THREATS TO FOREST HEALTH PUT ARIZONA AT RISK

Why Healthy Forests Matter to Our Health, Environment, Economy & Quality of Life

ARIZONA FORWARD

October 1, 2015

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Dear Reader:

It's true what they say – sometimes you can't see the forest for the trees. That may be why most Arizonans feel powerless to do anything about the devastating fires that have scarred our state's landscape, tarnished our watersheds, depressed our economy and threatened our quality of life.

Some perceive forest health issues are only relevant in Northern Arizona. Too many of us are oblivious to the impact forest ecosystems have on everyone who lives in the Grand Canyon State from Flagstaff to Phoenix and all the way to Tucson, and beyond.

Were it not for the rains we had in June and July of this year, the loss of life and property Californians recently experienced as a result of rampant wildfires could have happened here. This matters to all of us – we need to pay attention, get educated and be part of the solution.

Arizona Forward has developed this primer to provide you with unbiased facts, background information and viable options to consider as our state moves forward with efforts to restore and maintain healthy forests.

Our business-based environmental public interest organization has been bringing public, private, non-profit and educational sectors together to convene thoughtful dialogue and action on sustainability issues since its founding in 1969. We are a non-partisan "Do Tank" with a basic agenda focused on: land use planning and open space, water management, transportation and air quality, energy, and healthy communities, in addition to forest health.

We appreciate the expertise and support of our members and friends who participated in the development of this primer. A special thanks to: Eric Marcus of the Sustainable Economic Development Initiative; Bruce Hallin of Salt River Project; Bill Meek, former Chair of Arizona Forward; Debra Duerr of Godec Randall & Associates; along with the Ecological Restoration Institute at Northern Arizona University and The Nature Conservancy in Arizona.

We hope this document will serve as a catalyst for discussion to further awareness of the importance of healthy forests to all Arizonans, as well as to help find workable and affordable solutions to this urgent statewide issue.

Please be informed and get involved.

Sincerely,

Diane Brossart

Diane Brossart
President & CEO
Arizona Forward

TABLE OF CONTENTS

"We came to a glorious forest of lofty pines, through which we have traveled ten miles. The country was beautifully undulating…every foot being covered with the finest grass, and beautiful broad grassy vales extending in every direction. The forest was perfectly open and unencumbered with brush wood, so that the traveling was excellent."

E.F. Beale expedition, 1858

EXECUTIVE SUMMARY

In recent decades, Arizona's desert cities have added millions of new residents. And they have watched while huge wildfires ravaged Arizona forests, leaving more than a million acres of scorched earth, devastated watershed, and land with no defense against flooding and downstream contamination. Why? Government mismanagement? Lack of money? Mother Nature gone wild? All of the above?

For many desert dwellers with little or no information, a forest in flames is just another tragic story on the nightly news. But the time is past for urban Arizonans to behave like spectators. We must all understand what is at stake in forest health and what we can and should do to protect Arizona's forests.

Healthy forests are critical to maintaining a robust Arizona economy. In addition to being places of beauty, they are custodians of the very air and water we need to survive. Today, threats to our forests' health are putting Arizona at risk.

Chronic drought and decades of fire suppression have led to increasingly unhealthy forest conditions across the state. Long-term buildup of forest fuels and high tree density have caused a dramatic increase in the threat of catastrophic wildfire. Communities throughout Arizona along with animal habitats and watersheds, have become vulnerable to destruction.

All Arizonans Depend on Healthy Forests

It is critical for Arizonans to understand that unhealthy forests impact all of us – no matter where in the state we live:

- Putting lives at risk
- Threatening our water supply
- Harming air and water quality
- Endangering wildlife
- Causing flooding and soil erosion
- Costing hundreds of millions of dollars in damage to homes and businesses
- Reducing sales and property tax revenues that support our infrastructure

Arizona’s forests are critical to our water supply, billions of dollars of agricultural production, and vast economic activity. The next “megafire” could compromise the viability of northern Arizona’s communities and the water supply of the central and southern parts of the state.

Here’s what healthy forests do for us:

- Provide the majority of drinking water for our residents
- Bring tourists who spend billions of dollars throughout the state
- Provide habitat that sustains wildlife and forest biodiversity
- Reduce the risks of costly wildfires that threaten our homes and businesses
- Reduce greenhouse gas emissions
- Produce water that generates hydroelectric energy

- Improve water quality while lessening water treatment and facility costs
- Preserve our valuable natural resources, provide recreational opportunities and enhance our quality of life.

Healthy forests collect rain and snow melt that feed our rivers and streams, helping ensure an adequate water supply, while unhealthy forests that experience catastrophic wildfires contaminate water supplies and reduce the useful life of reservoirs. Investment in restorative treatments in Arizona's forests helps ensure healthy and resilient water supplies for the future. Ron Lehr, former President of the Denver Water Board, describes it simply: “We realized water doesn’t come out of the stream—it comes out of the forest.”

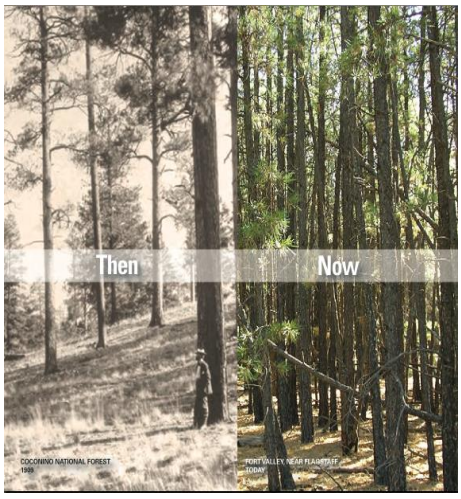
In fact, when the Salt River was dammed at the turn of the last century, the forest preserves above the Mogollon Rim were established to ensure that the Salt River Valley would always have a reliable water supply. Unfortunately, recent practices have put the Salt and Verde river watersheds at great risk.

Arizona's forests are a vital asset to the state's economy producing the water supplies that are fundamental to life in the desert. “If we want economic development within the greater Phoenix metro area, we have to ensure that there’s certainty associated with the water supply,” according to Bruce Hallin, Salt River Project (SRP) Director of Water Rights and Contracts. “To achieve that degree of certainty requires a water supply that can withstand prolonged periods of drought from a healthy and resilient watershed. A resilient and healthy watershed built on the foundation of healthy forests.”

Defining Healthy Forests

A healthy forest consists of small groves of trees with large openings between them filled with lush grasses and wildflowers. The individual trees in a healthy forest have greater access to water, sunshine, and nutrients than when they are crowded together. A forest made up of more widely spaced trees also has a substantially lower risk of catastrophic wildfire, instead supporting frequent low-intensity ground fires that rejuvenate soils and regulate the density of vegetation.

Healthy forests show increased resistance to bark beetle infestations. In 2002 vast swaths of Arizona's ponderosa pine forest were killed due to bark beetle infestation that was exacerbated by drought conditions. These forested lands also support an ecosystem consisting of diverse wildlife species including insect pollinators, birds, and small mammals. Overall, forests which retain their natural state or have received restoration treatments are healthier and are more resilient to drought, crown fire, and insect invasions. Although people frequently focus on the trees in the forest, the adjacent plants are the key producers that support the complex food webs that sustain wildlife and forest biodiversity.



Under pre-settlement conditions, healthy Arizona forests consisted of about 50 trees per acre. Today, that same acre supports up to 1,000 trees. Much of that growth is small diameter trees which, due to competition for nutrients and water, are much less healthy, highly susceptible to insect infestation and disease, and have become a substantial fuel load for wildfires. The consequence is when fires occur in the dense forests we see today, they burn hotter and typically result in fires that are catastrophic in size and destruction. Following a devastating fire, soil is scorched and vegetation is lost. The soils are unable to retain and absorb rain, causing enormous amounts of runoff that pour down burned slopes and cause flooding below. These post-fire floods are unpredictable and extremely dangerous. They carry significant loads of ash, sediment, and debris downstream that destroy fish habitats and riparian areas and reduce the available storage capacity of downstream reservoirs. This water is also costly for cities to treat and adversely affects the taste and purity of the water we drink.

The Cost of Wildfires

The direct costs of a wildfire event include the cost to suppress the fire, property losses, damage to utility lines and roads, damage to recreation resources, aid to evacuated residents, health-related impacts and post-fire flood damage. The indirect costs of a wildfire are equally heavy, the effects of which can be felt long after the wildfire has been put out. These include lost tax revenue, decreased property values, lost business revenue and a loss of ecosystem services. Throughout Arizona, one of the biggest impacts to businesses includes the loss of revenue as tourism declines. When the forests burn, many tourists stop coming. Restaurants, hotels, vacation rentals, golf, construction, renovation, bike and car rentals, and businesses that make their money from tourism suffer.

Economic Collapse

In 2014 the Slide Fire burned more than 20,000 acres of forest in and around Oak Creek Canyon just north of Sedona. Businesses in Sedona saw major decreases in visitors during the the fire and the Sedona Chamber of Commerce launched a significant marketing campaign to combat the heavy downturn in visitation with little success. Slide Rock State Park, located just downstream from the Slide Fire burn area, saw a dramatic decrease in visitors that summer due to the damaging effects of the fire. The water running through the park was blackened by ash run-off which occurred upstream of the state park and the number of park visitors fell from 44,834 in June 2013 to 2,730 in 2014. During the summer months, Slide Rock State Park generally brings in $8,000 per day in revenue for the Arizona State Park system, but in June 2014 the number dropped to about $200 per day. In addition, the decrease in visitors to Slide Rock rippled through the Sedona economy. The Sedona Chamber of Commerce estimates the financial loss from the Slide Fire was over $100 million.

The devastating 2010 Schultz Fire north of Flagstaff and the flooding that followed had a financial cost of between $133 million and $147 million. Those effects and costs would have been substantially lessened had only $15 million been invested in treatment and prevention, according to the Arizona Rural Policy Institute's detailed study. The Schultz Fire visibly marked 15,000 acres of landscape, yet the damage was relatively benign compared with the floods that resulted from the unstable soils in the burn area. The fire stripped the hills of trees and vegetation leaving a smooth slope unable to absorb moisture, allowing summer rains to push an avalanche of mud, rocks and other debris down into the community. A 12-year-old girl was killed. Millions of dollars in damage ensued. The Schultz Fire and subsequent flooding devastated the community and has left residents and businesses vulnerable to damaging floods in the future.

The Schultz Fire was one in a series of highly destructive fires that have ignited across Arizona over the past 15 years, including the 2002 Rodeo-Chediski Fire and the 2011 Wallow Fire, each around half a million acres. Since 1990, nearly 1.2 million acres of Arizona's timber has burned.

Damaged Watersheds

Today, 3 million acres of Arizona forests are at high risk for wildfire. Not only do wildfires have significant impacts on ecosystems and communities in northern Arizona, they also threaten water supplies that serve the fifth largest metropolitan area in the United States. Arizona forested areas contribute as much as 90 percent of the water that flows into streams and rivers and the Salt and Verde rivers supply about half of the drinking water in the Phoenix metropolitan area. Over the last several decades the watersheds that feed the Salt and Verde rivers have been severely damaged by wildfire.

Healthy forests in northern Arizona produce a reliable supply of good quality water to the Phoenix metropolitan area that keeps water costs affordable to residents and businesses alike. Source water quality management is an important component of keeping water treatment costs down. For example, New York City has invested more than $1.5 billion to restore and maintain the health of the watersheds that feed city supplies. This investment in watershed health allowed the city to avoid the $6 billion construction cost of a new water treatment facility and $300 million per year in operating costs. Water agencies in Denver spent over $45 million to reduce post-fire stream erosion streams and dredging sediment from reservoirs because so much soil had washed in from the burned areas. In January 2005, sediment issues resulted in Phoenix's 1.4 million residents, as well as residents in the western half of Paradise Valley, being encouraged to boil their tap water for three days and to limit the water they used.

Public Health Issues

Even the smoke from wildfires presents a significant public health risk. While the impacts of smoke from managed fires and prescribed burns can be minimized by taking into account weather conditions, air quality, time of year, and wind conditions this is not the case with wildfires. New modeling efforts by the National Oceanic and Atmospheric Administration indicate that each year, wildfires emit a total of 1.5 to 2.5 million tons of particulate matter. This is more than is emitted by such better-known sources such as fuel combustion, industrial processes and transportation. This smoke poses a danger for everyone, but is particularly hazardous to children and the elderly. U.S. Environmental Protection Agency (EPA) studies show that they are particularly harmful to children since they are able to go deep into a child's lungs. The American Thoracic Society found that with only a slight increase of 10 micrograms per cubic meter of particles over two years, the risk of dying was increased by 32% for people with diabetes, 28% for people with COPD, asthma and pneumonia, 27% for people with congestive heart failure and 22% for people with inflammatory diseases.

Restoring Forest Health

Planning and implementing forest treatment and restoration activities which could minimize the harmful effects of wildfires is estimated to cost between $500 - $1,000 per acre. This investment could save our state hundreds of millions of dollars in wildfire costs and damages but we have a wildfire budget crisis. Unfortunately, treatment and restoration must often take a backseat to fire suppression.

The Impact of Fire Borrowing

Unlike hurricanes, earthquakes, and tornados which receive disaster funds, the federal government requires that the U. S. Forest Service fight fires with funds from its operating budget – funds that were allocated to treatment and reducing wildfire severity. This negative feedback loop known as "fire borrowing" accounted for over $615 million in the last fiscal year. In this way, the growing cost of fire suppression activities negatively impacts the budgets needed to carry out critical restoration projects that protect the forests from catastrophic wildfire. In fact, the U.S. Forest Service has run out of appropriated suppression money eight times in the past decade, forcing it to take money from non-fire accounts. Over time, as the frequency and severity of fires have increased, fire borrowing has become a formidable burden. Everyone agrees that the current model of funding is badly broken and Congress is currently considering legislation that stops this fire borrowing and ensures funding for prevention, treatment and restoration of forests and grasslands.

A Proactive Investment

A local example of proactive investment in forest resources to avoid damages caused by the degraded state of our forests is the Flagstaff Watershed Protection Project. The people of Flagstaff passed a $10 million bond to fund the Flagstaff Watershed Protection Project. The Arizona Rural Policy Institute estimates that this treatment project will mitigate up to $1.2 billion in potential fire and flood damage. That is the equivalent of purchasing an insurance policy for for less than 1% of the potential loss.

Forest Health Is at a Critical Point

Fire is a natural process, but Arizona's forests are not in a natural state. Years of fire suppression and drought have ushered in the era of the megafire, as the Southwest experienced recently with the Wallow and Rodeo-Chediski fires. A 2006 study found that almost seven times more land burned from 1987 to 2003 than during the preceding 17 years, and large fires, defined in the study as more than 1,000 acres, occurred about four times more often.

When the U.S. Forest Service was established in 1905, it was given managerial control of the lands that would soon be renamed national forests. It seemed logical that forest management necessitated fire protection. Only five years later, a series of forest fires burned 3 million acres in Montana, Idaho, and Washington in only two days. The 1910 fires had a profound effect on national fire policy. Local and national Forest Service administrators emerged from the incident convinced that the devastation could have been prevented if only they had had enough men and equipment on hand. They also convinced themselves, and members of Congress and the public, that only total fire suppression could prevent such an event from occurring again.

The result was a national policy to prevent and eliminate fire from the ecosystem which reduced the natural thinning of young trees resulting in overstocked forests and adding tons of fuel per forest acre and conditions which allow fire to move to and race through the crowns of trees.

Four Forest Restoration Initiative

Arizona's forests need help now. The Four Forest Restoration Initiative (4FRI) will thin over 300,000 acres of trees in the next decade. Total mechanical treated area is estimated to be nearly 1 million acres in all. It is the largest forest restoration project in the nation and involves many public and private partners working to employ long-term forest harvesting contracts, which will require re-developing a forest products industry that was decimated over 20 years ago. Developing sustainable markets for the wood products is a challenge but it is anticipated to provide employment opportunities and economic benefits to local communities. One question that 4FRI will also address is the extent to which the value of the products removed from the forest can fully or partially subsidize the forest restoration efforts.

In addition to thinning, other approaches to restoring healthy forests in Arizona include prescribed burning to restore natural fire to the forest ecosystem; stream and wetland restoration that stabilizes stream banks, reconstructs and enhances wetlands; sediment and erosion management to improve runoff and drainage conditions reducing sediment loading into springs, streams and wet meadows; and, habitat improvement and re-vegetation projects that improve and restore forests, grasslands, and wet meadows. Not only do proactive forest treatment and watershed protection activities reduce the risk of wildfires, they can also help minimize sedimentation impacts on reservoirs and other water infrastructure by reducing soil erosion and decreasing the cost of water purification.

The Forests Can't Wait

Arizona's forests are critical to the water supply of millions of Arizonians, billions of dollars of agricultural production and vast economic activity. Very simply, it is conceivable that major forest fires could leave those living in northern Arizona "crispy" and those in central and southern parts of the state, "thirsty."

Arizona's forests provide the majority of the water we drink, provide habitat that sustains wildlife and bio-diversity, help maintain clean air by reducing greenhouse emissions, are a cornerstone to our tourism and hospitality industries generating billions of dollars of revenue, preserve our priceless natural resources, provide recreational opportunities, and enhance our quality of life.

In the words of President John F. Kennedy, "There are risks and costs to a program of action, but they are far less than the long-range risks and costs of comfortable inaction."

Now is the time for action to restore the health of Arizona's forests.

ACTIONS NEEDED NOW

In summary, there is much to be done in restoring and maintaining healthy forests. But as a nation and as a state we have moved beyond understanding the extent of our forest heath, developing the actions that need to be undertaken to restore the forest, and now must concentrate efforts on implementing those actions.

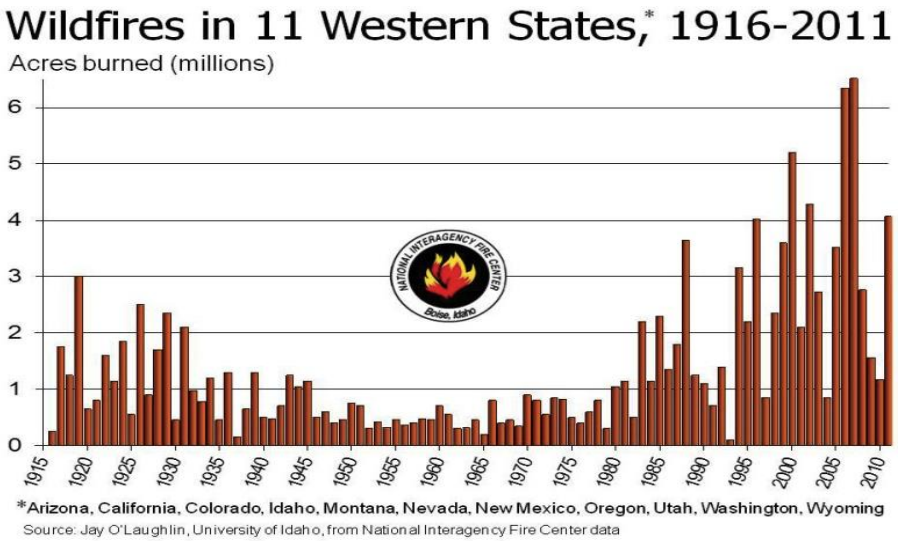
Recognizing that proactive management of our forests and watersheds minimizes the risk of catastrophic wildfires and the multitude of societal, environmental and economic costs, the time is now for Arizonans to express their support for:

- Forest thinning and prescribed burning
- Re-establishing a forest products industry
- Releasing more land for treatment by accelerating the National Environmental Policy Act (NEPA) process
- Support adaptive management of treated forested lands
- Sediment and soil erosion management
- Habitat improvement and re-vegetation projects
- Eliminating “fire borrowing” so that these projects can be fully funded

Arizonans can contact their elected representatives, invest their time, talent and finances in the partnerships and organizations that are making a difference in restoring our healthy forests and spread awareness throughout their communities of the urgency and critical importance to citizens throughout the state of healthy forests for our health, environment, economy and quality of life. It is critical for all Arizonans to understand that unhealthy forests impact us all – no matter where in the state we live.

HEALTHY FORESTS

Healthy forests reduce the threat of catastrophic wildfires, store and filter our water supply, provide habitat to thousands of species of wildlife and plants, absorb greenhouse gases, and generate billions of dollars in tourism and recreation-related activities. Maintaining healthy forests is more than just the right thing to do, it is essential to Arizona's future and the quality of our lives.

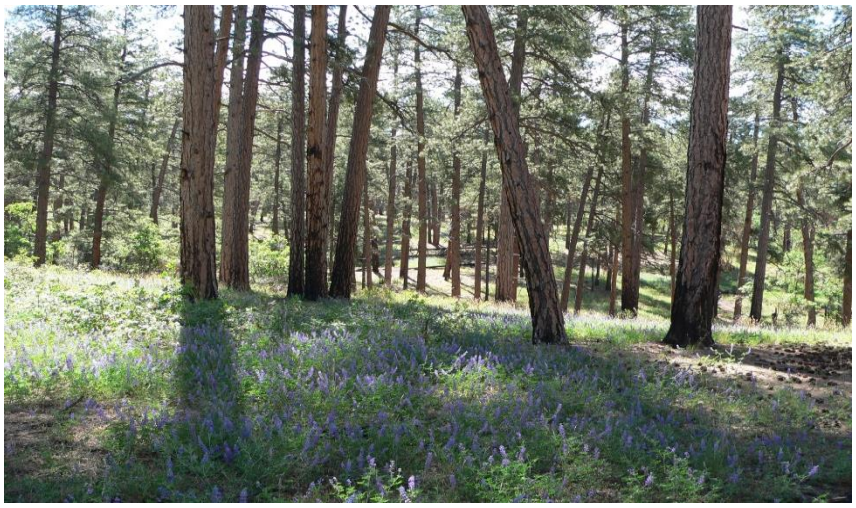


What Is a Healthy Forest?

There are a number of different forest types found across the Southwest, each with its own characteristics and level of health. In general, however, we can say that a healthy forest will have a mix of trees, grasses, and wildflowers across the landscape - to provide food and shelter to the many animals that call them home - and water to thirsty humans downstream. And equally important, a healthy forest will be better adapted to respond to natural disturbances without being completely destroyed or altered beyond recognition. A few such forests still exist in remote places like the North Rim of the Grand Canyon, and more are being assisted back to health every day by restoration treatments currently underway in forested regions across the state.

A healthy forest exhibits a wide range of desirable ecosystem characteristics. The most notable characteristic of most southwestern forest types in their healthy state is that they have far fewer trees across the landscape than in an unhealthy forest. Healthy ponderosa pine forests, for example, may have as few as 20-50 trees per acre, in clumps with the large openings between them filled with lush grasses and wildflowers. In contrast, the unhealthy forests seen across much of the state today may have over 1,000 trees per acre, with the ground between them covered instead by a thick layer of pine needles and few plants. The individual trees in a healthy forest have less competition for water, sunshine, and nutrients than when they are crowded together as in many degraded, unhealthy forests.

Because they are made up of more widely spaced trees, healthy forests also create a substantially lower risk of catastrophic wildfire, instead supporting frequent low-intensity ground fires that help regulate numerous forest cycles.



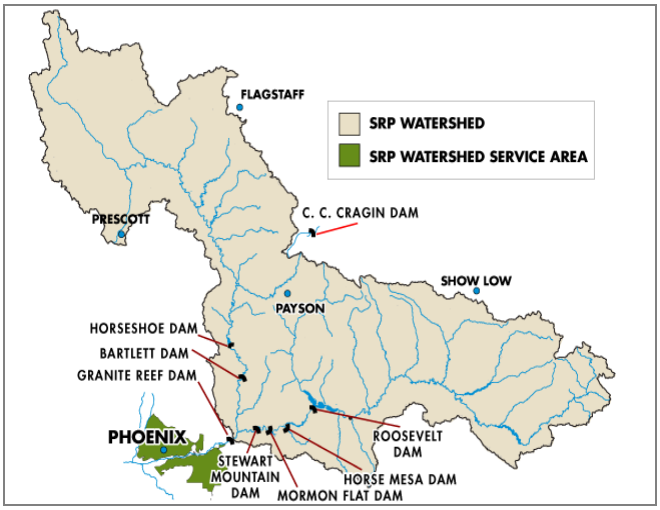
Managing Fire

Arizona's pine forests evolved over thousands of years with recurrent ground fire, ignited either by lightning or as part of indigenous land management practices. Fires typically spread through understory grasses and shrubs, seldom climbing into the forest canopy. Fire served many beneficial functions, including the thinning of dense thickets of tree seedlings and saplings that often establish following a string of wetter than average years. Fire also kept the forest understory productive by consuming fallen needles and other fuels that can blanket the forest floor, and by opening up the forest so that light and moisture can reach the diverse plant community below. Although people frequently focus on the trees, the understory plants are the key producers that support the complex food webs that sustain wildlife and forest biodiversity.

Producing Water

The forested lands of northern Arizona produce the majority of the water for the Salt and Verde rivers. The 13,000 square mile watersheds of the Salt and Verde rivers feed six reservoirs that provide water to a 400-square-mile service area and approximately 2 million Valley residents. The water provided by the Salt and Verde rivers not only allows people and businesses to thrive in a desert landscape, but also produces the water necessary to generate more than 270 megawatts of capacity through renewable hydroelectric generation—enough energy to power over 21,000 homes.

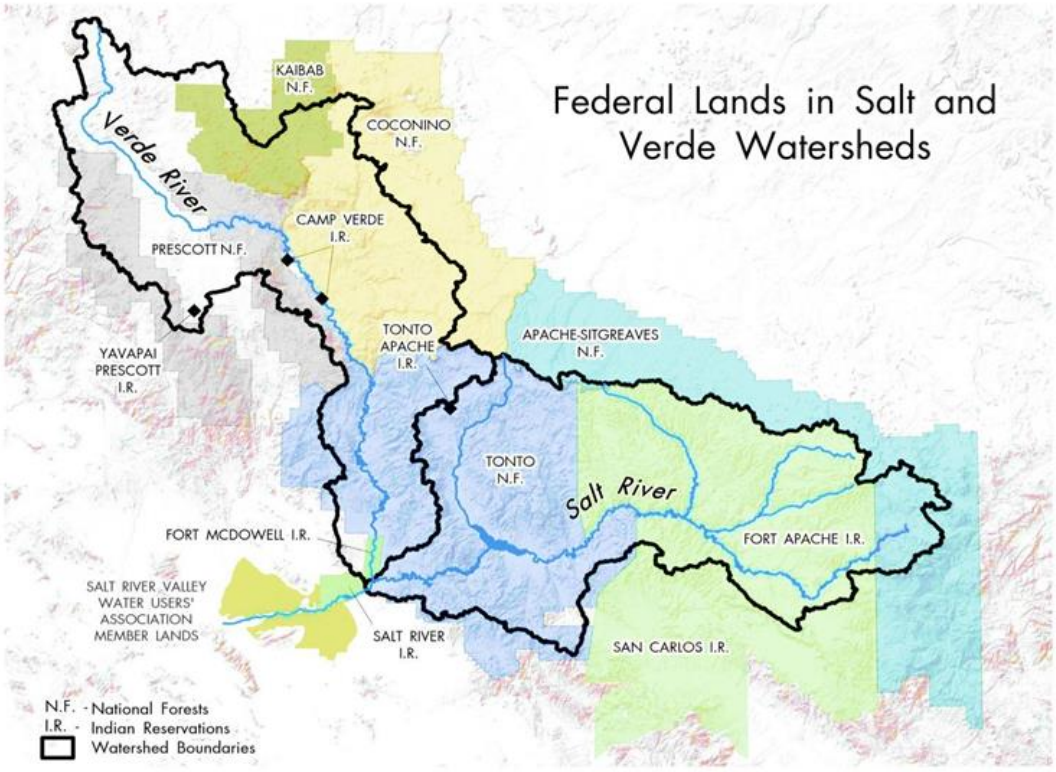
The majority of Arizona's residents live in the Phoenix and Tucson metropolitan areas. Greater Phoenix is largely served with water (and power) by the SRP, with the water coming from the Salt and Verde watershed, as shown in the figure below.



(Figure courtesy of SRP)

Most of the water supply for the Phoenix area comes from winter precipitation and runoff that occurs in the forested mountains of northern and central Arizona and drains into the Salt and Verde rivers. The forested lands in northern Arizona were set aside as forest reserves at the beginning of the 20th century in order to protect the watershed of these central Arizona Rivers. In 1891 and 1897, the U.S. Congress passed legislation enabling the federal government to set aside forests to help preserve the nation's water supply for future generations. In 1897, the Arizona Territorial Legislature wrote to Congress and stated, "The forests on these [Salt and Verde] water-sheds... are in great danger of being entirely removed by settlers and large lumber companies to the great detriment of our water supply." Over the next decade, forest preserves were created primarily to protect the watershed above Theodore Roosevelt Dam and to protect the watershed along the Verde River. In 1901 the Arizona Republican touted the designations by saying: "…protection to the magnificent forest and the conservation of the waters that feed the Verde and Salt Rivers. The value of this action to the people of the Salt River valley cannot be overestimated."

Today, 59% of SRP's 13,000-square-mile watershed lies within national forests as part of a plan to provide a renewable water supply for the Valley. The hydrologic values associated with healthy forests were recognized by the federal government during the early part of the 20th century, and were the underlying reason most of northern Arizona's forested lands were set aside from development. Today these lands are known as National Forest and continue to be vital to the production of flows in the Salt and Verde rivers. Four dams on the Salt River and two dams on the Verde River create six reservoirs capable of storing more 2.3 million acre feet of run-off from precipitation in the high country of northern Arizona.



Recreation, Tourism & Economic Development

In addition to producing water supplies vital to the largest economic center in the state, the most heavily forested counties in Arizona are home to some of the most scenic and visited recreation sites in the state. Grand Canyon National Park attracts millions of visitors every year to Arizona to see one of the Seven Wonders of the World. More than three million visitors per year travel to Sedona for the scenic beauty and the unique recreation opportunities in the area. Visitors spent more than $2.5 billion dollars in the forested counties of northern Arizona in 2014, with more than half of that being spent in Yavapai and Coconino counties. In 2014 the Slide Fire, which burned more than 20,000 acres of forest in and around Oak Creek Canyon, caused businesses in Sedona to see major decreases in visitors during the time of the fire.

Healthy forests bring tourists to Arizona. In 2014 travel and tourism generated:

- 40.7 million overnight visitors to Arizona
- $20.9 billion in direct spending
- $2.8 billion in local, state and federal tax revenues
- Direct impact of 171,500 jobs with earnings of $5.9 billion

Source: 2015 Arizona Office of Tourism “Travel and Tourism Work for Arizona”

Highlights

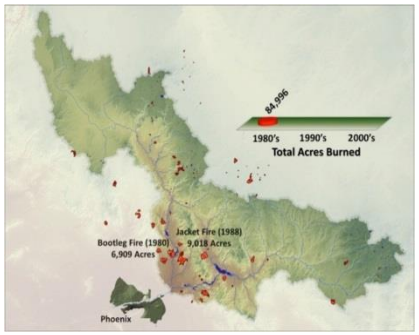
- Healthy ponderosa pine forests may have as few as 20-50 trees per acre with the large openings between them filled with lush grasses and wildflowers. In contrast, unhealthy forests seen across much of the state today may have over 1,000 trees per acre with the ground between them covered instead by a thick layer of pine needles and few plants.
- Unhealthy forests cause the threat of catastrophic wildfire to dramatically increase, negatively impacting our health, environment and economy.
- The forested lands of northern Arizona produce the majority of the water for the Salt and Verde rivers that supply most of the commercial and residential water for the Phoenix metropolitan area.
- Healthy forests are major contributors to Arizona's tourism and hospitality industry, creating jobs and attracting millions of visitors each year.

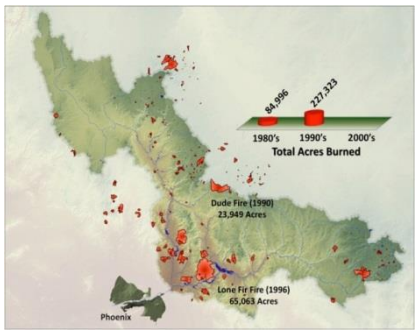
WILDFIRES

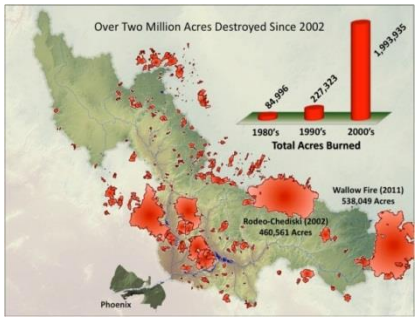
What Is the Role of Wildfire in the Natural Landscape?

Wildfire in particular is an important part of a healthy Arizona forest. Our forests in their natural state are an expression of their physical attributes of soils, elevation, moisture and temperature patterns; natural disturbances like fire, severe storms and drought; and the plants and animals that evolved within these landscapes. Wildfire is one of the naturally occurring disturbances that framed the composition of the plant and animal communities that make up these forests. For instance, in ponderosa pine forests, where wildfire ignitions occurred frequently during summer lightning storms, the trees developed thick bark, and naturally "pruned" lower branches to adapt to survival in habitats of common fire occurrences. Less dense forests under a frequent, low-intensity fire regime have a low risk of losing key ecosystem components (e.g. native species, large trees, and soil) since these systems have evolved together in space and time and are adapted to respond to the frequency and intensity of wildfire. As a result, the trees in a healthy forest and the entire forest ecosystem with all its attributes described above can coexist and, in fact, thrive with wildfire.

Decades of aggressive fire suppression have left forests more at risk of catastrophic crown fires. Photo courtesy of the Flagstaff Fire Department.







There has always been a fire season. Like there is a winter and summer, and wet and dry seasons. The combination of the physical environment with effects of seasonal variations in weather created natural landscapes composed of plants and animals that evolved with and responded to these naturally occurring fires across the greater landscape. Prior to European settlement, the "fire season" was a result of seasonal weather variations increasing or decreasing the efficiency of lightning strikes to ignite vegetation, which may be dry enough to support and transport wildfire once an ignition occurred.

Over geological time natural plant and animal communities evolved with these natural fires within their physical environments to become dominant on the landscape long before Euro-American settlement. Animal species then became dependent on the pine forests to meet their needs of individual and population survival.

How Can Fire Be "Good"?

Landscapes in their natural fire regime will sustain a low risk of loss of key ecosystem components (e.g. native species, large trees, and soil) since these systems have evolved together in space and time and area adapted to respond to the frequency and intensity of wildfire. In places where management actions have resulted in landscapes removed from the "natural disturbance regimes," functionality of the ecosystem is impaired, resulting in altered plant and animal communities, and reduced biodiversity and productivity. These altered ecosystems are not the ones that adapted to the

fire regime and are not functioning as they normally would in their biophysical settings. In these altered ecosystems, wildfire will not burn in characteristic frequency and intensity, resulting loss of key ecosystem function.

When Is Fire “Bad"?

Over the last century the highland forests of Arizona have become dense and overgrown. These forests once thrived with low intensity wild fire. As ground fires would burn through the underbrush, they would leave behind rejuvenated soils and reduced vegetation densities. Due to a number of compounding factors, wildfires that once burned low to the ground now behave in catastrophic and unpredictable ways. Wildfires across the country are burning more land and requiring more resources for suppression than ever before. Over the last three decades the average size of wildfires and the funds required to put fires out has tripled, creating strains on federal and state budgets. Beyond the direct costs incurred through fire suppression, the devastation that fires leave behind can have significant impacts on tourism and recreational opportunities. Additionally, the ecosystems that support clean water and air for an entire region and the reputation of the state as a quality place to live and develop is diminished by unhealthy forests, especially when the forests are subjected to high intensity catastrophic wildfire.

The growing size and impact of wildfires in northern Arizona and the Salt and Verde river watersheds can be clearly seen in the included graphics. In the 1980s just under 85,000 acres in the watershed burned and a 5,000-10,000 acre wildfire was considered very large. In the 1990’s the total acres burned grew to about 227,000, and since 2000 nearly 2 million acres have burned, with two fires alone consuming nearly 1 million acres.

Deteriorating forest health and catastrophic wildfires also impact the hydrologic characteristics of watersheds. Runoff and water yield, peak flows and low flows, erosion and sedimentation, and water temperature and chemistry are all negatively impacted by unnatural forest conditions and severe wildfires. Healthy forests provide a resilient water supply to the Phoenix area, while unhealthy and overgrown forests are a liability that can compromise the water system for decades following a wildfire.

Source	Low ($) millions	High ($) millions
Dry Lake Hills		
Response and Remediation	43	43
Structures and Contents	132	286
Property Value	256	524
Habitat	0.4	15
Communication Towers	30	80
BNSF Railroad Interruption	12	23
Retail Sales	15	15
Dry Lake Hills Total	**$489 million**	**$986 million**
Mormon Mountain		
Response and Remediation	12	12
City Water Supply	17	37
Habitat	1	22
Communication Towers	54	144
Mormon Mountain Total	**$84 million**	**$215 million**
Total, Both Areas	**$573 million**	**$1,201 million**

Several of these costs show no difference between high and low estimates. For those categories, only one figure was identified.

What are the Costs of Wildfires?

The direct costs of a wildfire event include the cost to suppress the fire, property losses, damage to utility lines and roads, damage to recreation resources, aid to evacuated residents, health-related impacts and post-fire floods damage. The indirect costs of a wildfire are equally heavy, the effects of which can be felt long after the wildfire has been put out. These include lost tax revenue, property value decrease, lost business revenue and a loss of ecosystem services. One of the biggest impacts to businesses will be the loss of revenue as tourism declines. If the desert and forests burn, tourists will stop coming. Restaurants, hotels, vacation rentals, golf, construction/renovation, bike/car rentals, and any business that makes its money from tourism will suffer. In turn, construction and renovation business will also be affected.

For example, the Arizona Rural Policy Institute conducted a study to estimate the potential financial damages mitigated by the Flagstaff Watershed Protection Project in the Dry Lake Hills and Mormon Mountain areas of Flagstaff, Arizona.

Source	Low ($) millions	High ($) millions
Dry Lake Hills		
Response and Remediation	43	43
Structures and Contents	132	286
Property Value	256	524
Habitat	0.4	15
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Several of these costs show no difference between high and low estimates. For those categories, only one figure was identified.

Nearly three quarters of Flagstaff voters voted to fund this $10 million project with an estimated cost avoidance of between $573 million and $1.2 billion.

These potential savings did not consider such factors as damage to utilities (e.g., electrical, sewer, water, etc.), health issues, evacuation costs, negative impacts on tourism and outdoor recreation, negative impact on air quality, damage to residential streets and vehicles, and increased potable water pumping and treatment costs.

Fighting and recovering from a catastrophic wildfire can cost up to 30 times more than restoration, and studies done following the 2011Wallow Fire, which is the largest fire to date in Arizona, have shown that the total economic impact is quickly approaching $1 billion.

Highlights

Wildfires occur naturally and are necessary to frame the composition of the plant and animal communities that make up healthy forests.

The high country forests of Arizona once thrived with low intensity wildfire. As low to-the-ground fires would burn through the underbrush, they would leave behind rejuvenated soils and reduced vegetation densities.

Over the last three decades the average size of wildfires and the funds required to put fires out has tripled.

Nearly three quarters of Flagstaff voters approved funding the $10 million Flagstaff Watershed Protection Project with an estimated cost avoidance of between $573 million and $1.2 billion - the equivalent of purchasing an insurance policy costing less than 1% of the potential loss.

WATER QUALITY

Healthy forests in northern Arizona provide good quality water to the Valley and help keep water costs affordable to residents and businesses alike. Source water quality management is an important component of keeping water treatment costs down. Not only do wildland fires have significant impacts on ecosystems and communities in Arizona, they also have major effects on the water supplies that serve the fifth largest metropolitan area in the United States.

Over time, Arizona's forests have become unhealthy and prone to catastrophic wildfire, posing significant risk to the quantity and quality of the run-off entering the Salt and Verde river systems. The runoff from wildfire carries ash and debris into reservoirs, reducing the storage capacity of reservoirs over time and diminishing water quality.

How Does Fire Affect Water Quality and Treatment?

Wildfire impacts on reservoirs in other western states provide a learning opportunity for Arizonans to proactively prevent catastrophic impacts to water supplies.

Denver Water, a major water utility and dam operator in Colorado, has seen significant impacts to its reservoir operations following catastrophic wildfires in its watersheds. The area surrounding the Strontia Springs reservoir, one of Denver Water's reservoirs located in the front range of the Rocky Mountains, was heavily impacted by catastrophic wildfire in 1996 and 2002. The fires devastated the landscape, creating unstable soils on the steep slopes surrounding the reservoir. Summer rains following the fires washed more than 1 million cubic yards of ash and debris into the reservoir. The significant inflow of sediment and debris required Denver Water to spend more than $60 million in slope re-stabilization efforts, water treatment and reservoir dredging to mitigate the impacts caused by these wildfires.

Similar to the impacts seen by Denver Water, Fort Collins Utilities in Colorado was forced to close water intakes on the Cache la Poudre River intakes following the 2012 High Park Fire, ultimately requiring the utility to increase water rates by 4 percent in order to make capital improvements necessary to maintain the river as a drinking water source. Albuquerque saw similar water quality impacts following the 2011 Los Conchas fire in Los Alamos County, New Mexico. Impacts to water quality could be seen more than 100 miles downstream of the fire at city water treatment intakes from the Rio Grande River. Run-off from summer rains following the Los Conchas fire forced the Albuquerque Water Utility Authority to close its intake from the Rio Grande to avoid clogging equipment and the additional cost of treating the sediment-laden Rio Grande water.

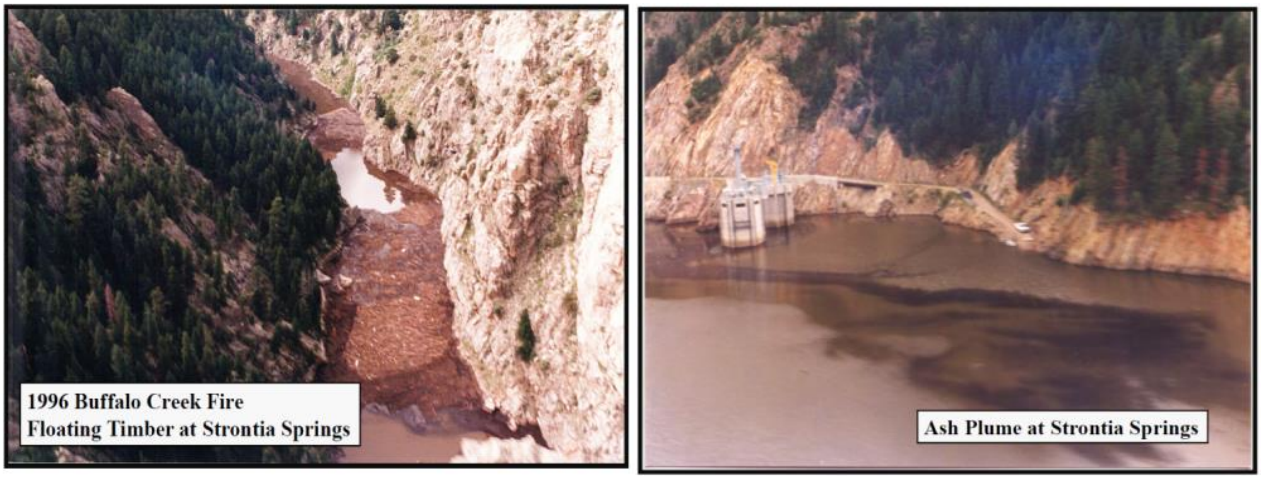

Photo Credit: Denver Water

The Los Alamos County Department of Public Utilities has been working to restore the Los Alamos reservoir since the year 2000 following the Cerro Grande fire, which filled the reservoir with sediment and debris. The project was originally budgeted at $3.5 million, but the 2011 Las Conchas fire and subsequent flooding and sedimentation has delayed the project and increased the total cost significantly. Large rain events over the unstable soils in the Las Conchas burn area in the summer of 2013 completely filled the reservoir with sediment—this large sediment inflow occurring only three months after the reservoir had been re-established following flooding events in 2011 and 2012. The large inflow in 2013 required extensive sediment removal efforts for the third time in three years just to re-establish the reservoir as a water catchment (see photos below). These events in Los Alamos show just how hard it can be to mitigate the extreme impacts inflicted on water infrastructure once a fire occurs.

Restored Los Alamos reservoir, May 2013, prior to large rain and flooding events

The aftermath of sedimentation into the newly restored Los Alamos reservoir following rain events over the burn area in summer 2013

Large wildfires in the Salt and Verde river watersheds have created significant challenges to water treatment facilities in the Phoenix area. The Sunflower fire burned more than 18,000 acres south of Payson in the summer of 2012. This relatively small fire occurred just above Sycamore Creek, a tributary to the Verde River, causing significant negative impacts on the water quality in the Verde River. Large rain events on the Sunflower burn scar created large flows of ash and sediment to wash down Sycamore Creek and into the Verde River, creating major problems for water treatment plants in the Phoenix area that receive water supplies from the Verde River.

During the 2012 monsoon season, SRP took significant actions to divert the contaminated fire run-off from entering the SRP canal system and flowing into Valley water treatment plants. SRP increased pumping from

groundwater wells and worked with the Central Arizona Project to divert water from the Colorado River into the SRP canal system in order to ensure that the water provided to water treatment plants was safe and economically treatable. Quick adaptation of water supply delivery and careful attention from water treatment plant operators ensured that water delivered to homes and businesses in the Phoenix area met safe drinking water standards.

In addition to the effects seen following the Sunflower fire, other wildfires in the Salt and Verde Watersheds such as the Rodeo-Chediski Fire, the 2005 Willow Fire and the 2006 Cave Creek Complex fire have impacted water quality. Following the Rodeo-Chediski fire in 2002 major changes in water quality entering Roosevelt Lake were observed. Summer monsoon rains moving across the Rodeo-Chediski burn scar washed large amounts of nutrients, sulfates, sediment and heavy metals such as arsenic into the reservoir. The decreased water quality and threat of spikes in sediment from fires have directly led to increasing capital and operational costs at city water treatment plants to ensure that water from extreme fire events can be treated to meet safe drinking water standards. In many cases treatment facilities have been upgraded by adding carbon filtration to handle the increased levels of organics and sediment at a cost of hundreds of millions of dollars.

Highlights

- Unhealthy forests prone to catastrophic wildfire pose significant risk to the quantity and quality of the run-off entering the Salt and Verde river systems – a primary source of water for the metropolitan Phoenix area.
- The significant inflow of sediment and debris caused by wildfires required Denver Water to spend more than $60 million in slope re-stabilization efforts, water treatment and reservoir dredging.
- The decreased water quality and threat of spikes in sediment from wildfires have led to increases in capital and operational costs at city water treatment plants in Arizona to ensure that contaminated water from extreme fire events can be treated to meet safe drinking water standards.

TREATMENT AND RESTORATION

Regardless of whether we live in the forest or in the desert, it makes sense to invest in the restoration of Arizona's forests that we all depend on. Fires like the Wallow Fire and the equally destructive Rodeo-Chediski Fire in 2002 destroyed homes, recreation areas and important wildlife habitat, and chased hundreds of residents from their homes. These fires bring home in glaring detail the need to change how forests are managed.

How Does Restoration Work?

Restorative forest treatments return the forests to a resilient state that is capable of fending off fire. The 2014 San Juan fire in the White Mountains shows how forest restoration enables the forest to resist catastrophic crown fire. The three images below were all taken while standing in one place. The image on the right shows a stand of trees that was not restored prior to the San Juan fire, while the image on the left shows an area that received restorative treatments several years prior to the fire. The image in the center shows how the fire behaved as it moved from an un-restored area to an area that had been restored. When the fire reached the area that had been treated, the fire dropped out of the canopy and traversed the ground, removing excess fuels and rejuvenating the soils. The image on the left shows grasses and diverse plant species covering the ground just one month after the fire burned the area, while the high intensity areas on the right have little plant regeneration.

Picture above is about 100 yards left to right, treated on left, middle has FS road, untreated on right)

Restoration treatments like those performed in the area on the left not only create a healthier, more resilient ecosystem; they also reduce the economic and social risks associated with catastrophic wildfire.

Most of Arizona's forests are very different from their natural state, and not functioning as well as they could. Forests restored through management activities to approximate their natural state exhibit a wide range of desirable ecosystem characteristics. Over the past few decades ecologists and land managers have implemented a series of projects to restore forests to something approximating reference conditions, especially around Flagstaff, Williams, and Show Low, with the goals of reducing fire danger and restoring proper functionality to forest ecosystems. This has resulted in a growing acreage of forest which is closer to its natural state.

What Do We Mean by Ecosystem Services?

Ecosystem services may be defined as a broad range of goods and services that can be viewed in three major categories: provisioning services (e.g., food, fiber, and fuel); regulating services (e.g., water regulation and purification, climate regulation, wildfire protection, and pollination); and cultural services (e.g., recreation and tourism, educational opportunities, cultural heritage, aesthetic and property values, animal habitat, and spiritual retreats).

The importance of ecosystem services can be easy to overlook in our modern lives, when clean water flows on demand from our taps and food comes conveniently packaged from grocery stores. However, the natural world is always at the root of our sustenance and existence. Mark Rose, CEO, Fauna & Flora International, wrote: "Regardless of our sophisticated technologies and increasingly urban lifestyles, humans – like all other creatures

– are still intrinsically linked to ecosystems and the many services and benefits they provide us." When natural systems are damaged or degraded, the services they normally provide can be impaired or curtailed, with very real effects to the humans who depend on them.

In the case of our southwestern forests, we have allowed them to become degraded by years of fire suppression and other management activities, such that now they are subject to catastrophic wildfires that threaten the numerous ecosystem services they normally provide.

Investing in forest restoration, then, is an attempt not only to repair ecosystems for the sake of the many plants and animals that call them home, but to preserve the many benefits to humans that come from having intact, healthy forests – that is, to maximize our returns on the natural capital such forests represent. Additionally, forest restoration can be seen as economic stimulus in a more direct sense. The economic impacts from restoration activities in Arizona and New Mexico in fiscal year 2005 created approximately 500 jobs and brought more than $40 million to the local economies.

How Do We Accomplish "Restoration"?

Restoration treatments in Arizona to reduce wildfire potential, along with estimated costs, include:

- Mastication – This treatment is used to eliminate shrubs and small trees for ecological or fuel reduction purposes. Generally, a tracked or rubber-tired machine chops, shreds, and/or grinds small trees, limbs, shrubs, and dead woody debris into chips to be left on site. Mastication is feasible where slope angles are 40% or less. Mastication moderates fire behavior by reducing fuel-bed depths to generally less than 6 inches. Removal of target species encourages the growth of desired plants. Mastication is sometime followed up with prescribed surface fire. Masticated material can also be removed as fuelwood. (Cost estimate: $150/acre)
- Thinning – This treatment is accomplished using hand tools, chainsaws, or specialized mechanical equipment and creates a prescribed spacing among trees and shrubs. (Cost estimate: $500 - $1,000/acre). It is justified when it is needed to:
  - Serve as a fire surrogate to directly restore desired, healthier vegetative structure.
  - Minimize the potential for unwanted wildfires by reducing surface and ladder fuels and decreasing contiguous, abnormally heavy fuel loads.
  - Pre-treat areas to reduce fuels in a way that enables the subsequent safe and effective application of prescribed fire.
  - Treat wildland-urban interface (WUI) areas in some vegetation types.

Trees and shrubs are selected for thinning based upon treatment objectives, tree-hazard ratings, snag recruitment, health and vigor, species, size, and age, in descending order of importance. The desired future condition for the ecological type determines species, size class, spacing, and residual stocking targets of thinning projects. Selective thinning favors retention of larger and older trees in uneven-aged stands and retention of the more fire-resistant species and sizes, while at the same time maintaining species diversity. Reduction of ladder fuels is generally an important treatment objective. Within 300 feet from existing structures, vegetation treatments may be more intense than in areas farther away.

Construction of fire control lines may require the removal of herbaceous vegetation, pruning, and/or cutting breaks in the fuel by hand and clearing all vegetation down to mineral soil. After fires are completed, rehabilitation may involve returning previously pulled material back onto the control lines, hand-constructing water diversion channels, or laying shrubs or woody debris on the lines following burning.

In addition to rehabilitating a fire control line, other post-thinning activities may include:

- Removal of woody debris by hand or machine to an off-site location for other uses or burning.
- Chipping of woody debris. The use of chipping is limited by the slope of the area. Chipped material may be dispersed over the treatment area and/or transported offsite for other uses.

- Lopping and scattering, which disperses woody material on the ground to decrease fire intensity. Previously felled trees and shrubs are limbed, lopped, and bucked using chainsaws so that the resulting slash material lies closer to the ground surface (as opposed to creating burn piles). The slash material is then spread, more or less evenly, over the ground.
- Pruning, which may be applied along major system road corridors, within fuel breaks, or in conjunction with fire control lines to remove ladder fuels and facilitate prescribed burning. Using hand tools and chainsaws, tree branches are pruned as close to the bole as possible without damaging it. Trees are generally pruned no higher than 10 feet above ground level or one-third of the tree height, whichever is less.
- Prescribed Burning – Prescribed fire (planned ignition) originates as a planned ignition to meet specific objectives identified in a written, approved plan for which all regulatory requirements have been met prior to implementation. (Cost estimate: $50-300/acre depending on whether it is the first or subsequent prescribed burn and whether or not it is in a wildland urban interface). In parts of Arizona, steep slopes make this treatment the most practical tool in the toolbox. Prescribed burn plans contain specific resource objectives as follows:
  - Reduce abnormally high fuel loads to begin to allow for a return to historic fire patterns and frequencies.
  - Release nitrogen and other nutrients into the soil in support of new plant growth.
  - Encourage germination of various plant species. Many native plant and forest communities have adapted to fire for their germination and growth. Some species require seed contact with soil that is exposed by fire to naturally regenerate.
  - Thin overcrowded forests. Thinned forests recover faster and are more resistant to insect and disease attacks. Currently, many of the mature forests in the project area are overcrowded, resulting in a lack of vigor and health.
  - Create diversity needed by wildlife. Wildlife, such as deer, benefit from new growth as plants produce more palatable browse/forage when re-sprouting after a fire.
  - Prescribed fire applies low- to moderate-intensity fire using hand, mechanical or aerial firing methods. Burn plans include, but are not limited to, a risk assessment that identifies hazards and potential mitigating actions to protect life, property, and resources.
  - Treat wildland-urban interface (WUI) areas where the objective is to reduce the threat of severe wildland fires to private property and increase resident and firefighter safety (Cost estimate: $300 per acre).
  - A natural (unplanned) ignition of a wildfire (such as a fire caused by lightning) may also be managed to attain similar objectives, and is authorized under the Forest Plan (Cost estimate: $10-60 per acre).
- Buffelgrass removal - Buffelgrass is treated generally two ways: hand pulling or herbicide application. (Cost estimate: $233/acre).

Compare these estimates to the costs of wildfire suppression and the losses and damage such a fire causes and it is clear that action needs to be taken now.

Highlights

- Forests that retain their natural state or have received restoration treatments are healthier than the degraded forests currently seen across much of Arizona, and are more resilient to drought, fire, and insect invasions.
- In the case of our southwestern forests, due to years of fire suppression and other management activities, our forests are now subject to catastrophic wildfires that threaten the numerous values and benefits forests provide our State.
- There are many different treatment and restoration strategies available for Arizona forests. Restoration in virtually all instances is much less costly than the loss and damage wildfires bring. Responsible stewardship calls on us to make the investment today.

ACTIONS UNDERWAY IN ARIZONA

All Arizonans have a stake in the health of Arizona's forests. Healthy forests support our economy, provide quality drinking water and unlimited recreation opportunities to the state. Unhealthy forests are a liability to the health and wellbeing of both the residents and economy of Arizona. A proactive approach to tackling this mammoth issue will help ensure the health of these valuable resources for generations to come.

We must act together to form partnerships that support forest restoration efforts. Some of today's partnerships include:

Four Forests Restoration Initiative (4FRI)

The Four Forest Restoration Initiative (4FRI) is a collaborative effort to restore forest ecosystems on portions of four National Forests - Coconino, Kaibab, Apache-Sitgreaves, and Tonto - along the Mogollon Rim in northern Arizona. Unfortunately, these forests have been degraded by unsustainable historical land uses and fire exclusion. The result is overgrown forests with thin, unhealthy trees and the threat of unnaturally severe wildfire.

The vision of 4FRI is restored forest ecosystems that support natural fire regimes, functioning populations of native plants and animals, and forests that pose little threat of destructive wildfire to thriving forest communities, as well as support sustainable forest industries that strengthen local economies while conserving natural resources and aesthetic values.

The key to 4FRI is the collaborative effort that brings in private industry to perform restorative treatments that are paid for through the products produced by the timber taken off the land. Rather than the federal government footing the bill to pay for each acre of restorative treatment, the Forest Service has contracted out the work to private industry in a goods-for-service contract. This approach, known as a stewardship contract, allows private industry to use the timber and biomass resulting from restorative treatments to produce products such as lumber, wood pellets and biomass power. The implementation approach taken by 4FRI lets the restoration treatments pay for themselves. 4FRI is a collaborative effort that has the Forest Service working with more than 50 stakeholders to ensure that the multi-purpose nature of these Federal Lands is preserved. Additionally, 4FRI works to re-establish a strong forest products industry in the state that is essential in performing the restorative treatments necessary to reach the goal of a healthy and resilient forest.

Northern Arizona Forest Fund (NAFF)

Developed in partnership between SRP and the non-profit National Forest Foundation (NFF), NAFF was created to provide a funding mechanism for investment in site-specific projects on federal lands that are critical to improving the health and resiliency of forests located within the Salt, Verde and East Clear Creek watersheds. These watersheds provide surface water supplies and other important natural resources to SRP's customers, shareholders, and municipalities. With declining forest health and tighter federal budgets, leveraging public-private partnerships is critical.

NAFF's projects focus on reducing wildfire risk, improving streams and wetlands, enhancing wildlife habitat, and minimizing erosion and sedimentation that can affect Arizona streams, rivers and reservoirs. NAFF's first year projects include two high-priority projects in the Verde Watershed; The Oak Creek Erosion Control Project and the Upper Beaver Creek Forest Health Project. Together, these projects will restore over 1,000 acres of forested land that is also critical habitat for the Mexican spotted owl and improve conditions of over 20 miles of forest roads by reducing sedimentation into the Oak Creek Watershed.

Along with SRP and NFF, Valley stakeholders, businesses, and cities are committing to their engagement in the NAFF, improving the resiliency of the Salt and Verde watersheds – especially addressing the threats of fire, insects, drought and a variable climate. At the same time, the NAFF is building capacity and awareness of the critical link between our forests and the long-term sustainability of the Valley's water supply.

White Mountain Stewardship Project

The White Mountain Stewardship Project was launched to tap into a collaborative history of diverse groups working together to address forest restoration and stewardship. The result was a new approach aimed at preventing or minimizing the impacts of devastating fire, healing the forest, protecting wildlife and creating jobs. Almost 75,000 acres in the Apache-Sitgreaves Forest have received fuel reduction treatments through this project.

Flagstaff Watershed Protection Project

In November 2012, Flagstaff voters approved a $10 million bond measure to support the Flagstaff Watershed Protection Project. This partnership brings together the State, City of Flagstaff and the Coconino National Forest to help reduce the risk of catastrophic wildfire and flooding in the Rio de Flag and Lake Mary watersheds. This is one of only a handful of examples in the country where forest restoration work on the National Forests is being funded by a municipality, and the only known instance where such an effort is funded from municipal bonds.

The experience of the Schultz Fire in 2010 demonstrated the potential for severe downstream impacts even when residential areas are spared from the fire itself. Following the Schultz Fire, severe and repeated flooding occurred in unincorporated neighborhoods just outside Flagstaff city limits, causing tens of millions of dollars of damage to infrastructure and private property. Projections indicate that a wildfire on the steep slopes above Flagstaff could cause similar impacts to large portions of the City of Flagstaff, and that a wildfire and subsequent erosion on the steep slopes of Mormon Mountain could render 50% of the city's water supply (Lake Mary Reservoir) unsuitable. These areas have not been treated in the past due to several complicating factors, including steep and rocky terrain, wildlife and social concerns, and economic unfeasibility due to low timber value and the costs of treatments.

The risks of wildfire and post-wildfire flooding cannot be completely eliminated, but the objective guiding this effort is to reduce those risks as effectively as possible given the constraints inherent to the project area (inaccessible, rocky terrain; presence of threatened species; cost of treatments; etc.). Every treatment option is being considered, something that has never been feasible until the passage of the bond initiative.

The effort will include a combination of treating areas already approved by previous National Environmental Policy Act (NEPA) decisions, analyzing new areas, re-analyzing areas where all treatment options were not previously considered, and accelerating treatments currently being analyzed under 4FRI. Treatments will likely progress continuously for a period of 8 to 10 years before the entire undertaking is completed. Public involvement is a large and important component of this project given the importance and proximity of the area to Flagstaff residents, the complexity of the issues, and the unique nature of the funding.

Greater Flagstaff Forests Partnership (GFFP)

The Greater Flagstaff Forests Partnership, one of the state's first collaborative partnerships, is an alliance of environmental, governmental, and business organizations dedicated to researching and demonstrating approaches to forest ecosystem restoration in the ponderosa pine forests surrounding Flagstaff, Arizona. The GFFP is currently assisting the City of Flagstaff in managing the Flagstaff Watershed Protection Project as well as managing fuel hazard and forest health projects on private land.

Arizona Department of Transportation (ADOT) - Forest Industry Partnership

The Forest Health Council has partnered with the Arizona Department of Transportation over the last two years to promote more efficient transportation means for forest products on the state highways. The council provided education to state transportation officials on the critical importance of restoring forests and being able to efficiently transport forest materials to mills and other utilization centers. Successes in this partnership include reopening previous closed haul routes and development of a pilot project to increase load limits on haul routes in eastern Arizona.

Programs such as 4FRI, Collaborative Forest Landscape Restoration Program, expanding the role of the State Forestry Division in forest restoration, in synergism with local restoration efforts such as the City of Flagstaff's

Forest Health and Water Supply Protection Project will create the “all lands all hands” approach that must be implemented to manage all the intricate pieces of our local, state and federal forested landscapes.

Restoration of the C.C. Cragin Reservoir Watershed

The National Forest Foundation, the U.S. Forest Service, the U.S. Bureau of Reclamation, SRP and the Town of Payson have partnered to restore more than 64,000 acres in the C.C. Cragin Reservoir Watershed. This project was formed under the Western Watershed Enhancement Partnership enacted by the U.S. Departments of Interior and Agriculture in 2013. This partnership works to prevent the negative impacts on water quality and sedimentation that catastrophic wildfire could have on the C.C. Cragin Reservoir—a vital water supply to the Town of Payson and other communities in northern Gila County. The project team is currently working to develop a 5-year action plan which specifies accomplishment targets for planned restoration and protection activities within the project area. The goal of the partnership is to reduce the risk of catastrophic wildfire in this valuable municipal watershed through a collaborative environmental planning process, getting fuels reduction treatments into the project area as soon as possible. The planning process will follow guidelines for fuels reduction treatments as outlined in the Healthy Forest Restoration Act of 2003.

Sky Island Restoration Partnership (SIRP)

In Southern Arizona, the Sky Island Restoration Partnership (SIRP) Fund is seeking innovative funding mechanisms to accelerate restoration treatments on the Coronado National Forest. The funding mechanisms under consideration for southern Arizona include corporate donations from businesses that benefit from tourism and recreation, enhancing the wood products industry, and opt out fees on hotel room nights and utility bills.

The Nature Conservancy

The Nature Conservancy (TNC) is working to enhance the use of new technology, facilitating a science-informed adaptive management program that enhances trust among the USFS, contractors, and other stakeholders and helps continually improve business practices. TNC is piloting the use of tablet technology for timber/restoration project planning, harvesting, reporting, monitoring, and adaptive management. This technology is currently being tested by the Arizona chapter of TNC in partnership with the USFS (4FRI team, USFS Region 3, and the Technology & Development center in Missoula, Missouri), Ecological Restoration Institute, Arizona State Forestry, and local wood harvesting business. This technology will help cut costs, promote efficiencies, and support the following objectives:

- Marking timber/forest products at a greater pace and scale reducing costs/acre of labor and paint
- Monitoring information of actual forest product removals will better inform land managers and support collaborative processes by proving timely and scientifically rigorous information of treatment results
- Geospatially explicit harvesting guidance, including in-cab tablet technology, will support timber sale purchasers and stewardship contractors

Federal and State Partnerships

Just as we have a national policy on clean air, clean water, and endangered species, our Federal and state agencies have worked together to develop a national wildland fire management strategy, This strategy addresses the challenges of managing wildfire across the national landscape and established national goals and performance measures necessary to meet the goals in meeting challenges and opportunities to meet the vision of the National Strategy to “Safely and effectively extinguish fire, when needed; use fire where allowable; manage our natural resources; and as a nation, live with wildland fire.” National programs such as the Collaborative Forest Landscape Restoration Program, a groundbreaking approach to improving our nation's forests, help make communities safer and bolstering local economies. Since 2010, the Collaborative Forest Landscape Restoration Program has brought local communities and timber companies together to improve forests conditions across 23 high-priority project sites resulting in 1.45 million acres of America's forests and watersheds – an area larger than Delaware – being healthier as a result of collaborative partnerships to reduce the risk of catastrophic wildfires. The coordination with local partner organizations is essential to getting substantial work done.

Arizona has been aggressive in determining the health and condition of our forested landscape and in developing strategies for restoring these landscapes. In 2007, the Governor's Forest Health Advisory and Oversight Councils developed the Statewide Strategy for Restoring Arizona's Forests. The Arizona State Forestry Division in 2010 produced the Arizona State Forest Resource Assessment, organizing the state's critical forest resource issues into seven major categories:

1. People and Forests
2. Ecosystem health
3. Water and air
4. Fire
5. Economics
6. Climate change
7. Culture

Also in 2010 the Arizona State Forestry Division produced the Arizona Forest Resource Strategy specifically to address forest-related conditions, trends, threats and opportunities that lead to a finding of three overarching needs that cut across all seven issues identified in the Resources Assessment:

1. Conserve working lands
2. Protect forests form harm
3. Enhance public benefit from trees and forests

Federal Approach

There is a deep body of science that clearly demonstrates the need and benefit of thinning projects in overgrown forests, and important partnerships between academia, local stakeholders and conservation groups, and the federal, state and local governments that are working to translate the science into action. However, despite the strong coalition and engagement from a diverse set of interests, limits on U.S. Forest Service budgets and resources as well as considerations imposed by the lengthy environmental compliance requirements slow the progress of restoration. The U.S. Congress and the President have recently worked on legislation and appropriations that work to help the U.S. Forest Service perform restorative, fire prevention treatments in critical areas across the West. Supporting legislation that helps further the Forest Service's ability to perform fire prevention treatments is important to ensure that fuels reduction treatments can be implemented where needed.

The growing cost of fire suppression activities negatively impacts the budgets needed to carry out critical restoration projects that protect the forests from catastrophic wildfire. This negative feedback loop known as "fire borrowing" currently requires the Forest Service to use appropriate funds designated for restoration and fire prevention efforts. When a fire season is severe enough, it diminishes the budgets designated for fire suppression activities, requiring the Forest Service to dip into other budgets in order have the resources necessary to put fires out. Over time, as the frequency and severity of fires have increased, the act of fire borrowing has become a formidable burden that diminishes the Forest Service's ability to perform treatments intended to prevent catastrophic wildfires—further diminishing the health and resiliency of forests over time. Two bills have been recently introduced to stop the impact that fire borrowing has on the Forest Service's ability to perform fire prevention treatments.

Conducting the extensive analysis and administrative steps needed to comply with the National Environmental Protection Act (NEPA) and Endangered Species Act (ESA) commonly takes multiple years and is often required prior to undertaking any work to reduce fire risk. Legislation such as the Healthy Forest Restoration Act of 2003 (HFRA) and the Collaborative Forest Landscape Restoration Program (CFLRP) established under the Omnibus Public Land Management Act of 2009 produced guidelines for collaboration and stakeholder engagement to produce restoration and fuels reduction projects that reduce the risk of catastrophic wildfire through environmental planning processes that address a wide variety of stakeholder interests on a landscape scale. While more action is needed to modify legislation that will accelerate the administrative process associated with NEPA and ESA compliance, these two programs help ensure that the multipurpose nature of these lands are included in proposed restoration projects.

The continued value of our National Forests in providing wildlife habitat, ecological protections, clean water supply, recreational opportunities, forest products and healthy rural economies depend on accelerating restoration and hazardous fuels reduction. Arizona's support of legislation that promotes the Forest Service's ability to perform restoration treatments more expeditiously will help get on-the-ground restoration where it is most needed to prevent catastrophic wildfire and ensure that Arizona's forests continue to be valuable assets to the State Economy.

State Level Approach - Firewise

Firewise USA is a national program to encourage and recognize communities that actively treat their land and structures to reduce wildfire damage. Arizona State Forestry, in conjunction with local fire departments, community associations, and the Arizona Insurance Council, have been emphasizing the creation of Firewise Communities across Arizona through education and training of property owners, HOA's, and fire department personnel. Through this effort, the Division provides State level certification for Firewise Assessors and Advisors to assure proper treatments are carried out within communities. To date the Division has certified over 290 Firewise Assessors and Advisors, and over 60 communities have received the National Firewise USA recognition.

Highlights

- A proactive approach to tackling the issues around healthy forests - including multistakeholder partnerships - is helping ensure the health of these valuable resources for generations to come.
- The continued value of our forests in providing wildlife habitat, ecological protections, clean water supply, recreational opportunities, forest products and healthy rural economies depend on accelerating restoration and hazardous fuels reduction.
- Two bills have been recently introduced in Congress to finance fire suppression and stop the impact that "fire borrowing" has on the Forest Service's ability to perform fire prevention treatments.

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