Improved Estimation of Surface Water Production and Groundwater Recharge by Dominant Pine Forest Types

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Forests cover ~2/3 land area of S.C.
Forestry’s economic impact is ~$21 Billion
How are water resources impacted by forests?
- Evapotranspiration and temperature moderation
- Infiltration – surface runoff/ groundwater recharge and contaminant filtering
- Wetland forests and river flood mitigation
How are forest ecosystem services dependent on water resources?
- Forest productivity depends on water availability
- Evapotranspiration and productivity: C uptake proportional to ET
- Drought or flooding reduce forest productivity
  - Exacerbate insect and disease impacts
Clemson’s new “eddy flux” tower for coastal plain forest carbon and water research at Baruch Institute
Project goals

1. **Measure in situ evapotranspiration** (water flux) and water budget in a South Carolina coastal plain pine forest for the first time.

2. Improve and validate a **hydrologic model** to predict water yield and groundwater recharge for coastal plain pine forests.

3. **Disseminate results** through extension materials, publications and regional meetings with stakeholders.
Hobcaw Barony Mature Longleaf Pine Tower

Measurements

- CO₂ flux and evapotranspiration
- Air temperature and humidity at 4 heights
- Incoming and reflected radiation, diffuse and direct, transmittance
- Vegetation indices (NDVI, PRI, greenness)
- Precipitation and throughfall
- Soil moisture and temperature
- 29 groundwater wells
- Surface water flow via flume (pending)
Participation in international research networks

**AmeriFlux**
- Quantify the magnitude of the **carbon sources and sinks** for a range of terrestrial ecosystems in the Americas

**PhenoCam**
- Measures effects of temperature and precipitation on **ecosystem phenology**
Training next generation in forest-water science

- Summer 2019
  - 2 undergraduate interns
  - 1 Ph.D. student
  - 2 technicians

- Received training from 4 faculty co-PIs in:
  - Traditional forestry
  - Forest hydrology
  - Environmental sensors
Lower coastal plain forest hydrology

ET = evapotranspiration

Wet E => T
Dry E << T
Eddy Covariance
tower footprint, watershed, vegetation, FIA plots
Well locations, soil, and aquifer material
Preliminary results 2019
Initial results: water table during Hurricane Dorian
Future work

- Continued data collection for water budget at mature longleaf site
- Expanded instrumentation on groundwater at longleaf restoration site
- Development of hydrologic model for budgeting and forecasting water yield
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