

## Effectiveness of Tree Islands as Focal Points of Regeneration for Abandoned Pastures in Honduras

The information contained in this case study was extracted and summarised from two published papers and information from [Eco-Index](#). This case study is part of the doctoral thesis of Rakan Zahawi awarded from the University of Illinois.

### Ecosystem description

The study was conducted in Pico Bonito National Park, which is a 100 000 ha mountainous park located on the north coast of Honduras (latitude 15°30'N, and approximate longitude 87°00'W). The National Park consists of a core zone of undisturbed forest covering an area of 80 000 ha. Common forest species included *Brosimum alicastrum*, *Dialium guianense*, *Jacaranda copaia*, *Symphonia globulifera*, *Tabebuia guayacan*, *Terminalia amazonia*, *Virola guatemalensis* and *Vochysia guatemalensis*. The buffer zone surrounding the core is heavily deforested. Within the northern buffer zone three sites were established for this study. The sites were:



A medium *Bursera* island, 5 months after planting  
©Rakan Zahawi

1) an abandoned but well established pasture, which had been seeded with the exotic aggressive forage grasses *Urochloa brizantha* and *Pennisetum purpureum*; 2) a ridge that originally was a native pine plantation that has been deforested and was now dominated by the bracken fern *Pteridium aquilinum*; and 3) an abandoned pasture that was poorly established 15 years ago and now dominated by a variety of native grasses and forbs.

### Project description and aims

This study examined how the creation of tree islands can serve as seed and seedling recruitment foci, and ultimately accelerate forest restoration in abandoned tropical pastures. It is thought that such islands would provide bird perches in a grass-dominated landscape, as well as, ensure seedling establishment by providing an improved microclimate, with reduced competition from shade intolerant grasses.

The study objectives were:

- Increase the introduction of naturally dispersed seeds into pastures
- Improve the microenvironment within tree islands
- Reduce competition from grasses
- Accelerate the process of succession within these areas

To create tree islands, two species commonly used as living fence species were used in this study: *Bursera simaruba* (Burseraceae) and *Gliricidia sepium* (Fabaceae). Living fences are common throughout the tropics but particularly in southern Mexico and Central America. Many species used in fencing are also found as shade trees in coffee plantations and pastures, as well as, supplying fuel wood, fodder for livestock, food control, soil enrichment (N-fixation) and lumber. Their widespread use, and

the ability of these species to tolerate and establish under harsh conditions found in pastures, offer these species as attractive tools for restoration. Generally, the species are planted as vegetative stakes during the establishment of a new fence row and stakes are harvested from extant fence rows. In the case of this study, 2 metre tall stakes were planted in a grid format to create islands. The experimental design created islands of different sizes: 4, 16 and 64 m<sup>2</sup>.

The National Science Foundation, U.S.; Organisation for Tropical Studies (OTS), Costa Rica and the University of Illinois, U.S, funded this study.

## Restoration activities

### Creation of tree islands



A large *Gliricidia* island at 6 weeks  
©Rakan Zahawi

Tree islands were established at each study site as a monoculture and in a grid format.

First, all above ground vegetation was cleared using machetes, creating four blocks per site (each 20 metres wide and 100 metres long).

In each block, one replicate for each island size (4, 16 and 64 m<sup>2</sup>) was created for each of the two species used.

Stakes were planted at 2 metre intervals in a grid system, with a fifth stake planted in the centre. Each block was individually fenced, to exclude cattle.

### Monitoring

Extensive monitoring of the study sites followed after the creation of tree islands and comparisons were made to open pasture areas. The different aspects monitored were:

- Observe the area covered by tree islands (percentage of shade generated).
- Note the survival rate of the stake used to create islands and measure their growth.
- Collect and identify the seeds that fall into the traps placed inside and outside of tree islands.
- Identify, label and measure tree seedlings that established inside and outside of tree islands.
- Birds, were identified and visitation was recorded. The number of nests built within islands was also recorded.

## Outcomes

The main conclusions from this study are:

1. Island development was rapid for *Gliricidia* species and after nearly two years, a majority of the islands had complete canopy cover, with some canopies reaching heights of 6 metres.
2. Islands of *Bursera* failed to develop a uniform canopy, resulting in a higher mortality of stakes and only partial development of canopies. However, the stakes provide perch sites for birds.

3. The creation of tree islands accelerated succession by increasing seed rain and seedling establishment.
4. Dispersal of zoochorous tree seeds was significantly greater (2-fold) in islands than in open pasture, and by the end of the study, seedling establishment in islands was three times that found in open pasture.
5. Twenty-three bird species were recorded in the study, with overwhelming preference shown to tree islands compared to open pasture.
6. The size of the island was important, with dispersal of zoochorous tree species greater in large islands compared to small islands (*Gliricidia* only).

## Lessons Learned

The identification of species that have high establishment success is extremely important, as most species grow well in certain areas and do poorly in others. For example, *Bursera simaruba* establishes better if there is a prolonged dry period after it is planted such as is typically experienced in Veracruz, Mexico and other dry areas in Central America. The use of *B. simaruba* in this study created many problems. This study recommends liaising with local farmers to determine which species grow best in the area, the size of the stakes to be planted, and how deep they should be planted.

The northern coastal areas of Honduras, are very wet, and hence planting stakes is best accomplished during the dry season as too much water during the first two months damages the underground portion of the stake leading to its loss.

This study has also highlighted the importance of stake stem thickness. Stakes with thinner stems had a lower survival rate. When determining the ideal stem thickness, it is advised to take into consideration the average size of stakes used by local farmers in the construction of live fences.

It should also be noted that stakes must be handled with care during transportation to the site as damage to the bark of some species (such as *Gliricidia sepium*) can affect the growth and development of the tree.

The technique of using live fence species to create tree islands for restoration of abandoned pastures could have broad application throughout tropical America by offering a cheaper alternative to many other restoration practices.



A *Gliricidia* sprout (~2 months old)  
©Rakan Zahawi

## Contact

Rakan (Zak) Zahawi

Organization for Tropical Studies  
Apdo 676-2050  
San Pedro, Costa Rica

Email: [zahawi@ots.ac.cr](mailto:zahawi@ots.ac.cr)

### Other References

- Budowski, G. and Russo, R. O. (1993). Live fence posts in Costa Rica: a compilation of the farmer's beliefs and technologies. *Journal of Sustainable Agriculture* 3:65-87.
- Zahawi, R.A. and Augspurger, C.K. Tropical forest restoration: tree islands as recruitment foci in degraded lands of Honduras. *Ecological Applications* in press.
- Zahawi, R. A. (2005) Establishment and growth of living fence species: an overlooked tool for the restoration of degraded areas in the tropics. *Restoration Ecology* 13(1):92-102.
- Zahawi, R. A. (2003) *Island biogeography and restoration: the role of living fence islands as regeneration foci in the rehabilitation of degraded lands in Honduras*. Ph.D. Dissertation. University of Illinois, Urbana, Illinois, USA.

Claire Brown and Rakan Zahawi, 27 September 2005