SOUTHWEST FIRE SCIENCE CONSORTIUM
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2011 Horseshoe 2 Fire
Chiricahua Mountains, Arizona

The Horseshoe 2 Fire, located along the southeastern flank of the Chiricahua Mountains in southeastern Arizona, began in Horseshoe Canyon on the Douglas Ranger District of the Coronado National Forest on 8 May 2011. The human-caused fire burned over 9,000 acres in its first day. By 1 June 2011, the fire had burned over 80,500 acres of grasses, shrubs, and trees along the mountain slopes. By 17 June, the fire was 65% contained and had become the fifth-largest wildfire in Arizona history. The fire was 100% contained 25 June after a total area of 222,954 acres had burned and 23 structures destroyed.

In February 2010 the area experienced the "100 years freeze." Trees that were just barely saplings when the last "big freeze" hit wilted, withered and snapped off at their bases. Scores of cactus and low desert vegetation were killed. Having had another year to cure, those same fuels fed the Horseshoe 2 Fire for more than 70 days. Fuel moisture content was at a level that encouraged extreme fire behavior from the first day the Horseshoe 2 started, and it only got drier from there. Sixty days after the fire started the Monsoon season hadn't hit yet and crews weathered 26 days of red flag conditions.

Heavy late summer rains produced floods and debris flows in many of the burned areas. There was ample evidence of post-fire erosion and sedimentation in and along the main channel, tributaries and hillslopes of Emigrant Canyon. Intense erosion on the steep upper hillslopes of Rough, Wood and Dug Road Mountains scoured and transported surface materials leaving a dense concentration of rill (wide and shallow erosional features) and gully (narrow and more deeply incised features) channels.

Aerial lighting in Chiricahua National Monument.
Photo courtesy of USFS.

2011 Horseshoe 2 Fire At-A-Glance

Dates: 8 May to 25 June, 2011

Cause: Human

Total Size: 222, 954 acres. Acres by ownership: Private 13,934; State 2,874; USFS 192,647; BLM 1,336; NPS 12,163.

Location: Near Portal, AZ in the Chiricahua Mountains.

Vegetation types: Mixed conifer, oak brush, pinyon, juniper, ponderosa pine and grasses

Burn Severity	Acres	% of Area
High	27,730 acres	12.4%
Moderate	66,226 acres	29.7%
Low	84,852 acres	38.0%
Unchanged	44,146 acres	19.8%

Bark Beetle Impact

Some species of bark beetles, such as Douglas-fir beetle, are known to preferentially infest fire-damaged trees. Other species show no preference or we do not know how they respond to fire (i.e., southern pine beetle in Chihuahua pine). Mexican spotted owl habitat could be threatened by additional post-fire tree mortality caused by Douglas-fir beetle. The Arizona Zone of Forest Health Protection is monitoring populations of Douglas-fir beetle in the Chiricahua Mountains and may recommend using a pheromone treatment to help protect large diameter, fire-damaged Douglas-fir. This management strategy involves sending out a "No Vacancy" signal to dispersing beetles and can work to protect individual trees or whole stands of trees depending on treatment design. It is important to note that bark beetle species and wood boring insects often provide a valuable food resource for many insectivorous organisms following fire.

This fact sheet and corresponding maps are available online at swfireconsortium.org

POINTS OF INTEREST

Chiricahua National Monument Flood Effects
Chiricahua National Monument has several high-value resources susceptible to flooding including Bonita Canyon Campground, Visitor Center, Headquarters, historic Faraway Ranch structures, the main park road, and an air quality monitoring station. Over half of the watershed area above these sites was classified as having moderate or high burn severity. The loss of upland vegetation has contributed to increased frequency and magnitude of flash floods following the fire. Mitigating the risk to life and property at these sites has included installation of an early warning system, development of an evacuation plan, strategic campsite closures, and sandbag wall construction. These preparations were tested on 17 August 2012, when the park received 2.9" of rain in two hours. With post-fire conditions this rain event produced water levels comparable to a 100-year flood. The flood caused extensive culvert plugging, soil movement, and debris deposits on roads; however, there was no significant impact to visitors, staff, or park infrastructure.

Post Wildfire Erosion
Post wildfire erosion, typically from high frequency, low magnitude monsoonal rainfall, commonly occurs in concentrated flow paths forming rills and gullies. Shallow sheet and rill erosion removes topsoil where about half of nutrients reside, while more concentrated gully erosion removes soil to greater depths, often to bedrock. Post Horseshoe 2 Fire erosion ranged from minor soil loss to intense erosion in new and reactivated rills and gullies. Areas twice burned by the 1994 Rattlesnake and 2011 Horseshoe 2 Fires appear to have undergone more intense erosion. Upper hillslopes are heavily rilled and newly formed gullies range from ~2m to ~8m deep. In Ward Canyon, a post-Rattlesnake Fire mega-gully was ~10m deep in 1996. By 2004 the gully had filled to ~4m. The gully was reactivated after the Horseshoe 2 Fire and is now ~12m deep. In unburned/undisturbed areas, a general rule of thumb is that soil regenerates at about 1-5 tons/acre/year depending on parent material, climate, biota and topography. In the post fire environment, rates of soil regeneration will be in the lower range with rates decreasing as slopes increase. Soil regeneration in gullies may be on the order of decades or longer. In the case of mega-gullies, geomorphic thresholds determining slope stability may have been crossed thereby eliminating the potential for recovery to pre-fire conditions.


Burned forest clearing near Rustler Park. Photo courtesy of USFS.

2011 Horseshoe 2 Fire Resources

Peak Total Personnel: 1,379

Resources: 38 Crews; 66 Engines; 36 Water Tenders; 4 Dozers;

Air Support: 9 Helicopters; 3 Heavy Airtankers; 3 Heavy Helitankers

Suppression Cost Total: $50 million as of publication date

BAER Efforts
Under the BAER Program, the Forest requested and received emergency funding to implement recommended treatments such as: temporary barriers to protect recovering areas; warning signs to inform Forest Visitors of post-fire hazards; and road and trail stabilization structures to reduce the potential for loss of Forest roads and trails. Other treatments included seeding, removal of hazard trees, and removal of woody debris from channels. The Forest continued to monitor and make repairs to stabilization treatments throughout the first year post-fire to improve the effectiveness of implemented treatments. Long-Term Recovery and Restoration utilizes non-emergency actions that are done within three years or more after fire containment to improve fire-damaged lands that are unlikely to recover naturally and to repair or replace facilities damaged by the fire that are not critical to life and safety. The Forest obtained funding to replace burned structures at developed campgrounds and day use areas. The Forest also received funding to continue road maintenance, remove hazard trees, replace range fences, and improve wildlife habitat.