HAYMAN FIRE IMPACTS

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Hayman Fire Impacts*

The Hayman Fire near Denver, CO (fig. 1), was the largest in Colorado history. First reported on June 8, 2002, the fire did not stop its destructive march until 20 days later. Fuel conditions, coupled with dry and windy weather, produced the ideal wildland fire medium. Ecological, social, and economic impacts were colossal and will haunt the local community for years, perhaps centuries.

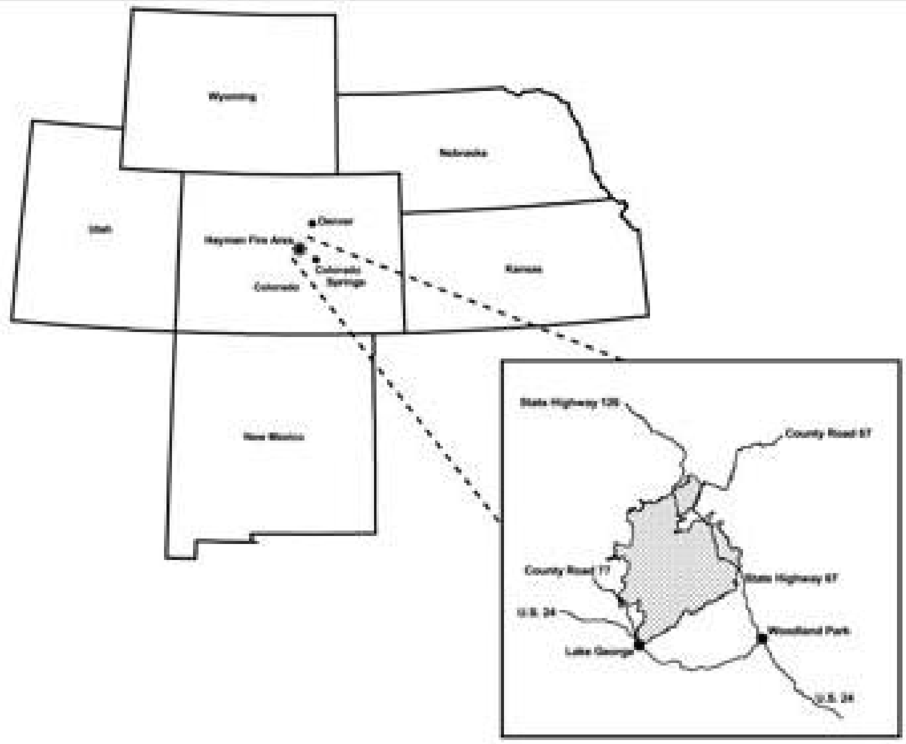

Figure 1—*On June 8, 2002, the Hayman Fire ignited just south of Tarryall Creek and County Highway 77 near Tappan Mountain on the Front Range of the Rocky Mountains between Denver and Colorado Springs, CO. It ultimately affected some 138,000 acres (46,000 ha), making it the largest fire in Colorado history. Illustration: USDA Forest Service, Rocky Mountain Research Station, Ft. Collins, CO, 2002.*

Perfect Firestorm Conditions

Since 1998, Colorado had been experiencing below-normal precipitation and unseasonably dry air. The predominantly ponderosa pine and Douglas-fir forests were becoming drier with each passing season. When the spring of 2002 arrived, fuel moisture conditions were drier than any in the previous 30 years. The moisture content of large dead logs and stems along the Front Range was less than 10 percent.

Fire exclusion, forest succession, and vegetation development all contributed to dense stands of ponderosa pine and Douglas-fir. For thousands of years, a mix of nonlethal surface fires and lethal, stand-replacing fires had burned at approximately 50-year intervals. But for the previous hundred years, no major fire had occurred in the area, and forest densities had dramatically increased.

On June 8, when the Hayman Fire was first reported, the air mass over Colorado was extremely dry. An upper level low pressure system centered over eastern Washington brought sustained southwest winds exceeding 15 miles (24 km) per hour, with gusts of up to 30 miles (48 km) per hour. On the following day, with the relative humidity hovering at about 5 to 8 percent, windspeeds increased to 51 miles (82 km) per hour, forcing the fire to the northeast.

Fuels were generally continuous, both horizontally and vertically, for at least 10 miles (16 km) downwind from the point of ignition, with little variation in structure and composition. Surface fuels consisted of ponderosa pine duff and needle litter, short grasses, and occasional shrub patches, which were easily ignited by blowing embers (fig. 2). Crowns of ponderosa pine, Douglas-fir, and blue spruce were low, helping the fire move from the surface into the canopy.

After the Hayman Fire was reported, an aggressive initial attack involv-

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* The article is based on technical reports by the authors (Graham 2003a, 2003b). For copies of the reports, visit http://www.fs.fed.us/rm/main/pubs/order.html.

Figure 2—*The fuels downwind from the ignition point were continuous, consisting of trees with low crowns, shrubs, and a deep layer of needles on the forest floor. Photo: Charles McHugh, USDA Forest Service, Fire Sciences Laboratory, Missoula, MT, 2002.*

ing air tankers, helicopters, engines, and ground crews failed to subdue the flames. Within hours, torching trees and prolific spotting advanced the fire to the northeast, allowing it to burn several hundred acres. On the morning of June 9, the fire was estimated at 1,000 to 1,200 acres (400–490 ha).

Fire Behavior

The combination of fuels, weather, and topography positioned the fire for a major run on June 9. In a single day, the fire traveled 16 to 19 miles (26–31 km) along the South Platte River, burning some 60,000 acres (24,000 ha). The fire burned with extreme intensity, accompanied by long runs through tree crowns and spotting a mile (1.6 km) or more ahead of the fire front. Fire spread rates averaged more than 2 miles (3.2 km) per hour, with pryocumulus clouds developing to an estimated 21,000 feet (6,400 m) (fig. 3).

On June 9, the Hayman Fire, burning with extreme intensity along a broad front, overwhelmed most of the fuel treatments, prescribed burns, and previous wildfire sites that existed within the final perimeter. The majority of fuels burned were similar in age, composition, and structure. These uniform conditions facilitated rapid fire growth, which in turn limited the effectiveness of isolated forest treatment units in affecting fire behavior.

The Hayman Fire was perhaps 20,000 acres (8,000 ha) when it

Figure 3—*A day after ignition, pyrocumulus clouds tower above the Hayman Fire as high winds, supported by low humidity, push the fire out of control. Photo: Mark Finney, USDA Forest Service, Fire Sciences Laboratory, Missoula, MT, 2002.*

The Hayman Fire was the largest and most expensive fire in Colorado history.

encountered Cheesman Reservoir and the adjacent Schoonover Fire site, which forced it to fork (fig. 4). Burning as a crown fire, the eastern head stopped when it encountered fuel conditions created by the Polhemus prescribed burn of October 2001 (fig. 5). Similarly, when the fire was intensely burning on June 17, it was prevented from becoming a crown fire along a 2-mile (3-km) front when it encountered fuel conditions created by the 1998 Big Turkey Fire and adjacent prescribed fires in 1990 and 1995 (fig. 4).

On the afternoon of June 10, the high winds decreased and the relative humidity climbed above 10 percent, a weather pattern that persisted for several days. During this period, the fire advanced mostly to the south and several miles to the east. Surface fire predominated, although torching and some crown fire occurred along slopes and in drainages. Under the moderate wind and humidity conditions, recent prescribed burns lowered burn severity more than older burns.

On June 17, low humidity returned, accompanied by high west and northwest winds. Fire intensity increased along the eastern flank (fig. 4), pushing the fire eastward for 4 to 6 miles (6–10 km) until monsoon conditions arrived on June 18. Ten days later, firefighters finally contained the Hayman Fire.

Ecological Effects and Rehabilitation

The record-breaking Hayman Fire affected 138,000 acres (46,000 ha),

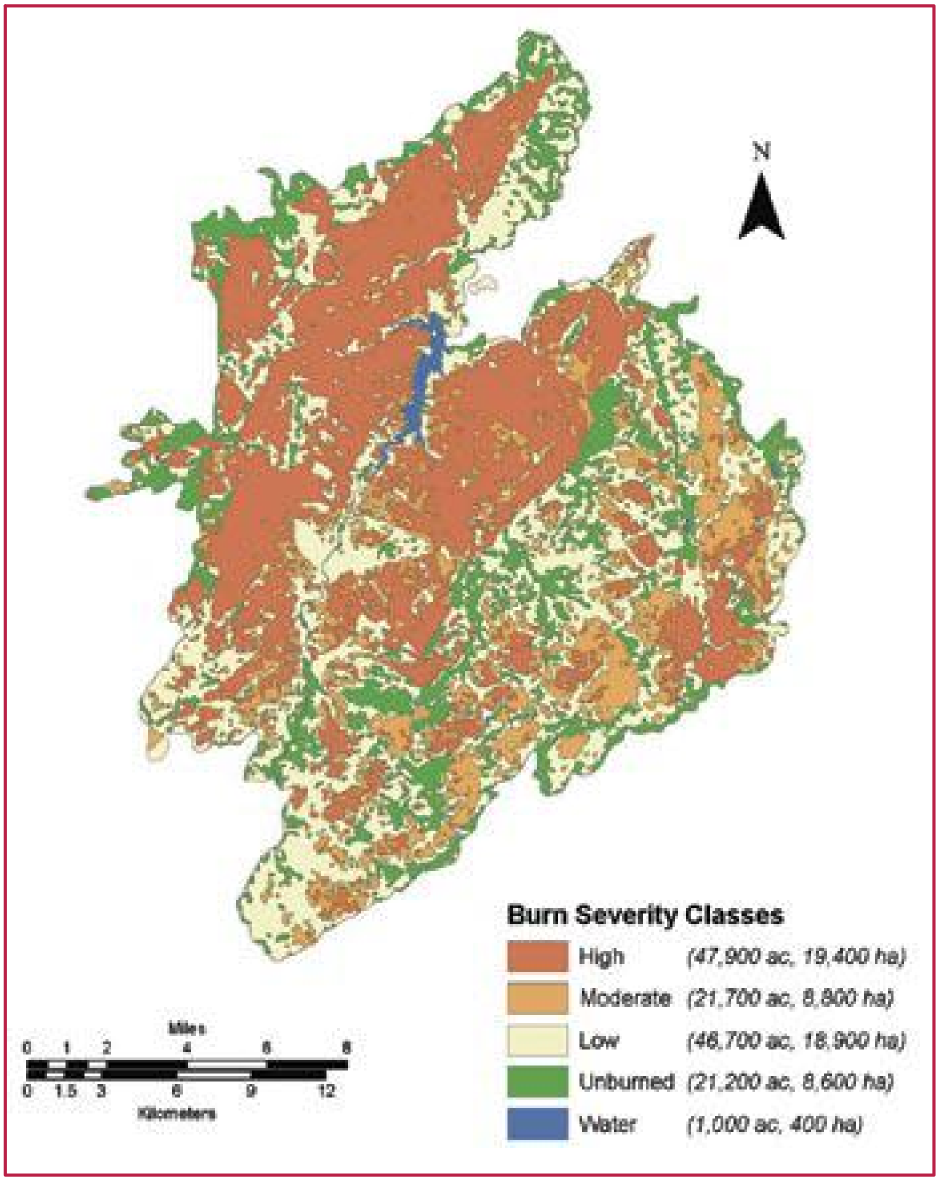

Figure 4—*Hayman Fire perimeter. The Cheesman Reservoir (top center) and the relatively recent Schoonover Fire site (the unburned area northeast of Cheesman) caused the Hayman Fire to form two fronts. The eastern front was stopped by the relatively recent Polhemus prescribed fire site (to the lower left of the compass point). The 1998 Big Turkey Fire and adjacent prescribed fires in 1990 and 1995 (the green patches southeast of the eastern front) also lowered fire severity. Illustration: USDA Forest Service, Rocky Mountain Research Station, Ft. Collins, CO, 2002.*

including 47,900 acres (16,000 ha) that were severely burned (fig. 4). Areas where the surface soil organic layers were consumed might not return to prefire conditions for decades or perhaps centuries. In addition, where the soil surface was severely burned, hydrophobic layers might persist for years.

Postfire rehabilitation efforts were designed to reduce surface runoff and soil erosion during peak flows. Treatments were applied as soon as fire suppression activities allowed, including soil scarification, grass seeding, aerial and ground-based hydromulching, and aerial dry mulching. These measures were designed to prevent or reduce the projected sediment load expected for the Cheesman and Strontial Springs Reservoirs and the South Platte River.

Weather and fuel conditions came together to promote extreme fire behavior.

Where preburn vegetation was dominated by aspen, cottonwood, and other sprouting species, a rapid return to prefire conditions is expected. Areas with low to moderate burn severity that are dominated by ponderosa pine and Douglas-fir should also recover within the next few years. However, large patches of severely burned ponderosa pine and Douglas-fir will not rapidly recover because the fire damaged seed sources. Natural reforestation in these areas might take centuries.

The speed at which slopes and riparian vegetation recover will determine how quickly aquatic environments improve. The recovery of aquatic systems will depend on their connection to unburned or aquatically diverse habitats, which could provide the aquatic plants and animals needed for recolonizing.

Some opportunistic species, such as woodpeckers, will benefit from new habitats created from the fire. Although severely burned tree crowns will provide habitat for new species, species that require mature conifer forests will find their habitat diminished.

Throughout the area of the Hayman Fire, nonnative invasive species are a serious threat. Species such as hawkweed, spotted knapweed, and cheatgrass can adversely affect nutrient cycling, hydrologic processes, native plant abundance, and fire regimes. In the first 5 years after the fire, riparian areas will likely suffer the most from invasive species, and rehabilitation activities might

Figure 5—*Border of the Polhemus prescribed burn (October 2001) and the Hayman Fire. The Hayman Fire moved as an intense surface fire and crown fire up the slope from the southwest (lower right to upper left) but did not burn into the adjacent Polhemus prescribed fire area (top center). Photo: Karen Wattenmaker, USDA Forest Service, National Interagency Fire Center, Boise, ID, 2002.*

Hayman destroyed so much habitat for a threatened butterfly—the Pawnee montane skipper—that its future is uncertain.

inadvertently facilitate their spread. Unless controlled, nonnative plants might persist in riparian areas, open-canopy areas, and along roads and trails for 50 to 100 years following the fire.

Social and Economic Impacts

Social and economic effects of a large fire like Hayman are complex and far reaching, especially in the wildland/urban interface. Those alive during the Hayman Fire will probably not see the total recovery of the Hayman burn area in their lifetimes. People who previously recreated in the burn area will be forced to look elsewhere, and local economies will suffer. Businesses dependent on prefire resources will possibly lose their clientele.

The fire stripped many people of their homes—600 structures burned. Real property losses totaled $24 million, total insured private property losses are estimated at $39 million, and uninsured losses are estimated at $5 million. The Hayman Fire destroyed 132 out of the 794 homes (17 percent) within its final perimeter. Homes were destroyed where the fire burned severely as well as where it was less severe. Their fate likely depended on building characteristics in relation to fuel characteristics within 30 to 60 yards (27–55 m) (fig. 6).

In addition to real property losses, the fire caused $880,000 in damage to transmission lines and $37 million in damage associated with water storage loss. About $34 million worth of timber was destroyed. Concessionaires of developed recreation sites estimated their revenue loss for 2002 at $382,000.

On a cost-per-acre basis, the fire was not that expensive (about $275 per acre). But because of its size, the Forest Service spent $38 million in suppressing it—more than three times the average annual suppression expenditure for all of the Forest Service's five-State Rocky Mountain Region from 1992 to 2001. Colorado and other Federal agencies spent an additional $6 million on suppression and related activities. Rehabilitation expenditures are expected to cost another $74 million.

The Hayman Fire had a profound impact, both locally and nationally. The more we can learn from this fire, the more we can use it to inform future debates about forest and fire management strategies. For more information, visit http://www.fs.fed.us/rm/main/fire_res/fire_pubs.html.

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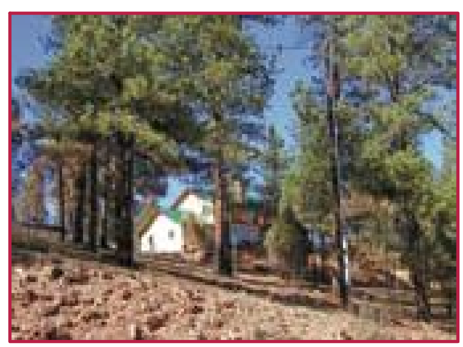

Figure 6—*Surviving home on the Hayman Fire where fire severity was low. Home survival is expected if fire severity is low and surrounding fuels are sufficiently controlled. Photo: Jack Cohen, USDA Forest Service, Fire Sciences Laboratory, Missoula, MT, 2002.*