

Attracting More Butterflies to Achiote:
*A Preliminary Biological and Social
Investigation*

La atracción de mariposas en Achiote,
una investigación biológica y social preliminar.



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Time allotted to project:

Number of equivalent full days spent on the project in Panama = 33.66

Number of equivalent full days spent in Achote = 15.33

(daily activities were recorded by each individual and then averaged)

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Attracting butterflies to Achiote: A preliminary biological and sociological investigation

General Context

The Centro de Estudios y Acción Social Panameño (CEASPA) has been present in the town of Achiote since 1999. Achiote is a haven of tremendous biological and cultural richness and CEASPA's presence in the community has helped to facilitate a number of successful sustainable development initiatives to preserve this wealth.

CEASPA began to contemplate the possibility of exploiting the tremendous butterfly diversity in the area as an apparatus to further promote sustainable development. Promoting butterflies has the potential to enrich the community and environs through conservation, education and knowledge sharing, beautification and socio-economic development.

Given that there exists a broad scope of possibilities to butterfly garden initiative, our work has been to assess what scale of project is most appropriate in the community of Achiote. As such this was both a biological and social investigation.

The biological objectives

A working list of lepidoptera species common to the area is pivotal to the success of a butterfly garden. Butterfly species are very specific about the plant on which they feed and lay their egg. In order to attract a particular species of butterflies to a garden, both their feeding and their larval host plants should be identified and planted.

The biological objectives of the project was to establish a list of lepidoptera species in the community, determine which species were most abundant during the time of sampling, and provide the community with a *folleto* illustrating the lepidoptera species identified in the community and their host and feeding plants.

The sociological objectives

The social objectives were to understand the interest in butterflies as expressed by both current and potential stakeholders, the context of gardening in Achiote and the interactions between community members and visitors. We also sought to impart our accumulated knowledge on butterflies and their lifecycle to community members through a workshop, a guidebook and informal conversations.

This was a preliminary investigation and subsequently the social methodology focused mainly on the acquisition of qualitative data. Three groups were identified as informants; community members, tourists and tour operators and professionals indirectly implicated to the project.

An informal and formal exchange of information took place through the use of semi-structured interviews, survey questionnaires, participant observations, email communications and a workshop. With the data gathered we were able to formulate initial suggestions on how the promotion of butterflies could best benefit the community.

Findings

The research findings indicated that the promotion of personal butterfly gardens was currently the most feasible option for butterfly attractions in Achiote. Resources in the community are limited and members have identified other more pertinent goals that they wish to realize. As such, instigation a large-scale butterfly garden initiative would lack leadership and support. The establishment of personal butterfly gardens was, however, deemed feasible because of the considerable interest that exist in personal gardening and the general beautification of personal spaces.

Recommendations

The groundwork has been laid for the successful realization of personal butterfly gardens in the community through; the establishment of a preliminary species list, the creation of a lepidoptera guidebook and the successful execution of an educational workshop. It is our wish that our contributions will not only facilitate the construction of personal butterfly gardens but that it might stimulate further investigations into butterfly garden initiatives in Achiote.

Atraer Mariposas a Achiote: una investigación biológica y social preliminar

El contexto general

El Centro de Estudios y Acción Social Panameño (CEASPA) ha estado presente en el pueblo de Achiote desde que 1999. Achiote es un refugio para la presencia tremenda de diversidad biológica y cultural y en la comunidad CEASPA ha ayudado a facilitar exitosas iniciativas sostenibles del desarrollo para preservar esta riqueza.

CEASPA comenzó a contemplar la posibilidad de explotar la diversidad tremenda de mariposa en el área como un aparato que promueve aún más el desarrollo sostenible. Promover mariposas tiene un potencial para enriquecer la comunidad y los alrededores, para la conservación, la educación y el conocimiento que comparten, el embellecimiento y el desarrollo socioeconómico.

Dado que allí existe un ancho alcance de posibilidades para la iniciativa de un jardín de mariposas, nuestro trabajo ha sido de valorar qué escala de proyecto es apropiada en la comunidad de Achiote, por lo cual esto es una investigación biológica y social.

Los objetivos biológicos

Una lista de las especies de lepidópteros comunes al área es esencial para el éxito de un jardín de mariposas. La especie de mariposa es específica acerca de la planta en se alimentan y colocan sus huevos. Para atraer una especie particular de mariposas a un jardín, las plantas que se alimentan y las plantas hospederas se deben identificar y ser plantadas.

Los objetivos biológicos del proyecto debían establecer una lista de las especies de los lepidópteros en la comunidad, determinar cuáles especies son muy abundante durante el tiempo de muestreo, y proporcionar a la comunidad con un folleto que ilustra las especies de los lepidópteros identificados y las plantas de las cuales se alimentan y las hospederas.

Los objetivos sociales

Los objetivos sociales debían entender el interés en mariposas como expresado por los terratenientes actuales y potenciales, el contexto de la horticultura en Achiote y las interacciones entre miembros de la comunidad y los visitantes. Procuramos impartir también nuestro conocimiento acumulado en mariposas y su ciclo vital a miembros de comunidad en un taller, una guía turística y conversaciones informales.

Esto era una investigación preliminar y subsiguientemente, la metodología social se enfocó principalmente en la adquisición de datos cualitativos. Tres grupos se identificaron como informantes; miembros de comunidad, los turistas que viajan, operarios y profesionales indirectamente implicado en el proyecto.

Un cambio informal y formal de información sucedió por el uso de entrevistas medida estructuradas, cuestionarios de inspección, las observaciones de participante, correo electrónico, comunicaciones y un taller. Con los datos reunidos, fuimos capaces de formular las sugerencias iniciales acerca de cómo la promoción de mariposas podría beneficiar la comunidad.

Los hallazgos

Los hallazgos de investigación indicaron que la promoción de jardines personales de mariposa era actualmente la opción más posible para atracciones de mariposa en Achiote. Los recursos en la comunidad se limitan y los miembros han identificado otras metas más pertinentes que ellos desean. Cuanto tal iniciativa a gran escala del jardín de mariposa carecería de liderazgo y de apoyo. El establecimiento de jardines personales de mariposa era, sin embargo, creído posible a causa del interés considerable que existe en la horticultura personal y el embellecimiento general de espacios personales.

Las recomendaciones

La base se ha colocado para la realización exitosa de jardines de mariposa personales en la comunidad debido a; el establecimiento de una lista preliminar de la especie, la creación de una guía turística de lepidópteros y la ejecución exitosa de un taller educativo. Es nuestro deseo que nuestras contribuciones no sólo facilitarán la construcción de jardines personales de mariposa, sino que quizás estimule las investigaciones adicionales en iniciativas de jardín de mariposa.

Introduction

General Context

Achiote is a small town located on the Atlantic side of Panama. The town is situated to the west of the city of Colón, within the region of Costa Abajo. The town of Achiote also abuts the San Lorenzo Protected Area and thus falls within its 'buffer zone'. The buffer zone was established to help to mitigate the anthropogenic degradation of the environment

In 2000, Achiote had a population of 365 inhabitants whereas the larger corregimiento was composed of 784 inhabitants (Contraloría 2000). There were 89 homes in the village. The average family size within Achiote was five to six people (Contraloría 2000).

Political context

Within the province of Colón, Achiote falls within the district of Chagres. Districts are further separated in corregimientos. The town of Achiote is part of the Corregimiento of Achiote that is comprised of Achiote, Caño Quebrado and La Tagua. (Villareal; personal communication; March, 2005). Within the corregimiento of Achiote, the chief public servant is the corregidor. The function of the corregidor is to settle minor disputes and collect commercial taxes. Belisario Villareal is the current corregidor of Achiote.

The main administrative body in Achiote is the *junta comunal* or the municipal assembly. The junta communal is composed of an elected *representante*, a *vice-representante* and five chosen members of the community (Villareal; personal communication; March, 2005).

Economic context

There have been three main waves of economic development in Achiote. Until the 1960s, Achiote was subject to the 'Golden' era where banana plantations were the principle form of employment in the area (Bracho & Delgado, 2004).

The 'Yellow Gold' era was succeeded by the 'Red' era. The 'Red' era witnessed the emergence of coffee as a profitable cash crop. World supply of coffee ultimately succeeded demand, however, and prices became extremely volatile for smaller farmers. Today the economy has shifted into the "Brown" era, where cattle ranching is the most profitable form of economic activity in the region (Hayden; personal communication; March 2005).

Arguably, the next economic era to emerge in Achiote may be the "Green" era, where eco-tourism, through initiatives by such groups as Los Rapaces, may provide a more environmentally sustainable form of economic development to the region.

Host Information (CEASPA)

The Centro de Estudios y Acción social Panameño is a non-profit NGO founded in 1977. Their mission is to work towards sustainable human development and the improvement of democracy through citizen empowerment and to promote the participation of different sectors of society (San Lorenzo, 2004). To achieve this mission they work in three main areas; sustainable development, gender and development and democracy and participation. CEASPA has considerably impacted the town of Achioté through its promotion of both community enrichment and environmental conservation.

After the US pullout from defense sites and facilities in Fort Sherman in June 1999, CEASPA started the *San Lorenzo Project*. The project sought to preserve the fragile ecosystems contained within the buffer zone of the San Lorenzo Protected Area (SLPA) by fostering sustainable development within the adjacent communities (San Lorenzo 2004). To achieve this goal, CEASPA supported and promoted a variety of initiatives such as the ‘Community, Coffee and Environment project’ launched in 1999.

Eco-tourism is essentially an attempt to bridge ecological and cultural conservation with development to produce a more viable form of economic generation. CEASPA provides resources and training to local residents in order to facilitate community involvement in development initiatives. CEASPA has assisted various eco-tourism initiatives in the Costa Abajo region. Specifically, CEASPA involvement has been paramount to the success of Los Rapaces, a grass-roots eco-tourism that evolved from CEASPA workshops in the community.

Eco-tourism in Achioté

There is currently a paucity of local eco-tourism initiatives within the community. The town of Achioté is world renowned among bird-watchers as a haven for rare tropical species. As such the community should have little problem enticing tourists to its doorstep. There are several bird-watching tours that pass through the town and capitalize on the region's eco-tourism potential but these tours operate from either Colón or Panama City.

For their credit, members of Los Rapaces have attempted to broaden interest in the region by diversifying the activities available in the community. Tourists can visit an ecological farm, cascades, nature trails and a local cheese operation. In 2004, ANAM, CEASPA and Los Rapaces inaugurated ‘El Sendero Ecológico’, a 2 km nature trail on the outskirts of the town. Tourists are also encouraged to partake in a cultural immersion experience through the Achioté homestay program (Bracho and Delgado 2004).

A number of potential eco-tourism projects have also been identified in the community (Bracho and Delgado 2004). The failure to exploit these initiatives owes either to a lack of resources or leadership.

Achiote possesses tremendous potential for the exploitation of their natural ecological resources for economic gain. By looking at the possibility of specifically exploiting the rich biodiversity of butterflies in the region, we will investigate what broader issues are encountered when initiating an eco-tourism project in the region.

Before these broader issues can be evaluated, however, we must first assess the biodiversity of butterflies in the region and attempt to understand the social underpinning that will ultimately determine whether the project becomes established.

Rationale behind butterfly promotion in Achiote

One needs to only drive through Achiote to witness the amazing array of butterflies that flutter along the roadside. These butterflies are much more than just aesthetically pleasing, they also play a major role within the complex ecosystem that exists around them. The majority of butterflies are dependent on specific larval host plants and adult nectar plants and as such they are part of a complex web of biological interactions; specifically mutualism.

This also means that butterflies are extremely susceptible to landscape alteration and other activities that result in biodiversity loss. According to Robert Michael Pyle, large scale, rapid and constant conversion of moist tropical forests to weedy pastures, highways and housing currently represent the greatest threat to butterfly populations (Pyle, 2004).

Achiote, unfortunately, has not been spared from rapid land conversion, a practice that plagues most developing countries. During the seventies and eighties, Achiote was invaded by an increasing number of migrant families and land was rapidly deforested for cattle ranching. Agricultural land conversion as well as home and road construction also altered species richness in the region by reducing the extent of natural habitats (forested habitat) and increasing the extent of disturbed habitats (pasture land and roadside habitats).

Butterfly conservation, however, has been garnering increased interest in recent decades. Butterfly interest is by no means a new phenomenon as “scholars, scientists and naturalists in Europe, and later North America, have created and maintained special habitats where to raise and study these beautiful insects throughout most of modern times (Spirogyra Butterfly Garden, 2005).”

More recently, however, interest in butterflies has moved beyond the scientific community. An increasing public interest in natural history and concern for environmental conservation has correlated with a heightened interest in butterfly attractions and displays

(Bronaugh, 1993). As stated by Bronaugh (1993), “people have always been fascinated by butterflies so it is not surprising how much business the butterfly industry has generated.”

Butterfly attractions are particularly appealing in many developing tropical countries because it is a form of economic development that is accessible to local people. These operations not only promote conservation but have also become an educational medium as well as enhancing the aesthetic beauty in the communities where they have been undertaken (Costa Rica Butterfly Farm, 2005).

Promotion of Butterflies in Achiote: A Range of Possibilities

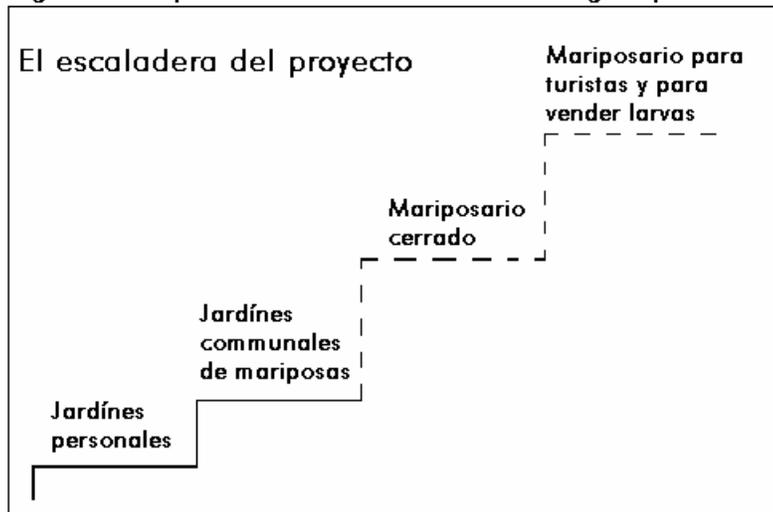
The Staircase

Myriad factors are encouraging the interest of capitalizing on butterflies in Achiote; among them are CEASPA’s agenda, enthusiasm from eco-tourism groups for new alternatives and increasing tourism to the region.

While the rationale behind attracting butterflies to a region may be apparent, the logistics behind attracting and maintaining populations of butterflies in a specific destination is a less obvious. In order to understand the feasibility of a butterfly project as it pertains to Achiote, it was necessary to determine the scope of project. With the information gathered through literature reviews, Internet searches and informal discussions with STRI scientists, it has become apparent that it would be impossible to prescribe one specific set of instructions on how to proceed with a butterfly garden project in Achiote.

Instead, we believe that the potential scope of a butterfly attraction in Achiote could exist along a spectrum or ‘staircase’ (fig. 1). At each step in the staircase there exists a different set of social and biological benefits.

Fig 1. How to promote butterflies in Achiote: a range of possibilities



Step one – Personal Butterfly Garden

The first ‘step’ focuses on attracting more butterflies to existing personal gardens. Butterfly gardens are a great way to attract additional butterflies into an area. Maintaining a personal butterfly garden is an enjoyable and rewarding pursuit and requires only a modest amount of background knowledge.

A working list of lepidoptera species common to the area is pivotal to the success of a butterfly garden. Butterfly species are very specific about the plants on which they feed and lay their egg. In order to attract a particular species of butterflies to a garden, both their feeding and larval host plants should be identified and planted. Whereas butterfly species often have a unique relationship with their larval host plant, many lepidoptera species often feed on the same nectar plant (DeVries, 1997). If costs and space are limitations, gardeners can opt to include only nectar plants. The drawback to this practice is that by omitting a habitat for the butterflies to lay their eggs, the abundance of butterflies in the garden will be significantly reduced (Annette Aiello; personal communication; April, 2005).

Logically, butterflies have developed relationships with the native or endemic plant species in their habitat. Consequently butterfly gardens can help to preserve native plant populations in a region. In fact, ‘natural’ gardens attract the greatest number of butterflies (Jones, 2005). Moreover, aside from water and maintenance, these gardens do not require a great deal of capital investment (Butterfly Gardening and Conservation, 2003).

Step two – Communal Butterfly Garden

There exists a different set of advantages for creating a larger, communal butterfly garden. A successful initiative of this sort necessitates the constant cooperation and collaboration of village residents. Communal partitioning alleviates the daily task of watering and maintenance and plant sharing networks can help to populate the garden at a low cost. Owing to their larger size, a communal garden can attract a greater abundance of butterfly species. A community butterfly garden is an excellent apparatus for conservation education within the community. It is through education that intrinsic value can be bestowed to the biodiversity of the area.

Furthermore, on account of its aesthetic beauty, the community butterfly garden may become a source of interest to visitors as well. A community butterfly garden in Achiote could serve as an ‘ecological corner’; a place in which to relax and a place to photograph (Spirogyra Butterfly Garden, 2005). In the most sophisticated operations, tourists could even be charged and native plants could be sold. Such a community-driven initiative has the potential to not only be economically profitable but, moreover, to augment community pride through the beautification of the environs.

Step three – Butterfly House

A successful community butterfly garden is capable of educating, organizing and empowering the community. It can also facilitate the transition into a larger scale butterfly house or *mariposario*. The *mariposario* could feasibly develop from an existing communal butterfly garden but necessitates the input of a significant amount of additional of planning, capital and operational management.

A *mariposario* is a net-enclosed garden that contains a variety of butterflies and their respective nectar and host plants. Butterflies are housed within the structure and visitors can enter and stroll through the garden. The structure ensures that the butterflies are consistently present in large numbers.

While the physical infrastructure of the *mariposario* is not technologically sophisticated, the availability of knowledgeable staff for constant maintenance is imperative to its success. Adult butterflies have a short life span (2-8 weeks) and thus must be reared on site or purchased in order to ensure constant viewing pleasure (Bronaugh, 1993). The rearing process is not particularly technical but does require constant attention. The expertise lies mainly in understanding the butterfly life cycle. The butterfly house contains both feeding and host plants so that the females can lay eggs on their respective host plant.

Maintenance workers must check plant leaves daily for laid eggs. Eggs are retrieved for rearing in plastic boxes or cages. Larvae must be fed and monitored until they pupate. Once the metamorphosis is complete, and the butterfly emerges from its chrysalis, the butterfly can be returned to the butterfly garden.

Mariposarios can guarantee that visitors will see a large number of butterflies and consequently these more sophisticated butterfly attractions are quite popular within the global ecotourism industry. Currently only one *mariposario* exists in Panama and it is located at the Gamboa Rainforest Resort in Panama City.

One benefit of developing a *mariposario* in Achioté is that there already exists a tourist market in the region. Achioté Road entices a large number of national and international bird-watchers to the region. Bird-watchers are typically avid conservationists and environmentalist and subsequently a *mariposario* in Achioté could capitalize on this trait by promoting itself as a butterfly refuge.

More importantly, there are few tourist attractions in Achioté that promote any sort of interaction between locals and tourists. Ideally, a *mariposario* would employ local residents and allow them to impart their knowledge to visitors through informal tours.

Step four – Butterfly Farm

The final step in the butterfly attraction staircase is the creation of a butterfly farm. This is the most commercially intensive step where larvae are reared not only for display in the mariposario but also for sale on the global market.

There exists a “booming industry of exhibiting live tropical butterflies in Europe and North America” ((Bronaugh, 1993). The establishment of butterfly farms to meet this market demand has proven incredibly fruitful for many communities in developing nations around the globe. One butterfly farmer in Papua New Guinea describes how villagers have benefited greatly from the creation of small-scale butterfly farms as well (Vietmeyer, 1996). The farmer described the enterprise in terms of its sustainability and remarks that “profits go entirely to the villagers and butterflies are nurtured as a continuous resource, both butterfly populations and their habitats are conserved” (Vietmeyer, 1996).

In the context of a global push for ‘sustainable development’ initiatives, the establishment of a butterfly farm in Achiote may be a viable option for the future.

Concluding remarks

This hypothetical ‘staircase’ is not indicative of a direction for development. Rather it is an attempt to illustrate the spectrum along which various butterfly garden initiatives can contribute to sustainable development in Achiote.

Promoting butterflies not only enhances the aesthetic beauty of the environment but it also promotes education and conservation of plant and animal biodiversity. Even at the most basic level of personal gardens, there still exists the possibility of augmenting tourist interest in the region by beautifying the region and creating a less threatening, more pleasant area in which to visit.

Regardless of the scope of the butterfly garden implemented in Achiote, any such form of development will help to diversify the economic possibilities in the community. Moreover, the implementation of a smaller development could readily be converted into a larger scale development in the future.

Given that a butterfly attraction can assume various scopes, our work has focused on understanding how butterflies can be best promoted within the community of Achiote. As such, this has been both a biological and social investigation. Creating a list of lepidoptera species in the region was fundamental. Plant species for the butterfly garden could not be recommended until this list is compiled. The project set forth by sampling various habitats around the community of Achiote. The biological objectives were to begin a working list of lepidoptera

species present in the community, determine which species were most abundant during sampling, and provide the community with a *folleto* illustrating the identified lepidoptera species and their host and feeding plants.

Understanding the social, political and economic context within which a butterfly attraction would function was also fundamental to our project. The specific social objectives of this project were to understand the interest in butterflies from both current and potential stakeholders, understand the context of gardening in Achiote, understand interactions between the community and tourists, and teach the community about the lifecycle of butterflies.

Biological component

Methodology

The methods explained here have been designed after careful consideration of available literature on tropical butterfly studies (Santos, Hughes, DeVries) and communication with scientists regarding their personal experience and recommendations for successful butterfly collection (Aiello, Santos, Valderrama).

In an attempt to obtain a representative sampling of the butterfly species present in Achioté, both entomological sweep nets and bait traps were used. Despite some weaknesses inherent in both methods, they were deemed to be the most appropriate for our limited time, experience, and resources.

The sweep nets allow sampling of butterflies while moving through selected sites. The bait traps allowed for sampling of butterflies that were not directly observed; specifically species that are notoriously unrepresented using sweeping methods and species that feed on rotting fruit rather than nectar (Hughes, Santos).

Sampling was conducted in the vicinity of Achioté, Colón, Panama between February and April 2005. There are many diverse habitats in Achioté; both natural and disturbed. Achioté is located directly adjacent to San Lorenzo Protected Area. The section of the park that encroaches on the town is considered a wet tropical forest. A highway paved in 1996 traverses through the park and the town of Achioté and is a disturbed yet ecological diverse habitat for lepidoptera sampling. There is also a considerable amount of agricultural activity in Achioté and the fallowed land provides another unique habitat for sampling.

Habitat Description

Map 1 has been produced as a visual aid to show the location of each habitat site. The spatial integrity of the map is questionable and as such should only be used as a guide.

Forest interior

Site one is located in the forest, abutting the road to Caño Quebrado. Access to this site is to the left of the roadside, after crossing the bridge, on the hill to the coffee farm. It is necessary to scale the hill after walking into the forest from the roadside.

Site two: El Sendero Ecológico El Trogon

Forest light gap

Site one is also located in the forest, abutting the road to Caño Quebrado. Access to this site is to the same as for the forest interior, namely to left of the roadside, after crossing the bridge, on the hill to the coffee farm. It is necessary to scale the hill after walking into the forest from the roadside. The site is located at the top of the hill.

Site two: El Sendero Ecológico El Trogon

Forest edge

Site one is located along the road to Caño Quebrado, on the roadside, directly after the second bridge, on the hill to the coffee farm.

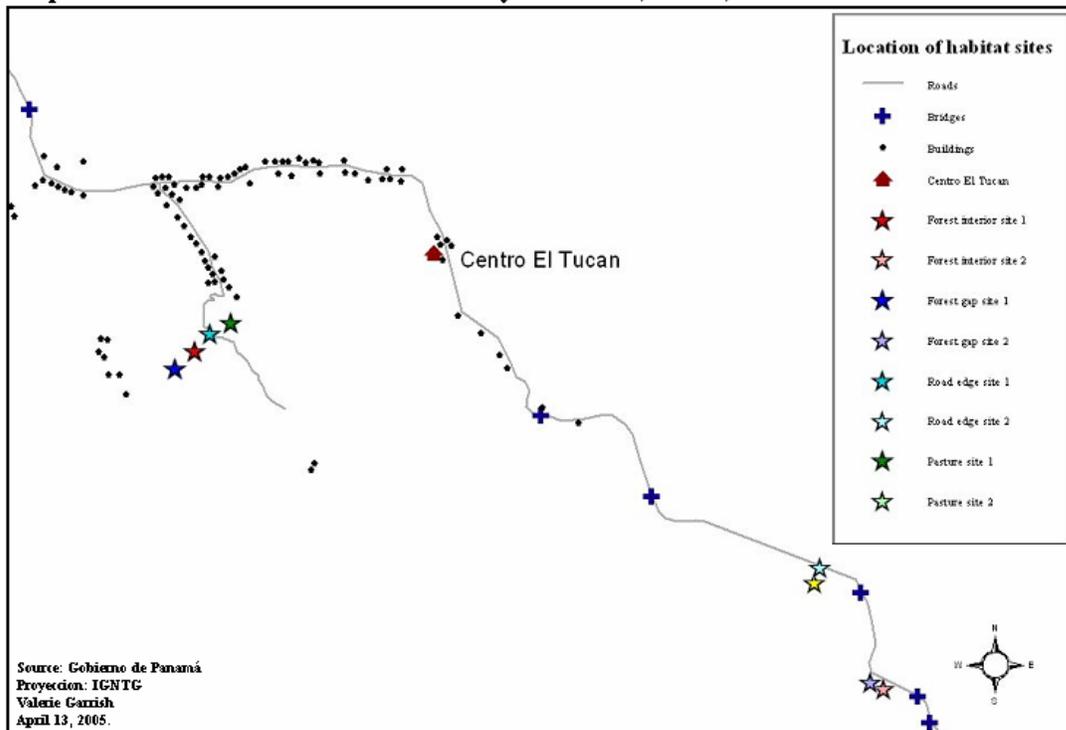
Site two is located approximately 2 km before the El Toucan Centre, along the principle road that passes through Achiote. Sampling was conducted primarily on the roadside near the bridge.

Pasture

Site one is located along the road to Caño Quebrado and is accessed directly after the bridge, to the right of the roadside, on the hill to the coffee farm. It is necessary to walk through the forest and down the hill to access the pasture.

Site two is approximately 2 km before the El Toucan Centre, along the principle road that passes through Achiote. Sampling was carried out in a pasture that can be accessed by walking approximately 100m through the forest that abuts the roadside.

Map 1. Habitat sites around the Community of Achiote, Colon, Panama.



Sampling Methodology

Sweep nets

The principal sweep net was a 'tropical' model, chosen for its size and compatibility. It was purchased from an online equipment distributor at www.bioquip.com.

An aquatic net was used as a secondary net for the first week for lack of a better substitute. It was replaced in the second week a lightweight insect sweep net, provided by Oscar Puebla. The diameter of the net, however, was significantly smaller than that of the principle net.

During the second internship week in March, Marianne Akers supplied 3 additional sweep nets, thus increasing sampling capacities.

Bait traps

Two bait traps modeled after the Van Someren-Rydon trap (DeVries 1987) were used. They consisted of a cylinder of nylon netting sewn around two metal rings at either end. The structure was 70cm in height, with a diameter of 30 cm. The top of the cylinder was closed with wire meshing. The bottom of the cylinder was open with a paper plate suspended several centimeters below the netting. The bait was placed on a paper plate. Traps were baited with a mixture of rotten banana, molasses, and rum that has been left to ferment (Hughes, 1998).

Frequency

Sampling was carried out over 10 days from February to early April 2005. Sweep net collection was conducted during three intervals each day: a morning collection took place between the hours of 8:00 to 10:00, a midday collection was carried out between 12:00 and 14:00 and an afternoon collection was undertaken between 16:00 to 18:00.

Due to travel restraints, only two of the four habitats could be sampled in any one day. This generally resulted in a coupling of the *forest interior* with the *forest light gap* habitat and the *forest edge* with the *pasture* habitat. Each habitat was swept for one hour during each interval in the day for a total of three hours per day. Each habitat was, in turn, sampled on five different days for a total of the 15 hours of sampling per habitat. Within each habitat, site 1 was sampled for 9 hours (3 days) and site 2 was sampled for 6 hours (2 days).

For each day that sweep net collection was conducted, the bait trap was also placed in various habitats. The bait trap was used for a total of ten days. The methodology was modified from procedures used by Griffis, Horner-Devine, Hughes and Sparrow.

Method of collection and identification

At the beginning every attempt was made to capture each species of butterfly that was observed. This approach was pivotal to the ability to record the presence of butterflies by species. With time, however, the samplers became more accustomed to identifying the common species by sight and as such it was no longer necessary to capture and kill a representative of each species.

If an unfamiliar specimen was observed, it was captured. If it could be identified through the net it was subsequently released unharmed. The date, location, approximate time, species, and number of individuals observed or caught were recorded.

If the specimen could not be identified, the butterfly was killed and preserved in order to identify it and retain it for documentation.

Initially, the butterflies were incapacitated by pinching their thorax. Later, the butterflies were retained within an inflated plastic bag and returned to the Toucan centre at the end of the sampling session where they were promptly killed using a chemical agent

Two killing jars of 16oz. and 21oz were used to debilitate the butterflies. The jars were also purchased from Bioquip and contained *Plaster of Paris* at their base that absorbed and slowly released the chemical agent. The jars were recharged each day prior to sampling with approximately one tablespoon of ethyl acetate.

Immediately after the specimens were killed, they were placed within envelopes to protect them against damage and packed into a well-cushioned Tupperware container. The container also held camphor to protect the species from excess humidity. The specimens were then placed in the refrigerator at the El Tucan Centre in Achiote until they could be transported to Panama City for identification.

Anayansi Valderamma initially identified of the species. Henry Stockwell and Marianne Akers also provided assistance during one of the first identification session. Thereafter species were classified using DeVries and Anayansi Valderamma verified the classifications if there existed any doubts.

Folleto guía

After compiling a species list, research commenced on establishing the relationship between each lepidoptera species and their host and feeding plants. DeVries and Janzen were used wherever possible and when information was unavailable, Internet resources were consulted (Refer to Folleto Internet sources) as well as Annette Aiello from STRI.

Statistical analyses

A list of all species identified in Achiote was compiled. Species richness (S) was then determined according to habitat and time of day. The Chao-1 diversity index was determined to reconcile the problem of species rarity in the dataset as follows:

$$\text{Chao-1 diversity index} = S + n_1^2 / 2n_2$$

Where n_1 = number of singletons in the sample

n_2 = number of doubletons in the sample

Diversity indices, with regards to habitat and time of the day, were calculated using Shannon's index (H') (Coe, 2003).

$$H = - \sum p_i \ln (p_i)$$

Where p_i = the proportion of each species in the dataset

Similarity between habitats and time of day was determined using Jaccard's similarity coefficient (J) and Mountford's index of similarity (M) (Meyer, 2004).

$$J = j / d$$

Where j = the number of species common to both samples

d = the number of species specific to each samples

$$M = 2j / (2(ab) - (a+b)j) \times 100$$

Where j = the number of species common to both samples

a = the total number of species in sample one

b = the total number of species in sample two

The Kruskal-Wallis test was performed to test for differences in species abundance across both time of day and habitat. The test was set up such that;

$$H_0 : \mu_{\text{forest interior}} = \mu_{\text{forest light gao}} = \mu_{\text{forest edge}} = \mu_{\text{pasture}} \text{ OR}$$

$$\mu_{\text{morning}} = \mu_{\text{midday}} = \mu_{\text{afternoon}}$$

$$H_a : \mu_{\text{forest interior}} \neq \mu_{\text{forest light gao}} \neq \mu_{\text{forest edge}} \neq \mu_{\text{pasture}} \text{ OR}$$

$$\mu_{\text{morning}} \neq \mu_{\text{midday}} \neq \mu_{\text{afternoon}}$$

Test statistic (H):

$$H = 12 / n (n + 1) \sum R_i^2 / n_i - 3(n + 1)$$

This statistic approximates a chi-square distribution with $k-1$ degrees of freedom if the null hypothesis of equal populations is true. The null hypothesis was rejected if the test statistic H is greater than $CHIPPF(\text{ALPHA}, K-1)$ where $CHIPPF$ is the chi-square percent point function (Heckert, 2003).

Critical region : $H > CHIPPF$

Simply put, the null hypothesis can be rejected if the test statistic is in the critical region.

Note: for each analysis, the data were pooled across all days sampled.

Results

The bait-trap failed to detain a single lepidoptera species and thus results are representative of sweep-net sampling only. A total of 30 lepidoptera species were identified in the community of Achote between the three months from February to April 2005. Table 1 shows the

distribution of individuals caught with regards to species type and habitat whereas Table 2 shows the distribution of individuals caught with regards to species type and time of day.

The overall most common species in the dataset were *Anartia Fatima* (19.5 %), *Phoebis philea philea* (16.4 %) and *Polythrix asine* (10.4 %). In the dataset, there were 9 species which were singletons (0.27 %) and 3 doubletons (0.55 %).

Species Richness

With regard to habitat, Table 3 shows that species richness was greatest in the forest edge (19 species) and smallest in the forest interior (5 species). Chao-1 diversity index slightly reduced the dissimilarity between the habitats but the overall pattern remained unchanged.

For time of day, Table 4 shows that species richness was greatest in the afternoon (25 species) and smallest in the morning (10 species). Chao-1 diversity index slightly augmented the dissimilarity observed in the time of day but the general pattern remained unchanged. Species richness for the entire sample was 30 with a Chao-1 diversity value 43.50.

Diversity

Shannon diversity index was used to assess diversity at the various habitats and at various times of day. With regard to habitat, Table 3 shows that diversity was greatest in the forest edge (2.35) and smallest in the forest interior (1.56). The diversity index for the forest interior was particularly small with the 3 habitats possessing diversity indices greater than 2.14.

As concerns the time of day, Table 4 shows that diversity was greatest in the afternoon (2.65) and smallest in the morning (1.99). The diversity index for the entire sample was 2.59

Similarity

According to Jaccard's similarity coefficient, the forest edge and the pasture habitats possessed the greatest similarity (47.01%) and the forest interior and pasture habitats showed the greatest dissimilarity (0%). Using Mountford's index of similarity, the forest interior and the forest light gap habitats possessed the greatest similarity (13.33%) and the forest interior and pasture habitats showed the greatest dissimilarity (0%).

From Jaccard's similarity coefficient, afternoon and midday sampling had the greatest similarity (107.14%) whereas morning and afternoon sampling yielded the greatest dissimilarity (33.33%). Mountford's index of similarity indicated that morning and midday sampling had the greatest similarity (15.10%) whereas morning and afternoon sampling yielded the greatest dissimilarity (5.49%).

Kruskal-Wallis test

For differences in species abundance between habitats, the null hypothesis was rejected with a confidence of level of 0.001. For differences in species abundance between times of sampling, the null hypothesis could not be rejected.

Discussion

Bait-traps

Bait trap provide a method of sampling frugivorous Lepidoptera species and, implicitly, species that might not otherwise be caught by more conventional sampling methods (Hughes, 1998). It can be quite cumbersome to sample certain species in forest habitats. Moreover, many such frugivorous species are very fast in flight and difficult to capture with traditional sweep nets. Bait traps are an effective solution to this predicament.

The bait-trap was fashioned after Van Someren-Rydon model and construction techniques from previous studies were consulted (Hughes, Raguso, Shahabuddin). The bait trap took 10 hours to construct and as such only one trap was completed. Unfortunately the bait trap failed to detain a single Lepidoptera species. One of the problems was uncertainty about the distance at which the holding plate should rest below the trap itself. The plate was typically suspended anywhere from 5 cm to 15 cm beneath the trap.

Another issue, which further compounded the problem, was a decision to test the bait trap in each habitat. Bait traps are used to capture frugivorous species of Lepidoptera. Species such as *Archaeoprepona meander centralis* or *Morpho amothonte*, which would be expected to visit the trap, are also found predominantly in forested habitat. These species do not linger in open areas and thus hanging the bait trap in open pasture area was unproductive. Ideally, the bait trap should have been left in forest light gap habitat until the problem was resolved. For any future sampling, the design of the bait trap needs to be improved prior to the commencing work.

A final identifiable problem was that the bananas employed as bait had not putrefied sufficiently to attract butterflies. This was due to logistics, time limitations in Achiote, and consumption of bait by birds and rodents. Ideally the bananas should have been allowed to ferment for six days before being used in the trap (Devries, Stockwell). The bananas, however, never fermented more than three days because of the practical problems. The one attempt to bring fermented bananas from Panama City ended in disaster.

Thereafter, ripe bananas were brought to Achiote but time on site was never sufficient to allow them to fully ferment before using them as bait. It was also noticed that the bananas rarely

remained on the plate at the end of the day. A system of covering the bait with a perforated plate (Raguso, 1990) was considered but rejected as it might also deter any butterflies from feeding.

Without results from the bait trap, it is evident that species abundances from the dataset almost certainly do not reflect the true abundances of frugivorous species in the region. The inadequacy of sampling methods for frugivorous species might also explain why species abundance and richness were noticeably lower in forested habitats, particularly the forest interior habitat.

Site selection

The selection of habitats was modeled on studies conducted by Raguso, Shahabuddin Sparrow. Initially there was only one site sampled for each habitat but this was modified after being informed certain sites were within an ANAM protected area and required a permit.

The initial selection of sites within each habitat was arbitrary in nature; either on account of perceived species abundance or convenience. Butterflies require water for their physiological and metabolic functioning (DeVries, 1997; Vane-Wright, 2003) and Lepidoptera abundance will be greater near sources of water. None of the initial sites, therefore, were more than 15 metres away for a source of water and thus the effect of water availability on study results was negligible.

The forest interior and forest light gap were chosen because of their easy accessibility within the Sendero. The forest edge site was selected after having observed many butterflies clustering around the nearby bridge. Through preliminary sampling in this site, we discovered a large pasture area slightly set back from the roadside and opted, for reasons of convenience, to use this location as a site.

The second habitat sites were hastily chosen after realizing we were defiance of ANAM laws by sampling without a permit. Charlotte Elton suggested the second sites for their proximity, accessibility, and position outside of ANAM boundaries. These sites were in much closer proximity to one another and were not near a source of water.

Unfortunately results were tabulated on an on going basis and therefore comparisons between sites within habitats were not possible. It was thus assumed that the two sites within each habitat were equally representative of the habitat they represent.

From the outset, there was one obvious deficiency in the selection of habitats for sampling. Given that the overall goal of the exercise was to suggest species that could be attracted to a personal garden, it would be logical to include a garden site. Because of the aggressive nature of the sampling technique, however, it was felt to be an imposition to ask permission to sample in personal gardens.

Some preliminary sampling was carried out in the garden in front of the El Tucan centre. There was a high abundance of individuals in the garden but species richness was low. The butterflies that visited the garden were primarily *Anartia fatima*, *Anartia jatrophae* and *Phoebis philea philea*. All of these species were well represented in other habitats and thus we were not terribly concerned with the absence of this habitat.

There were some reservations expressed by CEASPA about sampling in the forest. The intention was to create a preliminary species list of Lepidoptera in the region and as such it was felt that any particular habitat should not be arbitrarily omitted from the sampling. Moreover, at the beginning of sampling, there was not any compelling argument to suggest that species in the forest habitat could not be induced to visit, and feed in, a personal garden.

Sampling Issues

By far the greatest restriction to creating a species list was the timescale of the project. Sampling could only be conducted between the months of February and April, which is the driest time of the year (Annette Aiello; Personal Communication; March, 2005). Lepidoptera abundance is low during the dry season and visibly decreased as sampling continued into the final month. According to Annette Aiello, species abundance in the region decreases significantly in March and is extremely low in April and that it is not until the end of May that populations begin to recover. This would suggest that species richness is significantly higher throughout the rest of the year than the indications derived from the current sampling.

In addition, the samplers had no previous experience. Samplers partook in preliminary sampling exercises but still struggled to capture all observed individuals. To help rectify this shortcoming, Jose-Luis Bonilla, a Panamanian student in Biology with previous experience in Lepidoptera sampling, was recruited to help. The species list increased considerably on the days he was able to assist suggesting that the sampler's own ineptitude might have been the greatest hindrance to developing the species list.

Another limitation in the sampling was the quality of the sweep nets. The sweep net used by the primary sampler, with the most experience, was large in diameter and quite effective. The secondary sampler, however, had to make do with a net that was small in diameter with a short handle and was less than satisfactory. The secondary sampler was certainly more disadvantaged and therefore could not be as effective.

There were many species that simply could not be caught using conventional sweep net methods. *Morpho peleides limpida* and *morpho amathonte* were two species that were frequently observed at sites but were never actually netted. In addition, there were certainly many other forest or canopy dwelling species that could not be captured with nets. The bait traps were

intended to remedy this problem slightly but the failure of the traps meant that many species were not accounted for. Ultimately, however, the species list is intended for use in designing personal butterfly gardens and, as such, canopy dwelling species are of little relevancy.

As a final personal observation, it should be noted that the abundance of species might be biased given the relatively short time-scale of the sampling. It was noted that species like *Dryadula phaetusa* or *Danaus gilippus thersippus* tended to occur in groups. The four individuals of *Danaus gilippus thersippus* and the six individuals of *Dryadula phaetusa* observed in pasture were all recorded within the same 15 minutes. A longer sampling period would mitigate this effect.

Species abundance and richness

Species abundance was used to determine the most common species in the area. This information does not appear in the folleto, as the results are only applicable for limited period during the year.

The Chao-1 diversity index was calculated as a supplement to species richness. Chao-1 adjusts species richness by taking into account the prevalence of rare species and by the fact that rare species can result in the species richness being underestimated.

The Chao-1 values between the forest interior and the forest light gap habitats were similar whereas the species richness values were not. The forest habitat is actually quite unique. Five of the six individuals caught within the forest interior habitat were unique species. This habitat is deceptively diverse and, with improved sampling methods, the location might prove to be as equally rich as the other habitats.

Diversity

The low diversity and species richness in the forest habitat may be due to a multitude of factors. The forest may simply be a less diverse habitat; the results may be more a reflection of our inability to capture individuals in the forest; or it might simply be reflective of the fact that the second site in the forest habitat was very fragmented and as such may not have been a satisfactory location.

Diversity values, according to time of day that sampling occurred, suggest that sampling is best conducted in midday and afternoon. From species richness, the greatest variety of species occur during the later hours of the day. The diversity values reaffirm that not only is species richness greater but overall species abundance is also greater. Otherwise stated, more species are present after midday and the species are present in greater abundance. This is important for subsequent sampling in the region. If resources are limited, time is best spent sampling in the later hours of the day.

Similarity

Two similarity indices were calculated because of confusion that arose in calculating the Jaccard's similarity index. The similarity between midday and afternoon samples, based on Jaccard's index was greater than 100 percent, which seemed counterintuitive. One possible explanation is that Jaccard's index is sensitive to differences in sample size and the sample sizes from each of the habitats was quite different.

This problem tends to be less severe in Mountford's Index of Similarity (*I*) (Meyer, 2004). Mountford's index, on the other hand, tends to under estimate similarity between sites except when two sample sets are very small. For this reason, both indices were included in the analysis.

Through an analysis of the similarity between the habitats, the question whether sampling from a forest habitat is really relevant for future studies can be answered. If the intention is to create a list of species that the people of Achiote can hope to attract to their gardens, and not a general species list of the region, then the efforts made to sample in the forest were wasted.

The forest interior habitat is completely unlike that of the pasture habitat, which is the closest representation of a garden. If resources are scarce, future studies should concentrate sampling in pasture and forest edge habitats. The forest interior and forest light gap habitats are quite possibly too dissimilar from the pasture habitat to even think that species caught in such species could ever be lured to a pasture/garden habitat.

Looking only at species abundance and species richness, there is a temptation to suggest that sampling is better conducted after midday. This practice is acceptable if resources are very limited, but attention should be drawn to the fact that sampling in the morning is dissimilar from sampling in the afternoon. Looking at Jaccard's, similarity between these two sampling periods, there is only a 33% similarity where as similarity between the other sampling periods is greater than 80%. Therefore it can be deduced that the species caught in the morning are not observed in later hours and that morning sampling still has value.

Kruskal-Wallis

In order to test assumptions about differences in species abundance between habitats and period of day, a Kruskal-Wallis test was performed. The test reaffirmed the trend had already begun to emerge from diversity and similarity indices.

According to the test, species abundance is not dependent on time of day ($H < \text{CHIPPF}$) but is dependent on habitat ($H > \text{CHIPPF}$). Sampling in future should therefore not waste time in

forest or heavily shaded habitats. Some caution should be exercised, however, because these results refer to species abundance and not species richness.

Therefore, although the same number of butterflies might be caught in the morning as in the afternoon, it would be incorrect to assume that the composition of the catch would be the same. As far as habitat is concerned, it might be tempting to concentrate sampling at the forest edge as many more species are present, however, from the similarity tests it is clear that the species caught in the forest edge in no way mirror the species that would be caught in the other habitats.

Ultimately, in order to get a complete representation of species present in Achiote, it may be necessary to sample all habitats in all time periods.

Folleto guía

The reasoning behind the guidebook was to express our appreciation to the people of Achiote by leaving a tangible record of the information acquired through the sampling of the Lepidoptera. The information was collected primarily from books (DeVries, Janzen) as well as from Internet sources (references) and personal contacts (Aiello, Valderamma).

There were several shortcomings to the folleto that, with more time, could easily be rectified. In its present form, the folleto contains species trapped in the forest interior. From the analysis of the data, it is now reasonably clear that forest interior species would not likely be attracted to a personal garden. Thus community members might unwittingly plant *Ischnosiphon* in an attempt to lure *Eurybia unxia*, not realizing that such a species is found exclusively in forested locations.

A second weakness is that the plants in the folleto are not necessarily indigenous to Achiote or even locally available. Many of the plant species in the folleto are certainly not presently available in Achiote and it is uncertain whether these species are even available from suppliers in Colon.

The guide does, however, serve to remind people that there is no direct correlation between plant species and their corresponding lepidoptera species. Specifically the acquisition of a particular plant does not automatically guarantee the appearance of specific lepidoptera species. People are instead encouraged instead to acquire plants of specific color and plants that are rich in nectar. The text also provides a background on butterflies and their lifecycle and offers helpful hints in attracting butterflies to personal gardens.

If more time had been available, these shortcomings in the guía could have been addressed by using plant information supplied by Marianne Akers, specifically a database with all the plant species present around the community of Achiote. The list of plant species developed

during the study could then have been crosschecked with the list from Marianne to determine which species were indigenous to the region. Secondly, in instances where only the genus of plant species was supplied, it would have been possible to suggest a species that was already in Achote instead of having to make an educated guess.

When the first brainstorming session on the idea of a folleto was held, it was suggested that the butterflies be set and photograph by the members of the study group. Unfortunately the deterioration in the condition of the butterflies by the time they arrived in Panama was such that a photograph simply would not have done them justice. The chemical agent used to debilitate the lepidoptera was so strong that it either stripped the butterfly of its color or considerably altered the color. In the future, it would be advisable to refrain entirely from using the chemical agent and instead kill the specimen by pinching gently on its thorax. Otherwise, it is suggested to reduce the amount used to the absolute minimum and minimize the amount of time that the butterfly remains in the killing jar.

Final Remarks

During the last week of sampling, it was discovered that professor Francisco Delgado at the University of Panama in Santiago has a completed species list for the region (Francisco Delgado; Personal communication; April, 2005). Therefore continued sampling in the region may not be the most optimal use of resources.

Effort should concentrate instead on developing a list of the most common species in the region during both the wet and dry season. Sampling should only recommence if the common species during the wet season can not be established through communication with Delgado and Aiello.

Additional considerations should also address the plants species that were referenced in the folleto. Future efforts should concentrate on ensuring that the recommended plant species can be easily obtained by members in the community.

Sociological component

Methodology for Social Investigation in Achiote

Essentially, this project was carried out in an effort to understand how promoting butterflies can best be linked to community enrichment in Achiote. The limited timescale of the project necessitated the review of secondary-source literature from CEASPA in order to avoid the unnecessary duplication of previous work. Since the social implications behind developing a butterfly initiative in the region had not yet been examined, the methodology was designed with a qualitative data-gathering focus so that we could acquire a broad account of the social context in the community. A range of informants were consulted so that a balanced perspective from both current and potential future stakeholders could be obtained (Mitchell, 1997, 183). Ultimately, three different groups of informants were identified during the investigation; community members within Achiote, tourists and tour operators who visited the area, and professionals who would be implicated in a project of this type. Owing to the uniqueness of each informant, both formal and informal methods of communication were chosen. Tailored approaches were developed in an effort to best relate with the different types of informants. We therefore employed a series of semi-structured interviews, survey questionnaires, participant observations and email communications.

Communication with Achiote Community Members

When attempting a social investigation of this sort, it is imperative to recognize one's limitations as an 'outsider' within the community and conduct careful and culturally sensitive research (Ellen 1984). This said, one can not act solely as a "fly on the wall" observer and must take care to be engaging and open (Ellen 1984). For this investigation, participant observation methods were used in conjunction with a series of semi-structured interviews with community members.

Participant observations commenced during the first visit to the community and continued throughout the entirety of the investigation. Participant observations allowed us to observe processes, relationships and patterns in Achiote that later could be compared with findings from interviews and other studies conducted within the town (Ellen, 1984 and Mitchell, 1997). Observations began by walking through town with Dina Martinez; a resident of Achiote and sister of a CEASPA employee. This afforded us the opportunity to familiarize ourselves with the community's geographical and social space. In order to cultivate relationships, which would later become crucial to our investigation, we walked through the town introducing ourselves and distributing our 'Hola Achiote' handout (APPENDIX). The handout explained a bit about ourselves and the context of our research. It was distributed with the purpose that it might assist

in the progression from passive forms of observation to more active engagement during the interviews. Observations continued with each subsequent visit to Achiote. It occurred mainly while we were doing 'other things' (Mitchell, 1997, pp. 221). Observations were most readily noted during times spent with host families or during attendance of community functions such as the Annual March Festival and local baseball games. Participation in these events also enabled us to gradually breakdown the initial barriers we experienced as foreigners and, in doing so, permitted us to observe more 'normal' behaviour (Mitchell, 1997, pp. 221).

Semi-structured interviews were chosen as the other method of qualitative data gathering with Achiote community members. These interviews were conducted with a total of twenty four individuals and occurred mainly at their place of residence. Interviews took place with both key informants or 'specialists' as well as with 'casual informants' (Ellen 1984, 225). The initial review of CEASPA's secondary literature allowed us to identify potential data sources and the key community informants or 'specialists' we were seeking (Mitchell, 1997, 221). Key-informants were selected because of their involvement in prior CEASPA projects, their participation in the annual town garden contest or owing to their involvement in the community eco-tourism group, Los Rapaces. Casual informants were individuals who were typically less active participants in community initiatives. These participants were chosen according to their availability as well as through referrals from other informants.

To help people feel more comfortable with the pre-established questions, we started each interview by explaining our research intentions and, most importantly, we reassured informants that the information abstracted would be used to benefits the community. Interviews rarely lasted for more than an hour and notes were taken throughout the entire dialogue (Mitchell, 1997, 221). The interviews were driven by key questions. Key questions pertained to one of the following four categories; personal gardens, community garden potential, tourist relationships and other development project interests (APPENDIX). Interview were, however, intentionally flexible so that additional or unexpected topics could be explored (Mitchell, 1997, 221). Open questions were spread throughout the conversation. Whenever a misunderstanding arose, a series of related questions were asked in order to clarify the issue (Ellen 1984). It was also necessary to think critically about how questions should be phrased before posing them. All questions were 'tested' and approved by our CEASPA advisor, Daniel Holness. We aimed to begin and end each conversation with neutral questions, while asking the more difficult or controversial questions in the middle of the conversation (Ellen 1984, 235). Notes were taken throughout the interview (APPENDIX).

We selected a more open-ended type of interview in an effort to facilitate more honest dialogue. In the interview, we sought to better understand the current social context in Achiote and the possible implications of promoting butterflies in the region. This interview format also allowed us to ask initial questions in order to know what questions to ask next; in other words we were able control the direction of the interview (Ellen 1984, 235). We hoped that this control would enable us to mitigate any sentiments that we were merely extracting information and thereby reduce the number of errors that arise from a negative “interview dynamic” (Ellen 1984, 235).

Communication with Tourists and Tour Operators

As mentioned, the tourist presence in Achiote is still relatively limited. Currently, the majority of tourists who visit the Tucan Center are part of an organized bird watching tour. These visitors are quickly ushered through the centre, most are only given enough time to use the washroom facilities and take a quick look around. The infrequency of tourist visits, coupled with the brief nature of our own visits to Achiote, hindered our ability to communicate with tourists in person. While it is likely that personal interviews with tourist groups would have been more informative, it was simply not feasible. Consequently, we were forced to employ a variety of indirect methods in order to gain a better understanding of their thoughts and opinions concerning Achiote. Specifically, tourist opinions were assessed through the distribution of a formal survey questionnaire, informal semi-structured interviews, and email communication. These methods were chosen because they were both ‘culturally appropriate’ and the ‘length of discussion’ of each method was compatible with the limited time tourist spent in the community (Ellen, 1984, 222). Tourist communication was conducted in English. This enabled us to be transparent with regards to the purpose of our research and the information we were seeking.

The survey questionnaire was administered when a group of tourists stayed in Achiote for a week (APPENDIX). The questionnaire was designed to be anonymous and completely optional. Questions focused on tourist’s perception of the town, perception of the people of Achiote, and their own personal interest in butterfly gardens. Daniel Holness reviewed the surveys in order to ensure the appropriateness of questions. When the opportunity presented itself, formal surveys were distributed while speaking directly with tour guides and tourists at the Tucan Centre. These semi-structured encounters allowed us to supplement our other findings. Interviews rarely lasted more than five minutes and addressed the same issues as presented in the questionnaire.

Email communication took place with the tour group operators who frequented Achiote Road. We were unable, however, to arrange any personal meeting. Relevant tour operators were

identified in one of two ways. Operators were first identified through meticulous review of the last two years of the Tucan Centre's guest registration book. The remaining operators were identified through an extensive Internet search for bird tours travelling through Achote Road. In total, eight different tour operators were identified as potential informants (APPENDIX). A mass email was sent to each group. Within this email we introduced ourselves and explained our association with CEASPA and STRI (APPENDIX). The email also inquired about general impressions of their customers concerning Achote and, more specifically, whether they thought a butterfly attraction in Achote would garner tourist interest. A second email was sent to the groups who did not respond to the first email. Subsequent email communication was dependent on the nature of these initial responses.

Professional Communication

After an extensive secondary-source literature review, it was determined that communication with different type of professionals would likely enhance our own investigation in Achote. Four professionals were chosen because of their knowledge pertaining to the social objectives of this project. These interactions were also conducted as informal interviews but were more open-ended than the community member interviews. These interviews were focused primarily on extracting as much information from these individuals as possible. The information obtained always pertained to their area of expertise. We also sought their feedback on our ideas, findings, and the direction our project. Our informants were:

- Frander Arroyo, the designer and technical advisor of the Gamboa Rainforest Resort Mariposario, was interviewed in order to gain a better understanding of the requirements for planning and operating a mariposario.
- Belisario Villareal, Achote's main public servant (corregidor) was interviewed about land use and town organization.
- Micela Madrid, the director of the primary school, was consulted in order to verify the most appropriate design for an educational workshop about butterflies for the children of Achote.
- Carlos Abrego, a CEASPA associate who conducted a workshop on organic agriculture and helped in the organization of the 2004 garden contest in Achote, was consulted about the level of local knowledge about gardening and the practices he taught.

Results

Communication with Achiote Community Members

A series of twenty four semi-structured interviews were conducted in Achiote. As mentioned previously, interviews were based on key questions that fell within the following four categories: personal gardens, community garden potential, tourist relationships and other development project interests. The results have been categorized in terms of these listings but it is important to note that each interview was unique and covered a variety of issues. Respondents elaborated on many topics and often failed to address some of the questions raised. These results are a compilation of both the notes taken during interviews (APPENDIX) and also from our personal recollections of the conversations that took place.

Personal Gardens

Interest

Fifteen of the 24 respondent interviewed expressed considerable interest in his or her own personal gardens. A growing interest in personal gardens was apparent from conversations, especially among participants of a CEASPA-organized garden competition which took place last October. It was reported that the existence of the *concurso de jardines* motivated them to take great care in cultivating and maintaining the aesthetic beauty of their gardens. It was also reported that during this time of year gardens received a great deal of attention from the entire town but general interest diminished greatly after the *concurso* was over. Respondents expressed confusion over whether the *concurso* will continue in the future because it was organized and promoted by Carlos Vigil, a CEASPA employee who no longer working in the area.

Vegetables

Beyond aesthetic importance and participation in the *concurso*, personal gardens were also reported as important for upholding families' health as many cultivated vegetables and to a lesser extent medicinal plants in their gardens. It was explained that vegetables require a great deal of maintenance and two respondents remarked that vegetables are very difficult. Other homes, however, have been quite successful at cultivating vegetables like cucumber, chives, celery, peppers, and carrots. These homeowners explained how this had led to the development of an informal network of vegetable sharing and sales amongst neighbors and friends. Moreover, there exist few other options for obtaining vegetables. Respondents reported that they obtained their vegetables either through sharing with family and friends, traveling to Colon markets or purchasing from a vegetable/fruit vender who passes through the community on a bi-weekly basis.

Maintenance

In the homes where personal gardens exist, garden maintenance was reported as a necessary daily task throughout the entire year. Main areas of concern discussed during interviews were watering, weeding, fertilizing, and pest control. Water and weeding were cited as the most time consuming and labor intensive of garden tasks. During the time of year when rainfall is frequent, weeds are abundant and must be tended to regularly. When it does not rain, plants usually must be watered at least twice a day (morning and afternoon). The issue of water is of particular concern because there are often times during the dry season when water is quite scarce for many homes. It was, however, made clear by the interviewees that, even at the times of greatest water scarcity, maintaining gardens was a priority. Three respondents reported that they often had to bring in tanks of water and one home had dug a small well on their property in order assure a constant source of water.

While fertilizing and pest control techniques varied among respondents, the information provided in a workshop given by Carlos Abrego and CEASPA was often cited as the resource behind the methods employed. It was through Abrego's workshop that they learned how to make organic fertilizer (compost and Bocashi), thereby augmenting soil nutrient levels through the addition coffee peels, riverbed sediments and other easily obtainable elements to their garden soil. In addition, they received various recommendations on how to deal with pests and plant diseases in a non-evasive, organic manner. Only one respondent indicated that she used chemicals in their gardens. The main problems reported were the presence of *hormigas* and *hongo*. When asked about the presence of *orugas*, or caterpillars, the responses were that they rid the plants of them by pinching them off leaves or by rinsing leaves with a soap and water mix. Respondents also indicated that they had learned various other practices at the workshop but did not use them either because they did not remember them or did not think they were necessary. The workshop was also praised for providing free seeds to its attendants.

Butterflies

The occurrence of butterflies in gardens was discussed at length during the interviews. Respondents shared how often and in which areas they encountered butterflies. Three informants explained how butterflies were much less prevalent now than they were in the past. In the interviews conducted at homes that had personal gardens, only one respondent reported never seeing butterflies in her garden. Other respondents explained how they see most butterflies in the morning, especially during the rainier months. Respondents pointed out plants present in their garden that attract butterflies. Butterflies were reported as being especially attracted to the

standing pools of water that often form in gardens. All respondents stated that they enjoyed seeing butterflies and would like to see more around the town.

Community Garden Potential

Community garden potential was discussed with fifteen respondents. Two main issues were discussed; potential site identification and general interest in the development of a community garden.

Potential Site Identification

Should a communal garden be established, it would have to be situated on communal land. In fact, seven respondents expressed how location was the main issue for this idea. In Achioté, no land was reported as currently being available for community use. One interviewee was asked about the potential use of the “Casa Comunal” located in the town. She explained how this building was owned by the former political leader of the town and is currently is not accessible to community groups or individuals. The school, as one person suggested, could be an ideal location but space is limited. One informant indicated she had a small piece of land available that she had previously offered to sell it to the ecotourism group for building cabanas, but obtained no reply. She also felt it could house a community garden if the land was worked a bit. Three people explained that even if there was land available, the sprawl of the community would limit the attractiveness of a communal area because of the distance required to get there. Two people expressed concerns that elderly people living outside the center would never have access to a communal site.

General interest

There existed a definite divergence amongst informants with regards to their interest in a communal butterfly garden. Eleven informants expressed a general interest in a communal garden in Achioté, simply saying that it would be a good idea for the town. When asked if they thought ‘people’ in Achioté would be willing to participate in its organization and functioning, eight people said yes. These eight individuals were then asked if they personally would be interested in participating, of which, two said they would, two said they would not and the others were unsure or avoided answering. One respondent was adamant that for the garden to be a successful communal operation, there would need to be an efficient system to coordinate participation. For those who were concerned about participation, they explained the main obstacle is the lack of time. In addition, one person pointed out how gardening in Achioté was more of a personal occupation than a shared activity. Accordingly, two respondents expressed the concern that if they were to work on a communal garden, they probably wouldn’t have time for their own garden. However, three informants mentioned that a communal garden could improve their

personal garden, stating specifically that they would have access to a greater variety of plants and also learn on how to attract butterflies.

Tourist Relationships

Tourist relationships were discussed during twenty of the informal interviews. Information regarding the type of tourists, amount of tourist activity, the level of interaction between tourists and local people and their general perception of tourism in Achiote was gathered. Issues that influence their relationship with tourists were also discussed.

Type

In general, three ‘types’ of tourists were described. The first type of tourists is the individual that pass as they head toward the coast, bringing everything they need for the day and not stopping in Achiote. There also exists a type of tourists who stop briefly at CEASPA and spend little to no time in the rest of the town; these were reported as mainly bird watchers. The third type includes the tourists who interact with some parts of the community through home stays and Los Rapaces’ tours.

Amount of Tourism

With regards to amount of tourism, one person explained how tourism was really in its infancy. Three people indicated how after the arrival of CEASPA there has been more tourism in Achiote. Three individuals said how tourism was much higher when the US military had an installation in Fort Sherman and American families would come to the region on weekends and holidays.

Level of Contact

It was indicated that there exists a range in contact levels between tourists and the people of Achiote. There were three issues mentioned which impact the level of contact; the community members’ participation with CEASPA, occupation, and geographical location within the town. People involved with CEASPA and the ecotourism group were said to have the highest level of interaction. In some instances, people accommodated tourists in their homes for the homestay program. Six of the respondents had done so before. Specifically, two bird watching guides were reported as having the most involvement with tourists in town. Even with limited English they interacted with foreigners as they lead tours every two weeks and spent up to two hours with tourists. People that lived closer to the road and in the part of town with the highest concentration of houses reported more, even if limited, greater interaction with tourists than people living outside this zone. Five respondents explained that this limited interaction might not extend beyond a wave to a tourist passing by on the street.

Perception

The perception of tourism varied with regard to the level of interaction the informant had with the tourists. The six respondents who had hosted tourists in their home before, outlined how the interaction with tourists fosters a positive cultural exchange. The individuals who were more involved with tourism took it a step further by explaining how the experience is mutually beneficial. During this exchange tourists got to experience life in a small rural Panamanian town, practice their Spanish, and perhaps witness/experience family customs, whereas locals received money and partook in a typically positive cultural exchange. An additional eight people *explicitly* indicated that tourism was a good activity and they perceived tourists positively. One person, however, explained deep misunderstanding for tourist motivations in Achote. In this case, the respondent said he sees tourists pass-by but does not interact with them. More specifically, “I don’t understand why they come from so far and spend so much money to see birds I see every day. I need this money more than the birds do” (Mario Moreno, personal communication).

Issues affecting tourist relations

Ecotourism is a relatively recent phenomenon in Achote yet there still arose four issues of concern expressed by respondents: language barrier, sharing the benefits, the need for more infrastructures and crime. The two bird watching guides were quick to point out how their work level is limited by their level of English. Three locals who we partook in the homestay program expressed how the interaction is at times limited by the level of Spanish of their guests. In terms of benefits, two people explained how they felt the benefit of tourism in Achote was reserved for a small group of people. Two other individuals, however, recognized and explained that it was normal at the beginning to have a limited spread of benefits and this situation will eventually change as the industry develops. Six people identified the lack of a domicile, such as a small lodge and a restaurant, as a concern for the development of tourism. Since tourists cannot stay in town, they do not spend as much money and the town benefits less. The presence of wealthy tourists and the absence of law enforcement was cited by two people as a potential concern in the expansion of tourism.

Other Development Project Input

Restaurant

One recurrent idea was the creation of a restaurant. This would provide a space where visitors could stay and sit, since there is no such place currently exists in town. The general idea discussed was that the restaurant would operate in a cooperative manner. Participants would cook on the night that suits them most, and the profits would be shared.

In town there is a centrally located restaurant-type building which is presently not operational, the name 'Parillada Itzel' is written on its exterior. When asked, informants explained that the owner has had leg problems and was looking to sell her property. The price being asked was too high, so no local individuals could afford to purchase it. A Chinese family from Colon has recently bought it and is converting the place into a mini-super.

Park

The construction of a park was also suggested. This public place would be beneficial for local people and visitors. One informant thought a garden would be a nice addition to it. The idea of a park was also suggested by one informant as a way of keeping the young people 'out of trouble'.

Accommodation

During interviews suggestions for the construction of cabanas or, alternatively, a small Bed and Breakfast arose. It was indicated that if tourists and visitors could stay overnight and spend more time in the town, their economic impact would be more significant.

Paths

People from the Café y Ambiente committee have considered the idea of adding flowers to the roadside and possibly to footpaths. One person suggested the promotion of a three-hour hike to the top of a hill.

Craft

In the corregimiento there are still a few people traditional artisans. It was suggested that a workshop could be organized by CEASPA to transmit their knowledge to the younger generations and, in the process, revive interest in the lost artisan art form. It could also become a source of revenue if products were sold at the Tucán Centre.

Tourist Communication

Tour Operators

Of the eight operators originally contacted via email, Gamboa Tours and Tropical Nature Travel did not respond at all. Exotic Birding responded but only to inform us that they had not yet done a tour to the area but were hoping to sell tours to the region beginning this summer. Sacred Earth Tours and Footloose Travel both responded indicating that their tours to Achiote Road were actually organized and run by the local Panamanian company, Ecocircuitos Panama. The director of Ecocircuitos, Annie Young, responded explaining that they promote ecotourism as a tool for conserving wilderness areas and admiring species in their natural habitat. The tours they run are oriented towards visiting natural areas and would not include visits to gardens. She did, however, indicate that Ecocircuitos has just signed an agreement with CEASPA and are very much looking

forward to working with local guides in the Achiote area. Canopy Towers suggested that instead of pursuing a butterfly garden, efforts should be focused on building a longer hiking trail with parking accommodations. They did not think that a butterfly exhibit would attract many people. Two senior guides responded from Ancon Expeditions. Rich Cahill explained how trips to Achiote are very popular amongst birders but they only can visit for the day because of a lack of accommodations and other attractions for tourists. He indicated that the idea of a butterfly attraction can only be beneficial by offering more things to do in the area. Another senior guide, Rick Morales, also conveyed his enthusiasm about a butterfly exhibit in Achiote but explained how a number of other elements also needed to be addressed. He wrote specifically about the need for decent accommodations so tourists could arrive the night before and be enticed to spend the day in the area. He also indicated that he did not think main-stream birders are the market to target. Birders, he said, “are not likely to become interested in butterflies unless there is some heavy downpour, or the birding is considerably slow (Morales, personal communication).” Instead, he suggested that more general natural history enthusiasts would enjoy a butterfly exhibit but would also want “the whole picture: the pristine forest, the mammals, some birds, insects and plants as well” (Morales, personal communication). Ryan Filchum, the owner of Emerald Planet, thinks that a community butterfly garden on its own is not enough to attract tourists into town. He suggested a hybrid model of a butterfly garden combined with a sustainable butterfly farm, a butterfly garden combined with accommodations or a butterfly garden being developed alongside other ‘natural’ products such as bird tours.

Tourist Surveys

On March 15th 2005, eighteen survey questionnaires were administered to the group visiting from Colorado State University. The demographics of the group provided a sample of 11 college students and 7 professionals. The survey questionnaire gave respondents the opportunity to comment on questions as they saw fit and thus provided us with a series of compound, qualitative responses.

Perception of Achiote

In the first question respondents were asked for their initial visual perception of Achiote. There are three main categories of answers: charming, natural, run-down. Seventeen people answered how the town gave an impression of a small and charming rural town with friendly people. Five people expressed how they felt the town was located in a nice natural setting. Seven people wrote about a certain unpleasantness about the place qualifying the town as run-down and poor. Along these lines three people commented on the perceived disorganization of the town in

that it lacked a central focal point. One person described how the town was very different to what he was used to in the US.

For this first question, we have categorized the responses into three main categories, positive, negative and mixed. There were nine comments containing only positive perception, three containing only negative first impression and six containing a mix of positive and negative perceptions. Here's an example of a mixed response: "It is small and dirty. The people are very friendly. The landscape is very beautiful. The small town feel is very nice. Keep it local" (anonymous survey questionnaire).

Comfort in Achiote

In the next question, the level of comfort individuals felt in Achiote was addressed. Sixteen people out of eighteen indicated they felt 'very comfortable' in town. Two people out of eighteen said they felt 'somewhat' comfortable in town. They were asked to write explanations on their answers which can be classified in three main categories, comfort, increasing comfort, and discomfort. People expressed comfort in the town because people were friendly (five), the children were easy to communicate with (four) and people were patient about language (one). Three people write about an increasing comfort in town as time passed. Discomfort was caused by the presence of trash (one), stares (two) and the language barriers (two). The Tucan Center itself was described by one individual in the following statement. "I felt very comfortable with the Panamanian helpers at the Tucan Center, but did not feel that the people in town were very connected to the center or to each other" (anonymous survey questionnaire).

Town Beautification

Ideas about what the town needed in order to be more attractive were also provided. Answers fell into three main categories: the public places, the personal homes, the tourist infrastructures. In the first category, respondent expressed how the town could be physically improve with the removal of litter (nine), the addition road-side plants such as hibiscus (three) and a place for the community to gather (one). Respondents also suggested the personal homes could be made more attractive through; planting more gardens (three), removing barb-wired fencing (one) and painting the houses (three). Wider suggestion pertaining to the community included creation of a restaurant (five), a shop which could sell crafts and provide multilingual information (three) and better advertised tours (four). "There is some trash, broken glass, and things like that that just take away from the beauty of the people and the lifestyle in this town (anonymous survey questionnaire)."

Interest in a butterfly garden

The final aspect of the survey addressed tourists interest in visiting a butterfly garden. Ten people out of eighteen said they had already visited a butterfly garden. Seventeen out of eighteen said they would be interested in visiting an open-air butterfly garden. Comments were provided explaining the informant's motivation for visiting such an attraction. Answers could be pigeonholed into two categories: butterfly appreciation and appealing tourist attraction. Nine people expressed an interest to learn about butterflies, their life-cycles and their biological characteristics. Six people expressed how they think it is an interesting addition to current tourist attractions such as bird watching and could be a nice addition to a future restaurant. Individuals also made suggestions on how to make a butterfly garden more relevant by including hummingbirds alongside butterflies. One respondent suggested that this could improve the marketability of the attraction. Someone also suggested to that butterfly-feeding plants should be planted along the roadside to make it more area more attractive.

Tourist Interviews

An informal interview was conducted with two bird watching tourists passing through the Tucan Center. These individuals were asked whether they would be interested in visiting a butterfly garden in Achiote and what sort of other attractions might bring them back to the area. One respondent explained how birders are not generally interested in butterflies. The other said that if, perhaps, a butterfly attraction was advertised by the tour operator they were traveling with as an option that they could visit while also having lunch in town, they may be more apt to come. Both indicated that the tour guides or operators suggestions would be the main reason for their visit to a butterfly attraction in the area.

Professional Communication

Frander Arroyo

An informal interview was conducted with Frander Arroyo, a Costa Rican biologist who works as a consultant on butterfly houses and butterfly farm development in Costa Rica and Panama. Mr. Arroyo was contacted because he has been in charge of the operation of the Gamboa Resort mariposario since its conception. After initial contact was made, he mentioned being interested in hearing more about the possible development of a butterfly garden in Achiote. This interview was conducted in order to gain a better understand the planning and operation of a large scale butterfly attraction. Frander Arroyo provided some general information with regards to butterfly rearing, as well as relevant information on the planning and operation of mariposarios which are listed below.

General

In butterfly rearing there are two main types of exploitation. The first one is a butterfly house which is an enclosed structure designed for tourists. For the purpose of tourism, care in design and more attention to plants in a butterfly house is crucial. This infrastructure is currently the only one of its kind in Panama. At one time there existed two others but both closed down due to a change in management. The second type of butterfly exploitation he explained is a butterfly farm. This is a rearing facility wherein larvae are bred and sold, often without any aspect of public presentation. Currently, there exists no exportation of butterflies from Panama either in larval form or as souvenirs. This is much more popular in Costa Rica. Arroyo indicated that a butterfly farm can be complemented by a butterfly garden and vice versa.

Planning and Operation

The two most important aspects for the success of a butterfly house are the design of the structure and spatial organization of plants. There is also a need to have sufficient capital for the construction of the structure and the research about the local area.

There are three important aspects to a butterfly house structure that will allow the butterflies to thrive. These include the floor space, the roof, and the mesh. First, the amount of floor space is important. The ideal floor space necessary for a well functioning mariposario is between 500m² to a 1000m². At The Gamboa Resort the floor space is 300m² which sometimes creates a problem in the reproduction of butterflies. The roof shape needs to be flat or have a very small inclination. If not, the top of the roof will act as a trap and the butterflies can get stuck. The roof and the walls must also be made out of the appropriately sized mesh. Sixty percent of the light should go through the mesh to optimize the living conditions of the insects. Butterflies are sensitive to light level and this helps maintain a normal level of activity.

To have a successful butterfly house, the surrounding area must be well-studied in order to understand the existing plant-butterfly relationships. This is important for two main reasons: design and breeding larvae. First, a study will provide information on how to design the spatial arrangements of plants within the house, which is a crucial factor for a proper functioning. Through observation in the field, one can understand how plants are naturally spaced and recreate this relationship inside the structure. Arroyo explained how host plants are often visited more often when they are situated on the sides of gardens rather than centrally located. Another reason to study the area is that host plants from the local environment will often contain more eggs and are useful additions to the larvae being reared.

In terms of the knowledge necessary for this sort of butterfly exploitation, he stated that it is important to understand the rearing of larvae. At Gamboa, they raise their own butterflies

inside a simple laboratory where eggs are put in transparent plastic boxes where they are fed fresh leaves. When the chrysalis is formed it is put on a hook outside until the butterfly hatches.

Costs

The initial construction of a butterfly house usually costs 7000\$. In the case of Gamboa, the land belongs to the hotel and the construction costs were included in the hotel's construction. He also indicated that there often needs to be a sum of money available for the study of the area and the design of the paths and the spatial arrangement of flower by a specialist.

To keep a continuous supply of butterflies flying throughout the mariposario there exist two options. One can either buy them from elsewhere, which can be quite expensive or raise them, which can be complex. Operating a butterfly house thus requires both capital.

Human resources are the main costs associated with the operation Gamboa Resort's Mariposario. It is essential to permanently have a person overseeing the biological and administrative operation of the butterfly house. Arroyo comes eight times a year to Panama to raise more butterflies and attend to any problems which arise. He gets paid 50\$ a day and stays about a week during each visit. In addition, it is necessary to have people working on the maintenance of the garden to keep it attractive for the visitors, and free of pests or butterfly predators. These employees need to work two to three hours a day and are usually paid minimum wage. It is also beneficial to have trained guides which will enhance the experience of the visitor and protect the garden from the visitor-induced damage.

Belisario Villareal

Belisario Villareal, Achioté's corregidor, was interviewed in order to better understand the current land use practices and the political steps to obtaining land in Achioté.

Currently, there is no land which is the actual property of the town. However, there is national land that is owned by the Panamanian government on which the churches, one of the baseball fields and the *Sendero Ecologico El Trogon* are located. For the most part, land is requested for the construction of new houses. Most people, according to the corregidor, have a legal title to their land, but many can not afford the costly legal process and thus use land on a usufruct basis. There are a few absentee landlords who own a significant amount of land in the area for cattle farming.

In order for the community to obtain national land for their own use, the people of Achioté must bring the issue to the *junta communal*. According to article 248 of the Panamanian constitution, the *representante* must then ask the relevant government office for help. This is often a very time consuming process. For example, it took two years of administrative processes before the new baseball field was finally created through the Instituto Nacional de Deportes

(INDE). If the national government wants to use land in the area it must either buy it directly or, if it land is not legally titled, appropriate compensation must be provided.

Micela Madrid

Micela Madrid, the director of the Achiote School, was interviewed in order to obtain feedback on the planning and organization of the workshop we designed for the children of Achiote. We gave her a proposal explaining the objectives. These included, teaching about the lifecycle of butterflies and the common species in the area. The main issues she raised were regarding the age and number of children participating in this educational experience. She explained how while the younger children (ages five and six) would really enjoy the arts and crafts they would not gain as much from the video presentation or explanation posters we were providing. The number of children was also a concern due to available space in classrooms. She recommended we schedule the workshop for the forty students in the school who were ages eight and nine. A final write up and pictures from the workshop are included in the APPENDIX.

Carlos Abrego

Carlos Abrego is an organic agriculture specialist who has been associated with CEASPA for the last 5 years. Last year, upon the recommendation of the people involved in *Comunidad, Café y Ambiente*, he helped to organize and hold the Achiote garden contest (concurso). The goal was to bring the rich biodiversity, especially birds, in the area closer to the people. Fourteen people participated in the contest in the end. There was not, at that time a focus on butterfly attraction.

He also conducted a workshop in an effort to teach local people about sustainable agriculture practices. Abrego recalls about 35 persons attending the workshop. Before the workshop he estimated that some people already knew about organic practices, especially people that were related to the Vivero El Macano (a prior community initiative). He explained how to create Bocashi, a Japanese fermented compost and regular compost. He also provided information on how to naturally repel insect. In addition, he taught attendants how to build seed beds and gave away some free seeds. The general perception he gave was that people participated in the workshop and learned from it, but it seems to him that many people might have forgotten what they learned.

He described in detail the difficulties of obtaining large communal land area in Achiote. First, he said, there is a problem with the topography. In the lowest and flattest part of town, where it would be easiest to plant, there is seasonal flooding. In the hilly part of town, the soil is very fragile and the forest cover needs to remain in place to protect against erosion. This, he

explained, leaves little space for a communal garden since the flattest strip of land along the road and between the fragile hills and the flooded plains is already occupied by personal homes.

Discussion

Based on the findings of this research, we are suggesting that the promotion of a personal butterfly garden is the most feasible option for a butterfly initiative in Achiote at this time. Regardless of the inconclusiveness nature of our social findings, attention should still be drawn to the significant issues that lay behind this recommendation. To begin with, other existing development priorities and the unavailability of potential sites are both obstacles negatively impacting the feasibility of any larger scale butterfly projects in Achiote at this time. Furthermore, personal gardens already boast significant importance in the village and town beautification is not only a source of interest to community members but is also a way of garnering more tourists. These issues are further elaborated upon in the subsequent discussion.

Priority of Other Development Initiatives

The data collected from tourists and community members in Achiote seems to indicate that other development initiatives have priority over butterfly initiatives. Community members openly discussed five other development initiatives that they considered more important. Tourist's responses gave the impression that, even if there is a general outside interest in a butterfly attraction, it is unlikely to become popular until other tourist attractions are developed as well. Initiatives explicitly cited by both informant groups were the need for a restaurant, a place to stay, and additional ecological paths. Given the perceived priority of these other development initiatives, it does not seem that the establishment of a more sophisticated butterfly attraction would increase tourism in the town nor would it bring benefits to the community at this time. The promotion of personal butterfly gardens is, however, still feasible regardless of whether higher priority initiatives are being pursued. The benefits they provide to the community can be realized even without the mobilization of a community groups. Moreover, they do not require the constant influx of visitors to ensure their success.

Geographical and Physical Limitations

The data gathered also appears to indicate that there exist a number of geographical and physical limitations that would impede the development of a more centrally located butterfly attraction. Issues regarding the lack of an available site were raised by all informant groups contacted. As mentioned by three tourists, the town itself is spread out along Achiote Road with no center square or gathering area. Thus, even if efforts were concentrated on developing a communal space, it would impossible to accommodate all residents and ultimately some resident

would be excluded due to access restraints. This was also a concern raised by community members. The topography of Achiote makes it difficult, if not impossible, to identify a large, flat piece of land with decent soil and enough available water to support a community garden at this time. Carlos Abrego indicated that the type of land that is ideal for the creating a butterfly garden is already occupied by personal homes. The concentration of the most ideal gardening land in people's places of residence only further supports the idea that personal butterfly gardens are the most feasible option for attracting more butterflies Achiote.

Existing Importance of Personal Gardens

Personal gardens are currently of great interest in Achiote. Given the tremendous pride, knowledge and work ethic already devoted to personal gardens, it would not be difficult to promote butterfly gardening practices. Respondents described at length the practices of daily water and maintenance practices employed in personal gardens as well as information regarding when and where they see butterflies in their gardens. Moreover, personal gardening has also been gaining popularity in the village in the past year, thanks to the garden contest organized by CEASPA in which fourteen households participated and the workshops on organic agriculture practices. This was articulated both by homeowners and by Carlos Abrego. Beyond this, there is a sense that interest in personal gardens will continue to be a priority over communal gardening. Overall, interest expressed by locals when asked about a community garden was limited. Out of the fifteen individuals that were asked about participating in a communal garden, only two said they would be willing to do so. These results are not conclusive, but it is quite plausible this limited initial interest in a communal butterfly space would not translate into the group organization and participation that is necessary to realize a more communal butterfly initiative.

Benefits of Town Beautification

Another conclusion that can be drawn from the results is that the creation of personal butterfly gardens has the potential to improve the aesthetic beauty of Achiote, bringing benefits for both local people and visiting tourists. It seems that the 'attractiveness' of Achiote is a limiting factor in tourist's current perception of the town and the level of comfort they feel when visiting. Half of the survey respondents did not have a positive visual perception of the town. The creation of personal butterfly gardens would result in the additional planting of a wide variety of colorful flowering plants and increase the presence of butterflies among the community. This would contribute directly to the aesthetic pleasure people experience when passing through town and might potentially increase their comfort level and time spent in Achiote. Tourists spending more time in Achiote would facilitate greater interaction with local people and potentially lead to more mutually beneficial relationships. Fourteen out of the twenty

community members asked about tourism, expressed that increased tourists presence in town would be a positive improvement.

Limitations

The objectives of this research focused mainly on acquiring a broad understanding of the general context within which a butterfly initiative might be developed in Achiote. In order to meet these objectives we sought out a number of informants with unique perspectives and seemingly different stakes in Achiote development. We gathered a tremendous amount of information and a number of very relevant issues were raised. We were by no means, however, presented with a uniform or cohesive depiction of development in Achiote. Despite our far-reaching intentions, this research inevitably suffered from our relative inexperience in conducting social research in a foreign setting and the very limiting time constraints within which we were working.

Our ‘incompetence’ (Ellen 1984) in understanding the cultural and linguistic nuances while conducting research was a major limitation to truly understanding the social implications of a butterfly initiative in Achiote. All of the techniques we chose were designed with our academic intentions in mind and were thus very ‘culturally loaded’ (Mitchell, 1997, 225). In choosing semi-structured interviews with people from Achiote we strove to reduce the reactive effect that interviews have and allow people to speak freely about all relevant issues. Unfortunately, what we perceived as an informal conversation might have been perceived as a much more formal process since we were actively taking notes and recording what people said. This may have limited the degree of comfort people felt during the process. Moreover, because notes were taken while we were speaking, it was virtually impossible to record everything. Small details and linguistic nuances were likely never detected and thus our impressions and understandings of situations explained to us are incomplete. Along the same line, our affiliation with CEASPA may have impeded the acquisition of some information depending on people’s perception of the group.

In terms of obtaining a greater understanding from tourists, the methods chosen were also bias and incomplete. The remoteness of our research site, coupled with the infrequency of tourist visits, prevented us from interacting with the tourists on a more regular basis. The formal survey questionnaire was intended to give us access to a larger sample set but in the end proved very limited as only one visitor group completed it. The answers provided in the survey must also be critically analyzed. Since only one version of the survey questionnaire was distributed, it is quite possible that questions were ambiguous and interpreted differently by respondents. Surveys were intentionally anonymous and optional so individuals could feel more comfortable providing a

broader range of comments. Unfortunately, we have no way of knowing how they were interpreting the questions. This too, limits the quality of results received and restricts later analysis and conclusions. Given more time, we could have provided a series of surveys that would have allowed us to test the clarity of questions and design a more useful questionnaire. Choosing to gather subjective and personal data within such limited time greatly restricted our ability to gather data from a large enough sample set in order draw any solid conclusions from findings. The constantly evolving nature of interview encounters was flexible enough to allow us to cover a number of different informants but allowed us little to no direct comparison between the interviews. As stated in the methodology, interviews evolved as we came to better understand what questions to ask and how to ask them. Unfortunately, once we found which questions to ask, our initial respondents had not been asked these questions. Time constraints limited the possibility to return to previous informants and thus not all informants provided input on all the topics covered. Time constraints also prevented us from re-working our survey to incorporate the topics we came to recognize as more relevant issues to the study.

Final Remarks

Personal Butterfly Gardens: An opportunity in education and knowledge sharing with magnificent possibilities.

Throughout our research experience in Achiote we have had the amazing opportunity to observe and experience the learning and knowledge sharing that takes place within the village. This was particularly apparent through the elaborate descriptions informants provided about their natural environment, social history of the town, and their own personal gardens. This preliminary investigation has drawn attention to the fantastic array of possibilities that exist in Achiote and we are hopeful that future investigations can draw on our findings and further contribute to ecological conservation and community enrichment in Achiote.

In recent years, CEASPA projects and workshops have encouraged sustainable garden practices through the use of interactive knowledge sharing opportunities. Personal gardens have been a tremendous success and it appears as though they are achieving unprecedented popularity. We believe that promoting personal butterfly gardens in Achiote can only continue to enhance the knowledge sharing processes that already exist among community members. The success of the children's workshop further confirms that community interest in butterflies is well represented across all demographic cohorts in Achiote.

The creation of a personal butterfly garden is not a difficult task provided there is a readily obtainable source on information or knowledge on native butterflies and their specific feeding and larval host plants. Whereas this information had been previously unavailable to community members, through the creation of a *folleto* and common species posters, the information is now present and, more importantly, tangible. The groundwork has been laid for knowledge about personal butterfly gardens to readily diffuse through the community; promoting conservation and enhancing the Achiote's rich biodiversity.

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APPENDIX

¡Hola Achiote! ¡Mucho Gusto!

Somos estudiantes de la Universidad de McGill en Montreal, Canada.



Vamos a trabajar con CEASPA durante los tres meses siguientes y nos gustaria presentarnos a Ustedes.

Val

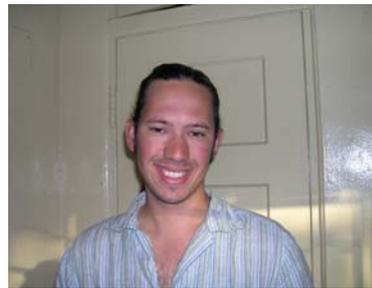


23

Estudiante de geografia
Canadiense

Esperamos con ansia conocerles y aprender mas de las mariposas en su pueblo Achiote.

Juan-Olivier



22

Estudiante de desarrollo internacional
Canadiense

Carolina



22

Estudiante de medio ambiente
Estadounidense



Note: These questions were not always asked. They served as a reference for guiding the semi-structured interactions with the people of the town.

Preguntas para la gente de Achiote sobre los jardines, mariposas y el turismo.
14 de marzo de 2005.

1. Cuál es su ocupacion?
2. Usted mira mariposas en el pueblo?
3. Qué les parecen?
4. Dónde hay más mariposas en el pueblo?
5. Qué le parecía tener un jardín con muchos mariposas?
6. Qué usted piensa en el proyecto de un mariposario / jardín de mariposas?
7. Qué otro tipo de proyecto usted piensa que se podría desarrollar en Achiote?
8. Cuál es algunas cosas positivas de la presencia de turistas en su pueblo?
9. Cuál es algunas cosas negativas de la presencia de turistas en su pueblo?
10. Qué plantas tienen la mayoría de los insectos nocivos a las plantas?
11. Qué hace usted cuando ellos están comiendo o atacándolas?
12. Cuanto tiempo a la semana trabaja en el jardín?
13. Qué tipos de plantas atraen la mariposas en su jardín?
14. Qué hacen para mantener bonitas la plantas de su jardín?

Appendix - Summary of Interviews in Achiote

Interviews done with people from the town

Bellis Villarreal

Note: She lives with her mother. She did not mention a specific professional occupation.

Butterflies

- She likes a garden with a lot of butterflies.
- She thinks a butterfly garden is a good idea.

Personal Garden

- There are more flowers in her garden after the garden contest.
- She works on her garden when she has time.
- No plants in particular are affected by insects; they all are, at times.
- To protect her plants she sprinkles flowers with water and garlic.
- She works on her garden when she has time.
- One kind of plant that particularly attracts butterflies is Flor de Huevos, a white flower.

Vegetables

- She thinks Achiote needs to develop more vegetable gardens like her mom owns.

NANA Benedicta Sosa and Antonio Perez

Note: Her husband works in Colón as a heavy machinery operator and earns a good income.

Butterflies

- She sees a lot of butterflies in the morning
- Seems somewhat interested in learning more about the common butterflies of achiote

Personal Garden

- Won garden contest last year
- She sometimes uses water with lemon but she also buys an insecticide at Melo in Colón.
- On her garden maintenance she spends a bit of time everyday and at times about an hour or more to do more labor intensive work.
- Use tricks from the workshop with Carlos Abriego: coffee peels for compost, sedimentary earth from river banks.
- Cindias attracts butterflies (these are daisy like with a corolla of red petals, but I think they can also be yellow)
- She buys some plants in Colón
- After the garden contest the interest in gardening dropped in the town.
- There is a problem with WATER; there are not enough for people to drink at times during the dry season, so gardens do not get the priority. This could be a concern for a communal garden
- Husband helps in garden maintenance a lot

Vegetable

- Aside from the contest, vegetables are important
- She shares plants/veggies with neighbors

Communal Garden

- And a garden project would be interesting and thinks there would be people to help with it BUT she doesn't think there is anywhere to put it

Tourism

- Tourists spend little time in the town, mostly at or with CEASPA.
- Does not see them much
- Yet she holds a positive opinion of tourists.
- It is possible to do a cultural exchange with them.
- Thinks tourists are good for Achiote but she rarely sees them and didn't have any suggestions for how/why there should be more

Faustina Barco

Note: She works as a nurse in the coregimiento

Butterflies

- When the road was unpaved and the forest was closer to it in the 70s and 80s there were massive amount of butterflies.
- There was less people and no cattle farming which as destroy much coffee plantation that were good to breed butterflies.

Her personal garden

- There are problems with the caterpillars of butterflies people lose in three ways: loss time, lose the seed, lose the time invested, lose money (if plant was bought).
- She often has problems with crickets (grillo?)
- To maintain her flowers pretty she does turn over (couella?) the soil to avoid compaction, use coffee peels, and wood molasses (done by letting some wood soak in water for 15 days and spraying this water on flower, don't know which wood).
- She also sometimes buys a plant treatment from the store Melo in Colón.
- She does the heavy work every 15 days and waters her plants every morning and night, because they are in flower pots.
- Flowers that attracts butterflies: Amistad, Cola de Camaron, Diciembre, guayaba.
- The plants she shares: A rose called Rellena crema de Chagres, one from Nana, Díez de la mañana.
- She shares many plants with a friend of hers in Chagres.
- She feels she didn't win the contest because she didn't have enough medicinal plants in her garden. She has always had a garden.
- The land is not so good, more dramatic for some houses, and made worse by the use of non-native plants.
- Problem with the lack of water.

Vegetables

- Land is so poor that after one harvest of cucumber, the earth got very dry and unproductive
- Two times a week (Tuesday and Friday) a pick-up truck with a loud speaker rolls in the street selling all kinds of vegetables and fruits
- Some people like Faustina buys her vegetables in Colón
- In the 80s and the 90s, many people were working on vegetables but the earth lost its fertility

Tourism

- She has a good relation with tourists
- Tourists are a source of income (especially with home stays, some people stayed with her) and an opportunity to share knowledge and ideas.
- She feels the community accepts tourists.
- Language is a problem in communicating ideas
- She feels tourism will develop more and more there
- What is important during this development is to share the benefits from tourism and not concentrate them in a small group. A good recommendation would be to build a cooperative restaurant in the town where every night a different woman could cook and get paid for it.
- Yet, benefits will probably be spread in the long term.
- Tourists need to stay in town to spend more.

Other information

- What she would like to learn in a workshop on gardening:
 - o recommendation on native plants
 - o knowledge on how to design a garden
 - o the presence of a professional gardener

Mario Moreno

Note: For a living he sells palm fruits on the street to cars that pass by.

Tourism

- He doesn't understand why people come all the way from the US and pay so much money to see birds he sees all the time.
- He doesn't interact with them much
- He feels he doesn't benefit at all from the presence of tourists.
- He would like the benefits to be more spread.
- He thinks that cabins should be built in the community
- He believes CEASPA's work only benefits a few.
- He wishes that CEASPA would provide more opportunities to obtain professional training to provide employment.

Vincente Moreno

Note: He was born in Achiote in the 1950's. His parents were part of the initial wave of settlers and he observes the village change over the years.

Butterflies

- In the 70s and the 80s there were so many butterflies that there were clouds of them on the unpaved road. There were many holes with water in them on that street.
- Maybe the pavement emits too much heat for the butterflies and not enough watering possibilities.

Tourism

- A nice three hours hike could be developed up the mountains in front of the Tucán guaranteeing a nice view of Colón and the locks.

Belsin Vegara (mother of Bellis Villarreal)

Note: She owns a vegetable garden and lives with one of her daughter.

Personal Garden:

- There hasn't been much done since CEASPA's garden initiatives
- She liked the workshop with Carlos for its tricks (use coffee peels), but also because he gave seeds away for free.
- She waters her garden in the late afternoon.
- To maintain her garden rich she uses earth from a lot close to Misella, use cow manure and earth from some the river banks in the mountain.
- She doesn't like to do compost and feel she doesn't need it.

Vegetables

- What she has in her garden: Chives, cucumber, carrots, celery, tomatoes
- She sells her vegetables to people in town (e.g. 15 cents for a bunch of chives)
- There is not much barter exchange in vegetables.
- Felipe said that other town have this sort of exchange. (? Not sure of note)
- She likes growing vegetable because it is useful while cooking

Belisario Villareal (coregidor del coregimiento de Achiote)

Land use

- There are no communal land belonging to Achiote
- There are however national land that could be available upon requests
- The "casa comunal" is not a community place since it is own by the ex-representante and is being abandoned now.
- Most land is being requested or seized to build houses
- Most houses have a legal title to their land, but many don't have property rights
 - o It is a very costly process, up to 1500\$.
- Churches are located on national land except one (cuadrangular). (For free?)
- There are a few absentee landlords that holds significant amount of pasture land for cows such as Leonardo Borrás and a Colombian business man. A member of the legislative assembly also owns a lot of land in Achiote but lives most of the time in the capital.
- Parks
 - o Achiote doesn't have a park in the town
 - o Town squares are found, in the Chagres District, in the corregimientos of :
 - Pina, Chagres, Palme Bellas, Salud, Guabo

Obtaining new land

- For National land to be used, the "junta comunal", the equivalent of a municipal government, according to article 248 of the Panamanian law must ask the relevant office to obtain land. The "representante" is the medium of communication between the town people and the decision makers in Panama City.
- Baseball courts
 - o The one around Misella is a national land that the community through the "junta comunal" asked the Instituto Nacional de Deportes (INDE) to make available for use.
 - o The one close to the Catholic Church was given by the community by a wealthy individual, José de la Cruz Navarro.
- "El Sendero Ecológico el Trogon"
 - o CEASPA asked ANAM to obtain some land and make it available for conservation effort

- If the government wants to use a piece of land of someone without property rights, it must pay the value of the services found on the land (fruit tree, etc.)

Politics

- The corregimiento are usually comprised of smaller units called regimientos. The Coregimientos of Achioté are made out of the towns Achioté, Cano Quebrado and La Tagua.
- Members of the junta communal
 - o Manual Hayden
 - o Aura Justiniani
 - o José del Carmén Domínguez
 - o Ancelmo Mosquera
 - o Daniel Moreno
- Representante: Sergio Sosa
 - o The Representante is only in Achioté during the weekends, he works in the Colon Free Zone.
- Vice-Representante: Jacob Gonzalez
- The representant for Costa Arriba, Costa Abajo is Nelson Jackson, he lives in Portobello.
- The corregidor administers the payments to the government such as taxes on commercial buildings, taxes on killing cow (5.5\$ for ♂, and 6\$ for ♀) and cow transport tax (1\$/cow)

Tourism

- The fact that Los Rapaces was created shows there is a real interest in tourism.
- The community was built by strangers that congregate together because of available land, so there is a significant open mindedness.
- Benefits, it is normal, will first benefit a smaller group, but will eventually expand to the rest of the town.
- Exchanges between tourists and the community are important. Win-win situation
- Achioté could benefit from a workshop about craft making to help gather, save and propagate the local knowledge.

Manuel Hayden

Personal Garden

- Carlos Vigíl, who used to work in Achioté for CEASPA, organized and promoted the garden contest
- How the promotion was done:
 - o Conversation to spread the idea
 - o Suggest that people could sell flowers to earn income
 - o Collaborate with Nicolaza that was in charge of the vivero and could provide the seeds (?)
- Now that Carlos is gone, there is a lot of apathy, since the motivation he created has not been renewed but morale dwindles down.
- Probably won't happen this year because it was Carlos' idea and he is gone.

Tourism

- There has been suggestion by the Café y Ambiente group to promote the town beautification by the creation of flowering "orillas", that is the sides of the road.
- In Chiriquí there is some path with flowers on the side so it inspired them.
- The discussion of a Mariposario was initiated by Carlos Vigíl who thought of adding this to the bird watching movement.

- From all the kinds of tourism in the market, he thinks of form of it that is low in impact and respectful is a good kind.
- Lots of butterflies in the 70's and 80's.
- He has personally hosted some foreigners before

Town Participation

- Organization is the problem in a communal activity
- People seem not to like it.
- Self-gestion is low in Achioté
- Café and Ambiente is decreasing more and more in energy.
 - o Lack of communal action in dealing with the coffee middle men who manipulated people and end up paying them less.

Achioté's history

- Green Gold: Bananas (1936-1970), large export market
- Red Gold: Coffee, large export market now suffering from oversupply worldwide depressing the prices.
- "Brown Gold": Cattle farming, create lots of deforestation, is not very productive and does provide with any agricultural products

Vigiles Ortega and Margarita Castillo

Note: This family use to live in the mountains far away from town, but they now live in Achioté to make it easier for the kids to go to school.

Personal Garden

- they did not participate in the garden contest because their land is too hard to grow anything

Tourism

- People do not like to do craft
- It takes 15 days to make a hat, if you carry your normal activities and it sells for (only) 10\$, or 40\$ if it is with special design.

Monday March 13, 2005

Sra. Nicolasa

Note: She has been very involved with CEASPA working on the Vivero El Macano and other projects.

Butterflies

- Sees most butterflies in the morning, afternoon there are not many
- During the wet season, when puddling occurs in her garden she has a lot of butterflies

Personal Garden

- Garden maintenance is a lot of work, she waters 2 times a day but weeding/cleaning maintenance is by far the most time consuming
- She doesn't use any chemicals on her garden, when leaves are being eaten (this is the biggest problem along with a white mold that only occurs on the impaciensis when its really humid) she uses a soap water mixture and washes the leaves the quantity in mix etc depends on the

extensiveness of the problem, uses a wash cloth on affected leaves so as not to damage the other healthy leaves

- These are methods taught by Carlos Abrego during the fall lecture, she uses these methods in her vegetable garden and flower garden
- For the community in general, gardens are not important, they are much more of a personal interest, they become most popular during the garden competition in October (16 different homes participated last year) for her the main important aspect of a good garden are aesthetic and horticulture (hortoleza)

Tourism

- Interested in increasing tourist relations because there really isn't much at all at this time, right now she believes the people of Achiote are not equipped to deal with the exchange of lifestyles/culture, but slowly she thinks the town would benefit from sharing their culture with tourists and vice versa, it would help them to be more comfortable outside Achiote
- She herself has received tourists, including us, into her home
- The most difficult aspect of tourist-Achiote interactions is the language barrier, it is frustrating b/c so limited understanding of one another
- For any gardening initiative she thinks it is important to teach the children as well because when they don't know about the importance of say, butterflies or birds, they often want to damage them unknowingly (she has taught her children which plants not to touch and how to be gentle with her garden),
- She also thinks it is important to teach the children about the importance of conservation and thinks they are doing this now in school
- development in achiote should focus on a restaurant because at this time there is no place for people to stay or sit for awhile, in a restaurant the people can share the work, for example some people can cook from home, Achiote has a lot of good cooks and people could help on the days when they have the most time available
- other projects could include a park or a field for sports, she thinks there isn't much for the kids to do right now so the community should focus on them too (so they stay out of trouble)

Vegetables

- vegetables are quite difficult to obtain in Achiote so she grows them in her garden (apio, pimenton, cebollina, ahi picante, pepinos)
- informal network of selling to neighbors when you have a enough of something and they ask to buy your extra

Communal Garden

- If there were a more communal garden she thinks some people would visit but it really depends on the person
- As for now she doesn't think there is any available space for a public/community garden (school would be good for education/scholastic reasons but there isn't a place there)

Isabel

Butterflies

- When it rains a lot she has many more butterflies because there are standing water puddles

Personal Garden

- She puts marigolds to detract insects because they don't like the smell/taste
- She learned methods from garden charla (with grupo de jardines last july) when they offered recommendations for cases of insects and disease in plants

- She has to water everyday and changes the dirt in her beds between plantings in order to maintain health of plants, usually uses dirt from the ground and also coffee shavings from piladora (sometimes dirt from close to stream or river because it has minerals)

Communal Garden

- She thinks both tourists and people of Achiote would be interested in visiting a butterfly garden but there is no community group to construct/manage it,
- it really isn't much of a well known interest and it would be hard for people to work in both their own personal gardens as well as another garden
- She thinks that a butterfly garden could happen but she can't think of any space available to do so

Vegetables

- Vegetables are very important in her garden, pepino apio tomate, cebollina, for her family to eat
- She often has an interchange of both vegetable plants and flowers with her friends
- Otherwise she has to purchase them in Colón in the markets

Tourism

- Bringing tourists is good because it would help promote developments/improvements in achiote (basically meaning that once the ball gets rolling things could build on prior projects, making it easier to see positive results)
- Achiote should construct a small hotel/b&b type place where people could stay overnight

Johnny

Butterflies

- Butterflies come all the time to her garden, no specific time

Personal Garden

- She maintains the soil with fertilizer (river bed soil and café peels, garbage) which she puts in all areas not just veggies
- Other major work in garden includes pest control but she wasn't very clear on the methods she uses except that she pinches the leaves off

Vegetables

- Vegetables in her garden are small right now so she is not benefiting much from them

Communal Garden

- If there was a garden some people would be interested, she would want to learn more about the butterfly species and the flowers that attract them so her own garden could have more
- Not sure if people would help

Tourism

- She thinks more tourist relations would be good, can share language and learn to speak English
- Development project with birds because they are already popular in Achiote, but any project would have to be initiated by CEASPA because she doesn't think the people of Achiote have the ability to do it,

Cecilia (sister of Daniel Moreno, large family in Achiote)

Note: Her husband (Michael) is a bird guide and is currently working up at the Mirador

Personal Garden

- She always has to water her garden in order to maintain,
- In her garden impatiens are the most difficult to maintain because of the mold, largest pest problem is hormigas

Communal Garden

- She thinks people would like a butterfly garden and would help
- Water is a big problem in Achiote, sometimes it gets so bad that they have to carry it to the house in tanks
- For development, a park in Achiote would be a good idea because it could benefit both visitors and the people, you could put a garden inside the park with places to sit etc
- She can't think of a place where a park should go because most land is private and she doesn't know whether government land is a possibility

Tourism

- He has a good relationship with tourists because he sees them more, for her it is different because they just pass right through without stopping, always say hello and smile but nothing else

Other information

- She has a decent size piece of land for a garden that she had sent a proposal to the eco-tourism group about selling for development of a tourist attraction, maybe a cabana because it has a beautiful view, it is flat and 'terra firme' composed of land that was moved and deposited there during highway construction, and in the afternoon the light is beautiful, she never received any response to her proposal
- With a turning and fertilizer addition she thinks the land would be really good for gardening

Sarah

Personal Gardens

- When plants start flowering is when she sees the most butterflies in her gardens
- Orange flower plants attract the most butterflies
- Hormigas are her biggest insect problem and she deals with it using soap/water (learned the practice from a friend/neighbor, her garden is chemical free)
- Hongo, mata blanca is also a big problem for some of her plants
- She attended the charla by Carlos Abrigo but doesn't remember much from the talk, she didn't implement many of his suggestions because her gardens were already established and quite successful and it takes a lot of work to change soil etc. she really didn't think it necessary

Water

- This is an issue. They need tanks at times because the aqueduct gets empty and the pipes don't flow, when this happens she still waters the garden because they have made a small well (puso) so plants won't die

Vegetables

- Right now no vegetables in her garden, had difficulty growing this year, planted the seeds but to no avail

Communal Garden

- She thinks a butterfly garden would be good for Achiote because it would be a place to look at the plants that are there and see which ones she doesn't have and then they could share/interchange so more butterflies would be attracted to her personal garden
- Whether it was a park or a butterfly garden, she doesn't know where it would go because there isn't land or space free that she knows of, but she also said she doesn't walk through town much so she wouldn't see or know such things
- She also doesn't think that people have time to help now with a butterfly garden, there are other issues that are more important to them
- She might charla on butterflies and gardens but doesn't know for sure, but she would definitely want a pamphlet or foletto and thinks she would use it as well

Tourism

- Tourists just pass through on the road, she never sees them and they really don't affect her. Nevertheless, she feels it is important to have tourists come, to see Achiote and spend time here
- A good development project would be an 'ecological park', because people already come to achiote for ecological reasons like the trees and bird diversity

Rosita

Butterflies

- She doesn't see many butterflies in her garden

Personal Garden

- Hongo is her major problem, doesn't have many issues with hormigas
- Maintains/pest control using water/soap method she learned at the charla,
- She took part of the garden contest
- Sun is really strong and makes it even harder to maintain garden so she has let hers get smaller
- Currently the plants in her garden are either shared or purchased in Colon
- Water
 - o Water is a big deal for her house too, nevertheless she Always waters the garden, everyday it needs it

Vegetables

- She doesn't have vegetables because they are too much work to take care of (plant from seed and take much care etc)

Communal Garden

- She doesn't know if tourists would want to visit a butterfly garden but the people from Achiote would come so they could see the plants they don't have and bring them to their garden
- She thinks people would help with maintenance if it was set up in a way that made it possible to do so

Tourism

- For a development project she thinks it should include something similar to the vivero because people could contribute their share and also benefit from the sharing/interchange of plants (veggies and meds), work load was shared as well, they had certain days for watering and looking after plants so it was never too much for one person
- Horticulture/flowers and medical plants would make it good for everyone

Aureliano Borbua

Note: He lives by himself in a modest wooden shack on poles and work on a farm.

Personal Garden

- Women like it a lot and like it more after the contest.

Communal Garden

- No site for it because of the topography: if it is too low there will be a lot of water in the rainy season.
- It could be a good place to have celebration such as during the Holy Week.
- If there was one people would go
- A land would need a lot of work such as 'rellenacion' to fill it with earth to protect it against the rains.
- Some people might have time to work only on their garden

Tourism

- There was a lot of tourism when the soldiers where here, they came all the time to Pina with their families on Sundays.
- Tourism doesn't bother, there is much more in Colon
- He read in the newspaper that the tourism industry in Costa Rica is very successful and he thinks it would be a good thing if it came to Panama.
- The problem is that there is no hotel

Michael Moreno

Note: He is a bird watching guides who works with many groups of foreign tourists from the Hotel Sierra Rellona(?), Works about 15 to 18 days a month

Butterflies

- Birds watchers he met are fanatic of blue morpho and owl butterfly. He thinks they might be interested in a place with lots of butterflies.

Communal Garden

- Foreigners already likes the town because there is a lot of flowers and it is quiet, simple
- People would have time for such a garden because many people in town are really concerned about conservation
- He would like such a garden to be there
- He thinks it's a good idea because he would like to see his pueblo develop.

Tourism

- Tourism in the area is a success
- People have a good image of his work
- CEASPA was good to help start the wave, it open a fantastic window
- There is about 5% increase per year
- There aren't more tourists because there is no place for them to stay, they need a good room, good food and good attention. Need something modest
- One problem in bird watching is that the Canopy Tower sends too many groups at one spot and their careless behaviors affects the wildlife.

- For birdwatchers to stop, maybe a picnic area would be nice, maybe it should be situated around the mini-super.
- Some people once on the site actually wants to give donations to some projects but don't really know where to address their gift.
- Tourism development brings in jobs, business.

Maxima Borbua

Note: A mother of 8 children, she now operates a small tienda next to her house and spends time with her husband.

Vegetables

- She gets them from Colon or the vegetable truck

Communal Garden

- There is no space because all the land is already occupied or flooded
- She likes to see all the flowers around after the contest
- Before the gardens weren't formal, now they are more ordered.
- It is possible to build a communal garden in town nonetheless.

Tourism

- After CEASPA there is more tourism
- She hosted people in her house twice and liked it
- She doesn't know why there isn't much tourism here

Other info

- The largest families ranked by size in the town of Achiote are Moreno, Rivas, Villareal, Sosa, Borbua. Other families are smaller

Regino Estrada and Merciede Augusto Herrera Cordoba (a.k.a. Vergada)

Note: Regino lives in the wooden house (rancho) next to Felipe's house. He is retired. His friend Vergada was over for a visit on his way to the store.

Butterflies

- He likes to see butterflies and all their color

Communal Garden

- It's a good idea
- There would be a need for a park, but there is no land.
- **The town is not concentrated like Chagres. It is difficult to site a park when there isn't a center because people who live far away might not go.**

Tourism

- It changes things. It creates economic activity such as when people cook for them through CEASPA or when they buy food at a tienda.
- More tourism is good, because it brings more jobs

- Some students stayed at Vergada's place and he liked it. He rents his daughter room (who is in Colon) for 4\$ per night.
- A bit of development is better than nothing
- **Tourism also can lead to more crime such as theft.** He protected a girls camera against theft when the group was there by hiding it in her room since he knew people were looking at it.
 - Not every body is nice, there are some problem with young people. They have damaged the phone around the Cantina and many of them are drunks.
- Tourism is in its beginning
- Nobody went to the restaurant

Esther Sosa

Note: She is the wife of the vice-representante who lives in a large house in the town.

Personal Garden

- She doesn't have one yet, because she has been focusing on the construction of her house (which finished a year ago)
- This year she has plans to plant flowers in bucket as a start because it's simpler
- When she'll start her garden she'll ask her sister Nana Sosa
- If someone likes plants and flowers enough they can take a bit of time to work on their garden
 - She feels she has enough time

Communal Garden

- It could be done, but where would it be sited?
- She says the Casa Communal belongs to the junta communal (*conflict with two previous answers*)
- The junta communal is considering fixing it.
- Maybe it could be extended to create a park
- Maybe would have the time, she would have some to help
- Because the town is spread out, it could be difficult for older people to get there: they can't walk much or ride a bike and they don't most people don't own a car.
- Such garden would require money to build material as well

Eutmia Dias

Note: She is 77 years old and the owner of the Cantina. She is the mother of 8 kids and takes care of a grand-children who is now an orphan. She has three daughters who got married to gringos and now live in Florida.

Butterflies

- She likes butterflies and hummingbirds as well. Both come to her garden.

Personal Garden

- She has a nice garden in the back that is not "formal", but rather flowers into pots.
- She loves gardening
- She does it one day, once in a while, not that much time, busy cleaning
- She often buys earth in Colon and flowers too

- Did not participate in the contest because nobody told her. She thinks people did not tell her because she is too old.

Communal Garden

- Good idea
- But she is old and sometimes sick so she wouldn't be able to get there
- Younger people might be able to get there
- If she could get to the communal garden, she is concerned that she wouldn't have time for her own garden.

Tourism

- She doesn't see much tourists
- But she like to speak with these people
- **She is 'people' too!**
- People like tourists because they are nice and they are a source of income
- After CEASPA there is more tourists

Other info

- People in Achote work in small groups, not as a united group.

José de la Cruz

Note: He is also a birdwatching guide but does not get some much employment. He is hoping to get a job at Gamboa Resort as a security guard or a driver to pay for the schooling of his son.

Butterflies

- For him, bird watchers, like to see birds, nothing else.

Personal Garden

- Him and his wife work on the garden together
- He did not participate because he didn't feel like it.

Communal Garden

- Some people don't like to work into groups and would rather do their own gardens
- He feel he would not have time to help out in a communal garden

Tourism

- He gets business when people call him on his cell phone
- He is a living example of language barrier. Because he can not speak English he does not get a lot of call from hotels.
- There is no place to stay and not enough marketing in the town

Other info

- Not enough house for Cable and Wireless to install public phone, need at least 300 houses, Achote has around 100.

José de la Cruz Navarro

Note: He his retired from the US army where he worked in the Airbone Special Forces Unit. He worked in Fort Sherman and was an instructor during the Jungle Warfare training. He now has US citizenship but prefer to stay retired in Panama. He his 44 years old.

Butterflies

- There are a lot of butterflies around their house
- He finds them very pretty, it is a kind of therapy for him

Personal Garden

- He and his wife have a significant garden
- They did not know about the garden contest, if not they would have participated
- He brings lots of seed every time he comes back from the US.
- Doesn't have a lot of time to work on the garden because he travels a lot

Communal Garden

- Would be an interesting idea
- Needs a good location, problem of dispersed houses

Tourism

- There is not a lot of tourism
 - There are no special attraction in the town.
 - Nobody knows about the town
- He thinks the temperature is good here
- When there was the military basis, there was much more tourism, lots of people went to the beach in Pina, in Gatun there was a place to swim as well.
- Since the Americans are gone there is more danger for people and for tourists. There are some traps on the road where people are robbed.

Other info

- When there is a project, people get really excited (animo?), but then lose interests quickly
- He would like to cooperate, but alone he can't do much
- He feels he could even help financially
- People need to work together more

Interviews done with people from outside the community

Carlos Abrego

Note: He gave a workshop for the garden contest on organic control of pests. He also discussed the use of compost and seed beds for gardens.

Communal garden

- Problem with the topography, in the lowest and flattest part of town, where it would be easiest to plant, there is seasonal flooding. In the hilly part of town, the soil is very fragile and there cannot be deforestation. It leaves little place then for a communal garden since all the flat strip of land where the road is, between the fragile hills and the flooded plains are occupied by houses.

Personal Garden

- Before the workshop some people already knew about organic practices. Now a lot of people participated in the workshop and learned it, but many seem to have forgotten it now.
- 14 people took part in the garden contest in the end.
- The contest idea came from the training CEASPA gave to coffee producers to promote shade-grown coffee by the program *Café Amigable y Aves??*. The organizers thought that garden could also attract birds, especially hummingbirds. There was no focus on butterfly attraction at the time.
- Some tricks he gave
 - Bocashi: a Japanese recipe for compost which uses fermentation to accelerate the process.
 - Pest repellents:
 - water with macerated garlic, onions and pepper
 - planting tobacco, except around tomatoes and pimentos
 -
 - Growth stimulants from macerating 'ortie' or 'ortigua' in water.
 - How to build seed beds
 - Gave away some plants

Ryan Filchum (ecotourism tour operator)

Note: His company organizes tour promoting conservation, so groups meet with the relevant organizations, visit conservation projects and also have fun.

Butterfly garden

- He thinks that a butterfly garden in itself wouldn't be enough to attract people to Achiote
- Butterflies works well to attract butterflies in Mexico where the Monarchs migrate
- It might have a potential if it is a full scale enterprise that would include a farm and sustainably produced framed butterflies
- He gave the example of Honduras where one American started 4 butterfly farms and they are hugely successful
- These centers give an important emphasis on environmental education
- A butterfly garden would be a good product to draw people in town and could be very effective if combined with a restaurant.
- Again, selling raised butterflies in frame is an excellent idea.
- An emphasis between birds, plants, butterflies and forest, if well promoted, could attract more tour groups.

April Manganiello, Derek Brown (Tourists who visited Achiote)

Tourism

- Basically, birders don't come looking to see butterflies but if there was a garden to visit during their 'downtime' ie. After 11 when birds aren't out as much, and also a place to eat lunch they would definitely make a plan to visit it
- It would have to be mentioned by the tour they were with as an option, otherwise they wouldn't really know about it, even it were just advertised in a small write up that could bring tourists around

General

- A butterfly garden for tourist (mariposario de exhibicion) needs to be much prettier than the butterfly farm. It must include ornamental plants and weed control.
- There are no international exportation of butterfly from Panama.
- There are no other mariposario in Panama
- The hours that butterfly fly between the morning and around 1 pm.
- In the garden there are about 50 species and around 500 individual in the garden.
- He acts as a consultant to help start butterflies gardens in Costa Rica. He also helped start two ens
- The most popular butterflies are the Morpho and the Owl butterfly

Planning

- They key to a successful butterfly garden is the structure and the organization of the plants
- An architect did the plans of the structure and engineers build it at the same time as the hotel.
- When Mr. Arollo arrived, only the main structure was up, so he had to request the lab and design the whole garden with much attention to floral details and how the paths would be designed
- Everytime one wants to build a butterfly garden, one needs to do a study on the area in which the garden will be situated.
- The butterfly-plant relationship need to be very well understood to inform how the garden will be design. For example, an host plant should not be in the middle of the garden, but on the side, so the butterfly will be more willing to put its egg there. Another example is that plant for the morpho functions best in the corner
- He got the plants from the surrounding land
- Needs quite a bit knowledge to grow the larvae but also to collect the plants on which they feed and the eggs of some butterflies who require protection against parasites.
- .

Operation

- You need a fixed person to take care of the operations of the mariposario
- In the butterfly garden it is important to provide food for all types of feeding habits. For examples, there needs to be the appropriate nectar plants for nectar feeders, and there needs to be fermented rotting fruits with beer or rum for those who feed on that. There is also the need to have water where butterflies can come and drink.
- Passiflora, is an important plant for heliconius butterfly
- He uses a trap to catch butterflies that can be more
- Operation costs. Not cheap: he gets paid 50\$ per day and spend about a week there 8 times a year. There are two people that work in all the ecological exhibits of the site for the maintenance of the grounds and the plants. There is also the need to have guides, who at Gamboa are separated from the maintenance staff.

Raising Larvae

- The production is internally controlled: they don't buy any larvae
- In the production facility they put the eggs in plastic where the caterpillars can grow and eat the leaves of the fresh branches inside the box. It is better when the it is made out of mesh, but the advantages of a plastic boxes is that the plant can better do photosynthesis.
- To raise larvae, they collect the eggs from the host plants and put them in the laboratory where they raise them.
- Caterpillars feed when the temperature is low

Building

- The minimum ground around for a well working mariposario is 500m² up to 1000m², the one at Gamboa is about 300m², which is small
- One of their structural problems is the size of the mesh around the structure. The mesh is too small and does not let enough light enter the inside of the structure. Since butterflies are active in bright light their behaviour can be altered.
- 60% of the light should go through a mesh to optimize its efficiency.
- The best roof structure is flat or it can be an arc, but of a very small inclination. This needs to be in place to avoid the mariposario to end up being a trap where the butterflies would be stuck up there.

Appendix: Survey Questionnaire

Good day! This questionnaire is brought to you by three students from McGill University (Montreal, Canada). We are in Panama for four months for a field study semester. Part of our work is an internship which takes place here, in Achiote. We are conducting a feasibility study on a butterfly attraction that could be located in Achiote. Your input is very valuable to us and to make this project a possibility.

What is the purpose of your visit today?

- (a) birdwatching
- (b) visit of the town
- (c) Los Rapaces package
- (d) Other: _____

What is your first impression of the town?

How do you feel in the town?

- (a) I feel comfortable
- (b) I feel somewhat comfortable
- (c) I don't feel comfortable
- (d) Other: _____
- (e) Comments:

According to your travel experience, what do you think this town would need to be more attractive?

Have you been to a butterfly garden before?

- (a) Yes
- (b) No

Would a visit to an open air butterfly garden be of interest to you today?

- (a) Yes
- (b) No
- (c) Maybe
 - a. Why?

Appendix– Tour operators going to Achote

Tour Operators	Contact Information
Ancon Expeditions of Panama	Street Address: Calle Elvira Mendez, Edif. El Dorado #3, Bella Vista, Panamá. Mailing Address: P.O.Box 0832-1509 WTC, Panamá, Rep. de Panamá E-mail: info@anconexpeditions.com Tels: 011(507) 269-9415 Fax: 011(507) 264-3713 http://www.anconexpeditions.com/
Gamboa Tours	Telephone: (507)269-1262, (507)269-3375, (507)269-3391 Toll Free: 1 800 908 1980, Fax: (507)269-1500 P.O. Box: 7338, Zona 5, Panama, Republica de Panama Email: tours@gamboaresort.com Web: http://www.gamboatours.com
Exotic Birding	http://www.exoticbirding.com/panama-schedule.html (1-877-247-3371), info@exoticbirding.com
Sacred Earth Tours	http://www.sacredearth.com/travel_info/features/ecocircuitos/Bridwatching1.htm
Tropical Nature Travel	http://tropicalnaturetravel.com/travel/panama/birdingpanama.shtml travel@tropicalnaturetravel.com Elizabeth Sanders 1-877-888-1770, Toll call: (352) 376-3377, Fax: (352) 376-3346 Eliana Espejo 1-877-827-8350, Toll call: (919) 380-0966, Fax: (919) 380-0966 Tropical Nature Travel: PO Box 5276, Gainesville, FL 32627-5276
Birdtreks	Robert M. Schutsky 115 Peach Bottom Village Peach Bottom, PA 17563-9716 Phone: 717-548-3303, Fax: 717-548-3327, e-mail: info@birdtreks.com
EcoCircuitos Panama	Hotel Country Inn & Suites Amador, Causeway Panama Telephone:(507) 314-1586 Fax:(708) 810-9350 www.ecocircuitos.com , Contact email: annie@ecocircuitos.com

Tourist Email Communication

Hello,

My name is Caroline Neary and I have just come across your website while researching tours in Panama. I am writing because I am very interested in learning more about your bird tours to Achote Road. I am currently studying in Panama with the Smithsonian Tropical Research Institute and working with the organization CEASPA in Achote in an effort to learn more about ecotourism and the possibility of developing a butterfly attraction for the community and tourists in the future. We have encountered precious few tourists during our stay in Achote and I was hoping to learn more about the general impression your tour groups have of this area and more specifically, if there could potentially be any tourist interest in a butterfly attraction as well. I know you are probably very busy but any feedback would be incredibly useful for our investigation. I would be more than happy to call your company if there is any possibility we could discuss some of these questions over the phone. Thank you very much for your time. I look forward to hearing from you at your earliest convenience.

Thanks Again,
Caroline Neary

Appendix – School Workshop

On April 8, 2005, a butterfly education workshop was conducted at the primary school in Achiote. Forty second and third grade students attended. The children were very attentive and appeared to be enjoying themselves thoroughly. Our own personal experience was also tremendously positive. We are hopeful that future butterfly education workshops will be conducted and have provided a description below with instructions for how to lead such a workshop.

Material needed:

- Forty cut-out paper outline provided at www.eduplace.com (included)
- 5 boxes of colored crayons
- 3 bottles of liquid white glue
- 3 packages of 5 containers of colored glitter
- 1 poster with the common butterflies of Achiote
- 1 poster explaining the lifecycle of a butterfly
- 1 video on the lifecycle of butterflies
- 3 large plastic bags
- Forty wooden clothes pins

Workshop Program

Part 1 – Video – 15 minutes

First, a video on the life cycle of butterflies was presented. The video is owned by CEASPA and was provided from the Butterfly Farm in Costa Rica. The school has a television but no VCR, thus it is important to bring one.

Part 2 – Posters – 5 minutes

We then presented the classroom with the two separate posters we had made.

Part 3 – Crafts – 30 minutes

Children were then given a paper butterfly cut-out and crayons to share. They were encouraged to decorate the butterfly similar to their favorite Achiote butterfly. While they were coloring, we had established three stations with a black plastic bag on the floor with glitter and glue. Once children had finished coloring, they could come and sprinkle glitter on the strips of glue we applied to the butterfly for them. Finally, a wooden clothes-pin was glued to the backside of the butterfly so students hang them where they pleased once they dried.

OTHER REFERENCE AND CONTACT RESOURCES

Appendix– Contact and Reference List

Name	Contact Information	Qualifications
Daniel Holness	226-6602 naturaleza@sanlorenzo.org.pa	CEASPA, supervisor for McGill 2005 internship
Roberto Ibanez	ibanezr@si.edu 650-6544	McGill Supervisor
Rafael Samudio	samudior@si.edu 222-3934	McGill Supervisor
Charlotte Elton	226-6602 coord@sanlorenzo.org.pa saranela@orbi.net	CEASPA
Pedro Cedeno	226-6602 viipedro7@yahoo.com	CEASPA
Aris Delgado	589-2122	Wrote a thesis on the development of ecotourism in Achioté (#1300 in CEASPA's document center, Achioté)
Jose Loaiza	probocis24@hotmail.com , lacinio06@hotmail.com 623-0861	Estudiante de biología, UP Santiago
Annette Aiello	aielloa@si.edu 507 212-8022	STRI Staff Scientist
Anayansi Valderrama	anyvald@hotmail.com , valderramaa@tivoli.si.edu	STRI fellowship research
Robert B. Srygley	bob.srygley@zoo.ox.ac.uk	STRI/BCI
Roberto A. Cambra T.	rcambra@ancon.up.ac.pa	Universidad de Panama, Museo de Invertebrados G.B. Fairchild
Jesus Mavarez	mavarezj@naos.si.edu	STRI research student
Icela Diaz	277-4229	UNIPAM, mariposas en Colon
Ricardo Mallarino	212-8816, 212 8834, mallarinator@si.edu	STRI researcher
Jaret C. Daniels	McGuire Center for Lepidoptera and Biodiversity Florida Museum of Natural History University of Florida SW 34 th Street and Hull Road Gainesville, FL 32611 352-392-5894 352-316-0113 jdaniels@flmnh.ufl.edu	Assistant director for research at Center, very interested in discussing the topic of butterfly conservation in Panama
Marianne Akers	Contact reference: Dr. Joseph Wright (STRI) (507)212-8132	STRI Plant Image Database collaborator
Henry Stockwell	(507) 212-8000	STRI research associates on insect/plant relationships
Frandar Arroyo	Cel: (506)302-4459 (Costa Rica) Cel2: (507)680-5760 (Panama)	Technician in Lepidoptera. Technical advisor to the Gamboa Rainforest Resort

	franderarroyo@yahoo.es	Butterfly Garden.
Manuela McDonough	ammcdono@hotmail.com 595-9373	Peace Corps Volunteer, Escobal (Until August 2005)
Ryan Fychum	ryan@emeraldplanet.com 888-883-0736	Ecotourism operator
Felipe	Achiote	President of Los Rapaces.
Manuel Hayden	Achiote	Productor de café, El Suspiro del Valle
Julian de La Cruz	Achiote	Bird Watching guide
Micela Madrid	Achiote	School director
Belisario Villarreal	Achiote	Corregidor de Achiote
Jacobo Gonzalez	Achiote	Representante de Achiote
Daniel Moreno	Achiote	Vecino del Centro de Tucan
Michael Castro	Achiote	Bird Watching guide

Appendix – Web Resources

Butterfly Organization	Description of the Project / Resource Available	Web Address
Case Study in Butterfly Gardens / Farms		
The Costa Rica Butterfly Farm	This butterfly farm is located in Costa Rica. It is both a tourist attraction and a production facility for butterfly pupae. They offer a 2 hour-long tour and are very successful.	http://www.butterflyfarm.co.cr/
El Bosque Nuevo	This operation is a butterfly farm concerned with teaching the local residents about butterflies in Costa Rica. They offer a price list of pupae.	http://www.elbosquenuevo.org/butterflies/ El Bosque Nuevo S.A., San Jose, Costa Rica, Phone: (506) 382-3843, E-mail: info@elbosquenuevo.org Mailing address: El Bosque Nuevo, P.O. Box 997471, Miami, FL 33299
Indonesian Communal Butterfly Farm	This site has a description of problems with community monitoring.	http://www.worldwildlife.org/bsp/bcn/projects/irianjaya97_fact.htm
Project Amazonas	They are seeking to establish a butterfly farm, along many other projects they are working on.	http://www.projectamazonas.com/subpages/communitydevelopment/Sustainable%20Dev.htm
Spirogyra Butterfly garden	In downtown San Jose, they operate a butterfly garden-park where butterfly are in the open-air. They also support initiatives to capacitate local campesino group to grow the butterfly for export.	http://www.infocostarica.com/butterfly/index.htm
Kipepeo Butterfly Project	Set up in Kenya in the buffer zone of a national park, this butterfly farm is involving the community in its operation. They obtain 50000\$ from	http://kipepeo.org/fact-sheet.htm

	UNDP Global Environment Facility.	
Penang Butterfly Farm	Located on an island in Malaysia, this is one of the first butterfly farm in the world opened in 1986. They specialize in tourism and in breeding for export. They don't seem well integrated in the community in which they operate.	http://www.butterfly-insect.com/butterfly-insect/index.html
Smithsonian butterfly garden	A museum which presents four habitats: wetland, meadow, wood's edge and urban garden. Adjunct to the National Museum of Natural History.	http://www.gardens.si.edu/horticulture/gardens/nmnh/butterfly.html
Mariposario Peten - Guatemala	A request for support was presented by Fundación Naturaleza para la Vida, a committed local conservation organization, to develop a breeding center for tropical butterflies produced for exportation, education, and as a reference for local fauna. The funds were used to purchase building supplies for a butterfly farm.	http://www.rainforest-alliance.org/programs/cce/recipients.html
The Butterfly Farm in St. Martin	This commercial butterfly was build in 1994 in the Carribbean island of St-Martin/St-Maarten. They are also expanding into other island. The link here provides a list of butterfly conservatories in US.	http://www.thebutterflyfarm.com/usa_public_butterfly_gardens.htm
Educational Resources		

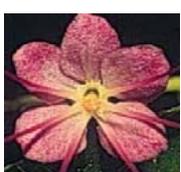
The Butterfly Learning Center	An educational resource created by the Butterfly House & Education Center of the Missouri Botanical Garden.	http://www.butterflyschool.org/
International Association of Butterfly Exhibitions	Members of this association are found all around the world. Click on the second link for a complete list of their members.	http://www.butterflyexhibitions.org/ http://www.butterflyexhibitions.org/memberfacilities.htm
Enchanted Learning	Butterfly education website	http://www.enchantedlearning.com/themes/insects.shtml
Education Place	Example of one activity to be done in class	http://www.eduplace.com/activity/butterfly.html
Dea's Crafty Creations	Arts and Crafts activities	http://www.dcrafts.com/springarts.htm
Technical Resources		
Butterfly Gardening and Conservation	Information on biology of butterflies	http://www.butterflygardeningandconservation.com/articles/intro.php
The Butterfly Site.com	Every resources possible on butterflies	http://www.thebutterflysite.com/gardening.shtml
42 explore (thematic pathfinders for all ages)	All about butterflies	http://www.42explore.com/butter.htm
Butterfly Pavilion: Colorado	List of tropical plants	http://www.butterflies.org/abt.cfm?section=abt#organization
Lepidopterist Society	This society offer membership to more specialized individuals. In addition, they provide information on some biological aspects of butterfly.	http://alpha.furman.edu/~snyder/snyder/lep/index1.htm
XERCES society	The Xerces Society is an international non-for-profit organization dedicated to protecting biological diversity	http://www.xerces.org/

	through invertebrate conservation.	
The Butterfly Botanical Gardens	A good source for host plant and feeding plant information as well as pictures.	http://www.butterflygardens.co.cr
CentralAmerica.com	A good explanation of butterfly farming in Costa Rica.	http://centralamerica.com/cr/butterfly/bflyart4.htm
Insectnet.com (network for insect collectors)	This section has links to everything related to a butterfly farm from insect trade to collection techniques.	http://www.insectnet.com/links.htm
Butterfly Garden website	More links to more resources	http://www.butterfly--garden.com/articles.html
Sonoran Arthropod institute	Rachel Arenstein, article on conservation and indoor butterfly house construction Lots of work in Costa Rica Contact info	http://www.sasionline.org/costarica/pages/journal-intro.html Sonoran Arthropod Studies Institute PO Box 5624 Tucson, AZ 85703-0624 520-883-3945 SASI@SASionline.org If link does not work, click on front page text saying 'instar'.

La lista de Mariposas se compiló durante la estación seca alrededor de la comunidad de Achiote, Colón, Panamá entre los meses de febrero a abril de 2005.

Las Mariposas	Las Plantas de Alimentación de los Adultos				Plantas Hospederas	
 <p data-bbox="359 516 516 537">Adelpha phylaca</p>	 <p data-bbox="684 516 749 537">Cordia</p>	 <p data-bbox="930 516 995 537">Croton</p>	 <p data-bbox="1125 516 1283 537">Psidium guajava</p>	 <p data-bbox="1371 516 1528 537">Cecropia peltata</p>		
 <p data-bbox="369 729 506 750">Anartia fatima</p>	 <p data-bbox="669 729 764 750">Asclepias</p>	 <p data-bbox="888 729 1037 750">Hyptis mutabilis</p>	 <p data-bbox="1184 729 1226 750">Sida</p>	 <p data-bbox="1402 729 1497 750">Dicliptera</p>	 <p data-bbox="1656 729 1732 750">Justicia</p>	
 <p data-bbox="359 941 520 963">Anartia jatrophae</p>	 <p data-bbox="674 941 758 963">Blechum</p>	 <p data-bbox="919 941 1010 963">Casearia</p>	 <p data-bbox="1173 941 1247 963">Ruellia</p>	 <p data-bbox="1413 941 1493 963">Bacopa</p>	 <p data-bbox="1650 941 1745 963">Lindernia</p>	
 <p data-bbox="352 1154 525 1175">Anthanassa tulcis</p>	 <p data-bbox="659 1154 779 1175">Bidens alba</p>	 <p data-bbox="877 1154 1043 1175">Emilia sonchifolia</p>	 <p data-bbox="1152 1154 1262 1175">Hypoestes</p>	 <p data-bbox="1413 1154 1493 1175">Justicia</p>	 <p data-bbox="1602 1154 1787 1175">Pseuderanthemum</p>	
 <p data-bbox="338 1367 537 1388">Aphrissia boisduvalii</p>	 <p data-bbox="680 1367 753 1388">Cassia</p>	 <p data-bbox="919 1367 1010 1388">Hibiscus</p>	 <p data-bbox="1125 1367 1283 1388">Lantana camara</p>	<p data-bbox="1373 1247 1520 1300">Imagen no disponible</p>	 <p data-bbox="1591 1367 1791 1388">Entada monostachya</p>	

Las Mariposas	Las Plantas de Alimentación de los Adultos			Plantas Hospederas	
 <p data-bbox="317 488 562 508">Archaeoprepona meander</p>	 <p data-bbox="621 488 808 508">Musa X paradisiaca</p>	 <p data-bbox="884 488 1041 508">Mangifera indica</p>	 <p data-bbox="1125 488 1283 508">Pouteria Sapota</p>	 <p data-bbox="1398 488 1509 508">Nectandra</p>	 <p data-bbox="1656 488 1730 508">Ocotea</p>
 <p data-bbox="348 704 527 724">Caerois gerdrutus</p>	 <p data-bbox="617 704 821 724">Brosimum alicastrum</p>	 <p data-bbox="915 704 1005 724">Heliconia</p>	 <p data-bbox="1104 704 1297 724">Musa X paradisiaca</p>	 <p data-bbox="1360 704 1535 724">Socratea durisima</p>	
 <p data-bbox="317 919 562 938">Caligo eurilochus sulanus</p>	 <p data-bbox="617 919 821 938">Brosimum alicastrum</p>	 <p data-bbox="915 919 1005 938">Cecropia</p>	 <p data-bbox="1157 919 1247 938">Heliconia</p>	 <p data-bbox="1398 919 1493 938">Calathea</p>	 <p data-bbox="1591 919 1787 938">Musa X paradisiaca</p>
 <p data-bbox="317 1135 562 1154">Caligo memnon memnon</p>	 <p data-bbox="621 1138 808 1157">Musa X paradisiaca</p>	 <p data-bbox="884 1138 1041 1157">Pouteria Sapota</p>	 <p data-bbox="1125 1138 1283 1157">Psidium guajava</p>	 <p data-bbox="1398 1138 1493 1157">Heliconia</p>	 <p data-bbox="1591 1138 1787 1157">Musa X paradisiaca</p>
 <p data-bbox="327 1352 552 1372">Catonephele mexicana</p>	 <p data-bbox="621 1352 808 1372">Musa X paradisiaca</p>	 <p data-bbox="884 1352 1041 1372">Mangifera indica</p>	 <p data-bbox="1125 1352 1283 1372">Psidium guajava</p>	 <p data-bbox="1346 1352 1556 1372">Dalechampia triphylla</p>	 <p data-bbox="1581 1352 1808 1372">Dalechampia scandens</p>

Las Mariposas	Las Plantas de Alimentación de los Adultos				Plantas Hospederas	
 <p data-bbox="365 483 512 505">Cissia hesione</p>	 <p data-bbox="680 483 764 505">Eugenia</p>	 <p data-bbox="911 483 1016 505">Manilkara</p>	 <p data-bbox="1129 483 1285 505">Pouteria Sapota</p>	 <p data-bbox="1411 483 1495 505">Eleusine</p>	 <p data-bbox="1654 483 1738 505">Panicum</p>	
 <p data-bbox="310 695 567 716">Danaus gilippus thersippus</p>	 <p data-bbox="638 695 798 716">Lantana camara</p>	 <p data-bbox="877 695 1045 716">Lippia lanceolata</p>	 <p data-bbox="1129 695 1285 716">Scandix pecten</p>	 <p data-bbox="1402 695 1495 716">Asclepias</p>	 <p data-bbox="1633 695 1759 716">Sarcostemma</p>	
 <p data-bbox="352 906 525 927">Dryadula phaetusa</p>	 <p data-bbox="667 906 764 927">Asclepias</p>	 <p data-bbox="877 906 1041 927">Hirtella racemosa</p>	 <p data-bbox="1129 906 1285 927">Stachytarpheta</p>	 <p data-bbox="1348 906 1549 927">Passiflora mucronata</p>	 <p data-bbox="1621 906 1768 927">Passiflora rubra</p>	
 <p data-bbox="386 1117 491 1138">Dryas iulia</p>	 <p data-bbox="659 1117 777 1138">Bidens alba</p>	 <p data-bbox="928 1117 995 1138">Cassia</p>	 <p data-bbox="1129 1117 1285 1138">Hamelia patens</p>	 <p data-bbox="1356 1117 1537 1138">passiflora platyloba</p>	 <p data-bbox="1612 1117 1780 1138">Passiflora vitifolia</p>	
 <p data-bbox="382 1328 499 1349">Eresia Clara</p>	 <p data-bbox="676 1328 760 1349">Belchum</p>	 <p data-bbox="928 1328 999 1349">Justicia</p>	 <p data-bbox="1163 1328 1247 1349">Mikania</p>	 <p data-bbox="1381 1328 1516 1349">Acanthaceae</p>		

Las Mariposas	Las Plantas de Alimentación de los Adultos			Plantas Hospederas	
 <p data-bbox="352 483 533 505">Euptychia hermes</p>	 <p data-bbox="680 483 758 505">Cassia</p>	 <p data-bbox="911 483 1016 505">Oenothera</p>	 <p data-bbox="1173 483 1241 505">Salvia</p>	 <p data-bbox="1339 483 1556 505">Axonopus compressus</p>	 <p data-bbox="1604 483 1787 505">Cynodon dactylon</p>
 <p data-bbox="359 699 520 721">Eurema grata</p>	 <p data-bbox="653 699 785 721">Bidens pilosa</p>	 <p data-bbox="894 699 1026 721">Cassia biflora</p>	 <p data-bbox="1125 699 1283 721">Lantana camara</p>	 <p data-bbox="1415 699 1482 721">Cassia</p>	 <p data-bbox="1629 699 1751 721">Desmodium</p>
 <p data-bbox="373 911 508 932">Eurybia unxia</p>	 <p data-bbox="674 911 764 932">Calathea</p>	 <p data-bbox="894 911 1026 932">Ischnosiphon</p>	 <p data-bbox="1152 911 1262 932">Renealmia</p>	 <p data-bbox="1394 911 1503 932">Saccharum</p>	
 <p data-bbox="317 1127 562 1148">Heliconius hecale zuleika</p>	 <p data-bbox="663 1127 764 1148">Cephaelis</p>	 <p data-bbox="921 1127 1003 1148">Gurania</p>	 <p data-bbox="1152 1127 1262 1148">Palicourea</p>	 <p data-bbox="1352 1127 1545 1148">Passiflora auriculata</p>	 <p data-bbox="1604 1127 1787 1148">Passiflora oerstedii</p>
 <p data-bbox="296 1338 583 1359">Heliconius melpomene rosina</p>	 <p data-bbox="680 1338 758 1359">Cissus</p>	 <p data-bbox="921 1338 1003 1359">Hamelia</p>	 <p data-bbox="1163 1338 1247 1359">Psiguria</p>	 <p data-bbox="1352 1338 1545 1359">Passiflora oerstedii</p>	 <p data-bbox="1604 1338 1787 1359">P. menispermifolia</p>

Las Mariposas	Las Plantas de Alimentación de los Adultos			Plantas Hospederas	
 <p data-bbox="344 483 531 505">Heliconius pacheus</p>	 <p data-bbox="667 483 768 505">Cephaelis</p>	 <p data-bbox="877 483 1052 505">Manettia reclinata</p>	 <p data-bbox="1150 483 1268 505">Tournefortia</p>	 <p data-bbox="1339 483 1562 505">Passiflora costaricensis</p>	 <p data-bbox="1612 483 1776 505">Passiflora vitifolia</p>
 <p data-bbox="310 699 569 721">Itaballia demophile centralis</p>	 <p data-bbox="646 699 789 721">Hamelia patens</p>	 <p data-bbox="884 699 1037 721">Lantana camara</p>	 <p data-bbox="1157 699 1262 721">Psychotria</p>	 <p data-bbox="1373 699 1524 721">Capparis indica</p>	 <p data-bbox="1604 699 1780 721">Capparis frondosa</p>
 <p data-bbox="338 911 541 932">Leucochimona lagora</p>	 <p data-bbox="684 911 751 932">Cassia</p>	 <p data-bbox="884 911 1037 932">Hamelia patens</p>		 <p data-bbox="1373 911 1524 932">Coccocypselum</p>	 <p data-bbox="1591 911 1787 932">Hemidiodia ocimifolia</p>
 <p data-bbox="348 1122 527 1143">Morpho amathonte</p>	 <p data-bbox="617 1122 814 1143">Brosimum alicastrum</p>	 <p data-bbox="915 1122 1010 1143">Manilkara</p>	 <p data-bbox="1129 1122 1283 1143">Pouteria sapota</p>	 <p data-bbox="1360 1122 1545 1143">Pterocarpus hayesii</p>	 <p data-bbox="1591 1122 1797 1143">Pterocarpus officinalis</p>
 <p data-bbox="323 1333 554 1354">Morpho peleides limpida</p>	 <p data-bbox="638 1333 800 1354">Mangifera indica</p>	 <p data-bbox="890 1333 1031 1354">Musa coccinea</p>	 <p data-bbox="1129 1333 1283 1354">Spondias dulcis</p>	 <p data-bbox="1409 1333 1488 1354">Mucuna</p>	 <p data-bbox="1650 1333 1734 1354">Swartzia</p>

Las Mariposas	Las Plantas de Alimentación de los Adultos			Plantas Hospederas	
 <p data-bbox="338 483 541 505">Papilio thoas nealces</p>	 <p data-bbox="659 483 791 505">Caesalpinia</p>	 <p data-bbox="911 483 1018 505">Impatiens</p>	 <p data-bbox="1136 483 1281 505">Sabicea villosa</p>	 <p data-bbox="1383 483 1516 505">Piper auritum</p>	 <p data-bbox="1646 483 1743 505">Rutaceae</p>
 <p data-bbox="338 699 541 721">Phoebis philea philea</p>	 <p data-bbox="659 699 791 721">Delonix regia</p>	 <p data-bbox="858 699 1062 721">Malvastrum arboreum</p>	 <p data-bbox="1136 699 1281 721">Stachytarpheta</p>	 <p data-bbox="1377 699 1516 721">Cassia grandis</p>	 <p data-bbox="1633 699 1751 721">Caesalpinia</p>
 <p data-bbox="359 911 520 932">Phoebis sennae</p>	 <p data-bbox="659 911 785 932">bougainvillea</p>	 <p data-bbox="932 911 993 932">cordia</p>	 <p data-bbox="1167 911 1249 932">hibiscus</p>	 <p data-bbox="1383 911 1516 932">Cassia biflora</p>	 <p data-bbox="1608 911 1780 932">Cassia obtusiflora</p>
 <p data-bbox="369 1122 520 1143">Polythrix asine</p>	 <p data-bbox="669 1122 772 1143">Asclepias</p>	 <p data-bbox="915 1122 1014 1143">Casearia</p>	 <p data-bbox="1125 1122 1291 1143">Lantana camara</p>	<p data-bbox="1377 1003 1516 1057">Imagen no disponible</p> <p data-bbox="1392 1122 1503 1143">Amerimnon</p>	<p data-bbox="1623 1003 1761 1057">Imagen no disponible</p> <p data-bbox="1629 1122 1761 1143">Icthyomenthia</p>
 <p data-bbox="369 1333 520 1354">Thisbe irenea</p>	 <p data-bbox="680 1333 762 1354">Alibertia</p>	 <p data-bbox="905 1333 1020 1354">Palicourea</p>	 <p data-bbox="1167 1333 1249 1354">Serjania</p>	 <p data-bbox="1356 1333 1549 1354">Croton billbergianus</p>	 <p data-bbox="1629 1333 1759 1354">Croton draco</p>