From: Susan D. Radzinski [mailto:sradz@lanl.gov]
Sent: Monday, January 10, 2005 1:01 PM
To: kIRK.W.OWENS@saic.com
Subject: Fwd: Affected Environment

Kirk,

Attached is the supplemented environmental changes section that was in the SA information document.

Susan

X-Sender: sloftin@esh-mail.lanl.gov
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Date: Wed, 05 Jan 2005 15:17:42 -0700
To: sradz@lanl.gov
From: Sam Loftin <sloftin@lanl.gov>
Subject: Affected Environment
X-PMX-Version: 4.7.0.111621

Susan,

Attached is the updated Affected Environment piece for the SSWEIS.

################################
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Sitewide Environmental Impact Statement

Affected Environment

Introduction

The period between 1999 and 2004 has seen significant environmental change on the Pajarito Plateau and subsequent LANL institutional changes to address them. Drought, wildfire, and bark beetle damage to surrounding forests have had the most widespread and detrimental impacts and are likely to continue to impact the LANL area well into the future.

Drought

The Los Alamos region is currently experiencing a severe multi-year drought, which is perhaps the most widespread and pervasive environmental disturbance to the region. LANL precipitation records (Figure 1) show that six of the past ten water years (Oct. – Sept.) have been below the 58-year mean (18.1 in). The last major drought in the area was in the 1950's when only three water years in a ten year period (1947-1956) were above the mean. The drought has been partially responsible for several disturbances that have greatly affected the regional environment. Dry weather facilitated the Cerro Grande Fire in May 2000 and set the stage for the bark beetle infestation that started around the summer of 2002. The 1950's drought was also marked by significant regional tree mortality (Allen and Breshears 1998).

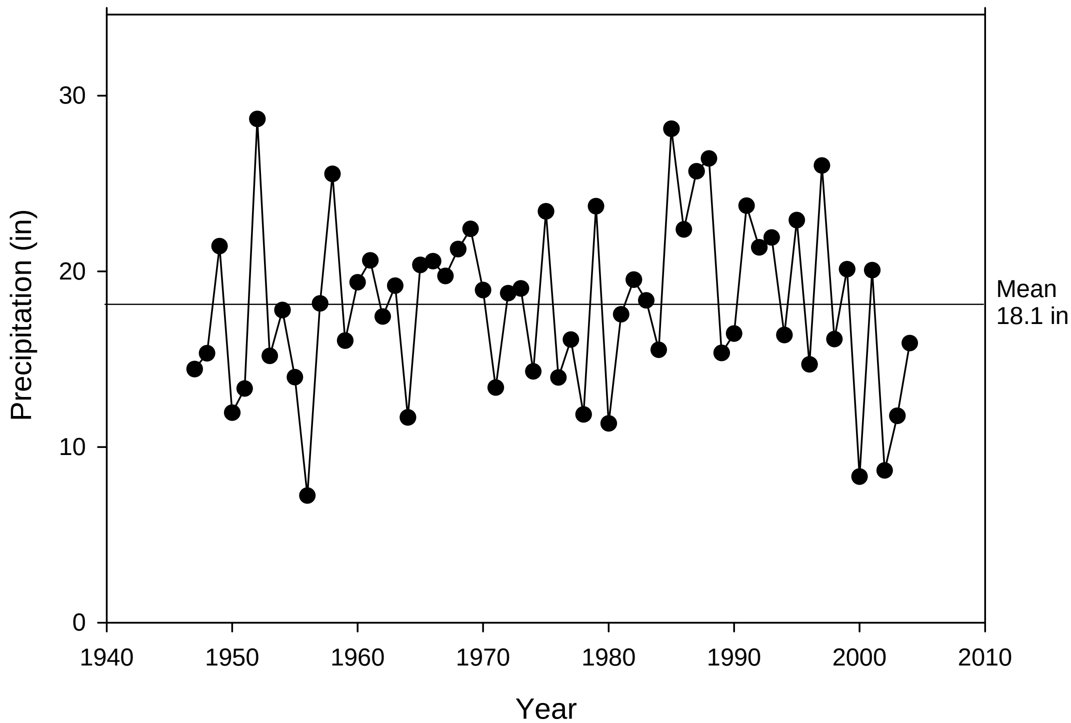

Figure 1. Los Alamos annual precipitation.

Cerro Grande Fire

Perhaps the first serious manifestation of the drought was the increase in wildfire activity in the region. Four out of the past five years have been above average for number of acres burned (Figure 2) in the Southwest Area (Arizona, New Mexico, and West Texas). Much of the regions' forests and woodlands are suffering from the effects of negligence and mismanagement. Livestock grazing and wildfire suppression have led to an increase in tree density and fuel accumulation, with a subsequent increase in competition between trees for water. Under these conditions, drought will reduce the live tree fuel moisture below levels that would normally be observed in a healthy forest. Combine this with the gusty winds and low humidity typical for fire season weather and the outcome can be catastrophic.

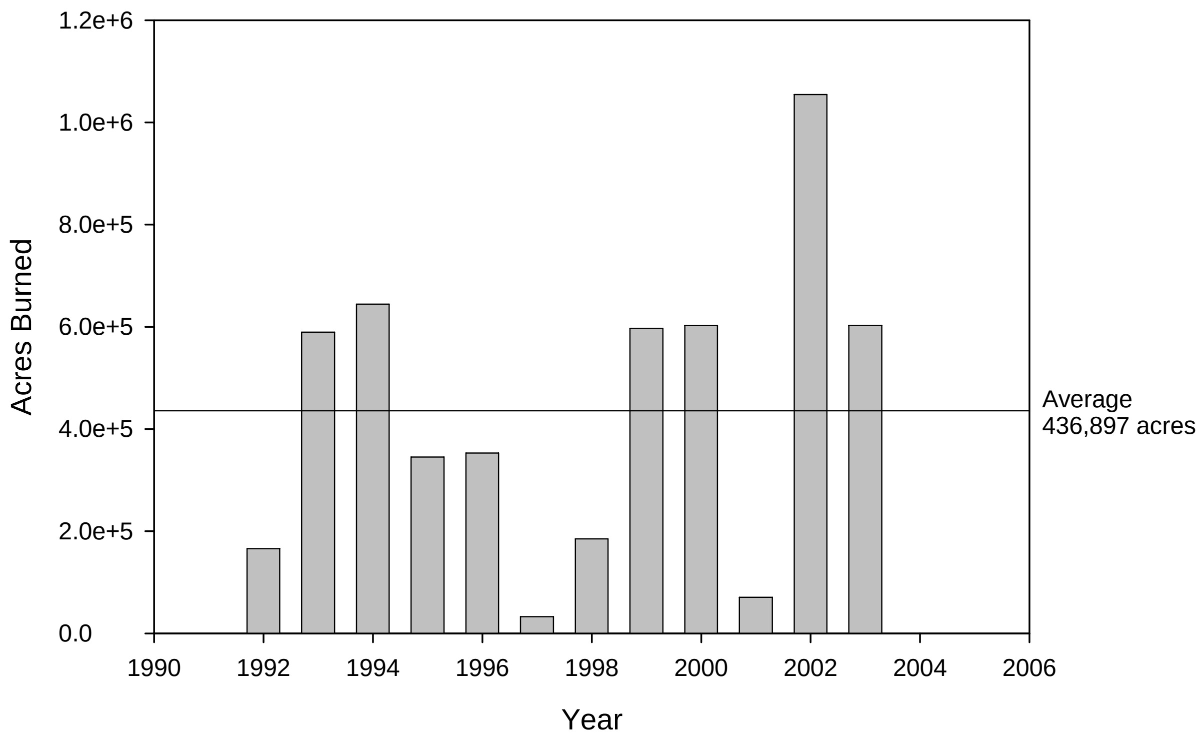

Figure 2. Acres burned in wildfire for Southwest Area (Arizona, New Mexico, and West Texas). Data from the Southwest Area Wildland Fire Operations (SAWFO) website (6/28/04).

In the evening of Thursday, May 4th, 2000, a fire crew from Bandelier National Monument was conducting a prescribed fire on Cerro Grande, approximately 3.5 miles west of LANL (LANL 2000). The fire was being used to reduce fuels and woody plants in a high mountain meadow. Gusty winds carried the fire out of containment and it was declared a wildfire less than 24 hours later. By Monday, May 8th the fire had progressed east to SR 501 and north to the rim of Los Alamos Canyon. Spot fires were reported on LANL property and the Laboratory suspended all programmatic work. On Wednesday, May 10th the fire moved into upper Los Alamos Canyon, which prompted the evacuation of the remainder of the Los Alamos townsite. The fire burned about 20,000 acres including portions of the Los Alamos townsite. The greatest advance came on Thursday, May 11th with the main fire burning north through US Forest Service property across Rendija and Guaje Canyons, almost to Santa Clara Canyon. The fire on LANL burned north and east across the Lab and onto San Ildefonso property. In all, approximately 33,000 acres burned with about 5,000 acres on LANL. By the time the fire was fully contained on June 8th, the fire had consumed close to 43,000 acres with about 7,500 acres on LANL (Figure 3).

Insert Figure 3, (from p. 15, Wildfire 2000).

Immediately after the fire an Interagency Burned Area Emergency Rehabilitation (BAER) team was organized to assess fire impacts and to design and implement mitigations on non-DOE property. The LANL Emergency Rehabilitation Team (EMT) was organized to execute a similar function for DOE. Although the BAER team was not responsible for actions on LANL, many of the BAER assessments included DOE property and many of the mitigations applied to non-DOE lands were also used on the Lab. The BAER team and the EMT worked together to assess the fire intensity and subsequent burn severity using a combination of aerial surveys and ground truthing. The BAER team mapped approximately 5,900 ha (14,500 acres) of high burn severity, 1,300 ha (3,300 acres) of moderate burn severity and 10,000 ha (25,000 acres) of low severity and/or unburned areas within the entire burn perimeter (CGBAER 2000, p. 279). LANL had approximately 82 ha (203 acres) of high severity, 334 ha (825 acres) of moderate severity, and 2,580 ha (6,376 acres) of low burn severity (Buckley et al. 2002).

High intensity wildfire often results in a high severity burn. The severity of a fire refers to the impact on soils and to some extent, vegetation. High intensity fires often consume standing vegetation as well as the soil organic layers and associated seed bank. In addition, a common characteristic of high burn severity is hydrophobic, or water-repellant, soils. Hydrophobic soils are formed when compounds from plant litter are volatilized by the heat of the fire, forced deeper into the soil and precipitate out on cooler soil particle surfaces. Together, these factors can lead to the potential for substantial runoff, soil erosion, downslope flooding, and degradation of water quality.

The upper portions of watersheds were treated to provide some stability to burned soils. The BAER team arranged for aerial seeding of approximately 8,500 ha (21,000 acres) of Forest Service and BIA lands (Kuyumjian 2004), including approximately 300 ha (700 acres) of DOE property (Buckley et al. 2002). The seed mix was composed of 30% annual ryegrass (*Lolium multiflorum*), 10% barley (*Hordeum vulgare*), 30% slender wheatgrass (*Elymus trachycaulus*), and 30% mountain brome (*Bromus marginatus*). The ryegrass and barley were fast-germinating annuals for quick cover and the wheatgrass and brome were relatively short-lived perennials that should protect soils for up to ten years before dying out and being replaced by native plant species. Overall, the aerial seeding program was effective on north-facing slopes and areas where straw mulch was applied over the seed. Unmulched, south-facing slopes were too hot and dry for successful seed germination and survival.

Other watershed treatments included raking, hand seeding and straw mulching, hydromulching, log erosion barrier, contour felling, and straw wattle installation. The Forest Service implemented approximately 4,250 ha (10,500 acres) of these other watershed treatments (Kuyumjian draft report). The acreages are not additive since many of these treatments were made in combination. The total acreage that received some combination of watershed treatment other than just aerial seeding is approximately 2,500 ha (6,300 acres). LANL implemented over 700 ha (1,800 acres) of watershed treatments on high and moderate severity sites (Buckley et al. 2002). Results from three years of vegetation monitoring on LANL rehabilitation units show that most units are stable but cover has been decreasing through time, probably another consequence of the current drought (Buckley et al. 2003). If cover continues to decline, additional treatments may be necessary.

In addition to soil and watershed treatments, a number of in-channel treatments were implemented and structures installed by LANL and the BAER team to protect downstream property and resources from potential flooding. Flows generated from summer thunderstorms in the major canyons that originate in the Sierra de los Valles, cross LANL, and discharge into the Rio Grande were estimated to increase up to 16 times their preburn rates (USDOE 2003). Floatable debris was removed from channels to prevent damming and clogging culverts. Trash racks were installed above road crossings to catch debris. Road crossings were reinforced and undersized culverts were replaced. The reservoir in upper Los Alamos Canyon was drained and the dam reinforced. It has since been dredged to retain its capacity to store stormwater and sediment and there are plans to dredge it again if necessary. A low-head weir was installed in lower Los Alamos Canyon near Hwy 4 to prevent sediments from moving off site. A flood retention structure was constructed in Pajarito Canyon approximately 3 km (2 miles) upstream from TA-18 to prevent flooding at TA-18 and White Rock. Watershed and in-channel treatments will need to be monitored and maintained until watersheds are recovered or hydrologically stable. Given the extent and severity of the fire and the erosion after the fire, it is unlikely that many watersheds will return to prefire hydrology. A more realistic goal is to attain hydrologic stability in the watersheds. Current data suggest that many of the watersheds are relatively stable. Pueblo, Rendija, and Guaje Canyons appear to have been altered to a greater extent than Los Alamos, Pajarito, Canon de Valle and Water Canyons and are expected to continue to discharge at rates much greater than those recorded before the fire (Kuyumjian 2004).

Following the fire, LANL received funding from Congress to continue postfire activities initiated under the LANL EMT and to address remaining wildfire risks at the Lab. The Cerro Grande Rehabilitation Project (CGRP), housed within the Facilities and Waste Operations Division, was created to facilitate and implement these activities in collaboration with other LANL organizations. An ambitious, sitewide project was initiated to assess and reduce the risk of wildfire to LANL personnel, facilities, and infrastructure. The Wildfire Hazard Reduction Project Plan (LANL 2001) was developed to identify and prioritize projects and to provide guidelines for project implementation. Up to 35 percent or approximately 4,000 ha (10,000 acres) of LANL property would be treated under this program. Thinning activities started in January 2001 and some carry-over funds have allowed the program to operate through the end of FY04. To date, 1,766 ha (4,363 acres) of piñon-juniper and 1,200 ha (2,920 acres) of ponderosa pine on LANL have been treated. This includes defensible space around facilities, firebreaks around roads and firing sites, utility corridor thinning, and forest health thinning. Future wildfire risk assessment, mitigation, and monitoring roles and responsibilities will be described in the LANL Wildland Fire Management Plan due out in September 2004.

Bark Beetle Impacts

Following the Cerro Grande Fire, regional land management agency personnel were on the alert for signs of bark beetle activity. Bark beetles often attack trees that are weakened by fire and can quickly reach epidemic proportions. Some bark beetle activity was recorded in the first year after the fire but not enough to cause undue concern. It wasn't until the following summer (2002) that widespread activity was observed in the regional piñon and ponderosa pine populations. Interestingly, despite the concern that the fire would initiate a bark beetle outbreak, it appears to be more a consequence of drought stress. Extensive bark beetle-induced tree mortality has been recorded throughout the southwestern United States, roughly coincident with the extent of the drought. Multiple species of bark beetle are involved in attacking several species of trees. Mortality estimates (Balice 2004) at LANL range from 97 % mortality of piñon pine >3 m (10 ft) in 2,677 ha (6,617 acres) of unthinned piñon-juniper woodland, 14 % mortality of ponderosa pine >3 m (10 ft) in 923 ha (2,326 acres) of unthinned ponderosa pine forest, and 96 % mortality of ponderosa pine, Douglas-fir, and white fir >3 m (10 ft) in 250 ha (600 acres) of unthinned mixed conifer forest (acreage estimates from McKown et al. 2003).

The potential environmental consequences of the tree mortality are largely unknown. The 1950's drought led to extensive mortality of ponderosa pine on the Pajarito Plateau and it is thought to be partially responsible for the overall low herbaceous plant cover and high erosion rates that are common to the area (Allen and Breshears 1998). With sufficient rainfall, herbaceous plant species could colonize much of the space left vacant by the trees and actually reduce runoff and erosion from some of these sites. If the drought continues, erosion rates could increase. There are concerns about the fire hazard associated with the standing dead trees, particularly while the dead needles remain on the trees. In general, piñon pine, Douglas-fir and white fir trees appear to lose their leaves in less than a year while ponderosa pine can retain leaves for many years, thus the threat may be greater in the mid elevational range occupied by ponderosa pine. Previous CGRP defensible space and forest thinning activities should greatly reduce the risk of wildfire to personnel and facilities. However, wildfire in beetle-killed forest and woodland could have substantial impacts to hydrologic stability and negatively impact soil erosion, contaminant transport, and water quality. Eventually however, the dead trees will fall and provide surface material that would stabilize soils and promote the growth of herbaceous plants.

Summary

Despite the dramatic changes to the regional environment over the past five years, the future could be equally dynamic. Vegetation recovery on the burned areas and in bark beetleimpacted forests and woodlands could be rapid, given adequate rainfall. Unfortunately, short-term projections show little relief from the drought and long-term projections are fraught with uncertainty. Wildfire will continue to be a major environmental risk for LANL and the surrounding region. If the drought continues it is likely that continued tree mortality will add to the woody fuel base and if the drought ends there should be an increase in understory fuels. The hydrologic response is largely dependent on the vegetation. Although counterintuitive, more rainfall generally increases herbaceous vegetation and decreases runoff. Less rainfall reduces herbaceous vegetation and leads to higher runoff rates during summer thunderstorms. With all this uncertainty, the best strategy is a strong monitoring and management program to identify and mitigate risks before they become problems.

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