January 29, 2007

North Kaibab District Ranger
Kaibab National Forest
430 S. Main Street
Fredonia, AZ 86022

RE: WARM FIRE PROPOSED ACTION

This letter responds to your December 19, 2006, proposal to log fire-killed trees on 9,900 acres in the Warm fire area. Thank you for soliciting input.

I submit the comments below on my own behalf as an independent wildland fire ecologist. I formerly worked in the Fire Ecology Program of the National Park Service at Grand Canyon National Park and assisted in wildland fire use, prescribed fire and wildfire suppression operations on the Kaibab Plateau, including the Warm fire incident, as a fire fighter, fire monitor and helicopter crewmember. I am personally familiar with the planning area, having hiked substantial portions of it in the summer and fall of 2006 to observe post-fire plant community succession and natural recovery processes, as well as to evaluate burned area management actions including roadside hazard tree logging, road stabilization and other mitigation practices.

In my observation, forests that burned in the Warm fire do not require further management intervention to promote ecosystem health except to limit competitive success of exotic plants such as Bromus spp. and Chenopodium spp., which can displace native flora and negatively impact the landscape fire regime. Proposed logging of burned forest stands for economic recovery could adversely affect sensitive soil resources, which in turn could harm forest and aquatic ecosystem health as well as spread exotic plants and increase the likelihood of a harmful reburn in the short-term.

Furthermore, I am concerned about the potentially chilling effect on wildland fire use (WFU) this proposed action may create by transforming a WFU project into a post-fire timber sale. Educated land managers who understand the profound ecological values of fire restoration and burned forests on a landscape scale may not be as willing to recommend or use WFU if administrative priorities dictate timber „salvage‰ following such events. That this WFU project became a wildfire suppression incident is irrelevant, as that risk accompanies every decision to use wildland fire for resource benefit. For this reason, I am philosophically opposed to your proposed action: WFU projects should not become timber sales as a matter of ethical land management practice.

I encourage you to develop an action alternative that would forego road construction and ground-based logging systems and limit tree extraction to one-quarter mile distance from existing roads. Such an alternative would respond to the purpose and need for action as well as to significant scientific controversy and uncertainty regarding environmental effects of post-fire logging, as described below.

SIGNIFICANT ISSUE: FIRE AND FUELS

Post-fire logging creates dangerous residual fuel profiles that may undermine the stated purpose and need for action. The proposed action would substantially increase available fuel loads by relocating to the soil surface tree crown material (tops, limbs, needles) that is not currently available to burn. Relocating flammable biomass from the canopy to the ground would significantly change the fuel complex in the project area and increase the short-term hazard of a severe reburn that could endanger public safety and ecosystem resilience (for empirical analysis of the relation between post-fire logging and increased fire hazard see Donato et al. 2006).

The National Fire Danger Rating System assesses fuel properties relative to potential fire behavior and helps to determine the likely effectiveness of control efforts. It considers heavy logging slash to generate the highest fireline intensity of any wildland fuel type when it is dry (Andrews and Rothermel 1982, Rothermel 1991). The change in surface fuel model that results from post-fire logging causes higher rates of fire spread and greater flame lengths when an ignition occurs. Logging without timely treatment of slash is the single most important factor contributing to observed increases in the severity and duration of wildfires (Stephens 1998, van Wagtendonk 1996, Weatherspoon 1996).

Research on the Klamath National Forest in northwest California found greater proportions of high severity fire on lands where post-fire logging occurred after a 1977 wildfire compared to burned sites that were not logged (Weatherspoon and Skinner 1995). Another refereed paper points to an increased likelihood of catastrophic reburning at very short timescales when burned forests are logged (Odion et al. 2004). This is primarily due to accumulations of residual logging slash. In the absence of post-fire logging, intense reburns are not likely.

The residual fuel conditions likely to prevail after logging is completed would redener direct attack of any wildfire impossible under common summer afternoon weather conditions, and indirect suppression measures would become necessary. This, in turn, would increase the size and cost of the next wildfire. It also would increase the likelihood of severe soil heating with corresponding losses of productivity (Reinhardt and Ryan 1998), and threaten fire fighter safety by making wildfires more erratic and difficult to control.

NEPA requires federal agencies to assess the direct, indirect and cumulative effects of proposed actions in addition to past, present and reasonably foreseeable future actions (40 C.F.R. 1502.16, 1508.7). The EIS must disclose at a unit scale how much slash would remain on the ground after logging is completed. Fuel that is most available for flaming combustion (twigs) recently was found to increase from three to 13 tons per hectare in Oregon following post-fire logging without slash treatment (Duncan 2002).

Creation of even-aged tree plantations on logged sites will compound hazardous fuel conditions and endanger fire fighter safety.

Even-aged young tree plantations typically created after logging as a standard operating procedure on National Forests contain unnaturally combustible fuel complexes, which further increase the potential severity and difficulty of control of the next wildfire. Plantations are far more susceptible to severe fire behavior and effects than unmanaged burned forests (Odion et al. 2004, DellaSala et al. 1995), especially where logging slash remains untreated. The elevated susceptibility of plantations to severe fire is due to:

Structural characteristics that promote high heat energy output by fire (Sapsis and Brandow 1997).

Warm, windy and dry microclimates compared to what would exist in an unlogged forest that possessed more structural diversity and ground shading (van Wagtendonk 1996).

Accumulations of fine logging debris on the ground surface (Weatherspoon and Skinner 1995).

Furthermore, most plantations occur next to roads, which spread invasive and exotic plants with poor resistance to fire (DellaSala and Frost 2001) and where elevated risks of human-caused ignitions exist (USDA 2000).

Two key considerations with regard to fire suppression efforts, which the Forest Service identifies as the issue of concern in its purpose and need statement, are the fuel bed depth and the size and moisture of dead woody fuels. Those factors primarily influence flame length, rate of fire spread and resistance to control (Albini 1977, Andrews 1986, Burgen and Rothermel 1984, Rothermel 1991). Thus, the vertical fuel loading is more important to the resistance to control of a wildfire than is horizontal fuel loading. Deeper beds of uncompressed, fine and dry fuels support significantly longer flame lengths and more erratic fire behavior than shallower beds of relatively large and moist fuels. In other words, logged plantations with accumulated slash would be far more resistant to control than an unlogged burned forest occupied by live brush, forbs and grass, even with large downed logs on the ground.

Research in forest science and landscape ecology notes that the number and distribution of even-aged plantations has altered fire behavior and effects at both stand and landscape scales (Countryman 1955, Hann et al. 1997, Huff et al. 1995, Lindenmeyer and Franklin 2002). The existence of combustible even-age tree patches on a forest landscape creates the potential for „a self-reinforcing cycle of catastrophic fire‰ that post-fire logging and tree planting in the Warm fire area would perpetuate (Perry 1995).

Large tree removal will increase fire hazard in the project area. The objective of post-fire salvage logging is to remove large-diameter, commercially valuable trees that were killed but not consumed by fire. Large-diameter snags and downed logs possess several features that mitigate their potential contributions to fire hazard, and depending on weather conditions and time of year, their presence on the landscape can reduce the danger of intense, rapidly spreading fires. In general, fires burning through large-diameter downed logs tend to burn slowly, and depending on their spatial arrangement and moisture levels, large downed logs can dampen a fire's intensity and rate of spread (Rothermel 1991).

This is so because large-diameter fuels have low surface area-to-volume (S/V) ratios, which inhibit the amount of oxygen feeding combustion. Moreover, large-diameter fuels retain moisture later into the dry season than do smaller fuels, further reducing their flammability precisely when wildfire potential is greatest (Amaranthus et al. 1989). Extremely dry snags and logs that combust into flames can emit burning embers that, if lofted by wind, may cause spot fires, but these embers can only ignite fine fuels and not other large snags or logs.

Fuel moisture levels, which vary according to season and prevailing weather, can further diminish flammability of large-diameter snags and logs. Large-diameter downed logs are capable of storing large amounts of water, especially if the logs lay directly on the ground surface. Indeed, the centers of large logs can actually be cool and moist even when the outer shell of a log is on fire (Amaranthus et al. 1989). Consequently, large logs can provide „fire shelters‰ that enable a number of wildlife species, as well as fungi and other flora and fauna essential to post-fire natural recovery, to survive fires (Bull et al. 1997, Harrod et al. 1998).

Large standing trees and downed logs also obstruct solar radiation and lateral wind movement. These microclimate influences moderate ground temperatures and surface wind speeds, which translate into greater live and dead fuel moisture levels compared to areas cleared of standing or downed trees (Sexton 1994). Large downed logs also reduce the speed and variability of surface winds, which inhibits extreme or erratic fire behavior (McIver and Starr 2000).

Live vegetation has greater moisture content and is thus less prone to ignite and carry fire than dead woody fuel (Reinhardt and Ryan 1998). The relative moisture in a fire-regenerated, early-successional brush field shaded by standing snags and buffered by downed logs would present a far less extreme fire environment than the slash-loaded, even-age plantations which the Forest Service seeks to create in the instant proposal (Countryman 1955, Odion et al. 2004 Weatherspoon and Skinner 1995).

It is true that when snags fall to the ground their relative flammability increases, but the time required for snags to fall is directly proportional to their size. It may take as long as 20 years for burned ponderosa pine trees between six and nine inches in diameter to fall, and Forest Service research suggests that larger ponderosa pines can remain standing up to 80 years after burning (Harrod et al. 1998). Even when they fall to the ground, large-diameter logs do not burn well, unless they are very dry and placed in close proximity to each other (i.e., one log diameter apart). Decayed logs with low moisture content can smolder for long periods, but this does not cause intense fire behavior. Log smolder may cause high severity burn effects in the soil, but such effects are spatially localized to the soil underlying and adjacent to the burning log (Sackett and Haase 1996).

SIGNIFICANT ISSUE: PLANT SUCCESSION AND SOIL PRODUCTIVITY

Post-fire logging may inhibit regeneration of early-successional species that promote ecosystem recovery after fire, and cause long-term harm to soil productivity.

The EIS should employ the best available science to describe possible trajectories of plant community succession under each alternative. Untreated logging slash may inhibit plant growth, and logging operations may virtually eliminate nitrogen-fixing shrub and forb species (Reinhardt and Ryan 1998). Inadequate regeneration of early-successional pioneer species could lead to localized extinctions of other species that restore site productivity after fire. Furthermore, inhibited plant regeneration would preclude burned slope stabilization and result in greater loss of topsoil and increased sedimentation in aquatic network than would occur in the absence of post-fire logging (Beschta et al. 2004). Loss of site productivity is a costly impact of post-fire logging because of its deleterious effect on nitrogen and carbon cycling and on future forest growth (DellaSala et al. 1995).

Loss of soil productivity caused by inhibited shrub regeneration and loss of topsoil is a long-term adverse impact (Beschta et al. 2004). Recovery would not occur for decades because it would take that long for the ecosystem to replenish organic matter removed by salvage logging that otherwise would decompose in situ. The effect of organic matter loss on long-term site productivity is not well understood for lack of research (McIver and Starr 2000). The EIS should discuss this matter of scientific uncertainty.

SIGNIFICANT ISSUE: SNAG DEPENDENT WILDLIFE

Existing fire-killed tree stands are highly valuable habitat for rare wildlife.

On a landscape sale, wildfires create patches of highly attractive habitat for a distinct array of rare avian wildlife species (Hutto 2006). Increased abundance of certain insects in burned stands attracts insectivorous birds. One consequence of changes in food composition and breeding habitat is that burned forests support different bird communities, with many species dependent on stand-replacement fires (McIver and Starr 2000). Indeed, the Warm fire created optimal habitat for black-backed woodpecker and other insectivorous birds.

Post-fire logging eliminates high quality habitat for rare fire-dependent wildlife.

Post-fire logging changes bird species composition in burned forests, reflecting effects of large woody debris removal on foraging and nesting habitat of cavity-nesting species (Smucker et al. 2005). For example, black-backed woodpecker (Picoides arcticus) and three-toed woodpecker (P. tridactylus) consistently show negative responses to post-fire logging, with significantly more nests found in unlogged sites (Caton 1996, Hitchcox 1996, Hutto 1995, Saab and Dudley 1998). Indeed, post-fire logging can negatively impact biological diversity in a number of ways (Lindenmayer and Noss 2006).

SIGNIFICANT ISSUE: WATER QUALITY

Proposed road construction will harm water quality.

Roads contribute more sediment to streams than any other land management activity (Gibbons and Salo 1973, Meehan 1991). Substantial increases in sedimentation are unavoidable even when the most cautious road construction methods are used (Gucinski et al. 2001, McCashion and Rice

1983). Beschta (1978) reports that mid-slope roads on steep terrain are the primary contributors to increased sediment production during logging operations. Swank and others (1989) estimates that while erosion after logging was seven times greater than in undisturbed areas, erosion rates on landings and roads were 100 times those of undisturbed areas. Despite the lack of studies looking at effects of post-fire road construction and use, it is likely that roads will contribute most to sediment production in the post-fire environment, just as they do in unburned stands (Beschta et al. 2004, McIver and Starr 2000, Karr et al. 2004).

Road-stream crossings in particular cause significant downstream sedimentation, largely resulting from channel fill around culverts and subsequent road crossing failures (Furniss et al. 1991, Trombulak and Frissell 2000). Road-stream crossings create unnatural channel width, slope and streambed form both upstream and downstream from the crossings, and these alterations of channel morphology can persist for long periods (Heede 1980). Channelized stream sections resulting from rip-rapping roads adjacent to stream channels are directly affected by sediment from side casting and road grading, and such activities can trigger fill slope erosion and failures (Gucinski et al. 2001). The EIS should account for these factors.

Best management practices alone will not ensure effective mitigation.

Road location, design, construction and engineering practices have improved over time, but few studies have systematically and quantitatively evaluated whether newer practices result in lower erosion rates (Gucinski et al. 2001). Even with improved practices and maximum mitigation effort, total accelerated erosion and sediment yields are still at least 50 percent greater than undisturbed conditions over time (Gucinski et al. 2001). This is a best-case scenario, according to the literature.

Riparian vegetation buffers around stream channels are a standard best management practice intended to mitigate adverse effects of road building and tree removal on sediment regimes. Considerable scientific controversy and uncertainty exist regarding the site-specific effectiveness of riparian buffers for sediment filtering (Reeves et al. 2006). Without clear understanding of surface and subsurface hydrology in riparian areas, it is impossible to accurately predict the effectiveness of riparian vegetation in trapping sediment (Gilliam 1994). Effects of sediment accumulation in vegetation buffers on their trapping efficiency over time have never been modeled or monitored (Dillaha and Inamdar 1996). It is necessary to account for sediment accumulations within riparian areas over time because they do not revert to an undisturbed condition after each storm event.

SIGNIFICANT ISSUE: CUMULATIVE EFFECTS

Fire suppression operations caused significant direct and indirect effects to the Warm fire environment, and the EIS should account for cumulative effects with this proposal.

The Warm fire was monitored and allowed to burn within a maximum manageable area for approximately two weeks as a wildland fire use project before winds shifted and it became a wildfire, drawing a particularly ferocious extended suppression response that lasted another two weeks. Fire fighting has numerous significant adverse effects on the environment including:

Direct soil damage resulting from emergency road, fire line, and helispot construction.

Hydrological impacts caused by fire lines, which route overland water flow and disrupt soil infiltration.

Chemical pollution of water and soil from aerial flame retardant drops.

Destruction of snags and other ecologically significant large woody debris.

Spread of highly flammable exotic plants.

NEPA demands full disclosure of cumulative effects of fire suppression operations in addition to proposed post-fire logging in the project area. The public and the decision maker must be able to discern from this EIS whether these factors combined might result in significant cumulative adverse effects.

Post-fire logging on nearby federal and private lands caused cumulative impacts.

Private timber operators and landowners have salvaged burned timber from within and adjacent to the project area using tractors and cable systems. The Warm fire caused elevated watershed sensitivity to human disturbances, and post-fire logging compounds effects of lost vegetative cover, soil erosion, mass wasting, increased overland water flow, increased sedimentation in creeks, and reduced cover for wildlife. Such effects already have occurred on private lands, making the proposed federal action a potentially significant cumulative effect.

In order to determine whether significant adverse cumulative effects would occur, the Forest Service must assess the direct and indirect effects on the key resources and issues resulting from post-fire salvage that already has occurred. It is not adequate to focus analysis on federal resources in the project units proposed for treatment and make only general statements that additional salvage occurred elsewhere. The ecosystem does not recognize property boundaries.

CONCLUDING REMARKS

Thanks again for the opportunity to comment. Please consider me an interested party to the proposed action and keep me updated on new developments in the planning process as it unfolds. Specifically, please notify me at the address below of the availability of the draft EIS so that I may review it and provide timely comments. I will prefer to download an electronic version of the document from your website rather than receive a hard copy by mail. In addition, I commend for your review the attached science papers that cover many of the issues raised in these comments.

/s/ Jay Lininger, wildland fire ecologist
Firefighters United for Safety, Ethics & Ecology (FUSEE)
1253 Tolman Creek Road, Ashland, OR 97520
jay_lininger@yahoo.com

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