



Issue No. 13: Fall / Winter 2007

Nutcracker Notes

Whitebark Pine Ecosystem Foundation



Painting portrays whitebark ecosystem (Larry Eifert)

WPEF
P.O. Box 16775
Missoula, MT
59808



Whitebark ecosystem diorama (Jane K. Smith)

WPEF Director: Diana F. Tomback

University of Colorado at Denver &
Health Sciences Center
Dept. of Biology, CB 171
PO Box 173364
Denver, CO 80217
diana.tomback@cudenver.edu

Assoc. Director: Cyndi M. Smith

Box 200
Waterton Lakes National Park,
Alberta T0K 2M0, Canada
cyndi.smith@pc.gc.ca

Secretary: Helen Y. Smith

RMRS Missoula*
Hsmith04@fs.fed.us

Treasurer: Steve Shelly

USDA Forest Service, N. Region
200 E. Broadway
Missoula, MT 59802
sshelly@bigsky.net

Membership & Outreach Coordinator: Bryan L. Donner

Flathead National Forest
1335 Highway 93 West
Whitefish, MT 59937
bdonner@fs.fed.us

Publications editor: Steve Arno

5755 Lupine Lane
Florence, MT 59833
sfarno@msn.com

Other Board Members: Carl Fiedler

School of Forestry & Conservation
University of Montana
Missoula, MT 59812
carl.fiedler@cfc.umt.edu

Robert E. Keane
RMRS Missoula*
rkeane@fs.fed.us

Katherine C. Kendall
U.S. Geological Survey
Glacier National Park
West Glacier, MT 59936
kkendall@usgs.gov

Michael Murray
National Park Service
Crater Lake N.P., OR 97604
Michael.Murray@nps.gov

Dan Reinhart
National Park Service
Yellowstone National Park, WY 82190
Dan_Reinhart@nps.gov

Web Site Manager: Chuck Crouter

chuck@crouter.com
www.whitebarkfound.org

*USDA Forest Service
Rocky Mountain Research Station
PO Box 8089 Missoula, MT 59807



Whitehawk restoration project, Boise N.F. (see article by Liz Davy)

Ron Mastrogiuseppe
Crater Lake Institute
Crater Lake N.P., OR 97604
m13cli@yahoo.com

CONTENTS

Page

Director's Message (D. Tomback) 3

Painting Captures Whitebark Ecosystem (L. Eifert)..... 5

Whitebark Ecosystem Displayed Indoors (J. K. Smith)..... 6

Theatre Brings Whitebark Ecosystem to Park Visitors (J. McKeown) 6

News and Notes..... 7

Whitebark Pine in Western Canada: Workshop (A. Yanchuk et al.)..... 8

Whitebark Pine Restoration in the Intermountain Region (L. Davy) 10

Lonely Whitebarks of Mt. Ashland . . . Nearest Neighbors (M. Murray)..... 10

Mountain Pine Beetle Caused Mortality (K. Gibson et al.) 13

Whitebark Pine Regeneration in Montana and Oregon (E. Larson) 16

Separate "Call for Nomination" Enclosed:

Director's Message



Diana F. Tomback

A long, hot summer

In the midst of another hot, dry summer and merciless fire season in the West, the completion of the Fourth Assessment report by the Intergovernmental Panel on Climate Change (www.ipcc-wg2.org/) precipitated a cascade of media attention to the global warming issue. The following quote from section TS.2 of the IPCC report summary provided some reason for concern: "Observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases (very high confidence). A global assessment of data since 1970 has shown it is likely that anthropogenic warming has had a discernible influence on many physical and biological systems."

How does this relate to whitebark pine? In July, the Natural Resources Defense Council, Bozeman office, headed by Louisa Wilcox, hosted a media workshop, focusing on the effects of climate change on whitebark pine, a major food resource for the grizzly bear; Jesse Logan, Diana Six, Steve Running, and I were invited research participants. In the course of the workshop, we pointed out that global warming is a critical factor in the current outbreaks of mountain pine beetle and will determine the future distribution of whitebark pine. Whereas the impact of climate change on blister rust is yet unknown, some scenarios (depending on rainfall) suggest higher transmission rates. Regardless, whitebark pine mortality from blister rust will confound latitudinal and elevational distributional predictions. This is another imperative to restore whitebark pine, so it can respond at the two "climate change fronts," — the northernmost end of whitebark pine's distribution, where warming should result in distributional shift even farther north, and alpine treeline, where an upward movement of treeline communities is predicted. EcoFlight, a non-profit organization, donated flyovers of Yellowstone National Park to workshop attendees, showing in particular the widespread whitebark pine mortality from mountain pine beetle around Avalanche Peak and adjacent areas on the east side of the park. The workshop resulted in a number of newspaper stories (e.g., *Seattle Post-Intelligencer* and several from *Casper Star-Tribune*),

4 and two recent website stories (PBS and *Time Magazine*).

Climate warming and, consequently, the question of which seed provenances to use for whitebark pine restoration planting were also among the topics of general discussion at the workshop "Whitebark pine in Western Canada," held August 21 to 24 at Whistler, B.C., and sponsored by the British Columbia Ministry of Forests and Range, Forest Genetics Council of British Columbia, and the Centre for Forest Conservation Genetics at the University of British Columbia. This very successful workshop, discussed in detail elsewhere, brought together researchers and managers from B.C., Alberta, and the U.S. to present on-going studies and projects, and provided opportunities for networking. Several workshop presentations and the field trip to Blackcomb Ski Area, where we observed cone collecting and restoration projects, broadened the understanding of the U.S. participants of the challenges facing whitebark's northern distribution. It was clear, overall, that many of the threats to whitebark pine were shared, and we concluded that more cross-boundary cooperation and information exchange would be useful in the near future.

Whitebark pine restoration funding

I mentioned in the spring/summer 2007 issue of *Nutcracker Notes* that Forest Health Protection (FHP), USDA Forest Service, had provided \$267,000 on a competitive basis for whitebark pine restoration projects this past summer. These funds were leveraged by nearly an additional \$300,000 matching funds acquired from numerous sources by the principal investigators. This Request for Proposals (RFP) was coordinated by John Schwandt, FHP, Coeur d'Alene office, who also assembled the Interdisciplinary Whitebark Pine Technical Committee, which was responsible for developing evaluation criteria and reviewing proposals. This fall, about \$200,000 will be contributed by the Washington Office of FHP for a second round of whitebark pine restoration funding, targeted for summer 2008. The RFP was sent out in early November. This year, there is no restriction on which regions may apply for funding.

I am grateful for FHP's support for whitebark pine restoration, and also for the tremendous effort by John Schwandt in administering restoration funding. However, given the rapidly increasing blister rust infection levels nearly rangewide, and growing outbreaks of mountain pine beetles, and the very real need for widespread restoration planting as soon as possible, I urge FHP, both Washington Office and western regional offices, to do everything within their power to increase this funding allocation significantly over the next few years.

2010: Countdown to symposium on high elevation white pines

It has been nearly a decade since the last whitebark pine symposium was held in Missoula (1998), and a great many developments have transpired since, including blister rust assessments, restoration strategies, mountain pine beetle outbreaks and research, climate change models, and a variety of other research findings both in the U.S. and Canada. Concern has also been raised for other high elevation white pines, including limber pine, foxtail pine, both bristlecone pines, and southwestern white pines; all these pines except the intermountain bristlecone pine have been infected by blister rust in part of their range, and there is a growing literature on these pines as well. The WPEF is organizing a symposium on high elevation five-needle pines, emphasizing rangewide participation of managers and researchers, for summer 2010, to be held on the University of Montana campus. This symposium will include several keynote addresses but primarily focuses on contributed oral presentation and poster paper sessions. In addition, there will be field trips to whitebark pine communities and demonstration projects. The next issue of *Nutcracker Notes*, will provide dates for the symposium and additional information.

New whitebark pine exhibit

Congratulations to Jane Kapler Smith and the Montana Natural History Center (MNHC), Missoula. On September 26 MNHC unveiled their new whitebark pine exhibit, which was partially funded by a donation from the WPEF. This exhibit features whitebark pine snags, procured with great effort by many helpers (see *Nutcracker Notes* No.11), and taxidermic mounts of two grizzly bears, a red squirrel, and, of course, a Clark's nutcracker, in a whitebark pine community setting. The ground debris and plant undergrowth in the exhibit are very realistic. Jane worked on this exhibit for several years, and its completion is a tribute to her inspiration and determination, and recognition by the MNHC of the importance of whitebark pine story. I was impressed that the exhibit was placed next to a mountain goat and bighorn sheep—whitebark pine side by side with these other icons of the high Rockies. Hundreds of schoolchildren come through the MNHC each year, and whitebark pine will now be part of their educational experience.

Whitebark as a "foundation species"

In my recent papers and talks, I refer to whitebark pine as a "foundation" species. Of course, whitebark pine has also been termed a "keystone" species beginning with our 1998 symposium and WPEF's 2001 book, *Whitebark Pine Communities: Ecology and Restoration*, (Island Press). I need to credit the article by Aaron M. Ellison et al. (2005), "Loss of foundation species: consequences for the structure and dynamics of forested ecosystems" (*Frontiers in Ecology and the En-*

vironment 3:479-486), which I now frequently cite, for reviving the term “foundation species.” The term originally came from a 1972 book chapter by P.K. Dayton, in which a foundation species is delineated as “a single species that defines much of the structure of a community by creating locally stable conditions for other species, and by modulating and stabilizing fundamental ecosystem processes.” The Ellison et al. paper goes on to use the losses of whitebark pine as one example of how a foundation species may be threatened by a variety of anthropogenic problems (i.e., blister rust and mountain pine beetles), with a resulting loss in ecosystem services and community stability. To clarify, whitebark pine’s role as a “foundation species” includes initiating community development after fire, and other ecosystem services, such as nurse species, pioneering treeline species, and protecting high elevation watersheds.

Housekeeping

I would like to welcome Dr. Michael Murray, ecologist at Crater Lake National Park, as a newly elected member of our Board of Directors, and congratulate Bob Keane for his re-election to the board. Michael replaces Dana Perkins, one of our founding board members. We thank Dana for her years of service; we hope to recruit her now and then for special projects. Many thanks as well to Steve Arno and Bob Keane for doing a tremendous job organizing the WPEF annual meeting in Lincoln, Montana, in late September and to District Ranger Amber Kamps and Helena National Forest for hosting us. The scientific program was of outstanding quality, and we had the best attendance (70 participants) yet recorded at an annual meeting. Furthermore, we had participants come from as far as B.C., Washington state, and Oregon. Lincoln is situated in the midst of a splendid ponderosa pine forest, and the nutcrackers busy working the ponderosa pine cones were a wonderful bonus.

Painting Captures Whitebark Ecosystem

To Larry Eifert, the duty is in the details. High in an imaginary Rocky Mountain cirque, rock headwalls tower above the viewer, a tributary creek falls noisily into the valley below. Whitebark pines, old trees and young, grace this glacial basin, surrounded by the birds and animals that depend on them. Eifert states: “One day while painting this mural, an East Coast client of mine called and asked if I was busy. Not really, I said, I’m painting alone, high in a lovely alpine meadow filled with the most glorious trees. A grizzly is just in front of me, digging up a cone midden.” “How are you getting phone reception she asked, not realizing she was calling my studio—never mind the grizzly.”

Crater Lake Institute has commissioned artist and writer, Larry Eifert to paint a mural of the whitebark

pine ecosystem. The idea is to show how these trees are connected to the wildlife that surrounds them—that depends on them, and how the tree is affected by these same creatures. There is interconnectivity with these trees and the accompanying wildlife that is important, and, with the whitebarks in peril, so too are all the critters that make their homes here. They say that art can save lives. In this case, it might just help save wild lives.

This idea isn’t something new to Eifert. He’s painted many dozens of “ecosystem images” for parks, refuges and places with critical environmental issues throughout the country, some as long as 90 feet, in a career that has spanned four decades. Visit Yosemite NP and you’ll find an Eifert mural showing the nature of Happy Isles. Joshua Tree NP has several of his paintings in visitor centers telling the story of the Mojave and Colorado Deserts. California coast redwood parks have Eifert art in almost every visitor facility from Santa Cruz to the Oregon border and over 300 wayside exhibits there as well. “I grew up in a large natural history museum where both my parents worked. My babysitters were librarians and paleontologists, ornithologists and taxidermists. The joke was that my dad was the fourth fossil in Case 23. I always thought of that place as somewhat sacred. It was my school. I learned to listen carefully” Eifert says, “to scientists and interpreters, who tell me the *good stuff* about each of the places I now paint. I take notes like a scientific Sherlock Holmes, not knowing which little obscure fact might end up on the canvas. And, it all has to somehow work together as a painting and not just become a jumbled-up pile of critters and plants filling the frame in some unorganized mass of facts. I can’t, for instance, put a coyote next to a bobcat, or a monkey flower next to stonecrop, it wouldn’t feel natural, especially to those who know about these things.”

This mural will become many things to many people. Posters are planned to be available for sale in spring 2008. These will find their way to countless walls, telling the whitebark story each day to new viewers. Jigsaw puzzles showing the mural (with an interpretive story and key on the box) will be assembled countless times, teaching whitebark ecology to each new puzzle solver. Postcards from the mural will be sent, with whitebark pines seen by both the sender and recipient. Eifert hopes that within a few years vast numbers of people will gain an appreciation of whitebark pine ecosystems as a result of exposure to his products. For more information on Eifert’s work visit his website at larryeifert.com.

Look for the whitebark products at National Park and National Forest visitor centers.

Whitebark Ecosystem Displayed Indoors

Jane Kapler Smith, Fire Sciences Lab,
Rocky Mountain Research Station,
Missoula, MT

If you had never seen a high-elevation whitebark pine community, if you had never picked up a whitebark cone emptied by nutcrackers, if you had never stepped over (or into) a bear scat full of pine nut shells, how could you appreciate the intricacy of whitebark pine habitat? How could you care about this beautiful, imperiled ecosystem?

We ask a great deal of children and the public when we want them to imagine the wonder of places they've never seen. It is best, of course, to get people up to the high country. But to capture their interest in the first place, you need "stuff"—photos, posters, presentations, educational activities, displays. That's why a partnership between the Montana Natural History Center and the Forest Service recently opened a whitebark pine display at the Natural History Center in Missoula, MT.

In an 8-foot-tall background photo, low-angle evening light glows in the cured grasses and reflects from the wind-polished wood of whitebark pine trunks (see cover photo). The photo sets the stage for "action" on the floor display: A squirrel peers out from a log and seems startled to see a grizzly bear cub peering back in. Another bear rakes through the squirrel's midden looking for a dinner of whitebark cones with their large, rich seeds. A Clark's nutcracker perches on a 15-foot snag, searching for locations to cache its year-round food supply of whitebark seeds.

The display opened officially on Sept. 26th with a presentation by University of Colorado at Denver Professor Diana Tomback, who described the relationship between pine and nutcracker. While most visitors at the presentation were adults, regular visitors at the Natural History Center are mostly children and families. More than 275 children attended week-long outdoor education classes at the Center last summer, and 150 - 200 student visitors are expected this winter, for a total of over 1,000 hours of student contact this year. The Center is open to the public Tuesday through Friday from 10 a.m. to 5 p.m. and 12 - 4 p.m. on Saturdays. The Center's programs and activities are described on their website [www.MontanaNaturalist.org]. The whitebark pine display, located within this hub of nature education, will spark visitors' imaginations to care about an ecosystem they may not have heard of before. Hopefully, the exhibit will inspire many families to visit a whitebark pine habitat and see these wonders in person.

The whitebark pine display was produced through co-

operation among many partners over the past three years. Funding was provided by grants from the Whitebark Pine Ecosystem Foundation and the Forest Service (Rocky Mountain Research Station, Fire Sciences Laboratory, and Forest Health Protection). Animal specimens and whitebark pine midden material were provided by the University of Montana. Wendy Smith of KLB Graphics, Missoula, completed the design and art work. Natural History Center Executive Director Arnie Olsen, Program Coordinator Jessie Sherburne, and volunteer Lane Reul collected materials from high-country sites and constructed the floor display. The whitebark snag was collected and transported by Able Tree Service, Missoula, and the hollow log was carried a long distance uphill by staff from the Fire Sciences Laboratory. For copies of material used in the display, contact jsmith09@fs.fed.us.

Theatre Brings Whitebark Ecosystem to Park Visitors

Justin McKeown, Park Interpreter,
Waterton Lakes National Park

Whitebark pine trees are in trouble in Waterton Lakes National Park, and park interpreters are letting visitors know about it. Through evening theatre and street theatre programs, park interpreters are raising the profile of whitebark woes in southern Alberta.

In 2005, park interpreter Carrie Dolan developed and delivered an interpretive theatre program called "ESI: Ecosystem Investigator." This was, of course, a spoof on the wildly popular TV program "CSI." In the program Agent Brasso (Carrie) re-creates the crime scene of a dead whitebark pine tree. Determined to get to the bottom of the case, Agent Brasso collects a number of clues with the help of audience members and interrogates suspects "Fire" and "Mountain Pine Beetle" but finds nothing. As the story continues, the fingers are finally pointed at an international criminal mastermind "White Pine Blister Rust." In the summer of 2005 and again in 2006, about 1,000 people attended the ESI program.

Additionally in 2007, park interpreters Justin McKeown and Leanna Braid developed and delivered "An Alpine Love Story: A Tree and its Bird" to visitors in Waterton. The program was developed as a piece of street theatre that was shown three times a day, twice a week, beside the Natural History Museum in the park's townsite. The 11-minute story showcased the "love" relationship between "Whitebark Pine" (Leanna) and "Clark's Nutcracker" (Justin). The evil villain, the introduced "White Pine Blister Rust", spreads airborne spores by sneezing on the tree, brings a squirrel from the woods to gnaw away at the bark, and recruits a young "Mountain Pine Beetle" from the audience to bore a hole and lay its eggs in the tree (see back cover). Even though "Whitebark Pine" dies, "Clark's

Nutcracker” reminds her that their love will live on through the forgotten caches throughout the forest that become new seedlings.

Both programs were designed to educate and entertain visitors about the serious threats facing whitebark pine in Waterton.

For more information contact Dee Jessome at Parks Canada at <Dee.Jessome@pc.gc.ca>.

News & Notes

WPEF Election News

The WPEF held its first elections in the spring/summer of 2007. Our Director, Diana Tomback and our Secretary, Helen Smith, were re-elected by acclamation. There was a very close three-way race for two positions on the Board of Directors. Robert (Bob) Keane and Michael Murray were elected. We thank all of the candidates for running and welcome Michael Murray (see below) as a new board member. We are now seeking nominations for two Board Members, Associate Director and Treasurer, to stand for election in 2008 (see “call for nominations.” Please become involved in your organization!

Michael Murray: Michael is working in his 6th year as Crater Lake National Park’s Terrestrial Ecologist where he gets to be both a manager and a scientist, responsible for wildlife, vegetation and fire. For example, he recently established whitebark pine guidelines in the park’s General Management Plan. He began researching fire and landscape ecology related to whitebark pine ecosystems in 1992, which led to a Ph.D. from the University of Idaho. Since then he has published a variety of works on whitebark including the “Landscape Ecology and Isolation” chapter of WPEF’s book *Whitebark Pine Communities*. Michael has also mapped an extensive bark beetle epidemic in Alaska, served as an environmental educator for 5th-6th graders, and taught college courses. In 1997, he co-founded the non-profit Wildlands Management Institute, which focuses on wildlands science/restoration. Prior to his work with the National Park Service, Michael worked for three years as Plant Ecologist for The Nature Conservancy of Oregon.

WPEF Membership Grows

A growing membership base is critical to the mission of WPEF—education, research, and restoration related to whitebark pine ecosystems. Our membership has continually increased at an annual rate of about 15 percent since WPEF was established in 2001. Equally

encouraging is our high rate of retaining members, as about 90 percent renew from one year to the next.

As of November 1, 2007, the WPEF has an all-time high of 152 members. A significant membership base attests to the credibility of our organization when we apply for grants to further our mission. Please consider recruiting a friend or colleague today.

Foundation board members unanimously approved a dues increase this past year to cover increased operating expenses and to better support restoration initiatives. Members at the Whitebark Level are now assessed a \$35 annual dues, up from \$25. Student Members are assessed a \$25 annual dues, up from \$15. Members who recently renewed in the above categories at last year’s rate, as a result of insufficient reminders about the dues increase, are asked to please send in the remaining \$10. All other membership categories remain at the same dues schedule as in previous years.

The foundation’s web site [www.whitebarkfound.org] lists the different membership levels and provides forms for initial membership and renewal. Questions, comments, or suggestions about membership in WPEF can be directed to Membership and Outreach Coordinator, Bryan Donner, at (406) 863-5408 or reindeer@centurytel.net Please put “WPEF” or “Whitebark” in the subject line of your e-mail.

Whitebark T-Shirts Available

One of many attractions at WPEF’s annual meeting in Lincoln, MT, two months ago was the newly designed T-shirts with attractive “whitebark pine ecosystem” logos (see inside back cover of this issue). The shirts are preshrunk 100 percent cotton and are available in small, medium, large and extra large sizes. Both short and long-sleeve shirts are available in white, sage, and ash colors. Shirts can be ordered by sending a check and order information to WPEF, PO Box 16775, Missoula, MT 59808. Short sleeve shirts are \$17 postpaid and long sleeves are \$22.

Whitebark Gains Media Attention

Liz Davy has assembled 10 news and commentary feature articles relating to whitebark pine habitat that stemmed from the media workshop hosted by the Bozeman office of the Natural Resources Defence Council in July (see Director’s Message, paragraph 2 for details). People who would like to receive electronic copies of these articles can request them from Liz [ledavy@fs.fed.us].

1962 Survey Reports Rust Damage in Limber Pine

Cyndi Smith recently discovered an old publication by the Canada's Department of Forestry, Forest Entomology and Pathology Branch (Bi-monthly progress report 19 (4), July-Aug. 1963) that presents quantitative results of a 1962 survey of blister rust in limber pine stands in Alberta. The report states that rust was detected in 1952 on limber pine in the Alberta foothills west of Pincher Creek. An extensive survey made in 1962 found infection rates up to 97 percent in some stands and mortality as high as 39 percent. People wishing to receive an electronic copy of the report can request it from Cyndi [Cyndi.Smith@pc.gc.ca].

Pacific Coast Conference Papers On-line

The individual papers from the Pacific Coast Whitebark Pine Conference, held in August 2006 at Ashland, Oregon, are now available on the internet: [www.fs.fed.us/r6/nr/fid/wbpine/proc.shtml]

Bristlecone Book Published

The Bristlecone Book: A natural history of the world's oldest trees, written by WPEF member Ron Lanner, was recently published by Mountain Press of Missoula, MT. This attractive book is written for general audiences and is illustrated by 27 outstanding color photographs. "Lanner exposes the trees' inner workings, taking apart a pine to examine bark, buds, needles, cones, roots, and wood. He follows a tree's lifespan from seedling to great old age, presenting a new interpretation of stages of growth." The book retails for \$12. A more-detailed description and order information is found at [www.mountain-press.com].

WPEF Plans Meeting at Grand Targhee in September 2008

Dan Reinhart is in the process of planning WPEF's annual conference likely to be held at Grand Targhee ski resort in the Teton Range east of Driggs, ID. Information gathered so far indicates a range of not-too-expensive accommodations are available at and near the resort, which provides easy access to interesting whitebark pine habitat. Dates being considered are in early or mid-September. Detailed information on the conference will be featured in the next *Nutcracker Notes* (Spring/Summer 2008) scheduled for delivery in May 2008. E-mail notices and a call-for-papers will be issued earlier in 2008. People with further questions about the planned conference can contact Dan [Dan_Reinhart@nps.gov].

Whitebark Pine in Western Canada: A workshop on current research and management issues – Whistler, B.C., August 22-24, 2007

A. Yanchuk, D. Douglas, and E. Campbell (FGC), Dave Kolotelo (BCFS), and S. Aitken (UBC)

A three-day workshop was held in Whistler, British Columbia this summer, sponsored by the Forest Genetics Council (FGC) of B.C., the B.C. Forest Service (BCFS) and the University of British Columbia (UBC), to discuss research efforts in whitebark pine genetics and ecology and developments in restoration activities. Interest in the future of whitebark pine in B.C. is increasing, largely brought on by the mountain pine beetle outbreak and the looming possibility of climate change in high elevation ecosystems.

While the workshop attempted to focus on activities in B.C., it was important to hear the latest developments and experience from the United States, as much more work has been underway there. It was helpful that Diana Tomback from the University of Colorado attended. She gave us an excellent overview and update in her keynote address entitled "Whitebark pine: uncertain future for the high elevation keystone species." That set the stage for a wonderful event, with talks ranging from the status of seed collections, recent findings on blister rust and mountain pine beetle mortality to the latest information on whitebark pine population genetics. Other whitebark pine researchers from the U.S., including Bob Keane, Michael Murray and John Schwandt, also provided updates on research activities and practical experiences in planting field trials. These presentations were important to the success of the meeting in our view, and we thank these participants for travelling so far!

The workshop speakers, titles and some of the Power-Point presentations have recently been posted on the UBC web site: <http://www.genetics.forestry.ubc.ca/cfcg/pa-workshop.html>

We wrapped up the Thursday afternoon presentation session with a break-out session, which provided an opportunity for participants to discuss four key research and conservation questions:

1. What is the role of seed collections and out-plantings? A) Since seed collections are difficult we should take all opportunities we can and collect as much seed as possible. B) If possible collect from trees not infected by blister rust in high blister rust attacked stands, even though we are not sure how resistant these trees may actually be. C) More information/research on seed pre-treatment, seedling production (cost-effectiveness/production expertise), out-planting protocols (e.g., micro-site selection), site preparation, seed and seedling predation and protection required. D) Additional work and strategies are needed around priority areas for seed collections, seed stratification procedures, seed longevity in storage, provenance testing approaches, blister rust screening, climate change modelling for strategic restoration activities, and the future out-plantings with respect to the slow growth of the whitebark pine and the continued threats from blister rust.

2. How can we maintain communications among whitebark pine researchers and managers? A) The WPEF is already doing a great job; more membership in the Foundation would assist (several B.C. groups have joined). B) Additional web utilization would be very helpful, e.g., a 'blog' site, posting presentations from this meeting, and considering other ways of sharing data. C) More brochures, posters and other extension mechanisms should be undertaken to increase awareness of the threatened whitebark pine ecosystems in North America. D) Canadian whitebark pine research and conservation work should be presented at the 2010 High-Elevation White Pine Symposium, and also at regional forums and local forest health meetings, wherever possible. E) Since limber pine is also threatened, it should be included in whitebark pine discussions. F) Communication with industry to stop (reduce) by-catch logging of whitebark pine.

3. How do we incorporate gene conservation into restoration activities? Two fundamental approaches were discussed. A) Since seed collections are the only practical short-term *ex situ* approach, seed collection criteria and protocols should be developed, including: a plan for geographic areas to be covered, seed banks to be maintained by the B.C. Tree Seed Centre, voluntary contributions to a seed bank solicited and a central seed registry maintained. B) *In situ* approaches should include: i) continuing to catalogue range, populations, and reserves and ii) develop specific 'criteria and indicators' of status (including decline rates),

4. What are the restoration activities that could work and how to prioritize where they should be targeted? A) We already have in our 'toolbox' some experience for starting restoration, including: i) planting (seed, seedlings, resistant seedlings), ii) burning (prescribed and wildfire management), iii) stand management options, e.g., thinning, fuel augmentation, pruning, iv) protection (beetle: verbenone, baiting, cut and peel), fire suppression or protection to save individual trees, and v) attempting to monitor success. B) We should develop a range-wide strategy for restoration (i.e., an AB, BC, US collaborative plan). C) We should coordinate planning activities with an array of tools applied at different scales (tree, stand, watershed, landscape, region, range), with a central database of GIS layers that we could share for developing and implementing a range-wide strategy. D) In the meantime, we should make use of documents like 'Whitebark pine in peril: A case for restoration' (Schwandt, J. 2006., USDA, Forest Service, Northern Region, R1-06-28) and 'Whitebark pine communities: ecology and restoration' (Tomback, D.F., Arno, S.F., and R.E. Keane (eds.) 2001. Island Press, Washington). E) Since our inventory of whitebark pine is not good, we need to take steps to improve this. F) We should prioritize restoration activities where whitebark pine is most imperilled (e.g., blister rust monitoring) and monitor for climate change impacts, particularly where models suggest they will be the greatest.

The last day was a field trip up Blackcomb Mountain, with several stops to see cone collection sites and techniques (Don Pigott), outplantings (Bob Brett) and blister rust survey plots (Stefan Zeglen). Bob Brett (SnowLine Research) was the field tour host, the weather was spectacular, and the discussions and the views made it a wonderful day in whitebark pine country. The amount of technical information exchanged, along with ideas and the outcomes of the break-out groups, was nothing short of fantastic. The meeting went a long way to rejuvenate interest in whitebark pine restoration strategies in B.C., and set substantial ground-work for cooperative efforts on a Canada and U.S. range-wide conservation strategy for whitebark pine.

Whitebark Pine Restoration in the Intermountain Region

Liz Davy, Forest Silviculturist,
Bridger-Teton National Forest

The forests in the Intermountain Region of the Forest Service (Nevada, Utah, western Wyoming and Southern Idaho) have been busy over the last several years restoring whitebark pine. Forests where whitebark pine exists and where restoration efforts are going on are Humboldt-Toiyabe, Caribou-Targhee, Bridger-Teton, Boise, Payette, Salmon-Challis, and Sawtooth.

These forests are active in the whitebark pine Plus Tree Program. Plus trees have been selected on all the forests and cones are being collected as opportunities arise to screen trees for blister rust resistance. At least 190 trees have been identified as potential rust resistant candidates. These will continue to be protected from mountain pine beetle attack either with spraying of an insecticide or with pheromone pouches that repel beetles. These treatments will continue until the beetle epidemic has subsided.

Several of the Forests have recently carried out restoration treatments in some of their whitebark pine stands. The Salmon-Challis did a whitebark pine release project to restore whitebark pine's competitive edge in stands crowded with other species. This occurred on 132 acres on Big Hill near Challis, ID, in Mill Creek watershed. This project involved removing competing vegetation adjacent to both the understory and overstory whitebark pine.

The Boise National Forest has been very active in restoring whitebark pine, with two projects completed on Scott Mountain and the Whitehawk area (see photo inside front cover). In 2006, two-year-old containerized whitebark pine seedlings were planted in the Whitehawk project area. This was the final step in a four phase restoration project which included removing competing conifers, treatment of slash created during the project, protecting cone producing whitebark pine from mountain pine beetle attacks and planting seedlings. Planting spots and spacing were selected in three different planting regimes. In the footprints of burned hand piles, three to five seedlings were planted about two feet apart. Within patches of girdled conifers,

seedlings were planted on a 10 x10-foot grid, varying spacing to select for planting micro-sites. The third regime was to plant clusters of three to five trees on the leeward sides of dead atolls (isolated tree clusters). This was micro-site planting at a larger resolution to give the seedlings protection from the wind. Survival of seedlings one year following planting ranged from 27 to 59 percent.

Scott Mountain is a 770 acre treatment area where a variety of whitebark pine restoration treatments were applied. On 50 acres all competing conifers were cut or girdled to allow whitebark pine to release. In order to release whitebark pine in the overstory and natural regeneration in the understory, competing conifers were cut or girdled within 25 feet of whitebark pine over 334 acres. This same release treatment was done on 180 acres to release cone-producing whitebark pines. These areas will be burned to encourage nutcracker caching to achieve natural regeneration of whitebark pine. Any areas where whitebark pine seedlings are not growing will be planted in the future.

All the whitebark pine forests in the Intermountain Region have plans for future projects. The Payette will restore whitebark pine at the Brundage Ski Area by removing conifers that are competing with healthy understory whitebark pine. The Sawtooth has some prescribed burns planned to reduce competition from subalpine fir. The Bridger-Teton will be doing several timber sales to remove competing conifers from healthy whitebark pine in the overstory as well as the understory.

Lonely Whitebarks of Mt. Ashland: A Survey of Nearest Neighbors

Michael Murray, Crater Lake National Park, OR

The Klamath-Siskiyou region (K-S) is a complex milieu of geology, topography, and weather patterns all leading to one of the richest botanical areas in the world's temperate zone. More than 30 conifers populate this place, more than any other small region in North America. Straddling northwestern California and southwestern Oregon, this mountain region is known to support small isolated populations of whitebark pine in the Trinity Alps, Russian Peaks, and Marble Mountains of California, plus Mt. Ashland in Oregon. Until this survey, there was little knowledge of whitebark pine's distribu-

tion north of the state line.

Whitebark pine was only described as occurring in Oregon's K-S a few years ago (Lang 2003)--on Mt. Ashland, one of the state's most heavily visited peaks. This recent discovery occurred after initial plans were already drafted to expand the Mt. Ashland Ski Area through the site occupied by these trees. The plan was eventually altered.

The overall goal of our survey conducted in 2005 was to identify populations of whitebark pine occurring at any other sites in the K-S Ecoregion of Oregon. Methods relied on GIS assessment of topography, aerial photo interpretation, and field survey.

Since western white pine (*Pinus monticola*) often appears very similar to whitebark pine in the area, care was taken to distinguish the two species. If no cones were found, foliage was tested by rubbing the needle tips between fingers. A slight roughness can be felt on needle ends of *P. monticola* but not whitebark pine. At least one bundle of five needles was collected and labelled from each tree examined. Field notes and GPS locations were recorded for trees and clusters of trees. The digital elevation model indicated whitebark pine habitat primarily along the Siskiyou Crest southwest of Ashland. All habitat was field-surveyed at least once, and mostly twice.

Based on my findings, Mt. Ashland appears to be the sole occupied habitat of whitebark pine in Oregon's K-S region. Despite other locations supporting similar habitat to Mount Ashland (vegetation, openness, and parent material), only western white pine was found elsewhere. Whitebark pine on Mount Ashland occur as low as 7,160 feet. This elevation is present on most of the other peaks surveyed. Given the similarities in habitat, the disparity of presence/absence between Mount Ashland and other summits is perplexing.

One or more natural processes may have played a role affecting the current distribution of whitebark pine in the K-S. The non-native blister rust disease is present on several whitebark pine trees on Mount Ashland, however, no whitebark pine snags were found in the survey. These snags can stand 60 or more years before falling. It's more likely that blister rust limits establishment of young whitebark pine in the study area,

rather than rendering a 'ghost of the past.' The disease was introduced into the region around 1930 (USDA 1949).

On most summits surveyed, a significant cover of chaparral exists. This vegetation type indicates an historic occurrence of somewhat intense and frequent fire which probably limited tree cover. The scarcity of older trees of any species in chaparral habitats of K-S summits reinforces this idea.

Besides chaparral, there are subalpine rock outcrops and bunchgrass habitats that probably do not experience high-intensity fires. Why no whitebark pine, living or dead, exist at these sites is a mystery. It should be noted that mature western white pine are restricted to upper slopes at these habitats, while only immature specimens are living on summits and ridgetops.

The apparent absence of whitebark pine from all other Oregon K-S summits amplifies the ecological importance of Mt. Ashland's population. This population consists of less than a dozen trees, most of which are immature (non-cone producing). One-third have blister rust.

Although the past history of whitebark pine is unclear, the species' future in the region is linked to the viability of Mt. Ashland as a seed source. The primary dispersal mechanism for regeneration is Clark's nutcracker--known to cache whitebark pine seeds in the ground up to 6.2 miles from the source (Tomback 1978) and other pines up to 13.6 miles (Vander Wall and Balda 1977). Because Mt. Ashland is well beyond this distance from its nearest known neighbors (Table 1), it can be considered an isolated population. Without importation of seeds, it must be self-replenishing in order to survive. Moreover, without influx of pollen, inbreeding becomes a concern. However, because genetic deterioration is a gradual long-term process, the most immediate threats to Mt. Ashland's whitebark pine are from direct disturbance. A small population of pines is highly prone to extinction simply because low numbers are more quickly eradicated by any given impact (Morgan and Murray 2001). Blister rust, fire, beetle, and direct human impact are all concerns here.

12 Table 1. Distances from Mt. Ashland to nearest known populations of whitebark pine.

Name	Location	Distance (miles)
Brown Mountain	1.8 miles south of Hwy 140 near Fish Lake, OR	29.8
Willow Creek Mtn	12.3 miles west of Macdoel, CA	30.6
Mount McLoughlin	3.3 miles north of Hwy 140 near Fish Lake, OR	31.7
Gooseneast	13.5 miles southwest of Macdoel, CA	35.5
Box Camp Mtn.	Marble Mtns. 4.6 miles west of Scott River, CA	40.8

What will the future hold for Mt. Ashland's whitebark pines? The population on Mt. Ashland may only survive with careful protection. The privately managed Mt. Ashland Ski Area revised its expansion plans to avoid all the pines. The manager is currently seeking input on how to protect and enhance the population. The U.S. Forest Service has collected seed for genetic tests and blister rust screening. There is a gap in survey coverage between Mt. Ashland and the Klamath River in California. A search for undocumented populations of whitebark pine in this area is needed.

The Mt. Ashland scenario may illustrate an emerging predicament for whitebark pine rangewide. Small isolated populations with a high vulnerability to extinction may be undetected – even at heavily used sites. With blister rust mortality compounded by the current severe bark beetle epidemic, it seems likely that many populations will be significantly reduced or eliminated, perhaps without our knowledge.

A complete survey report with maps can be downloaded from the WPEF's web site at: www.whitebarkfound.org/publications.html. Thanks to the Native Plant Society of Oregon (www.npsoregon.org) for funding this survey.

Lang F. 2003. Whitebark pine discovered on Mount Ashland. Nutcracker Notes (newsletter of the Whitebark Pine Ecosystem Foundation). Fall/Winter:11.

Morgan, P.; Murray, M.P. 2001. Landscape ecology and isolation: implications for conservation of whitebark pine. In: Tomback, D.F.; Arno, S.F.; Keane, R.E, (eds.)

Whitebark pine communities: ecology and restoration. Island Press, Washington, D.C. 289-309.

Tomback, D.F. 1978. Foraging strategies of Clark's nutcracker. Living Bird 16:123-161.

USDA. 1949. *P. monticola* blister rust control in the northwestern region: January 1 to December 31, 1949. USDA Agricultural Research Administration, Bureau of Entomology and Plant Quarantine, Division of Plant Disease Control, Government Printing Office, Washington, D.C. 109 p.

Vander Wall, S.B., and R.B. Balda. 1977. Coadaptations of Clark's nutcracker and the piñon pine for efficient seed harvest and dispersal. Ecological Monographs 47:89-111.

Table 1. Number of WBP killed (and acres affected) by MPB in various reporting areas, Northern Region. **Note:** Not all of each area was flown in all years, so numbers are not comparable across time. Blanks indicate either no WBP died or no WBP habitats were flown. (*IR=Indian Reservation, NF=National Forest, NP=National Park; **includes Garnet Range). Average number trees recorded per acre was 2.2; but ranged from 0.21-12.5. →

Mountain Pine Beetle-Caused Mortality in Whitebark Pine, 2001-2007

Ken Gibson, Brytten Steed, and Nancy Sturdevant
USDA Forest Service, Forest Health Protection
Missoula Field Office

Mountain pine beetle, *Dendroctonus ponderosae* Hopkins, (MPB) outbreaks are at unprecedented levels throughout western North America. About 20 million acres are infested in British Columbia alone. Nearly one million acres of host stands, mostly lodgepole pine, are infested in northern Idaho and western Montana at present. Almost 150,000 of those infested acres, in the U.S. Forest Service's Northern Region (northern Idaho and Montana), are in whitebark pine (WBP) stands.

In 2005, we observed the highest single year of MPB-caused WBP mortality for which we have records. Data for 2006 were not obtained in all affected areas, but total infested acreage may have exceeded that recorded in 2005 (Gannon and others 2007). Table 1 and Figures 1 and 2 show, with a slight decrease in 2006 due to incomplete data, infested acres have in-

creased significantly each year since 2001—the approximate beginning of current MPB outbreaks in the Region. Whereas just over 12,000 acres were infested in 2001; infested area increased to more than 142,000 acres in 2005 and almost 119,000 acres in 2006. During that time, an estimated 1.2 million WBP have been killed. MPB outbreaks continued at extreme levels in southwestern and central Montana—especially on the Beaverhead, Gallatin, Lewis & Clark, and Helena National Forests (NF). Yellowstone National Park (NP) was not flown in 2006, but we know many of the WBP stands there still harbored damaging outbreaks. Aerial detection survey (ADS) data for 2007 have not yet been analyzed, but ground observations confirm infestations are continuing at extreme levels, particularly in western and central Montana.

While we have no data for total number of WBP-dominated acres in the Region; in 2006, nearly 119,000 acres were infested to some extent, by MPB. In a 2006 report, Gibson (2006) reported in the Greater Yellowstone Ecosystem—comprised of Yellowstone NP and immediately adjacent national forests—about 16% of the nearly 1.1 million acres of WBP type in that area, contained some level of MPB-caused mortality.

TABLE 1 (caption is at lower left)

Area (ownership)*	2001	2002	2003	2004	2005	2006
Blackfoot IR				9 (4)		
Bitterroot NF	2 (2)	38 (6)	54 (78)	61 (68)	8,901 (7,199)	4,077 (3,005)
Beaverhead NF		89,860 (30,263)	138,413 (38,891)	135,179 (29,978)	136,636 (42,441)	120,761 (60,045)
Coeur d'Alene NF	8 (6)	1 (2)		110 (13)	6 (2)	
Clearwater NF	3 (3)		11 (2)	1 (2)		
Custer NF			653 (533)	2,281 (1762)	1,341 (1,087)	1,547 (179)
Clearwater IR		6 (21)		26 (11)		
Deerlodge NF	1 (2)	267 (420)	2,156 (424)	2,092 (1,321)	2,750 (2,075)	4,893 (2,485)
Flathead IR		10 (6)		938 (222)	229 (1,295)	20 (19)
Flathead NF	923 (780)	566 (468)	1,315 (1,810)	6,562 (2,416)	904 (612)	1,808 (632)
Gallatin NF			3,938 (9,014)	43,982 (47,844)	37,521 (20,316)	13,521 (31,230)
Glacier NP				40 (79)		
Helena NF		51 (14)	551 (345)	17,099 (7,821)	19,078 (8,607)	21,948 (7,054)
Kaniksu NF	30,511 (10,258)	40,798 (12,786)	38,732 (12,735)	32,722 (8,132)	19,509 (8,345)	77 (24)
Kootenai NF	3 (4)	1 (2)		5,368 (1,524)	16,480 (7,114)	3 (2)
Lewis-Clark NF	40 (39)		3,152 (4,698)	2,396 (8,431)	10,043 (6,541)	14,541 (12,777)
Lolo NF	234 (201)	509 (763)	4,870 (2,814) **	77 (289)**	10,762 (7,785)	1,599 (728)**
Nez Perce NF	442 (826)	223 (273)	448 (437)	21 (17)	19 (20)	
Saint Joe NF				20 (6)	5 (6)	
Yellowstone NP		11,529 (11,814)	27,871 (15,086)		365,168 (29,215)	829 (286)
TOTAL	32,167 (12,122)	143,859 (56,838)	222,164 (86,866)	248,984 (109,942)	629,352 (142,659)	186,514 (118,648)

14 We suspect that level of infestation is currently at least as high.

Unpublished office reports indicate equally devastating outbreaks existed in the 1930s, when warm weather rivaled that experienced in the past decade, in the vicinity of Yellowstone NP; but available information does not record extent. Furniss and Renkin (2003) quoted a 1934 report for Yellowstone NP: “The mountain pine beetle epidemic is threatening all of the white bark and lodgepole pine stands in Yellowstone Park. Practically every stand of white bark pine is heavily infested...and will be swept clean in a few years. If the insects spread from the white bark pine to the lodgepole stands, it seems inevitable that much of the park will be denuded.” So, while present outbreaks are unusual, they are not unprecedented.

Recent observations suggest atypically warm temperatures have increased MPB-caused impacts by enhancing beetle survival and reproductive success (Nijhuis 2004). At present, we find a combination of favorable climatic conditions, thousands of acres of susceptible host type, and abnormally high MPB populations. As a result, WBP stands throughout the intermountain West are experiencing higher-than-normal levels of MPB activity and extreme amounts of MPB-caused mortality.

ADS data for the Region indicate MPB-caused mortality has been recorded in most areas only during the past 4-5 years (excluding the “outbreak” years of the late 1970s and early 1980s). For the decade prior to 2000, only minor amounts of beetle-caused mortality were recorded in most areas surveyed.

Ground-collected data from beetle-infested stands, obtained to supplement ADS data, have been collected from plots in Yellowstone NP and adjacent forests during the past few years. Most show extreme levels of mortality—in many cases exceeding 90% of the WBP over 5 inches diameter (breast height). In twenty plots near Avalanche Peak (Yellowstone NP), MPB killed an average 96 trees per acre from 2001 to 2004, approximately 80% of the stand’s WBP, over 5 inches diameter. Near Lightning Lake (Gallatin NF), ten-plot average mortality, for those same years, totaled 162 WBP per acre—74% of WBP over 5 inches. More recent data, collected in 2005 and 2006, showed 92 and 96% of the WBP killed in selected stands in YNP; and 67% and 37% MPB-caused mortality in a few stands near Edith Peak on the Helena NF.

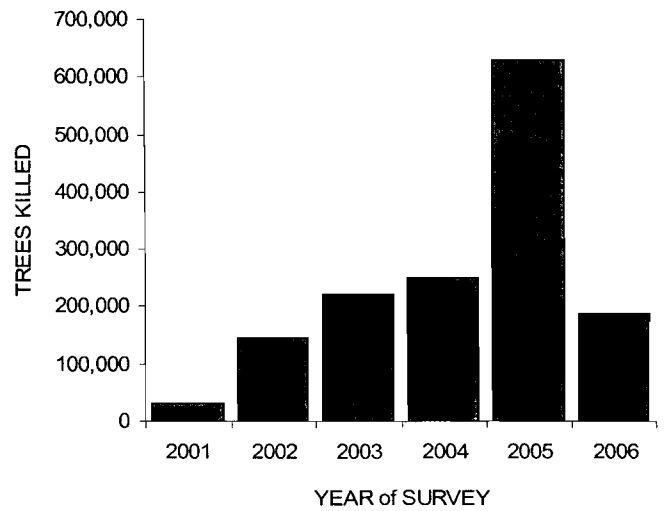


Figure 1. Total number WBP killed by MPB from 2001-2006. Actual differences between years are affected by total number of acres surveyed in a particular year.

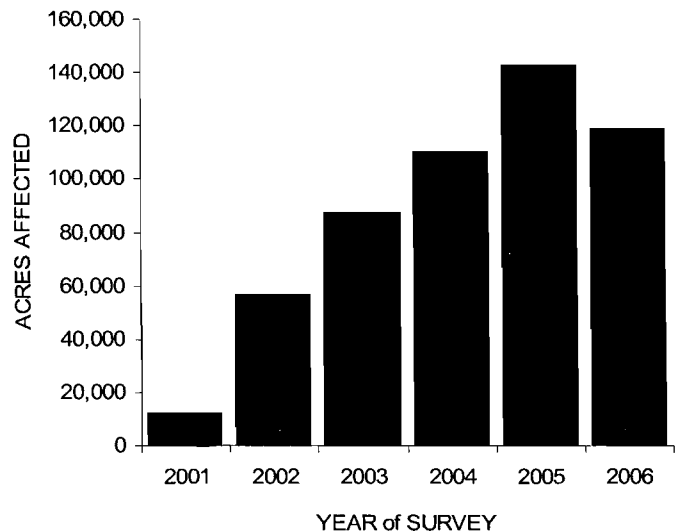


Figure 2. Total acres WBP affected by MPB from 2001-2006. Differences between years are affected by total number of acres surveyed in a particular year.

Sturdevant and Kegley (2006) recorded similar observations on the Helena NF, where data collected in 2005 showed 44% MPB-caused mortality in one area and 72% in another. In some of the more heavily impacted areas, host depletion is already resulting in declining levels of beetle-caused mortality.

WBP is one of the hardiest of the pine species and disturbance is an integral part of their ecosystems. Today, however, fire suppression and non-native pests are exposing WBP to threats never before encountered. Long-term survivability is especially threatened by an introduced fungal disease, white pine blister rust (*Cronartium ribicola* Fisch).

MPB, a native pest, presents an even more serious short-term threat to WBP. Occasional outbreaks can kill thousands of mature trees within a few years. Warmer- and drier-than-normal conditions often make outbreaks even more devastating. In unmanaged WBP stands, epidemics last until suitable hosts no longer remain or environmental conditions become less favorable to MPB.

We can silviculturally reduce beetle-caused mortality in some host stands (McGregor and others 1987). How effective those strategies, and others to include prescribed fire, may be in WBP is not fully known (Tomback and others 2001). In addition, we have learned to use beetle-produced pheromones to our advantage. Attractants have been used to manipulate beetle populations (Borden and others 1983); and verbenone, an anti-aggregation pheromone, has been used to protect high-value trees (Bentz and others 2005). Protective treatments with insecticides have also prevented beetle-caused mortality.

WBP breeding programs are attempting to develop planting stock more resistant to white pine blister rust. These and other restoration programs will depend upon survival of cone-bearing and rust-resistant trees, the success of which will require their protection from MPB. Only the combined efforts of forest managers and other specialists will preserve and restore WBP throughout its historic range.

References

- Bentz, B.J.; Kegley, S.; Gibson, K.; Thier, R. 2005. A test of high-dose verbenone for stand-level protection of lodgepole and whitebark pine from mountain pine beetle (Coleoptera: Curculionidae: Scolytinae) attacks. *J. Economic Entomology* 98: 1614-1621.
- Borden, J.H.; Conn, J.E.; Friskie, L.M.; Scott, B.E.; Chong, L.J.; Pierce, H.D. Jr.; and Oehlschlager, A.C. 1983. Semiochemicals for the mountain pine beetle, *Dendroctonus ponderosae* (Coleoptera:Scolytidae), in British Columbia: baited tree studies. *Canadian Journal of Forest Research* 13:325-333.
- Gannon, A.; Sontag, S.; Skov, K. (compilers). 2007. Montana forest insect and disease conditions and program highlights. Missoula, MT: USDA Forest Service, State and Private Forestry; Montana Department of Natural Resources and Conservation. Numbered Report 07-1.
- Gibson, K.E. 2006. Mountain pine beetle conditions in the Greater Yellowstone Ecosystem, 2006. Missoula, MT: USDA Forest Service, State and Private Forestry; Forest Health Protection. Numbered Report 06-03. 7 p.
- Furniss, M.M; Renkin, R. 2003. Forest entomology in Yellowstone National Park, 1923-1957: A time of discovery and learning to let live. *American Entomologist* 49:4:198-209.
- McGregor, M.D.; Amman, G.D.; Schmitz, R.F.; Oakes, R.D. 1987. Partial cutting lodgepole pine stands to reduce losses to the mountain pine beetle. *Canadian Journal Forest Research* 17:1234-1239.
- Nijhuis, M. 2004. Global warming's unlikely harbingers: The west is heating up—and bark beetles are moving in for the kill. Bozeman, MT: High Country News. Feature article, July 19, 2004.
- Sturdevant, N.; Kegley, S. 2006. Mapping mountain pine beetle and white pine blister rust in whitebark pine on the Helena National Forest. Missoula, MT: USDA Forest Service, State and Private Forestry, Forest Health Protection. Numbered Report 06-05. 6 p.
- Tomback, D.F.; Arno, S. F.; Keane, R.E. (Editors). 2001. Whitebark pine communities, ecology and restoration. Washington, D.C.: Island Press. 440 p.

Whitebark Pine Regeneration in southwestern Montana and eastern Oregon

Evan R. Larson, Minnesota Dendroecology Laboratory
Department of Geography, University of Minnesota

While field work in whitebark pine ecosystems offers much to enjoy, the wonder of these places is increasingly tempered by the presence of cankers on trees infected by blister rust or a sea of orange needles signifying a dying forest infested with mountain pine beetles. Today, I am writing from observations made over the past two field seasons of my dissertation research and why these summers have given me a reason for hope.

My dissertation research is focused on reconstructing the disturbance history and successional pathways of whitebark pine forests at sites across the central latitudinal distribution of the species. I collected data from sites in the Gravelly Range and Pioneer Mountains of the Beaverhead-Deerlodge National Forest in southwest Montana and the Eagle Cap Wilderness in the Wallowa-Whitman National Forest of eastern Oregon. To cope with the broad environmental tolerance and distribution of whitebark pine I stratified my sampling by targeting whitebark pine forests at the highest elevations of these mountain ranges.

My research placed plots in 35 whitebark pine stands among these three mountain ranges. Stand structure was generally open, with mean total basal areas of 31 m²/ha in the Eagle Cap Wilderness, 34 m²/ha in the Gravelly Range, and 39 m²/ha in the Pioneer Mountains. Forest composition varied slightly among the stands in each range, and substantially between the ranges (Fig. 1). A few scattered trees displayed fire scars as evidence of past wildfires. Ghost trees were ubiquitous and provided stark reminders of previous mountain pine beetle activity. Blister rust was present in all three ranges, with evidence of current or past infections on 32% of the whitebark pine inventoried in the Eagle Cap Wilderness, 30% of the whitebark pine inventoried in the Gravelly Range, and 49% of the whitebark pine inventoried in the Pioneers. These infection rates may be somewhat misleading, however, as many infected trees still maintained full canopies and were in relatively good health (Fig. 2).

I found both new and advanced whitebark pine regeneration at all of the sites in the Pioneers, all but one site in the Eagle Cap Wilderness, and all but one site in

the Gravelly Range. An active mountain pine beetle outbreak in the Gravelly Range was causing extensive mortality among the whitebark pine in that range; however, even under the red canopies of dying trees whitebark pine regeneration was common. With respect to whitebark pine across all three sites, I tallied an average of 215 seedlings and 149 saplings per hectare in the Eagle Cap Wilderness, 375 seedlings and 468 saplings per hectare in the Gravelly Range, and 3,346 seedlings and 932 saplings per hectare in the Pioneers (Table 1).

Whitebark pine regeneration has been limited at many other sites I have visited in the Northern Rockies, making what I observed the past two summers all the more spectacular. Across all three mountain ranges I observed regeneration in open stands, recently disturbed stands, and closed-canopy mature stands. I recorded regeneration in stands that appeared to have been decimated by 20th century mountain pine beetle outbreaks (Fig. 3). In a few limited cases I even saw whitebark pine saplings growing out from under more shade-tolerant tree species such as subalpine fir and Engelmann spruce, although the ultimate success of such whitebark saplings is open to question. Many of the seedlings and saplings were growing closely clumped together in the shelter of rocks, stumps, or down pieces of wood, indicative of the caching habits of Clark's nutcrackers. Almost invariably there was at least one stand of whitebark pine near our plots, often on isolated ridges or nearby slopes, which could have served as a seed source for this regeneration.

Observations hint at possible reasons behind the regenerative success of whitebark pine at these sites. The whitebark pine cone crop in the Pioneers was tremendous in 2005, and a bumper cone crop occurred across a large portion of the entire distribution of whitebark pine in 2006. These mast events likely provided the seed source for the abundance of recently emerged whitebark pine seedlings; however, the advanced regeneration I observed indicates that there have been multiple episodes of successful whitebark pine establishment over the recent past. Additionally, abundant seed production would do little for regeneration without a similar availability of sites suitable for regeneration. The relatively harsh biophysical settings of the areas in which I worked may favor whitebark pine regeneration. Perhaps whitebark pine is not strictly limited to the role of a pioneer species at these sites.

The observations I have reported here are for a specific set of sites in a small portion of the range of whitebark pine, but a message can still be drawn from them.

The whitebark pine communities of the Eagle Cap Wilderness and Pioneer Mountains seem to be more vigorous and regenerating better than many whitebark pine stands found farther north in the Rocky Mountains. With respect to the whitebark pine forests of the Gravelly Range, even the heavy beetle mortality of mature whitebark pines seems somewhat mitigated by the abundant regeneration. This regeneration may illustrate an age-old adaptation to mass die-off.

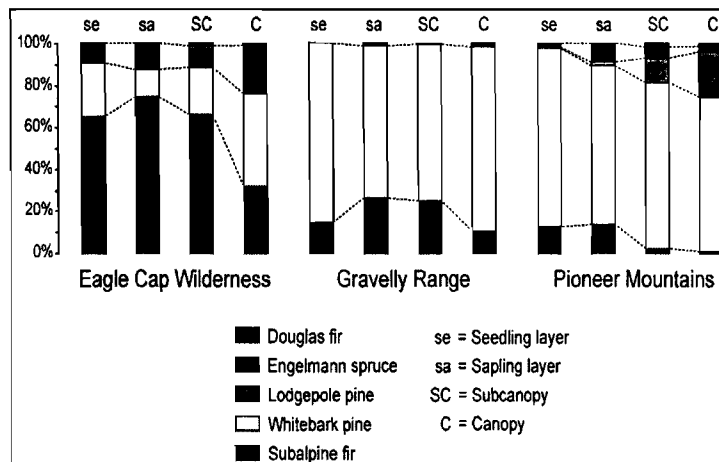
While this by no means suggests that active management is unnecessary, it is encouraging to know that the ecological challenges faced by whitebark pine are being engaged both by humans through restoration treatments and by the trees themselves. Readers who wish to discuss

my research, are welcomed to contact me at lars2859@umn.edu or check out my personal web site that includes a whitebark pine photo gallery at <http://www.tc.umn.edu/~lars2859/>.

Table 1. Forest density of the sampled stands in the three study areas.

	Eagle Cap	Gravelly Range	Pioneer Mountains
<i>Seedlings/ha</i>			
Subalpine fir	546	63	508
Whitebark pine	215	375	3346
Lodgepole pine	77	0	15
Engelmann spruce	0	0	77
Douglas fir	0	0	0
<i>Saplings/ha</i>			
Subalpine fir	845	170	172
Whitebark pine	149	468	932
Lodgepole pine	142	0	22
Engelmann spruce	0	8	106
Douglas fir	0	0	2
<i>Subcanopy trees/ha</i>			
Subalpine fir	182	134	9
Whitebark pine	62	403	355
Lodgepole pine	29	0	53
Engelmann spruce	3	1	24
Douglas fir	0	0	8
<i>Canopy trees/ha</i>			
Subalpine fir	72	30	3
Whitebark pine	99	250	316
Lodgepole pine	51	0	92
Engelmann spruce	2	5	12
Douglas fir	0	0	5

Figure 1. Relative forest composition of sampled



stands in the three study areas. Seedlings were defined as any tree less than 1.2 cm diameter at ground level (dgl). Saplings included any trees greater than 1.2 cm dgl but less than 5 cm diameter at breast height (1.2 m; dbh). Subcanopy trees were greater than 5 cm dbh but that had less than 50% crown exposure to the sky. Canopy trees were greater than 5 cm dbh and had at least 50% crown exposure to the sky.

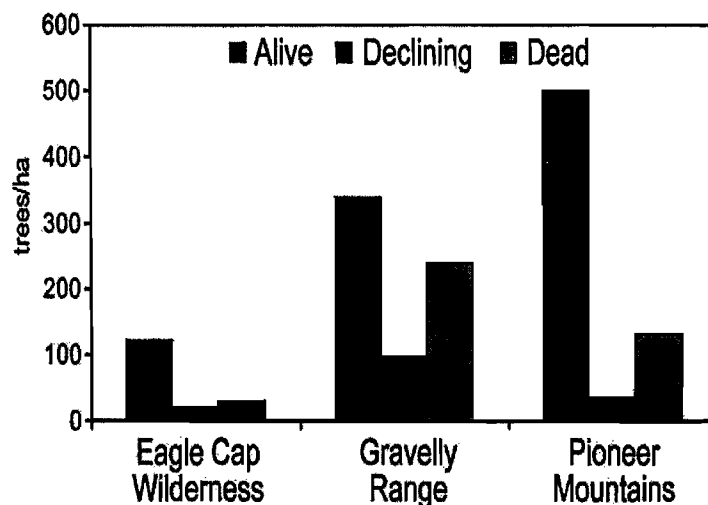


Figure 2. Health of whitebark pine trees inventoried at the three study sites. Trees were classified as Alive if their crowns were full and the tree appeared to be in generally good health. Declining trees included those that showed crown dieback, multiple flagging limbs, and/or numerous pitch tubes. Dead trees included those that still held needles but which were entirely red, recently deceased trees, and ghost trees.

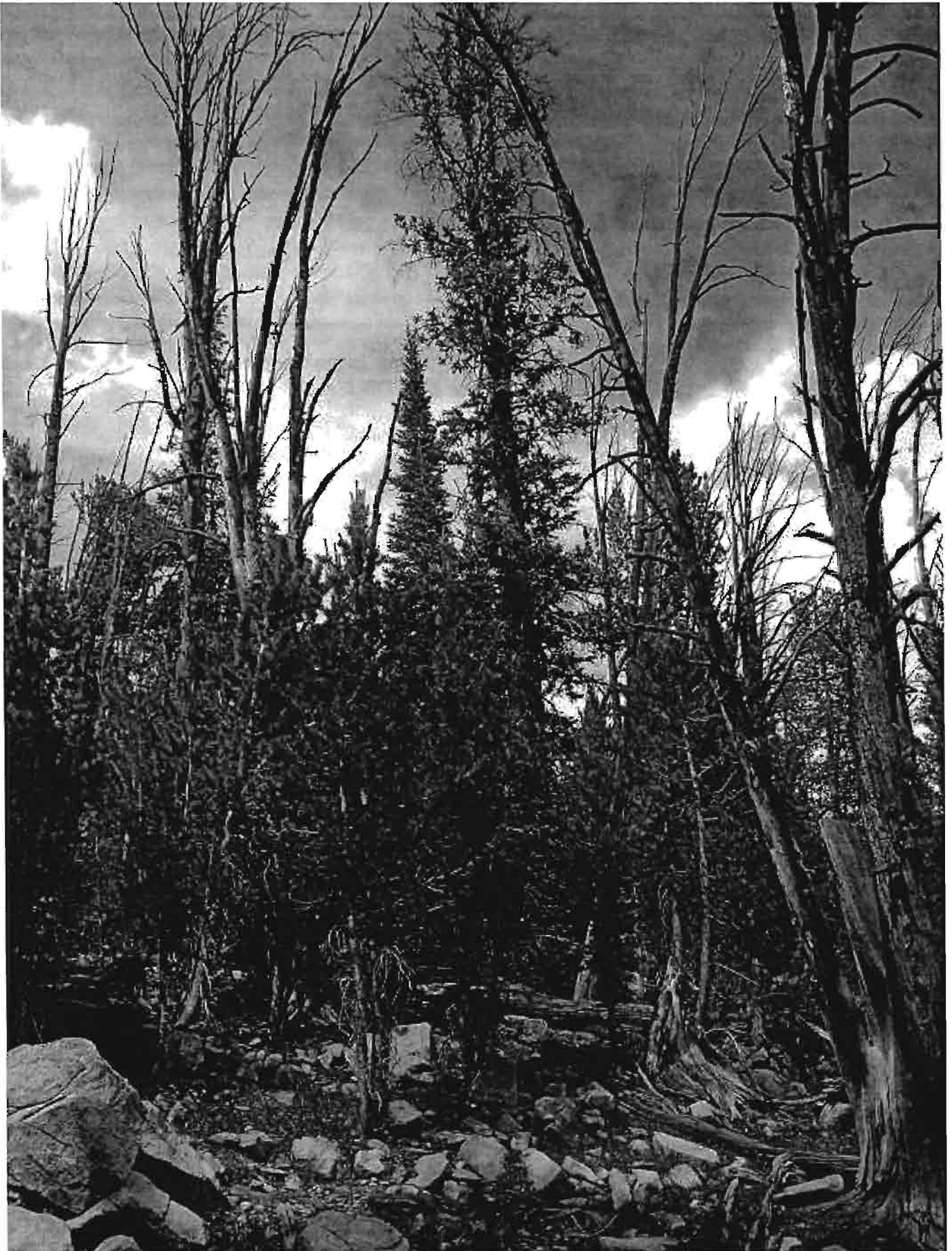


Figure 3. A thick layer of whitebark pine saplings underneath an overstory of whitebark pine snags likely killed during a 20th century mountain pine beetle outbreak. Photo taken near Tub Lake in the Pioneer Mountains.

Whitebark Pine Ecosystem Foundation

P.O. Box 16775

Missoula, MT 59808



"working to restore whitebark pine ecosystems"

New Membership Form

please print, check one of the categories, fill in the blanks, and mail with a check to the address above

- Whitebark Level (\$35)
- Nutcracker Level (\$75)
- Grizzly Level (\$1000)
- Student Level (\$25) Please include copy of current student ID
- Institutional Level (\$150) Applicable to companies and government offices

Date _____

Name _____

Address _____

City _____ State/Prov _____ Postal Code _____

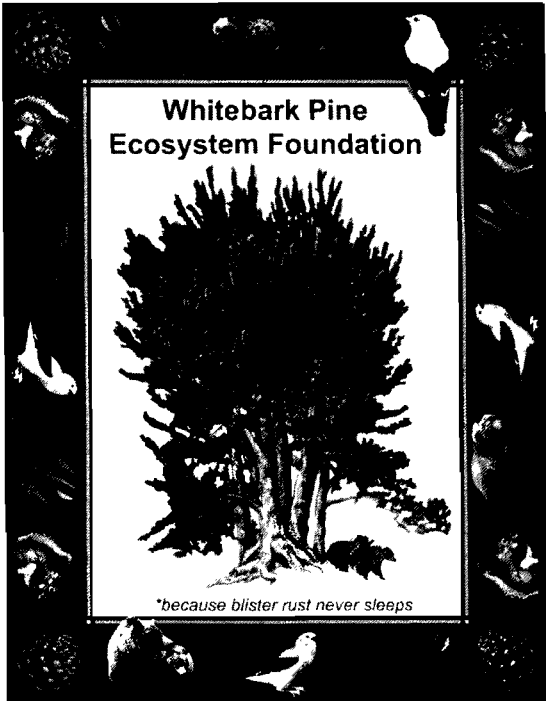
Phone _____ Work _____ Home _____

E-Mail _____

Employer _____

Recruited by: _____

The membership year is October 1 to September 30.



T-shirt Logo

Whitebark pine workshop at Whistler, B.C. (A. Yanchuk)



Scene from street theatre (Parks Canada)

Beetle-killed whitebark pine near Sun Valley, ID (Charlie Webster photo)

