Economic Analysis of the Potential Impact of *Sirex noctilio*,
With Emphasis on Pines in the Southeastern United States

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Executive Summary

- *Sirex noctilio*, a woodwasp native to Europe, Asia and north Africa, was first found in New York in February, 2005. Delimiting surveys have found it in five counties in New York and recently in Ontario, Canada.
- There has been significant mortality of North American pines planted in other countries infested with this woodwasp.
- Although it is not known what impacts Sirex will have on the forests of North America, there is concern that it could cause mortality and economic loss.
- This economic analysis assumed that Sirex would spread from the current New York infestation at 25 miles/year and take 55 years to infest the entire southeastern US.
- A current estimate of sawtimber and pulpwood values were used, and all future values were discounted to the present using a 4% discount rate.
- At a 10% mortality threshold, in the South, there would be 244 million square feet lost valued at $1.9 billion dollars; in the total infested area, 360 million square feet and $2.9 billion would be lost.
- If mortality reaches 50%, losses would reach 1.4 billion square feet and $11 billion lost in the South, and 2.1 billion square feet and $17 billion in the infested area.

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Introduction

A fall 2004 collection of a female woodwasp in a New York survey trap was identified in February 2005 as *Sirex noctilio*. Infested red and Scots pines were subsequently found in nearby Oswego, NY later that spring. Delimitation trapping surveys conducted in summer and fall 2005 recovered *S. noctilio* specimens in 5 counties around Oswego, NY. In late fall of 2005, it was announced that *S. noctilio* was recovered from two locations in Ontario, Canada, approximately 100 miles from the New York infestation. These collections represent the first known establishment of *S. noctilio* in North America.

Sirex noctilio is a woodwasp native to Europe, Asia and northern Africa that has been inadvertently introduced into a number of countries in the southern hemisphere including: New Zealand, Australia, Uruguay, Argentina, Brazil, Chile and South Africa. In its native range, where it is generally considered to be a secondary pest, it attacks pines almost exclusively, e.g., Scots (*Pinus sylvestris*), Austrian (*P. nigra*), and maritime (*P. pinaster*) pines. In the southern hemisphere the insect has caused upwards of 80 percent mortality in plantations of North American pines especially Monterey pine (*P. radiata*) and loblolly pine (*P. taeda*). Other known susceptible pines include slash (*P. elliottii*), shortleaf (*P. echinata*), ponderosa (*P. ponderosa*), lodgepole (*P. contorta*), and jack (*P. banksiana*).

Although the area of known infestation in New York State does not have extensive pine forests, there are at least 11 softwood lumber producing sawmills in the infested counties. In addition, in the eight counties surrounding the infested area there are numerous sawmills with a combined annual softwood capacity of 51MMBF. The most significant economic impact will be if the woodwasp spreads to the pine forests of the southern US.

This economic analysis was conducted to project the impact of mortality caused by *Sirex noctilio* on the pine forests of the South. Infestations of *Sirex* will likely have the greatest impact on the sawtimber and pulpwood industries, and although impacts on the Christmas tree industry, as well as ecological impacts may be significant, they were not part of this analysis.

There are still many unknowns about the biology of *Sirex noctilio* in North America, and many assumptions had to be made for this analysis. Although there are several native *Sirex* species in North America, it is not known how this non-native will interact in this new environment. The interaction of *S. noctilio* (and its fungal associate) with native predators, parasites, tree defenses and abiotic factors will ultimately determine tree level and stand level mortality, as well as rate of spread across the area. Anthropogenic movement of infested material, such as untreated wood products and pallets, would greatly increase the spread rate from New York. This analysis used a conservative 25 miles/year natural spread rate; any human-aided movement would significantly increase the economic impacts.

The USDA Forest Service, Forest Health Protection, Forest Health Technology Enterprise Team (FHTET) has developed hazard models for *Sirex noctilio* based on risk of introduction and establishment. The establishment surface, based on susceptible host species basal area (BA) was the basis for calculating the spread and impact of *Sirex* in this analysis. The following methods and assumptions were used throughout this economic analysis:

- The rate of spread is estimated at 25 miles/year, and assumes no management, control or regulatory actions. This rate is based on experience from other countries infested with *S. noctilio*.
- At this rate of spread, the woodwasp would spread south from New York State, and take approximately 55 years to reach western Texas, therefore, this analysis was carried out for this 55 year period
- Basal area at risk by year was calculated based upon a pre-existing map of pine basal area used to develop the *Sirex noctilio* risk map (Figure 1, also see: http://www.fs.fed.us/foresthealth/technology/riskmaps/docs/sirexsusceptibility_surface.pdf)
- Future iterations of the risk model will take into account vulnerability and anthropogenic movement of pine materials from the infested area. This would greatly affect economic impact by accelerating movement of *S. noctilio* into new areas, and any future economic analysis will take these factors into account as well
- We assume that a wave of mortality moves across this pine basal area map as the pest spreads from NY at maximum realizable mortality rates of 10% and 50%. These rates were chosen as moderate (10%) and high (50%) impacts that *S. noctilio* may have in North America
- The model produced basal area lost (square feet) for each pixel in the risk map in rings 25 miles wide as the woodwasp spread from New York
- It was assumed that the mortality rates used in this analysis would not occur all in the first year of infestation; therefore mortality in each infested area was spread over a five year period.
- The only monetary value lost considered was for sawtimber and pulpwood. Although infestations by this insect will have other economic impacts, including costs for management and control, they were not considered in this analysis
- To estimate monetary value of the basal area lost, square feet of basal area was converted into board feet for sawtimber assuming that there were 2.7 sixteen-foot merchantable logs (4"-6" mean top diameter) per tree
- Square feet of basal area was converted into a pulpwood cord measure assuming 3.3 eight-foot sticks per tree
- Current prices for sawtimber and pulpwood were obtained from Timber Mart South and several individual state's websites, and were estimated to be $300/MBF for sawtimber and $20/cord for pulpwood
- Based on the Southern Forest Resource Assessment, the distribution of softwood timberland was estimated to be 57% sawtimber and 43% pulpwood
- We applied a blended sawtimber/pulpwood value of $29.20 /square foot of basal area
- All future values were discounted to the present (2005) using a 4% discount rate
- We assume there would be markets for all projected timber value lost

Analysis

Based on a 25mile/year spread of *Sirex noctilio* from the current infestation near Oswego, New York, it would take approximately 55 years for the woodwasp to completely infest the pine growing region of the South. Within 10 years, Virginia would be the first state to become infested in the South, and in 42 years it will be reaching the Gulf Coast in Alabama.

Figure 1. Map of Sirex noctilio susceptibility risk
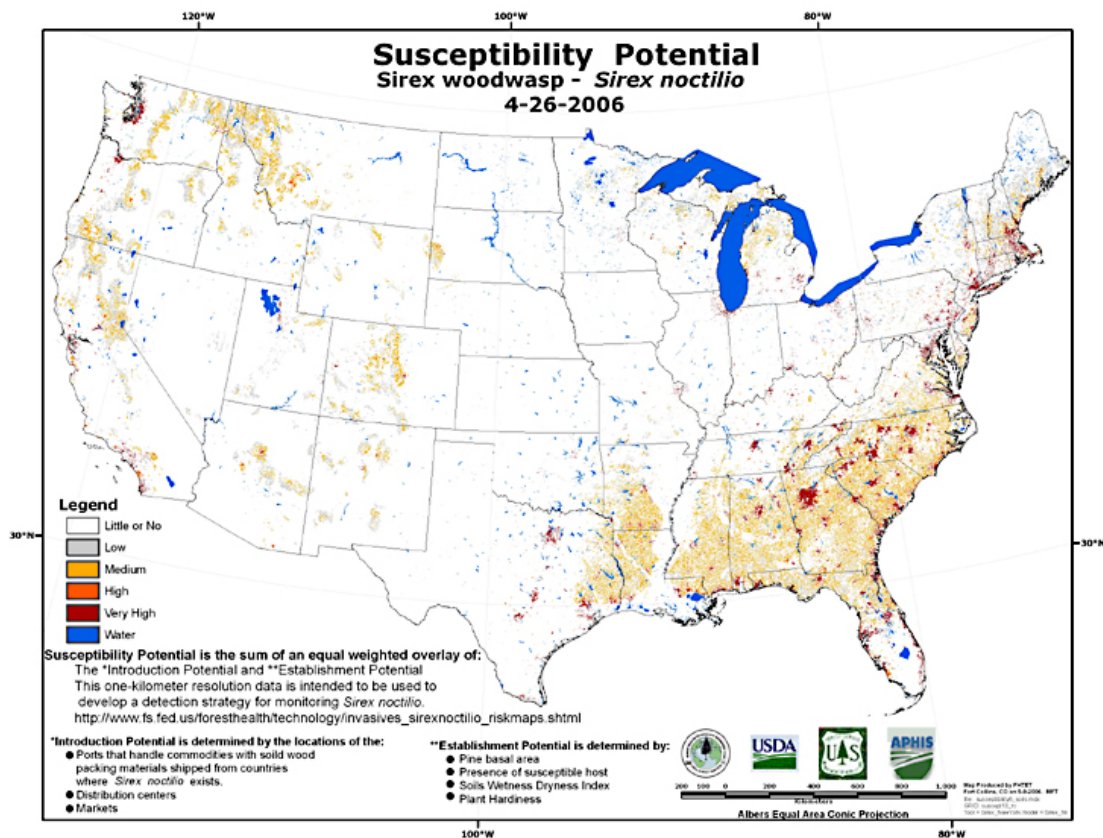
The 10% mortality threshold model would result in a total loss of pine basal area of 244 million square feet over the 55 year infestation period (Table 1). Georgia, which has the highest basal area of pine in the South, would experience the greatest loss of 50 million square feet beginning 25 years from the present. Based on a 4% discount rate, the total present value lost in the South would be more than $1.9 billion. The non-southern states infested during this 55 year time period would experience an additional $968,000 loss. At the 50% mortality threshold in the South, both the basal area lost and the value lost would greatly increase to 1.4 billion square feet and $11 billion, respectively (Table 2).

Table 1. Basal area and value lost due to spread of *Sirex noctilio* from New York with **10%** mortality threshold.

State	Years Infested	BA Lost (sq ft)	Total Discounted $ Lost
Alabama	29-43	37,779,978	**$247,325,229**
Arkansas	36-46	24,492,454	**$126,854,198**
Florida	35-48	24,148,733	**$144,647,866**
Georgia	25-38	50,159,888	**$395,697,416**
Kentucky	18-29	353,853	**$3,977,090**
Louisiana	42-51	30,607,290	**$134,172,513**
Mississippi	33-45	28,097,455	**$155,597,190**
North Carolina	17-27	30,759,753	**$365,795,885**
Oklahoma	42-47	3,083,858	**$14,253,541**
South Carolina	23-31	31,804,015	**$304,483,209**
Tennessee	20-35	6,174,635	**$60,373,869**
Texas	45-55	21,440,720	**$80,263,212**
Virginia	10-21	11,458,707	**$166,849,084**
Total South		**244,166,428**	**$1,889,095,923**
Non-Southern states		**115,587,591**	**$968,309,814**
Total infested area		**359,754,019**	**$2,857,405,737**

Table 2. Basal area and value lost due to spread of *Sirex noctilio* from New York with **50%** mortality threshold.

State	Years Infested	BA Lost (sq ft)	Total Discounted $ Lost
Alabama	29-43	223,322,711	**$1,464,433,411**
Arkansas	36-46	141,036,585	**$731,176,857**
Florida	35-48	144,215,578	**$862,515,471**
Georgia	25-38	294,548,709	**$2,322,983,866**
Kentucky	18-29	2,573,094	**$28,980,441**
Louisiana	42-51	166,919,988	**$926,143,597**
Mississippi	33-45	184,312,155	**$2,191,672,354**
North Carolina	17-27	17,519,921	**$80,958,460**
Oklahoma	42-47	184,401,854	**$1,767,980,015**
South Carolina	23-31	37,483,453	**$367,631,253**
Tennessee	20-35	121,514,628	**$455,224,399**
Texas	45-55	223,322,711	**$1,464,433,411**
Virginia	10-21	68,076,658	**$991,160,088**
Total South		**1,425,463,656**	**$11,099,309,874**
Non-Southern states		**694,909,328**	**$5,896,832,491**
Total infested area		**2,120,372,984**	**$16,996,142,365**

The basal area and value lost for both of these mortality thresholds assumes no management or control actions, and a constant 25 mile/year rate of spread, with no long distance human-aided dispersal. Whereas a faster rate of spread would affect the timber prices and discounted value used in the calculations, control and regulatory measures would reduce the impact and slow the spread rate.

The values lost for both of these scenarios may not be realized if control and regulatory actions are implemented. They point to the potential impact that this species may have on the pine forests of the southern US, and the need for mitigation. Even with a conservative spread rate and 10% mortality, there may be losses of $57 million per year. Mitigation to slow the spread and reduce mortality would result in significant cost-benefit savings even if management and control programs cost $10-20 million per year.