279

Ecophysiological Proficiency of Mature Baldcypress on Hummocks and in Hollows Within a Freshwater Tidal Swamp

Jamie A. Duberstein[1], Ken W. Krauss[2], and William H. Conner[1]

[1] Baruch Institute of Coastal Ecology
Clemson University
Georgetown, South Carolina, USA

[2] National Wetlands Research Center
U.S. Geological Survey
Lafayette, Louisiana, USA

INTRODUCTION AND HYPOTHESIS

Hummock and hollow microtopography (Figure 1) is found throughout much of the range of tidal freshwater swamps. Hummocks are particularly important during tree seed germination and seedling stages of life, but little was known regarding the effect of hummocks vs. hollows on mature trees. We investigated the effects of flooding and microtopography on the physiology of mature baldcypress trees using thermal dissipation probes (Figure 2), a technique that was first developed for plantation trees, but has since been used to link relationships between environmental variables and the physiology of several tree species. Flooding is most often a stressor on tree physiology, so we expected to see reduced sap flow through trees in hollows during flooded conditions, at times when the trees on hummocks were not flooded.

Figure 1. Typical hummock shown during a high tide effect, with hollows flooded.

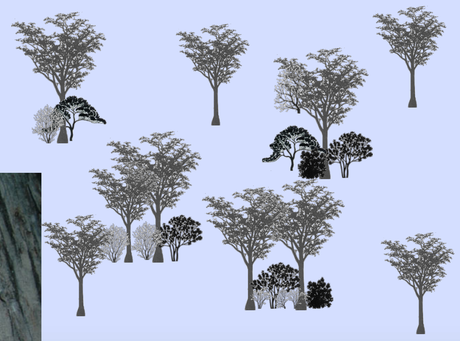
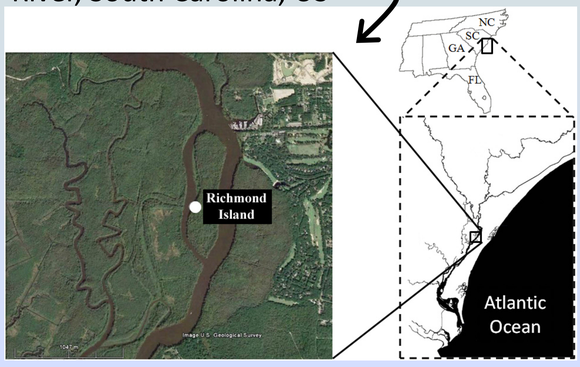


Figure 2. Thermal dissipation probes inserted into a co-dominant baldcypress tree.

Figure 3. Study Site: a swamp tupelo and baldcypress dominated tidal freshwater swamp on Richmond Island, Waccamaw River, South Carolina, US



STUDY AREA AND DESIGN

We measured rates of sap flow through 22 mature baldcypress trees in a tidal freshwater swamp (Figure 3).

- 11 trees were on hummocks
- 11 trees were in hollows

This design made use of a natural flood disparity related to microtopographic position, as hollows are typically flooded during high tide events, while hummocks stay above the water line for most of the time.

Many studies have found that sap flow rates are greatest in the outer sap wood, so we focused on measuring sap flow at 15 mm into the sapwood (n=22), with limited (n=4) measurements at a depth of 25 mm.

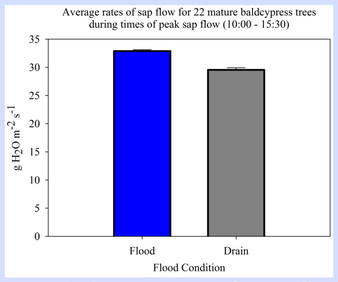


Figure 4. Higher rates of sap flow during flooded conditions.

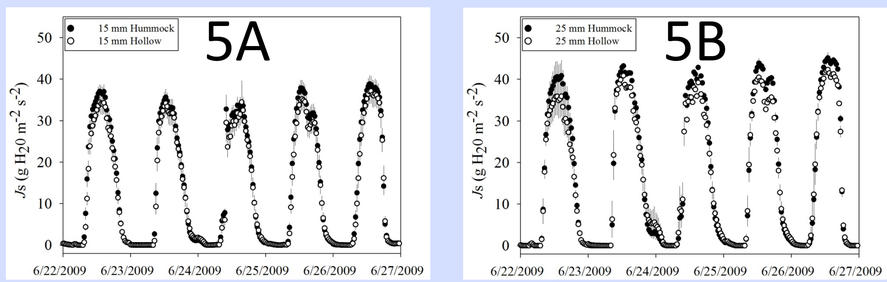


Figure 5. Greater expression of hummock/hollow effect at (a) 25 mm than (b) 15 mm depth.

RESULTS AND DISCUSSION

1) Sap flow increased by 11% during flooded conditions, regardless of microsite (Figure 4). This is equivalent to 18 kg H_2O m^{-2} for the peak sap flow period (10:00 am – 3:30 pm) analyzed each day.
2) Microtopographic position was not found to be a significant factor related to sap flow in mature baldcypress.
3) Sap flow rates at 25 mm into the sapwood (Figure 5A) suggest greater differences between trees on hummocks versus in those in hollows than rates at 15 mm (Figure 5B), but comparisons using 25 mm rates are insignificant.
4) The ability of baldcypress to thrive in flooded conditions is reflected in our results. Hummocks provided positive, but insignificant, physiological advantage to mature baldcypress (Figure 5), but the finding that sap flow increases with flooding (Figure 4) does not support our original hypothesis that hummocks would provide a physiological escape from flood stress, as short-term (tidal) flooding does not appear to be a stressor on mature baldcypress in tidal freshwater swamps.