Contact your local State Forester or any USDA Forest Service office for additional information about what you can do to protect your family, home, personal property and surrounding forests.

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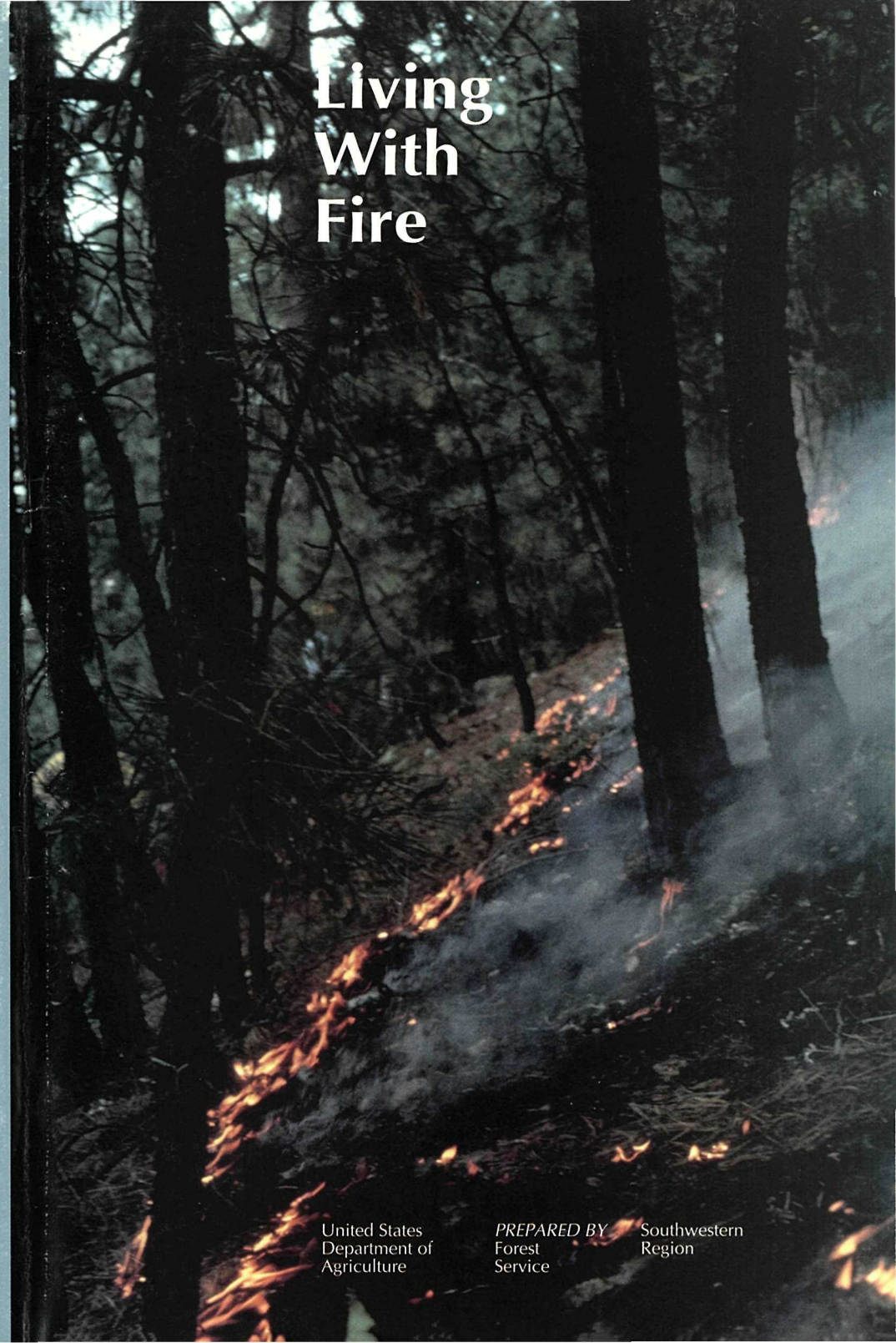
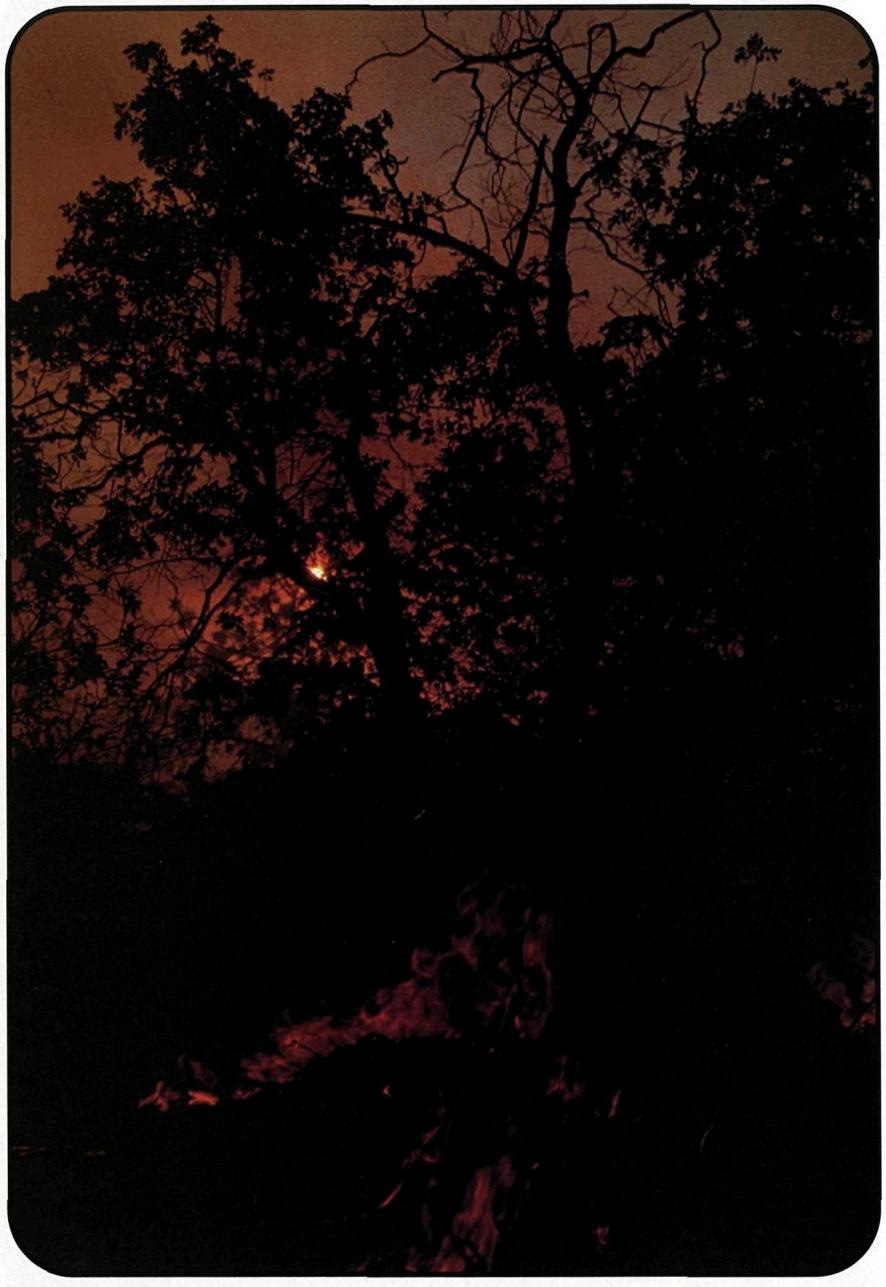


Living With Fire

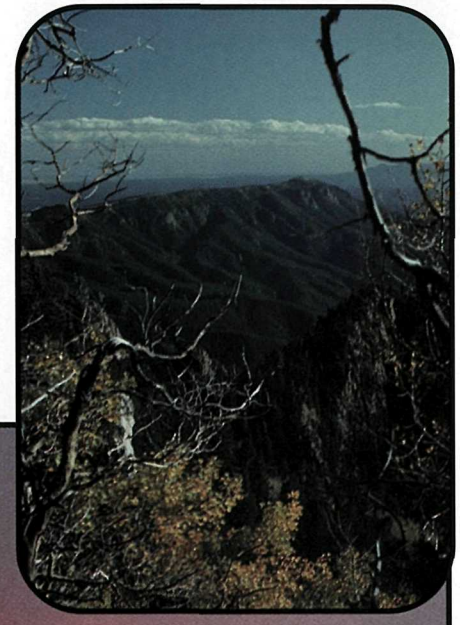
United States Department of Agriculture

PREPARED BY Forest Service Southwestern Region

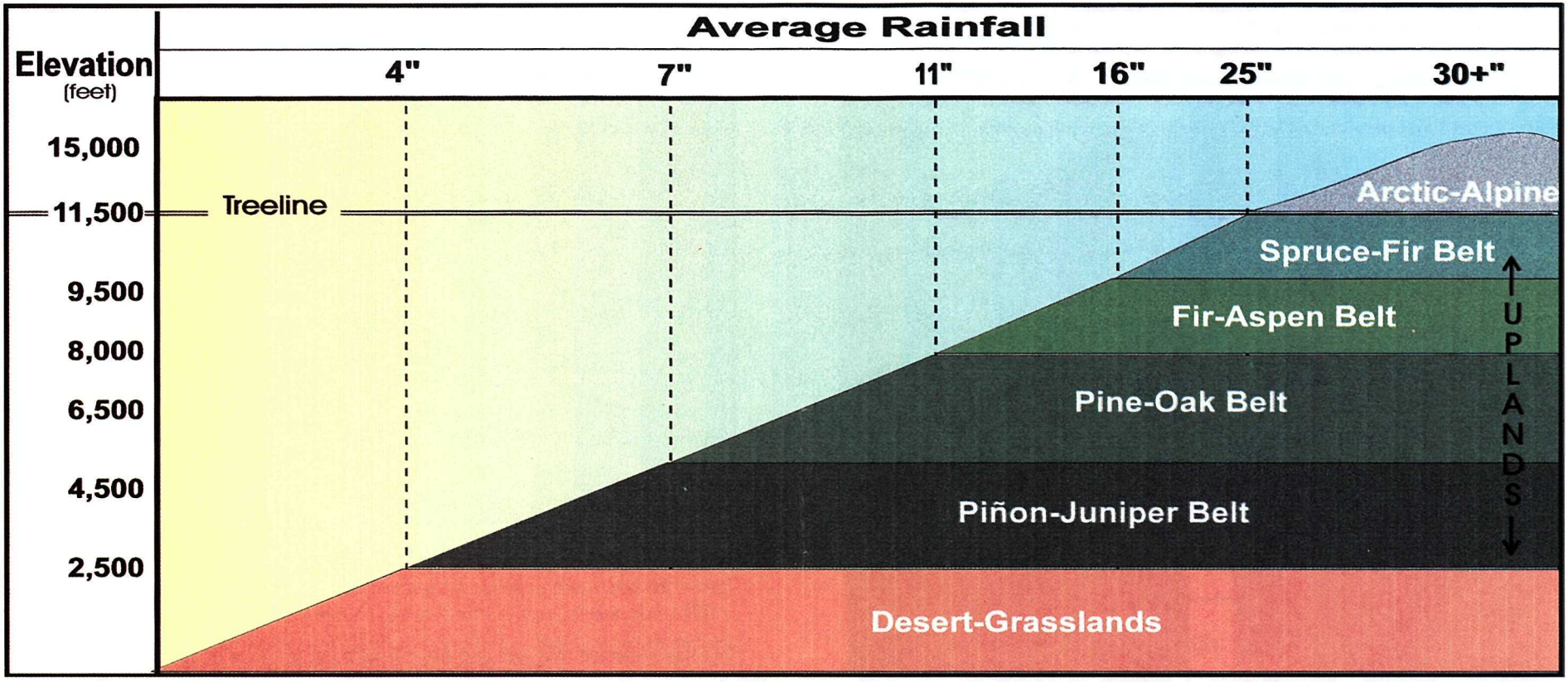


Fire!

Let this powerful natural force work for, not against you. Learn the natural role it's played on Earth throughout time and how you can help restore that natural role. Learn to ensure your personal safety and that of your family and forests. Through this publication, you'll see the various faces of fire and the part you play in ecosystems of the Southwest.



Southwest Vegetation Zones



Understanding the vegetation zones of the Southwest is key to understanding fire's role.

To learn how fire has shaped the health of Southwestern ecosystems, we need to understand the properties of different vegetation zones.

The Southwest is unique in that its vegetation zones are far more distinct than such zones are in other parts of the country. Fire behaves differently in each of the vegetation zones of the Southwest. Every 1,000 feet you rise in elevation is like traveling 400 to 500 miles north in latitude. Temperatures differ as much as 20 degrees from lower to higher elevations in Southwest mountains. While average rainfall varies from 4 to 30 inches, these differences create the vegetation zones that react differently to fire.

Under natural conditions, fire in the ponderosa pine and oak zone elevation (shown in the chart above) acts as a selective force, burning at a low intensity on a 7- to 10-year cycle.

At higher elevations, the fir-aspen zone and above, fire burns less frequently—a cycle of up to 100 years or greater. When fire does occur, it can be hotter and less selective than fire in lower vegetation zones, similar to what occurred in Yellowstone National Park.

In the Southwest, piñon-juniper and desert grasslands need an accumulation of vegetative fuels to burn. These zones burn most actively when a wet period is followed by a dry period, fluctuating between periods of 5- to 30-year cycles. Often, vegetation is a determining factor for ecosystems.

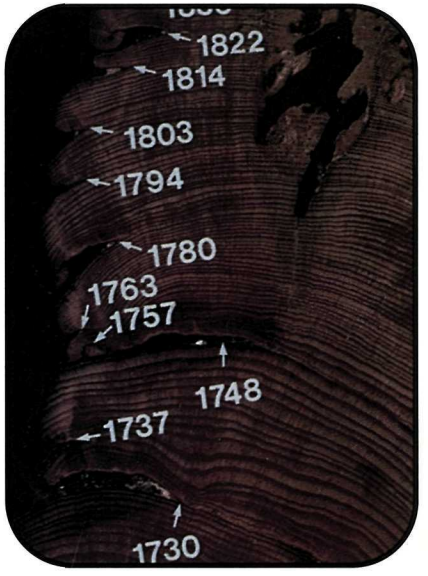
Tree Rings and Fire Scars

If the story of the future is found in history, there is much to learn from the history spelled out in the tree rings and fire scars of the Southwest.

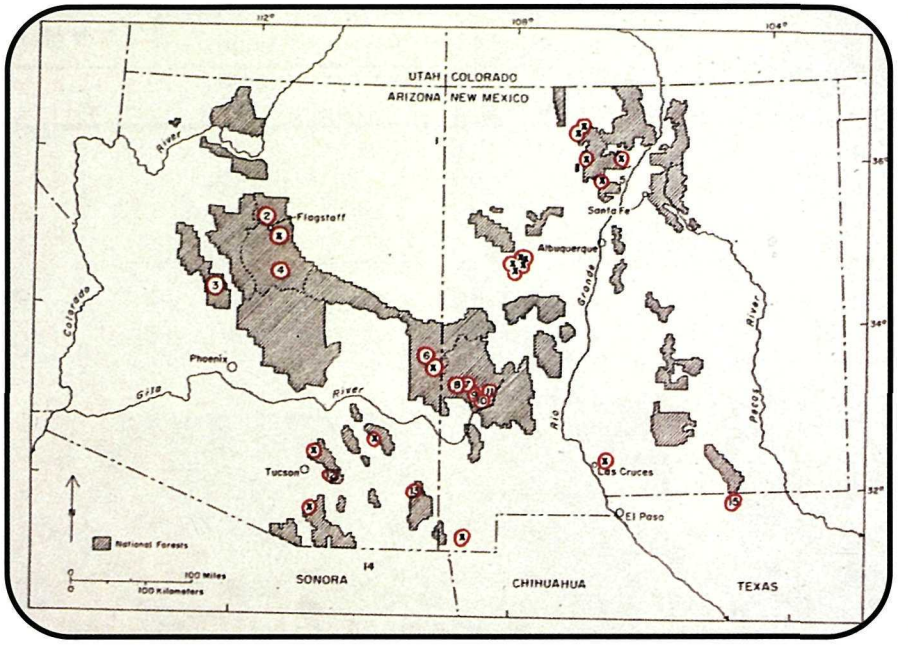
Over the past 10 years, different tree ring studies have been conducted throughout the Southwest by the University of Arizona's Tree Ring Laboratory. These studies have provided much information about the mountain ranges of the Southwest and how often fire visited them in the past.

Not only do the rings tell a story, but fire scars are studied also. Once a tree is scarred, every fire that passes re-scars the tree, leaving a marker on the tree to be read in the future. Scarred material has been found in dead material lying on the forest floor as well as in standing dead trees.

Fire-scarred white fir in Arizona.



Sample dated by the University of Arizona's Tree Ring Laboratory.

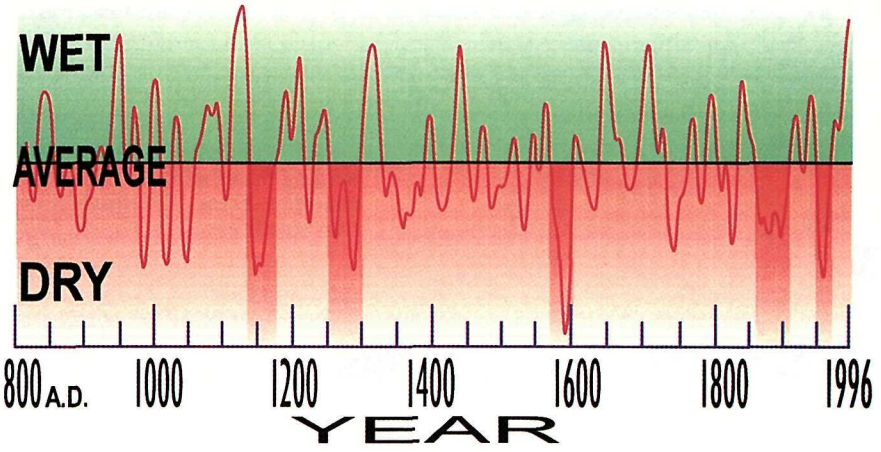


Locations of fire history study sites in the Southwest through 1992.

We have learned that wet and dry climatic cycles have occurred in the last 2,000 years throughout the Southwest. From fire scars, we have learned what kind of fires occurred and in which years. Past fire size and intensity can be determined by sampling different trees and determining if they were visited by fire in the same years.

The stories of the past have helped us determine what role fire should play in the future and that fire has always been a crucial force in the ecology of mountains in the Southwest.

Southwest Drought Index



The drought index pictured here is based on a tree-ring chronology from the Sandia Mountains in New Mexico. The drought trend shown can be applied throughout the Southwest.

The center line represents the average of all the years surveyed. Parts of the curve above the center line represent years of higher than average precipitation. Parts of the curve below the center line represent years of lower than average precipitation. Periods of drought occurred in the mid-1100's and 1200's, 1570 through 1580, at the turn of the 20th Century, and in the 1950's. Although wildfires occur in all precipitation conditions, fires that occur during and just after periods of drought are larger and more intense.

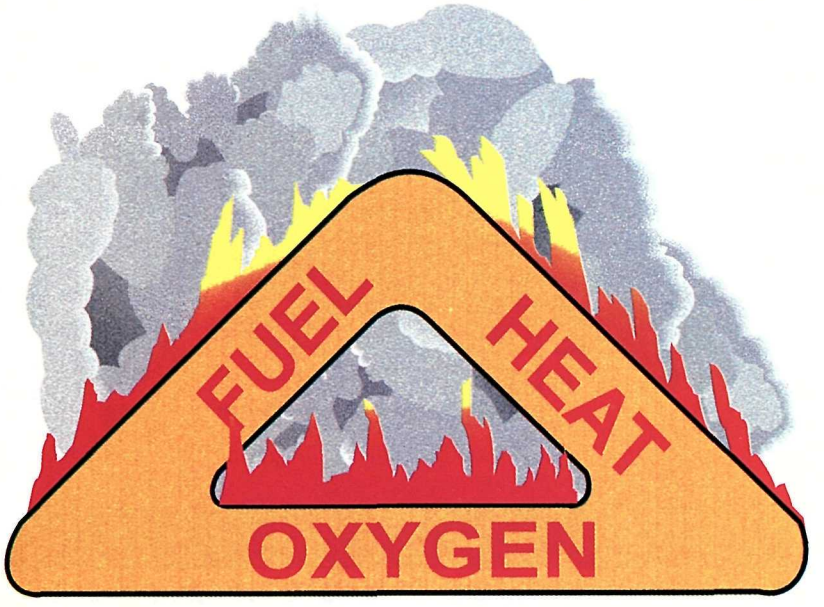
It is no coincidence that a policy of total fire suppression was implemented at the turn of the 20th Century. Large, devastating fires were occurring in the United States, partially due to drought conditions. The fires burned entire towns and killed many people, from Wisconsin to Washington to Texas. Relief from the fires came through fire suppression combined with an end of the drought.

The last long drought period for the Southwest was in the 1950's. The 1970's and 1980's have been some of the wettest on record. Can you guess what that means for the future?

Understanding fire means understanding its behavior and some basic fire terms you may have heard before, which are taken from basic fire training courses for firefighters.

Behavior Of Wildland Fire

Availability of oxygen, heat, and fuel dictate how a fire will behave. If any of these elements are missing, fire will not spread. Heat is supplied by a lightning bolt, match, or ongoing fire. Fuel is anything that will burn, including grass, shrubs, trees, material lying on the ground, and sometimes structures.

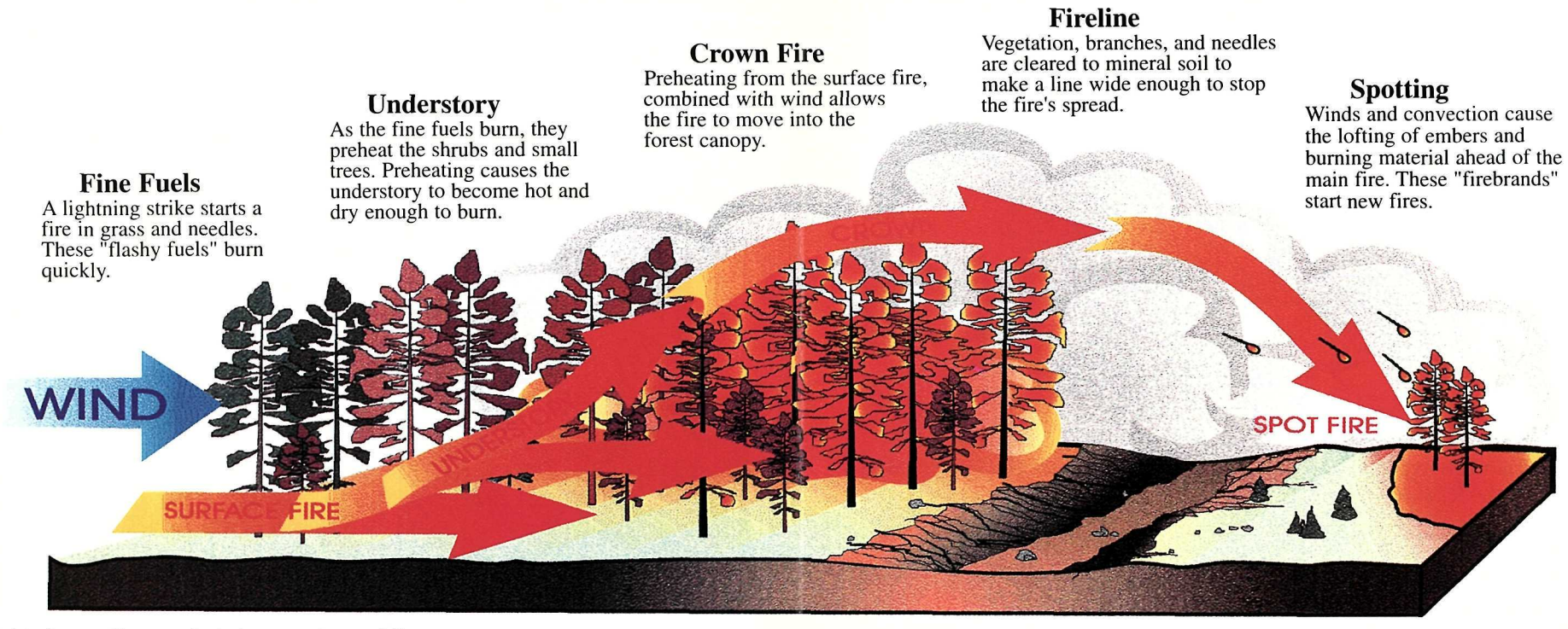


Understanding the Fire Triangle

If fuel, heat, or oxygen are lessened, fire changes with them. For example:

- Building firelines breaks the fuel "leg" of the fire triangle by removing fuel from the path of moving fire. This is done by fire crews, equipment, and aircraft.
- The heat side of the fire triangle is broken by cooler weather and higher humidities. In firefighting, helicopters and air tankers drop water and fire retardant; engines carry limited water.
- Smothering a fire with dirt, water, or foam breaks the oxygen side of the triangle. Wind increases the amount of oxygen available to a fire, increasing the fire's intensity.

Fire also interacts with the natural landscape. Topography, fuel, and weather are the three major influences on fire behavior.



This diagram illustrates fire behavior on large wildfires.

Wildfire has many faces that change over space (landscape) and time. As temperatures rise and humidity drops, fires will burn more intensely. Conversely, when temperatures drop and humidity rises, fires burn less intensely.

Fine Fuels like grass react quickly to temperature and humidity changes. They can dry within minutes.

Understory vegetation within five feet of the forest floor and downed logs do not react as quickly as fine fuels.

Crown Fire occurs when the fuels in the understory are dense enough to form a "ladder" and carry fire into the trees.

Fireline varies in width based on how hot the fire is and how far it is spotting.

Spotting occurs when humidity drops below 20% and winds carry pieces of burning debris, "firebrands," into vegetation ahead of the fire.

Each year, millions of acres of desert, grassland, and forest, and many communities are at high risk from wildfire. If you live or recreate in these areas, it's important to understand that risk is the chance of damage or loss of life, property, and wildland values from wildfire. Many people have been willing to take these risks but the consequences have been tragic. Annually, many homes are destroyed and at times firefighters' lives are lost fighting catastrophic wildfires.

The Current Situation

Current vegetative conditions in the Southwest are unnatural and potentially highly flammable. They are the result of a century of fire suppression and past public values and policies, coupled with a growing trend of people moving to the wildlands. This has caused a fire environment prone to catastrophic fire that will periodically overwhelm our best efforts to prevent and suppress wildfires.

The Solution

Preventing catastrophic wildfire requires a major change in the way we view wildfire. We can no longer count entirely on fire suppression with fire engines, air tankers, and hand crews. We can weaken catastrophic wildfire by:

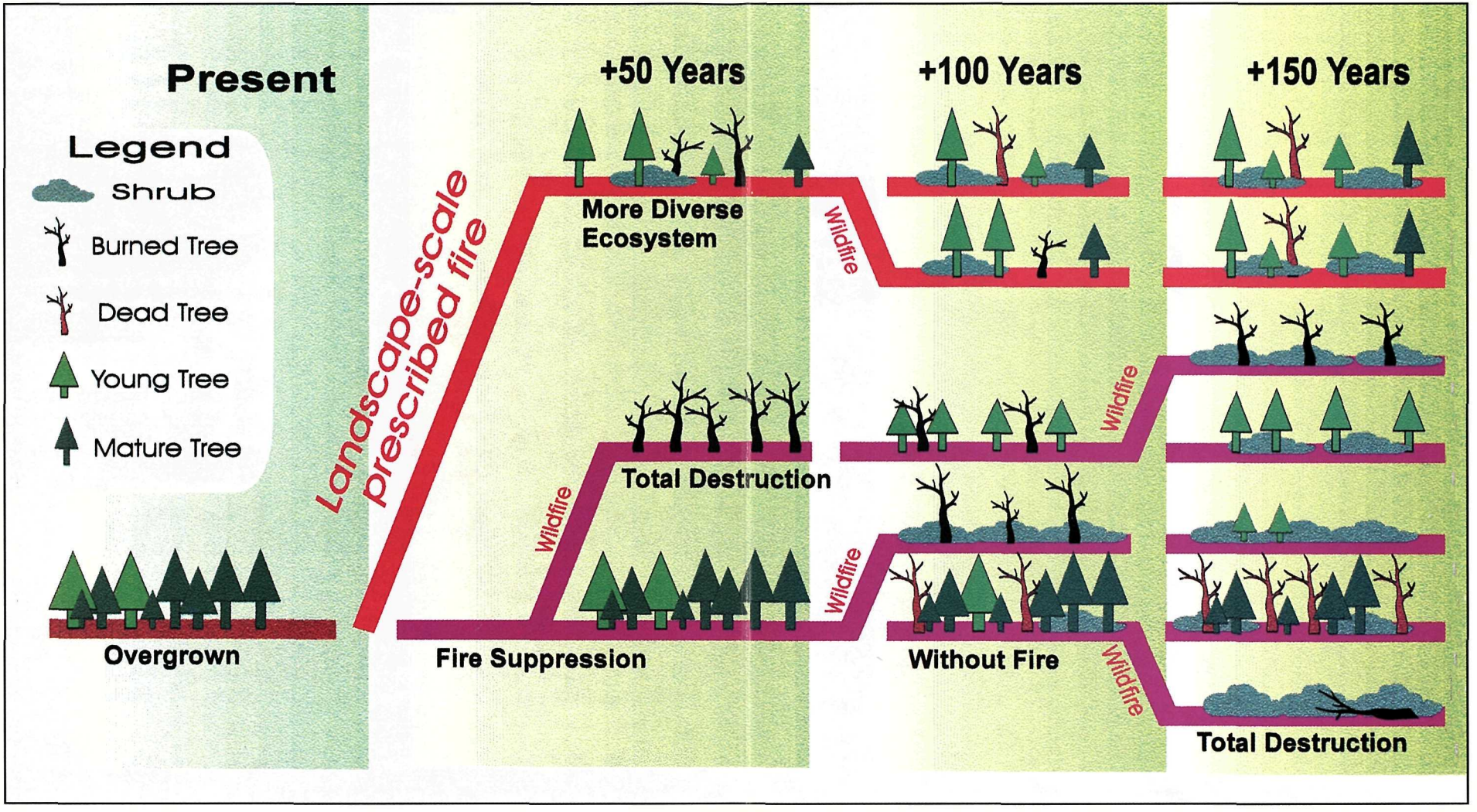
- reducing natural and unnatural fuel buildup;
- breaking up large, continuous areas that are at higher risk from wildfire; and
- improving rural building standards and codes.

Lesson Learned: Fighting Fire With Fire!

One of our best tools for fighting wildfire is prescribed fire. Used on a landscape scale along with other land management practices, prescribed fire can help create a healthier, safer, more maintainable land condition. As shown in the diagram, the forest maintained by prescribed fire is much less susceptible to catastrophic wildfire, or insect and disease outbreaks. Allowing today's conditions to continue unchecked is a prescription for disaster.

Pay Now or Pay Later

Prescribed fire is expensive, but not nearly as much as fighting wildfire. More than $250 million is spent annually on firefighters laboring to save timber, wildlife habitat, and dream homes. If conditions are allowed to stay as they are or worsen, the cost of fire suppression will continue to rise. The smaller investment in pre-treating areas to make them less flammable is money well spent in the long run.



"Pay Now Or Pay Later" chart shows the risk of not doing prescribed burning.

Note that even when wildfire burns in areas previously burned with prescribed fire (as shown above the red lines), damage is minimal. But dense forests in which fires have always been suppressed are vulnerable to highly destructive wildfires (shown above the pink lines). Once burned, they can take over a century to recover.

Shrubs replace trees in the forest's cycle of life as the first step of vegetation after a fire.

Even without wildfire, an ecosystem's health fades.

What Is the Wildland/Urban Interface?

"Wildland/urban interface" is the point where rural meets urban. Often, this leads to conflict between urban and rural values and expectations of how natural resources should be managed. From the standpoint of wildfire, the "interface" is where combustible homes meet combustible vegetation.

Over the past 10 years, many private homes, property, and lives have succumbed to wildfire. Each year, about 112,000 fires start on forest, brush, and grasslands, destroying an average of 5 million acres. The chilling scenario is all too familiar, repeated in places like Oakland, Spokane, Payson, and Boulder, and suffered by all 50 states at one time or another.

Although well-intentioned over the past century, the practice of quickly, effectively suppressing all fires on public lands has taken its ecological toll. By excluding periodic, small fires from the natural equation, Americans have unwittingly increased the danger of living near forests and grasslands.

The risk to those who live in the wildland/urban interface is real. Fortunately, so are the solutions.

What Are The Solutions?

Fire managers know that under the right circumstances, fire is a valuable tool for restoring and maintaining the health of forests and grasslands. The solutions lie in proper use of prescribed fire and in private landowners taking responsibility for reducing the threat of wildfire to their homes.

What Are The Tradeoffs?

- With quiet, isolated, inexpensive rural living comes life in a "tinderbox."
- With the shelter and seclusion of a home in the woods comes the hazard of living in a home surrounded by combustible vegetation.
- Rural living also means trading structural fire protection for wildland fire protection—longer emergency response times; equipment differences; few if any water sources; firefighters trained to protect natural resources, not private property.

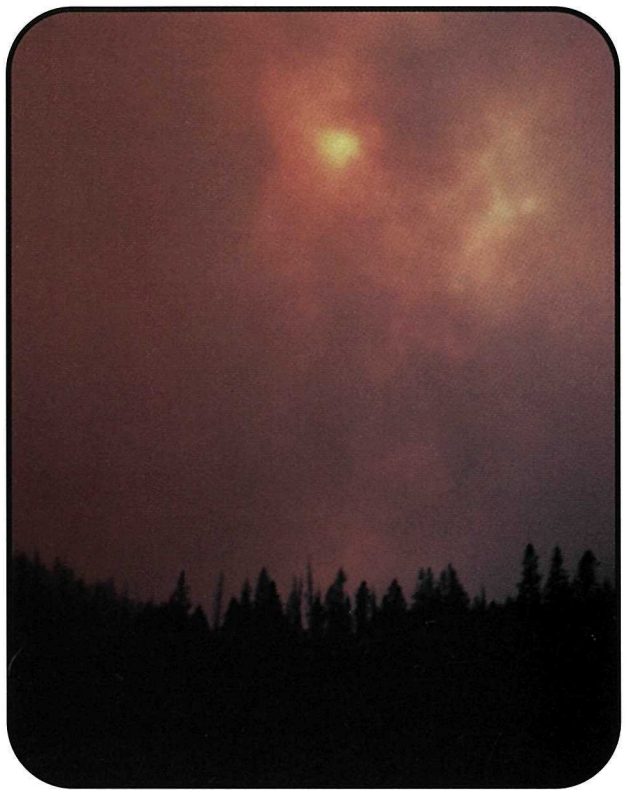
People have built homes on steep slopes. Homes are surrounded by dense, flammable trees and shrubs. Firewood and propane tanks are stored next to homes. Other hazards include shake roofs on houses, tree limbs hanging above or touching roofs, poor access for emergency vehicles, and inadequate outdoor water supplies.

Property owners in the interface must actively protect their property from fire by creating defensible space. Information is available at local offices of state and federal natural resource agencies.

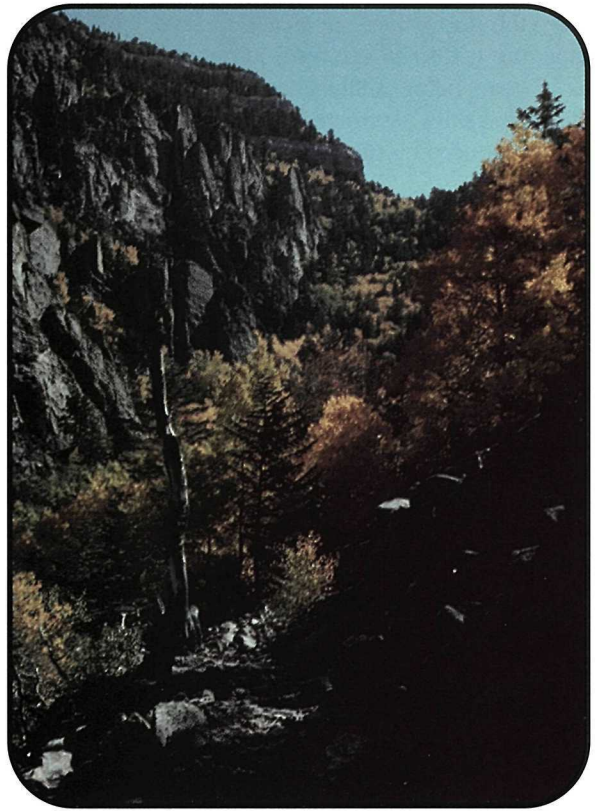
By using prescribed fire, we can restore and maintain forests and grasslands as diverse, healthy ecosystems that face less risk of wildfire. Areas treated with prescribed fire are less likely to burn intensely. Wildfires that start in these treated areas cause less resource damage and are easier and less expensive to control.

Benefits of Prescribed Fire

- Reduces buildup of natural and human-caused forest fuels.
- Creates the biological diversity needed by wildlife.
- Prepares the land for new growth.
- Controls vegetation.
- Encourages a healthy variety of plants, many of which are food for wildlife.



Planning Prescribed Fire



Prescribed fires are planned months in advance. Special considerations include smoke-sensitive areas, wildlife habitat, expected fire behavior based on computer models, weather forecasts and patterns, and natural barriers such as rock and water to control the fire's spread.

A prescribed fire plan includes a range of weather conditions, the ignition pattern, a holding plan outlining needed firefighters and equipment, mop-up and monitoring, escaped fire contingencies, smoke management, public information, and monitoring the project's success.

Time of year is also crucial to success. Most prescribed burning is done in the fall and early spring because conditions are right for burning the understory. Winter is the best time for burning slash piles since surrounding snow provides a natural buffer. Spring fires improve wildlife and range habitat by providing nitrogen as desired plants begin growing. During the summer, fires are controlled if they pose a threat to life and property.

Smoke Is Natural

From the study of tree rings and fire scars, we have discovered that ponderosa pine forests throughout the Southwest burned on the average of once every 5 to 12 years before settlers came to the area. There were times when the crystal-clear blue skies associated with our mountain vistas were obscured by smoke from uncontrolled wildfires.

Generally, the wildfires were of low intensity, burning only small amounts of fuel accumulation in the short period since the last burn. As settlers moved in and began to extinguish fires, the number of smoky days was reduced, but the forest fuels began to increase.

These time-lapse photos show smoke dispersal over an 8-hour period during a summer day in the skies above Gila National Forest in southwestern New Mexico.

Smoke Management

With our use of fire as a management tool, smoke management has become important to fire managers. Prescribed fires produce varying quantities of smoke, and prescribed fires can be planned to minimize smoke production.

When weather changes and creates a situation where smoke lingers over an area, burning is discontinued until weather conditions become suitable. Prescriptions used today for prescribed burns provide for rapid smoke dispersal and reduction of lingering haze.

Total smoke released into the air will happen in either of two ways—heavy smoke over a short period during a wildfire or less smoke at more favorable conditions with prescribed fire.