

Out of the Ashes

A Story of Natural Recovery



This work is dedicated to all
who have experienced the fire:
physically, emotionally, spiritually.

*T*oday in Los Alamos, the word fire brings many images to mind. We see the flames coming over the ridges, we think of evacuation, and we remember returning home and seeing the mountains burned. We look at the charred landscape and feel hopeless. Many ask, will it stay this way? Others want to know if this is still a good place to live and play now that the trails are scarred by fire.

We find it hard to relate to fire as friend.

In 1975, I began my career as an ecologist studying fire. In 1977, the La Mesa fire burned over 15,000 acres near Los Alamos and I began to understand nature's adaptation to fire. When I walked into that burned area 23 years ago, I also felt hopeless. But during the ensuing years, I saw opportunities for forest life that did not previously exist. Though fire seems to be an end, it is actually a beginning. We know that there will not be tall forests on the mountains within our lifetimes. For this, we need to grieve. But with this booklet, we would like to show you another way of thinking

—there is new life that rises out of the ashes.

To help you understand more about nature's rejuvenation, the first section, entitled 'the setting,' describes the Pajarito Plateau and explains about forests and fire as they are affected by human activities. When forests are healthy, fire helps maintain that health. When forests are overstocked, fire becomes menacing, threatening lives and property.

However, through forest management, forest health can be regained.

The next three sections, entitled 'fire, a fundamental element,' 'maintaining a healthy forest,' and 'fire, the force of change,' describe the changes that fire brings. Nature is adapted to fire—even the most devastating fire. These sections will help you to observe what happens after fire—recovery.

The key is to look beyond the burned trees.

One exciting aspect about observing change is how features previously unseen become visible. In 'seeing the unseen' and 'the mountain,' we share with you sights invisible before the fire and artists' depictions of how the area might look in the future. Dorothy Hoard, from years of traversing the trails and observing the landscape, shares her vision.

Some cultures call fire "Grandfather," which is a name of respect. If we better understand fire and recovery, I believe that we will better understand a healthy relationship with fire. But most of all, we will be amazed at how nature has adapted to fire, which is both friend and foe.

Teralene S. Foxx
Fire Ecologist, September 2000





*An early morning walk along trails once familiar.
Trees, dark shadows before the breaking dawn.
They stand like ghostly sentinels to
what was and will be.
The sun rises, sprinkling early morning light on
blackened landscapes.
Dark ash, sunlit sprouts, emerald grass,
flowers adding color.
Breathless awe and wonder;
For out of the blackened landscape, new life arises.*

June 24, 1977, Teralene Foxx, after the La Mesa fire;
experienced again August 2000, after the Cerro Grande fire

*Early morning, August 2000, three months
after the Cerro Grande fire.*





Looking west, January 2001

welcome



Welcome to the beautiful Pajarito Plateau, home to Los Alamos, White Rock, and Los Alamos National Laboratory.

Welcome to an area rising out of the ashes of the most recent wildfire—the Cerro Grande fire (May 2000)—a landscape shaped and changed by fire.

This is a story about natural recovery of a charred landscape, fire, and the cycles of nature. This is also a story about how we all have a role in preserving, enjoying, and entering a landscape that still provides a beautiful place to live, work, and play.





Looking west, September 2000

the setting

The Jemez Mountains are located in north-central New Mexico and are volcanic in origin. High peaks rim a giant valley called the Valle Grande, which is now part of the Valles Caldera National Reserve. The peaks that rim the caldera include Cerro Grande, Pajarito, Caballo, and Tschicoma. Around the eastern base of the mountains skirts a plateau formed from ash flows a million years ago.

The plateau is called the Pajarito Plateau. On mesa tops of the plateau, which is dissected by canyons, are the community of Los Alamos and Los Alamos National Laboratory. Near the eastern edge of the plateau is the smaller community of White Rock. The communities are about 100 miles north of Albuquerque and 25 miles northwest of Santa Fe. Bordering these communities are lands of Bandelier National Monument, Santa Fe National Forest, Santa Clara Pueblo, and San Ildefonso Pueblo.

The plateau and high peaks create an elevational gradient of around 5000 feet—from 5300 feet at the Rio Grande to over 10,000 feet on the peaks. Beginning along the river, five major vegetation zones correspond to elevation—juniper savannah, piñon-juniper woodland, ponderosa pine forest, mixed conifer forest, and high mountain grassland. These diverse habitats provide food and shelter for many plant and animal species. These diverse habitats, along with the spectacular panorama,

also provide opportunities for recreational activities, including photography, hiking, biking, and exploring, for inhabitants and visitors.

The climate is influenced by the steep elevation change. At the lowest elevations, the climate is arid-continental, while upper elevations are temperate-semiarid. Most precipitation comes during summer monsoons and winter snows.

In May 2000, the Cerro Grande fire—ignited on the slopes below Cerro Grande peak—ultimately burned over 43,000 acres of piñon-juniper woodland, ponderosa pine and mixed conifer forests, and high elevation grasslands of Bandelier National Monument, Los Alamos County, the national forest, and pueblo land.

The intensity of the burn varied. The areas burned most intensely were within ponderosa pine forest of the mountain slopes and the mesa tops where Los Alamos and the Laboratory are situated and on lands of Santa Clara Pueblo and Santa Fe National Forest.

For a time, resident and visiting outdoor enthusiasts had to avoid areas with severe burn because of flood and dead tree hazards. However, the fire had only momentarily disrupted their diversions.

fire, a fundamental element

*F*ire has been both friend and foe to humankind. Fire of the sun warms the earth. Fire of the campfire warms the night. Fire along the forest floor cleanses a stagnant forest. However, uncontrolled fire raging throughout the tree tops threatens life and property as well as forests of the area. The forests long ago adapted to frequent but gentle burning.

fire,
friend and foe



Today, as when the plateau was first inhabited, fire is a part of the natural cycle. Although the most recent local fires have been human-caused, most fires of the west are lightning caused (far left). In fact, over a 21-year period in Santa Fe National Forest, officials recorded 68 lightning-caused fires per year. However, many fires remain as ground fire (left) because crown fires only occur when forest and weather conditions are right for fires to get out of control.



The thick bark of the ponderosa pine protects the tree from ground fires. The tree is not burned on all surfaces and therefore can live. The burned face of the tree heals and leaves scars recorded in the wood. These scars provide a clue to the frequency of fire within a forested landscape. Studies show that fire was a frequent occurrence before the turn of the 20th century. Trees were scarred by fire every 5 to 10 years. The changes resulting from human settlement on the Pajarito Plateau in the late 1800s caused suppression of fire, and today many areas have not had a fire in over 100 years.

Ponderosa pine is fire resistant. Ground fires may scar a tree (above) but will not kill it.

Examination of stumps with fire scars (right) reveals that many areas in the Jemez Mountains have not burned for over 100 years.





Although the Española valley had been settled by the Puebloans in the 1100s and the Spanish in the 1600s, not until the Homestead Act of 1862 and the opening of the narrow gauge Chili Line railroad in the late 1870s did the Pajarito Plateau begin to increase in population. These events opened the area to farms and large-scale grazing of sheep and other livestock as well as lumbering and homesteading. Grazing contributed to removal of grasses and forbs that compete with pine seedlings. That condition, along with years of above average rainfall, contributed to the large numbers of tree seedlings over vast areas of the Southwest. Without frequent fire, forests became increasingly dense.

Brook Homestead with sheep grazing in a fallow field (above).

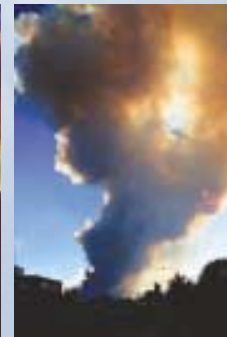
Cattle waiting near Buckman to be shipped on the Chili Line. Cattle were driven from the plateau and Valle Grande to the river (right).

The Chili Line locomotive passing through Buckman (far right).





Studies indicate that the last major fire in the 19th century on the Pajarito Plateau was in 1893. Through the ensuing years, without the cleansing of frequent low-intensity fires, forests of the plateau became overgrown. In 1977, environmental and meteorological conditions were right for the ignition of a wildfire, the La Mesa fire. This was the first large-scale wildfire for the plateau in the 20th century, burning over 15,000 acres of mostly ponderosa pine. Twenty years later, the Dome fire burned 16,000 acres, and, in 1998, the Oso fire another 5,000 acres. In May 2000, over 100 years after the last large fire in the 19th century and 23 years after the La Mesa fire, the Cerro Grande fire burned over 43,000 acres of the eastern slope of the Jemez Mountains. Although there was no loss of human life, property damage ranged into the millions of dollars. The startling realization is that in the past 23 years over 80,000 acres of forested landscape on the Pajarito Plateau and east Jemez Mountains have been burned by wildfire.



Different views of the smoke plume from the Cerro Grande fire.



crown fires vs ground fires

A crown fire burns into the tops of the trees and moves rapidly through the landscape.

In a dense forest with a multi-storied canopy (below), the small trees provide a ladder for fire to move into the tops of the taller trees. This type of forest is more prone to destructive crown fires.





A ground fire (left) burns along the ground and does not reach into the tops of the tall trees.

In forests with open canopies (below), fire will remain on the ground. The thick bark of fire-resistant trees protects them from damage.





A dense forest has a closed canopy and many small trees (left), which enables the fire to crown. This picture was taken in 1976 in an area that had not burned for 84 years.

The same area (below), taken within a month after the La Mesa fire, shows the result of crown fire. All of the trees have been consumed. Soil has become hydrophobic, which means that it repels water and does not absorb moisture. The hydrophobic soil is formed by the melting of resins in the thick needle layer found on the floor of dense canopy forests. The hard surface is eventually broken down by raindrops, the cycle of freezing and thawing, and decomposition. The hard surface can also be broken down by hand.





This site (left) had an open canopy and had burned in 1960, 17 years before the La Mesa fire. The fire did not crown but stayed on the ground, the heat scorching the lower branches. This picture was taken one year before the La Mesa fire.

The same area (below), taken within a month after the La Mesa fire, shows scorched trees and the duff layers of soil burned, but the trees were not killed.





The recovery process after crown fire takes much longer than recovery after ground fire. This picture (left) was taken in an area of crown fire within one year after the La Mesa fire. Note sprouted oak.

This is the same site (below) as left, taken 16 years after the La Mesa fire. Note that the native grasses and small ponderosa pines now dominate the site.





This picture (left) was taken in an area of ground fire one year after the La Mesa fire. Note that the native grasses and trees have recovered.

The same site as left (below) taken 23 years after the La Mesa fire.



maintaining a healthy forest



a mechanically
maintained mosaic

*O*n the Pajarito Plateau, there are thousands of acres of closed canopy forests prone to destructive crown fires. To reduce the fire risk and to return the forest to a more natural mosaic, various tools and techniques can be used, including thinning, chipping to reduce the slash from thinning, prescribed fire, and logging.





Crews work to thin a dense forest. Smaller trees may be cut down to reduce the number of trees per acre. Once these trees are cut down and trimmed, the logs can be hauled away and used for lumber or firewood. The trimmed material—called slash—is burned or chipped (bottom left) into mulch, which can be spread over bare ground for protection from erosion or stockpiled (bottom right) to be hauled away and used in other areas.

Prescribed fire can also be used to reduce the quantity of fuels lying on the forest floor and to return nutrient ash into the soil. Notice in the picture below left how prescribed fire has reduced downed logs to ash and new growth has begun.



a fire-maintained mosaic

A healthy forest is a mosaic of many elements: open canopies, closed canopies, meadows, and burned areas. In higher elevations, aspen is also included. Ideally, no one element dominates large expanses of land. Instead, a balanced mix is desired. The forest mosaic creates different habitat niches that accommodate more plant and animal species. Some animal species prefer meadows while others prefer the forest for habitat. Still, others will live in the forest but hunt in the meadow.

severely burned forest

Severely burned forests are created by crown fires in closed canopy forest that kill the trees and char the soil so badly that it

cannot absorb moisture. Insects are first to increase in population, becoming abundant and attracting insect-eating species such as lizards and birds. In the arid southwest, the dead trees will fall over after 5 to 8 years. A few will remain standing and are important habitat for flickers, blue birds, and woodpeckers. Over time (5 to 20 years), grasses and shrubs increase creating meadows.

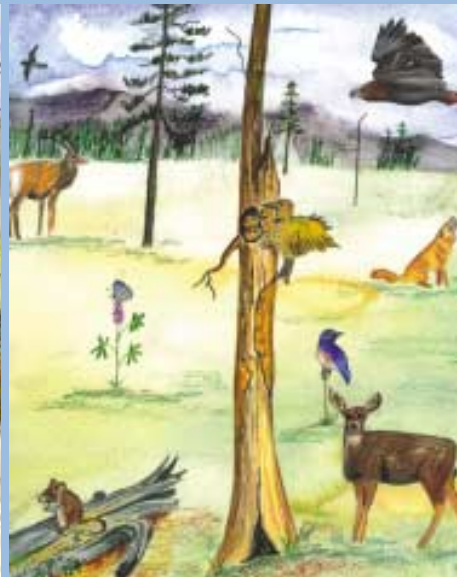
meadows

Coyotes and raptors such as the red-tailed hawk hunt for rabbits, mice, and other small mammals and reptiles. Butterflies are attracted to abundant and varied wildflowers. Deer

severely burned area



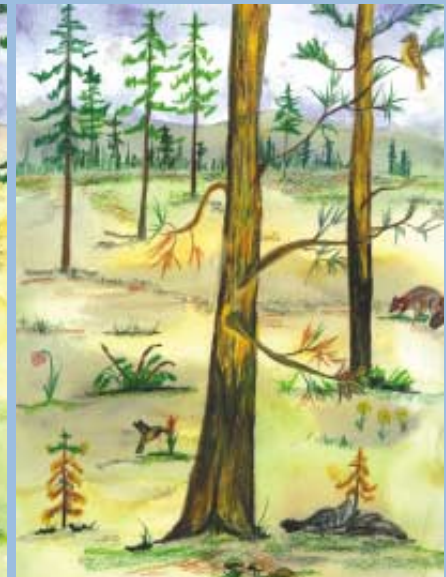
meadow



open canopy forest



lightly burned forest



and elk find the large expanses of grass and shrubs good areas to browse, graze, or bed down. Wild turkey and other game species increase in numbers.

open canopy forest

For the next 20 to 50 years, meadows grow into open canopy forest. With 50 to 100 trees per acre, these forests provide habitat for many species that use the tree canopy for protection. The variety of species in this habitat is more diverse than what is found in closed canopy forests. Some of these animals will live in the canopy but will venture out into the meadows to browse or to hunt.

lightly burned forest

The open canopy forest is maintained by periodic light fires, preventing the build up of fuels. These fires burn the grass, dead leaves, and pine needles that accumulate on the ground. Such fires also burn small trees and underbrush, thus maintaining the open canopy. Newly burned areas attract elk and deer as the nutrient-rich grass again grows in more vigorously. In time, the standing trees increase in size.

closed canopy forest

When no periodic light fires occur, the forest canopy thickens over time (50 to 150 years). Grass, dead leaves, and pine needles accumulate on the ground. Small trees form another layer underneath the upper canopy. The forest becomes closed with several hundred to greater than a thousand trees per acre. A few species, such as the mountain chickadee, Stellar's jay, and warbler use these dense stands of trees.

closed canopy forest



aspen forest



aspen forest

At higher elevations in mixed conifer forests, aspen becomes part of the mosaic. Trees like Douglas fir, spruce, and white fir have thin bark and are not as fire-resistant. Openings created by fire are replaced by aspen, which has a leafy canopy that shades young conifers that will again dominate the landscape after 150 to 200 years or so.

fire, the force of change



recovery of shrubs

Nature is adapted to fire. Even in areas of severe burn, change is immediate. As the tops of shrubs, like oak, and trees, like aspen, are removed by fire, mechanisms take place within the roots to begin sprouting. The fire-adapted species become pioneers in areas of moderate to intense burn. Through time, thickets of oak and other sprouting shrub species, such as New Mexico locust, mountain mahogany, and wild rose, add color to the landscape and become nurse plants for more shade-tolerant species.

A mountain slope burned in 1977 is dominated by Gambel oak in 2000 (left).



Hydrophobic soils (left) do not prevent oak from sprouting (center). Oak sprouts are 12 inches high or higher only two-and-a-half months after the Cerro Grande fire (right).



Sprouting species found in the summer of 2000 in the burned area of the Cerro Grande fire include Gambel oak (above left), choke cherry (above center), Rocky Mountain maple (above right), mountain mahogany (far left), and New Mexico locust (left).

recovery of aspen



Aspen is considered a “fire species” because it sprouts rapidly after fire and may be an indicator of past fire. Aspen groves near Pajarito Mountain ski area (above) may have had their origin from the mid-1800s.

Aspen groves in the Sangre de Cristo Mountains date back to the late 1800s (right).





After fire, aspen sprouts rapidly from the hundreds of roots under the ground surface.

Three months after the Cerro Grande fire, aspen had grown to about 3 feet (left).

You can see aspens sprouting from a root system about one month after the La Mesa fire (below far left). After one year, aspen are 4 to 5 feet tall (below), and, by 8 years, the trees are 10 to 12 feet tall (below center).

After 20 years, the trees are mature (below far right).



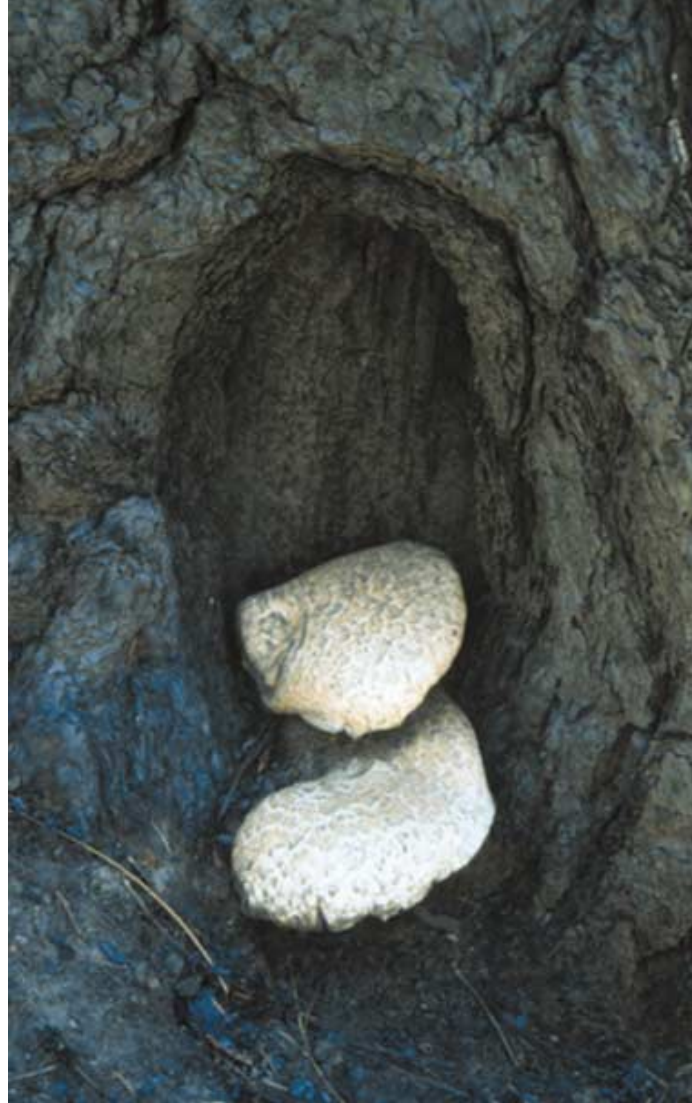
succession

Change is constant within the environment. But often we don't notice. When a tree falls in a forest allowing sunlight to enter, we don't notice the change. When a cool fire cleanses the forest floor, we note a freshness to the landscape but don't notice the change. When a catastrophic fire removes the forest canopy, change becomes apparent. The process of succession—the progression of species occupying a site—becomes more obvious and amazing. Within months after a fire, where there once were trees and grass, wildflowers can cover severely burned areas. The abundance of wildflowers is one of the early stages of succession after fire.



After fire, wildflowers are stimulated to grow, especially without competition from trees, shrubs, and grass. Wildflowers that were once seen in small numbers will be profuse. Fields of green thread (above) were seen in burned areas after the La Mesa fire. Other wildflowers include dogbane (right) and goldenrod (far right).



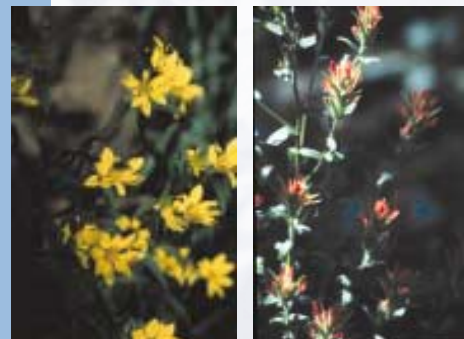


Fireweed (far left) is an early pioneer on burned areas. Fireweed was found in the Cerro Grande fire area at higher elevations.

Fungi (left) can be found on burned logs and on the ground.

Dayflower (lower left) is stimulated by fire, is rarely seen except in burned areas, and is often found in severely burned areas.

Golden-eye and Indian paintbrush (lower right) can be quite vibrant after fire because of the release of nutrients.





rehabilitation

After fire, rehabilitation efforts can help prevent erosion and further protect life and property.

Wattles (left) placed along drainages provide a catchment for seeds that would otherwise run off.

In June, community volunteers rake and spread seed and straw after the Cerro Grande fire (lower left).

By August, areas seeded and mulched after the Cerro Grande fire were green with annual grasses (lower right).





Slender wheatgrass was seeded on areas burned by the La Mesa, the Dome, and the Cerro Grande fires. Within the first two years after the La Mesa fire, burned areas were covered with the seeded grass (left). Through time, slender wheatgrass decreased and native grasses, such as mountain muhly, little bluestem, and pine dropseed, increased. Today, very little slender wheatgrass is found in areas burned by the La Mesa fire.

Areas burned by the Dome fire in 1996 still have an abundance of slender wheatgrass.





recovery of grass

Rehabilitation of areas moderately and severely burned include the spreading of grass seed of species not native to this region. These species are used because they germinate quickly, which provides erosion control sooner, but die out as native species recover and eventually dominate.



Needle-fall from burned trees acts like mulch (right).

Where root crowns have not been damaged, native grasses sprout rapidly (far right). Many seeded perennials will need winter months of moisture to begin to sprout.





However, not all areas are seeded with grass. The top picture on page 26 is an area not seeded and is dominated by a weedy species one year after the La Mesa fire. The top picture on page 27 is a seeded area and is dominated by nonnative grass one year after the La Mesa fire. After 21 years, both sites are once again dominated by native grasses, such as little bluestem, mountain muhly, and blue grama.



Within areas burned by the Cerro Grande fire, needle-fall has increased germination of seeded grasses. In areas where there is no natural or straw mulch there is less germination as of September 2000 (right).

Needle-fall from burned trees increased the rate of germination of grasses in the area burned by the La Mesa fire (far right).



wildlife

Animals adapt to fire, especially if the fires are ground fires. Very often, wildlife merely move away as the forest burns. In fact, such animals as the coyote have been observed waiting at the perimeter of the fire to capture small mammals, like mice and rabbits, moving out of the area. Expansive fires cause loss of habitat for various species and sometimes cause them to move into another's territory. This can cause conflict and animals can be more aggressive for a time.



This flammulated owl chick (right) was found in a burned area of the Cerro Grande fire.

New growth of shrubs and grass a year after fire attracts deer (above) and elk (far right).





After fire a diversity of species can be found.

Owls hunt for prey in open areas. Deer and elk are attracted to the new succulent shoots of grasses and shrubs.

Lizards forage on ants and other insects. This prairie lizard (left) was found in a severely burned area of the Oso fire soon after the fire.

Butterflies must lay their eggs on specific plants. Caterpillars of the blue butterfly, depicted in the painting (below far left), can only feed on lupines (below left). After fire, lupines increase and so do the butterflies.



When wildfire comes during calving or fawning, some young can be lost. However, species like elk and deer increase once forage has returned.



seeing the unseen



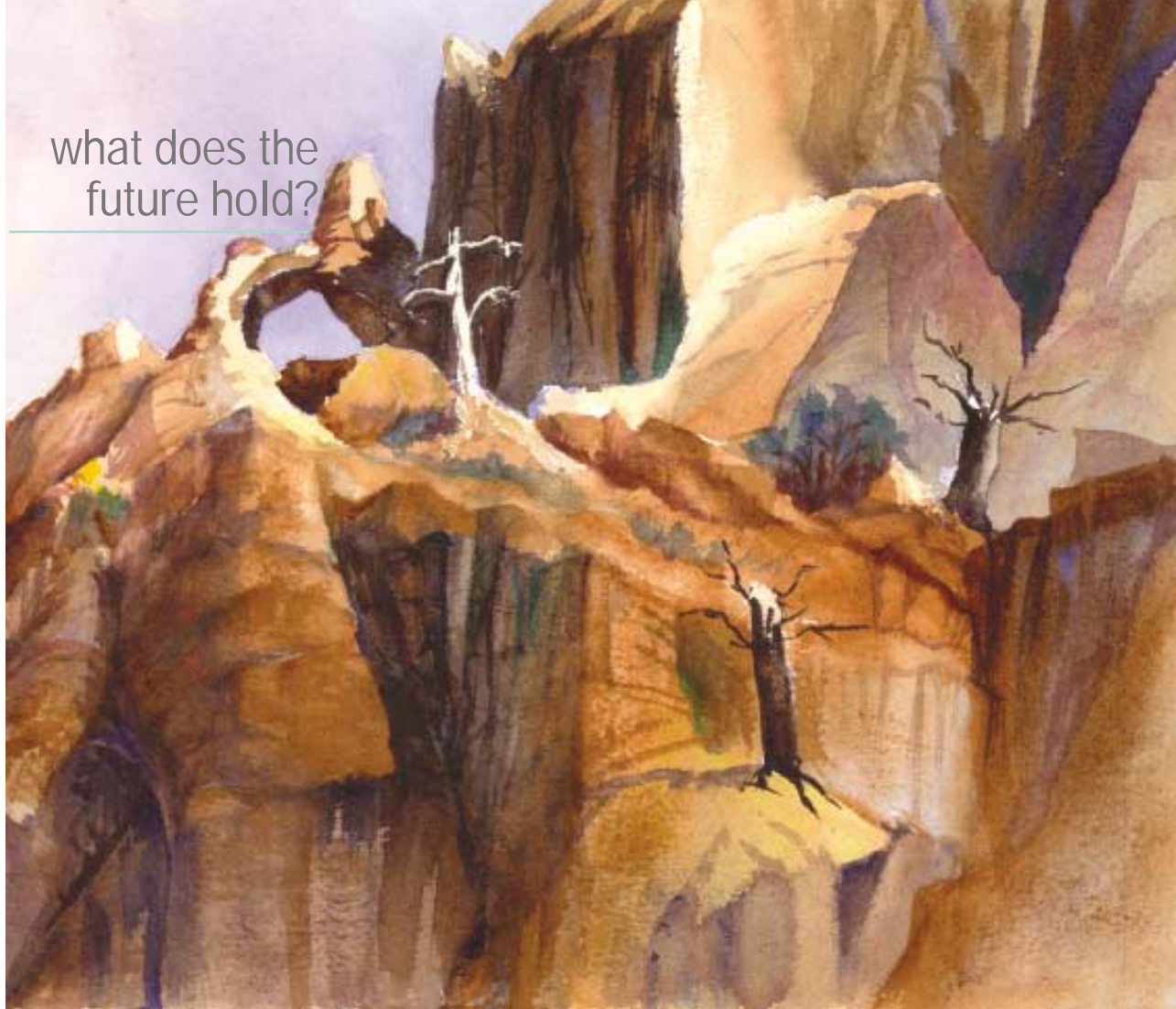
*T*rees hold a special significance to all of us. Trees shade us, live longer than us, and provide for us. When we walk in a forest, we revel in the trees. When the trees are gone, we grieve. We may feel that “all is lost.” But fire can reveal the hidden. Many more archaeological sites have been located both in Bandelier and Mesa Verde National Monuments after fire. What was once hidden by the forest is now seen. We begin to see large things such as rocks and vistas and small things such as spider webs and ants. Our eye for beauty is expanded.





When severe fire passes through an area, most of the trees either burn away or fall over. Sights and scenery previously hidden by the trees become visible. Examples include rock structures and rock faces (far left and left), dramatic vistas, like the view of Boundary Peak from the La Mesa fire area (bottom, far left), and small wildlife, including squirrels (bottom left) and spiders (bottom right).





what does the
future hold?

The Mitchell Trail, a once favorite trail of hikers and bikers, is within the severely burned zone of the Cerro Grande fire. A walk along the trail reveals the hidden. An arch within the rock formations (left) was once unseen from the trail before the fire because of the tree canopy. To view the arch

required hiking a steep slope. Now, through the blackened trees, the arch is visible from the trail and will become more visible through time as the burned trees fall over (right). There are plans to rehabilitate the trail, making it more accessible to those who wish to enjoy the rocky landscape.



The Mitchell Trail as it was in 1994 (top left), June 2000 (top center), and August 2000 (top right). Notice the oak sprouting in the most recent photo, as well as how runoff has washed away rocks and debris.

These thumbnail sketches show what the area might look like in 5 to 8 years (far left) and in 25 years (left).

the mountain. . .

as it was

Looking west, July 1999



Aldo Leopold, the great conservationist, spent his early years in New Mexico. Over 50 years ago, the classic *Sand County Almanac* was published. What was unique about Leopold was his willingness to look back at his career and see what he did right and what he did wrong. He used his lessons and mistakes to impact the future. He understood that, in a short lifetime, he could not fully comprehend the changes. In one of his essays, he says it was the mountain that missed the cry of the wolf [or felt the scorch of fire]. It was the mountain that beheld history long enough to see changes and the impact of those changes on future generations.



as it is
as it will be

And so it is. As with Leopold, the Jemez Mountains are our 'mountain' that will survive longer than we will to see how the area ultimately recovers. We, from our brief knowledge, can predict only a mere 25 years, knowing that it will take far longer than our lifetimes to see the mountain covered with forests again. Today we look at the mountain and see the dead trees standing like toothpicks on the ridges. We know that those trees will fall within the next 5 to 8 years. Next spring the flowers will bloom and the mountain will begin to green again with grass and oak. In the fall it will have the gold and brown of the ripening oaks, aspens, and grass.

We will walk trails and discover things we did not see before. We will be amazed by the change. We will find that the mountain has a new beauty. We will see that it has color and

life that has arisen from the ashes. But only the mountain will survive long enough to see all the changes and their impact on future generations.

some reading

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