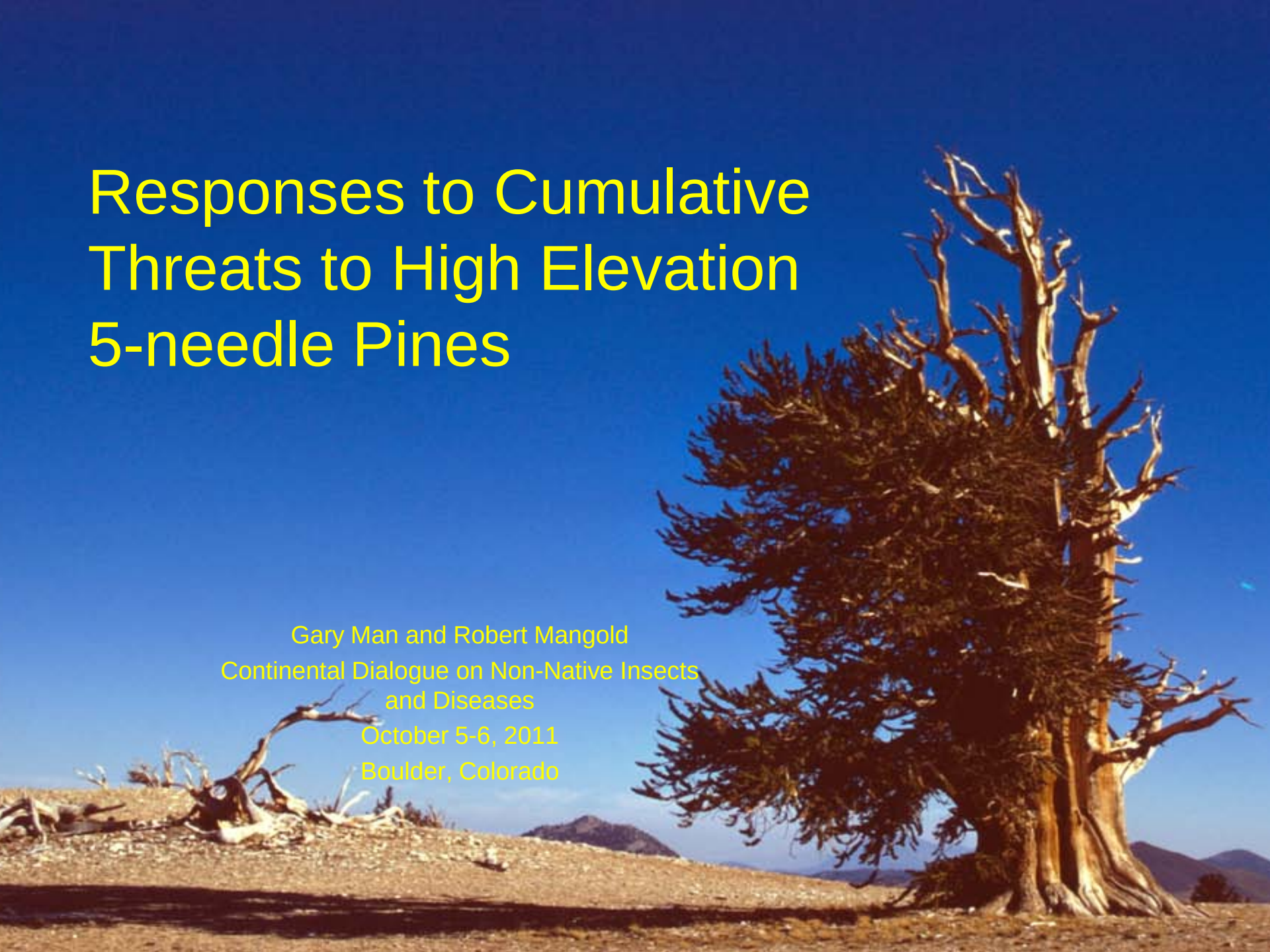
Responses to Cumulative Threats to High Elevation 5-needle Pines



Gary Man and Robert Mangold

Continental Dialogue on Non-Native Insects and Diseases

October 5-6, 2011

Boulder, Colorado

Outline

- **The Need for Action**
  - Mountain Pine Beetle
  - White Pine Blister Rust
  - Climate Change

Outline

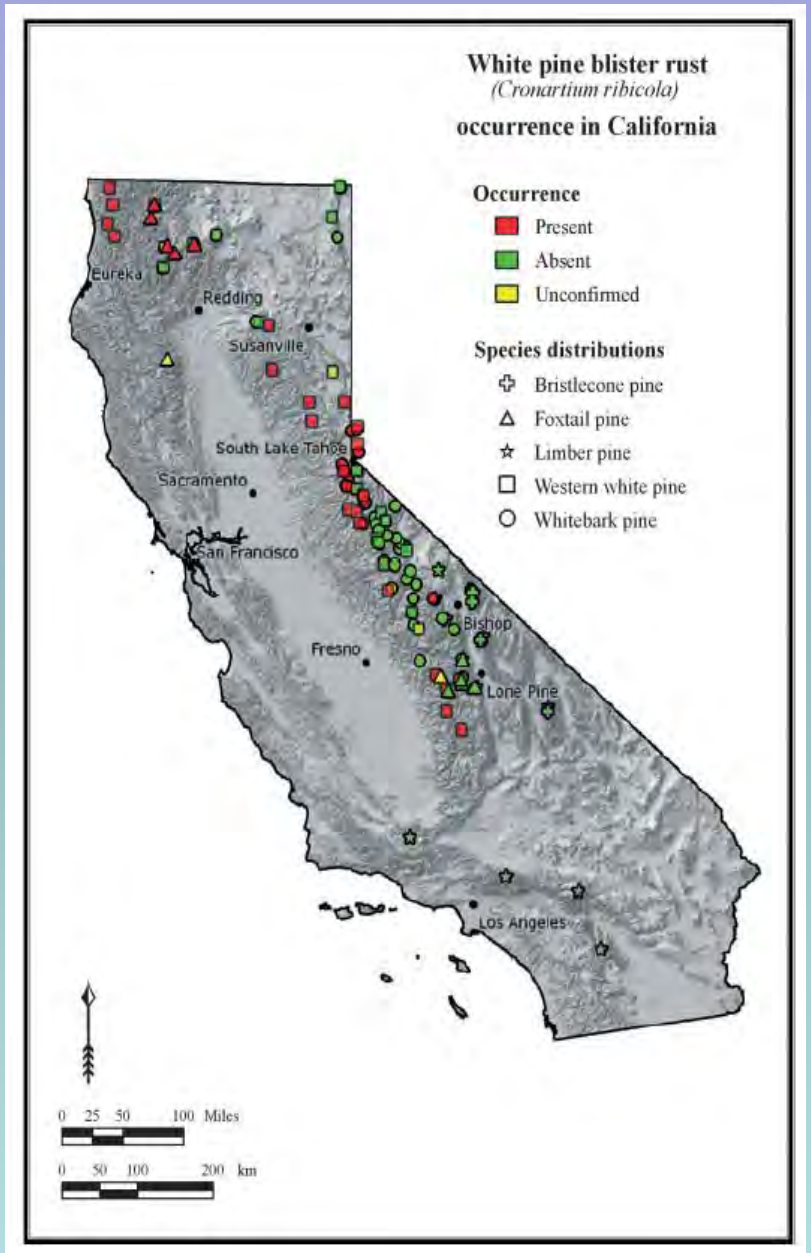
- **Response by the Forest Service and its Partners**
  - Restoration strategies
  - Fire ecology and management
  - Genetic variation
  - Gene Conservation
  - White pine blister rust resistance screening
  - Restoration – activities

Mountain Pine Beetle

- Aerial surveys recorded 6.8 million acres of mortality in 2010
- Mortality reported in many high elevation 5-needle pine habitats
- Running out of quality hosts (lodgepole pine) at lower elevations

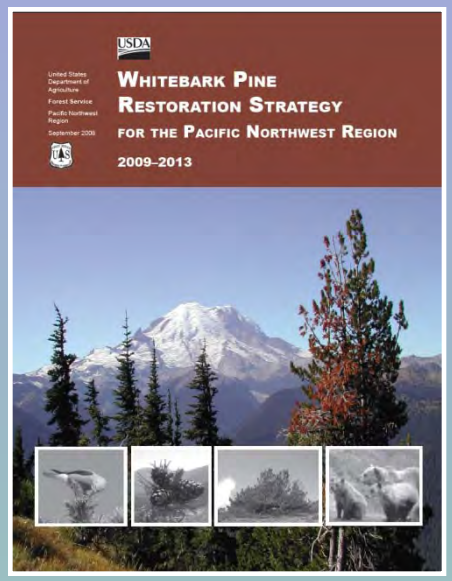
White Pine Blister Rust

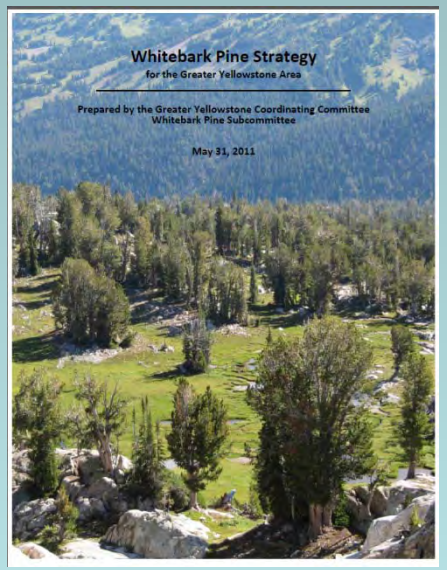
- Infection reported in all high elevation 5-needle pines except for Great Basin bristlecone pine
- Reported in approximately 500,000 acres above 5,000 feet in Idaho and Montana
- California reported highly variable infection rates but a high of 24% in the northern Sierras



Restoration Strategies

- A Range-wide Restoration Strategy for Whitebark Pine (Keane et. al., In Press)
- Whitebark Pine Restoration Strategy for the Pacific Northwest Region (Aubry et. al., 2008)
- Northern Region Restoration Strategy for Whitebark pine
- The Greater Yellowstone Area Whitebark Pine Restoration Strategy (GYCC, 2011)



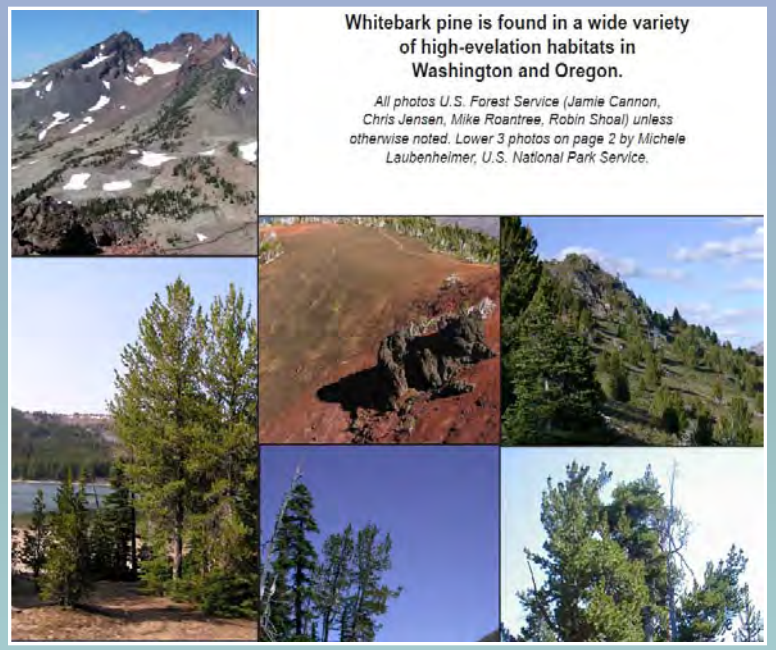


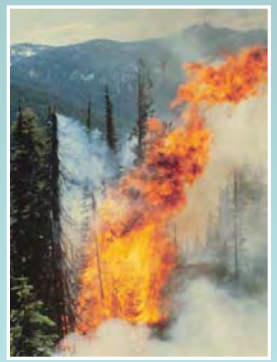
Restoration Strategies - Components

- Assess Condition
- Promote rust resistance
- Conserve genetic diversity
- Save seed resources
- Employ restoration treatments
  - Plan activities
  - Implement activities
  - Monitor
  - Conduct research

Restoration Strategies - Challenges

- WBP found in a wide variety of habitats
- Occupy at least 3 different fire regimes
- Not as much operational research on high elevation 5-needle pines as compared to other species





Fire ecology and management

- Research
  - The role fire plays
  - Reintroduction of fire into the ecosystem
  - Fire as a restoration tool
- Management
  - Reintroduction of fire into the ecosystem
  - Fire as a restoration tool

Genetic Variation

- No range-wide genetic variation studies on any high elevation 5-needle pines
- Regional Studies – (Garden Plots)
  - Pacific Northwest (WBP)
  - Interior West (limber pine)
  - Underway – RM Bristlecone pine (closest to range-wide study
- Molecular Studies–
  - Pacific Northwest (WBP)
  - Inland West (WBP)
- Preliminary Results – Generalist similar to WWP – broad range

Gene Conservation

- Focuses on four out of nine native 5-needle pine species:
  - Whitebark pine
  - Rocky Mountain bristlecone pine
  - Foxtail pine
  - Limber pine in parts of the range where heavily impacted by MPB

Gene Conservation

- Approach –
  - Genes conserved in seeds
  - 50 individual tree selections per seed zone or conservation area
  - Long-term storage at ARS facility in Fort Collins, CO
  - Redundant storage at local facility
  - Leverage existing efforts
  - Flexible

Gene Conservation

Accomplishments: 2008 to 2010

Region	Species					
		Whitebark pine	RM bristlecone pine	Limber pine	Foxtail pine	GB bristlecone pine
RM			71			
R5		10		43	51	10
R6		169				
PSW		84		25		
R1				3		
Collections in 2008-2009 from FHP Program		299	174	239	45	322
Totals		**562**	**245**	**310**	**96**	**332**
Target		1100	540	1087	110	
Percent Completed		**51.1%**	**45.4%**	**28.5%**	**87.3%**	

White pine blister rust resistance screening

- All are susceptible in the lab, only Great Basin bristlecone pine not documented to be infected in its natural range
- Testing over 650 WBP families as of 2010
- Preliminary results for resistance look promising
- Testing underway for the other species

Restoration activities

- Over 100 projects supported through the Forest Health Protection Whitebark Pine Restoration Program started in 2007.
- Forest Health Protection provided over $1.4 million to date that was matched with more than $1.8 million.

Table 1. Whitebark pine restoration program funding history.

	Totals	2007	2008	2009	2010
# Proposals Received	211	56	64	52	39
$$ Requested from FHP	4,661,135	1,005,700	1,981,134	960,851	713,450
Total Matching Funds	3,824,302	850,500	1,202,290	878,532	892,980
# Projects Funded	106	24	26	35	21
Forest Health Funds	1,448,032	267,320	398,900	481,612	300,200
Match for Funded Projects	1,782,358	291,700	433,850	444,683	612,125
TOTAL FUNDS INVESTED	3,230,390	559,020	832,750	926,295	912,325

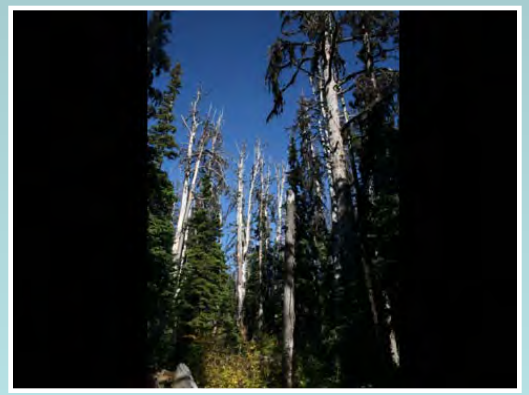
Response by the Forest Service and its Partners

Over 50 FHP Supported Projects in 2011

Interagency Monitoring for GYE
Asses WBP following WPBR, BB & fire
GYA WBP Seed Orchard-Site prep
Inoculation of seeds w/ ectomycorrhizal
WBP Restor & Cone Coll @ Crater Lake NP
Toboggan Ridge WBP Rest Planting
WBP Rust Validation & Monitoring
Broadaxe Plant
Rodent abundance & Seed Predation/Dispersal
Consolidated Direct Seeding Test
Conserving Genetic Diversity
Craddock Peak Cone Collection
Harnessing Rust Resistance
WBP Cone Coll Helena National Forest
Meridian Academy WBP Dendrochronology
Restoration of Gird and Dominic Fires
Bitterroot Op Cone Collection 2- lots
Remeasure Plots in Burns
WBP cone coll following MPB outbreak
Operational&Rust screening cone collections
Grouse Mtn Restoration Proj
Barker Lake Thin Study: Reduce comp veg to promote PIAL
WBP Plant Okanogan-Wenatchee NF
Seven devils WBP health Monitoring
Demographics of WBP recruitment pops. GYE
Natural Regen Surveys in the Purdy Fire Area
Identify & Map High Resistant WBP @ GYE
WBP release via Lodgepole Thinning
GYE-wide Database of Planted WBP seedlings, survivorship rates & site characteristics
BLM Inventory in WY & MT
Cache Crk WBP Restoration
Plains/Th Falls RD WBP Daylighting
Expand WBP inventory in R6
Tissue Culture Micro-Propagation of WBP
PIAL Sowing Beaverhead-Deerlodge
Cook City WBP Project
Landscape Tools for Strategic Cons & Mngmnt
PIAL cone coll Beaverhead Deerlodge NF
BLM Bighorn Basin/Wind River WBP Inventory
Monitoring the Effect of Treatment to WBP
Dev R1 PIAL Inv & Mon Protocols w/NFS corp tools
Fund force account climbers for cone col.
Remeasure R1 Perm Growth Plot w/ WBP
WBP Plus tree Cone Collection
Trinity Mt Forest Health Survey
Cabinet RD WBP Restoration KNF
NEPA Planning 4 WBP Planting
WBP Cone Coll in N. Cascades Nat'l Park
Microsatellite Genetic Markers
Tree ring Analysis & Advanced Regen & survival

Restoration activities - Fire

- Reduce competition from other species
- Reduce fuel loads
- Can treat larger areas at lower costs
- Create openings for natural or artificial regeneration



Restoration activities – Mechanical Treatments

- Thinning
- Girdling

Restoration activities – Seed Collection

- Collect seed for regeneration (natural and artificial)
- Collect seed for studies and research

Restoration activities –Natural Regeneration

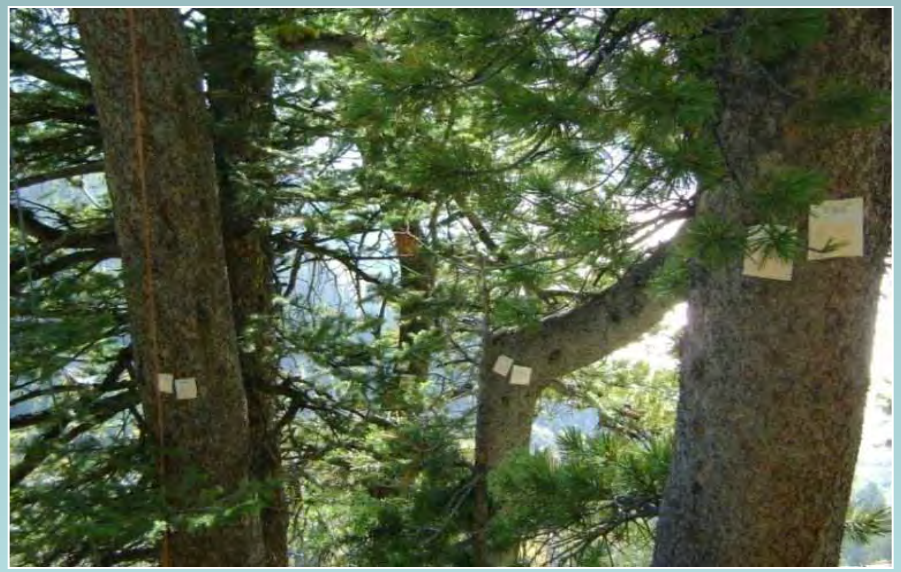
- Studies to determine best practices for natural regeneration
  - Supplemental seeding
  - Caging seeds
  - Rodenticides

Restoration activities – Artificial Regeneration

- Plant seedlings to:
  - Convert areas to shade intolerant WBP
  - Restore heavily trodden recreation sites and parking areas
- Planted 2,725 acres of WBP in the Inland West from 1988 to 2011

Restoration activities - Protection

- Apply verbenone and carbaryl to protect trees from mountain pine beetle



Restoration activities – Rust Screening

- Identify potential blister rust trees
- Test for possible resistance to rust

Thank You

Robert Mangold
USDA Forest Service, Forest Health Protection

- Photo acknowledgements and resources:
- Whitebark Pine Restoration Strategy for the Pacific Northwest Region (Aubry et. al., 2008)
- The Greater Yellowstone Area Whitebark Pine Restoration Strategy (GYCC, 2011)
- Management Guide to Ecosystem Restoration Treatments: Whitebark Pine Forests of the Northern Rocky Mountains, USA , RMRS- GTR-232, USDA Forest Service (Keane and Parsons, 2010)
- Maloney. P.E. Incidence and distribution of white pine blister rust in the high-elevation forests of
- California. For. Path. 41 (2011) 308–316.
- The Future of High-elevation, Five –needle White Pines in Western North America, RMRS- P-63, USDA Forest Service
- Anna Schoettle, USDA Forest Service
- Art Zack, USDA Forest Service
- Steve Thomas, National Park Service