Issue No. 25: Fall/Winter 2013-2014

Whitebark Pine Ecosystem Foundation

Nutcracker Notes

Ancient Whitebark Pine Plus Tree that we visited on WPEF's September field trips.

Sabine Mellman-Brown examines whitebark planted 20 years ago at treeline.

Whitebark Pine Ecosystem Foundation

Nutcracker Notes, Issue No. 25; Fall/Winter 2013-2014

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Our Mission: The Whitebark Pine Ecosystem Foundation (WPEF) is a science-based nonprofit organization dedicated to counteracting the decline of whitebark pine and enhancing knowledge of its ecosystems.

Membership Information and an application is found at <www.whitebarkfound.org>

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Director's Message

Diana F. Tomback

***Climate Change and Whitebark Pine*: WPEF's First White Paper**

In early November, we posted on the Whitebark Pine Ecosystem Foundation website our first white paper, *Climate Change and Whitebark Pine: Compelling Reasons for Restoration*. http://whitebarkfound.org/?p=659. This paper, authored by founding board member Bob Keane, Treasurer Vick Applegate, and board members Liz Davy and Melissa Jenkins, and myself, and approved by the WPEF Board of Directors, was written in response to questions and comments over the past few years from researchers, managers, and the public regarding the questionable value of restoring whitebark pine in an uncertain climatic regime. These questions have been asked by colleagues, including those actively involved in whitebark pine restoration, as well as those at higher levels of management and oversight. We feel that these concerns are based on misinterpretations of predicted distributional changes from climate warming, and potentially harmful if used as justification for abandoning restoration efforts for whitebark pine. Here, I summarize the major points in the white paper, but I urge everyone to read the paper, which presents more detail and context.

The questions we hear are exemplified by: "Why are we bothering to restore whitebark pine when its range is projected to shift north, even north of the Canadian border, within this century. " This view is simplistic for several reasons. Fundamentally, we require healthy, cone-bearing whitebark pine and natural genetic diversity to enable populations to respond to selection pressures exerted by new climate and disturbance regimes, particularly at the "climate change frontiers" of treeline and northern latitudes, but rangewide as well. This requires that we continue to implement restoration projects that include planting blister rust-resistant whitebark pine seedlings, or take advantage of sufficiently healthy whitebark pine seed sources and encourage natural regeneration through silvicultural treatments and prescribed burning. We can also plan for climate change by including more southern genotypes in our planting efforts, or at least ensure high genetic diversity. The basic restoration tools and best practices are outlined in Keane et al. [2012, A range-wide restoration strategy for whitebark pine (*Pinus albicaulis*), RMRS-GTR-279].

More importantly, distributional predictions are based on scenarios from climate change models, which are imprecise. Although the current General Circulation Models (GCMs), which predict the extent of climate change, are constantly being improved, they still show a wide range of uncertainty (IPCC 2012, eventual warming of 1.5 – 4.5˚C) in climate response. As the WPEF white paper points out, "the range of possible predictions of future climate from General Circulation Models….is much greater than the variability of climate over the past two or three centuries…, and the variability across GCMs is greater than the variability in each model's weather projections." Thus, these models cannot predict regional changes in climate with any certainty.

Bioclimatic Envelope Models, also known as Species Distributional Models, describe the current distribution of a species by characterizing its "climatic niche" and then determine future distribution of the species based on the predictions of climate change by a selected GCM or the mean of GCM predictions. The predicted shifts in distribution are extremely coarse-scaled and compound uncertainty. They do not take into consideration a number of major factors that impact species' distributions at finer scales. For example, climate may vary greatly with local and regional topography, providing suitable refuges. Whitebark pine may persist at the southern end of its distribution by retreating to yet higher elevations, north-facing slopes, frost-pocket mountain valleys, or other local cold spots. Furthermore, the Species Distributional Models do not consider the effects of climate on life history stage, including the processes of seed germination, seedling survival, and cone production, nor do they consider ecological interactions such as seed dispersal by nutcrackers and mycorrhizal symbioses, herbivory, disease and parasites, competition with other vegetation, and the timing (phenology of many processes). Given that whitebark pine can live for hundreds of years and even occasionally for a thousand years, the trees have endured major swings in climate over long timeframes, indicating a high degree of resilience in established individuals. Whitebark pine also has the largest distribution of any five-needle white pine in the U.S. and Canada, spanning about 18˚ of latitude and 21˚ of

longitude, with substantial genetic variation in adaptive traits across this range. The paleoecological record also suggests that whitebark pine persisted in areas within its range during much warmer and drier periods, and even increased in population size in these regions.

Ultimately, a major factor that may alter the distributional responses of many species will be changes in disturbance regimes. Drier conditions and warming temperatures are leading to increased frequency and severity of wildfire. Assuming that reasonably healthy seed sources remain in many areas or will develop from restoration efforts, whitebark pine may have an ecological advantage over its more shade-tolerant competitors. Clark's nutcrackers effectively disperse whitebark pine into large burned areas in the years following fire, and whitebark pine's morphology enables it to survive low- to moderate-severity fires. With reduced competition, whitebark pine communities may actually expand under conditions of more frequent fires. If fires burn and we maintain a successional mosaic of pine communities on the landscape, future mountain pine beetle outbreaks may be reduced in scale and better contained as well. To further confound prediction, we cannot accurately guess what the effects of attempted fire suppression will be in high-elevation habitats in the distant future.

The white paper also makes the point that restoration projects implemented now and in the near future have the greatest chance of succeeding. Seed sources are still intact in some areas, and proactive restoration maintaining regeneration and a diversity of age classes, coupled with planting blister rust–resistant seedlings has the greatest chance of succeeding under these conditions. As seed sources succumb to bark beetles and blister rust, the options become more limited. We cannot afford to wait to restore whitebark pine until clearer predictions of future climate are available.

Restoration of whitebark pine communities requires a long-term commitment from scientists, the concerned public, agencies, and managers, with the incorporation of new tools and techniques over time. The support for whitebark pine restoration must continue with additional resources whenever possible. Without restoration we face the loss of a major western forest ecosystem, regardless of how climate change proceeds.

Annual WPEF Science and Management Workshop

The 13th annual WPEF Whitebark Pine Science and Management Workshop, held September 19 in the Strand Union Building at Montana State University in Bozeman, was deemed by all to be a great success, with the largest attendance for one of our annual events to date (see elsewhere in this issue for details). Co-hosted by the Northern Rockies Fire Science Network, and co-sponsored by the Union of Concerned Scientists and Montana State University, the theme of this workshop was "Challenges of whitebark pine restoration: issues and solutions." The program was also ambitious, with four plenary presentations and two simultaneous sessions of contributed papers, a late afternoon panel discussion addressing restoration challenges, and an evening social and program open to the public. Field trips to whitebark pine communities in the region were held both on Saturday and Sunday. Our thanks to Bob Keane who headed the WPEF program committee, and Dave McWethy of Montana State University who organized the venue and arranged the events. We also very much appreciated the organizational support from a number of other folks from MSU, the Gallatin National Forest, and the Bozeman Forestry Sciences Laboratory of the Rocky Mountain Research Station.

Changes in Website and Webmaster

Much to the sorrow of the board, our longtime webmaster, Chuck Crouter asked to resign last spring. Chuck had been with us nearly from WPEF's inception, through thick and thin. Many of our early WPEF annual meeting and field trip group photos include Chuck as part of the crowd on top of this mountain or that ridge. In his very active "retirement," Chuck developed and maintained websites for a cadre of local non-profits too numerous to mention, keeping abreast of the latest technology and reporting on this with relish at our board meetings. Alas, Chuck, now an octogenarian, decided to retire a second time—this time more seriously, citing family responsibilities and other needs. We miss Chuck and sincerely wish him well.

In the midst of an impending website disruption, we were rescued by JoAnn Grant, who is now our new webmaster. JoAnn is also program assistant and webmaster for the Heart of the Rockies Initiative, a non-profit organization that works to implement conservation plans for private lands in the Greater Yellowstone Area. In crisis there is opportunity, and JoAnn redesigned and rebuilt our website on a user-friendly platform. She also attended our fall board meeting and whitebark pine workshop in Bozeman. We are extremely pleased with the new website and very pleased to have JoAnn join our efforts at the WPEF as a working partner. ■

Director's Message: WPEF Canada
Randy Moody

It was great to see all of our whitebark pine colleagues at the meeting in Bozeman this fall. Many of the major Canadian projects concerning whitebark pine were covered at the meeting including progress on the federal recovery strategy, blister rust screening in B.C., and recent publications by Cyndi Smith and her crew of collaborators. There were 10 Canadians in attendance, which isn't bad considering the travel distance. As many of the Canadian members are aware, a draft of the federal recovery strategy is nearing completion, however consultation with key stakeholders needs to be concluded before this document becomes final. This strategy is a key document to guide recovery of the species in Canada.

This year the foundation secured a grant from the Columbia Basin Trust to conduct some plantings in areas burned by wildfires in the last several years in southeastern BC. A local expert in post-fire silviculture was used to identify suitable planting sites for whitebark pine. In many cases volunteers were used to assist with planting, including the Elkford ATV club and local guide outfitters. In total over 5,000 seedlings were planted, and numerous people were educated about whitebark pine. This project was a great example of cooperation between non-traditional collaborators and everyone involved learned something.

In B.C., there was a large amount of whitebark pine work undertaken. Board member Michael Murray reports that efforts to identify blister rust resistance in Canada have taken significant steps ahead this past year. Artificial inoculations of 10 families took place in August at the Kalamalka Forestry Centre (see Murray's article in this issue). A parallel effort was launched to collect and field-screen 500 families province-wide. Meanwhile, several more families are being assessed as part of a genome investigation of resistance. These three projects are a result of fruitful collaboration between the B.C., Canadian, and U.S. Forest Services plus the University of B.C. Also during 2013, B.C. provincial staff participated in a scoping workshop aimed at assisting Environment Canada's developing recovery strategy. Two permanent monitoring plots were installed near the northernmost known limits of whitebark pine."

In Alberta, there has been quite a bit of regulatory development with regards to both whitebark and limber pines. WPEF Canada board member Brad Jones reports that the provincial committee that advises the minister (ESCC – Endangered Species Conservation Committee) recommended that the whitebark pine recovery plan be approved. Oil and gas development guidelines and setbacks for working in whitebark and limber pine habitat were developed. Shell Oil Co. has conducted plantings of limber pine to offset some of their development in limber pine habitat. Plantings of limber pine have been made by Dr. Vern Peters of Kings University College in Edmonton as part of his on-going research program. This was a citizen engagement project set up as a trial.

As many readers are aware, most of our board has been around since the inception of the Whitebark Pine Ecosystem Foundation of Canada, and we will be looking for some new blood in the next year. As we move forward with this level of planning it would be great to get feedback from people who may be interested in a board position or are willing to be more active with the foundation. Please give this some thought over winter while skiing among the whitebark pines. ■

Bozeman Conference Sets a Record

On September 20, 2013, 120 participants registered at WPEF's annual Science and Management Workshop held at Montana State University in Bozeman. A majority also attended an outstanding field trip into the Bridger Mountains the following day.

The conference, co-sponsored by the Northern Rockies Fire Science Network and the Union of Concerned Scientists, was held in the bustling confines of MSU's student union building. After a welcome by WPEF Director Diana Tomback attendees were treated to four presentations that set the stage for concurrent sessions with speakers addressing whitebark pine restoration and management, and research and development. First, Dr. Cathy Whitlock of MSU provided a rare overview of the post-glacial history of whitebark pine and its relationship to fire as revealed in the fossil record. Next, Dan Reinhart of the National Park Service provided an overview of issues and concerns associated with whitebark pine restoration. Then Dave Mattson of Yale University's Carnivore Policy Center recounted the long history of brown bears and stone pines in the northern hemisphere and then he transitioned to more recent knowledge of that whitebark pine has been demonstrated to be a critical food for grizzly bears in the Greater Yellowstone area.

Mary Frances Mahalovich, from the Forest Service's Coeur d'Alene Nursery, followed with an account of her 16 years of selective breeding of whitebark pine to enhance blister rust resistance through location of "plus trees," examination of genetic traits and variation, and establishment of seed zones.

After coffee break participants shuffled back and forth between the two concurrent sessions. Just a few highlights of the restoration and management session include (1) an entertaining, real-world review of TreeFight's efforts to involve children and adults in educational field projects related to whitebark pine restoration; (2) accounts of planning and implementation of comprehensive protection and restoration programs on the Bridger-Teton and Flathead National Forests; (3) starting a whitebark pine rust resistance breeding program from scratch in British Columbia; and (4) modeling the effects of climatic warming on whitebark pine in the Greater Yellowstone region. Some cherry-picked highlights of the research session include (1) relation of climatic data to whitebark pine cone production; (2) effects of manipulating mycorrhizal fungi on survival of whitebark pine seedlings; (3) studies of whitebark pine as an initiator of tree-islands at upper treeline; (4) regenerating whitebark pine via direct seeding; and (5) measuring the decline of whitebark pine in the Beartooth and Absaroka mountains.

Late-afternoon was spiced up by a panel discussion on meeting challenges to whitebark pine restoration. U.S. Forest Service silviculturist Barry Bollenbacher was asked to cite successes and failures in efforts to restore whitebark pine. In terms of success, he brought up the rust-resistance breeding program, widespread planting, and widespread publicity on the importance of whitebark pine ecosystems. On the other hand, he noted the disappointing failure to get an exception for whitebark pine in measures to protect the Endangered Canada lynx, and the irony that due to lynx habitat restrictions even a small circle of thinning around individual whitebark pine plus trees isn't permitted.

After these "business" sessions participants were treated to sumptuous hors d'oeuvres and refreshments at a social hour while examining arts and crafts available at the silent auction, under the direction of volunteer Laura DeNitto. This fundraiser netted more than $800 for restoration activities. This was followed by a public presentation, "Whitebark pine in peril: what can be done?" that attracted many people from the Bozeman community. Diana Tomback, Liz Davy, and American Forests' liason Jami Westerhold discussed restoration projects in the Greater Yellowstone Area.

Field Trips

After a full day at indoor sessions, participants were eager to get outside on the field trip to whitebark pine habitat in the nearby Bridger Mountains. A caravan of vehicles took off Saturday morning under sunny skies for the Fairy Lake area up Bridger Canyon. Upon arrival our hosts Kirk and Beth Horn led us up the Shafthouse hiking trail, ascending limestone slopes clothed in dry meadows and limber pine, many of which had been killed by blister rust and mountain pine beetles. At about the 8200-foot level the underlying geology changed to mixed aggregate rock and limber pine gave way rather abruptly to whitebark pine, also heavily impacted by rust and bark beetles. Generally the two pines could be distinguished by growth form, with whitebark pines tending to grow more-or-less straight where not subject to extreme wind-shear, while nearby limber pine generally have a crooked or wavy main stem.

Jodie Canfield and Clay DeMastus of the Gallatin National Forest and John Schwandt of the US Forest Service FHP office in Coeur d'Alene showed us the area burned in a 2004 fire, which was planted in 2009 with whitebark pine seeds and nursery grown seedlings. A lively discussion followed about factors affecting regeneration success. After while, we resumed trekking up the trail, and stopped for lunch on a steep slope with a sweeping view of the sprawling Shields River Valley and beyond it the Crazy Mountains. Another highlight of this overlook was a giant centuries-old whitebark pine plus tree, with a full healthy crown, standing out in contrast with its rust- and beetle-impacted kin. After lunch and a short, informal business meeting to acquaint participants with operations of the Whitebark Pine Ecosystem Foundation participants either headed back down the trail or sauntered farther along, enjoying the ambience of the Bridger high-country on one of the last summer-like days.

The following morning, Sunday, a smaller group assembled at Columbus, MT, and later at Red Lodge to make the optional field trip to a whitebark pine treeline community along the Beartooth Highway. Ascending the highway grade southward from Red Lodge, we stopped at the 9200-foot vista point overlooking Rock Creek canyon. This provided an opportunity to compare limber and whitebark pines growing side-by-side, some with cones for identification and others without them. The progression of recent blister rust and especially bark beetle damage provided start testimony to the vulnerability of these trees. Following the road up, at 9800 feet we reached the lip of the Line Creek Plateau. We parked here and hiked a short ways across flat alpine tundra aiming for a mosaic community of stunted whitebark pines and

krummholz interspersed with tundra in the Line Creek Research Natural Area of the Custer National Forest.

Here we were treated to a tutorial on results of wide-ranging ecological research by Diana Tomback and three of her graduate students. Libby Pansing and Aaron Wagner demonstrated their microclimatic monitoring equipment and procedures that measured wind and surface temperatures at ground line on windward and leeward sides of small krummholz islands, factors critical to seedling survival. Sabine Mellman-Brown showed us 20-year-old whitebark pine saplings one to two feet tall in the krummholz zone that resulted from her seed planting experiments in the early 1990s. Diana and her students were able to answer or at least shed light on many questions raised by the group about the treeline relationships of whitebark and associated spruce and subalpine fir by the time blustery squalls and the need to depart for our home bases intervened.

We thank our sponsors the Northern Rockies Fire Science Network, Union of Concerned Scientists, and Montana State University for contributing to a highly successful annual meeting.

In retrospect the Bozeman-based conference and field trips were a great success. Please consider attending next September's annual WPEF conference—the first ever planned for northern Idaho—to be held in Coeur d'Alene. ■

WPEF Announces Future Workshops

Following on the success of the 2013 annual workshop, WPEF has announced venues for its future meetings.

Next year's workshop is being planned for Coeur d'Alene, Idaho, tentatively on Friday and Saturday, September 19-20, 2014. John Schwandt, Paul Zambino, and Mary Frances Mahalovich have agreed to host the event. The venue has not yet been finalized but the field trip will be to the USFS Coeur d'Alene Tree Nursery to observe blister rust screening and nursery techniques for propagation of whitebark pine. In addition, another field trip is planned for Sunday to view study sites along the Idaho-Montana divide west of St. Regis where there are direct seeding trials, "daylighting," and whitebark pine release studies. Please enter this date on your calendar and plan to attend an exciting meeting.

WPEF's program committee has also been planning locations and hosts for the next three WPEF annual meetings. The 2015 meeting is tentatively planned for Ashland, Oregon. The 2016 meeting, to be hosted by Melissa Jenkins, is planned for the Flathead Valley, Montana. The 2017 WPEF meeting is being planned for a site in Canada (to be determined) and hosted by the Canadian chapter of WPEF. ■

Membership Report

Membership in the foundation not only provides financial support for the education and restoration of a high mountain resource, but also allows for the networking necessary to bring the considerable expertise of the 180-plus members together to meet our goals. This membership level has remained steady for about the past four years.

The Board of Directors recently decided to increase the rate for the Grizzly level lifetime membership to $3000. This rate increase became effective on October 1st, which gave members the opportunity to secure their lifetime membership at the former rate of $1000 prior to the deadline. Several members took the BOD up on the opportunity and renewed at the Grizzly level. Thanks to these folks who made the substantial commitment to the Foundation and whitebark pine ecosystems. These member's actions will make the 2014 renewals the best financially in our history.

Canadian membership has been steadily increasing over the past few years. The total number of Canadian members, mostly from Alberta and British Columbia, now stands at 39. The Board of Directors are very excited about this increase in involvement from north of the border.

Are you wondering what to give that special scientific someone for Christmas? A WPEF membership is an excellent choice, as it takes up very little room in the house and lasts an entire year! **Exclusive between now and December 25: all gift memberships will also receive the totally awesome 2014 WPEF calendar for any membership level!** Please indicate in ***PayPal*** comments or on the membership form that this will be a gift, and where and when to send the packet. Please contact Bryan if you would like more information about this great gift idea. Not only can you satisfy your gift giving obligations, but you can support your Foundation as well. As with the past couple of years, the calendar is also available for new memberships at the Nutcracker and higher levels any time of the year.

The foundation's web site at www.whitebarkfound.org has a complete discussion of the different membership levels and forms for initial membership and renewal. Joining or renewing by using ***PayPal*** at the web site is a quick and convenient way to maintain your membership. Questions, comments, or suggestions about membership in our foundation can be directed to the Membership and Outreach Coordinator Bryan Donner, at (406) 758-3508 or donnermt@yahoo.com. Please put "WPEF" or "Whitebark" in the subject line of your e-mail.

Reminder: Several of you have not renewed your membership for the coming year. Please contact me if you are unsure if you need to renew.

Bryan Donner
WPEF Membership Coordinator ■

2014 Nominations for Whitebark Pine Ecosystem Foundation Board

Our bylaws dictate that elections are to be held every year for various positions – this way there is always a rotation of experienced Board Members and Executive Committee officers and we would never face a complete turnover of officers and the chaos that could ensue. Please consider running for one of these positions!

Board members and officers commit to working collectively to advance the business of the WPEF and the conservation and restoration of high elevation pines. This includes attending two board meetings per year, one of which is usually in March or April in Missoula, MT, and the second is in conjunction with the annual WPEF science meeting and field trip in mid-to-late September somewhere within the range of whitebark pine. To find out more about the duties of these positions, please refer to the back of this form, consult the WPEF Executive Handbook on the website www.whitebarkfound.org, or contact one of us.

Diana F. Tomback, Ph.D.
Director diana.tomback@ucdenver.edu

Cyndi Smith
Associate Director cyndi.smith9@gmail.com

Nomination Form – Whitebark Pine Ecosystem Foundation

Nominations are being sought for the following four (4) positions, to begin serving on the Board of Directors in September, 2014. All positions are for a 3-year term:

- Associate Director
- Treasurer
- Board Member
- Board Member

RULES:

- All board members can serve up to 3 terms consecutively [Bylaw E(h), E(i) and F(a)].
- All nominees must be members of the WPEF in good standing [Bylaw F(b)(iv)].
- Any nomination must be made by 2 members in good standing [Bylaw F(b)(i)]; signatures can be on one form, or on separate forms.
- Any nomination must be validated by the signature of the nominee [Bylaw F(b)(i)]; this signature can be on the same form as a nominator, or on a separate form.
- **Only one nomination per form**. If you need more forms, please copy this one, or download another one from our website <www.whitebarkfound.org>.
- Nominations may be sent by mail [Box 17943, Missoula, MT, 59808], E-mail wpefsecretary@gmail.com or fax (406-758-5379), and must be postmarked/dated no later than **01 Feb 2014.**

We, the undersigned, nominate _____ for the position of ASSOCIATE DIRECTOR ___, TREASURER ___, BOARD MEMBER ___ [*please check the one that applies*].

Nominator #1: _____ _____ _____
Signature *Print Name* *E-mail address*

Nominator #2: _____ _____ _____
Signature *Print Name* *E-mail address*

Nominee: _____ _____ _____
Signature *Print Name* *E-mail address*

The purpose of the Board of Directors (BOD) is to make decisions affecting the general membership of the WPEF. This includes making policy, deciding on major spending, or solving major problems concerning the organization.

1. Responsibilities of the Associate Director:

- Take over duties of the Director if he/she is incapacitated
- Serve as the Chair of the Nominating Committee
  - Oversight of board member terms and status
  - Publish a request for nominations article in the Fall issue of *Nutcracker Notes* and solicit nominations from a variety of sources
  - Prepare a list of candidates and create a ballot for mailing by the Secretary
  - Solicit nominations for the general board members that will be elected by the existing BOD members and coordinate election with Secretary
  - Advise newly elected BOD members and thank outgoing BOD members
- Facilitate BOD and Executive Committee meetings
  - Serve as time-keeper
  - Keep order and facilitate discussion from all board members
- Serve as Chair of the Proposal Evaluation Committee
  - Prepare any request for proposals as approved by the BOD
  - Convene a committee to evaluate each proposal
  - Prepare a recommendation to the BOD for approval
  - Receive review requests and solicit BOD members or other WPEF members to review and prepare review for Director's signature
- Serve as Chair of the Bylaws Committee
  - Receive proposals for Bylaw changes from the BOD and membership
  - Prepare proposed Bylaw changes for BOD review and vote
  - Once approved by BOD prepare Bylaw changes for membership vote

2. Responsibilities of the Treasurer:

- Manage the finances of the WPEF
  - Deposit all receipts for membership dues, donations, merchandise purchases, grants, and other income
  - Store all bank statements, receipts, and financial correspondence
  - Disburse payments for all invoices and other financial obligations
  - Balance monthly checking and savings account statements
  - Coordinate cost-share agreements in cooperation with the Director and other WPEF officers
  - Submit forms regarding non-profit status, and other related forms and payments, as needed
  - Have accounts reviewed as necessary for tax and audit purposes
  - Coordinate with accountant for submission of tax material to IRS
- Maintain records of the financial status of the WPEF
  - Attend BOD meetings and present a Treasurer's Report containing a summary of next year's budget and last years expenditures, income, and current holdings
  - Prepare budget and yearly expense reports as needed

3. Responsibilities of a general board member:

- Members of the WPEF Board of Directors (BOD) that are NOT members of the Executive Committee have the following responsibilities:
- Attend all BOD meetings
- If it is impossible to attend, the BOD member must notify the Chair as to their absence.
- Attendance can be in person or via a conference call.
- Attend all WPEF annual meetings
- Participate in WPEF activities when appropriate
- Form Working Groups
- Organize annual meetings
- Volunteer for Evaluation Committee
- Perform fundraising as needed
- Other tasks as needed

Student Research Grant Awarded

A call for proposals for the second annual WPEF student research grant was released in the Spring/Summer issue of Nutcracker Notes. The proposals were reviewed by Board members Edie Dooley, Bryan Donner and Cyndi Smith. ***ZOLTON BAIR****, an M.S. student in Botany and Plant Pathology at Oregon State University in Corvallis, was chosen as the grant recipient for 2013. Following is a short description of his project:*

Identification of blister rust resistance genes in whitebark pine to facilitate breeding and restoration.

Introduction

While researchers have not yet discovered any major gene resistance against white pine blister rust (*Cronartium ribicola*) in whitebark pine (*Pinus albicaulis*), partial genetic resistance to the disease exists within naturally occurring whitebark pine populations. Partial resistance holds more promise in tree restoration efforts because it is durable over time, making whitebark pine an excellent candidate for resistance breeding programs. However, the basis of this partial resistance remains unknown in whitebark pine. If we can identify genes responsible for blister rust resistance, breeders can simply screen whitebark pine DNA for associated genetic markers. This rapid screening has the potential to significantly expedite and economize tree restoration by reducing the dependence on costly inoculation trials.

My research will identify candidate genes for blister rust resistance in whitebark pine. Thus, it will lay the groundwork to facilitate rapid screening technology for whitebark pine breeding programs. In particular, I will integrate bioinformatics and histology to identify candidate genes and gene networks. Additionally, my work will help elucidate the mechanism(s) underlying blister rust resistance in whitebark pine.

Study Plan and Methods

At the Dorena Genetic Resource Center in 2010, hundreds of whitebark pine seedlings were sown from cones collected from various populations in the Pacific Northwest. In September 2012, we selected over 600 of these seedlings for an inoculation experiment. While half were inoculated with *C. ribicola*, half served as controls. Three days after inoculation, needles were collected from each experimental group and flash frozen to preserve tissue. Throughout the year, we have assessed each of the seedlings for symptoms indicating either susceptibility or resistance to blister rust. These data will be used to select individuals for transcriptome comparisons using bioinformatics.

First, RNA will be extracted from needle tissue and sequenced. Then, I will assemble a reference transcriptome, an important molecular resource and prequisite for gene expression studies. This tool will permit transcriptome comparisons between susceptible and resistant individuals, revealing which specific transcripts are unique to resistant phenotypes. By spring 2014, I intend to present preliminary results of the reference transcriptome assembly and any candidate blister rust resistance genes identified through differential expression. I also plan to couple this analysis with histology or microscopic imaging of needle cross-sections to help interpret the gene expression results.

Anticipated Outcomes

My study will produce a reference transcriptome for whitebark pine, providing an atlas of expressed genes for future studies of differential gene expression in whitebark pine exposed to *C. ribicola*. The research will promote a basic scientific understanding of blister rust resistance in whitebark pine, with the ultimate goal of identifying resistance genes. This knowledge will facilitate technology development for marker-assisted selection, allowing breeders to quickly and efficiently target resistant individuals for restoration efforts. In turn, the ultimate goal of restoring whitebark pine populations may be realized at a pace that could overcome current rates of decline.

Acknowledgements

I would like to thank Kristen Chadwick and the US Forest Service Special Technology Development Program for funding this work. I would also like to thank Nancy Grulke with the Western Wildland Environmental Threat Assessment Center for their funding contribution. I would like to extend my deepest appreciation to the Whitebark Pine Ecosystem Foundation for their support of this valuable research effort. ■

Whitebark Pine Education: Programs Available

Jane Kapler Smith
USFS, Missoula Fire Sciences Lab
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We may all agree that the best place to learn about whitebark pine is high in the mountains, but what if it's winter, raining or snowing, and there's no money to bus students into the high country? Consider using these three creative, interactive activities from the *FireWorks* educational program to teach children about whitebark pine, its relationship to fire, and threats to its future. You can access the *FireWorks* curriculum, a list of trunks available for loan, and directions for assembling the materials listed below through the following webpage: http://whitebarkfound.org/?page_id=636.

- Encourage research skills and creativity of *elementary and middle-school students* as they present a drama illustrating whitebark pine ecology. Each student adopts the character of a plant or animal, presents the character to the class with a mask or costume, and plays the role of the character in a drama developed by the class. Instructions are in the curriculum, pp. 150-156.

- Have *elementary and middle-school students* puzzle out the ecology of whitebark pine in relation to neighboring forest communities. The 11-piece jigsaw puzzle describing whitebark ecology looks simple—until you see that the puzzles for lodgepole pine and ponderosa pine ecology are cut on the same template! Students can only solve this 3-dimensional puzzle successfully if they know the ecology or interpret the clues provided on puzzle pieces. Instructions are in the curriculum, pp. 162-165.

- Tell the whitebark story to *preschool and primary students*. Have them help you illustrate the story using felt figures representing residents of whitebark ecosystems. Students enjoy the tactile nature of the activity, taking responsibility for a particular plant or animal throughout the story, and creating sound effects for weather and fire. Instructions are in the curriculum, pp. 157-161.

If you would like to learn more about the *FireWorks* program, consider attending a teacher workshop. Contact Ilana Abrahamson (iabrahamson@fs.fed.us, 406-329-4831). ■

Get Your 2014 Calendars

The 2014 whitebark pine calendar is now available. Are you looking for a beautiful and unique holiday gift that supports conservation of whitebark pine ecosystems?
Look no further. For only $12 you can give a great gift to important people in your life and also to the mission of the Whitebark Pine Ecosystem Foundation.

If you would like a calendar, e-mail Libby Pansing at Elizabeth.Pansing@UCDenver.edu

New Bookmark Includes Canada

With establishment of the Whitebark Pine Ecosystem Foundation Canada, the Foundation's bookmark—originally published in 2008—was outdated. A new version, released this fall, features a map of the *complete* geographic range of whitebark pine (including the half that occurs north of the international border) and reports the legal status of the species—endangered in Canada and a candidate for listing in the United States. For copies of the bookmark, use the contact information on one of the Foundation websites: whitebarkfound.org (US) and www.whitebarkpine.ca (Canada). ■

Range of Whitebark Pines

Interview with Libby Pansing
WPEF Director's Assistant

Editor: How were you first introduced to whitebark pine?

Pansing: I finished high school in the Colorado Rocky Mountains, right as the mountain pine beetle outbreak peaked. As I watched the forest turn red before my eyes, I began to read every journal article I could find about the beetles. The more I read, I found that my interests lay more in the interactions between climate, the beetles and the trees than in the beetles in and of themselves. In an "a-ha" moment, I realized where my passions lay, and that I wanted to study these high mountain ecosystems. I began working in Diana Tomback's lab at the University of Colorado, Denver, as a research assistant, helping to investigate the role of whitebark pine at treeline in Glacier National Park and the Beartooth District of the Custer National Forest. The tree immediately grabbed me, even in its krummholz form. I fell in love with its tenacity, its persistence, its hardiness, and its beauty.

Editor: What aspect of whitebark pine are you studying?

Pansing: I am researching whitebark pine germination and early seedling survival and the role that rodents play in the regeneration process. In 2012, I created over 700 simulated Clark's nutcracker caches at two different study areas in the Northern Rocky Mountains, and in 2013 I monitored them for germination and seed removal by rodents. Using the germination data, I hope to enhance direct seeding techniques by creating a management tool that will allow managers to input planting site characteristics to estimate probabilities of successful germination. Factors taken into consideration include microsite type, vegetation, slope, and aspect, among others.

In addition to looking into the role that small, granivorous rodents play in the regeneration process by estimating seed removal rates, I am estimating the density and abundance of rodents that might eat whitebark pine seeds, informing how changes in rodent density impact removal rates. Lastly, in 2013 we piloted fluorescent pigment seed tracking to determine the potential fate of seeds taken by small rodents. I will collect data on fluorescent pigment tracking of seeds and seedling survival in 2014.

Editor: You've entered into whitebark pine research in a time of uncertainty, but also in a time where possible solutions are developing. What are the most surprising sights you've seen, and what are the most hopeful?

Pansing: The most surprising sight has been the ubiquitous nature of blister rust at our study area on White Calf Mountain, Glacier National Park. Here we rarely see a tree that is not infected with rust. This paints a very bleak picture for the future of whitebark pine in the Northern Continental Divide Ecosystem. While the fate of the mature trees is disheartening, hope comes in the form of germinants. The germination of the planted seeds reminds me of the amazing tenacity, persistence and hardiness of whitebark pine- the qualities that I originally came to appreciate in this species. Germination rates ranged from about 25 to 38 percent depending on the study area, and these numbers give me hope for the next generation of whitebark pine.

I've also seen the drive and determination of the members of the Whitebark Pine Ecosystem Foundation and the commitment of the researchers and managers who participate in our annual Science and Management Workshops. I am consistently reminded that those passionate individuals are not going to let whitebark's decline continue without a fight!

Editor: What do you believe are the strengths of the Whitebark Pine Ecosystem Foundation?
Pansing: I've been lucky to work for the WPEF since 2011, and in that time I've learned many of the challenges and rewards of being a part of a conservation non-profit. What I believe we do best is educate and raise awareness. Not only do we raise the profile of whitebark pine and the challenges it faces, we also remind supporters, researchers, managers, and policy makers that whitebark pine is not a lost cause. There are effective conservation and restoration techniques we can employ to ensure these ecosystems continue to persist.

Because we are a science-based operation, we are in a unique place to extend our message to a wide range of supporters. Our Science and Management Workshops present both managers and researchers with the latest information and allow attendees to

network. Managers have an opportunity to inform researchers about what they see on the ground, while researchers can inform managers about the latest science. This dialogue creates an environment in which new solutions can emerge.

Editor: What is your role at the Whitebark Pine Ecosystem Foundation?

Pansing: I provide support to the volunteer Board Members, helping complete some of the administrative and routine work. I administer WPEF's Facebook page, the photo contests and calendar, design ads (check upcoming issues of *High Country News* for our first ad!), and help organize the agenda for the Board of Directors meetings. I've been involved in website design and upkeep and carry out many other administrative duties. ■

Whitebark Pine Restoration on the Helena National Forest

Amanda Milburn, Forest Silviculturist

Vegetation on the Helena National Forest (HNF) is characterized by transition because of its position straddling the Continental Divide and inclusion of several island mountain ranges that support a broad range of ecosystems, from treeline down to sagebrush and grassland. The area represents a corridor between the Greater Yellowstone and Northern Continental Divide ecosystems. Whitebark grows in some of the most beautiful and recreationally valuable areas, and its ecological importance is being demonstrated to an ever-growing audience. Whitebark pine grows on a variety of sites and is represented in every mountain range on the HNF. However, finding a 5-needled pine doesn't mean you've found a whitebark because limber pine grows with whitebark in many locations, typically where limestone substrate is present. It also commonly grows among juniper and sagebrush. In addition to the other threats whitebark faces, in recent years the mountain pine beetle outbreak has caused notable mortality in the Helena area. Still, there are whitebark pine seedlings and saplings persisting in most areas along with some seed-bearing trees that give hope for restoration.

The HNF is active in the regional tree improvement program for whitebark pine, and is conducting whitebark restoration projects. One of the earliest of these was the Granite Whitebark Timber Sale which harvested 40 acres in the 1990's to promote young whitebark. Today over 300 whitebark pine saplings per acre are present at this site, although future removal of small subalpine fir will likely be needed. Prescribed burning has been employed in recent years to promote whitebark over thousands of acres, particularly on the Lincoln Ranger District. One such project burned whitebark habitat near the Granite Butte lookout. This created site preparation for new seedlings, and in 2012 the first operational planting on the Forest was completed in this area after several years of cone collections. More than 7000 seedlings were grown for 3 years in a nursery prior to being out-planted on 25 acres in the fall by hand. After one growing season initial estimates of survival are extremely high (>99%).

Whitebark pine restoration is included as a highlight of many upcoming projects including a full suite of hand, mechanical, and prescribed fire methods designed to retain seed bearing individuals, reduce competition from other species, and create sites suitable for natural and artificial regeneration.

Public field trip to whitebark pine restoration area near Granite Butte (photo by Kathy Bushnell).

The increasing awareness of whitebark pine and its importance was demonstrated in September 2013 during a field trip to the Granite Butte area hosted by the HNF in partnership with the Montana Discovery Foundation. The diverse group of participants from the Helena area shared a common interest in understanding more about the high elevation ecosystem in their backyard. The group walked through the ghost forest where whitebark pine had dominated in the past, but is now growing thick with subalpine fir. Here, the group learned about whitebark ecology and the threats to the species.

"Ghost forest" of whitebark pine seen on public field trip to Granite Butte (photo by Kathy Bushnell).

The group also observed the full range of restoration activities that have been done near Granite Butte, including cone caging for seed collection, timber harvest, prescribed fire, and tree planting. It was a wonderful opportunity to talk about the unique characteristics of whitebark, and to show results of restoration activities. The highlight of the tour was a scavenger hunt to find the 3-inch-tall seedlings planted in 2012—hardy little underdogs that offer hope for a future forest. While the health of many whitebark forests appears dire, momentum for restoration of this unique species is building on the Helena National Forest. ■

Canada Launches Blister Rust Screening

Michael Murray, Ministry of Forests, Nelson, BC
michael.murray@gov.bc.ca

Introduction

During the past several years, demand for disease resistant whitebark pine (*Pinus albicaulis*) seedlings has grown steeply in Canada. Seedlings are used for restoration by parks, mines, and First Nations (Native Americans). Burned, disturbed, and harvested Crown land (public acreage) is increasingly planted with whitebark pine. In 2012, whitebark pine was designated as a federally endangered species in Canada. With a federal recovery strategy being drafted now, it is likely that the dissemination of disease-resistant trees will be a key component of the strategy.

The artificial inoculation of seedlings is a commonly applied step in the screening process to identify genotypes (or parent trees) of whitebark pine that are resistant to the blister rust fungus (*Cronartium ribicola*) (Sniezko and others 2011). Until our trial began, there had been no reported inoculations conducted in Canada. Instead, seeds have been sent to the USDA Forest Service facilities (Dorena Genetic Resource Center (DGRC), Oregon and the Coeur d'Alene Nursery, Idaho). Although very effective, this has proved very costly.

During August, 2013, an inoculation trial was performed at the Kalamalka Forestry Centre (KFC), Vernon, BC, operated by the Ministry of Forests, Lands, and Natural Resource Operations (MFLNRO). The associated team representing MFLNRO consisted of Randy Armitage (Research Technician), Vicky Berger (Research Technician), Michael Murray (Forest Pathologist), Ward Strong (Research Scientist), and Nick Ukrainitz (Research Scientist).

Methods

Seedlings representing 10 whitebark pine families were used. An additional family (#1402) represents a susceptible 'control'. These are the same 10 that DGRC is also inoculating in 2013 and will provide a unique and useful comparison of results. Each family consists of 50 individuals per inoculation run (10 families x 50 seedlings x 2 runs = 1,000 seedlings). The control used only 25 seedlings per run. Our methods were adapted from the protocol in use by DGRC (Danchok and others 2004). This includes randomized blocks of seedlings and achieving a basidiospore load of 3,000/cm^2.

Figure 1. Greenhouse inoculation chamber with *Ribes nigrum* leaves.

To produce inoculum (basidiospores), we relied on leaves collected from a cultivated currant hedge of *Ribes nigrum* (Ben variety) located at the Ministry's nearby Skimikin Seed Orchard, Tappen, BC. Leaves were first inspected for the necessary telial columns indicating imminent basidiospore production. They were kept wrapped in wet paper towels stored in a portable cooler until used.

Two separate inoculation runs were executed. These two runs provide a comparison between chamber performance (relative humidity and temperature), spore production, and spore germination. The first run took place within a greenhouse where a plastic (pvc piping) frame formed an inoculation chamber (Figure 1). The frame held removable trays of metal mesh for positioning *Ribes* leaves about 11 inches above the seedlings. To promote a target relative humidity of 100%, a garden

soaker hose was fastened around the top perimeter of the frame. This saturated the overlapping burlap and cotton sheets that were draped all around the frame. A removable clear plastic sheet covered the top. Temperature settings aimed for 60-68 deg F.

The second run was conducted in the newly remodeled growth chamber room. Entomologist, Ward Strong installed a stand-alone commercial heater/cooler. Two portable household cool mist humidifiers were also employed. A wooden table with metal mesh surface held *Ribes* leaves 11 inches above seedlings. Burlap sheets were fastened around the sides of the frame to baffle air currents created by the small fan-driven humidifiers and heater/cooler. We used portable temperature/relative humidity probes to monitor and record chamber conditions during the duration of the trial runs. All seedlings were sprayed with a hand-sprayer to moisten foliage just prior to introducing leaves. Care was taken to successfully avoid large water droplets forming on the foliage – which could hamper spore-to-needle contact.

Results

Run 1: Greenhouse Chamber (Aug 27-29)

The currant leaves were collected Aug 23 at Skimikin. Telia had been observed as early as Aug 8 (V. Berger, communication). Seedlings were placed in the chamber at 3pm on Aug. 26. Depending on which temp/RH instrument we read, the chamber reached 100% RH at 8pm or 3:30am (Figure 2). There were rainstorms around 6pm. The currant leaves were placed on the wire racks at 4pm (Aug. 27). Relative humidity was about 97% at 5pm. We observed a sheen of moisture on the upper surfaces of currant leaves during the entire night indicating very high humidity. The first spores were detected at about 10:30pm, however, the target spore load was not detected on any slides until 3am (Aug 28). At this time, only the north side of the chamber reached the target, while the south side achieved 500-1,500 spores/cm^2. Thus, at 3am, the *Ribes* trays were removed from the north half of the seedling table and were placed on top of the south half. Interestingly, our monitoring indicated that the south half did not achieve more than 800-1,500 spores/cm^2 by 4pm (24 hours after introduction).

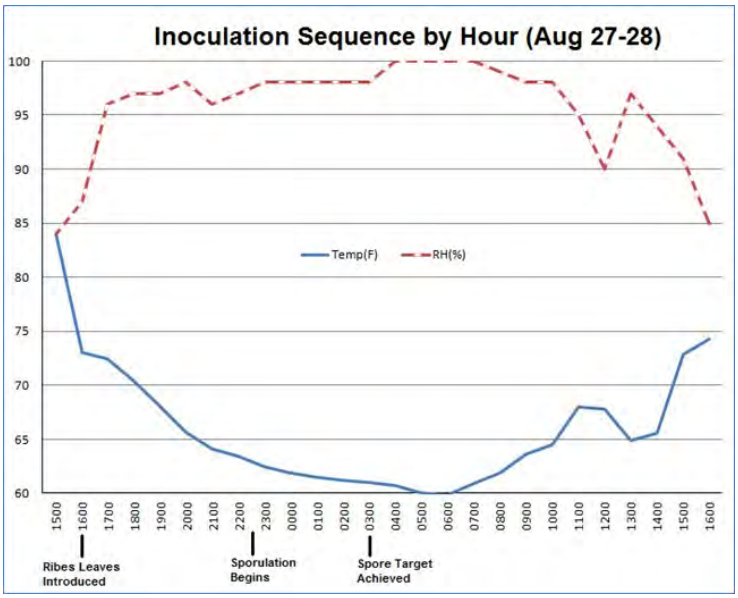

Figure 2. Environmental conditions within the greenhouse chamber.

After the leaves were removed, RH ranged in the high 90s%. At 5pm, the spore germination rate was about 50%. By 8am the next day (Aug 29), germination was 84%. After 48 hours, the seedling trays were returned to long-term storage in a larger greenhouse and placed in the same exact orientation as used in the greenhouse chamber.

During the inoculation, weather was unseasonably cool and cloudy which provided conducive environmental conditions for sporulation. If outside temperatures & RH were more disparate from our target values, it may have been too much of a challenge to maintain optimal values within the greenhouse.

Run 2: Interior Room Chamber (Aug 29-30)

Because we had used nearly all the collected Ribes leaves for the Greenhouse run, a new collection was performed by Vicky and Nick on Aug 28 at Skimikin. The telia were darker and browner than those collected for the greenhouse inoculation on Aug 20. This typically indicates advanced age and lower ability for spore production. There had been brief rain showers for the past several days in the Skimikin area.

There was no spore drop during the first 24 hours. Thus, this run failed to inoculate the seedlings. A separate subsample of currant leaves was monitored in another location within the room. We determined that only leaves which had been collected the previous week (Aug 20) produced basidiospores (10-15 spores/mm^2). However, these did not germinate although the chamber was kept at about 20.5deg / 100% RH. Perhaps these leaves were too old.

Summary and Conclusions

A successful inoculation run was achieved in the greenhouse chamber meeting the target spore load of

approximately 3,000 spores/cm^2, although about half of the chamber may have reached only 800-1,500 spores/cm^2. The separate run which was conducted in the chamber room did not sporulate indicating that the telia were post-mature. Although this run failed, we found that the temp/RH was easier to control in the room versus the greenhouse. Thus, future runs should occur in the chamber room. Inoculation runs of 30 additional families plus establishment of corresponding field trials are scheduled for 2014 at KFC. This work would not have been possible without the generous cross-border technical assistance of USFS staff (Joan Dunlap, Angelia Kegley, John Gleason, Richard Sniezko, Det Vogler, and Paul Zambino), cone collectors (Adrian Leslie, Don Pigott, and Randy Moody), Rich Hunt, and the Columbia Basin Trust.

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Danchok, R.; Sharpe, J.; Bates, K.; Fitzgerald, K.; Kegley, A.; Long, S.; Sniezko, R.; Danielson, J.; and R. Spence. 2004. Operational manual for white pine blister rust inoculation at Dorena Genetic Resource Center. Unpublished report. USDA Forest Service. 31 p.

Sniezko, R.A.; Mahalovich, M.F.; Schoettle, A.W.; and D.R. Vogler. 2011. Past and Current Investigations of the Genetic Resistance to Cronartium ribicola in High-elevation Five-needle Pines. In: Keane, Robert E.; Tomback, Diana F.; Murray, Michael P.; and Smith, Cyndi M., eds. 2011. The future of high-elevation, five-needle white pines in Western North America: Proceedings of the High Five Symposium. 28-30 June 2010; Missoula, MT. Proceedings RMRS-P-63. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 246-264. Online at http://www.fs.fed.us/rm/pubs/rmrs_p063.html. ■

"High Five" Pines Restoration Website

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Whitebark pine (*Pinus albicaulis*), an ecologically important high elevation species, is declining throughout most of its range. Scientists and managers began to implement experimental restoration projects and devise longer term restoration strategies in the late 1990s. A general assessment of the condition of whitebark pine, authorized by Forest Health Protection, USDA Forest Service, found this critical species to be declining dramatically within many regions (Schwandt, J. S. 2006. Whitebark pine in peril. USDA Forest Service, R1-06-28). At this time, the WPEF had begun a dialogue with the Washington Office of the Forest Service, urging funding for whitebark pine restoration. Recognizing the urgency and scale of decline, FHP Director Robert Mangold created the FHP Whitebark Pine Restoration Program in 2006, with John Schwandt as the FHP National Program Coordinator.

The Whitebark Pine Restoration Program promotes all phases of restoration from development of strategic restoration plans to gene conservation, health monitoring and surveys, silvicultural treatments and planting, as well as educational and public outreach programs. The great success of this program has been largely due to the tremendous support by a wide array of cooperators and partners that have more than doubled the FHP funding levels. These include state and private agencies, foundations, and universities as well as over 30 National Forests across 5 Regions, and 10 national parks.

About 180 projects were funded since 2006, representing more than $2 million in restoration support with a cumulative value of over $5 million, but their outcomes were far from accessible to the general public. As a result, in July 2012 the USDA Forest Service signed a partnership agreement with the Whitebark Pine Ecosystem Foundation to develop a website containing all the information related to the FHP Whitebark Pine Restoration Program. The aim of the website is, first, to provide key information related to these restoration projects. With additional funding, the WPEF hopes to grow the website to include information related to all high elevation five needle white pine species ("High Five") restoration studies, no matter the funding source. The *High Five Restoration Redux* website will serve as scientific and educational resource for managers, restoration practitioners, researchers, media, policy makers, environmental groups, and the public interested in supporting High Five restoration. The website will be hosted on the Whitebark Pine Ecosystem Foundation Website www.whitebarkfound.org, and linked to the Region I and Washington Office FHP website. We hope to "go live" with the website sometime during summer 2014.

Examples of the standard set of categories of information that each project will have on the website:

- *Project*
- *Agency/forest or park/ district*
- *Project coordinator*
- *Contact*
- *Cooperators*
- *Source of funding /amount*
  FHP:
  Supplemental funding:
- *Dates of restoration efforts*
- *Objectives*
- *Acres/ha treated*
- *Methods*
- *Planting? If so, source of seedlings? Resistance?*
- *Outcome*
- *Monitoring since completion of the project Dates*
- *Plans for future monitoring?*
- *Will outcome meet goals?*
- *Future actions/follow up?*
- *Miscellaneous comments*

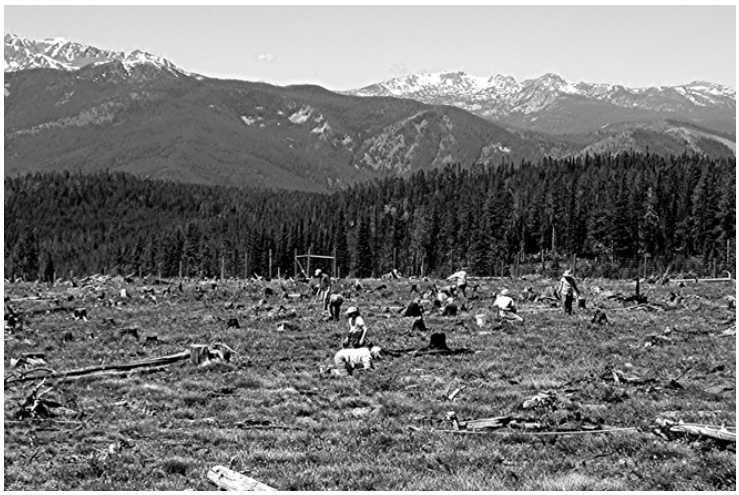
We began developing the database in April 2013 by compiling information on the restoration projects funded by the FHP Whitebark Pine Restoration Fund, and also incorporated projects on the list compiled by Steve Shelly, in the Regional Office, Region 1. However, many National Forests, Parks, and BLM lands across the West have funded restoration projects from agency funds and other sources. Thus, it will take some time and effort to locate all relevant information. **You can help**! Please contact me if your agency has a completed restoration project that was not funded by FHP. ■

Whitebark Seed Orchard on the Gallatin National Forest

Keith Konen, Silviculturist,
Gallatin National Forest, Bozeman, MT

On a ridge at 8,400 feet elevation with a stunning view of the Spanish Peaks, 240 whitebark pine (*Pinus albicaulis*) grafts await their first Montana winter. On June 27 and 28, 2013, a group of Gallatin National Forest employees, Forest Service retirees, and volunteers planted the first whitebark pine trees at the Little Bear Whitebark Pine Seed Orchard.

The seed orchard is located an hour and a half south of Bozeman, and encompasses an area of nearly seven acres. This is an intensely managed area with a comprehensive management plan and infrastructure which includes an eight foot tall wildlife fence, access roads, and an irrigation system. Trees are planted at specified locations on a 20 foot by 20 foot surveyed grid. When planting is completed the orchard will house approximately 1,000 whitebark pine trees.



This seed orchard was designed and developed to help implement the whitebark pine tree improvement program for the Greater Yellowstone Grand Teton (GYGT) whitebark pine seed zone by providing a reliable source of white pine blister rust (*Cronartium ribicola*) resistant whitebark pine seed. The GYGT seed zone includes Yellowstone and Grand Teton National Parks and all or portions of the Custer, Gallatin, Beaverhead-Deerlodge, Shoshone, Caribou-Targhee, and Bridger-Teton National Forests.

Mature whitebark pine trees that phenotypically exhibit resistance to blister rust have been identified throughout the seed zone during the past 20 years. Seeds were collected from these trees, and seedlings were screened for rust resistance. Analysis of this screening identified which trees would be included in the seed orchard. Root stock was grown from selected resistant seed and 80+ year old scion (branch tips from the upper portion of mature trees) was then grafted to the young root stock. This process allows individual grafts in the orchard to produce cones and seed in a much shorter timeframe.

The orchard will also support the *Whitebark Pine Strategy for the Greater Yellowstone Area,* prepared by the Greater Yellowstone Coordinating Committee's Whitebark Pine Subcommittee in 2011

(available at http://www.fedgycc.org/WhitebarkPineOverview.htm). This document recognizes the benefits of blister rust resistant seed and the logistical challenges of whitebark pine cone collections, thus identifying the seed orchard as a critical restoration tool.

The goal of the seed orchard is to produce seed for restoration planting within the next 10-15 years. The design is consistent with agency seed procurement plans and intended to produce approximately 100 pounds of seed per year. This seed will assist with a target annual whitebark pine planting program of 900-950 acres within the seed zone. Following their first growing season in the orchard surveys indicated that the trees planted this spring are healthy and survival is over 98%. The second phase of planting is planned for the orchard in 2014, moving one step closer to restoration of whitebark pine in the Greater Yellowstone Ecosystem. ■

A Study of Thinning to Favor Whitebark Pine

Colin T. Maher, PhD Student, University of Montana

Silvicultural restoration treatments, such as competition-removal, intend to release whitebark pine trees from encroachment by shade-tolerant species. However, these treatments are often not monitored. As a result, the efficacy and effects of this type of treatment are unknown. As part of my dissertation research on whitebark pine ecology and restoration, I lead the implementation of a study to assess the effects of whitebark pine silvicultural restoration treatments at five sites in Oregon, Idaho, and Montana. This study is funded by a McIntire-Stennis Cooperative Forestry Research Grant and is a collaboration with Drs. Cara Nelson, Andrew Larson, and Anna Sala at the University of Montana and with forest managers from the Boise, Umatilla, and Helena National Forests.

My specific research questions are:

1) What are the effects of thinning treatments on rates of tree-ring growth in whitebark pine trees?
2) What effect do restoration treatments have on rates of natural regeneration in whitebark pine and other species? and 3) what are the effects of thinning treatments on rates of mortality, frequency or severity of beetle attacks, and incidence of white pine blister rust in whitebark pine?

To answer these questions, I used a sampling method based on Keane and Parsons (2010). At each site, I sampled 10 plots each within treatments and in untreated areas, or "controls." I chose control plots that were as nearby and similar in slope and aspect to the treatment areas as possible. However, because controls plots may be different ecologically (for example, in snow accumulation, previous stand condition, etc.), differences in some of the variables of interest between treatment and control plots can't be fully attributed to the restoration activity. Nevertheless, the results generated from my study will be informative, as there is currently little information on the efficacy or effects of competition removal treatments in whitebark pine stands. In order to contribute to knowledge on treatment effects as soon as possible, my first goal is to provide a report to managers on the short-term outcomes of the five restoration treatments I studied. I expect to reach this goal and submit this work for publication by late 2014.

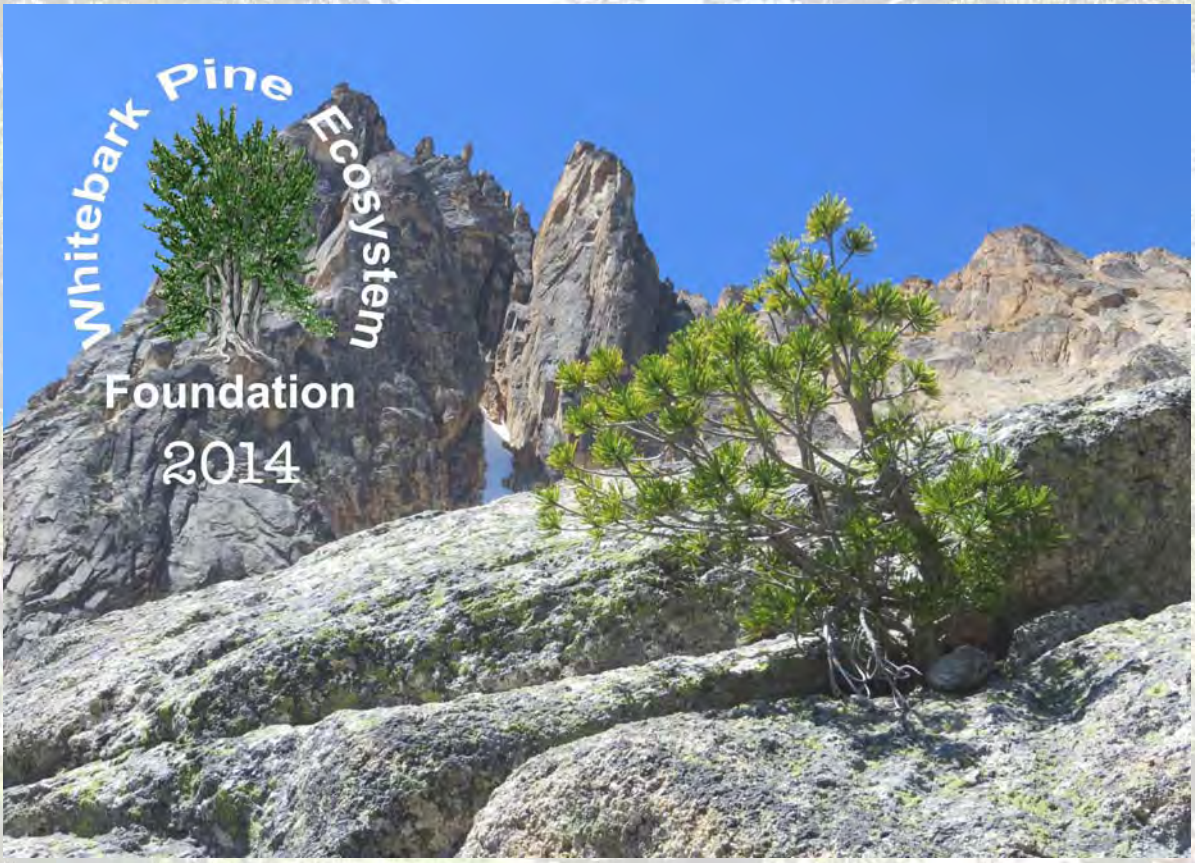
References:

Keane, R. E., & Parsons, R. (2010). Restoring Whitebark Pine Forests of the Northern Rocky Mountains, USA. Ecological Restoration, 28(1), 56–70. ■

CAPTION: Spiral grain is common in whitebark and other "high-five" pines. Here two foxtail pine snags spiral in opposite directions. (Photo by S. Arno)

Clark's Nutcracker in Western White Pine, Washington Cascades, photo by Ellen Stepniewski

Felt board used in whitebark pine education program. (see page 9)



2014 Whitebark pine calendar on sale (details on page 9)