Sustainable farming practices in Tarrazú

Dr Mark Chandler

Background

Improving productivity of agricultural landscapes and decreasing impact of agriculture on natural ecosystems are two of the great challenges to environmental sustainability.

Coffee is one of the most widely grown crops and a major source of export revenue for many tropical countries. An estimated 100 million people are dependent on coffee for income. Coffee production practices range from rustic traditional techniques to intensive farming, which uses synthetic fertilisers, herbicides and full sun exposure to increase photosynthesis of energy from sunlight to boost productivity.

The coffee industry in Costa Rica typifies the dramatic shifts towards intensive production practices in the last 35 years. Many farmers in the mountainous region of central Costa Rica, where coffee production is the main economic activity, are growing coffee under full sun and with high amounts of synthetic inputs for increased yield. The initial gains in productivity, however, have been the cause of degraded soil conditions (nutrient leaching and increased acidity) and a growing pest problem resulting from the removal of native vegetation that would support natural parasites and predators of these pests.

CoopeTarrazú, a coffee farming co-operative in the Tarrazú region of central Costa Rica (figure 1), has recognised the threats that poor management strategies pose to its coffee production and has begun a sustainability campaign to address them. The co-operative provides central services such as technical assistance and education to the 2,400 farmers which it represents and has a strong partnership with the Starbucks Coffee and Farmer Equity (C.A.F.É.) Practices Programme. This verification programme aims to improve social and environmental aspects of the coffee production process by paying producers higher prices for beans produced in a more sustainable manner. However, farmers still a lack considerable knowledge about how to balance the methods used to increase yield without compromising the environmental sustainability of coffee production.

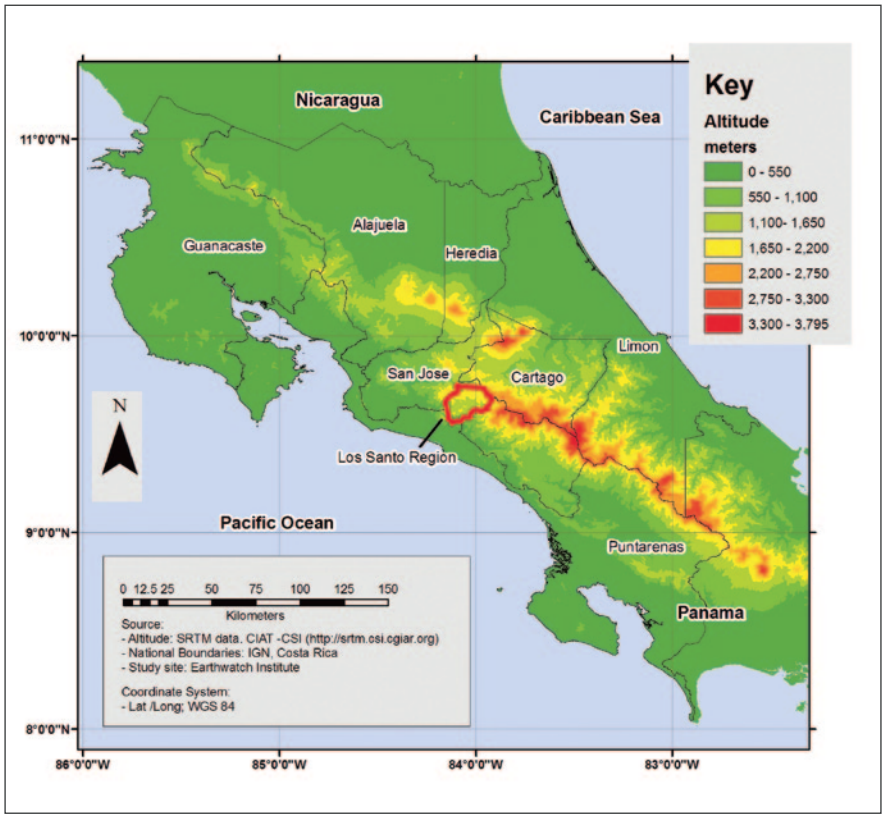

Figure 1. Study area in Los Santos Region, Costa Rica

Project overview

The project aims to bridge knowledge gaps by studying relationships between farm management practices and soil nutrient content, coffee productivity and quality. The information collected in the field is being used to help farmers of CoopeTarrazú by arming them with the practical training and knowledge needed for sustainable coffee production.

Specific objectives:

- Develop a landscape level Geographic Information System (GIS) tool for targeted planning and management interventions to improve sustainability of farming practices at CoopeTarrazú
- Examine how fertiliser and shade tree management relate to coffee production, environmental sustainability and certification criteria
- Increase sustainable farming practices by CoopeTarrazú farmers through:
  a. Transfer of knowledge from field research and GIS maps to CoopeTarrazú and its farmers
  b. Participation in practical training in the field and workshops
  c. Increased awareness of sustainable farming practices as designed by certification programmes such as C.A.F.É.) Practices, Rainforest Alliance and Fair Trade
- Increase awareness among global and regional audiences about sustainable farming, and the relationship between consumer choices, verification programmes and global farming practices

Since 2007, Earthwatch has worked in partnership with Starbucks to develop this pioneering research which directly benefits coffee farmers and engages volunteer participants to increase understanding of sustainable coffee production. Volunteer teams – composed of employees from Starbucks, Starbucks customers, Nestlé employees, teachers, and members of the public – work closely with scientists and the farmers at CoopeTarrazú to make a meaningful contribution to agricultural sustainability in Central America. Volunteers assess coffee production, soil conditions and ground vegetation, as well as biodiversity indicators, such as number and types of trees and insects. To date, over 70 volunteers and over 55 farmers have participated in this field research, enabling data collection on 40 farms in the region.

Increasing the knowledge of alternative and more sustainable farming practices is part of Earthwatch's Ecosystem Services Research Area.

Outcomes and actions

This research has identified the extent to which soil acidity is linked to over-fertilisation, poor farming practices, and poor yields from coffee plants in Tarrazú. However, no relationship has been found between fertiliser input and coffee production across the 40 farms, which is surprising given the cost and historical assumptions about the link between fertiliser input and production.

The failure of fertiliser input to lead to higher yields is attributed to the negative effects of higher soil acidity, which inhibits the plants' ability to absorb, and decreases the availability of key soil nutrients. Many farmers appear to be over-applying fertiliser, leading to increased soil acidity as excess nitrogen (and ammonia) decreases soil pH. Following the dissemination of this information, many farmers in the research group appear to be moving away from high fertiliser application, instead investing more in application of lime to increase soil pH in the hope of increasing coffee production. The project is also working with a group of 10 farmers who are experimenting with more organic fertiliser application. Some of the farmers have found increased soil pH and flowering on their coffee plants, which should lead to increased coffee production next year.

The project has initiated an educational programme with farmers on their fields, looking into the effects of slope, erosion and herbicide management choices on ground vegetation. Following efforts to work with them on these issues, farmers have shown a shift away from broad scale application of herbicide on all ground cover, to more targeted application and increased use of mechanical management of ground cover. The interest in these measures to control erosion has been most noticeable in the Bajo San Carlos region of Los Santos where coffee fields are most often found on steep slopes. This should have a positive effect on soil condition and consequently coffee production, as well as decreasing soil erosion.

Shade trees are known to benefit both biodiversity and coffee production and quality. However, there is also thought to be a negative effect on production through increased fungal pathogens. On the 40 farms, coffee fields have recently been replanted with shade trees following the conversion of most fields to full sun through removal of all shade trees in the 1980s. Overall, no effect of shade trees on production was identified; however, a negative relationship between shade and coffee production occurred when density of shade trees exceeded 2 within 1.5 m of coffee plants. This information has been passed along to farmers to use in managing their shade trees.

A preliminary assessment of the impact of different farmer management strategies on insect biodiversity on a subset of farms did not find a consistent strong relationship. Nevertheless, preliminary analysis suggests that farms surrounded by more natural habitat tend to have a greater diversity of parasitic wasps, which could act as pest control agents.

Earthwatch developed and distributed log books for farmers within the co-operative to track their inputs and farm management practices. Project partner Instituto del Café de Costa Rica (ICAFE) has requested to use the log books in other parts of Costa Rica for precision farming. Broader distribution of a soil management tool developed by Earthwatch, Starbucks and ICAFE is also being considered. This tool will allow farmers to incorporate soil analysis findings specific to their individual farms to help address problems such as soil acidity and excessive application of unnecessary fertilisers.

The project has conducted over 10 workshops and discussions with farmers about key issues on sustainability,

certification and the use of the log books. These sessions have been led by Earthwatch staff and other key stakeholders such as Starbucks staff, CoopeTarrazú agronomists, and ICAFE, and they were well attended by producers. As a result of the workshops and farmers' implementation of log books, third-party certifiers reported increased performance by CoopeTarrazú farmers on certification scores. CoopeTarrazú has requested a further 10 workshops be organised to increase the reach of the programme to additional farmers within the cooperative.

This project has also developed a Geographic Information System (GIS) dataset for the Los Santos region in Costa Rica, using the latest aerial and satellite imagery. The data include environmental features (land cover, slope, rivers, etc.), as well as roads and land use classifications (urban, farm, forest). Outputs of this work so far include:

- Orthorectified aerial pictures of all farms included in the research
- Mapping support to CoopeTarrazú who are conducting their own inventory and analysis of the entire cooperative
- Analysis of key regions for forest conservation in the Los Santos region, including a demonstration of growth of forest cover over 10 years in a region under private management
- Identification of key regions in Los Santos under threat from erosion

In general, the outcomes from the project are delivering benefits at both the local and international level. Farmers have increased opportunities to participate in scientific research and workshops to understand the relationship between coffee production and farming practices.

The project is providing tools for farmers that allow them to make better management decisions about inputs (e.g. fertiliser) and track the impact of those choices. The GIS maps are allowing farmers and the co-operative to plan production practices at a landscape level. Moreover, the farmers and the co-operative have an opportunity to learn about the other end of the supply chain from staff and volunteers from Starbucks Coffee Company and Nestlé volunteers.

Collaborative organisations

- National Biodiversity Institute of Costa Rica (InBio)
- Centre for Agronomical Investigations of the University of Costa Rica
- Centro de Agricultura Tropical de Investigación y Enseñanza (CATIE), Costa Rica
- Instituto del Café de Costa Rica (ICAFE)
- CoopeTarrazú, Costa Rica
- Starbucks Farmer Support Centre, Costa Rica

Project website

http://www.earthwatch.org/europe/exped/chandler_research.html

Key publications

Chandler, M.W., Tanzi, S.C., Banks, J.E. & Ureña, N. (2009) Trade-offs and win-win opportunities among farm practices, coffee production and environmental sustainability in the Los Santos region, Costa Rica. *Ecological Society of America 94th Annual Meeting*, Aug 2-7, Albuquerque, New Mexico, USA

Chandler, M.W., Ureña, N., Tanzi, S.C., Fortescue, A., Banks, J.E., Goodman, J. & Janovicz, A. (2009) Farmer and volunteer participatory research on sustainable coffee farming in Los Santos region of Costa Rica. *Ecological Society of America 94th Annual Meeting*, Aug 2-7, Albuquerque, New Mexico, USA

Internationally, the project is identifying relationships between crop production practices, coffee supply chain, certification, biodiversity, shade trees, soils (for highland regions) and natural variability. It has supported the development of tools that can be transferred to other coffee growing regions worldwide. The project also offers a great opportunity for educating the public about a crop of global significance and how the decisions they make through their choices impact global sustainability.

Lead scientist profile

Dr Mark Chandler is International Director of Research at Earthwatch Institute, where he has worked since 2001. He has spearheaded various Earthwatch conservation research initiatives in Brazil, Kenya, USA, Australia and Belize. He earned his BSc in Wildlife Ecology from the University of Guelph, and his PhD in Evolutionary Ecology from McGill University, both in Canada. Before joining Earthwatch, he worked as a research scientist at the New England Aquarium for eight years. He has extensive research experience of biodiversity conservation in Latin America, East Africa and New England and has published extensively on marine biodiversity and conservation.

Additional key scientists

Dr John E. Banks – Associate Professor at the University of Washington, Tacoma, USA

Sebastián Castro Tanzi – Earthwatch Institute

This project is kindly supported by Starbucks Coffee Company