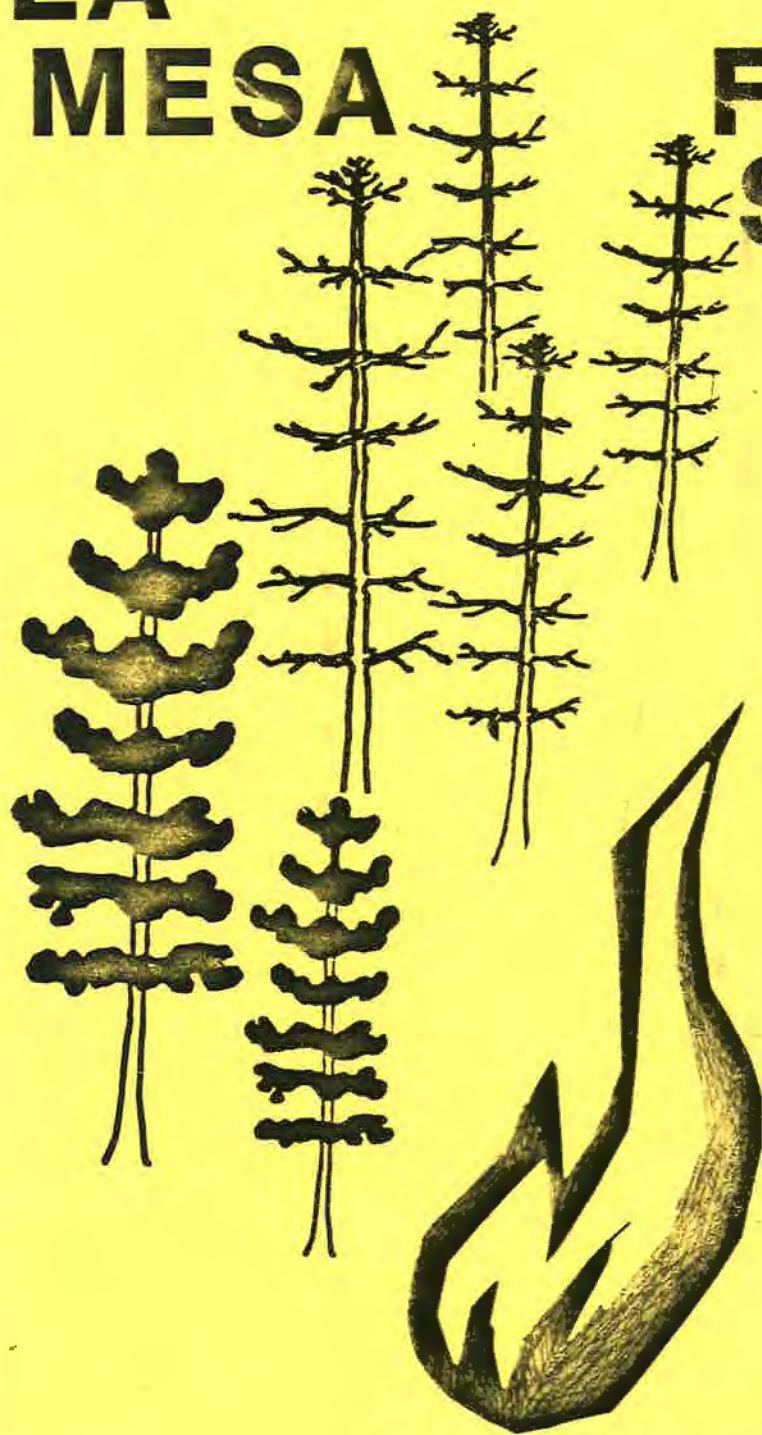


LA MESA FIRE SYMPOSIUM



OCTOBER 6 and 7, 1981

**LOS ALAMOS
NATIONAL
LABORATORY**

Los Alamos, N.M.

**SOUTHWEST FIRE COUNCIL
NATIONAL PARK SERVICE
LOS ALAMOS NATIONAL LABORATORY**

AGENDA

LA MESA FIRE SYMPOSIUM

October 6, 1981

8.00 a.m.	Bus pick-up at the Hill Top House Motel for participants
8.30 a.m.—9.00 a.m.	Registration Physics Bldg Auditorium
9.00 a.m.—9.15 a.m.	Welcome — Charles I. Browne, Associate Director for Technical Support, Los Alamos National Laboratory Jack Neckels, Associate Regional Director Park Operations, National Park Service Jim Martinez, New Mexico Department of State Forestry
9.15 a.m.—9.50 a.m.	Interagency Fire Suppression Jerry Schmidt, United States Forest Service
9.50 a.m.—10.20 a.m.	Fire Ecology at Bandelier National Monument Teralene Foxx (University of New Mexico Los Alamos National Laboratory)
10.20 a.m.—10.50 a.m.	Post-Fire Studies at Bandelier National Monument Loren D. Potter (University of New Mexico)
10.50 a.m.—11.05 a.m.	BREAK
11.05 a.m.—11.25 a.m.	Water Relations on Seeded Grasses — Fairley Barnes (Los Alamos National Laboratory)
11.25 a.m.—12.00 noon	Erosion — Steve Well (University of New Mexico)
12.00 noon—12.30 p.m.	Soil Nutrient Studies Edward Freeman (University of Texas, El Paso)
12.30 p.m.—1.30 p.m.	LUNCH — Laboratory Cafeteria
2.00 p.m.—4.00 p.m.	Field Trip — John Lissoway (National Park Service) Teralene Foxx (Los Alamos National Laboratory) Ed Collins (United States Forest Service)

October 7, 1981

7.45 a.m.	Bus pick-up at the Hill Top House Motel for participants
8.15 a.m.—8.40 a.m.	Archeology — Lindi Hubbell (National Park Service)
8.40 a.m.—9.10 a.m.	Water Quality and Management Implications William Purtymun (Los Alamos National Laboratory)
9.10 a.m.—9.30 a.m.	Invertebrates — Warren Pippen (National Park Service)
9.30 a.m.—10.00 a.m.	Small Mammals — Dan Guthrie (Claremont College, California)
10.00 a.m.—10.15 a.m.	BREAK
10.15 a.m.—10.45 a.m.	Birds — Roland Wauer (National Park Service)
10.45 a.m.—12.00 noon	Elk Studies — Gary White (Los Alamos National Laboratory) Mary Roland (Colorado State University) Bruce Weber (Utah State University)

FIRE ECOLOGY AND BANDELIER NATIONAL MONUMENT

by

Teralene S. Foxx and Loren D. Potter

ABSTRACT

Because Bandelier National Monument is a dissected plateau with canyons that rise from grassy, low plains of the Rio Grande up through juniper, piñon-juniper, ponderosa pine, and into stands of mixed conifer, and because of the policy of total fire suppression over the past 40 years, the many even-aged stands, the heavy fuel accumulation, and the potential pathways for fire to sweep up-country was well as a high plateau susceptible to lightning strikes, Bandelier was a prime situation for a fire management plan. These factors combined with the recent acceptance by the National Park Service that fire is a natural and sometimes necessary component of the ecosystem (National Park Service, 1976) led to the establishment of the initial study, which was to be completed November 1977. The primary study had essentially six parts: (1) researching the complete fire history of the Monument, (2) correlation of the fire history with climatological data, (3) measurement of standing biomass of both mature and reproductive stock, (4) determination of fuel loading in selected areas, (5) inference of successional vegetation from a variety of age stands to determine normal recovery, and (6) to determine the influence of fire upon the growth rates of the dominant tree species.

Before the initial study could be completed, a wildfire burned 14,000 acres of the Monument and surrounding areas. This interrupted the study and changed the complexity of the information gained as the La Mesa fire burned 11 of the 13 previously measured study plots. A remeasure of these areas has allowed for some definite conclusions made from experimental evidence rather than from inference. Fire damage to sites of known fire history was compared. Sites which had not burned in the last 27 years were found to be severely burned. Many areas had not had a major fire for 84 years.

POST-FIRE RECOVERY AND MORTALITY OF THE PONDEROSA PINE FOREST AFTER THE LA MESA FIRE

by

Loren D. Potter

ABSTRACT

Because of a study in Bandelier National Monument of stands of known fire history before the La Mesa fire, there was a data base to correlate with the effects of the fire. Recovery or mortality of ponderosa pine stands was related to previous fire history, stand density, crown damage, and competition of herbaceous vegetation (both native and seeded). Soon after the fire, nearly 900 trees were labeled and classified as to degree of foliar damage. After two growing seasons the trees were re-examined for changes in foliar condition, amount of new growth, height of trunk scorch, insects, mistletoe, and pitch. About 36% of the 14,361 acres burned were in foliar damage classes 5 and 6 with few or no seed trees. Foliar damage classifications increasing from 1 to 4 in increments of 25% showed recoveries of 91, 83, 74, and 83%. After two growing seasons, 80% of trees in classes of 50 to 90% foliar singeing were still alive. Severity of foliar damage decreased with decreasing time since the last burn, being negligible in areas burned 27 years or less before the La Mesa fire; these stands with lower tree density and fuel loads also showed the highest percentage post-fire improvement in foliar condition. The mean fire interval for the area before fire control is 17 years. Fewer sprouts of shrubs were found both in the stands of long fire interval and severe burn and in the stands of short interval, light burn, and dominant ground cover of grasses.

Of six species of grasses seeded to reduce erosion, slender wheatgrass and sheep fescue were most successful. Initial success of grasses was best in areas of pine needlefall, but after two growing seasons, grass biomass and cover were nearly equal to areas of no needlefall; total herbaceous biomass was essentially equal to control plots with no seeding, which were dominated by forbs. The study also included physical and biological microsite factors related to natural pine regeneration.

WATER RELATIONS OF THE DOMINANT GRASSES ON THE LA MESA BURN

by

Fairley J. Barnes

ABSTRACT

Leaf water potentials (LWP) of three grass species, two seeded (*Agropyron trachycaulum* and *Festuca ovina*) and one naturally occurring (*Muhlenbergia montana*), were measured periodically at two sites on the La Mesa burn during the summer of 1980. Measurements were performed between 1200 and 1400 hours using a Scholander type pressure chamber. Soil Samples at the two sites were taken from 10, 20, 30, and 40 cm depths whenever LWP was measured. Soil moisture content of the samples was determined gravimetrically. Two specimens of each species were excavated to a depth of 30 cm and the root structure examined. *F. ovina*, a cool season grass, has a major growth period in the early spring when the LWP is high. After seed set, the LWP decreases to -60 bars during the early summer drought and then increases again with the summer rains. It has a shallow and very dense root system. *M. montana*, a warm season grass, has a similar seasonal course of LWP, but doesn't commence growth until the summer rains start and LWP is high. The root system is somewhat deeper and more diffuse. *A. trachycaulum* has much less variation in LWP during drought stress and maintains a noon summer LWP between -30 and -40 bars during the period of greatest stress, which is also the period of growth for this species. It has a very deep root system extending below 30 cm.

Regression analyses were performed on different models of the relationship between LWP and soil water content. The model of best fit was found to be

$$Y_i \approx -B_3 - B_2 e^{-B_1 X_j}$$

where Y_i is the LWP of species i , X_j is the % soil water at depth j , and B_1 , B_2 , and B_3 are constants. For *F. ovina* and *M. montana* over 70% of the variability in LWP is explained by regression on soil water at 10 and 20 cm depths. Confidence intervals of the regression constants show that the 10 cm depth is of primary importance. The statistics for *A. trachycaulum* indicate that all soil layers contribute significantly to LWP variation, with the r^2 values for the 20 and 30 cm depths being the highest.

The study indicates that ponderosa pine seedlings would experience severe competition for water from *F. ovina* early in the growing season, and continued competition with *A. trachycaulum* through the summer. *M. montana* seems to have a water usage pattern and phenology that coordinates well with the known requirements for ponderosa pine seedling survival. The findings suggest that artificial or natural regeneration of tree species can be facilitated by seeding undercover species that will stabilize soils yet have niche requirements that are complimentary to those of the regenerating tree seedlings.

GEOMORPHIC EFFECTS OF THE LA MESA FIRE
BANDELIER NATIONAL MONUMENT, NEW MEXICO

by

William D. White and Stephen G. Wells

ABSTRACT

In 1977 the La Mesa fire burned forested portions of the Pajarito Plateau in the Jemez Mountains, northcentral New Mexico. Six small drainage basins within the Frijoles Canyon watershed, Bandelier National Monument, were instrumented to measure the geomorphic adjustments of the watershed in response to devegetation. Three drainage basins representing a qualitative estimate of devegetation (i.e., intense, moderate and light burns) were instrumented at an elevation of approximately 2530 m; three basins were instrumented at a lower elevation of 2195 m. The amount of sediment derived from devegetated hillslopes is influenced by: (1) the amount of fire-induced devegetation and organic ash formation, (2) seasonal variations in weathering and runoff, (3) sediment production from burrowing animals, and (4) protective post-fire forest litter. Increased rilling in the headwaters, and channel cutting and filling at the basin mouths make these portions of the study basins most responsive to devegetation. Rapid revegetation in the upper-elevation study area reduced sediment production within two years after the La Mesa fire. Lower-elevation mesas have been identified as the landscapes most susceptible to fire-induced erosion. Morphometric analysis defined a greater number of first-order streams developed on the lower mesas than on the upper mesas. The greater number of first-order streams permits rapid sediment removal from devegetated headwater hillslopes to the trunk ephemeral drainages. Post-fire sedimentation occurs as bar deposits along third-, fourth-, and fifth-order ephemeral drainages and as overbank deposits on the floodplain of the deeply incised, perennial Rito de los Frijoles. Post-fire hydrographs of the Rito de los Frijoles exhibit sharp runoff peaks with steep limbs indicating an increase in flashy flow behavior. Undercutting of the banks of the Rito de los Frijoles is a result of the increased bedload the perennial channel is carrying after the La Mesa fire.

**EFFECTS OF THE LA MESA FIRE
ON BANDELIER'S CULTURAL RESOURCES**

by

Diane Traylor

ABSTRACT

The La Mesa fire in June 1977 provided a unique opportunity for archeologists to work hand-in-hand with fire suppression crews in an attempt to prevent damage to Bandelier National Monument's abundant cultural resources from fire fighting activities. National Park Service archeologists emphasized monitoring fireline construction by both heavy machinery and hand crews.

A follow-up study, enacted to measure the success of this innovative archeological/fire suppression cooperative effort, (1) revealed through survey and excavation, actual site damage incurred both by the fire itself and by suppression procedure, and (2) formulated recommendations to resource managers as to how fire fighting activities can best be carried out while keeping the interests of cultural resources in mind. These recommendations emphasize communication procedures, priority planning, prior resource inventories, monitoring practices, previous fire training for archeologists, on-the-job recording, and suggestions for cultural resource protection as it relates to prescribed burning.

CHEMICAL QUALITY OF SURFACE WATER IN BANDELIER NATIONAL MONUMENT

by

William D. Purtymun

ABSTRACT

Surface water occurs in Cañon de los Frijoles and in the upper and middle reaches of Alamo and Capulin Canyons. Quality of water data were collected in these canyons to evaluate the effect of the fire.

The chemical quality of surface water in Cañon de los Frijoles changed slightly after the La Mesa fire. The most noticeable change was an increase in calcium, chloride, bicarbonate, and total dissolved solids. Analyses taken over a 20-month period after the burn indicated a general decline in most of these constituents. Similar analyses of surface water in Alamo and Capulin Canyons indicated similar results over a 12-month period.

Analyses of samples collected of summer storm runoff compared with base flow in Cañon de los Frijoles may be attributed to lead in automobile emissions as it was not reported in a similar runoff event in Capulin Canyon, which is remote from vehicle traffic.

OBSERVATIONS OF ARTHROPOD POPULATIONS
FOLLOWING THE BANDELIER NATIONAL MONUMENT
FIRE OF 1977

by

Warren F. Pippin and Barry Nichols

ABSTRACT

Sampling sites were selected in burned and unburned areas where transects for bird surveys had previously been established. Plots were selected randomly in each site and sampled weekly. A 50 m plot was selected in a severely burned area and an unburned area nearby and observations made on Arthropod populations. There were more genera collected in the unburned than the burned areas. Generally, the most common Arthropods found in burned and unburned areas were ants and spiders. A New Jersey light trap operated at Ponderosa campground in 1977, before the fire, collected several hundred specimens per trap night. In 1978 the volume of specimens collected in the trap was similar to that collected before the fire. In some areas the reduction in Arthropod populations might have an adverse effect on populations of some insectivorous birds and other animals; especially if there were some specificity in their diet and they occupied a limited niche in the ecosystem.

AQUATIC INVERTEBRATES OF RITO de los FRIJOLES
BANDELIER NATIONAL MONUMENT, NEW MEXICO

by

Warren F. Pippin and Belle D. Pippin

ABSTRACT

One hundred seven taxa of Arthropods were collected in a survey to establish a check list of the invertebrate fauna of the stream; to access the relative population density of various genera between test areas on the stream and to determine the period of time necessary for populations to reestablish themselves after heavy flooding. The greater number of specimens were found in the Orders that are important as far as food for trout is concerned. Greater diversity of species and in general overall population numbers occurred in the upper areas of the Frijoles. The lower section of the stream is subjected to severe pressure due to flooding, human activity and stream clearing projects. The stream from upper crossing to the forks is a more stable system and may support a larger trout population than at present. Flooding with the accompanying grinding action of rocks and sand is probably the most important factor in reducing aquatic populations in the Frijoles. Most of the aquatics were reduced up to 98% in certain areas after heavy flooding. Many species were so depleted they failed to recover during the summer. However, it is apparent some species such as the mayflies and blackflies reestablished themselves rather quickly, frequently in one month. It probably requires at least one year for most populations to recover.

EFFECTS OF FIRE ON SMALL MAMMALS WITHIN BANDELIER NATIONAL MONUMENT

by

Daniel A. Guthrie

ABSTRACT

A live-trapping program was conducted during the summers of 1977, 1978, and 1979 to determine the effects of the La Mesa fire on small mammal populations within Bandelier National Monument. Trapping grids were established in all vegetational zones affected by the fire: piñon-juniper woodland, ponderosa forest, fir-ponderosa forest, and riparian woodland. Except for a reduction of arboreal species, notably red squirrel (*Tamiasciurus hudsonicus*), the fire had little direct effect on small mammals. After the fire, species dependent upon trees destroyed by the fire decreased in number in the burned area. These species include the piñon mouse (*Peromyscus truei*) in the piñon-juniper woodland and red squirrel in the ponderosa zone. Species known to be colonizer species or grassland species increased after the fire. These include deer mouse (*Peromyscus maniculatus*) in all areas and montane and long-tailed vole (*Microtus montanus* and *M. longicaudus*) at higher elevations where reseeding efforts resulted in lush grasslands. Chipmunks (*Eutamias quadrivittatus* and *E. minimus*) also increased in these grasslands, apparently taking advantage of annual plant seed production. The annual reduction in population of these species caused by winter conditions makes rodent population explosions in the burn areas unlikely.

LA MESA FIRE EFFECTS UPON AVIFAUNA

by

Roland H. Wauer and Terrell Johnson

ABSTRACT

Three populations of birds were studied to determine the effects of the 15,000-acre La Mesa fire upon avian density, diversity, and biomass. Data were accumulated on three separate areas in Bandelier National Monument—Burnt and Escobas Mesas and Apache Spring—before the fire, immediately after the fire, and for two consecutive years. Avian populations most affected were those situated on study areas that experienced the most severe burns. However, both species diversity and evenness values increased on all three units after the fire, and middle-sized species that utilize the timber-drilling-insect feeding guild (woodpeckers) and the cavity and depression nesting guild received the greatest benefit from the fire. These data suggest that fire is a positive influence upon a large portion of the avifauna, and therefore should be utilized to best benefit species diversity and reduce the probabilities for environmental impacts such as erosion, overgrazing and infestations.

COMPARATIVE WINTER NUTRITION OF ELK IN THE JEMEZ MOUNTAINS, NEW MEXICO

by

Mary M. Rowland, A. William Alldredge, James E. Ellis, and Gary C. White

ABSTRACT

A study of winter diet quality and nutritional status of elk (*Cervus elaphus nelsoni*) was conducted in the Jemez Mountains, New Mexico during January-April 1980. A recently burned montane area, including Bandelier National Monument and Los Alamos National Laboratory lands, and an unburned upper montane area in the Valles Caldera were selected for winter range comparisons. Botanical composition of elk diets, determined from fecal analysis, was markedly different between the two areas. Grasses dominated diets in the burned area ($\bar{x} \approx 90\%$), but were consumed in nearly equal proportions with browse in the unburned area ($\bar{x} \approx 52\%$, grasses; $\bar{x} \approx 41\%$, browse). Forbs were a uniformly minor dietary component. Grasses were more digestible than browse, but protein was similar between forage classes. Comparisons of forage protein and *in vitro* digestible organic matter (IVDOM) revealed no differences between locations. Dietary proteins ranged from 3.5-7.2% and 4.7-7.5% in burned and unburned areas, respectively, and was consistently higher in the unburned area. Diet IVDOM increased from 36 to 48% in the burn and from 33 to 39% in the unburned area from January-April. Compared with the unburned area, diet IVDOM of elk on the burn increased more rapidly and was superior in 5 of 6 periods. Observed differences between areas in diet quality were caused primarily by differences in diet composition, rather than in forage quality. Increases in diet quality during the study were highly correlated with increases in quality of grasses consumed by elk. A simulation model of ruminant energy and nitrogen balance was used to predict effects of diet quality on elk nutritional status. Greater energy deficits were predicted for elk in the unburned area, effecting greater losses of fat and lean body in this area. Superior dietary protein was insufficient to compensate for these losses.

Fire plays an important role in maintaining quality habitat for elk in the Jemez Mountains. Other winter ranges of the Jemez Mountain elk include proposed geothermal sites. Knowledge of winter range qualities associated with nutritional status of elk may assist in mitigation of potential losses of habitat due to energy development in the Jemez Mountains.

PHYSIOLOGIC RESPONSE OF ELK TO VARIATIONS IN WINTER RANGE QUALITY

by

Bruce J. Weber and Gary C. White

ABSTRACT

Thirty-six elk were live-trapped during February-April 1980, approximately 2.5 years after the La Mesa fire. Twenty elk were captured on Burnt and Escobas Mesas at Bandelier National Monument (BURN). The remaining elk were caught on the Valle San Antonio (BACA), an unburned winter range. Comparisons of body condition between elk wintering on the BURN and those wintering on the BACA were made using a 3-way analysis of variance (location, age, sex) model that incorporated the covariates of day and time of capture.

All elk captured were radio-collared and tracked. The locations obtained substantiate the use of discrete winter ranges and use of a common summer range on the Valle Grande and surrounding areas. Comparisons of winter weights from the two areas yielded substantially higher values for elk from the BURN. Average weights for elk calves, adult females, and yearling males exceeded the average weights of BACA elk by 17.7, 36.0, and 25.1 kg, respectively ($P \geq 0.01$). The thickness of back fat was highly variable between all elk, but was detected on only one BACA elk, while 14 of the 18 elk sampled on the BURN had discernible fat levels. Blood metabolites were measured and produced highly significant differences ($P \geq 0.01$) between locations for alkaline phosphatase, triglycerides, anion gap, total bilirubin, and mean corpuscular volume (MCV). Significant differences ($P \geq 0.05$) were found for serum CO_2 and albumin levels and for total monocyte counts. These metabolic differences suggest that the diet of elk wintering on the BURN was substantially higher in available protein and energy.

All adult female elk captured were diagnosed as pregnant by rectal palpation and serum progesterone levels. No yearling females were captured on the BACA so interpretations on the effect of winter range condition on this younger age class are limited. However, differences in elk body condition from adult female elk sampled on the BURN and BACA may elicit changes in subsequent calf production and survival between the two groups.