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Before the U.S. House of Representatives Natural Resources Committee, Subcommittee on Oversight and Investigations
September 27, 2017

Oversight Hearing "Exploring Solutions to Reduce Risks of Catastrophic Wildfire and Improve Resilience of National Forests"

Chairman Westerman, Ranking member Hanabusa, and subcommittee members, thank you for the opportunity to discuss wildfires on national forests. I am the Chief Scientist of the nonprofit organization, Geos Institute in Ashland, Oregon. Geos Institute works with agencies, landowners, and decision makers in applying the best science to climate change planning and forest management. As a scientist, I have published in peer-reviewed journals on fire ecology and climate change, I am on the editorial board of several leading journals and encyclopedias, and I have been on the faculty of Oregon State University and Southern Oregon University. A recent book I co-authored with 28 other scientists outlined the ecological importance of mixed-severity fires in maintaining fire-resilient ecosystems, including ways to coexist with wildfire (DellaSala and Hanson 2015).

Wildfires are necessary natural disturbance processes that forests need to rejuvenate. Most wildfires in pine and mixed-conifer forests of the West burn in mixed fire intensities at the landscape scale that produce large and small patches of low to high tree mortality. This tapestry of burned patches is associated with extraordinary plant and wildlife diversity, including habitat for many big game and bird species that thrive in the newly established forests. From an ecosystem perspective, natural disturbances like wildfires are not an ecological catastrophe. However, given there are now 46 million homes in naturally fire-prone areas (Rasker 2015), and no end in sight for new development, we must find ways to coexist with natural disturbance processes as they are increasing in places due to climate change.

In my testimony today, I will discuss how proposals that call for increased logging and decreased environmental review in response to wildfires and insect outbreaks are not science driven, in many cases may make problems worse, and will not stem rising wildfire suppression costs. I will also discuss what we know about forest fires and beetle outbreaks in relation to climate change, limitations of thinning and other forms of logging in relation to wildfire and insect management, and I will conclude with recommendations for moving forward based on best available science.

I. WHAT WE KNOW ABOUT RECENT FOREST FIRE INCREASES

Recent increases in acres burned of forests are mainly due to a changing climate - Scientists have known for sometime that fire activity tracks regional weather patterns, which in turn, are governed by global climatic forces such as the Pacific Decadal Oscillation (PDO - a recurring long-lived El Niño-like pattern of Pacific climate variability– see chart 1). For instance, the very active fire seasons of the 1910-1930s, occurred during prolonged drought cycles determined by the PDO that resulted in much larger areas burning historically than today (Powell et al. 1994; Interagency Federal Wildland Fire Policy Review Working Group 2001; Egan 2010) (chart 1). In fact, compared to the historic warm PDO phase of the early 1900s, most of the West is actually experiencing a *fire deficit* (Littell et al. 2009, Parks et al. 2012). However, with warming temperatures, early spring snowmelt, and longer fire seasons over the past few decades more acres are burning each year (Westerling et al. 2006; Littell et al. 2009) (chart 1).

For instance, wildfire season in the West has lengthened from an average of five to seven months, and the number of large wildfires (>1,000 acres) has increased since the 1980s (Dennison et al. 2014) from 140 to 250 per year (UCS 2017). This is occurring as average annual temperature in the West has risen by nearly 2 degrees F since 1970s and winter snow pack has declined (UCS 2017). If measures are not taken to stem greenhouse gas emissions, wildfire acres are projected to increase further in dry areas as annual temperatures are expected to rise another 2.5 to 6.5 degrees F by mid century (UCS 2017). Some researchers estimate more than half of the increase in acres burned over the past several decades is related to climate change (Abatzoglou and Williams 2016). This increase is expected to continue with additional warming leading to even greater suppression costs if the agencies continue to suppress fires across the landscape (Schoennagel et al. 2017).

Increasing Human Development is Lengthening Wildfire Seasons and Adding to Fire Ignitions - The direct role of human-access via roads and development in the Wildlands Urban Interface (WUI) is increasing wildfire activity. Scientists recently evaluated over 1.5 million government records of wildfires nationwide from 1992 to 2012 (Balch et al. 2015). During that time, human-caused fire ignitions have vastly expanded the spatial and seasonal occurrence of fire, accounting for 84 percent of all wildfire starts and 44 percent of the total area burned nationally. We now have the phenomenon of a human-caused fire season, which was three times longer than the lightning-caused fire season and added an average of 40,000 wildfires per year across the US over this 20-year period of time. Ignitions caused by people – whether accidental or arson – have substantial economic costs. This will only worsen with continued development of the WUI adding to the 46 million homes (Rasker 2015) already in these fire-prone areas.

Thus, given expansion of homes in the WUI, the best way to limit damage to homes is to reduce fire risks by working from the home-outward instead of the wildlands-inward (Syphard et al. 2013). For instance, if a fire-brand travels miles ahead and lands on a flammable roof that home is very likely to burn compared to a home that has a fire resistant roof and cleared vegetation within a narrow defensible space of 100-200 feet immediately surrounding the home (Cohen 2000). Logging outside of this narrow zone does not change home ignition factors.

II. WHAT WE KNOW ABOUT FIRE AND FOREST MANAGEMENT

Wilderness and other protected areas are not especially prone to forest fires – proposals to remove environmental protections to increase logging for wildfire concerns based on the assumption that unmanaged – or protected areas – burn more intensely are misplaced. For instance, scientists (Bradley et al. 2016 of which I was a co-author) recently examined the intensity of 1,500 forest fires affecting over 23 million acres during the past four decades in 11 western states. We tested the common perception that forest fires burn hottest (most intensely) in wilderness and national parks while burning cooler (less intensely) or not at all in areas where logging had occurred. What we found was the opposite – fires burned most intense in previously logged areas, while they burned in natural fire mosaic patterns in wilderness, parks, and roadless areas, thereby, maintaining resilient forests (see chart 2). Consequently, there is no reason for reducing environmental protections.

State lands are not at lower wildfire risks compared to federal lands - there is much discussion about whether state lands are being managed in a way that reduces fire occurrence and intensity. However, in a recent report of wildfire risk (that included acres likely to burn), scientists (Zimmerman and Livesay 2017) used the West Wide Wildfire Risk Assessment model, an important assessment tool of the Council of Western State Foresters and Western Forestry Leadership Coalition. They evaluated risk for western states based on historical fire data, topography, vegetation, tree cover, climate, and other factors. According to the Center for Western Priorities analysis, state (22%) and federal (23%) lands have approximately equivalent levels of fire risks in the West, and for some states, risks were higher than federal lands. Notably, allegations of higher fire risk based solely on the number of federal acres burned in a fire season are misleading as there are over 7 times as many federal lands (362 million acres) in 11 Western states as compared to state-owned lands (49 million acres) (Zimmerman and Livesay 2017).

Thinning is Ineffective in Extreme Fire Weather – thinning/logging is most often proposed to reduce fire risk and lower fire intensity. Thinning-from-below of small diameter trees followed by prescribed fire in certain forest types can reduce fire severity (Brown et al. 2004, Kalies and Kent 2016) but only when there is not extreme fire weather (Moritz et al. 2014, Schoennagel et al. 2017). Fires occurring during extreme fire-weather (high winds, high temperatures, low humidity, low fuel moisture) will burn over large landscapes, regardless of thinning, and in some cases can burn hundreds or thousands of acres in just a few days (Stephens et al. 2015, Schoennagel et al. 2017). Fires driven by fire weather are unstoppable and are unsafe for fire fighters to attempt putting them out, and, as discussed, are more likely under a changing climate.

Further, there is a very low probability of a thinned site actually encountering a fire during the narrow window when tree density is lowest. For example, the probability of a fire hitting an area that has been thinned is about 3-8% on average, and thinning would need to be repeated every 10-15 years (depending on site productivity) to keep fuels at a minimum (Rhodes and Baker 2008).

Thinning too much of the overstory trees in a stand, especially removal of large fire-resistant trees, can increase the rate of fire spread by opening tree canopies and letting in more wind, can damage soils, introduce invasive species that increase flammable understory fuels, and impact wildlife habitat (Brown et al. 2004). Thinning also requires an extensive and expensive roads network that can degrade water quality by altering hydrological functions, including chronic sediment loads.

Post-disturbance salvage logging reduces forest resilience and can raise fire hazards – commonly practiced after natural disturbances like fires or insect outbreaks, post-disturbance logging hinders forest resilience by compacting soils, killing natural regeneration of conifer seedlings and shrubs associated with forest renewal, increasing fine fuels from slash left on the ground that aids the spread of fire, removing the most fire-resistant large live and dead trees, and degrading fish and wildlife habitat. Further roads that increase sediment flow to streams triggering widespread water quality problems (Lindenmayer et al. 2008).

III. WHAT WE KNOW ABOUT BEETLE-KILLED FORESTS AND FOREST MANAGEMENT

Beetle Killed Forests are Not More Susceptible to Forest Fires - forests in the West are being affected by the largest outbreaks of bark beetles in decades, which has caused concern about forest resilience and wildfire risk and led to proposals for widespread tree removals. Such proposals stem in part from the rationale that bark beetle outbreaks increase wildfire risks due to dead trees and that logging in beetle-affected forests would therefore lower such risks. However, beetle-killed forests are not more susceptible to forest fires (Bond et al. 2009, Hart et al. 2015, Meigs et al. 2016). This is mainly because when conifers die due to drought or native bark beetles, the combustible oils in the needles quickly begin to dissipate, needles and small twigs begin to fall to the ground. Without the fine fuels that facilitate fire spread, potential crown fires are actually lowered in forests with beetle mortality (Donato et al. 2013). The beetle-killed standing dead trees (snags) are the least flammable part of the forest and act more like a large log in a campfire, rather than kindling which is what causes fire spread.

In fact, studies of beetle-killed forests in the West found that when fires occurred during or immediately after the pulse of snag recruitment from beetle kill, fire severity consistently declined in the stands with high snag densities in the following decades (Meigs et al. 2016). In pine and mixed-conifer forests of the San Bernardino National Forest (CA), fires occurred immediately after a large pulse of snag recruitment from drought and beetles. However, scientists (Bond et al. 2009) found "no evidence that pre-fire tree mortality influenced fire severity." In studies of beetles and wildfires across the western U.S., scientists (Hart et al. 2015) stated "contrary to the expectation of increased wildfire activity in recently infested red-stage stands, we found no difference between observed area and expected area burned in red-stage or subsequent gray-stage stands during three peak years of wildfire activity, which account for 46 percent of area burned during the 2002–2013 period." And finally, in a comprehensive review of fire-beetle relations in mixed-conifer and ponderosa pine forests of the Pacific Northwest, scientists

(Meigs et al. 2016) found: “in contrast to common assumptions of positive feedbacks, we find that insects generally reduce the severity of subsequent wildfires. Specific effects vary with insect type and timing, but insects decrease the abundance of live vegetation susceptible to wildfire at multiple time lags. By dampening subsequent burn severity, native insects could buffer rather than exacerbate fire regime changes expected due to land use and climate change.”

Most importantly, climate change is allowing more insects to survive the winter, triggering the rash of recent outbreaks (Meigs et al. 2016).

Thinning cannot limit or contain beetle outbreaks - once beetle populations reach widespread epidemic levels, thinning treatments aimed at stopping them do not reduce outbreak susceptibility as beetles over run natural forest defenses with or without thinning (Black et al. 2013).

IV. CLOSING REMARKS AND RECOMMENDATIONS

In sum,

- Recent increases in wildfires and insect outbreaks are a result of a changing climate coupled with human-activities including expansion of homes and roads into the WUI that will only continue to drive up fire suppression costs.
- Policies should be examined that discourage continued growth in the WUI; any new development must include defensible space and construction from non-flammable materials.
- The most effective way to protect homes is to create defensible space in the immediate 100 feet of a structure and use of non-flammable materials. Wildland fire policy should fund defensible space, not more logging and thinning miles away from communities.
- No amount of logging can stop insect outbreaks or large fires under extreme fire weather. Logging may; in fact, increase the amount of unnatural disturbances by homogenizing landscapes with more even aged trees, residual slash left on the ground, and compounding cumulative impacts to ecosystems.
- Thinning of small trees in certain forest types, maintaining canopy closure and in combination with prescribed fire can reduce fire intensity but treatment efficacy is limited in extreme fire weather, and by the small chance that a thinned site will encounter a fire during a very narrow window when fuels are lowest.

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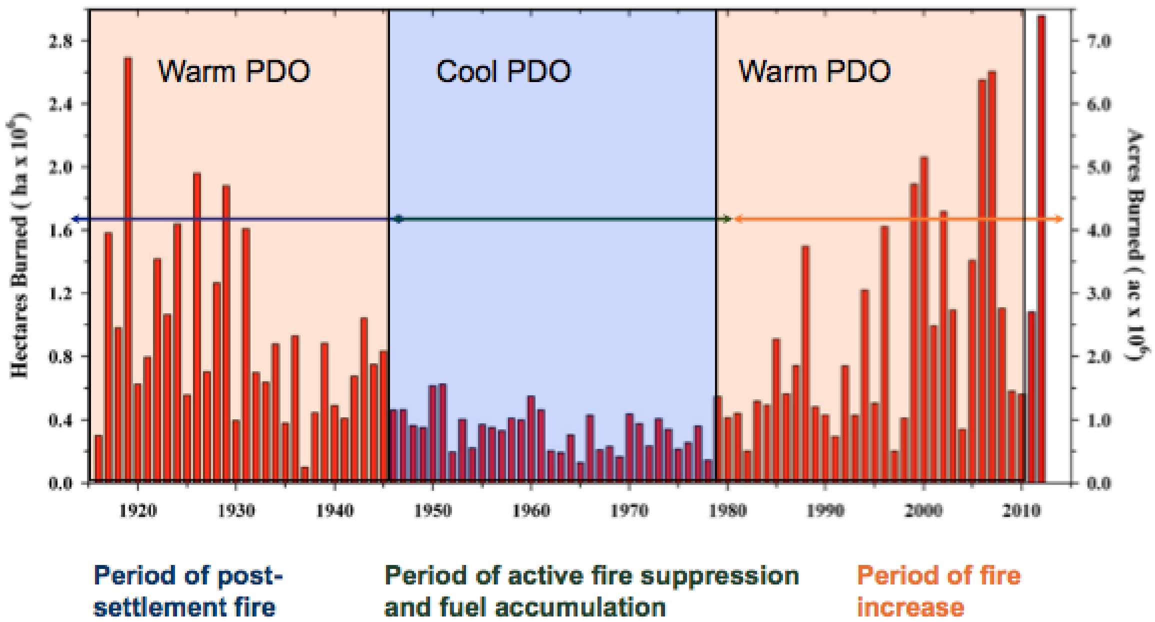

Chart 1. Fires track regional climatic variations governed by global processes such as the Pacific Decadal Oscillation (PDO). The PDO is recurring pattern of ocean-atmosphere (El Niño-like) climate interactions centered over the mid-latitude Pacific basin. When the PDO is warm, fire activity is high and vice-versa (modified from Littell et al. 2009).

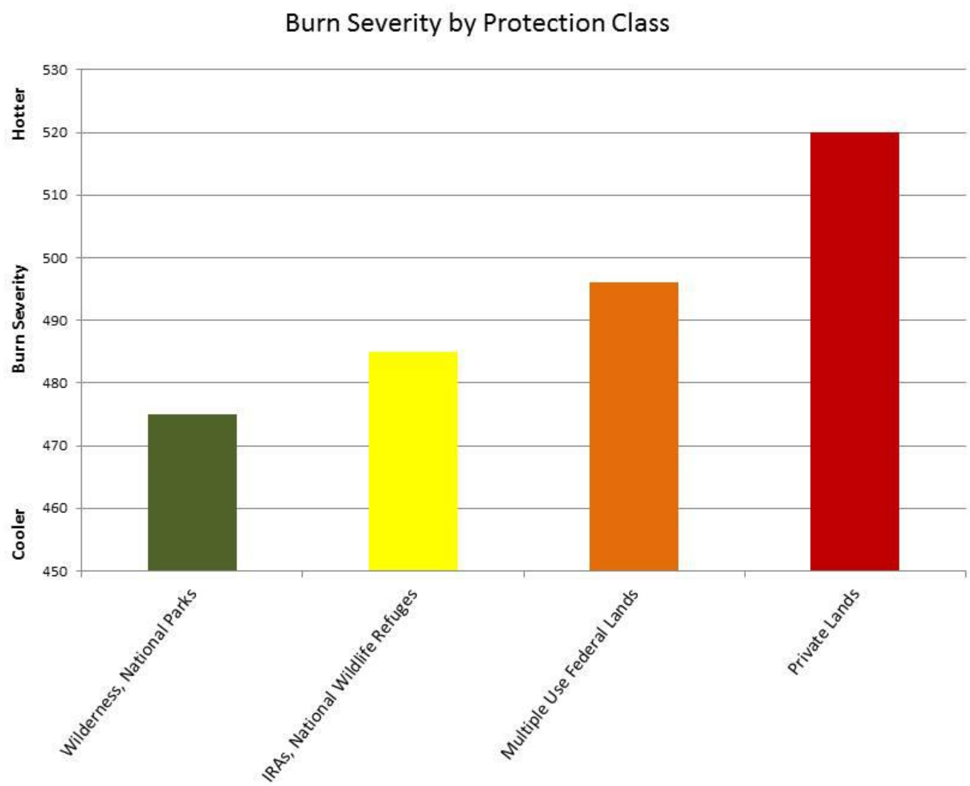

Chart 2. Burn severity (cool to hot fires) arranged by land-use categories from maximum protection (parks, wilderness) to minimal (private lands). Fire severity was assessed from the Monitoring Trends in Burn Severity project (http://www.mtbs.gov) managed by USDA and USDI. Fire severity data in acres burned and severity classes were available from 1984 to 2014 and analyzed for 1,500 fires affecting ~24 million acres burning in mixed-conifer and pine forests of 11 western states using GIS and robust statistical analyses (Bradley et al. 2016). The chart reflects average burn severities for land categories with the largest differences between wilderness/parks vs. private lands.

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3(A)

3(B)

Chart 3. (A) Google Earth image of the Douglas-fire complex, southwest Oregon showing the burn perimeter in red. This 2014 fire burned mostly on private lands and in high fire intensities when it encountered densely stocked tree plantations and logging slash that acted as kindling. A similar fire nearby in 2012, Oregon Gulch fire (not shown), blew up when it encountered slash piles on private lands the height of three story buildings. The Google image is illustrative of the general pattern of uncharacteristic fire intensity observed in “actively managed” forests by Bradley et al. 2016. The area was also extensively post-fire salvage logged leading to chronic impacts to forests and streams that accumulate in space and time and predispose fire-rejuvenating forests to the next uncharacteristic high intensity burn (i.e., a perpetual intense fire-logging-intense fire feedback loop).

(B) The so-called “checkerboard” of private and Bureau of Land Management (BLM) lands, southwest Oregon, showing extensive fragmentation by roads and clearcuts. Flammable tree plantations on private lands have replaced most of the fire-resistant/resilient older forests that once dominated the Pacific Northwest. Remaining older forests are mainly on public lands and provide myriad ecosystem benefits in the form of outdoor recreation, carbon sequestration and storage, clean water, aquatic strongholds for salmon, and unique habitat for species that are reduced in intensively/actively managed areas.

Both landscapes have been extensively damaged by decades of clearcutting and road building. High road densities fragment wildlife habitat and cause chronic water quality and invasive species problems. Increasing logging on federal lands, where the last intact forests and watersheds remain, will make forests and aquatic systems less resilient to natural disturbances especially when coupled with the emergence of a new fire-climate era and an increase in human-caused wildfire ignitions. Unprecedented cumulative impacts from logging and climate change will likely trigger the onset of a wave of species extinctions in terrestrial and aquatic systems.

Chart 4. Post-fire logging within a late-successional reserve (LSR) managed for spotted owls and other old forest species (under the Northwest Forest Plan) in the Biscuit fire area 2002 (upper left) vs. the same LSR 10 years later (upper right). Upper right panel shows lack of conifer establishment mainly when loggers dragged logs up steep slopes killing most of the naturally regenerating seedlings (Donato et al. 2006). Bottom photo just upslope of the logged LSR was from an unlogged botanical area with abundant "biological legacies" (large snags) that protected soils, shaded conifer seedlings from intense sunlight, and provided soil nutrients and moisture for the developing forest. Notice the difference in forest establishment. A detailed study was conducted in the Biscuit burn area (Donato et al. 2006) and documented statistically significant losses of conifer establishment due to logging and higher fuel accumulations in post-fire logged plots from slash. Thus, these photos are illustrative of the general negative impact of post-fire logging on forest resilience.

Citation: Donato, D.C. et al. 2006. Post-wildfire logging hinders regeneration and increases fire risks. Science Brevia 5 January 2006 / Page 1 / 10.1126/science.1122855

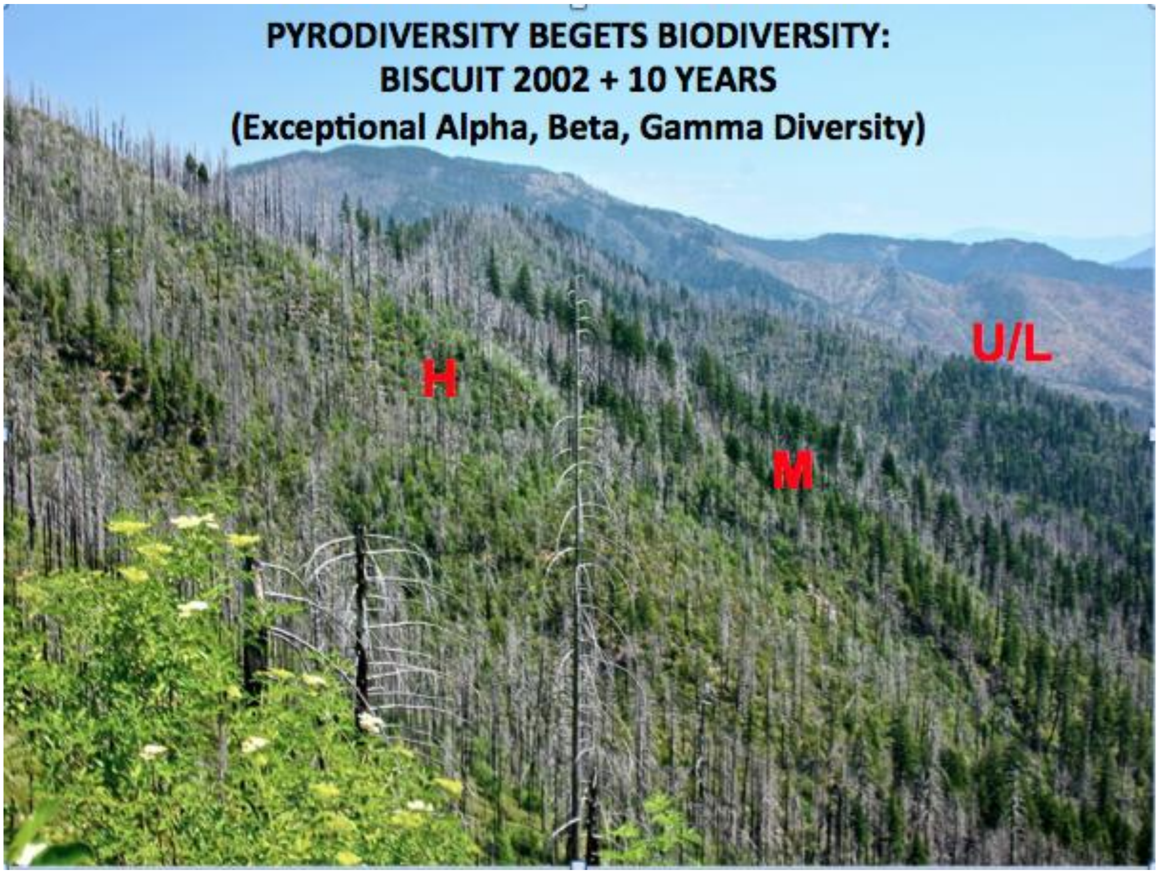

Chart 5. Wildfires in western pine and mixed-conifer forests produce mixed fire effects on the vegetation (known as fire severity). This pattern of large and small patches consists of unburned/low (U/L), moderate (M), and high (H) burn severity patches ("pyrodiversity") associated with extraordinary levels of plant and wildlife richness, including habitat for rare plants, songbirds, woodpeckers, big game, small mammals, and spotted owls. Alpha (number of species at stand level), beta (number of species summed across burn patches), and gamma diversity (number of species at regional scales) are ways to measure diversity at different spatial scales. Burned areas are rich in these diversity metrics and are not ecological "catastrophes."

Chart 6. A tale of two connected forests. The old-growth forest (left), rich in plant and wildlife diversity, eventually burned (right). The burned forest is known as "complex early seral forest" with the dead standing trees (snags) acting as "biological legacies" that connect the various stages of forest succession through time. Soon after the fire in the old growth, colonizing plants and wildlife occupy the site and richness of species accumulates, quickly rivaling that of an old-growth forest. A forest fire is not an ecological "catastrophe" but is a resetting of nature's successional clock that forests have been resilient and uniquely adapted to for millennia (DellaSala and Hanson 2015). Logging in these forests degrades forest resilence and is not restoration.