

TITLE: Locate, Map, and Establish Long-Term Monitoring of Exotic-Invasive Plant Species in Forests of the Southern Appalachian Mountains—Year 3 (FY07).

APPLICANT: Equinox Environmental Consultation and Design, Inc.

LOCATION: Appalachian District, Pisgah National Forest in/around Hot Springs, NC; Nolichucky-Unaka District, Cherokee National Forest near Hartford, TN; Mount Rogers National Recreation Area, Jefferson National Forest in/around Konnarock/Whitetop, VA

DURATION: Year 3 of 3-year project **FUNDING SOURCE:** Evaluation Monitoring-Fire Plan

PROJECT LEADER:

Andy Brown, Equinox Environmental Consultation and Design, Inc.; Coordinator of Level 1 Surveys (SAVEM) of Exotic Plants and Coordinator of Locate, Map, and Establish Long-Term Monitoring of Exotic-Invasive Plant Species in Forests of the Southern Appalachian Mountains project Years 1 and 2.

COOPERATORS:

Jack Ranney, University of Tennessee; lead investigator on SAMAB—SAVEM Program
 Gary Kauffman, National Forest Systems, Southern Region
 Ken Stolte, USDA Forest Service, Southern Research Station RWU-4803
 Lindsey Majer, Equinox Environmental Consultation and Design, Inc
 Kevin Caldwell, Equinox Environmental Consultation and Design, Inc

PROJECT OBJECTIVES:

The Southern Appalachian Man and the Biosphere (SAMAB) Foundation, in cooperation with the USDA Forest Service and with funding from the National Forest Foundation, initiated in 2002 a simple, presence/absence study based on invasive-exotic plant surveys (Level I Surveys), utilizing *Citizen Scientists* to inventory and monitor exotic species along trails, roads, and other rights-of-way in National Forests of the southern Appalachians (<http://samab.org/Focus/Monitor/Invasives/invasives.html>). In 2005 and 2006 the FHM-EM program (EM-Fire) funded the development of a Level 2 Survey (L2S) that explored the intrusion of 22 exotic invasive plant species, common in the Level 1 Surveys, into forest interiors and new habitats in recently-burned areas. In 2007 L2 Surveys will move into new areas, and L3 monitoring (establishment of fixed-area Phase-4 type plots) will explore ecological effects of exotic plants on native species. Risk models for common L2 exotic species will be developed from the results of all L2surveys.

- Year 1 (FY05): We developed Level 2 (L2) Survey methods, and located and mapped exotic-invasive plant species that had *expanded into forest interiors and spread rapidly in recently-burned areas*. We documented biotic and abiotic site factors where exotics were found in L2 surveys that addressed site, soil, forest, and other factors and determined that it was feasible to develop risk models for invasion of exotic invasive species.
- Year 2 (FY06): We expanded L2 surveys into new areas in Hot Springs and Mount Rogers and developed protocols for establishing long-term FHM plots (Phase 4 type—additional indicators to P3 indicators and more subjective—stratified-random—location of plots) in L2 survey areas where exotic-invasive species are common. Continued analyses of L2 survey data and identified key variables for risk models for each common exotic invasive species found in L2 surveys. .

This proposal submitted to the FHM program for FY07 would extend that collaboration to accomplish the following objectives:

- Year 3 (FY07): Continued expansion of L2 surveys into new areas (burned and unburned National Forest lands) to increase sample-sizes and explore different habitat types. Combine data from Years

1-3 and analyze to refine variables important for development of risk models for each common exotic plant species found in L2 surveys. Develop risk models for each common exotic species found in L2 surveys using variables associated with the highest proportion of each exotic species biomass, and other factors. Determine initial ecological affects of exotic plant species on native plant communities. Compare development of forest plant communities (plant species and abundance, tree regeneration, etc.) containing exotic invasive species with similar forest plant communities containing no exotic invasive species.

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Year 3 will continue to target 22 of the 33 plant species identified as Nonnative Invasive Plants of Southern Forests (Miller, FS-SRS General Technical Report SRS-62, 2003), species abundant in L1 surveys, and other invasive exotic plant species as suggested by US Forest Service botanists and land managers. The FHM surveys and plots will expand coverage of recent wildfire burn areas, and some areas slated for proposed prescribed burn areas.

JUSTIFICATION:

Exotic-invasive plant species have been identified in the National Fire Plan and by the Chief of the USDA Forest Service as one of the biggest threats to forest health and sustainability. Dr. James Miller (Forest Service-Southern Research Station) has identified, described, and proposed treatments for 33 exotic-invasive plant species of particular concern to southern forest ecosystems. What is poorly known is the geographic extent of these exotic-invasive plant species within forest interiors, particularly the colonization strategies and preferences in burn areas, and the ecological ramifications of the establishment and spread of these exotic species on native plant communities in the Southern Appalachian forests. Risk models are needed to focus invasive exotic plant control efforts conducted by the NFS Districts and others, understand the role of fire and fire management in invasive plant colonization and spread; and the influence of the urban/forest interface in exotic plant introductions and distribution. This research has high *on-the-ground* relevance for the Appalachian District of the Pisgah National Forest where SAMAB and others are currently working to control exotic invasive plant introductions and spread within significant natural heritage areas, particularly at sites that have recently burned and at the urban/forest fringe in the town of Hot Springs, NC. Partners involved in this project and those directly benefiting from this study include: Appalachian Ranger District of the Pisgah National Forest, National Forests in North Carolina, Appalachian Trail Conservancy, Western North Carolina Alliance, North Carolina Natural Heritage Program, National Park Service Southeast Exotic Plant Management Team, North Carolina Exotic Pest Plant Council, and University of Tennessee.

DESCRIPTION:

a. Background: The SAMAB SAVEM program utilizes volunteer recruits (e.g., Citizen Scientists or Citizen Environmental Monitors) from nearby communities and trains them on Level I Survey protocols involving: a) identification techniques for these species; b) data entry indicating species presence/absence, relative abundance, and area infected; and c) GPS mapping of these plants. Many of these surveys were conducted through or adjacent to recent-burn areas—suggested by NFS personnel. SAMAB has shared the data from this program with district rangers and their staffs. These spatially-limited “right of way” based data sets are providing useful information for environmental assessments and larger invasive species control plans at the local and district level (personal communications, 2004; L Randolph [Pisgah NF] and C. Thomas [MRNRA]). The National Forests still have critical needs to: identify exotic plant species that are introduced into forests along roads, trails, etc. and are most likely to spread over-time into forest interiors—therefore should be the first species to be eliminated when they get introduced; identify where exotic species are likely to “spread” after being introduced along roads, trails, etc.; identify areas where exotic species targeted for elimination are most likely to be found; determine the ecological effects of exotic species on native plant species within forest interiors; and develop protocols for the use/collaboration of Citizen Scientists as volunteers to make resource management dollars stretch.

In Year 1 (FY05) the Level 2 Survey identified 22 exotic invasive plant species (3 trees; 7 shrubs; 5

vines; and 7 herbs) that were frequently encountered, abundant, or of high ecological risk in Level 1 Surveys (subset of the 33 plant species identified as Nonnative Invasive Plants of Southern Forests (Miller, FS-SRS General Technical Report SRS-62, 2003). We compiled a list of key ecological characteristics of each species (e.g., physical habitat requirements, soil requirements, reproductive strategies, etc.), grouped species by similar ecological characteristics when possible, and designed stratified-random Level 2 Surveys into forest interiors, streams corridors away from roads or trails, within burn areas, etc. Level 2 Surveys were conducted with significant assistance from Citizen Scientists (trained and field-audited) in the Fall 2005, and the Spring and Fall of 2006. Many of the exotic species could be identified and enumerated even when in a dormant state or dead, due to the structural characteristics of the species (e.g., stem types, branching patterns, fruits, etc.).

b. Methods: In Year 3 we will establish FHM P4 plots in areas identified in L2 Surveys in 2005 and 2006 that have significant concentrations of 1 or more of the 22 target species. P4 plots are composed of most of FIA's P3 suite of indicators with addition of canopy density, digital photography, and salamander/reptile monitoring (the latter at a subset of mesic plots). Some L2 Survey sites will be identified as potential LS3 sites by type and number of exotic species, abundance, and biological and physical site characteristics. In forest areas the initial level of native and exotic species establishment will be compared to observe how each exotic species replaces native species over time—what native species are first and last to be displaced, what is the process in each displacement, and what physical and other biological factors are relevant in the process. In FY06 our emphasis will be on defining the biological and environmental factors that predominate in process of exotic replacement of native species, identifying the P3 FHM/FIA indicators that are most informative when establishing P4 plots in these areas, and how new or developmental Phase 4 indicators (P3 plus canopy density, digital photography, salamanders/reptile, etc.) can improve the determination of the effects of exotic species on native plant communities. Digital photography will provide a visual record of the exotic/native interactions and will be linked to quantitative data from P4 indicators. Consequently our emphasis in FY06 will be pairs of P4 plots in a variety of burned and unburned habitats. The results of FY06 evaluations will allow establishment of additional P4 plots in FY07 to begin to understand the effects of exotic species on native communities at local spatial scales—FY07 will be a more population-based evaluation of exotic plant effects. The P4 plots will provide an excellent source of information on the effectiveness of herbicide and other eradication procedures that will be administered by NFS units in some of these areas. Citizen monitors from nearby communities will continue to assist in data collection and their work will be subject to rigorous QA/QC checks. The NPS Southern Appalachian Information Network's (SAIN) National Biological Information Infrastructure (NBII) will be used for data storage, communication among exotic species teams, and dissemination of information to land managers, policy makers, academia, and the public.

c. Products: The Level 2 Surveys and P4 plot establishment (FY07) will generate a web-based database on exotic species found in NFS and NPS units in the Southern Appalachians, reports on interactions of exotic and native plant species, generate a poster for FHM annual Workgroup meetings, journal articles (abstract for FIA Science Symposium accepted), and interpretive materials that can be used by National Forest Systems and National Park Service units. A framework will be developed for FS-NFS, NPS, and others to monitor the effectiveness of exotic-invasive plant treatment methods, prescribed and natural fire effects on establishment and spread of exotic-invasive species, and spread of these exotic species into forest interior areas and within burn areas.

d. Schedule of Activities: Fall 2006. Conduct L2 Surveys in areas where exotic invasive species were found in Level I surveys (2002-Spring 2006) and begin establishment of P4 plots. Winter 2006-2007. Analyze data from L2 Surveys, interpret, and identify areas where establishment of FHM Phase 4 plots will create a baseline of current conditions and determine the effects of exotic plants on native plant species over time.. Write L2S report and prepare poster for FHM Annual Meeting (January 2007). Spring 2007. Train new and returning CEMs in exotic species identification for L2 surveys and establishment of FHM P4 plots. Conduct additional L2 surveys and establishment of P4 plots in areas

with high concentrations of exotic, invasive species. Summer 2007. Continue L2 Surveys and establishment of P4 plots. Fall 2007. Analyze data, write Level 2 and 3 reports, and develop risk-models for common exotic invasive species. Develop posters, submit portions to journals. Provide relevant information products to NFS and NPS for interpretive and education purposes.

e. Progress/Accomplishments: Fall 2005—Summer 2006: Developed target list of 22 exotic plant species; reviewed literature and developed exotic species and ecological characteristics for L2 Surveys; and implemented Level 2 Surveys (contiguous w/o stratification; contiguous with stratification of habitat-types; and stratified-random surveys of specific habitat types (gaps in forests, rocky outcrops, etc.)). Trained Citizen Scientists and conducted L2 surveys with their assistance. Analyzed L2 survey data from Year 1, wrote draft report, developed poster, and identified initial environmental variables for risk models that were highly related to the biomass (cover, stems, etc.) of common L2 exotic species (e.g., aspect, soil moisture, forest types, duff+litter depths, elevations, and others). Designed Level 3-monitoring system (paired P4 plots—similar areas with and without exotic invasive species to tease-out exotic species effects from natural forest successional patterns)—will implement Fall 2006. Developed and presented poster at 2006 FHM Workgroup Meeting, developed Exotic Plant Species Severity Index (in review), and submitted abstract for 2006 FIA Science Symposium—presentation on October 19, 2006 in Monterey California). Methods developed for this study are being proposed to the Exotic Plant team for development of an Appalachian Trail monitoring system (NPS lead).

BUDGET:

YEAR 3 (FY07)	Item	Requested FHM EM Funding	Other-Source Funding/In-Kind Support	Source
Administration	Salary	\$11,000	\$2,500	NFS—So. Apps.
	Overhead	0		
	Travel	\$2,300		
Procurements	Contracting	\$28,000		
	Equipment	\$1500		
	Supplies	\$1500		
Year 3-TOTAL		\$44,300	\$2,500	
TOTAL 3YR COSTS		\$121,900	\$7,500	

- FHM Funding for YR 3 Administration Salary = \$7,000 to FS Southern Research Station RWU-4803; \$4,000 to Co-PI J. Ranney
- FHM Funding for YR 3 Contracting = \$24,000 to Equinox Environmental fieldwork and Citizen Monitor supervision; \$4,000 to PI J Ranney
- Other Source Funding/In-Kind Support for YR 1-3 Salary = \$1,500 each year from NFS as in-kind contribution of Gary Kauffman

LITERATURE CITED

Brown,A., Kauffman, G., Ranney, J., Stolte, K., Majer, L., and Caldwell, K. 2006. Poster: Invasive Exotic Plants in Southern Appalachian Mountains—Level 1-2-3 Exotic Plant Monitoring System. 2006. Forest Health Monitoring Work Group Meeting. January 30 – February 2, 2006; Charleston, SC.

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Swearingen, J., K. Reshetiloff, B. Slattery, and S. Zwicker. 2002. Plant Invaders of Mid-Atlantic Natural Areas. National Park Service and U.S. Fish & Wildlife Service, Washington, D.C. 82 pp.

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