Introduction

Researchers in various disciplines have been seeking solutions to unsustainable land use and agricultural techniques for communities in the Amazon rainforest (Hiraoka and Yamamoto 1980; Pichon 1997; Ryder and Brown 2000). Increased settlement and extensive use of land for commercial crops such as coffee and cacao are not well suited to the fragile rainforest ecosystem (Hiraoka and Yamamoto 1980).

In the Rio Napo region, where the colegio Tecnico Yachana is situated, the majority of land is tied up in cacao production. Most families are growing cacao as a commercial crop and many have abandoned basic subsistence crops. As a result, most of the food consumed in their homes is purchased through the market. Market goods consumed in the Rio Napo region are imported to the lowland from the Ecuadorian highlands. Various socioeconomic and historical factors at both the micro and macro levels have contributed to the move from subsistence agriculture to commercial production, however these will not be discussed here (Bronfman 2004).

Over the last few years, the students at the colegio Tecnico Yachana have worked to develop agricultural methods that are step toward the elimination of linear system of production and towards a regenerative intensive system. The intentions of this poster is to discuss the techniques and methods being introduced at the school and their implementation. Key questions include:

What are the goals of intensification and sustainable agriculture at the colegio? What are the models that are being employed as a step toward achieving sustainability?

Sustainable Agriculture

The terms sustainability and sustainable agriculture are often operationalized and therefore have various definitions (Rogers et al. 2006; Sandrine 2000). Broadly, sustainability incorporates economic, environmental, and social components (Rogers et al. 2006). Definitions can emphasize any of these components depending on the paradigm from which it approached. However, in all approaches accounting of returns and impacts is an important factor (Rogers et al. 2006; Sandrine 2000).

Focusing on agricultural production can be useful for understanding how input and output accounting can work (Sandrine 2000). Agriculture is sustained through the internalization of productivity into the biophysical and social context in which it takes place (Sandrine 2000). According to Sandrine (2006):

"The general principle of sustainable production process is that it functions as a never ending and self-generating loop. Products and by-products are 'final commodities': they satisfy needs, but also make the loop regenerate itself. If some by-products are not re-used in the loop, they should be used in another loop." (119).

The agriculture system at the colegio will be discussed in terms of the internalization of agricultural productivity and the self-generating loops that have been identified.

Goals of Sustainable Agriculture At The Colegio

The colegio wants to create resource loops that operate on both macro and micro levels and take into consideration natural, economic and social aspects of the whole system.

Environmental accounting at the colegio will limit resource depletion and environmental damage in terms of inputs and outputs. They are looking at ways to utilize agriculture practices that allow for sustainability of both internal and external loops.

Models of Sustainable Agriculture

The students have chosen intensification as a method to increase crop yields by maximizing resources and labor without extending agricultural land. The students have implemented the following methods of intensification:

- Raised Beds and Mandalas
- Crop Rotation
- Crop Interplanting
- Hydropower
- Natural Pesticides

Figure 1. Mandalas, raised beds, and a tomato house are being used for intensification at the colegio.

Models of Sustainable Agriculture Continued

Crop Rotation

Table 1. Crops are grown in the colegio. Many of these plants have qualities that allow them to be inter-planted or raised with other crops.

Table 2. Nutrient cycling with peanuts, rice, and maize.

Figure 2. Nutrient cycling with peanuts, rice, and maize.

Inputs and Outputs

The agricultural system at the colegio is not a completely closed and self-generating loop. Some of these inputs cannot be easily eliminated.

- Natural Pesticides
  - Free range chickens roaming amongst crops.
  - Mixtures of natural ingredients: e.g. barbasco and ash

Energy

- Methane released during decomposition of pig manure in bio-digester is captured in plastic piping and utilized to heat the chicken house.

Future Research

1. The colegio is working on transferring sustainable agriculture into the community. They are developing an intensive cacao variety that can be introduced to local farmers. Students are also working on individual agricultural projects that they will implement in their own communities. The success of these technology transfers can be monitored.

2. How successful are the attempts to reduce inputs and outputs?