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Understanding and Managing Forest Disturbance

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A forester's worst nightmare is to see many years of hard work go up in smoke in a wildfire...or in an insect outbreak… or to a rapidly spreading root rot. These are relatively rare events in the big picture, but when they do occur, they can cause economic losses and alter ecological pathways in forest ecosystems for decades.

These rare events, generally termed disturbances (see sidebar for definition), are part of the ecological history of most forest ecosystems, influencing vegetation age and structure, plant species composition, productivity, carbon storage, water yield, nutrient retention, and wildlife habitat. Climate, and weather in a shorter time scale, influences the timing, frequency, and magnitude of disturbances in any particular location. For example, a one-year drought may in itself not have significant direct effects on a forest, but it can reduce the resistance of trees to insects and can desiccate living and dead vegetation sufficiently to increase fire hazard.

PHOTO COURTESY OF US FOREST SERVICE

Large wildfires, such as the 2006 Tripod Fire in Washington (200,000 acres), have occurred throughout western North America during the past decade. These disturbances have a significant effect on landscape pattern and forest structure, and may become more common in a warmer climate, especially in forests with heavy fuel accumulations.

Interacting disturbances and other stressors have the biggest effects on ecosystem responses, simultaneously altering species composition, structure, and function. Termed "stress complexes," these interactions are a normal component of forest ecosystems. However, altering one particular factor can potentially exacerbate the effects of other stressors, leading to a rapid and possibly long-lasting change in forest ecosystems.

The recent proliferation of mountain pine beetles in lodgepole pine forests in western North America is a good example of how a warmer cli-

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Disturbance is a temporary variance in average environmental conditions that causes a pronounced change in an ecosystem. Ecological disturbances include fires, floods, windstorms, and insect outbreaks, as well as anthropogenic disturbances such as forest clearing and the introduction of exotic species. Natural disturbances are influenced mainly by climate, weather, and location. Disturbances can have profound immediate effects on ecosystems and can greatly alter the natural community. Because of the impacts on populations, disturbance effects can persist for an extended period of time. (from Dale et al. 2001. Bioscience 51:723-734)

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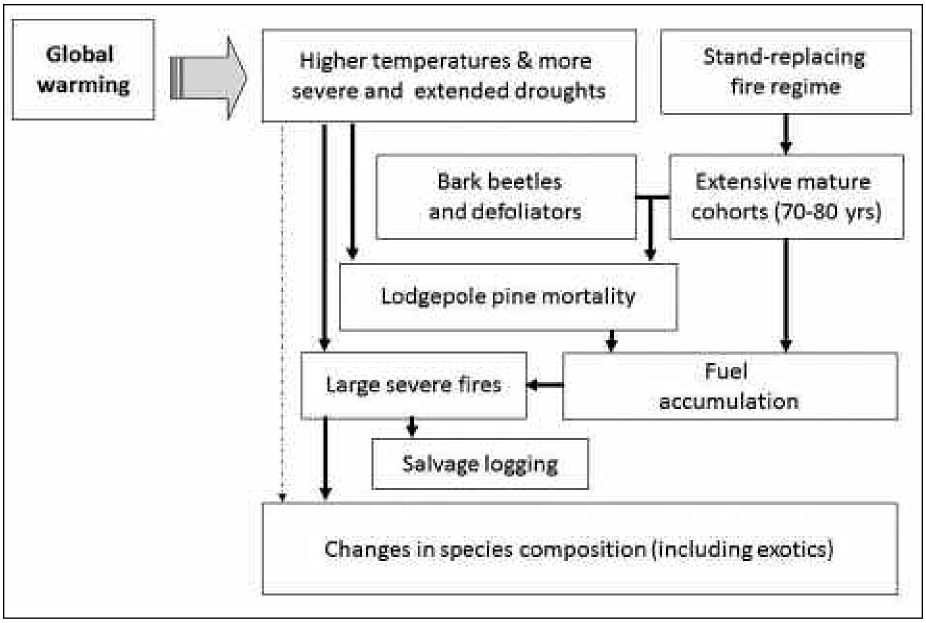
mate can propagate widespread disturbance (see Fig. 1). Mountain pine beetles have affected 88 million acres of forests in the western United States and British Columbia over the last two decades, largely as a consequence of increasing temperatures and drought in mostly older, low-vigor forests. The effects of disturbance across large geographic areas are especially pronounced where forest regeneration is low or delayed, leading to a potential change in dominant vegetation.

The effects of disturbances in forest ecosystems should be considered in the broader context of past disturbances and stressors that have been occurring for millennia, as well as more recent human-caused changes. Some factors have increased over the past century, such as non-native plant and animal species. Other factors have decreased, such as the frequency of low-intensity wildfire in dry forests. Logging has removed about 90% of the original forest in the western United States, converted most landscapes to younger forests distributed in mosaics of different age classes, and altered the distribution, abundance, and genetic diversity of species in some forests. Agriculture, suburban and exurban communities, and other land uses have reduced the connectivity of forests and added a new socioeconomic complexity to resource management.

The expansion of human communities and infrastructure into forested



SOURCE: PNW RESEARCH STATION

Figure 1. Stress complex in interior lodgepole pine forests. The effects of disturbance (insects and fire) are exacerbated by global warming. Stand-replacing fires and beetle mortality can contribute to species changes.

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Next Issue: Forest Soils, Nutrition, and Productivity

regions, typically called the wildland-urban interface (WUI), has complicated the issue of managing forest disturbance. Many communities are now located in areas where fire has been suppressed for several decades and residents assume that local agencies will continue to protect their property in the future. Efforts to protect homes in the WUI account for at least half of the annual cost of firefighting in the United States. Mitigative measures such as hazardous fuel treatment are highly effective, but are expensive in the WUI and are sometimes unpopular among local residents (especially removal of small trees that alters aesthetics and prescribed burning that creates smoke). However, there are excellent examples of cooperative projects between agencies and communities that have reduced fuels and saved properties from wildfire.

Forest managers, whether on public or private land, spend a significant amount of time assessing the risk of disturbances and ways to cope with

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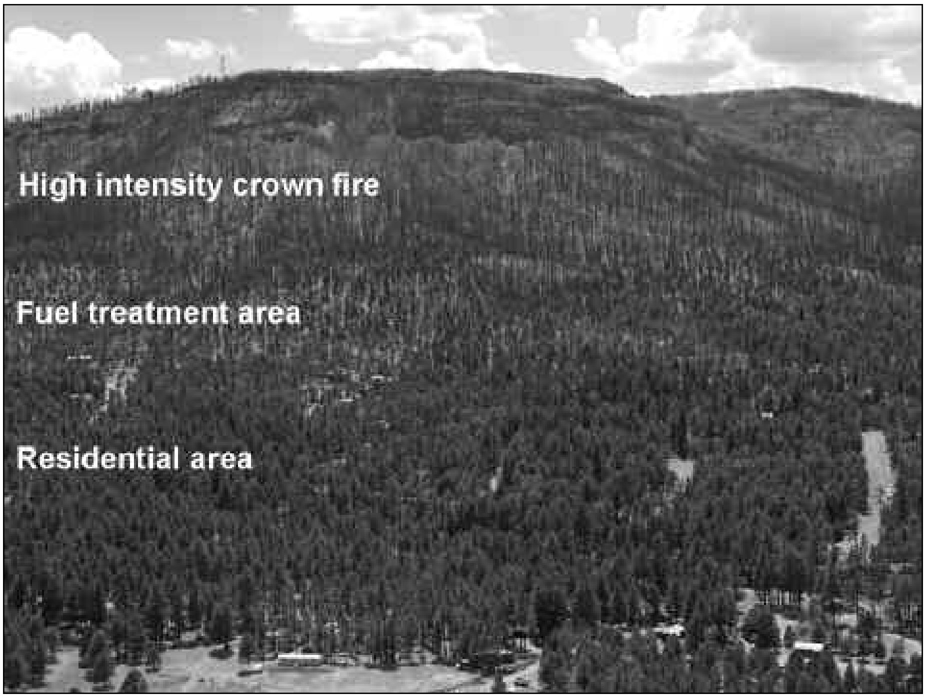

PHOTO COURTESY OF US FOREST SERVICE

The effectiveness of fuel treatments is seen in this portion of the 2011 Wallow Fire near Alpine, Arizona. High-intensity crown fire was common in this area, but forest that had been thinned and had surface fuels removed experienced lower fire intensity, and structures in the residential area (lower portion of photo) were protected.

them. Most federal lands have fire management plans that describe current fuel conditions, potential for fire occurrence, likely effects of wildfire, fire suppression strategies, and post-fire activities designed to reduce secondary damage such as erosion. Similarly, plans that assess the management of insects and non-native plants must assess the risk of their occurrence as the basis for developing appropriate responses. Large private landowners focused on timber production may also have such plans, but family forest landowners rarely have them.

In some cases, the effectiveness of pre-disturbance and post-disturbance actions may be limited. For example, many non-native species are so well-established that it is not feasible to remove them from a particular location; prevention is usually the best approach. Following large, intense wildfires, it may be impractical and expensive to install erosion control across a broad, mountainous landscape with minimal access. Active management in some forested regions—Wilderness, most national parks, riparian areas, and lands with endangered species—may be forbidden or so difficult to accomplish that it is not practical, thus precluding mitigation of known risks.

A warming global climate is a new factor that will increasingly affect forest ecosystems. The most rapidly visible and significant short-term effects will be caused by disturbance, often occurring with increased frequency and severity. As the climate continues to change, we expect increased disturbance to be facilitated by more frequent extreme weather events, including severe storms and drought. Indirect effects—wildfire, insect and pathogen outbreaks, and invasive species—may amplify these changes. The type and magnitude of disturbances will differ regionally and will pose significant challenges for resource managers to mitigate damage to resource values.

A warmer climate may cause some critical thresholds in ecosystem structure and function to be exceeded. This may already be occurring in some locations. For example, in parts of northern New Mexico, there has been die-off of pinyon pine on 1 million acres during the past decade, the result of extended drought and in some cases pinyon ips beetles. It is unclear if pinyon pine will regenerate in these areas. During the past 20 years, in southern Alaska, spruce beetle and wildfire have caused widespread mortality in 3 million acres of forest dominated by white spruce and black spruce. In some of these areas, only hardwoods are regenerating. A rapid change in dominant vegetation suggests that a threshold has been crossed, at least temporarily, and that new ecological conditions may be difficult to reverse in a warmer climate.

Forest ecosystems in western North America will continue to change as a result of disturbance, sometimes slowly in response to past human activities such as logging, and sometimes quickly in response to weather extremes. In most cases, it will be advisable to develop strategies that allow us to live with increasing disturbance and stress in forests, especially as the climate continues to warm. For example, it will be increasingly important to keep forests "healthy" through density management and other practices that encourage high vigor. Reducing hazardous fuel loadings, especially in the WUI, will be critical in dry, fire-prone forests.

The good news is that this sort of active management and planning in anticipation of changing conditions can reduce risk and the severity of short-term and long-term hazards. Foresters have been dealing with disturbances and other "surprises" for decades. Based on a strong scientific foundation compiled on the effects of forest disturbance, we should be able to successfully address many of our future challenges. ◆

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2014 SAF/CIF National Convention Call for Presentations

In 2014, SAF will partner with our Canadian counterpart, the Canadian Institute of Forestry/l'Institut forestier du Canada (CIF/IFC), for our national convention. In addition, the convention will be co-located with the International Union of Forest Research Organizations (IUFRO) World Congress, which only takes place once every 5 years and has not been hosted in the United States since 1971.

This is an exceptional convergence, which will bring several thousand forest scientists and managers from over 100 countries together in Salt Lake City, Utah during the first full week in October. We are thrilled at the opportunities this will bring for our US-based conference to enhance knowledge exchange and networking among professionals who study and manage forest resources around the globe.

The convention theme reflects the need for an introspective look at the forest science–management partnership. We want to take a critical look at the roles of science and management in service to society and in sustaining and enhancing forested ecosystems, locally and globally.

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Abstract submissions for individual presentations and panels in the scientific & technical concurrent sessions or poster symposium will be accepted for the following tracks:

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- Reexamining the Forest Science–Policy Interface
- Challenges in Emerging Markets
- Reconciling Professional and Research Ethics in Forest Science–Management Partnerships
- Making and Interpreting Long-Term Forecasts
- Learning and Success in Partnerships
- Communicating Science

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www.safconvention.org • (866) 897-8720

Key Deadlines

Online submissions open: November 1, 2013

Presentation submissions deadline: March 9, 2014

Notification of acceptance: April 2014

Poster submissions deadline: September 1, 2014

Notification of acceptance: September 22, 2014

All presenters must register for the convention. For more information, and complete track descriptions, go to www.safconvention.org and click on Presenters.

SAF NATIONAL CONVENTION

Salt Lake City, Utah
October 8-11, 2014

Disturbance is a Key Factor in Plant Invasions

BY BECKY K. KERNS

Exotic invasive plants (hereinafter invasive plants) are recently introduced nonnative species that are or have the potential to become successfully established or naturalized, and spread into new localized natural habitats. These species are often referred to simply as "weeds." However, invasive plants differ from weeds one might see in the garden in that they can successfully establish and spread to new habitats after their introduction, without further assistance from humans. Their introduction and establishment is likely to cause substantial economic or environmental harm. Foresters may be largely familiar with state-listed noxious weeds, as these species often require mitigation during or after management actions. But not all invasive plants are necessarily recognized as state noxious weeds. Table 1 lists examples of plants that can invade western upland forests and woodlands.

In general, the detrimental effects of invasive plants may include reduced tree recruitment and/or survival, a reduction in native biodiversity, changes in species composition, loss of habitat for dependent species (e.g., wildlife), changes in biogeochemical cycling, and alteration of disturbance and hydrologic regimes (see case study sidebar). But some claims about the negative impacts of these species are disputed or later discovered to be more subtle or complex. For example, the presence of actual toxic and detrimental levels of allelopathic compounds associated with spotted knapweed has been called into question. Some invasive plants also offer new ecosystem services, such as bioenergy opportunities or wildcrafted medicines. Sometimes invasive plants can also preserve ecosystem function, and in some cases their eradication may have unanticipated or negative results.

Millions of hectares of US wildlands are infested with invasive plants and billions of dollars are spent every year mitigating or controlling impacts. However, the economic impacts of most invasive plants are poorly documented and can be controversial. This is generally due to a lack of quantitative information on impacts and the spatial extent of infestations, and challenges in assessing nonmarket costs to society and the environment such as changes in fire frequency, wildlife habitat, aesthetics, and biodiversity. The spatial extent of many invasive plants at any point in time has also proven to be difficult to determine, limiting assessment of overall impacts.

How does plant invasion happen?

The process of invasion can be broken into three phases: introduction, colonization, and naturalization. Sources or vectors for exotic species introduction are highly variable but typically

Table 1. Examples of some exotic plants that have had significantly invaded western forests and woodlands and their potential impact

Common Name	Origin	Form	Species	Potential Environmental Impact
Cheatgrass	Eurasia	Annual grass	*Bromus tectorum*	Community type conversion; decreases native diversity; alters fire frequency, successional patterns, and nutrient cycling.
Yellow star-thistle	Eurasia	Annual forb	*Centaurea solstitialis*	Reduces forage; decreases native diversity; depletes soil moisture; reduces productivity in agricultural systems.
Spotted knapweed	Europe	Biennial/perennial forb	*Centaurea stoebe*	Reduces native diversity, cryptogam cover, soil fertility; reduces forage production; poisonous to horses; increases bare ground, surface water runoff, stream sedimentation; allelopathic.
Scotch broom	Europe	Shrub	*Cytisus scoparius*	Interferes with conifer establishment; reduces growth and biomass of trees; alters community composition and structure; increases soil nitrogen; toxic to livestock.
English ivy	Europe	Vine	*Hedera helix*	Alters community structure; decreases native diversity; weakens or kills host trees; can negatively impact water quality and increase soil erosion and soil nitrogen.
St. Johnswort	Eurasia, N. Africa	Subshrub	*Hypericum prolificum*	Crowds out native species and forage; toxic to livestock.

SOURCE: Varied sources on file with the author

PHOTO COURTESY OF DALE WHALEY

Noxious weeds can become attached to vehicles and transported to new sites.

include plants or seeds imported for horticulture, intentional introductions (e.g., seeds for erosion control), or accidental seed transfer via animals and equipment. However, only a small percentage of exotic plants that are introduced to a new region actually establish, colonize, and become invasive.

During the introduction phase, plants may be present in an area or on a site at low levels for many years or decades, and then rapidly expand during the colonization phase. Detection and rapid response to invasive plant introductions is an economically effective way to manage invasive plants. Control during the colonization phase can be expensive, and eradication after naturalization is unlikely. A species becomes naturalized in its new region when it can maintain its population and is incorporated into the existing flora. Most state and other agencies remove invasive plants from their noxious weed lists after naturalization because the populations are too difficult or expensive to control or eradicate (e.g., cheatgrass is not on most state noxious weed lists).

Invasive species seem to have traits or combinations thereof that enable them to gain an advantage over native species. These include, but are not limited to: fast growth, rapid reproduction, high dispersal ability, generalism, and adaptability. However, researchers disagree about how useful such traits are for understanding whether or not a plant will be invasive. The successful invasion of a forested community or site is influenced by several other factors related to specific site conditions such as the environment, disturbance history, resource availability (water, nutrients), health and vigor of the existing plant community, and the quality, quantity, and frequency of invading organisms (propagule supply).

Invasion and the role of disturbance

The importance of disturbance and interplay with available resources, such as water and nutrients, is a key factor in plant invasions. Natural and anthropogenic disturbances such as fire, landslides, volcanic activity, logging, and road building alter resource availability in forests by opening canopies and exposing mineral soil. These types of disturbances allow more light to reach the forest floor and can increase available soil water. Invasive plants are particularly prone to spreading after fire, especially if burn effects are severe. Similar trends are reported for thinning and logging. Generally, the more highly disturbed the area (e.g., high severity burn conditions, logging landings) the more likely it is that invasive plants may establish. Even patches of weeds can serve as sources of propagules and can make the surrounding area more vulnerable to invasion.

Invasive plants have been described as both "passengers" and "drivers" of environmental change. From the passenger perspective, the species become dominant as a result of human actions or natural disturbance. Rather than driving the transformation of plant communities, the invasive plants are passengers of more fundamental environmental change that is limiting to the existing flora (e.g., reduced dispersal due to fragmentation, altered disturbance regimes, climate change).

The driver perspective infers that invasive plants become dominant as a result of a variety of related means gen-

(CONTINUED ON PAGE 18)

Case Study: Invasive Annual Grasses

Invasive annual grasses such as cheatgrass (Table 1; others include medusahead, *Taeniatherum caput-medusae*, and North Africa grass, *Ventenata dubia*) are recognized as some of the most important ecosystem-altering species in the west. Cheatgrass is prevalent in low-elevation forests, woodlands, and rangelands of the interior western US. Following disturbances such as fire, logging, and thinning, this species is capable of invading and creating surface fuel continuity between arid lowlands into forested uplands. Species traits enhance its ability to exploit soil resources after disturbance and to increase its dominance in the community. Sometimes this dominance may be persistent. Of particular concern are effects of fuel and fire management on exotic annual grass invasion. Reducing fuels and reintroducing fire is a high priority for forest and rangeland restoration and management in dry interior environments. However, these areas are often near abundant exotic annual grass seed sources.

After establishment, cheatgrass tends to alter the fire regime. The fine, continuous, and highly combustible fuels dry early in the season, which can increase the length of the fire season and also increase how frequently areas burn.

PHOTO COURTESY OF BECKY KERNS

In this eastern Oregon ponderosa pine forest, cheatgrass is invading an area that experienced overstory tree mortality after a prescribed fire.

Forest Insects and Pathogens as Disturbance Agents

BY KAREN RIPLEY

Forest insects and pathogens often get the blame for causing disturbances—especially noticeable, simultaneous tree death, defoliation, or disease. Although exotic species do cause dramatic, persistent changes, the activities of native species are more commonly part of how a normal forest ecosystem develops and stays robust. Occasionally, native insects and pathogens can cause severe disturbances with long-term effects, but they have usually been aided by extensive pre-disposing factors such as severe drought or forest composition changes caused by long-term fire suppression or unsustainable management practices. Managers can take action now to exclude exotic pests and reduce recognized vulnerability to native pests, extreme weather, and severe wildfire.

There's no doubt that exotic pests can really knock an ecosystem off kilter. Thanks to white pine blister rust, western white pine is now present across only about 5% of its past range, leaving mixed conifer forests without the benefit of this root disease-resistant, mast-producing, fast-growing pine tree component. The emerald ash borer has urban foresters alarmed that the handsome, adaptable ash trees along city streets throughout the country will be decimated (baseball bat makers and riparian advocates are concerned too). Balsam woolly adelgid threatens subalpine fir seed production and survival in the warmer, usually lower-elevation parts of its range, possibly leading to forest succession on alpine meadows and avalanche chutes veering different directions.

Because of exotic pests, trees will die. Ecosystems will be changed and habitats will be lost. This is the most extreme, irreversible category of insect- or pathogen-related disturbance. The Washington Invasive Species Council's 2008 Strategic Plan "Invaders at the Gate" (www.invasivespecies.wa.gov/documents/InvasiveSpeciesStrategicPlan.pdf) recommends short-term actions like enhancing early detection and rapid response capabilities for dealing with exotic pests. Forest managers can occasionally host exotic pest detection traps but can always be aware to report observations of suspicious symptoms or mortality to state Agriculture, Forestry, or University Extension offices. Familiarize yourself with your state's Priority Species. Washington's list of 50 Priority Species can be found at www.invasivespecies.wa.gov/mgt_priorities.shtml; the chart includes electronic links to information about each pest (37 are already present in Washington) and "What should I do if I find one?"

Native insects and pathogens also cause mini-disturbances as they kill, defoliate, or injure their host trees. Plenty of examples exist of how this activity is obviously the grease that keeps a "normal" forest robust. Do you have a forest plantation that is plagued by foliage disease? Check the site requirements and source of the seedlings. Persistent foliage diseases may be clues to off-site trees that aren't able to thrive in the environment they have been planted. Do you have hundreds of Douglas-fir saplings growing like dog hair? As light and water become more limited, the less competitive trees tend to be put out of their misery by opportunists like secondary Douglas-fir engraver beetles or Armillaria root disease.

When the least competitive, maladapted, or unlucky trees have been killed, the survivors take advantage of additional resources and relinquished growing space. The same is true for the non-host trees and understory plants beneath and near intense defoliation, such as an alder stand that's being consumed by tent caterpillars or leaf beetles. In this case these adjacent plants and defoliation survivors grow like crazy, taking advantage of additional light and a liberal sprinkling of caterpillar feces fertilizer that may help them persist until the next insect outbreak or until the alder reaches its normal life span and passes from the site.

Disturbance or diversity?

When native insects or pathogens prevent full-site occupation by vigorous conifers, does that indicate a disturbance is taking place or is the broader ecosystem being expressed? Pockets of laminated root rot can spread slowly in the vicinity of diseased stumps and roots, killing susceptible ingrowth and causing windthrow that perpetuates forest openings and shifts composition from conifers to flowering plants or other non-host species. Laminated root rot is also commonly expressed on sites with high water tables, probably favored because the shallow rooting zone allows lots of root-to-root contact that enables the pathogen to spread and infect any ingrowth. Although the Douglas-fir production may be interrupted, the forest ecosystem may be thriving. Similarly, low number tree killers like endemic bark beetle populations or top-killing stem cankers promote gaps and snag habitat features that are part of a healthy ecosystem.

Not normal

The perfect storms for native insects or pathogens to contribute to significant, lasting ecosystem disturbance arise when the forest or environment has departed from the conditions wherein the pests and host trees co-evolved. Although mountain pine beetle has always been capable of killing mature lodgepole pine, the unusually warm temperatures that improved winter survival, synchronized beetle generational development periods, and stressed continuous expanses of larger trees created a cake walk for beetles that previously had been challenged to skillfully locate, cooperatively attack, and infect target trees with sapwood-colonizing fungi necessary to overcome host defenses. Eighty-eight million acres of lodgepole forests have been killed because huge expanses of older trees were available and unprotected by normal weather, and highly versatile beetles responded.

Although dwarf mistletoe has always been a part of interior western forests, its abundance and prevalence now threaten the occurrence of large trees on many sites. Trees will either: 1) never grow to sizes the species are capable of reaching because of direct infection; or 2) be killed when wildfires rage through a fuel-packed environment.

It is the forests that are pre-disposed to disturbance—by overstocking, fuel build up, monotonous composition, uniform structure, or compromised seed sources—that are really at risk of a major disturbance by insects or pathogens that derails the ecosystem. We can't see all the parameters of the future clearly, but we can recognize and attempt to mitigate many features that make our forests vulnerable to dramatic, severe disturbance. Actions now that exclude exotic pests and reduce recognized vulnerability to native pests, extreme weather, or wildfire are smart management choices to conserve functional forest ecosystems and productivity into the future. ◆

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PHOTO COURTESY OF KAREN RIPLEY

This pine tree was recently killed by bark beetles. You finish the caption:

(a) The beetles are carrying an exotic magenta-stain fungus that's native to China. This is the start of a grave disturbance and means significant changes to pine forests. (Unlikely, but possible)

(b) The tree was wounded by a lightning strike. The wood is deeply cracked. The resulting food and habitat resource will be a boon to local woodpeckers. (Normal)

(c) The tree occupies a dry rocky site that, due to recent and likely-to-worsen high summer temperatures and low winter snowpack, is anticipated to be unlikely to sustain tree cover into the future. More trees are likely to die on this site so be alert to salvage. Spend your next management dollar to thin the crowded stand on the adjacent northern aspect. (Reasonable on some sites)

The Human and Fire Connection

BY THERESA B. JAIN

We refer to fire as a natural disturbance, but unlike other disturbances such as forest insects and diseases, fire has had an intimate relationship with humans. Fire facilitated human evolution over two million years ago when our ancestors began to use fire to cook. Fire empowered our furbearers to adapt to cold climates, allowing humans to disperse and settle into North America when they migrated over the land bridge on the Bering Strait. American Indians used fire throughout North America because it was an ideal tool to chase away predators, clear land, facilitate travel, and increase hunting opportunities. Tribes also used fire to regenerate edible plants such as berry bushes and camas for food and to rejuvenate beargrass and willow to produce supple materials for basketry. American Indians used fire to fell trees, and shape canoes, weapons shafts, and bows. Finally, fire was used as an instrument of war or as a ruse to escape from warring tribes. Tribes rarely extinguished fires and they allowed fires to burn hundreds to thousands of acres. Human- and lightening-ignited fires contributed to landscape diversity.

As settlers moved into the West in the late 1800s, they transformed our forests and fire regimes. Gold and silver brought thousands of miners to the region, and commerce followed with hotels, restaurants, general stores, and other business ventures that created towns throughout the Northwest. Many settlers used fire in a similar fashion as the American Indian tribes to clear land for farming, grazing, or prospecting. However, the largest and most damaging fires arose from primitive logging practices, sparks from trains, and human carelessness (e.g., abandoned campfires). Individuals also started fires to create work (firefighting) or to retaliate against others for real and perceived wrong doings. Unregulated grazing altered surface fuels between the mid-1800s and early-1900s. Overgrazing changed plant communities and reduced grass and favored woody vegetation, altered the surface fuels, and lengthened the fire return interval.

After the 1910 wildfires, society changed their cavalier approach to fire and began to recognize fire as a destructive force. This view prompted managers and scientists to develop a systematic approach to fire suppression through the 1910s and 1920s. World War II's innovative war tactics introduced new firefighting capabilities. Paratroopers introduced during the war led to using smoke-jumpers as an initial attack method, and surplus jeeps and helicopters combined with improved road access enhanced suppression efforts that decreased the total acres burned in the western US during the 1950s through 1987. This decrease also coincided with cooler and wetter weather that enhanced fire suppression abilities but perpetuated regeneration. As the century progressed, the advent of successful fire suppression, harvesting practices, and the introduction of diseases, the forests of the Northwest (eastern Oregon and Washington, Idaho, Montana) shifted from ponderosa pine, western larch, and western white pine to less fire resilient species. True firs flourished and so did root disease and insect epidemics that resulted in an overall decrease in forest health and an increase in hazardous fuel conditions. In the high elevation forests, fire suppression allowed lodgepole pine to age, thus becoming susceptible to mountain pine beetle. In 1988, 12 fires burned more than 1.42 million acres of lodgepole pine forests within the Greater Yellowstone ecosystem. A third

The *Dictionary of Forestry* defines a fire regime as the frequency, extent, intensity, severity, and seasonality of fires within an ecosystem. Terms such as "frequent, low-intensity surface fire" or "mixed and variable fire regime" are used to classify a fire regime.

PHOTO COURTESY OF ANDRIS EGLITIS, DESCHUTES NATIONAL FOREST

This mountain pine beetle infestation at Mount Jefferson is taken from the Warm Springs Indian Reservation.

(794,000 acres) of Yellowstone National Park burned and cost the United States government $120 million to fight. Yellowstone was the first large fire the United States had experienced in decades, but it definitely was not going to be the last.

The 2000 fire season burned nearly 7 million acres and cost the United States government $1.6 billion. These fires led to a shift in fire policy. First, Congress directed the five federal agencies (Forest Service, Bureau of Land Management, Park Service, Bureau of Indian Affairs, and Fish and Wildlife Service) to standardize all aspects of wildfire response. Second, Congress established the National Fire Plan to diminish the growing threats of large, costly, and life-threatening wildfires. This plan provided funding to ensure sufficient firefighting resources, to rehabilitate and restore fire-damaged ecosystems, to reduce fuels in forests and rangelands (particularly near communities), and to work with local residents to reduce fire risk and improve fire protection. Even with this plan, large fires have continued to burn Northwest landscapes, including the 2002 Biscuit Fire (500,000 acres), 2007 Cascade Complex (302,376 acres), and 2006 Tripod Complex (113,011 acres) that burned close to a combined one million acres.

In 2009, the Federal Land Assistance, Management and Enhancement (FLAME) Act directed the development of the National Cohesive Wildland Fire Management Strategy (cohesive strategy). The cohesive strategy uses a collaborative process at all levels of government and non-governmental organizations and the public to seek national all-lands solutions to wildland fire management issues. The cohesive strategy is to systematically develop a dynamic approach to: 1) restore and maintain resilient landscapes; 2) create fire-adapted communities; and 3) improve suppression response to wildfires (www.forestsandrangelands.gov/strategy/overview.shtml).

Fires do have significant positive effects on forest ecosystems and create conditions that sustain many forest characteristics we value. They produce snags and down wood for bats, birds, and mammals to use for dens, perches, and hiding cover. They kill trees and create openings where grasses, forbs, and shrubs flourish, and that enhance forage for ungulates (deer, elk, and moose). Soils, if scorched by fire, can release nutrients allowing quick vegetation recovery. In dry and mixed-dry conifer forests, ponderosa pine and western larch flourished because fires removed competition. After fire, lodgepole pine forests regenerate and begin another growth cycle—a positive outcome from the Yellowstone fires. Fuel (live and dead vegetation), topography, and weather influence wildfire behavior and effects, and historically this combination produced a complex mosaic of vegetation compositions and structures that made these forests fire resilient.

Large fires will continue to occur, particularly if hot, dry summers lengthen the fire season. Fuel treatment placement and effectiveness can mitigate fire's destructive role; however, fuel treatments also have limitations. They will not fire proof a forest. Fuel includes all live and dead vegetation and given the right conditions (wind, drought, high temperatures), fires can burn through fuel treatments in undesirable ways. Fuel treatments continue to grow and develop over time, thus fuel maintenance is a necessary piece of fuels management. Even large and extensive landscape-level fuel treatments may not reduce the size of area burned or how quickly a fire burns through a landscape. However, if applied in the right place, fuel treatments can provide suppression opportunities and alter post-fire outcomes. The challenge is to identify the best places (close to homes and in the landscape), treatment methods, and maintenance schedules so when a wildfire does occur, it performs as we expect and actually contributes to the future resilience of our forests. ◆

Theresa B. Jain is a research forester with the Rocky Mountain Research Station in Moscow, Idaho. She can be reached at 208-883-2331 or tjain@fs.fed.us.

For Further Reading

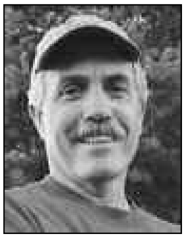
Pausas J.G. and Keeley, J.E. A burning story: the role of fire in the history of life. BioScience 59(7): 593-601.

Pyne, S.J. 1982. Fire in America: a cultural history of wildland and rural fire. Princeton, NJ: Princeton University Press. 654 p

Mann, C.C. 2011. 1493: uncovering the new world Columbus created. New York: Alfred A. Knopf. 535 p.
Jain, Theresa B.; Battaglia, Mike A.; Han, Han-Sup; Graham, Russell T.; Keyes, Christopher R.; Fried, Jeremy S.; Sandquist, Jonathan E. 2012. A comprehensive guide to fuel management practices for dry mixed conifer forests in the northwestern United States. Gen. Tech. Rep. RMRS-GTR-292. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 331 p.

Forestry in the Wind

BY GLENN AHRENS



Extreme windstorms serve as a periodic reminder of the importance of wind as a recurrent disturbance agent in the forest. While rare, catastrophic wind events are often seen as the exception rather than the rule, and foresters need to plan for the full spectrum of acute and chronic effects of wind. Strong winds are actually a relatively frequent phenomenon in the Pacific Northwest, even in areas away from coastal or montane extremes. Weather records for Portland and Seattle show storms with winds exceeding 55 mph occurring dozens of times over the last 54 years, and even hurricane-force winds are not so rare in the lifespan of a tree (see Table 1). Windthrow hazards increase as trees grow in height, and given that foresters commonly manage trees attaining heights of 100-200 feet, there is no escape from the need for serious consideration of wind hazards.

Table 2. Wind Hazard Evaluation Factors in Forests

WIND FORCE FACTORS	
HIGH HAZARD	LOWER HAZARD
• Topographically exposed locations: crests, saddles, upper slopes, etc. • Boundaries on the windward edge of a stand • Tall trees • Large dense crowns	• Topographically protected locations • Boundaries on the lee edge of a stand • Short trees • Small open crowns
RESISTANCE TO OVERTURNING OR BREAKAGE	
HIGH HAZARD	LOWER HAZARD
• Trees with low taper and no butt flare • Height to diameter ratio >90 • Shallow rooting or shallow soils (<0.4m) • Root rot areas • Poorly drained soils	• Trees with high taper and large butt flare • Height to diameter ratio <70 • Deep rooting or deep soils (<0.8) • No evidence of root rot • Well drained soils
OTHER FACTORS	
HIGH HAZARDS	LOWER HAZARD
• Moderate to extensive natural windthrow present on site or on similar adjacent cutting boundaries • Pit and mound micro-topography	• No natural windthrow present on site or on similar adjacent cutting boundaries • No evidence of pit and mound microtopography

Adapted from Windthrow Handbook for BC Forests, Stathers, Rollerson, and Mitchell 1994
www.for.gov.bc.ca/hfd/pubs/docs/wp/wp01.pdf

Table 1. Frequency of windstorms from 1950-2004 (number of events)

Weather Station	Winds exceeding 55 mph ("Storm" force)*	Winds exceeding 74 mph ("Hurricane" force)*
Astoria, OR	30	9
Portland, OR	24	2
Seattle, WA	20	1

*Beaufort Scale

SOURCE: The Storm King Website, compiled by Wolf Read, www.climate.washington.edu/stormking/

While wind as a disturbance agent seems complex and unpredictable, there is a growing body of work that will help foresters both understand local wind climate and manage forests on wind-prone landscapes. As an Extension forester on the north coast of Oregon stationed in Astoria, I was in the middle of the "Great Coastal Gale of December 2007." High winds > 30 mph were nearly continuous for 40 hours, gusting 80-90 mph on flat ground and hitting 125-140 mph at stations in more wind-prone topography. Blowdown occurred across tens of thousands of acres of forest. In the aftermath, I found a great deal of research on assessment and management of wind risk in forests around the world including the Pacific Northwest. This information was recently summarized in an excellent synthesis paper by Dr. Stephen J. Mitchell, an international leader in the field of wind and forestry at the University of British Columbia. (S.J. Mitchell. 2013. *Wind as a natural disturbance agent in forests: a synthesis.* Forestry, v. 86, pp. 147-157. http://forestry.oxfordjournals.org/content/86/2/147.full.pdf)

Generally, the first step in understanding and managing wind risk is an evaluation of forest trees or stands based on the key factors influencing windthrow hazard. A general hazard evaluation guide is illustrated in Table 2.

Basic tree, stand, and site conditions are more important than species alone for determining wind hazard. Other factors being equal, deciduous trees—such as red alder, bigleaf maple, and black cottonwood—are less prone to wind compared to evergreen conifers. This is due to lack of leaves during the winter storm season and the generally lower crown density of deciduous trees, providing less of a "sail" in the wind. Among the conifers, western redcedar and Douglas-fir are most resistant to wind. Sitka spruce is intermediate. Less resistant species are western hemlock and shore pine.

Foresters should become familiar with the "acclimative responses" of different tree species to wind and changes in wind exposure from silvicultural practices. Younger, shorter trees are generally safer in the wind. The best opportunity to cultivate characteristics that minimize wind risk (promote healthy trees adapted to the site and acclimated to the site wind environment) is in the early stages of stand development.

Several approaches can be taken to minimize damage in the face of wind hazards. Some general silvicultural alternatives for managing forest stands to minimize wind damage include:

• ***Establish evenaged stands at relatively low densities and maintain low density by thinning*** in order to develop and maintain stable trees throughout the life of the stand. Stable trees have relatively high taper, a low ratio of height:diameter (H:D <70, expressing height and diameter in the same units). Prevent over-dense stand conditions from ever developing. This approach is often best for maintaining silvicultural options over the longer term.


PHOTOS COURTESY OF GLENN AHRENS

Before and after photos from the Great Coastal Gale of December 2007 at Mail Creek in Clatsop County, Ore. The photo on the left was taken in September 2006 and shows a dense western hemlock stand exposed by an adjacent timber harvest. The December 2007 photo on the right shows complete wind breakage on the north-facing slope—the lee side of the hill in the zone of turbulence. For a reference point, note the old stump in the lower right corner of both photos.

• ***In evenaged stands, develop and/or maintain higher density stands with inter-tree damping***—avoid excessive opening of dense stands and design stand edges or boundaries to prevent sudden exposure. Options are limited to either very light thinning or clearcutting on relatively short rotations.

• ***In unevenaged stands, maintain stability of dominant trees*** in the process of managing the size distribution to produce relatively low densities of dominant trees (low level of crown competition between dominant trees). This also maintains more options for continued management with objectives to grow older (taller) forests requiring long-term wind stability.

When you know that harvesting will expose new stand edges to the wind, sometimes you can minimize risk via:

• Smoothing boundaries—rough or jagged edges of stands are more vulnerable to wind damage.

• Placing clearcut boundaries where they are sheltered from or parallel to prevailing storm winds.

• Reducing the canopy at the exposed edge by pruning and even topping to reduce abruptness of the edge.

While the research pertinent to managing forests in the wind is advancing rapidly, more work is needed to adapt this interdisciplinary work for application. Mapping of wind hazards to forests is underway for Washington state (current project at University of British Columbia by S.J. Mitchell et. al). Work on modeling the responses of trees and stands to wind are ongoing, led by researchers in the Pacific Northwest and the United Kingdom. The most recent development is *WindFIRM/ForestGALES_BC*, a mechanistic model for predicting windthrow in partially harvested stands in British Columbia. Extension of these kinds of windthrow hazard maps and modeling tools is needed for application across the Pacific Northwest region.

Ultimately, integration of the research in several key areas will help foresters manage trees and forests for the winds of the future. This includes development of better tools for: (1) mapping and predicting regional wind climate and wind hazards due to interaction of wind with local terrain; (2) predicting tree and stand stability resulting from alternative silvicultural regimes; and (3) assessing tree and stand stability based on effects of soils on both productivity and anchorage.

Foresters can look forward to using these tools to plan site specific silviculture to integrate local wind hazards in a landscape context. ◆

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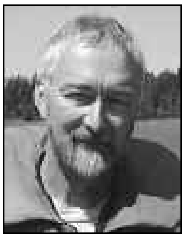
Buried and Submerged Forests of Washington and Oregon: Time Capsules of Environmental and Geological History

BY PATRICK PRINGLE



Tree rings of subfossil forests are unlocking secrets about the past history of earthquakes, volcanoes, and landslides in the Pacific Northwest and elsewhere. The tree victims are found in more than 50 different locations in Oregon and Washington. Dead trees are labeled "subfossil" when they have been preserved with little or no permineralization. Some subfossil trees are found submerged in intertidal zones along coastal British Columbia, Washington, Oregon, and the Salish Sea. The subsided trees indicate these locations likely dropped dramatically during great earthquakes; the trees show the scale of the movement (as much as 3 m) and the tree rings record the timing of those events. In valleys of rivers that head on volcanoes, it is a common occurrence to find forests buried by far-flowing volcanic debris flows (lahars) and lahar-derived sediment-rich floods (see Fig. 1). Closer to the volcano, trees might be charred and/or buried by pyroclastic flows (hot avalanches of ash and rock).

PHOTO COURTESY OF PATRICK PRINGLE

Figure 1. Photo of an in situ subfossil Douglas-fir (about 10 feet in diameter) at Orting, Wash., that was buried by the Electron Mudflow from Mount Rainier about A.D. 1502-03.

PHOTO COURTESY OF PATRICK PRINGLE

Figure 2. This 1992 photo shows a subfossil forest in Spider Lake in the southeast Olympic Mountains. The trees were killed about 1,100 years ago when a rock avalanche blocked a tributary in the headwaters of the middle fork of the Satsop River.

Landslides can bury forests or block streams to create landslide-dammed lakes that drown forests (see Fig. 2). Many of these landslides, most in Washington State, were likely triggered by ancient earthquakes, and thus dating the trees via radiocarbon and possibly by tree rings could estimate the timing of the earthquakes. At least two faults, the Saddle Mountain fault and Tacoma fault in Washington, and two lava flows impounded water to drown ancient forests (at Merrill Lake in Washington and Clear Lake in Oregon).

Glacial deposits buried trees, and local standing (unburied or partially buried) "ghost" forests, such as the one on the south flank of Mount Hood, are preserved near timberline—the ones at Mount Hood might have been killed by a pyroclastic flow. Still other subfossil trees are preserved in dunes.

Lewis and Clark were among the first to document subfossil trees in the Pacific Northwest. On October 30, 1805, near the mouth of the White Salmon River along the Columbia, Clark writes[1]: *a remarkable circumstance in this part of the river is, the Stumps of pine trees are in maney places are at Some distance in the river, and gives every appearance of the rivers being damed up below from Some cause which I am not at this time acquainted with...*

And also on October 30, from the present location of Cascade Locks, Ore., Clark notes that rocks there had fallen into and obstructed the river and…*"must be the Cause of the rivers daming up to Such a distance above"* (to drown trees along its banks).

Botanist Donald Lawrence, a native of Portland, Ore., was a pioneer in

[1] All Lewis and Clark quotes use the original journal spelling, capitalization, and punctuation.

PHOTO COURTESY OF OREGON HISTORICAL SOCIETY

Figure 3. Photo of the submerged forest of the Columbia at Wyeth, Oregon. The view is to the north with Wind Mountain in the background.

studies of the subfossil trees in the Pacific Northwest. Having read Lewis and Clark's interpretations, Donald and his wife Elizabeth spent decades investigating the geologic and botanical history of the Columbia Gorge. They counted more than 3,000 of the submerged forest trees along the banks of the Columbia River upstream of the great landslide. The trees are now drowned again by the Bonneville Dam impoundment. Lawrence sampled the snags beginning in the mid-1930s, and in 1958 he and Elizabeth published the first radiocarbon dates on what is now called the Bonneville landslide, which at one time had dammed the entire Columbia to form the "Bridge of the Gods." Some of the stumps sampled by Lawrence are visible in a 1909 George Weister photo taken at Wyeth, Ore. (see Fig. 3). Lawrence began sampling the submerged forest trees in 1934 and continued his work for nearly 60 years, publishing papers on the subject in 1936, 1937, and 1958.

During field work in 1987 Lawrence noted with disappointment that all his samples of the submerged forest had disappeared—disks he had stored at his mother's house had vanished, and he had assumed the ones located at the Forestry Building in Portland were lost when the building burned in 1964. But in 2001, research colleague Nathan Reynolds inquired about the slabs at the World Forestry Center (WFC), and staff there said they had some slabs stored in a large crate that might be of interest. Inside the crate were two disks of the submerged forest trees that had been sampled by Lawrence as well as two disks from living trees that he had hoped to use for ring matching!

In a great twist of luck, the disks had been on loan to Thornton Munger, director of the Pacific Northwest Forest and Range Experiment Station, at the time of the forestry building fire and had ultimately been returned to the WFC!

(CONTINUED ON PAGE 22)

SAF Council Update: CEO Decision Made

BY JOHN WALKOWIAK, JOHNNY HODGES, AND ED SHEPARD

SAF President Dave Walters opened his first SAF Council meeting on March 28-30 at the Embassy Suites Old Town in Alexandria, VA. The main order of business was to meet and interview candidates for SAF's new CEO. A Search Committee led by Past SAF Presidents Roger Dziengeleski and Joann Cox, along with many others, worked for the past several months with Chip Magee of Signature Search to identify and meet qualified candidates.

The committee provided Council with three highly qualified candidates with vast natural resources and non-profit organizational experience. Each candidate presented their qualifications and their view on the future needs of SAF. An officers' interview team of President Walters, Past Present Cox, Vice President Bob Alverts, and Interim EVP Louise Murgia conducted additional intensive interviewing. Each interview also involved personality and leadership analysis testing by consultant Dave Goodenough of Seattle. In the end, candidates performed at a high level and any of the three would be great leaders for SAF, but based on the recommendation of the interview team, a decision for the new SAF CEO was approved by Council. President Walters will pursue negotiations on salary and starting date. In order to maintain candidates' confidentiality, an official announcement from President Walters will come out soon that identifies the new SAF CEO (this information was not available at press time).

While the SAF officers were involved in the in-depth CEO interview process, District 4 Representative Hodges presided over the remainder of the Council meeting. SAF continues to grapple with our finances as membership (although relatively stable at the 11,900-12,000 member level) saw 7% more of our current Gold member level renew at the Silver membership level, thus reducing revenue. For the close of the 2013 budget cycle, SAF had a $260,000 loss that was covered by our investment proceeds.

Left to right: 2014 Council representatives Johnny Hodges, Ed Shepard, and John Walkowiak.

For 2014, SAF has a balanced budget that will utilize proceeds from the final payment of the sale of the Wild Acres property (to close on August 22) investment proceeds and will defer certain staff, equipment, and Council expenses. Working with SAF CFO Jorge Esguerra, the Finance Committee has developed improved reporting and tracking of finances. Originally, the Thomas Busch Trust indicated that their donation could be used for SAF operations, but before funds were received, the Trust trustee clarified that the proceeds had to be used for an SAF awards fund, which we do not have. With Trust's trustee concurrence, SAF Council approved placing $220,000 in the Mollie Beattie Fund and $52,000 in the Gregory Fund. The Gregory Family provided a matching $34,000 donation. Once the final balloon payment for the Wild Acres sale is received, Council selected the services of Wilmington Trust (now operated by M&T Bank) as our investment advisor and is finalizing investment guidelines.

Based on recommendations of the Membership and Credentialing Task Force, Council approved minor clarifying changes to the SAF mission statement:

The mission of the Society of American Foresters is to advance sustainable management of forest resources through science, education, and technology to enhance the competency of its members; to establish professional excellence; and to use our knowledge, skills and conservation ethic to ensure the health, integrity and use of forests to benefit society in perpetuity.

District 7 Council Member Kim Steiner of Penn State and chair of the ad hoc Governance Document Committee led discussion on proposed SAF governance documents involving Articles of Incorporation and Bylaws in order to comply with the new DC Incorporation Law. Based on comments and input from Council, the committee will further refine and present recommendations at the June 7-8 Council meeting. Plans are to develop a communications plan and share recommendations with membership well in advance of the October elections.

There was extensive discussion regarding efforts for all parts of SAF to "live the brand" involving "Thriving forests, essential resources, and a strong community." Council voted to change "a strong community" to "strong communities" to better reflect SAF's regional perspectives. Council will continue to review and refine based upon member recommendations.

District 3 Council Member J. Lopez asked Council to reconsider reestablishing the National Leadership Academy that was suspended in 2009 to encourage and invest in new leadership. Christopher Whited, SAF Membership director, provided information on how younger members use extensive technology to communicate. He provided several initiatives that both the Strategic Planning Committee and House of Society Delegates (HSD) will investigate along with recommendations from the Communications Committee's final report prioritizing young member recruitment and recognition, along with ways to increase the value of Gold and Platinum SAF membership.

Council was updated on preparations for the 2014 annual convention that will be co-located with the International Union of Forest Research Organizations (IUFRO) world congress, the first in North America since 1971. Over 2,500 delegates from across the world including our joint partners, the Canadian Institute of Forestry (CIF), are expected to come to Salt Lake City from October 8-11. SAF members will be able to register for the SAF/CIF convention separately from IUFRO delegates at lower costs and will be able to attend either SAF/CIF or IUFRO events Thursday-Saturday. SAF/CIF field trips will not be held, but SAF members can attend one of 27 different IUFRO field trips on Wednesday. If you are planning to attend the Salt Lake City Convention, you are encouraged to seek lodging arrangement early by going to www.safconvention.org.

Council and staff continued work on investigating options for regional assistance to state societies and chapters, and improving cost effectiveness of Certified Forester (CF) and Continuing Education credits (CFE). For those who have read Jim Collins's Good to Great book, Council is finalizing a Big Hairy Audacious Goal (BHAG) to help inspire SAF's vision for the next 30+ years. Finally, as we hire a new CEO, Council will be developing Key Performance Indicators or KPIs for both the new CEO as well as for Council. This evaluation hopes to remain simple but complete, and will involve a 360-degree review from staff and committees.

The next Council meeting is set of June 7 and 8 in Bethesda, MD. ◆

This Council report is a joint effort between District 1 Council Representative John Walkowiak (253-320-5064, jewalkowiak@harbornet.com); District 2 Council Representative Ed Shepard (503-487-6423, sssstr1@comcast.net); and District 4 Council Representative Johnny Hodges (970-226-6890, jah.16@live.com).

UW Student Chapter Regeneration

The University of Washington School of Environmental and Forest Sciences Student Chapter of SAF hosted the February meeting for the South Puget Sound Chapter. Students prepared a pasta dinner for approximately 30 professionals and students. The speaker was Bruce Lippke, professor emeritus, who spoke on the role of forests, management, and forest products on carbon mitigation.

The student chapter has regenerated with guidance from Matthew Aghai, PhD student with previous leadership at Purdue and the University of Idaho. New officers are Sam Israel (MFR) chapter chair; Tessa Putz (ESRM, senior), chair-elect; and Marissa Bass (ESRM, sophomore), treasurer. Eric Turnblom, associate professor of forest growth and yield modeling, sampling and inventory, and biometrics, is the faculty advisor.

The UW Student Chapter will be assisting with presentations and logistics at the WSSAF annual meeting at Pack Forest May 7-9.

Disturbance Factor in Plant Invasions

(CONTINUED FROM PAGE 7)

erally having to do with species traits, competitive interactions with other species, and their ability to use resources like soil, water, and nutrients more effectively. Given that the introduction and spread of invasive plants are often accompanied by other human-caused changes to the landscape, it is often difficult to determine whether these species are the passengers or drivers of observed changes in community composition. It is most likely that both the passenger and driver models come into play.

Climate change and invasive plants

Climate change will alter the environmental conditions under which plant species can establish, survive, reproduce, and spread. Increased temperature, longer growing seasons, less snow, and more common drought conditions are expected to increase plant stress and decrease a species' ability to survive in the drier, warmer, and lower parts of its range. These conditions may reduce the range of some invasive plants, but new habitat, once too cold and/or wet, may become available. Therefore climate change could enable invasive plants to survive outside their current ranges and/or expand current ranges. Changes in species growth, productivity, and reproduction may also change as the climate changes. Some evidence exists that invasive plants may be better able to adjust to rapid changes in environmental conditions than species that tend not to be invasive.

PHOTO COURTESY OF SASHA SHAW

Trees covered with English ivy have a harder time withstanding strong winds and can be prone to disease.

It is well established that increases in CO_2 can significantly stimulate photosynthesis. Increases in productivity in response to elevated CO_2 have been documented for many invasive plant species including cheatgrass, Canada thistle (*Cirsium vulgare*), spotted knapweed, and yellow star-thistle. However, plant response to increased CO_2 outside of the laboratory is less predictable. The actual response of plants may be limited by other nutrients and water availability. Another consideration is that more CO_2 can increase plant water use efficiency, which can help plants deal with drought, and decreased water availability or increased salinity (for plants with the C_3 or cool season photosynthetic pathway). In general, future climate change will probably increase the likelihood of invasion of forestlands and the consequences of those invasions. ◆

Becky K. Kerns is a research ecologist with the Disturbance and Restoration Team, Threat Characterization and Management Program, Forestry Sciences Laboratory, USDA Pacific Northwest Research Station in Corvallis. She can be reached at bkerns@fs.fed.us.

Calendar of Events

Northwest Wood-Based Biofuels and Co-Products Conference, Apr. 28-30, Seattle, WA. Contact: Vikram Yadama, vyadama@wsu.edu, http://nara-renewables.org/blog/?p=280.

Understanding Wood Behavior During Cutting, Shaping, and Drying, Apr. 30, Tillamook Bay Community College, Tillamook, OR. Contact: Jim Reeb, jim.reeb@oregonstate.edu, or Emily Henry, emily.henry@oregonstate.edu, http://calendar.oregonstate.edu/event/90290/.

Oregon SAF Annual Meeting, Apr. 30-May 2, Seven Feathers Casino Resort, Canyonville, OR. Contact: Mark Buckbee, 541-580-2227, buckbeefamily@msn.com, www.forestry.org.

Washington State SAF Annual Meeting, May 7-9, Pack Forest, Eatonville, WA. Contact: Paula Hopkins, 360-492-5441, hopkinsforestry@yahoo.com.

Alaska SAF Annual Meeting, May 14-17, Juneau, AK. Contact: Wayne Nicolls, 907-780-6318, nicolls3@gci.net.

Washington Farm Forestry Association annual meeting, May 15-17, Bellingham, WA. Contact: WFFA, 360-736-5750, info@wafarmforestry.com.

Western Forest Economists annual meeting, May 18-20, Missoula, MT. Contact: Keith Stockman, 406-329-3549, kstockman@fs.fed.us.

2nd Annual Western Hardwood Association Convention and Exposition, May 19-22, Holiday Inn Airport, Portland, OR. Contact: Dave or Kristine at 360-835-1600, wha@westernhardwood.org, http://westernhardwood.org/ICE2014.html.

Forest Insect and Disease Identification and Management Workshop, May 20-22, Coeur d'Alene, ID. Contact: Candee Wilfong, 208-765-7201, cwilfong@fs.fed.us if you are a federal or tribal worker, or Tom Eckberg, 208-666-8625, teckberg@idl.idaho.gov if you work for the state or in private industry.

Practical Applications in Vegetation Management, sponsored by OSAF Coos Chapter, June 4, North Bend, OR. Contact: Scott Nichols, 541-290-7266, jscott.nichols@gmail.com.

Oregon Small Woodlands Association annual meeting, June 26-28, Seven Feathers Casino, Canyonville, OR. Contact: OSWA, 503-588-1813, jenerains@gmail.com.

Applied Forest Finance Workshop, July 14, DoubleTree Hotel, Portland, OR. Contact: WFCA.

National Tree Farmer Convention, July 17-19, Pittsburgh, PA. Contact: 202-765-3660, info@treefarmsystem.org, www.treefarmsystem.org/tree-farmer-convention.

The Basics of Forestland and Timber Appraisal, July 28-Aug. 1, Oregon State University, Corvallis, OR. Contact: WFCA.

Forest Products Forum 4, Sept. 16, World Forestry Center, Portland, OR. Contact: Greg Lewis, 978-496-6335, glewis@getfea.com, http://wwotf.worldforestry.org/wwotf10/.

Who Will Own the Forest?10, Sept. 16-18, World Forestry Center, Portland, OR. Contact: Sara Wu, 503-488-2130, swu@worldforestry.org, http://wwotf.worldforestry.org/wwotf10/.

Access, Easements, Rights-of-Way and Timber Trespass: What Every Forest Manager Needs to Know, Sept. 25 in Grand Mound, WA. Contact: WFCA.

SAF National Convention, Oct. 8-11, Salt Lake City, UT. Contact: Christopher Whited, 301-897-8720, whitedc@safnet.org, www.xcdsystem.com/saf/site14/.

Pacific Northwest Reforestation Council, Nov. 16, Heathman Lodge, Vancouver, WA. Contact: WFCA.

Forestry/Songbird Symposium, Nov. 18, Linn County Expo Center, Albany, OR. Contact: Fran Cafferata Coe, 503-680-7939, fran@cafferataconsulting.com, www.cafferataconsulting.com.

Forestry Leadership Academy, Jan. 16-17, 2015, Oregon Garden Resort, Silverton, OR. Contact: Amanda Mattern, 503-224-8046, amanda@forestry.org.

Washington State SAF Legislative Reception, Jan. 22, Olympia, WA. Contact: Ellie Lathrop, 360-274-3057, ellie.lathrop@weyerhaeuser.com.

Contact Information

WFCA: Western Forestry and Conservation Association, 4033 SW Canyon Rd., Portland, OR 97221, 503-226-4562, richard@westernforestry.org, www.westernforestry.org.

Send calendar items to the editor at rasor@safnwo.org.

We Remember

Robert "Bos" Bosworth
1940-2014

Robert "Bos" Bosworth, 73, passed away unexpectedly on January 17 at his home in Bonners Ferry, Idaho. Bos grew up in New Mexico and received a bachelor's degree in forest management from the University of Montana in 1962 and a master's degree in forestry from the University of Idaho in 1974. During his school years, he was very active in clubs and activities, including sports, band, forestry club, Chi Sigma Phi, and the Forester's Ball.

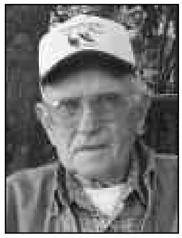
Bos served in the Army and spent 13 months in Korea, after which he married Jill in 1965. He spent 26 years as a fire/silviculture assistant and district silviculturist on the Bonners Ferry Ranger District of the Idaho Panhandle National Forest. He was a certified Silviculturist and fire manager. Bos joined SAF in 1967 and was very active at all levels including chair and chair-elect of the Inland Empire, general chair of the national SAF convention in 1989, SAF Council representative for District 1 from 1991-1993, SAF vice-president in 1995, and president in 1996. He was the first field forester ever elected president of SAF. He was named Fellow in 1987.

Logger sports were very important to Bos and he won several world championships with his son, Carson. His daughter, Megan, and grandsons Hunter and Sawyer also participated with Bos in logger sports. His dedication to family and wide-spread participation in SAF and other programs provided inspiration for many.

In honor of Bos' influence on and commitment to SAF, a special fund is being established in his honor by the Inland Empire Society. The Robert "Bos" Bosworth Inland Empire SAF Leadership Sponsor Fund will focus on the support of active leadership activities. Bos believed that the development of leadership skills was key and this sponsorship encourages IESAF member participation and leadership within the entire SAF organization. If you would like to donate to this fund, please contact Tera King at 208-883-4488 x133 or king@nmi2.com.

Bos was loved and highly respected in all aspects of his life and will be deeply missed by all who knew him. He left some very large shoes to be filled.

Robert W. Mezger
1922-2014



Robert W. Mezger, 91, passed away January 9 surrounded by family. Bob was raised in New Jersey and attended Penn State University. He took a leave from college from 1942-1945 to serve in the US Army Air Corps as a second lieutenant. He married Patricia Cosley while still in the service in 1945. He finished forestry school in 1947 at Penn State and went on to receive a Master's degree from the University of California at Berkeley.

Bob became a forester in the Pacific Northwest and Idaho, working for the Bureau of Indian Affairs, Klamath Indian Reservation, and the US National Bank Trust Department until he retired at 65. Though retired, Bob continued to work in the industry he loved. He bought forest property, was named the American Tree Farm Program's Western Region Tree Farmer of the Year in 2008, and published a book in 2013 titled "A Forest History of the Oregon's Klamath Basin 1910-1980."

Bob was a 67-year member of SAF. He was active in the First United Methodist Church and participated in many areas from teaching Sunday school to singing in the choir. He was a member of many other community organizations including the Rotary Club and YMCA. His favorite things, though, were being with his family and his trees. People loved Bob's sense of humor, his patience, work ethic, and his appreciation for diversity.

Ronald "Ron" Dippold
1935-2014

Ron Dippold, 78, of Juneau, Alaska, passed away January 17 due to cancer complications. Ron was born in Cheektowaga, NY and graduated from the Syracuse School of Forestry. He served as a Lieutenant Commander in the US Navy and then joined the US Forest Service.

Ron was a dedicated forester and member of SAF, joining in 1958. He received his 50-year certificate from Governor Sarah Palin at the 2007 Alaska SAF annual meeting in Juneau.

Ron was fortunate to spend most of his career in his beloved Alaska. He had a passion for skiing and was active in the Juneau Ski Patrol for 52 years. He served as southeast regional director for the Alaska Division of the Red Cross, held many Red Cross certification classes, and was an active member of that organization for 50 years. In addition to skiing, he took great joy in his immediate and extended family. A celebration of Ron's life will be held when ski season is over in late spring.

George Hartman
1923-2013

George B. Hartman, Jr. passed away November 4, 2013, just short of his 90th birthday. George had a love of athletics and excelled at football, basketball, and track throughout his high school years at Ames High School in Ames, Iowa. At Iowa State College, he was a center fielder for the Cyclones and joined Phi Delta Theta fraternity while studying forestry.

In 1943, George was sent overseas with the Army to India. He became a cartographer for the 653rd Topographical Engineering Battalion and helped the Allies by creating complex artillery maps. He returned home in 1945 and was able to finish his forestry degree at Iowa State in 1948. George moved to Burns, Ore., after accepting a position with Edward Hines Lumber Company. He enjoyed cruising timber and playing baseball there in a semi-pro league. Then, George married Dorothy Goins in 1955, moved to Portland, and began work with the Bureau of Land Management.

George worked for BLM as a biometrician for the next 30 years and earned his master's degree in 1968 from Syracuse University in New York. Portland adopted an NBA franchise in 1970 and George submitted the name "Trail Blazers" for the team thinking of the Oregon Trail. George and a few others received official congratulations on successfully naming the new NBA team, "The Portland Trail Blazers."

The United States Department of the Interior also recognized George's accomplishments by honoring him with the Distinguished Service Award in 1988.

For the next 17 years, George and his wife traveled extensively until her passing in 2008. George was a helpful, caring, and devoted husband and father who will be greatly missed.

Carl A. Newport
1924-2014

Carl Newport passed away March 5 in Bend, Ore., just four days shy of his 90th birthday. Carl was encouraged to continue schooling from his high school biology teacher, set his sights on becoming a forester, and then enrolled at the University of Michigan.

In 1942, Carl enlisted in the United States Army Air Force. Two years later while stationed at an air base in Ainsworth, Nebraska, he met his wife Gwen Remington and they married in 1947. Carl received his B.S. in Forest Management, and they headed west to begin his career as a forester as district ranger in Gunnison, Colorado. They spent several summers in the Rocky Mountains, living in wall tents and mountain cabins.

In the fall of 1950, the family relocated to Corvallis, Ore., where Carl pursued his M.S. in Forest Management. In 1951 he enrolled at New York State College and received his Ph.D. in Forest Economics. They moved back to Colorado for him to teach forest economics at Colorado State University in Fort Collins. In 1957 he rejoined the US Forest Service, where he spent the next nine years of his career, eventually becoming the assistant station director of the Pacific Northwest Experiment Station. In 1966 he joined the forestry consulting firm Mason, Bruce and Girard where he remained until retiring in 1994.

In 1971, Carl and Gwen built their home at Black Butte Ranch and Carl loved to display his photography in the community throughout his retirement. Carl joined SAF in 1948 and was elected Fellow in 1988. He remained active in forestry during retirement and served as a member on the Board of Directors for the World Forestry Center. ◆

Vegetation Management Workshop Slated for June

The Coos Chapter of the Oregon SAF is hosting a one-day workshop on Practical Applications in Vegetation Management on June 4 at the Mill Casino in North Bend. Pesticide credit hours and SAF CFE credits will be available.

A wide range of topics will be presented including:

- Why we manage competing vegetation;
- Vegetation management timeline from pre-harvest application to site prep to release;
- Plant mode of action;
- Neighbor relations;
- Weeds developing resistance to herbicide;
- Safety in the real world;
- Integrated solutions to problem weeds;
- How much is enough? (economic analysis basics).

Cost for the workshop is $75 if registered by May 14. Workshop flyers were mailed to Oregon SAF members. For additional information, contact Scott Nichols at 541-290-7266 or jscott.nichols@gmail.com, or visit www.forestry.org. ◆

Buried and Submerged Forests

(CONTINUED FROM PAGE 15)

With assistance from staff at the WFC, we were able to sample the wood. Radiocarbon analysis of the drowned forest disks facilitated by another research colleague, Jim O'Connor of the US Geological Survey, showed they died in the mid-1400s, and tree ring analysis indicates that the ring pattern of the two drowned forest samples correlates with that of a tree that had been buried by the Bonneville landslide and was recovered during excavations for the second powerhouse in 1978. We are continuing our tree-ring studies of Lawrence's samples in hopes of dating the Bonneville landslide more precisely.

My own investigations of buried trees began in 1983 with US Geological Survey colleague Ken Cameron and were initially focused on Mount Hood and the buried forests there described by Lawrence and USGS geologist "Rocky" Crandell. A turning point for Ken and me came when we realized that Lewis and Clark's observations of the "Quicksand" River—now renamed the Sandy River—probably were not long after an eruption and lahar from Mount Hood.

On November 3, 1805, Clark had written: [we] *"halted at the mouth of a large river on the Lard Side, This river throws out emence quanty of quick Sand and is verry Shallow, the narrowest part 200 yards wide bold Current, much resembling the river Plat, Several Islands about 1 mile up and has a Sandbar of 3 miles in extend imedately in its mouth, discharging it waters by 2 mouths, and Crowding its Corse Sands So as to throw the Columbia waters on its Nothern banks, & confdg it to 1/2 ms. in width..."* (confined it to 1/2 mile width).

Given that the buried trees we were seeing along the Sandy and Zigzag rivers might have died only a couple centuries earlier and that there were much older trees growing in localities of the Mount Hood National Forest, it seemed imperative to try using tree rings to solve the case. We teamed up with USGS geologist Thomas Pierson, who was also using tree rings to better understand the effects of the Mount Hood eruptions on the Sandy River. Cross dating revealed the trees had died after the end of the growing season in 1781 and before the growing season of 1782, and the sedimentation in the Sandy River continued for decades after the eruption, thus explaining Lewis and Clark's curiosity about the "quick sand" river.

Dendrochronologist David Yamaguchi has dated several past explosive eruptions of Mount St. Helens to within a year or two by studying subfossil trees buried in pumice and ash from ancient Mount St. Helens eruptions, as well as the ring patterns of living trees that survived the ashy bombardment but recorded trauma in their tree rings. He later teamed up with USGS geologist Brian Atwater to date the death of trees in the coastal ghost forest of western Washington to about 1700. Japanese historical records of an "orphan tsunami" showed that a great earthquake (~ Mg. 9) had occurred on the Cascadia Fault on the evening of January 26, 1700! In a separate study, dendrochronologist Gordon Jacoby also dated the Cascadia earthquake to about 1700.

While this article describes selected subfossil forests of the Pacific Northwest, it is not by any means an exhaustive listing. For example, the ages of more than 30 landslides have been estimated by radiocarbon dating of associated subfossil wood or by dating of volcanic ash. However, fewer than 25 percent of these allow constraint of the actual timing of tree mortality, and more sampling will be required to obtain outer wood. Additional tree-bearing lakes have been discovered but not sampled, and more than two dozen candidate sites lack reconnaissance. Many likely record paleo-earthquakes, but funding for radiocarbon dating is an ongoing challenge.

Aside from providing clues to the timing of the geologic events or disturbances that killed subfossil forests, the samples of these trees are of great value as repositories of climate and environmental information and should be archived for future studies. We have established a small tree-ring lab at Centralia College via a Department of Education grant so we can use tree-ring research as a tool for teaching science and training future researchers. We are also collaborating via a National Science Foundation grant to develop undergraduate science curriculum that uses tree-ring data. Selected students are studying the subfossil wood and helping to unlock the secrets in the rings. ◆

Patrick Pringle is an associate professor of Earth Science at Centralia College in Centralia, Wash. He can be reached at 360-736-9391 x550 or ppringle@centralia.edu.

Policy Scoreboard

Editor's Note: To keep SAF members informed of state society policy activities, Policy Scoreboard is a regular feature in the Western Forester. *The intent is to provide a brief explanation of the policy activity—you are encouraged to follow up with the listed contact person for detailed information.*

Wildfire Management. While the SAF's Committee on Forest Policy is in the process of revising the expired SAF position statement on Wildland Fire Management, the National Cohesive Wildland Fire Management Strategy (CS) is moving from the development phase to implementation. Meanwhile, the federal fire management agencies are preparing the third Quadrennial Fire Review (QFR). Previous efforts were completed in 2005 and 2009. According to a US Forest Service Fact Sheet, the CS and QFR efforts complement each other. To keep up to date on these developments, subscribe to the Western Region Cohesive Strategy newsletter by asking Kate Lighthall, klighthall@bendcable.com, to add you to the WRSC email list. Contact: Jay O'Laughlin, Inland Empire SAF, 208-885-5776, jayo@uidaho.edu.

Collaborative efforts on Idaho's national forests attract policy-makers' attention. In February, 80 people attended the Idaho Forest Restoration Partnership's fourth annual winter conference. Company executives, loggers, environmentalists, and others shared success stories and talked about how to speed up forest restoration. To date, nine collaborative groups have accounted for 130 million board feet of timber in the pipeline or already cut in the last five years. That success brought US Forest Service Chief Tom Tidwell and all four members of Idaho's congressional delegation to participate in the recent workshop. Conference agenda, presentations, and associated references are available online at http://idahoforest-partners.org/reference-library.html. Contact: Jay O'Laughlin, Inland Empire SAF, 208-885-5776, jayo@uidaho.edu.

Unclear Outlook for O&C Lands Bills. In December, Senator Ron Wyden introduced a bill (S. 1784) to address concerns about future management of the BLM O&C lands, which span about 2.4 million acres primarily in western Oregon. Wyden's bill follows a similarly focused set of amendments by Rep. Peter DeFazio in a bill (HR 1526) that passed the full House in September. Although the House bill's passage and a February hearing on the Senate bill have provided some momentum, their collective future is uncertain given some important differences in the bills and other major issues. For example, some features of the House bill resulted in a veto threat by the President and interest groups are strongly divided about both bills and related concerns about the O&C lands.

Another notable development is Wyden's departure as chair of the Senate Energy and Natural Resources Committee, which has yet to vote on S. 1784, to assume chairmanship of the Senate Finance Committee. The scope and complexities of the House and Senate bills are substantial, but OSAF is planning to respond with a comment letter to the Oregon delegation sometime this spring, with a focus on forestry issues and related science and practice by professionals. The text and current status of these and other forestry-related bills introduced in Congress can be found via http://thomas.loc.gov and further information typically is available at the websites of the bills' primary sponsors. Contact: Paul Adams, OSAF Policy chair, 541-737-2946; paul.adams@oregonstate.edu. ◆

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