Special Technology Development Program
New Project Proposal

Complete a copy of this form for: 1) each new project proposal, and 2) each resubmitted but previously unfunded project proposal. Add lines within the form as necessary.

PROJECT NUMBER: R6-01-02--

PROJECT TITLE: Develop an Accurate Western Spruce Budworm Hazard Rating System for Central Oregon

PROJECT STATUS: New

EXPECTED PROJECT DURATION (total years for project including current fiscal year)**:** 2 years

EXPECTED COMPLETION DATE OF THE PROJECT (2002)**:**

SUBJECT: (mark all that apply using 1 for primary category and 2 for secondary categories):
Biological Control___ Invasive Species___ Methyl Bromide Alternatives___ Models___ Monitoring___ Organism Biology___ Pesticides: Microbial ___ Pesticides: Synthetic___ PTIPS___ Population___ Risk and Hazard_**X**_ Remote Sensing___ Semiochemicals___ Silvicultural Technology___ Social Values___ Spray Technology___
Other_____

STATUS OF SUBJECT SPECIES: **NATIVE**

PROJECT OBJECTIVES: To develop (or adapt from an existing system) a usable quantifiable hazard rating system Western Spruce Budworm Hazard Rating System for Central Oregon by 2002. By hazard rating system we mean a relative measure of predisposing conditions for damage (Paine et al 1983). This will be written in the form of a formal R6 report (2002) and also submitted to a refereed journal for publication. A set of FVS (Forest Vegetation Simulator) keywords will also be written describing this system and be made available to users so that it can be incorporated into stand projections.

BRIEF DESCRIPTION OF PROJECT: Hazard rating system (model) will consist of assigning individual stands a quantitative value which describes likelihood of the stand sustaining light, moderate or heavy damage during an outbreak. Development of the hazard rating system will depend heavily on comparing areas that were severely impacted by the recent budworm outbreak (1985-1992) with non-impacted or lightly impacted areas. These comparisons will be made both on a stand and landscape level. The project will be conducted in two phases. In year 2001 stand data will be gathered and formatted for analysis throughout the western spruce budworm host type in Central Oregon. We are seeking funding for this first phase only. In 2002, this data will be analyzed and the hazard rating system developed. Paper and reports will be written by the PI's.

FHP LEAD CONTACT (FHP person submitting proposal)**:**

Name	Affiliation (Office or Dept.)	Phone, E-mail, Fax
Helen Maffei	Central Oregon FHP Service Center	541-383-5591

PRINCIPAL INVESTIGATOR (S) (add lines as necessary)**:**

Name	Affiliation (Office or Dept.)	Phone, E-mail, Fax
Helen Maffei, Pathologist	Central Oregon FHP Service Center	541-383-5591
Andy Eglitis, Entomologist	Central Oregon FHP Service Center	541-383-5701
Kathy Sheehan, Entomologist	FHP R6 Regional Office	503-808-2674

COOPERATORS (contributing to, but not leading, the project) (add lines as necessary)**:**

Name	Affiliation (Office or Dept.)	Phone, E-mail, Fax
John Arena	BIA, Forestry Warm Springs IR	
Barbara Fontaine	Ochoco NF, Silviculturist	

Rob Rawlings	Ochoco NF, Silvicuturist
Brian Tandy	Deschutes NF, Silviculturist
Jim Stone	Deschutes NF, Silviculturist
Kim Johnson	Deschutes NF, Silviculturist
Jim Tyler	Deschutes NF, Veg Mgt Coord.
Tom Gregg	FHP Regional Office, mensuration

COOPERATOR INVOLVEMENT: The above cooperators will provide the stand exams, forest inventory plots, remote sensing information and other pertinent vegetation information as requested by the principal investigators. There will be significant time commitment from these individuals. Tom Gregg will provide council with the statistical analysis

JUSTIFICATION: Western spruce budworm is a key disturbance agent in Central Oregon and can have a significant effect on resource values. For example, in the McCache Late Successional Reserve on Sisters RD, approximately 70% of the spotted owl nesting habitat was lost during the most recent budworm epidemic 1985 -1992. Because of its significance, land managers have many questions both in regards to the potential for a western spruce budworm epidemic AND the potential for damage should an outbreak occur. Because it is difficult to predict the occurrence of an outbreak, it is very important to understand which areas have high potential for damage if one should occur. With this understanding, resiliency and sustainability can be built across the landscape by maintaining significant areas of vegetation that are at low risk. In some cases management would be required to lower the risk, in others no action might be required. Decisions of whether or not to allocate scarce resources could then be made more effectively. In other words being able to visualize how and where hazard and risk to western spruce budworm would change under proposed management scenarios would add valuable information to the decision process. If managers are fully informed regarding hazard, they are in the position to make better management decisions.

URGENCY: We need to take advantage of the opportunity provided by the last spruce budworm outbreak as soon as possible. At present, there is a large amount of available measured stand and plot information on stand attributes before and after the recent western spruce budworm outbreak. There are even more available data where conditions could be reconstructed, either before or after the outbreak. However, these data need to be analyzed and processed quickly before they become scattered or lost. In addition, some field re-measurements are required. This can still be easily done at this time, later it will be difficult if not impossible.

NATIONAL FHP TECHNOLOGY DEVELOPMENT PRIORITY (check one):

Priority 1: __ Priority 2: __ Priority 3: _X_ Priority 4: __

TECHNICAL COMMITTEE DEVELOPMENT PRIORITY (check one):

Priority 1: __ Priority 2: __ Priority 3: __ Priority 4: __

Priority 5: _X_ Priority 6: __ Priority 7: __ Priority 8: __

SCOPE OF APPLICATION: The results will be used by land managers in Central Oregon for analysis ranging from landscape application and forest planning to individual project areas.

RESEARCH BASIS: There have been a number of hazard rating systems developed for Central Idaho and in other locations across the west. They are based on measurable stand and site attributes and there is no reason to believe that a hazard rating system for central Oregon could not either be modified from an existing system or developed using similar attributes. Some of these attributes include age of stand, percent of host type, total basal area or canopy cover of the stand and stand structure. Comparison of hazard rating systems that have been developed in the Northern Rocky Mountains indicate that, while these hazard ratings share many of the same parameters, extrapolation to other geographic areas may not be appropriate (Steele et al 1996). Discussions with research entomologist Russ Mitchell further support the hypothesis

that none of the previously developed systems will be directly transferable to Central Oregon. However, none of the other systems have been formally tested here and there is no reason to think one or several cannot be modified.

METHODS: The following hypothesis will be tested in the course of this work:

1. Is the developed hazard rating significantly better able to predict areas of: significant **damage** to western spruce budworm in central Oregon when an outbreak occurs than simply deducing hazard from general forest conditions known to be conducive to outbreaks or using and already existing hazard rating system.

The methods used to answer these questions consist of the following:

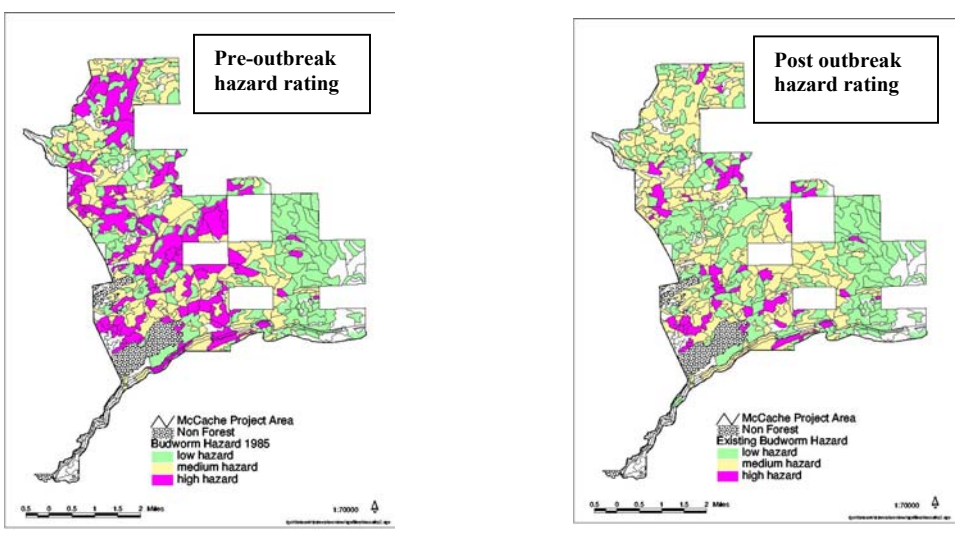
1. Gather as many existing, recent, stand exams as possible in mixed conifer areas of both high damage and low damage from the last budworm epidemic on the Deschutes and Ochoco NF. Put these stands in FVS format.

2. Reconstruct pre- or post outbreak stand conditions from recent stand exams (or forest inventory (CVS) plots). For each stand exam, a pair of stand exams will be created; one describing the pre-outbreak conditions; one the post outbreak conditions. .

3. From these areas, identify stands that experienced high, medium and low damage using post outbreak information on stand structural change. .

4. Test the predictive accuracy of existing hazard rating systems both in terms of the overall hazard of the area and the accuracy of the hazard to the individual stand. This will be done using the event monitor and the reports generator feature of FVS. Write FVS keyword files describing the risk rating systems to be tested (Carlson and Wulf is already completed, Figure 1).

Figure 1. Carlson and Wulf (1989) Hazard Rating System Applied to stands before (inferred from stand reconstruction) and



after outbreak in McCache Late Successional Reserve.

5. Revise to be suitable for central Oregon. If one of the systems seems promising (our initial investigations indicate that Carlson and Wulf has promise, Figure 1), then work on modifying it. Test modification against new areas of high and low damage. Develop new predictive variables if necessary. Some variables with potential include: susceptible host crown volume; presence of root disease or other stress agents. slope, aspect, acres of nearby susceptible stands.
6. Goodness of fit of the hazard models will be tested using chi-square.

7. Once the hazard rating system is satisfactory, it will be described as an FVS keyword set that land managers can incorporate into their long-term projections.

MEASURES OF SUCCESS:

Standard of Success: When rating system appears to reliably predict significant hazard to western spruce budworm based on the data we already have.

Expected Outcomes: This tool will be used routinely in long range planning throughout central Oregon.

Implementation of Products/methods: Procedure will be written up as a R6 report and distributed to customers. A keyword set describing the hazard rating system will also be provided so that managers can incorporate it into their long-term projections on FVS.

PRODUCTS AND DUE DATES: 2001, data compiled and formatted for analysis**. 2002** analysis completed, R6 report written, draft journal article submitted, FVS keyword set completed.

PUBLICATIONS Results will be submitted for publication to a refereed journal and as a formal R6 FHP report**:**

TECHNOLOGY TRANSFER (How will products or methods be transferred to users, adapted to other uses, or sustained by continuing technology transfer?)**:** Products will be delivered to users throughout the Service Area by specialized training sessions conducted by Area entomologist and pathologist.

LONG-TERM BUDGET REQUEST: (estimates by fiscal year and funding, both monetary and in-kind, excluding FHP base funding) (extend table as necessary)**:**

	Item	Requested FHP STDP Funding	Other-Source Funding	Source
FIRST YEAR				
Administration	Salary	20,000	15,000	NFS, BIA, Service Center
	Overhead		2000	Same
	Travel	3,000		
Procurements	Contracting			
	Equipment	2,000	3,000	Same
	Supplies			
Year Totals		25,000	20,000	
SECOND YEAR				
Administration	Salary	0.0		NFS
	Overhead			
	Travel			
Procurements	Contracting			
	Equipment			

	Supplies			

Enclosure 2 continued

Year Totals				
THIRD YEAR				
Administration	Salary			
	Overhead			
	Travel			
Procurements	Contracting			
	Equipment			
	Supplies			
Year Totals				
PROJECT TOTALS				

BENEFIT AND COST.

Using the Production Function Handbook (FHTET Publication 97-12, found at http://fsweb.ftcol.wo.fs.fed.us/fhtet/stdp/handbook/pf_handbook.html.), fill out the production function worksheet to capture economic costs and benefits for this project. Attach the worksheet to this application**.** **(See separate document)**

LITERATURE, CITATIONS, ATTACHMENTS

Carlson, C. E. and Wulf, N. W. 1989. Silvicultural strategies to reduce stand and forest susceptibility to the western spruce budworm. USDA Forest Service Agricultural Handbook No. 676. 31 p.

Brooks, M. H.; Colbert, J. J.; Mitchell, R. G.; Stark, R. W., tech coords. Managing trees and stands susceptible to western spruce budworm. Tech. Bull. 1695. Washington, DC: U. S. Department of Agriculture, Forest Service, Cooperative State Research Service: 111 p.

Heller, R. C; Kessler, B. L. 1985. Rating stand hazard to western spruce budworm: aerial photo interpretation models. In: Brooks, M. H.; Colbert, J. J.; Mitchell, R. G.; Stark, R. W., tech. coords. Managing trees and stands susceptible to western spruce budworm. Tech. Bull. 1695. Washington, DC: U. S. Department of Agriculture, Forest Service, Cooperative State Research Service: 46-48.

Kemp, W. P. 1985. Climatological discriminant model. In: Brooks, M. H.; Colbert, J. J.; Mitchell, R. G.; Stark, R. W., tech. coords. Managing trees and stands susceptible to western spruce budworm. Tech. Bull. 1695. Washington, DC: U. S. Department of Agriculture, Forest Service, Cooperative State Research Service: 43-45.

Stoszek, K. J.; Mika, P. G. 1985. Rating stand hazard to western spruce budworm: ground survey models. In: Brooks, M. H.; Colbert, J. J.; Mitchell, R. G.; Stark, R. W., tech. coords. Managing trees and stands susceptible to western spruce budworm. Tech. Bull. 1695. Washington, DC: U. S. Department of Agriculture, Forest Service, Cooperative State Research Service: 48-50.

Paine, T.D.; Stephen, F.M.; Mason, G.N. 1983. A risk population level. In Safranyik, L., ed. The role of the host in population dynamics of forest insects. Victoria, BC: Canadian Forest Service 201-212.

Steele, R.; Williams, R. E.; Weatherby, J. C.; Reinhardt, E. D.; Hoffman, J. T.; Thier, R. W. 1996. Stand hazard rating for central Idaho forests. Gen. Tech. Rep. INT-GTR-332. Ogden, UT: U. S. Department of Agriculture, Forest Service. Intermountain Research Station. 29 p.

Wulf, N. W.; Carlson, C. E. 1985. Generalized indexing model. In: Brooks, M. H.; Colbert, J. J.; Mitchell, R. G.; Stark, R. W., tech. coords. Managing trees and stands susceptible to western spruce budworm. Tech. Bull. 1695. Washington, DC: U. S. Department of Agriculture, Forest Service, Cooperative State Research Service: 51-54.