Central Rocky Mountains White Pine Health Working Group
Fort Collins, Colorado
March 2-3, 2005

Wednesday March 2, 2005:
Attendance: 30

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Welcome and Introductions
Bill Jacobi, Tree Pathologist, Department of Bioagricultural Sciences and Pest Management, Colorado State University.
Bill thanked Mr. Dave Hattis, Region 2, Silviculturist for the Canyon Lakes Ranger District, for setting up the meeting room arrangements in the new Arapaho/Roosevelt NF Office, Building E of the Federal Natural Resources (2150 Centre Avenue).
Bill Jacobi asked that each meeting participant introduce themselves, stating their name and affiliation

White Pine Health Survey Status
Region 4:
Jim Hoffman, U.S.D.A. F.S. Region 4, Forest Health Protection, Boise, ID
John Guyon, U.S.D.A. F.S. Region 4, Intermountain Region, Ogden, UT
White Pine Blister Rust was first detected in NV in 2001. The survey objectives were to confirm or deny rumors / reports of WPBR in *Pinus albicaulis* (whitebark pine) and *Pinus aristata* (bristlecone pine) trees in the Jarbidge Mountains of northeastern NV, and in an additional population of *Pinus albicaulis* in the Shell Creek area just to the east in the western UT.
WPBR was found in Jarbidge area only on whitebark Pine. The prevalence of WPBR in the area raises the concern of WPBR moving into stands of Bristlecone pine in The Great Basin National Park.
WPBR infection levels in stands of whitebark pine was considered “High” (50-60% of plots infected with WPBR) in Jarbidge area.
WPBR infections were estimated to be only about 10 years old in the Whitebark pine stands.
No WPBR was found in the stands of bristlecone pines in the Ruby Mountains of the Great Basin National Park.
In general, the health of the Bristlecone pines in the high elevation areas of NV was considered to be “Good”.

Region 4 plans to survey plots along UT/NV border during the 2005 field season. In the “Deep Creek” area west of Salt Lake City.

Discussion:
Brian Geils, Rocky Mountain Research Station, Flagstaff, AZ
Asked about the occurrence of a canker pathogen that was found on which in the area … an ascomycete … John said appears to be a species of Cytopsora.
Brian also commented on *Ribes* in the area … *Ribes aureum* apparently is the most prevalent, but other species including *Ribes cereum*, *R. montogyum*, *R. visossisimum*, and what appears to be *R. hudsonianum* also grow in the Jarbridge area.
Brian said there is interest in the “Deep Creek” area because of report of an “eastern species of Ribes”

Region One:
Greg DeNitto, U.S.D.A. F.S. Region 1,Forest Health Protection,Missoula, MT
Reported that there is currently a WPBR monitoring study in the Greater Yellowstone Park Area; this study is coordinated by National Parks Service, and involves input from several other agencies.
Currently there are 41 transects in 45 WBP stands.
Current data indicates that the incidence of WPBR infection greater than expected.
Current data suggests that highest infection rate is in the northwest corner of Yellowstone Park .
The 2004 survey area was limited to the fire recovery zone
John Schwandt, U.S.D.A. F.S. Region 1, Forest Health Protection, Coeur d'Alene, ID

Reported on survey in the “Southern Devils” area, Both WPBR and Mountain Pine Beetle in the area on WBP

Jim Hoffman, U.S.D.A. F.S. Region 4, Forest Health Protection, Boise, ID

They will help with the “Deep Creek” survey next year – this is an area in UT with 12000’ peaks. Currently WPBR is NOT known to occur in UT.

Region Three:
White Pine Health and WPBR-Resistance Screening in New Mexico

David Conklin, Forest Health, New Mexico Zone l Office, Albuquerque, NM

1990 high incidence of WBPR due to “wave” year of infection in 1985, Possibly that WPBR had been in the area since 1969. First reported by Frank Hawksworth on *Pinus strobifornis*, Southwestern White Pine (SWP) in 1990 in high elevations of the Sacramento Mountains in the Lincoln National Forest
The Sacramento Mountains are located in Otero County of New Mexico, just to the east and southeast of Alamogordo. The highest elevations in the area are managed by the US Forest Service. The southern part of the complex is part of McGregor Range, a military reservation that is jointly managed by BLM and the US Army. WPBR found in many areas via informal surveys
3 plots were established in 1991, as of end of 2004, there are now a total of 14 plots
Cankers were remeasured on a 3-year measurement cycle.
Wilks Canyon plot is one of the oldest plots No WPBR was found at this plot in 1990, prior to logging. Trees in this plot were logged later in 1990. During the year following logging (1991), many *Ribes* seedlings, especially those of *Ribes pinetorum* (Orange gooseberry) were found in

this area along with *Pinus strobiformis* seedlings. Since 1991, incidence of WPBR has increased 2-3% per year.
Smaller trees more likely to have stem cankers, which are associated topkill; thus the impact of WPBR is most dramatic on smaller trees.
Nearby larger trees are likely to be infected
The incidence of WPBR increased with increasing elevation.
The estimated time of first occurrence of WPBR infection at high elevation sites is earlier (1980-1985) than the time of occurrence at lower elevations.
In fact, at most of the lower elevation sites, WPBR infections have not occurred, and the *Pinus strobiformis* are still growing quite well.
Pinus ponderosa in this area severely impacted by Dwarf Mistletoe
Ribes pinetorum is a highly susceptible alternate host for WPBR, with *Ribes* infection most obvious during the rainy period of July-August.
Ribes pinetorum in many ways is very similar to *R. nigrum* , but the leaves of *R. pinetorum* are smaller than those of *R. nigurm*.
In northern NM, *P. flexilis* often occurs along with *P. strobiformis*.
According to Diana Tomback, there is evidence that these 2 species may hybridize.
No *Pinus aristata* found in the Sacramento Mountains area.
Bradford Canyon Resistant Candidate Area consists of approximately 180 acres of mixed conifers, with about 15% WP (*P. flexilis* along with *P. strobiformis*).
Heavy WPBR infection occurs throughout the Bradford Canyon Area.
Many apparently WPBR-resistant *P. strobiformis* have been noted in this area.
In 1994 about 80 resistant candidates were selected; cones and seed were collected and sent to the Placerville (California) testing area; some seeds were also sent to Dorena (Oregon) testing area, where 3 year old seedlings are already producing pollen!
Seed was again collected in 2004; 8 more resistant candidate trees from Bradford Canyon area, and 7 more resistant candidate trees from the Wilks Canyon area were identified. Due to the length extension limits of the pole pruner, cones could only be collected from the low 40' of resistant candidate trees.

Discusssion:
Brian Geils mentioned that *Pinus edulis* also occurs in the area of WPBR infected *Pinus strobiformis*; if the *Pinus edulis* were infected with *Cronartium occidentale*, the cause of Pinyon blister rust. Could hybridization of *Cronartium ribicola and C. occidentale* occur?

For details on Conklin report refer to the published report pertaining to this study :
Conklin, David A. Development of the White Pine Blister Rust Outbreak in New Mexico, 2004. U.S.D.A. F.S. Southwestern Region, Forestry and Forest Health, R3-04-01

Region 2 Update:
Jim Blodgett, U.S.D.A. F.S. Region 2, Rapid City Service Center, Rapid City, SD

Reported that the Biological Evaluation of WPBR on Limber pine for the Bighorn National Forest was published in February of 2005 Citation: Blodgett, J.T., W.C. Schaupp, Jr., and D.F. Long. 2005.Evaluation of White Pine Blister Rust and Mountain Pine Beetle on Limber Pine in the Bighorn National Forest U.S.D.A. Forest Service Biological Evaluation R2-05-08 Report

Objectives of this study:
Determine the major disease and insect problems, and other mortality agents, in limber pine stands of the Bighorn National Forest.
Examine relationships among various ecological variables and limber pine condition
Evaluated 92 limber pine plots installed in 2002
Clear evidence of increase of incidence of WPBR!
On a scale of 1-5 (5=extremely severe)
Incidence of WPBR increased from 1.4 (1998), to 1.5 (2000), to 1.8 (2003), over the 5-year period.

During 2003, 22 Pest Trend-Impact Plot Systems (PTIPS) were installed along with and additional 8 plots.

First report of WPBR on Rocky Mountain Bristlecone pine in Colorado
(Blodgett, J.T., Sullivan, K.F. 2004. First Report of White Pine Blister Rust on Rocky Mountain Bristlecone Pine. Plant Disease 88:311)
Jim and Kelly located eight Rocky Mountain Bristlecone pine trees that exhibited symptoms suggestive of WPBR. After careful examination, six of these trees were confirmed positive for WPBR; of these six trees, four had stem cankers.
The WPBR-infected BC pine trees all had truck diameters of less than 4".
Jim and Kelly collected spore samples to send to Det Vogler in CA.
Jim and Kelly also collect samples of the *Ribes* species growing in the area, and sent samples to Det Vogler in CA.
A branch of a WPBR-infected Rocky Mountain Bristlecone pine tree with aecial blisters was deposited with Colorado State University Herbarium in 2004.

Jim also reported that he surveyed for *Ribes* in the Cathedral Peaks area of Custer State Park in the Black Hills of SD on July 8, 2004.
Jim brought samples of some of the *Ribes* species he collected; he asked participants for help in the clarification of these species.
Based on his information, it appear that the *Ribes* composition for that area is:
1% *Ribes cereum*, 15% Ribes oxyacanthoides, and 84% Ribes missouriense.
Showed an image of Ten Sleep Canyon area in the Bighorn National Forest where there is a high mortality of Limber Pine due to WPBR as well as Mountain Pine Beetle.
In 2004, collected WPBR aecial spores from bristlecone, whitebark, and limber pines for two students.
Collected from 17 stems and branch cankers in WY and CO.
In 2003 & 2004, collected infected *Ribes* leaves for Det Vogler, USDA-FS, PSWRS, Davis, CA, USA.
Also reported on the Pest Trend impact Plot System PTIPS plots originally established in 1998.

Colorado State University
Completion of survey of *Pinus flexilis* stands in Wyoming and northern Colorado for WPBR
Holly Kearns & Bill Jacobi, Department of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins, CO
Reported on completion of her survey of *Pinus flexilis* stands in Wyoming and northern Colorado for WPBR for Holly's Ph.D. graduate work.
Put in 504 plots in Wyoming & Colorado during 2002 & 2003; was analyzing cankers and plot data during 2004.
Average incidence of WPBR for the study area is 15.5%, but she noted extreme variations in incidence among limber pine stands …
Incidence of WPBR on limber pines in the Wind River Reservation area of Wyoming is 100%!
Holly hopes to be able to correlate meteorological data with WPBR incidence as there is a RAWS station located in this area.
Holly's data indicates a faster canker growth rate than that reported by Jim Blodgett (4.8cm vs. 2.8cm)

Discussion:
Kelly Burns asked about the southern limit of WPBR in northern CO.
Bill reported that Betsy Goodrich surveyed area during the summer of 2004 …WPBR currently found on limber pines located -three miles north of Goodel Corners- about 11 miles north of Rocky Mountain National Park, and about 15-17 miles south of Wyoming border!

BREAK 10:25 - 10:40

White Pine Survey Plans for 2005-2006

Bill Jacobi asked about current active white pine surveys in Rocky Mountain Region.

Jim Blodgett will survey the Shoshone National Forest.
Brian Geils will conduct a collection of aeciospore from *Pinus albicaulis and Pinus flexilis,* beginning at Mosca Pass in south central CO, and ending at Moscow, ID. Brian is particularly interested in areas of co-existence of *Pinus contorta* (Lodgepole pine) and *Pinus albicaulis and P. flexilis*. Requested help in locating such areas of mixed pine stands. Collected aeciospores will be examined and analyzed genetically.
Greg DeNitto reported continuation of Greater Yellowstone Area survey
Dave Conklin will continue looking at sites in NM
Anna Schoettle asked about vegetation survey at Great Sand Dunes National Monument --- will they be looking for WPBR?
Kelly Burns responded that the U.S.D.A. F.S. Region 2 has hired the C.S.U. Natural Heritage Program to conduct a vegetation survey of the area; however, the C.S.U. Natural Heritage Program crew would not be looking for specifically WPBR.
Bill Jacobi suggested that the Natural Heritage Program at CSU Be informed about WPBR --- perhaps they would be willing to scout for WPBR in this area.

Jim Blodgett, Bill Jacobi, and Kelly Burns

Pest Trend-Impact Plot Systems is a series of permanent plots for the purpose of data collection and monitoring of pest trends, behavior and impacts in diverse forest types, and a variety of environmental conditions over time.
Refer to meeting packet document entitled, “Permanent Ecological and White Pine Health Monitoring Plots”
Bill Jacobi asked about how many plots should be put in order for these to be statistically meaningful

WPBR PTIPS plots currently in Region 2:
only 22 plots now.
drop 3 plots after 2006.
there will only be 19 plots.
plan revisit plots in 2006.

Jim Blodgett indicated that new WPBR PTIPS plots should be established in Region 2:
40 plots would be nice … currently have 19 … if the Forest Service could add another 2, that would give 40 plots. Hopes to re visit every plot, every 3 years.

PTIPS plot setup 2006:
specific site selection criteria.
specific site/tree variables.
much plot/subplot set-up involved.
a long day for each new plot.
3 new plots/crew/week.
21 / 3 = 7 weeks + resampling 22 plots.

Kelly Burns indicated that 26 plots permanent White Pine plots established in 2004 in Mosca Pass area
Jeri Lyn Harris put in original White Pine PTIPS plots in WY about 1995
Original White Pine PTIPS plots were placed in areas where white pines were known to occur; and attempted to put plots in areas where WPBR might occur.
Data would allow for a model to be developed
Judy Adams PTIPS coordinator commented on intent and purposes of PTIPS- a multitude of purposes
Judy said that most of the data out there is just not good data
Diana Tomback asked about the methodology and standards used for PTIPS
Jim Blodgett said the methods are not exactly the same in all Regions.
John Guyon asked about consistency of methodology.
Several folks commented that the methods have been quite variable from region to region.
Jeri Lyn Harris indicated that originally she used the methodology established for PTIPS Dwarf Mistletoe Plots.
Eric Smith said the data structure is the same as FSVEG (information about plot design can be variable)
Kelly Burns said that major problem is the limited amount of data collected … for example, white pine PTIPS only collect data related to white pines other species associated with the white pines are not evaluated.
Jim Hoffman commented that there is a lot of money going into PTIPS.

Diana Tomback expressed concern about statistical soundness of currently established PTIPS.
Jeri Lyn Harris expressed need to have access to FIA data.
Bill Jacobi emphasized the need for permanent plots for assessing the health of white pines.
Blakey Loskman expressed concern about PTIPS monies being available ONLY for reevaluation of previously established PTIPS plots – these monies are NOT available for establishment of NEW white pine plots! Apparently PTIPS funds will not be available for new white pine studies.
Lynda Joyce asked about the plan (5-10 year cycle) for Forest Health Inventory --- could the white pine health folks utilize these plots?
Greg DeNitto said that white pine health folks could possibly join the Forest Health Inventory crews so that white pine health and damages could be surveyed. Currently FIA crews to NOT assess tree health. Gregg indicated that "piggy backing" on FIA would increase the cost of conducting FIA surveys. It may be more cost effective to just rely on FIA and FHM to give the white pine health folks the best data that they can. But the value of these data will be limited in that they will not specify the cause of tree damage.
Bill Jacobi asked about white pine stands on Bureau of Land Management land (BLM).
Diana Tomback said we need to put out the question as to whether or not the FIA AND PTIPS data will provide the needed information when it comes to the issue of revegetation of areas where WPBR has decimated the white pine population.
Judy Adams said that new director (Frank Sappio) is a supporter of permanent plots, so there may be funding available in the future. Judy also added that PTIPS regulations need to be revisited.
John Guyon said that there have been recent examples of establishment of new plots based on "particular needs", the white pine health folks need to find out what criteria define "particular needs".
Greg DeNitto pointed out that the monies for PTIPS is limited --- if new plots are established, then some of the existing plots would have to be dropped.
Bill Jacobi wanted someone in the group to take concerns to the Washington office!
Eric Smith indicated that the new (as yet to be determined) White Pine Coordinator may be the person to take these concerns to Washington.

Long Distance Spread of WPBR
Brian Geils, U.S.D.A. F.S. Region 4, Rocky Mountain Research Station, Southwest Forest Science Complex,Flagstaff, AZ

Synoptic Level Meteorology.
Working with climate specialist at University of Delaware.
Need to look at spread of WPBR on a much larger scale.
Started off looking at the meteorological data associated with the Sacramento Mountains in southwestern United States.
Data revealed that climatic conditions of June 1969 corresponds to date of oldest WPBR canker on *Pinus strobiformis* in the Sacramento Mountains area .

Eastward movement of WPBR from CA --- approximately 1200km
Favorable Event = the number of 6 hour periods of temperature, relative humidity, & air transport (window of time: April – July). Wet conditions have to follow within 3 weeks or less of the favorable air flow conditions.
Temperature + Relative Humidity >>> 500 millibars level.

Transport to Sacramento Mts: Between 1964 and 1975, favorable conditions occurred 33 times (most of these during June of 1969)

Sangre De Cristo Mountains, CO >>> 145 favorable events
Jarbidge Mountains, NV>>> 2,614 favorable events
Flagstaff, AZ >>> 0 favorable events (spore transport happens, but conditions for establishment not likely to occur).
Mount Charleston >>>98 favorable events (commandra blister rust and white gall rust do occur in this area). Have possibility of getting WPBR, as Ribes species seem to be favorable.
Mount Zion >>> 76 favorable events. Have possibility of getting WPBR, as Ribes species seem to be favorable.

Aerial survey of White Pines in Region 2
Jeri Lyn Harris, Eric Johnson, Forest Health Monitoring, Lakewood Service Center, Golden, CO
Currently surveying *Pinus flexilis* and *Pinus albacaulis* in WY
Found some "holes" in the map --- not complete.
Less Koch (WY Dept Forestry Specialist)surveyed a lot of private land in WY
Graphs include: land ownership, *Pinus flexilis* and *Pinus albacaulis* (healthy and damaged)
Pinus flexilis and Pinus albacaulis damage very prevalent >>> some Mountain Pine Beetle damage.
Graph C indicated Tree Mortality vs. Acres Affected by MPB in WY
1995-2004
The numbers increased dramatically between 2000 & 2004
Wants to survey the Yellowstone National Park area.

Eric Smith announced that there should be some monies available for a person to work with Kelly Burns 2005.
Take the 2004 aerial maps and overlay these with the plot (ground) data that has been collected in CO & WY.
Add in aerial photographs of some of these plots.
Wants to know IF WPBR can be differentiated from other damages when viewed from the air?
Where should we keep looking for WPBR?

Lunch Break: (Sandwiches, chips, fruit, and cookies in meeting room)

Noon-time Presentation:
CO's New Infestation in the Sangre De Cristo and Wet Mountains
Kelly Burns, Forest Health Management, Lakewood Service Center, Golden, CO
During the summer of 2003 Betsy Goodrich and Sally McElway (sp?) found WPBR on *Pinus flexilis* (limber pine) in vicinity of Mosca Pass.
Later in October of 2003, Kelly Sullivan Burns and Jim Blodgett found WPBR on *Pinus aristata* (Rocky Mountain Bristlecone Pine) in the Great Sand Dunes National Monument, Alamosa County CO, near Mosca Pass.
The discovery of WPBR in this area is cause for concern, as the Rio Grande National Forest lies to the west of the Sangre de Cristo Mountains, and to the east, lies the San Isabel National Forest.
This was the first time that WPBR had been reported Rocky Mountain Bristlecone Pine.
Two big questions: HOW and WHEN did WPBR get here?
The nearest areas known to have WPBR-infected white pines are:
200 miles to the north in extreme northwestern Larimer County, CO and 250-300 miles to the south in the Sacramento Mountains of NM.
How did WPBR get to south central CO?
Two possible ways that WPBR got to the Mosca Pass area:

Long distance transport of aeciospores in high level air currents, possibly from CA and /or Local transport of teleiospores from WPBR-infected *Ribes* or local transport of aeciospores from WPBR-infected 5-needle pines in nearby urban landscape plantings.
When did WPBR get here?
Initial infection most likely occurred in 1990; initial fruiting occurred 14 –18 years from initial infection!

Study objectives:
Delineate the outbreak areas in the Sangre de Cristo and Wet Mountains
Determine the incidence of the disease on Rocky Mountain bristlecone pine
Install long-term monitoring plots in the Sangre de Cristo Mountains to track thedisease over time
Methods:
Established 28 plots long-term monitoring plots in Sangre De Cristo Mountains and 51temporary survey plots in the Wet Mountains.
Stands were identified by: Querying GIS datasets (RIS and CVU), Information from local forest managers, and
Field scouting. Selected stands were chosen based on accessibility; stands were selected that could be reached within a ½ day of driving and/or hiking.
Plot locations are monumented with rebar.
All trees were tagged at breast height.
Site variables recoded:
elevation; slope; aspect; transect length, transect width, transect bearing, stand structure, slope position, 3 most common species, occurrence of regenerat;ion.
occurrence of WPBR on regeneration, maximum needle retention for the dominant white pine species, presence of *Ribes* species in the plot, and density of *Ribes* species.
Species variables recorded:
white pine species, diameter at breast height, height, health status, crown class, percent of crown with cones, number and size of cankers, distance to the main stem of the most lethal branch canker, number of stem cankers, size of stem cankers, and location of stem cankers, other damages and their severities.
Examined total of 2705 white pine trees (985 in Sangre De Cristo Mountains and 1720 in the Wet Mountains).

Findings:
8040-11789’ elevational range
Limber pine and Bristlecone pine commonly occurred with Douglas-fir, Engelmann spruce, ponderosa pine, aspen, and white fir.
Less common in association with subalpine fir, pinyon pine, and juniper.
Bristlecone pine was commonly associated with Engelmann spruce with no other species present .
The most common understory species were juniper, grasses, bearberry, and snowberry.
Limber pine occurred in plots at all elevations but was most common in plots below 10,800 feet..
Bristlecone pine was not observed in any plots below 8,800 feet, was much more common in plots above 10,200 feet.
Pure stands bristlecone pine occurred only on the south and west aspects.
WPBR was found in 23 of the 79 plots … 12 of these in the Sangre De Cristo Mountains and 11of these in the Wet Mountains,
WPBR was found on limber pine only, WPBR was not found on the bristlecone pine growing in the 28 plots in Sangre De Cristo Mountains nor in the 51plots in the Wet Mountains.
Intensity of WPBR in Sangre De Cristo Mountains – highest: 56%
WPBR incidence near hiking trails

No apparent differences in canker lengths between cankers found on white pine trees in the Sangre De Cristo Mountains and cankers found on white pine trees in the Wet Mountains.
WPBR was found to be more common on east side of CO HWY 165.
Greater occurrence of WPBR near the town of Beulah, CO (20 miles SW of Pueblo, CO).
No WPBR found in plots near the Boy Scout Camp. Camp Alexander, Lake George, CO; San Isabel Scout Ranch, Pueblo, CO.
WPBR was found at remote area known as "Dry Lake", east of northeast corner of GSDNM, and just east of the Saguache - Huerfano County line.
Huerfano State Wildlife Area, southwest of GSDNM and southeast of Mosca Pass, in Huerfano County, CO, is the most southern occurrence of WPBR in CO known to date.
Of the WPBR-infected trees, 33% had stem cankers; over 50% of these trees had "severe' cankers.
Other damages observed due to: shoot borers, twig beetles, Bifusella needlecast, mountain pine beetle, and dieback and decline due to unknown causes.

WPBR on Rocky Mountain Bristlecone Pine in Mosca Pass area of CO.
Eight bristlecone pine trees were examined in June 2004; 6 of 8 were found to be infected with WPBR.
Occurrence of WPBR in the Sangre de Cristo Mountains is concentrated within the southern portion of the range; extends 7 miles north of Mosca Pass, and about 5 miles south of Mosca Pass.
At this time the incidence of the disease on bristlecone pine is very low and is concentrated in the Mosca Creek drainage
Bristlecone pine may be more resistant to WPBR, or it may take longer for symptoms of WPBR to develop.

Monitoring Whitebark For Blister Rust: Methods Update
Diana Tomback, U of Colorado, Denver.

Monitoring Whitebark Pine for Blister Rust: A Methods Workshop
Conducted by the Whitebark Pine Ecosystem Foundation (www.whitebarkfound.org), in West Yellowstone, Montana June 28-30, 2004.

Sponsors: USDI National Park Service, Rocky Mountain Cooperative Ecosystems Study Unit, Greater Yellowstone Coordinating Committee, USDA Forest Service, Fire Sciences Laboratory, Rocky Mountain Research Station, Missoula, Montana, USDA Forest Service, Northern Region, State and Private Forestry, Forest, Health Protection
University of Montana, Missoula, Continuing Education

Revised methods hopefully available by early April of 2005
Available on Whitebark Pine Ecosystem Foundation website www.whitebarkfound.org.
Summary of attendance:
102 registered participants, including 20 instructors and presenters
18 National Forests and Forest Service Research Stations
3 U.S. National Parks
Representatives from Parks Canada
5 colleges and universities in both the U.S. and Canada
Alberta Sustainable Resource Development
2 environmental education programs

Methods for Surveying and Monitoring Whitebark Pine for Blister Rust Infection and Damage
Composed by:
Diana F. Tomback (Dept. of Biology, University of Colorado at Denver)
Robert E. Keane (USDA Forest Service, Fire Sciences Laboratory,
Rocky Mountain Research Station)
Ward W. McCaughey (USDA Forest Service, Rocky Mountain Research Station)
Cyndi Smith (Parks Canada, Waterton Lakes National Park)

A sample field data sheet is provided; this data sheet may be used as a template.
The variables on this sheet correspond directly to the Whitebark Pine Ecosystem Foundation(WPEF) methods.
The variables correspond to the input fields in the MSAccess XP database application, "White pine blister rust survey database: whitebark pine application" , designed for WPEF by David Pillmore and Brent Frakes (Rocky Mountain Network Inventory and Monitoring, National Park Service).
Also known as the "NPS database", this database will download directly into the rangewide database being developed by U.S.D.A Forest Service's Forest Health Protection (Blakey Lockman and Gregg DeNitto).
Additional methods available for those desiring to conduct more complete, but more time-consuming surveys; these are useful for targeted research or for obtaining a more detailed picture of either the habitat type or dynamics of spread of blister rust.
Additional survey information includes:
Counting stem and branch cankers,
Ribes survey,
Potential regeneration survey,
(focusing on seedlings and saplings and excluding suppressed trees),
Whitebark pine ages, and Other forest trees.

Recommended plot design: fixed plots with minimum of 10 live trees per plot

Methods are considered an on-going project!
Revised methods will be posted on the Whitebark Pine Ecosystem Foundation website www.whitebarkfound.org by early April.

The revised Database will also be available from WPEF, as well as from Rocky Mountain Inventory and Monitoring, Natural Resources Program Center, National Park Service (David Pillmore and Brent Frakes).
Diana announce Request for Proposals for short-term project funding for summer 2005 through 2006.
May be for silvicultural thinning, prescribed fire, collecting seeds, growing and planting seedlings, or other aspects of restoration.
Award amounts range from $10, 000 - $20,000 (visit www.whitebarkfound.org for details).

General observations pertaining to whitebark pine health:
Mortality rates greatest in northern U.S. and south central Canada

Report:
Whitebark Pine Regeneration in the Northern Rocky Mountains: Examining the Effects of Declining Seed Sources
Diana F. Tomback, Dept. of Biology, University of Colorado at Denver

The questions:
Given the poor status of the seed source in the northern Rocky Mountains, U.S., is whitebark pine regenerating after fire?
How does regeneration density vary with seed source health?
How does regeneration density vary with time since fire?
How does regeneration compare with healthy / unhealthy seed sources in other geographic areas?
What are the management implications if whitebark pine shows poor regeneration?

Conducted a seed source survey in 3 whitebark pine study sites in the Bob Marshall Wilderness Area and adjacent Flathead National Forest in northwestern Montana.

Sampling techniques:
50 m transects with consistent elevation and aspect.
Transects continuous or separated vertically by 10 m.
Plot placed at 0 m and every 10 m thereafter.
Circular plots, 20 m^2 in area.
All conifers assessed and aged.
Goal was to sample 20 to 30 plots per sampling location.

Comparisons of regeneration at burn sites:

Age of Burn	Burn Site Name	Number of Regeneration sites within Burn	
		Minimum	Maximum
10 years:	Helen Creek	0.004	0.027 sites per m2
7 years:	Greater Yellowstone	0.016	0.055 sites per m2
13 years:	Greater Yellowstone	0.020	0.092 sites per m2
19-20 years:	Red Owl	?	0.025 sites per m2
Charlotte Peak		0.076 sites per m2	
25-26 years:	Sleeping Child	0.070 sites per m2	
Saddle Mountain		0.044 sites per m2	
Sundance		0.008 sites per m2	

Helen Creek regeneration appears on the low side, especially SW (camp)
Red Owl regeneration appears on the low side.
Seed source and regeneration at Sundance is considered poor.
Regeneration at Red Owl is low, but not as poor compared to that at Sundance.
Aspect does not seem to affect regeneration density in a consistent way.

Conclusions:
The regeneration in the Red Owl Burn and part of the Helen Creek Burn does not compare well to other old burns in the northern Rocky Mountains.
There is some evidence for the effects of diminishing seed source over time.
Data are needed from additional burns in the Flathead National Forest for comparison.
Seed source deterioration and impacts on regeneration may be comparatively recent, but the future trajectory is clear.
Active management in the form of hands-on restoration may be needed as seed sources continue to decline.

Report:
Whitebark Stand Dynamics in the Greater Yellowstone Areas
Randy Walsh, CSU Graduate Student,Master of Science student working with Dr. Bill Romme

Fire Regimes & Stand Dynamics in Whitebark Pine (*Pinus albicaulis*) communities of the Greater Yellowstone Ecosystem
Current theory
Rapid colonization of area by whitebark pine following fire.
Fire important to maintenance of whitebark pine.
Whitebark pine replacement by fir and spruce over time.
Fire intervals are variable across the Greater Yellowstone Areas range:
29 to >400 years
Low-intensity, patchy fires common on dry sites and near timberline
Due to modern fire exclusion: Natural fire cycles in many whitebark pine communities have been postponed.
Both the frequency and extent of modern fires are outside of their historic range of variability.
As a result, structure in whitebark pine communities has been altered.
Accelerated the replacement of whitebark by fir and spruce.
Overall forest health reduced.

Project overview

This study examines:
physical structure (basal area, density, species composition)
stand-age structure
historic fire regimes of whitebark pine communities throughout the GYE where whitebark pine communities are surrounded by an extensive, continuous subalpine forest composed of spruce, fir and lodgepole pine

Hypothesis:
Infrequent, high-intensity crown fires have historically been the dominant fire type in the area, controlling stand structure of not only the whitebark pine community, but the surrounding subalpine forest as well.

Methods:
PCQ for structure 3 size classes
Cores at 1 m
Collection of scars – utilized multiple increment borer for fire history
2 types of sampling intensive & extensive
2003 – established 3 study sites
2004 – established 4 additional study sites

Results to date:
Golden Trout Lake in Gallatin NF, Intensive, 9005’
Age Structure WBP – 3 major peaks
GTL fire history overlaid on age structure reveals mixed fire regime
Compare with Avalanche Peak in age structure much different compared to GTL site
Stand replacing fire that occurred about 400 years ago

Wind River Lake, Shoshone NF by Togowtee pass
Abundance of scars on large mature trees
Colected several scars, looked at rings and cross-dated
Age structure graph indicates that either scars are not result of fire or scars are result of a few isolated small fires

Blue Ridge in the Shoshone NF
Extensive type, 9850'
WBP growing in clusters above 10000'
Unique root system
Huge extensive WBP forest in area
No evidence of fire at this site

Yellowstone fires of 1988 resulted in stand replacement
Mixed severity fires can mean a couple of different things
Evidence of both stand-replacing and mixed regimes
A "one-size-fits-all" management approach will not be effective in the management of WBP forests.
WPBR found throughout the Greater Yellowstone Ecosystem study area.
Discussion followed concerning the "fire scars":
Apparently there are several factors that can cause the inverted "V" scars at the base of mature whitebark pine.
Without the presence of charcoal, it is extremely difficult to determine the cause of the damage.
Some speculate root damage as being associated with these large basal scars.

Whitebark Limber Pine Information System, a.k.a. "WLIS" Database Update
Blakey Lockman, U.S.D.A. F.S. Region 1, Forest Health Monitoring, Missoula Field Office, Missoula, MT
Tony Courter, U.S.D.A. F.S. Forest Health Technology Enterprise Team (FHTET), Fort Collins, CO

Objectives:
Determine general condition of whitebark pine and limber pine in western North America
Analyze relationship between condition and presence of WPBR
Collected whitebark pine and limber pine data from studies conducted in the western U.S. and western Canada.
Input collected data into a Microsoft Access XP database.
Incorporated U.S.D.A. F.S. Forest Inventory & Analysis (FIA) data .
Developed an interface with data.
Incorporated a mapping function with the interface.

Funding sources:
FHTET
INTECS
Whitebark Pine Eco
Forest Health Monitoring
Forest Health Projection (Management)
National Park Service
CSU
Canadian Parks

University of Colorado @ Denver

Hot link to Whitebark Pine Ecosystem Foundation, as well as to several other whitebark pine and limber pine related websites.

Interface allows user to choose among several options:
- View (view previously entered data)
- Add (add new data)
- Modify (modify previously entered data)
- Import NPS Data (enables incorporation of NPS records)

Interface based on the following specific data fields:
Source, Survey Month, Survey Year, Species (whitebark, limber, or both), White Pine Blister Rust Present (yes, no, or not evaluated), Percent Infection, Density of Trees (whitebark, limber, or both; measured or not evaluated, Basal Area (BA) And / or Trees per Area (TPA), Percent component of other tree species (in BA or TPA)
Location (of plot):, U.S. or Canada, State or Provenance, Administrative Unit, Elevation (entered in metric or English units, but stored in English units), Latitude and Longitude or UTM coordinates

Whitebark Pine / Limber Pine Mortality
- % percent Mortality from all Causes (in BA orTPA)
- % Mortality from Blister Rust
- Other Damaging Agents
- Regeneration evaluated

Query option allows user to query the data (can query on any one or all of 53 variables)
Mapping feature allows user to:
locate and map location of plots meeting query specification.
put a title on their map.
export a map.
print a map.
Tony gave a demonstration using WLIS.
Several questions arose concerning the availability of the FIA data.
Blakey informed the group that the FIA coordinates have been “blurred” so that they do not indicate exactly plot locations (this is because several of these plots are on private lands).

Data Base Discussion:
Steve Johnson, U.S.D.A. F.S. Region 2, Lakewood, CO

FSVEG and other options
Module of Natural Resource Inventory System
FSVEG (FS stands for “Field Sampled” NOT “Forest Service”)
Designed and maintained by U.S.D.A. F.S.
FIA and PTIPS data can be put into FSVEG

Other vegetation databases:
FAWNA
Natural Resource Information System (NRIS)
Natural resource data needed to support the management decisions that form the core business of the Forest Service.

Corporate databases and computer applications designed to support field-level users.
Provides advanced applications and tools to manage and analyze geographic information consistently throughout the Agency.
NRIS Modules:
Air
Fauna
FSVeg
Terra
Water
Human Dimension
Tools

Field Sampled Vegetation (FSVEG)
An ORACLE Relational Database
Updated January 2005
Includes Field Sampled Vegetation data from:
Common Stand Exams (CSE)
Grid Inventories
Growth and Yield Plots
Special Pest Surveys
Research Studies
FIA data

CSE … More than just Stand Exam!
Gathers information about:
Stand Exam
Down Woody Debris
Fuel Loading
Vegetation Composition
Surface Cover

CSE consists of standardized:
Field Protocols
Codes
Interface
Reports

FSVEG/CSE Documentation:
CSE User Guide
Regional Appendices
Regional Field Guides
Data Dictionary
Insect and Disease Reference Manual
Standard Contracts

Sample design consists of:
Unique, mutually exclusive subplots

CSE Data Collection Levels
Quick Plot
Extensive
Intensive

CSE Data Collection
Field forms
Electronic data recorders

FSVeg/CSE Data Processing
CSE Reports:
Basic Stand Characteristics vs. diameter classes
Gross Volume
R2 complete,
R3 and R4 in progress
RMStand Reports
Still accessible through RMVEG.

FSVeg Production:
FSVeg Roles:
Public
Stand Exam Collector
FSVeg Wizard
FSVeg Summary

Jeri Lyn Harris and Judy Adams indicated that they have had experience with inputting data into FSVEG

R2VEG – a Region ARCVIEW project that keeps track of all the polygons
species, etc.

R2VEG allows for interactions among several data sets:
Stand Summary
FSVeg
Activities
Along with GIS

RMRIS - ACTIVITIES
tracks activities to a stand
tracks all activities
Fuels
Range
Recreation
Timber
Watershed/Soils
Wildlife
Pest Control
Tracks :
Current Activities

Planned Activities
Historic Activities
By Fund Codes

Link to GIS -- Existing Veg Layer

EXCEL spreadsheets can be uploaded into the ORACLE database program.
Datasheet format MUST match the underlying ORACLE table.

Questions arose as to the ability to enter location coordinates

Report:
Hazard Criteria for WBBR
Gene Van Arsdel

The role of *Ribes* species genotypes and *Ribes* species distribution, as well as meteorological factors in the determination of WPBR hazard classes.
Review of published information pertaining to the relative susceptibility.
Methods of comparing Ribes resistance:
Field observations
Greenhouse inoculation of leaves
Petri dish inoculation of leaves

Field observations:
Give a better idea of how the species functions as a host in nature
Ribes lacustre and *Ribes montigenum* usually grow in sites too cold for *Cronartium ribicola* infection.
VERY SUSCEPTIBLE (commonly defoliated due to WPBR):
Ribes cynosbati – predominately in eastern U.S.
Ribes pinetorum – predominately in NM
Ribes roezlii – predominately in CA

Greenhouse inoculation of leaves:
Greenhouse moist chamber inoculations –
Oldest study by Spaulding & Gravatt (1917)
Compared relative susceptibility of 48 Ribes species
Ribes nigrum was most susceptible
Ribes leptanthum was least susceptible
Ranking of remaining 46 species not included in report.
Later study by Hahn (1928)
Compared relative susceptibility of 16 Ribes species
Ribes triste showed low susceptibility
Remaining species (?) all showed high susceptibility.
Often show unrealistically high levels of infection.
Tend to make all of the plants appear as more highly susceptible.

Petri dish inoculation of leaves:
According to Gene, “aren’t worth a damn” … These basically tell you how long the leaf remains a favorable environment for *Cronartium ribicola* spores.
Tests and observations on the eastern species of *Ribes*:
Looked at Regional Annual Reports from the North Central Region and Special Studies Reports.
Tests and observations on the western species of *Ribes*:
Looked at reports of studies conducted by Kimmey (1935), Kimmey and Meilke (1944), Meilke (1937), Meilke, Childs, and Lachmund (1937), and Meilke and Hansbrough (1933). Kimmey (1938) contains probably the most complete listing of western Ribes species and their susceptibility to WPBR. Hummer and Finn (1999) looked at 55 Ribes species, but gave no indication as to the relative susceptibility of each of these species.
Van Arsdel and Geils (2004) looked at 15 Ribes species in CO and NM.
The *Ribes* of Colorado and New Mexico and Their Rust Fungi.
Importance of *Ribes* species in the spread of WPBR In the Sacramento Mountains of NM.
7 *Ribes* species known to occur in this area.
R. pinetorum is most important; most abundant 8,000-10,500 feet.
R. cereum most abundant at 7,500 feet.
R. inerme and *R. wolfii* are rare for this area.
R. aureum occurs far below the natural range of white pine.
R. montigenum occurs above 10,000 feet, in areas too cold for *Cronartium ribicola* to infect *Ribes*; thus NOT a major factor in the spread of WPBR in the Sacramento Mountains.
Other important factors include elevation, local drainage winds, mesoclimatic conditions, and microclimatic conditions.
In the Sacramento Mountains, *Ribes pinetorum* is very similar *to R. cynosbati* in Wisconsin in that both species prematurely defoliate in response to infection by *Cronartium ribicola*. However, these two species differ in that *R. pinetorum* can put out a late flush of growth after earlier defoliation due to WPBR infection, this late flush is highly susceptible to WPBR, which does allow for *R. pinetorum* to be a major component in the spread of WPBR in the southwestern U.S.

Importance of *Ribes* species in the spread of WPBR In southern Appalachian Mountains of eastern United States
3 *Ribes* species known to occur in this area are considered susceptible alternate hosts for WPBR.
R. cynosbati
R. glandulosum (= *R. prostratum*)
R. rotundifolium
Other important factors include elevation, local drainage winds, mesoclimatic conditions, and microclimatic conditions.
Average July Temperature significant in predicting the incidence of WPBR in NC.
Importance of *Ribes* species in the spread of WPBR In the Lake States and North Central Region of the United States:
R. cynosbati is so susceptible that it typically defoliates BEFORE telial formation; this species does not put out a late flush of growth, as does *R. pinetorum*.

Order of *Ribes* susceptibility:

R. nigrum (most susceptible)
R. cynosbati
R. hudsonianum
R. oxyacanthoides
R. lacustre
R. hirtellum
R. triste
R. glandulosum (=*R. prostratum*)
R. americanum (least susceptible)

Importance of *Ribes* species in the spread of WPBR In New England area of the United States
Lack of highly susceptible native *Ribes* and exclusion of *R. nigrum* have held down the WPBR hazard.
R. cynosbati less common this far east; occurs only in 2 counties on west edge of Maine.

Ribes species known to occur in the New England area:

R. nigrum
R. cynosbati
R. hirtellum
R. lacustre
R. glandulosum (=*R. prostratum*)
R. triste
R. rubrum
R. aureum (known to occur in Connecticut and Vermont, but NOT in New Hampshire and Maine)
R. americanum

Importance of *Ribes* species in the spread of WPBR the Cascade Mountains of Oregon and Washington of the United States
Proximity of *Ribes hudsonianum* to white pine is important in the spread of WPBR in this area. Moisture holds down the diurnal temperature range and favors infection by *Cronartium ribicola*.

Importance of Ribes species in the spread of WPBR In the Yellowstone area of northwestern Wyoming of the United States
Proximity of *Ribes hudsonianum* to white pine is important in the spread ofWPBR in this area. Dryness favors large diurnal temperature ranges, thus much of this area is both too hot during the day AND too cold during the nights for abundant *Ribes* infection.

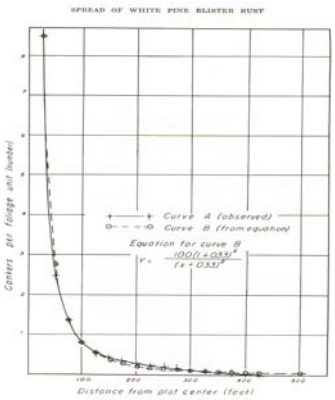
Importance of *Ribes* species in the spread of WPBR In the Sangre De Cristo Mountains of Co and NM of the United States

Meteorological conditions suggest favorable conditions for occurrence of WPBR on white pines.Most prevalent *Ribes* species in this area is *R. inerme*, which is NOT highly susceptible to *Cronartium ribicola*; much less susceptible compared to *R. pinetorum*, which is the most prevalent *Ribes* species in the Sacramento Mountains of NM. Long distance transport of *Cronartium ribicola* spores less likely, thus local intensification of WPBR should be less.

Incidence of canker related to the square of the distance from plot center

$$Y = \frac{100\,(1+0.33)^2}{(X+0.33)^2}$$

Where
Y = number of WPBR cankers
X = distance (feet) from plot center
0.33 = ???



Standardization of the National Risk Map Utilizing a GIS Based Multi-Criteria Modeling Framework
An Update on the National Progress and Application to White Pine Research
Frank Krist, U.S.D.A. F.S. Forest Health Technology Enterprise Team, Fort Collins, CO

The National Risk Map is not NEW, it is merely building upon the risk maps that have already been developed
History / Background
Folks in the Lake States (MI, MN, and WI) were not happy with the mapping approach developed in the late 1990s
In 2000, met to discuss revamping the National Risk Map; this lead to the development of a GIS-based multi-criteria risk mapping approach. During 2005, FHTET will present updated multi-criteria risk mapping approach to U.S.D.A. F.S. personnel in western U.S.

What is a Multi-Criteria Model?
Allows for the combination and weighting of multiple factors related to risk. Provides a framework for evaluating criteria and simulating the decision making process.

Advantages of GIS-Based Multi-Criteria Modeling
Easy to implement and document.
Consistent, repeatable, and transparent process.
Very dynamic
- Scalable
- Accommodates pest interactions
- "Tweakable"
- Provides a means for evaluating "trade offs"

Accommodates various levels of knowledge
Accepts nearly any type of spatial data as input
Includes toolset for quantifying and describing measurements
Includes toolset for decision rule uncertainties

Ways that this GIS-based multi-criteria modeling can streamline the National Risk Mapping efforts:
Provides a common means for ranking, standardizing, and comparing risk criteria and model outputs.
Reduces variability of risk along political boundaries. Will allow for the production of a truly National Risk Map, rather than a "federation" of regional risk maps.

Little effort is needed to bring existing risk models into a multi-criteria framework.

It Really Works!

Frank provided examples of risk maps developed for: Gypsy moth defoliation of oak in southwestern lower MI.

Goal:
"To simulate areas that are likely at risk to experience 25% mortality over the next 15 years"

The Multi-Criteria Modeling 5-Step Process:
1. Identifies tree species and risk agents
- species distributions
2. Identifies, ranks, and weights risk agent criteria
- Determines the criteria related to the risk of establishment and vulnerability of that particular pest
-Determines susceptibility and vulnerability :
Susceptibility: criteria related to the risk of introduction and establishment, over a 15 year period, of a forest pest within a tree.
Vulnerability: criteria related to the risk of experiencing a given mortality of a tree species, over a 15 year period, IF a forest pest were to become established.
- Develops a spreadsheet for data entry
- After the criteria had been established, these criteria are ranked based on the importance of each, this determines the susceptibility and/or vulnerability
- This information is put through a software program that weights these criteria
3. Standardizes criteria values
- After weighting, the criteria values are standardized (0-10, with 10 indicating the highest amount of risk)
4. Converts values to basal area loss and sums them by cover type group
5. Flags pixels where values are greater than the 25% simulated basal area loss.

Bill Jacobi asked the question as to if the U.S.D.A. F.S. is collaborating with other U.S.D.A. agencies, particularly APHIS (Animal and Plant Health Inspection Service).
Marla Downing commented that APHIS's focus is on agronomic crops, where as the Forest Service' focus is on forest crops.
Brian commented the possibility of using existing data for a species to project or predict risk of another pest for which data has not currently been collected --- Brian gave the example of using Western Spruce Bud Worm data to predict locations of Douglas-fir stands.

Wednesday's Portion of the meeting Adjourned at 5:00 P.m.

Thursday, March 3, 2005
8:15 a.m.
Maps on wall from Dave Hattis “Bristlecone Line Pine Cover Types” based on CVU analysis

White Pine Research Update:
Working toward developing proactive management options to sustain high elevation white pine forests in the presence of WPBR
Anna Schoettle, Rocky Mountain Research Station, Fort Collins. CO

Survival of current trees
Ability to produce seeds
Viability of WPBR-resistant seedlings
Ability of these WPBR-resistant individuals to produce seeds

Need to focus on rust resistance of progeny for acceptable establishment!

The challenge: Four-part approach
Accelerate natural selection
Accelerate the establishment of WPBR-resistant individuals
Considerations:
Colonization dynamics
Geographic patterns of local adaptation
Frequency of rust-resistance hazard models

Geographical patterns
26 sites established in 2001 ---Involved adaptive variation and rust screening of pine seedlings.
Geographical patterns BC Pine research:
Assess geographical variation in growth and stress tolerance traits.
Develop technology to facilitate detection of WPBR-infection and disease development in Rocky Mountain BC pine.
Assess frequency of resistance for BC pine.
Develop tools to predict the effects of WPBR on ecological processes through the comparison of the geographic distribution of WPBR-resistant BC.

2001 --- collected cones
2002 --- seeds germinated
200 families / 20 seedling / family
ended up with seedlings from 184 families
Summer 0f 2004 took growth measurements, then in July loaded onto refrigerated truck and took seedling to testing and evaluating center in Dorena, Oregon.
At Dorena, seedlings were planted out in replicated soil block
20 replicates of 3 frames each to be inoculated.
Total of 60 frames; each frame with 64 seedlings.
Soil blocks on pallets, that were moved via fork lift.
In September of 2005, seedling will be Inoculated in a large inoculation garage.
Inoculated seedlings will be evaluated throughout 2006-2009.

Study will:
Provide information pertaining to level of resistance and level of amount of resistance that exists in nature.
Enable prioritization of efforts in habitat modification for restoration.

Ribes leaves will come from Oregon, thus CO plants will be inoculated with the strain of *Cronartium ribicola* common to the Pacific Northwest --- NOT with the of the strain that occurs in CO!
Diana expressed the need to bring resistant individuals back to CO and then inoculate them with the CO strain of *Cronartium ribicola*.
Anna expressed preference to rely on the Zambino genetic group rather than take the risk of bring back potentially *Cronartium ribicola*.-infected but asymptomatic seedlings to CO!
Both Eric and Brian expressed concern about moving seedlings, but agreed that seeds from the parent trees could be tested in the future WPBR in CO.
Dave Conklin apparently has a similar study underway in NM on Southwestern White Pine.
Kelly asked about inclusion of Limber Pine in Anna's study --- Anna said she would like to include Limber pine in the study in the future.
John Schwandt asked about inclusion of additional pines potentially susceptible to WPBR, particularly BC pines --- Anna expressed interest in getting seed sources from more northern regions in Rocky Mountain area.
Anna commented that BC pine cone collection can be a bit difficult, messy, and time consuming.
Diana commented that squirrels can be very damaging to both Whitebark and BC pine.
Anna commented that cone and seed insects can significantly reduce seed harvest
Brian mentioned the work of Jeff Mitton, and asked if Anna had collected seeds from these sites.
Anna found high mortality of seedlings from seeds collected from some high elevation seed sources --- apparently Jeff Mitton had similar poor results with some high elevation seed sources.

8:55 a.m..
Development of a BC Pine Website
Anna Schoettle is currently building a website to increase the awareness of BC pines

Anna asked WP meeting participants provide her with ideas
John Schwandt mentioned the value of *P. aristata* in the commercial nursery industry
When asked about inclusion of Limber Pine, Anna said probably NOT
John Hart said other organizations include Rocky Mountain Elk, Wildlife Federation, other wildlife organization.
Brian Geils mentioned that Dave Charlet , Las Vegas Community College, published book entitles "Nevada Conifers" (John Guyon actually had a copy of this book with him)
Slow the Spread Program: Minutes are not available

9:25 a.m.
WBPR Genetics:
Update on inoculation trials at Dorena: Minutes are not available
Bill Jacobi Holly Kearns C.S.U.

9:45 a.m. Break

10:00 a.m.
Genetics: Update on whitebark screening project
Minutes are not available
John Schwandt, Jim Hoffman, John Guyon

11:20 a.m.
Genetics: Limber Bristlecone pine screening project
Groups Discussion

Newly Recognized "Alternative" Alternate Hosts of White Pine Blister Rust: Concern or Breakthrough?
Paul Zambino Geral McDonald, Bryce Richardson, Ned Klopfenstein, Mee-Sook Kim USDA Forest Service-RMRS
Moscow, Idaho Presented by John Schdwandt

Review of Typical Life Cycle of North American *Cronartium ribicola*:
Aecial host: Five-needle pines
Telial host: *Ribes* species
"Alternative" Life Cycles of *Cronartium ribicola*:
Aecial host: Five-needle pines
Telial host: *Ribes* species (members of *Grossulariaceae)* OR members of *Scrophulariaceae*

"Alternative" Life Cycles of *Cronartium ribicola* reported by Zambino, Hamelin, and McDonald at the 2002 American Phytopathological Society meeting in Wisconsin.

1. *Pedicularis racemosa* (Sickletop Lousewort, Ram's Horn Lousewort, or Parrot's Beak) Uredinia developed on artificially inoculated leaves of *Pedicularis racemosa*, and telia have been found occurring naturally on this species

2. *Castilleja miniata* (Scarlet Indian paintbrush)

Tests have been conducted to confirm the causal agent to be *C. ribicola*: rDNA sequence (ITS region) resulted in 27 variable sites identical with *C. ribicola*; these were determined NOT to be hybrids of *C. ribicola* and *C. coleosporioides*.
Inoculations were conducted using aeciospores collected from WPBR infected Whitebark pines: urediniospores and later teliospores were produced on *R. nigrum*, *P. racemosa*, and *C. miniata*.
Germination of teliospores on *Pedicularis* shows regular meiosis.
Rust retains its ability to infect its original hosts!
Urediniospores from *P. racemosa* gave rise to telia on *R. nigrum*; the resultant teliospores were used to inoculate *Pinus monticola* seedlings, which developed symptoms of WPBR.
So where did these "Alternative" alternative hosts originate from?
Preliminary data of AFLP* markers indicates that the "Roman Nose" isolates derived from *Pinus*, *Ribes*, or *Pedicularis* hosts are highly similar, and these "Roman Nose" isolates are highly similar to other western populations of *Cronartium ribicola*.

So where did *Cronartium ribicola* acquire the ability to develop uredinia and telia on plants not related to *Ribes* species?
New introduction from Asia? --- No! New “strain”? --- If so, NOT recent (Hiratsuka & Maruyama 1976)
Could these “alternative” alternate hosts have been overlooked in the past? This possibility does explain observed stand epidemic dynamics cycles and alternative life cycle(s) hypothesized by McDonald, Zambino, and Sniezko (McDonald, Zambino, and Sniezko 2004).

So what are the possible implications?
Assuming that *Cronartium ribicola* does have the ability to infect these hosts DOES NOT increase the pathogens ability to infect pine.Multigenic resistance mechanisms in *Pinus* species will retain their effectiveness. Better knowledge of alternate hosts will allow for better estimates of stand hazard, stand-to-stand spread, and intensification at sites.

There is a need to test other potential WPBR hosts, including:
Pedicularis bracteosa and
Pedicularis groenlandica;
As well as other species of *Pedicularis* and *Castilleja*.

There is a need to look in other locations:
Pedicularis racemosa is widespread across western United States, especially in upper montane and subalpine habitats.

Important to minimize sampling from areas with lodgepole stands infected with stalactiform rust (*Cronartium coleosporioide*), because of possible confusion with other species of *Cronartium*, as well as to accurately determine stand GPS and host identification.

Lunch Break

Inoculating CO *Pinus aristata* with CA Isolates of *Cronartium ribicola* to Clarify Multiple Gene Resistance (MGR)

Anna Schoettle for Det Vogler
Inoculation work done at Placerville, CA

Inoculated 1355 seedlings of *Pinus aristata* grown from seeds collected in CO. CO seedlings performed differently in CA compared to CO. Images of symptoms on *P.aristata* seedlings. Spots on inoculated seedlings --- indication of induced resistance to *Cronartium ribicola* (hypersensitive reaction). 24% of inoculated seedlings produced NO symptoms (285 out of 1208 seedlings)
76% of inoculated seedlings DID produce symptoms (spots (127) and / or stem cankers (796) out of 1208 SEEDLINGS)

Preliminary results:
Some *Pinus aristata* individuals may exhibit reduced susceptible to infection by *Cronartium ribicola*.

John Schwandt for Mary Francis Mehalovich

2001 inoculation, Annual evaluation, Long term performance plots in northern ID. Will be placed at high elevation sites to resemble natural conditions to promote reproductive stage, Field collection of seeds of phenotypically resistant trees

Dave Conklin expressed skepticism about basing conclusions on needle spotting of inoculated WB pine seedlings.
Percentage of resistant WB pine seedlings: 82% percent seedlings exhibited leaf spotting.
Only 37% of seedlings survived the first year – of these 57.3% (results appear typical to those found in inoculated P. monticoloa. Mountain Pine Beetle and cone insects are a major limiting factor.

2:10 p.m.

Genetic Strategies for Limber, Bristlecone, and Southwest White Pine Health --- Group Discussion

Jim Blodgett indicated that the Forest Service is collecting limber pine seeds in the Bighorn NF --- U.S.D.A. Forest Service fire suppression monies are being spent to fund this project!
Eric Smith put out the idea that the "soon to be appointed Federal white pine health coordinating person" should be the new national white pine coordinator.
Bill Jacobi expressed need for STANDARDIZED seed collection protocols.
Bill Jacobi was excited to learn that U.S.D.A. Forest Service suppression monies can be used for seed collection!
Anna Schoettle indicated that she was using protocols developed by Mary Frances Mahalovich (U.S.D.A. F.S. Regional Geneticist).
Kelly Burns added that the Shoshone NF is collecting seeds of WB pine with fire suppression dollars (but these seem to be attachment to some requirement for applications of insecticide to control beetles
Brian Geils commented that training is needed so that folks do not confuse dwarf mistletoe cankers with cankers of WPBR.
Discussion arose over concern as how to go about tagging the WPBR-resistant "+" trees in such a way that "radical environmentalists" do not remove trees and plot markers.
Anna Schoettle shared experience where she had had tags removed from trees she had marked as "+" BC pine
Jim Hoffman said that Mountain Pine Beetle behavior in whitebark pine is different than that known to occur with lodgepole pine.
Eric Smith indicated that one should not rely on catch traps to accurately reflect beetle activities in pines.
Bill Jacobi asked WHO would be interested in going out to look for genetically resistant limber pine.
Kelly Burns and Anna Schoettle both suggested that the folks associated with the Medicine Bow NF should be the ones looking for potential WPBR-resistant trees.
Bill Jacobi returned to the possibility of establishing the White Pine nursery in southern WY , i.e. the "Common Garden".
John Hart lives about 7 miles from the old nursery site in WY and has agreed to help maintain this nursery IF it every gets established.
Kelly said that she had talked with Terry Shaw in Washington, D.C. office --- Terry was not excited about this idea --- but several folks in the group believe that Terry must have misinterpreted Kelly's message.
Bill said he will "dust-off" the proposal that was submitted (and rejected) last year.

MOVING ON…

Discussion pertaining to the proposed NEW federal Whitebark Pine Coordinator
Several folks thought that this was to be a White Pine Coordinator
Brian added that it appears to be focused on the genetics of Whitebark pine ONLY!
John Schwandt pulled out a paper with the job description …

…"To access the health of whitebark pine across its range and the response of this species to WPBR with very little effort focused on the actual "genetics" of whitebark pine!
Anna Schoettle said there is not time to go the route used for Western White Pine and Sugar Pine's response to WPBR i.e. … "wait and see"!
Brian Geils indicated that the limited funding will require that such an effort for limber pine and bristlecone pine be kept as simple as possible!
Eric Smith expressed the need for real science in the evaluation and selection of WPBR-resistant white pines … there needs to be a focus on the physiology and biology of identified WPBR-resistant white pines.
Brian Geils included that there needs to be more research related to the virulence of (or lack of) *Cronartium ribicola*.
Eric Smith expressed concern for the loss of certain genes that will occur as a result of selection focused only on WPBR-resistance.
Peter Brown suggested that the group pool ideas into a large project and apply to the National Science Foundation for funding …. Interdisciplinary & interagency!

3:00 p.m. Break

Prescribed Fire
Anna Schoettle emphasized the need to maintain cycle in order to maintain limber pine and bristlecone forests:
Mature forest >>> Disturbance >>> Regeneration >>> Young forest >>> Mature forest
FIRE is a necessary disturbance … new stand development initiated because of FIRE!
What about the impacts of major insect pests, such as Mountain pine beetle?
What can we expect if we do nothing or if we do "something" too late?
Top kill of limber pine, whitebark pine or bristlecone pine, due to WPBR, results in lack of seed source for regeneration of these forest types!
Cronartium ribicola causes chronic stress … this pathogen will be present in ALL stands EVENTUALLY!
Young trees are more susceptible to infection by *Cronartium ribicola*.
Mortality of white pines at high elevations will transition forest types and ecosystems.
Need to accelerate the establishment of WPBR-resistant genotypes while sustaining ecosystem resilience.

"Be Proactive Rather Than Reactive!"

Ideas From Anna Schoettle:
Manipulate existing forest stands now to create a mosaic structure of mixed aged stands.
Create regeneration opportunities that favor white pine establishment.
Integration of areas where regeneration can occur in old forests BEFORE invasion of *Cronartium ribicola*.
Greater infection in younger patches, possibly less in the older cone producing population.
Those young trees that do survive will have a high degree of WPBR- resistance.
Repeat of this cycle will result in WP forests that are sustainable even in the presence of *Cronartium ribicola*.
Limber pine, as well as bristlecone pine forests, require rather large openings to ensure the establishment of these white pine species.
Need to know:
Frequency of resistance
Adaptive traits

Colonization
Regeneration
Management

The idea is to get regeneration started at periodic intervals to ensure mix-aged stands!
Jim Worrall questioned how we could explain to the public the cutting down of OLD bristlecone pines?
Questions arose as to effectiveness of this approach in mixed conifer stands.
Manipulation of existing forests should be appealing to public and private wildlife management groups … "They" appear to be able to "mange forests for wildlife habitats".
So be it if the forests are being burned "in the name of the wildlife habitat management" rather than for "forest tree species management", it is still good and necessary that such disturbances occur in order to maintain HEALTHY MIXED AGED FORESTS.

Need to come up with "how" to "sell" the idea to the forest service as well as to the public!
Could suppression funds be used for this type of proactive forest management?
WE should visit some of these big horn sheep management areas to access the effects on stands of limber, whitebark, and bristlecone pine.
Due to fire suppression, limber pine has encroached into lower elevations …
How can WE justify preservation of a species that in some places has taken over ecosystems where these trees had not historically occupied?

Prescribed fires as a management tool for low as well as high elevation white pine sites.
John Schwandt commented that WHITEBARK PINE REGENERATION is FIRE DEPENDENT;
Limber pine and bristlecone pine regeneration is only partially dependent on fire.
STDP funds may be justified for projects designed to demonstrate thinning effects in various types of stands.
Dave Conklin shared that in NM, southwestern white pine management is underway using funds for Bark Beetle and dwarf mistletoe suppression …. without designating such projects as "research" (for which STDP funds cannot be used!
Dave encourages genetic diversity in southwestern white pine management … no need to remove every southwestern white pine that is infected with WPBR!
There is a need to retain genetic diversity.
Bill Jacobi emphasized the need to develop "WPBR Management Protocols for Five-Needle Pines"
U.S.D.A. Forest Service Suppression monies were awarded the Great Sand Dunes National Monument $15,000 for pruning for WPBR management.
Jim Hoffman cautioned about creating favorable environments for invasion of Mountain Pine Beetles!
Jim Worrall suggested that the time of year of pruning is important!!!
Discussion followed pertaining to pros and cons of pathological pruning for management of WPBR.

The 2005 meeting was adjourned at 4:30 p.m.