UDZUNGA ECOLOGICAL MONITORING CENTRE

CONCEPTUAL MASTER PLAN FOR THE UEMC AS AN EDUCATIONAL / OUTREACH / RESEARCH HUB FOR LOCAL VILLAGES AND TOURISTS

ALEX SMITH
PENN STATE UNIVERSITY
LANDSCAPE ARCHITECTURE

THE UEMC AS AN EDUCATIONAL HUB

The proposal for the Penn State Tanzanian Study Abroad Studio Project will focus on and feature design possibilities for the Udzungwa Ecological Monitoring Centre. It shall look to the advancement of the Monitoring Centre as an educational hub in the hopes that in the near future it can have useful and viable influence on surrounding villagers, tourists, researchers, and conservation practices of the Udzungwa Mountains National Park region. The UEMC has unlimited potential to become an educational aid and research hub for local community members and tourists. The Monitoring Centre could allow for innovative and interactive demonstrations/research areas which focus on sustainable and environmentally-friendly practices, each potentially having huge, positive implications on surrounding villages. The sustainable demonstrations and research practices which will be implemented within the UEMC include:

- 1. Sustainable woodlot design methods
- 2. Irrigation demonstration plots
- 3. Alternative biogas and energy solutions
- 4. Nature-based business options

The overall goal of the design concept is to introduce the UEMC as more than just a monitoring centre. In the near future the facility has the opportunity to become an outreach hub for dozens of local communities, while also seconding as a learning aid for tourists interested in Tanzania's effort to conserve and become self-sufficient. It is the hope that with this design concept, present and future conflicts between villages and the Udzungwa Mountains National Park will cease thus allowing both parties to coexist.

DEMONSTRATION PLOTS OVERVIEW

OUTDOOR CLASS ROOMS

Two outdoor class rooms are provided within the UEMC as areas for both gathering and teaching. The rooms consist of numerous benches and are located in popular areas for maximum usage (behind the UEMC Office and parallel with the visitors living arrangements). The outdoor class rooms provide areas in close proximity to the demonstration plots, enticing discussions and observations.

SUSTAINABLE WOODLOT DESIGNS

The Sustainable Woodlot Plot encompasses two distinct areas: two nurseries for initial plant growth, and the actual demonstration woodlot area. These demonstration plots will teach villagers and tourists of the best strategies and vegetation types for constructing, maintaining and planting a small, sustainable woodlot.

IRRIGATION DEMONSTRATION PLOT

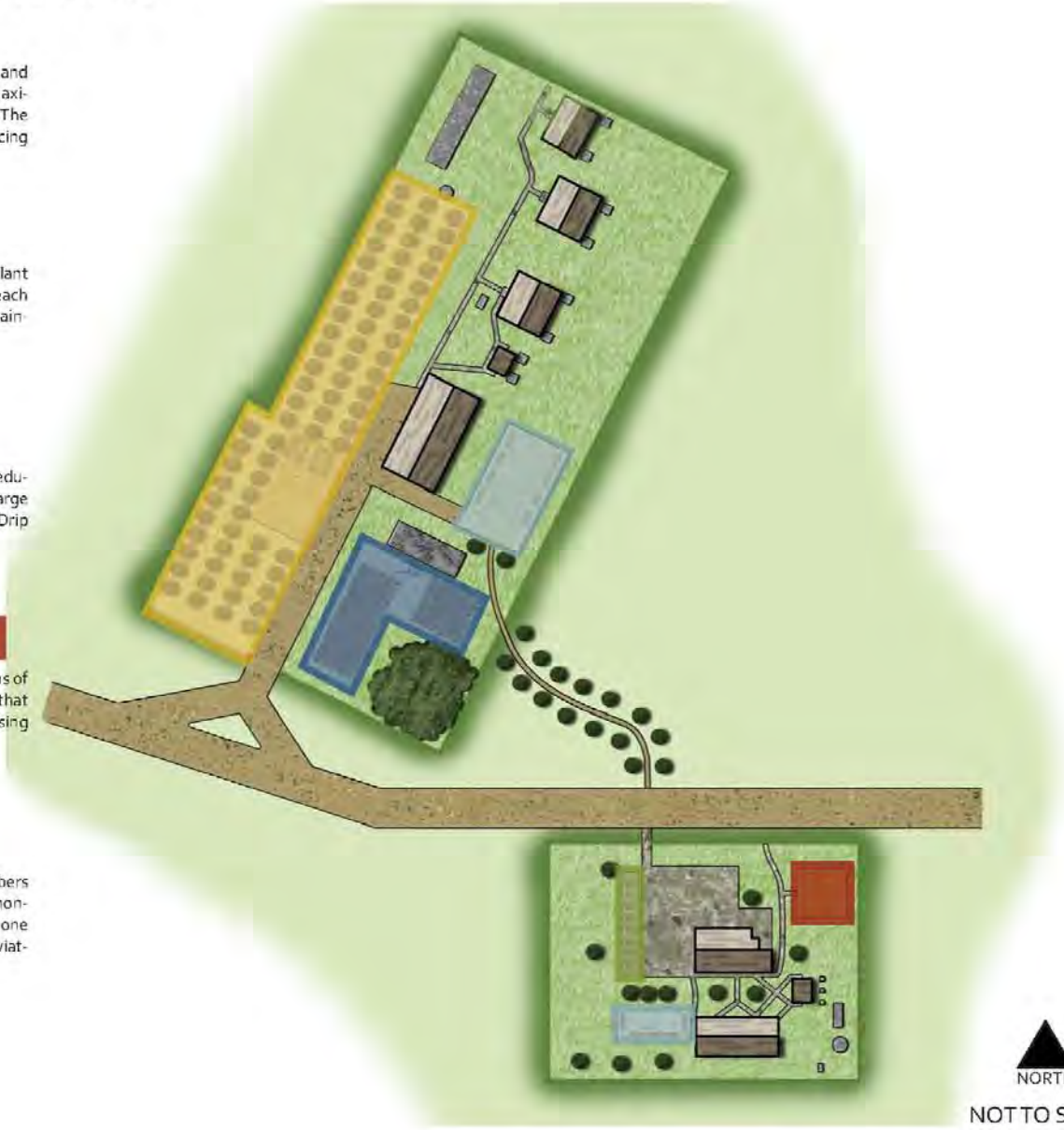
The Irrigation Demonstration Plot, located near the UEMC office, provides visitors an educational experience focusing on Drip Irrigation strategies. The plot demonstrates both large and small scale irrigation,using two different techniques: the Bucket Drip and the Tank Drip Methods.

ALTERNATIVE BIOGAS / ENERGY SOLUTIONS

The Alternative Biogas and Energy Solutions demonstration area will focus on new options of energy use and efficiency. Specifically, visitors will learn of fuel and cost efficient ovens that are easily accessible to villagers. Additionally, new energy options will be introduced focusing on reducing the need for firewood and charcoal.

NATURE-BASED BUSINESS OPTIONS

The Nature-based Business plot will demonstrate various options for local village members to create sustainable work options for themselves or the community. The area will demonstrate the benefits of Nature-based Businesses as well as a few examples of what can be done within local villages. The implementation of N.B.B.s will diversify the economy, thus alleviating the uses of Udzungwa Mountains natural ecosystems.



NORTH

NOT TO SCALE

SUSTAINABLE WOODLOT DESIGNS

Within the Udzungwa Region, "fuel wood is the main source of energy and it accounts for approximately 95 percent of all energy requirements. Over 98 percent of the total population depends on fuel wood mainly for domestic use... [In the past,] firewood was previously obtainable from close proximity. The increasing demand and mode of collection have depleted the dead wood at nearby sites. As the demand and consumption increases, the distance covered and time taken in firewood collection [also] increase daily. The majority of people, especially women, take an average of seven hours to complete dead wood collection trips." (Nyundo 2006).

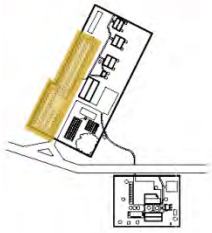
The depletion of forest dead wood, in addition to the increase in time and effort it takes to collect it, are pressing subjects within the region of the UMNP. As one can see, the required amount of either dead wood or live wood is hugely important for local village members. But due to the upcoming TANAPA enforced law changes, villagers need to find alternative solutions for their firewood, charcoal and timber needs. Sustainable woodlots are the best solution available. Sustainable woodlot options are a viable source for villagers, and can effectively assist in producing the require fuel wood and timber needed for both energy and construction uses. Additionally, having your own woodlot saves time and effort collecting wood. This area within the Udzungwa Ecological Monitoring Centre provides a demonstration plot and nursery, showing how to plant, maintain, and reuse effective plants typically found within a woodlot. This strategy can then be implemented within a small portion of a village or privately owned land, thus having huge impacts on both the needs of villagers and the UMNP's conservation strategies. The more villagers who create woodlots, the less illegal timbering and poaching will occur within the park boundaries. Constructing woodlots within villages will help both economically and environmentally. The remainder of this page depicts possible woodlot design solutions found in local villages today, useful tree and shrub types, as well as strategies of planting and managing the lot.

BEFORE AND AFTER

Photographs From: Smith 2010.

In front of the UEMC office now, two viable woodlot plants are systematically lined within 4m width rows ***(Khaya anthotheca, Azadirachta indica)***. The UEMC demonstration woodlot will plant additional firewood and timber trees making the area a densely vegetated exhibit. Showing visitors a typical woodlot will help them visualize what should be done back at their own villages or homes. The diagrams (above) show a "before" and conceptual "after" representation of what could be implemented at the UEMC.

CONTEXT MAP



Existing on site already are viable woodlot trees in rows separated by 4 meters. To complete the demonstration area, new vegetation types will be added every 2 meters, thus making additional rows within the plot. This alternating of young and old trees will allow for a continuous yearly process of cutting the old and replanting new. Trees within the demonstration plot are fast growing and can be used after the first 4 years of growth. Typically, alternating trees will be cut for use, thus allowing the younger trees to grow until ready, then the process is continuously repeated.

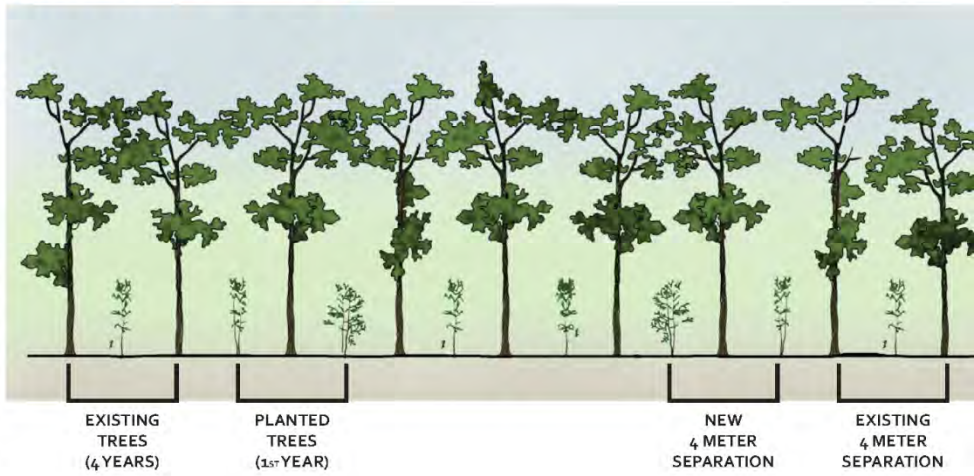
NURSERY DESIGN

Nurseries are typically small structures (10m x 10m). Inside they are separated by plant types into individual species blocks. The structures must be shaded and protected by a thatched fence. Additionally, watering occurs daily, providing additional opportunities for visitors to learn of the woodlot strategies.

Photographs From: Smith 2010.

Two nurseries will be located next to the demonstration woodlot areas. The areas will provide examples of how to initially start a sustainable woodlot. Seeds, typically provided by WWF, can be planted, maintained and monitored by either facility members or guests wishing to learn of the strategies. Each seedling or seed is planted within a small black rubber tube, allowing for root growth. Once the plants are mature enough to survive the first dry and rain seasons, they are implemented in the early weeks of the wet season, thus allowing for maximum growth potential. Within the demonstration plot, visitors will learn of the main plant species that are given out by WWF, all of which are useful for both fuel wood and timber. Villagers and tourists will also have the opportunity to plant newly ready seedlings within the actual wood lot.

WOODLOT DESIGN

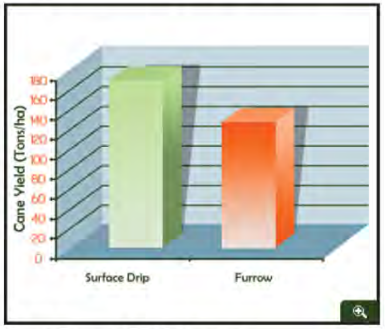


IRRIGATION DEMONSTRATION PLOT

For the majority of people within rural areas of Tanzania, subsistence agriculture is the number one source of income. According to Alfan Rija, professor at Sokoine University, TZ, "agriculture is the back bone of Tanzania. It contributes to fifty percent (50%) of the nation's overall GDP, and over eighty percent (80.66%) of the population depend on agricultural practices as a way of life (Rija 2010).

As one can see, agriculture within local villages is considered to be one of the highest priorities for individuals, thus abundant water supplies are needed year round for continual crop production. Water within the region comes from the Udzungwa Mountains waterways, but conservation of these systems is needed for the protection of local ecosystems. Therefore, creating an efficient strategy for irrigation is essential. During the rainy season, ample water supplies the region, but during the dry months, thousands of crops are destroyed due to water shortages. With a sustainable irrigation demonstration plot, tourists and visitors will learn of the possibilities such approaches can offer. This demonstration area will show the beneficial impacts of "Drip Irrigation" both for individual and large scale shambas. The area will provide opportunities for learning how to construct and use the techniques presented. According to NETAFIM, an online research team, a recent study concluded and listed some of the major benefits "Drip Irrigation" can have on both large and small scale agricultural fields (the graph below also depicts how Drip Irrigation can help villagers financially as well):

1. Saving in water up to 45 to 50% contributing to higher water use efficiency
2. Saving in fertilizer (25 to 30%) due to fertigation consequently improved fertilizer use efficiency
3. Less weed growth and saving in labour due fewer weed control, fertigation & plant protection operations
4. Less pest and disease incidence due to better field sanitation
5. Optimum soil/water/air relations contributing to better germination, uniform field emergence and maintenance of optimum plant population
6. Early harvesting
7. Day/Night irrigation scheduling is possible
8. Higher cane and sugar yields (NETAFIM 2010).



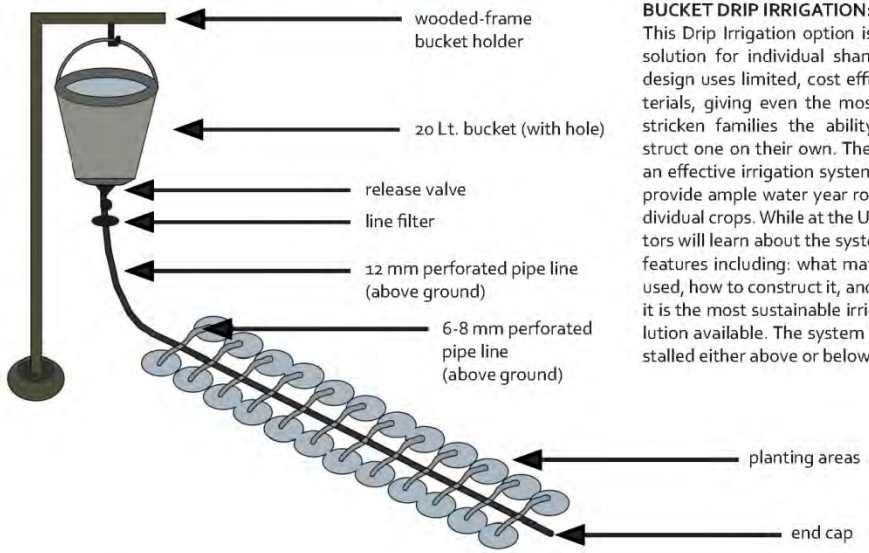
Graph From: (NETAFIM 2010).

DRIP IRRIGATION EXAMPLES:

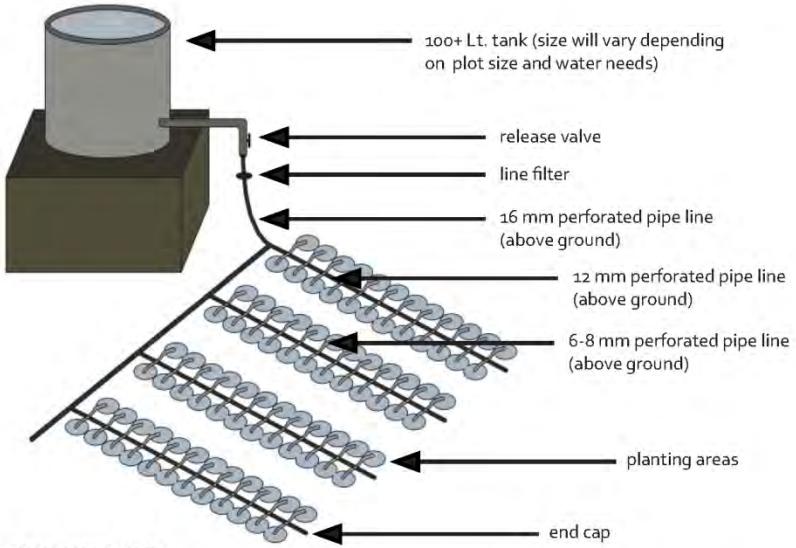
Photographs From: Water Technology Centre (TNAU)

CONTEXT MAP

DRIP IRRIGATION DESIGNS



BUCKET DRIP IRRIGATION:
This Drip Irrigation option is the best solution for individual shambas. The design uses limited, cost efficient materials, giving even the most poverty stricken families the ability to construct one on their own. The design is an effective irrigation system that can provide ample water year round to individual crops. While at the UEMC, visitors will learn about the system's main features including: what materials are used, how to construct it, and also why it is the most sustainable irrigation solution available. The system can be installed either above or below ground.



TANK DRIP IRRIGATION:
Tank Drip Irrigation has the same overall approach as the Bucket Drip, although its purpose is for larger scaled shambas or village community gardens. The system uses the same gravitational forces as the bucket system does, and again is cost efficient especially when considering how much water is conserved. For larger scale projects, the system will provide each individual plant sufficient water, in addition to saving large amounts of water coming from UMNP's valuable supply.

ALTERNATIVE BIOGAS / ENERGY SOLUTIONS

With the continual loss of viable land and the ever increasing demand for fuel wood, alternative energy solutions are needed to sustain rural villages within the region. The UMNP's newest protection plan will further hinder the energy crisis occurring within many of the local villages. As we already know, 98% of the population uses firewood and charcoal for energy uses, but this strategy cannot persist at the same level for much longer. At the UEMC visitors will learn of new energy efficient appliances in addition to accessible alternatives for fuel, specifically biofuel (biogas) options. With new technological advancements, and the UEMC's demonstration plots, many villagers will soon have the capabilities and knowledge needed to implement such strategies thus alleviating the need for firewood.

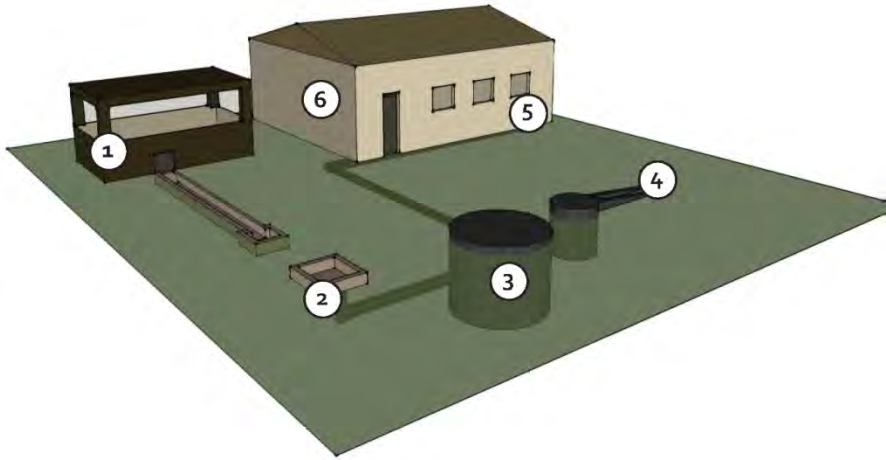
Villagers and tourists will learn of such alternatives in the hope that these cost effective products could potentially help themselves and their local ecosystems. New energy strategies could be implemented within villages if the knowledge for them were present. Biogas systems, for example, could provide individual families or two neighbors enough energy to sustain all their energy needs on a daily basis. Finding other viable options is necessary especially with the high dependency on a resource that is becoming very limited. Other options developed within the demonstration area will be: rice husk uses, and solar energy, in addition to the biogas and new oven appliance plots. According to a recent 2006 socioeconomic study, completed by the WWF and Paul Harrison, "The general feeling towards the potential introduction of such stoves once they have been explained to people is that they will save time collecting firewood, energy in cooking and reduce the degradation of forests. If there is education in how to use them, they would be welcomed" (Harrison 2006, 27). The problem within many of the surrounding villages is not that people do not want the new solutions, but that they have limited knowledge on how to build and use them properly. If the UEMC were advanced, many local village members could learn for the area, thus aiding to their needs as well as the environments.

ENERGY EFFICIENT APPLIANCES

The alternative energy solutions demonstration plot will provide visitors with educational teachings of such options including clay and metal energy efficient stoves (1 + 2), and rice husk fuel options (3). It is the hope that with exposure to new solutions, villagers will realize the possibilities and advantages of using such products, thus diminishing the need for firewood. Photographs From: Harrison 2006, Smith 2010.

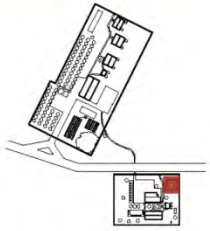
SUSTAINABLE BIOGAS DESIGNS

Using a sustainable biogas system will alleviate the need for all firewood usage. The system can provide an entire family the needed energy that is required for both kitchen appliances and lighting. The system first begins by using the manure of at least 3 cows, which are typically owned and non-grazing (seen in picture 1). The cows' waste is then collected and siphoned (2) into a concrete storage chamber located underground (3). At this point the manure produces ethanol gas which is forced into a piping system by water within the underground chamber. Pressure then drives the ethanol gas to the house, where it can be turned on and off for both heating and lighting (5 + 6). After the ethanol is collected, the excess waste is then dispersed through a clearance canal, which can be recycled as fertilizer for the family's shamba. Overall the system produces enough energy to provide an entire family year round. This process, although complex, is a sustainable and viable solution for hundreds of village members looking to save both the environment and time typically used for firewood collection. Maintenance of the system is limited and only takes 20 minutes per day to run effectively. With such a useful strategy, the only need is education on how to implement and run such a system, the UEMC can offer this.



At the UEMC, the addition of a biogas system can provide the needed electricity and energy required to run the kitchen and dinning room areas. Because the system will be fully functional, visitors will have the opportunity to learn from it, seeing its potential first hand.

CONTEXT MAP



ACTUAL BIOGAS SYSTEM

Photographs From: Smith 2010.

NATURE-BASED BUSINESS OPTIONS

Nature-based sustainable business options can be a reliable source of income for local village members around the region. Nature-based businesses are a key to enhancing conservation efforts around the Udzungwa Mountains National Park. The less emphasis there is on agricultural, specifically cash crops, the more land that could potentially can be conserved. Teaching villagers and tourists about nature-based businesses will diversify the economy, thus alleviating the vast amounts of land needed for typical farming practices. If villagers were to find an alternative for their monetary needs in the form of nature-based business options, many would partake.

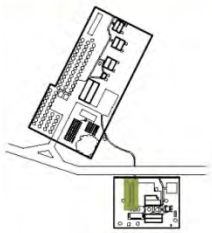
According to a 2005 Conservation International study, "experience within the hotspot has shown that nature-based businesses that benefit local populations can build significant constituencies for conservation. Because of extreme poverty, even small incomes from such businesses can make real differences in local attitudes towards conservation, provided that the linkage between revenue and the continued existence of the biodiversity resource is direct and obvious. It follows that revenues must be reasonably reliable and that any resource use must be sustainable" (Conservation International 2005, 55). If villagers can commit the time and effort towards sustainable businesses, profits are available from numerous sources. The UEMC has the potential to show villagers how to create such businesses. Within the demonstration plot, education will present how to start and maintain a nature-based business, possible marketing techniques, and how to make profits. Additionally, the Centre will show various types of nature-based businesses that are feasible within the Udzungwa region. Such business option demonstrations include:

1. Butterfly Enterprises
2. Beetle Enterprises
3. Organic Honey Production (Beekeeping)
4. Medicinal Plant Based Businesses
5. Raw Silk Production
6. Woodlot Nurseries (both for trees or grasses)
7. Tourism (Conservation International 2005)

Examples of such nature-based business options have proven to work locally. For instance, "two community groups in Taita Hills are farming 14 species of butterfly including the two Taita Hills endemics Cymothoe teita and Papilio desmondi teita. The groups are also planting Toddalia, Teclea, Clausena and Asystasia, the food plants of the most lucrative butterflies (Papilios and Salamis) on their farms. Within six months of starting butterfly farming the groups had produced 1,052 pupae. The sale of 61 percent of these pupae earned the groups US$ 600" (CEPF 2007). If local villagers take the initiative to learn and create their own business, there is a good chance they will make suitable profits, thus strengthening their overall standard of living, while also conserving land.

The pictures right demonstrate the nature-based businesses that could be developed within the region. Each demonstration area will show visitors what the benefits of N.B.B. are in addition to how to start and maintain the practices back in the villages. (For further information on Nature-based Businesses, specifically on the benefits of butterfly enterprises, reference Penn State Student Matt Weir's educational packet.)

CONTEXT MAP



The conceptual nature-based business plot will allow visitors to explore the varying opportunities villagers have within the Udzungwa Region.

SUSTAINABLE BUSINESS OPTIONS

Photographs From:
CEPF 2007, Smith 2010.

local butterfly production

local honey production

local fishing net

local bee production

local wood selling

tourism

Businesses within the region can range from local tourism companies to honey production work. If villagers are able to find a business they enjoy and can make money off of, the need for agricultural practices will decrease, thus saving village land for future expansion or conservation of protected areas.