

**TITLE: The Effects of Silvicultural Manipulations on Spruce Beetle Populations.
INT-EM-07-04**

LOCATION: Colorado

DURATION: Year 1 of 3 years **FUNDING SOURCE:** Base, Evaluation
Monitoring

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COOPERATORS: J. Wayne Brewer (Auburn University, Auburn, AL.), Jim Thinnes (Regional Silviculturist, Rocky Mountain Region), Jan Burke (Forest Silviculturist and Timber Program Manager, White River National Forest), John Murphy (Timber Program Manager, Rio Grande National Forest), Bob Vermillion (Timber Program Manager, GMUG National Forest), Gary Roper (Timber Program Manager, Pike/San Isabel National Forest)

PROJECT OBJECTIVES: Spruce beetle populations are currently increasing throughout much of Colorado and northern New Mexico. In many cases these outbreaks have been precipitated by severe weather events (blowdown, avalanche, etc.), prolonged drought conditions, and susceptible stand conditions. While the relationship between stand conditions and bark beetle activity has been elucidated for many bark beetle / host systems, the extended periods of time associated with spruce stand development (ranging from 250 up to 400 years) has meant that there is little information on the impact of stand and landscape level conditions upon bark beetle activity. Although there is significant anecdotal and circumstantial evidence that stand manipulations can reduce the impact of spruce beetle, there is little definitive data to support this hypothesis. The proposed project would determine the extent, severity and causes of the current severe and widespread spruce mortality throughout southwest Colorado. This project would fill an important information gap by providing direct evidence whether or not silvicultural techniques can reduce spruce beetle activity. It would result in monitoring and compilation of data related to managed and unmanaged spruce/fir stands in Colorado. Specifically, this project would address the interactions of stand conditions upon current high levels of tree mortality.

JUSTIFICATION: The most significant source of mortality for mature spruce is the spruce beetle (*Dendroctonus rufipennis*), whose populations can increase to very high levels and kill large numbers of trees over significant areas. The impact of spruce beetle outbreaks is equally significant in economic and social terms.

Specifically, we plan to address the evaluation criteria in the following manner:
Linkage to FHM Detection Monitoring: This project will establish mortality estimates due to spruce beetle which can be compared to mortality estimates derived from Detection Monitoring.

Significance in terms of geographic scale: The geographic range of susceptible spruce species encompasses much of the high elevation forested lands in western North America.

Biological impact and/or political importance of the issue: This criterion may be the most important for this project. Spruce / fir stands are of enormous biological and economic importance. They provide habitat for numerous wildlife species, are an important component of the water resource and provide a most valuable recreation resource.

Feasibility or probability that the project will successfully be completed: This project will be conducted by several entomologists with experience in monitoring and managing spruce / fir cover types, our primary cooperators are researchers with numerous publications from similar work.

DESCRIPTION:

a. Background: Do silvicultural treatments reduce tree mortality caused by spruce beetle? While this question has been answered definitively in some bark beetle/host systems (mountain pine beetle/lodgepole pine, for example), information is lacking in the case of spruce / spruce beetles. We propose to measure and monitor stand conditions in areas that have recent spruce beetle activity.

In general, silvicultural treatments can affect a stand's species composition, age class distribution and tree density. We would expect all of these stand characteristics in turn to affect a stand's resistance to spruce beetle attack. We base our hypothesis on 3 lines of evidence: 1) the behavior of other bark beetle/host systems. 2) The tried and true spruce beetle risk rating system (Schmid/Frye 1976) tells us that 4 factors (heavily stocked stands, higher percentage spruce, larger size classes and higher site quality) contribute to an increased risk of spruce beetle activity. Conversely, we can expect that stands with low values in these parameters will be less susceptible to bark beetle attack; and 3) Studies which have examined the application of various techniques including the use of baited beetle traps, trap trees and concurrent stocking reduction to lessen the impact of spruce beetle activity (Bentz and Munson 2000, Hodgkinson, 1985).

b. Methods: We intend to measure stand parameters of managed spruce stands in order to determine what effect management inputs have on spruce beetle impacts. Managed stands will be compared with unmanaged stands in areas with current and recent spruce beetle activity. Both unmanaged and managed mature spruce stands will be monitored for degrees and causes of tree mortality.

Stand Selection: USDA Forest Service data will be used to select stands to be used in the study. A list of candidate stands will be created on five National Forests based on 2 criteria: at least 50% of the stems are spruce and there is a record of silvicultural manipulation at some point in the past. This screening process will be used to locate stands that were similar, but not subject to management activities. The decision support tool "Most Similar Neighbor 2.12" produced by the Rocky Mountain Experiment Station will be used to develop a list of managed and unmanaged stands that can be compared for spruce beetle activity. *Selected stands will be projected onto GIS generated maps to be used by the field crew.*

Stand Location: Stand (or Activity) boundaries will be projected onto Digital Ortho Quads and a series of plot locations within the boundaries will be randomly determined using Stage II sampling guidelines (i.e. number of plots allocated by stand size, not to exceed 5 plots per stand).

Stand Measurement: Field crews will collect stand level data in both treated and untreated matched pairs of stands. The data collected will be based upon Stage II inventory guidelines, variable radius plots will be established and the following data taken from each plot: Tree species, tree diameter, tree height, and tree condition. Tree conditions will be summarized on a per plot, and ultimately a per stand basis in order to determine relative levels of spruce beetle activity. Spruce beetle impacts upon the stand can be expressed as measures of mortality (trees per acre, basal area, CCF volume, etc.) as well as changes in species and size class composition. Plot characteristics including slope, aspect, and plant association will also be recorded. Regeneration counts will be made on 1/100 acre areas surrounding plot center.

Data Analysis: Determination of which parameters are the most critical in determining resistance to spruce beetle activity will be determined by examining the various factors with a bifurcation or “tree-structuring” process.

c. Products: Field managers are interested in information that supports silvicultural inputs designed to reduce spruce beetle activity. They need “how-to” documentation to achieve these results, but also need documentation of these findings to support NEPA decision documents. Specific guidelines that will be of interest include: Description of stand characteristics that reduce beetle susceptibility and the silvicultural methods that can (with time) result in stand conditions that resist spruce beetle activity.

d. Schedule of Activities: Year 1: Collect Stage I data and Record of Activities from 5 National Forests in Colorado and evaluate candidate stands using “Most Similar Neighbor” analysis.

Year 2: Field data collection will begin. Data will be entered into database management programs.

Year 3: Field data collection will be completed. Final analysis and report writing will commence following data entry.

e. Progress/Accomplishments: *The preparations for FY08 field work began in 2007. Stand data has been reviewed in an ongoing process in order to select field sites for FY08. Stand data from RMRIS has been used in conjunction with activities information from RMAC to select a preliminary listing of potential study sites. In addition to the collation of stand data, a “pilot study” was initiated on the Rio Grande NF in order to evaluate field techniques to be used during the FY08 field season. Plots have been established and the field data will be analyzed in order to fine-tune the field techniques. The project is proceeding as expected, both within budget and “on track” with regards to the proposal schedule.*

Administration	Salary	\$10,000.	Procurements	Contracting	
	Overhead (15%)	\$2,925.		Equipment	\$500.
	Travel	\$8,500.		Supplies	\$500.

FY07 Total = \$22,425.00

The services of a contracting company, RMC Inc. of Denver, CO, has been procured in order to contract the services of Dr. Brewer. Their responsibilities include the completion of work requested by the Project Leaders as well as the payment of salary and travel expenses to Dr. Brewer. Funds for this contract have been obligated from FY07.

Administration	Salary	\$18,716.	Procurements	Contracting	\$2,000.
	Overhead (15%)	\$2,817.		Equipment	\$500.
	Travel	\$8,500.		Supplies	\$500.

FY08 Total = \$33,033

Administration	Salary	\$18,716.	Procurements	Contracting	\$2,000.
	Overhead (15%)	\$2,817.		Equipment	\$500.
	Travel	\$8,500.		Supplies	\$500.

FY09 Total = \$33,033