Spring - Summer 2005

Nutcracker Notes

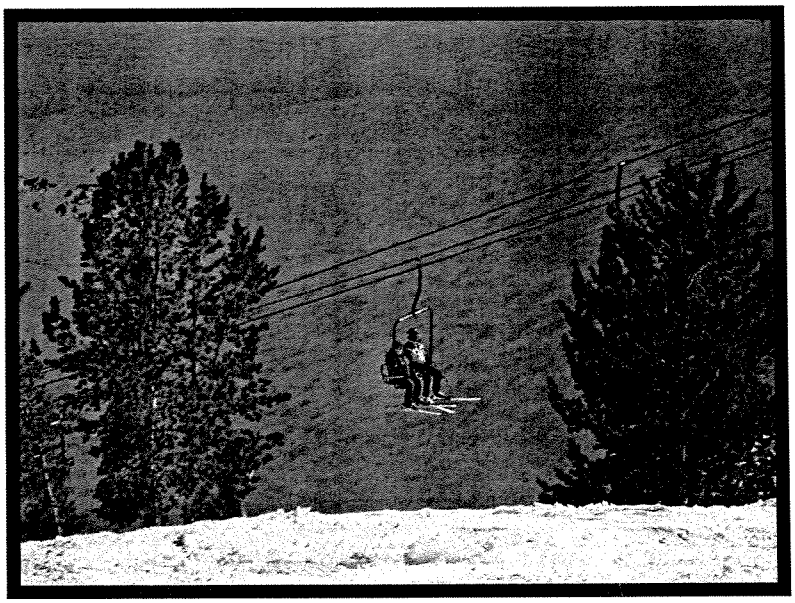
Whitebark Pine Ecosystems Foundation

Issue 8

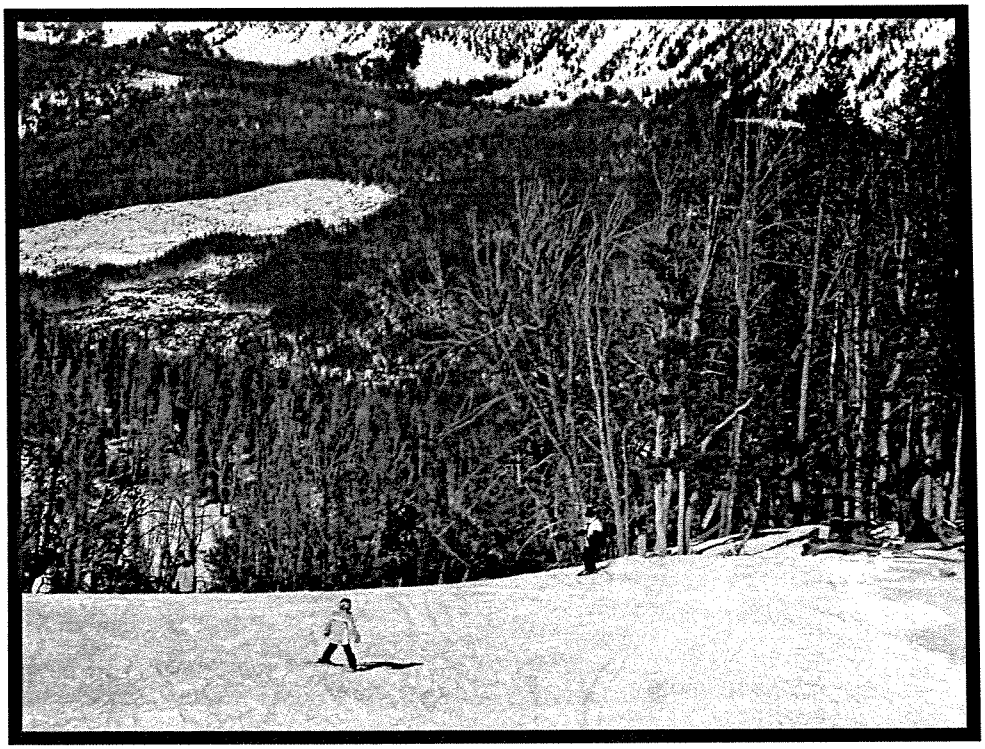
Topics

WPEF
P.O. Box 16775
Missoula, MT
59808

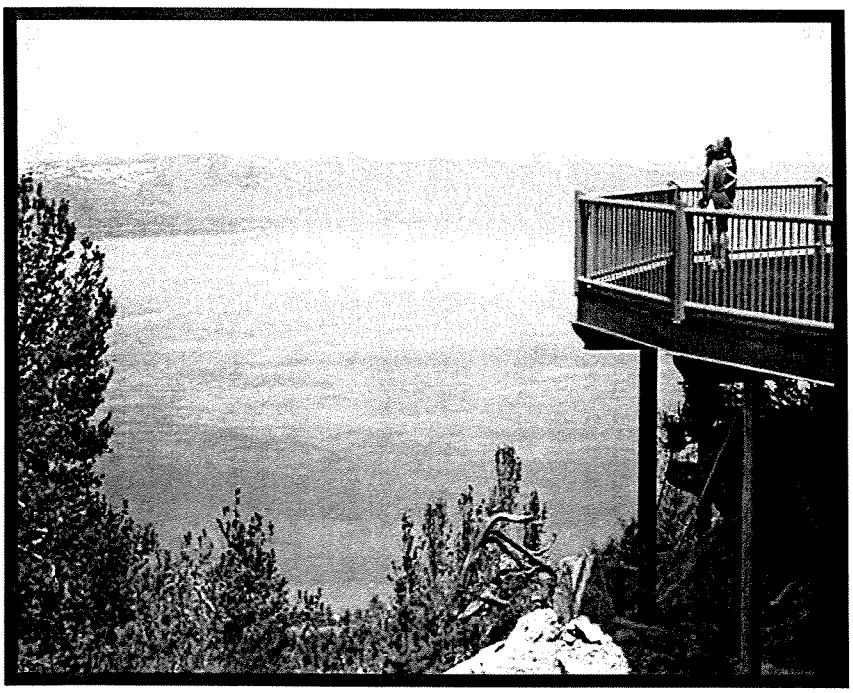
Whitebark Pine at Ski Resorts: Photo Essay"



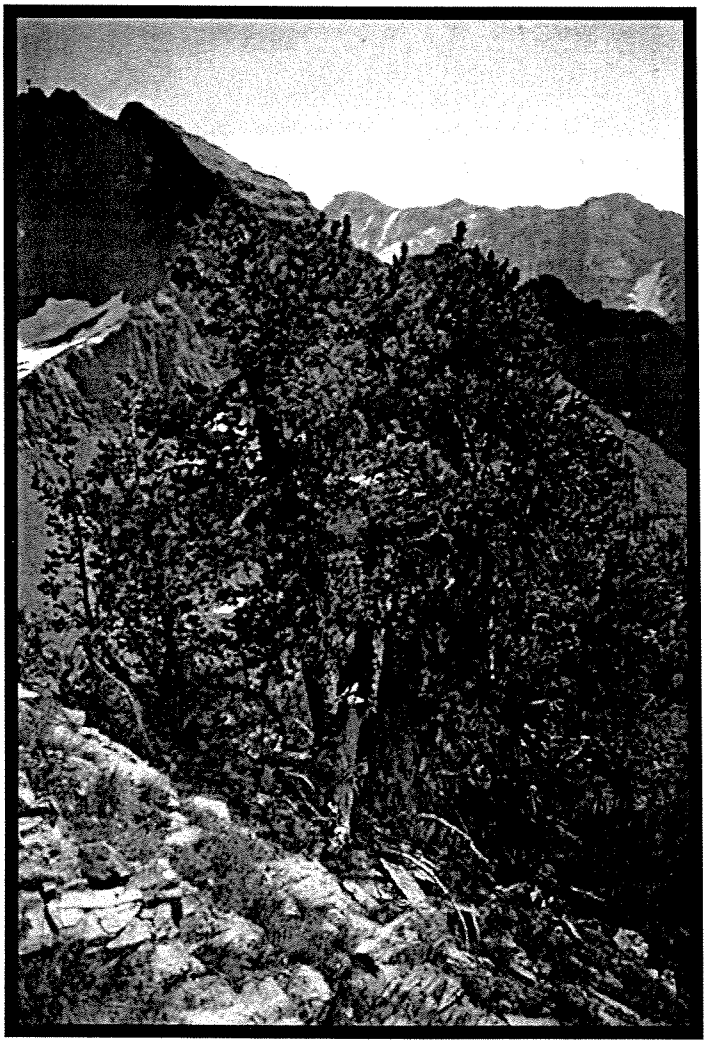
Whitebark Pine near Tree Line, Big Sky Resort, MT. Bob Keane.



Bark Beetle-Killed Whitebark, Big Sky Resort, MT. Bob Keane.



Heavenly Ski Resort, Lake Tahoe. From Web Cam.



Whitebark Pine in Glacier National Park, site of WPEF's annual meeting. David Schirokauer, U.S. Geological Survey

Glacier Park to Host WPEF

Mark your calendar for WPEF's Annual Meeting, including a whitebark pine field trip and mini symposium to be held in Glacier National Park (GNP), Montana, on Sunday and Monday, September 11 and 12, 2005. (This is preceded by a business meeting of the WPEF governing board from 9:30 a.m. to 5:00 p.m. September 10th at the Whitefish City Library, which WPEF members are welcome to attend.)

Sunday, September 11th, 8 a.m. to approx. 5 p.m.—Field Trip

Meet at the Community Room at GNP headquarters in West Glacier and we'll organize car pools to Two Medicine area. Please bring your own lunch.

Trip Description: Get hands-on experience planting whitebark pine seedlings and creating seed caches in a spectacular field setting. Join GNP staff Tara Carolin and Joyce Lapp for a hike up the Scenic Point Trail near Two Medicine Lake on the east side of the Park. During the walk, we'll hear lessons they have learned about collecting seed and planting during drought while we observe older plantings of whitebark pine along the trail. Then, we'll roll up our sleeves and put some whitebark seedlings in the ground. We will have lunch in this area and hold an informal meeting to bring members up to speed on Foundation business. These activities will occur approximately 1.5 miles and 1000 feet in elevation up the trail in an area with scattered whitebark and limber pine. After lunch you may choose to continue up to Scenic Point (total distance 3.1 mi, elevation 7500 feet) and beyond to a small stand of whitebark pine.

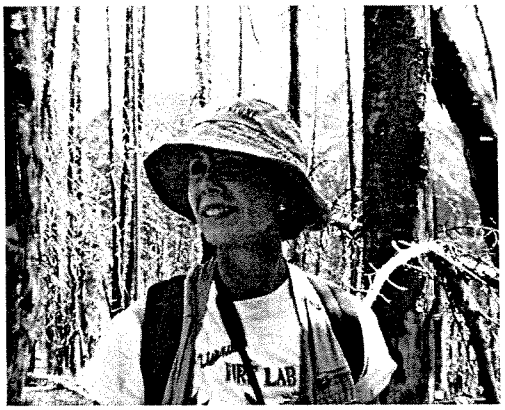
Monday, September 12th, 8:30 a.m. to 12 noon--Science Presentations

Community Room at Park Headquarters, West Glacier

Scientists, managers, students, and interested citizens are invited to make 15 to 30 minute presentations on subjects related to the research and restoration of whitebark pine and limber pine ecosystems. Please contact Kate Kendall at kkendall@usgs.gov if you are interested in making a presentation.

WPEF members will receive a more-detailed announcement about the meeting in August.

Director's Message



Diana F. Tomback

Optimism and Trepidation

Many of us are preparing for the 2005 field season with feelings of both cautious optimism and trepidation with respect to the status of whitebark pine. The optimism comes from growing awareness of the importance of whitebark pine to high elevation forests, the causes of whitebark pine decline, and the management actions that lead to restoration. The concern arises from the warm, droughty winter of 2004-05 across the northwestern United States and southwestern Canada. The very low snow pack and warm temperatures of the past winter may not only result in potentially severe fire seasons in many areas, but may also fuel the widespread upsurge in mountain pine beetles in whitebark pine stands. While it is true that some successionally-advanced whitebark pine communities may burn during these fires, which could be viewed as helpful, the reality is that few healthy cone-producing whitebark pine trees remain in many areas as seed sources. Furthermore, fires will shift attention and resources from whitebark pine needs, and mountain pine beetles may kill blister rust resistant trees in stands with high blister rust damage and mortality. These potentially rust-resistant trees are the future hope for restoration efforts, and I would like to urge all forest and park managers to protect them with packets of verbenone. The effectiveness of verbenone in protecting whitebark pine has been demonstrated in field tests, as described by Kegley and Gibson (2004, USDA Forest Service, Forest Health Protection, Report 04-8, Northern Region, Missoula; phone 406-329-3308).

WPEF Accomplishments

Since the Fall Winter 2004 issue of *Nutcracker Notes*, the Whitebark Pine Ecosystem Foundation has been involved in a variety of activities designed to promote whitebark pine awareness and restoration,

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Grant Awards: The Winners are.....

Diana F. Tomback

In the Fall / Winter 2004 *Nutcracker Notes*, the WPEF published a call for whitebark pine restoration proposals. We received seven interesting and fairly diverse proposals from researchers and managers across the range of whitebark pine. The Evaluation Committee, headed by Associate Director Ward McCaughey, and consisting also of Bob Keane and Carl Fiedler, ranked the proposals by giving highest priority to projects with clear feasibility involving "on the ground" whitebark pine restoration. Three proposals were very closely ranked, and we truly wish we had enough funding for all three.

The proposal with highest ranking, "Whitebark pine cone collection and seedling production," was submitted by Vicki Edwards, Fuels Planner, Powell Ranger District of the Clearwater National Forest, Idaho. This project will receive $10,000 in funding. The proposal ranked as second, "Flathead National Forest whitebark pine wildfire recovery project, " was submitted by Cathy Barbouletos, Forest Supervisor of the Flathead National Forest, with liaison Ed Lieser, Forest Silviculturist. The Foundation will contribute $6,000 towards this project. The funds are available either for summer 2005 or 2006.

The funding for these projects came in part from the Albert and Tricia Nichols Foundation, which is based in Costa Mesa, California, and from the Whitebark Pine Ecosystem Foundation, through donations by members and proceeds from some of our past activities. Supporting and promoting restoration is a fundamental part of the mission of the Whitebark Pine Ecosystem Foundation, and we are hoping to sponsor another initiative in the near future.

Has your postal address or e-mail changed? If so, please notify

WPEF at:
PO Box 16775
Missoula, MT 59808

or e-mail our membership coordinator at bdonner@fs.fed.us

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and we would like to inform you of our efforts. First of all, we published in the last *Nutcracker Notes* a call for whitebark pine restoration proposals, with a March 1, 2005 deadline. We received seven proposals from national forests, parks, and researchers and have selected two of these to fund. Support for restoration comes both from the WPEF and the Albert and Tricia Nichols Foundation. We announce the winners and present the details in an accompanying article in this issue.

We have launched a Whitebark Pine Education Initiative, now under the capable leadership of Dr. Anna Sala from the University of Montana, with expert guidance from educational specialists Jane Kapler Smith and Marcia Hogan. The objectives of this initiative are to educate audiences, including students, policy makers, land managers, and the general public, about the ecology of whitebark pine, the cascading effects of its decline, and the ways in which we can restore whitebark pine communities. We have also submitted a detailed pre-proposal to the National Fish and Wildlife Foundation for large-scale whitebark pine restoration and monitoring efforts in the Northern Continental Divide Ecosystem and the Greater Yellowstone Area as well as for funding for the education initiative, and are discussing the possibility of matching funds with The National Arbor Day Foundation.

Blister Rust Methods Now Available

Now available on the WPEF web site (www.whitebarkfound.org) is the long-awaited revised document, "Methods for surveying and monitoring whitebark pine for blister rust infection and damage." Revisions incorporate helpful suggestions from those folks who attended the workshop last June, "Monitoring whitebark pine for blister rust," as well as from those who applied the methods in the field last summer. Also on the website is information for obtaining a CD with the revised Microsoft Access-based software designed for these methods, "White pine blister rust survey database: Whitebark pine application," by David Pillmore and Brent Frakes of the Rocky Mountain Network Inventory and Monitoring, National Park Service. The new version of the software is directly compatible with data entry in the range-wide whitebark and limber pine blister rust database under development by USDA Forest Service, Forest Health Protection (FHP), Region I, in partnership with the WPEF. This rangewide database project was conceived and guided by Blakey Lockman and Gregg DeNitto of FHP for the purpose of compiling past and current information on blister rust infection levels across the ranges of these two pines, in order to help prioritize areas for restoration and to understand rates of blister rust spread. By the way, the data sorting and mapping capabilities of this database are very impressive. CDs with this range-wide database should be available soon, and information about how to obtain one will be posted on the WPEF website. We hope that you will spread the word about the availability of these important monitoring tools.

Outreach Initiatives

I recently had the opportunity present a talk on the decline of whitebark pine communities and the spread of white pine blister rust at a Writer's Workshop hosted by the Wild Bears Project of the Natural Resources Defense Council, which is based in Livingston, MT. Although the workshop focused on issues surrounding delisting of the grizzly bear population in the Greater Yellowstone Area, I emphasized the importance of whitebark pine losses and the threat posed by blister rust as stand-alone issues worthy of attention. I have had some follow-up contact by members of the media, and we shall see what develops. On behalf of the WPEF, I am greatly to Louisa Wilcox of the NRDC for the opportunity to participate.

The last two WPEF Annual Members' Meetings have been attended by Ron Mastrogiuseppe, who represents the Crater Lake Institute, Oregon. Ron, a member of the WPEF has been greatly concerned about the spread of white pine blister rust to the whitebark pine in Crater Lake National Park. Ron and other folks who are aware of increasing blister rust infection levels in whitebark pine in Oregon and Washington are organizing a blister rust workshop for fall of 2006. The organizers have graciously invited the WPEF to lend its support and expertise to this effort, and I will attend an organizational workshop in Oregon in early October 2005.

Housekeeping

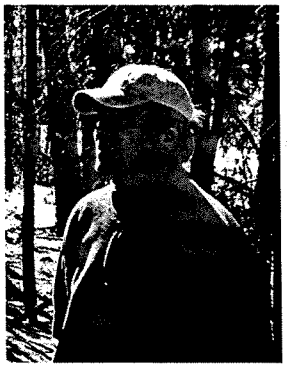
The board has been dealing with a very important housekeeping issue for more than a year: by-laws for the Whitebark Pine Ecosystem Foundation, which lay out processes and procedures. Bob Keane has kindly taken the lead for this challenging effort, which has engendered several spirited discussions at board meetings. We hope to have these by-laws completed and available for a vote by the membership in time for the fall winter issue of *Nutcracker Notes.*

Next Annual Meeting

Speaking of the annual meeting, the WPEF accepted the offer from board members Bryan Donner and Kate Kendall to host our September 2005 Annual Members' Meeting in Whitefish and Glacier National Park, Montana. Given the good attendance and success of the scientific paper session at the Members' Meeting at Waterton Lakes National Park last September, we have decided to make a scientific session a routine event at our meetings. Please see the accompanying article in this issue for dates and scheduled activities. If you have not attended an annual meeting previously, I urge you come. These meetings are a wonderful opportunity to network and obtain technical advice from the experts, as well as to present your own whitebark pine research or management accomplishments.

An Interview with Bob Keane, Restoration Pioneer

Editor's Note: Robert Keane is Quantitative Ecologist at the Rocky Mountain Research Station's Fire Sciences Lab in Missoula, MT, and a member of WPEF's Board of Directors.



Editor: How did you become involved in studying whitebark pine ecosystems?

Keane: In the mid 1980s, I had just finished my M.S. degree at the University of Montana which dealt with modeling of forest succession. I went to the Missoula Fire Sciences Laboratory looking for work. Project Leader Jim Brown found funding for me to create computer programs and ecosystem models to simulate fire effects in Northern Rocky Mountain forests. At the same time, Steve Arno was observing that whitebark pine was declining in much of its range and that it depended on fires to create open sites for regeneration. So naturally, when it came time to apply my models to fire excluded systems, the whitebark pine ecosystem seemed the perfect fit. I thoroughly enjoyed working in whitebark pine forests, and from then on I was hooked, eventually choosing this topic for my Ph.D. project at the University of Idaho.

Editor: What revealed whitebark pine's ecological importance to you?

Keane: This revelation came from visiting healthy whitebark pine forests in the southern parts of the species range in the Rockies, in the Yellowstone and Salmon River country. I had been sampling high mortality whitebark pine stands farther north for so long that I'd forgotten what these once beautiful and unique forests looked like. It really hits home when you walk through miles of healthy whitebark pine forests at the peak of cone ripeness and witness the flurry of activity that this tree provides. It is one of the special stories in ecology. The usual silence is replaced with constant calls of the Clarks nutcrackers and the canopy is alive with harvest activities from squirrels, birds, insects, and often bears. Once you have seen healthy whitebark pine forests, the tragedy of blister rust becomes all to clear.

Editor: What are some of your most memorable findings regarding whitebark pine ecology and restoration?

Keane: I think the most important finding thus far in the restoration work is the slow pace at which the whitebark pine ecosystem recovers from fire. We hadn't realized how dynamic high mountain systems were until we disturbed them. Then, it becomes evident that the severity of site conditions becomes an overwhelming factor in ecosystem recovery. For example, when you observe the effects of extraordinarily deep snowpack slowly creeping down the hill and ripping seedlings out of the ground, then you start to understand how tough it is for trees to gain purchase in this environment.

Editor: Are any land managers moving toward whitebark pine restoration operationally as opposed to just a trial basis?

Keane: I think that most districts are in the experimental stage where they are trying various restoration measures for the first time. These districts are identifying potential treatment sites and planning treatments on these sites based on the literature and communication with others who had carried out similar efforts. Some districts, notably the Powell District of the Clearwater NF, have gone beyond experimentation and are actually implementing large scale burns to facilitate whitebark regeneration aided by supplemental planting. The experimental phase has to come first because it is through experimentation that we become familiar with the special methods

necessary for this species and gain confidence to apply restoration strategies across large areas. Education, both within government agencies and across the general public, needs to be part of the restoration process.

Forest Service Assigns Whitebark Pine Coordinator

John Schwandt, USDA Forest Service, FHP, Coeur d'Alene Field Office

I have recently been appointed to a 1-year "detail" by the Washington Office of Forest Health Protection (FHP) to focus on whitebark pine issues. The primary objectives of this detail are to assess the health of whitebark pine across its range and to develop a conservation and restoration plan for FHP activities related to whitebark pine. This effort may be used as a template for other 5-needle pines in the future.

The assessment portion of this detail will focus on working with folks doing surveys to create accurate range maps of both whitebark pine and blister rust impacts. Since sound surveys are the basis for this information, I plan to encourage people involved with surveys to share techniques and procedures as well as results. I have been working with white pine blister rust for 30 years and have been conducting small surveys in whitebark pine for blister rust and bark beetles for the past several years, so am keenly aware of at least some of the issues involved.

The conservation and restoration plan will need input from many different disciplines including plant and fire ecologists, pathologists, entomologists, wildlife and watershed specialists, as well as geneticists and nursery growers.

Since whitebark pine has such a broad range of interest, it is vital to share scientific information and methodologies across organizational barriers by a wide variety of disciplines and agencies. I will be looking for ways to facilitate this exchange. There will also be a strong public outreach/educational aspect of this position to help increase the awareness of this important species. If you have comments or suggestions, I would like to hear from you. My e-mail is: jschwandt@fs.fed.us

New Studies Assess Restoration Potential

Ward McCaughey, Rocky Mtn. Research Sta., Missoula

Restoration projects involving whitebark pine are dependent on the knowledge of seed production, availability of seeds for natural regeneration, and dispersal mechanisms. Two recently funded studies will assess seed production characteristics, the probability of seed dispersal, pre-dispersal seed survival, and the frequency and timing of seed dispersal.

A study titled "Determining Natural Regeneration Potential as a Key to Restoring Northern Rocky Mountain Whitebark Pine Forests" coordinated by Carl Fiedler is being conducted by Shawn T. McKinney and will be completed by October 2008. This study is funded by Bob Keane and Ward McCaughey from the Rocky Mountain Research Station.

Study Abstract: Restoration of whitebark pine often entails the intensive and costly effort of growing and planting rust-resistant seedlings. Yet little is known about the contribution to regeneration from existing stands. My research integrates multiple-scale sampling, uni- and multivariate analyses, and modeling approaches to determine the influence of habitat composition and structure on the probability of seed dispersal in high infection, heavily-damaged forests in the Northern Continental Divide Ecosystem; and low infection, lightly-damaged forests in the Greater Yellowstone Ecosystem. To assess the probability of seed dispersal I estimate the strength of the relationships among habitat conditions and 1) pre-dispersal seed survival and 2) the frequency and timing of occurrence of Clark's nutcracker. Using this information, I will develop a GIS-based habitat model of seed dispersal potential that can be used in restoration planning to predict areas with a strong likelihood of natural regeneration and distinguish those that will require restoration planting.

A second study funded by Bob Keane and Ward McCaughey of the Rocky Mountain Research Station is titled "Mast-seeding in perennial plants: a test of the 'pollen coupling model'." This study, anticipated to be completed by the fall of 2008, is coordinated by Elizabeth E. Crone and Anna Sala from the University of Montana and will be conducted by Eliot McIntire a post-doc at the university.

Study Abstract: In many plant populations, reproductive output fluctuates dramatically over time. These fluctuations, often called mast-seeding, directly affect population and community dynamics of plants, pollinating animals, and seed consumers. Through changes in plant and consumer populations, mast-seeding indirectly drives numerous ecological and evolutionary processes, including dynamics and stability of economically important wildlife and pest species. Although many studies have explored the ultimate, evolutionary advantages of mast-seeding, empirical tests of the proximate causes of mast-seeding are virtually nonexistent. Crone and Sala will test related mechanisms of mast-seeding in whitebark pine, a wind-pollinated tree. Specifically, Crone and Sala will test the effect of pollen availability on seed production and the effect of seed production on stored resources. Crone and Sala will also explore long-term effects of pollen limitation and resource allocation for individuals and populations. These experiments will directly test the assumptions and predictions of pollen coupling, a recently proposed but untested model of mast-seeding based on the dynamics of stored resources in plants.

Whitebark and Limber Pine Information System

Gregg DeNitto and Blakey Lockman USDA Forest Service, FHP, Missoula, MT

The whitebark pine/limber pine information system (WLIS) is nearing completion by the USDA Forest Service. It was highlighted in the Spring/Summer 2004 issue of Nutcracker Notes. This project began in 2003 at the suggestion of the Whitebark Pine Ecosystem Foundation and has been funded by the USDA Forest Service Forest Health Monitoring Program. Its purpose is to be a database of all summary data that have been collected on these two species through surveys and studies. This compilation of summary data will permit range-wide assessments of whitebark and limber pines in the United States and Canada. In addition to survey data, the information system includes data and approximate plot locations for FIA (Forest Inventory and Analysis) plots with whitebark or limber pine in the U.S.

There are three main components associated with WLIS. The first is an interactive interface that allows for the easy entry of data and review of data already in the database. This interface will accommodate English and metric units. It also recognizes and converts various forms of geographic coordinates, including UTM, decimal degrees, and latitude/longitude. Over 2,200 records have been gathered and entered into the database. Additional data can be entered into one's own copy of the database. This can either be through direct entry via the interface or by collecting data utilizing the U.S. National Park Service database (Pillmore and Frakes) and importing it directly into WLIS.

The second component of WLIS is its query builder. This tool allows one to easily construct queries of the data. Queries can be built for any of the variables included in the database, either individual elements or combined. The results of a query can be viewed through the mapping application, and also can be exported through the interface into a commercially available spreadsheet.

The third component is the GIS mapping ability of the program. Selected plots can be mapped along with other spatial components. The survey plots can be pictured along with FIA inventory plot locations. This component of WLIS has limited GIS capabilities, but geospatial data can be exported and used in higher-powered GIS software.

We expect to release WLIS to selected individuals for beta testing early this summer. Following testing and revisions, it will be made available to those interested. We hope to eventually make the system available for download from the web with periodic updates of the data.

Monitoring Whitebark Pine in the Greater Yellowstone Area

Submitted by Dan Reinhart, National Park Service for the Greater Yellowstone Whitebark Pine Monitoring Working Group

Forest health monitoring is showing a decline of whitebark pine in varying degrees throughout its range due to non-native white pine blister rust and mortality from endemic mountain pine beetle. Given the ecological importance of whitebark pine in the Greater Yellowstone Area (GYA), a small working group was formed in 2003-2004 with representatives from U. S. Forest Service, National Park Service, U. S. Geological Survey, Greater Yellowstone Coordinating Committee, and Montana State University in order to integrate common interests, goals and resources of whitebark pine conservation into a single range-wide monitoring program for the Greater Yellowstone area. The

2004 field season represented the initial results of this collaborative effort.

Our study area included the GYA which is comprised of 6 National Forests and 2 National Parks. During 2004, our sample of whitebark pine stands was restricted to the Grizzly Bear Primary Conservation Area (PCA) because we had a mapped distribution of whitebark pine for that area. This region is approximately 9,200 mi2 (5.9 million acres) and includes approximately 50% of the known distribution of whitebark pine within the GYA. An ongoing mapping effort should expand our monitoring area of whitebark pine throughout the GYA starting in 2005.

The goal of the 2004 sampling effort was to characterize the current status of blister rust in the GYA. The sampling effort started in early July and continued through late October.The basic design was a 2-stage design. Primary sampling units were stands of high-elevation whitebark pine dominated stands of approximately 2.5 hectares or larger. Secondary sampling units were 10 by 50 meter transects located within each stand. A simple random sample of primary units was selected followed by random selection of secondary units within each primary unit. Methods approximated protocols for range-wide monitoring of whitebark pine established by the Whitebark Pine Ecosystem Foundation. Variations from these methods were implemented when we selected for a more statistical sampling approach.

To identify potential monitoring transect locations throughout the PCA, 100 primary stands of varying whitebark pine density were randomly selected from the existing mapped distribution of whitebark pine derived from aerial photo interpretation. Of these 100 stands, 45 were chosen based on their distribution in the study area and logistical practicality. These were grouped by geographic proximity into clusters of 3 stands, with the designations of one "Primary" stand and two associated "Alternate" stands per cluster. Within each stand 5 random points were selected to serve as potential center points for each transect and a corresponding random number between 0 and 359 which would define the vector for the transect. The random points are listed in rank order of selection, such that the first point in the list is the intended starting location. However, should that location be unsuitable (i.e., misclassified as having whitebark pine when it does not); the next, closest point on the list became the starting point, and so on.

The 2004 field effort produced the permanent establishment of 45 plots with 51 transects surveyed. Preliminary data analysis showed of the 51 transects, 36 were infected with blister rust, 19 had mountain pine beetle infestation, and 12 were infected with both blister rust and mountain pine beetle. One plot had evidence of mistletoe on one seedling whitebark pine. Seven of the plots were located in burned stands. The number of live, above DBH (1.4 m) trees per transect ranged from 1-141 and the number of regenerating whitebark pine ranged from 0-478. A tree was recorded as "infected" if aecia was present or if at least three of the five auxiliary signs of blister rust, including rodent chewing, branch flagging, swelling, roughened bark and oozing sap, occurred simultaneously at a particular location on the tree. Of 1026 live trees above DBH sampled in 2004, 230 were infected with white pine blister rust. Of these trees, 128 had confirmed aecia while the remaining 102 had cankers recorded based on three of the five auxiliary signs criteria. When this data was statistically estimated to the whitebark pine population in the GYE, the percent of infection based on our first year's data was approximately 18.9 %. It was quite possible that we underestimated the rate of blister rust infection due to the conservative nature of our "auxiliary sign" requirement.

In order to assess observer variability, 6 of the 45 transects were independently surveyed on the same day by three different observers. The variability among the observers was assessed out of the field (no discussion at the plot between the crew). The focus on these additional six was on blister rust identification (cankers and aecia) and canopy percent estimation. Results from this effort showed a substantial disparity between observers.

Given the recent mapping advancements in whitebark pine distribution, the study area will be expanded to whitebark pine distribution for the entire GYE in the 2005 field season. There may also be changes in the sampling design to incorporate some type of stratification in regards to stand selection. As our 2004 results indicated, there appeared to be substantial observer variability in several measurements. We will continue to analyze this aspect our data collection. An additional objective of the 2005 field season will be to increase the number of replicate transects per stand in order to assess within stand variation.

Protecting Whitebark Pine from Bark Beetles: Verbenone Test in Central Idaho

Dana Perkins, Ecologist
Bureau of Land Management, Challis, ID

The Bureau of Land Management's Challis Field Office, will conduct a field experiment to determine appropriate application rates of Verbenone, an anti-aggregating pheromone, to provide individual whitebark pine trees protection from mountain pine beetles. Mountain pine beetles are responsible for killing thousands of whitebark pines and lodgepole pines in the upper Salmon River Basin of central Idaho, an event reminiscent of the historic mountain pine beetle epidemic of 1909-1940. While epidemics eventually run their course, this time we hope to preserve some cone bearing trees for future re-establishment of whitebark pines.

BLM researchers will replicate Verbenone pouch treatments originally conducted by Forest Health Protection researchers (USFS) that have previously demonstrated effective tree protection from beetles (Kegley and Gibson 2004, Kegley et al. 2003). The BLM experiment will determine the effectiveness of verbenone pouches at high elevations (9,400 ft) and in open and dense stands and will determine whether one application, or an application replaced midseason would be needed to protect trees. Previous research conducted at lower elevation has shown that an application replaced mid-season was more effective at protecting trees than one application (Kegley and Gibson 2004). We hypothesized that at higher elevations, with associated cooler temperatures, release rates of Verbenone may be slower and that one application may be sufficient to protect trees.

Our study area in near the confluence of the East Fork of the Salmon River and main Salmon River near Clayton, Idaho. It is an approximately 200 acre stand of homogenous whitebark pine on a flat ridge top at an elevation of 9,400 feet. Mountain pine beetles have infested at least 20% of the stand.

The method to protect whitebark pines is minimally disruptive to the stand. Individuals selected for the study will be reproductive aged and at least 10" DBH. Verbenone pouches would be stapled to the stem of each of the trees, which would be randomly assigned for different treatments: either two pouches left up all season, or two pouches that would be replaced at mid-season. Verbenone is the EPA-approved synthesized version of the pheromone beetles produce.It signals that there are enough beetles in a given tree and newcomers should go elsewhere. Verbenone is dispersed from the capsules in 40-50 days. Trees would be located at least 130 feet apart, and pouches would be stapled to the NE to NW sides of the tree as high up the stem as we can reach. A control group of trees with no Verbenone application would also be marked, and all trees in the study would be recorded with Global Positioning System (GPS) devices.

This experiment will provide valuable information about protecting high-value, seed bearing whitebark pines from mountain pine beetles. Determining the appropriate Verbenone dosage for high-elevation whitebark pines could result in the cost-effective uses of Verbenone pouches. Protecting cone-bearing trees will provide a future seed source for re-establishing whitebark pines, as well as providing food and habitat for wildlife. The protection of potentially blister rust resistant trees, such as those in the Whitebark Pine Genetic Restoration Program (USFS Regions 1, 4, and 6), would also be enhanced by information about the effectiveness of Verbenone pouches applied once or twice per season. Finally, the study would give us data for future protection of limber pine, a more common and less well-studied species on the Challis Field Office. We will monitor the test areas this fall and report results next winter.

References:

Kegley, S., K. Gibson, J. Schwandt, and M.Marsden. 2003. A test of verbenone to protect individual whitebark pine from mountain pine beetle attack. USDA-FS Forest Health Protection Report 03-9.

Kegley, S. and K. Gibson, 2004. Protecting Whitebark pine trees from mountain pine beetle attack using verbenone. USDA-FS Forest Health Protection Report 04-8.

Whitebark Pine Regeneration: Influence of Fire and Undergrowth

Editor's Note: The following excerpt is edited from an abstract of a Ph. D. Dissertation by Judy L. Perkins, Division of Biological Sciences, University of Montana, 2004

Abiotic conditions rather than competition often limit plant growth in high-elevation systems. However, both periodic fire and presence of neighbor plants can alter abiotic conditions by modifying microclimate or soil nutrient availability. Whitebark pine is believed to be dependent on fire for regeneration, and seedlings are thought to compete poorly with understory plants. To test these premises I conducted vegetation surveys in five sites varying in age since fire. I found no relationship between time since burn and whitebark pine seedling recruitment, but a positive correlation between pine seedlings and one understory species, whortleberry (*Vaccininium scoparium).*

To test effects of fire on whitebark pine establishment, I planted seeds in burned and unburned sites. I found greater recruitment, survival, growth, and leaf nitrogen, and greater soil nitrate and available phosphorus at the burned site. I also tested for facilitation of whitebark pine seedlings by whortleberry, and for potential negative effects from sedge (*Carex* sp.). Whortleberry had neutral to positive effects on planted pine seedling survival and growth. Sedge reduced seedling survival and growth. Experimental results showed no plant association effect on water availability, but point to a below-ground interaction.

To test nutrient availability as a mechanism, I fertilized naturally regenerating whitebark pine seedlings. No nitrogen or phosphorus response was observed, but seedlings growing with whortleberry had greater growth and leaf phosphorus concentrations than seedlings on bare ground. Seedlings in a greenhouse experiment also had increased growth and leaf phosphorus when grown with whortleberry, but only when pine needles were added to the soil surface.
My results suggest that fire improves whitebark pine seedling success, and that sedge negatively affects seedling success. Whortleberry appears beneficial to pine seedlings, possibly through increased soil phosphorus availability.

Pathologists Warn of Bark Beetle Threat

The May issue of *The Forestry Source* (Society of American Foresters 2005) discusses implications of the gigantic mountain pine beetle epidemic sweeping western Canada. The article cites USDA Forest Service Rocky Mountain Research Station entomologists Jesse Logan and James Powell whose forthcoming publication — "Ecological Consequences of Climate Change—Altered Forest Insect Disturbance Regimes" warns of devastating ecological consequences. The mountain pine beetle epidemic first detected in 1994 has already covered 28 million acres in western Canada, primarily in lodgepole pine forests.

The entomologists warn that mountain pine beetle is aggressively attacking whitebark pine at elevations up to 10,000 feet in Idaho, where beetles do not normally prosper. Mountain pine beetle previously caused major mortality in whitebark pine during a decade-long warm period in the 1930s, when summer temperatures were more than 4.5 degrees above average.Logan says that the continuing beetle epidemic threatens whitebark pine throughout its range, and also poses a risk to bristlecone and high-elevation limber pines.

White Pine Blister Rust: Pathologists Identify New Hosts

Editor's Note: The following is edited from a news release circulated in February 2005 by the USDA Forest Service, Rocky Mountain Research Station (RMRS). Paul Zambino and his associates are awaiting acceptance of their journal article detailing this discovery, and indicates he will provide a description and commentary for a future issue of Nutcracker Notes.

RMRS pathologists at Moscow, Idaho, have identified new alternate hosts in the life cycle of the white pine blister rust fungus. While making field collections in August 2004 for blister rust research Geral McDonald, Research Scientist emeritus, and Bryce Richardson, biological technician, discovered suspicious rust lesions on *Pedicularis racemosa* (sickletop lousewort) a common perennial herb in montane and subalpine habitats in the Northwest. DNA sequencing by Bryce revealed an identical match to *Cronartium ribicola*, causal agent of white pine blister rust. A more intensive survey by the

pathology group discovered lesions on *Castilleja miniata*, (scarlet paintbrush) that also had a positive match to *Cronartium ribicola* DNA. Greenhouse inoculation tests by Paul Zambino, research plant pathologist, have shown that *C. ribicola* can complete its lifecycle and re-infect white pines from these new alternate hosts. This discovery could change how we conduct research and manage for white pine blister rust in North America.

"Restoration Forestry" Book Highlights Whitebark Pine

Many of the magnificent stands of old-growth trees that once characterized forests in western North America depended on periodic fires for their creation or survival. Today, in remaining old-growth stands that are deprived of the "historical fire regime," the old trees die, leaving an overcrowded growth of small trees often of a different, shade-tolerant species. These modern forests are more vulnerable to intense blazes and epidemics of insects and disease.

In *Mimicking Nature's Fire: Restoring Fire-Prone Forests in the West*, recently published by Island Press (Washington, D.C.), WPEF board members Steve Arno and Carl Fiedler present practical solutions to the pervasive problem of deteriorating forest conditions. The authors advocate a new direction in forest management called "restoration forestry"—an ecologically based approach that seeks to establish sustainable forest structures by applying knowledge of historical fire regimes and the conditions associated with them.

After explaining the "nuts and bolts" underlying the concept of restoration forestry, *Mimicking Nature's Fire* profiles 23 restoration projects being conducted in a variety of forest types that are managed for diverse goals. These range from wildland-urban interface to sustainable timberland to large natural areas. One chapter discusses needs and opportunities for restoration in whitebark pine communities, and gives a synopsis of restoration activities thus far. The chapter concludes by citing WPEF's leadership in a range-wide assessment of whitebark pine, which will serve as a basis for prioritizing restoration projects.

Whitebark pine community twenty five years after the Sabe Mountain fire (1961) destroyed the old forest dominated by subalpine fir. [Steve Arno] →

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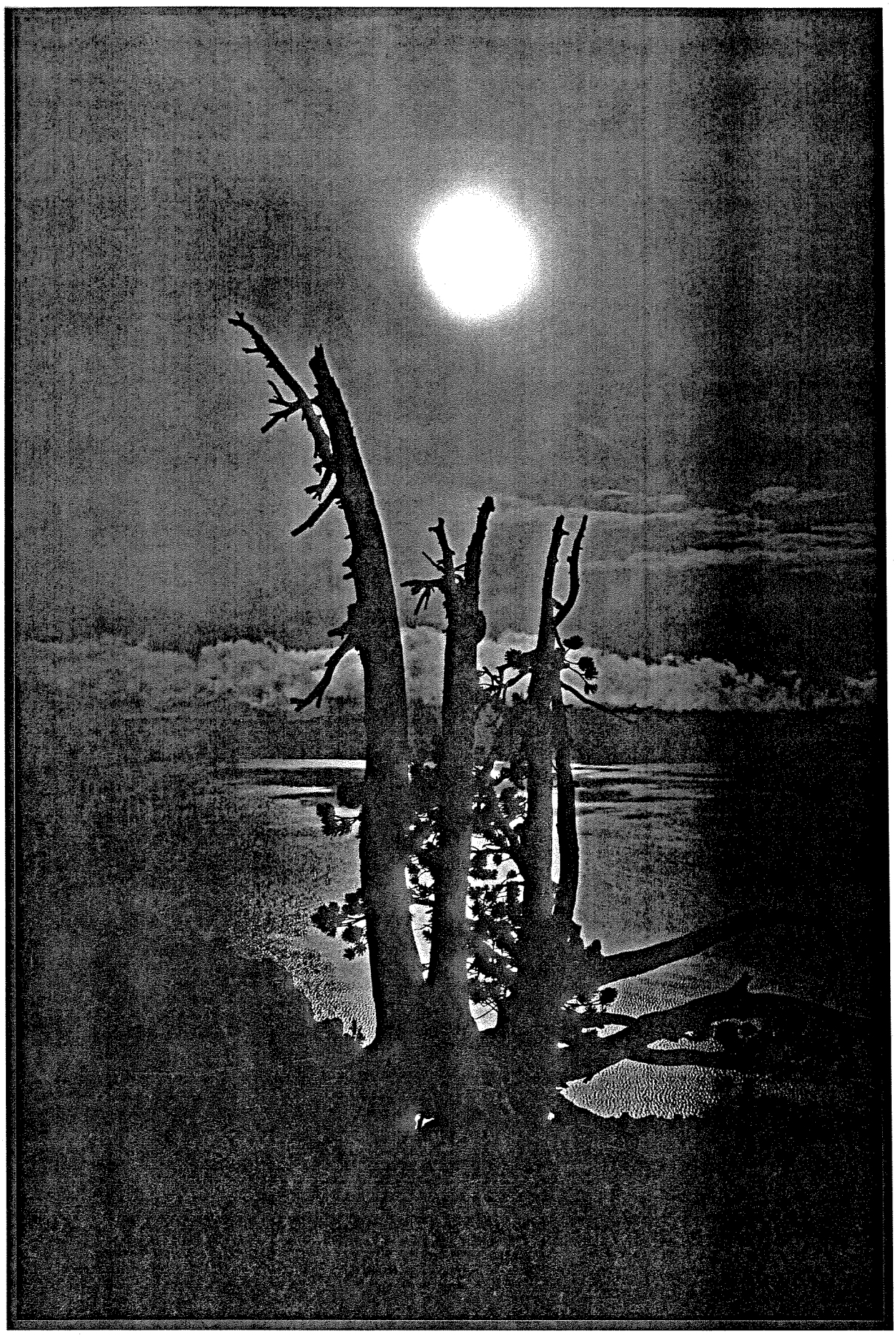
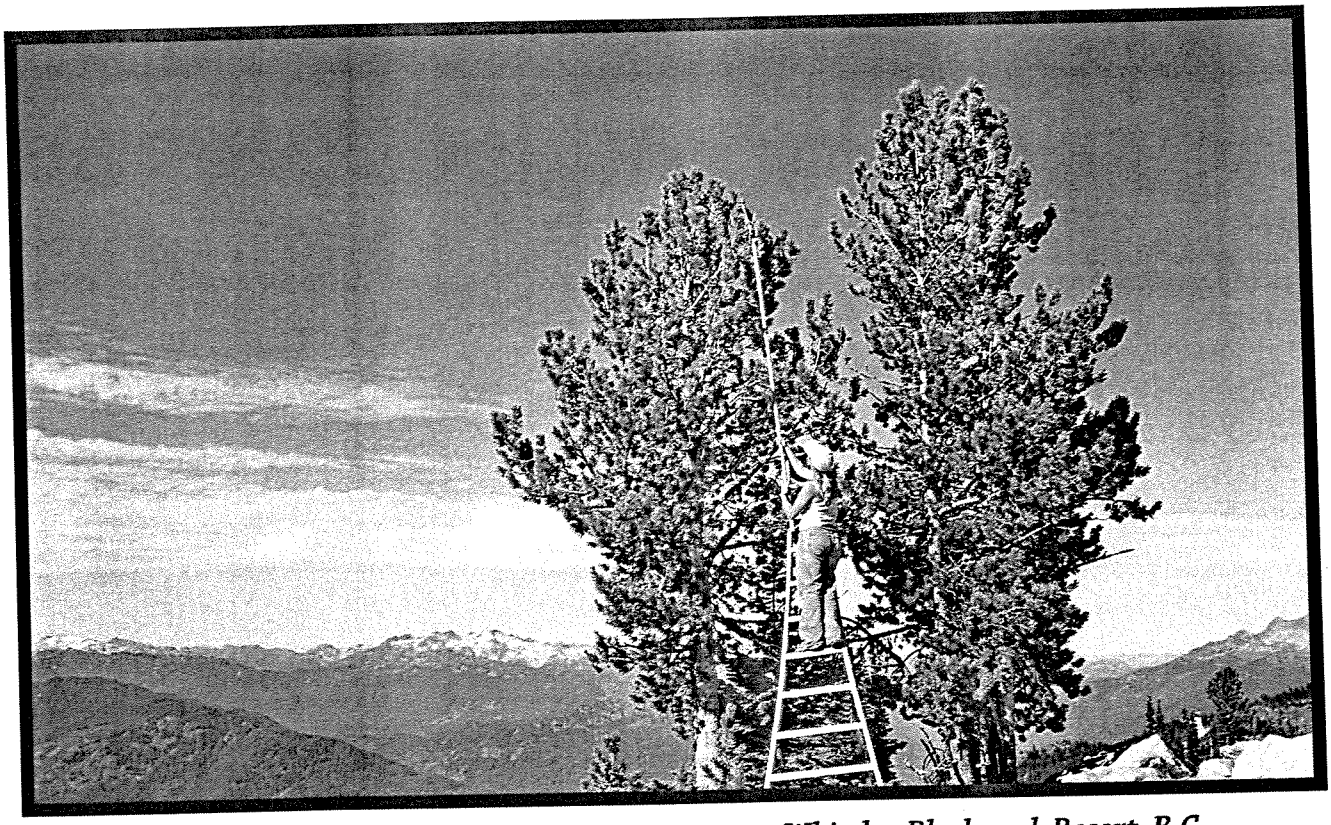
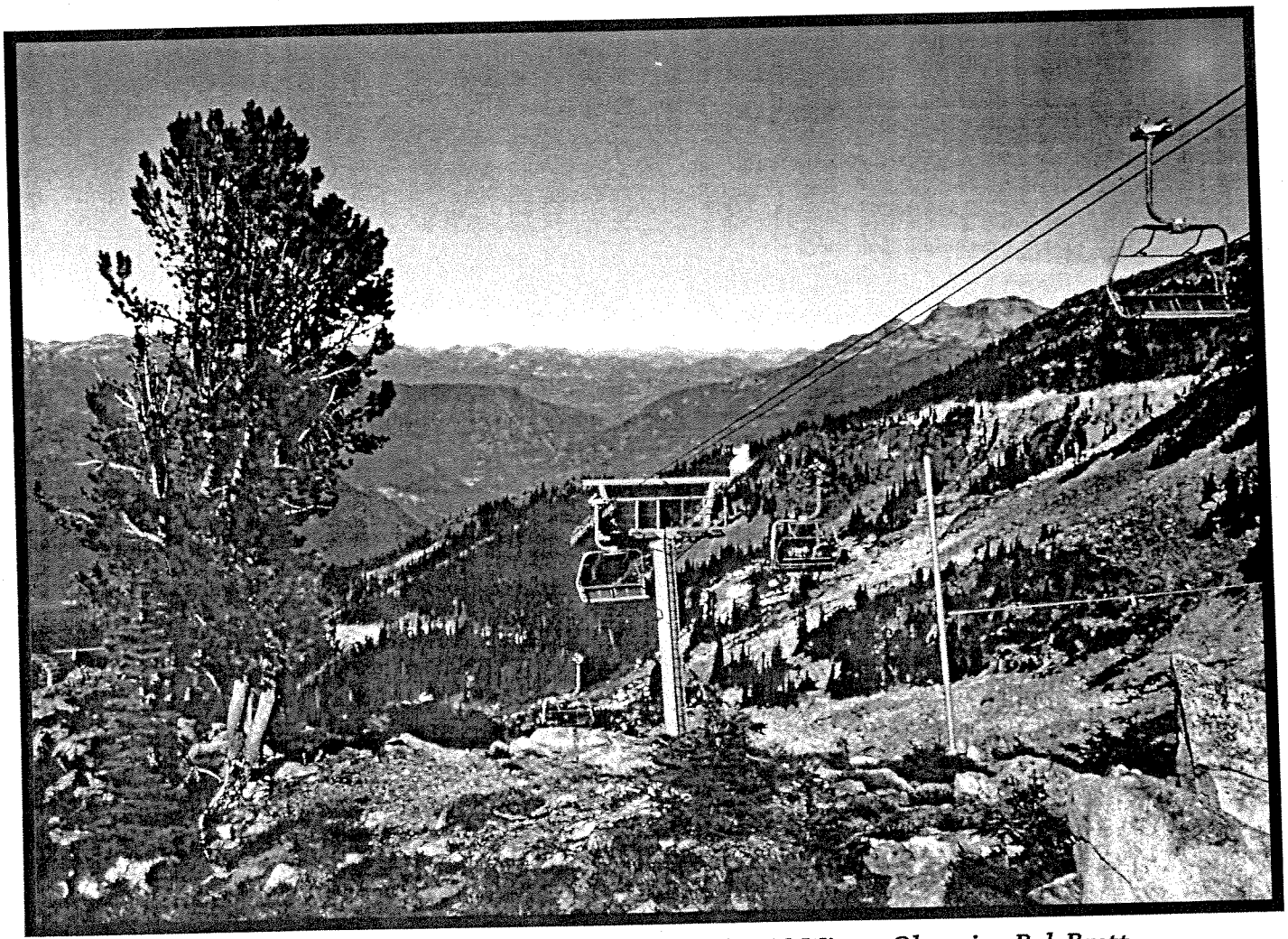


Whitebark pine snag at Crater Lake National Park. Photographer Robert Mutch is working with the Crater Lake Institute to produce post cards that feature the area's whitebark pine and mention restoration needs and WPEF.



Volunteer whitebark pine restoration program at Whistler-Blackcomb Resort, B.C. Bob Brett, Whistler Naturalists. [The Whistler restoration program will be described in the next issue of Nutcracker Notes.]



Whitebark pine at Whistler-Blackcomb, site of 2010 Winter Olympics. Bob Brett.

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