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Southern Forest Health and Research Update

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Emerging Invasives Update

Sirex Woodwasp Update

In 2006, a large grid-based *Sirex noctilio* delimitation survey covered most of New York, parts of northern Pennsylvania, and northwestern Vermont. Many other states in the eastern United States were also surveyed but at less intensity. Canadian surveys from Ontario and Quebec focused on high-risk sites. As a result, an additional twenty New York counties were found positive for *S. noctilio* in addition to the five counties found positive in 2005. The wasp was also found in two Pennsylvania counties. *Sirex* was not detected in any of the other states where the surveys were conducted. Canadian surveys indicated most of southern Ontario as positive, while no other provinces detected the insect. Surveys conducted in 2007 shifted west and south of the areas included in the 2006 effort. These surveys found two counties in Michigan and one county in Vermont positive for *S. noctilio*. The U.S. Forest Service is currently evaluating silvicultural treatments for reducing the impact of *S. noctilio* on northeastern pine stands. This work, in conjunction with assessment of infested stands, will hopefully provide management recommendations for reducing the susceptibility of pine stands to attack. Other ongoing work includes trap tree method development work in conjunction with APHIS, trap tree protection from bark beetles, competition studies with bark beetle associated fungi, and nematode controlled releases.

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Invasive Insects and Fungi: Redbay Wilt

Extensive mortality of redbay, a tree commonly found in the coastal forests of the southeastern United States, has been observed in Georgia and South Carolina since 2003, and more recently in Florida. Other trees in the laurel family (sassafras, avocado, pondspice and pondberry) have also been affected. SRS-4552 scientists, in cooperation with university and government and state agency partners, have determined that this mortality is due to a vascular wilt disease. The disease is caused by a previously unknown species

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of fungus (*Raffaelea sp.*). The new fungus is a symbiont of the redbay ambrosia beetle, *Xyleborus glabratus*, which is an exotic insect native to Southeast Asia. Trees affected by the disease often exhibit a rapid wilting of foliage and a dark black discoloration of the sapwood. Inoculation studies demonstrate that redbay is very susceptible to the disease. Furthermore, redbay ambrosia beetles can also attack the seedlings of laurel trees that are exposed to the beetles. The female beetles carry the pathogenic fungus within specialized structures within their heads (mycangia) and transmit the pathogenic fungus to trees that cause the development of the wilt disease. This is the first ambrosia beetle symbiont known to cause a vascular wilt. The frequent introduction of ambrosia beetles on solid wood packing materials suggests that other similar pathogens could appear in the Americas. The wilt currently affecting redbay, avocado, and sassafras represents a major threat to other members of the Lauraceae. Research is underway to address the susceptibility (or resistance) to this wilt of other species in the Lauraceae family to help understand the epidemiology and to describe the biology of the beetle and the fungus. Studies are also examining the effectiveness of various attractants for trapping the redbay ambrosia beetle.

More information about this disease can be found at: http://www.fs.fed.us/r8/foresthealth/laurelwilt/

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Invasive Plants: Control of Chinese Privet

Chinese privet, *Ligustrum sinense*, was introduced into the United States in 1852 as an ornamental shrub and by 1932 was established throughout the Southeast. This highly invasive plant readily spreads beyond its point of cultivation and poses a threat to native ecosystems and vegetation. Chinese privet crowds out native vegetation and impedes forest regeneration. Recent estimates show Chinese privet completely covering 0.9 million acres in the Southern Region, with colonies of varying densities found on another 17.6 million acres. Our studies on the Oconee river floodplain alone found an average of twenty tons of privet biomass per acre. We have tested two methods of removing Chinese privet and found both methods to work well. These control measures also increase densities of native pollinators. Just two years after privet removal, the number of bee species on plots free of privet was five times higher and bee abundance twenty times higher than that on privet infested plots. In collaborative work with Dr. JiangHua Sun from China, SRS-4552 scientists have found more than eighty species of insects feeding on privet in its native range. Preliminary testing has identified several promising candidates for further evaluation as biological control agents of privet in the United States.

For additional information contact Jim Hanula at (706) 559-4253, jhanula@fs.fed.us.

Southern Research Station Funding of SPB Research and Development

SRS-4552 has continued its funding of a cooperative agreement program, expanding to include work on invasive insects. Recently funded research includes:

- Restoration planning and evaluation following damage by the southern pine beetle (SPB) in southern Appalachian forests.
- Landscape evaluation of establishment probability and outbreak potential for the SPB in nontraditional host forests.

- Species diversity and genetic relationships among fungi associated with the SPB and Mexican pine beetle in the United States and Mexico.
- Exploring symbiotic associations between antibiotic-producing bacteria and SPB.
- Geographic variation in pheromone profiles of the SPB and the application of endo-brevicomin as an attractant in Arizona.
- SPB: the causes of transitions between endemic and epidemic conditions.
- Interactive keys to mites associated with bark beetles and their galleries in the southeastern United States.
- Inferring the magnitude of migration rates in SPB using genetic markers and diffusion models.
- SPB Hypertext Encyclopedia.
- Molecular dissection of two mycangial glands in the SPB.
- Assessing the damages of the SPB infestation to the viewsheds of South Carolina using modeling, GIS, and 3D visualization.
- Systemic insecticide injections for protection of southeastern pines from the SPB.
- Effect of habitat fragmentation on migration rates in the SPB using genetic markers.
- Effects of interspecific competition and predation on the abundance of the SPB in southwestern ponderosa pine forests.
- Determination of stand susceptibility to the SPB during periods of endemic population levels.
- Development of silvicultural treatments to restore SPB-affected forests in the Francis Marion National Forest.

For more information, contact Kier Klepzig at (318) 473-7238, kklepzig@fs.fed.us.

Southern Pine Beetle Prevention Program

The Southern Pine Beetle (SPB) Prevention and Restoration Program continues to be a cornerstone piece to the Southern Regionís effort to institute a comprehensive and integrated approach for managing SPB in all thirteen southern states and on twelve national forests. This program is a welcome paradigm shift in the management of SPB, putting increased emphasis on proactive integrated pest management strategies.

Funding for this program has been substantial (Table 1). The emphasis for program funding has been for on-the-ground accomplishments. Since 2003, more than 550,000 acres have been treated on federal, state, and private lands with an additional 120,000 plus acres targeted in 2008 (Table 1). Treatments include precommercial and first thinning of stands to create healthier conditions and restoration of forests recently impacted by SPB. Ten states have used cost-share programs to directly reach more than 6,000 landowners. These cost-share programs provide incentives for landowners who have forest stands that need thinning, but who are reluctant to treat the stands due to lack

Table 1: Funding and the Number of Acres Treated on NFS and State and Private Land

	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
Funding (1,000s)	$3,700	$10,000	$14,000	$17,000	$13,500	$9,631*
NFS (acres)	N/A	24,000	17,597	23,018	22,959	7,000
State (acres)	10,000	49,000	134,680	129,900	149,098	115,000
Total (acres)	10,000	73,000	152,277	152,918	172,057	122,000

**Acres for FY 2008 are a conservative estimate of the number of acres targeted for completion*

of markets and contractors to accomplish the work. A fifteen-year target of two million acres treated has been set.

New 30-meter resolution **Southern Pine Beetle Hazard Maps (Version 1.0)** produced by the Forest Health Technology Enterprise Team and funded by the SPB Prevention and Restoration Program were recently released and can be accessed at http://www.fs.fed.us/foresthealth/technology/nidrm_spb.shtml.

These maps will be used to prioritize areas where SPB Prevention and Restoration Program treatments should occur on the landscape. The maps are available as image files that can be incorporated into GIS software, allowing the maps to be overlaid with projected data layers, such as roads, water, property boundaries, known SPB spots, previous prevention treatments, and more. The maps were produced using a multicriteria framework developed during the construction of the 2006 National Insect and Disease Risk Map (NIDRM). Models were developed from variations of existing SPB hazard rating systems for the Coastal Plain, Piedmont, and Mountain regions. Each model is constructed at a 30-meter resolution within a GIS environment using a set of forest parameter layers, such as percent host, basal area, diameter, and stand density index.

For additional information please contact John Nowak at jnowak@fs.fed.us or visit www.fs.fed.us/r8/foresthealth/.

SRS-4552 — Insects, Diseases, and Invasive Plants (IDIP)

It has now been almost two years since the creation of the new unit SRS-4552: Insects, Diseases, and Invasive Plants (IDIP). The unit continues to emphasize research on SPB, invasive insects, tree diseases, and invasive plants. Some highlights from the past two years are as follows:

Selected Publications

1. Fraedrich, S. W., T .C. Harrington, R. J. Rabaglia, M. D. Ulyshen, A. E. Mayfield III, J. L. Hanula, J. M. Eickwort, and D. R. Miller. 2007. A fungal symbiont of the redbay ambrosia beetle causes a lethal wilt in redbay and other Lauraceae in the southeastern USA. *Plant Disease*. 92(2): 215–224.
2. Johnson, J., L. S. Reid, A. E. Mayfield, III, D. Duerr, and S. W. Fraedrich. 2007. New disease epidemic threatens redbay and other related species. *Georgia Forestry Today*. 3: 35–36.
3. Campbell, J. W., J. L. Hanula, and T. A. Waldrop. 2007. Effects of prescribed fire and fire surrogates on flower visiting insects of the Blue Ridge Province in North Carolina. *Biological Conservation* 134: 393–404.
4. Klepac, J., R. Rummer, J. L. Hanula, and S. Horn. 2007. Mechanical removal of Chinese privet. USDA Forest Service, So. Res. Sta. Res. Paper SRS–43. 5 pp.
5. Fraedrich, S. W., T. C. Harrington, R. J. Rabaglia. 2007. Laurel wilt: a new and devastating disease of redbay caused by a fungal symbiont of the exotic redbay ambrosia beetle. Newsletter of the Michigan Entomological Society 52(1&2): 15–16.
6. Fettig, C. J., K. D. Klepzig, R. F. Billings, A.S. Munson, T. E. Nebeker, J. F. Negrón, and J. T. Nowak. 2006. The effectiveness of vegetation management practices for mitigating the negative impacts of bark beetles on coniferous forests in the United States. *For. Ecol. Manag*. 238: 24–53.
7. Lafon, C. W., J. D. Waldron, D. M. Cairns, M. D. Tchakerian, R. N. Coulson, K. D. Klepzig. 2006. Modeling the effects of fire on the long-term dynamics and restoration of yellow pine and oak forests in the southern Appalachian Mountains. *Restoration Ecol*. 14: 400–411.
8. Waldron, J. D., C. W. Lafon, R. N. Coulson, D. M. Cairns, M. D. Tchakerian, A. Birt, and K .D. Klepzig. 2006. Simulating the impacts of southern pine beetle and fire on the dynamics of xerophytic pine landscapes in the southern Appalachian mountains. *Applied Vegetation Science.* 10: 53–64.
9. Vasanthakumar, A., I. Delalibera,, J. Handelsman, K .D. Klepzig, P. D. Schloss, and K. F. Raffa. 2006.

Characterization of gut-associated bacteria in larvae and adults of the southern pine beetle, *Dendroctonus frontalis* Zimmermann. *Env. Entomol*. 35: 1710–1717.

10. Hofstetter, R. W., T. D. Dempsey, K. D. Klepzig, and M. P. Ayres. 2007. Temperature-dependent effects on mutualistic, antagonistic, and commensalistic interactions among insects, fungi and mites. Community Ecology 8(1): 47–56.

11. Miller, D. 2007. Limonene: attractant kairomone for white pine cone beetles in an eastern white pine seed orchard in western North Carolina. *J. Econ. Entomol*. 100: 815–822.

12. Miller, D. R. and D. A. Duerr. 2007. Comparison of arboreal beetle catches in wet and dry collection cups with Lindgren multiple funnel traps. *J. Econ. Entomol*. 101(1): 107–13.

13. Miller, J. H., N. J. Loewenstein, and C. J. Hansen. 2006. Alabama Invasive Plant Councilís list of invasive plants by cultural use categories. *Wildland Weeds*. 10(1): 16–18.

14. Miller, J. H. 2006. Non-native wisteria control with herbicides. *Wildland Weeds*. 10(1): 19–21.

15. Miller, J. H. 2003 (Fifth Reprinting 2007). Nonnative invasive plants of southern forests: a field guide for identification and control. Revised. Gen. Tech. Rep. SRS-62. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station, 93 p. (55,000 more copies)

16. Mulrooney, J. E., T. L. Wagner, T. G. Shelton, C. J. Peterson, and P. D. Gerard. 2007. Historical review of termite activity at Forest Service test sites from 1971 to 2004. *J. Econ. Entomol*. 100: 488–494.

17. Peterson, C. J. 2007. Imidacloprid mobility and longevity in soil columns at a termiticidal application rate. *Pest Management Science*. 63: 1124–1132.

18. Shepherd, W. P., D. P. W. Huber, S. J. Seybold, and C. J. Fettig. 2007. Antennal responses of the western pine beetle, *Dendroctonus brevicomis* (Coleoptera: Curculionidae) to stem volatiles of its primary host, *Pinus ponderosa*, and nine sympatric nonhost angiosperms and conifers. *Chemoecology*. 17(4): 209–229.

19. Smith, S. L., B. L. Strom, and J. R. Meeker. 2007. Early detection pest risk assessment: Erythrina gall wasp. R5-FHP-2007-01.

20. Sullivan, B. T., M. J. Dalusky, D. Wakarchuk, and C. W. Berisford. 2007. Field evaluations of potential aggregation inhibitors for the southern pine beetle, *Dendroctonus frontalis* (Coleoptera: Curculionidae). *Journal of Entomological Science*. 42: 139–49.

21. Sullivan, B. T., W. P. Shepherd, D. S. Pureswaran, T. Tashiro, and K. Mori. 2007. Evidence that (+)-*endo*-brevicomin is a male-produced component of the southern pine beetle aggregation pheromone. *J. Chem. Ecol.,* 33: 1510–1527.

22. Slone, D. H. and B. T. Sullivan. 2007. An automated approach to detecting signals in electroantennogram data. *J. Chem. Ecol.,* Vol. 33: 1748-176.

23. Termites and Wood Destroying Insect Team. 2006. Revision of the popular publication, Subterranean Termites – Their Prevention and Control in Buildings. Home and Garden Bulletin #64.

24. Wagner T., C. Peterson, J. Mulrooney, and T. Shelton. 2008. USDA-FS termiticide report. Pest Management Professional. Feb: 34-36, 38, 40, 42, 45.

For more unit publications, visit the Southern Research Station website: http://www.srs.fs.usda.gov/pubs/index.htm

Electronic and Audiovisual Outputs

- Miller, J. H. More than 800 forest plant and forest operation images available on forestryimages.org, invasive.org, and PLANTS Database. Images regularly appear in publications, displays, and presentations throughout the United States.

- Miller, J. H. Assisted with editing, interviewing location coordinator, and identifying plants, Alabama Public Televisionís Discovering Alabama series, Alien Invaders: Invasive Plants of Alabama episode.

- Miller, J. H. and E. B. Chambliss. University of Georgia. Invasive plants of the thirteen southern states, updated database on invasive.org cataloging all listed invasive plant species by state.

Awards

- Jim Hanula received the USDA Forest Service 2007 *Celebrating Wildflowers Award for Excellence in Pollinator Conservation*. The citation read ìThe North American Pollinator Protection Campaign gratefully acknowledges the effort of James Hanula in creating a pollinator-friendly partnership.î Jimís work was also recognized in a June issue of *Forest Service Today*.
- Jim Miller co-authored an article selected for the prestigious Silvicultural Prize, which is awarded annually to the author(s) of the best paper published in Forestry on the subject of silviculture during the preceding three years. (http://forestry.oxfordjournals.org/). Balandier, P., C. Collet, J. H. Miller, P. E. Reynolds, and S. M. Zedaker. 2006. Designing forest vegetation management strategies based on the mechanisms and dynamics of crop tree competition by neighboring vegetation. *Forestry* 79: 3–27.

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