Issue No. 34: Spring 2018

nutcracker notes

JOURNAL OF THE WHITEBARK PINE ECOSYSTEM FOUNDATION

Limber Pine Monitoring along Montana's Rocky Mountain Front

By Dave Hanna, The Nature Conservancy

On the Rocky Mountain Front along the eastern edge of the Crown of the Continent, limber pine occurs from lower to upper treeline. At lower treeline, along the ecotone with the grasslands of the Great Plains, these limber pine forests occur along the ecological margin, in a mixed grassland, savanna, and woodland matrix.

The limber pine trees at the grassland ecotone are also cultural features on the landscape. Many of the individual limber pines are centuries old, and were shaped by native peoples managing fire and buffalo. These forests are also important for an array of wildlife, including wintering elk and deer, grizzly bears, cavity nesting birds and, of course, Clark's nutcrackers.

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OUR MISSION The Whitebark Pine Ecosystem Foundation is a science-based nonprofit organization dedicated to counteracting the decline of whitebark pine and enhancing knowledge of its ecosystems.

WHITEBARK PINE ECOSYSTEM FOUNDATION

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WHITEBARK PINE FOREVER
Restoration Fund Campaign

How can you help? Donate now to fund restoration projects such as:

- Plant whitebark pine seedlings
- Collect whitebark pine cones for future seedlings
- Grow blister rust resistant trees in whitebark pine seed orchards
- Protect high value whitebark pine trees from bark beetle attacks
- Remove other trees from growing whitebark pine

Go to our website whitebarkfound.org and donate NOW to Whitebark Pine Forever.

WPEF Interim Director's Message

By the time you read this many of you will be gearing up for your field seasons. Wildfires played havoc with many projects last summer, and impacted many whitebark pine restoration efforts, although it opened up opportunities in other areas. What will summer 2018 bring?

Some of you may also be collecting additional field data to feed into the National Whitebark Pine Restoration Plan. This is a major initiative that the WPEF is involved in, and you can read more in the article by Diana Tomback, our Policy and Outreach Coordinator.

The WPEF board of directors (BOD) would like to extend its gratitude to Bryan Donner, who has stepped down as Membership and Outreach Coordinator. Bryan was a founding member of WPEF and had served the membership since the beginning. But Michael Murray has returned to the fold, and after serving the maximum nine years as a general board member Michael has taken on the Membership and Outreach Coordinator position.

In December we welcomed Dr. Kathy Tonnessen to our board of directors. Kathy was a senior scientist for the National Park Service for much of her career. As the leader of the Rocky Mountain Cooperative Ecosystem Studies Unit at the University of Montana, she coordinated research, education and technical assistance for the Rocky Mountain parks, through partnerships with federal and state agencies and a consortium of Universities and non-profit research groups.

As a member of our Development Committee, Rob Mangold is keen to approach some appropriate corporations for donations, particularly to help defray our administrative costs. While we have had some success in attracting donations for restoration activities, it has been harder to keep enough funds

Cyndi Smith

coming in to defray the costs of the work we do. If you can suggest any companies (large or small) that you think might be a good fit with the WPEF, please contact our Executive Assistant, Julee Shamhart julee.shamhart@whitebarkfound.org, with your ideas.

I look forward to seeing everyone at the fall science meeting and field trip in Stanley, Idaho. Have a great summer.

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the direct benefits to whitebark pine.

Current restoration efforts should be continued, as they will be vital to the long-term survival of whitebark pine.

Acknowledgments

We thank the field crew Sarah Flanary, Brian Izbicki, Chris Stalling, Lindsay Grayson, Finn Leary and Michael Reitz for all of their diligent data collection and editing, as well as all current or former employees of the USDA Forest Service, Rocky Mountain Research Station Fire Sciences Lab who assisted with suggestions on improvements to methods and data analysis. We also thank the USDA Forest Service, Rocky Mountain Research Station Fire Sciences Lab for funding and logistical support, and finally the University of Montana for general project support

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WPEF Canada Director's Message

Despite the longer than normal winter we have been getting in Canada, it seems that whitebark pine recovery has become a hot item and we are finally seeing progress in planning and implementation; the 2018 field season may see more recovery work conducted than any other year to-date.

In late January, I was fortunate enough to attend Parks Canada's open standards for conservation planning workshop in Banff.
Over the course of a week the group was able to discuss the range of threats, the urgency in various regions, and the development of results chains and recovery objectives. All results were tied directly to the proposed federal Recovery Strategy, it was nice to see higher level planning taken to the next stage. Further outcomes from the workshop resulted in Parks Canada developing working relationships with other parties to develop some strategic alliances in whitebark pine recovery work.

In addition to planning work, several new players have entered the whitebark pine planting arena, which may see far more hectarage planted. I will be meeting with American Forests in early April to discuss seedling purchase commitment; to compliment this, Canfor, the largest licensee in BC, has agreed to plant all whitebark pine seedlings provided to them. A win-win scenario – If only there were more seedlings available. In late April I will be making a presentation to the Canada West Ski Areas Association AGM in Lake Louise. All ski resorts in western Canada will be in attendance at this meeting and it will be a great venue to discuss whitebark issues and the Foundation's Ski Area Certification program. This is a group we have been trying to reach out to for several years so it's great to finally be accepted to present at this event.

There has been some rumbling about hosting

Randy Moody
www.whitebarkpine.ca

a small meeting in Revelstoke to engage Mountain Caribou biologists and discuss recovery opportunities and conflicts. Watch for this potential meeting in the coming months. Many reports from 2017 have indicated that 2018 will be a solid cone crop across much of the Canadian range, so hopefully this snow will melt soon (we got 25 cm on April 2) and we can get out to implementing whitebark pine recovery across the Canadian range.

National Restoration Plan: Whitebark Pine Data Request

By Gregg DeNitto

Development of a national plan for the restoration of whitebark pine in the U.S. was identified as a priority need at the recent national whitebark pine summit. The identification of priority core areas in need of restoration is a key outcome of the National Whitebark Pine Restration Plan (See Diana Tomback's article on page 12). Identification of priority core areas will focus limited resources to meet restoration needs. In order to identify these areas, spatial data on whitebark pine is needed for an accurate assessment. Much of this data has been compiled, but we are aware that there is additional data that exists with individual agencies, organizations, and researchers.

An effort by Rocky Mountain Research Station is underway to collect any and all data on whitebark pine in the U.S. to add to existing datasets. This includes data on distribution, condition, regeneration, wildlife, or any other aspect that includes whitebark pine information. Any data that concerns whitebark pine is being requested. Examples include stand inventories, research plots, or other field studies. The complete dataset will be integrated into a Decision Support System to assist with development of the final restoration plan.

If you have any data that includes whitebark pine that you can contribute, please contact Chris Stalling or Dr. Bob Keane at RMRS (contact information below). They can provide information on how to compile and submit the data. They also know what data they currently have to avoid duplication. Data submissions are needed by *****.
Dr. Bob Keane, 406- 329-4846, rkeane@fs.fed.us
Christine Stalling, 406-829-7386, cstalling@fs.fed.us

A separate but comparable effort on data collection is underway for the other high elevation five needle pines in the U.S. (foxtail, Great Basin bristlecone, limber, Rocky Mountain bristlecone, southwestern white). This effort is designed to compile data on these species to develop a single database on these species that are at risk to white pine blister rust and other damage agents. This effort is an outgrowth and expansion of the original USFS Forest Health Protection Whitebark-Limber Pine Information System (WLIS). The data from this effort will be available to anyone interested in further analysis and will provide baseline data on the condition of these species.

Variables in this dataset are the same as those being developed for whitebark pine above to ensure compatibility. If you have any data on these 5 species that you can contribute, please contact Gregg DeNitto (contact information below). There isn't a deadline on receipt of these data, but if you can provide data this year it would be appreciated. Dr. Gregg DeNitto, 406-880-1812, gdenitto@fs.fed.us

Please share these requests with others who may be working on any of these 5-needle pine species. All contributions are welcomed and will be credited appropriately. Thanks for your support!

***LIMBER** continued from front*

While the old-growth limber pines along the Rocky Mountain Front are mostly intact, some stands have changed over the last century, most notably from the lack of frequent fire which historically maintained open savanna conditions. Many limber pine stands now appear to be overstocked, which likely creates competition stress, that then increases vulnerability to drought and stand-replacement fires.

In some places managers can reintroduce fire or conduct mechanical treatments for stand restoration, but there are numerous factors also affecting these stands – white pine blister rust (WPBR), mountain pine beetle, and other insects and pathogens. And given that these low elevation stands occur along the ecological edge for limber pine, they are likely more susceptible to drought and climate change impacts interacting with insects and pathogens.

Anecdotally, there appears to be a lot of variability in how all these factors interact with limber pine across the landscape – resulting in stands with lots of mortality to stands with very little mortality. So a critical step for making sure we get management right is to gain a better understanding of what's going on at the landscape scale, and how these stands are responding to the various stresses, including climate change and drought.

Figure 1. Installing and monitoring plots on the Rocky Mountain Front in 2017.

The Montana Department of Natural Resources and Conservation, USDA Forest Service, and The Nature Conservancy have partnered to characterize the condition of low elevation limber pine on the Rocky Mountain Front south of Birch Creek. Montana Fish Wildlife and Parks, USDI Bureau of Land Management, and numerous private landowners have also allowed access to enable sampling across the landscape.

We identified limber pine-dominated stands with aerial imagery and generated random plot locations using Region One Plot Locator (ROPL) software. We chose to focus our sampling effort approximately within the Sun River, Teton River, and Dupuyer Creek watersheds. In this area a total of 105 potential plot locations were identified using a combination of aerial imagery

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Whitebark Pine Growth & Climate in the Rocky Mountains

Sarah Flanary [1], *, David Affleck [2], Edwin Burke [2], Ray Callaway [2], and Robert Keane [1]
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2 University of Montana, W. A. Franke College of Forestry and Conservation, 32 Campus Drive, Missoula, MT, 59808
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Introduction

Alongside fluctuating precipitation and temperatures in the form of climate change, whitebark pine (*Pinus albicaulis*) has seen a territory wide decline in population. While the most direct influences on whitebark pine health and mortality are mountain pine beetle (*Dendroctonus ponderosae*) outbreaks, fire exclusion policies, and the spread of white pine blister rust (*Cronartium ribicola*), climate change impacts the intervals and severity of such outbreaks, and may affect the growth and health of whitebark pine directly.

The objective of this study was to use tree-ring analysis and statistics to determine the current relationship between whitebark pine growth and climate throughout a range of healthy stands in the United States Rocky Mountains, as well as to produce data to help with future predictions of habitat and success.

Methods

92 tenth-acre sites were selected within whitebark pines Northern U.S. Rocky Mountain habitat range and site, stand, vegetation, and fuel data gathered at each, as well as cores from mature trees, saplings, and seedlings if available (Figure 1).

Stands were chosen for vigor and lacked a history of disturbance such as beetle attacks, white pine blister rust presence, fire, or thinning. PRISM monthly climate variable data for maximum temperature, minimum temperature, and precipitation was downloaded for each of the sites for the past 100 years (Daly 2004).

Using the site data gathered, mortality and regeneration were examined, although the results may only pertain to non-disturbed stands.

The cores from each site were mounted and sanded using standard dendrochronological techniques, and crossdating and ring-width growth measurements performed using the CooRecorder and CDendro packages from Cybis (Larsson 2014). As many areas sampled did not have master chronologies available, individual site chronologies were developed instead. Individual tree ring width data were de-trended using a modified negative exponential curve and the chronologies built using Tukey's robust mean.

The ring-width index (RWI) chronologies were then correlated with monthly climate variables from prior year June to current year

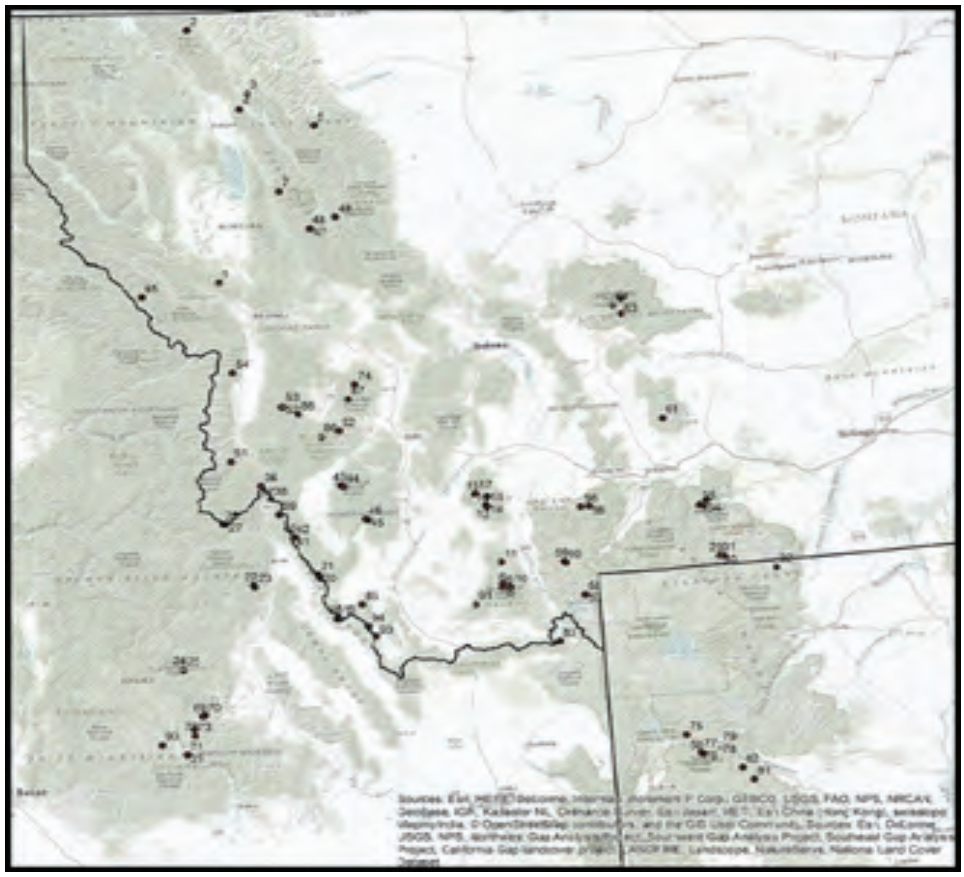

Figure 1. Map locations of sites sampled.

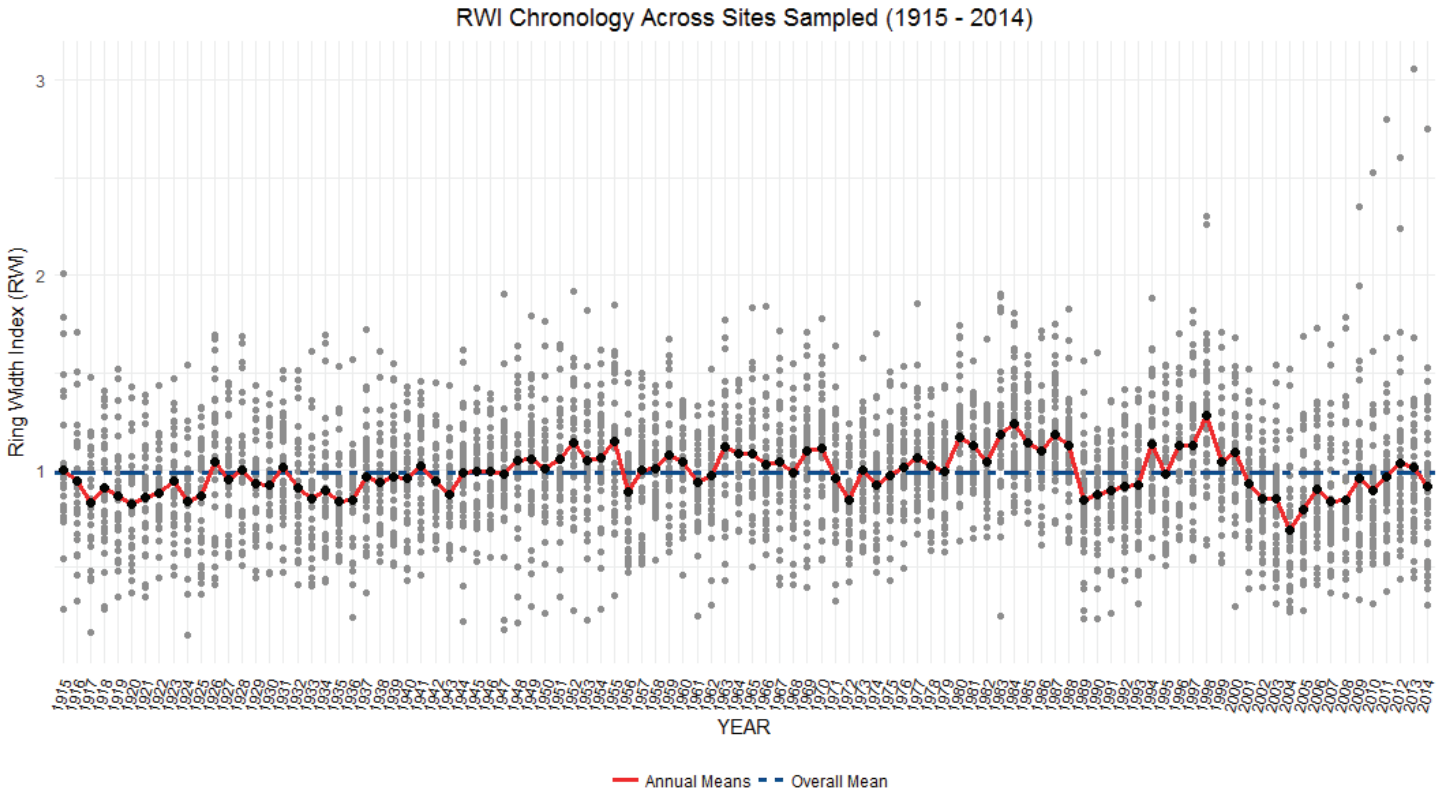

Figure 2: Plot showing a ring-width index (RWI) chronology. The connected points shows the annual mean RWI value from all sites included

September using the R-packages treeclim and dplR (Bunn 2010, Team 2015, Zang and Biondi 2015).

Results

Regionwide, mortality percentages on the sites sampled were found to be significantly different between whitebark and other conifer species when split into decay classes (p-value < 1.471e-08).

Among the 230 snags sampled over the region, 134 were whitebark. 51% of the sampled whitebark snags were visually assessed as being dead more recently, falling within the decay classes of 1 and 2, compared to 88% of the other conifer species measured on the plots falling within those same decay class.

While snags were not cored to assess date of death, as neither insect nor disease outbreaks were visually present, death is assumed to be related to an isolated stem attack or an unmeasured variable, such as climate change.

Looking at regeneration within the sampled sites, given the breadth of the region sampled and the variance among stand characteristics, proportional data was used in the analysis. Overall, whitebark made up the majority proportionally of the mature tree presence on the sites, but subalpine fir (*Abies lasiocarpa*) made up the proportional majority of the seedlings on almost all non-grass undergrowth dominant sites.

Plotted establishment dates for the whitebark seedlings and saplings did not indicate a drop off in dates established among the sites in which whitebark seedlings were captured in the sampling methods, although only 46 of the 92 plots had whitebark seedlings data recorded, compared to 45 sites with subalpine fir seedling presence.

The combined RWI data, when plotted, did not show a great decrease in growth among sampled sites, as is a concern with climate change predictions and resulting drought stress.

While there was a period beginning in 1998 where growth steadily declined, in the most recent decade the sampled whitebark showed increasing growth and at the end of the sampled period had a similar growth rate to early in the century for many of the sites (Figure 2).

When climate data was plotted and fitted with a Lowess smoothing line, the PRISM data showed an increase of about 5 °F for both annual minimum and annual maximum temperature over the past 100 years among the sites sampled. With the increasing temperature data, annual precipitation amounts have been declining for the past 30 years (Figure 3).

Ring-width growth was most often significantly correlated with current and prior year July climate variables, as well as February and March. When examined, these monthly minimum temperatures have increased on a similar scale as the annual values, from 4-7 °F for each site.

Maximum temperatures saw less of an increase in the summer months over the 100 years examined, although spring month temperatures increased around 5 °F each. Future climate predictions for the Rocky Mountains show a future of increasing temperatures and decreasing precipitation amounts.

GROWTH continued on page 14

Early signs of success: Growth response of whitebark pine (*Pinus albicaulis Engelm*) regeneration to thinning and prescribed burn treatments

By Molly McClintock Retzlaff[1] , Robert E. Keane[1], David L. Affleck[2], and Sharon M. Hood[1]

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Whitebark pine (*Pinus albicaulis*) plays a prominent role throughout high elevation ecosystems of the northern Rocky Mountains. It is an important food source for many birds and mammals as well as essential to watershed stabilization. Whitebark pine forests are currently experiencing a severe decline across most of their range in western North American due to the interactions of an invasive fungal pathogen, native bark beetles, and successional replacement by more shade-tolerant species due to fire exclusion.

The combination of these three factors, white pine blister rust, mountain pine beetle, and fire exclusion, have contributed to a nearly range-wide decline in whitebark pine populations; as a result, it was recently listed as both a candidate species under the United States Endangered Species Act (Service 2011) and an endangered species in Canada under the Species at Risk Act (Canada 2012).

In this study, we examined the effectiveness of restoration treatments by measuring the diameter growth of whitebark pine regeneration in stands that were treated using a combination of silvicultural cuttings and prescribed burning. We evaluated growth release primarily as a relative increase in annual radial growth before and after the release treatments of the combination of selective thinning and prescribed burns conducted on the study sites.

We selected four sites in the Northern U.S. Rocky Mountains (Bear Overlook, Beaver Ridge, Coyote Meadows, and Snow Bowl) which were part of the Keane and Parsons (2010) long-term monitoring study examining whitebark pine restoration through selective thinning and prescribed burnings (Figure 1). The four sites were treated in 1999-2001. Details of the pre- and post-treatment conditions, and the implementation of the treatments are documented in Keane and Parsons (2010). Each site was composed of a number of units, and each unit was thinned, burned, received a mix of both treatments, or was left untreated as a control.

To evaluate the efficacy of the Keane and Parsons (2010) treatments for improving tree vigor, we randomly located plots within the treatment units (control, prescribed burn, thinning, and both). Then one to four sample trees were selected from the 11.4 meter radius plot. We collected site characteristics from the plot and cored each sample tree at breast height. If the trees were too small to be cored then the tree was cut down at the base and sections were removed.

Cores and tree sections were sanded with a belt sander and hand-polished with 9 micron grit sandpaper, then scanned using an Epson platform scanner at 1200 dpi. Cores were crossdated and annual radial growth measured using CooRecorder 7.8 (Cybis Elektronik & Data AB) . We verified dating using CDendro (Cybis

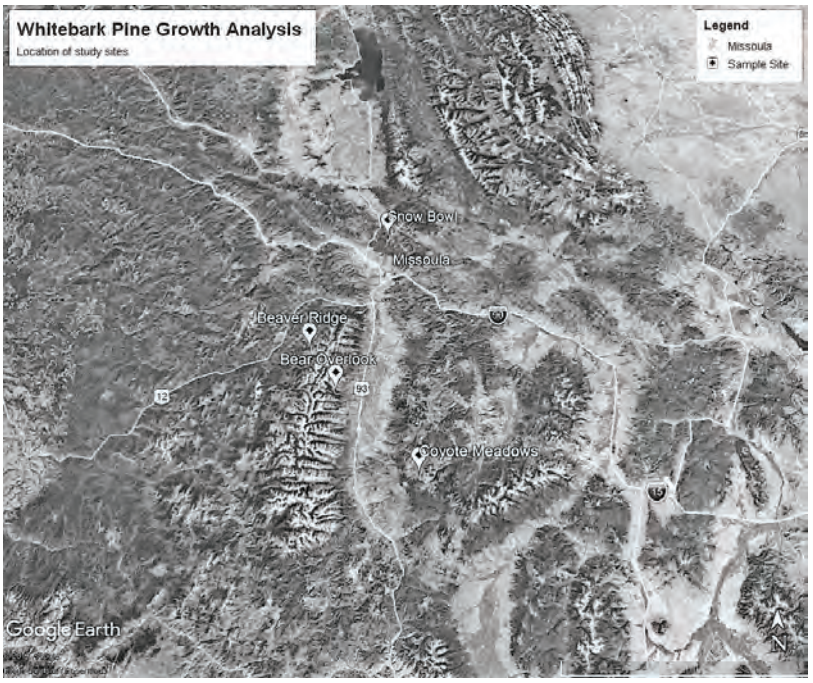

Figure 1: Location of the four sample sites (image generated in Google Earth Pro 2017)

Elektronik & Data AB) and create a chronology for each site (site specific series intercorrelation = 0.35-0.4; mean sensitivity =0.3).

We used the dplR package (Bunn 2008) in RStudio (RStudio 3.3.2 Team 2016) to determine cross-sectional area increments (BAI; mm^2 yr^{-1}) at the base of each tree (not breast-height) from the year of sampling back to the year of germination.

We then used BAI measurements to calculate growth ratios (GR), relating growth post-treatment to growth pre-treatment. GRs greater than 1 translate to an increase in growth after treatment, and GRs less than one correspond to a decrease in growth. GR was calculated by dividing the post-treatment 10-year BAI by the 10-year pre-treatment BAI.

We used an analysis of covariance (ANCOVA) to explore factors that might influence radial growth response (RStudio 3.3.2 Team 2016). Specifically, GR was linearly related to the independent variables site (a factor variable differentiating study sites), treatment, tree age at time of treatment, tree basal diameter at the time of treatment, elevation, tree vigor at the time of sampling, and plot basal area at the time of sampling. Included in the ANCOVA model were the interactions of site with tree age, elevation, tree vigor, plot basal area at time of sampling, tree basal diameter at time of treatment, and treatment.

The importance of these factors and interactions were assessed at a significance level of 0.05. Two-sample t-tests were conducted to evaluate differences between the average GRs of trees in the control areas and the trees in the treated areas. The data were checked for possible outliers using both Tukey's Range test and an analysis of the standard deviations around the mean (Tukey 1977)

Results

In total we sampled 93 trees with DBH < 23 cm from the control and treatment units of four sites in Idaho and Montana that received release treatments between 1999 and 2001.

Trees sampled from treated units ranged in age from 17 years old to 201 years old, with an average age of 65 years. Trees sampled from the control units ranged in age from 24 years old to 269 years old with an average age of 81 years. Coyote Meadows had the youngest sampled trees with a mean age of 56 years old, while the trees at Snow Bowl were on average the oldest with a mean age of 108 years old.

The species composition of the four sites was dominated by subalpine fir and whitebark pine (in that order) on the control plots, and by whitebark pine, subalpine fir, and lodgepole pine in the treated units.

The average annual BAI (mm^2 yr^{-1}) for whitebark pine trees varied by site and treatment (Table 1). At Bear Overlook, the average BAI, before treatment, in the control was 232.43 mm^2 yr^{-1}, and the average BAI of the thinned and burned unit was 204.05 mm^2 yr^{-1}. After the treatment, the average BAI of the control unit

Table 1: Site, treatment, sample size, mean BAI (basal area increment; (mm^2 yr^{-1}) before and after treatment, mean growth ratio (GR), and standard error in parenthesis. ** = statistically significant difference at $p < 0.05$, GR greater than 1 indicates and increase in growth after treatment. GR less than 1 indicates a decrease in growth after treatment.

Site	Treatment	n	pre-BAI (mm^2yr^{-1})	post-BAI (mm^2yr^{-1})	Mean GR
Bear Overlook	Control	10	232.43	209.98	1.09 (0.17)
	Thin- Burn	10	204.05	277.07	2.34** (0.51)
Beaver Ridge	Control	12	984.78	939.86	1.59 (0.22)
	Burn	8	335.28	627.25	2.49 (0.62)
Coyote Meadows	Control	12	574.32	648.53	1.44 (0.14)
	Burn	8	123.38	225.84	2.67 (0.49)
	Thin- Burn	11	903.58	1232.97	2.25** (0.29)
Snowbowl	Control	13	676.78	519.90	0.99 (0.16)
	Thin	9	545.64	520.22	1.04 (0.15)
All Sites	Control	13	617.08	579.58	1.28 (0.17)
	Thin	9	545.64	520.22	1.04 (0.15)
	Burn	8	229.33	426.55	2.58 (0.55)
	Thin-Burn	21	553.82	1086.42	2.30** (0.40)

decreased to 209.98 mm² yr-1, but the average BAI of the thinned and burned unit more than doubled to 277.07 mm² yr-1 (Table 1).

The pattern was the same at Beaver Ridge where the average BAI decreased in control units and increased in the treated units. The average BAI increased in all units at Coyote Meadows, though the increases were proportionally greater in the treated units. Conversely, average BAI declined in all unit at Snowbowl, though the decline was proportionally greater in the control unit (Table 1).

GRs varied greatly among trees and this variation could only be partially explained from measured tree, plot, and site factors (overall model goodness of $R^2 = 0.53$). Some of the variability in GR was attributable to treatment: in particular, linear modeling results showed that sample trees in treatment units had higher GRs than those in control units ($p = 0.0009$).

Within a site, the mean GR was greater (105%-215%) for all of the treated units than the control units. Site-level t-tests indicated that units which were thinned and later burned (Coyote Meadows and Bear Overlook) had a significantly higher GR than controls ($p = 0.05$). The other burn-only unit, at Beaver Ridge, showed an increase in GR of 2.49 versus 1.59 in the control unit.

Yet owing to the small sample size and the high variability of growth rates between trees, the difference between the treated and control means was not statistically significant. The thinned unit at Snowbowl showed almost no difference in GR between the treated unit and the control unit (Table 1).

In addition to treatment effects, tree age negatively impacted GR, albeit in a manner that varied by site (Figure 2). In contrast, the aggregate basal area of the sample tree plots as measured in 2016-2017 did not affect GR ($p=0.76$). This may be because the plots were too large to capture neighborhood tree competition, or because aggregate basal areas were affected by multiple factors between 2000 and 2016-2017.

Similarly, plot elevation did not appear to influence GR, possibly due to the small differences in elevation between plots within sites (variation among sites is absorbed by the site factor variable). Vigor class of the sample trees – as measured in 2016-2017 – also did not contribute to GR.

The vigor classifications used in this study were modified from a crown ratio classification system used for ponderosa pine (Pinus ponderosa Lawson and C. Lawson) and may not have been sufficient for accurately classifying whitebark pine. Alternatively, the vigor observed in 2016-2017 may not represent the status and dynamics of tree vigor prior to and within 10 years of treatment.

Summary

Whitebark pine is widespread in the high-elevation ecosystems of western North America. Its loss could have cascading impacts on many other species and lead to landscape-level changes. The results from this study show that whitebark pine regeneration can respond to release treatments intended to restore whitebark pine vigor, resilience, and cone crops.

Younger trees showed higher GR than older trees, and most trees in thin-burn and burn only units had higher GRs than trees in thin-only or control units. Not all treatments were implemented on all sites and trees at some sites responded better to treatments. There is much debate about how whitebark pine will respond to modified wildfire regimes, mountain pine beetle outbreaks, and blister rust attacks as climates change.

It is, however, widely agreed upon that restoration will be key to this species' survival. Climate change will likely become more challenging for managers as they make decisions about allocating resources and limited funding.

Collaboration between researchers, modelers, and managers will be essential to ensure the best decisions are made using recent, relevant research that will maximize

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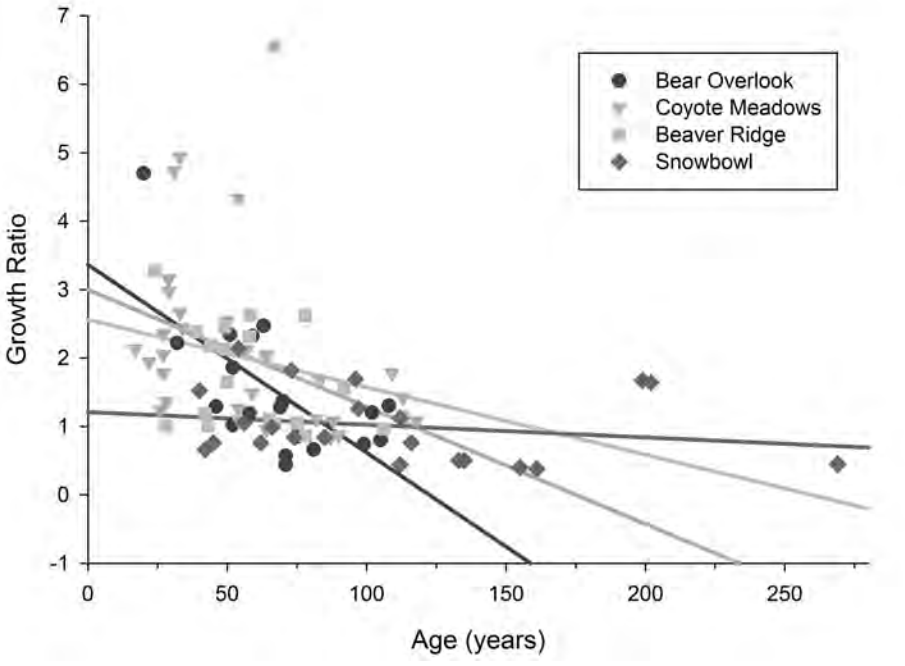
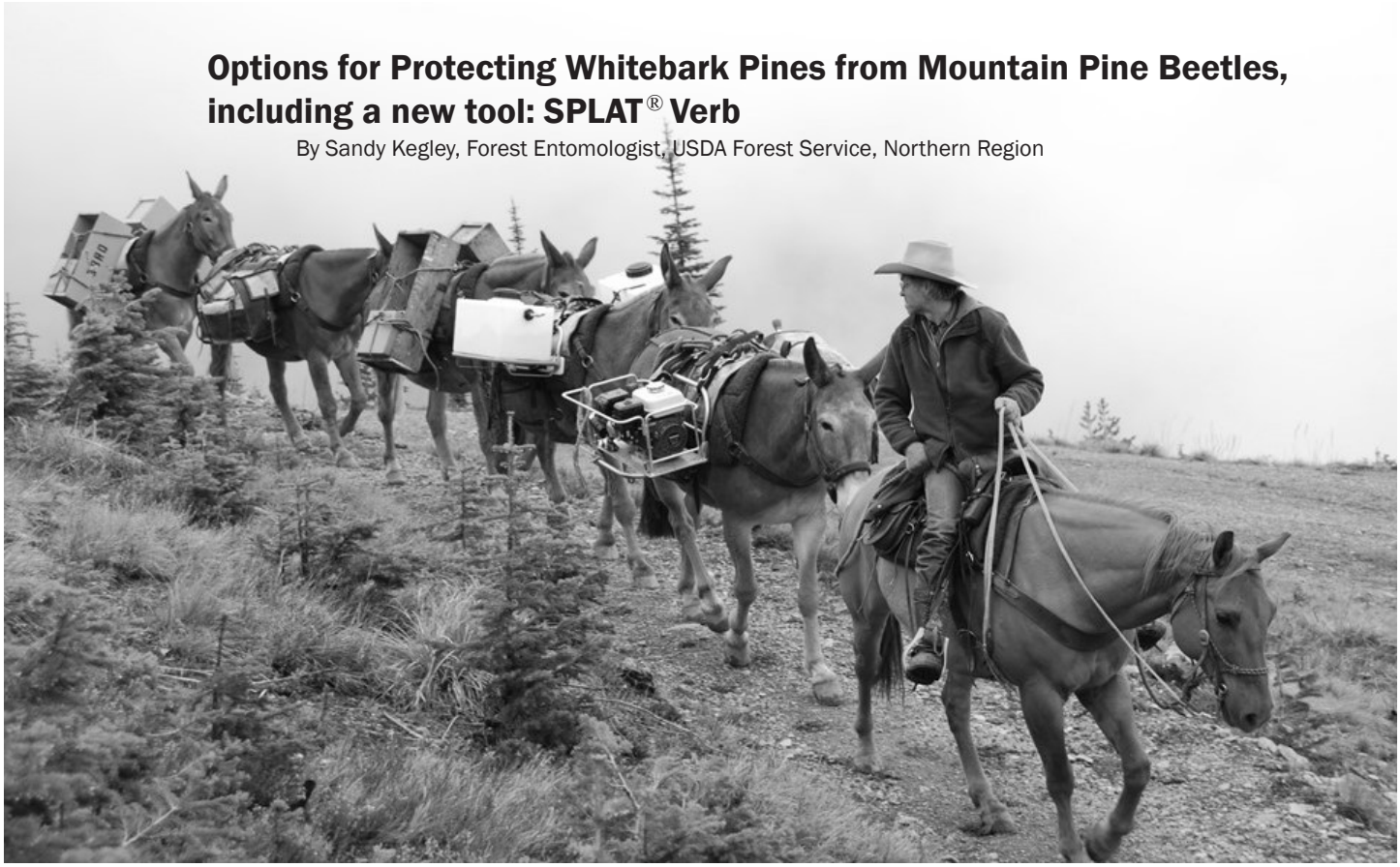
Figure 2: Relationship between growth ratio and tree age by site (CM: Coyote Meadows; SB: Snowbowl; BO: Bear Overlook; BR: Beaver Ridge).



Options for Protecting Whitebark Pines from Mountain Pine Beetles, including a new tool: SPLAT® Verb

By Sandy Kegley, Forest Entomologist, USDA Forest Service, Northern Region



Mule pack train carrying spray equipment and insecticides to a high elevation whitebark pine site. Photo by Melissa Jenkins (Figure 4)

Mountain pine beetles are one of the major threats to whitebark pine and kill numerous mature cone-bearing trees throughout whitebark pine's range each year. Tree mortality from the beetles affects many resources and key benefits that whitebark pine provides. For restoration efforts, it is critical to protect blister rust-resistant plus trees and elite trees from mountain pine beetles when there is a risk of beetle attack. Mountain pine beetles must mass attack a tree in order to overcome the tree's defenses. They coordinate tree colonization and regulate their density by communicating with pheromones. Mountain pine beetles naturally produce an anti-aggregation pheromone, verbenone, to disperse adult beetles away from a fully colonized tree.

Many formulations and dosages of verbenone have been tested to protect pine trees from mountain pine beetles. Preventive insecticide treatments have also been used to protect pine trees. The purpose of this article is to describe current management tools for short-term tree protection from mountain pine beetles.

Anti-aggregation pheromone formulations

Verbenone has been synthesized and available for many years in slow-release pouches that can be stapled to trees (see Using Verbenone to Protect Trees from Mountain Pine Beetle). The standard recommendation is to apply 2 pouches per tree on the north side of the trunk, as high as can be reached (figure 1). Verbenone has also been formulated in small inert polymeric flakes that can be aerially applied to pine forests by small aircraft (Gillette et al. 2012), and would be most economical for remote areas.

More recently, verbenone has been formulated in a wax emulsion matrix that is applied with a caulking gun (SPLAT® Verb, iscatech.com). SPLAT® Verb showed efficacy in protecting lodgepole pine, ponderosa pine, and sugar pine from mountain pine beetles (Fettig et al. 2016). SPLAT® Verb is applied to tree bark in dollops from a calibrated caulking gun on four different sides of trees, as high as can be reached (figure 2). In 2015-16, we tested SPLAT® Verb on individual whitebark pine trees in Montana, and one acre whitebark pine blocks in Oregon and California (Progar et al. 2017). For the individual tree test, we tested 5g, 7g, and 14g of verbenone in SPLAT dollops, along with the standard two 7g pouches per tree and control trees with no verbenone.

To ensure beetle pressure, all trees in the test were baited with an attractant pheromone. Results were positive—all verbenone treated whitebark pines were protected from mountain pine beetle mass attack and over 90% of control trees died from mountain pine beetle attacks during two years of testing. The only attacks that occurred on treated trees were pitched out (unsuccessful) (figure 3). For the one acre blocks, verbenone pouches and SPLAT® Verb were applied to different blocks at a rate of 40 pouches or dollops/acre (about 99 pouches or dollops/ha). Unfortunately, low beetle populations at those locations prevented treatment effects in the block areas.

Either verbenone pouches or SPLAT® Verb can be used to protect individual or small

areas of pine trees when there is mountain pine beetle activity threatening an area. Advantages of SPLAT® Verb are that it is cryptic and biodegradable. A disadvantage is that it is easily rubbed off of treated plus trees by tree climbers caging and collecting cones. Cost of each formulation is comparable (Table 1). Costs are often less expensive in bulk orders.

Verbenone does not always protect all treated trees or areas, particularly when mountain pine beetle populations are extremely high. Preventive insecticides, such as carbaryl or synthetic pyrethroids (permethrin and bifenthrin), can be 100% effective in protecting individual trees from mountain pine beetle when properly applied to the bole (see Using Insecticides to Protect Individual Conifers from Bark Beetle Attack in the West at https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5295376.pdf). Carbaryl can protect trees for two years. Synthetic pyrethroids protect trees for one year. Spray equipment, including a pump and insecticides, have been taken to high elevation sites on horse/mule pack trains to spray high-value whitebark pine (figure 4) (Windell & Jenkins 2014).

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Progar, R.; Fettig, C.; Kegley, S.; Steed, B.; Cluck, D.; Snyder, C.; Munson, S.; Spiegel, L.

SPLAT continued on page 13

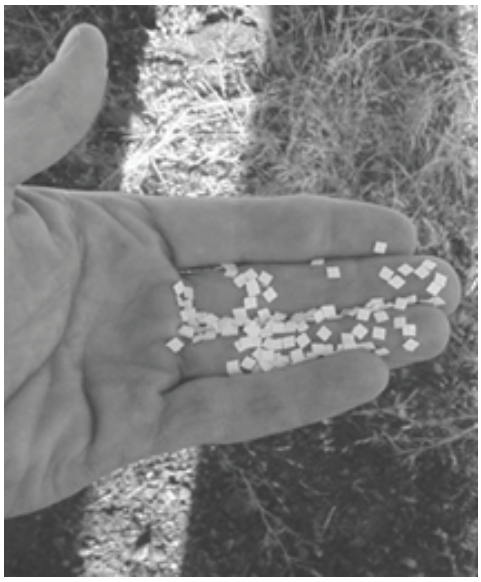


Figure 1. Left: verbenone pouches on whitebark pine trunk; Right: verbenone formulated into flakes that can be applied by aircraft to remote areas.

Figure 2. Left: SPLAT® Verb applied to whitebark pine with a caulking gun; Right: dollops of SPLAT® Verb shown on 2 sides of the tree (arrows), two other dollops not visible.

Table 1. Cost of verbenone pouches and SPLAT R Verb for individual and bulk orders.

	Price on website	**2016 Northern Region Forest Service Bulk Order**
Verbenone Pouch	$8.85 each or $17.70/tree	$3.39 each or $6.78/tree
SPLAT® Verb	$120/tube or $12/tree	$69/tube or $6.90/tree
SPLAT® calibrated caulking gun	$29.90 each	$29.90 each

Progress report: National Whitebark Pine Restoration Plan (NWPRP)

Diana F. Tomback - Policy and Outreach Coordinator, WPEF Spring 2018

In the Fall 2017 issue, I reported on the background, goals, and first steps in the development of the National Whitebark Pine Restoration Plan—an inter-agency collaboration led by the Washington Office of the Forest Service in partnership with the Whitebark Pine Ecosystem Foundation and American Forests.

The report covered the steps through the National Whitebark Pine Summit, held November 7-9, 2017, in Missoula, MT. We are at the beginning of the data acquisition stage of the process, and according to the timeframe recommended by agency points of contact, anticipate the draft plan now sometime during the summer of 2020. The components of the draft restoration plan are depicted in Fig. 1, and the steps in the process, which have been further developed, are depicted in Fig. 2.

Since the November Summit, the leaders of the effort, Dr. David Gwaze—National Silviculturist for the U.S. Forest Service; Eric Sprague—Director of Forest Conservation, American Forests; and I have had a number of planning conference calls, several held with Bob Keane, technical expert from the Rocky Mountain Research Station, and Julee Shamhart, Executive Assistant of the WPEF. The following is a summary of activities and steps in the process (Fig. 2) accomplished in 2018 to date:

January 30. US Forest Service Washington Office-based conference call with agency "points of contact" (or liaisons). Leslie Weldon, Deputy Chief of the National Forest System, introduced the call and reiterated her support for the restoration plan. The key issues discussed included core area identification and criteria, details of the data call, and data call.

F**ebruary 14. Dissemination of coarse-scale whitebark pine spatial data layers to agency liaisons, compiled and organized for us by Bob Keane and his staff at the Missoula Fire Sciences Lab.** The attachments included: the National Whitebark Pine Restoration Spatial Archive, Geospatial data inventor, Layer library references_NWPRP, and layer library GIS NWPRP.

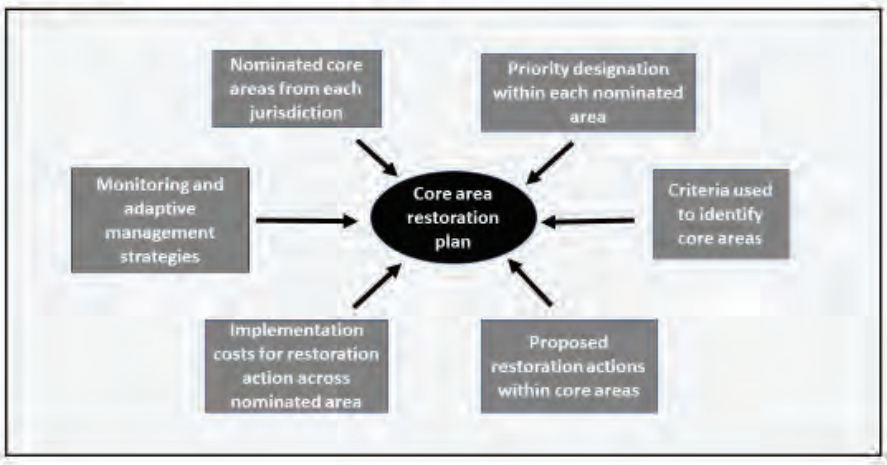
March 2. Conference call with U.S. Fish and Wildlife Services (F&WS), Cheyenne Office with US F&WS regional participation. The primary reason for this call was to answer questions concerning timeframe of the status review, whether information could inform Data Call 2 and the writing of the restoration plan, and to organize data sharing.

With regard to the latter point, we had hoped that the final NWPRP would include information required for the F&WS recovery plan, but recovery planning specifics are in flux at F&WS, and timing may not work. We are expecting the draft F&WS Whitebark Pine Species Assessment Plan to be available for review at any time.

March 19. The Data Call 1 letter was emailed on this day to all liaisons except Forest Service points of contact. A separate email will be sent to Forest Service liaisons in mid-April, allowing us time to obtain Forest Service distributional data previously sent to F&WS. Target deadline for Data Call 1: May 15, 2018.

In preparation for this data call, instructions for submitting data, a WPEF web page, and Forest Service t-drive were prepared by Julee Shamhart, Bob Keane and his staff. The information requested by this data call

Fig. 1. Components of plan

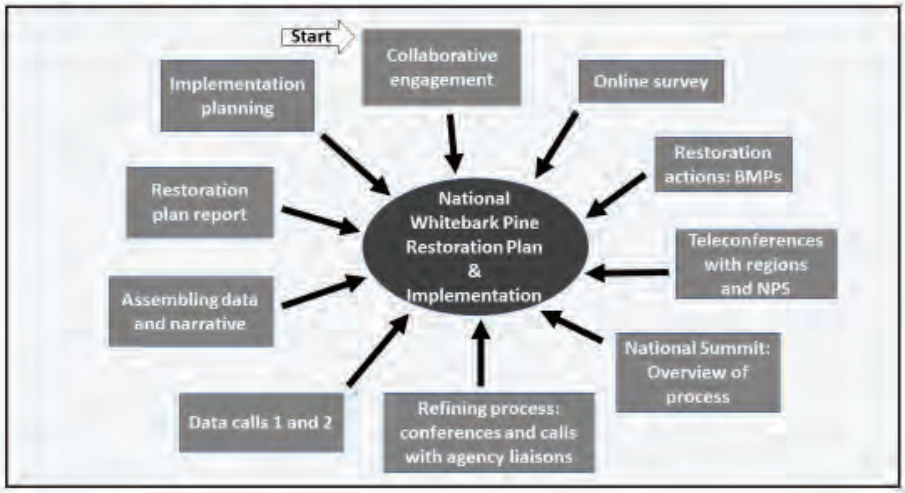


included spatial layers as GEOTIFF or zipped shapefiles and plot-based data information submitted through the Hi5DB, now administered by Bob through the USFS Rocky Mountain Research Station.

Data Call 2 will request the fundamental information required for development of the NWPRP (Fig. 1). Prior to this Data Call 2, we anticipate that there will be a series of Washington-level inter-agency meetings, two liaison conference calls, and presentations to leadership. These events and outreach efforts are to be tentatively scheduled for the week of May 14, 2018, including a webinar presentation at DOI on the NWPRP. During the week of the 14th, we will work out in detail the information requested in Data Call 2, with input from liaison points of contact, the Forest Service, and other agencies.

The information requested may be determined in part by the draft Whitebark Pine Species Status Assessment expected from F&WS at any time. We anticipate that Data Call 2 will occur sometime in late spring or early summer, 2018, with a target deadline of late spring of 2019. For additional information, please email me at Diana.Tomback@whitebarkfound.org

Fig. 2. Steps in process



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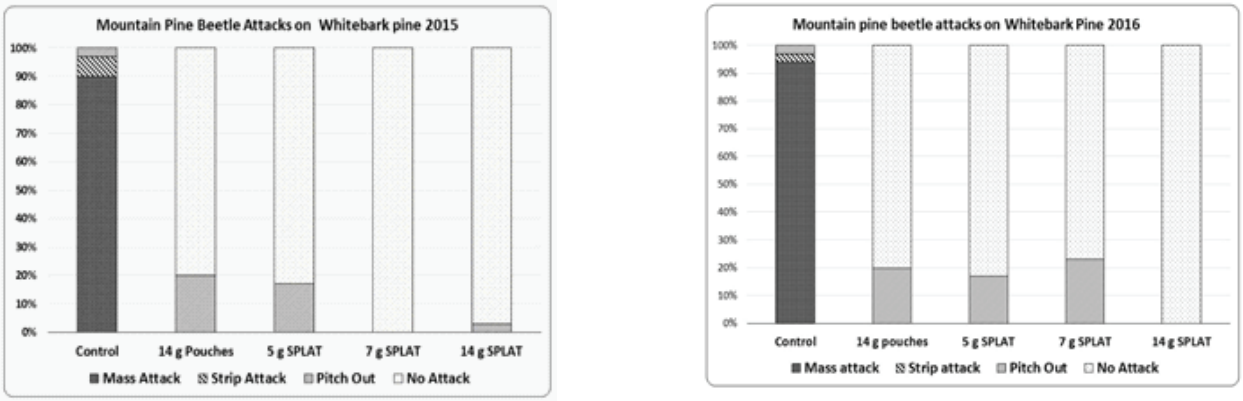

Figure 3. Graphs showing two years of testing verbenone pouches and different doses of SPLAT® Verb on individual whitebark pine trees in Montana. The only attacks on verbenone treated trees were pitch outs (unsuccessful attacks), while control trees experienced >90% mass attacks.

2017. Protecting Whitebark Pine from Mountain Pine Beetles with SPLAT® Verb. STDP project R1-2015-01. Poster presented at Whitebark Pine Ecosystem Foundation Science Workshop, Whitefish, MT 2016 and Western Forest Insect Work Conference, Denver, CO 2018.

Windell, K.; Jenkins, M. 2014. Backcountry high-pressure sprayer system. USDA Forest Service, Missoula Technology and Development Center Tech. Rep. 1424-2821-MTDC, Missoula, MT. 30 p. Currently available online within the Forest Service at http://fsweb.mtdc.wo.fs.fed.us/php/library_card.php?p_num=1424%202821

GROWTH continued from page 6

Results from the climate data and growth correlations would lead to predictions of decreased growth, however, whitebark pine seems to be continuing to grow at similar rates as in the past.

This may be the result of increasing growing degree days, allowing the drought tolerant whitebark to practice their adaptive ability and begin growing earlier in the spring.

Summary

While whitebark pine continues to decline throughout it's range from the combined effects of mountain pine beetle attacks, white pine blister rust, and fire exclusion policies, the data from this study does allow for a potential future for whitebark in the changing climate conditions in stands that may be more beetle or rust resistant.

In sites that have a current population of healthy whitebark pine, they are continuing to establish in the area alongside the prevalent subalpine fir, despite the Clarks nutcracker preferring to stash in areas that have seen disturbance.

While seedlings and sapling data were not captured in every stand sampled due to the minimized sampling area, there were visual identification of their presence in almost all areas sampled.

Whitebark pine in these non-blister or beetle impacted stands are still displaying lower mortality rates than other conifer species, even others are also adapted to the higher elevation and drier sites such as subalpine fir.

Within these non-disturbed stands, despite the increasing threat of drought stress from lessening precipitation and increasing temperature, whitebark pine are continuing to grow at similar rates as the past 100 years on a range of spatially distinct sites.

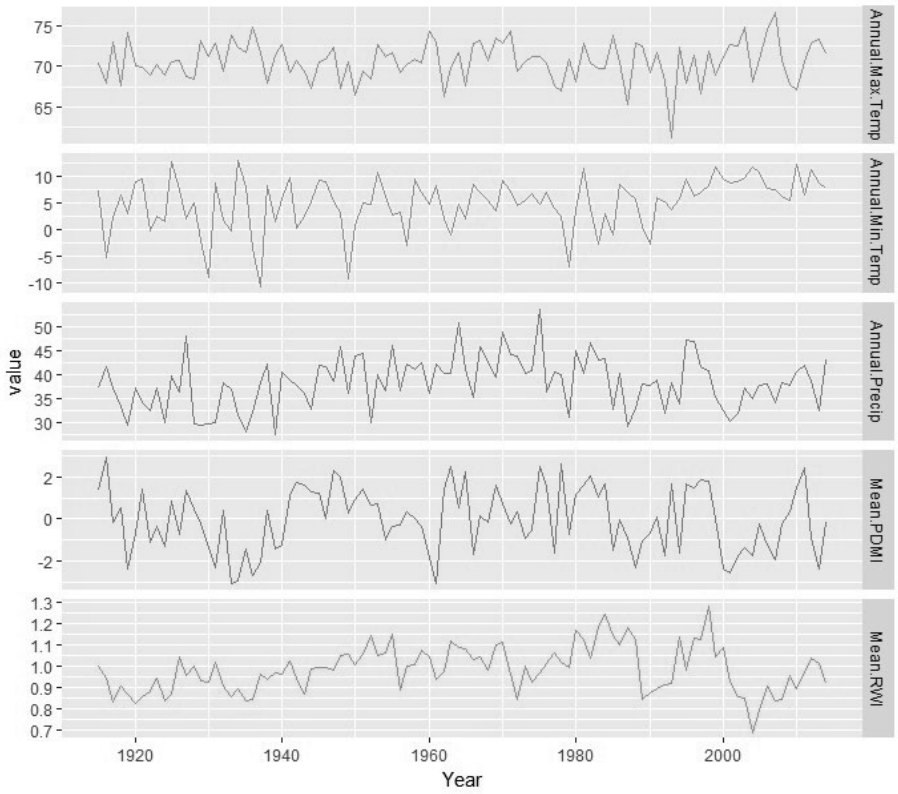

Figure 3: Plot showing, from the top, averaged values for yearly maximum temperature (°F), yearly minimum temperature (°F), total yearly precipitation (inches), mean Palmer Modified Drought Index value, and the mean ring-width index from the cores and sites sampled.

The results from this study suggest that further north may not be the only place to focus re-establishment efforts through planting and management; but that there is an opportunity for whitebark pine to continue to have a presence in their historic range as well.

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STUDENT RESEARCH GRANT

WPEF student research grant awarded for 2018

A call for proposals for the annual WPEF student research grant was released in the Spring/Summer issue of Nutcracker Notes, and online. The proposals were reviewed by former board members Bryan Donner and Edie Dooley, Nutcracker Notes editor and interim associate director Bob Keane, and interim director Cyndi Smith. MICHAEL HOWE, a PhD student in the Department of Entomology at University of Wisconsin-Madison, was chosen as the grant recipient for 2018. His supervisor is Dr. Kenneth Raffa. Following is a description of Michael's project:

Is whitebark pine more amenable to mountain pine beetle attack behavior than historical hosts?

Whitebark pine faces numerous biotic and abiotic threats including blister rust, Cronartium ribicola (Tomback & Achuff 2010), mountain pine beetle (*Dendroctonus ponderosae*: MPB) (Logan et al. 2010), and warming temperatures that exacerbate MPB outbreaks (Raffa et al. 2008, Bentz et al. 2010).

Warming temperatures increase beetle overwintering survival, hasten development, and increase transpiration stress, thus reducing tree defenses (Raffa et al. 2015). By the end of this century, almost all whitebark pine habitat in the Greater Yellowstone Ecosystem will be thermally suitable for MPB during most years (Buotte et al. 2016).

Mountain pine beetle is an eruptive insect that causes landscape scale mortality events that are increasing in severity and frequency (Hicke et al. 2006). Beetles engage in pheromone mediated mass attacks (Blomquist et al. 2010) that exhaust tree defenses (Raffa et al. 2014).

During outbreaks, beetles can overcome the defenses of most trees, but at the lower population densities at which beetles usually occur, tree defenses are an important constraint on beetle colonization and development (Raffa et al. 2008, Boone et al. 2011, Burke & Carroll 2017). Conifers defend themselves against beetle attacks with integrated constitutive and induced defenses that exert both chemical and physical barriers.

Differences in defense chemistry between lodgepole (Pinus contorta) and whitebark pines have recently revealed important clues into the relative susceptibility of historically exposed versus less exposed trees (Raffa et al. 2013, Bentz et al. 2015, Raffa et al. 2017). These differences in tree chemistry are manifested by varying MPB behaviors. For example, MPB attacks lodgepole pine at higher rates, but the percent of attacks that succeed is higher in whitebark pine (Bentz et al. 2015).

In cut bolts, MPB successfully attacks lodgepole pine at higher rates, but gallery density is higher in whitebark pine (Esch et al. 2016). Predators of MPB are equally likely to land on unattacked whitebark and lodgepole pines, but are more attracted to lodgepole pines undergoing attack (Raffa et al. 2013). Similarly, populations of predators are relatively higher in lodgepole than whitebark pine habitat (Krause et al 2017).

Objectives

We will examine whether whitebark and lodgepole pines differ in the ease with which low-density mountain pine beetle populations can successfully elicit aggregation.

Specifically: 1) What signals indicative of MPB attack do trees use to induce anti-aggregants, precursors, and synergists, and in what tissues? 2) Does the number of pioneer beetles needed to elicit arrival by flying beetles differ between lodgepole and whitebark pines? 3) Do properties associated with tree defenses such as resin flow, resin canals, and phloem chemistry differ between lodgepole and whitebark pines?

Methods

Obj. 1: We will induce defenses of lodgepole pine and whitebark pine by simulated attack, using a cork borer, fungal (using MPB's primary associate Grossmania clavigera) inoculation, or simulated attack and addition of trans-verbenol and exo-brevicomin packets. Phloem and foliage tissues will be sampled before application of treatment attack and 21 days post treatment (Mason et al. 2017) using an arch punch and pole pruners.

Composition and concentration of defensive compounds will be analyzed using gas chromatography (Keefover-Ring et al. 2016, Howe et al., accepted). Additionally, 30 trees will be induced with methyl jasmonate and fungi to compare local defensive response to a general tree defense signal and MPB specific signal (Burke et al. 2017).

Obj. 2: We will attach 5 different doses of trans-verbenol/exo-brecomin packets to trees to simulate initial number of beetles attacking a tree and record attack density (and possibly cage trees to measure beetle emergence).
Obj. 3: Fifty trees of each species will be cored to compare resin ducts and resin will be collected to record rate of resin flow (Karsky et al. 2004).

The constitutive phloem defenses of a small subsample of these trees will be analyzed using gas chromatography to examine relationships between resinous defenses and constitutive phloem defenses.
Site location and collaborators: This work will be conducted in two locations, near Bend, OR, and Kootenai, BC. Both regions have large populations of whitebark pine, which are reproductively separated from previous work in the Greater Yellowstone

Ecosystem, and have not been previously studied. Field work will be performed in collaboration with Robbie Flowers of USDA FS in OR, and Dr. Allan Carroll, University of British Columbia.

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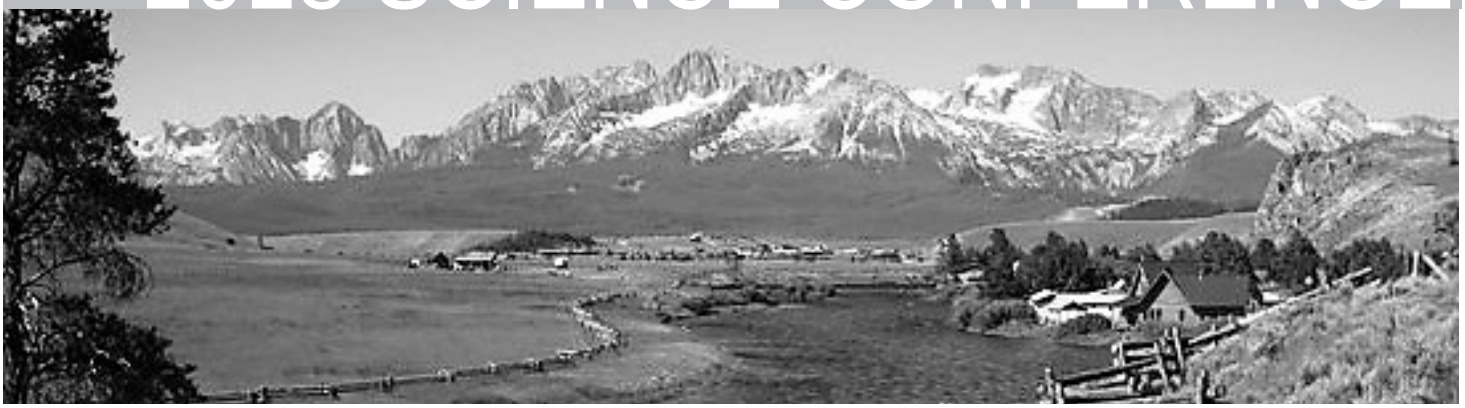
2018 SCIENCE CONFERENCE



The 2018 WPEF Annual SCIENCE CONFERENCE: Come Join Us in Stanley, Idaho

Submitted by Laura Lowrey and the Conference Planning Committee

The Whitebark Pine Ecosystem Foundation's 2018 Science & Management Meeting this September is in Stanley, Idaho, the heart of central Idaho whitebark pine. Please come join us for a great couple of days!

Stanley in the fall is an experience not to be missed, a place for extraordinary beauty and recreation in all seasons. The spectacular backdrop of the snow-tipped Sawtooth Mountain Range and the nip in the air will get your electrons vibrating to explore the mountains and rivers. Discovered by fur trappers in 1820's and named by a gold prospector, Stanley has not lost its rugged appeal and unparalleled recreation opportunities. For the intrepid explorer there are 40 peaks over 10,000 feet and over 300 high mountain lakes within the Sawtooth National Recreation area which includes the Sawtooth Wilderness and the two newest wildernesses in Idaho, the White Clouds and Hemingway-Boulders. www.stanleycc.org

The meeting will start off with indoor presentations on Thursday held in the town of Stanley at the Community Center with the theme, "Central Idaho: High, Dry and Burned". Followed up by a field trip on Friday to Cache Creek Restoration project area on the Boise National Forest accessed by an off-trail hike. During the hike, discussions will include efficacy of mechanical treatments completed prior to the back-to-back wildfires of 2016 resulting in widely different impacts to the whitebark.

Saturday's field trip will be a short morning drive to Basin Butte lookout just 10 miles north of Stanley for a spectacular view of a 2012 wildfire that severely burned whitebark pine across the Salmon River Mountains. Saturday's field trip will focus on management discussions including plus tree needs, verbenone efficacy against mountain pine beetle-caused tree mortality, and partnering across the Bitterroot Plateau seed zone.

Reminder to Reserve Accommodations as soon as possible! Stanley is becoming more popular as a vacation destination and traditional accommodations can be limited, however camping and VRBO options abound. Rooms at the Mountain Village Resort is reserved for meeting participants until August 20th, first-come, first-serve, www.mountainvillage.com. Other options can be found at, http://stanleycc.org/sleep/hotels-motels.

Stay tuned: other opportunities for a day hikes to high mountain lakes surrounded by whitebark pine will be posted on the website soon, https://www.fs.usda.gov/recarea/sawtooth/recarea/?recid=5842. Conference registration will be available online in the near future and will be limited to the first 100 people who register. Keep checking the WPEF website for accommodation links and conference updates.

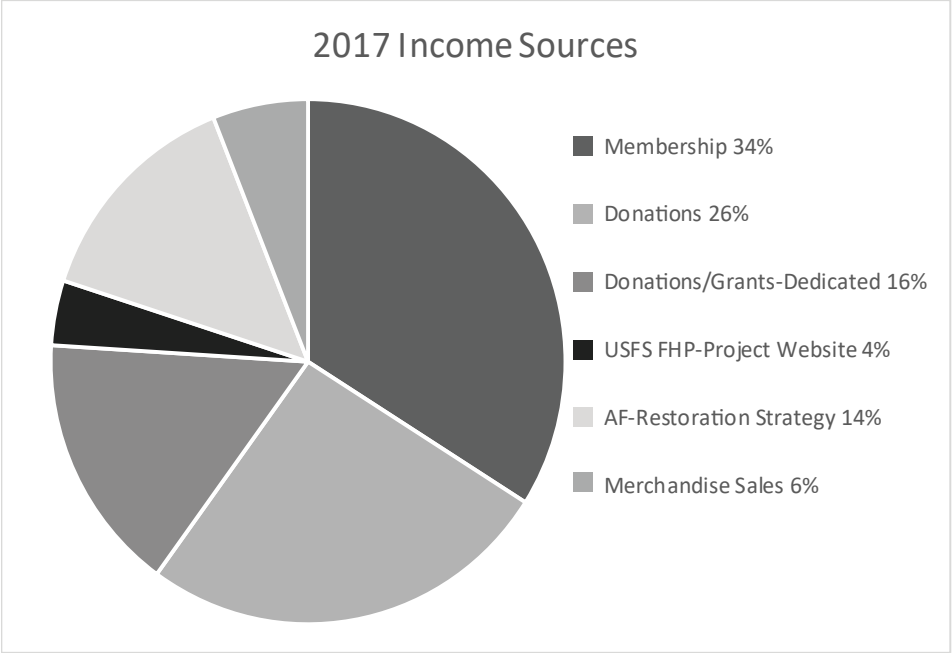
Call for Silent Auction Items: the annual tradition continues! The Silent Auction will be held Friday, September 21st at the science meeting and during the social that follows at the Mountain Village Bar/Restaurant with seating inside and a fire pit outside. Please consider donating an item in support of student research grants. For more information contact Glenda Scott (glenda.scott@whitebarkfound.org), or Liz Davy (edavy@fs.fed.us).

Call for Speakers: we will hear from a variety of speakers who have expertise in high elevation five-needle pine restoration in dry and burned areas. Expect the latest research and operational findings! If you'd like to give a presentation, please contact laurallowrey@fs.fed.us.

TREASURER'S REPORT

By Glenda Scott

The WPEF has accomplished a significant amount of work contributing to the restoration of whitebark pine and strategies in restoration, and a variety of education outlets including Nutcracker Notes, social media and conferences. It is with the donations from members and caring community that we have made the difference.



Our expenses for 2017 exceeded the income primarily because the restoration projects were funded with donations made in prior years; and American Forests had yet to reimburse the Foundation for work completed from September through December. Conversely, we had not yet been invoiced for the BLM thinning project, which now has been paid. These items have been processed providing some much-needed operating funds.

2017- Where our money came from:

- Membership dues- The largest part of our income
- Member donations- To support operations and education and specified for restoration or other specific activities.
- Foundation grants- In 2017, the Clif Family Foundation granted funds for the the citizen science project: Holding on to whitebark pine by reaching out to citizens.
- Community Fundraisers: Generous donation by Thomas Meagher Bar (Missoula) during Community Monday as well as support for our raffle; support by Montana Brewery (Missoula) for our raffle fundraising after the Summit meeting.
- WPEF merchandise sales- Cool shirts, mugs by Opportunity Resources crafters, stickers, pint glasses
- Annual meeting registration and donations- Attendee registration; Parks Canada and the WPEF-Canadian chapter donated to defray the cost of the meeting.
- Silent auction donations – Annual meeting auction items donated by members and supporters, with income from the successful bidders.
- Combined Federal Campaign- Donations made by US federal employees to support non-profit organizations.
- Idaho, Montana, Missoula GIVES campaigns- A one day of giving to support the local community.
- WBP Project website (partnership with the US Forest Service)- Comprehensive library of reports from all the WPB projects funded in part by the USFS Forest Pest Management. Accessed on the WPEF website.
- WBP National Restoration Strategy contract- Develop and implement a national whitebark pine strategy, in partnership with American Forests and US Forest Service

What we accomplished:

- Support to the Science and Management Conference- Incredible conference in Jasper, Alberta, set in the Canadian Rockies, complete with snow storms; great conference and auction with support from the town.
- Support student research- Research grant to Kiah Allen the study the level of hybridization of a non-native and native tree rust, Croanrtium x flexilii, and the relative fitness of the parental rusts onto their hosts as compared to the hybrid rust.
- Restoration projects- Grant restoration funds for planting in Glacier Park and direct seeding in isolated areas of the Millie Fire on the Custer/Gallatin National Forest. Fund tree release on the Whiskey Basin Wildlife Habitat Area, Wyoming BLM, in memory of Bob Means, WBP advocate. Work was complete in 2017, billed and paid in 2018.
- Publish two editions of Nutcracker Notes- premier publication with state of the science information of whitebark pine and other five-needle pines.
- Maintain the website for education and members services- http://whitebarkfound.org/ Leading site for information on Foundation conferences, restoration project reports, past Nutcracker Notes editions, current research and publications, inventory processes, ski area certification references.
- Initiate and co-sponsor the first phases of the National Restoration Strategy- in conjunction with American Forests and under contractual responsibility, completed the outreach to practitioners and to resource leaders to access data and develop the Strategy. Co-lead multi-day Summit with resource leaders.
- Maintain WBP restoration project website- Added project reports to the data base of restoration projects, 2007 through 2017 projects supported by the US Forest Service Forest Health Protection. Developing GIS mapping for project location.
- Supported the citizen science project: Holding

on to whitebark pine by reaching out to citizens. Provided field instruction to leaders in the Wyoming whitebark range to lead data collection on whitebark pine health and nutcracker presence.

• Outreach for WBP friendly ski area certification program- Continued engagement with ski areas for their involvement in education and conservation of whitebark pine.

Outlook: the 2018 budget projections are like 2017 with the addition of income from the National Restoration Strategy contract. The executive assistant's time will be directed to this work, relying on the volunteer efforts of the Board of Directors and Foundation members to take up some of her typical workload.

The Board has decided not to continue with the Combined Federal Campaign beyond 2018 as the associated fees do not justify our involvement. We will continue with the community GIVES campaigns, community fundraisers, business support and grant opportunities to fulfill our mission. Already, in 2018, the Community Coop in Bozeman and the Glen Mueller family in honor of Glen's 100th birthday have donated to support restoration activities. Board members met a challenge by Diane Tomback to kick off the year with a little extra cash in our treasury!

Our biggest financial challenge is to engage like-minded donors to support the work we do to suppport education, restoration, and research in whitebark pine ecosystems. We hope you, as members, will stretch your feelers to engage partners who may be able to provide in-kind services and financial support. Please refer to the following chart for finance details and direct budget questions to treasurer, Glenda Scott, glenda.scott@whitebarkfound.org or any board member.

Courtesy Ben Wilson

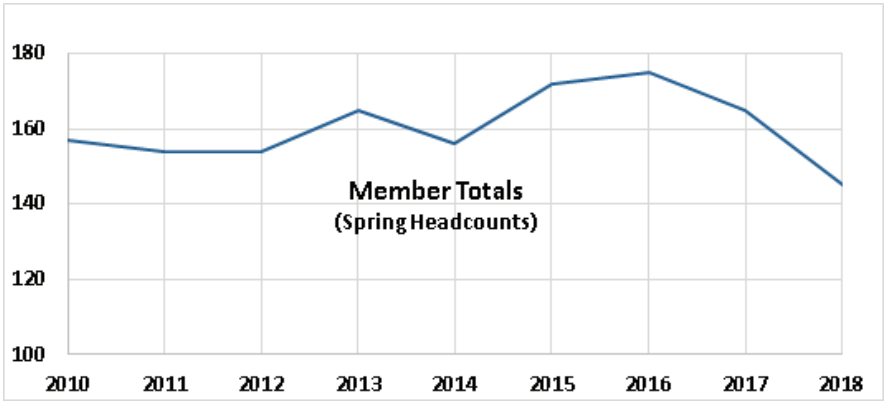
2016 yearend balance	**$33,111**
2017 yearend balance	**$8,713**
Dedicated to restoration	$1,625
Unrestricted funds	$7,088
INCOME	
Membership	**$10,910**
Donations	**$8,615**
• Individual	$3,288
• Annual Mtg Registration	$1,197
• Silent Auction	$1,051
Donations for Restoration	**$5,122**
Fundraisers	
• Community Events-	$1,720
• Combined Federal Campaign	$895
• GIVES campaigns	$463
Merchandise Sales	**$1,851**
US Forest Service- Project Website	**$1,335**
American Forests- National Restoration Strategy	**$4,454**
Other	**$16**
TOTAL INCOME 2017	**$32,302**
EXPENSES	
Operating	**$12,374**
• Supplies/subscriptions	$541
• Liability Insurance	$1,193
• Postage-Mailing	$584
• Professional fees	$300
• Bank fees	$207
• Director travel	$1,284
• Exec Asst wages	$6,612
• Taxes/Work Compt	1652
Education/Outreach	**$8,936**
• Nutcracker Notes	$2,880
• 2017Annual Meeting	$1,738
• 2018 Meeting deposit	$250
• WPEF website maintenance	$856
• Citizen Science project	$4,500
• Executive Asst	$2,708
• Taxes	$504
Ski Area Certification Program	**$267**
• Executive Asst	$225
• Taxes	$42
Fundraising/Grant Proposals	**$3,708**
• Combine Fed Campaign fee	$940
• ID Gives/MT Gives registration	$100
• Executive Asst	$2,249
• Taxes	$419
Student Research Grant	**$1,000**
Restoration Projects	**$9,277**
• Glacier NP planting	$5,000
• Custer/Gallatin NF seeding	$4,000
• Executive Asst	$234
• Taxes	$44
WBP Project website	**$1,142**
• Web related	$320
• Exec Asst	$693
• Taxes	$129
National Restoration Strategy	**$12,693**
• Operating/Insurance	$810
• WPEF website	$441
• Summit Field Trip	$410
• Travel-Director	$4,811
• Executive Asst	$5,245
• Taxes	$977
TOTAL EXPENSES 2017	**$56,701**

MEMBERSHIP REPORT

By Michael Murray

Currently, our membership total seems to be experiencing an eclipse. We have historically maintained our ranks above 150 people. However, as of April 1, 2018, our presence in numbers, has dimmed.

Total Eclipse, August 21 (Umatilla NF)



The greatest reduction seems to be displayed in our basic membership level (Whitebark). Moreover, our annual meeting (Jasper, Alberta) did not recruit as many folks as expected. Is the weak Canadian dollar (ca. 75% value of USD) a factor? Is this just a celestial anomaly?

Although the quantity of members is stalling, the incredible wealth of experiences and backgrounds we represent is stunning. We have District Rangers, Scientists, Professors, Students, Land Managers, Nature Enthusiasts, Book Authors, and more. One member was Director of Wildlife for the US Forest Service. Another retiree was Chief Botanist in Canada's federal government. Speaking for myself, I feel so fortunate to be working, and sometimes playing, alongside such an incredible array of folks.

Please share our greatness! If you're on social media, there's many ways to keep WPEF in the spotlight. For example, share posts from our Facebook Page, or submit your own links to our FB guru: julee.shamhart@whitebarkfound.org. Consider hosting an event in your town to recruit members. Write a letter to the local newspaper editor. The opportunities are out there.

A big thanks to Bryan Donner, our retiring Membership Director. Bryan is a founding member of WPEF and provided more than 16 years of service in the role! (Bryan is one of the District Rangers I mentioned earlier – awesome!).

And finally, thanks to the many renewing and NEW members! I'm always excited to see new names and faces come in the mail or at our meetings. Welcome!

Bryan Donner

LIMBER *continued from page 4*

and ROPL. Given the mix of land ownership and access issues, we estimate that approximately 90 of these plots will be accessible for sampling. In 2017 protocols were established and refined, personnel were trained in field methods, and 45 plots were installed and measured. We plan to install the remaining plots in 2018. Plots were constructed in a 200 x 50 foot rectangle and included at least 30 limber pine stems (> 4.5 ft.) which were permanently tagged and individually assessed. Assessments included diameter, condition, height, growth form, cone abundance and damage agents. Trees with WPBR were assessed for crown and stem impacts, number of live and dead cankers, and canker lengths. Three 11.8 ft.-radius vegetation survey subplots were established at equal increments along the principal transect. Regeneration (< 4.5 ft.) of all species was counted on sub- and whole-plot levels and limber pine stems were examined for WPBR.

This study will provide a baseline of current condition of limber pine in this area, and repeated sampling in the future could detect change and trend over time. Most importantly, this effort will inform management efforts to maintain this iconic part of the landscape.

Dave Hanna: dhannah@tnc.org

BOARD NEWS

Meet our board member Kathy Tonnessen

Who are you and what are your interests?
I am Kathy Tonnessen and I was elected to the Board of the Whitebark Pine Ecosystem Foundation in December 2017.

I got busy right away on the Education Committee, and have worked on two Citizen Science grant applications in the early days of 2018. I retired from the National Park Service, Rocky Mountains Cooperative Ecosystems Studies Unit, in 2014 and have been doing a lot of travelling, kayaking, hiking and cross-country skiing around western North America and Alaska.

My specialty with the NPS and with the California Air Resources Board before that was the effects of air pollution on natural resources and high-elevation lakes. I still have a fondness for the mountain lakes of the Sierra Nevada, California, where I did my Ph.D. dissertation work while at the University of California, Berkeley.

What piqued your interest in whitebark pine?
While working with the Rocky Mountain National Parks (Glacier, Yellowstone, Grand Teton, Rocky Mountain National Parks) I was educated by the park resources staff about the loss of five-needle pine due to blister rust and bark beetle (and climate change and fire exclusion).

I worked with a number of graduate students who were investigating Whitebark pine and Clark's nutcracker ecology, and I helped to sponsor the High Five Symposium in Missoula. Living in western Montana, it is hard to avoid the reality of loss of our high elevation forests, especially in Glacier National Park.

Why did you decide to be a board member?
I have attended a number of the annual technical meetings of the Whitebark Pine Ecosystem Foundation over the years, including the excellent symposium recently held in Jasper, Alberta.

The enthusiasm and dedication of the WPEF members and leadership have impressed me. As a retiree I was looking for a way to use my research administration skills to help preserve, protect and restore mountain ecosystems.

Working with the WPEF gives me that opportunity. And I get to continue to attend technical meetings in some really scenic spots in western North America.

What is a book and movie that changed your life?
While in graduate school in Berkeley I read *Ecotopia* by Ernest Callenbach, a utopian fantasy about northern California, Oregon and Washington breaking away from the rest of the United States to form a sustainable "country".

It describes how we might evolve into as "biology conscious" society. This was pretty revolutionary even for the 1970's Bay Area community.

This book, along with the dedication to energy conservation and restoration of natural ecosystems of my Energy and Resources colleagues at Berkeley (including Dr. John Holdren, former Science Advisor to President Obama), lead me into a career involved with ecosystem protection.

What place in the world would you most like to see?
My Norwegian father inspired me to want to spend time in the Nordic countries. I have visited and skied in Norway, but would like to round out that experience with trips to Iceland and Greenland.

Then I want to complete the Viking migration by visiting the L'Anse aux Meadows site in Newfoundland, Canada.

Are you a dog or cat person?
I identify more with alpine fauna, such as picas, lynxes and wolverines. These critters are fascinating, and gravely threatened by climate change and ecosystem change.

Help Restore Whitebark Pine

Wednesday
May 16, 5-8 pm

Northside
KettleHouse

Community UNite

313 N. 1st Street
Missoula

Lots of fun with raffles, swag, beer, friends & supporters

KETTLE HOUSE

WHITEBARK PINE
ECOSYSTEM FOUNDATION

PO Box 17943
Missoula, MT 59808
www.whitebarkfound.org

WHITEBARK PINE
ECOSYSTEM FOUNDATION

SAVE THE DATE

Whitebark Pine Ecosystem Foundation's Annual Science & Management Conference

September 20-22, 2018
Community Center, Stanley, Idaho

WPEF's 17th annual conference will showcase:
The latest news, science, and management tips for practitioners, students, educators, the public, and others with an interest in dwindling five-needled pines.

Exceptional on-the-ground learning experience by visiting high-elevation forests with interpretation by experts.

Opportunities for improving cross-border networks.

Find more information and register on the web: www.whitebarkfound.org

Show your support for Whitebark Pine and shop our online store

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