Using Stable Isotope Analysis of Plant Water to Inform Landscape Planning and Water-use Reductions at CSU Fullerton

(Redesign of Biol_444 Plant Physiological Ecology)

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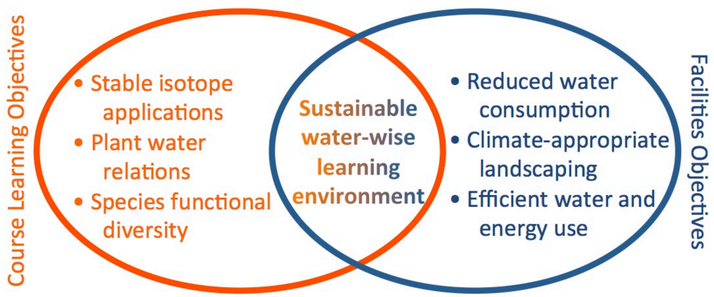
Overview of Our Campus as a Living Lab

Through the Campus as a Living Lab (CALL) program, we will integrate goals from the redesign of the plant water relations curriculum in Biol_444 Plant Physiological Ecology with three major objectives of the CSUF Facilities Management office to create a more sustainable, water-wise campus environment that will be used directly and indirectly as a learning resource, now and into the future.



Course Redesign

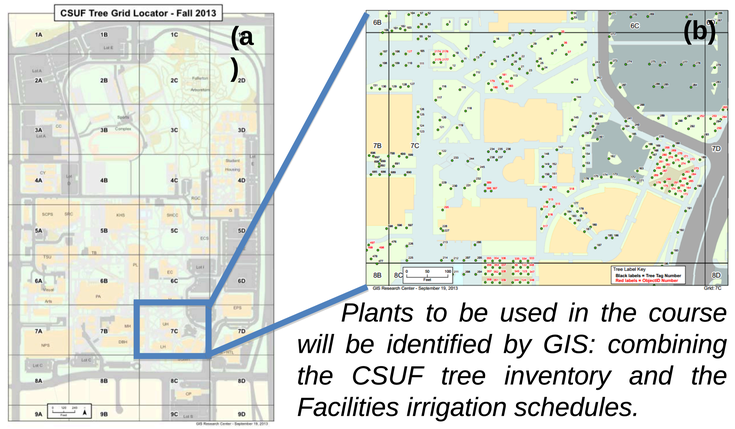
Biol_444 Plant Physiological Ecology is a lab-based course in which plant water-relations is taught using demonstration rather than investigative labs. Via the CALL program we are redesigning this course to include more high-impact educational practices (HIPs) and integrate CSUF facilities objectives (FOs)

General Academic Goals:
1.Use the High Impact Practices. This redesign will apply the following HIPs: Undergraduate Research, Collaborative Project, Common Intellectual Experience, and Community-based (Partnership) Learning
2.Skill Development and Higher-order Thinking. Ability to apply GIS and stable isotope analyses are emerging marketable skills that require higher-order thinking.

Course-specific Goals:
1.Identify Water Sources and Use by Campus Vegetation. Using a stable isotope approach, identify water sources used by different plant species across campus
2.Provide Advice for Irrigation and Future Planting. Identify plant water-use functional groups (irrigation- vs ground-water users) for Facilities Management planning

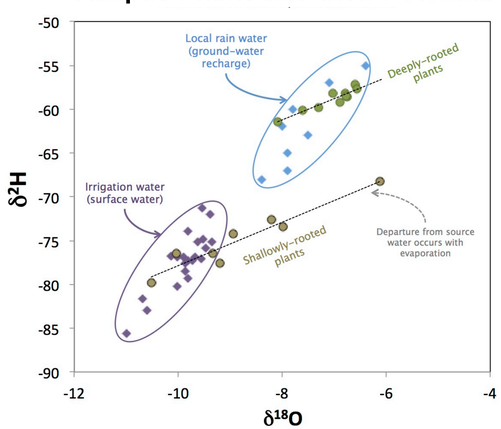
Integrating Course and Facilities Operations

1. Designing Investigation: Use of CSUF tree grid locator and Facilities' irrigation schedules



Plants to be used in the course will be identified by GIS: combining the CSUF tree inventory and the Facilities irrigation schedules.

2. Data Collection and Analysis: Stable Isotopes of Campus Plants and their Potential Water Sources

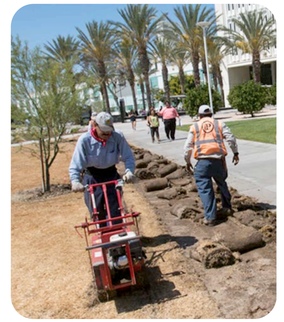


Stable isotope ratio bi-plot values of hydrogen (H) and oxygen (O) for potential water sources (irrigation vs fall/winter precipitation) and two plant functional groups (deep vs shallow roots).

The distinct difference between water sources (ovals) allows determination of what water sources plants are using. Deeply-rooted plants (green symbols) have isotope values that cluster near rain water values that recharge groundwater (blue oval). Shallowly-rooted plants (brown symbols) have isotope values that overlap with irrigation water values (purple oval), but spread beyond the oval due to source-water evaporation near the soil surface. Plants using both deep and shallow water sources (not shown) fall between the two source ovals.

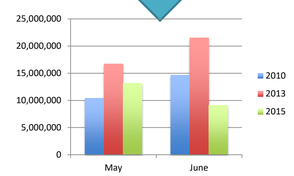
Desired Collaborative Outcomes

HIPs in Courses and Smart/Qualified Students



Changed Irrigation and Landscaping

Sustainable Living Laboratory Campus



Water/Energy Reduction

We are looking for CSU and Other Partners

- Curriculum Partners – to collaborate on cross-campus studies, share databases and create a CSU Isotopes learning community
- Facilities Partners – to more broadly apply methodologies, discuss design plans and develop sustainable strategies
- Community Partners – to facilitate sustainable practices among other organizations and across California
- **Interested?** Please contact Megan Moscol (mmoscol@fullerton.edu)

Acknowledgements and Citations

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