

Summary

In 2002, residents of and visitors to New Mexico became increasingly concerned with the visible effects of a massive bark beetle outbreak across the Southwest. The relevant forest health issue in the Southwest is not simply that ponderosa or piñon pines are dying from bark beetle infestations; it is that entire forest systems are so far out of their normal ecological range that they are now at risk from disturbance factors such as forest insects, disease, drought, and wildfires.

Since most of the forests in the Southwest are under federal management, the public expects Forest Service managers to address their concerns. People want information to help them understand the forest health issue, and they expect the Forest Service to take action to resolve the situation.

Background

Pine forests in the Southwest are under attack from several species of native bark beetles. In Arizona, millions of ponderosa pines were killed in 2002 by the Arizona five-*spined ips*, pine engraver, western pine beetle, and round-headed pine beetle. In northern New Mexico, millions of piñon pine trees were killed by the piñon ips and mortality of ponderosa pine from the pine engraver and the western pine beetle is on the increase.

Although the current drought is the primary catalyst, several factors have contributed to the insect epidemics. This infestation of bark beetles is not unique, although it's been about 50 years since the last large-scale outbreaks. Unprecedented high tree densities are further exacerbating competition for moisture. As a result, tree losses over the next 5 years could be worse than has ever been experienced in recorded history.

When trees are stressed due to over-crowding and drought they become susceptible to attack from bark beetles. In fact, the defense mechanisms of trees must be weakened before certain bark beetle species can successfully colonize and kill them.

People value trees, but they often don't understand that forests are dynamic. This means that over time, landscapes change. People do not like to see trees die anywhere, but they are especially concerned about the loss of trees on their property or in and around communities in which they live.

Many people are now aware of what is causing the trees to die and are turning to government agencies for assistance. The question has evolved from "What is causing this?" to, "What is the Forest Service going to do?" Now communities and private landowners are looking for information and alternatives to minimize the tree losses.

Since the Forest Service manages a significant portion of the forested areas in the Southwest, the public expects the agency to take action to resolve the bark beetle situation. There is an increased concern that mortality could increase the risk of wildfire. Many people expect that the Forest Service will remove the dead trees from around communities and adjacent to private lands. Where the structural failure of dead trees is a threat to people or property, the expense of removing such hazard trees is a concern on both public and private lands. And there is a

concern about the adverse impact the dead trees will have on visual quality and property values.

Forest managers become concerned when trees begin to die in large numbers and worry about the adverse effects on forest resource values and uses. They evaluate options to respond to the infestation. Providing accurate information to the public and protecting high value sites are two of their concerns.

The long-term view is that we need to thin pine forests. If we don't change forest conditions that favor bark beetles, we will experience similar epidemics in the future.

Problem Statement and Goals

The Southwest is experiencing widespread pine bark beetle epidemics. These infestations are causing a high rate of mortality in piñon woodlands and ponderosa pine forests. Tree losses are expected to increase. The resulting change in the landscape has potential for far-reaching impacts on forests, communities and private lands New Mexico. The magnitude of the problem and the land manager's limited options in resolving the situation could easily erode the public's confidence in our ability to manage our forest resources.

Key Messages And Talking Points

- 1. The pine bark beetle outbreak is nature's response to too many trees and too little moisture.**
 - A dramatic decrease in precipitation combined with high tree density and the natural presence of bark beetles has resulted in a bark beetle population explosion.
 - Southwestern forests are now highly susceptible to widespread bark beetle attacks. Bark beetles are exploiting optimal conditions.
 - As the agency responsible for managing over 20 million acres of forested land in the Southwest, the Forest Service is very concerned with the long-term effects of this beetle outbreak.
- 2. There are no practical means to slow or stop this widespread outbreak and extensive trees losses may continue for several years.**
 - Tree mortality is occurring rapidly and extensively because southwestern beetles produce several generations per year.
 - Due to the extent of the beetle outbreak, and the way these insects attack trees, there is little or nothing that can be done to affect them. The beetle infestation will continue until drought conditions subside and trees recover their vigor.
- 3. There will still be forests and woodlands in the Southwest, but their appearance and vegetative mix will change in many areas.**
 - From an aesthetic standpoint, the outbreak looks severe in many areas.
 - While our landscapes may change, not all trees will be lost. There will still be forests and woodlands after this event runs its course.
- 4. Uninfested high value trees in limited areas can be protected.**

- Land managers and landowners should learn to recognize evidence of bark beetle presence.
 - It is important that people seek out the most current and accurate information and advice before taking any actions.
 - Because there are so many variables that influence management options, actions should be considered on a case-by-case basis.
 - It is possible to protect uninfested individual trees using preventive insecticide sprays on the bark applied from ground-based equipment.
 - There is nothing that can be done to save a tree once it is infested with bark beetles.
- 5. We can reduce the impacts of future outbreaks by improving the health of our forests and woodlands through thinning of overcrowded stands of trees.**
- Thinning overpopulated forests isn't just about reducing fire risks.
 - Thinning creates healthy forests that can withstand many kinds of disturbance, including bark beetle attacks.

Expanded Talking Points

Current Situation:

- Major bark beetle epidemics are occurring in New Mexico.
- The outbreak may continue for several years.
- A large number of ponderosa pine and piñon pine trees are dead and millions more will die.
- The loss of trees will have a significant impact on public lands, communities and landowners.
- The Forest Service is extremely concerned with the long-term effects.

Causes:

- On average, the pine forests are 37 times denser than they were 100 years ago.
- Competition for moisture has weakened forests and made them vulnerable to bark beetles.
- The last five years has been one of the driest periods in the last century.
- The bark beetle species involved in the epidemics are native to the Southwest.
- The combination of drought and tree density has resulted in conditions favoring the bark beetle epidemics.

Constraints:

- Due to the condition of the forest and scope of the epidemics, there is little that can be done to slow or prevent large scale tree loss.
- Because the bark beetles reproduce so quickly, we cannot slow or stop the epidemics.
- The epidemics will not slow down until drought conditions subside and trees regain their vigor.
- Indications are that multiple years of above average precipitation will be needed before the epidemics subside.

Short-term treatment options:

- It is critical for land managers and landowners to become knowledgeable about bark beetles and treatment options.
- People should not be implementing any treatment until they know about the presence of bark beetles or the potential risk of losing trees.
- Contact your local county extension agent, state district foresters or forest health specialist for pest management advice.
- Landowners can protect uninfested trees with insecticides. The two insecticides registered for bark beetle control are carbaryl (Sevin SL®) and permethrin (Astro®) which are applied to the bark of trunks and limbs greater than three inches in diameter.
- Landowners need to realize that infested trees cannot be saved.
- The timing of removing trees is critical and advice must be sought before thinning trees. The presence of fresh slash and chipped material can attract bark beetles.

Long-term view:

- These epidemics will kill a substantial number of trees and will significantly alter vegetative structure and species composition across the landscape.
- These forests are in an unsustainable condition: too many trees are competing for too little water.
- If we don't thin the forests, insects and fire will do it for us—without regard for human aesthetic or economic values.
- It will take decades of extensive and sustained thinning to achieve a level of forest health that is resistant to bark beetle outbreaks.
- An important tool in maintaining low tree densities in thinned stands is the use of prescribed fire.
- Once the epidemic runs its course, there will still be a forest, although perhaps not as we have known it.
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- Woodlands will look different in the future, with a higher proportion of juniper.

Expanded Talking Points

Current Situation

- Many millions of piñon trees have died in New Mexico due to their drought-weakened condition being exploited by the piñon ips bark beetle.
- Most of the piñon mortality is on public, private, County, and Tribal lands.
- Limited ground surveys indicate 40 to 70 percent of the piñons in affected piñon-juniper stands have been killed. At the lowest elevational ranges of piñon only seedlings and saplings less than three inches in diameter are surviving.
- Juniper is not affected by the piñon ips bark beetle.
- Most of the piñon mortality is at the lower elevational limits of piñon's range, and on rocky, poor, dry sites.
- Total acreage affected is unknown, but northern New Mexico appears to be the hardest hit.

- Other species of bark beetles that attack ponderosa pine are also on the increase, but their activity is thus far limited to lowest elevational limits of ponderosa pine around Los Alamos, on poor, dry sites having very shallow soils.

Causes

- Reduced levels of precipitation, particularly winter and spring snows, over the past several years, have left overly dense stands in a moisture-stressed condition.
- The piñon ips bark beetle (scientific name *Ips confusus*), is breeding prolifically in the weakened piñon trees, completing three or four generations per year.
- The tree's natural defense of using sap to push out the attacking beetles as they enter the tree has been compromised by lack of sufficient moisture.
- Above average precipitation in the last several decades has allowed piñons to successfully colonize lower elevation grasslands. Given the reduced precipitation levels of the last few years, the high densities of juniper and piñon on these sites now exceed the carrying capacity.

Constraints

- Due to our inability to influence precipitation patterns, and the scale of the bark beetle outbreak, landscape level approaches to limit piñon mortality are not feasible.
- Individual uninfested trees can be protected with an insecticide spray applied to the bark, but this treatment is costly.
- Where piñon ips has reached epidemic proportions, removing infested trees may not be an effective treatment option if the adjacent landscape harbors a reservoir of beetles.
- Detection of green infested trees is often difficult, limiting the effectiveness of preventive spray treatments.

Short-term treatment options

- It is critical for land managers and landowners to become knowledgeable about bark beetles and treatment options.
- Contact your local county extension agent, other state district foresters or forest health specialist for pest management advice.
- Landowners can protect uninfested trees with insecticides. The two insecticides registered for bark beetle control are carbaryl (Sevin SL®) and permethrin (Astro®) which are applied to the bark of trunks and limbs greater than three inches in diameter.
- Landowners need to realize that infested trees cannot be saved.
- The timing of removing trees is critical and advice must be sought before thinning trees. The presence of fresh slash and chipped material can attract bark beetles.

Long-term view:

- The epidemic will kill a substantial number of trees and will significantly alter the vegetative structure and species composition across the landscape.
- Our forests and woodlands are in an unsustainable condition: there are too many trees and too little water.
- If we don't thin the forests, insects and fire will do it for us, without regard for aesthetics, economics, or other human values.
- It will take decades of extensive and sustained thinning to achieve a level of forest health that is resistant to bark beetle outbreaks.

- An important tool in maintaining low tree densities in thinned stands is prescribed fire; however most stands are presently too dense for fire to be safely reintroduced prior to thinning.
- Once the epidemic runs its course, there will still be a forest, although perhaps not as we have known it.
- Woodlands will look different in the future, with a higher proportion of juniper.

Questions And Answers

1. What is the overall pine bark beetle situation in the Southwest?

Several species of pine bark beetles have experienced population explosions over the last few years. In 2002 conditions were especially favorable for these insects because the region-wide drought weakened trees' normal way of resisting these insects. Consequently, millions of trees were killed in Arizona and New Mexico.

2. When the drought ends, will bark beetle populations return to normal levels?

Yes, but this may take some time, because trees depend on moisture to fight off beetle attacks. Because beetle populations are so high and geographically widespread, bark beetles have, in essence, a huge head start. In order for beetle populations to dwindle to normal levels across millions of acres, sufficient moisture over an extended period of time will be required.

3. Can insecticides be used to combat these insects?

Applying an insecticide to the bark prior to beetle attack can protect individual trees. This treatment will protect trees for about a year. Once a tree is infested it is too late to consider the use of insecticides. Large-scale application of insecticides is not feasible from either an economic or practical standpoint. Aerial spraying is not viable as an alternative because the insecticide would not adequately cover the bark surface.

4. What happens once a tree dies?

Within 3 to 6 months of a tree dying, its needles will drop to the ground. The snag (a standing dead tree) will stand for anywhere between 2 and 6 years before falling to the ground. How long a snag remains standing depends on a number of factors, but especially on the rate of decay of the tree's root system. Dead trees could pose a hazard if the path of their fall threatens structures or areas frequented by people.

5. Where did these beetles come from?

These native bark beetles are always present in our southwestern forest ecosystems, but usually at low population levels.

6. How do these beetles kill trees?

Bark beetles chew their way through the outer bark of a tree and feed on the nutritious soft inner bark. After attack, they emit a chemical scent (called a pheromone) that attracts other beetles. The beetles then mate and lay eggs in galleries or chambers they

construct between the bark and the wood. A “blue stain” fungus carried by the beetles contributes to the death of tree by clogging water-conducting tissues.

7. What is the FS doing to address the bark beetle infestations on National Forests?

The infestations developed so quickly and are so widespread that there is nothing the Forest Service or anyone can do to stop them. However, assessments of the situation are being conducted on affected National Forests and trends in tree mortality are being monitored. Thinning in and around recreations sites or adjacent to communities is being considered to enhance tree vigor.

Several developed recreation sites are being evaluated for insecticide application to protect high value trees. The objective of these treatments is to protect the FS investment in these facilities by maintaining aesthetic quality and minimizing the hazard dead trees pose to visitors.

If we look at the bark beetle epidemic at the “Big Picture” scale, the recipe for future success requires thinning of unhealthy forests to restore their ability to naturally withstand these events, even in tough drought years.

8. What can an individual landowner do to protect trees on their property?

That depends on a handful of variable factors. For example, if a landowner can afford to, one could treat individual trees with insecticides to prevent bark beetle attacks. Or, another strategy is to water trees to bolster their natural defenses. (Watering is no guarantee of protection, though, because a mass attack of bark beetles can overwhelm even a healthy, thriving tree and kill it.)

Another way to protect a small stand of trees is to thin the smaller and less healthy trees in the stand so as to give the dominate trees that remain a better chance to regain enough vigor to fight off beetle attacks. Do not initiate thinning unless slash can be removed, burned or chipped and dried (see #9).

9. What actions should be *avoided* when attempting to protect trees?

Do not do anything that will introduce further stress to your trees. For instance, anytime a tree is damaged and must produce sap to cope with an injury, it has to expend precious moisture (in the form of sap). That weakens the tree and makes it that much more susceptible to beetle attack.

Removing small or poorly competing trees from a stand can improve the vigor of the remaining trees, but it is a mistake to fail to deal with the slash (tree tops and limbs generated by cutting). Untreated slash left on the site is actually an attractant to additional beetles. If they breed in the slash, they represent yet another source of new beetles to attack the remaining trees.

Because feeding by the non-lethal bark moth or pitch nodule moth can resemble bark beetle attack, do not cut down trees before confirming bark beetle presence.

10. What are the impacts of this epidemic?

It is difficult to measure the social, environmental and economic impacts related to tree losses due to the beetle outbreak. The duration and extent of the epidemic cannot be predicted. Not all impacts will be negative. Potentially positive results will be the natural thinning of some stands, improved watershed yield, improved wildlife habitat, and enhanced biological diversity. Trees reproduce and die throughout the life of the forest; in this event, though, the process of trees dying is far more apparent. Even under the worst circumstances that can be envisioned, there will still be a forest; it just may not resemble the forest with which we are now familiar.

11. How bad is this PBB outbreak compared to other outbreaks?

While we know that bark beetles have been a part of the natural ecology of the Southwest for as long as our forests have existed, early reports don't provide many details. We know severe outbreaks occurred during the 1950s drought, but historic records do not detail locations, extent or severity. We cannot predict the duration of the current outbreak or how many trees will ultimately die. However, stand densities are believed to be well beyond the natural range of historic variability, so trees losses could potentially be greater than previously experienced.

12. How have past Forest Service management practices contributed to this problem?

It is generally accepted by the scientific community that many forest management policies and practices contributed to the unnatural tree densities that now exist in our forests. Fire prevention and suppression activities appear to be the primary factors interrupting the natural fire return cycle. Fire suppression during the first three-quarters of the 20th century was supposed to protect forests from a perceived "enemy" but it only succeeded in programming our forests for fiercer wildfires in the final quarter-century—not to mention these first few years of the 21st century.

13. Are federal funds available to help me thin trees on my property?

No federal funds are directly available to private landowners for bark beetle prevention thinning. Some communities are participating with State forestry organizations in fuels reduction programs that could have a secondary benefit in reducing bark beetle susceptibility where thinning achieves improved vigor in the remaining trees. Community assistance grants of this type are generally announced in the local media.

14. How much salvage logging is the FS going to do to clean up this mess?

Salvage options are being considered by the Forests on a case-by-case basis, but due to economic and administrative limitations, very little of the affected timber would likely be salvaged. Removal of dead trees vacated by beetles will have no impact on bark beetle populations.

15. How will this beetle outbreak contribute to our wildfire problems?

Many people are concerned that numerous standing dead trees will contribute to our already ominous fire situation. However, the situation isn't as bad as it seems. Typically, beetle-killed trees shed their needles within a few months of dying, so they won't create as big a threat to massive fire spread as one might imagine. The millions of new snags do present a threat of spotting when a forest fire is burning around them,

and that threat will have to be considered every time a fire is burning near beetle-killed trees. Once trees fall, a fire in these large fuels would burn longer and hotter, damaging soils and adversely affecting the site in the long-term.

16. Who should a private landowner contact for information on protecting trees or reducing their susceptibility to pine bark beetles?

In Arizona, private landowners should contact the local county extension agent or the local AZ State District Forester and AZ State Fire Management Officer. **In New Mexico, they should contact George Duda, Urban Forester, New Mexico Forestry Division at (505) 476-3332, or their local New Mexico Forestry District Office.**

17. What will our future forests look like?

People need to recognize that the pre-outbreak forests they once knew will not be the forests of the future. In the affected ponderosa pine type, woody shrubs and other under story vegetation will become predominant in the short-term. A ponderosa pine element will still exist where the impact of the beetles is less severe. Introduced exotic plants could also be at an increased advantage. In the piñon-juniper type, the loss of piñon will result in juniper becoming more dominant. In any case, forests will still exist, just not in the same condition we have previously known.

18. Who is responsible for addressing the potential hazard of dead trees falling onto roadways?

Dead or dying trees, which have been attacked by bark beetles, can fall onto the roadway or shoulders, either striking vehicles directly or placing an obstacle on the travel way. The hazard from such trees is worst during windstorms, heavy rain, and snow events, but dead or dying trees can fall at any time. Public road authorities have the responsibility to remove trees and other vegetation that present a hazard to motorists. Public roads are defined as roads under the jurisdiction of and maintained by a public authority and open to public travel (23 U.S.C 101). Public road authorities are those federal, state, county, town or township, Indian tribe, municipal or other local government or instrumentality thereof, with authority to finance, build, operate or maintain highway facilities (23 CFR 460.2(b)). An important maintenance objective of public road authorities is to provide safe highway travel to protect human lives and property.

The approach to this concern varies by national forest district. Contact your local ranger district office for further information.

New Mexico Partners And Cooperators- State Government

New Mexico Partners And Cooperators- Federal Agencies

Agency/Title	Name	Location	Service Wide	Phone	E-Mail
NM State Forestry Division, State Office Urban Forester	George Duda	EMNRD, State Forestry Division, State Forester's Office, Santa Fe, NM	Statewide	(505) 476- 3332	gduda@state.nm.us
NM State Forestry Division, Chama District/ Timber Mgmt. Officer	Craig Daugherty	State Forestry Division, Chama District Office, Chama, NM	Rio Arriba, San Juan Counties and the west half of Taos County	(505) 588- 7831	cdaugherty@state.nm.us
NM State Forestry Division, Cimarron District Timber Mgmt. Officer	Arnie Friedt	State Forestry Division, Cimarron District Office, Ute Park, NM	Colfax, Union Counties and the east half of Taos County	(505) 376- 2204	afriedt@state.nm.us
NM State Forestry Division, Socorro District Timber Mgmt. Officer	Nick Smokovich	State Forestry Division, Socorro District Office, Socorro, NM	Catron, Dona Ana, Grant, Hildalgo, Luna, Sierra, and Socorro Counties	(505) 835- 9359	nsmokovich@state.nm.us
NM State Forestry Division, Las Vegas District Timber Mgmt. Officer	Roberta Padilla	State Forestry Division, Las Vegas District, Las Vegas, NM	San Miguel, Mora, Quay, Curry, Guadalupe, and Harding Counties	(505) 425- 7472	rpadilla@state.nm.us
NM State Forestry Division, Capitan District Timber Mgmt. Officer	Bill Duemling	State Forestry Division, Capitan District, Capitan, NM	Lincoln, Otero, Chavez, Eddy, DeBaca, Roosevelt, and Lea Counties	(505) 354- 2231	bduemling@state.nm.us
NM State Forestry Division, Bernalillo District Forest Resource Mgmt. Officer	Todd Haines	State Forestry Division, Bernalillo District, Bernalillo, NM	McKinley, Cibola, Los Alamos, Sandoval, Bernalillo, Torrance, and Santa Fe Counties	(505) 867- 2334	thaines@state.nm.us
NM State University, Cooperative Extension Service Extension Agent	Carlos Valdez	Los Alamos County	Los Alamos County	(505) 662- 2656	cvaldez@nmsu.edu

AGENCY/TITLE	NAME	LOCATION	PHONE	E-MAIL
Bureau of Land Management, State Office, External Affairs Chief	Hanson Stuart	Statewide	(505) 438-7510	hanson_stuart@blm.gov
Bureau of Land Management, State Office,	Mckinley-Ben Miller	Statewide	(505)	
National Park Service	Gerald McCrea	Statewide	(505) 988-6024	Gerald_mccrea@nps.gov
Fish and Wildlife Service	TBD			
Bureau of Indian Affairs	TBD			

New Mexico Bark Beetle Epidemics

January 2003

General:

- Much of New Mexico is currently experiencing a large upswing in piñon and ponderosa pine mortality due to outbreaks of several species of *Ips* beetles and the western pine beetle. Low tree vigor caused by several years of drought and excessively dense stands of trees have combined to allow bark beetle populations to reach outbreak levels.
- These insects are native to piñon-juniper woodlands and ponderosa pine forests of the Southwest, normally attacking only a small number of diseased or weakened trees. Healthy trees are usually not susceptible to these beetles.
- The bark beetles are tiny, roughly 1/8 inch in long, or about the size of a match-head.
- These beetles have multiple generations per year, and when conditions are favorable, they have a tremendous capacity to increase their populations.
- The beetles attack trees by chewing through the outer bark and laying eggs. When the eggs hatch, the larvae feed on the soft, nutritious inner bark. Also, the beetles introduce a “blue-stain” fungus that spreads through and clogs the water and nutrient conducting tissues, hastening tree death. Once the insects mature, they leave the infested tree and travel to a new host. Usually, they travel only a short distance, but they are capable of moving up to ½ mile or more.
- Millions of piñon trees have already been killed, mostly where piñon and juniper grow together. Juniper is unaffected by the insect attacking the piñons. In some localized areas, up to 70 percent of the piñons have died, leaving only the smallest seedlings to survive. Even then, small piñons may be vulnerable to another, less aggressive insect, the twig beetle. Ponderosa pine mortality is also on the increase, although not at the scale of piñon. This is the worst bark beetle epidemic in the Southwest in almost 50 years. If the drought persists, more trees can be expected to die.
- Currently, tree mortality is centered in “stress-zones” such as drier south-facing slopes, transition areas between ponderosa pine and piñon-juniper areas, recent construction sites, and areas heavily infected with dwarf mistletoe.
- Infested trees will start to turn reddish-brown within a month of attack. Evidence of infestation can include sawdust at the tree’s base or in bark crevices, small pop-corn-like masses of sap called “pitch tubes”, small boring holes, and a “fading” of the needles. If the tree is extremely drought-stressed, it may not produce pitch tubes, which are its natural defense against the beetles.

- Once beetles have left a tree, it no longer poses a threat to other trees as a source of beetle infestation.

Treatment:

- There is *nothing* that can be done to save a tree after it has been successfully attacked by bark beetles and infected with the blue-stain fungus. If the goal is to kill the beetles under the bark, then infested trees must be cut-down and treated by one of the following means:
 - o Pile and cover logs with clear plastic in a sunny site (this produces high temperatures by a greenhouse effect),
 - o Peel the bark from logs, or
 - o Burn, chip, or bury the logs. (It must be noted that fresh pine chips can attract *Ips* beetles and should to be immediately removed from forested sites.)
 - o Fresh pine debris over 4-inches in diameter, created during tree thinning operations, must be removed from the forest or treated as noted above to prevent it from becoming breeding material for *Ips* beetles.
 - o There is no effective insecticide treatment for infested trees. Injecting trees with systemic insecticides is not an effective method of control or prevention due to the feeding location of the beetles within the inner bark.
 - o Be aware that removal of actively infested trees may not be an effective treatment option during an epidemic because of the difficulty in detecting and removing all green-infested trees, the asynchrony and rapidity of beetle reproduction, and the sometimes overwhelming opportunities for re-infestation from adjacent untreated properties.
 - o Due to the extent of the outbreaks and the tremendous capacity of bark beetles to reproduce, the implementation of effective large-scale control actions to prevent further tree losses is not feasible.

Protecting High-Value Trees:

- Trees not yet infested can be protected by annual applications of a preventive insecticide. Carbaryl and permethrin are specifically labeled for this purpose, but carbaryl is the preferred material because it provides longer protection. Typical home and garden insecticides should not be used. The entire surface of the trunk and large limbs must be thoroughly sprayed. *Ips* beetles will attack any limb or trunk 3 inches in diameter or larger, so care must be taken to treat to these diameter minimums.
- Over the long run, reduction of tree density, disposal of the resulting woody debris, and appropriate use of prescribed fire, will not only improve forest health, but also greatly reduce the probability of bark beetle outbreaks and catastrophic wildfire.

For further information contact:

- Debra Allen-Reid, USDA Forest Service, Forest Health New Mexico Zone Leader, at 505-842-3286; George Duda, Urban Forester, New Mexico State Forestry, at 505-476-3332; or your local New Mexico State Forestry District Office. Local county extension agents can also provide assistance.
- Additional information can be obtained at:

USDA Forest Service, Southwestern Region, Forest Health web site:
<http://www.fs.fed.us/r3/resources/health>

State of New Mexico Division of Forestry bark beetle web site:
<http://www.emnrd.state.nm.us/forestry/factsheets/barkbeetles/beetles.cfm>

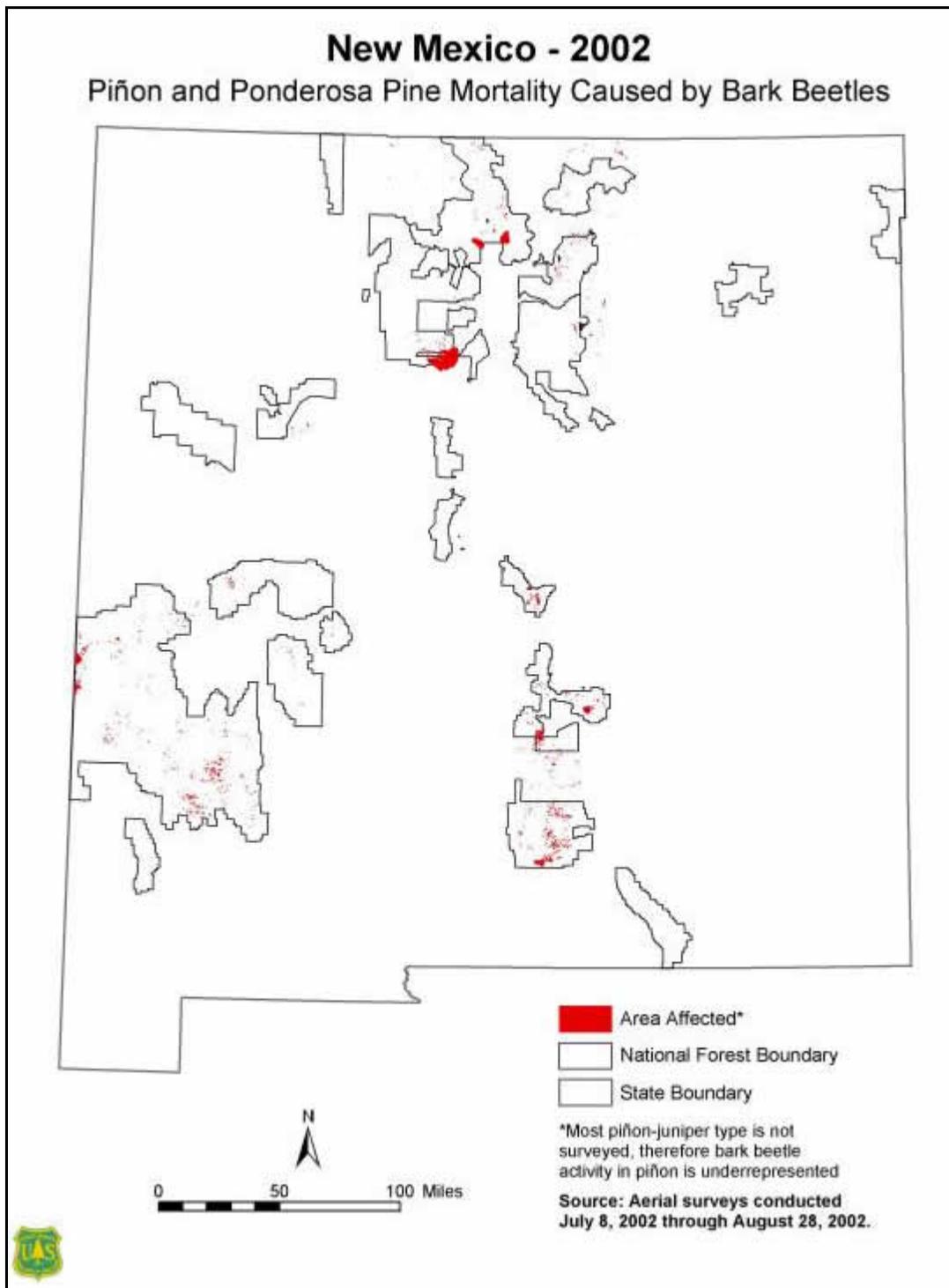
SW Yard and Garden addresses why systemics are not helpful:
<http://www.cahe.nmsu.edu/ces/yard/1997/090897.html>

University of AZ, Yavapai County Coop. Extension:
<http://cals.arizona.edu/yavapai/anr/foresthealth/PrescottBarkBeetles.pdf>

Acres of Forest Insect and Disease Activity Detected from Aerial Survey in New Mexico

	Western pine beetle	Mountain pine beetle	Round- headed pine beetle	Western pine beetle/ Round- headed pine beetle	Ponderosa <i>Ips</i>	Piñon <i>Ips</i>	Douglas- fir beetle	Spruce beetle	Fir engraver	Bark Beetle Total
2002										
Carson NF		3,265				16,240	90	1,675	455	21,725
Cibola NF	1,055				1,210	4,670		155	970	8,060
Gila NF	31,515				325	1,440	40	15	410	33,745
Lincoln NF	3,270		3,195	23,635	1,545	860	10	610	350	33,475
Santa Fe NF	2,970	230			825	5,425	175	2,440	1,655	13,720
Valles Caldera NP	25							20		45
Bandelier NP*						2,405				2,405
Cochiti Pueblo Tribal*						15,705				15,705
Isleta Pueblo Tribal										0
Jemez Pueblo Tribal	770					45				815
Jicarilla Tribal		5				75			160	240
Mescalero Apache Tribal	660		475	1,675	20				20	2,850
Picuris Pueblo Tribal		25								25
Santa Clara Pueblo Tribal	30	30					10		320	390
Santo Domingo Pueblo Tribal*						2,735				2,735
Taos Pueblo Tribal		210					45	490		745
State & Private	150			1,365	4,795	21,185			460	27,955
2002 New Mexico Total	40,445	3,765	3,670	26,675	8,795	70,710	370	5,405	4,800	164,635
2001										
Carson NF		1,500				275	75	1,225	200	3,275
Cibola NF	2,735					1,640	100	135	335	4,945
Gila NF	27,545					11,595	175	50	50	39,365
Lincoln NF			690			1,375	15	745	15	2,840
Santa Fe NF		525				680	410	2,515	560	4,690
Valles Caldera NP		60					75	20		155
Isleta Pueblo Tribal	475									475
Jemez Pueblo Tribal										0
Jicarilla Tribal		105				295	45		100	545
Mescalero Apache Tribal			840				65		80	985
Picuris Pueblo Tribal		30								30
Santa Clara Pueblo Tribal		5					45		5	55
Taos Pueblo Tribal		60						360		420
State & Private	150				2,080	10,960		510	195	13,895
2001 New Mexico Total	30,905	2,285	1,530	0	17,940	10,960	1,005	5,510	1,540	71,675

* Included in special survey flown to map piñon mortality during August 2002 in specific areas



Pinon and Ponderosa Pine Mortality Caused by Bark Beetles, New Mexico, 2002

Briefing Papers

September 2002

Briefing Paper: Sequence of Events Causing Pine Mortality in the Southwestern Region and Possible Actions that can be Taken to Protect High-Value Trees

Prepared by Doug Parker

As many people have noticed this summer, especially those who live in communities close to forested areas, a substantial number of piñon and ponderosa pines have died over extensive areas throughout Arizona and New Mexico. Forest Health specialists have conducted pest detection surveys this summer to record the location and intensity of the ponderosa pine losses. Information about piñon mortality is not as complete.

Several factors have contributed to these tree losses, although the current drought is the primary catalyst. This event is not unique to the Southwestern Region, although it has been almost 50 years since such similar losses have occurred as a result of a drought.

Another factor contributing to the tree mortality is the high density of trees in many forests and woodlands. For example, average tree densities in ponderosa pine forests have increased about 37 fold over the past 150 years. A similar trend has been documented in piñon/juniper woodlands. When trees grow too close together, they compete for limited moisture; and they become stressed if this situation persists for many years. Trees can appear to be relatively healthy, in spite of the hidden condition of being less tolerant to drought. Trees growing on south-facing slopes, dry hilltops, and rocky ridgelines or rocky flats, are most vulnerable to drought conditions.

When trees are stressed due overcrowding and drought, they become susceptible to attack from several species of bark beetles. In fact, the defense mechanisms of trees must be weakened before certain species of bark beetles can successfully attack them. Adult beetles bore into the trunk and large limbs and lay large numbers of eggs, which hatch into very small grubs that chew through the tree's inner bark. The beetles also infect the tree with a fungus that clogs the water conducting tissues. Within a few months after being attacked, most pine needles turn from a pale green color, to straw tan, to reddish brown. The tree is essentially dead following a successful attack by bark beetles, even though the foliage may still be green.

Forest and woodland systems are so far out of normal ecological ranges that virtually every element in the system is affected and at risk from this sequence of disturbance events.

Forest Health specialists have identified four species of bark beetles that are involved in killing pines: western pine beetle (*Dendroctonus brevicomis*), Arizona five-spined ips (*Ips lecontei*), and pine engraver (*Ips pini*) attacking ponderosa pine; and the piñon ips (*Ips confuses*) attacking piñon. These species are native forest residents, which typically do little damage. But when conditions are favorable, their populations can increase exponentially and kill thousands of trees. Given the nature of bark beetle outbreak cycles, Forest Health specialists expect to see more trees die, especially if the drought persists.

Once bark beetle outbreaks are underway, there is little if anything that can be done to reduce beetle populations; however, there are some actions forest managers and homeowners can take to protect the loss of high-value trees.

Prevention Practices: When beetle outbreaks are underway, strict prevention measures are needed to avoid creating conditions that favor further bark beetle population buildups, especially for engraver beetles (*Ips* spp.), that prefer to attack fresh pine slash. This may help to reduce local trees losses, which is especially important in urban settings. When possible, tree cutting and thinning operations should be avoided until beetle outbreaks subside. If treatments cannot be delayed, destroying slash by burning, burying, etc., should be done. Removal of the bark from freshly cut trees also will prevent bark beetle attacks. Chipping is another acceptable approach, although fresh pine chips must be immediately removed from areas with susceptible pines to avoid attracting bark beetles. It is especially important for homeowners to avoid cutting infested trees for firewood and stacking beetle-infested logs near susceptible pines. Covering bark beetle-infested firewood with clear plastic sheeting and anchoring the sheets to the ground with soil and rocks has shown to kill beetle broods through a greenhouse effect if the piles are exposed to intense sunlight.

Once bark beetles have invaded a tree, it cannot be saved.

Handling Infested Trees: Nothing can be done to save a tree after it has been successfully infested by bark beetles and infected with the blue stain fungus they carry. Forest managers and homeowners should not be fooled by pest control operators who claim they can save an infested tree by treating it with an insecticide. Most insecticide treatments are ineffective against bark beetles under the bark. It is important to understand that the fungus infection alone will kill a tree. As a precaution, currently infested ponderosa pines should be cut and treated as soon as possible to reduce the risk of beetles emerging from an infested tree and attacking adjacent, high-value trees. Removal of infested piñons may not be cost-effective, such as in northern New Mexico, where bark beetle populations and tree losses are exceedingly high. If beetles have already emerged from a tree, its removal will have no effect on the overall beetle population. Likewise, homeowners need to know how to identify bark beetle infested trees and avoid cutting uninfested, live trees. When beetles bore into the trunk or limbs, they produce a fine-grained, tan to reddish brown dust that collects in bark crevices and at the base of trees. On ponderosa pines, small pitch tubes (less than $\frac{1}{4}$ of an inch across) often appear on the trunk of infested trees. Piñons infested with engraver beetles often do not have pitch tubes. Also, piñons can have larger masses of pitch produced by other insects that should not be confused with pitch tubes caused by bark beetles. To confirm that a tree is still infested, removal of a small section of the bark will reveal the presence of adult beetles (less than $\frac{1}{4}$ inch long), beetle grubs, and their galleries. At this stage, the foliage on infested trees can still be green.

Keeping Trees Healthy: Maintaining tree health is the best approach to minimizing susceptibility to bark beetles. Periodic, slow, and deep watering of high-value trees from March through June will help to maintain tree vigor during droughty periods.

Application of Preventive Sprays: Trees at risk from bark beetle attack can be protected by spraying the trunk and large branches with a 2 percent suspension of the insecticide carbaryl (Sevin). One application will protect a tree for at least a year. The

insecticide will kill the adult beetles as they try to chew through the bark to enter the tree. The application of preventive sprays can be expensive, especially for large ponderosa pines that require high-pressure sprayers or the use of equipment to elevate the applicator. Nevertheless, it must be realized that the cost of removing large, beetle-killed trees, that eventually will pose a safety hazard, can be more expensive. Insecticides must be used with caution and in compliance with the label instructions. Pesticides used improperly can be injurious to humans, animals, and the environment.

Further Assistance:

In New Mexico, assistance can be obtained from Debra Allen-Reid, USDA Forest Service, Forest Health New Mexico Zone Leader, at 505-842-3286; George Duda, Urban Forester, New Mexico State Forestry at 505-476-3332, or New Mexico State Forestry District Offices.

Local county agents also can provide assistance.

Additional information can be obtained at: <http://www.fs.fed.us/r3/resources/health> and <http://www.emnrd.state.nm.us/forestry/factsheets/barkbeetles.cfm>.

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