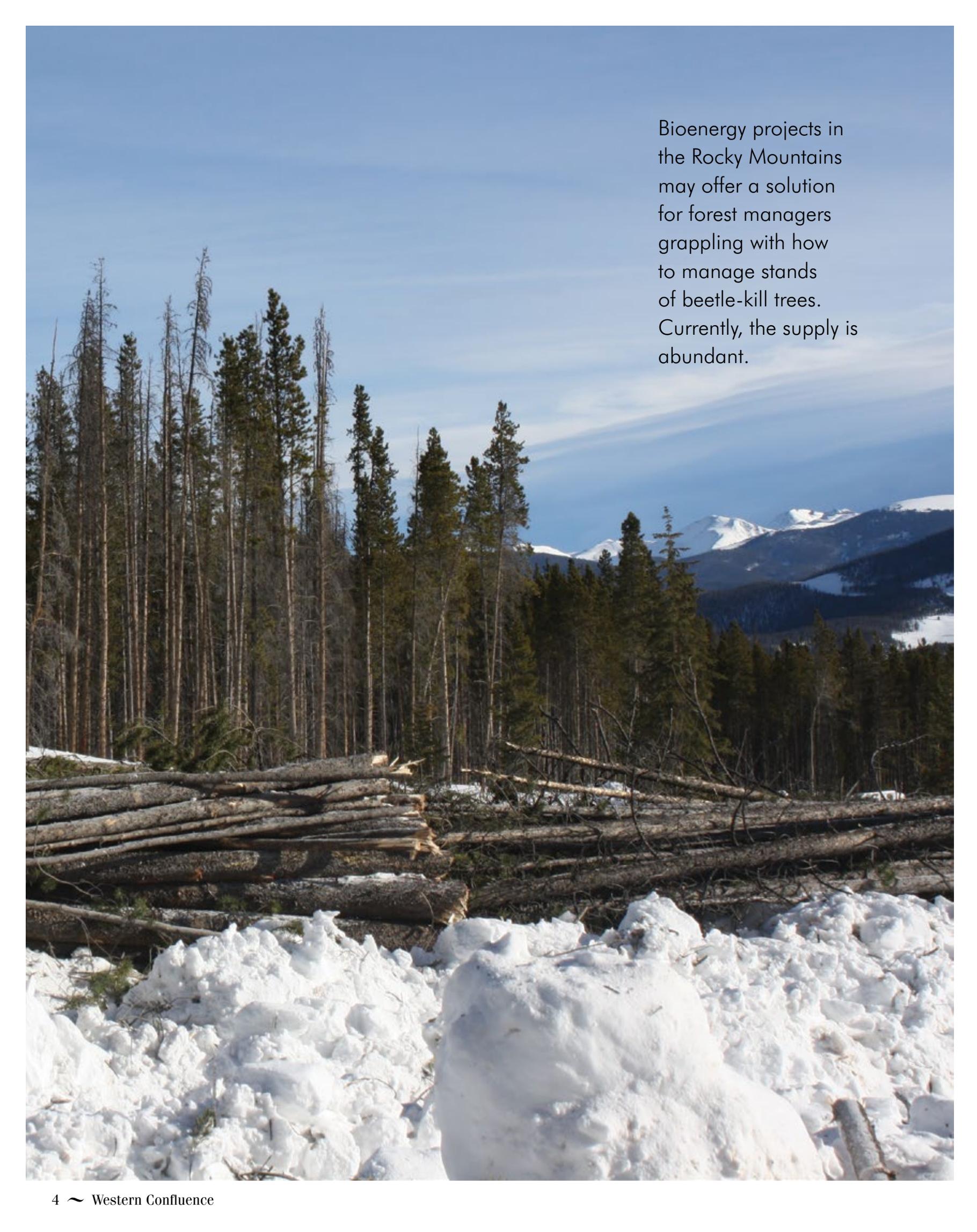
machinery dominates a flat lot covered with snow, stumps, and piles of logs that, a few hours ago, were a stand of lodgepole pine. Before dawn the harvester, a machine headed by a large rotating saw, cut down the trees. A skidder picked up the fallen trees and piled them next to the chipper, which is parked now on the edge of the clearing. As I watch, the skidder's claw grabs a handful of logs and feeds them into the mouth of the chipper. In front of me, the chips pour out of a high shoot into the back of the trailer.

In a day's work, WRR will fill ten to fifteen semi truck trailers with woodchips—about 250 tons. Neff estimates about 70 percent of that is beetle-kill. The destination for these chips is not one of the WRR's traditional markets: landscaping companies, dowel mills, pallet manufacturers. Rather than line playgrounds or gardens, these chips will be burned to generate electricity, enough to power thousands of Colorado homes.

The beetle epidemic has created a new, abundant feedstock for energy production in the form of dead trees, and now Rocky Mountain forests are becoming a testing ground for biomass energy projects. Using dead trees to make electricity and fuel requires harvesting, transporting, and processing massive amounts of wood, and questions remain about the economic, environmental, and social feasibility of bioenergy.



Cody Neff, owner of West Range Reclamation, at a work site in Colorado.



Bioenergy projects in the Rocky Mountains may offer a solution for forest managers grappling with how to manage stands of beetle-kill trees. Currently, the supply is abundant.

TWO GIANT CHALLENGES: FOREST MANAGEMENT AND ENERGY PRODUCTION

Aerial photos of Rocky Mountain forests show red and gray patches marking the trail of the bark beetle epidemic. When pine or spruce beetles attack and kill trees, the needles dry out, turn red, and eventually fall, leaving a grey trunk and branches. Bark beetles have affected an estimated 42 million acres of forestland in the Rocky Mountain region since the late 1990s.

The outbreak raises questions about the future of forests, the impacts of climate change, and risks of wildfire, but the immediate question for forest managers is what to do with the acres of dead or dying stands. Leaving dead trees to eventually fall in the forest can pose risks to hikers and other outdoor recreationists and clog up roads and waterways. Tree removal, on the other hand, is costly and, given the low commercial value of beetle-killed wood, incentive to harvest stands in difficult-to-reach areas is low.

“We haven’t seen more salvage logging because there’s just a few sawmills here and there, or pellet mills, and the cost of hauling the material hundreds of miles doesn’t pay off,” says University of Wyoming researcher and botanist, Dan Tinker.

When a forest needs to be thinned and no market for the wood exists, foresters stack cut trees into slash piles. Visitors to the region’s national forests have likely seen these towering heaps of jackstrawed trees along roadsides. According to a US Forest Service report there were a total of 170,000 slash piles in Colorado’s Medicine Bow-Routt, Arapaho-Roosevelt, and White River National Forests in 2010. Every year, hundreds to thousands of these piles are burned in Colorado’s forests alone.

Capturing that energy seems obvious. But the logistics still present huge challenges.

While turning biomass into electricity or fuel is on the rise worldwide, debate still surrounds its sustainability and economic viability.



Morgan Larimore takes a break from operating a skidder at the WRR worksite.

Biomass is any organic matter, including wood, agricultural crops, municipal organic wastes, and manure, used to produce energy. Bioenergy processes burn biomass to generate electricity or heat, or convert biomass into liquid or gaseous fuels, known as biofuel. As efforts to reduce carbon emissions drive the demand for bioenergy, a holistic analysis of carbon cycles and other impacts along entire energy chains requires new research, testing, and long-term monitoring.

“Biofuel is a pretty hot topic and it’s being well developed in a lot of parts of the country right now,” Tinker says. “But often it’s [made from] agricultural crops, in some cases crops that directly compete with food stock.” The most common biomass sources are agricultural crops, such as corn, sugarcane, and soybeans. (In developing nations, wood is also commonly burned for cooking or heat.)

Bioenergy projects in the Rocky Mountains may offer a solution for forest managers grappling with how to manage stands of beetle-kill trees. Currently, the supply is abundant. Because beetle outbreaks are cyclic, Tinker says there could be a continuous supply into the future,

though predicting where and how much remains a large unknown.

Beetle kill “might be a sustainable feedstock for biofuel if the technology exists to take advantage of it, and if [harvesting and burning it is] not environmentally insensitive and damaging, if local communities and stakeholders embrace the idea,” Tinker says. “There are so many ifs.”

Entrepreneurs like Neff, and researchers like Tinker, are now testing these “ifs.” New biomass projects are trying to overcome the challenges associated with feedstock location and management, transportation, financing, scale and technology, community receptiveness, and ecological impacts.

TURNING TREES INTO ENERGY

The woodchips pouring into the truck bed in the White River National Forest will be hauled 70 miles to a new biomass plant in Gypsum, Colorado.

Colorado’s Climate Action Plan calls for a 20% reduction of greenhouse gas emissions by 2020. To help achieve this goal, in 2011 utility company Hope Cross Energy issued a call for proposals from developers

for a 10-megawatt renewable energy plant. Hope Cross Energy selected a proposal by Evergreen Clean Energy to contract a biomass plant called Eagle Valley Clean Energy, fed in part by beetle-killed trees.

The plant started operating in December 2013 but the partnerships that make the plant possible were in place years before. Eagle Valley partnered with WRR while in the development process to supply woodchips for the plant. In 2013, the White River National Forest awarded WRR a ten-year stewardship contract, securing a reliable supply of fuel to power the biomass plant.

Stewardship contracts differ from timber sales (where contractors bid on stands of commercial lumber) and service contracts (where the Forest Service pays contractors to complete a thinning). Stewardship contracts are, in some ways, a combination of the two. The Forest Service pays contractors for prescribed thinning, and the high-value timber removed offsets some of the cost to the Forest Service. Stewardship contracts may also be awarded for longer periods than service contracts, up to ten years. The contract in the White River



National Forest guarantees WWR at least 1,000 acres of forest for thinning each year. This wood, along with waste lumber from a local landfill, powers Eagle Valley Clean Energy.

Securing a local feedstock is the first hurdle for any biomass project. The second is getting the feedstock to the plant. For Neff's operation, transportation is costly, and therefore, carefully considered. To remain profitable, the company trucks wood no farther than one hundred miles.

The Eagle Valley Clean Energy plant produces electricity using boiler technology. It burns the woodchips to heat water into high-pressure steam, which spins the blades of a turbine-driven generator. Boiler technology is the most common method of converting biomass into electricity. The technology is tested and reliable, making it a low-risk investment.

"We carefully evaluated a broad spectrum of technology for this project," Evergreen Clean Energy chairman Dean Rostrom says. "In the end, we concluded that 'old school' boiler technology, with the addition of latest innovations for efficient combustion and emissions control, offered the best choice. It has been proven over many decades, is far beyond the testing and proving stage of the other emerging technologies, is more cost efficient, has a wealth of experts available for engineering and constructing, as well as ongoing repairs and improvements, and ultimately is the most financeable and reliable technology available."

Partnerships, a reliable feedstock, financing and well-tested technology were the big factors that got this project off the ground, making it the first all-biomass plant in the state.

While Eagle Valley offers one model for future bioenergy plants, it's not the only way. Renewable energy company Cool Planet will soon begin to test a different method of bioenergy production, also using beetle-killed wood.

Cool Planet takes a different approach to securing and transporting

feedstock. Rather than setting up one centralized plant, the company uses "micro-refineries"—temporary plants that can be installed near a feedstock—to manufacture biofuels, which are trucked away and sold, like fossil fuels, to burn in vehicles or to generate heat. The company's demo site in California looks less like an industrial plant and more like a row of parked trailers on a half-acre of land. The model cuts transportation time and costs and could make biomass projects more feasible in out-of-the-way areas.

The technology is relatively new. The company has run small tests using corn stover and non-food energy crops, and in the next few years, they'll scale up the model, building micro-refineries throughout the Rocky Mountain region.

Cool Planet makes fuel using technology called "bio-fractionation." This technology is used to produce fuels through a process known as pyrolysis in which the micro-refineries heat up woody biomass—in this case beetle-killed trees—under extreme pressure. That forces hydrocarbons to steam out of the wood. Next, a catalyst facilitates thermochemical decomposition that converts these complex hydrocarbons into simple hydrocarbons. The process results in two end products: biofuel and biochar, porous chunks of leftover plant matter.

Farmers can plow biochar into their soil where it helps retain water and nutrients. In addition, because biochar is pure carbon, burying it in the soil keeps carbon dioxide out of the atmosphere.

Despite the small size of plants, the output is significant. Each micro-refinery has the potential to produce 10 million gallons of fuel per year.

PROBLEM SOLVING FOR BIOENERGY PROJECTS

Eagle Valley Clean Energy's energy capacity, 10 megawatts, is minimal in comparison with coal-fired power stations, which average 500 megawatts. This

plant's small size is by design. If bioenergy continues to expand in the region, developers will have to address issues of scale. Potentially, small biomass plants could be built throughout the region. Scaling plants to produce more electricity, however, would require careful planning in terms of feedstock location and relative supply.

In an article published in *Science* in 2010, Tom Richard addresses the challenges of scaling up biomass energy projects to increase worldwide renewable energy production without detrimental environmental impacts. "The logistics of harvest, storage, processing, and transport weave a complex web of interactions that will require massive investments in research, development, demonstration and deployment to scale up biomass energy systems to meet societal goals," Richard writes.

Both Eagle Valley and Cool Planet have developed ways to address the technical logistics of bioenergy production, but how bioenergy projects interact with ecosystems and local communities presents a new set of questions.

This is where Tinker comes in—he and other researchers from the University of Wyoming and four other universities have partnered with Cool Planet to assess the feasibility and the environmental and social impacts of biofuel production. The consortium, the Bioenergy Alliance Network of the Rockies (BANR), received a \$10 million US Department of Agriculture grant to study biofuel production from beetle-kill wood.

Teams of researchers from regional universities are working under five categories: feedstock supply; feedstock logistics and processing; system performance and sustainability; education; and extension, outreach, health and safety. Tinker is leading the task group on ecological assessment, part of the system performance and sustainability team. His team will analyze the environmental impact of biofuel production.



Over the five-year research period, BANR will gather the data necessary to measure the overall carbon footprint of Cool Planet’s biofuel production. Currently, BANR is assessing potential feedstock sources. The goal is to conduct trials on forests in a range of ownerships, including national, state, and private forests.

After the first trials, Tinker and his team will assess the environmental impacts of harvesting the trees. Tinker is optimistic about the project but careful not to jump to any conclusions about its environmental sustainability.

“Anything that has a potential environmental impact, that’s what my task group is charged with. The goal for this is to have no negative impact, hopefully zero impact or even a positive impact, so we’ll be monitoring all aspects of ecosystem structure and

function—hydrology of soil nutrient recycling, biodiversity—to make sure that we’re doing it responsibly, and if it’s not [environmentally benign], then that’s what we’re going to report,” says Tinker.

Sarah Strauss, an anthropologist at the University of Wyoming is also part of the BANR team. Like Tinker, Strauss is a co-director of the project. She is also leader of the health and safety task group and a member of the regional scale socioeconomic and policy analysis group. Her research will focus on how communities perceive biofuel production, and how they see the future of local forests. She and her team will look at historical community archives and conduct surveys and interviews.

As a social scientist, Strauss is interested in the human dimensions of climate change. How climate

change causes, impact, and need for solutions are perceived can affect how projects like bioenergy production are viewed. “It’s important for people to understand this [climate change] as a human problem,” Strauss says. The BANR project, “allows us to look at climate change in terms of impacts and drivers as well as solutions.”

Strauss notes that communities in the Rocky Mountain region do not have homogenous perceptions of forest values and uses. She gives the example of a Montana community with a long-standing timber-driven economy, as opposed to a Wyoming community where there has been little timber industry activity in the past. In the Montana community, residents might be more receptive to beetle-kill-fed bioenergy projects, whereas communities without a history of timbering—and the supporting

infrastructure—might resist such development.

These attitudes reflect how people view forestlands, as intrinsically valuable, as recreational land, as an economic resource, or as some combination of the three, and influence how forests are managed. Understanding how communities throughout the Rocky Mountain region think about climate change and forest management could steer location of future bioenergy projects and help the BANR team target areas for educational outreach.

The goal is to take a big-picture approach, to analyze biofuel production not only as an economic endeavor but also to zoom out and look at interactions in the “web” *Science* contributor Richard refers to.

LINGERING CONCERNS

Our ride down the mountain is stop-and-go, not because of ruts and divots, but because, for Neff, this remote road is like a neighborhood. We stop to meet a crewmember on his way to the worksite and again to check in with an employee clearing debris from the roadside. When we come across a snowshoer, Neff puts the truck in park and hops out. “Beautiful day!” he greets the man and introduces himself.

For Neff, spreading the word about WRR’s work and the biomass power plant is a high priority. Not everyone is in favor of burning wood to generate electricity. The strongest criticisms of bioenergy production fit into three categories: concerns about climate change, air quality, and impacts to forest ecosystems.

Some critics argue that bioenergy production, which is heavily reliant on fossil fuels for planting, fertilizing, harvesting, transporting, and processing, contributes as much to climate change as generating electricity from fossil fuels. Using beetle-killed trees instead of agricultural crops eliminates the energy needs of planting and fertilizing, but the equipment used to harvest and transport the wood does run on diesel, and the plant itself emits carbon during operation.

Bioenergy supporters claim that biomass is both renewable and carbon neutral, and therefore better for the environment than fossil fuel energy. All of the carbon released to the atmosphere when the biomass burns was captured out of the atmosphere during the plant’s life.

Strauss believes that new methods need to be tested in order to find viable alternatives to fossil fuel energy and solutions for climate change. She points out that the controlled high-temperature pyrolysis process used by Cool Planet and other companies to produce energy from biomass is far better for the environment than the current National Forest policy of burning slash



piles and sending that carbon directly into the atmosphere. “We need to be looking at all the alternatives,” she says.

Some local community members and organizations are worried about how the plant’s emissions will affect human health. In a letter from Colorado’s chapter of the American Lung Association, Natalia Swalnick describes how particulate matter, carbon monoxide, and volatile organic compound emissions from bioenergy plants can rival or exceed those of coal plants if not properly controlled. “If biomass is combusted, state of the art pollution controls must be required,” Swalnick writes.

The Eagle Valley Clean Energy plant uses scrubber technology that offers the “latest innovations for

efficient combustion and emissions control,” says Rostrum.

Proponents of bioenergy point out that burning the material in a power plant is no worse, and possibly cleaner than, burning slash piles on the forest floor without controls.

The third critique of bioenergy is how it affects ecosystems. In 2012, the community group Stop Gypsum Biomass wrote, “Industrial-scale biomass incineration is one of the greatest threats to functioning forest ecosystems today.” Forest ecosystems provide clean air and water, erosion control, and fertile soils. The group is concerned that timber harvest could damage these systems and ruin wildlife habitat. Removing dead and downed trees, for example, could eliminate habitat for species like

woodpeckers and owls that nest in snags. Over the next five years, Tinker and his colleagues at BANR will study these impacts, and hopefully, provide answers to these concerns.

Meanwhile out on the forest, every encounter is an opportunity for Neff. He’s proud of his employees, of WRR’s reputation with the Forest Service, and of the work he’s doing, and he’s eager to talk about all of it. He knows that not everyone supports harvesting beetle-killed trees for energy production, but to Neff, the criticism is a matter of misunderstanding.

“There’s a large population who really looks down on what we do and feel that we’re in this for the money or trying to get everything we can out of the forest,” he says. “But we’re up here because we believe we’re helping sustain and promote a natural resource that we love more than anything, for many generations to come, and that feels really good to us.”

MORE INFORMATION

Bioenergy Alliance of the Rockies
banr.colostate.edu

Cool Plant Energy Systems
www.coolplanet.com

Evergreen Clean Energy
evergreencleanenergy.com

West Range Reclamation
www.westrangereclamation.com

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www.westernconfluence.org

Kelly Hatton is finishing her master of fine arts in creative writing and environment and natural resources at the University of Wyoming and was Western Confluence’s 2013-14 Editorial Fellow.



UP IN SMOKE

THE ECONOMICS OF PROTECTING HOMES IN THE WILDLAND URBAN INTERFACE



Text by Samuel Western
Paintings by Lissa Bockrath

This photo, taken by Casper Star-Tribune photographer Alan Rogers during the 2012 Sheep Herder Hill fire on Casper Mountain, says it all:

We've built—and to continue to build—homes in the wrong places.

The house, home of Casper resident James Swingholm, survived. It was one of the fortunate structures; a fire crew was on hand to turn back the flames, although Swingholm says his family, not firefighters, saved the property. The gods of edifice protection have not been so kind to others as of late. From 2000-2008, wildfire destroyed on average 2,700 homes each year, many of them in the mountain west and California. In 2012, more than 4,000 homes succumbed to flame.

The Wildland Urban Interface

(WUI) is generally defined as forested private land within a half a mile of forested public land. It's not all majestic stands of ponderosa pine or crowded acres of spindly lodgepole. Think of a blue-green sea of juniper and piñon pine, one of the most common woodlands in the western United States, including 22.4 million acres in Colorado alone.

Industry data suggest the number of homes at risk for WUI fire is about to go off the charts. In October 2012, CoreLogic, an analytics and business intelligence company out of Irvine, California, estimated that the number of mountain west and California homes at risk to WUI fire jumped 62 percent from 782,450 in 2011 to 1,262,022 in 2012. The firm estimated about \$190 billion worth of homes were at risk or high risk.

The increasing number of houses vulnerable to wildfire is a long-time trend. Forest Service Chief Thomas

Tidwell testified during a June 2013 appearance before the Senatorial Energy and Natural Resources Committee that the number of houses within half a mile of a national forest grew from 484,000 in 1940 to 1.8 million in 2000.

The Forest Service now estimates a total of almost 400 million acres of woodland are at moderate to high risk from uncharacteristically large wildfires. "Over 70,000 communities are at risk," said Tidwell.

Then, of course, there's the money or rather the lack of it. In 1991, firefighting costs made up 13 percent of the Forest Service budget; in 2013 they constituted 50 percent. The budget for overall federal fire fighting has tripled since the 1990s according to a Congressional Research Service report. Fire suppression expenditures for the Forest Service and Department of Interior for 2012 were about \$3 billion. Despite these increases,

Congressional funding hasn't been keeping up.

In 2009, Congress created the Federal Land Assistance, Management and Enhancement (FLAME) Act, which provides for emergency wildfire suppression, and in 2010, appropriated \$415 million for it. Yet as part of the agreement to keep the government running, Congress took roughly \$200 million from the FLAME fund in 2011.

The crux of the issue lies in that the problem (houses burning and firefighters dying to prevent them from burning) has been outpacing the solution (preventing fires and fatalities) at a furious rate with predictions that matters will get worse. What's more, the fire suppression expenditures are focused on the 16 percent of private land prone to WUI fires – the "Settled 16" – that has already been developed.

This begs a pair of questions: how are we going to manage climbing suppression costs for the Settled 16 percent of the WUI? Furthermore, as the population of the American west climbs and we build more homes, how do we keep the rest, the currently “Undeveloped 84” percent of fire-prone WUI land, from turning into another pit that pulls firefighters into an early grave and costs taxpayers, year after year, billions?

MOUNTAIN HOMES

Casper Mountain is a good example of development in the WUI. It has a history typical of mountain west communities: in the waning years of the 19th century, ranchers and miners pushed roads into higher elevations, homesteading ground for summer pasture and filing patents on minerals claims. The minerals—asbestos in the case of Casper Mountain—played out and recreational users began buying abandoned mining claims to erect summer cabins. Ranchers, mostly sheepmen, saw the writing on the wall and went searching for greener pastures with fewer people (although there still are 13 grazing allotments in the vicinity of Casper Mountain). Swingholm bought his 40-acre tract from a local ranch, the Miles Land and Livestock Company.

Artistic elements arrived. In the 1930s, writer and artist Elizabeth “Neal” Forsling and her husband Jim fostered an artist’s colony on Casper Mountain named Crimson Dawn.

According to Sam Weaver, Natrona County’s Wildfire Mitigation Coordinator, the real development of Casper Mountain did not occur until after WWII. The BLM began selling five-acre lots, which the buyers then subdivided into one-acre parcels. In 1959, Hogadon Ski Area opened on Casper Mountain with a T-bar and rope tow. Still, “there wasn’t a lot of year ‘round use,” says Weaver. “In the mid-1960s, there were only about ten people living up here full time.”

That changed. Casper residents joined the millions of other Americans

in the great 1960s exodus out of cities, destined either for the suburbs or recreational homes beside a lake or in the cool woods. Casper Mountain is now, in reality, an unincorporated suburb of Casper. “We’ve got 150 resident families living up here,” says Weaver. “From our last census, we figure there’s roughly 1,200 landowners and somewhere in the neighborhood of about 855 structures. They vary from nice year-round homes to one-room cabins.”

Fires weren’t a problem at first. “We probably had a pretty good fire around 1870,” says Weaver. “There’s layers of carbon in the duff that would indicate that. I’ve talked to people who remember a fire in 1916. Then there were lots of little 20-acre fires, mostly on the periphery, 98 percent of them caused by lightning.”

These conflagrations caused enough anxiety among Casper Mountain residents for them to form their own fire department in the 1960s, which is still in operation. “We got old equipment. It’s all volunteer and supported by a local mill levy,” says Weaver. “We’ve got a budget of \$32,000 per year.”

Then in 1985, the 500-acre Red Creek fire burned, a remote area that threatened no structures; three-years later, the Elkhorn Fire. “That was kind of a wake-up call. We had no defensible space around our homes,” said Weaver.

A SYSTEM OF INCENTIVES

Creating defensible space around homes is one challenge. Managing homes that are increasingly getting built in indefensible spaces is another.

What disturbs Ray Rasker, executive director of Headwaters Economics, a research group in Bozeman, is the state of affairs over developing the remaining 84 percent of WUI-prone private land. “That’s a state and local responsibility, but their development would significantly increase the federal cost of wildfire protection,” he said.

In other words, counties, which have zoning authority over these

lands, make decisions with profound financial implications for state and federal government, that is, taxpayers.

This situation constitutes a classic example of what ethicists call a moral hazard, says Rasker. “The United States government has sent a message to the county commissioners: go ahead, build homes, and we’ll pay the bill. The Forest Service is basically doing the same thing. Through their Firewise program [a fire prevention program sponsored, in part, by the federal government], they are telling people it’s OK to build in WUI areas. Just thin and take precautionary measures. But Firewise is not the same as fire proof.”

When trying to figure out how to discourage people from building homes in fire-prone areas, consider a medical analogue: fighting cigarette smoking. The most pragmatic way to cut costs to society is not by outright prohibition, which is impossible, but through education and limiting access: boost the price per pack, no cigarettes to minors, hold tobacco companies accountable for their actions, raise insurance rates for smokers, and make smokers *persona non grata* in public places. The anti-smoking campaign

has been reasonably—some would say remarkably—effective. Smoking rates have dropped from 42 percent of the American populace in 1965 to 19 percent in 2011.

But after a 46-year fight, smoking—an activity with no Constitutional protection—still costs Americans \$290 billion per year, according to the Centers for Disease Control and Prevention. Imagine the legal and financial hullabaloo if a government entity tried to ban home building on fire-prone private property, an action that is, more or less, protected by the Constitution.

The property problem isn’t limited to fire. Geologists in Washington State say the recent deadly mudslide in Oso while tragic was not a surprise. That particular area of the North Fork of the Stillaguamish River had a long history of instability. There had been a smaller slide in the area eight years previous. People built anyway and government officials lacked support to impose zoning.

So-called “market solutions,” such as banks and insurance companies declining to finance or cover homes built in WUI areas, have been tepid. Banks have largely been silent on the





In December 2012, commissioners in Lewis and Clark County, Montana, signed a resolution declaring that local firefighters have no obligation to protect a home from a WUI fire. This doesn't necessarily resolve issues from a homeowner's point of view, as many property holders have been assessed a fee, mostly from counties, for protecting their homes and structures.

CASPER MOUNTAIN TINDERBOX

Yet a continued focus on the Settled 16 reveals cracks in cultural assumptions as well as financial woes. Natrona County is a fine example. Of the privately owned land in the county's WUI, 91 percent is undeveloped.

Casper Mountain, the county's hotspot for WUI fire, is 76 percent privately owned and the location of two scorchers in the last decade. The 2006 Jackson Canyon fire burned 11,775 acres. The September 2012 Shepherd Hill Fire covered 15,554 acres. Not all of these acres were on Casper Mountain, but they were on adjoining lands.

These fires collectively cost \$9 million in suppression costs. When it came to paying the bill, Natrona County only paid about ten percent. The state of Wyoming paid 61 percent and the federal government paid the rest.

Actually, figuring out the costs of fire suppression in Wyoming is complicated. The state has something called a Fire Suppression Account. It works like insurance. Any Wyoming county can pay an annual fee into the state-run account. Natrona County pays around \$30,000 per year, according to Crapser. As long as a county is paid up, the state foots the bill for firefighting costs.

This differs from say, Montana, which only covers about 25 percent of fire-fighting costs. "It's an extraordinary arrangement," said Bill McDowell, chairman of the Natrona County Commissioners. "Without the

issue of loaning mortgage money to new homes in fire-prone areas. Insurance rates are rising, but slowly.

"It's on our radar, definitely," says Carole Walker, executive director of the Rocky Mountain Insurance Information Association (RMIIA). "More and more insurance companies are expecting mitigation from the home owner. They've got to share the risk."

"However," she added. "There are different types of risk. In the mountain west, we live in hail ally. If you look at the pie for catastrophic costs, hail is still our most expensive concern. In 2009, Colorado insurance companies paid out \$1.4 billion for hail damage. [By comparison] the Waldo Creek fire, the most expensive fire in Colorado

history, cost insurance companies \$575 million."

No one condemns the work done to protect property. Building what's called *defensible space* around homes prone to WUI fire has saved thousands of structures. A post-fire report of the Yarnell Hill Fire (a 2013 WUI fire in Arizona that killed 19 firefighters) showed that 95 percent of the structures with defensible space survived.

"If done right, it works, believe me," said Weaver, the wildfire mitigation coordinator in Natrona County. He's a veteran of dozens of fires both large and small on Casper Mountain, a place he's lived his entire life. Weaver knows, as one fire official said, "more about Casper Mountain

than most people have forgotten."

Protecting the Settled 16 percent of WUI is also changing the way society views justifiable risk in home protection, although at tragic costs. *No burning structure is worth a human life* is a credo that firefighters hear from day one. But Bill Crapser, Wyoming State forester, says the firefighting culture runs on machismo. "I was part of discussions after Yarnell Hill fire, we talked extensively about clarifying a leader's intent. They need to know what we're asking of them. It's not uncommon for a firefighter on the ground to say, yeah, that's what they (command) say, but what they really mean is this. We're saying no, what we (the policy makers) really mean is not every home should be saved."

fire suppression account, we could not afford to fight fire.”

The primary concern is that the section of Casper Mountain with the most houses, about 15,300 acres, remains unburned. It’s what some folks refer to as “the middle.”

After the Shepherder Hill fire, District Forester Bryan Anderson wrote an open letter in the Casper Mountain Forest Stewardship Association Fall 2012 newsletter. It read, in part, “There have been many comments by landowners saying ‘I’m so relieved that our place survived another big fire!’ Again this was a large fire, but it won’t be the only large fire that will burn across Casper Mountain and the fact that most of the structures are located in the most heavily vegetated central portion of the mountain should be unsettling to everyone.”

Anderson hopes homeowners will thin trees and create defensible space around their structures, but there are three problems with this noble invocation. First, people, by and large, are ignoring treatments. “Create defensible space!” has been the *cri du cœur* of Firewise Task forces everywhere. Casper Mountain has Wyoming’s oldest, most well-established Firewise program in the state. Weaver says of the 850 structures on Casper Mountain, only about 250 have created defensive space around their homes. “We shake our heads over that one,” says Weaver.

This unwillingness for homeowners to assume responsibility for their own structures is not limited to Casper Mountain.

“I think it’s pretty much the same across the board,” said Chris Weyeveld, a consulting forester who does work for Firewise in Wyoming. “In Big Horn and Washakie County, we’ve done a tremendous amount of public outreach and yet we’ve got only a little more than ten percent of the landowners to embrace the Firewise program,” he said.

The Yarnell Hill Serious Accident Investigation Report noted, “Although the Yavapai County had a community

fire protection plan, many structures were not defensible by firefighters responding to the Yarnell Hill fire. The fire destroyed over one hundred structures.”

When investigating the Yarnell Hill fire, the *Arizona Republic* discovered that the Yarnell Fire Department had a \$15,000 grant to clear vegetation around homes in town. The money was never used because the fire department let the grant lapse.

Second, even when money does go to creating defensible space, it doesn’t necessarily save firefighting expenses. The logic used in funding Firewise has come under scrutiny by Headwaters Economics. In April 2014, the research group released a study that found the Firewise program does not actually reduce suppression costs.

The third problem with concentrating fire prevention in areas already dotted with homes is that, as fire historian Stephen Pyne of Arizona State University said, “We’ve seen this movie before.” We’ve gone through similar epochs of big blazes and they weren’t solved by expensive fire prevention schemes, he explains.

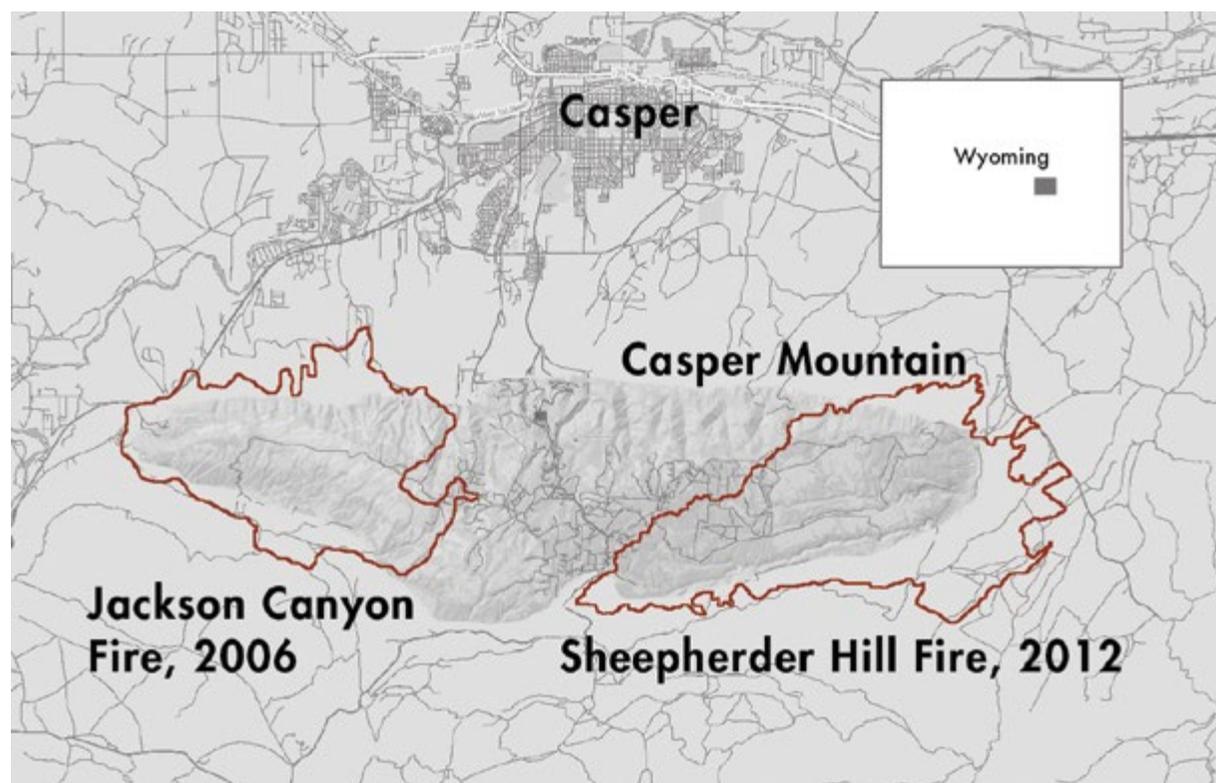
In February 2014 Pyne wrote a letter to participants of the Wildfire Solutions Forum, a closed-door meeting held in Jackson, Wyoming. Its organizer, Ray Rasker, says attendees included representatives at the apex of government, scientific, financial and insurance organizations concerned with WUI fire. Pyne was invited but, due to a previous engagement, couldn’t attend. Instead, he wrote a letter to the forum noting that America has gone through “serial holocausts” of fire, from the Great Chicago fire of 1871 to the enormous and deadly Fire of 1910, which killed 87 people and burned three million acres in Washington, Idaho, and Montana.

Then these fires stopped, wrote Pyne. Why? It wasn’t due to eminent domain or fire protection measures. They stopped due to systemic economic and policy shifts. The federal government began putting large tracts of land in the forest preserve (the predecessor to the Forest Service), and the government restricted homesteading. In urban areas, less flammable materials became part of the accepted building code.

Because people build homes in beautiful places, often in a forest loaded with debris, Pyne suggests fire now follows houses. “Redefine the WUI as an urban fire,” he wrote. Furthermore, consider fire from a historian’s point of view. Historians are “liable ... to point out that most of the world’s landscapes are cultural creations and that fire ecologists have generally ignored those landscapes, even obvious ones like agriculture,” wrote Pyne in his essay, *History with Fire in Its Eye: An Introduction to Fire in America*.

A few steps have been taken to prepare Casper Mountain for the blazes to come. Weaver began a Firewise program in the late 1990s. Structure protection got a boost in 2004 when an updated Natrona County zoning code required property owners on Casper Mountain seeking a new building or home modification permit to create defensible space. “That was Sam (Weaver)’s idea and I honestly don’t know how he did that. He was a miracle worker,” said Weyeveld.

When it comes to new structures, WUI fires on Casper Mountain differ



Large fires torched the ends of Casper Mountain in 2006 and 2012, leaving the tree- and house-covered middle unburned.



from other recent catastrophic fires in the west, such as the Waldo Canyon Fire (2012) or the Black Forest Fire (2013) near Colorado Springs. During a July 2, 2012, interview by Warren Olney on KCRW's radio program, *To the Point*, former USDA Under Secretary for Natural Resources and the Environment, Sherman Harris said, "40 percent of the new housing starts (in the west) during the 1990s occurred in the WUI areas. In Colorado, one-in-five is built in this area."

That's not the case on Casper Mountain. Only about four or five permits for new home construction are given for the Casper Mountain area each year, says Weaver.

And therein lies at least part of

the problem. All that's left is smoke and ash. The sections of Casper Mountain, the most undeveloped parts, have already burned in the previous two fires. The state and federal government picked up the tab. The remainder, the unburnt and populous middle, remains ripe for flame, but only one in three homeowners takes part in any remediation.

THE SKIN-IN-THE-GAME SOLUTION

What these interviewees are pointing out, some more directly than others, is the limitation of local communities to self-correct. This recognition runs counter, deep in the

bone, to the western community idea of self-sufficiency.

When it comes to discussing solutions to keeping the Settled 16 safer, County Commissioner McDowell and Weaver hint of the eventual inevitability of government intervention. That is, either the federal government or state fire marshals coming on people's land and mandating that landowners take certain actions in order to protect the public good.

"I have the power to tell you what to do on your land," is not a popular narrative in Wyoming. "That's exactly right," says McDowell. "But there's a lot of narratives that aren't popular in Wyoming."

McDowell recalls the time the Wyoming legislature resisted raising the drinking age to 21 but eventually, in 1988, raised it because the federal government was withholding \$10 million per year in highway funds to states that refused to go along with the plan. "Eventually they ask: how long can we stand on principal and not look at the fiscal reality?" says McDowell.

"The problem is existing landowners who aren't taking care of their property," says McDowell. "They're not providing the protection to my property and neither the state nor the county can do anything about that."

Weaver is passionate and obviously exasperated. "Somebody's

got to step up and say to landowners, 'you're responsible for protecting these structures.' It boils down to the fact that many homeowners don't want to recognize that this is their responsibility."

The reason for the inaction? "People don't deal well with catastrophic events," says Weaver. "They'd rather sit on the porch and drink beer than go out and bust their ass cutting down trees. Still they pound their heads and call the fire inspector and government a son of a bitch. People have to step forward and take responsibility or Uncle Sam's going to take it for them," he said.

Actually, when it comes to public safety, this sort of uninvited intrusion already happens regularly in other industries, even in property-rights-crazy Wyoming. State statutes permit a fire marshal to inspect commercial property such as a hotel or motel.

However, as is so often in politics, it's the cultural credo that matters. "The only thing worse than the state telling people what to do is the federal government telling people what to do," says Crapser.

"Even conservative politics is in conflict with itself," wrote Pyne in an e-mail. "So they don't want to be told how and where to build? Then why should public money protect them? Westerners—and I'm a lifelong member of the tribe—are generally hypocrites. They're happy to take federal money; they just don't want strings attached."

Pressure is coming to bear on home turf, however. During his

conversation on *To the Point*, Harris said, "This is a local government issue. Local governments and state governments are increasingly being asked to step up to the plate, to assist here."

"We at Headwaters are saying: don't count on the locals to fix this. They have no incentives to do anything. They are doing very, very little," says Rasker.

When it comes to discussions about how to limit home construction in the undeveloped 84 percent of the WUI, county and state officials get skittish. "I recognize it's a serious problem," says Crapser. "The topic is ripening, but our office isn't prepared to discuss solutions. We're about education and fire fighter and public safety."

Pyne and Rasker are not so reluctant.

"We're not going to control future costs and dangers associated with the WUI unless there are strong financial disincentives for local governments who permit homes on fire-prone lands, and strong financial rewards for those who find creative ways to direct future home building onto safer, less costly lands," says Rasker.

It's the narrative that needs to change, wrote Pyne in his letter to the Wildlife Forum. "Presently, the prevailing narrative is that the WUI is a regional idiocy, the result of stupid westerners moving houses to where fires are. Until the past few years it has been effectively the story of a California pathology, and has been quarantined within that state (California does

remain to the WUI what Florida is to hurricanes). This is not a narrative calculated to rally national interest.

"A more useful one is to suggest, as climate modelers propose," wrote Pyne, "that fires will begin to move to where the houses are, and these are overwhelmingly in the southeast."

Rasker and Headwaters Economics have suggestions, some pretty simple. "It has to be a combination of carrot and stick but nuanced, as in more carrot than stick," he said.

This would include a standardized collection of data and a national mapping system, somewhat like FEMA has now on its Maps Service Center. "Lots of states have maps of fire zones, but we need consistency," says Rasker.

The FEMA website allows viewers to look at a federally recognized flood zone in any county or municipality in the US. If the same was done for fire zones, "it establishes a full disclosure of fire risk," says Rasker. "If the US government determines that an area has a high risk of fire, it is then a known hazard. If a zoning board or county commissioners goes ahead and approves a subdivision in there anyway, they are opening themselves up for a lawsuit. And we are a society that is motivated by lawsuits."

The federal government could also refuse to give any mortgage deduction to a homeowner who builds in a fire zone. Rasker says he hopes federal designation of a fire zone would give the banking community

pause before issuing mortgages to potential homeowners in the WUI.

Whether it's the Settled 16 or the Undeveloped 84, Rasker is passionate that local governments have to have more skin in the game. He cites the City of Flagstaff, Arizona, which in November 2012 passed a \$10 million bond measure to pay for forest treatments on surrounding federal land to reduce the risk of severe wildfire and subsequent post-fire flooding in the Rio de Flag and Lake Mary watersheds.

"With the housing market picking up again, climate change as the big accelerator, and vast stretches of undeveloped land ready for more homes, the situation will get much, much worse," said Rasker. "Thinning trees and landowner education are fine. But directing future development away from the most dangerous places is critical, and not yet tried. Anywhere."

Samuel Western is a writer based in Sheridan, Wyoming. He is author of Pushed off the Mountain, Sold Down the River: Wyoming's Search for Its Soul, and is currently working on a book titled The Last Subsidized Subdivision: How Demographics and the Rise of the Local Economy Are Changing Mountain West Communities. The book is supported, in part, by the Sonoran Institute. A version of this article will appear as a chapter in that book.

Lissa Bockrath's paintings of our changing environment can be viewed at www.lissabockrath.com.

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Find links to these documents online at www.westernconfluence.org.



ON FIRE

AN ARTIST RECKONS WITH THE BLAZE THAT CONSUMED HIS FAMILY'S HOME

By Emilene Ostlind

All images courtesy of Bentley Spang

On a June morning Bentley Spang's mother, son, niece, and nephew watched a column of smoke climb into the sky about eight miles north of their home. The house was tucked into a hilly pocket above the Tongue River on the Northern Cheyenne Reservation in southeast Montana. Over the 31 years they'd lived there, the Spangs had watched many fires burn through the ponderosa-covered breaks surrounding their ranch.

In the summer of 2012, Montana was as crackling bone dry as the rest of the West. From Mexico to Canada, westerners smelled smoke in the air and watched blazes on TV—or from their porches and driveways. Already, Colorado's High Park Fire had swallowed more than 250 homes. New Mexico would see its largest wildfire that summer, and over a million acres would burn in Oregon alone.

As the Spangs watched, a weather cell formed above the smoke column

and the wind shifted 90 degrees. The blaze started racing south, toward the ranch. Sandra Spang told her grandchildren to pack suitcases while her husband rushed to open gates so the family's 36 horses could escape. Within twenty minutes the family piled into their vehicles and sped away while flames licked the skyline and yellowish smoke roiled into the sky.

The next day the Spangs returned to the ranch. The barn and tack shed were still standing, and the horses,

who'd fled toward the river, were alive. But where their home had stood they found a concrete foundation brimming with reeking, bubbling ash and rubble.

"When the fire is done burning, there is a whole other fire that starts," says Bentley Spang, Sandra's oldest son. "All our grass was gone. ... All of our wells burned up. ... You have to make sure you have food for your horses, make sure they have water, make sure they're not going to get out and get hit by a car."

Bentley, an artist who lives in

Billings, spent countless blistering hot hours in August and September sifting through the ashes of the house in search of pieces of artwork, his mother's wedding rings (he never found them), and other belongings. He stayed on the ranch through the winter to help feed round bales to the horses.

He spent much of this time thinking about the fire and processing the loss of the home and his family's close call during the evacuation. And over this time he photographed the aftermath of the fire on the ranch. In January an idea came to him that would evolve into *On Fire*, an installation at the University of Wyoming Art Museum.

On Fire is a series of charcoal drawings Spang made by taping sheets of paper to boards and rubbing them across the trunks and branches of the burned trees. At the UW Art Museum, the drawings line three walls of a small, square gallery. A film of Spang out on the ranch making the drawings



projects on the fourth wall. One shot shows the foundation of the lost house in the background. In another, the family's horses trot through the standing dead trees.

"The trees are not just burnt trees," Spang says. "They watched this whole thing happen with my generation and a lot of other generations, so they need to be honored. ... My feeling is that that final drawing is their voice, is them telling the story of the fire."

The smaller trees with harder wood left thin brittle streaks and gouges in the paper, while the huge, softer ponderosas painted wide licks

of deep black. The images do convey flames lapping at a forest. They also look like handwritten stories, or wind whipping through grass, or silhouettes of burned trunks shadowed by the ghosts of the living forest.

"We are in a time period now where we are having these big wildfires a lot," Spang says. "The issue of climate change is right upon us. It's a reality."

In the face of climate change and its associated environmental disasters, Spang calls on his role as an artist and as a Native person. He has collaborated with scientists to help people think critically about their connections to the natural world. And he has advocated

bringing Native leaders to the table during climate discussions.

"Scientists feel there is a disconnect with the public about their findings. The public really doesn't quite understand," Spang says. "Maybe artists are this intermediary. We are going to express what we express, but we are going to do it in a way that can make [climate change] more accessible to folks on a nonverbal level, which is hopefully what this piece can do."

Bently Spang was an Eminent Artist in Residence with the University of Wyoming American Indian Studies Program during the spring 2014 semester. His work has been exhibited widely in venues that include the Denver Art Museum, the Brooklyn Museum, the Peabody-Essex Museum, and the Institute of American Indian Arts Museum.

Emilene Ostlind is Western Confluence magazine's editor.



Zombie Trees

If Bark-Beetle-Killed Trees Aren't Using the Water, Where is it Going?

By Elizabeth Nysson

“We call them zombie trees.” Brent Ewers, a University of Wyoming botany professor, smiles. He’s describing trees under attack from spruce beetles in the Snowy Range’s high alpine forest.

Spruce beetles, like many other bark beetles, kill trees by exposing them to a blue stain fungus, which colonizes in the xylem, the part of the wood that transports water. The fungus prevents water from traveling up the trunk to the branches and needles. As the tree dries out, it becomes akin to the “living dead” because scientists, like Ewers, do not know exactly when it dies. Eventually, the tree turns brown, loses all its needles, and topples to the forest floor.

Bark beetle impacts are different from other common forest disturbances such as wildfire or logging because the standing dead trees can change the ecological functions of a forest, such as water and carbon cycles, without immediately changing forest density. Like the zombies in movies, these trees look alive for a few months without “breathing” in carbon dioxide from the atmosphere or “feeding” on water or nutrients in the soil. Managers, and citizens who rely on water and other forest resources, want to know exactly how all these standing dead trees are changing the forest.

As a botanist, Ewers is a critical part of an interdisciplinary team of University of Wyoming scientists affiliated with the Wyoming Center for Environmental Hydrology and Geophysics (WyCEHG, pronounced why-keg). Initially, WyCEHG

scientists wondered if there would be more water available in rivers and streams because of the decrease in water uptake from dead and dying trees. But stream flow analysis showed there is not more water in the streams now than before the beetle outbreak. This discovery led to a new research question: Where did the missing water go?

Steve Holbrook, a geophysics professor and one of WyCEHG’s principle investigators, posits a couple of hypotheses. “One possible location of the ‘missing water’ is that it sinks into the soil and ultimately groundwater, where it might reside for

years before reappearing in streams.... An alternative hypothesis is that the water gets used by new growth in the ‘understory’ of the forests.” WyCEHG researchers are on a mission to figure out if one of these answers is correct.

Like any good zombie hunter, one of Ewers’ scientific tools is a shotgun. He shoots high branches and collects them to learn more about trees attacked by spruce beetles near the Glacier Lakes Ecosystem Experiment Site (GLEES) nine miles northwest of Centennial, Wyoming. At GLEES, University of Wyoming scientists partner with the U.S. Forest



Service to monitor spruce beetle impacts and assess how this epidemic has changed forest conditions. Data collected and analyzed from GLEES will not only inform local management in this forest, but can also inform regional and national natural resource policies and practices for other areas affected by bark beetles.

Throughout the western United States and Canada, bark beetles have been attacking in exceptionally high numbers, and changing forest landscapes. The beetles target the biggest trees first, boring through protective layers of bark and introducing the blue stain fungus—the real killer. Small, bubbled masses of viscous resin along the trunk reveal the beetles' presence. These "pitch tubes," along with bark dust from the boring process, indicate the tree has succumbed to this widespread epidemic.

Yet, bark beetles are not a new forest resident. During endemic or "normal" conditions, bark beetles attack small stands of weak trees, ultimately contributing to a healthy forest environment. Cold fall and spring temperatures in high altitude regions can kill off bark beetle larvae and regulate the population. But in

the last decade, warmer temperatures have allowed beetle populations to skyrocket, drought conditions have weakened trees, making them more vulnerable, and many tree stands are at an optimal age and size for bark beetles. These factors have led to epidemic conditions throughout the forests of western North America.

With snake-like cords draped across the forest floor, WyCEHG scientists send jolts of electricity through the ground. Water conducts electricity, so the current travels more easily through wet ground than dry. The researchers use instruments that measure electrical conductivity, or how easily the electricity travels, to create maps showing groundwater aquifers, soil thickness and geological structure. Preliminary studies show higher conductivity—indicating more soil moisture—under dead trees than under living trees.

Maps of the earth's underground structure from these and other geophysical tools also let scientists like geophysicist Holbrook, identify pathways water might take in the ground and estimate water quantities in the soil and deeper aquifers.

"By comparing the amounts of water residing in the subsurface between beetle-affected and healthy tree stands, we can test the competing hypotheses for the fate of the missing water," said Holbrook.

These geophysical images show just part of the story WyCEHG is trying to piece together. Other WyCEHG researchers are studying surface water in streams, snowpack quantities and composition, and water vapor in the atmosphere to determine where water not used by dead trees is going.

The GLEES research station, managed by the Forest Service's Rocky Mountain Research Station, is in a forest of Wyoming Engelmann spruce and subalpine fir trees. Researchers working here have been opportunely situated to watch the spruce beetle epidemic unfold. Photos taken throughout the 2000s from the top of a research tower show the progression of the spruce beetle outbreak through the forest. Unlike other species of bark beetle, such as the well-known mountain pine beetle with a yearlong life cycle, spruce beetles have a two-year life cycle. Therefore, visual evidence of the outbreak, in the

form of dead and dying trees, was not apparent in this area until 2010 although epidemic conditions began around 2008.

Since the 1930's, researchers have gathered data about high alpine and subalpine ecological functions in and around GLEES. In the 1960's, the Snowy Range Observatory collected metrological data about temperature and precipitation at the site. In more recent decades, the Rocky Mountain Forest and Range Experiment Station officially established GLEES to collect data related to atmospheric conditions and study the influence of climate change.

With visual evidence and decades of baseline data at their disposal, scientists are learning how the spruce beetle epidemic is changing the forest around GLEES. They are amassing water, snow, soil, and metrological data in a large database. The WyCEHG researchers haven't been working long enough to find the missing water just yet, but these long-term data sets are starting to help scientists understand changes in the ecosystem, and consequently inform better management of beetle-killed forests.

"There are still big questions about how the beetles are affecting stream flow in the region," says Scott Miller, a watershed hydrology professor and another WyCEHG principle investigator. "These basic questions are essential to water resources management since they determine how much water is available to municipalities, agriculture, or ecosystem services."

In a changing world with changing forest ecosystems, research gathered by WyCEHG and other scientists at GLEES can be vitally important to Wyoming and other western states grappling with issues related to water management.

Elizabeth Nysson is the education, outreach, and diversity coordinator for Wyoming's Experimental Program to Stimulate Competitive Research (EPSCoR) at the University of Wyoming.



Rails-to-Trails... Derailed?

The US Supreme Court Decides a Wyoming Property Rights Case



By Bailey Schreiber and Temple Stoellinger

In 1909 the United States granted the Laramie, Hahn's Peak & Pacific Railway Company a right-of-way to construct a railroad in southeast Wyoming from Laramie to Centennial, south to Albany, through Fox Park, and on to Coalmont, Colorado.

The railway line was not terribly successful and it changed ownership a number of times over the years, finally residing with the Wyoming and Colorado Railroad in 1987. After a failed attempt to turn it into a tourist attraction, the company announced in 1996 plans to abandon the right-of-way and the abandonment was finalized in 2003.

Meanwhile in February 1976, the Brandt family, through trades and a purchase, acquired eighty-three acres from the Medicine Bow National Forest in Fox Park, Wyoming, including a stretch of the railroad right-of-way, to build a sawmill and cabins.

Shortly after the Wyoming and Colorado Railroad announced its intent to abandon the right-of-way, the Forest Service asked the US District Court of the District of Wyoming to declare that the right-of-way reverted to the federal government. The Forest Service was specifically interested in twenty-one miles of the abandoned railroad crossing federal and private property, which the government intended to turn into a recreational rail-to-trail. The Forest Service's action involved not only the Brandts' property, but also land belonging to approximately fifty other landowners, which the right-of-way crossed.

Marvin Brandt, through his legal counsel, Mountain States Legal Foundation, was the only landowner to contest the Forest Service's action. He argued that he and his family owned the entirety of the parcel, including the abandoned right-of-way. A legal battle over the railroad's abandoned interest ensued, first in

the federal court in Cheyenne, then at the Tenth Circuit Court of Appeals in Denver.

Ultimately, the case made its way to the United States Supreme Court, whose final decision on the matter promised to have significant implications to private landowners and to public access on rails-to-trails. If the Supreme Court ruled in favor of the Forest Service, landowners could see abandoned easements across private property converted to other uses without their approval. On the other hand, if the Supreme Court ruled in favor of the Brandts, public access to thousands of miles of rails-to-trails across the country could be put in jeopardy.

While the case made its way through the legal system, the Forest Service proceeded to construct the twenty-one-mile recreational Medicine Bow Rail-Trail, transecting the Brandt property in Fox Park.

THE SUPREME COURT DECISION

Owning land is like owning a bundle of sticks. Each stick represents a right related directly to the land, and each right can be separately owned, sold, and added back to the bundle. When the United States granted a right-of-way to the Laramie, Hahn's Peak & Pacific Railway Company (LHP&P), pursuant to the General Railroad Right-of-Way Act of 1875, it gave away one stick out of the bundle. The stick allowed LHP&P to use a portion of land for a specific and limited purpose—to build and operate a railroad. The United States retained the remainder of these proverbial sticks. In 1976, the Federal government transferred the sticks associated with eighty-three acres of land in Fox Park to the Brandt family.

A lingering question remained, despite the transfer of the property to the Brandts: Upon the railroad's



The immediate implications for the Medicine Bow Rail-Trail are not as significant as the potential overall impact of the Supreme Court's decision may be to other existing, and future rails-to-trails on federally granted rights-of-way.

abandonment of the right-of-way, did the United States hold onto a right for the public to access the right-of-way? Or did this stick pass on to the Brandt family?

The Brandts argued that they had full control and ownership of the right-of-way across their property. The right-of-way, they said, constituted an easement, and under traditional legal principles, once an easement is abandoned, the land underlying the easement simply becomes unburdened. In other words, the stick representing the railroad's right to access the land rejoined the rest of the sticks in the Brandts' bundle.

The Forest Service, on the other hand, argued that the General Railroad Right-of-Way Act of 1875 granted something more than an easement. The government gave the railroad company a property right for the railway. If the railroad ever stopped using the land for that purpose, the Forest Service argued, the right-of-way would return to the US government.

The Supreme Court determined that the General Railroad Right-of-Way Act of 1875 only granted a right-of-way, unlike earlier, more generous statutes. To encourage development and settlement in the American West, these earlier statutes granted railroad companies rights-of-way through public lands, along with outright grants of land along those rights-of-way. One result of these generous statutes is the checkerboard pattern of publicly and privately owned land across Wyoming and much of the west.

In 1872, however, Congress stated that public lands would, from then on, be held or transferred for the purposes of settlement and education. In subsequent legislation, like the 1875 Right-of-Way Act, Congress only granted rights-of-way across public lands, without accompanying grants of land. The Brandt family relied on this policy shift to argue that the right-of-way granted to the LHP&P Railroad was nothing more than an easement.

Additionally, the Brandt family relied upon *Great Northern Railway Co. v. United States*, an earlier Supreme Court case in which the federal government had admitted that any right-of-way granted pursuant to the 1875 Right-of-Way Act gave an easement and nothing more.

Ultimately, the Supreme Court agreed with the Brandts. It found that all the government had given to LHP&P was an easement, which, once abandoned, simply reverted to the landowners. The Supreme Court determined that any interest in the right-of-way belonged to the Brandt family, and not the Forest Service. It was up to the Brandts to say whether or not a recreational trail could traverse their property.

RAILS-TO-TRAILS IN JEOPARDY

The immediate implications for the Medicine Bow Rail-Trail are not as significant as the potential overall impact of the Supreme Court's decision may be to other existing, and future rails-to-trails on federally granted rights-of-way. As Brandt was the only landowner to object to the Forest Service's action, only the portion of the Medicine Bow Rail-Trail on his property will have to be re-routed. An adjacent Forest Service road is available as alternative route.

The solution for other existing rails-to-trails will likely not be as simple. As the lone dissenting voice in *Brandt v. United States*, Justice Sonia Sotomayor cautioned that "today, the Court undermines the legality of thousands of miles of former rights-of-way that the public now enjoys as means of transportation and recreation. And lawsuits challenging the conversion of former rails to recreational trails alone may well cost American taxpayers hundreds of millions of dollars."¹

One of the complicating factors in determining the potential impact of this decision is the fact that the Federal government does not have a record of how many miles of recreational trails have been built on abandoned federally granted rights-of-way. Not every mile of every rail-to-trail will be affected, but those built on federally granted rights-of-way may face challenges. To avoid right-of-way challenges, many trail builders have relied on the 1994 Trails Act, which enables "rail-banking." Rail-banking allows the federal government to preserve the unused, but not yet abandoned, railway right-of-way for

future railroad use by converting it to a multi-use trail in the interim.

Not all landowners will see this case as a victory. Due to the potential environmental hazards associated with abandoned railroad lines, including contamination from creosote and other chemicals used to treat railroad ties, some landowners may choose to donate abandoned rights-of-way back to the Federal government rather than face the potential liability associated with remediating an abandoned rail line.

It is certainly not every day that a case originating in Wyoming makes it to the United States Supreme Court. Time will tell whether or not this Wyoming based property law case will derail the rails-to-trails program.

Bailey Schreiber is concurrently seeking a law degree from the University of Wyoming College of Law and a master's degree from the Haub School of Environment and Natural Resources.

Temple Stoellinger is the Deputy Director of the UW College of Law's Center for Law and Energy Resources in the Rockies and Adjunct Assistant Professor for the Haub School of Environment and Natural Resources.

The authors would like to thank Steven Lechner, Mountain States Legal Foundation Vice President and Chief Legal Officer, for his presentation at the University of Wyoming College of Law on February 13, 2014, and for providing his outline of the case.

The Supreme Court of the United States Blog (SCOTUSblog) has compiled the Supreme Court's opinion and the briefs filed in the case, available at: <http://www.scotusblog.com/case-files/cases/marvin-m-brandt-irrevocable-trust-v-united-states/>

1 *Marvin M. Brandt Revocable Trust v. United States*, 134 S. Ct. 1257, 1271 (2014) (Sotomayor, J., dissenting).

Prescribed Burns, Toppling Trees, and Vulnerable Cabins, **OH MY**

Social Scientists Reveal what the Public Thinks of Post-beetle Forest Management

By Manasseh Franklin

At the height of the mountain pine beetle epidemic in northern Colorado and southeastern Wyoming, Phil Cruz, Forest Supervisor of Medicine Bow-Routt National Forests needed answers. Not only was he looking for ways to curb the epidemic, he was also seeking a deeper understanding of the public's take on landscape-altering effects of the beetle. A group of Colorado State University researchers proposing a social science study on public perception of the mountain pine beetle approached Cruz and the supervisors of the Arapahoe-Roosevelt and White River National Forests. Would the Forest Service be interested in collaborating?

"At the time, the issue was bigger than anybody knew. We knew the beetle epidemic needed to be understood by the public and the government," said Cruz. In an effort to get a better sense of how the public perceived Forest Service efforts to control the epidemic, Cruz and his colleagues said yes.

This opened the gateway for a groundbreaking look into how the public viewed not only the mountain pine beetle epidemic, but also the national forests as a public resource and the Forest Service's management of those lands. "We really wanted to know where people were coming from and how they felt about management activities on the land," said Cruz. "Do people think the Forest Service knows

what they're doing? Is the Forest Service listening to the public?"

The social scientists joined forces with the Forest Service to write a series of questions aimed at increasing that understanding. Together, they developed questions based on Forest Service needs, including public comfort with prescribed burning and trust in forest manager decisions, as well as social science inquiry, such as how much value the public places in forests, and for what reasons.

Between November, 2011 and January, 2012, the researchers mailed surveys to 4,500 households and collected responses from over 750 stakeholders scattered from Colorado's western slope to the Front Range and up into south-central Wyoming. The result is *Public Perceptions of the Mountain Pine Beetle in Three Study Areas in Northern Colorado and Southern Wyoming* published by the Department of Human Dimensions of Natural Resources at Colorado State University in 2012.

Some of the findings, said social scientist and one of the study authors, Jessica Clement, came as a surprise.

"Study results indicate that the public is more comfortable with prescribed fire than previously thought," Clement said. That realization gives land managers more confidence to use controlled burns as a management tool.

For Cruz, the surprise was the general public understanding





Joe Riis/USFS

of the interconnectedness of the issues surrounding Forest Service management and mountain pine beetle control. “Study results told us the public had a depth of knowledge, awareness and support that showed the Forest Service is on the right track,” he said. Pretreatments, such as thinning and salvage on Forest Service boundaries, prescribed fire and pile burning, can help mitigate the effects of wildfire. The study, noted Cruz, showed that people had an understanding of that reality.

The study also provided insight into who uses the forests and for what activities. Recreationists—like hikers, campers, hunters, and anglers—made up the highest percentage of respondents. Smaller percentages identified as conservationists, government agency officials, and people gaining economic benefit from the forest through activities like timber harvest, livestock grazing, and outfitting.

Results also show that participants value how forest health contributes to the production, preservation, cleaning, and renewal of air, soil, and water. This “tells us that local residents living with the beetle outbreak are gaining an understanding and awareness of how important forests are in maintaining earth, air, and biodiversity,” said Clement.

While a large percentage of respondents think people should be able to build houses on land close to affected forests, an equally high percentage believe that homeowners, not land managers, are responsible for protecting those homes from wildfire. Additionally, 92% of respondents are in favor of forest managers allowing harvest of beetle-killed trees for wood products and biomass. Ninety-six percent agreed that recreationists should accept the danger of tree fall when recreating in affected areas.

Cruz noted the generally high level of trust the public has in the Forest

Service to manage wildfires, which came in at 87%. Only 59%, however, believed that forest managers are doing everything within their abilities to control the mountain pine beetle outbreak.

So, where will the public see their input put into practice? Now that the study is finished, Clement and Cruz agree that there are two priorities: get the information to the public, and use the information to inform future management decisions. “We can’t let up on maintaining and building relationships with communities,” said Cruz. This includes educating the public, listening to concerns, and teaching about and discussing the issues in public settings. Information divulged by the study “presents new opportunities to work with people, and helps with adaptation of management priorities.” That includes educating and working with Forest Service employees.

“A continuously moving and improving body of knowledge is a

key factor in management,” said Cruz. Though this study may be one of the first of its kind, the valuable insight it provided will hopefully ensure that it won’t be the last.

Manasseh Franklin is pursuing a master of fine arts in creative nonfiction writing and environment and natural resources at the University of Wyoming and has reported for magazines such as Rock and Ice, Trail Runner, and others.

FURTHER READING

Czaja, Michael, Stuart Cotrell, Alan Bright, and Jessica Clement. *Public Perceptions of the Mountain Pine Beetle in Three Study Areas in Northern Colorado and Southern Wyoming* (Fort Collins, CO: Department of Human Dimensions of Natural Resources and Department of Forestry and Rangeland Stewardship, Colorado State University, 2012).

Find the full report online at www.westernconfluence.org.

Collaboration in Action

Wilderness and Livestock Advocates Advise US Forest

By Kelly Hatton

When Jim Magagna, Executive Vice President of the Wyoming Stock Growers Association, arrived at the first national advisory committee meeting for forest planning, he looked around the room and wondered how he and the twenty other committee members would ever reach consensus.

The group included representatives from the timber industry, environmental and wilderness organizations, and the public sector. “I knew some of the individuals,” Magagna said, “and I knew the organizations that some represented were organizations that I had done battle with for years.”

This diversity was by design, part of the Forest Service’s recent effort to include the public and stakeholders in the planning process.

“We used to develop proposals and then put them out to the public,” said Tony Tooke, national director of ecosystem management coordination for the US Forest Service. “Now we’re talking to the public first.”

The National Forest Management Act of 1972 establishes standards for national forest management and requires the development of land management plans for national forests.

The first National Planning Rule was published in 1982. For over twenty years, the Forest Service has been attempting to implement a new rule. Most recently, planning rules from 2005 and 2008 were challenged in California Federal Courts. In both cases, the court found the plans did not adequately provide protective measures for plants, wildlife and waterways and the Forest Service



reverted to the 1982 rule.

In 2012 the US Forest Service made yet another attempt to bring their planning process up to date. The goal, said Tooke, is to “support cultural, economic and social sustainability while meeting desired ecological conditions.” The turbulence of the planning process over the past two decades illustrates the complexities of managing public lands.

The Forest Service thought collaboration might be one way to address this challenge. “The way this planning rule was developed was one of the most collaborative efforts of

the forest service,” Tooke explained. The agency arranged public meetings, solicited comment letters, and consulted with Tribes in an effort to bring stakeholders to the table early.

Following publication of the National Planning Rule, the Forest Service created the advisory committee Magagna is part of to continue this collaboration. The official title of the group is the National Advisory Committee for Implementation of the National Forest System Land Management Planning Rule.

While the National Planning Rule sets national policy for public

land management, the agency publishes directives to guide how these provisions and regulations should be implemented in the 155 National Forests. The committee has been reviewing and offering revisions to the Forest Service’s draft of directives for forest managers.

The committee met eight times between 2012 and 2014 to review the directives. In that time, the group covered a range of issues, including water, wilderness, climate change, and conservation concerns.

For Magagna, wilderness was one of the toughest issues the committee

Service on New Planning Rule



worked on. Each of the committee’s recommendations needed unanimous approval before it could go forward. He doubted the group would reach consensus.

“One of the directives implied that forest managers are to protect wilderness characteristics even if it means eliminating other uses in wilderness areas,” Magagna said. According to the Wilderness Act, Magagna pointed out, grazing is a protected use in wilderness areas where it was traditionally permitted.

Ultimately, everyone, including Magagna, agreed on each issue—even

wilderness. “We’re not going to ignore the impact livestock are having, but we’re not going to eliminate grazing,” Magagna said. Overall, the experience for Magagna was positive.

“Everyone individually really had the spirit of wanting to reach out and find some common ground,” he said. He plans to continue working with the group to encourage and increase opportunities for collaboration in forest planning.

The Forest Service is currently integrating the committee’s recommendations and other feedback

into the directives, and implementing the 2012 rule in eight early-adopter forests. Following their work on the directives, the committee developed a Citizen’s Guide to the 2012 Planning Rule to help the public participate in the planning process, and a Government to Government Guide to help state and local governments assume a more active role. Both of these documents are nearly complete. The Forest Service plans to continue using collaborative approaches to land planning and management. “This planning rule is a change from how we’ve done things for a long time,” Tooke said.

He is hopeful that the agency’s new effort at collaboration has led to a more widely accepted rule, and that the opportunities for early stakeholder participation will help prevent litigation. Bringing stakeholders to the table early, he said, “can lead to more broadly supported decisions. We haven’t avoided litigation everywhere, but our belief is that the best way to go is involve as many people as possible.”

Learn more about the US Forest Service Planning Rule at www.fs.usda.gov/planningrule.

LETTERS TO THE EDITOR



“THE BIRD THAT TORE THE WEST APART”

Editor:

I was shocked to read, in the winter 2014 edition article on sage grouse, the statement that the State of Wyoming has broad authority to enforce the core area policy on non-federal land. While the State of Wyoming has authority over state lands and most permits required by state agencies, the State of Wyoming has no authority over private land and private minerals. There is no state law that gives the Governor the power to regulate private property for sage grouse. Absolute arbitrary power over private property by state government is specifically prohibited by the Wyoming Constitution (Article 1, Section 7). Private property was included in the sage grouse core areas without notice to the owners or any opportunity to speak at a hearing. The Governor’s Sage Grouse Implementation Team (SGIT) established the core boundaries but kept no minutes of where or how these boundaries were established. The SGIT did not have to adhere to Wyoming’s Administrative Procedures Act. In one case the state protected wind leases on state land by moving the boundary just outside of the area leased for wind development. Private mineral leases were not allowed the same consideration and were included in core areas. The Legislature has not addressed the sage grouse core areas in statute. The Legislature did encourage the core strategy by use of a pass around resolution that has no legal standing. I have asked the SGIT many times to provide me with the statutory authority for their actions and have been ignored. Unlike wolf recovery, the core area strategy is not established in state law. The idea that sage grouse has brought the West together is entirely false.

Doug Cooper
7L Livestock Company
Casper, Wyoming

As Mr. Cooper’s letter illustrates, and indeed, as the article itself pointed out, broad disagreement exists regarding the appropriate management of sage grouse and governmental roles in doing so. And, in states such as Wyoming, where public lands are extensive, private land holdings relatively limited, and wildlife respect no property boundaries, the costs of sage grouse conservation (or wildlife conservation more generally) are not necessarily uniformly shared.

The Core Area Policy adopted by Governors Freudenthal and Mead provides that then-existing land uses within Core Areas “should be recognized and respected by state agencies,” and assumes that such activities existing prior to August 1, 2008 will not be managed subject to Core Area stipulations. It further provides that activities occurring after that date for which state agency review or approval is required by federal or state law are subject to review under the Policy. The Executive Order further contains a list of activities, predominantly relating to agricultural and ranching activities, which are exempted from review under the Policy. Whether this balance represents an appropriate policy determination is certainly open to debate.

The broader question, however, remains whether the sage grouse states, working together and with both the federal government and the private sector, can accomplish the goal of making a federal listing of the greater sage grouse under the Endangered Species Act unnecessary, or whether divisions among us over these and similar issues will continue the cycle of species conservation driven and overshadowed by litigation.

Michael J. Brennan, P.C.
Conservation Law and Policy

ROTATIONAL GRAZING DOES THE TRICK

Dear Editor,

I was shocked, and honestly appalled, at your article “Conservation Grazing: Ranchers Lead the Way.” You have created a totally false dichotomy between season-long grazing practices and what you call “rotational” grazing. It is certain that “high intensity, short duration” grazing, even in a rotational system, does not work in the western US. We never had the same native ungulate ecology as Africa. However, it is absolutely scientifically documented across the western US, that rotational grazing systems, utilizing proper use standards, are far superior to the previous season-long grazing practices. Rotational grazing systems, utilizing proper use standards, can rapidly restore degradation in stream conditions, as well as riparian and meadow vegetation; the degradation that occurred under “high intensity,” season-long grazing systems. I have worked with ranchers applying rotational grazing systems, including proper use standards, for over 20 years, with monitoring and scientific review, and the results are clearly evident and well documented.

Edith Asrow
Modoc County, CA

As Ms. Asrow’s letter points out, strategies for rotational grazing have many forms, and cannot be simplified to represent a dichotomy between livestock rotating among pastures vs. season-long grazing. The article “Cattle as Ecosystem Engineers” by Drs. Derner, Augustine, and Kachergis in the last issue, makes it clear that indeed, grazing strategies that implement rotations with different timing and intensities can improve wildlife habitat to increase biological diversity, and be used as conservation strategies. Indeed, the article “Conservation Grazing: Ranchers Lead the Way” shows that ranchers are receiving tangible benefits when they adjust grazing strategies and apply adaptive management, and that these strategies are benefitting wildlife as well. The article elaborates the difference between the way that ranchers

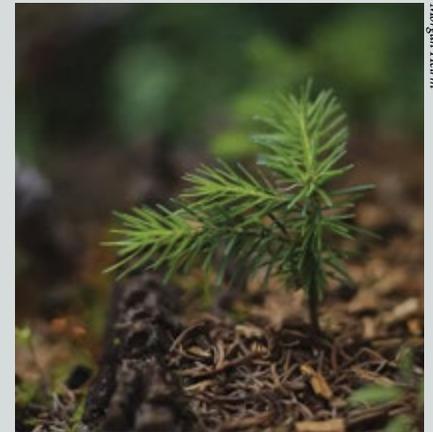


About *Western Confluence* magazine

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If we do start to charge subscription fees in the future, it won't be until 2016 at the soonest, and we will notify all readers ahead of time. No one will be charged unknowingly.

We welcome letters, story pitches, tips on interesting research, critiques, and other ideas. Please send all correspondence to editor@westernconfluence.org.



Still frame from the film "Regeneration" produced by the Ruckelshaus Institute and Medicine Bow-Routt National Forests.

know and understand systems, and the way that range scientists do.

The scientific community, as evidenced in much of the recent literature, grapples with how to study the results of adaptive management, constrained in many ways to traditional approaches of experimental designs, including replicates and "controls" and peer-reviewed evidence. Through our title, about ranchers *leading*, we hoped to explore the contrast between the responsiveness of ranchers to new ideas, and the skepticism of the scientific community. It was not our purpose to make too much of the "rotational grazing" vs. "season-long grazing" issue. Thank you very much for helping us to clarify this.

On a related note, in March, we (two range scientists from Wyoming) took students from both the UW Haub School of Environment and Natural Resources and the University of Buenos Aires on a field trip of rangelands in Patagonia (photo above). We met with ranchers and consultants practicing holistic management (adaptive management that includes rotational grazing), and with university scientists and national agricultural scientists of both Chile and Argentina. It was a provocative and productive experience for all of us, as we explored the communication gap between rangeland scientists and holistic grazing managers in South America as well as here in the western US.

Indy Burke
Director, Haub School of Environment and Natural Resources
University of Wyoming

Ruckelshaus Institute work on forest issues

Forest Task Force

The Ruckelshaus Institute Collaborative Solutions Program has been facilitating Wyoming Governor Matt Mead's **Task Force on Forests**. The Task Force on Forests is made up of 19 stakeholders representing government, land management agencies, industry, conservation groups, outdoor recreation, and others. They are charged with developing consensus recommendations for enhancing the social, economic, and ecological values of Wyoming's forests. The group has organized its recommendations into three themes: fire and other disturbance, resource management, and economic opportunities and innovation.

"Beyond Bark Beetles" film series

The Ruckelshaus Institute partnered with the Medicine Bow-Routt National Forests to produce a series of ten short films exploring the bark beetle outbreak in our local forests and how people are responding to the outbreak. The films take viewers to meet fire lookouts, rock climbers, hunters, biologists, water managers, loggers, foresters, and more, all while trying to figure out how our forests are changing following the bark beetle outbreak and what those changes mean for the people who use the forests.

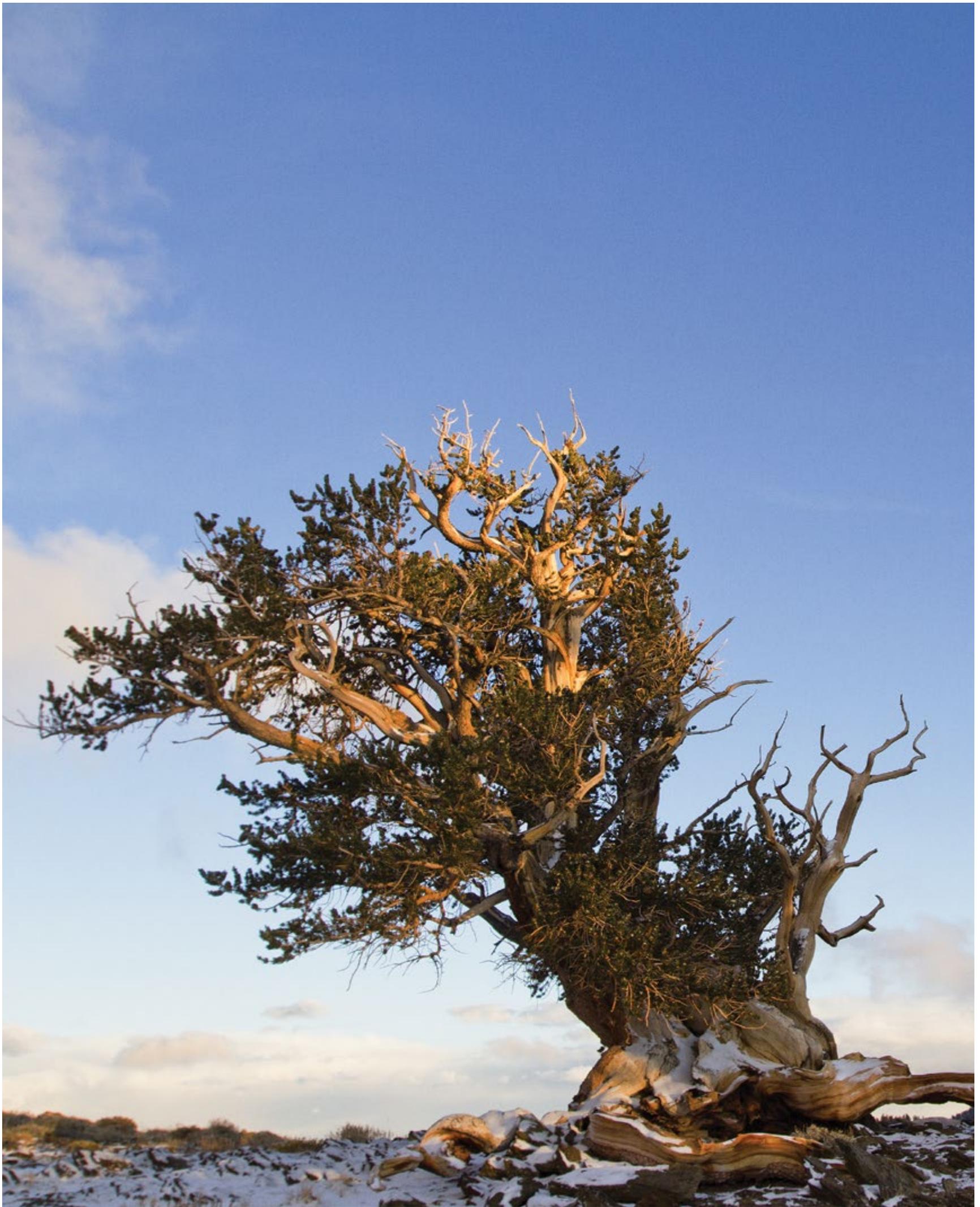
For information on these initiatives and programs, visit our website: www.uwyo.edu/haub/ruckelshaus-institute

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The Ancient History and Uncertain Future of Western Forests

By Dennis H. Knight

Throughout the western states, trees grow abundantly over large areas only on the higher mountain ranges. However, trees were scarce everywhere about 20,000 years ago, based on evidence from pollen and plant fragments preserved in lake bottoms. Widespread mountain glaciers and the surrounding tundra-like landscape were not good environments for tree growth.

As the glaciers melted about 10,000 years ago, present-day forest ecosystems began to develop. Engelmann spruce, subalpine fir, and whitebark pine gradually became abundant at mid and high elevations, and they were followed by the slow expansion of limber pine, lodgepole pine, Douglas fir, and aspen. Open woodlands became forests, providing habitat for forest dwelling birds and mammals that previously had been rare. Several of them, such as the red squirrel and Clark's nutcracker, consumed large quantities of pine seeds. Bark beetles and mistletoe surely were common, some years more than others. Like most of the trees, many small shrubs and herbaceous plants in the understory retained green leaves or stems throughout the year, enabling photosynthesis before and after the short summer. A few were capable of nitrogen-fixation, an adaptation for surviving on nitrogen-deficient soils (and which made nitrogen more readily available for other plants and animals).

If it were possible to look at a series of time-lapse aerial photos during the last 5,000 years or so, the mountain landscape would appear as a shifting mosaic of open woodlands, young forests, middle-aged forests, old forests, and various kinds of meadows.

Forest fires would have burned with varying intensity over large areas during summers that were unusually dry and windy. Smoke would have hung in the air. The fires, however, would not have burned most of the tree trunks, which would fall to the ground one by one (or all at once during a windstorm). The dead trees and downed logs provided habitat for cavity nesters and contributed to soil development.

About 3,000 years ago, the time-lapse photo series would have showed forests at low and possibly mid-elevations giving way to meadows and shrublands, caused by further warming and drying of the climate. Native Americans might have appreciated more forage for bison and other large herbivores. Indeed, they might have started fires to reduce shrub and tree cover. Commonly the fires, whether started by people or lightning, would burn until rain or snow extinguished the flames. Eventually the climate cooled and trees again occupied the previously forested land.

Clearly, forest plants, animals, fungi, and numerous microbial organisms have evolved adaptations that enabled them to survive short, cool, and often dry summers; long winters; periodic wildfires; and young infertile soils. Throughout history, dead trees must have been common due to fire, wind storms, insect epidemics, and the death of older trees. The forests would have appeared messy, with downed wood making it difficult to walk, as noted by early explorers in their journals.

In current times bark beetle epidemics and wildfires have killed millions of trees. Some beetle-killed trees are harvested for their still-valuable wood. Other dead trees,

so-called snags, are cut because they are hazardous along roads and in campgrounds, or they appear highly flammable. In some nearby forests, harvesting has been proposed because the trees are old, slow-growing, and a potential food source for the troublesome beetles. These "healthy forest initiatives" are an understandable response, but the wildfires and insect epidemics that have attracted so much attention in recent years have occurred before, with new forests developing after each disturbance. Some species benefit from the disturbances.

So is there nothing to be concerned about? Indeed there is. If wood production is a primary goal, large-scale disturbances provide an economic hardship, often killing trees while they are growing most rapidly. Also, roads and other development have fragmented once-extensive forest habitat, making the smaller populations of forest-dwelling species vulnerable to further disturbances of any kind. Moreover, so many mountain watersheds are now accessible by roads that those few that remain unroaded have become highly valued for dispersed recreation and less impacted habitat for sensitive species, helping maintain the biodiversity of the region. Fortunately, over large areas, traditional commodities such as wood and forage are still available and can be harvested in sustainable ways.

During the past 150 years, mountain forests have become highly valued for the commodities and amenities they provide—lumber, wildlife habitat, erosion control, forage for livestock (where the trees are not overly dense), and a pleasing contrast to the grasslands and shrublands of the surrounding lowlands. They are part of

the attraction of living here. We know their abundance and distribution have changed dramatically since the glaciers retreated, and we know that beetle epidemics, fires, and windstorms will occur again in the future. That's reality.

But climate change in the 21st century has introduced a troubling level of uncertainty. Some kinds of forest may become less common because wildfires occur so frequently that young trees burn before they can produce sufficient seed for the next generation. Moreover, if unburned seed does germinate, many seedlings may not survive because of more frequent droughts in late summer. Meadows may become more widespread reducing habitat for some species while others thrive.

The effects of climate change will be highly variable, influenced by elevation, topographic position, unusual weather events, human activities, and the kinds of plants and animals present at the time of the inevitable disturbances. The native forest species present today have survived such changes in the past. This time, however, climatologists have concluded the climate is changing more rapidly than before, and it's occurring at a time when forest habitats already have been impacted over large areas by fragmentation, the presence of non-native species, and a growing demand in an otherwise semi-arid landscape for the habitat and resources that only mountain forests can provide. Just when forests are more fully appreciated than ever before, it appears that some of them could become less widespread.

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