



Fire and Disturbance in the Pinaleño Mountains

The Pinaleño Mountains in southeast Arizona are the tallest of the Madrean sky island ranges, spanning a vertical gradient of more than 6,900 feet and containing forest types representative of a latitudinal transect from Sonora Mexico to British Columbia Canada. Above 7,000 feet, pine oak assemblages transition to a dry mixed conifer forest dominated by Douglas-fir, southwestern white pine, and ponderosa pine, with minor components of white fir and aspen. Above 9,300 feet, mesic mixed-conifer forests are dominated by Douglas-fir and white fir with minor components of southwestern white pine, corkbark fir and Engelmann spruce. At the highest elevations and along north-facing slopes, Engelmann spruce and corkbark fir predominate. The Pinaleño Mountains host the southernmost extent of spruce-fir forest in North America, and dense upper elevation forests serve as critical habitat for several threatened and endangered species.

2004 Nuttall Complex

The Nuttall Fire, located on the Safford Ranger District, Coronado National Forest, began on 26 June on a hillside between Nuttall and Carter Canyons in steep, rugged terrain. Values at risk included the Mount Graham International Observatory complex, summer homes in Old Columbine and Turkey Flat, the Arizona Bible School, threatened and endangered species habitat, Native American shrines, numerous Forest Service recreation areas, communications facilities and a historic lookout and cabin on Heliograph Peak. Due to the complexities involved, a Type I Incident Management Team was ordered. State Highway 366 (also known as



Nuttall Complex, 2004. Photo courtesy of USDA Forest Service.

2004 Nuttall Complex At-A-Glance

Dates: 22 June 2004 (Gibson Fire) and 26 June 2004 (Nuttall Fire) - 19 July 2004

Cause: Lightning

Total Size: 31,881 acres

Location: Pinaleño Mountains south of Safford, Arizona in Graham County. The fire burned in National Forest land only.

Vegetation types: oak woodland, ponderosa pine forest, mixed conifer forest, and spruce-fir

Burn Severity	Acres	% of Area
High	3,354 acres	11.0%
Moderate	8,911 acres	27.0%
Low	12,347 acres	39.0%
Unburned	7,247 acres	23.0%

the Swift Trail), the only ingress/egress to the mountain range, was closed at the Forest Boundary, with all non-firefighting persons eventually being evacuated. No structures were lost and only two sustained damage. Communications instrumentation at that location also sustained damage. Due to the complex topography and weather systems, shifting winds hampered suppression efforts. The forest was in weakened condition resulting from extended drought and a high level of insect mortality. The terrain around the perimeter was extremely steep (80% to 100% slopes), presenting hazards for firefighters and causing reliance on air resources. Due to an increase in temperature and winds, and a decrease in relative humidity, on 2 July, fire activity increased on the Nuttall Fire and the nearby Gibson Fire. The Gibson Fire, ignited by lightning on 22 June, had shown little activity prior to that point, and had been managed by the Ranger District. On 2 July, the Incident Management Team assumed responsibility, and both fires were managed jointly as the Nuttall Complex. Wildfire suppression and rehabilitation costs of the 2004 Nuttall Complex was approximately \$12.7 million. Community wildfire protection plans have been developed by Graham County for the Pinaleño Mountains and approved by the State of Arizona primarily for protection of Special Use permitted recreational cabins.

POINTS OF INTEREST

Fire and Forest Change

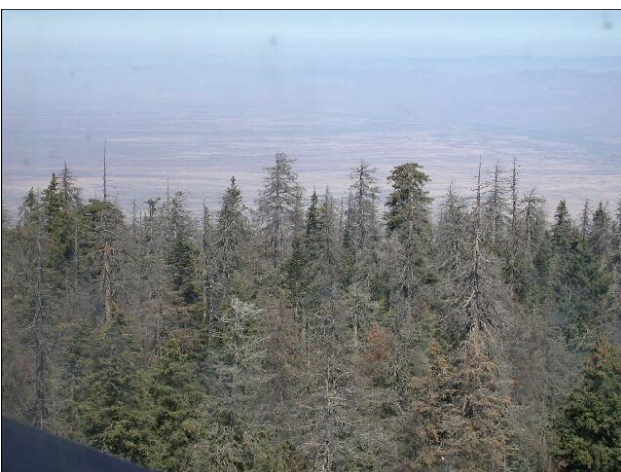
Fire size and frequency varied considerably along gradients of elevation, forest type, and aspect in the Pinaleno Mountains. For 300 years prior to the onset of fire exclusion, pine and mixed-conifer forests experienced small (<200 ha) fires every 2-4 years and large spreading fires (>3000 ha) every 10-20 years. During this period a single fire occurred in the spruce-fir forest and burned with high-severity during the most intense drought conditions in four centuries. It has been more than 140 years since large spreading fires have been recorded in most of the pine and mixed-conifer forest and intervals between smaller fires have increased by up to 30-fold. Fire maintained a mix of ponderosa pine, southwestern white pine and Douglas-fir through most of the mixed-conifer forest prior to fire exclusion. From 1870-1995, the area occupied by fire-intolerant white fir more than doubled and stem densities increased up to 100-fold, changing forest structure, species, and likely future fire behavior.

Insect Outbreaks

In the mid-90s the Pinalenos began experiencing a multitude of anomalous insect outbreaks – outbreaks significantly dissimilar to outbreaks in the legacy record. These outbreaks include three defoliators, three bark beetles, and an exotic sap sucking insect. Some outbreaks are thought to be responses to climate change, while others are probably responses to fire exclusion. Several have population and outbreak dynamics that are known to be responsive to warm temperatures. Forest managers have recognized for some time that the Pinaleno high-elevation forests are in declining health and resiliency, and at risk of catastrophic fires and insect outbreaks.

Suppression Effects

Firefighting efforts in the insect-damaged spruce-fir



Insect damage as seen from the Large Binocular Telescope. Photo courtesy of Ann Lynch

Recent Anomalous Insect Outbreaks

Insect Type	Years	Type	Anomaly
Janet's looper	1996-1999	defoliator	previously innocuous
Spruce beetle	1999-2006	bark beetle	extreme severity, extent
Western balsam bark beetle	1999-2004	bark beetle	extreme severity, extent
Spruce aphid	1999-current	sap sucker	exotic
Mountain pine beetle	1996-2012?	bark beetle	previously innocuous
Douglas-fir tussock moth	2012-current	defoliator	previously innocuous
Western tent caterpillar	2012-2013	defoliator	severity (though possibly within HRV), extent

forest were aimed at protecting the Mount Graham International Observatory. During the Nuttall Complex in 2004, burnout efforts along FR 507 in insect-killed spruce-fir successfully protected the astrophysical complex. Tree felling and aerial drops of PSDs, repeated in some places, were successful and had a variety of ecological consequences. Importantly, along with the Astrophysical complex, a surrounding patch of intact spruce-fir forest was protected and serves as a seed source for repopulating the spruce-fir forest. Tree recruitment is excellent in some burnout areas, and Mount Graham red squirrels have begun to utilize those areas. In other areas, burn severity was so extreme that only charred, limbless snags of the largest trees remain, creating large vegetation-free patches.

Current Landscape Treatments

The Pinaleno Ecosystem Restoration Project (PERP) will thin dense forests, remove dead trees and down woody debris, and use prescribed fire to begin restoring what was once a fire-adapted mixed-conifer ecosystem. Implementation will occur over the next 10 years under a Stewardship Agreement with the National Wild Turkey Federation. This project is needed to restore the fire-adapted ecosystem and to protect and restore habitat for the endangered Mount Graham red squirrel. The project is relatively small, but plays a strategic role in the larger landscape. An ultimate goal is to return fire to a more natural role throughout the Pinaleno Mountains. This will be accomplished using prescribed fire and wildland fire use on a large-scale basis in the future.