

Faculty: Colin Orians, Professor, Arts and Sciences

Project Locations: 8 weeks in Costa Rica

Dates: mid-May – mid-July.

Project Title: Agrosocial Resilience in a Changing Climate

Project Details: Farmers are highly vulnerable to fluctuations in production, a challenge magnified under a changing climate. This study addresses three critical knowledge gaps that together can increase farm and farmer (“Agrosocial”) resilience. First, little attention in the field of resilience has been given to inherent fluctuations in yield from one year to another, or to tradeoffs between quality and quantity. This is particularly important in alternative bearing crops (i.e., apples, coffee and tree nuts) (Smith and Samach 2013). We will explore the natural and social factors that prevent farmers from producing a steady supply of high quality produce.

Most research on climate impacts in agriculture and adaptation strategies has focused on annual crops. Yet perennial crops pose unique and important challenges, and we know surprisingly little about the physiological causes of such variability, how fertilization and other management practices might alter reproductive variability, or how climate might exacerbate these fluctuations.

This project builds nicely from Orians' ongoing research on the effects of climate on tea production systems. We aim to address the following questions/hypotheses.

Questions: How do different management practices differentially impact the nature and mechanisms of short-term and long-term tradeoffs in quantity and quality? What are the major ecological, socio-economic and landscape factors that affect yield variability over time, and how do they interact?

Hypotheses: (1) Agroforestry systems will be associated with more stable yields in the long-term but lower maximum yields, whereas full-sun systems will be associated higher yields in “high” years but greater long-term instability. (2) In an optimal coffee-growing region, there will be no significant effect of agroforestry on quality since fruit ripening is already slowed. (3) Fertilizer inputs will have a positive effect on quality but could exacerbate yield variation.

This coffee project, started in March of 2017, is forming the basis for the PhD thesis of Orians' graduate student Gabriela Garcia. The Research Assistant will help conduct farm assessments and initiate manipulative experiments in Santa Maria where we have extensive contacts both with farmers and with the local coffee cooperative. We will arrive in Costa Rica in mid-May and depart in mid-July.

Tasks and Responsibilities of Research Assistant:

Student tasks will be divided between a manipulative experiment and a farm assessment

Manipulative Experiment. Students will be involved in our tests of how resource availability (as determined by fertilization and fruit removal) and agroforestry influence fluctuations in fruit production. Because this is a long term experiment, Students will not see the outcome.

Farm Assessment. Here students will be able to witness firsthand how farming practices impact plant health and production. Farm level measurements and farmer interviews will provide key insights into the challenges facing farmers and the possible solutions.

Upon returning to Tufts in the fall there would be the possibility of continued research as a Bio93 project.

Qualifications: Students with a background in biology, an interest in agriculture and knowledge of Spanish would be preferred. Preference will be given to students with prior research experience, and evidence of independence and comfort working in the field.

Housing in Costa Rica: We will stay in a hotel in San Jose before departing to Santa Maria, where we will rent a house.