ECOHYDRAULICS COMPETITION

Don't go with the flow, keep the roots down below!

1. BACKGROUND

Mature mangrove forests (Figure 1a) protect Florida's coastlines during extreme events, such as hurricanes. Hydrodynamic energy is dissipated when flows interact with mangrove roots or canopies (Figure 1b), keeping high water levels and waves from reaching inland areas. This is an example of wetland plants acting as green infrastructure. But young aquatic plants can have a rough time. During vulnerable early life stages, mangrove seedlings (Figure 2) must withstand hydrodynamic forces to remain rooted in place in order to eventually reach maturity.

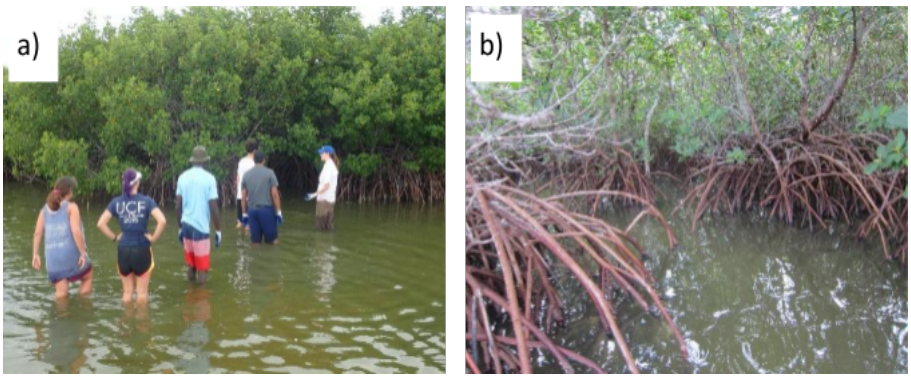

Figure 1. Exterior (a) and interior (b) of a mature mangrove forest

2. OBJECTIVE

Teams will compete to maximize resistance of a seedling to transport by hydrodynamic forces.

3. ELIGIBILITY

Each university may have one (1) team of up to four (4) members.

4. SEEDLING DESIGN

Teams will construct their seedling in advance and bring assembled seedlings to the competition. The team may use a variety of materials of their choosing. Creativity in material selection and configuration is encouraged, though evidence of nature-based design is also considered. Seedling design need not be inspired by mangrove alone! Inspiration by any aquatic plant is encouraged.

Each team's seedling must conform to the following in order to compete:

a. Seedlings must have a stem affixed to an anchor representing flow resistance by plant roots.
b. Total mass of wet seedling and anchor may not exceed **50 grams**.

c. The anchor may be made of any material, but must rest on the bed of the flume and be fully contained within a volume no more than **30 cm wide by 30 cm long by 5 cm high**, as measured from the bottom of the flume.
d. Seedling stem must measure **10-20 cm** in height from the top of the anchor.
e. Each seedling must have no fewer than **12 leaves**, each of which have a surface area of at least **5 cm^2.**
f. Total seedling height (anchor+stem+leaves) may not exceed **30 cm**.

Figure 2. Red Mangrove Seedling

5. TECHNICAL REPORT

Teams will prepare a short report on the design of their seedling, include the following components:

1. Cover page – Include University name, all team member names, date of submission.
2. Introduction – Describe what happens when a 1D hydrodynamic force is applied to a seedling. How does the seedling react as the flow increases? Include a force diagram with all salient forces labeled. Feel free to include any basic fluid mechanics equations that may apply to your explanation.
3. Methods – Outline the design of your seedling. Explain all materials used to construct all parts of your seedling and include a detailed schematic drawing with all Seedling Design Standards listed with dimensions. Please use SI units.
4. Discussion – Discuss how hydrodynamic forces shape distributions of vegetation in nature and strategies seedlings nature may apply to resist being uprooted.
5. References – List full citations of any references utilized, in APA format.

5. PROCEDURE

The University of Central Florida will provide:

- Hydraulic flume for testing, filled to a depth of **30 cm** of fresh water **(23-25° C)**.
- Ruler for measuring displacement from starting line.

Teams will bring to the competition:

- Constructed seedling for testing.

1. Teams will place their seedling in the bottom of the flume, with the seedling aligned along a starting line. Flow will begin slowly and ramp up at **30 second** intervals.
2. Official transport will be recorded when any part of the seedling and/or anchor have been transported at least **5 cm** from the starting line.
3. The flow at the time of transport will be recorded.
4. Teams will complete the following sentence:
   "The seedling was uprooted and transported at a minimum flow of _____ m^3/s, which corresponds to a mean velocity of _____ cm/s."
5. Stem or leaves may deform more than **5 cm** without being officially transported, provided that all remain attached to the anchor.
6. Free transport of any portion of the seedling qualifies the transport flow. For instance, if leaves or stem detach from anchor and move more than **5 cm,** the transport flow is recorded.
7. Any anchor movement over **5 cm** or seedling failure by tipping (anchor rolls or tips over) qualifies the transport flow.

7. SCORING

7.1 Report Score (60%):

Completeness of information	15
Technical writing style; conciseness and clarity of explanations	15
Technical accuracy	15
Professional presentation	15

7.2 Seedling Design Score (15%):

Uniqueness, creativity of design	7
Aesthetics	4
Evidence of inspiration by actual plant adaptation strategies	4

7.3 Transport Score (25%)

Teams will be ranked from highest to lowest according to the transport flow result. The highest ranked team will receive the full 25 points. All other points allotted will be linearly determined in descending order.

8. QUESTIONS

Direct any questions to conference organizers. Answers will be posted on the Q&A page.