COLLATERAL DAMAGE: THE ENVIRONMENTAL EFFECTS OF THE 2002 BISCUIT FIRE SUPPRESSION ACTIONS

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INTRODUCTION

In 2002 the largest wildfire in the U.S. was the Biscuit Fire in southern Oregon. Sparked by several lightning ignitions and aided by severe drought, record-breaking heat, steep mountainous terrain, and high fuel accumulations, the wildfire burned for two months and encompassed 499,570 acres (202,169 hectares). Over 7,000 firefighters and hundreds of vehicles, aircraft, and equipment fought the wildfire. The majority of the Biscuit Fire burned in lands with special protective status or high value as natural areas, including the entire Kalmiopsis Wilderness Area, seven Inventoried Roadless Areas, two Research Natural Areas, 11 Botanical Areas, and several Late-Successional and Riparian Reserves. At a cost of over $155 million (USD) in direct firefighting expenditures, the siege-like suppression operation also earned the distinction of being the world's most expensive wildfire suppression incident in history.

Suppression records and other documents produced by the U.S. Forest Service were qualitatively analyzed to determine the location and kinds of suppression operations applied during the Biscuit Fire, and assess their environmental effects. Analysis reveals that fire suppression actions caused significant adverse environmental impacts in many of the special natural areas (Ingalsbee 2005). The Biscuit Fire makes an excellent case study for raising broader policy questions about the effects and efficacy of fire suppression in protected natural areas and roadless wildlands. The study results also call for more systematic research of other wildfires to determine the influence of suppression firing operations on the apparent increasing size and severity of wildland fires.

METHODS

A Freedom of Information Act (FOIA) request was used to gain access to Biscuit Fire suppression records including daily Incident Action Plans (IAPs), weather reports (both forecasts and observed weather data), fire behavior analyses, maps and GIS data of the daily fire spread and suppression operations, and the narrative executive summaries produced by the various Incident Management Teams (IMTs) assigned to the Biscuit Fire. The IAPs were analyzed for data on fireline construction (especially dozerlines), water and retardant drops, tree felling, and burnout ignitions. Suppression records were supplemented by the Biscuit Post-Fire Assessment and the Burned Area Emergency Rehab reports produced by Siskiyou/Rogue River National Forest staff. Importantly, the Biscuit Fire was divided into four incident management zones, constraints imposed on access to suppression records allowed examination of documents only in Zone One (the eastern half) of the fire.

A key research interest due to its public controversy was analysis of the locations and effects of firing operations (backfires and burnouts). Data from the IAPs and fireline maps were

compared to the IMTs' executive summaries, fire progression maps, and post-fire severity assessments to determine the specific location of suppression ignitions and their relationship to the spread and severity of the wildfire. Weather data (temperature, relative humidity, wind speed and direction) was examined to determine the influence of weather conditions on firing operations. GIS data was used to estimate the amount of acreage between ignition points and the wildfire's edge. Firefighters who worked on the Biscuit Fire were interviewed for additional insights into the techniques and objectives of the backfires/burnouts. Finally, fire behavior specialists helped analyze daily fire progression maps and estimate the amount of fire spread due to suppression firing operations.

RESULTS

In general, fireline construction unavoidably kills surface vegetation, displaces soil, and makes slopes more vulnerable to erosion. Biscuit suppression records and related documents reveal that approximately 405 miles (652 kilometers) of fireline were constructed, with about half of that constructed by bulldozers and fellerbunchers, and the rest by handtools or explosives. Over 57 miles (92 kilometers) of firelines were constructed on fine-grained serpentine soils and steep slopes that are highly-erosive and slow to revegetate. Nine miles (14 kilometers) of dozerline were cut directly within Riparian Reserves, and involved 196 stream crossings. Soil and vegetation loss were somewhat lessened, though, because firefighters utilized existing logging roads, hiking trails, or even old firelines from the 1987 Silver Fire that had not successfully revegetated after 15 years of recovery time.

Fireline construction also routinely involves tree felling, especially large-diameter snags prized for wildlife habitat. Innumerable trees were felled during fireline construction, mop-up, and hazard tree removal on the Biscuit Fire. Documents included a few unconfirmed reports of crews engaging in "recreational" tree falling, and several private contract fallers were dismissed due to their "poor performance." In the northern portions of the wildfire dozers and fellerbunchers were used to cut firelines in areas of mature and old-growth conifer forest. During fireline construction, many of these trees were limbed, cut to log truck lengths, and decked for later commercial removal as "hazard trees."

Fire suppression also tends to include large amounts of fire retardant chemicals that are highly toxic to aquatic wildlife. Records reveal that in just one zone of the Biscuit Fire, 491,547 gallons (1,860,708 liters) of fire retardant was used, with 104,664 gallons (396,196 liters) dumped on a single day (August 14th). Although the precise locations of retardant drops were not well documented, records did reveal that retardant was dropped directly within some riparian areas, including heavy direct applications into tributaries of the lower Illinois River. Ironically, use of water drops without retardant was one of fire managers' highest concerns for potential adverse suppression effects because an exotic water-borne pathogen, *Phytophthora lateralis* (a.k.a. Port-Orford-cedar root disease), is present throughout the wildfire area. At least 227,960 gallons (862,922 liters) of contaminated water was dropped from helicopters on ridgetops under the assumption that Port Orford Cedar grows only in drainages. Chlorine was used to treat contaminated water, and approximately 4.5 million gallons (1.7 million liters) of chlorinated water was sprayed on the wildfire from fire engines, tank trucks, and helicopter buckets. Native fish mortality occurred at three water pumping sites due to improper pumping procedures with chlorinated water.

Firefighters also routinely "fight fire with fire" to consume fuel in the path of wildfires. Analysis of suppression records reveal that approximately 106,690 acres (43,176 hectares) were burned from suppression firing operations in just Zone One alone. Some burnouts were ignited along firelines that were located as much as eight miles (13 kilometers) away from edge of the wildfire, while aerial ignition device systems (e.g. "ping pong balls") were used to light backfires of unburned "green islands" deep inside the interior of the wildfire. In some cases, ignition sites were located at the base of steep slopes with heavy fuels during weather conditions predicted to produce extreme fire behavior. On several occasions, burnouts were the major source of active burning or fire spread. Some burnouts lasted several days, burning strips for over 30 miles (48 kilometers) and encompassing 30,000 acres (12,141 hectares) in a single firing operation.

Biscuit firing operations resulted in a full range of behavior and effects from low-severity underburns to high-severity crownfires. In the Briggs and Fishhook Late Successional Reserves that were extensively burned out, 40,536 acres (16,404 hectares) of old-growth habitat and 37,244 acres (15,190 hectares) of suitable northern spotted owl habitat burned with high severity. One stark indication of the severity of the suppression firing operations is their association with proposed post-fire salvage logging units that centered on stands with 75% or greater mortality of mature or old-growth trees. Approximately 11,275 acres (4,563 hectares) of proposed post-fire logging units in the Forest Service's Biscuit Fire Recovery Project were located in the burnout areas of Zone One.

DISCUSSION

A number of problems emerged with the quality and quantity of data in fire suppression records, raising reliability issues that affect the analysis. Not every suppression action was properly documented, especially retardant and water drops. In some cases, the IMT narratives contradicted the IAPs. Additionally, it often required rough "guestimation" to decide where on the map a given burnout operation eventually merged with the wildfire. Finally, the fact that the research only had access to documents from one of the four incident management zones makes the analysis both an incomplete and essentially "conservative" assessment of the effects of the Biscuit Fire suppression operations.

Generalizing from this case study, it is hypothesized that firing operations are adding to the total size and severity of "project fires" (large wildfires) across the western U.S., especially wildfire complexes located in roadless wildlands. Two potentially adverse ecological effects of large-scale suppressions ignitions are: 1) the natural landscape mosaic of burned and unburned patches is being artificially homogenized due to burn-out of unburned interior "green islands," and 2) there are larger patch sizes of high severity effects due to backfires/burnouts ignited during conditions that propagate high-intensity fire.

Anecdotally, it appears that the scale of suppression firing operations has vastly increased in the last 10-15 years, and is likely part of the recent phenomena of wildfire complexes such as the Biscuit Fire becoming huge "Megafires." Consequently, claims that wildfires are growing in size and severity as a result of "past" fire suppression must account for the role of contemporary *ongoing* suppression actions. Using indirect attack strategies that intentionally map out large fire perimeters, and then igniting large-scale backfires or burnouts in severe fire weather conditions

during the peak burning periods will predictably result in large-scale, high-intensity wildfires. Further research of suppression records from a large sample of wildfire incidents might reveal whether or not these kinds of firing operations are becoming more prevalent on project wildfires.

SUMMARY AND CONCLUSIONS

The Biscuit Fire suppression actions caused significant "collateral damage" to soils, vegetation, wildlife habitat, water quality, scenic/recreational values, and ecological integrity. It is speculated that an unprecedented amount of burnout/backfiring occurred on the Biscuit Fire. Some high-intensity burnouts caused public controversy when they resulted in post-fire salvage logging units being located in special management areas supposedly protected from commercial logging. Vexing questions remain as to whether or not the wildfire would have naturally spread to the areas that were burned out, and if it had, would the wildfire have burned with the same intensity or severity as the burnouts?

Analysis of the environmental effects of the Biscuit Fire suppression actions raise broader policy questions about the efficacy of standard firefighting techniques in protected natural areas and roadless wildlands. In particular, the role of suppression firing operations in the spread and severity of large-scale wildland fires needs to be further explored. Such research may discover one of the greatest ironies of modern wildland fire management: reintroduction of human-caused fire into wildland ecosystems is occurring at a vast scale under the guise of wildfire suppression. A programmatic analysis comparing the environmental effects of reactive wildfire suppression versus proactive prescribed burning and restorative wildland fire use would help firefighters and land managers resolve policy questions about how best to manage wildland fire in special natural areas such as the Biscuit Fire area.

LITERATURE CITED

Ingalsbee, T. 2005. Collateral Damage: The Environmental Effects of Firefighting: The 2002 Biscuit Fire Suppression Actions and Effects. Unpublished research paper available on the website of Firefighters United for Safety, Ethics, and Ecology (FUSEE): <http://www.fusee.org/ffighters/FUSEE_Collateral_Damage_Biscuit_Fire_Report.pdf>