Title
TER2: Multiscale Multimodal Embedded Sensing of Plant Phenology and Physiology

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Multiscale Multimodal Embedded Sensing of Plant Phenology and Physiology

Terrestrial Ecology Observing Systems at the James Reserve – www.jamesreserve.edu

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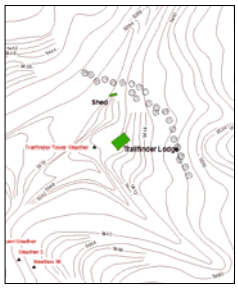
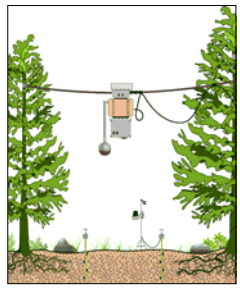
Goals: Sensing the environment from the leaf to the landscape level

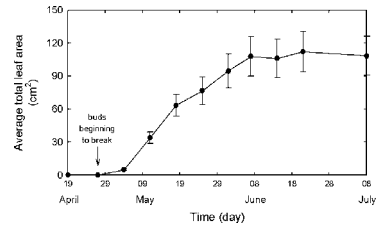


Biological and climate microsensors coupled with real-time observation and imaging systems

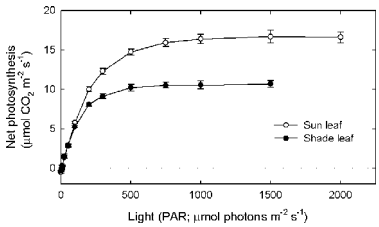
- **Sensing on the landscape level**
  - Cold air drainage and valley dynamics
  - Terrain affects the variables that affect plant growth
- **Sensing on the leaf level**
  - Instantaneous light and temperature measurements
  - Photosynthesis and growth rates
  - Images and color information



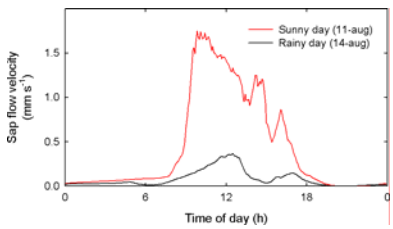
Sensors and Experiments: GPS, microclimate and biological data sources



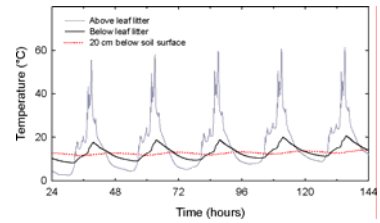
NIMS and fixed-camera technologies allow the real-time and automated observation of plant phenological events: leaf flushes, flowering, herbivore attack, and pollination and flower-visitation events.



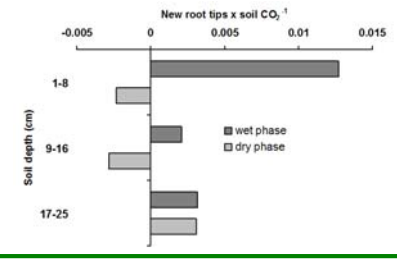
Micro light sensors sensitive to photosynthetic photon flux (PPF; 400-700 nm wavelength) installed on leaf surfaces indicate leaf- and plant-level responses to changes in light conditions over periods ranging from minutes to seasons.



Sap flow sensors measure the velocity at which the transpiration stream flows by the dissipation of heat within a branch. Micrometeorological conditions change the driving force for transpiration and affect water balance on a plant- and landscape-level.



Soil temperatures affect rates of respiration and plant growth and change with time of day and season. The damping depth of the soil reduces the amplitude changes in temperature and is affected by water content, which in turn affects microbial activity.



Minirhizotron tubes enable the direct measurement of root growth and allow for the estimations of microbial activity in the soil. Root elongation rates, and within-soil CO_2 sensors and above-ground microclimatic measurements will allow the extrapolation of below-ground biological activity to landscape levels.