

DATE: March 15, 1991

TOPIC: Bark Beetle RD & A Plan for Western US including Alaska

ISSUE: Bark beetles throughout the West are killing millions of trees weakened by drought and other factors. An estimated 6 billion board feet have been killed in California alone. Millions of acres of forests are suffering similar damage in the Pacific Northwest, Interior West, and Alaska. Public outcry over this massive tree-killing highlights the need to accelerate development and implementation of technology to reduce these beetle-caused losses.

BACKGROUND: This plan proposes a program to reduce short- and long-term bark beetle-caused tree mortality. It will not, however, provide a panacea. Results will be primarily applicable in areas such as homesites, recreation areas, campgrounds, and high value timber stands. In many places, values will not warrant substantial investment in bark beetle management, and over the long-term aggressive application of silvicultural principles will be needed. The development of this plan was directed by USDA Assistant Secretary James R. Moseley to respond to the severe bark beetle problems in the West.

Bark beetles are the most destructive insects pests of North American coniferous forests. Major outbreaks can devastate large areas of mature or stressed forests. This increases the risk of fire, impacts recreation values, and destroys billions of board feet of timber. These epidemics are often symptomatic of stressed tree conditions. In many areas, effective long-term fire suppression and past harvesting practices have contributed to the creation of large acreages of overstocked stands. Trees in these stands suffer from severe competition for the limited amount of available sunlight, water, and nutrients. Often, massive bark beetle epidemics result when these already stressed trees are further stressed by drought, insect defoliation, disease, air pollution, and/or other factors.

In recent years, tree killing by bark beetles has increased significantly. Increased concern about tree mortality is especially acute in the urban/wildland interface areas in California, in the vast forests that are in poor health in eastern Oregon and Washington and the Interior West, and in extensive stands of spruce in Alaska. Mortality is occurring in all major forest tree species--ponderosa pine, sugar pine, lodgepole pine, Douglas-fir, spruce, and true firs.

Presently, there are few effective short-term management options for protecting trees from bark beetles. Techniques are needed that reduce beetle-caused mortality in high-value areas until the stresses caused by competition and/or drought are alleviated.

The most promising tools for reducing bark beetle losses in the short-term involves the use of behavioral chemicals such as "pheromones". Pheromones are natural compounds produced by insects that enable them to find a mate or locate suitable breeding sites. Results of past research and development activities on bark beetle pheromones suggest that there is a high probability that successful management systems can be developed through an aggressive RD&A effort.

The use of silviculture to improve overall forest health can prevent and greatly reduce bark beetle-caused tree mortality over the short- and long-term, even under severe drought conditions. Although some additional silvicultural research is needed, technology transfer of existing information can make a significant contribution to forest health immediately. Effective dissemination of information on silvicultural management practices to increase public understanding and acceptance of silviculture is needed.

OBJECTIVES:

- * Provide pheromone technology to reduce bark beetle-caused tree mortality that impacts recreation, wildlife habitat, woodland homesites, and high value timber stands.
- * Promote long-term Forest Health by developing and demonstrating silvicultural prescriptions for preventing and reducing bark beetle outbreaks.
- * Increase public awareness/understanding of bark beetles and forest ecology.

SCOPE: The program will address the important tree-killing bark beetles in the western U.S., including Alaska. The species to be addressed are listed in the table below.

<u>Bark Beetle Species</u>	<u>State</u>
Western Pine Beetle	CA, ID, NV, OR, UT, WA
Mountain Pine Beetle	AZ, CA, CO, MT, NV, OR, SD, UT, WA, WY
Spruce beetle	AK, AZ, CO, ID, MT, OR, UT, WA, WY
Douglas fir beetle	AZ, CO, ID, MT, OR, SD, UT, WA, WY
Ips beetles	AK, CA, CO, ID, MT, NV, OR, SD
Fir engraver beetle	AZ, CA, CO, ID, MT, OR, UT, WA
Jeffery Pine Beetle	CA, NV

PROGRAM NEEDS:

The focus of the program is to develop pheromone-based bark beetle management strategies and to transfer currently available silvicultural techniques to reduce losses from bark beetles. The environmental safety of pheromones and cultural practices make them highly suitable as management options. Short- and long-term management information needs to be transferred and promoted to ensure long-term forest health. Where appropriate we will carry out cooperative projects with States to achieve program objectives.

Development and implementation of pheromone-based management strategies involves five major steps:

- 1) The chemical identity of pheromones for many of the bark beetles is incompletely known. Information on their identity, synthesis, and application needs to be determined to test the utility of pheromones as a management strategy for reducing beetle damage.

- 2) Practical use of pheromones for preventing bark beetle damage depends on dispensing pheromone formulations in ways that maximize their effectiveness. Effective delivery systems such as time-release formulations to dispense pheromones under a variety of field conditions need to be developed and tested.
- 3) Little is known of the movement (dispersal) of bark beetles. Knowledge of bark beetle movement is critically important for developing management tactics using pheromones. Pheromones do not kill beetles directly but affect their movement, aggregation, dispersal, or other behavior. Knowledge of how far beetles fly in response to attractive pheromones, or where beetles go when caused to disperse in response to repellent pheromones, is a necessary prerequisite to developing pheromone control tactics.
- 4) Detailed information on environmental fate and non-target and environmental effects of pheromones is needed to prove environmental safety and support registration by the Environmental Protection Agency.
- 5) Three basic pheromone-based management strategies need to be investigated:
 - 1) the use of attractant pheromones to lure beetles to baited trees.
 - 2) the use of repellent pheromones to inhibit beetle attacks in treated areas,
 - and 3) the use of pheromones or insecticides to repel or kill beetles attacking individual high-value trees.

Implementation of silvicultural and pheromone beetle management will require public understanding and acceptance.

Thinning, increasing the diversity of tree species, and other silvicultural treatments can reduce beetle-caused tree mortality over the short- and long-term. This aspect of the program will focus on increasing public knowledge, acceptance, and support for these silvicultural management techniques.

A technology transfer/public information program is also needed to transfer pheromone-based management strategies that will be developed in this program.

PROGRAM COSTS AND ACCOMPLISHMENTS: Estimated costs for the Bark Beetle Research, Development, and Applications Program are \$5.72 million per year (appropriations level) for a 5-year program. The following Tables show projected accomplishments and estimated costs per year for the 5 year period.

PROJECTED ACCOMPLISHMENTS OF A 5-YEAR BARK BEETLE RD&A PROGRAM

Management Products

- * Produce a system to protect resources from western bark beetles by attracting them to traps or trap trees.
- * Produce repellent pheromone products and procedures for protecting resources from western bark beetles.
- * Produce a repellent pheromone system for protecting individual trees from bark beetles.
- * In cooperation with industry register a new pyrethroid insecticide for protecting individual high-value trees.
- * Produce pheromone-based monitoring systems for bark beetles.

Beetle Biology/Behavior

- * Determine dispersal and attack behavior related to pheromones for major western bark beetles
- * Determine geographic differences in beetle pheromone production and response.

Pheromone Product Development

- * Produce a timed-release formulation for dispensing pheromones.
- * Identify bark beetle aggregation (attractant) and anti-aggregation (repellent) pheromones.
- * Determine environmental fate of pheromones and non-target effects of pheromone-based management systems.

Technology Transfer

- * Conduct program including demonstration projects to increase public understanding, awareness, and acceptance of pheromone and silvicultural bark beetle management strategies.
 - * Produce "Best Management Practices" guides for western bark beetles.
 - * Produce publications on the role of bark beetles in forest ecosystems.
 - * Produce "How to" publications describing individual tree protection techniques.
 - * Produce videos for secondary education, general public information, and homeowner training.
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PROJECTED COSTS OF 5-YEAR BARK BEETLE RD&A PROGRAM
 (in \$1000/year at the appropriations level)

Activity	Research (FIDR)	Devel./Appl. (FPM)
Management Products		
Attractant systems	590	390
Repellant systems	720	390
Individual tree protection	65	65
Beetle Biology/Behavior		
Dispersal/Response to pheromones	975	
Primary attraction	325	
Pheromone Product Development		
Pheromone identification	315	
Pheromone formulation	390	195
Pheromone effects	130	
Technology Transfer	130	1040
	<u>3640</u>	<u>2080</u>
TOTAL		5720