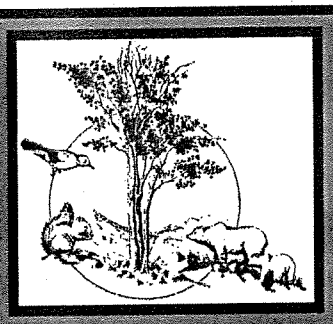
Spring | Summer 2002

# Nutcracker Notes

## Whitebark Pine Ecosystem Foundation



Issue 2

## Topics

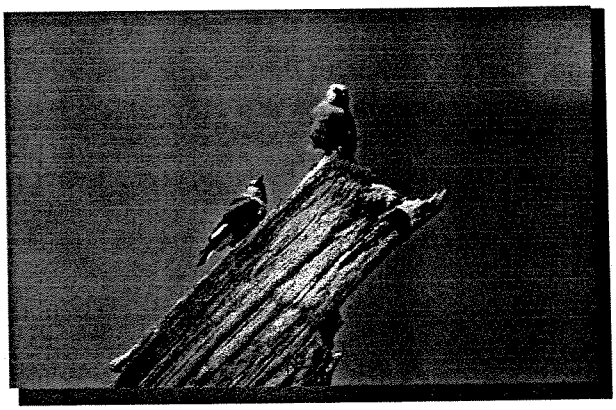


WPEF
P.O. Box 16775
Missoula, MT
59808

Clark's nutcracker looking for seeds in whitebark pine at Tioga Pass, CA.

## *Nutcracker Photo Essay . . . .*

### *Photos By Diana Tomback*



Adult nutcracker on snag and juvenile below.

Nutcracker with full throat pouch harvesting seeds.

## WPEF's Mission:

Conserve the whitebark pine ecosystem for the benefit of humans and wildlife

# Mountain Pine Beetle Activity Increases in Whitebark Pine

Diana L. Six, University of Montana,
Missoula, MT 59812; six@forestry.umt.edu

Populations of mountain pine beetle are currently increasing in whitebark pine at several sites in Montana and Idaho. During outbreaks, mountain pine beetles can kill large numbers of pines over extensive areas. The mountain pine beetle is part of the natural disturbance regime of many western forests. In the high elevation whitebark pine ecosystem, outbreaks of these beetles result in a large number of dead trees that can eventually fuel fires. The openings left by dead trees and fire allow caching of seeds by nutcrackers and the subsequent regeneration of new whitebark pine stands. However, given the present decline of whitebark pine, the loss of mature trees to beetles at this time may be especially devastating. Only mature whitebark pine bear cones. Unfortunately, mature trees are also those most preferred by the beetles. By greatly reducing the number of mature trees at a site, the beetles indirectly contribute to a strong reduction in seed production. When seed production is low, most or all seeds cached by nutcrackers may be used by the birds for food, leaving few or none to grow into new trees. Nutcrackers may also abandon low-production stands for more productive areas effectively halting regeneration.

Very little is known about the biology of the mountain pine beetle in whitebark pine. For many years, it was believed that the harsh conditions and short growing season experienced in high elevations sites were not conducive for beetle development and survival. The biggest threat to whitebark pine from the mountain pine beetle was thought to be from populations of the beetle infesting adjacent lower elevation stands of lodgepole pine. It was thought that the beetles initially build up in lodgepole pine and then move into whitebark pine stands, killing trees and laying eggs, but with few of the beetle brood surviving to adulthood. Thus, whitebark pine was viewed as a sort of dead end for the mountain pine beetles that ventured into these areas. Therefore, it was suggested that whitebark pine would be best protected from mountain pine beetle by managing the beetle in adjacent lodgepole pine. However, while mountain pine beetle populations have been observed to move into whitebark pine from adjacent infestations in lodgepole pine, not all infestations in whitebark pine appear to originate in this manner. Therefore, information is needed on beetle behavior and survival in whitebark stands in order to develop appropriate management strategies.

Parent nutcracker harvesting whitebark pine seed cache while fledgling begs for food. Cache is on volcanic pumice.

Continued on Page 13 . . . with photo

## Whitebark Pine Ecosystem Foundation Officers

Director: Dr. Diana Tomback
University of Colorado at Denver

Vice Director: Kate Kendall
U.S. Geological Survey, West Glacier, MT

Secretary: Helen Smith
Rocky Mountain Research Station, Missoula, MT

Treasurer: Steve Shelly
USDA Forest Service, Northern Region, Missoula, MT

Publications editor: Stephen F. Arno
Rocky Mountain Research Station (retired), Missoula, MT

Membership & Outreach Coordinator: Bryan Donner
Flathead National Forest, Kalispell, MT

## WPEF Brochures and Website

Readers can help us reach others by distributing WPEF's attractive full-color brochures and directing people to our interesting and educational website (www.whitebarkfound.org). The brochures are suitable for visitor centers in areas that include whitebark pine habitat. They can be ordered for free, individually or in quantities, from Helen Smith (hsmith04@fs.fed.us) (phone: 406 329 4707) at the Fire Sciences Lab in Missoula, MT.

## Whitebark Pine Ecosystem Foundation Board of Directors

Stephen F. Arno
USDA Forest Service (retired)
Rocky Mountain Research Station
Fire Sciences Laboratory, Missoula, MT

Bryan Donner
USDA Forest Service
Flathead National Forest, Whitefish, MT

Carl E. Fiedler
School of Forestry
University of Montana
Missoula, MT

Robert E. Keane
USDA Forest Service
Rocky Mountain Research Station
Fire Sciences Laboratory, Missoula, MT

Katherine C. Kendall
USDI Geological Survey
Biological Resources Division
Glacier Park Field Station, West Glacier, MT

Ward W. McCaughey
USDA Forest Service
Rocky Mountain Research Station
Forestry Sciences Laboratory, Bozeman, MT

Dana L. Perkins
USDA Forest Service
Pacific Northwest Research Station
Forestry Sciences Laboratory, La Grande, OR

Helen Y. Smith
USDA Forest Service
Rocky Mountain Research Station
Fire Sciences Laboratory, Missoula, MT

Diana F. Tomback
Department of Biology
University of Colorado at Denver
Denver, CO

# An Interview with Diana Tomback

Director of the Whitebark Pine Ecosystem Foundation

**Editor:** How did you become interested in whitebark pine ecosystems?

**D. Tomback:** I was first exposed to whitebark pine and Clark's nutcracker simultaneously in the summer of 1971. I had just finished an ornithology course as a master's student at UCLA and was backpacking in the California Sierra Nevada. Climbing into the high country, I stopped to rest at the base of a whitebark pine and noticed that a bird at the top of the tree was digging into one of the cones and removing seeds. My field guide identified the bird as Clark's nutcracker. After returning to campus, I spent hours on a literature search and was surprised at how little was known about this bird. Intrigued by the nutcracker and its apparently unknown relationship to pines, I considered this as a subject for my doctoral studies.

The fall that I began my doctoral work at UC Santa Barbara, the university acquired two field stations on the east slope of the Sierra Nevada near Mammoth Lakes. For five field seasons I stayed at these stations. I took a "pine" tutorial from Dr. John Haller, an expert in pine systematics. In the field, I was able to examine how and when nutcrackers used whitebark pine seeds. One field season (1975) there were high densities of newly-germinated whitebark pine seedlings throughout my study area at Mammoth Mountain. The seedlings germinated in clusters, in exactly the same kinds of microsites that nutcrackers had used for caching seeds in previous years. This was a breakthrough! It was clear that nutcrackers were dispersing whitebark pine seeds. My dissertation (1977) was on the behavioral ecology of Clark's nutcracker and one chapter was about the ecological relationship between the nutcracker and whitebark pine. The finding that nutcrackers were dispersing (and in effect "planting") whitebark pine seeds led me to design future studies to reveal how nutcrackers affected the biology and ecology of both whitebark and limber pine ecosystems.

**Editor:** What was the status of scientific knowledge of the ecological importance of whitebark pine when you began your studies?

**D. Tomback:** Virtually nothing was known about the ecological importance of whitebark pine when I began my work. In fact, the method of seed dispersal for the tree was unknown or misinterpreted by many foresters until comparatively recently. Far more was known about whitebark's closest relatives, the Siberian and Swiss stone pines, which are disseminated by the Eurasian (spotted) nutcracker. Also, it was not until Kate Kendall's studies in the late 1970s that the importance of whitebark pine seed to grizzly bear nutrition was discovered. In addition, our realization of this tree's importance in stabilizing soils and snowcover is also very recent.

**Editor:** Today's scientists tend to associate mostly with their peers in narrow specialties, and yet you and your colleagues in the WPEF represent a broad array of disciplines working not only to advance science but also to aid management of high-elevation ecosystems. How did this come about?

**D. Tomback:** The interdisciplinary collaborative effort for whitebark pine really began with an informal group of researchers and managers brought together in the mid-1980s by Steve Arno, Wyman Schmidt, and Ward McCaughey of the Forest Service's Intermountain Research Station who were concerned about the lack of information on this species as well as its conspicuous decline. Initially, the biologists and foresters presented their findings in small workshops and helped identify "holes" in our knowledge of whitebark pine that were critical if we wished to restore it. Group members responded enthusiastically designing research to fill these holes, often accompanied with logistical support or funding from the Intermountain Station. We were all working within our own areas of expertise, but could see how our "piece" fit into the bigger picture. In 1989 this group sponsored a major symposium on the ecology and management of whitebark pine ecosystems. In 1991 the members received a Centennial Conservation Award from the Forest Service. The group has continued to sponsor symposiums and workshops nearly every year, and they collaborated on a book "Whitebark pine communities: ecology and restoration," published in 2001 by Island Press, which has been recognized by reviewers in scientific journals as a model for ecosystem restoration. Not surprisingly, this same group of collaborators established the Whitebark Pine Ecosystem Foundation, where they continue to bring together more people with various backgrounds and interests to help improve understanding and restoration of these high-mountain ecosystems.

Continued on Page 5 . . . . . .

## *An Interview Continued . . . .*

**Editor:** Do you think WPEF can expand the appreciation of whitebark pine ecosystems and the need for innovative restoration to a broader audience including the publics that value high-mountain environments?

**D. Tomback:** WPEF's mission includes educating the scientific and lay public about the importance of whitebark pine ecosystems, and promoting and supporting local and regional restoration activities. We believe these two goals are connected and that education about the uniqueness of whitebark pine and the ecosystem services it provides leads to community concern and support for whitebark pine restoration. WPEF is exploring several avenues for raising community awareness. One direction is to establish partnerships with ski areas that include whitebark pine communities. We have already begun to work with Big Mountain Ski and Summer Resort and Missoula Snow Bowl and have had favorable contacts with a major ski area in the Cascade Range. Some WPEF members are also working with a ski area in British Columbia (see Page 9). We plan to reach winter and summer visitors through interpretive exhibits and whitebark pine restoration projects. In the near future we hope to commission Monte Dolack to paint a very special picture depicting whitebark pine in its "circle of life" with nutcrackers, bears, squirrels, and fire. This picture will serve as a symbol of both the value of whitebark pine ecosystems and the importance of helping with WPEF's mission.

The longer term vision for WPEF, as I see it, is to obtain on-going community and foundation support that will enable us to initiate two to four new restoration projects per year by providing matching funds or technical expertise. This vision challenges the WPEF board and also the membership to seek out financial support and to determine where our help is most required. As WPEF establishes a presence in the United States and Canada, it is my hope that the public will help ensure that whitebark pine ecosystems are recognized, valued, and maintained.

# Symposium on "The Decline of White Pine Ecosystems"—Coming Soon

WPEF is co-sponsoring a symposium the morning of August 9, 2002, at the Ecological Society of America annual meeting in Tucson, Arizona. The title is "The Rapid Decline of White Pine Ecosystems of the West: Causes, Consequences, and Restoration Strategies." It is scheduled for 9:00 a.m. until noon in the Tucson Convention Center's Tourquoise Ballroom. Organizers explain that the introduction of white pine blister rust (*Cronartium ribicola*) coupled with nearly a century of fire suppression has resulted in major losses in western white pine (*Pinus monticola*), whitebark pine (*P. albicaulis*), limber pine (*P. flexilis*), and sugar pine (*P. lambertiana*) and expanding declines in foxtail pine (*P. balfouriana*) and southwestern white pine (*P. strobiformis*). These pines play important roles in natural ecosystems and are important for maintaining biodiversity. The purpose of this symposium is to increase understanding of white pine ecosystem losses, discuss ways to restore impacted ecosystems, and explore new concepts, findings, and technologies that have emerged in the process of learning about blister rust impacts.

Here is a list of topics and speakers:

A century of blister rust and fire suppression in white pine ecosystems: biodiversity consequences (D. Tomback); The biogeography of blister rust invasions: the challenges of new outbreaks (E. Smith and others); Population genetic structure of white pines: implications for blister rust management (B. Richardson and others); Genetic interactions between the blister rust fungus and white pines: resistance as a foundation for restoration (P. Zambino and M. Mahalovich); Local epidemics: evidence for interactions among alternate hosts, climate, and pine genetics (G. McDonald); Stress tolerance of subalpine white pines: potential consequences of selection by blister rust (A. Schoettle and A. Sala); Testing the natural selection stand model for whitebark pine restoration (S. McKinney and others); Use of fire and silvicultural techniques for whitebark pine restoration: successes, caveats, and assessment techniques (R. Keane and others); and Concluding remarks (a discussion).

If you are interested in more information about the symposium, contact Diana Tomback via e-mail (dtomback@carbon.cudenver.edu) or FAX 303-556-4352.

# A Whitebark Pine Restoration Program for the Intermountain West

Mary Frances Mahalovich
Geneticist for the USDA Forest Service's Northern, Rocky Mountain, Southwestern, and Intermountain Regions

During the year 2000 wildfires burned about 2.3 million acres (929,200 hectares) on USDA national forest lands, with a significant fraction occurring in the high elevation whitebark pine ecosystems. Although fire is an essential natural feature of these ecosystems, because of drastic declines in some whitebark pine populations it may now be necessary to use artificial regeneration to restore this important conifer. Emergency National Fire Plan funding was made available for 2001-2005 to initiate a landscape-level approach to restoring whitebark pine on National Forest System lands in Idaho, Montana, Nevada, and Wyoming. As news of the program spread, restoration efforts were broadened to include Forests in Oregon and Washington and we expanded our partners to include the USDI National Park Service—Yellowstone, Glacier, and Grand Teton National Parks and the Nevada Division of Forestry, while garnering the support of the Greater Yellowstone Coordinating Committee (GYCC).

The cornerstone of the recovery effort emphasizes genetic resistance to white pine blister rust and mountain pine beetle, along with an active planting program. Early and active intervention involving *both* burned over and non-burned areas are essential to restoring degraded communities. The action plan involves designating permanent leave trees, emphasizing trees that have not been infected in areas having a high incidence of blister rust or mountain pine beetles, but it also includes the outlying populations and scattered trees where unique gene complexes have developed over time with or without the selection pressure to major damaging agents. We need a broad genetic sample from throughout this species' range to conserve diversity and to reconstruct populations that are being lost to blister rust, mountain pine beetle, successional replacement by other conifers due to fire suppression, or even to modern wildfires. Borrowing from the western white pine story, when blister rust was introduced in the early 1900s, genes didn't mutate to provide resistance to the rust. Western white pine had a basic resistance to disease in its genetic makeup which allowed a small percentage of the trees to survive. So we're extending the same principle to whitebark pine. We need to be careful not to impose too many restrictions on ourselves, such as limiting our collection areas, as the biology of whitebark pine already imposes several limitations on our recovery efforts.

As 650 "plus trees" (trees appearing distinctly superior to the average—free of insects, diseases, or problems like poor growth or cold hardiness) across seven seed zones are identified, cone collections are ongoing to provide an immediate seed source for wildfire recovery efforts and to facilitate gene conservation (putting seed in cold storage for the future). Once we have enough seed from 100 trees per zone, we will expose their seedlings to blister rust to evaluate and utilize any resistance we find in selected trees.

During field season 2001, approximately 75 collections were made throughout Idaho, Montana, and eastern Washington. Collections will continue in 2002. Also during 2001, the majority of the partners in this effort provided information on the species' current or potential distribution to fine-tune overall planning and implementation of the restoration program and to help refine seed transfer guidelines by developing a database for a seed transfer expert system. Knowing how difficult it is to access remote cone-bearing trees and to protect the crop from Clark's nutcrackers, we are evaluating the need for seed orchards to secure a reliable cone crop. Later, we'll also collect pollen for gene conservation (pollen bank, much like a zoo's sperm bank) and to advance blister rust resistance in the seed orchards, since conifers typically produce seed cones for several years before pollen production begins.

Monitoring cone crops will begin in June, followed by installation of wire cages to protect this year's cones. Based on the experience on the Helena National Forest, if one waits until July to install wire cages, it is too late as the nutcrackers begin to work the trees over long before the seed has matured. Collecting seeds in squirrel cone-caches is not advisable because of possible contamination by fungi.

While the cone collections are continuing, the Forest Service has a blister rust screening trial of 110 seed sources at the Coeur d'Alene Nursery to help refine our current seed transfer guidelines for planting and to develop a better understanding of the degree and types of resistance present in whitebark pine. Three-year old seedlings were inoculated in

Continued on Page 8 . . . . . .

# Dendrochronology of Whitebark Pine in the Selway-Bitterroot Wilderness

Kurt F. Kipfmueller
Laboratory of Tree-Ring Research,
University of Arizona

One of the lesser-known values of whitebark pine is its ability to record ecological variation at long time scales, due to its longevity and sensitivity to its surrounding environment. Over the last five years I have conducted research that uses dendrochronology to reconstruct subalpine fire regimes and climate. Dendrochronology studies tree rings to gain knowledge of past environments. It relies on crossdating—examining patterns of wide and narrow growth rings to precisely date the annual rings and interpret variations in climate and other environmental factors.

I am using dendrochronology to reconstruct fire history—the timing and severity of past fires—in four subalpine watersheds (averaging about 2000 acres) in the Selway-Bitterroot Wilderness (SBW) of Idaho and Montana. In addition, I am reconstructing summer climate using tree-ring patterns from whitebark pine and alpine larch (*Larix lyallii*). These reconstructions are compared with the fire histories to identify relationships between fire and climate. This article summarizes some of the results with an emphasis on the value of whitebark pine for dendrochronological studies.

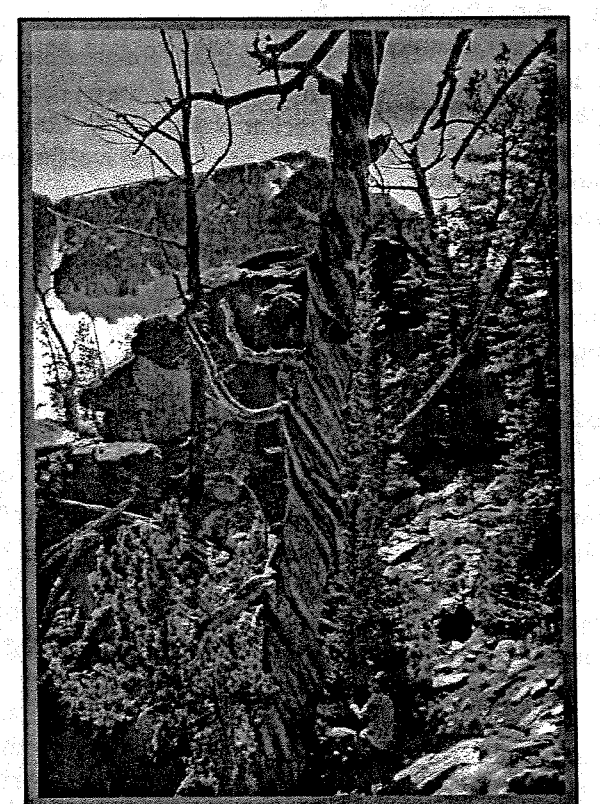


**Figure 1. An old, spiral grained whitebark pine in the Selway-Bitterroot Wilderness Area. The only remaining living portion of the tree is a large branch near the bottom left of the tree. The innermost ring collected from this tree is dated at 721 AD but samples do not reach the tree's center (Photo by K.F. Kipfmueller).**

## Fire History

Whitebark pine has played a key role in developing fire histories for the sampled watersheds. In these watersheds most fires are stand-replacing. Most of the trees, including lodgepole pine, subalpine fir, and Engelmann spruce, have thin bark and are susceptible to mortality when a fire occurs. Lodgepole pine occasionally survive fires, recording fire events as cambial scars, but whitebark pine in its rocky habitat with discontinuous fuel often survives while forming a fire scar.

Whitebark pines grow throughout the four watersheds sampled for fire history. The whitebarks growing along ridgetops have been particularly important to this research. Here, the forest canopy is relatively open and fuel breaks are common. Fires that burn with stand-replacing intensity within the lower portions of the basins often lose their intensity along the ridges, often burning along the ground surface rather than in the forest canopy leaving behind evidence as cambial scars. Dendrochronology allows the assignment of precise annual dates to each of these cambial scars by ensuring there are no locally absent rings (a common occurrence in fire-scarred materials collected in the Selway-Bitterroot). These fire dates, when compared to age structures of fire-initiated tree regeneration within the basin can provide some information on a fire's extent within the watershed.

Most of these fire-scarred whitebarks are dead, having succumbed to beetle epidemics or blister rust, but dendrochronological techniques enable these remnant snags and logs to be incorporated into fire chronologies, dramatically increasing the length of the chronologies. For example, the oldest fire scar recorded by a living tree in my study was dated to 1719. However, dendrochronological dating enabled the fire history of one watershed to be extended back as far as 1204 by using fire scarred stumps and snags.

Return intervals between fires are quite variable among the four sampled watersheds, and many fires appear to have been quite small. The mean number of years between fires in the combined watershed areas was around 20 years; however large fires occurred approximately every 200 years and appear to be related to two consecutive drier-than-average summers.

## Climate Reconstruction

I have developed 8 chronologies of tree growth from whitebark pine and alpine larch, and these extend

Continued on Page 9 . . . . . .

# Greater Yellowstone Whitebark Pine Committee—An Update

Melissa Jenkins, Chair, GYCC Whitebark Pine Committee

In the fall/winter 2001 issue of Nutcracker Notes, readers were introduced to the Greater Yellowstone Coordinating Committee's (GYCC) Whitebark Pine Committee, which coordinates information and activities within the six National Forests, two National Parks and two National Wildlife Refuges in the Greater Yellowstone Area. The Whitebark Pine Committee mission is "to ensure the long-term viability and function of whitebark pine ecosystems in the Greater Yellowstone Area." Since its first meeting in June 2001, the Whitebark Pine Committee has made progress on several action items:

- We are in the process of developing a map of whitebark pine in the GYA.
- We have developed an identification key for the species of *Ribes* present in the GYA.
- The Committee has received funding to create a whitebark pine annotated bibliography, which should be completed by early summer.
- The Committee has agreed upon a standard monitoring protocol for the GYA.
- We plan to expand a 1995 study that established monitoring plots primarily within Yellowstone National Park to include the entire GYA.
- We have established whitebark planting guidelines and are reviewing all previous whitebark planting in the GYA to further refine these guidelines.
- We are working on restoration guidelines for the GYA; this will be an emphasis item at our next meeting. Our draft guidelines will be sent to the WPEF for review.

Our next meeting is being held in West Yellowstone on June 24th and 25th, 2002 and features presentations by Diana Tomback, Bob Keane, and Jim Hoffman, and a review of recent research by Diana Six and Dana Perkins. The meetings are open to anyone interested in whitebark pine. If you would like to be on the mailing list to receive meeting announcements and notes, contact Melissa Jenkins mmjenkins@fs.fed.us, (208) 652-5412. Our fall meeting will most likely be held in Bozeman, MT, in November.

# Yellowstone N.P. Highway Project—An Impact and An Opportunity

The comment period is now over and the National Park Service is evaluating responses to their proposal to widen and upgrade the 18.4 mile segment of the narrow highway from Canyon Village to Tower Junction. This includes a stretch of the road climbing through mature whitebark pine stands on 8800-foot Dunraven Pass. Park officials expect to issue a proposed alternative soon, which will be posted on their website (www.nps.gov/yell/technical/planning/index.htm). It seems likely that many whitebark pines will be removed, perhaps into the hundreds, which may present an opportunity for dendrochronology investigations as well as for testing methods of revegetating steep cut and fill slopes in whitebark pine habitat. Biologist Dan Reinhart has agreed to provide a writeup on the planned action for the fall/winter issue of Nutcracker Notes. Doug Madsen is the planner in charge of the project and can be reached by phone at (307) 344-2017.

---

**Restoration Program Continued from Page 6 . . . .**

September 2001, and along with the control seedlings were recently planted in the nursery beds. Survivors from this and future blister rust screenings will be planted in clone banks for gene conservation purposes and to serve as donors for future seed orchard establishment and to facilitate selective breeding for blister rust resistance.

Two key concerns are that designated leave-trees are dying from wildfire and other causes faster than we can collect their cones, and we need to not let our seed sit in storage too long before scheduling a screening for rust resistance. We also need to learn more about long-term seed storage requirements to improve seed germination.

The multi-state, multi-agency collaboration forged in this endeavor provides a unified front to enhance restoration efforts. Here's wishing all of our partners and supporters good luck this field season!

For more information contact the author at the Forestry Sciences Lab, 1221 S. Main Street, Moscow, ID, 83843; phone (208) 883-2350; fax 883-2318; e-mail mmahalovich@fs.fed.us

Continued From Page 7 .....

back almost 800 years. In addition, one whitebark pine chronology extends to 721 AD and includes samples from a living whitebark pine that covers the entire record (721-1998, Figure 1). This tree is likely much older than the oldest growth-ring sampled because the center of the tree was not obtained, due to decay. Many other samples from this area also include inner ring dates before 1000 AD.

The strongest statistical relationships between tree growth and climate occur during the summer months. Summer temperature has a positive relationship with tree-growth and this will allow the reconstruction of average summer temperatures. In addition, there is a somewhat weaker (but nonetheless significant) relationship between tree-growth and summer Palmer Drought Severity Index (PDSI). A PDSI reconstruction would be useful to fire managers for understanding the relationships between fire and climate.

These reconstructions of fire and climate can provide important information about the range of variability in subalpine ecosystems over long time scales,and can also assist in the assessment of the potential impacts of global climate change. By substantially lengthening the record of climate with a high quality climate reconstruction we can better understand the behavior of climate, as well as important ecosystem responses at long time scales. Further, linking fire with climate might provide managers with important tools for planning strategies to restore subalpine habitats where substantial changes may have occurred.

Currently fire histories are completed in the four basins under study. Tree-ring chronologies extend back as far as 721 A.D. for whitebark pine and 982 for alpine larch. The period of sufficient data for climate reconstruction purposes extends back to about 1200. This research is part of my dissertation research directed by Dr. Thomas W. Swetnam at the University of Arizona's Laboratory of Tree-Ring Research in Tucson, AZ 8572. I expect this study to be completed by December 2002.

The author can be contacted via e-mail at: kurt@LTRR.Arizona.edu

# Boise National Forest Considers Restoration

The Boise National Forest is planning to propose one or more road accessible areas at high elevations as candidates for whitebark pine restoration treatments. Treatments might include prescribed fire, removal of competing conifers, or planting of rust-resistant whitebark seedlings. Some of the possible sites include areas near Deadwood Lookout and Scott Mountain on the Lowman Ranger District. For information on upcoming proposals, contact Lynn Morelan, Vegetation/NEPA Staff Officer, at the Boise National Forest Supervisor's Office, 1249 S. Vinnell Way, Suite 200, Boise, ID 83709; phone (208) 373 4100.

# Genetics of Whitebark Pine Studied at the University of British Columbia

The Centre for Forest Gene Conservation, in the Faculty of Forestry at the University of British Columbia, under the direction of Dr. Sally Aitken, is continuing it's work on the genetics of whitebark pine. A Master's project that examined the mating system, and population genetics of whitebark pine was recently completed by Jodie Krakowski, and Andy Bower is following up that work with a Ph.D. project that will examine rangewide trends in genetic variation of adaptive traits. Seed was obtained from over 200 individual trees throughout the range of whitebark pine in both B.C. and the U.S. Germination percentage will be determined and compared for seed from different geographic locations that have been in storage from zero to 10 years. Seeds have recently been sown to establish a common garden experiment (grow the seedlings in a common environment) in which genetic differences can be quantified over a two-year period. Measurements of adaptive traits (i.e. growth, phenology, and cold hardiness) will be taken to determine if geographic variation in these traits corresponds to the distribution of genetic variation observed in previous studies that utilized molecular markers. An additional study will examine the impacts of inbreeding and white pine blister rust on levels of genetic variation in British Columbia populations. The study should be completed by early 2005.

For more information, contact Andy Bower (adbower@interchange.ubc.ca) or Sally Aitken (aitken@interchange.ubc.ca). Department of Forest Sciences, University of British Columbia, 3401-2424 Main Mall, Vancouver, B.C., Canada, V6T 1Z4.

# Annual Meeting and Field Tour, September 20

The theme of WPEF's annual meeting and field tour is **Restoring Whitebark Pine at Ski Areas.** The meeting and tour begins at 9 a.m. and ends about 4 p.m., Friday, September 20, 2002, at the Fire Sciences Lab immediately west of the Smoke Jumper Center which is ½ mile west of the Missoula International Airport on old highway 10. WPEF has been contacting ski areas throughout the greater northwest, encouraging them to partner with us in efforts to restore whitebark pine. At the meeting we will learn about the results of these contacts and also hear about restoration projects being planned or conducted at Big Mountain, Mount Hood, Whistler, and Sun Valley. We will tour a restoration project being conducted by Bob Keane of the Rocky Mountain Research Station in cooperation with the Snow Bowl Ski Area and the Lolo National Forest.

WPEF members will receive a notice at the end of August telling them how to sign up for the meeting and tour. Others who wish to attend can phone the Fire Sciences Lab in Missoula at (406) 329 4800 on or after September 2, 2002.

---

# Current Whitebark Publications

Bob Keane, Rocky Mountain Research Sta.,
Fire Sciences Laboratory, Missoula, MT
rkeane@fs.fed.us

In case anyone doubts whether whitebark pine is declining across its range, several new publications detail the plight of this five-needled species. Campbell and Antos (2000) describe the severity of blister rust in British Columbia including variable rates of infection and severity of blister rust. The declining status of whitebark pine at Crater Lake, Oregon is detailed by Murray and Rasumussen (2000) and Smith and Hoffman (2000) describe the status of whitebark in the Intermountain West. Kegley et al. (2001a) describe current beetle and rust activity in whitebark pine in various stands in Idaho. The decline of whitebark pine in the west Big Hole range is documented by (Murray et al. 2000). Schmitt and Scott (1998) detail the current condition of whitebark pine in Oregon and western Idaho. And last, Goheen et al. (2002) describe some major whitebark pine mortality on the Umpqua National Forest. Taken together, these publications paint a bleak picture for whitebark pine populations in the greater Northwest.

New publications concerning whitebark pine restoration include Janet Howard's master's thesis on seedling transplantation response (Howard 1999) and a summary of current restoration activities by Keane and Arno (2000). Kristen Baker presents the results of her study looking at bark beetles on restoration sites (Baker and Six 2001). Peterson (1999) details some ideas on prioritizing whitebark pine restoration in Glacier National Park. And, Kegley et al. (2001b) present cone and seed insects in whitebark pine. Finally, Smith and Hoffman (2001) present some site and stand characteristics for blister rust in whitebark pine that might be useful for prioritization criteria.

Some very interesting whitebark pine ecology publications include a study on delayed germination mechanisms in whitebark pine (Tomack et al. 2001), a paper on limber pine autecology (Ronald et al. 1999), and another paper on whitebark pine genetics (Rogers et al. 1999). Donnegan and Rebertus (1999) have published a good paper on succession in whitebark pine forests. There are also a couple of papers that discuss the interactions in whitebark pine ecosystems; Jesse Logan uses whitebark pine in his paper detailing global warming effects and the bark beetle (Logan and Powell 2001) and Hunt (2000) discusses blister rust and bears. Mark Matthews wrote a general article on whitebark pine that was published in the New York Times and High Country News (Matthews 2000).

*(Reference list on next page.)*

## REFERENCES


Baker, K. M., and D. L. Six. 2001. Restoring whitebark pine (*Pinus albicaulis*) ecosystems: A look at endemic bark beetle distribution. Pages 501-502 *in* Society of American Foresters 2000 Annual Meeting. Society of American Foresters, Washington, DC, USA.

Campbell, E. M., and J. A. Antos. 2000. Distribution and Severity of White Pine Blister Rust and Mountain Pine Beetle on Whitebark Pine in British Columbia. Canadian Journal of Forest Research **30**:1051-1059.

Donnegan, J. A., and A. J. Rebertus. 1999. Rates and Mechanisms of Subalpine Forests Succession Along an Environmental Gradient. Ecology **80**:1370-1384.

Goheen, E. M., D. J. Goheen, K. Marshall, R. S. Danchok, J. A. Petrick, and D. E. White. 2002. The Status of Whitebark Pine Along the Pacific Crest National Trail on the Umpqua National Forest. General Technical Report PNW-GTR-530, USDA Forest Service, Portland, OR.

Howard, J. L. 1999. Transplanted whitebark pine regeneration: the response of different populations to variation in climate in field experiments. Master of Science. University of Montana, Missoula, MT.

Hunt, R. S. 2000. White Pine Blister Rust, Root Disease, and Bears. Western Journal of Applied Forestry **15**:38-39.

Keane, R. E., and S. Arno. 2000. Restoration of Whitebark Pine Ecosystems in Western Montana and Central Idaho. Pages 324 - 330 *in* Society of American Foresters 1999 National Convention. Society of American Foresters, Portland, Oregon.

Kegley, S., J. Schwandt, and K. Gibson. 2001a. Forest Health Assessment of Whitebark Pine on Pyramid Pass, Russell Mountain, and Burton Ridge in the Selkirk Mountains on the Idaho Panhandle National Forests. 01-08, USDA Forest Service, Missoula.

Kegley, S., N. Sturdevant, J. Stein, B. Wilhite, P. Flanagan, J. Weatherby, and M. Marsden. 2001b. Cone and Seed Insects and Their Impact on Whitebark pine. 01-06, USDA Forest Service, Missoula, MT.

Logan, J. A., and J. A. Powell. 2001. Ghost Forest, Global warming, and the Pine Beetle (Coleoptera: Scolytidae). American Entomologist **47**:160-173.

Matthews, M. 2000. Last chance for the whitebark pine: a remarkable tree, spread by birds and eaten by bears, finally gets some attention. Pages 5 *in* High Country News.

Murray, M. P., S. C. Bunting, and P. Morgan. 2000. Landscape Trends (1753-1993) of Whitebark Pine (Pinus albicaulis) Forests in the West Big Hole Range of Idaho/Montana, U.S.A. Arctic, Antarctic, and Alpine Research **32**:412-418.

Murray, M. P., and M. Rasumussen. 2000. Status of Whitebark Pine in Crater Lake National Park. US Department of Interior Park Service, Crater Lake National Park, Crater Lake, OR.

Peterson, K. T. 1999. Whitebark Pine (Pinus Albicaulus) Decline and Restoration in Glacier National Park. Master of Science. University of North Dakota, Grand Forks.

Rogers, D. L., C. I. Millar, and R. D. Westfall. 1999. Fine-Scale Genetic Structure of Whitebark Pine (*Pinus albicaulis)*: Associations with Watershed and Growth Form. Evolution **53**:74-90.

Ronald, F., D. F. Tomack, and J. Koehler. 1999. Cost of Mutualism: Competition, Tree Morphology, and Pollen Productions in Limber Pine Clusters. Ecology **80**:324-329.

Schmitt, C. L., and D. W. Scott. 1998. Whitebark Pine Health in Oregon and Western Idaho. BMZ-99-03, USDA Forest Service, LaGrande.

Smith, J. P., and J. T. Hoffman. 2000. Status of White Pine Blister Rust in the Intermountain West. Western North American Naturalist **60**:165-179.

Smith, J. P., and J. T. Hoffman. 2001. Site and Stand Characteristics Related to White Pine Blister Ruse in High-Elevation Forests of Southern Idaho and Western Wyoming. Western North American Naturalist **61**:409-416.

Tomack, D. F., A. J. Anderies, C. K. S., M. L. Powell, and S. Mellmann-Brown. 2001. Delayed Seed Germination in Whitebark Pine and Regeneration Patterns Following the Yellowstone Fires. Ecology **82**:2587-2600.

## Membership Freebies

At their February meeting, the WPEF board decided that all memberships will run from October 1st through the following September 30th—a fiscal year basis that allows everyone to renew memberships at the time of the annual meeting in late September. To ease the transition into this new "membership year" arrangement, those who joined in spring or summer will be granted a few extra months of free membership.

As of June 2002 WPEF has 54 members, accumulating at a healthy rate, but certainly with a long way to go. As an inducement to gaining more members we have a small number of extra copies of Nutcracker Notes issue no. 1, which we will be glad to mail, while they last, to people who current members identify as good prospects for joining WPEF. Please send name and mailing address of good prospects to the editor (arnos@mcn.net) or to WPEF, P.O. Box 16775, Missoula, MT 59808.

## Membership Coordinator added to WPEF

Bryan Donner has agreed to become WPEF's first Membership and Outreach Coordinator. He will keep track of the membership roster and help to expand our ranks as well as find ways to get more visibility for WPEF and our mission. One of Bryan's first assignments is to develop different categories of membership, such as regular, sustaining, and life membership and ways to encourage donations for our special projects, such as the Monte Dolack painting (see D. Tomback interview), or for specific restoration activities. If you know of a visitor center or good place to give out WPEF's color brochures, or have other ideas for expanding our membership rolls or our outreach, please contact Bryan via e-mail (bdonner@fs.fed.us) or phone (406 863 5408).

---

## To join the Whitebark Pine Ecosystem Foundation, please mail the coupon below with a check to:

Whitebark Pine Ecosystem Foundation
PO Box 16775
Missoula, MT 59808

____ $25 Annual Membership
____ $75 Annual Membership and a copy of the 440-page book, "Whitebark Pine Communities: Ecology and Restoration"
☐ Check box if you would like information about institutional membership

Name _____

Mailing Address _____

City _____ State _____ Zip _____

E-mail _____

**Continued From Page 2 . . . . .**

Because so little information exists on mountain pine beetle in whitebark pine, several students (Joel Adams, Carmen Austin, and Kristen Baker) and myself have conducted a number of studies to determine how well mountain pine beetle is able to reproduce and survive in whitebark pine, and what factors contribute most to the susceptibility of whitebark pine to mountain pine beetle. A good measure of the ability of mountain pine beetle to maintain populations, or increase in number (outbreak) at a site or in a particular tree species, is its reproductive potential. The reproductive potential is simply the average number of offspring produced per pair of parents should all survive to adulthood. After, the reproductive potential is calculated, average number of offspring that die due to various mortality factors before adulthood are subtracted from the average reproductive potential to give an overall estimate of production of offspring. It is well known that the mountain pine beetle is capable of sufficient increase in lodgepole pine to develop outbreaks. Therefore, we compared the reproductive potential and production of offspring of the beetle in the two tree species to get a feel for whether whitebark pine functioned as "dead end" for the beetles or, alternatively, could support an increase in numbers of the beetle. We found that mountain pine beetle produces two to five times more young per unit area in whitebark pine than in lodgepole pine. We also found, that a higher proportion of brood died during development in whitebark pine than in lodgepole pine due to freezing and various other factors. Despite the increased mortality of brood in whitebark pine over the winter, the higher reproductive potential of the beetle in that tree greatly offset these losses, allowing higher overall beetle production than occurs in lodgepole pine. Therefore, it appears that mountain pine beetle not only is able to reproduce and survive in whitebark pine, but whitebark pine appears to be a superior host to lodgepole pine and capable of supporting a rapid increase in beetle populations. Such high overall production of beetles in whitebark pine may account for the very rapid increase from rare to outbreak status observed in several mountain pine beetle populations in whitebark pine over the last three years.

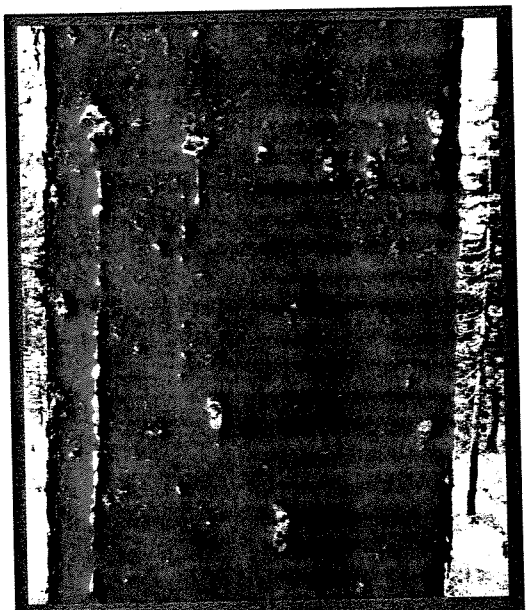


Figure 1. Whitebark pine attacked by mountain pine beetle showing strong resin defense typical of trees with high sapwood moisture content.

More than just high beetle production contributes to the development of outbreaks. Mountain pine beetles stands typically do not develop outbreaks unless certain supporting stand and environmental conditions exist. Stands dominated by large diameter host pines are preferred by the beetles (the beetles do not attack small diameter young trees). Stands with unnaturally high densities of trees may also be more susceptible to beetle attack. Trees in dense stands are stressed due to competition for water, light, and nutrients. As stress increases, defensive capabilities of trees decrease leaving tress more susceptible to beetle attack. Another factor that increases tree stress and susceptibility to bark beetle attack, and often triggers outbreak development, is drought.

We believe that drought conditions affecting much of the northern Rockies over the last few years have contributed to the increased beetle activity observed at several whitebark pine sites. To determine whether trees were drought stressed, and whether drought stress was related to beetle activity, we measured sapwood moisture content of whitebark pine trees at several sites in Montana and Idaho. At sites where the trees were being heavily attacked by beetles, the sapwood moisture content of the trees was very low. At sites were few or no trees were being attacked, sapwood moisture content was high. We also observed a strong relationship between sapwood moisture content and resin flow, a major tree defense against the beetle. In trees with low sapwood moisture content, the trees had little-to-no resin flow, and consequently little defense against attack. In trees with high sapwood moisture contents, resin flow was profuse indicating strong defensive capabilities. In stands where densities are unnaturally high, such as where subalpine fir has encroached into once open stands of whitebark pine, we expect to see this effect exacerbated because competition for water in such stands would be intensified during periods of low rainfall.

White pine blister rust may also play a role in maintaining bark beetle populations in whitebark pine. At two sites, we measured sapwood moisture content of whitebark pine trees with varying levels of blister rust infection. We found that as blister rust infection level increased, sapwood moisture content decreased. Thus, such trees are likely to be more susceptible to beetle attack. Indeed, at these sites, we found that beetles preferentially attacked trees with higher levels of blister rust infection.

# *Nutcracker Photo Essay . . . .*

## *Photos By Diana Tomback*

Parent nutcracker harvesting whitebark pine seeds and fledgling begging for food.

Parent nutcracker feeding fledgling in crown of whitebark pine.