

TREE STRESS RINGS

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Saltwater intrusion is a growing problem with rising sea levels. Only a limited number of plants can survive regular saltwater inundation or exist full time in saltwater. Bald Cypress (*Taxodium distichum*) can survive inundation for a short time due to hurricane storm surge, but not regular immersion due to tidally influenced intrusions. Narrowness in tree rings shows evidence of stress that can be caused by numerous factors. Bald Cypress trees in the Dog River Watershed were selected, cored, and examined to see if evidence of saltwater intrusion could be found. Cores were used to create a skeleton plot showing perceived stress in trees, and compared to each other and rainfall data from ICP. Due to the influence of tropical storms on the Dog River Watershed, effort was made to control for damage from tropical storms and rainfall from them.

Introduction

Evidence of stress in a tree's environment can be seen in the growth rings produced by trees. Bald Cypress trees in the Dog River Watershed may contain evidence of environmental stress. This stress can be caused by pollution and other materials coming downstream, but it can also be caused by salt water intrusion into Dog River related to a loss of freshwater head as permeable surfaces proliferate (Griffin, 2013).

The growth of the percentage of land covered by impermeable surfaces in the Dog River Watershed will change the profile of the stream flow. Instead of a moderate rate of flow with high pulses of flow after precipitation events, the stream will have a low rate of flow with very high rates of flow after precipitation events. The lower rate of flow will allow salt water from Mobile Bay to intrude farther into upstream Dog River's tributaries (Milam, 2006) (Griffin, 2013). This is complicated by the fact that much of Dog River is a tidal river and responds to the fluctuations of the tide, which brings regular saltwater intrusions to large parts of the river.

Research Questions

Do Bald Cypress trees in the Dog River Watershed show evidence of stress?

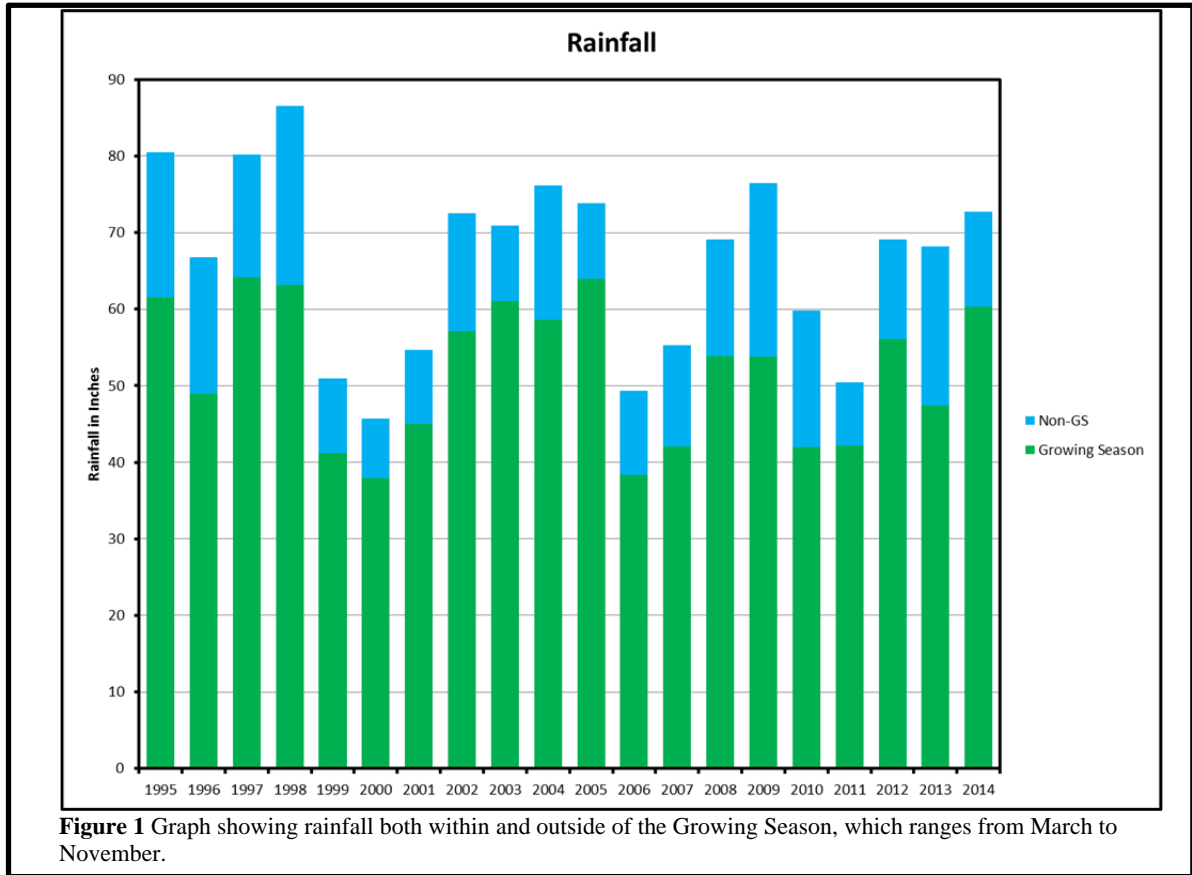
Methods

I used a boat to approach trees found along Halls Mill Creek, a sub-basin in Dog River Watershed. Trees selected were bald cypress trees (*Taxodium distichum*) and were sorted on distance from open water. Some trees were approached by foot without permission of property owners, after scouting locations from land

Using a tree corer, cores were obtained from bald cypress trees distributed in the study area. Each tree had notes taken on its conditions (living or dead) and location, both geographic and relative to the tidal zone. Each core was stored in a labeled straw and taken back to a base location for processing and analysis. Cores were mounted on boards using wood glue and planed and sanded to reveal the rings (Stokes & Smiley, 1968) (Braker, 2002). After doing this, skeleton plots were constructed for each core (Stokes & Smiley, 1968). One core had experienced too much damage from this process and several others had knots affecting the construction of a skeleton plot for the final rings (Stokes & Smiley, 1968). Skeleton plot data was entered into excel for statistical processing. Rainfall data was acquired from ICP and was processed in excel, though some additions had to be made to the data from WeatherUnderground.com.

Results

Rainfall data indicates that, while some years have received lower amounts of rainfall than other years, the rainfall largely occurs in the growing season, defined as March to November of each year. As seen in Figure 1 the bulk (greater than half) of all rainfall occurs in the Growing Season. This is not unusual as the Growing Season makes up a large part of the year.

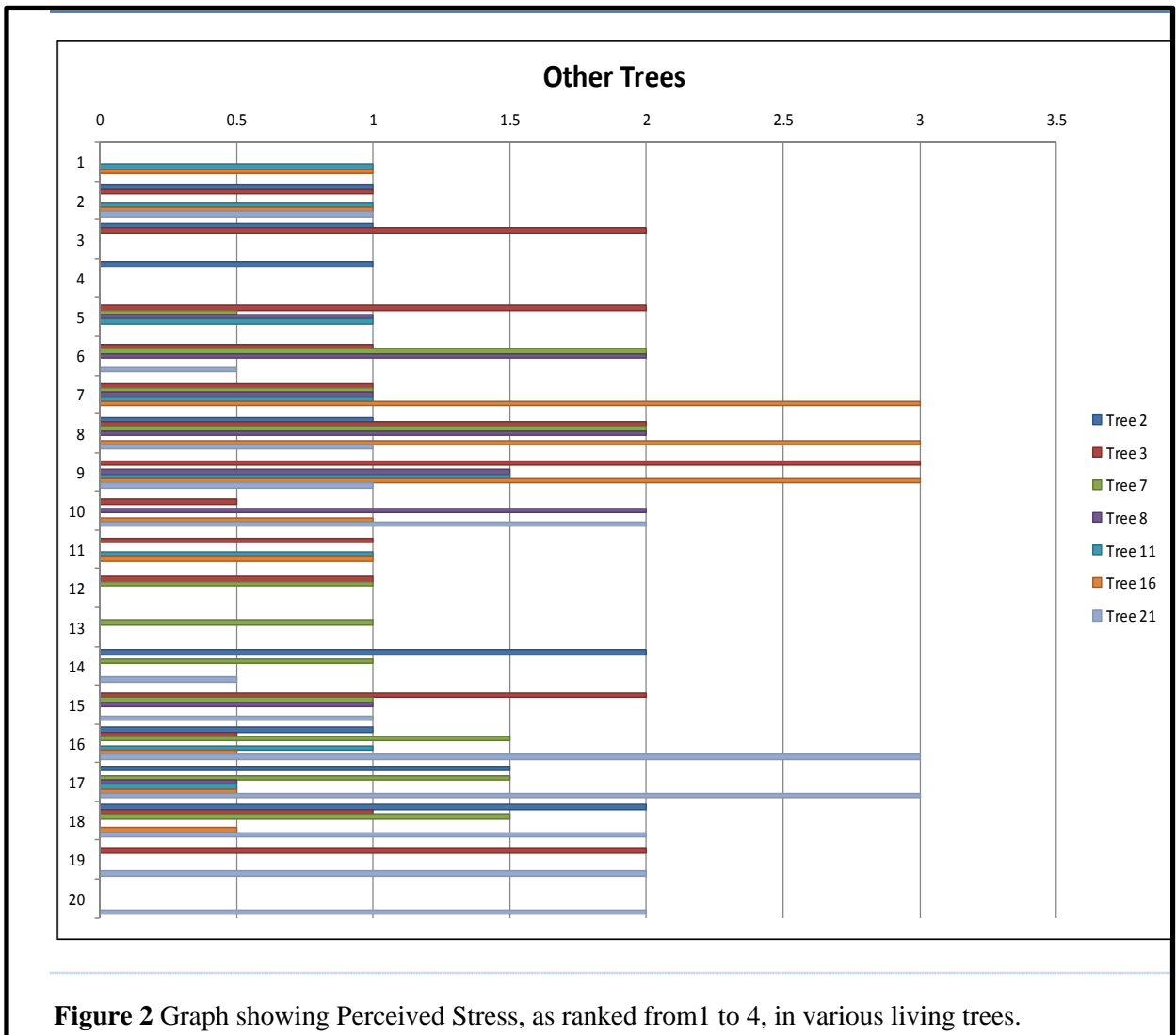


The processed cores of living trees show two periods of higher levels of stress. The seventh to the tenth rings from the bark show clusters of higher levels of stress. The rings in Tree 16 were given a rating of 3 out of 4 from the seventh ring to the ninth ring; Tree 8 also register a 3 in ring 9, while Tree 14 registered a 3, the method of judging the narrowness between rings, in ring 10. A total of twelve different living trees registered stress during that time span out of a sample of 18 living trees. There appears to be low, but steady level of stress in more recent rings.

Interestingly, this period spans two peaks in rainfall and some years of below average rainfall (see Fig. 1) the ring with the highest numbers in the most trees occurs in the ring after the

year of lowest rainfall. This indicates a possible delayed response to the stress after a period of dormancy that might have started earlier than usual.

The second period occurred in the fourteenth to eighteenth rings from the bark. In this period the ten living trees register stress, though it was lower than the first period described above. One tree, Tree 21, did peak at 3 out of 4, the method of judging the narrowness between rings, two rings in a row, thus it may be said that this period of stress was less extreme than the one described above (Fig. 2).



This period of stress starts in a time of high rainfall and ends after three years of lower rainfall in Mobile. The rings following that ring do not show high levels of stress in numerous trees, just one tree.

For comparison, the most recent five rings show thirteen different living trees with some stress. However, this time span covered years when both below average rainfall occurred, but when more rain was falling outside the growing season. Figures 2 and 3 show a low steady level of stress in trees in the last five rings.

Discussion and Conclusions

The sample size was not large enough nor did it penetrate deep enough into the Hall's Mill Creek sub-basin for a truly definitive sample. These errors should be corrected in a further or similar study. Also, since much of Hall's Mill Creek is tidally influenced samples should be observed at both low and high tides to verify the classification scheme, which may need to be modified. Classification of locations were done using the current tidal pattern only once, with

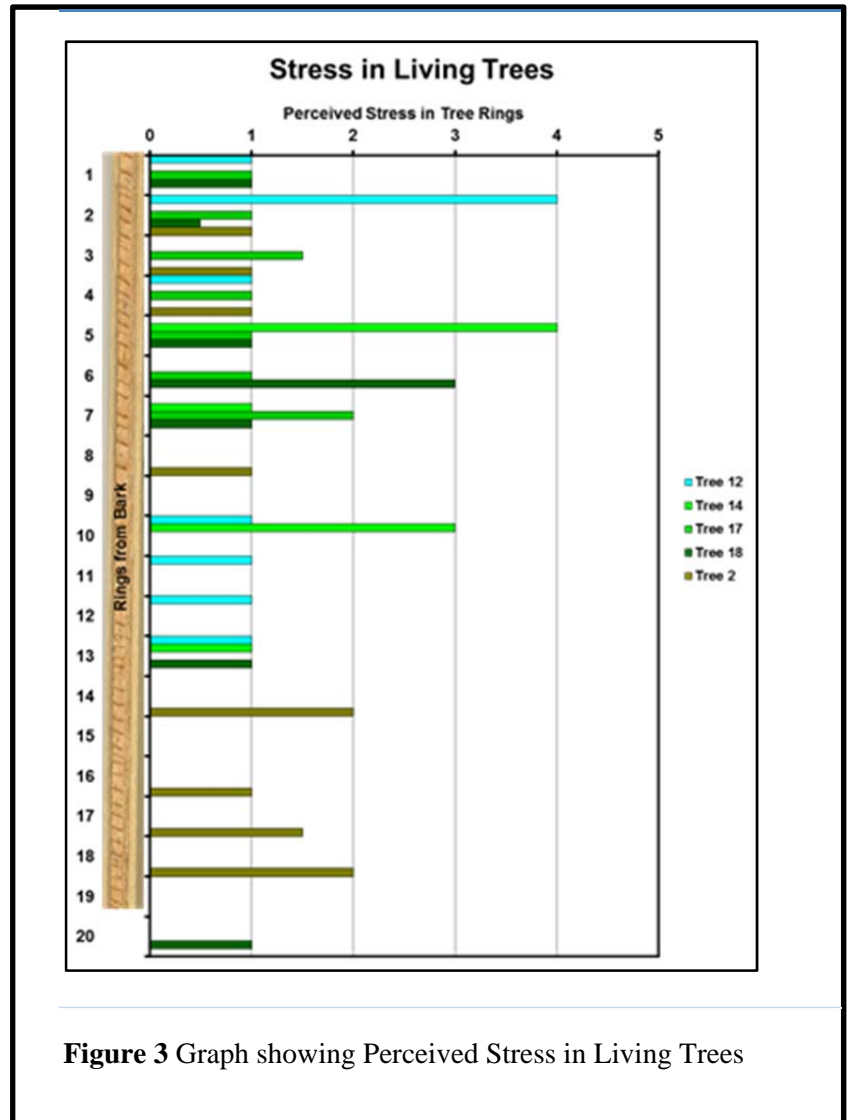


Figure 3 Graph showing Perceived Stress in Living Trees

extrapolation made based on evidence surrounding the tree such as tide lines, location of trash, and pollen or debris on trunks, by observing this classification method can be verified and refined for future use in an extension of this project or another project.

Evidence of environmental stress can be seen in tree rings, via tree cores. This stress does not show a strong relationship with the amount of rainfall received during the estimated year of growth. However, efforts should be made to break the rainfall down into portions of the growing season that might influence the appearance of rings in Bald Cypress trees, earlier versus later, a hurricane's deluge versus steady rainfall across months. This would help eliminate variability that might occur in data by showing which years a tree would have optimal early, middle and late growing seasons.

Sources

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