

## **FHP TECHNOLOGY DEVELOPMENT PROJECT PROPOSAL**

**PROJECT STATUS:** New, not previously funded.

**PROJECT NUMBER:** R8-1999-01-New-Proposal

**PROJECT TITLE:** The Southern Pine Beetle Internet Control Center

**SUBJECT:** Bark beetles, *Dendroctonus frontalis*, management tools, information dissemination, comprehensive interactive website development.

### **PROJECT OBJECTIVES:**

1. Develop a comprehensive, interactive web-based delivery system for all current information and management tools concerning the prediction, evaluation, and treatment of southern pine beetle (SPB).
2. Build a self-maintaining website that will be continuously updated from user inputs into the various databases developed or incorporated.
3. Provide a basis to expedite the development of similar websites for other major forest pests.

**BRIEF DESCRIPTION OF PROJECT:** The Southern Pine Beetle Information Directory' will be transformed into an interactive website that provides current and historical information on southern pine beetle (SPB) status, management, research, events, and personnel, and will include a searchable bibliographic database. This website will substantially increase the accessibility and utility of the vast amount of information available on SPB. The search engines built into the site will utilize state-of-the-art technology developed at Virginia Tech, allowing experts and data collectors throughout the region to either access or update critical databases embedded in or linked to the site, minimizing the cost and effort that generally goes into site maintenance. Prediction models, decision keys, and training modules for SPB suppression techniques built into the site will provide foresters or private landowners with a one-stop source for information on managing SPB on their lands. Technologies developed from this project will enhance and speed the development of similarly comprehensive websites for other major forest pests throughout the nation.

**FHP PERSON WHO WILL LEAD THE PROJECT:** Stephen R. Clarke, FHP, Lufkin, TX.

**CO-PRINCIPAL INVESTIGATORS:** Dr. Scott M. Salom, Assistant Professor, Dept. of Entomology, Virginia Tech, Blacksburg, VA; Dr. Nicholas D. Stone, Associate Professor and Director of Information and Insect Systems (INIS), Dept. of Entomology, Virginia Tech, Blacksburg, VA. Both Drs. Salom and Stone will contribute 10% of their time to this project.

**COOPERATORS:** Texas Forest Service; Dr. Fred Stephen, University of Arkansas Southern Pine Beetle Working Group; ISIS, Virginia Tech.

**JUSTIFICATION:** Currently, land managers and researchers must search a variety of sources to find information on SPB activity and management. Yearly training sessions on SPB control and biology presented by FHP or state agencies to all interested landowners and land managers are often the only opportunity to present cohesive instruction and new information to these groups. Prediction models and instruction on SPB suppression techniques are available but not always easily accessible.

This project will utilize new web-based technologies which enable computer programmers to develop interactive websites that can be updated continuously from user inputs, reducing website maintenance. The site will provide current information and management tools to land managers, allowing them to make timely and informed decisions on SPB prevention and suppression, as well as giving them the names, phone numbers, and e-mail addresses of SPB experts in their area. Researchers will have access to historical and current databases on SPB activity. This SPB Internet Control Center will serve as a national model for information dissemination for major forest pests, and improve FHP's ability to deliver new programs.

A Southern Pine Beetle Workshop<sup>1</sup>, attended by over 40 researchers and professional entomologists, identified lack of communication among research and user groups as one of the most important barriers to cooperation among professionals working with SPB. Important suggestions listed for enhancing cooperative effort were 1. compile and analyze existing data, 2. produce a directory of researchers and professionals involved in SPB research and control efforts, 3. update the annotated bibliography, and 4. enhance the ability of resource managers to respond to outbreaks. This project is designed to meet these needs.

**URGENCY:** Southern pine beetle remains the most destructive insect pest of southern forests. Accessibility of information and tools for southern pine beetle biology, impacts, control, research, and status is fairly limited. Information is currently disseminated in a variety of forms and from a number of locations. A centralized location for dissemination of this information in a consistent form would improve our ability to train resource managers. The interactive website would make historical and current information on SPB accessible with just a click of the mouse. Most landowners now have access to the world wide web, and can use a search engine to look for information on SPB. Without a comprehensive website on SPB, they often spend a great deal of time searching for answers and may miss valuable management tools, training, or expertise.

The technology now exists to provide a comprehensive, interactive website. The development of the site should lead to reduced losses from SPB and keep FHP at the forefront of technology development and delivery.

**LINK TO NATIONAL FHP TECHNOLOGY DEVELOPMENT PRIORITIES:**

The SPB Internet Control Center ties into the high priorities developed by the STDP Steering Committee. The project will allow land managers to develop an integrated approach to reducing the adverse effects of SPB by providing information and tools on SPB prevention, prediction, and suppression. It will also help quantify the impacts of SPB across all ownerships by providing a readily available and easily accessible assessment of SPB activity and losses in southeast U.S., both numerically and visually.

The SPB Internet Control Center will enhance resource and pest managers' ability to:

1. Learn and review hazard rating systems, useful in helping managers develop management plans designed to reduce the intensity of SPB outbreaks.
2. Access information on prediction, from updateable pheromone trapping results; on current activity, from the SPB Information System; and on prognosis for spot growth, by inputting data into the Arkansas Spot Growth Model and receiving spot growth predictions. Such tools will improve decision-making during critical outbreak periods when there is little time to act.
3. Learn and review how to use standard and new pest management tactics designed to suppress SPB spot growth.

**SCOPE OF APPLICATION:** The SPB Internet Control Center will be utilized by natural resource managers and entomologists throughout the South, and will be a national model of information delivery for other major forest pests. We expect this site to be the first choice for professionals and laypeople searching for management information or tools on SPB. Dr. Salom has created a precursor to this site, the Southern Pine Beetle Information Directory. It has been highly successful, serving as the principal source of information for SPB on the internet. The site has received over 4,200 hits from the U.S. and 39 other countries in the past 15 months.

**RESEARCH BASIS:** The southern pine beetle is considered the most serious insect pest of pine forests in the southern U.S. (Salom et al. 1998), with yearly losses estimated as high as \$250,000,000 (Southern Forest Insect Work Conference Committee Report), and in Virginia as high as \$25,000,000 (Dr. Tim Tigner, VA Dept. of Forestry). The devastating impact of this pest led to a national federal research initiative in the 1970's called the Expanded Southern Pine Beetle Research and Application Program (ESPBRAP) (Thatcher et al. 1980), followed by a second initiative in the 1980's called the Integrated Pest Management Research, Development, and Applications Program for

Bark Beetles of Southern Pines (Branham and Thatcher 1985). This along with continued research and development has resulted in a vast amount of information available on the biology, impact, and control of SPB. This information has tremendous value to foresters, homeowners, researchers, and policy makers. However, access to the information is limited. Research results and impact information can be found in journal articles, compilations, government handbooks and factsheets, videos, and more recently the Internet. Practitioners who want access to existing pest management tools like the Arkansas SPB Spot Growth Model often need to contact the tool developer. Even such fundamental information as the current status of SPB infestation throughout the South is available only to a small group of professionals in state and federal agencies.

Through information technologies, we can and should provide widespread access to this material. Therefore, we propose to create a comprehensive, interactive web-based delivery system of all resources generated in research, prediction, evaluation, and treatment for the SPB throughout the insect's geographic range.

This proposal builds on the national leadership of Virginia Tech's Entomology Department in developing information delivery systems via the Internet for teaching, research, and outreach. Examples of this expertise are given in Appendix A.

**METHODS:** The web site will be developed as an integrated web-database application, in which most of the pages served will be generated from data stored as a relational database. A SPB Intranet will be developed at the same time as the administrative tool for maintaining information in the web site database. Contributors will be able to update their information through the access-controlled intranet site, so that central updating and maintenance will be minimal. A web-crawler will be used as well to populate an indexed database of related SPB information links. Individuals and organizations providing information related to SPB will be encouraged to include specific metatags in their web pages to facilitate storage and retrieval of information from the indexed web site. This approach is similar to that used by the National IPM Network.

The SPB Internet Control Center will include an Information Network that provides summaries and images of SPB life history and impacts, and a set of newly developed interactive search engines that provide current information on SPB status, research, events, personnel, and a searchable bibliographic database (Fig. 1). A Pest Management Tools area will provide comprehensive information on available and emerging tactics for SPB suppression and prediction. An example of a suppression tool includes the 'Verbenone Online Workshop'. Prediction tools will include the Arkansas SPB Spot Growth Model, which will be accessible directly from the web (possibly utilizing the new Javamatic@ technology developed at Virginia Tech) and an interactive version of SPB pheromone trapping program currently proposed by the Texas Forest Service. A directory of all state federal, and university personnel involved in SPB research or suppression will be included. An Online Workshop that pulls together resources from the Information Network and Pest Management Tools Areas will be developed. Expert contributions to the site will be solicited where appropriate. Links to other sites concerned with SPB or

other bark beetles will be provided. See Appendix B for a schedule of activities and examples of planned components.

The Information Systems and Insect Studies lab (ISIS), in the Department of Entomology at Virginia Tech, develops state-of-the-art web interfaces, databases, and interactive web utilities. ISIS will provide expertise and support by working with a programmer to integrate web-crawler, database, and search engine technologies to create the definitive SPB information resource on the web. The distributed nature of this resource will allow experts throughout the region to contribute and maintain information, reducing the effort and resources that go into long-term maintenance of the site.

**MEASURE OF SUCCESS:** This project is designed to speed the flow and gathering of information on SPB, plus improve the quality of management decisions for SPB. The project will be considered successful if a one-stop information source for the management of SPB is created and is utilized by land managers and forest pest control experts. The impact and success of the website will be evaluated by collecting data on the number of hits the site receives and the source of those hits. These data will provide insight on who we are reaching. For a more in-depth evaluation of how the site is utilized, an interactive questionnaire will be included. This survey will be implemented using the WhizQuest@ program developed and maintained by the ISIS lab. Questions will be developed that ask the user about their background, what they were looking for, did they find what they were looking for, were they pleased with what they found, and what types of improvements do they recommend for the site. It will be presented in a form similar to the survey site used for ENT 2004 Distance Learners.

Quality control issues will be handled the following way:

1. We will build in an automated review process. Data input into the site will be dated and the source of input will be identified. E-mail will be generated to the owner requesting them to proof their submission.
2. Sites listed in the database and linked via webcrawler will be randomly chosen and peer reviewed by members of the SPB Working Group. Criteria for content review will be established. Website presentation will be evaluated using standardized guidelines available at the Wolfram Memorial Library Website Evaluation checklist

**PRODUCTS:** The most comprehensive website available for a forest pest to date will be available to anyone with Internet access. The technologies used and developed for the site will be documented in a toolbox that will be presented as a General Technical Report. This publication will provide an explanation of the tools developed, used, and integrated into the making of the SPB Internet Control Center. Website developers will be able to incorporate the components of the toolbox into the building of comprehensive interactive websites for other major forest pests.

**PUBLICATION:** The process of site development and the results of the effort will be written up as an article for the American Entomologist. Any new technologies developed from creating the website will be published in Computers and Electronics in Agriculture.

**TECHNOLOGY TRANSFER:** The SPB Internet Control Center will be maintained on the Virginia Tech Entomology Department's webserver. The Department has two UNIX machines, one of which runs Apache web server software. This is compatible with current and future hardware and software commitments by the USDA Forest Service for all its web-based activities.

It is anticipated that half-time salary support for a content manager to work with the ISIS group will be required for maintaining the website after the project is completed. We will solicit financial support from any federal and state agency, private company, consulting firm, and state forestry associations that may have an interest in seeing this site maintained. We will also seek out other organizations interested in advertising on the site.

**PROJECT DURATION:** 3 years (1999 - 2001).

**LONG TERM BUDGET:**

<u>Year</u>	<u>STDP</u>	<u>FHTET</u>	<u>Region 8</u>	<u>V.A. Tech</u>	<u>Total</u>
1999	29,180	21,132	21,132	39,840	111,284
2000	29,680	22,082	22,082	37,420	111,264
2001	<u>30,180</u>	_____	_____	<u>17,771</u>	<u>47,951</u>
TOTAL	89,040	43,214	43,214	95,031	270,499

Both Region 8 and FHTET have committed to share salary support for a computer programmer for FY 1999 and 2000, conditional upon approval of the STDP.

**FY 1999 BUDGET REQUEST**

<u>Items</u>	<u>STDP</u>	<u>Region 8</u>	<u>FHTET</u>	<u>VA Tech</u>
Salary for Content Manager (non-classified)	21,919			2,580
Fringe @ 24%	5,261			620
Salary for Computer Programmer (classified)		16,255	16,255	
Fringe @ 30%		4,877	4,877	
Equipment				3,500
Travel	2,000			
Indirect				<u>33,140</u>
Total	<u>29,180</u>	<u>21,132</u>	<u>21,132</u>	<u>39,840</u>

**LITERATURE CITED:**

Branham, S.J. and R.C. Thatcher (eds.). 1988. Integrated pest management research symposium: The proceedings. USDA Forest Service Gen. Tech. Rept. SO-56.

Salom, S.M., R.F. Billings, C.W. Berisford, S.R. Clarke, Q.L. McClellan, M.J. Dalusky, T.J. Robinson, and J.E. Johnson. 1998. Basis for technology transfer of inhibitor-based suppression tactics for the southern pine beetle. *So. J. Appl. For.* 22:24-34.

Thatcher, R.C., J.L. Searcy, J.E. Coster, and G.D. Hertel (eds.). 1980. The Southern pine beetle. USDA Forest Service Tech. Bull. 1631.

**APPENDIX A:** Examples of web-based information delivery systems developed by or with the support and leadership of Virginia Tech.

1. A course, entitled Insects and Human Society (ENT 2004), serves as a model for online instruction at Virginia Tech and for entomology courses of its kind in the U.S. An online examination was recently given to the 400 on-campus and 200 off-campus students. 50 questions were randomly presented to the students who accessed the exam website. After completion, their exams were then submitted and graded instantaneously with a list of all the questions the student got right and wrong, including explanations for each answer. This effort was based on WhizQuiz@ technology developed by Dr. Stone and pioneered in distance education by the Entomology Department at Virginia Tech.
2. The Gypsy Moth Server' and the Southern Pine Beetle Information Directory are among the most comprehensive information-based websites for forest pests in the U.S.
3. The Slow the Spread website' is one of the most dynamic forest pest websites available, integrating databases that report current activity with a decision-support system that directs resource managers to appropriate pest management tools.
4. The Verbenone Online workshop developed by Dr. Salom, is the only web-based tutorial available for instructing potential users on how to implement a forest pest management tactic in the field. It is very timely and appropriate since this tactic is currently under review for registration by the Environmental Protection Agency.
5. A web-based searchable bibliographic retrieval system called CIRS (CRSP Information Retrieval System) was developed in the Entomology Department at Virginia Tech for an ongoing USAID pest management project.



4. SPB Online Workshop Tutorial: An interactive workshop will be created that accesses critical sections of the SPB Internet Control Center for training and review purposes. Instructors will be able to use the resources for developing their training sessions and trainees will have an interactive dialogue in which test their knowledge through WhizQuiz@ technology.

**PRODUCTION FUNCTION**

**PROJECT NUMBER:** R8-1999-01\_New\_Proposal

**PROJECT COST:**

Year	1999	2000	2001	TOTAL
STDP	29,180	29,680	30,180	89,040
OTHER	82,104	81,584	17,771	181,459
TOTAL	111,284	111,264	47,951	270,499

**PROJECT OBJECTIVE:** The project will develop a comprehensive, interactive web-based delivery system for current information and management tools for the prediction, prevention, evaluation, and suppression of the southern pine beetle (SPB). The website produced will provide a consolidated, self-maintaining site for all users searching for information and/or expertise on SPB. Benefits of this project include 1) reduced costs for training, data and technology transfer, and information- gathering, and 2) increased timber value at harvest due to the ready access to current information on SPB prediction models, hazard rating systems, and suppression techniques and more timely application of appropriate suppression measures. Benefits not quantified in this analysis include avoiding pest suppression costs, avoiding pesticide-related costs, protecting endangered species habitat, and reduced-costs for website development for other forest pests.

**ASSUMPTIONS:**

Project benefits will accrue for the life of the project (3 years).

The website developed will be the first choice and a one-stop source for all land managers and their operatives to obtain information on SPB prediction models, hazard rating systems, experts, suppression techniques, etc., plus provide training and tech transfer on all facets of SPB biology and control.

Land managers and others working with SPB spend approximately 25 hours per year on SPB training, data entry, and resource gathering, and a comprehensive website will reduce this time by 1/3.

One-fourth of all hits on the site are serious users who will utilize several aspects of the site.

The average salary of serious users is \$15 an hour.

Utilizing the services provided by the website will lead to a 5% reduction in losses of sawtimber to SPB which could not have been salvaged, due to increased prevention and more timely and effective suppression.

Harvest will occur on average in 20 years.

Differences in detection, treatment, and harvest costs between with and without scenarios offset and are negligible ( with project scenario: fewer trees treated, more harvested. Real benefit comes from value of timber saved).

### **BACKGROUND DATA:**

The current site received 4000 hits in one year.

Number of trees cut and left or cut and hand sprayed (not salvaged) due to SPB for 3 average years (93, 95, 97) = 426424. (SPBIS data)

Average CF per pine sawtimber tree at harvest = 50. (TX timber sale data and southwide volume tables)

Average price pine CCF = \$165 (current TX timber prices)

### **EXPENDITURE AND OUTPUT VALUES (EOV) WITHOUT PROJECT**

Reduction in training and information costs =  $4000 \text{ site users} / 4 * (24 \text{ hrs} * 0\%) * \$15/\text{hr} * 3 \text{ years}$

Timber benefits =  $426424 \text{ trees cut} * \$0 = 0$

### **EXPENDITURE AND OUTPUT VALUES (EOV) WITH PROJECT**

Reduction in training and information costs =  $4000 \text{ site users} / 4 * (24 \text{ hrs} * .333\%) * \$15/\text{hr} * 3 \text{ years} = \$360,000$

Timber benefits =  $426424 \text{ trees cut} * .05 \text{ loss reduction} * 50 \text{ CF/tree} = 1066060 \text{ CF saved}$   
 $10660.6 \text{ CCF} * \$165 = \$1,758,999$  discounted to  $\$802,790$

Total =  $\$802,790 + \$360,000 = \$1,162,790$  -

### **BENEFIT (CHANGE IN EOV) ATTRIBUTABLE TO PROJECT:**

$\$1,162,790 - 0 = \$1,162,790$

### **BENEFIT/COST RATIO:**

$\$1,162,790 / \$262,601 = 4.43$

**BENEFIT ATTRIBUTABLE TO STDP:**

4.43 \* \$85,621 STDP COSTS = \$379,301

**PNV OF PROJECT:**

\$1,162,790 - \$262,601 = \$900,189

**PNV OF STDP:**

\$379,301 - 85,621 = \$293,680

Year	PV factor	STDP	Other	Disc. STDP	Disc. Other	Total Disc.
0	1.0000	29,180	82,104	29,180	82,104	111,284
1	0.96154	29,680	81,584	28,538	78,446	106,984
2	0.92456	30,180	17,771	27,903	16,430	44,333
	Totals	89,040	181,459	85,621	176,980	262,601

# SPB Internet Control Center

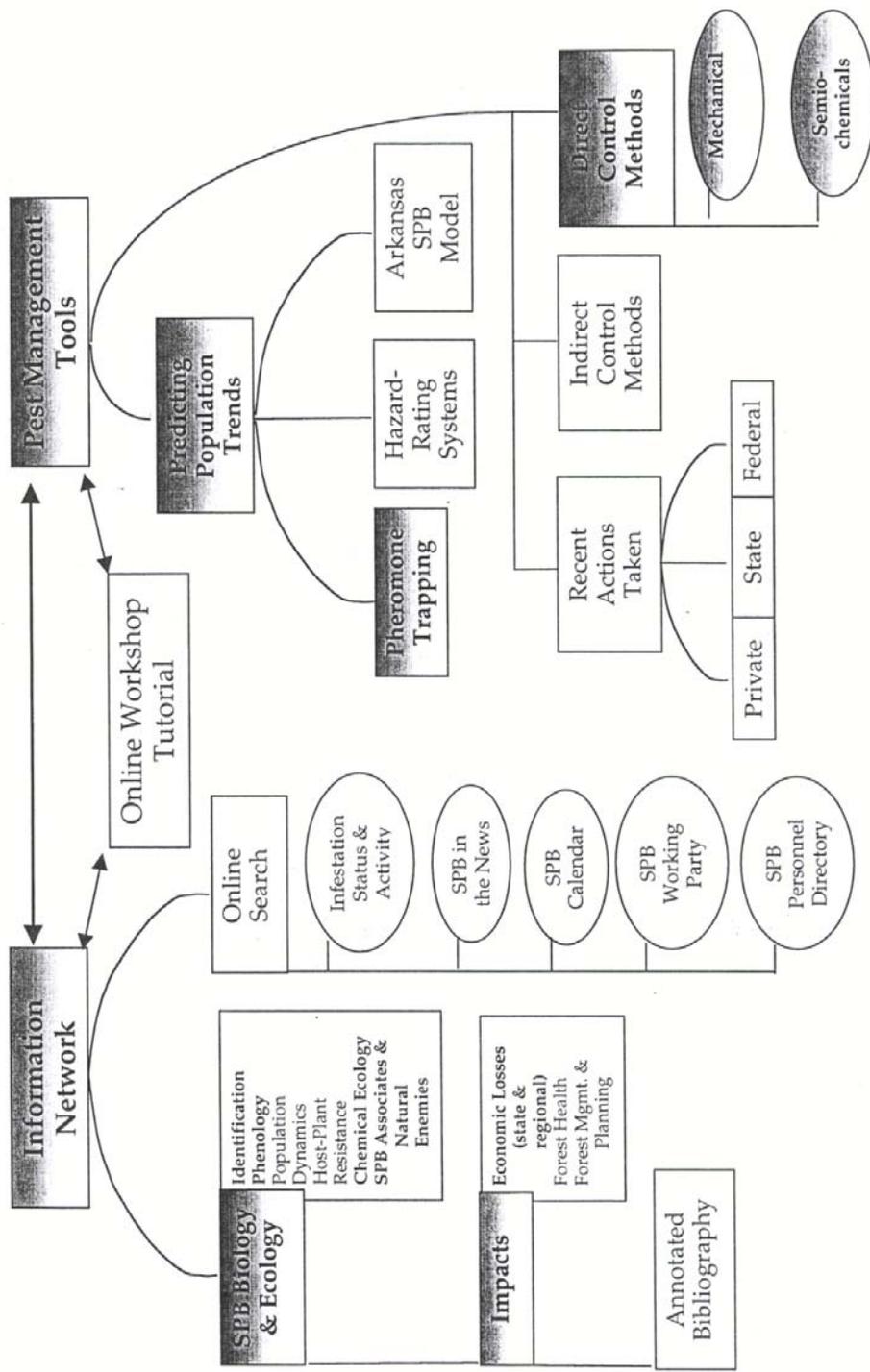


Figure 1. A conceptual plan for the SPB Internet Control Center. Shading and bold face lettering indicates where information is already available on the internet.

