

# Scale dependence of host susceptibility to the southern pine beetle

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## Introduction

- Southern pine beetle, *Dendroctonus frontalis* (Scolytidae) attacks and kills pines of several species throughout the southeastern United States.
- Beetles initiate new infestations each spring by aggregating on one or a few trees at points scattered through the forest landscape.
- Overall tree mortality is largely due to the subset of initial infestations that grow to include hundreds or thousands of trees.
- Within an infestation, beetles land on and attack Virginia pine (*Pinus virginiana*) more than loblolly pine (*Pinus taeda*) but the per capita reproductive success of the beetles is lower in Virginia pine than in loblolly pine (FIG. 1).
- Spatial scale of a study determines the pattern and processes that can be detected. This is an especially important consideration for forest insects, which are often managed at a coarser scale than they are studied.

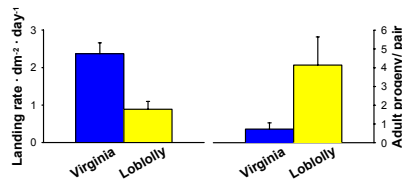


FIG 1. Landing rates of beetles on trees and per capita reproductive success in Virginia and loblolly pines within a mixed stand (mean + SE).

## Hypotheses

**H1:** Behavioral preferences of attacking beetles predicts the susceptibility of host species.

→ Thus, rank order of damage is:

Virginia pine > Mix of Virginia and loblolly > loblolly pine

**H2:** Relative susceptibility of pines species depends on species composition within the scale of beetle movement.

→ Thus, rank order of damage within mixed species stands is:

Virginia pine > loblolly pine, but

→ Rank order of damage across the landscape is:

Loblolly > Mix of Virginia and loblolly > Virginia

## Study area: Bankhead National Forest, Alabama

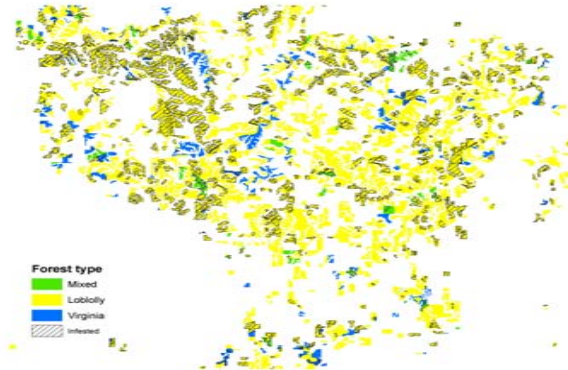


FIG 2. GIS map with one layer showing pine stands classified as loblolly pine, Virginia pine, or their mixture, and the other layer indicating areas of high mortality from southern pine beetle activity from 1998-2000.

## Fine scale: within infestations within stands

We sampled five, randomly selected beetle infestations within mixed stands of loblolly and Virginia pine. Within each stand, we scored a sample of ~100 trees (classified by species) as attacked (dead) or not attacked (alive).

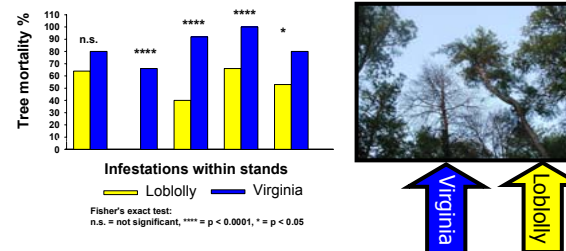


FIG 3. Within infestations that included both pine species, southern pine beetles systematically attacked and killed a higher proportion of Virginia pines than loblolly pines.

## Wide scale: landscape level

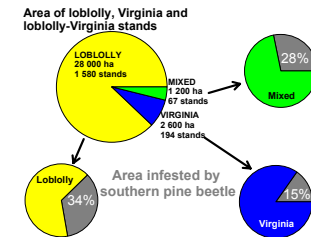


FIG 4. Throughout the Bankhead National Forest larger area of loblolly stands suffered more severe damage due to the southern pine beetle than mixed stands of loblolly and Virginia or pure Virginia stands (see FIG 2).

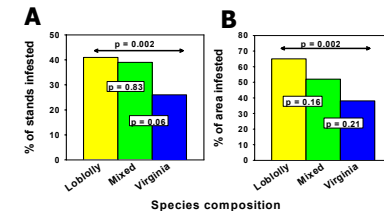


FIG 5. **A)** Significantly higher number of loblolly stands than Virginia stands were infested within the landscape. **B)** Within those stands that became infested, a larger proportion of loblolly stands were consumed by beetles compared to Virginia stands. P-values are based on pairwise randomization tests.

## Conclusions

- The pattern of host susceptibility within infestations was the opposite to that at the landscape level (**H1** rejected).
- Southern pine beetles prefer Virginia pines to loblolly pines, but because their reproductive success is lower in Virginia pine, infestations in Virginia stands are less likely to grow compared to infestations in loblolly pine (**H2** supported).
- Favoring Virginia pine in forest regeneration plans could decrease landscape impacts of the southern pine beetle.
- A large forest with the same overall composition of potential host species, can have different susceptibility to biotic disturbance depending on the spatial pattern of hosts.

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