

**Faculty:** Colin Orians, Professor of Biology & Director of Environmental Studies, School of Arts & Sciences

**Project Locations:** Costa Rica and Medford, MA

**Dates:** Late May – Late July (9 weeks total)

**Project Title:** Exploring Resilience of Coffee Production in Costa Rica

**Project Details:** Small-scale farmers around the world struggle to maintain stable production to support their livelihoods. Annual fluctuations in the quantity of perennial crop yields, also known as alternate-bearing, pose an important challenge to farmers. Such oscillations are widespread, and despite efforts to control alternate bearing, often synchronize within and among farms and even at national scales. We are exploring patterns and mechanisms for alternate bearing. Specifically predict that environmental shocks such as disease, heavy rains, and other climate related factors, can determine pattern of alternate bearing, and that nitrogen-based reserves drive the magnitude of fluctuations. We have two primary objectives:

**Objective 1:** Gather local and regional data on coffee production and use it to determine if specific shocks cause synchrony at different spatial scales. We hypothesize that disease outbreaks have caused widespread synchrony.

**Objective 2:** Determine how nitrogen reserves might drive alternate bearing. Nitrogen is the primary building block of proteins critical to growth and reproduction. We hypothesize that high protein storage in stems may limit fluctuations.

This project builds on our previous work in Costa Rica. Starting May 21st, the GRAP Assistant will travel with PI Orians to Costa Rica and spend time at CATIE (Tropical Agricultural Research and Higher Education Center) collaborating with colleagues, and then we will spend time conducting field work and processing samples for subsequent chemical analysis at Tufts. Then we will return to Tufts on June 17th and spend 5 weeks using existing and new methods to measure nitrogen and protein reserves in stems and berries.

**Tasks and Responsibilities of Research Assistant:** The specific tasks for the summer of 2024 GRAP assistants are described below.

**Objective 1: Costa Rica.** The student will participate in discussions and data collection on patterns of production and help collect and process plant tissue samples to be analyzed for nitrogen and protein.

**Objective 2: At Tufts.** The student will learn how to process tissue samples for analyses, how to measure total nitrogen and protein levels using instrumentation at Tufts.

**Qualifications:** All interested students are encouraged to apply. Students with knowledge of Spanish, background in biology/ecology, experience working in the lab, and an interest in agriculture are especially encouraged to apply. Preference will be given to students with prior research experience and evidence of independence and comfort working in the field.

**Description of Field Site:** The field site is in a small, rural town, and WiFi access may be limited to the local cafes and restaurants, though cell service is good if students choose to purchase an international plan or a local SIM-card (requires an unblocked phone). The team will stay in a combination of hotels, dorms and AirBnBs. The student should feel comfortable preparing most of their own meals.