

Title: Monitoring bark beetle-caused mortality and relation to fire occurrence

Location: National Forests in Colorado

INT-F-07-03

Duration: 2 years

Funding Source: Fire

Project Leader:

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Cooperators:

- Jose Negrón, Rocky Mountain Research Station, Fort Collins, CO
- Bill Jacobi, Colorado State University, Fort Collins, CO
- Steve Gregonis, GIS Coordinator, Forest Service Region 2

Project Objectives:

1. To determine if there is a relationship between bark beetle outbreaks and subsequent occurrence of forest fires.
2. To determine if absence of fire in bark beetle-affected stands is related to weather patterns.
3. To determine if there is a pattern in time since outbreak where fire is more likely to occur given appropriate fire-conducive weather.

Justification:

Bark beetle populations are at outbreak levels in many parts of the West and in many forest types. Forest health aerial survey maps and ground surveys well document this phenomenon. The implication of extensive tree mortality and subsequent fire risk is not well understood. This is a west-wide issue in all forest types. To adequately address the question we propose to work in the National Forests in Colorado. Findings will be applicable to other Rocky Mountain forests and provide a framework for continuing work across other western states.

Risk of catastrophic fire after bark beetle outbreaks is of concern among policy makers, land managers, and the public. The assumption is that catastrophic fires will undoubtedly occur. It is crucial to rigorously examine the question with thorough approaches to better inform all concerned groups. This understanding will lead to management approaches consistent with ecological processes.

Description:

a. Background

As early as Hopkins (1909)¹ references are found indicating that fires follow bark beetle-caused tree mortality. Furniss and Carolin (1977)² also state that extensive bark beetle-caused mortality “set the stage” for devastating fires. These reports are based primarily on anecdotal and observational evidence. Little empirical work has been

¹ USDA, Bureau of Entomology, Bulletin No. 83

² Western Forest Insects, USDA Forest Service, Misc. Publication No. 1339

conducted concerning this topic. Bebi et al. 2002³ and Kulakowski et al. (2003)⁴ examined disturbances in a spruce-fir forest in Colorado and suggested that there is no relationship between bark beetle mortality and fires. Bebi et al. 2002 indicated that disturbances such as fire following bark beetles are dependent on co-occurrence with extreme weather conditions suitable for fires. Studies need to be conducted in other spruce-fir forests and other forest types to identify conditions in which fire after beetles may or may not occur.

Stuart et al. (1989)⁵ indicated that the likelihood of fire increases as fuels accumulate after a mountain pine beetle outbreak in lodgepole pine. Considering the work of Agee (1981) and Gara et al. (1985) they suggest two periods in which a fire could spread after a bark beetle outbreak: the first few years after tree fall through aerially supported fine fuels and again 50 years later when fire could spread along partially decayed logs.

Clearly this is a significant gap in knowledge that needs to be addressed so that land managers can make informed decisions and assessments of fire risk after previous and current bark beetle outbreaks.

a. Methods

We propose to use historical fire maps from Colorado in combination with aerial detection surveys, ground surveys, and spatially referenced GIS modeling to examine the relationship between bark beetles and subsequent fires. To demonstrate this relationship a number of factors need to occur concurrently. Fuels accumulated from bark beetle-caused mortality need to be present and conditions suitable for a fire must occur. We will use GIS approaches to overlay historical fire locations over aerial detection maps. The frequency of areas where fires occurred after an outbreak will be compared to the frequency of areas where a fire did not occur after an outbreak. This will be followed by a historical weather conditions analysis to determine if areas without fire after an outbreak were ever exposed to fire-conducting weather. Finally, in areas where fire occurred after bark beetles, the time since outbreak will be examined to see if there is a given time at which fire frequency increases.

b. Products

Information from this study will be of value to land managers facing catastrophic mortality to current bark beetle epidemics and determining the urgency or timing needed for managing fuels resulting from extensive tree mortality.

c. Schedule of Activities

February – March 2007	Begin GIS analysis
Summer 2007	1 st summer ground verification
Fall - Winter 2007 - 08	Continue GIS analysis and identification of gaps and need for adjustments in methods
Summer 2008	2 nd summer ground
Winter 2008 – Spring 09	Final data analysis and report preparation

³ Ecology 84: 362-371

⁴ Journal of Biogeography 30: 1445-1456

⁵ Canadian Journal of Forest Research 19: 1096-1104

d. Progress / Accomplishments

- Document relationship between beetle-caused mortality and risk of subsequent fire.
- Discern if weather influences the lack of fire in bark beetle-attacked stands.
- Determining the role of time since mortality in influencing the risk of fire.

Costs:

	Item	Requested FHM EM Funding	Other-Source Funding	Source
Year 2006				
Administration	Salary *	20,100		
	Overhead	5,180		
	Travel	2,500		
Procurements	Contracting**	5,000		
	Equipment			
	Supplies			
	Mileage	1,500		
Total		34,280		

	Item	Requested FHM EM Funding	Other-Source Funding	Source
Year 2007				
Administration	Salary *	20,100		
	Overhead	4,290		
	Travel	2,500		
Procurements	Contracting			
	Equipment			
	Supplies			
	Mileage	1,500		
Total		28,390		

*Salary for a graduate student at Colorado State University.

**Contracting funds used for additional digitizing of aerial survey prior to 1994.