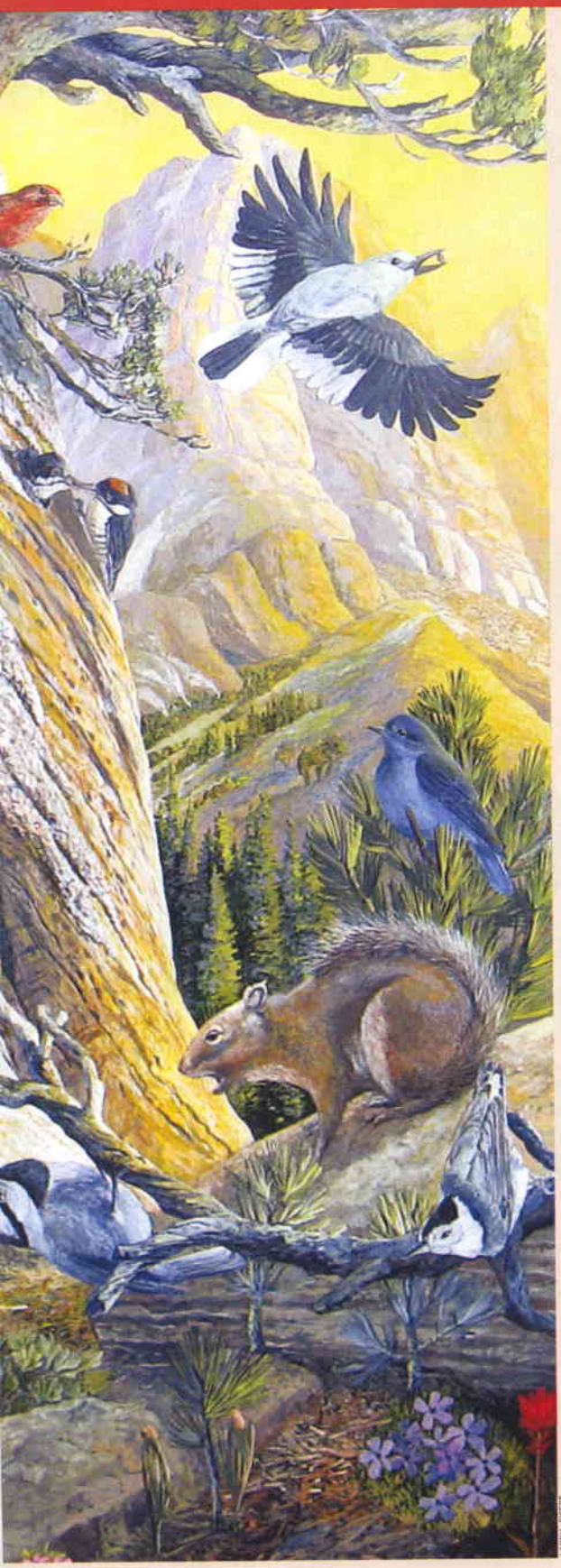
Whitebark Pine
AN ECOSYSTEM IN PERIL



LARRY KIEFER

"When we try

to pick out

anything by itself,

we find it hitched

to everything else

in the universe."

— John Muir

US FOREST SERVICE, RICHARD SNEZKO

Imperiled in High Places

A tree that in many ways defines life atop the windswept crown of western North America's high country is in trouble. Whitebark pine, which has evolved to both live and foster other life forms in a landscape where existence is a struggle, faces decimation from blister rust, an outbreak of mountain pine beetles, fire suppression, and climate change. If something can't be done to help these trees, whitebarks could disappear from the Sierra, Cascade, and northern Rocky Mountain summits. And along with the trees, we could lose a complex web of plant and animal life, all with the potential to become ecologically unraveled if efforts to protect this symbol of subalpine tenacity should fail.

Whitebark pine (*Pinus albicaulis*) is a five-needled species most often found near the timberline. Younger trees are known for their whitish bark, thus the name. The trees often grow in small groves, the crowns can be bushy, and the trees themselves sometimes display the gnarled effects of harsh, high-altitude living.

Mature whitebark pines do much to orchestrate the way life revolves near mountain summits. To begin with, the tree's seeds are crucial to much high-elevation ecological interaction. They're large, extremely rich, and capable of boosting a whitebark seedling's chances in a habitat where the elements seem to conspire against survival. Despite all the inclemency they're up against, whitebarks are successful reseeders. However, due to an evolutionary twist of fate, they can't manage this crucial act of species self-preservation on their own.

Unlike other pines, whitebark seeds neither drop from the cones, nor wait for the wind to provide dispersal. Instead, these pines have evolved a mutualistic partnership with a bird at home in subalpine forests, the Clark's nutcracker.

These handsome, gray, white, and black members of the Corvid family (crows, jays, ravens, and magpies), are vital to manipulating a specialized environmental niche, and in doing so, are fostering the success of its own species by simply planting a seed.

If efforts to protect the Whitebark Pine fail, we could lose a complex web of plant and animal life.

-by-

Gary Lantz

US FOREST SERVICE, RICHARD SNIEZKO

Whitebark pines (left) are essential to life in subalpine ecosystems.

Some biologists estimate that a single Clark's Nutcracker may store as many as 98,000 whitebark seeds in as many as 30,000 various sites.

JOSEPH GARER/ISTOCK

DORENA GENETIC RESOURCE CENTER

The Clark's Nutcracker, seen above right, separates the seeds from the Whitebark pine's cones (above) and buries them to retrieve during the winter and spring.

Clark's nutcrackers are adept at prying seeds from the whitebark cones and storing them in a throat pouch with the capacity to hold 80 to 100 of the nutritious nuts. Then the birds spread out to do their gardening. A nutcracker may fly 100 yards to a mile or more before depositing several seeds an inch or so deep in the soil. The birds seek open, sunlit meadows like recently burned areas or places where strong winter winds will sweep away the snow. Then, somehow, the nutcrackers manage to remember the location of the caches as summer turns to autumn, and the cold and unrelenting winter winds begin to blow.

Some biologists estimate that a single Clark's Nutcracker may store as many as 98,000 whitebark seeds in as many as 30,000 sites in its lifetime. About half the seeds are then recovered as either food for the adult birds or essential nutrients for their young.

The rest have the opportunity to sprout as tough seedlings with a rapidly stabilizing taproot and the ability to survive some of the most frigid temperatures, debilitating gales, and intense solar radiation on the continent. In time, these whitebark seedlings form groves that provide the nursery shade needed for seedlings like Engelemann spruce. Then, as the Engelemann spruce mature, other high-altitude species become established. Over the years, sunny, open country near the timberline that was once thinly dotted with islands of pioneer whitebark pine is transformed into a dense forest with a complex vegetative understory, attractive to elk, bear, moose, red squirrels, and a variety of songbirds.

As the high-altitude canopy spreads and matures, it creates a microclimate supporting an increasing complexity of plants and animals. Whitebark pine groves block wind and prevent rapid snowmelt. This in turn prevents erosion and ensures a constant source of cold water to feed mountain streams throughout the summer. Trout fishermen are among those who benefit from the role these high-altitude pines play in preserving the quality midsummer flows that trout require. The loss of good trout habitat can, in turn, affect mountain life ranging from the well-being of grizzly bears to the regional economy.

Donald Peattie, in his classic book *A Natural History Of Western Trees*, noted, "Of all the trees in its range, [the whitebark pine] is the most completely alpine. And at last it stands, or rather creeps and struggles, alone, rooted in desolate mountain rock, its limbs on the windward side dismantled, its stem foreshortened to a height of three or four feet, its limber branches so intertwined you can walk on them. There is little white bark to be seen on such a timberline specimen, and, as John Muir said, the tree seems to have been stopped in its growth by a low ceiling."

Peattie added, "That ceiling is real, if invisible. It is determined by the shrieking gales—winds of the very planet's turning—and by the storms of sand; by the crushing load of ice and snow that last at high altitudes sometimes nine months of the year."

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John Muir, naturalist, father of the Sierra Club, and poet laureate of the western North America high country, loved these trees that grew at the top of the world. "During stormy nights," he said, "I have often camped snugly beneath the interlacing arches of this little pine. The needles, which have accumulated for centuries, make fine beds; a fact well known to other mountaineers such as deer and wild sheep, who paw out oval hollows and lie beneath the larger trees in safe and comfortable concealment."

Muir reported that he once counted 255 annual rings in a whitebark pine tree that stood a scant three feet tall. Another three-footer, he said, contained 426 annual rings. Muir added that although the trees were of great antiquity, the branches remained so supple he could tie them into knots.

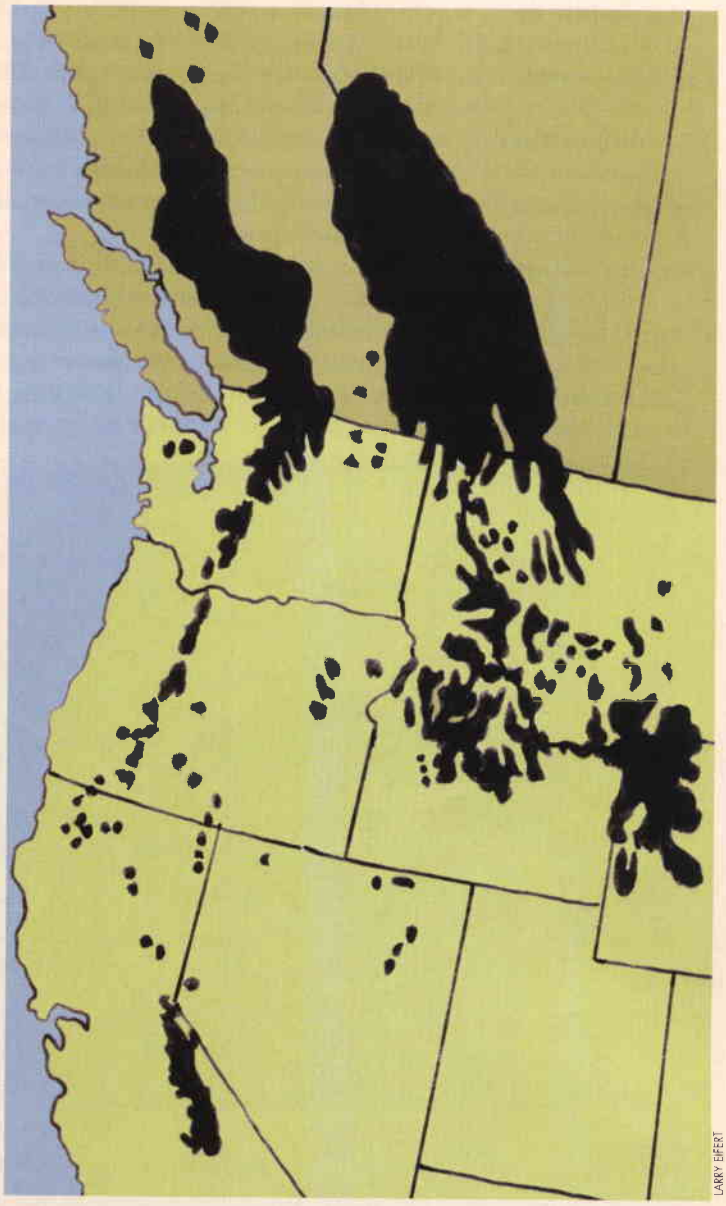
Autumn arrives early in whitebark pine country. While Clark's nutcrackers prepare for the winter by planting whitebark seeds, red squirrels are busy gleaning cones and gathering them into large caches called middens. Certainly the squirrels go about this end-of-season task with no intention of sharing. But black and grizzly bears could care less. Whitebark seeds are a prime source of nutrition prior to hibernation. Grizzlies are experts at locating squirrel stashes, even in the snow. And when sow grizzlies emerge from the winter den with cubs in tow, the famished bears seek out pine seeds as an emergency ration.

The big bears carefully pick each seed from the cone, much like a kid from the South shells peanuts or sunflower seeds. Whitebark seeds are the gift of life for this rare and charismatic predator, just as they are for red squirrels, nutcrackers, and others creatures that benefit from the nuts' rich sustenance. Were it not for the whitebark pine, grizzlies would be forced to seek food at lower elevations, and thus suffer even more frequent contact with man.

As history has shown, the grizzly is better off as a bear of the wilderness, beyond man's daily haunts, and few trees better symbolize America's remaining wild places than the whitebark pine. What would happen to the endangered bears of the Greater Yellowstone region if whitebark pines were to disappear remains a matter of speculation. However, biologists know that the seeds remain a critical food source. Grizzlies need the pine nuts both for their food value and for their ability to influence distribution. Whitebark seeds keep bears high in the mountains and away from temptation, thus avoiding conflicts that tend to result in more dead bears.

Getting a toehold in a rugged timberline environment takes enormous resources. However, when a whitebark pine manages to take root and grow, the trees make the best of it. Many trees live to be 500

WHITEBARK PINE RANGE



LARRY EIFERT

From the Canadian Rockies and North Cascades, to Yellowstone and the high Sierra, some 98 percent of the tree's range is national forestland, national parks, state lands, Indian reservations, and national wilderness.

As much as 77 percent of the whitebark community from Canada to the California Sierras, may be succumbing to whitepine blister rust.

DAN SMITH

The skeleton of this whitebark pine in the Targhee National Forest is the first of many; the entire

years old or more, with some individuals tipping the scales of time at over 1,200 years, and still going. Whitebarks reach sexual maturity at 20 to 30 years, but bountiful seed crops aren't to be expected for another three or four decades. Nothing happens overnight up where whitebark pines prefer to grow, and patience provides its own ample reward for this symbol of subalpine tenacity.

Patience is certainly a virtue in a tree that colonizes the roof of a continent. However, patience tends to be difficult among those working to maintain whitebark pines as an integral part of the future of our high-mountain wilderness, for the trees are being buffeted by diseases both natural and introduced.

As of this year, estimates indicate that as much as 77 percent of the whitebark pine community stretching from Canada to the California Sierras may be succumbing to white pine blister rust, mountain pine beetle infestation, or some combination of the two. The threat is so pervasive the Natural Resources Defense Council has petitioned the U.S. Fish and Wildlife Service to list the tree as an endangered species—the first major tree with a continent-wide distribution to be nominated for the list.

Scientists working to save the species agree that a recovery effort needs to be both immediate and far-reaching. The blister rust is an introduced assailant from Europe—the trees haven't had time to evolve natural defenses. The pine beetles are native, and outbreaks have been common throughout the history of our North American forests.

HIGH & WILD: WHITEB

In many ways, whitebark pine is the perfect symbol for America's remaining wild places. Some 98 percent of the tree's range is national forestland, national parks, state lands, Indian reservations and national wilderness.

Whitebark pine communities spread south from the Canadian Rockies to the Sierra Nevada in California. A preference for subalpine habitat restricts this tree to major mountain ranges in Alberta and British Columbia, the Sierras, the Cascades and the Rockies of Montana and Wyoming.

In a report compiled for the U.S. Forest Service, forest pathologist John W. Schwandt noted that whitebark pine occurs as both a climax species at tree line, as well as an early successional species, contributing far more to high elevation ecosystems than might be concluded based on biomass and abundance alone.

In its ability to colonize and persevere at high altitudes, the tree is a pillar of alpine ecosystems, Schwandt points out. Subalpine communities depend upon whitebark pine for stability, diversity and in many cases, even existence itself. Whitebark groves allow inhospitable areas to moderate and become, over time, thriving communities containing diverse populations of plants and wildlife.

Whitebark pines are so proficient at this task that they impact life forms ranging from soil microorganisms to very big bears. At the same time, the trees stabilize erosion prone slopes and capture snow, slowing spring runoff, reducing flooding, and improving water quality in the valleys below.

Schwandt says that if conditions are favorable, whitebark pines can grow to 100 feet in height, reach several feet in diameter, and persist for a thousand years. However, whitebarks growing at timberline may also display the weathered, stunted "krumholtz" look of trees battered by harsh winds, low temperatures and abundant winter precipitation.

The whitebark pine's ability to nurture other species is well known to wildlife biologists. These trees are critical to the overall health of the lower 48's grizzly bear population, a federally

protected threatened species.

Today grizzlies are found in some two percent of their original range south of Canada and Alaska. Biologists believe that between 1800 and 1975, grizzly populations declined from an estimated 50,000 of these big bears to less than 1,000.

Grizzlies require a huge home range to provide for their voracious caloric needs—50 to 300 square miles for females, 200 to 500 square miles for males. Therefore it's important to protect prime subalpine food sources. Whitebark seeds are both high in nutrition and available at critical times of the year.

Red squirrels also love whitebark seeds, and stay busy each autumn gathering cones to store. Squirrel activity isn't lost on both black and grizzly bears, who use their highly developed olfactory capacity to locate the cached cones and help themselves.

Research in Yellowstone National Park has shown that grizzlies feed almost exclusively on whitebark pine seeds in abundant years. Such feasting pushes reproductive rates higher, and allows the bears to generally stay in the high country, away from human/bear conflicts.

Bears have a bird to thank for all this subalpine bounty: Clark's nutcracker, the Johnny Appleseed of high elevation ecosystems, is a jay-sized corvid that's talkative, loud, and hard to overlook in its home territory.

Whitebark pine's symbiotic relationship with Clark's nutcrackers indicates how tightly intertwined the evolution of these two species has become over thousands of years. The whitebark seed is too heavy for typical pine seed dispersal. At the same time, the nuts have evolved a high fat content that nutcrackers can't resist. Over time, the birds have become such competent distributors of whitebark seeds that the tree's cone scales don't even bother to open wide enough for the seed to fall on its own. Instead, this jaunty, intelligent jay cousin is perfectly equipped not only to pry open the cones, but also store up to 100 seeds in a special throat pouch perfect for cross country distribution.

Nutcrackers are adept at finding seedbeds open to sunlight, and may fly several miles to do so. And, unlike wind assisted pine seeds, a feathered farmer of pine nuts cares little about which way the winds blow. Nutcrackers are just as apt to distribute upwind as down. The birds' main concern is finding a good stash site, which in turn generally proves to be a good seedbed.

Buried seeds are retrieved to feed both adults and young. Nutcrackers relocate seeds by memory, relying upon landmarks even when winter snows blanket the ground. Overlooked seeds have an excellent chance of becoming whitebark seedlings.

Few people know and appreciate the Clark's nutcracker better than researcher Diana Tomback, a professor at the University of Colorado Denver. Her studies indicate that the future of whitebark pine and Clark's nutcracker remains tightly interwoven.

According to Tomback, Clark's nutcrackers begin gathering seeds in late summer. These are stored in the sublingual pouch, a sac-like extension of the floor of the mouth unique to the genus Nucifraga. Nutcrackers also have evolved a long, sturdy and slightly decurved bill perfect for tearing into whitebark pine cones and prying out the seeds.

Seeds are generally buried on steep, south-facing slopes that accumulate minimal snowpack. Tomback says nutcrackers usually store around three to seven seeds per cache, thus reducing competition for moisture and space. Seeds are planted approximately two centimeters deep, perfect for germination requirements.

A single bird may store as many as 32,000 seeds per year, three to five times the number needed to meet bird and brood's annual energy requirements. Survival rates for leftover seeds can be 56 percent the first year, and still around 25 percent by as late as the fourth year, Tomback said.

She added that other seed distribution methods, including rodents and seeds left from disintegrating cones, provide far less reproductive potential.

Nutcrackers also deposit seeds more evenly throughout available habitat, in some cases covering several miles or more. Such mobility, Tomback said, is why Clark's nutcrackers are responsible for the whitebark pine's pioneering capacity. Bird and tree, she added, are both coevolved and mutualistic: made for each other no matter how wild the weather.

Yellowstone grizzlies rely heavily on whitebark seeds for energy and reproductive health.

PAUL TESSIER/ISTOCK

Whitebark pine restoration techniques are available, but these require a high level of commitment, along with funding.

Unfortunately, climate change resulting in high-altitude warming has allowed the beetles to damage trees that may have been protected in the past by longer, colder winters.

At the same time, centuries-old timber management practices have curtailed the fires that once created open space for new whitebark pine nurseries. Whitebarks require a regimen of natural disturbance so that seedlings can grow to sunlight and survive. In time, the forest will close back in, starting once more under the shade of whitebark boughs. But without a natural regimen of periodic fire, whitebark pines can't colonize.

And, as goes the whitebark pine, so go the birds and squirrels, the elk and the bears, and all the growing things that have evolved as part of this tightly knit tapestry of life at the top of the continent. The next few years will show us just how much the whitebark pine can endure. We'll discover whether we are willing to allow this keystone species to disappear from the planet, or if we will accept the challenge of saving a tree that clings to life in a high, hard country — and in doing so, opens so many critical ecological doors.

Time To Rally: Research & Restoration Are Key

The future of the whitebark pine may be in jeopardy, but the tree's champions are a diverse, committed, and maybe most importantly, a passionate group. Scientists from throughout the region have made whitebark conservation the focus of ongoing research efforts, working, as Aldo Leopold once advocated, to preserve the ecological integrity of subalpine communities by saving all the parts.

Whitebark benefactors include university research scientists, teachers, U.S. Forest Service professionals, U.S. Fish & and Wildlife Service and National Park Service personnel, communicators, photographers, conservation organizations like NRDC and AMERICAN FORESTS, school groups, and everyday citizens who do what they can, from writing letters to offering contributions. Most agree it will take a concentrated, prolonged effort to insure a future for this tree, plus the variety of plant and animal life it fosters by providing an important food source for as many as 110 species.

To save a species—whether it's whitebark pine, some charismatic megafauna, or a single small butterfly—first you have to understand both what it is and what it represents in the overall scheme of things. As researcher Diana Tomback pointed out

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Above, whitebark seedlings of two families show different resistances to blister rust, while the image at right shows the disease attacking a mature tree. Opposite, Rebecca Lawrence collects whitebark cones from a disease-resistant tree in Glacier National Park.

during a recent gathering of concerned scientists, whitebark pine restoration techniques are available, but restoration requires a high level of commitment over time, along with dependable funding. Without that commitment, she said, we risk the loss of whitebark pine and greatly diminished western forest diversity.

Robert Keane, research ecologist at the Rocky Mountain Research Station in Missoula, Montana, seconds Tomback's assertion. He works in the Missoula Fire Sciences Laboratory, and his whitebark pine restoration research includes evaluating the effects of prescribed burning, thinning, selective

CHRIS PETERSEN

cutting, and fuel-enhancement cutting.

Keane and coworkers studied fuel consumption, tree mortality, and undergrowth response to various treatments at one, five, and 10-year intervals. They found that all of those factors provided desirable seed-caching habitat for Clark's nutcrackers, the trees' natural dispersal agent.

On the other hand, Keane and his team discovered that regeneration rates were low due to nutcrackers reclaiming a higher percentage of cached seeds: a result of declining production in adjacent stands with high blister-rust mortality. Other factors included environmental elements (cold, snow, and high erosion rates), lack of plant cover, and a relatively short passage of time since site manipulation.

Keane says whitebark pine communities with a mortality rate of at least 20 percent and blister-rust infection rates above 50 percent should be treated by planting rust-resistant seedlings. This is the best way to shorten the gap between disturbance and regeneration. Long-term restoration of this complex ecosystem will depend on cost-effective, coordinated

TO LIST, OR NOT TO LIST

Late in December of 2008, the Natural Resources Defense Council (NRDC), a 1.3-million-member conservation organization, petitioned the U.S. Fish & Wildlife Service (USFWS) to place whitebark pine trees on the federal endangered species list. In its petition, NRDC pointed out that whitebark forests are being decimated throughout their range by an invasive disease, as well as insect infestations made more severe by climate change. The organization added that the tree could be driven to extinction, leaving vast ecological gaps in high mountain landscapes, and eliminating a critical food source for wildlife, especially grizzly bears.

With no response from the USFWS to the listing petition nearly a year after a response is required by law, in February the NRDC asked a federal court to intervene.

"The whitebark pine is central to many of North America's mountain ecosystems, and its loss would be devastating to some of our most majestic landscapes," pointed out Dr. Sylvia Fallon, the petition's author. "With help, the tree can be saved. Listing would result in a recovery plan and resources to advance solutions already out there, but still in need of support."

If listed, whitebark pine would become the first broadly dispersed tree protected by the Endangered Species Act. Fallon said scientists regard whitebark pine as a "foundation species" due to its role as a pioneer, creating the conditions necessary for other species to become established in harsh alpine habitat.

An NRDC spokesperson said that some of the threats facing whitebark pines are not uncommon in North America's western forests. However, the advent of global warming has allowed insects and disease to reach elevations where trees have not evolved biological defenses.

Until recently, according to NRDC, harsh winters kept mountain pine beetles mostly at bay. Recent warmer temperatures have allowed the insects to both increase in numbers and invade at higher altitudes.

Unfortunately, many whitebark pines attacked by beetles were already weakened by blister rust, an invasive fungus introduced from England. This fungus has been responsible for the death of as many as 50 percent of Northern Rocky Mountain whitebark pine forests during the past four decades. Sadly, 80 to 100 percent of the remaining trees suffer from pine blister rust or mountain pine beetle infestation, and will eventually die.

DAN SMITH (2)

The small whitebark tree above was planted in American Forests' 2002 Targhee National Forest project before other species (above right) replaced it entirely (photos 2009).

If seed crops fail, the birds can turn to other sources of pine nuts. However, whitebark pines have no other means of dispersal, except for man himself.

efforts, including ecological research, seed harvest from rust-resistant trees, prioritization of restoration and prescribed burning, and silvicultural cutting.

"We realize it will be impossible to implement treatment on all whitebark pine lands," Keane said. "But there will be critical forests requiring immediate and extensive proactive restoration." He added that many whitebark forests are in areas like national parks and wilderness areas where treatment is prohibited, so wildfire must be allowed to play a role.

"Though the outlook may seem bleak, exciting advances in research and many recent management successes exist," says Keane. "Hopefully these will help secure this keystone species' conservation."

Richard Sniezko, U.S. Forest Service scientist at the Dorena Genetic Resource Center in Cottage Grove, Oregon, has devoted years to developing rust-resistant seedlings for genetic restoration. Sniezko and colleagues collect whitebark pine seeds from forests in Oregon, Washington, and the Warm Springs Indian Reservation. Seedlings grown from these various "families" are tested by inoculating each with blister rust. After five years, each parent is rated for resistance based upon its seedlings' performances.

"Many trees are highly susceptible, in that 90 percent of their progeny become infected and die," Sniezko said. "Some families show infection rates of around 50 percent. The good news," Sniezko said, "is that some are showing surprising resistance to white pine blister rust." The staff is testing more than 350 selections from sites in Oregon and Washington.

Trees chosen as seed donors require both legwork and tree-climbing skills in order to ensure that samples aren't sequestered by nutcrackers before the researchers can complete their harvest. Cones on pines that show signs of resistance are covered with special cages—it's the only way to keep nutcrackers at bay until field workers can add to their collections.

As seed production diminishes, nutcrackers may consume nearly 100 percent of the seeds they cache. If seed crops fail, the birds can turn to other sources of pine nuts. However, whitebark pines have no other means of dispersal, except for man.

Fortunately, agencies and nonprofit groups like AMERICAN FORESTS and the Whitebark Pine Ecosystem Foundation are advocating and supporting more planting. AMERICAN FORESTS is partnering with state and federal agencies to plant seedlings in an ongoing effort to restore whitebark pine communities. The Whitebark Pine Ecosystem Foundation, under the direction of Dr. Diana Tomback, is committed to conservation education as well as providing financial support for whitebark pine projects. The group hopes to promote new strategies for restoration, and build coalitions dedicated to whitebark pine preservation.

Timing and funding are critical, supporters say. But most believe that, with patience, substantial effort, and a little good luck, whitebark pines can survive to remain a symbol of a landscape wrapped in clouds, caped in snow, and home to a tough little tree . . . and a bird that lives to garden.

Gary Lantz writes from Norman, Oklahoma

AN URGENT NEED TO PLANT WHITEBARK PINE

The pace at which whitebark pine trees are dying in our Western mountains is extremely alarming. In the Greater Yellowstone Area, 700,000 whitebark pines were killed by mountain pine beetles in 2004 alone. With Yellowstone grizzly bears obtaining as much as two-thirds of their summer energy from pine nuts, how will the grizzlies survive? Throughout the range of this vitally important tree, from the Cascades and Sierras to Glacier National Park and the Canadian Rockies, conditions are severe. Survival of this magnificent mountain tree will require a redoubling of current efforts. You can help by letting your elected officials and natural resource agencies know that this is important for the environment, for our natural heritage, and to you.

There is no simple restoration strategy for whitebark pine. Improving conditions for natural regeneration using prescribed fire and other means continues to be a priority. But with the loss of trees far outpacing natural regeneration, actively planting whitebark pine is increasingly important, especially with blister rust-resistant seedlings now available.

Since 1999, AMERICAN FORESTS has been raising funds to plant whitebark pine trees through its Global ReLeaf program. The largest of these projects - 34,000 rust-tolerant seedlings developed by the Regional Tree Improvement Program - will be planted this summer across 150 acres in the Clearwater National Forest in Idaho. The other six projects are:

1999 — Island Park Caldera - Targhee National Forest
5,000 whitebark pines

2001— Henry's Fork - Targhee National Forest
5,000 whitebark pines

2002— Caribou-Targhee National Forest
12,200 whitebark pines

2005— Blacklead Whitebark Pine Restoration -Idaho
11,615 whitebark and lodgepole pines

2006— Beaver Ridge Reforestation - Clearwater National Forest
2006 8,300 whitebark and lodgepole pines.

2010— Willow Burned Area - Caribou-Targhee National Forest
15,000 whitebark pines.

CONTRIBUTE TO THE RESTORATION

Help AMERICAN FORESTS help our federal and state forest scientists and land managers to greatly increase the number of whitebark pine seedlings they can plant each year. Your tax deductible contributions can be made online at www.americanforests.org or by phone at 202/737-1944 or 800-545-TREE. Every dollar plants a tree.

WHAT IS AMERICAN FORESTS?

AMERICAN FORESTS is the nation's oldest nonprofit conservation organization, and a world leader in planting trees to heal the earth. Since our first Global ReLeaf project in 1990, we have planted over 30 million trees in 600 projects across the globe. Our goal is to plant 100 million by 2020, including hundreds of thousands of whitebark pine. With your help, we can make it happen.

AMERICAN FORESTS®
www.americanforests.org

WHITEBARK PINE NETWORKS, ORGANIZATIONS & RESOURCES

The Whitebark Pine Ecosystem Foundation is a nonprofit organization dedicated to counteracting the decline of whitebark pine and extending the ecological knowledge of this and other five-needle pine ecosystems. www.whitebarkfound.org

The Natural Resources Defense Council is an environmental nonprofit organization of scientists, lawyers and environmental specialists that has petitioned the US Fish & Wildlife Service to list whitebark pine as an endangered tree. www.nrdc.org

The Greater Yellowstone Coordinating Committee (GYCC), Whitebark Pine Working Group is an interagency organization that oversees monitoring activities for resource management in the Greater Yellowstone Area. http://fedgycc.org/WhitebarkPineOverview.htm

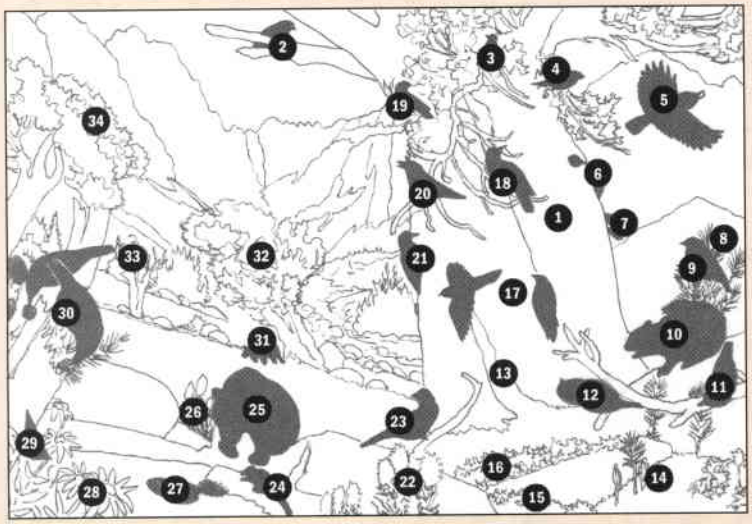
The Central Rocky Mountain White Pine Health Working Group has an annual meeting featuring status reports on the health of five-needled white pines in the central and southern Rocky Mountains, and strategy sessions for dealing with white pine blister rust and forest health issues.

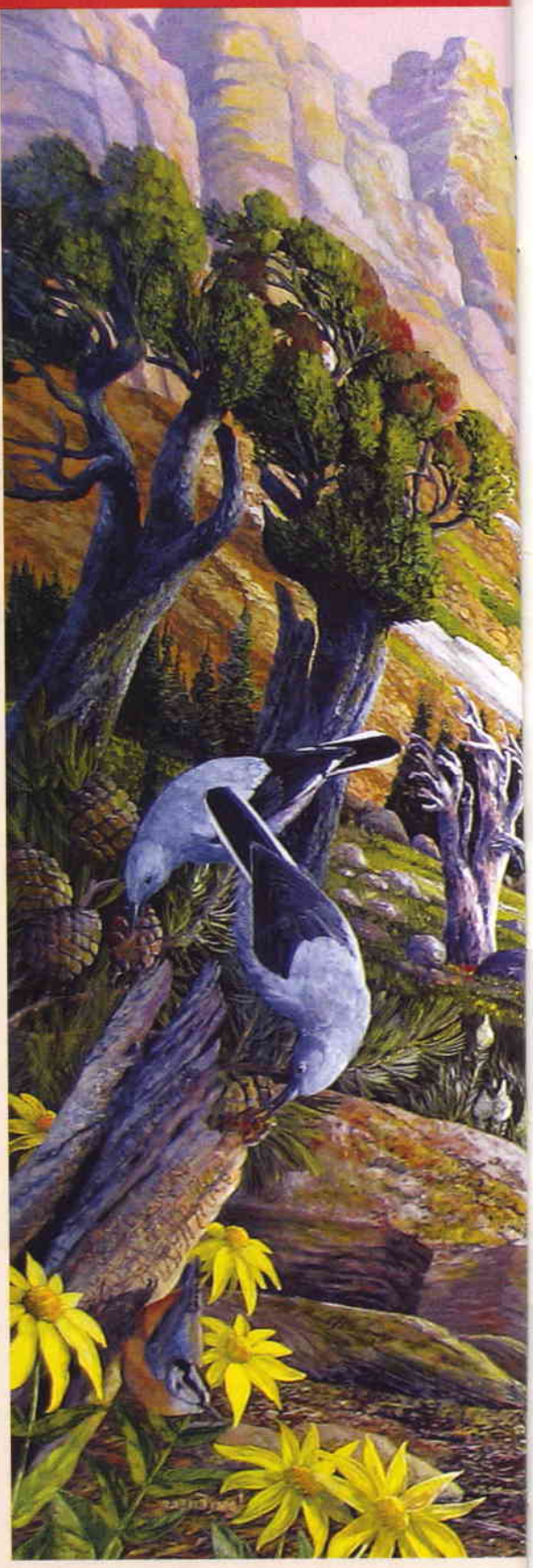
"High Five: The Future of High Elevation Five Needle Pines in North America" is the subject of a 3-day symposium June 28-30 for researchers, land managers and students. The U.S. Forest Service, U.S. Fish & Wildlife Service, National Park Service and many state agencies will be represented at the gathering at the University of Montana in Missoula. www.umt.edu/ce/cps/highfive

Copies of this special report are available for distribution at nature centers, visitor centers, and schools. Email info@amfor.org.

Key to the Species List

1. Whitebark Pine, *Pinus albicaulis*
2. Common Raven, *Corvus spp.*
3. Hairy Woodpecker, *Picoides villosus*
4. Red Crossbill, *Loxia curvirostra*
5. Clark's Nutcracker, *Nucifraga columbiana*
6. Black-backed Woodpecker, *Picoides arcticus*
7. Smoke from a distant wildfire
8. Whitebark Pine seedlings & saplings: the next generation of whitebarks.
9. Mountain Bluebird, *Sialia currucoides*
10. Red Squirrel *Tamiasciurus hudsonicus*
11. White-breasted Nuthatch, *Sitta carolinensis*
12. Mountain Chickadee, *Parus gambeli*
13. Fire scar on trunk of a whitebark pine; an indication of past fires these trees have survived.
14. Whitebark Pine seedlings - the next generation of whitebarks.
15. Spreading Phlox, *Phlox diffusa*
16. *Currant Ribes spp.*, host species for blister rust pathogen *Cronartium ribicola* that is currently killing many of these ancient whitebark pines
17. White-headed Woodpeckers, *Picoides albolarvatus*
18. Northern Flicker, *Colaptes auratus*
19. Pine Grosbeak, *Pinicola enucleator*
20. Clark's Nutcracker, *Nucifraga columbiana*
21. Williamson's Sapsucker, *Sphyrapicus thyroideus*
22. Cassin's Finch, *Carpodacus cassinii*
23. Paintbrush, *Castilleja miniata*
24. Chipmunk, *Eutamias spp.*
25. Grizzly Bear, *Ursus arctos horribilis*
26. Beargrass, *Xerophyllum tenax*
27. Whitebark Pine cones and seeds, important food sources for all these animals.
28. Arrowleaf Balsamroot, *Balsamorhiza sagittata*
29. Red-breasted Nuthatch, *Sitta Canadensis*
30. Clark's Nutcracker, *Nucifraga columbiana,* tearing cones apart for seeds.
31. Black Bear, *Ursus americanus*
32. Mature and healthy whitebark pine
33. Dead whitebark pine, providing homes for animals.
34. Brown whitebark pine treetop needles showing effects of blister rust pathogen *Cronartium ribicola.*





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