Unplanned wildfire in areas with slash piles

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A review of the literature suggests that treated units with unburned slash piles and untreated units with ladder fuels will experience similar fire behavior and effects

Millions of acres of fuels reduction treatments are being implemented each year to reduce the likelihood of uncharacteristic wildfire in overstocked stands. Typical hazardous fuels reduction treatments target small-diameter trees for removal producing large amounts of unmerchantable woody material and elevating surface fuel loadings. Currently, few commercial markets for this woody material exist, so it is commonly piled by hand or with heavy machinery and burned on site. One estimate suggests that at least 15,000 piles are created each year (Hosseini et al. 2014). Occasionally, unplanned wildfires, whether natural or human-caused, burn piles before managers are able to burn them under controlled conditions.

While unplanned fires in areas with piled fuels are not common, they still present a potential risk for managers and firefighters. Little is written or documented about piles burning during wildfires, making it difficult to assess the threat posed by unburned piles on the landscape. In an effort to better understand the prevalence, causes, and impacts of unplanned burning of piles, we reviewed the available literature and interviewed managers from across the country. What follows is a first step that will hopefully call attention to the issue and help frame incisive questions for future research.

Why are there unburned piles?

Piles are built and left to dry since green wood burns poorly. For example, the U.S. Forest Service's Lake Tahoe Basin Management Unit in California states that it takes approximately 18 months for the piles generated by their fuel reduction activities to dry sufficiently for effective consumption when burned. Weather conditions are another reason to delay pile burning. Material cut in the spring or summer may be left until conditions are safe for burning. In many areas pile burning is a winter activity that is carried out when there is snow on the ground to prevent unwanted fire spread. Although winter is a popular time for pile burning, the Coalition for the Upper South Platte in Colorado was unable to burn thousands of piles during the winter of 2012-2013 because snow depth did not meet their pile burn guidelines (Steiner 2014). Institutional factors such as available labor and funding also factor into the amount of time piles may remain in the woods before managers can safely burn them. In the Lake Tahoe Basin and the Okanogan-Wenatchee National Forest in Washington, there is a backlog of unburned piles because of limitations imposed by air quality restrictions, unfavorable weather conditions, available resources, and even funding (USFS 2014; Jim Bailey, U.S. Forest Service, personal communication).

Wildfire can bring unplanned fire to piled fuels, but so too can arson. Piling and burning is common in the wildland-urban interface (WUI) where the proximity of homes makes broadcast burning more challenging. Piles in the WUI are at risk of arson until they are dry enough to burn, environmental conditions are in prescription, and qualified personnel are available to burn them. Because piles can be burned safely under some conditions, arsonists may not realize that piles lit under unfavorable weather conditions can quickly escape control. Of course this is a dangerous miscalculation and arsonist-ignited piles can easily become life- and property-threatening wildfires. For example, in a case from 2006 in a California campground, managers suspect that the arsonists may have been motivated by curiosity rather than evil intent (Ben Jacobs, National Park Service, personal communication).

Do piles affect wildfire behavior?

One of the key questions is whether or how fire behavior changes in the presence of unburned piles. From the perspective of a wildfire, unburned piles are simply redistributed fuels. In other words, boles and branches that were previously in the canopy are aggregated into piles on the surface, so the same amount of fuel is available in a different arrangement. An assessment of the 2007 Angora Fire in California stated that the convective and radiant heat output in untreated stands and stands with piles burned by wildfire would be similar because the same amount of fuel would burn (Murphy et al. 2007). However, piling fuels can change fuel moistures by converting live fuels to dead fuels, which can affect flame length, fireline intensity, burning duration, and other aspects of fire behavior. Moving biomass from standing trees to piles decreases canopy bulk density, ladder fuels, and canopy continuity, which can reduce fire intensity and severity. Thinning or harvesting and piling, however, can also elevate fine fuel loading by increasing the amount of light that reaches the forest floor and encouraging herbaceous growth. Likewise, removing trees reduces stem and canopy density, which opens the stand to higher wind speeds and potentially elevated levels of fire behavior. Unburned piles contributed to fire intensity and duration during the 2010 Fourmile Canyon Fire in Colorado (Graham et al. 2012). In the Gold Hill area, the Fourmile Canyon Fire burned more intensely through stands with piles as compared to adjacent untreated stands, because of increased wind speeds in the thinned stands (Graham et al. 2012). An experimental burn at Nenana Ridge in Alaska that mimicked wildfire conditions showed that a stand with windrowed fuels had a lower maximum temperature but longer heating time than a stand with a lop-and-scatter treatment (Butler et al. 2012).

In some cases, even though the piles had not been treated when wildfires occurred, fire behavior appears to have been less active than might have been expected in an untreated stand. For example, in 2004 the Cal Hollow Fire threatened the community of Central, Utah. A fuel break had been put in place in the piñon-juniper forest above the community, but the fire occurred before the piles generated during fuelbreak installation could be burned under controlled conditions (USFS 2013). The fire approached the fuel break in the tree crowns, but dropped to the surface in the treated area, although it did burn intensely in the piles. Retardant drops and other suppression activities successfully contained the fire before it could enter the community (McAvoy 2004). Similarly, during the 2005 Camp 32 Fire in Montana, the untreated stand supported an active crown fire, but when the fire entered the stand with untreated piles it switched to a passive crown fire (Ron Hvizdak, personal communication; USFS 2006).

Wildfire in stands with unburned piles may increase spotting, as was observed when large landing piles ignited during the 2008 American Rivers Complex in California causing torching of nearby trees and spotting (Safford 2008). Similarly, during the 2013 Rail Fire on the Modoc National Forest, also in California, even though the rate of spread of the fire front decreased when the wildfire encountered a treatment where material had recently been piled, the uncured (or green) piles contributed to spotting, which ultimately made containment difficult (Kenneth

Heald, U.S. Forest Service, personal communication). In contrast, during the Angora Fire, spotting distance in stands with unburned handpiles was shorter than in untreated stands. In this case, repositioning fuels from the crown to the surface reduced ember loft and correspondingly, the distance embers traveled and the manner in which the fire spread (Murphy et al. 2007).

In addition to generating embers, piles can also be receptive to embers from other sources. For example, the 2013 Andrews Creek Fire in Oregon ignited piles in a recently thinned Douglas-fir stand. The fire then spotted from pile to pile but did not spread far outside the footprint of the piles (Patrick Skrip, Douglas Forest Protective Association, personal communication).

How do burning piles affect wildfire control?

In terms of wildfire suppression or control, ease of access to the affected area may influence operational success. In cases where there is good access (i.e., proximity to roads and trails) for staging suppression activities, wildfires in piles may be easier to control than comparable untreated stands, particularly if the piling activities reduced the horizontal continuity of the surface fuel layer. However, where access is difficult, wildfires in piles may be more difficult to control than fires in untreated or lop-and-scatter treatments because of the intense heat generated by burning piles. For example, in two Lake Tahoe, California area fires where piles burned, the success of suppression activities, and ultimately control, was determined by ease of access. When the Angora Fire burned an area with piles, the fire resisted control because access was difficult, however, an area with piles that burned during the American Rivers Complex was accessible via a public road, providing suppression personnel better access for fire fighting apparatus and therefore easier control. Firefighters kept some of the large landing piles that the

American Rivers Complex Fire threatened to ignite from burning by bulldozer blading and watering (Safford 2008). Similarly, safe, successful fire suppression in an area with piles on the 1999 Alder Fire in Grand Teton National Park, Wyoming was made possible by the existence of escape routes (via paved road) and ready access to plentiful water supplies (Mack McFarland, National Park Service, personal communication). The fast-moving 2008 Jack Fire burned through an area with piles of western juniper in Lava Beds National Monument in Northern California. Managers had been unable to burn the piles when scheduled the previous winter. When ignited by the wildfire the piles burned very intensely, but the fire was contained with minimum impact strategies such as use of existing roads and water rather than ground disturbing methods (Calvin Farris, National Park Service, personal communication; Augustine 2014). When the 2007 Tin Cup Fire in Montana entered treated areas it moved from a crown to a surface fire, even though not all of the piles had been burned before the fire front arrived at the piled area (Bitter Root RC&D 2014).

Do piles alter wildfire effects?

The effects of wildfires on the residual stand vary with weather, topography, forest type, fuel loadings, and other factors, potentially including whether unburned piles were present at the time of the wildfire. An area with handpiles that burned during the Angora Fire had slightly lower severity when compared to similar completely untreated stands (Murphy et al. 2007). Investigators attributed the reduced mortality to the wider crown spacing in the piled stand. The heat from the piles that burned in the Andrews Creek Fire caused approximately 40 percent mortality in the overstory even though there was little scorch (Patrick Skrip, Douglas Forest Protective Association, personal communication). The 2011 Wallow Fire in Arizona affected both stands with a lop-and-scatter treatment and stands with piles that had yet to be burned. Although both types of treatment resulted in canopy mortality, mortality in the piled treatment was concentrated around the pile locations (particularly landing piles) while the lop-and-scatter treatment experienced complete mortality (Bostwick et al. 2011, Palmer et al. 2011). In some areas that burned in the Wallow Fire near Nutrioso, Arizona, the delayed mortality of the overstory trees near piles that burned in the wildfire appeared to be driven by the long fire residence time associated with the burning piles (Russell Bigelow, U.S. Forest Service, personal communication).

In a number of cases when wildfire encountered unburned piles, the effects were worse than in similar untreated stands. The 2007 East Zone Complex burned about 156 acres in Secesh Meadows, Idaho, where contractors had thinned and piled small trees the year before, but had not yet burned the piles. Tree mortality was higher in the areas where the wildfire burned piles than in untreated areas (Hudak et al. 2011). When the 2011 Cougar Fire in California reached accumulations of trees cut by feller bunchers and left to cure before being chipped (also called 'doodle piles') the result was higher fire severity (Calvin Farris, National Park Service, personal communication; Safford et al. 2012). Wimberly and colleagues (2009) studied unfinished fuel treatments that burned in the 2005 Camp 32 Fire and the 2006 Warm Fire in Arizona. Though their analysis did not focus specifically on the impact of unplanned fire in piled fuels, they found that thinning without treatment of the resulting slash increased burn severity. In an analysis of the 2007 Tin Cup Fire, Harrington and colleagues (2010) stated that crown burn effects were similar between partially treated units with slash piles and untreated units with ladder fuels.

Where topography drives an increase in fire intensity, fuel treatments are often overwhelmed. For example, during the 2012 Little Bear Fire in New Mexico, burnout operations sent fire uphill into a stand where hand-piled fuels had yet to be treated and the result was high levels of mortality in the residual stand (Kuhar 2012).

In one case, an unplanned ignition of piles at Mount Rushmore National Park, South Dakota in 2005, resulted in rapid and complete pile consumption, a fire effect that park staff considered beneficial (e.g., greater fuel consumption) compared to other areas where piles that were burned within prescription failed to achieved desired levels of fuel consumption (Steve Ipswich, Bureau of Indian Affairs, personal communication).

Conclusions and research needs

Based on our review of the available reports and interviews with managers, it appears that unplanned fire in areas with piles may not be especially common. Our search only uncovered about 20 examples in the last decade. Although we suspect our review of the literature and limited survey of the management community potentially reflects a significant under-estimate, the fact remains that it is three orders of magnitude smaller than the total number of wildfires that occur each year (the National Interagency Fire Center estimates an average of about 10,000 lightning and 62,000 human-caused fires each year), and therefore, still a relatively minor occurrence in the broader context. Even in cases like the East Zone Complex in Idaho, where 156 acres of piles did burn in a wildfire, another 954 acres of piles had been burned under controlled conditions before the wildfire arrived (Hudak et al. 2011) highlighting the disparity between wildfire area burned with and without piles. Piles need not always exacerbate wildfire activity and severity; there are also some cases where, either because of location (easier access) or re-arranging of the surface fuels across the larger stand (disrupting horizontal fuel continuity) unburned piles increase control opportunities and potentially reduce wildfire severity.

Piling and burning is a proven fuel treatment method for reducing fuel loading in forested systems. It is often favored in the WUI and other difficult-to-burn areas because of the added measure of control over fire behavior and emissions it affords fuel management personnel. Piles are being created more quickly than they are being burned, however, leaving a surplus of unburned piles in forested landscapes of the United States that are susceptible to burning during wildfires. Personnel and environmental limitations, along with the need to allow piles to dry means there is frequently a risk that piles could be present in areas being burned during unplanned fires (i.e., wildfires). Therefore a key question is whether the risk of unplanned fire in piles should change the management approach to fuel reduction. In other words, in areas where resources and opportunities to burn piles are limited, should management focus on alternative fuel treatments such as chipping or mastication?

We consider this report a first look at the phenomenon wherein wildfires burn areas with piled fuels. Given the dearth of information and quantitative study, we suggest that the topic warrants additional inquiry. A more in-depth investigation of the area affected could help define the scope of the potential issue. A simple inventory of the total area with piles and of the annual area with piles burned during wildfires would be a good place to start. Planned experiments and opportunistic post-fire measurements should also be undertaken to assess how the presence of piles (and the associated changes to stand structure and surface fuels that accompany fuel treatments that include pile burning) affects fire intensity and severity in ecosystem types where piling and burning occurs so that land managers can better weigh the risks and benefits associated with piling as a fuel treatment.

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