THE LIVING VILLAGE

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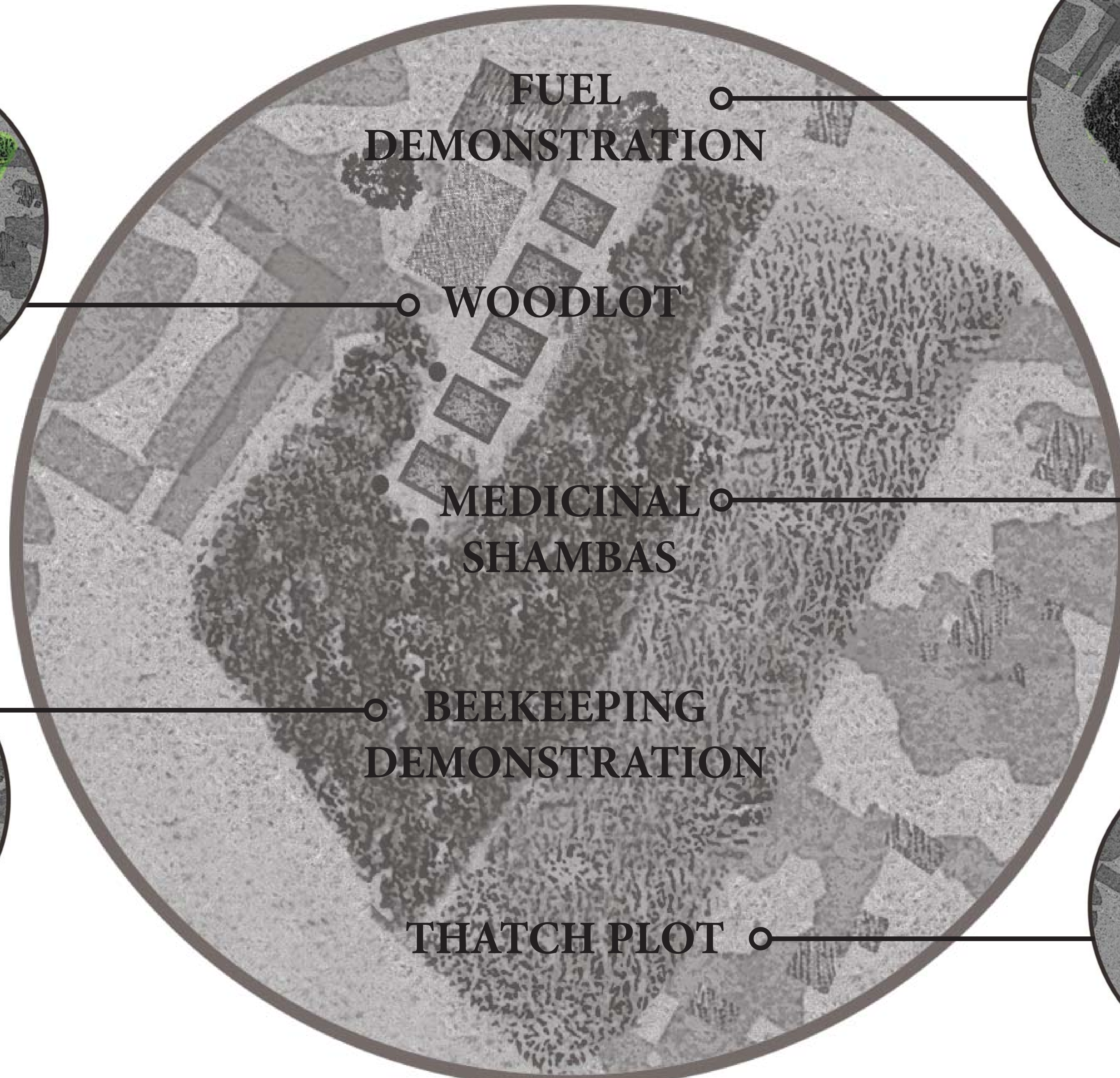
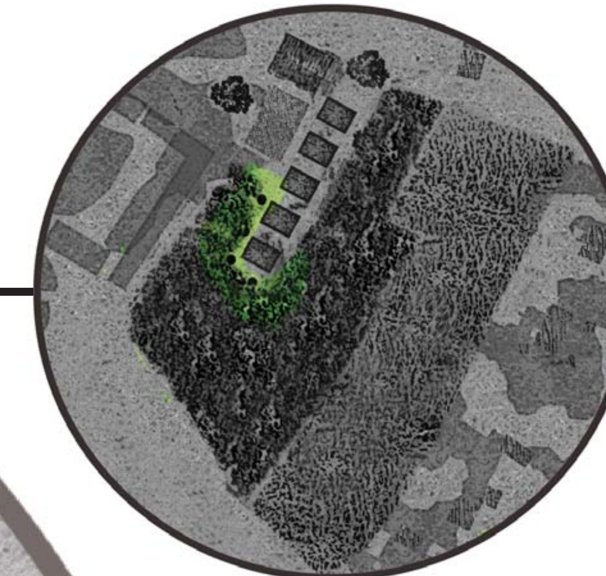
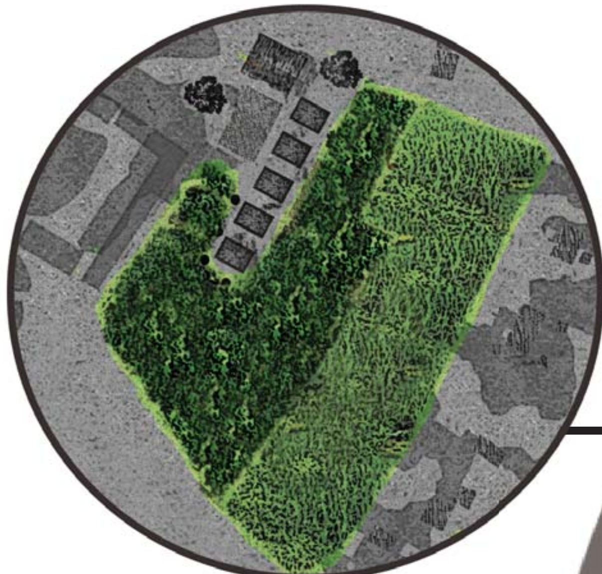
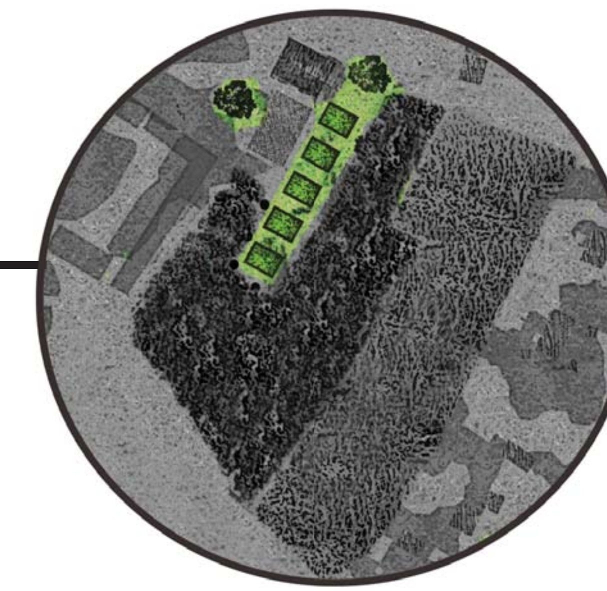
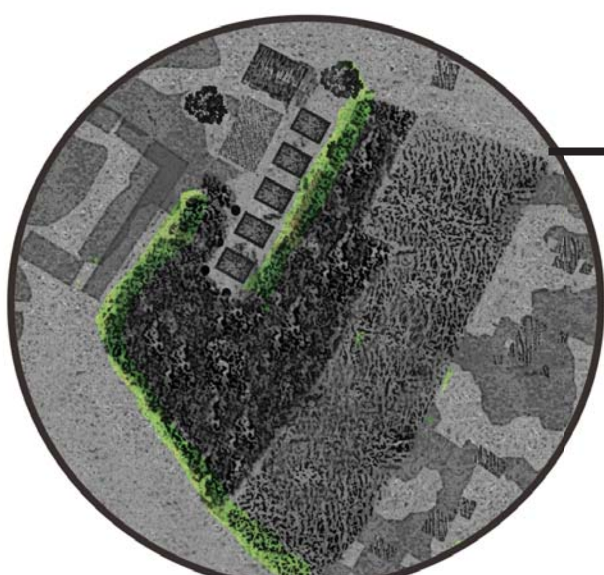
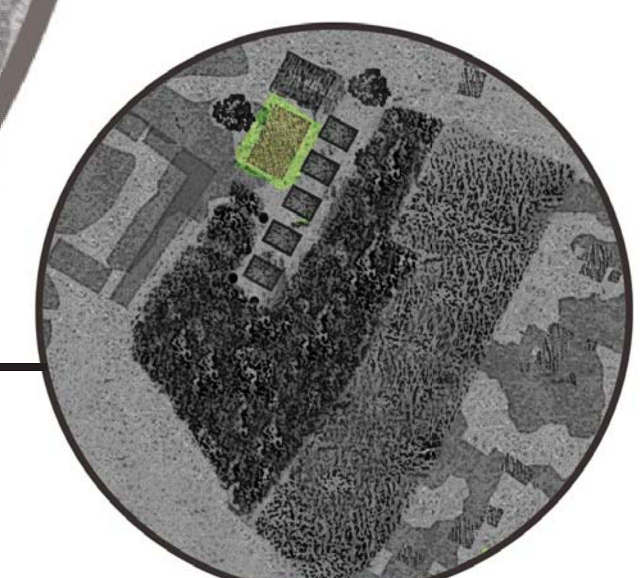




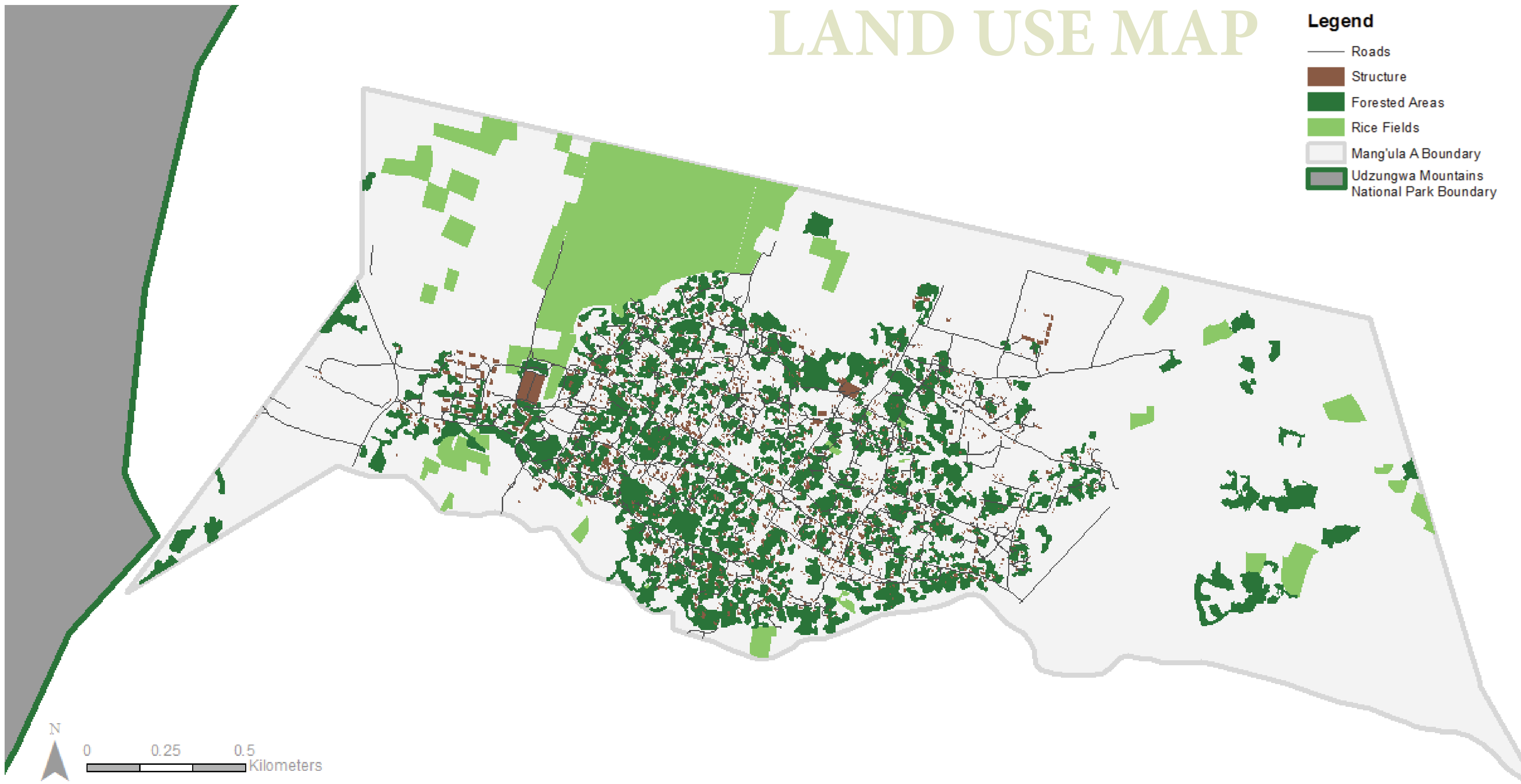








LAND USE MAP

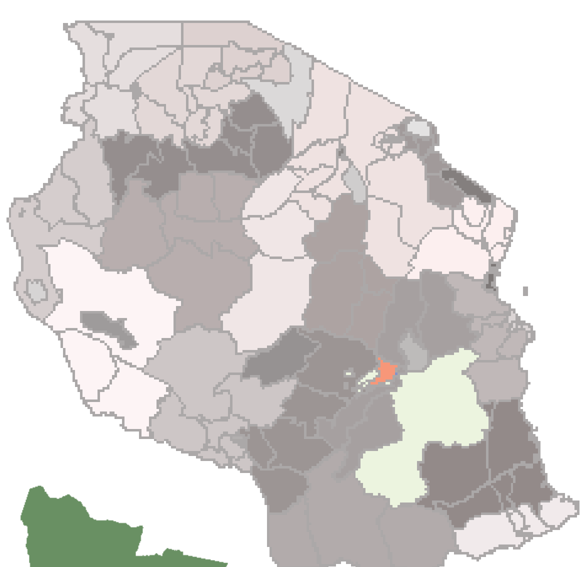


BACKGROUND

Out of more than **40 million** people living in Tanzania, approximately **94%** of the population relies on firewood and charcoal for cooking (United Nations Development Programme 2013). Since 1992, when Udzungwa Mountains National Park (UMNP) was gazette, there was a verbal agreement between two groups, **Tanzania National Parks Authority** (TANAPA) and **Kilombero District Council**, in which they permitted the collection of deadwood along with grass and medicinal plants. This agreement continued for a ten year period, and after this timespan, the act of gathering deadwood was difficult to stop because it had become a common practice in addition to an essential resource to the local communities. The collection of deadwood continued several years after due to the lack of research in the impacts collecting had to the forests as well as the necessity of the deadwood to the community (Nyundo et. al. 2006). Now the entire Eastern Arc Mountains system, which UMNP is part of, is confronted with challenges of **degradation**, **fragmentation** of forests, and **loss of habitat** (Griffioen 2005). In July 2011, the Tanzanian government "set in place a *firewood ban* on UMNP, leaving Magombera forest as the only fuel supply available and unprotected for 10 villages" (Marshall 2012). Factors such as "population growth, poverty leading to unsustainable use of forest resources, under-resourced government institutions and outdated or lack of effective environmental legislation" (Griffioen 2005) has increased the removal of deadwood from local forests.

Mang'ula A will be the focus community in this report due to its direct connection to UMNP. It is a small village along the boundary of UMNP that, over the past several years, has experienced population growth as immigrants move into the area and utilize the limited amount of land available.

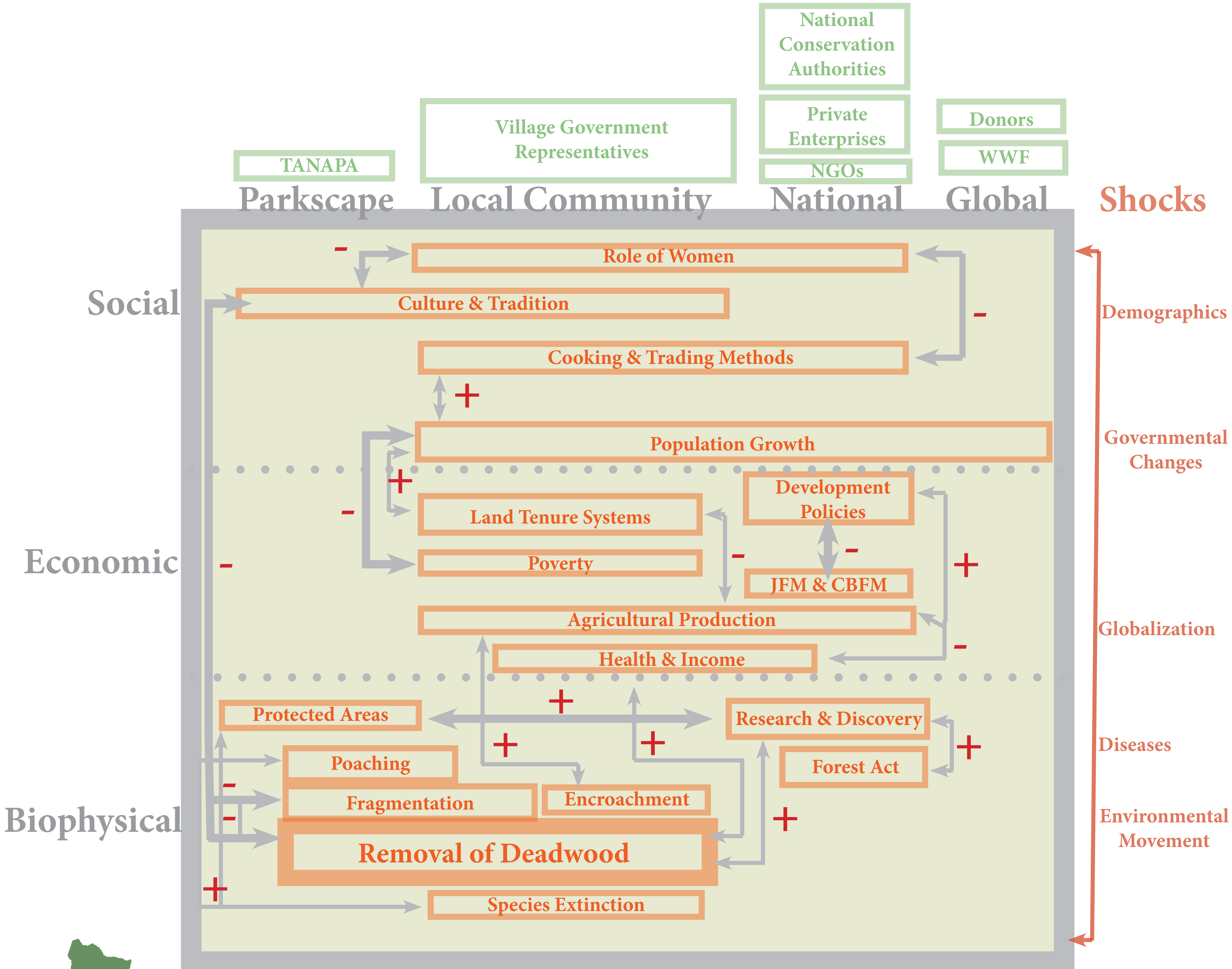
TANZANIA



KILOMBERO VALLEY

MANG'ULA A

GEOGRAPHICAL CONTEXT



The positive and negative symbols represent feedback loops, and by understanding components that change versus are stable, it will indicate where challenges may lie. By organizing the map into categories of social, economic, and biophysical factors, the many facets that link community to nature are realized. An addition of group s associated with each scale helps to visualize the effects of regulatory management and opportunities for participatory action.

This diagram highlights the main relationships within the complex system that ties human activities to the environment, specifically addressing the impact of deadwood collection in relation to several scales and factors. Shocks to the system are also detailed to indicate the ever changing dynamics of the system. The objective of the concept map is identify components of the equation that may not have been looked at in connection with other topics. Having a consistent approach to any issue forces the resultant solution to address small scale as well as large scale outcomes.

Deadwood Collection

Deadwood along with charcoal constitute approximately 95% of the fuel to cook and heat households within Mang'ula A (Nyundo 2006). Due to UMNP ban, the time spent and the distance traveled in search of fuelwood has increased and has negatively impacted means of income, human health, and food security. Resource extraction will need to be addressed if communities are to remain healthy and productive.

Thatch Collection

Thatch provides people in the community with a resource that aids in commerce as well as supports housing development. In Mang'ula A, many structures have a thatched roof including households, kitchens, latrines, and several local shops. Restricted access to thatch collection in UMNP has reduced the ability for people to earn extra income.

Medicinal Plants Collection

There are over 160 medicinal plant species within UMNP that many traditional practitioners and local people collected. Now with limited resource availability, people are struggling to scavenge plants are thought to improve many ailments.

Community Participation

The amount of immigrants entering the local area continues to increase, and as a result, a diverse background of traditions and cultures merge. There are then many disagreements pertaining to what is best for the community and its people.

Food Security

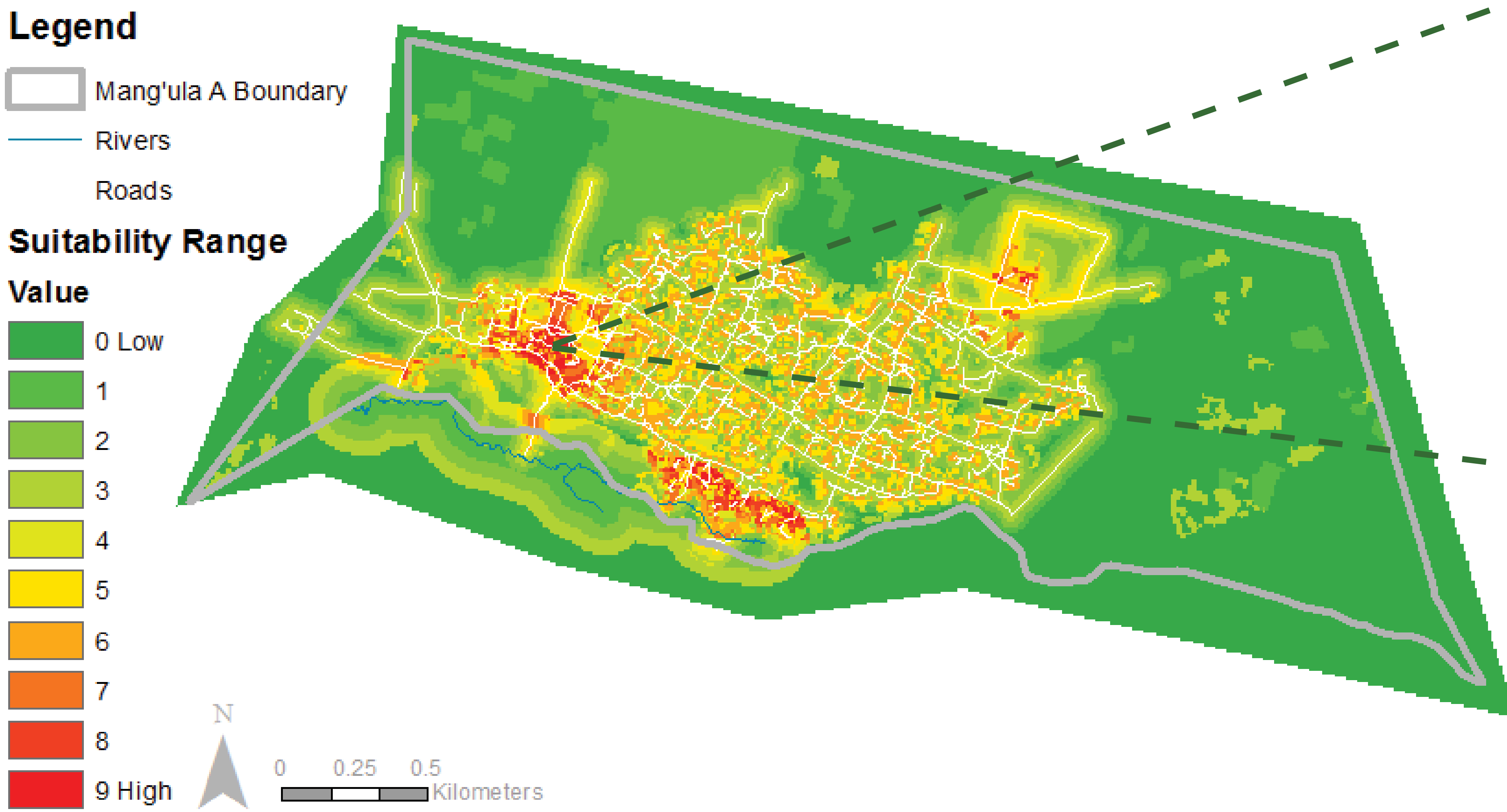
Human Health

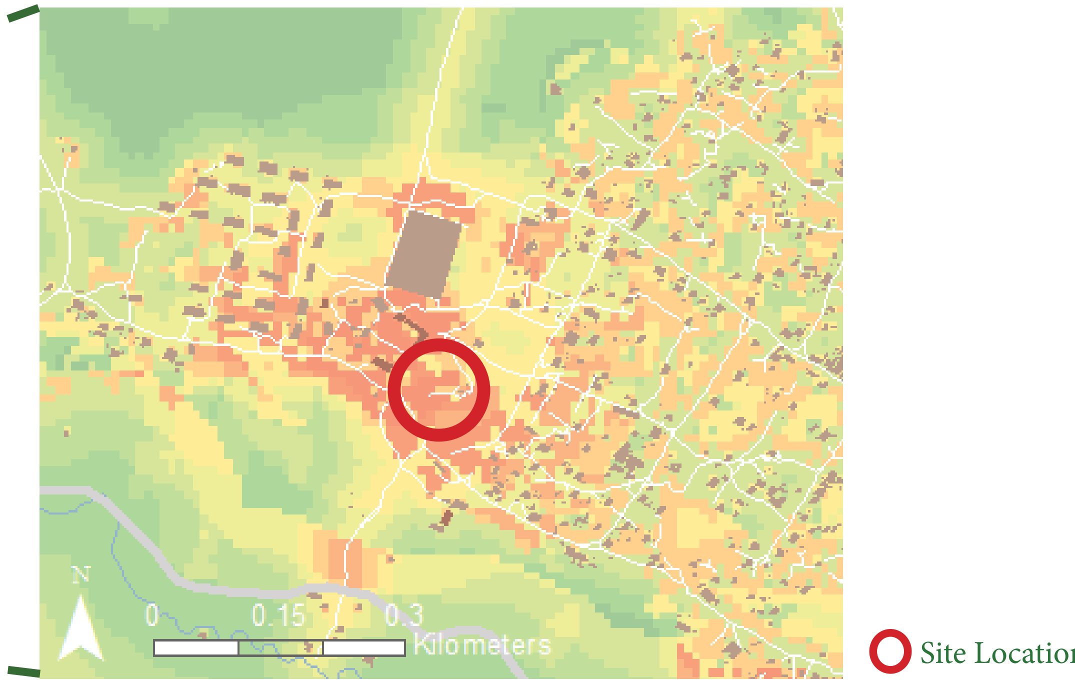
In Mang'ula A, agriculture and sustenance farming contributes to a large proportion of income and food supply. There is a high dependency on crops for food, but with the increasing effects of climate change, aspects like amount of rainfall and temperature change, directly alter the productivity of agriculture. Climate variability is negatively impacting countries worldwide through multiple facets, one of which is human health in respects to increasing the rates of air pollution, malaria, disease (Case 2006).

OVERVIEW

Consequences of a growing population and dwindling resource base increase the human footprint stamped onto the landscape, and these environmental implications of deforestation and degradation of the land decrease human well-being in addition to the sensitive biodiversity in the area. The necessity for firewood will be addressed through the demonstrations of cooking stoves and agroforestry measures. The negative effects of cooking with certain types of fuel will then have a direct and visual correlation to conservation, demonstrating to the community that it is in their best interest to identify more efficient and less costly ways of cooking. The economic component needed to be discussed is the instability of agriculture and how villagers can go about creating safety nets. Beekeeping and the presence of local shops are two schemes that can increase commerce and income, improve livelihoods and health of people benefiting from the design, and decrease cropland destruction. Community participation is another component that will be addressed in response to the need to protect and manage this "community green space." These environmental, economic, and societal implications are essential aspects to recognize in order for the community green space to function correctly and for the community to truly benefit.

CHALLENGES



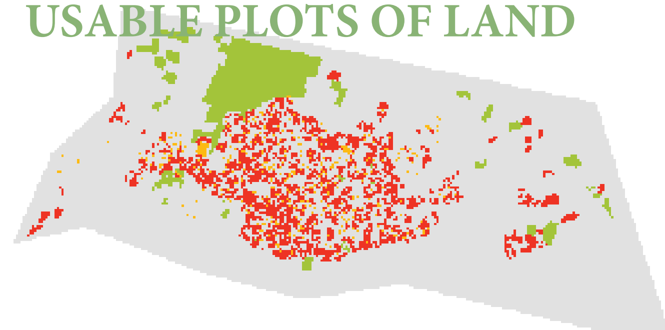


Based on four factors identified below, this is the most suitable location for the design. It is close to a school and within walking distance to multiple neighborhoods. Currently, the space is forested with minimal agricultural land adjacent. The size of the plot of land is approximately 2.5 hectares. This is determined based on proximity to structures and minimal disturbance of existing infrastructure.

PROXIMITY TO RIVER

The farther the location is from the river, the less valuable the land will be to farming. It is intended to choose a location that does not limit agricultural production.

USABLE PLOTS OF LAND

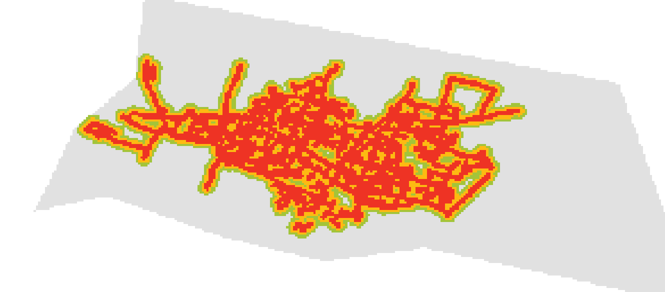


Areas that are existing woodlots are most suitable rather than agricultural lands or residences. The soil quality in the woodlots are likely to be low because they have not been converted to agriculture.

PROXIMITY TO SCHOOLS

It is important that the location be close to a school, for there is a major educational component to the design and schools can benefit to a great extent. Schools are also a major hub for community activities.

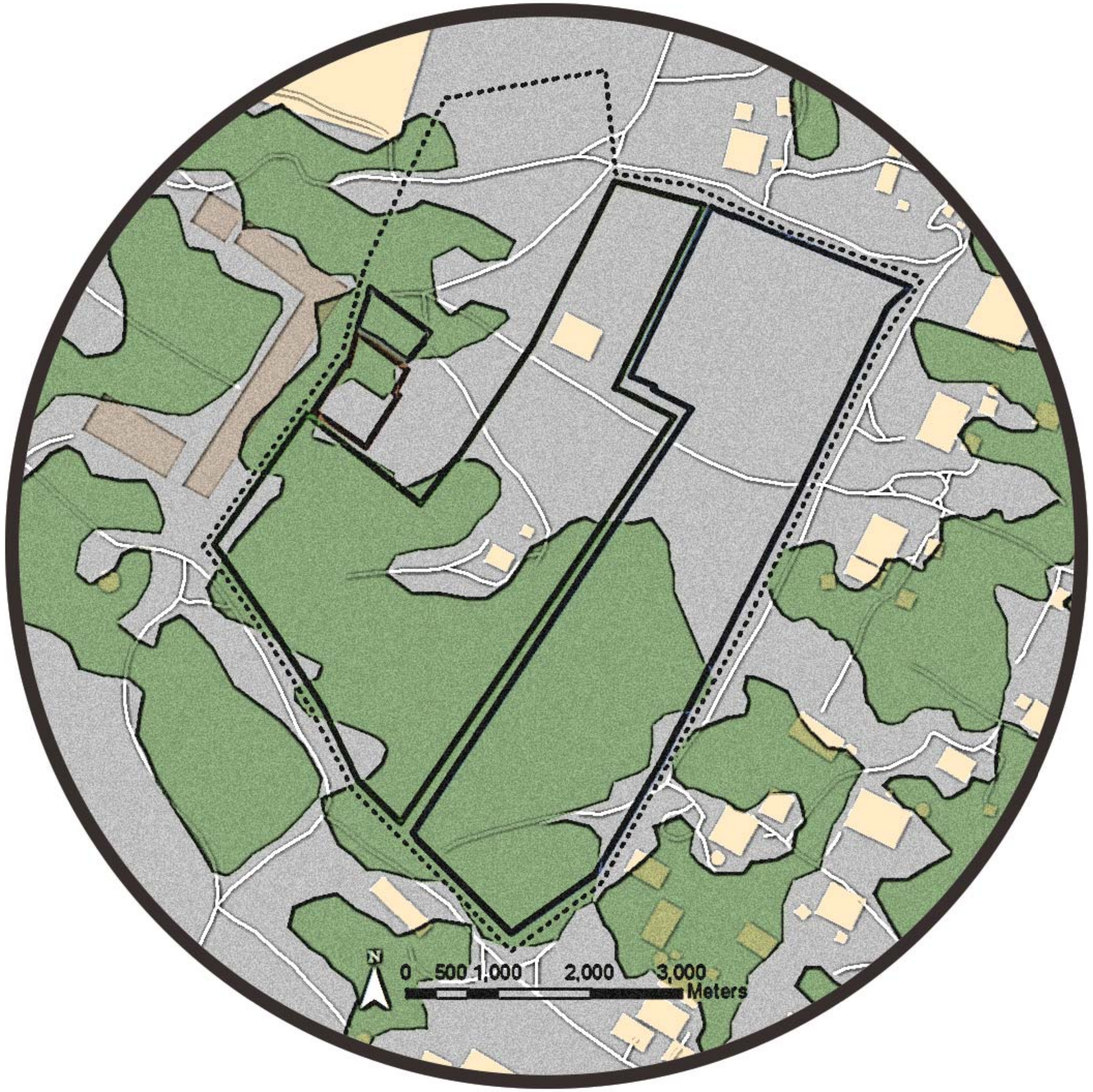
PROXIMITY TO ROADS



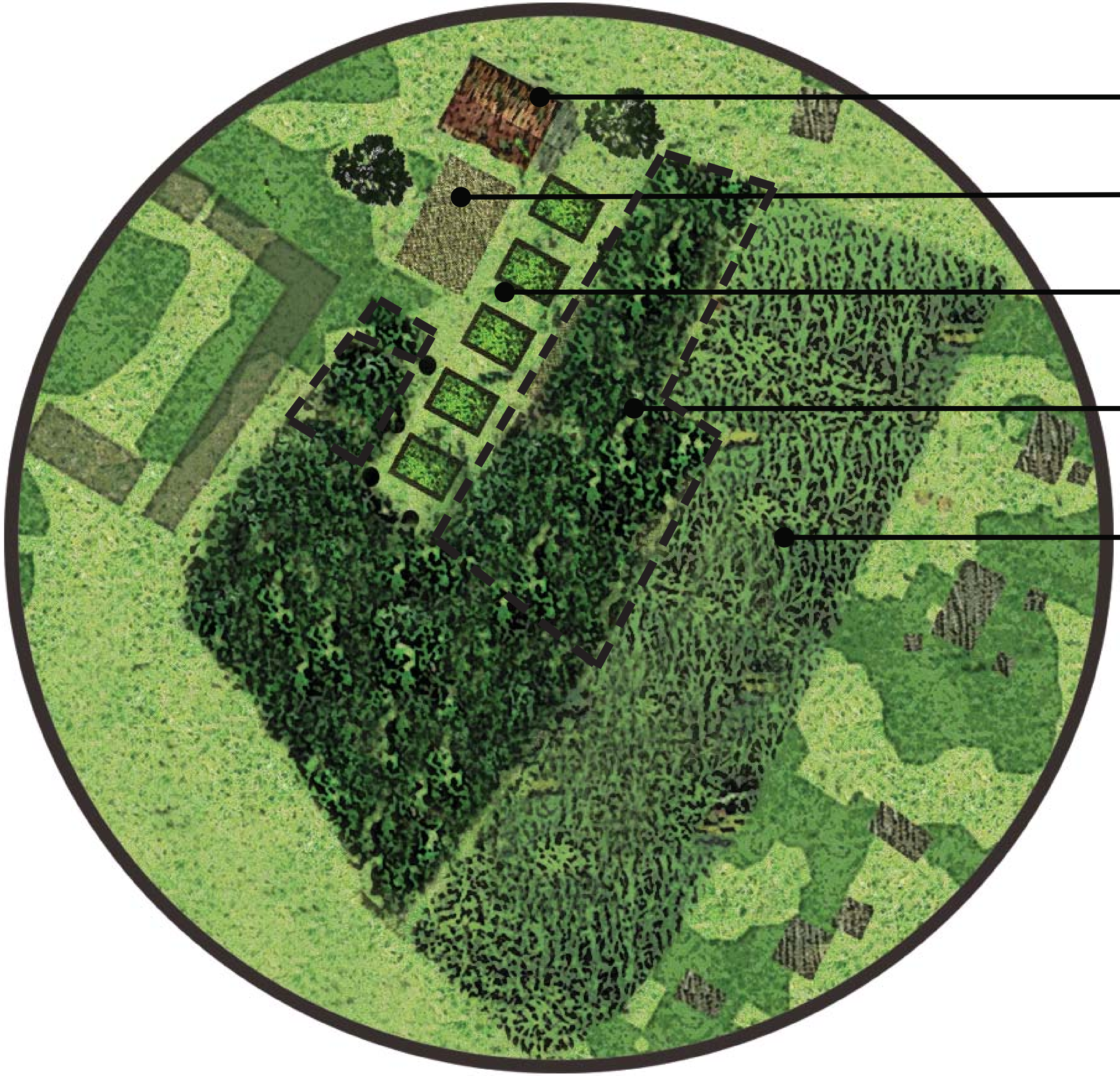
The locations of roads constitute where the population generally lives and highlights the density of areas of residence. Having easy access to the site location will be essential to draw in community members

SUITABILITY ANALYSIS

LOCATION MAP



Based on the suitability analysis, the area near the school in Mang'ula A has the best potential for implementation of the design. In the finding of a proper location, certain requirements and components needed to be met in addition to the factors that were addressed in the analysis. The overall concept of the design is to create community awareness about the amount resources exploited in order to fuel different types of stoves and the environmental impact it will have at a local scale. A 2.1-2.7 hectare area was essential in order for each fuel source to be exhibited in respects to the number of trees used per day, month, and year a household consumes for each stove in the analysis. The amounts of land necessary for the demonstration space to exist include 0.808 ha representing production of rice, 0.767 ha portraying amount of trees required for charcoal making, 0.015 demonstrating trees needed for a fuel efficient stove, and 0.034 ha for a three brick stove. This chosen location meets the requirements of the design as well as emphasizes the importance of environmental awareness through its connection to the school.



PLAN VIEW

The **ground-keeper** or askari lives here and guards the area of land. Training must be provided to ensure that the guard can also serve as a tour guide for tourists. The obligations of the askari include protecting the surrounding landscape from illegal activities such as cutting down trees and then they must also place example stoves in the demonstration areas daily to allow for local awareness.

The **thatch plot** highlights the prospect of generating income on a plant based resource. Handcrafts can be made and sold to tourists.

Medicinal shambas provide the community with an opportunity to grow species of plants that help improve overall human health. It also aids in the transitional dependency of medicinal plants previously collected in UMNP to individual gardens.

The **woodlot demonstration** is approximately 0.816 hectares and emphasizes the number of trees needed to supply fuel to a charcoal stove, an efficient stove, and three brick stove. It distinguishes the variabilities amongst stoves in Tanzania in addition to the costs to the environment.

The 0.808 hectares of **rice fields** represent the amount of land required to fuel a risk husk stove for a single year, supporting one household. An example of a rice husk stove is also adjacent to the fields to demonstrate the direct connection and the impact the stove has on the environment. The rice fields are multi-purposeful in providing a source of income as well as a source of fuel, for the rice husks that are waste products of the rice can be reused for fueling a stove.

MISSION

The **MISSION** of “The Living Village” is to raise community awareness of conservation-related opportunities through integration of ecologic, economic, and social components. By incorporating a green space that cohesively combines community initiatives with environmentally sustainable methods, the design becomes a multi-functional entity that strengthens the capacity of local people to manage resources equitably. The major objectives of the project include **(1)** providing opportunities to enhance *environmental stewardship* as well as *community resource management*, **(2)** stimulating *conservation* and improving biodiversity by minimizing environmental pollution, reducing carbon dioxide emissions in the air, and preserving local forests, **(3)** increasing *employment* and *income* generating opportunities, and **(4)** enhancing *quality of life* of villagers. The design incorporates five distinct spaces that utilize ecologically sustainable practices while catering to the needs of the community – a fuel demonstration, a woodlot, a beekeeping demonstration, a thatch plot, and a medicinal shamba space.

Three Stone Fire Stove

- space heater
- protects from **insects** because of the smoke
- provides **light, heat,** and a **social focal point** for friends and family

- 12% of energy content is actually used, 88% is lost
- poor indoor **air quality**, respiratory and eye problems
- too much **time** is spent collecting firewood
- contributes to deforestation and decreases biodiversity

Efficient Stove

- reduces **dependency** on firewood by 50%
- improves health by minimizing smoke inhalation
- diminishes poverty by decreasing deforestation
- **more time** can be spent on education rather than firewood collection

- still dependent on firewood

Rice Husk Stove

- fuel saving and quality of flame
- reduces carbon dioxide emissions
- minimizes problem of rice husk disposal which leads to environmental pollution
- helps preserve forests by reducing cutting of trees from firewood and charcoal consumption

- smokey even with a chimney
- start up of the stove is slow
- pot size choices are limited
- requires constant attention

Charcoal Stove

- relatively inexpensive
- easily portable
- adapted to various types of biomass fuels

- **heat loss**
- **health impacts from the smoke**

Propane (LPG) Stove

- healthier and cleaner fuel source
- more efficient and precise
- convenient

- relatively expensive

Rice Husk Briquette Stove

- relatively inexpensive
- does not require purchase of new stove
- minimizes collection of materials
- decreases deforestation and environmental pollution
- decreases GHG emissions and is reliable and clean energy

- **smoke requires proper ventilation**
- **can be slow to cook**
- **can be labor intensive making briquettes, taking 3-5 minutes each briquette**

	Three Stone Fire Stove	Efficient Stove	Rice Husk Stove	Charcoal Stove	Propane (LPG) Stove	Rice Husk Briquette Stove
Cost of Stove Construction (TSH)	300	1000	28,000	5000-8500	26,000	26,000**
Cost of Fuel (per month in TSH)	4000-8000	2500-3500	0	6,800	22,000	0
Annual Cost (per household in TSH))	48,000-96,000	30,000-42,000	0	81,600	264,000	0
Amount Needed (per household per month)	4-8 bundles (20 sticks)	2-4 bundles (20 sticks)	1-2 bags (100 kg)	2 bags (35 kg)	1 tank	500 briquettes
Accommodation (# of people)	3-5	3-5	3-4	4-6	1-3	4-5

**cost of homemade briquette making press included

Firewood Production

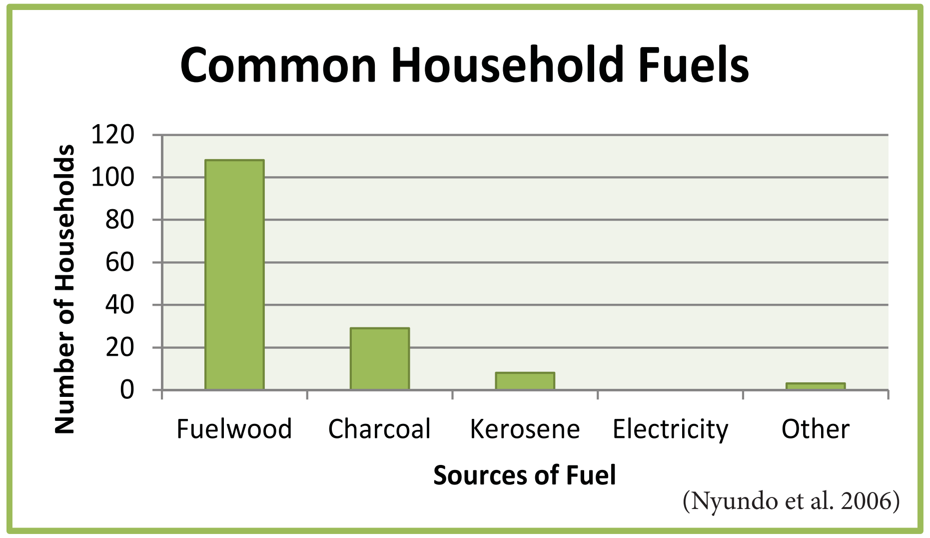
Inefficient Stove	Efficient Stove
46.86 hectares	20.62 hectares

per community per year

Inefficient Stove	Efficient Stove
14,200 trees	6,248 trees

per community per year

Inefficient Stove	Efficient Stove
20 trees per household	8.8 trees per household



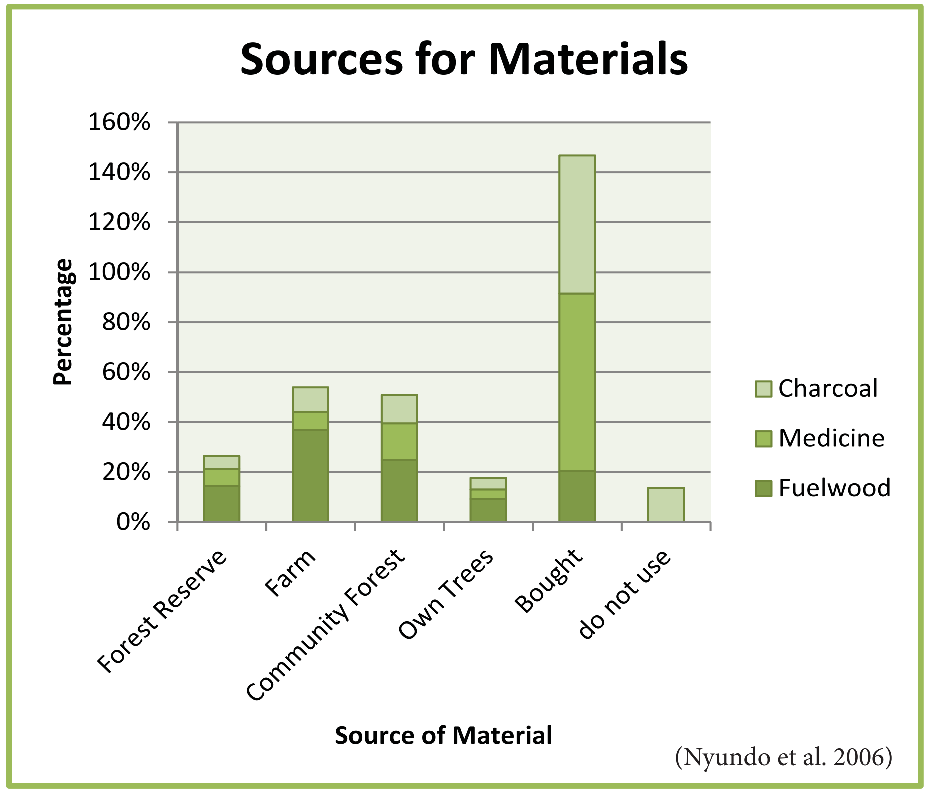
95% of household use fuelwood or charcoal are fuel sources for cooking and heating.

Charcoal Production

From field observations in Mang'ula A, approximately 25% of stoves ran on charcoal as a source of fuel. All clay and metal and clay stoves were available for sale in the marketplace, but no other options were present such as rice husk stove or LPG stove.

1 ton of Rice Husks SAVES 4-5 trees by firewood / 2-3 trees by charcoal

The community forest is the 2nd highest source for collecting firewood and charcoal. After the ban in UMNP was set in place, people began planting their own trees or buying fuel sources from local shops.



Rice Husk Production

20% mass of rice paddy that is rice husk

710 number of households based on 2,983 population and average household size of 4.2

1470 kg of usable rice husks per 73.5 bags of rice produced per hectare per growing season

60.4 number of households that can be supported by rice production

8.5% Mang'ula A's fuel needs met by rice husks

THREE BRICK STOVE EXAMPLE

This patch of trees portrays the amount of fuelwood needed for a household in three months to fuel a three brick stove.

These two trees in the distance represent the amount of fuel needed to supply a household with fuelwood for a month with a three brick stove. This method is unsustainable, for much of the energy from the fuelwood is underutilized (88%) .

The close proximity to a school allows children to venture out into the space and learn about the impacts of different types of stoves, so that in a few years when it is time to choose a cooking source, they will pick one based on cost in addition to efficiency and environmental impact.

The medicinal shamba borders the fuel demonstration in an attempt to emphasize the importance of plants to the diet as well as highlight essential uses of medicinal plants through the processing of boiling elements of the species to aid in heal ailments.

An example of a three brick stove is displayed to provide people with a visual as to the composition and components of this inefficient method of cooking.

The bundle of sticks represent one days supply of fuelwood required for cooking 3 meals on the three brick stove.

The material of the paths will be crushed stone with an edging of bricks to make the space more conducive to tourism efforts. The trees within the display y are in a rotational system geared towards a five year plan that aims to replace existing trees once they reach the peak of maximum growth. The intention of the site is to highlight a three month span of produce, since a full year supply of fuelwood for the three brick stove requires 0.102 hectares more than the location will allow.

***Similar presentation of the stove and amount of fuel required is exhibited in the demonstrations pertaining to the efficient stove, charcoal stove, and rice husk stove.

Tree Species

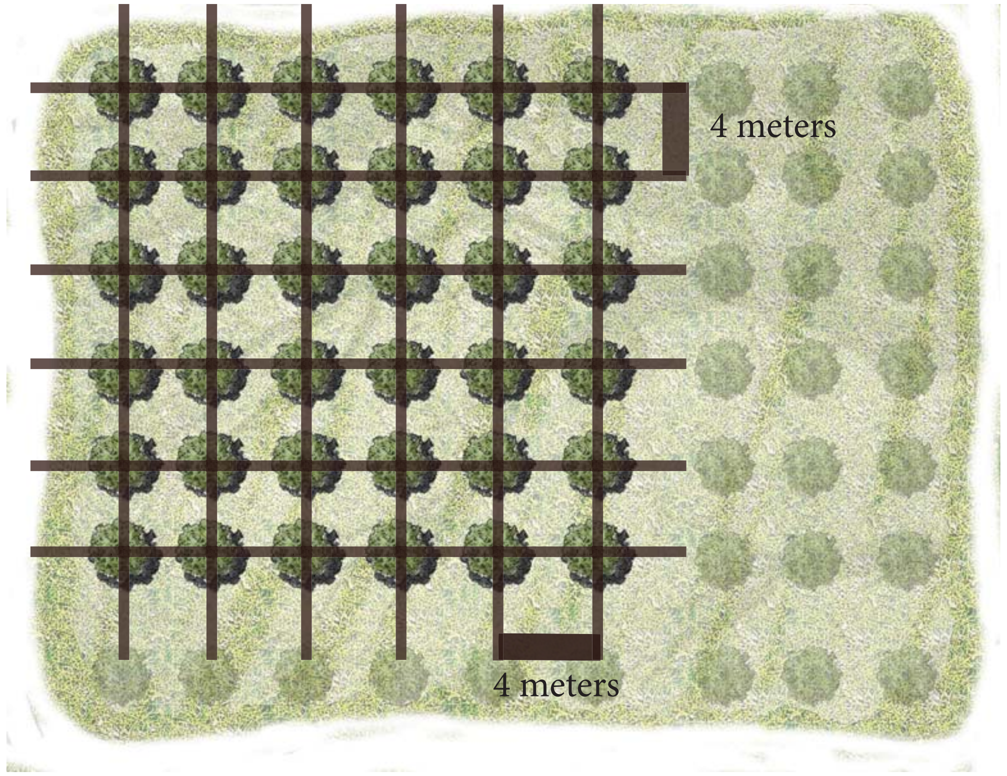
Azadirachta indica

The Neem tree is also known as "panacea" which refers to the tree that cures forty diseases. It is used for reforestation efforts, for it has good quality hardwood for supplying people with a fuel source. It is also an effective insecticide, repelling mosquitoes to help combat malaria. The twigs of the tree have been used for brushing teeth and the oil from this species is sometimes placed in sprays to fight against fleas for cats and dogs. This species was chosen for its medicinal value as well as a valuable fuelwood.

Khaya senegalensis

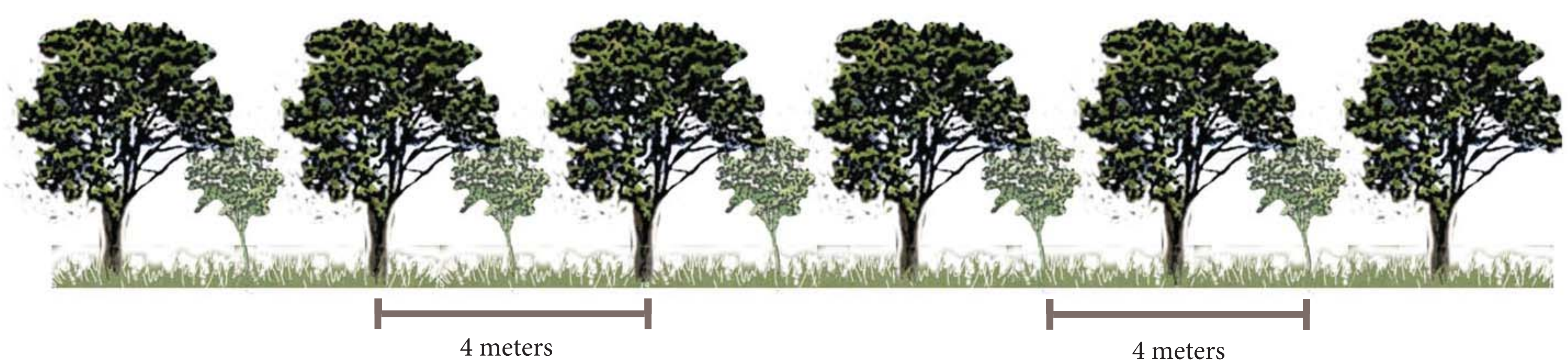
The wood from a Khaya tree is typically used for construction purposes or fuelwood. In addition to its valuable wood, the bark of the tree can be boiled and drank to combat fever caused by malaria, stomach issues, and headaches, It can also be applied to the skin to cure rashes and heal wounds.

LAYOUT OF DEMONSTRATION



There are three main sections of woodlots varying in size and species, each demonstrating the amount of land and trees required to supply the three brick stove, efficient stove, and charcoal stove. The fuel efficient stove has the least impact on the environment while the charcoal stove requires a large area of land. The purpose of separating each woodlot based on stove type and fuel capacity is to create awareness to the local community as well as provide them with viable cooking options that are sustainable and convenient. The connection between the fuel demonstration and the woodlots distinctly delineates patches of trees needed to fuel each stove per day, per month, and per year. A rice field is also included within this section to indicate the impact of rice husk stoves and briquette (made of rice husks) stove.

The below diagram indicates the spacing between the trees planted. Based on a 4 meter by 4 meter plot, approximately one hectares can supply 625 trees, each 6 meters high in an average of 5 years. The design will utilize tree rotation techniques that will provide villagers with an efficient way to use the limited land. Crop rotations can also be incorporated into the scheme in a second phase of implementation.



WOODLOT PRODUCTION

Hectares needed to fuel Stoves

	per month	per year
Three Brick Stove	0.003	0.128
Efficient (firewood) Stove	0.001	0.056
Charcoal Stove	0.029	0.344
Rice Husk Stove & Briquette (rice husk) Stove	0.061	0.745*

*calculation based on using waste product of rice, so income is an additional factor

**statistics measured in hectares

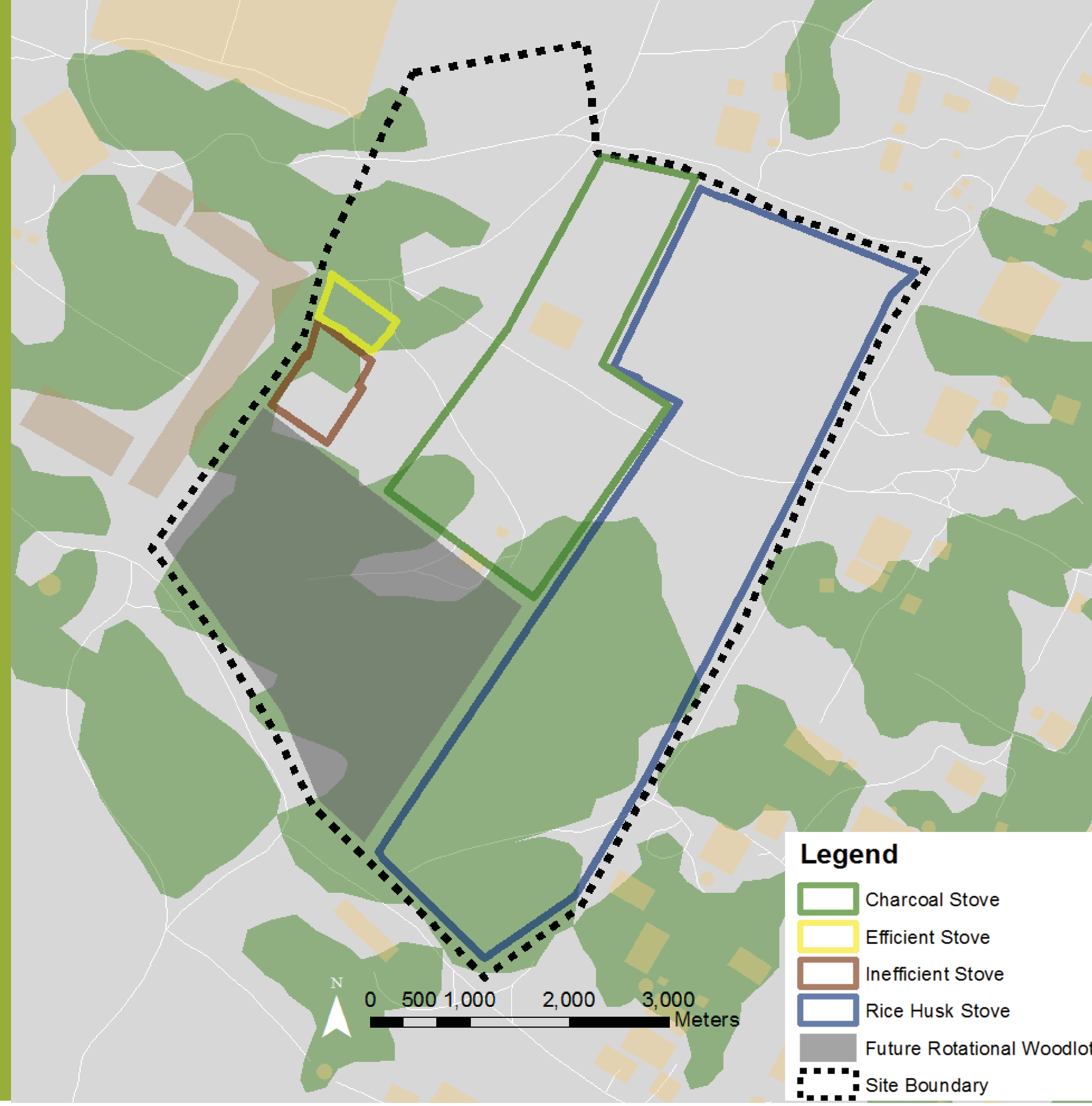
***per day equivalence will be visually seen through bundles of sticks for the stoves that use firewood and charcoal buckets for charcoal stoves (as well as the amount of wood required to make the charcoal) and rice husks with the briquette stove. Note that the hectares required for the three brick stove and the efficient stove are per year while the hectares in the design represent a 3 month period due to limited space.

Effectiveness of a Woodlot

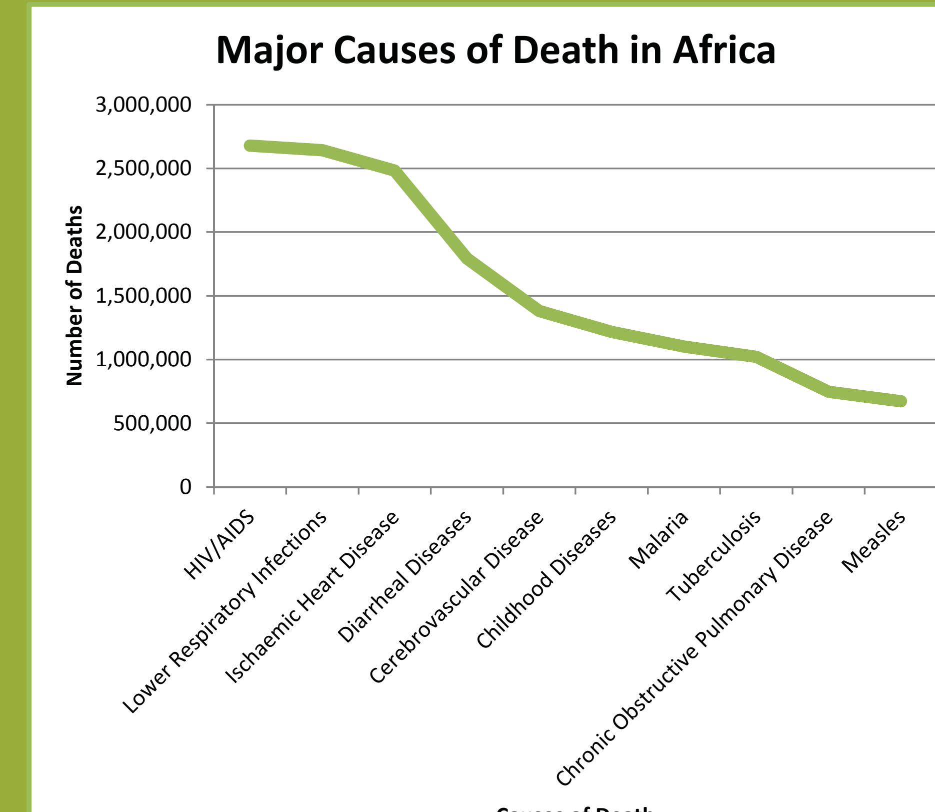
Deforestation diminishes amounts of rainfall to a small extent and the lack of protection for soil, increases erosion and decreases value of land to agriculture. It is important to also note that the traditional Tanzanian culture relies heavily on forest products, so by enhancing the amount of land devoted to woodlots, villagers will have an easier time growing as well as finding foods like wild fruit, medicinal plants, and honey (LPG 2002). The issue in respects to increasing woodlots in the community is the scarcity of land and resources. With a growing population, it will become more difficult to sustainably feed the village on the land allotted.

In order for the woodlot demonstration to be successful several things must happen: (1) a permanent askari must live with the designated area of land to safeguard as well as maintain the grounds, (2) community must be willing and open minded to solutions that do not follow traditional standards, (3) awareness in the importance of resource management, (4) ability for design to produce income opportunities and supply medicinal products year round, and (4) a clear understanding of the benefits that will result from the implementation of sustainable strategies.

Depending on the chosen tree species, the woodlot has the potential to be multi-functional, affecting resource management and challenging communities to increase utilization of native species. This woodlot provides this transition through the use of native and non-native species.



Effect on Human Health



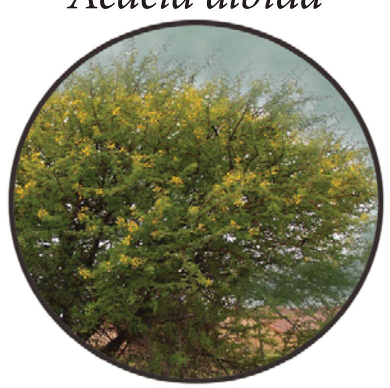
(Lotter & Clarke 2012)

Lower Respiratory Infections are the second highest cause of death in Africa, and within that statistic, many deaths are contributed to the constant inhalation of smoke from standing around a cooking stove. It is critical that stoves be modified to reduce the impact to air pollution and illness while also being efficient. Having a woodlot will help improve air quality and bring about new methods of cooking, ones that release healthier, cleaner air and decrease deforestation. The propane (LPG) stove, in particular, decrease fuel use and carbon dioxide emissions in addition to reducing the amount of particle matter entering the air by as much as 90% (LPG Committee 2002).

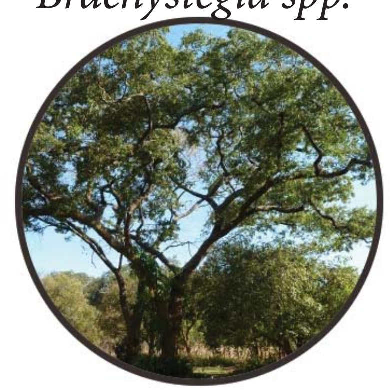
Alternative Tree Species

Acacia spp, Julbernadia globiflora, Brachystegia sp, Lannea schimperi, Leucaena leucocephala, Pseudolachnostylis maprouneifolia, Combretum sp, Mimusops kummel, Senna siamea and Tamarindus indica. (Malimbwi & Zahabu 2008)

Acacia albida

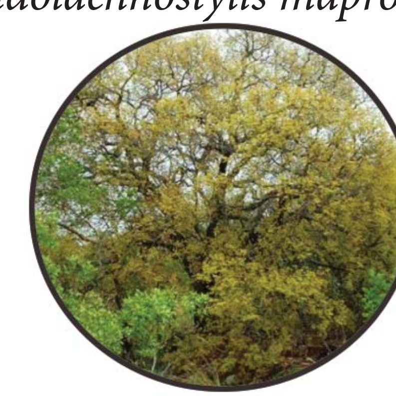


Brachystegia spp.

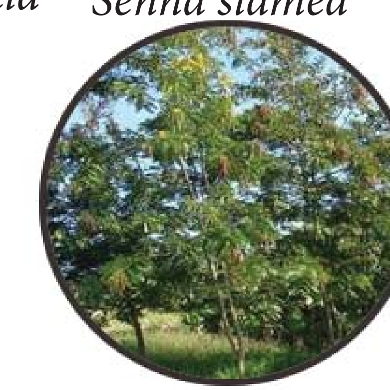


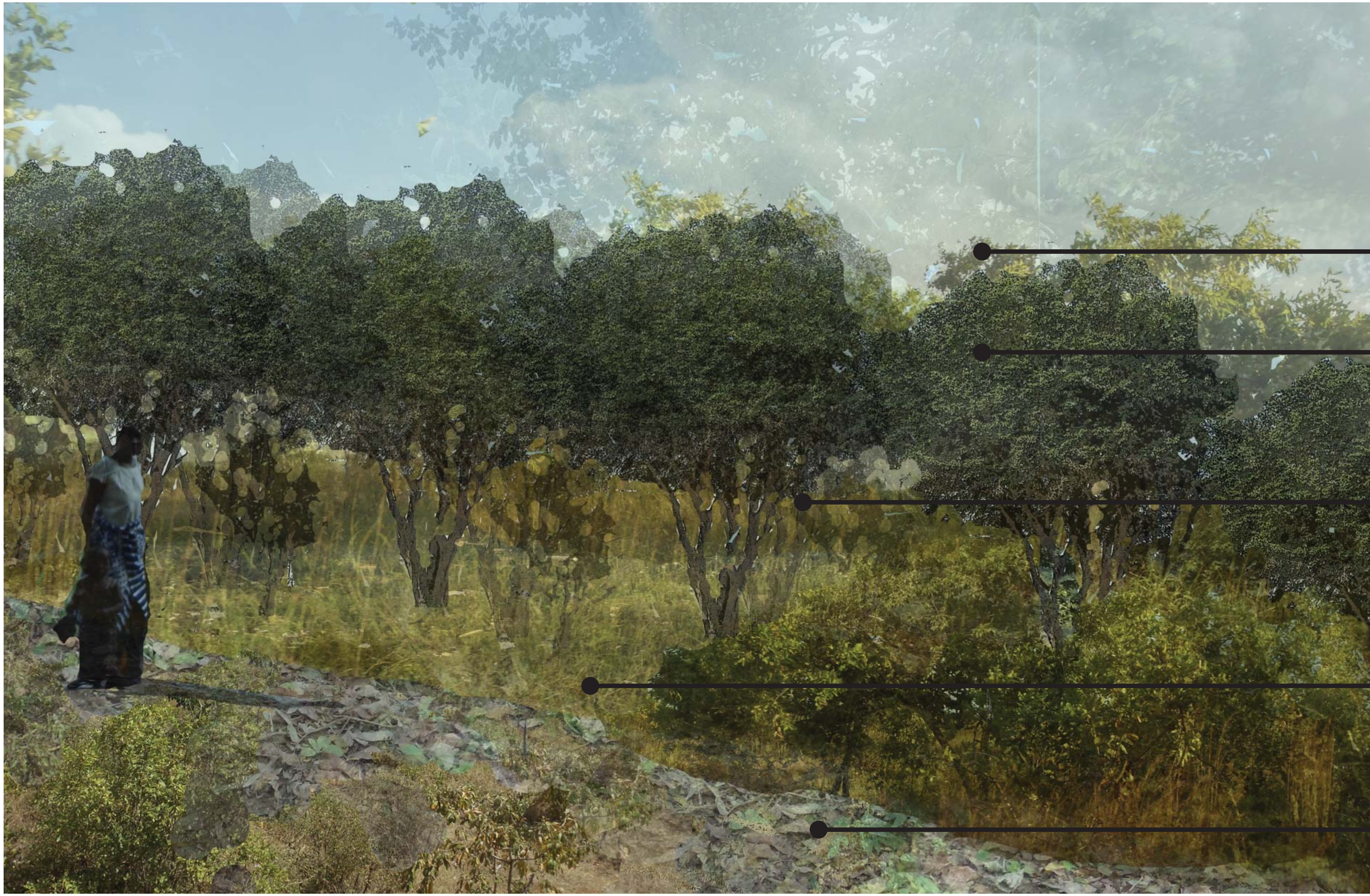
Leucaena leucocephala

Pseudolachnostylis maprouneifolia



Senna siamea





Additional Woodlot Area

The diverse composition as well as protection of land within the site will increase local biodiversity.

Spacing of trees is determined by the species of trees being implemented and the production rate of an average tree stand in a five year span.

Once the initial trees planted have reached maturity, additional seedlings must be incorporated to continue the cycle of growth. On average, 625 trees grow within a 4 meter by 4 meter composition.

Areas within the woodlot will be focused around a central space that exhibits the different types of stoves associated with that particular woodlot.

A crushed stone path promotes the tourist aspect of the site by incorporating structure and delineation. The paths that run through the woodlots can also serve as casual walking trails.

In the second phase of the design, this space will become a rotational tree and crop demonstration that identifies key relationships between the species of plants that harmoniously dwell together. Once species are chosen, the implementation stage will occur, and people will be able to observe how productive different combinations of plants are. The objective of this area is to enhance productivity within a small space as a model for community member to mimic around them homes.

MEDICINAL SHAMBAS

There is a distinct transition between the woodlots to the right and medicinal shamba towards the left within the image. Intention was put in the placement of each designated species to create a hierarchy of rich layering the mimic the ecosystem within the forests of UMNP. There is a mixture of plant species that do well in more urban areas while that flora that lies adjacent to the edge of the woodlot reflects species that typically found on the forest floor. In addition to habit, these species were chosen for their benefit to human health and their adaptability to the climate of Mang'ula A. In the lower left corner of the image, the ground-keepers house is identified to emphasize the need for management of this area. One person must protect as well as maintain the flora that is exposed to the local neighborhoods and tourists.

Tabernaemontana divaricata

It is considered the best herb for eye diseases. The milky juice from the leaves is an anti-inflammatory to place on wounds. The juice from the flowers serve as eye drops and can be applied to the skin to cure certain diseases related to the skin. The roots can relieve toothaches, and if ground up with water, it can aid in alleviating intestinal worms.

Psidium guajava

There is a high presence of tannina for anti-diarrheal related issues. It is an anti-bacterial as well as antioxidant. Often times, it is known to aid illnesses of dyspepsia, edema, swelling, dizziness, nausea, nervousness, HIV, and skin conditions. By boiling the leaves and drinking the remains as tea helps to cure diarrhea. It also has a high level of Vitamin C.

Citrus aurantifolia

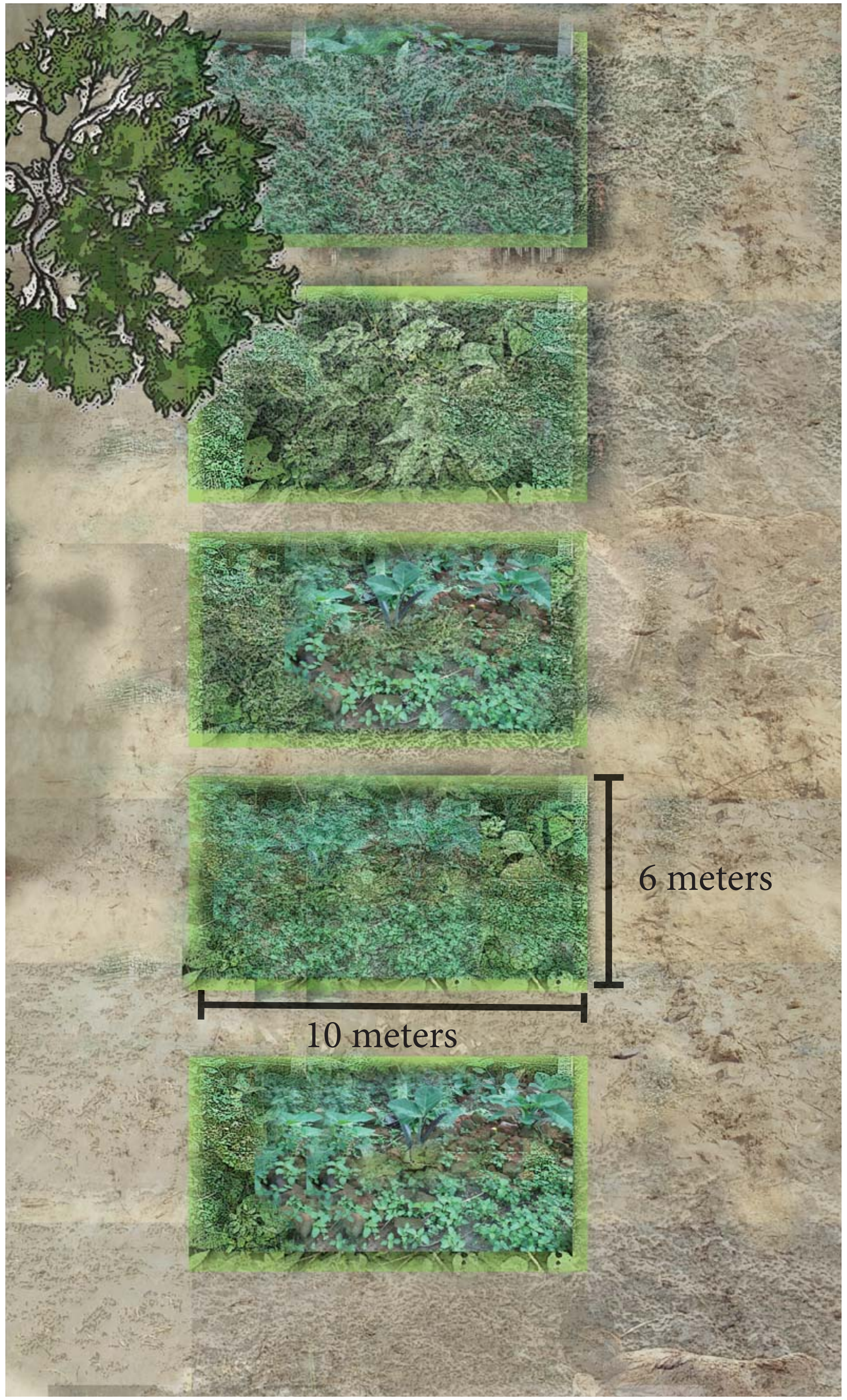
It is a great source of Vitamin C, B6, P, G, potassium, folic acid, and flavoniods. The lime plant can also relieve jaundice, menorrhagia, and symptoms of gastric or peptic ulcers. In addition, the roots can help babies to sleep easier, with a calming effect.

Aloe vera

"The miracle plant" has several medicinal benefits that have been recognized. The transparent gel within the spiked leaves can be used to treat skin and digestive conditions. It is aid in treating burns and is used as an inflammatory. It is an anti-bacterial, anti-parasitic, anti-diabetic form of medicine that also serves as a laxative and moisturizer.

Moringa oleifera

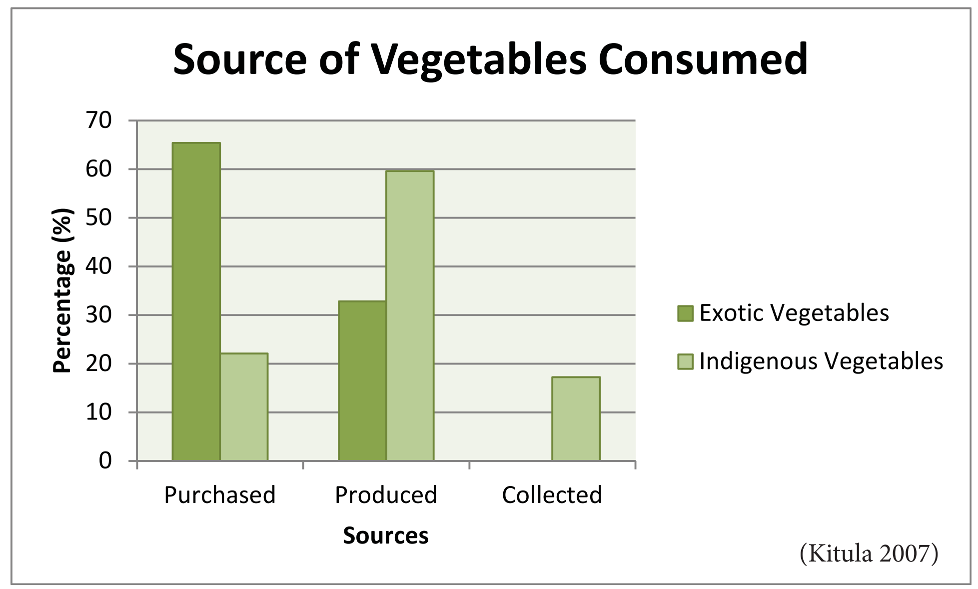
Also known as the "Miracle Tree," this flora helps to regulate glucose levels and high blood pressure. There are a number of micro-nutrients such as Vitamin A, B, C, K and beta carotene and Manganese. The leaves of the plant can be a source of food, preparing it similar to that of spinach.

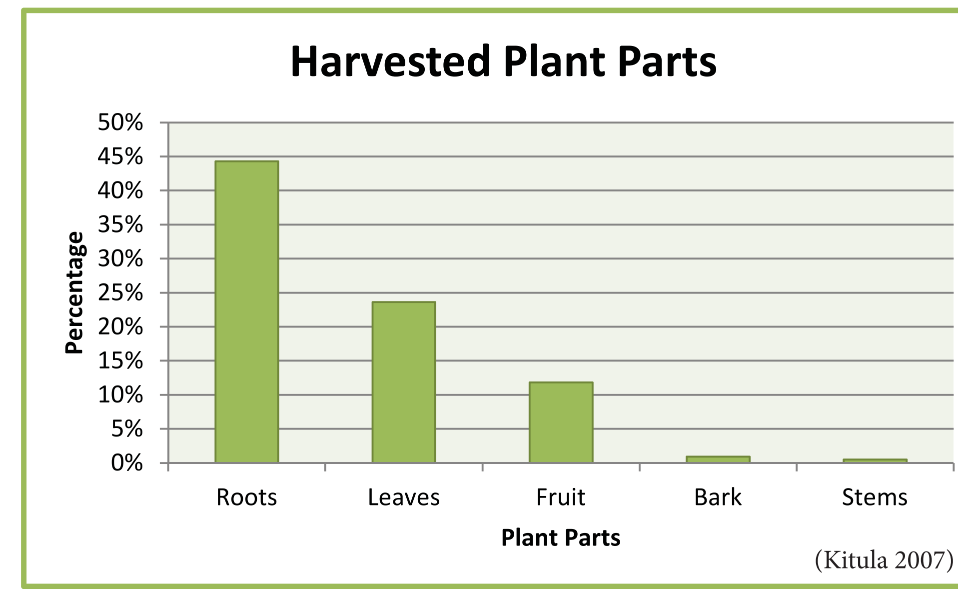


Impact of Medicinal Plants on Community

"A total of **45 plant species** within Udzungwa Mountains were documented curing about 22 human diseases" (Kitula 2007). Once the ban was set in place, people could no longer collect these medicinal plants that they relied on for health acre and income.

Roots are the most common part of the plant used. in medicine. The most common methods of preparing plant medicine in a form easily administered to people include **boiling** and **pounding.**





In the past, people had free access to medical services, but in 1993, **cost sharing** on medicine was introduced and rates of patients using these services dramatically declined. Registration fees were roughly **1000 TSH** or **5000 TSH per year** for the entire family. **Transportation** to these facilities were also an issue. In response to these overarching challenges, people reverted to growing or collecting medicinal plants because they were more accessible and cheaper (Kitula 2007).

There is an informal market within villages for selling medicinal plant parts. On average, **women** typically sold medicines in the form of roots, bark, and powder as rates between **300 and 7000 TSH.** Vendors have the capacity to make anywhere from **150,000 to 200,000 TSH** per month from sales (Kitula 2007). Therefore, the incorporation of medicinal shambas could potentially be an income generating source as well as a way to improve local human health.

The Value of Gardens

In addition to the gardens, there are two species of trees that will be planted that provide medicinal value and serve as shady areas to congregate and relax,

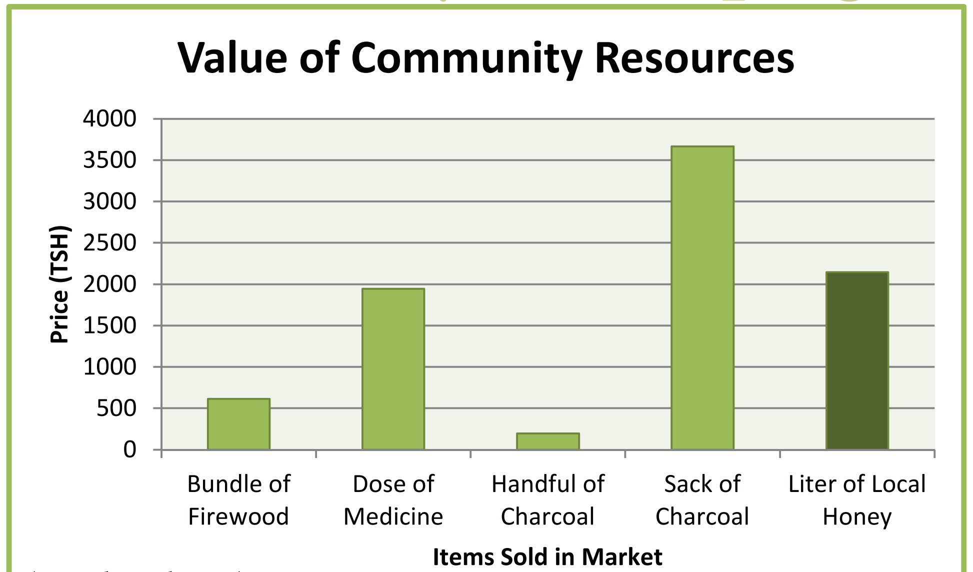
A house will be built on site to accommodate the grounds-keeper, or askari, that will be needed to watch over the area on a daily basis. Within the house, a storage area will be created to place the demonstration stoves at the end of each day to minimize stealing. They will need to protect as well as maintain the vegetation, so training will be required.

Close proximity to the school will allow children to learn how each demonstration works , and the goal is for this area to serve as an outdoor classroom where children can plant and grow species sustainably.

There are five shambas dedicated to medicinal flora, most of which were chosen based on the species typically grown in and around Mang'ula A.

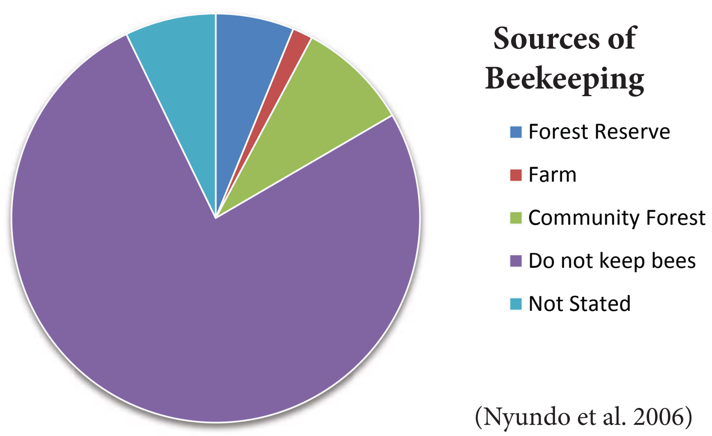
Each shamba will have a single plant species of medicinal value, and the three suggested plants for this area may be switched regularly with other species that the community sees as important. The intention of the medicinal shamba is to mimic a habitat similar to that within the UMNP in order to provide the community once again with a place to collect traditional medicine.

Community Beekeeping



(Nyundo et al. 2006)

This diagram directly relates aspects of each demonstration through the average cost of items produced within the marketplace. These figures portray how valuable certain items are to the community. Specifically, honey is valued to a greater extent than medicine.

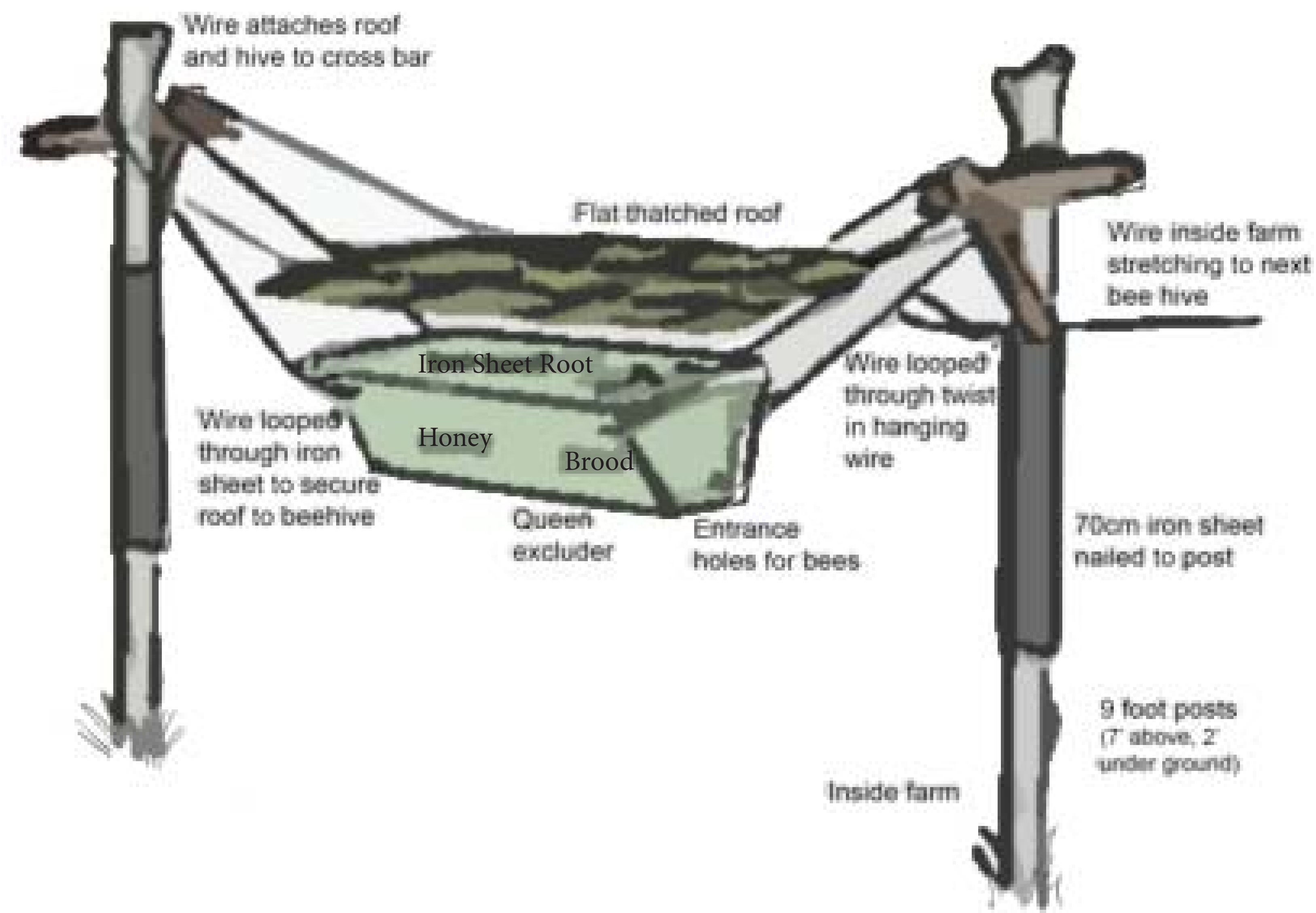


(Nyundo et al. 2006)

Efforts are already being made along the boundaries of Udzungwa Mountains National Park to incorporate beehive fences. Thus far, they are deterring elephants from entering the local villages, however more fences must be placed in order for the project to be successful. Beehive fences great an opportunity for community to partake in a possible solution to crop raiding. By creating awareness through this beehive demonstration fence and providing people with the tools necessary to start up the "business" of beekeeping - one in which directly benefits them.

Construction of a Beehive Fence

Beekeeping is a multifaceted activity that provides income to local villagers through the sale of honey as well as protects croplands from elephant raids. This method has been proven to prevent elephants from accessing agricultural lands because the stirring of the bees through the wire contraption attached to the beehive results in the irritation of bees around and in the trunks of the elephants. The beehive fence in the design is intended to hold 50 beehives in each metal cylinder at 10 meter intervals along the edge of the woodlots (Raleigh Expeditions 2012). However, based on the proximity to the village and school, the beehive demonstration will not contain bees. It is instead an educational tool in addition to a resource for locals to learn what it takes to keep bees. This system is very low maintenance and environmentally sustainable in practice.



Based on Diagram from: http://www.elephantsandbees.com/research_project/Beehive_Fence.html

The beehive fences are intended to bring awareness to the community as well as an additional method for generating income. This technique directly integrates environmentally sustainable practices associated with UMNP in a way that benefits both the park and the people.

Beehive Fences

The beehive fence borders the woodlots in order to mimic the importance of placing these fences along the edges of forests like those in UMNP. Beekeeping is dominantly in forest ecosystem because bees are able to obtain the resources they need from that landscape.

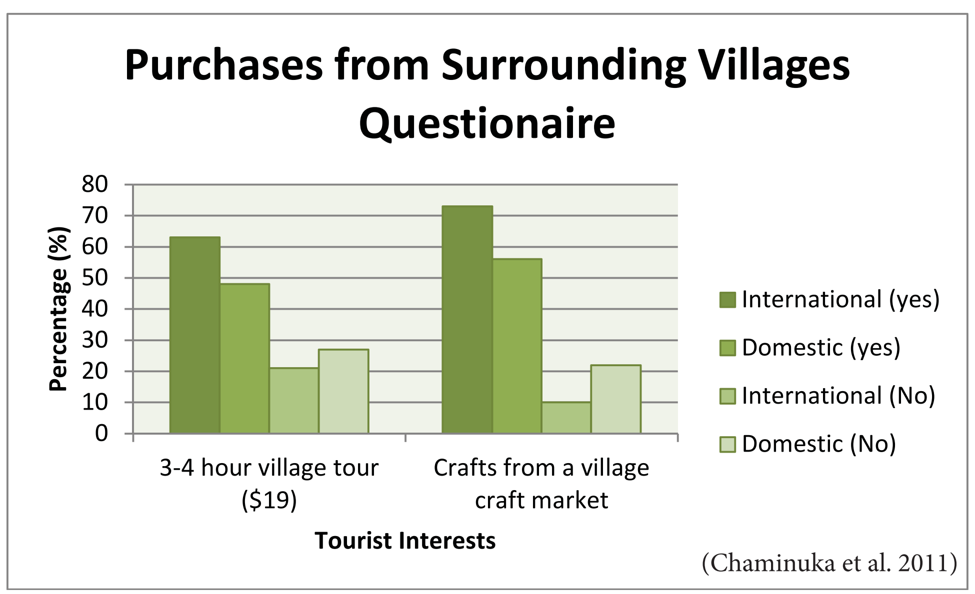
Having the beehives adjacent to the medicinal shambas allows for bees to pollinate the surrounding flora. It also represents the situation of crop raiding and how the fence provides protection from elephants.

Thatch covering over the beehive metal cylinder allow for a conducive climate for the bees. The thatch used to create these fences can come from the thatch demonstration plot.

Bee are not used in this demonstration due to the implications it would have on the community walking within the area.

Integration

The integration between commerce, tourism, and the local community is this thatch production. By utilizing the grass resource to make handcrafts, the community will be able to generate a higher income and tourists will be able to gain valuable insight into the culture and traditions of Tanzania, specifically Mang'ula A. In the perspective to the left, the thatch field that measures 10 meters by 20 meters. Based on consensus of the community, the size may change slightly to accommodate demand. Handcrafts will also be sold, under the thatched shop, to tourists that want to take in the Tanzanian lifestyle.



(Chaminuka et al. 2011)

ECO-TOURISM

Creation of two programs with different approaches, one that focuses nature and the other highlights culture within the tourism sector of a community. Half-day tours such as a "Nature Tour" which can consist of a walk through the village's tree nurseries and current conservation efforts while the "Culture Tour" can highlight the marketplace, schools, and local restaurants. They also encourage community participation and education through the potential monetary benefits and needed training of tour guides. In respects to the entire communities, the programs bring in revenue to fund other environmentally focused community projects. To the tourist, these tours promote cultural education and awareness.

Ex. Hondo Hondo in Mang'ula provides the opportunity for guests to visit Magombera and obtain a tour from a local guide. Profits within the first year were approximately 600,000 TSH (Marshall 2013).

The goal of the thatch plot is to draw attention to an additional source of income. The idea is for the wife of the grounds-keeper to make hand crafted items that can then be sold to tourists who have the opportunity to visit this site on a "culture tour."

Grass Fields

The thatch plot is adjacent to the grounds-keeper quarters in order to promote the idea that growing grasses that make thatch in the backyard could provide a source of income through the creation of handcrafts.

This area of land represents the thatch plot. In addition to its value to the economy, the grasses planted provide visual appeal and decrease soil erosion in the wet season.

The medicinal shambas directly relate to the concept of using sustainable vegetation methods to generate income. These practices may help to reduce the negative perspective communities may have for the environment and specifically for UMNP as a result of the ban on deadwood, medicinal, and grass (thatch) collection.

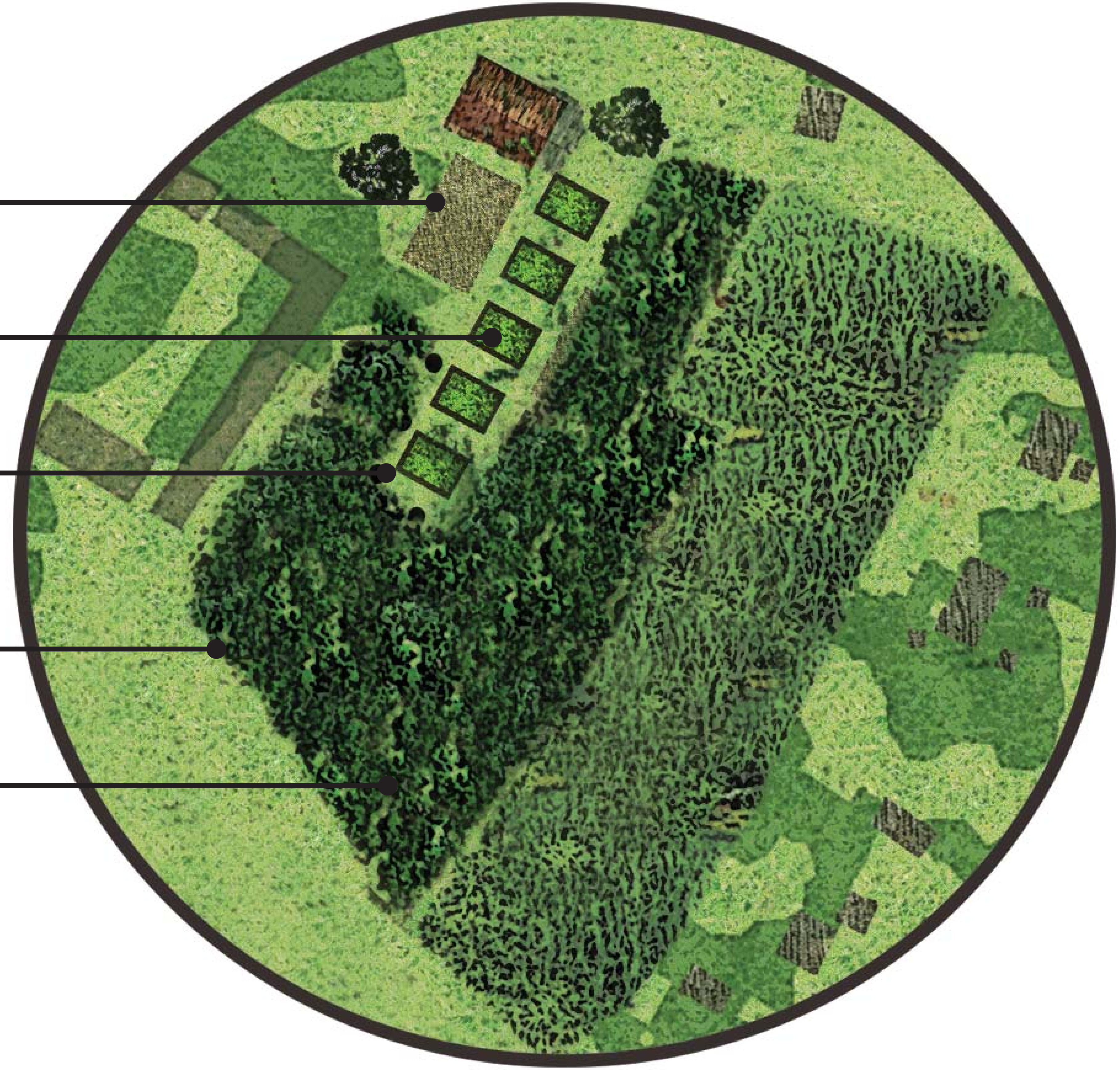
Thatch Plot

Medicinal Shambas

Fuel Demonstration

Beekeeping Demonstration

Woodlots



OVERALL PLAN

Establishment of the Woodlots

- Representatives from the school along with the grounds-keeper must receive proper training in order to carry out maintenance.
- Monthly monitoring reports should be created to reference and further research logical methods that will benefits both the environment and the community.
- All information pertaining to the design site must be publicly known in order to encourage community pride and participation

Development of Fuel Demonstration

- Establish woodlots that encourage rotational trees and crops
- Provide visual aids for each type of stove and the amount of fuel required to supply that stove per day, per month, and per year.
- Promote fuel-efficient stoves through direct connections to benefits to community as well as environment.

Promotion of Plant Species in each Demonstration

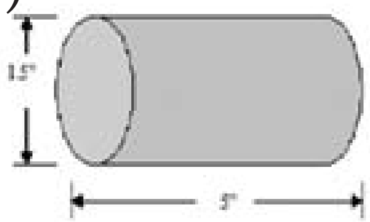
- Provide a list of native and non-native plants that dwell in the local climate that are valuable to the environment, human health, and food security.
- Monitor progress of design integration through use of surveys and questionnaires in order to realize project's full potential.

Enhancement of Community Participation

- Create awareness by locally promoting initiatives in the design.
- Engage community through tourism efforts such the making of handcrafts.
- Provide an area within site that allows community to interact.

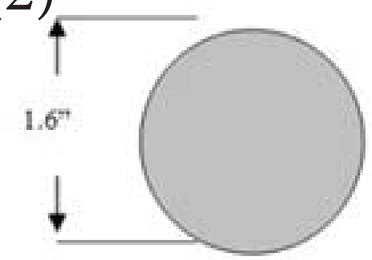
Instructions

(1)



1. Get a 1.5” diameter steel pipe preferably those used for water. Cut a uniform length of 6” using a hack saw. You can buy a ready cut piece from used pipes/scrap metal dealers.

(2)



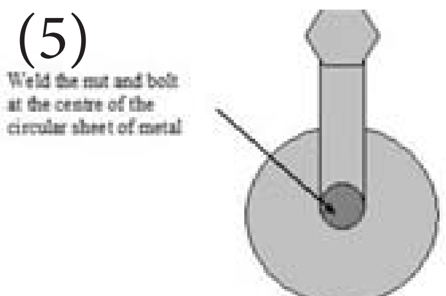
2. Cut a Circular Piece of Metal Sheet 1.6” in diameter and weld it onto one end of the steel pipe.

(3)

3. Buy two nuts and bolt 6” long - like those long screws used to fasten a bedpost to one of the adjacent side pieces.

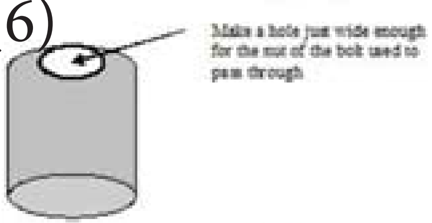
4. Cut two other circular pieces of metal sheets each 1.4” in diameter, such that each circular metal sheet can easily be moved through the inside of the pipe without sticking on the sides.

(5)



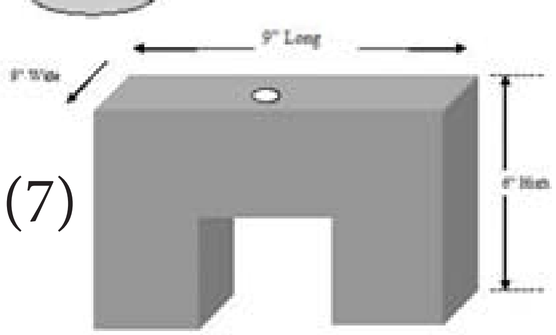
5. Attach each of the loose nuts to the end of the respective bolts. Weld the first ‘nut and bolt’ at the center of one of the circular sheet of metal such that it is perpendicular. The loose nut is to help the bolt attach itself firmly on the circular sheet of metal. Lets call this a Plunger. Repeat the same by welding the second ‘nut and bolt’ at the center of the other circular sheet of metal such that it is perpendicular. The loose nut is to help the bolt attach itself firmly on the circular sheet of metal. Lets call this an Ejector.

(6)



6. Take the metal can made and at the center of the end closed by the metal sheet, make a hole, by using a welding flame, so that the hole is just wide enough for the nut of the bolt.

(7)



7. Make a stand. Cut, using a hack saw, a piece of timber 3” X 3” by 9” long. Cut another two pieces of timber each 3” X 3” by 3” long. Fix the two smaller pieces of wood to the ends of the longer piece of wood such that they will act like legs. You need to use 5” nails to join the timbers. At the center of the longer piece of timber, drill a hole wide enough for the bolt to pass through.

8. Get a Hammer

i) Put the ejector into the can/cup such that the bolt protrudes out through the hole at the bottom of the can.

ii) Put the protruding bolt through the hole on the stand such that the cup together with the ejector sits on the timber stand.

iii) Put the briquette paste into the cup that you have just sat on the stand. You can use a separator made of disposable plastic if you want to make two/three shorter briquettes at once. Disposable plastic glasses can be cut with a razor to make nice separators. Short briquettes have a higher surface area that provides more oxygen for a faster burn of the briquette.

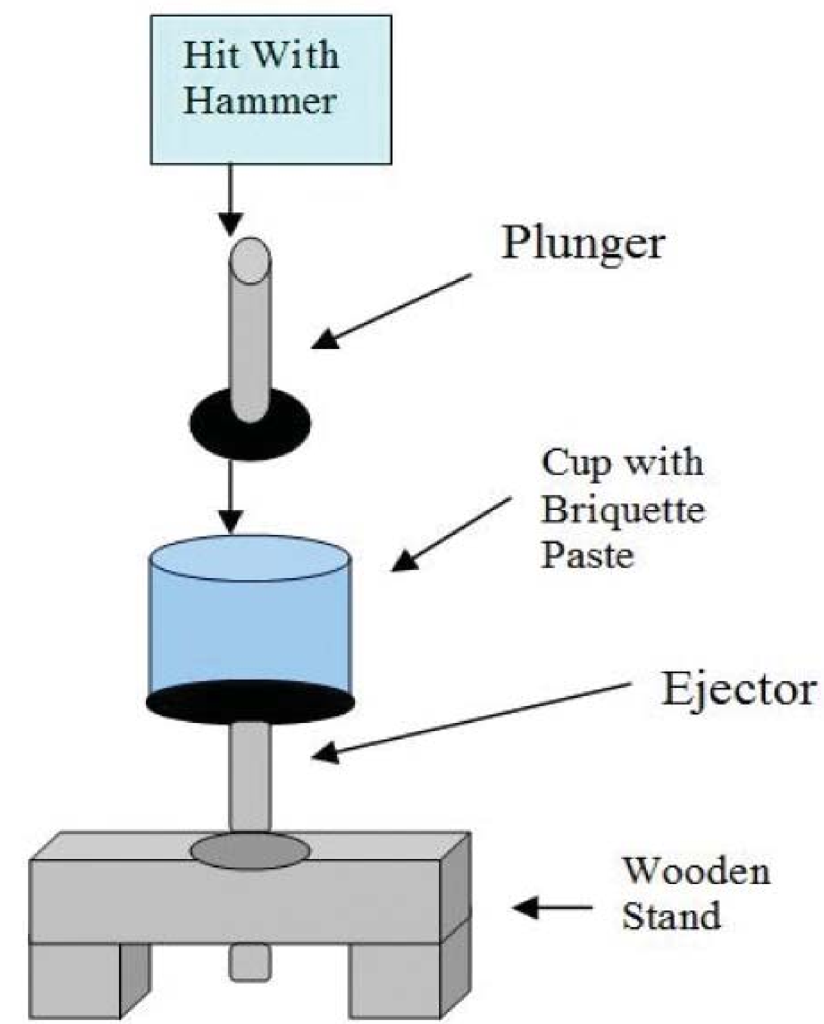
iv) Place the plunger on top of the paste that you have just put in the cup such that the attached bolt is facing upward.

v) Hit the bolt of the plunger with a hammer several times (3/4 times) until it can’t move any further down the cup - the compression of the briquette(s) is now complete.

vi) Remove the plunger. Remove the cup with the content of the pressed briquette from the hole of the wooden stand. Press the bolt of the ejector on the surface of the wooden stand or on the floor surface such that the ejector inside the cup will push the briquette formed upward.

vii) Remove the briquette(s) and put them on the sun to dry for three to four days. Drying time will depend on atmospheric temperatures, wind strength and relative humidity (amount of moisture in the atmosphere).

(Ngureco 2012)



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