



"The mission of the National Wildlife Refuge System is to preserve a national network of lands and waters for the conservation and management of fish, wildlife, and plant resources of the United States for the benefit of present and future generations."

Why Burn?

Most U.S. Fish and Wildlife Service lands evolved with fire and depend on it for their ecological health. These lands require periodic fire to survive as productive wildlife habitat. Without the unique ecological benefits of fire, refuges suffer from the effects of invasive weeds, and could perhaps be destroyed when a wildfire finally strikes.



An eastern massasauga rattlesnake returns to a burned area at Squaw Creek NWR in Missouri. The species is state-listed throughout its range. (USFWS)

Aside from a measure of safety it offers to surrounding communities, prescribed burning at certain times optimizes plant growth by returning nutrients to the soil. In many cases, new growth appears within a couple of weeks. This is possible because prescribed burns move quickly and at a lower intensity than most wildfires, leaving root systems alive under the soil. Also, fire produces healthier, more productive habitat by killing the tops of woody plants such as willow and oak, causing them to sprout from the base. The

resulting shoots provide tender, nutritious browse for deer, elk and other animals. Small mammals usually are first to seek the rewards of a fire. When their populations begin to rise, their predators are not far behind, and the chain of life mends itself.

Lack of periodic fire in wild areas increases the risk of a catastrophic fire. It's really not a matter of if, but when it will happen. Such high-intensity, destructive fires result from hazardous fuel accumulations that may result in serious injuries or deaths for firefighters and the public; property loss or damage; adverse health effects and poor visibility due to periods of unmanageable smoke; loss of plant and animal species and their habitats, and damage to soils, watersheds and water quality.



Elk herds seek tender new shoots in a burned meadow. (USFWS)

The Service has been using prescribed fire safely, expertly and cost-effectively since the 1930s, and to a limited degree, allows wildland fire use to play a role on its refuges. This can be the least-expensive method of managing fire. An initiative under the National Fire Plan that has gained momentum in recent years calls for reducing hazardous conditions

in wildland-urban interface areas adjacent to federal lands, while maintaining and restoring natural ecosystems. Restoring and maintaining all Service lands by increasing prescribed burning and wildland fire use continues to be the most cost-effective, ecologically sound long-term fire strategy.

The following case studies illustrate how prescribed fire and wildland fire use benefits National Wildlife Refuge System lands:

Seabird Restoration Through Prescribed Fire

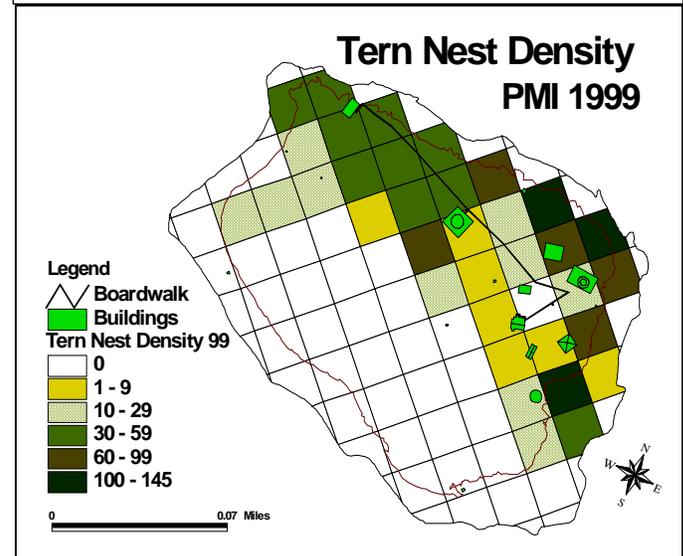
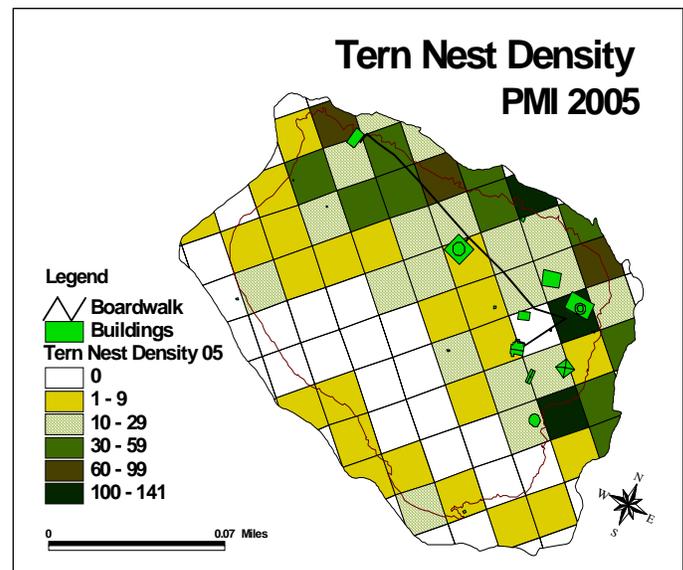
Prescribed burning has become a vital component of seabird restoration at Maine Coastal Islands National Wildlife Refuge over the past five years.

Petit Manan is a 16-acre island located approximately three miles south of Petit Manan Point in Steuben, Maine, and is one of many islands under the jurisdiction of the Service.

The island has historically been one of the most important seabird colonies in the Gulf of Maine. The Service acquired the island in 1974, and has been managing the seabird colony on the island since 1984. The island now supports a large mixed seabird colony including common, Arctic and Roseate terns, Atlantic puffins, razorbills, common eider, laughing gulls, Leach's storm petrels and black guillemots. Roseate terns are federally protected and puffins, razorbills, and Arctic terns are listed as threatened species by Maine Department of Inland Fisheries and Wildlife.

The island has several structures listed on the National Historic Register, and prescribed fires were used to treat fuels and minimize wildfire threats to these structures, as well as revitalize bird habitat.

Although the tern population had grown to 1,488 pairs in 1999, refuge staff had documented a shift in nesting distribution on the island, in likely response to vegetation changes. Terns prefer to nest in areas of low, sparse vegetation. As tall,



dense vegetation such as raspberry and Canada blue joint expanded on the island, terns were forced to nest along the island perimeter, where they are subjected to storms and higher predation events. Laughing gulls, which prefer to nest in rank vegetation, benefited from the vegetation changes and experienced a 20 percent per year increase in population size. Laughing gulls are now considered a major predator of terns; the terns nesting in close proximity to the gulls experienced significantly lower productivity rates as compared to other regions of the colony.

Petit Manan refuge initiated a spring prescribed fire program in 2000, and has burned a portion of the island every year since 2002. The island has several structures listed on the National Historic Register, and fire was used to treat hazardous fuels around them, minimizing the chance of future wildfire damage. Additional benefits of burning have been obvious: the spring burns have converted

the vegetation to habitat favored by nesting terns. The overall vegetation height on the island has been significantly reduced and annual refuge seabird census show a shift in tern nesting distribution away from the perimeter of the island, to the newly available habitat in the center of the island. The vegetation reduction also allows refuge staff to locate and destroy gull nests. By 2004 the tern colony had grown by 48 percent (2,252 pairs) and was the second largest tern colony in Maine. While a late spring storm in 2005 adversely affected the terns, decreasing the colony by approximately 33 percent, the refuge is confident that the improved habitat will attract terns in the future.

Managing Fire in Alaska's Wilderness

In midsummer 2003, Tetlin and Kenai national wildlife refuge employees discovered small lightning fires smoldering in remote areas on their refuges. Although the fires could have been quickly suppressed, managers decided to implement an alternative strategy: These fires were among the first in Alaska to be managed under national guidelines for wildland fire use.

Wildland fire use provides managers with a way to allow fire to play out its natural role in the environment. Under this strategy fires are closely managed, and suppression is implemented only to protect people, homes and communities. The physical and behavioral parameters of a fire, pertinent environmental conditions, and potential threats to people are assessed daily and used to develop management strategies. These plans develop and change as the fire grows and requires coordination with other agencies and adjacent landowners.

In addition to the ecological benefits of fire, money is saved by limiting suppression actions only to those necessary to protect important values. In Alaska, where a small number of suppression resources must be allocated over huge geographic areas and many fires, wildland fire use is a way to manage fires when there are limited firefighting resources. At Tetlin and Kenai refuges, where wildland fire suppression services are normally provided by State of Alaska cooperators, wildland fire use also gives refuge staff the flexibility to capitalize on research,

public outreach, and environmental education opportunities.

The Black Hills fire in 1997 on the Tetlin refuge eventually burned 42,800 acres, entirely on federal lands managed by the refuge and the Wrangell-St. Elias National Park and Preserve. A drought delayed the anticipated season-ending rains allowing the fire to burn well into September. An analysis was conducted in mid-August to predict the probability that the fire would have reached areas of concern that included Native allotments and cabins. Although contingency plans were enacted to protect private property, the analysis showed that the fire never posed a threat to public or private values. The predictions were correct, and no direct suppression was required.

During the fire, researchers gathered data from plots placed in the fire's path. The results will be used to help predict the smoke production, behavior and severity of future fires. Data plots similar to those used in the Black Hills fire were installed following the 1982 Kennebec fire. Since they remained in place, they were burned again by the Black Hills fire and will be re-monitored to provide data on how vegetation grows back following multiple fires. Forested communities that burned during the Kennebec fire provided an effective barrier against the spread of the Black Hills fire; however tundra communities tended to reburn easily. Additional research being conducted on the Black Hills fire includes development of a burn severity index, and post-burn berry, vegetation, and small mammal inventories.

In 2005, the Fox Creek fire on the Kenai Refuge grew to more than 26,000 acres in under two weeks. It was successfully managed in wilderness areas during a period of high fire danger and close proximity to people and structures. The fire was managed in such a way that it was allowed to reshape a portion of the wilderness as fire has for centuries, but within what is known as a maximum manageable area – that is, with specific suppression actions planned at set points to anticipate and counter potential expansions of the fire beyond the maximum manageable area.

This example of wildland fire use will increase biodiversity in the affected area. Specifically, it will help improve moose habitat while reducing hazardous fuels that could otherwise fuel a wildfire.

Whooping Cranes and People Benefit from Prescribed Burns

Endangered whooping cranes have responded well to prescribed burning in their wintering habitat at Aransas National Wildlife Refuge Complex in Texas, and people who live nearby have benefited as well.

Although in winter the birds maintain a steady diet of blue crab and various clam species, they also use upland coastal savannah sites for fresh water and alternate food sources such as acorns from a shrub known as running live oak. The problem is that this type of oak grows to about a meter in height and tends to overrun part of the refuge, rendering it useless to the cranes. The brush also creates a fire hazard surrounding communities.

Enter prescribed burns, which kill the top portion of the oak, allowing it to sprout again from its roots. Doing this controls hazardous fuels on the refuge and at the same time benefits a critically endangered species.

Fifteen burn units totaling 5,199 hectares on the Blackjack Peninsula are managed for whooping cranes. These units are burned on a three-year rotation to allow the sprouting oaks to produce acorns for the cranes, and to improve the overall health of coastal savannah habitat. Reducing grass and brush also makes insects, crayfish, and snails more visible to the birds. The bay side of Matagorda Island also is burned for whooping cranes during the winter. Winter surveys in 2003 and 2004 show that the birds return to the burn units the day after the fire, and are still coming back more than four months later.

Conserving an Imperiled Ecosystem and Reducing Fire Risk to a Community

Necedah Wildlife Refuge in central Wisconsin is home to a globally imperiled ecosystem known as oak savanna, but lack of regular natural fires was threatening the quality of its habitat as well as the neighboring community of Necedah.

At the time of the original land surveys in the 1850s, oak savannas covered more than 4.5 million acres of Wisconsin's landscape. Today, fewer than 5,000 acres of savanna can be found in the state. The habitat is characterized by prairie grasses, intermittent brush and widely scattered, mature



Karner blue butterfly (USFWS)

trees. Oak savannas provide important habitat for a variety of species including rare plants, songbirds and the endangered Karner blue butterfly. Oak savannas survive and flourish only with the help of occasional grass fires.

In the absence of fire, savannas advance through successional stages, allowing trees to encroach on the prairie and eventually reaching a hazardous fuels state. The extreme hazard that fire suppression caused is a fact of life for the community of Necedah, having burned twice in its short history. Consequently, Necedah and several nearby communities were identified as “communities-at-risk” in the National Fire Plan.

Necedah was built on a vast ridge prone to natural fires. The soil drains quickly, holds little moisture and is dominated by thick jack pine. Complicating matters, a mountain ridge near the town runs in a southwesterly direction, which tends to guide



A controlled burn removes invasive weeds and revives prairie grasses. (USFWS)

wildfire toward town, since the prevailing winds routinely come from the northwest.

Although the refuge's large blocks of jack pine brought the threat of wildfire to surrounding communities, the trees also presented an opportunity to restore rare habitat and contribute to the recovery of endangered species and rare migratory birds. Beginning in the late 1990s, the thick stands of timber were thinned using selective-cut timber sales.

All oak trees with diameters greater than 16 inches were marked so they would be left standing, as were all pines with diameters greater than 14 inches. The restoration sites were treated with a prescribed burn following the timber sale, which further reduced the mass of brush in favor of savanna grasses and small plants. After the machines were through working on the refuge, a seven-acre brush pile needed chipping, and Becky McMahan, the refuge's wildland-urban interface coordinator, was trying to figure out how to make it happen. Then she saw a late-night TV ad by a yard clean-up company promoting their chipping program. The company competed for the bid, and won, hauling away 100 20-ton truckloads of chipped slash. It was used as boiler fuel for commercial manufacturing operations.

After that, a vegetation-monitoring crew was hired to establish plots and collect data. A panel of fire and habitat restoration experts from across the country to evaluated the refuge's restoration program and presented the Service with a \$10,000 Alan Haney Award for excellence in restoration. The money was used to pay for the vegetation monitoring.

The refuge's savanna restoration program not only has reduced the threat of wildfire to the town of Necedah, but increased the amount of Karner blue butterfly habitat on the refuge from 540 acres to 1,245 acres, which meets one of the species' recovery plan goals.

Red-headed woodpecker populations within the restored oak savannas also have skyrocketed and the refuge is now home to Wisconsin's largest red-headed woodpecker population. A recent study shows that the refuge contains more than seventy red-headed woodpecker nests. Bird, mammal, and plant diversity has increased dramatically, with the number of neotropical migratory birds stopping at the refuge doubling to nearly 40. Also, at least two packs of gray wolves have denned on the refuge.

The oak savanna restoration program is expected to provide quality habitat for other rare species, helping preclude the need for federal Endangered Species Act protection, while increasing the safety of surrounding communities.

Reducing Risk and Restoring Desert Bighorn Sheep Habitat

The San Andres National Wildlife Refuge is located in the southern third of the San Andres Mountains in south central New Mexico. This mountain range is one of the largest contiguous, relatively undisturbed Chihuahuan Desert land masses in the United States. Since the refuge was established in 1941, its primary emphasis has been restoring a remnant population of desert bighorn sheep, a state-listed endangered species in New Mexico. Because there is restricted access and the lands remain relatively undisturbed, the refuge serves as a natural laboratory supporting research on southwestern flora and fauna, Chihuahuan Desert ecosystems, hydrological status, and the effects of fire, both natural and prescribed.

The build-up of woody species that has encroached on these desert grasslands serves as fuel for wildfires. This has potentially disastrous consequences for the refuge, and nearby federal facilities such the U.S. Army's White Sands Missile Range, as well as National Park Service lands. Periodic controlled burns reduce hazardous fuel loads and therefore the threat of uncontrollable,

severe wildfires. The burns also encourage habitat diversity, and enhanced watershed function. For the desert bighorn sheep, the nutrients that are recycled after the fire encourage growth of nutrient-rich shoots, and promote the growth of native species. Also, escape routes become available for bighorn sheep from predators like mountain lions and bobcats that use dense vegetation to stalk their prey.

Using fire to manage habitats over broader landscapes has reduced the wildfire risk to important facilities in this area while also helping prevent the need for federal protection for the desert bighorn sheep.

South Florida Prescribed Burn Helps Stop Wildfire from Spreading

In 2004, a prescribed burn on 7,000 acres at Arthur R. Marshall Loxahatchee National Wildlife Refuge in Florida was credited with halting a 4,000-acre wildfire that was ignited by lightning later in the summer.



Firefighters monitor a prescribed burn at Arthur R. Marshall Loxahatchee NWR. This burn prevented a later wildfire from spreading. (USFWS)

Only 80 acres of the 147,392-acre Loxahatchee refuge were affected by the wildfire. The refuge, part of the northern Everglades, contains slough habitat that is home to more than 257 bird species, including the endangered Everglades snail kite and wood stork.

When the wildfire advanced to the area where the prescribed burn took place, it fizzled out. Having

ignited in a state-owned water conservation area south of the refuge, it burned a few levees, but stopped a half-mile short of the refuge's pump station. Had the prescribed burn not taken place, the wildfire had the potential to travel through the entire refuge.

Fire Resurrects Prairies and Protects Communities in Oregon

If there is one thing everyone knows about western Oregon, it's the rain.

It is surprising then, to realize that fire has helped shaped the Willamette Valley landscape for possibly the past 10,000 years. Periodic burning by native peoples created wet prairies and oak savannas that supported abundant game animals and edible plants. Fire improved seed production, reduced brush undergrowth and created optimum conditions for hunting deer.

Today, more than 99 percent of the Willamette Valley's one million acres of native prairies are gone. More than 150 years of wildfire suppression, concurrent with the spread of agriculture and urban development, means that practically no prairie remains and the oak savanna is changing into oak woodland and Douglas-fir forest. Much of the original prairie that has not given way to development has been overtaken by introduced species including Scotch broom, pear, and Himalayan blackberry, as well as native shrubs and trees such as poison oak, black hawthorn, and Oregon white oak seedlings.

Major representations of the remaining fragments of Oregon's original landscape are located on two Willamette Valley National Wildlife Refuges: Baskett Slough and William L. Finley. These remnants provide important habitat for federally listed insect and plant species, including Fender's blue butterfly, Kincaid's lupine, Bradshaw's desert parsley, Willamette daisy, and Nelson's checkermallow.

Refuge managers have spent considerable effort for the past few years attempting to mimic the cleansing effects of fire. Crews thin the oak and



Two listed species that depend on each other and on fire: Kincaid's lupine and Fender's blue butterfly. (USFWS)

ash trees and cut back brush with big mowers bearing special rubber treads to minimize soil compaction and disturbance. This treatment increases the amount of sunlight reaching the ground, benefiting prairie plants and butterflies alike. It also protects nearby private property from the potential effects of a wildfire. Prescribed burning also plays a role in resurrecting native prairies. In 2003 the Fender's blue butterfly reached its highest population level in 10 years, a 64 percent increase over the 2002 count - after refuge fire crews burned 455 acres.

Thinning and prescribed fires also reduces hazardous fuels, prevents uncontrollable wildfires on the refuge, and lowers wildfire risk to nearby homes, agricultural lands, and private woodlands. Interagency cooperation and support during the burning operations came from the U.S. Forest Service, the Bureau of Land Management, the Oregon Department of Forestry and the Monroe Rural Fire District.

Fire on a Kansas Prairie Benefits People and Native Species

Fire managers at Kirwin National Wildlife Refuge in Kansas carefully protect nearby communities, while strategically improving habitat for its fragile feathered residents.

As part of its wildland-urban interface program to protect nearby communities from potentially damaging wildfire, managers hired a contractor in 2003 to reduce hazardous fuels by cutting and piling non-native Siberian elm, Russian olive, honey locust, black locust and eastern red cedar that have encroached on the prairie. The piles

were then burned by refuge personnel. Nine local volunteers regularly help the refuge by cutting some of these trees into firewood. A prison crew of seven routinely works at the refuge preparing areas for prescribed burns and mechanical treatments.

Dead standing timber is being burned away on other parts of the refuge to enable staff to gain access to certain areas to control noxious weeds. In addition to providing safer conditions, hazardous fuels reduction results in open areas for sandhill cranes, waterfowl and shorebirds and creates better hunting access. Fire also stunts sprouting cottonwood and willow trees, creating better habitat for nesting.

The timing of prescribed fires on this refuge is one of the keys to successfully reducing wildfire risk, while restoring open, native habitat: Late spring burns promote native warm season grasses by getting rid of the non-native grasses, which thrive primarily in the cool season. Another success factor is the support the refuge receives from neighboring Quivira refuge, since Kirwin has no qualified fire personnel of its own. The Rainwater Basin Wetland Management District in Nebraska also provides essential help, as do the firefighters of two local volunteer fire departments who are the first responders when wildfire strikes the refuge.

While protecting human life and property is the top priority of the refuge's fire program, the U.S. Fish and Wildlife Service also is entrusted by the Congress to protect wildlife habitats. Birds such as the greater prairie chicken and dickcissel, among dozens of others, depend on the characteristics of prairies to live and breed successfully. These two species are among dozens of grassland birds across the country that have the dubious distinction of being one of the fastest declining groups of birds in North America.

Reclaiming the Rio Grande by Removing Salt Cedar

Bosque del Apache National Wildlife refuge in New Mexico was named for the Native Americans who once camped in the riverside forests along the majestic Rio Grande River. Now, the "woods of the Apache" are under siege from salt cedar, also known as tamarisk, a small, invasive tree introduced from Asia early in the last century.

Highly fire-adapted and flammable, the plant has taken hold of vast areas of the Southwest, becoming a severe wildfire hazard to human as well as biological communities. The refuge is leading the fight against this invasion, and where it can, is restoring native plants, which evolved alongside native wildlife.

A large-scale fuels reduction study seeks to determine the best methods for removing invasive species from the Rio Grande Valley and restoring native cottonwoods and willows. Salt cedar is a major fire hazard along the Rio Grande corridor and has fueled several major fires there in recent years.

So far, the project has eradicated 343 acres of salt cedar using machinery and prescribed fires. Some of the treated areas will be seeded with cottonwood, black willow, and shrubs as well as other understory plants selected to restore native habitat.

Other research plots are being cleared on the refuge and flood-irrigated to see if native species will return without replanting. So far, revegetation has occurred on two plots and the results are encouraging, with salt cedar and other weed growth staying under control. Grasslands that were cleared and burned also are regenerating.

Employees of the U.S. Forest Service and the University of New Mexico have helped the refuge staff monitor the effects of this project in order to refine future treatments, and use the results for their managed lands, too.

Partners in the fuels reduction project include the U.S. Forest Service Rocky Mountain Research Station, U.S. Geological Survey, the Bureau of Land Management, the New Mexico State Land Department, the Middle Rio Grande Conservancy District, the City of Albuquerque and other local, state and federal partners.

Weeds vs. Rare Plants and Birds at Rachel Carson National Wildlife Refuge

Since 2002, Rachel Carson National Wildlife Refuge has been controlling non-native, invasive phragmites by mowing them without mercy.

Phragmites, a tall, aggressive, weed threatens not only refuge neighbors with its extreme flammability, but can adversely affect two rare wetland species.

This project has not only reduced the risk of severe wildfire on the refuge and to nearby homes, but has helped protect and promote the growth of rare plants. Removing phragmites helps prevent it from getting started in new areas. The weed can spread when storms dislodge it and deposit it in new areas along the coast.

The portion of the refuge with the biggest



phragmites infestation also is home to largest population of the state-endangered slender blue flag iris.

Thousands of irises grow on the refuge's Webhannet marsh, where phragmites is held at bay

with a specialized mower once or twice each summer.

The regimen seems to be working because the persistent phragmites stand has become much less dense in the past three years.

Other plants, including some of the rare iris, have begun to sprout in former phragmites strongholds. The periodic mowing also indirectly benefits the saltmarsh sharptailed sparrow, which inhabits the wetlands that phragmites can easily engulf.

Eagles and Humans Benefit from Fuels Reduction

Bear Valley National Wildlife Refuge and its subdivision neighbors in Worden and Keno, Oregon are working together to reduce the risk of wildfire that could threaten homes as well as one of the largest concentrations of winter-roosting bald eagles in the United States.

The 4,200-acre refuge, which straddles Southern Oregon and Northern California, contains a dense mix of pine, fir, juniper and brushy areas that have overwhelmed eagle roosting areas and created hazardous fuels conditions and therefore a wildfire threat. For the past several years refuge employees and contract crews have cleared or burned about 2,300 acres of flammable vegetation on the refuge. Neighbors have been doing the same, protecting their homes by removing excess brush and trees that are too close to buildings.

"One of the big successes of our project has been the reaction from adjacent landowners," said David Goheen, fire management officer at the refuge. "Several private landowners adjacent to the refuge have hired the same contractor that we've used to treat their side of the fence. Not only have we greatly reduced fire hazards on the refuge, but the clearing we've done benefits bald eagle habitat by protecting preferred tree species and tree characteristics."

Crews use a machine called a slash buster to grind up thick stands of tangled trees and vegetation. By December 2005, crews slash-busted 705 acres. Another 400 acres of brush was cleared using chain saws. In addition, timber sales were held on the refuge in 1999 and 2004 to selectively thin 1,200 acres of overgrown forests, lessening the likelihood that a wildfire could destroy the larger trees that eagles prefer for roosting. About 250 acres of slash piles have been burned in the past three years. Crews also burned 80 acres of underbrush in the fall of 2005.

The Keno Rural Fire District has applied for and received federal grants through the Service to purchase a chipper and hire a crew to remove flammable vegetation from high fire-risk subdivision lots next to the refuge. The Oregon

Department of Forestry has also received grants to treat some of the 400 acres it owns nearby.

Bear Valley refuge is part of the Klamath Basin National Wildlife Refuge Complex, which manages three refuges in southern Oregon and three in northern California.

Timing Is Everything- Juggling Multiple Burn Objectives

Since it was established in 1937, the Sacramento National Wildlife Refuge Complex in northern California has been juggling multiple resource objectives to better benefit the American public. The approximately 35,000-acre complex includes the Sacramento, Delevan, Colusa, Sutter, Butte Sink and Sacramento River refuges. The wetlands, alkali meadows and vernal pools at these refuges provide habitat for millions of waterfowl, shorebirds and other migratory birds. Vernal pools and alkali meadows also are home to a multitude of rare and indigenous plants as well as threatened and endangered invertebrates.

The timing and tactics of prescribed burns on the refuge can vary dramatically based on a balance of project objectives, which include habitat enhancement, firefighter safety, structure protection and air quality. Burning to manage cattails and bulrush occurs in the summer, while burning to reduce non-native grasses is generally scheduled in the spring. In some cases, burning is used and timed in conjunction with other treatments such as disking within wetlands, or grazing within vernal pools to better achieve and maintain habitat and species objectives.

The invasion of non-native annual grasses is a big issue for vernal pool management on these refuges. Invasive non-native plants compete for light and water and can alter the local hydrology affecting vernal pool function. Using fire, cattle grazing or other tools to remove annual grasses and other standing dead vegetation can help improve water drainage and infiltration in vernal pools. Research shows that spring burns timed prior to seed production of non-native grasses can enhance survival opportunities for vernal pools species, which grow later in the season. The following are just a few examples of prescribed burns on the

refuge timed to balance multiple objectives, including vernal pool management.

A 60-acre prescribed fire at Sacramento refuge in March 2005 was designed to reduce hazardous fuels for the protection of adjacent private property as well as to enhance wetland habitat. The project also was critical in enhancing nearby vernal pools. The burn area included overgrown cattails and hardstem bulrush that were reducing the diversity and productivity of waterfowl in the marsh and beginning to invade vernal pools and alkali meadows. While cattails and bulrush are desirable for many species within a managed wetland, they can be detrimental to vernal pools and alkali meadows as they crowd out less aggressive species. This vegetation had built up to the point that it created a large, volatile fuel load – too large for a summer burn when there was a chance that the fire could escape and risk damage to private property and jeopardize firefighter safety.

While the March 2005 burn was successful in reducing the hazardous fuel load and in increasing the wetland habitat diversity; it did not meet vernal pool objectives. The extreme build up of rank vegetation will require a follow-up of disking and/or burning. Now that the hazardous fuels have been reduced, additional projects can be better aimed at improving conditions for vernal pools.

Another prescribed burn in September 2005 was designed to enhance vernal pool and alkali meadow habitat by reducing invasive bulrush. The rampant growth of this invasive species was due to excess water seepage onto the refuge from breaks in a drainage ditch. The project called for a late-summer burn when the bulrush was completely dry. When bulrush is removed, native grassland and vernal pool species are able to germinate in the winter and spring. The results so far have been an increase in abundance and diversity of plants and wildlife.



Snow geese and pheasants forage after a prescribed burn at Sacramento NWR. (USFWS)

A collaborative project at Sacramento River refuge in June 2005 involved the refuge, The Nature Conservancy, and Llano Seco Ranch, and was designed to enhance vernal pool habitat by reducing invasive noxious weeds including medusahead and annual ryegrass. Grazing was the preferred management tool, but cattle would not eat medusahead due its high silica content. A prescribed burn was planned when the weed was dry enough to burn. Cattle were later used to help control ryegrass. This combination was successful in California at both restoring and maintaining vernal pools.

These projects are examples of how varied timing, conditions and tactics are necessary to meet a variety of conservation objectives. These projects could not happen without internal and external collaboration, both of which are essential for the long-term management of the Sacramento complex.

To learn more about the U.S. Fish and Wildlife Service's Branch of Fire Management, please visit www.fws.gov/fire