

What Forest Compositional Changes Can We Expect Following Redbay Mortality on a Barrier Island?

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Redbay (*Persea borbonia*) on Sapelo Island exists in variable age classes mainly due to management practices including pine timber harvesting and prescribed fire. Some old growth redbay stands exist mixed with live oak. On Sapelo, redbay is generally an early successional tree following pine harvesting, with much of the reproduction from root sprouts. Since redbay appears to be an early successional species, its disappearance may allow more effective recruitment by undesirable invasive species. Redbay mortality began on the north end of the Island 3 years ago. Disease appears to attack older trees first, while mortality of younger trees is less pronounced at this time. Additionally, forest species composition (particularly recruitment of oak seedlings) on Sapelo is subject to impact by large mammalian herbivores. Sapelo contains a high density of deer (~40-60/sq. mile) and feral cattle and hogs.

Study Design:

In order to study forest species replacement following redbay mortality, we established an experiment that manipulated presence of redbay and installed herbivore exclusion cages. The experimental design consisted of a 2x2x3 factorial design with 2 stand ages (1 year vs 5-7 years after logging), 2 herbivory levels (exclusion vs no exclusion, n=24 for each), and 3 redbay manipulations (removal - redbay stump treatment with Garlon® 4, protection - Merit® systemic insecticide soil drench, and control - monitor natural mortality rates). The three redbay manipulations were applied to 25 m x 25 m plots (n=4 for a total 12 plots). The two herbivore treatments were applied within each of these plots in 4 m x 4 m areas, each plot having two areas with cages and two areas without cages. Response variables for the 25 m x 25 m plots are stem density of all woody species and mortality, diameter class and presence of reproductive structures on redbay trees. Response variables for the 4 m x 4 m areas are species composition of seedling recruitment, herbaceous diversity, and herbaceous biomass.

Preliminary Results:

Preliminary results indicate other shrub layer species dominating recently disturbed redbay habitats included loblolly pine, wax myrtle, saw palmetto, and *Vaccinium* sp. Substantial herbivore defoliation and damage was noted on *Vaccinium*, wild azalea, and on the only two oak seedlings found in 4 plots. Lighter herbivore grazing was noticed on redbay seedlings. It appears from these early observations that species likely to replace redbay on Sapelo Island will depend on mammalian herbivore pressure. Further, species composition immediately after logging may be different when compared to stands having a well established shrub layer. Redbay mortality could possibly change island ecosystem productivity and composition by either facilitating establishment of exotic invasive species, or by creating monoculture environments of saw palmetto, loblolly pine, and wax myrtle. Disruption of nitrogen and carbon cycling resulting from species shift could lead to changes in timing of leaf litter fall and quality of litter biomass reaching the forest floor. To understand species replacement on a larger scale (mainland settings), we will need larger scale projects, with more replicates, standardized protocols, and consideration of major driving factors in each environmental setting. Other factors to consider include stand age, fire frequency, or other management activities, grazing pressures, and proximity of invasive species.

Redbay and Sapelo Island

- Variable age classes – management practices, some old growth stands
- Early successional shrub – much from root sprouts
- Decline symptoms - 3 years from the north
- Disease appears to attack older trees (first?)
- Mammalian herbivores
 - High density of deer
 - Recruitment of oak seedlings
 - Feral cattle and hogs



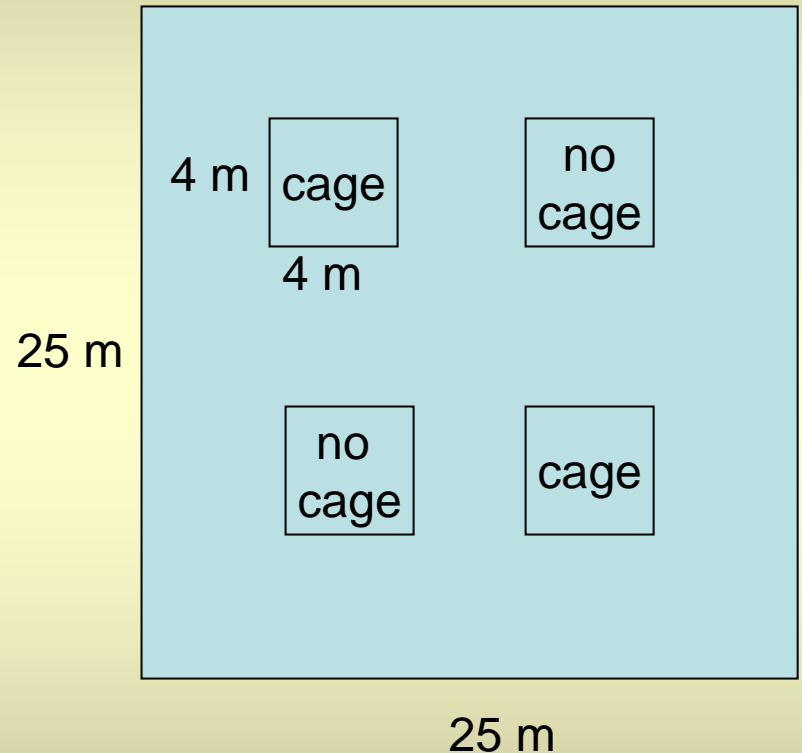
Experimental Design

2x2x3 Factorial

- 2 Stand ages
 - 1 year vs 5-7 years
- 2 Herbivory levels
 - exclusion vs no exclusion
- 3 Redbay manipulations
 - Removal - stump treatment with Garlon® 4
 - Protection - insecticide systemic Merit®
 - Control - monitor natural mortality rates

Plot Design

- 3 Redbay manipulations
 - 25 m x 25 m
 - Total 12 plots
- 2 Herbivore pressures within treatment area
 - 4 m x 4 m
 - 2 cages & 2 without cages



Response Variables

25 m x 25 m plots

- Stem density of all woody species
- Redbay
 - Mortality
 - Size

4 m x 4 m plots

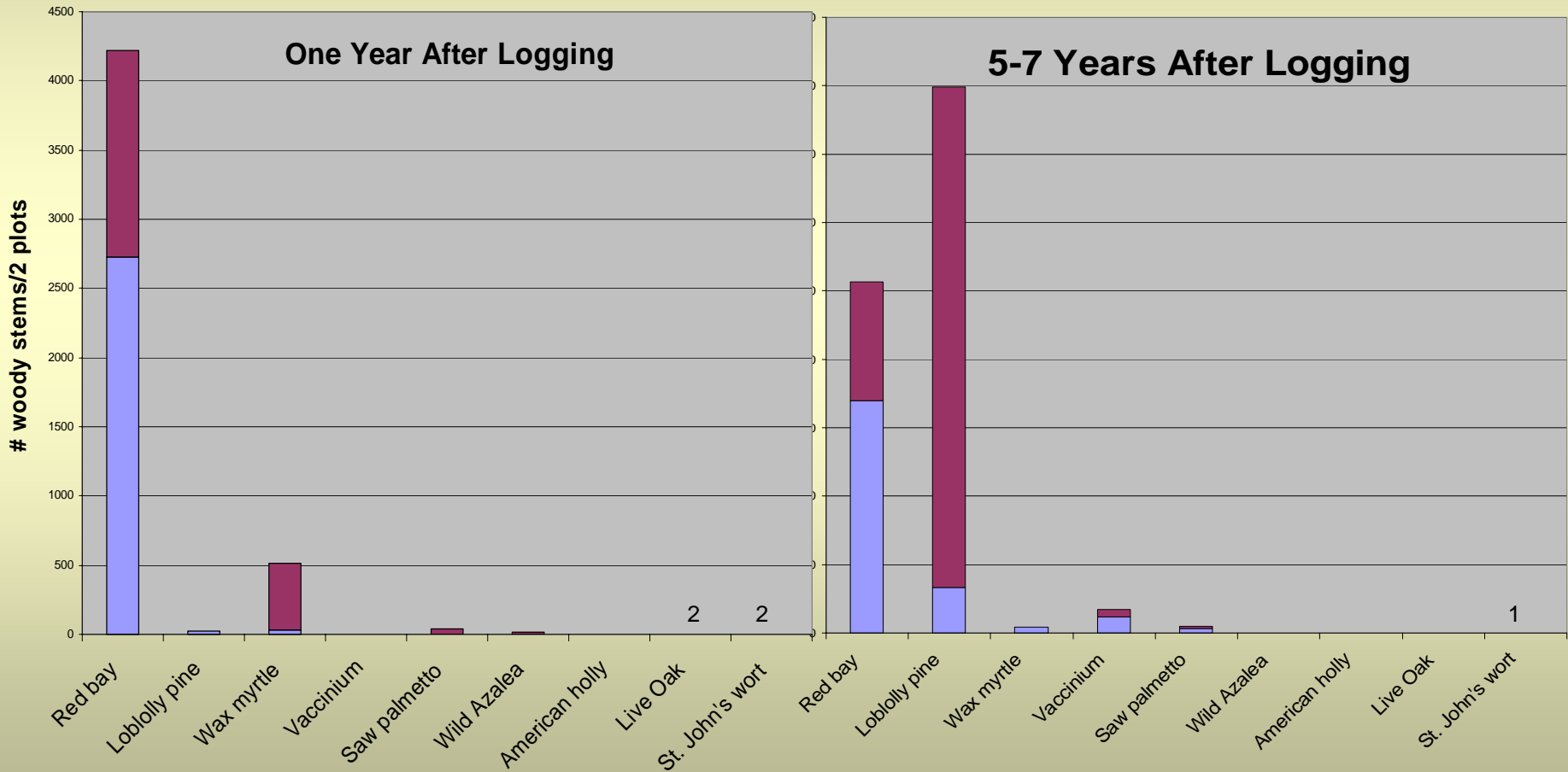
- Seedling recruitment
- Herbaceous diversity
- Herbaceous biomass





Stem counts

25 m x 25 m plots



So far...

- Other woody species dominating recently disturbed redbay habitats include loblolly pine, wax myrtle, and saw palmetto *Vaccinium*.
- Herbivore defoliation and damage was heavily noted *Vaccinium*, wild azalea, and on the only two oak seedlings found in 4 plots.
- Lighter herbivore grazing on redbay seedlings

What will replace redbay on Sapelo Island?



- Mammalian herbivore pressure
 - Seedling recruitment will likely vary in species composition and number



- Age of redbay stand
 - Species composition immediately after logging may be different compared to stands have a well established shrub layer.

Research Discussion

- Based on mainland mortality surveys, is there differential mortality associated with size class of tree?
- GFC - Systemic Merit® - Chip Bates
- Provide assistance in other protection applications (fungicide/herbicide complex) to redbay <10 years

Ecosystem Services and Processes

- Poor wildlife habitat
low species diversity
 - Monocultures -
palmetto, loblolly pine,
wax myrtle
- Disruption nitrogen
and carbon cycling
resulting from species
shift



What will replace redbay on barrier islands?

- Larger scale projects
 - More replicates
 - Cooperation standardizing protocols
- Age of redbay stands
 - Old growth barrier islands - Ossabaw
 - Disturbed islands – management activity
- Fire frequency
 - Species composition will vary with fire frequency
- Different herbivore pressures

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