Surviving Herbivory: Two year results of oak and hickory seedlings on shrink-swell soils

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Introduction

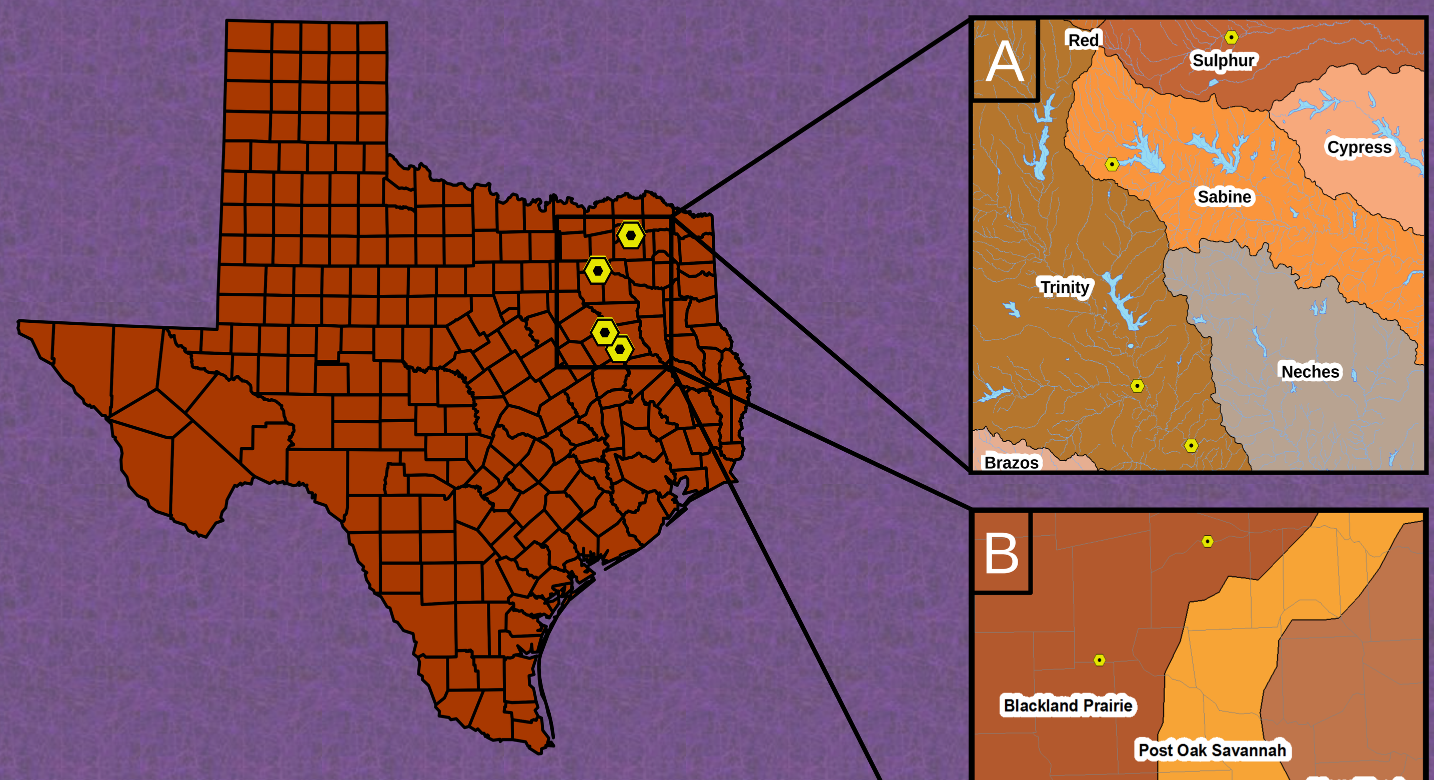
Planted oak and hickory seedlings on bottomland hardwood sites with shrink-swell soils in Texas typically have very low survival rates. In some cases survival is <15% due to a variety of known and unknown limitations. Of the possible limitations, herbivory impacts from feral swine (*Sus scrofa*) and white-tailed deer (*Odocoileus virginianus*) are thought to be significant. This research looks to determine if herbivory is a significant cause of mortality within the Western Gulf Coastal Plain.

Research Questions:

(1) Do white-tailed deer and feral swine cause a significant impact on seedling survival during bottomland hardwood forests restoration attempts across east Texas?

(2) What mitigation procedures are effective and practical in alleviating wildlife impact on seedling establishment in bottomland hardwood forest restoration sites?

Study Locations



Four study locations within Anderson, Freestone, Hunt, and Hopkins counties. They are spread across (A) three river basins and (B) two ecoregions within East Texas.

Methods

Nested split-split-plot design

- *In situ* restoration experiment replicated across four locations from January 2015 to December 2016 using ≈6,700 total seedlings.
  - 2 canopy cover types (0%, 50%).
  - 3 blocks per canopy cover type
  - 4 whole-plots treatment (8 ft. woven-wire fence, portable electric fence, individual tree shelters, and non-fenced, Fig. 1)
  - 3 subplot treatments (Shumard oak, bur oak, pecan).
- Recorded height, diameter, survival, and cause of mortality 2 months post-planting, year 1, and year 2.
  - Cause of mortality includes: growing conditions, feral swine, white-tailed deer, and other herbivory.
- Response variables analyzed with Proc Mixed (SAS 9.2 software, SAS Institute Inc., Cary, North Carolina).

Fig. 1: Examples of each whole-plot treatment constructed, January 2015.

Methods (Continued)

Wildlife Density Surveys

- Fall 2015: Conducted 14-day trail camera surveys at 1 camera per 41 ha over 445 ha to estimate population density for white-tailed deer and feral swine for each study location.

Estimated Days Inundated

- Compared observed flood depth at study locations to USGS surface water gauges near each study location.
- Retrieved archived data from USGS to the date at which seedlings were planted at each site in January, 2015.

Fig. 2: Example of 50% canopy cover area.

Wildlife Densities

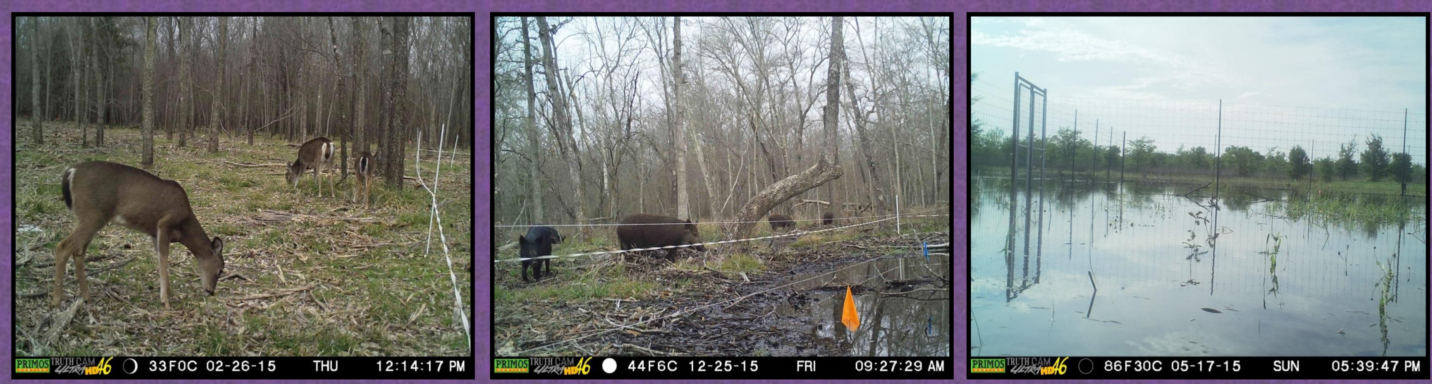


Fig. 3: Examples of white-tailed deer and feral swine outside electric fence treatments and major inundation within a 0% canopy cover high fence.

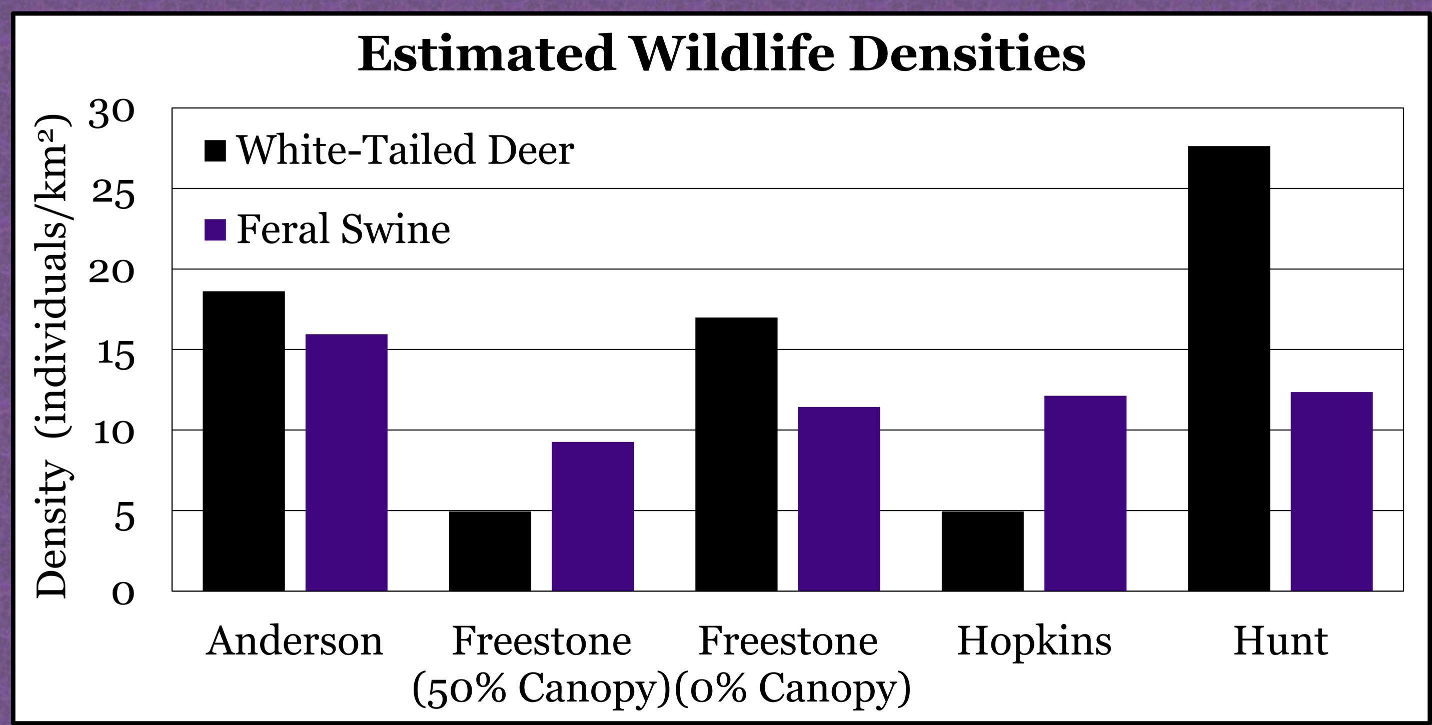


Fig. 4: Densities of white-tailed deer and feral swine for each study location estimated from trail camera survey. Freestone's canopy cover areas were far apart and both would not be within a single 445ha camera survey so separate 324ha surveys were conducted.

Inundation Duration

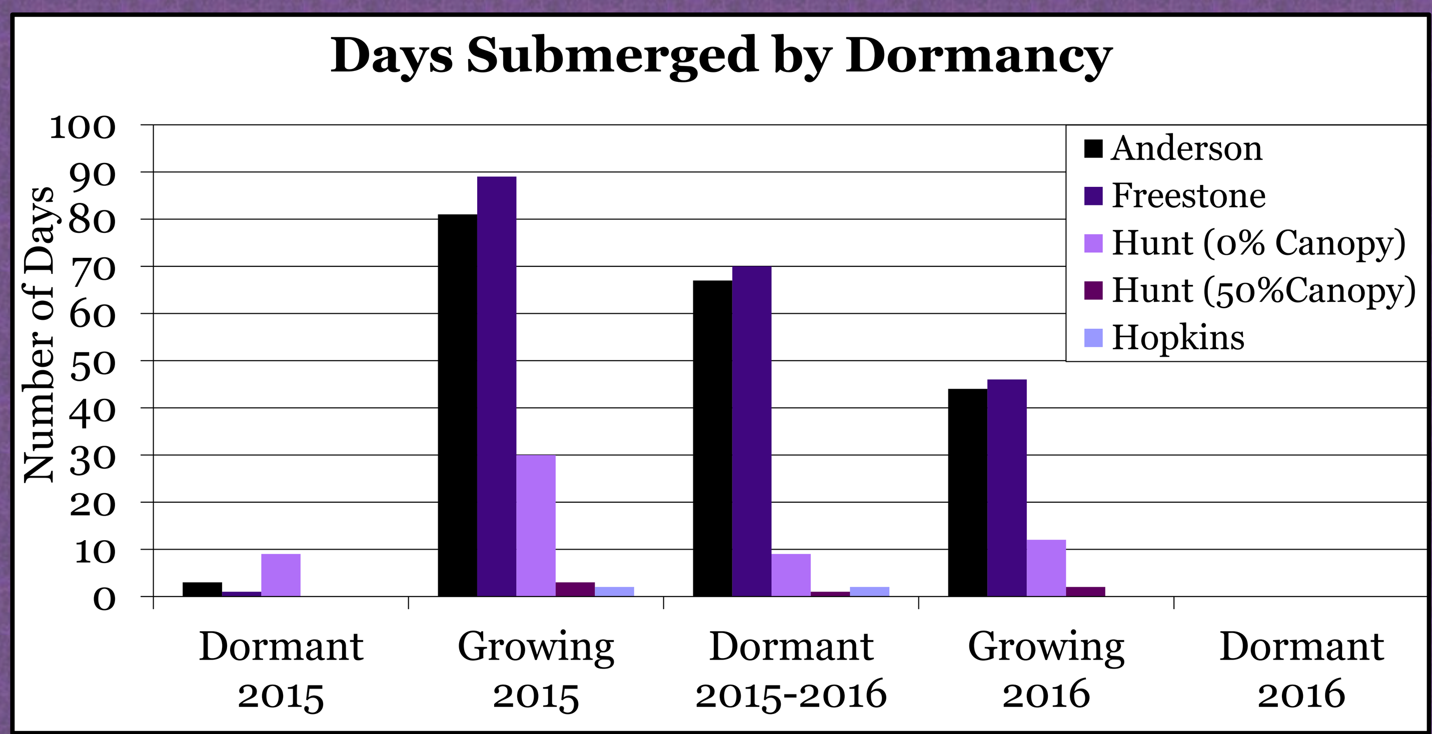


Fig. 5: Number of days study locations were inundated at the different stages of dormancy from January 2015 to December 2016.

Change in Height

Survival

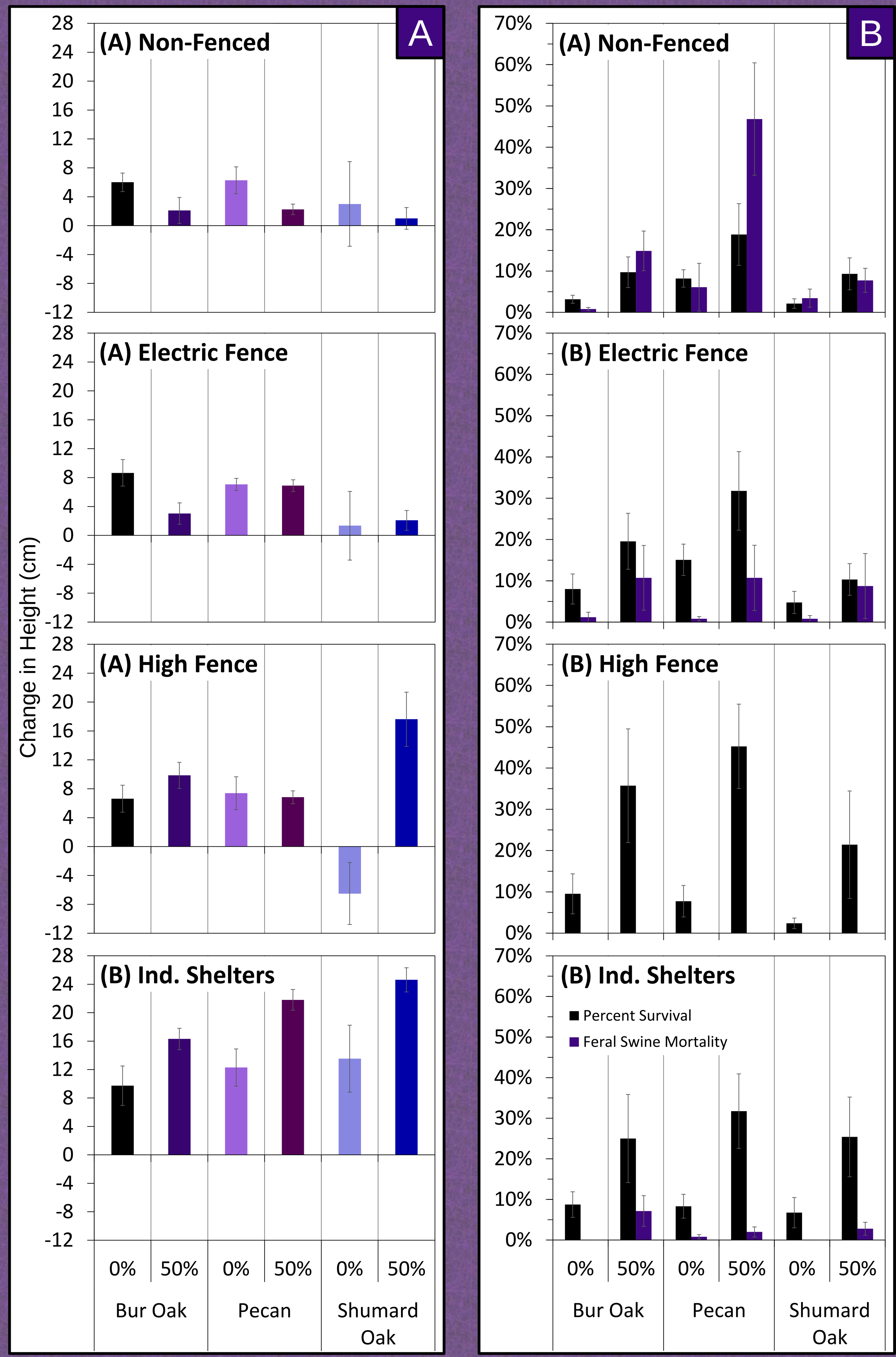


Fig. 6: Change in (A) height, (B) survival, and mortality caused by feral swine after two growing seasons. (B) Additional mortality due to 2015 and 2016 growing conditions. Letters denote differences of change in height and percent survival at the whole-plot level within each set of graphs (α=0.10).

Conclusions & Management Implications

- Wildlife impacts were episodic and not reliably predicted by population densities.
  - All locations contained moderate swine densities (Fig. 4), but only two experienced > 40% mortality within non-fenced plots in the 50% canopy cover areas. Similar behavior observed by Mayer *et al.* (2000).
- Growing season inundation impacts far outweighed herbivory in causing reduction in survival (Fig. 5).
- Seedlings within Ind. Tree Shelters grew 2-times taller (Fig. 6A).
  - This could allow seedlings to outgrow browse pressure and flood levels quicker.
- Fence treatments protected seedlings but varied in efficacy, ease of implementation, and maintenance requirements (Fig. 6B).
- After selecting species based off site characteristics, stagger plantings over multiple years while continuously monitoring for wildlife impacts. If impacts present, use Ind. Tree Shelters.

Citation: Mayer, J.J., Nelson, E.A., Wike, L.D., 2000. Selective depredation of planted hardwood seedlings by wild pigs in a wetland restoration area. Ecological Engineering 15, S79-S85.

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