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An Ethnobotanical Examination of Traditional Medicine in Ngezi Forest Reserve

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SIT Study Abroad

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Abstract:

Traditional medicine is an important aspect of the both the culture and health of communities worldwide. Ngezi Forest Reserve is a protected area on Pemba Island which is part of the Zanzibar Archipelago. This forest contains a wealth of botanical diversity which includes many species of medicinal plants. Traditional healers (*waganga*) use these medicinal plants to heal members of the community. Interviews and forest walks with these healers were supplemented by consultations with a botanist to determine medicinal value of the forest and the surrounding areas. In compiling information from 15 healers in the area, 98 species of medicinal plants were identified (most of which were outside of the forest), as well as a wide variety of uses and preparations. Priority medicinal species, which are used frequently by healers but are decreasing in abundance, include *Mjafari* and *Msoo*. Recommendations were made for the protection of these species while still accommodating their usage in traditional medicine in the area.

Introduction:

"Traditional medicine" is defined by the World Health Organization (WHO) as, "the sum total of all the knowledge and practices, whether explicable or not, used in diagnosis, prevention and elimination of physical, mental or social imbalance and relying exclusively on practical experience and observation handed down from generation to generation, whether verbally or in writing" (World Health Organization 2013). Around the world, each society maintains a set of these medicinal or healing traditions that are preserved and updated over time. These practices, and the materials with which they are carried out, are usually in accordance with the ecological features that surround communities; local natural resources were used before the presence of international or intercultural trade because there were no other options. Thus, regionally specific medicinal plants have been identified and cultivated throughout the histories of all societies.

There is much research on traditional medicine and medicinal plants around the world, but there is very little research on the specific medicinal plants found in and around Ngezi Forest Reserve in Pemba Island, Tanzania. This study attempts to demonstrate the extensive botanical diversity of medicinal plants in the Forest and also to explore their cultural significance to the

surrounding community. The data collected will not only add to the existing knowledge of medicinal plants used in Zanzibar, but will enable a stronger argument and recommendations for the conservation and management of these important resources, based on practical information given by traditional healers who are local experts.

Background:

Traditional medicine in Kiswahili is *dawa za asili*. In Tanzania, the practice of *uganga* is the traditional medicine. The word addendum "-*ganga*" originates from the proto-Bantu verb that means "to tie up" (Gonzales 2009). This was because health practitioners were supposed to tie-up the patient in good medicine to cure the "untying" that "evil medicine" or spirits had done to the person. *Uganga mitishamba* is a discipline of traditional medicine which utilizes specifically medicinal plants to heal afflictions. These afflictions range from mental and spiritual problems to purely physical ailments. The experts in this discipline are the traditional healers or *waganga (mganga sing.) mitishamba*.

A territory of Tanzania located in the Indian Ocean, the island system of Zanzibar has a dynamic history of trade and a unique tropical marine environment that promote a diversity of medicinal plants and intriguing practices of traditional medicine (Figure 1). According to a previous study on medicine in Zanzibar, some common medicinal plants used include *Azadirachta indica* (neem tree), for malaria, digestive problems and other ailments, *Solanum incanum* (bitter apple), as an anticancer agent and antioxidant, and *Ocimum suave* (wild basil), as an anti-microbial and ulcer healing agent (Baylor 2015). Traditional medicine provides the majority of health care to Zanzibaris, according to the Zanzibar Traditional and Alternative Medicine Policy (Ministry of Health and Social Welfare 2008). Traditional healers and modern Western "biomedical practitioners" coexist in Zanzibar, but do not necessarily interact with each

other due to language disparities and divergence in their belief systems (Meier zu Biesen et al. 2012). Due to the population growth on Zanzibar, in conjunction with shortages and consequent high prices of biomedical drugs, Zanzibaris depend increasingly on traditional medicine (Ministry of Health and Social Welfare 2008). Thus, more strain is put on the forests where traditional medicinal plants are collected. As Ernest Rukangira (2001) , the Executive Director at the NGO Conserve Africa International, wrote, "demand by most of the people in developing countries for medicinal plants has been met by indiscriminate harvesting of spontaneous flora including those in forests". Another factor to consider is the increasing use of plant-derived formulations in *developed countries* for "daily maintenance of personal health" (Hoareau and DaSilva 1999). The popularity of these alternative and cheaper healthcare items impacts the herbal reserves in developing countries. All of these factors pose a pressing threat: the potential overexploitation of medicinal plants as a natural resource.

Pemba is one of the main islands in the Zanzibar Archipelago. It split off from the African mainland around 10 million years ago (Nahonyo et al. 2005). It was part of the Eastern Arc Mountains, which is a unique environment supportive of many endemic species. Since then, many speciation events have occurred, producing a number of endemic Pemban species. Pemba has a hillier and more topographically dynamic landscape than its sister island, Unguja. It used to be covered mostly in forest, but, in the last 150 years, 95% of the forest was cleared for agricultural and industrial plantations (Beentje 1993). Ngezi Forest is considered the last major forest in Pemba. In the early 1920s, it was used as a site for commercial foresting (Nahonyo et al. 2005). Conservation based management began in 1959, when it became a forest reserve.

The Ngezi Forest is located on the northwestern tip of Pemba, in the Micheweni District (Beentje 1993). In more specific terms, it lies between E 39° 34', S 6° 16' and E 39° 45', S 6°28'

(Nahonyo et al. 2005). Its 14.4 km^2 consists mostly of moist forest and secondary bush. The combination of coastal forest and its association with the Eastern Arc Mountains makes Ngezi a biodiversity hotspot; an area where there is a rich biodiversity but habitats for many of the species are decreasing (Nahonyo et al. 2005). As a result, Ngezi is a home to a wealth of plant species, some of which are threatened. In the most recent survey done by C.L. Nahonyo et al. (2005), 355 vascular plant species were recorded, eight of which are strictly endemic to Pemba, five that are considered "rare", and 17 species that are threatened, according to IUCN or CITES red lists. There are 43 medicinal plant species reported in Ngezi.

The forest was divided into a natural zone and a multiple-use zone in the 1996 management plan (Nahonyo et al. 2005). Natural zones allowed for research and tourism. In the multiple-use zones, the villages surrounding Ngezi Forest are allowed to conduct low-impact activities, like fuel wood, fruit, and medicinal plant collection. But, according to Nahonyo et al. (2005), "implementation of this management plan was difficult due to lack of funds". There are 10 villages that immediately surround Ngezi Forest and depend on it for resources. In the URT (United Republic of Tanzania) 2002 census, 20,138 people were identified as living in these villages, with a 5.4% annual growth rate that places further stress on the resources within the forest. The current population of this region is much larger as it has undoubtedly grown in the years between 2002 and 2017. The park is now funded by CARE TANZANIA and the collection of medicinal plants and other natural resources in these areas is unspecified.

Ten villages immediately border Ngezi Forest, but many more are supplied and influenced by the resources present in the Reserve. Fourteen villages were visited. However, a total of 17 different areas were visited in order to record medicinal plant species as determined by individual healers.

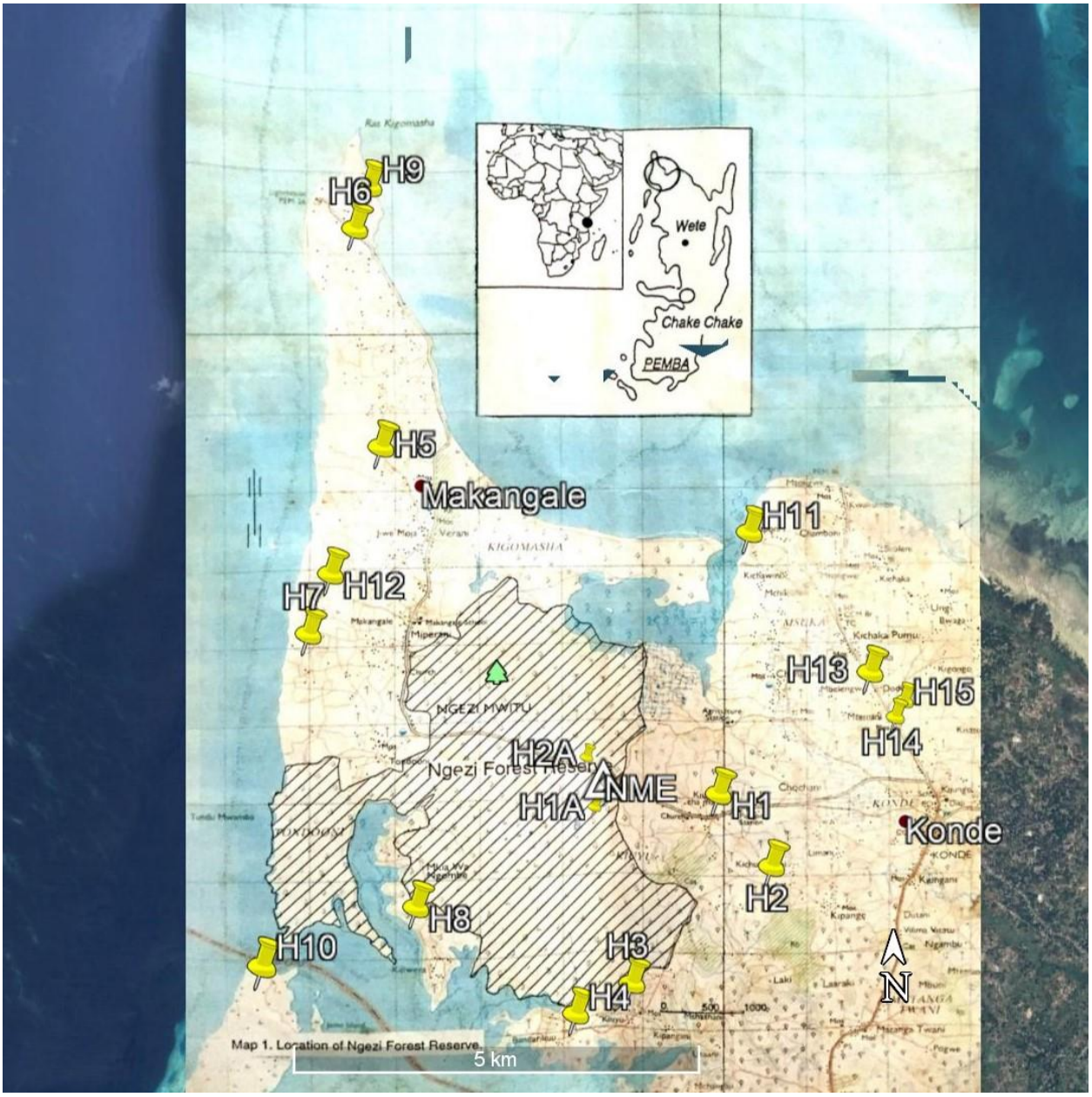

Figure 1 Map of observed medicinal plant collection around Ngezi Forest Reserve. NME = Ngezi Main Entrance (Google Earth 2017) & (Abdullah & Ali 1996)

Table 1 Locations of Healers' residence and plant collection areas around Ngezi Forest Reserve

Healer	Village of Residence	Area observed during study (marked on map)
H1	Kiuyu Kwa Manda	Kiuyu Kwa Manda and Ngezi (H1A)
H2	Chonja	Mjiampya and Mchechani in Ngezi (H2A)
H3	Kipangani	Kipangani
H4	Bandari Kuu	Bandari Kuu
H5	Jiwe Moja	Jiwe Moja
H6	Mnarani	Mnarani
H7	Mtondooni	Shamba Kihemeni
H8	Mkia Ngombe	Mkia Ngombe
H9	Micheweni Ndogo	Micheweni Ndogo
H10	Mkia Ngombe	Njau Island
H11	Mtoni	Mtoni
H12	Makangale	Makangale
H13	Msuka	Msuka
H14	Meli Hidashara	Meli Hidashara
H15	Chaleni	Chaleni

Methodology:

Data arose from four research activities: 1) Interviews of traditional healers, 2) Plant identification forest walks with healers, 3) Medicinal use data gathered from healers and 4) Specific plant identification with botanists.

1) Interviews of traditional healers

Upon meeting each healer, standardized interviews were conducted for at least 30 minutes to obtain broad information about the healer's background. An initial set of questions (Appendix A) included general demographic information, their work as *mganga mitishamba*, trends they saw in community afflictions (physical and spiritual), trends they saw in plant life, and their usual practice regarding plant collection and other subjects. It is important to note that names will not be mentioned in this report for confidentiality purposes. During these interviews, a translator fluent in both English and Kiswahili was present to directly translate the information shared.

These translators were asked to translate as accurately as possible. Most of these interviews were conducted in a private setting, so the healer could give his/her full attention. These interviews varied in length and in content per healer depending on their engagement. A list of each healer's most commonly used plants, and plants they perceived as decreasing in abundance was constructed.

2) Plant identification forest walks with traditional healers

Forest walks were conducted with healers in order to ascertain a general sense of the medicinal botanical diversity in the area in which the healer customarily collects her/his plants. Forest walks were not necessarily taken in the core zone of Ngezi Forest. One forest walk was conducted with each healer. Each of these forest walks took 2 hours to complete. In total, 15 forest walks were conducted. A main stipulation of these forest walks was that each was directed by the healer. The researcher did not interfere with the path chosen. Another stipulation was that the healer should identify as many known medicinal plant species as possible, as long as they had used the species. One or two photographs were taken of each plant specimen in its environment with a ruler in the picture for scale. In addition, photographs were taken of defining plant characteristics, such as leaves, fruits and flowers. Plant characteristics were recorded in a standardized table (Table 2), one table per healer. The purpose of notes was to aid in later identification by a botanist.

Table 2 Plant Characteristic Checklist

	Local Name(s) (Kis or Eng)	Type (tree, shrub, climber, grass)	Height estimate (m)	General area (scrub, brush, primary/secondary forest etc.)	Other observations and healer comments
Sp. 1					

There was an overlap in the species identified by each healer. Pictures were not taken of the overlapped species unless the researcher noticed an evident difference between species that had the same *Kiswahili* name.

The third component of these forest walks was GPS tracking. During each walk, a GPS was kept on and coordinates of important waypoints recorded. Most importantly, the GPS documented the general vicinity in which plants were collected, as well as the village in which the healer was based. The GPS also recorded the track taken during the walks in order to document the common trails (formal and informal) employed in Ngezi's multiple-use zones, as supplementary information. It is important to note that the specific locations of medicinal plants were not recorded, as this is sometimes regarded as sensitive and proprietary information, possessed by only a few community members.

3) Medicinal use data gathered from healers

After each forest walk, standardized interviews were held with individual healers in order to obtain information about preparations, uses and significances of the plants identified (Appendix B). This portion of the research delved into the medicinal value of the forest. Interviews averaged one hour each, but depended on the number of plants identified during forest walks. These were conducted in the same location as the background interviews, and the same conditions set for the translator. Each plant was discussed with the healer. The first type of data gathered was the medicinal uses of the plants with factors noted in Table 3:

Table 3 Medicinal Uses of Collected Plants

	Affliction used to treat	Preparation of the plant	Other uses/additional practical information
Sp. 1			

This information is important because it shows the practical medicinal uses of the plants that are collected. As with the plant characteristics table, separate tables for medicinal uses were constructed for each healer to observe variation in this information among healers and to avoid confusing their uses and preparations if there was variance. The second type of data gathered was stories, mythologies and general cultural significances of each plant. Again, the information in this section was kept separate with regard to each healer, allowing for further analysis of differences in knowledge of medicinal plants and significances among healers. Qualitative data, for example, stories, ideas and opinions were recorded as notes and were not tabulated.

4) Specific plant identification with botanist

The fourth strategy for data gathering was consultation with botanist experts in Pemban plants about the specific scientific identities of the plants identified by healers. Such sessions lasted from 2 to 3 hours, depending on the number of plants and photographs to be analyzed. The most important information obtained from meetings was the scientific name of each species, and their threat status.

Results and Discussion:

The results and discussion are broken down into sections. First there is an overview of the healers themselves to supply a picture of these experts who gave the information on medicinal plants. Second, there is data and commentary on the healers' interaction with their natural environment. Finally, a review of the specific medicinal plants is provided.

Who are the *waganga* around Ngezi Forest?

A total of 15 healers were interviewed. Although most of them do not know each other, the healers (*waganga*) make up a small community that maintains a concentrated and specific

botanical and medicinal knowledge of the region. Along with this wealth of knowledge, each healer shares the same passion for helping the community of his/her home village. Practitioners are generally similar in their demographic characteristics (Appendix C). All of them are from Pemba and were raised in the village where they live currently. Most are men, with the exception of one woman (Healer 3). The majority of healers were in their 40's and 50's with families. The average age was 49 years. Generally, they had learned the plants and healing skills from their parents, because their parents were also *waganga mitishamba.* It was never specified whether both of their parents or only one practiced traditional medicine. In most cases, the information passed down from their parents was solely practical: plant identities and their uses. This, unfortunately, has led to the loss of some of the fascinating historical and mythological information about plant. But they still try to pass down what they do know. A few of those interviewed had apprentices, sometimes their own children. Although each seemed well-versed in objective knowledge of medicinal plants and treatments, their experience ranged from two to 37 years. The average time of experience: 24 years. Some of them said that they had been flown to mainland East Africa several times to treat people. A few were somewhat "famous" in Pemba for their work; people from around Pemba lined-up to seek treatment.

They all stated that they are not specialists, but treat anyone who comes to them. Although health vocations in some societies can sustain a family, almost none of these healers practice traditional medicine as their only source of income; in fact, many do not charge for treatment. Thus, they are integrated into the community and their vocation does not seem to set them apart or endow them with a higher status than the other "common" people. Most of them also do other work. For example, the two healers interviewed from the coastal village of Mkia Ngombe, Healer 8 and 10, were also fishermen. Healer 7 was interviewed in the middle of his

cassava plot, which he had just finished tending to, in Shamba Kihemeni which is near his village Mtondooni. Many healers have more than one other job; Healer 5 is also a farmer, fisherman and driver. Despite multiple other vocations, each healer, nonetheless demonstrated an astounding volume of knowledge about medicinal plants and their uses.

Sketches of a few selected healers are provided below as examples, to demonstrate the lives and diversity of this unique group of people.

Healer 3

Healer 3 is 54-year-old woman who is around 5'2" and almost always carrying a baby on her hip or slung in a kanga around her back. Her voice is high, coarse and commanding and her eyes friendly and knowing. She is a *mganga mitishamba* who lives in the village of Kipangani, which is located near the southwest border of the forest. Not only a *mganga mitishamba,* she is a well-known mid-wife (*mkunga wa jadi*) who delivers babies both in her village and in multiple surrounding villages. Her house (and workplace) is separated from her village by a small valley striped with rows of cassava. At the time of the interview, around seven babies (probably all under the age of one) surround her house, lying on mats under the shade or being held by the women or mothers who help her. They give the restless and crying babies to her and it seems as though her touch instantly soothes them. At 17 years of age, she started learning the traditional practice of *uganga* from her parents, who were *waganga* themselves.

She, unlike many of the other healers, claims to never collect medicinal plants in Ngezi Forest. Her only place of collection is scrub and brush around the village -- part of the buffer zone. Due to deforestation for agriculture, she has noticed that the trees, *mdawadawa* and *msoo* are completely gone from the area in which she lives, so she has had to use substitutes for these

plants (instead of entering the forest and getting them). She grows some medicinal plants (eg. *mchaichai*) but not many. This is not her choice; she says that if she was given small plants or seeds to raise she would be more than willing to raise them, but she doesn't have the time or money to get these materials. Healer 3, in all, is someone who seems to have fallen into these roles of *mganga mitishamba* and *mkunga wa jadi* because of circumstance (her parents), but also seems to possess both an innate ability and need to help people. This is evident in the collection of many other people's babies, surrounding her house and under her care. Also, there is the fact that she does not take any money for her services to the community. It is interesting to note that she is one of the only healers who admitted to sending people to the hospital in Wete if they could not be treated by traditional means. These cases are primarily of the *Mgongwa Kiswahili,* involving *mashetani* (explanation in Appendix D) where she is not able to help.

Healer 8

Healer 8 is a 20-year-old man with three children. He is a smaller man, and is wearing a half-zipped windbreaker with the logo of an American high school track-team, and dress pants during the interview. He lives in Mkia Ngombe, on the eastern edge of Ngezi Forest and close to the ocean. Like most of the men in Mkia Ngombe, he is a fisherman; most of the houses in the village display fishing nets outside their doors, including his. He has only been a *mganga mitishamba* for two years and, unlike many of the other healers, he learned primarily from a friend, not his parent (even though his father is an *mganga*). But, his route to an education in *mitishamba* is still not that simple of a story. He says that he only really became a *mganga mitishamba* because a *shetani* came into his head and told him that he should learn the discipline. He tells me that *shetani* in Mkia Ngombe are very present, and the main disease that he sees is *Mgongwa Kiswahili,* or the affliction caused by bad *shetani.* His wife died of this disease

recently. He says that because of her death, one of his babies was raised solely on cow's milk instead of human breast milk. He does not say anything else about her death. In his estimation, *mashetani* are one of the biggest health problems that the community faces. Thus, his job is extremely important, as many of the plants he collects and medicines he uses are for protection against *shetani* or to rid the body of them. He collects plants as frequently as he has patients, but many of the plants he collects are on Njau Island, which is overwater directly east of the village. He says there are specific places in Ngezi Forest where there are no *mashetani* and he is able to cut trees for medicine without making them angry. He does not report forest officials stopping him from entering the forest at all. The plant that he sees most noticeably decreasing in frequency is *mshubiri* which he uses the most for *Mgongwa Kiswahili.* It is no longer present outside the Forest, difficult to find in the Forest, and one of the reasons he must now travel to the island of Njau.

The *Mashetani* Problem:

Mashetani are spirits that Pembans believe to cause people very serious afflictions (see Appendix D). The healers that were interviewed were well versed in these afflictions because they are so commonly seen in their practice. The question of most "common diseases treated" was not asked consistently throughout the research period, but when asked, a majority of healers (six out of ten) replied that they treat *mashetani*-related afflictions as some of their most commonly seen cases. These afflictions include *Mgongwa Kiswahili,* in which the patient unconsciously yells and makes strange noises and is sometimes paralyzed (the only concrete symptoms given) and *Homa mdudu* which is usually limited to children, and causes the child to convulse and seize while unconscious. These afflictions, according to Healer 7, are hard to treat, and can be fatal within a short time. The way most of these are diagnosed is through benevolent

shetani belonging to the *mganga mitishamba.* There was only one healer (H13) who did not mention these cases at all and said that he never sees any *mashetani.* When discussing *mashetani*, many of the *waganga mitishamba* stated that *mashetani* are increasing in recent years. The reasons believed to be responsible for this increase varied. Healers 7, 9, 10 and 14 said that the population of *mashetani* is only increasing because they are like humans and they reproduce. Healer 9 explained that there is a direct correlation between the population of humans and that of *mashetani.* He said that just as it is natural for the Pemban population to grow, it is natural for the *mashetani* population to grow. Healers 8 and 9 expressed belief that *mashetani* have been increasing their presence and activity in villages because they are acting under human command. They believe that there has been an increase in the amount of jealousy (mostly business related) within the villages, and the *mashetani* have been used as weapons in these conflicts; people order *mashetani* to steal to from rivals, destroy shops and cause disease.

Another common reason given for the increase in *mashetani* presence and activity in villages was directly related to anthropogenic impacts on the natural environment. Healers 2, 6 and 12 all stated a belief that the natural environment, notably Ngezi Forest, is the *mashetani*'s home. They agreed that by cutting down trees in the Forest and clearing brush around the Forest, people leave these spirits nowhere to go but into the villages. This also makes the *mashetani* angry, and they seek revenge on humans. The revenge taken is evident in the increased cases of typical related diseases. Healer 12 expanded on this: saying that some *mashetani* take care of certain fish populations (species: *kolekole* and *chewa*), and when fishermen harvest too many of them, the *mashetani* get angry and attack people.

Without diminishing the importance of local belief systems, it is reasonable to conclude that, from a Western perspective, the afflictions attributed here to supernatural forces appear to

represent not only physical diseases but the psychological (anxiety and panic disorder, mania) and societal ills (vandalism, theft) that result from the stress of shifting economic conditions and increasing modernization in a developing country. Specifically with physical illnesses in infants and children, the leading causes of death of this age group in Sub-Saharan Africa are: infantile sepsis, diarrhea, pneumonia and malaria (UNICEF and United Nations, 2012). These could explain these supernatural afflictions, as the late stages of all of these illnesses result in unresponsiveness and seizures/convulsions. In adults living in Sub-Saharan Africa, HIV/AIDS, malaria and pneumonia are the leading causes of death and could display similar symptoms to *Mgongwa Kiswahili* (yelling, shaking etc.) when the patient is severely ill with one of these diseases (Rao, Lopez, and Hemed 2006).

Waganga mitishamba interactions with environment:

Since the base tool of the *waganga mitishama's* profession is medicinal plants, they inevitably have a relationship with their surrounding environment (where they collect). One of the goals of the study was to determine the nature of the interaction between the villages and the Ngezi Forest Reserve.

Reserve management and healers

Currently, an informal multiple-use, or "buffer", zone surrounds the Forest's core zone. This "buffer" is essentially a partially protected set of "forest patches" monitored by Ngezi management and also by the villages that lie closest. The buffer zone was meant to be used in a responsible manner by the surrounding communities, according to the Reserve's management plan, drafted in 1996 by Abdullah et al. This included the responsible collection of medicinal plants. But, the classification of these multiple-use zones does not have much of an impact on

medicinal plant collection currently. According to the Head of the Department of Forestry and Non-renewable Natural Resources in Pemba, Said Juma, the collection of medicinal plants has such a negligible environmental impact compared to the harvesting of wood-products (cutting down large trees for firewood and construction), that collection of medicinal plants in the buffer zones is officially unlimited at the present time (Juma 2017). Unlike the harvesting of large trees, where a permit must be approved by the designated village committee, medicinal plants in buffer zones may be harvested without official approval in the buffer zone. This can be attributed to three reasons: (1) most of the plants are resilient herbs and shrubs that thrive in their environments (2) these plants are not necessarily getting shipped to foreign markets for profit, and (3) the healers harvest relatively small parts of these plants without killing specimens (pieces of bark, roots and leaves).

In the core zone of the Reserve, the situation is different. Technically, no collection of plants is allowed in the core zone. Juma says that after an Annual Allowable Cut Assessment has been performed on medicinal plants in the forest, healers may be able to come in and harvest under specific regulations guided by this assessment (Juma 2017). This technical and lengthy assessment measures the maximum amount of bark, leaf or root matter one can take away from the organism while still keeping it alive. Although no collection is officially allowed outside of these regulations, it does happen. The nature of medicinal plant collection in the core zone of the forest will be discussed below.

Collection of medicinal plants by healers

The *waganga mitishamba* interviewed for this study collect both inside and outside the core zone. The majority of their collection occurs in the areas surrounding their individual

villages. Out of the 15 healers spoken with, five reported that they do not go into the core zone of the forest at all for collection. Only two healers reported collecting in the core zone of the forest with frequency (10-15 times a month). The remainder of the healers reported entering into the core zone for collection a few times a month, at most. Many said that they only go into the forest if they have a patient who has an affliction that can only be treated by a medicinal plant found in the Forest. When asked for an average number of times that they collect in the core zone per month, they estimated 3 or 4. Two of the healers (H7 and H11) confessed to going into the core zone only a few times a month, but collecting a sizeable load of plants when they do go. By speaking directly with a Forest guard about the subject of medicinal plant collection, it was ascertained that collection of medicinal plants by local healers really is not considered an offense on the same level of urgency as illegal firewood or timber collection. This makes for inconsistency in the Reserve's ground-level enforcement regarding collection of medicinal plants. Even though medicinal plant collection is banned, sometimes officials will allow people to collect in the core zone and sometimes they will not. It depends on whether the Forest guards trust that the healer will not collect too much and not kill the plants he/she is collecting. Healer 1 reported that some healers go during the night and do not ask permission. Many times, if healers are found in the core zone without asking permission, they will be asked to leave by the guards. Some healers, notably Healers 5 and 7, said that this was one of the primary reasons that they do not enter the Forest.

For this reason, many healers have found ways to be independent of the core zone of the Forest as their main source for medicinal plants. This means collecting the vast majority of their plants in the areas surrounding their villages. These areas are strikingly similar to each other even though they are spread out (Appendix E). The vegetation type can be generalized as

"scrub": fairly dry soil, little shade and close proximity to agricultural areas, mainly cassava fields. In fact, many of the plants seemed to be growing on the paths between cassava fields. In the narrow northern peninsular region that was studied, including Mnarani and Micheweni Ndogo, this "scrub" evidently contained many coral rag types of vegetation, but these areas were still proximal to fields of cassava and/or sweet potato. Most of the healers followed common paths around the area to get to medicinal plants.

Besides searching and collecting in unrestricted areas, the other way that these healers have avoided going into the Forest is by planting medicinal plants of their own. Ten out of the 15 healers grow their own plants. Some healers only grow one type of plant that they use very often; others have small areas around their properties which contain mostly cultivated plants, almost like unfenced gardens (H11 and H14). A total of 18 different species were identified as being grown in the areas visited (Appendix F3). The plants that they choose to grow are not usually common naturally in the immediate area, or are decreasing in availability due to overuse. Some of them were taken from distant areas and planted in their surrounding areas; examples include, Healer 5 who took a small *mshubiri* plant from the area around the Manta Hotel and planted it on his land and Healer 14 who obtained his *mjafari* plant from Micheweni forest. The healers who did not grow their medicinal plants (or did so in very limited amounts) had various reasons for not doing so. Healers 1, 13 and 15 said that there are already enough medicinal plants in their collection areas, so that they do not need to plant anything. Although Healer 5 grew his own plants, he said that a lot of the plants that grow in the forest are hard to transplant because they only grow well in the moist forest environment, with lots of shade from trees. Another reason for not cultivating came from Healer 3 who said that it is expensive to harvest plants and grow them from seeds. Although she does plant some species, she said that if she was given saplings, she

would plant more. There is not much consistency in the species of medicinal plants that are being cultivated. The most common was *mjafari* (three healers) and secondly *shubiri/muolidera* (two healers) tied with *mrehani* (two healers). The other 15 species of cultivated plants were grown by one healer each.

The topic of challenges in medicinal plant collection (not restricted to forest collection) was occasionally brought up by the healer in talking about location of collection. The majority of the healers did not travel too far to collect their medicinal plants, but a few, notably Healers 2, 4, 8 and 9, had to take long journeys to find their plants. Healer #2 actually collects most of his plants in a completely different area than where he lives. His collection area is around the rolling cassava-covered hills of the village Mjimpya. He noted that as population increases in Pemba, so is the frequency of clearing for agriculture and residential areas. He said that because of this, the medicinal plants he uses are increasingly spread out, making his collection more difficult. Although Healer 1 does not walk far to collect, he agreed with Healer 2, stating that in the last 20 to 30 years, there has been a big increase in brush clearing for building and agriculture. He said the people who are clearing the brush do not know that they are clearing medicinal plants. Along the same lines, Healer 4 reported the need to take a very long walk around the edges of his village and to patches between the cassava fields and the ocean that have not been cleared. Healers 8 and 9 both said that they must travel by boat to the island of Njau to collect a lot of their plants.

A few healers gave information about the proper techniques of plant collection. Cutting needed parts (bark, roots and leaves) of the trees and big shrubs is a particularly interesting topic because some of the healers understand that there is a limit to how much they can take before a plant dies (similar to the cut assessment mentioned earlier). Healer 10 was passionate about not

cutting too much of any plant. He said that he often reminds other people that if they cut too much, the plant will die. Healer 4 said that when he needs leaves from a tree, he only collects the ones that have dropped to the ground. He also said that there are certain methods of cutting roots, so a plant's roots regenerate. Most of the healers said that they only collect plants when needed for a patient; only a few admitted to stockpiling.

Medicinal Plants used by Healers:

A total of 98 different medicinal plant species was identified over the course of the study. These plants came in a wide variety, including ten different plant types (Appendix G). The most common plant type was the "bush"; 32 different bushes were identified. The second most common was "tree"; 24 were identified.

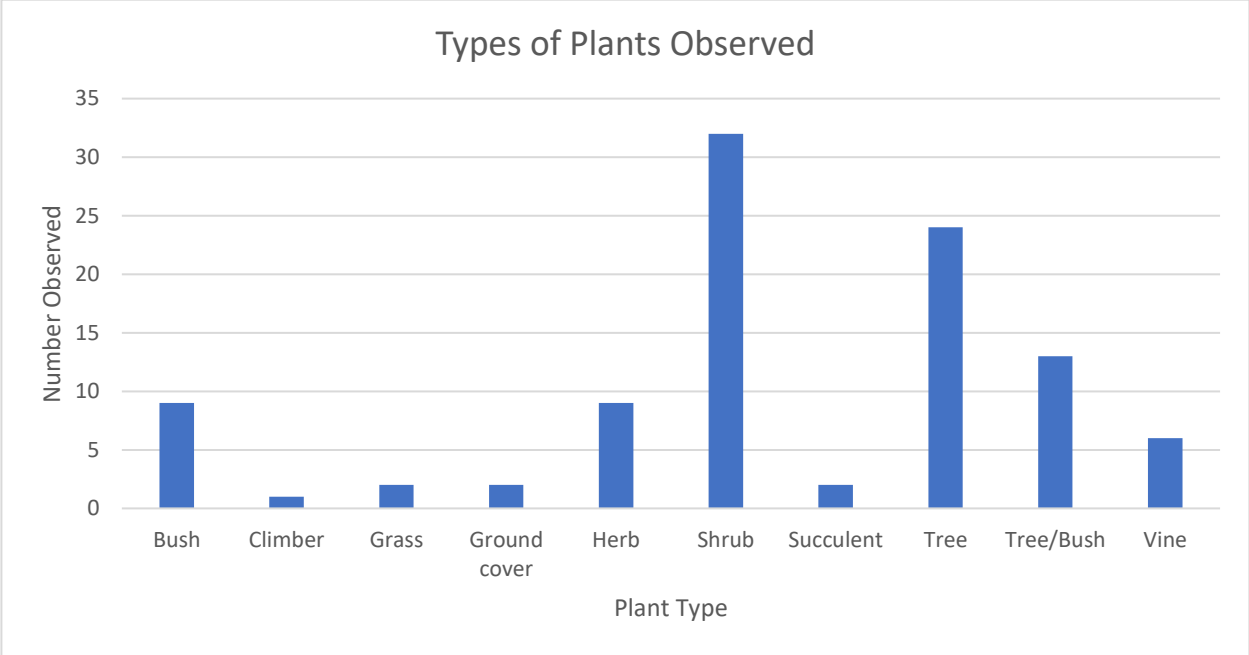

Figure 2 Cumulative account of types of plants observed during forest walks with healers.

As far as specific species of plant, *Kivumbasi* was identified the most often on forest walks: by ten of the 15 healers. *Mvumanyuki/Mchekanambingu,* and *Msoo* were the second most identified; each by nine healers. Sixty-one of the species were identified by only one healer.

Table 1 Medicinal Plants observed with at least 1/3 of Healers

Medicinal Plant	**# Times Identified**	**Plant Type**
Kivumbasi	10	Herb
Msoo	9	Tree/Bush
Mvumanyuki/Mchekanambingu	9	Herb
Mkundenyika	8	Shrub
Mzalianyuma	5	Shrub
Mtunguja	5	Shrub
Mg'ang'a/Mnamyamaji	5	Vine
Mongonye/Mpindapindapo	5	Bush
Mpatakuva/Mwendachasa	5	Shrub

In the "Most Commonly Used" plants category, the species and number of plants varied per healer (Appendix F1). Due to some very extensive lists, only the first five plant species mentioned were considered. The species that occurred the most often in this category was *Kivumbasi,* with five healers listing it among their most used plants. This is followed by *Msoo, Mjafari* and *Msinduzi* which each had four healers listing it as one of their most used plants. Another 18 species appeared on the favorites list of two healers. However, the majority of the plants included in these lists were in the top five for only a single healer, showing significant variation in practice. It should be noted that there are some plants named in this list that were not ever identified during forest walks; so that the researcher never saw them. These are *Mlazalaza* (H1), *Kaumwa* (H11), *Mlea watoto* (H12), *Mlazalaza* (H14) and *Mmahariha* (H15).

In the "Decreasing" plants category, fewer plants were mentioned than in "Most Commonly Used" category (Appendix F2). All of the plants mentioned were included in the count (not just the first five). It took the healers a much longer time to answer this inquiry, and overall there was little agreement, which may indicate their degree of subjectivity. The species that occurred most often in this category were *Mjafari* and *Msoo:* each with four healers listing it as "decreasing". Three healers agreed that *Mwendachasa/Mpatakuva* was decreasing. As with the previous subcategory, the majority of the plants were mentioned by only one healer: 14 out

of 21 (66%). Again, there were some plants in this category that were not seen during the forest walks. These are *Mfundofundo* (H6), *Mtonga* (H11), and *Mlea watoto* (H12).

It was a very complex task to analyze and draw solid numbers and percentages from the healers' responses to questions about the medicinal use of plants. Each healer seemed to have his or her own unique perspective on the afflictions prevalent in his or her community. Thus, there is a lack of uniformity in both uses and preparations. A comparison between Healers 9 and 11 illustrates the complexity of this situation. Healer 11's plant use was oriented mainly toward physical ailments. All of the diseases that he mentioned, when going over the identified plants, were purely physical: fever, knee injury, gum inflammation, pain during pregnancy etc. His primary methods of preparation were boiling or grinding roots or leaves. In contrast, some of Healer 9's identified plants were not even meant to "treat" or "cure" any ailments, but to increase the luck of his patient in certain situations. Some of his plants were used to treat physical ailments, like high blood pressure, headache and stomach pain, but others were used as love potions, and for good luck in business. The preparations included boiling and grating for some plants, but also creating a flour out of the plant and sprinkling on the shop's door. It is therefore difficult to categorize uses and preparations in Pemban traditional medicine.

That said, there were some commonalities between healers. Regarding preparation, the vast majority of the plants were prepared by boiling the roots, and then drinking the resulting liquid. Many of the plants were used to treat *Ngiri* in men, menstrual and pregnancy problems in women, and infant/child-specific illnesses (fever and weakness). Even for plants used by multiple healers, there was relatively little agreement between healers as to what a specific plant should be used for. Within the top species identified, *Kivumbasi's* most common use is to treat fevers, with agreement between four of the ten healers who use it. All eight of the healers using

Mkundenyika stated that they use it for children, either for reducing fever or for protecting them from illness or spirits. Five of the nine practitioners who use *Msoo* claim it is effective for *Ngiri*. *Mvumanyuki/Mchekanambingu ,* like most of the other plants, had no common uses among the nine healers who identified it.

*Note on plant mythology: Each healer was asked for any history, mythology, or general cultural significance associated with the plants that they identified. They generally did not have much to say on this topic. Most of them responded by saying that the people who taught them *uganga mitishamba* had only taught them the practical knowledge of each plant, that is, the uses and preparations. Even the older *waganga mitishamba* (H11 and H15) who were in their 80's had very little to say on this topic. Some said that it was possible to find more historical and mythological information in old texts (some mentioned the *Quran*). What became clear during the study was the important role played by spirits and the supernatural in Pemban traditional medicine beliefs. These forces are not regarded as myth, and do not have any special community significance, but are a reality for traditional healers, and addressing them makes up a large part of their work.

Further Discussion and Considerations:

The high value of Ngezi Forest and the surrounding area as a source for medicinal plant material is supported by the data collected. This type of value is difficult to quantify, especially for a region. However, it seems reasonable to assign value based on how the resource benefits the health of the communities that are nearby. The value of the Ngezi region is based on these factors: 1) high biodiversity of medicinal plants not found elsewhere 2) traditional healers' reliance on specific local plant materials according to established medical lore 3) the increase in

afflictions believed to be treatable by traditional means. First, the relative biodiversity of medicinal plants in Ngezi region naturally contributes to the medicinal value of the forest, because it provides healers with a great assortment of plants to choose from when treating patients. They depend on these plants as their primary modality for treatment. Second, it is crucial to recognize the importance of the healers' specific medical tradition, which is dependent on local plant material. The value of traditional knowledge of methods of collection, preparation and uses of these specific local plants, passed down over generations, would be lost if these plants were no longer available. Availability of medicinal plants and knowledge of traditional healers are both essential to maintain the availability of traditional medicine in the community.

In regions like Pemba, traditional medicine serves as the primary front-line source of health care, and prevents over-taxing of limited Western medical resources. In the case of Ngezi Forest, the 15 healers interviewed provided a total of 201 different uses and preparations of the plants that were observed. This does not include the many plants that were not observed and recorded during the study. Third, medicinal need in an area increases when the people in that area start to need medicine and health-related services more often. In any region of the developing world with a rapidly rising population, health problems are bound to increase in volume. This is the case in Pemba, the rural region around Ngezi in particular. Infants with underdeveloped immune systems are susceptible to the diseases that are endemic in these areas. In addition to the increasing incidence of physical health problems in these villages due to population growth, environmental damage, development and modernization bring conflict to communities and overall psychosocial stress. This manifests in the psychological maladies and societal ills that this culture attributes to supernatural forces, and are most effectively treated by

traditional means. The increase in afflictions attributed to *mashetani* puts additional pressure on the *waganga mitishamba,* but also the medicinal plants of the area.

Healers' uses of the area

The *waganga mitishamba's* complex relationship with their environment (and the Forest Reserve in particular) is another topic that requires further analysis. According to Reserve management, the healers do not cause as much readily observable negative impact on the environment as harvesters of wood-products, such as firewood and construction wood collectors. This perception has encouraged the Reserve management (in association with the village committees) to allow healers in these villages to enjoy unrestricted access to plant collection in all areas except for the Core Zone of the forest (even this restriction is not vigorously enforced). However, the results of this study suggest that this permissive approach may not be sustainable. Not surprisingly, the plants used most commonly by healers are also the plants that they recognize as threatened. This has been most noticeable for the following species (which will be referred to as "priority species"): Msoo (*Scutia myrtina*) and Mjafari (*Drypetes natalensis*). These two species were each on the "Most Commonly Used" list (4 healers) and on the "Decreasing" list (4 healers). These were not the same 4 healers.

Although this is a relatively small number of healers, it is remarkable that the top mentioned "Decreasing" species are in alignment with the top mentioned "Most Commonly Used" species (with the exception of *Kivumbasi*). The priority species at hand seem to be in a precarious situation. They are collected and used more than any other species, and the healers have noticed them declining. This situation is also complex because not all of the healers who listed a priority species seem to be aware or concerned about decreasing availability.

Recommendations for the protection of these priority species, to avoid a "tragedy of the commons" situation, is mentioned below. The species in decline might have been specifically recognized as such because of their treatment of a particular affliction for which there is no substitute.

It is important to note the apparent paradox with *Msoo*, as it is one of the most observed species, but it is also high on the "Decreasing" list. Healer 13 clarified this; he explained that only the roots of the large, older *Msoo* are useable; roots from smaller Msoo plants are not effective. These old *Msoo* are most likely what the healers were referring to in the "Decreasing" section. Most of the observed *Msoo* were small bushes (except for the large climbing *Msoo* found in Ngezi's core zone).

The situation with priority species is a good example of a broader issue that the community of healers faces regarding medicinal plant species: communication. These healers treat many of the same diseases and use many of the same plants, but there is virtually no communication among them. This is evident in the high percentage of isolated identifications within the "Most Commonly Used" list (65%), the "Decreasing" list (66%), but also with the full list of observed plants (61 of which were identified by a single healer). Lack of communication is also evident in the great variety of uses and preparations of some of the same medicinal plants and even different *Kiswahili* names for the same plants. These unique treatments attributed to individual healers could have originated from a competition strategy among healers. The establishment of a sort of specialization of knowledge with one healer and a specific illness, would result in village members, with this illness, having to come to them instead of other healers. This lack of communication is not necessarily a negative. It may only demonstrate that traditional medical practices that have been passed down over generations depend more on the

individual skills, strengths, and convictions of practitioners, and do not require agreement with a "mainstream" knowledge of traditional plants. But, absence of communication among healers comes at the cost of a general lack of awareness of threatened plants in the region. If this continues, the most commonly used plants will likely be depleted in the areas surrounding the forest, forcing the healers to apply even more pressure on the reserve of these species in the core zone.

For Healer 5, this is already a reality. He reports that some of the trees he samples grow only in the forest's core zone. When he sees a patient who needs a treatment that requires products from one of these trees, he is put in a difficult situation. He has to either take the risk of getting caught by a forest guard while collecting illegally in the core zone, or turn down the patient. If nothing is done to protect the priority species outside the core zone, this will likely become the reality for many of the healers who depend on certain species. Communication between healers could aid this situation. Many different plants can treat the same afflictions and each individual healer does not necessarily know all of them. For example, Healer #2 said that *Mjafari* and *Muinga jini* are the only plants that he uses to treat *mashetani* related diseases. This has put him in a difficult position, because he knows that *Mjafari* is decreasing in abundance and becoming harder to find. He has gone through the process of actually uprooting a small *Mjafari* tree from a distant location and growing it near his collection site. However, there are other less-pressured plants used successfully by other healers to treat such diseases, including *Moto wa jiwa/Mjoma* (H10), *Kishinde* (H12), *Mdimu* (H8), *Mkua usiku* (H1 and H7) and others (Appendix G). It is possible that these plants may be incompatible with his treatment style, but it is equally possible that he could learn to use them and reduce pressure on *Miafari.*

In Defense of Healers' uses of the area

It is important to note that healers are generally a neutral, if not a positive, presence in the community with regard to environmental conservation. Many healers do not regard their activity as impacting the environment at all, since the plants usually regrow after collection, using proper techniques. This is generally true. They are not affecting the environment as much as the "wood product" collectors who cut down trees. The extent to which the healers' collection is changing the environment was not measured, so it is impossible to say in a technical manner if their collection is the main reason for the decreasing abundance of plants mentioned. It is possible that some of the species in the "Decreasing" list seem to be decreasing, not because of collection for medicinal purposes, but because of agricultural clearing, collection for other purposes, climate change, or a mix of all of these factors. Healer 1 directly said that *Msoo* is sometimes used to make wood boards for building. In other words, the blame for the decreasing species should not be put fully or even primarily on the healers who collect them.

Some of the healers even help protect the forest and the areas around it by serving as unofficial forest guardians, whether they intend to or not. First, the medicinal plant species that are said to keep away *mashetani* or treat *mashetani*-related illnesses have, in themselves, a certain self-protection (Appendix G). People who know that these species are important in keeping these dangerous spirits away will be careful not to deplete these resources. Second, as stated in the results section, a few healers have been outwardly against overcollection, deforestation and brush clearing. They remind their fellow community members not to collect too much or damage the plants in irreversible ways. Some healers have apprentices and teach them what plants are medicinal in the brush; an indirect way of protecting these plants by increasing knowledge of their usefulness. The *mashetani* in the environment narrative, stated

earlier, is a remarkable way in which the healers, regardless of intention, are protecting the forest. It was supported by three healers. Everyone in this region is aware that *mashetani* are a problem. To say that the increased presence of *mashetani* in the villages is due to humans destroying their habitats by cutting down trees is a profound argument against deforestation. It is an argument that reaches further into communities than arguments against deforestation for the preservation of habitats of endemic species, which has no direct implication on the villages around the forest. The *mashetani* in the environment argument *does* have implications on the villages, seen in the rising cases of highly fatal *mashetani*-related afflictions. The healers' spreading of this narrative is a powerful way of protecting the forest.

Limitations:

First, the translators who participated in the research were employees of the Forest Reserve themselves. Nothing was explicitly said to the healers about where the translators worked, but it was evident that some of the translators were known around the area because they patrol the area. Having this presence during interviews with healers might have affected their responses in a few ways. If they did know that the translator was associated with or worked for the forest (as a forest guard), they might have reported not going into the core zone to collect and cut plants, or doing so, but minimally. This is because going into the core zone to collect, as stated earlier, is against management policy. The healers also might have withheld reporting their use of some endangered/endemic species in the area, (eg. *mshubiri*/*muolidera*). Thus, it might have been better to employ other translators who were not Forest-affiliated.

Another issue with translators, in general, is the reality that information is lost in translation. This was expected, but the level of English-*Kiswahili* translation ability can never be

ascertained until a few days of interviewing have been conducted. There were times when translators were not fully able to convey what the healer was trying to say. This could have been minimized by using a voice recorder and going through the recordings with someone fluent in both languages, but of course, there are the ethical concerns with audio recording that need to be considered.

The healers in this study gave virtually all of the information that was used (with the exception of interviews with forest guards, and the botanist). As stated earlier, some of them knew plants that others did not. It is likely that in many areas, there were plant species present that the healer of that area did not know, but others did. This absence of a cumulative knowledge of medicinal plants in the area withheld the thoroughness of the study. There could have been many more medicinal species in each of the areas studied.

Lastly, it is important to note the limitation of small sample size. There were only 15 healers interviewed, and there are most likely more in the Micheweni District who are collecting medicinal plants (maybe even in the core zone of the forest).

Conclusions

This study was intended not only to survey medicinal plants in the Ngezi region, but to conduct an ethnobotanical study, in which the local experts of the plants (in this case: *waganga mitishamba)* were consulted to provide a wider scope on the human-environment interface that is the *practical* argument for the protection of medicinal plants in these areas. Ngezi Forest Reserve and its surrounding areas represent a valuable natural resource, based on the biodiversity of medicinal plants not found elsewhere, the deep tradition of local healing practice which depends on these specific medicinal plants, and the increasing demand for traditional medicine services.

This study noted that lack of oversight and regulation of collection appears to encourage overuse of the resource, leading to a number of species that are diminishing in abundance, notably *Msoo* and *Mjafari*. Also noted was a striking lack of communication among the practitioners of traditional medicine, which may hinder their ability to treat people effectively, and also their ability to find substitute species for the ones that are under pressure from over-harvesting. However, with some modification of oversight, the presence of these healers in the area could be a positive influence to promote environmental conservation. They provide the health care to their villages using local plant material, highlighting the interdependence of population and environment to lay people, and also act as guardians of the forest out of self-interest.

Suggestions for future study

- Collection of quantitative data to confirm or refute the healer's subjective impression that certain species are decreasing in abundance. This would require an intensive and strictly botanical survey of such species in the region.
- Further study into how the spiritual beliefs prevalent in these communities impact attitudes on environmental conservation.
- Medicinal plant surveys in other regions of Pemba to find potential commonalities with findings in this study area (especially with the plants on the most used and decreasing lists).
- Analysis of the non-local market for medicinal plants that come from Pemba. This would involve the herbalists that sell plants in the shops in towns.
- Survey of public opinions on the value of medicinal plants and *mitishamba* in Pemba specifically.

Recommendations

Steps need to be taken to mitigate the increasing pressure on certain species of medicinal plants in the core zone. The three recommendations here are intended to ensure a stable, sustainable supply of medicinal plants around Ngezi Forest Reserve, while accommodating the demands of the healers and communities they serve.

1. Implementation of nurseries within the forest: This would target long-term revitalization of species under threat. The goal would be to create a reservoir of plants from which the healers could eventually draw to transplant elsewhere. A small area deep in the interior of the forest could be used to plant seeds of species such as *Msoo*, *Mjafari* and other species on the "decreasing" list. Once the seeds become saplings, they could be collected and replanted by healers who have paid the Reserve for permits to do so. *Msoo* would be left in the forest to grow. The revenue from these permits would fund further planting and care of these saplings. The management of this nursery would be supervised by forest guards and botanists who would ensure successful cultivation.
2. Formation of a Micheweni District *waganga mitishamba* council: This would include as many willing healers as possible who work in the villages around Ngezi Forest and in the Micheweni District. This group would organize annual or semi-annual meetings to discuss developments in the perceived scarcity of medicinal plants. These meetings would be a good way to potentially pool knowledge and develop alternative treatments, using species that are not under threat. Advice on cultivation of plants would also be shared including which plants grow well in certain areas, planting techniques and safe harvesting practices. Healers who are members of this council and attend meetings would

enjoy reduced prices for permits to access the aforementioned forest nursery. These meetings could be mediated by the Reserve staff.

3. Education of the broader community: General community awareness to the value and threat to medicinal plants is vital to their conservation. This applies, especially, to the community members who work in clearing brush for agricultural and residential purposes.
    a. The threatened status of the priority species (*Msoo* and *Mjafari*) and other notable decreasing species like *Mpatakuva* and *Mshubiri* would be mentioned to each village's environmental committee. These committees would share the information with people working in clearing and construction. If the species were identified while clearing, they would be preserved or transplanted.
    b. The Reserve management could distribute signs around the trafficked areas of the forest (main road) and in each village to raise awareness about these species. The signs would display photographs of the medicinal plants, and instructions from the Forest Reserve to stop cutting them. Healers would still be authorized to harvest them in a responsible manner.

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APPENDICES

APPENDIX A

Background Interview Questions for Healers:

1. Unaitwa nani? / *What is your name?*
2. Una miaka mingapi? / *How old are you?*
3. Kwa nini ulikuwa mganga? / *Why did you become a healer?*
    a. Unapenda kutibu watu? / *Do you like healing people?*
    b. Vipi ulielewa mitishamba (ulijifunza wapi)? / *How did you learn healing and medicinal plants?*
4. Kwa nini unafanya kazi hapa? / *Why do you work here?*
5. Umefanya kazi hii kwa miaka mingapi? / *How many years have you done this work?*
6. Unatibu nani? / *Who do you heal?*
7. Una kazi nyingine? / *Do you have another job?*
8. Ni mimea gani ambayo inapungua (inatumika zaidi)? / *Which plants are decreasing in amount?*
9. Maradhi gani ambayo unatibu zaidi? / *Which diseases to you treat most often?*
10. Mashetani hapa wanaongezeka au wanapungua? Kwa nini? / *Are the mashetani increasing or decreasing here? Why?*
11. Unataka kusema chochote kwa mashetani? / *Do you want to say anything about mashetani?*
12. Kwa mwezi moja, unaingia msituni mara ngapi? / *How many times per month do you enter the forest?*

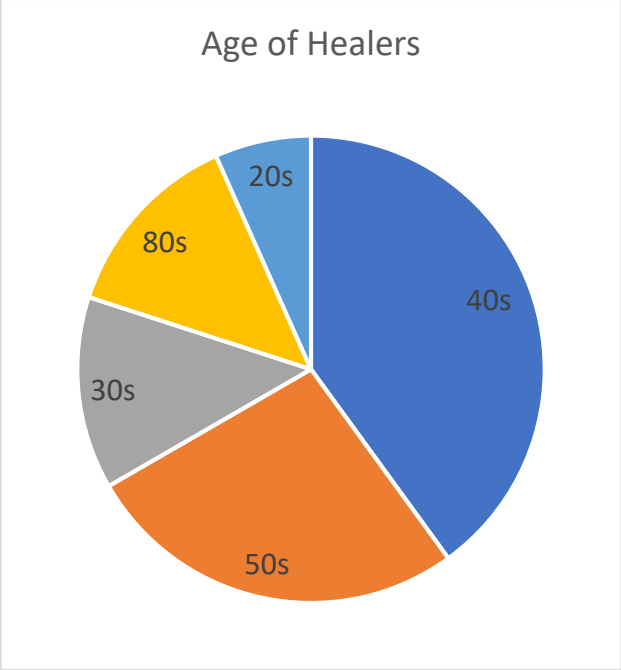
APPENDIX B

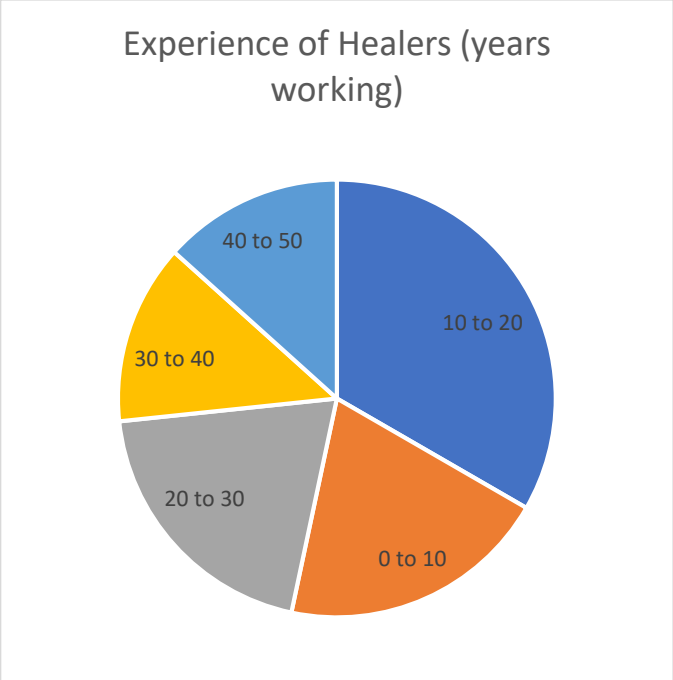
Medicinal use questions:

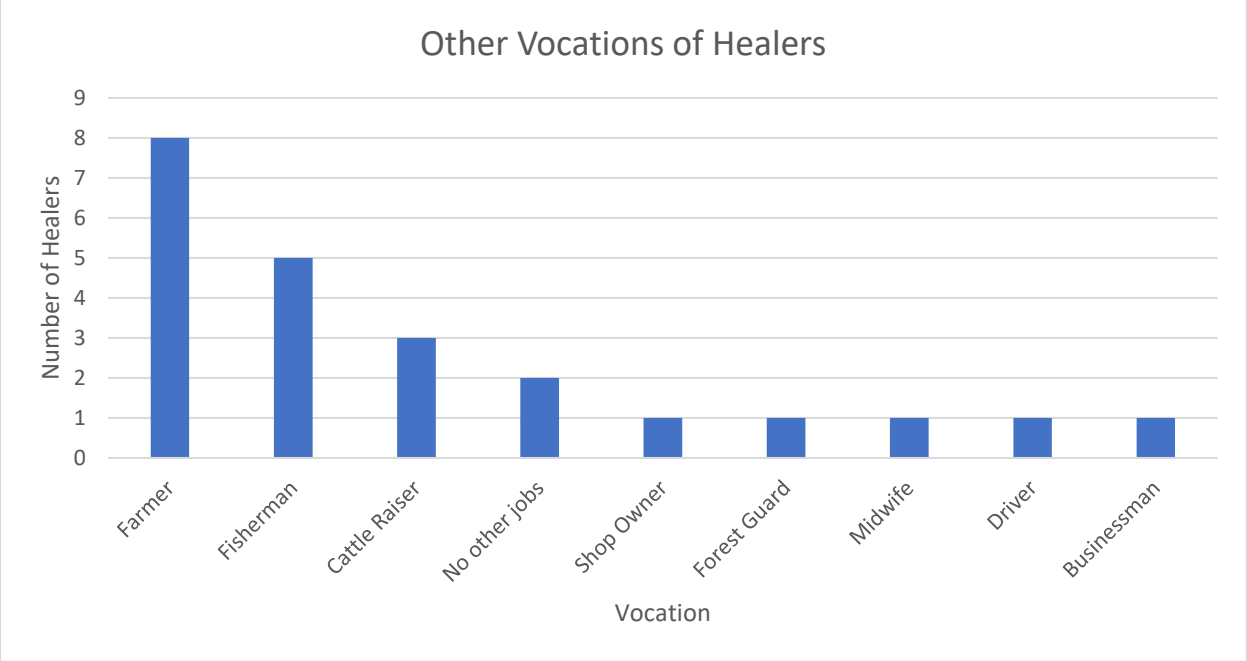
1. Mimea hii inatibu maradhi (au ugongwa) gani? / *Which disease (or illness) does this plant cure?*
2. Unatumia semehu gani za miti? / *Which part of the plant do you use?*
3. Vipi unatayarisha mitishamba hii? / *How do you prepare/process this plant*
4. Vipi unatumia mimea hii? / *How do you use this plant?*
5. Kuna historia, hadithi, au umuhimu wa mimea hii? / *Are there history, stories, or significance behind this plant?*
6. Je unataka kusema chochote kwa mitishamba? / *Is there any other information you would like to share about this plant?*

APPENDIX C

Demographic Data of Healers (n=15)







APPENDIX D

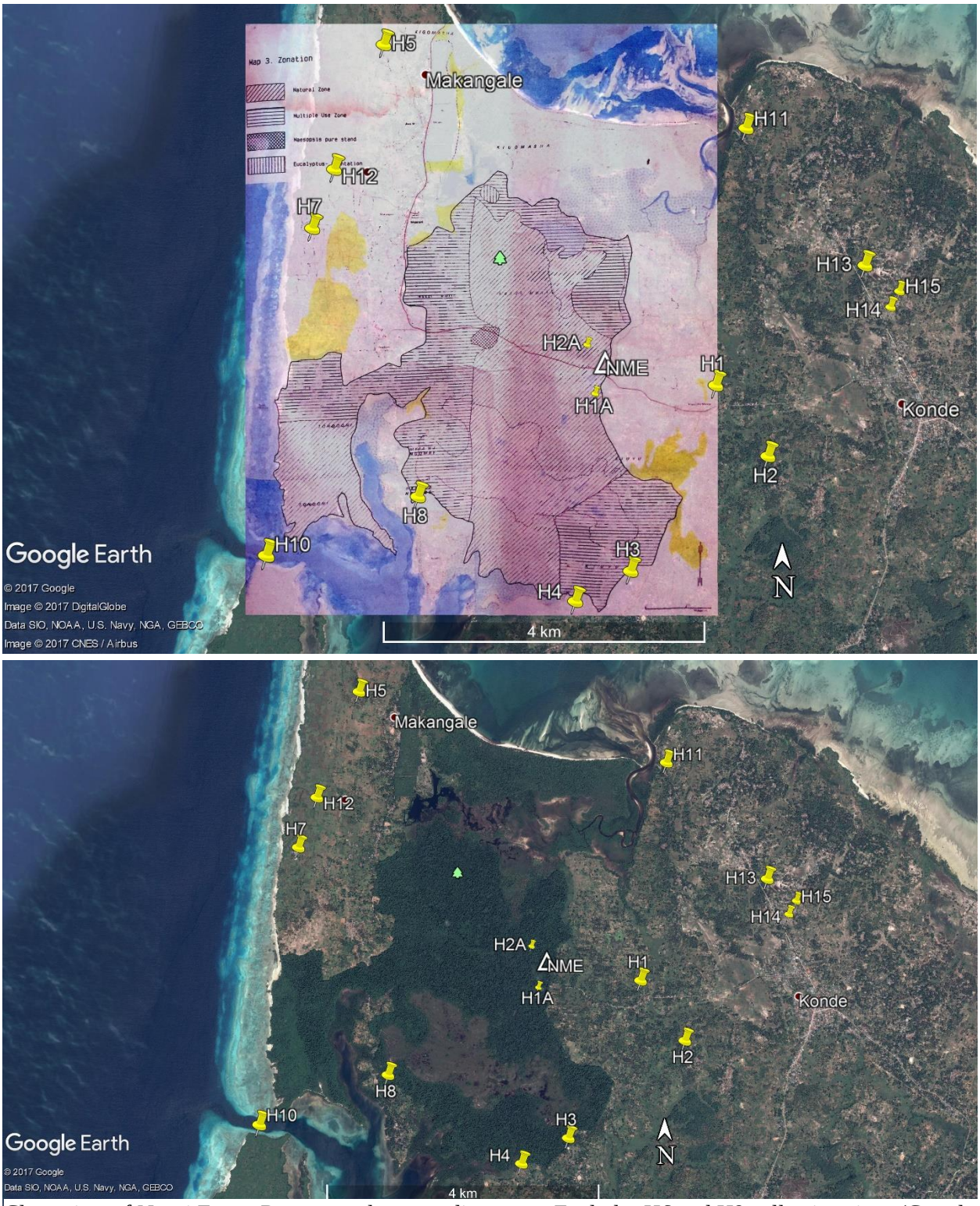
Mashetani and the supernatural

When speaking of traditional medicine in Pemba, it is important to explain the concept of *mashetani* (*shetani* sing.). Virtually all of the people living in rural areas of Pemba speak of supernatural presences or spirits called *mashetani* that act either against or in favor of the natural world. For the majority of residents of the villages around Ngezi Forest, *mashetani* are not a belief, but a reality. Many fear these supernatural forces because a slew of diseases, ransacked businesses and misfortunes in general are all blamed on *mashetani.* Although the focus of this study was not necessarily to gather information on belief in the supernatural in the area, it seems important to mention it, as many healers identified *mashetani*-related problems as the most common and challenging diseases that they heal.

A comprehensive background on these spirits is difficult to construct because of the lack of agreement between accounts given by different healers. It is anything but a settled topic. However, some common themes are as follows: *Mashetani* are spirits that may live in houses, forests, the ocean, sacred sites or *mizimu* (ponds, large trees, caves) and even in people's minds. They are very hard to see because one usually needs a *shetani* of his or her own in order to actually visualize or become aware of another *shetani's* presence. Healer #15 said that a person without his/her personal *shetani* would only be able to see one by sacrificing a cow. Sometimes they can be seen in other animals, for example a human could see evidence of a shetani in a bird's altered behavior. Again, not all *mashetani* are malevolent presences; in fact, three healers (H8, H10 and H12) reported to becoming *waganga mitishamba* due to their interactions with one of these spirits. Healer #12 explains that he had been a sickly person his whole life. While he was fishing, a *shetani* from the ocean named "Ruhani" entered his mind and told him that he would never become healthy until he was a *mganga mitishamba*. Consequently, he studied under a professional *mganga mitishamba* for 7 years in Dodoma and became one himself. He is still aided by "Ruhani" when he treats people; the spirit helps him identify whether patients have bad *shetani* in them and directs him to the plants he should use. Healer #1 and #8 also said that they were helped greatly by their own or their family's *mashetani* in the process of diagnosing and curing other people with bad *mashetani* inhabiting them. It is important to note the belief that sometimes *mashetani* can be used by their owners to hurt other people. Healer #8 and #9 said that people will use *mashetani* to ransack businesses, steal money and even kill people. Thus, these spirits are a very complex subject within these villages. The way they play into health beliefs gives the topic even more gravity; many people believe that their children and close relatives have died due to these supernatural forces.

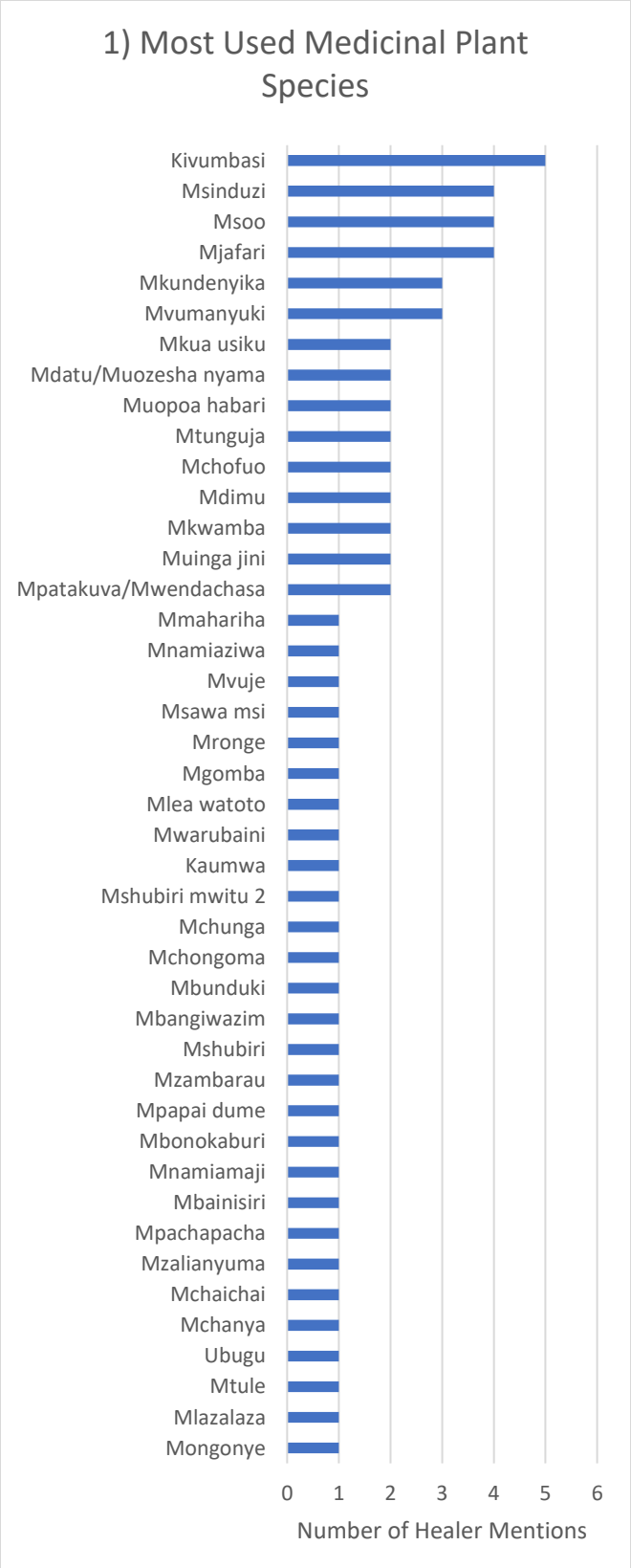
APPENDIX E

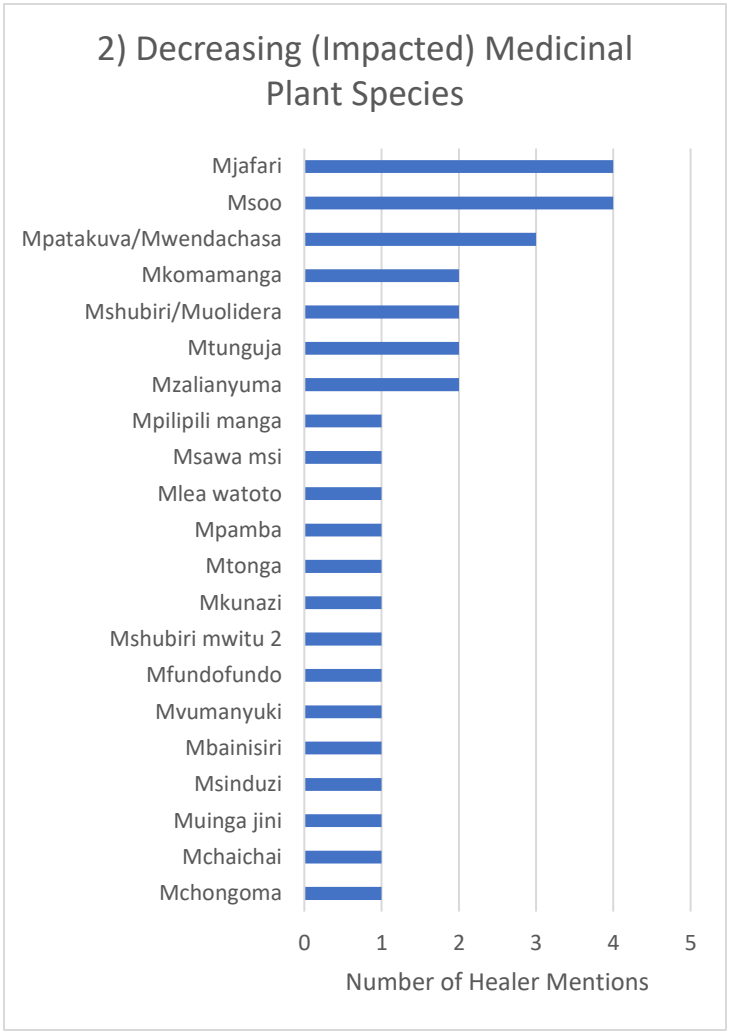
Maps of Ngezi Forest Reserve and Surrounding Areas

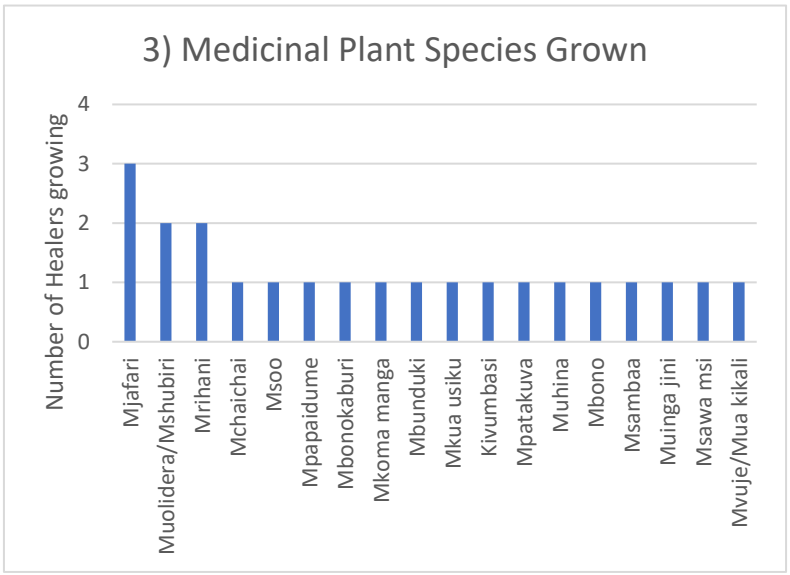


Close view of Ngezi Forest Reserve and surrounding areas. Excludes H6 and H9 collection sites. (Google Earth 2017) & (Abdullah & Ali 1996)

APPENDIX F: **Plant Categories (n=15)**







APPENDIX G

Medicinal Plants involved in Treatment of Mashetani Related Diseases

Kishinde (H12)	*Mkwamba / Muhina mwitu* (H2)
Mbangiwazim (H8)	*Moto wa jiwe / Mjoma* (H10)
Mchongoma (H2)	*Msawa msi* (H14)
Mchekanambingu / Mvumanyuki (H4)	*Msisimizi* (H2)
*Mchofuo / Ndugudugu (*H15)	*Msoo* (H5)
Mdimu (H8)	*Mtambuu* (H14)
Mg'ang'a/Mnamyamaji (H10)	*Mtunguja* (H9)
Mjafari (H6, H2)	*Muinga jinni* (H2, H3)
Mkua usiku (H1, H7)	*Muopoa habari / Mpeleka habari* (H8, H12)
Mkudenyika (H7)	*Mvuje/Muakikali* (H14)
	Mwezi Upande (H12)

Some species have two names which are separated by a front slash

APPENDIX H

Afflictions mentioned by Healers (informal)

Kiswahili	**English**
Baa Asili	Hemorrhoids
Fumbato	Disease in babies where they squeeze fists
Homa	Fever
Homa mdudu	Mashetani fever in children
Mgongwa Kiswahili	Mashetani disease
Mshipa	Nerve/Vein problems
Mvimbe	Inflammation/Bruising
Ngiri	Hernia (usually affecting testes)
Pumu	Asthma

APPENDIX I: **Master list of plant information observed during forest walks (organized in no particular order).**

Botanical Name	Common Name	Kiswahili	Plant type	Other	Uses	Preparation	Healer/Area
Flacourtia indica		Mchongoma	Tree/Bush		Ngiri (testes hernia), can't stop peeing, cleans urine, aphrodesiac	Boil roots and drink water	H6
					7 mix - homa mdudu (devil fever)	(7 mix) roots msisimizi, ubugu, mjafari, mchongoma, muhinamwitu, msoo, mpilipilidoria - boil and drink	H2
					Aphrodesiac	Boil roots (21 pc) with Octopus (7 legs), drink and eat 1 leg per day	H9
Fluegia virosa		Mkwamba/Muhina mwitu	Tree		Inflammation/bruise on body (mvimbe)	Pound leaves and apply paste onto injury	H13
					7 mix - homa mdudu (devil fever)	(7 mix) roots msisimizi, ubugu, mjafari, mchongoma, muhinamwitu, msoo, mpilipilidoria - boil and drink	H2
					To avoid pain during and right before period	Boil roots and drink water	H6
					Constipation	Boil roots (21 pc) with Ubani (3 pc) and drink	H9
Monathotaxis jurnicate		Mchofuo/Nduguduguu	Tree/Bush		Shetani related diseases	Boil roots and drink OR burn leaves and cover body in smoke	H15
					Roots - sick while pregnant/stomach pain Leaves- if you can't sleep from bad shetani	Boil roots and drink water/ Grate leaves and apply to skin like lotion	H6
					Morning sickness	Boil roots (7 pc) with honey and drink	H9

Scutia myrtina		Msoo	Tree/Bush		Stomach pain (mshipa)	Boil roots and drink	H15
					Ngiri	Boil roots and drink	H13
					Pain in testes (swollen - Ngiri sugu)	Roots + roots of Mshubirimmwitu, boil with water - drink water (sound in stomach)	H4
					Protect children from wizard/shetani	Grate leaves with water, read Quran, drink & wash with water	H5
					Ngiri (testes pain), grated roots to clean kids' eyes when they can't see	Boil roots and drink (Ngiri), Grind roots	H6
					Ngiri (testes)	Boil roots, when water changes color, drink	H10
					Children loss of apetite	Boil young leaves (21), boil and drink	H12
					Ngiri (pain in testes)	Boil roots and bark, drink water	H1A (Ngezi)
					Ngiri (testes)	Boil roots (21 pc) with ginger and drink	H9
Aganthathium bojeri		Mchekanambingu/Mvumanyuki	Herb		Love potion	Grate roots and apply to genital area	H15
					1) Mshipa 2) Good luck in court	1) Boil roots and drink 2) Put one root in mouth and one in pocket when in court	H14
					Homa mdudu/Sudiani (all ages)	Grate leaves with water- spread around heart (chest)	H4
					Baa asili (mshipa)	Boil roots with ubani and drink	H12
					Balding	Cut off flowers, mix with kerosene and rub on bald spots	H10
					Ngiri	Boil roots and drink	H7
					Diarrhea	Roots of this and ofmwino, mbustani, mtunguja,	H5

						mzalianyuma - boil and drink	
					period regulation	boil roots and leaves and wash vaginal area	H1
					1) good luck in business 2) good luck in love	1) create a flour from leaves, spread on arms and face and sprinkle in front of shop door 2) make shavings from main root (while saying lover and parents name), spread on fish and give to lover	H9
Drypetes natalensis		Mjafari	Tree	planted	Ngiri	Boil roots or grate, and drink for 3x/day	H14
				instructions in book: Saatu habar	Roots - mshipa, stomach pain, fever, shetani, fever Leaves - skin inflamation (mvimbe)	Boil roots and drink water/ Grate leaves and apply to skin like lotion	H6
				H2 grew his own	get rid of bad shetani	grate into paste with water, rub on body	H2
					Stomach pain (mshipa)	Boil roots and drink or grate up roots	H9
Phyllanthus niruri		Mzalianyuma	Shrub	sex dimorph.	Stomach pain	Boil leaves and drink	H13
					Stomach pain (tumbo la mkeketo)	leaves mixed with grated roots of mjafari, mkunguja, mchongoma - cook and drink	H5
					Children's fever, and Malaria	Make tea of roots and leaves, drink	H4
					bloody diarrhea	boil whole plant- drink water 3x day	H2

					Stomach pain (mshipa)	Boil whole plant (2-5) with ginger and drink	H9
Euphorbia hilta		Mdatu/Muozesha nyama	Herb		Ulcer	Boil whole plant and drink water	H13
					Stomach ulcer	Boil many whole plants, filter and drink before eating	H9
Launaea cornuta		Mchunga	Shrub	next to cassava, spade leaves	Food	Alone- just a vegetable to eat	H5
					Children cannot retain urine	Boil leaves and drink	H9
Psiadia arabica		Mwezi upande	Shrub	edge of beach	Shetani	Grind leaves with water and drink while reciting Quran	H12
					Mgongwa Kiswahili (Shetani)	Mix with 7 other plant leaves, cook without water, keep in steam, and cover person in steam	H10
					Headache	Cook roots with coconut milk to distill oil, rub oil on head	H9
Ocimum canum		Kivumbasi	Herb	minty/basil smell	Fever	Grind up whole plant, get juice and filter through cloth, and drink	H15
					1) Stomach pain 2) Eye irritation	1) Boil whole plant and drink 2) Juice from leaves as eye drops	H13
					High fever	Grind whole plant without the root, boil and drink	H10
					"King of medicines" 1) flu 2) luck in fishing 3) etc.	1) smell crushed leaves 2) boil roots and spread the water on to fishing nets	H8
					Childrens fever	Grate leaves with water and wash child	H7
					Malaria	Boil leaves and roots together and drink water	H6
					Wengu (childrens' spleen distended), Gas	Boil roots with chicken meat (wengu), and just eat leaves for gas	H3

					children's fever	boil leaves- drink water	H1
					gas	boil roots with mtule roots, drink to ease gas	H9
					High blood pressure	Boil whole plant and drink water	H9
Ethulia conyzoides		Mbangiwazim	Herb		Mshipa and gas	Boil roots and leaves and drink	H14
					Gum inflamation	Pound roots into paste, swish in mouth with water	H13
					Shetani (Mgongwa Kiswahili)	Boil leaves and roots with Mdimu and Kivumbachi, apply steam over head	H8
					Mshipa	Boil roots and leaves and drink	H9
Solanum incanum	Thorn apple	Mtunguja	Shrub		Woman stomach pain	Boil roots and drink	H12
					To increase fertility (if a woman can't get pregnant)	Boil roots and drink water	H6
					Stomach pain	Chew on roots (half cooked near fire)	H5
					Shetani (Mgongwa Kiswahili)	Boil roots and ubani and drink	H9
					Frequent vomiting	Boil roots and drink water	H1
Tragi jurialis	Stinging nettle	Weni	Vine	climbing mdimusitu	Lung issues, congestion	Boil whole plant and drink water	H10
					Asthma/ chest pain	Boil leaves and drink water	H6
					Asthma	Boil leaf + roots in water- drink water	H1
					Asthma	Boil leaves drink water	H9
Clerodendron sp.		Mg'ang'a/Mnamyamaji	Vine		Children's fever	Collect steam from leaves and cover body with steam	H15
					Fever	Boil leaves and drink	H14
					Sudiani/mapepo mbaya	Grate leaves with water, drink and spread over body	H4
					Shetani in stomach	Mix with 7 other plant leaves, cook without water, keep in steam,	H10

						and cover person in steam	
					Eye irritation	Juice the leaves, and use as eye drops	H9
Ficus sur		Mkuyu	Tree		Increase fertility in women	Boil roots and drink	H15
				only stump seen	Vomiting	Boil roots and drink	H9
Dichostachys cinerea		Mvunjashoka	Tree/Bush	woody Vines	Snake bite	Use mouth to pick leaves, chew them into paste, spit into bite and bandage	H12
					Baby stomach pain (mshipa)	grated roots of utupa, mtunguja, mchnga, mvunjashoka, mjafari, dry in sun to get flour - put in breast milk for baby	H5
					conflicts with others	Roots (3 pc) in a bundle- put in breast pocket	H9
Ficus exasperata		Msasa	Shrub	scratchy leaves	Asthma	Boil leaves, mix w/salt and drink water	H3
					to get people to lend you money	Rub roots in hands and shake persons hand who you want money from	H9
Arene lobata		Muopoa habari/Mpeleka habari	Shrub	2 forms	Bloody diarrhea	Mix roots of both forms of Muopoa habari in water until color change - drink	H4
					Aphrodesiac	Boil roots with honey and drink	H7
					Shetani (Mgongwa Kiswahili)	Grind leaves in hands, eat the paste, then choke yourself with a chicken feather to vomit it out	H8
					Homa mdudu (shetani)	Grind leaves, filter out plant matter and wash body with juice	H12
Latana sp.		Haungongwa/Mlakunguru	Shrub		Strong fever	Steam leaves with heat, gather steam and breathe and put over body	H15

					Fever	Dry out leaves, grind into flour, mix with water and drink	H14
					Fever	1) Collect steam from leaves and cover body 2) Boil leaves and drink	H13
					fever, tooth problems	boil leaves in water, wash body with water 2 times a day for 7 days	H1
Senna persiana		Mkundenyika	Shrub	yellow flowers	Children's fever	Pound roots and leaves with water and wash body	H15
					Ngiri or children's fever	Boil whole plant and drink water	H14
					Children's fever	Boil leaves and wash child	H13
					Children's fever (1-4y/o)	Boil roots and drink OR burn leaves - smoke over body	H11
					Shetani/pepo punda (bad wizard) OR Ngiri	Shetani - grate leaves with water, use like lotion Ngiri - boil roots and drink	H7
					Protect children from homa babu	Mix leaves with leaves of Mfuu, boil - drink water	H5
					children's gas	boil roots- drink water	H3
					children (6m-3 y) with fever/diarrhea	mix leaves and roots in water and wash body	H1
Persia americana	Avocado	Parachichi	Tree		clean teeth	boil leaves and swish water in mouth	H1
					blood deficiency from period/ contraception	boil roots- drink water	H3
Leonotis nepetaefolia		Mkua usiku	Shrub	purple flowers/harsh basil smell	1) Fever 2) Stomach pain	1) Boil leaves and drink 2) Boil roots and drink	H14
					Fever or high blood pressure	Boil leaves and drink	H13
					Children fever (homa ya mdudu) (devil)	Mix with water and bathe	H1

					To get rid of shetani OR excessive blood loss during period	Shetani - grind leaves with water and use like lotion all over body. Blood loss- boil roots and drink	H7
Ketia indica		Mongonye/Mpindapindapo	Bush		teeth, period regulation, fatigue	stem as toothbrush, boil leaves- wash body for fever/tired	H1
					Period regulation for women, Stomach pain for men	7 pieces of roots of each: mkwamba, mbonokaburi, mjafari, mtunguja, mvunjashoka- boil and drink (11 days)	H5
					Childrens' diarrhea	Boil leaves and drink water	H6
					Increase female fertility OR love potion	Fertility - Boil roots and drink water Love potion - bury roots under the place where the person will walk	H7
					Mshipa with pregnant women	Boil roots and drink water	H10
Rauvolfia mombasiana		Mwengachaa/Mchoa ulimi	Tree		Ngiri (swollen testes)	soak pieces of root in water, drink water	H2
					Ngiri (testes hurt)	Soak roots in water 15 min, drink water	H1
Latana salvifolia		Muinga jini	Bush		to scare bad shetani away	hit person all over with the branch	H2
					to stop vomiting or to vomit out shetani (if present)	boil leaves - drink water	H3
					Headache	Make tea with leaves	H8
Unidentified		Mpatakuva/Mwendachasa	Shrub		Increase women's fertility	Boil leaves and drink	H15
				planted	Stomach pain during pregnancy	Boil leaves and drink water	H11
					Pain while pregnant	Boil leaves and drink and wash body with water	H14
					F- period regulation M- Ngiri	boil leaves - drink water	H3
					Flu	Rub leaves in hand and smell	H7
Waltheria americana		Mtui/Mtakawa dume	Shrub		Good luck in fishing	Leaves with leaves of Mtarakanga, grate and spread around inside of boat	H8

					gas	boil roots- drink water	H3
Strychnos angolensis		Mvuje/Muakikali	Shrub		Fever and shetani	Boil leaves and drink water and wash body	H14
					1) Vomiting 2) Children's fever	1) Boil leaves and drink 2) Collect steam from leaves and cover body	H13
					headache	burn to get smoke - let smoke go over body	H3
Ocimum basillicum		Mzamba/Mrihani	Shrub	planted	F- period regulation M- Ngiri	boil leaves or roots - drink water	H3
					Headache	Boil roots and leaves, use water to wash head	H11
Citrus aurantifolia	Lime	Mdimu	Bush	citrus	Stomach pain (mshipa)	Cut up roots, boil in water- drink water	H4
					Shetani (Mgongwa Kiswahili)	Boil leaves and roots with Mdimu and Kivumbachi, apply steam over head	H8
Aloe pembana		Muolidera/Mzimakilio/Mshubiri	Succulent	" Rare and endemic" (both planted)	1) Snake bite 2) Diabetes and high blood pressure	1) Use juice when cutting into plant 2) Boil leaves and drink	H14
					Bad breast milk from mother (baby has vomiting and diarrhea)	Cult leaves in small pieces- soak in water (no boil), 2 hours	H5
Carica papaya	Papaya Tree	Mpapai dume	Tree		High fever	Boil the very top leaves (youngest) and wash body with the water	H11
				planted	Men not producing semen	Boil roots and drink water	H5
Salacia madagascariensis		Mchakuzi/Mtora	Tree/Bush		Distended stomach from Shetani	Boil roots (7 pc) and salt and drink	H8
					Aphrodesiac	Boil roots with octopus (like a stew)	H6
Albizia sp.		Mwino	Shrub		Stomach pain	Boil roots and drink water	H6
					Ngiri	Boil roots and drink water	H7
					Stomach pain	Boil roots and drink	H12
Cajanus cajan		Mbaazi	Tree/Bush		Childrens fever	Grind leaves in hands with water and wash body	H8

					Nosebleed	Roll up leaves and shove into nose	H13
Punicum gratanum		Mkoma manga	Tree		1)Fever 2) Sore throat 3)Shetani	1)Boil leaves and drink 2)Boil roots and drink 3) Burn skin of fruit to ward away Shetani	H11
					Period regulation	Boil roots and drink	H13
Lawsonia inermis	Henna	Muhina	Tree		Calloused skin on feet	Grind leaves and use as lotion OR Boil leaves and put foot into water	H11
					Abortion (when 1m pregnant)	Boil roots and drink	H13
Clarodendrum sp.		Mpepe	Shrub		Difficulty getting pregnant	Boil roots and drink during time of period	H12
Sorindeia madagascarensis		Mtarifeni/Pili pili doria	Shrub		Aphrodesiac	Boil roots with octopus and drink	H12
Catharanthus roseus		Mbustani	Herb		Women's stomach pain (mshipa)	Boil roots and drink	H12
					High blood pressure or diabetes	Boil roots and drink	H13
Annona senegalensis		Mtopetope	Bush		Joint pain	Boil bark and coconut to extract oil and use as lotion	H12
Terminalia catappa		Mkungu	Tree		Increase amount of blood in body	Boil bark and drink	H12
Manihot asculentus	Cassava	Mihogo	Bush		1) Wound care 2) fever	1) Burn roots, rub ash/coal in wound 2) Burn dry roots and old clothes and cover body in smoke	H12
Mimosa pudica		Kifa uongo	Herb	moves when touched	Weak child	Grind turtle shell and leaves with water, use as a lotion for whole body	H12
Ficus natalensis		Mkichaka	Tree/Bush		Bloody diarrhea	Boil roots with salt and drink	H12
Cyperus rotundus		Kishinde	Grass		Very stubborn shetani	Boil roots (7) and drink while reading Quran	H12
Croton sylvaticus		Msinduzi (dawadawa)	Tree/Bush		Skin Inflamation	Rub leaves together, apply to skin	H1A (Ngezi)

Majidea zunguebarica		Mchenya	Tree		Stomach pain, leg pain (mshipa)	Grate bark with water- apply to areas of pain	H2A (Ngezi)
Mucuna sp.		Ubugu	Shrub		Children fever (homa mdudu)	(7 mix) roots msisimizi, ubugu, mjafari, mchongoma, muhinamwitu, msoo, mpilipilidoria - boil and drink	H2A (Ngezi)
Azadirachta indica	Neem	Mwarubaini	Tree		1) Diarrhea 2) Fever from malaria	Boil bark and/or leaves and drink water 3x /day	H13
Mosa sp.	Banana	Mgomba	Tree		Asthma	Boil roots with ubani and drink	H13
Parinari curatilifolia		Mbura	Shrub		Toothache	Boil bark and swish water	H13
Unidentified		Mchakati	Shrub		Couching and fever	Boil leaves and drink and wash body with water	H14
Unidentified		Msawa msi	Shrub		Fever and shetani	Boil leaves and drink water and wash body	H14
Piper betle		Mtambuu	Shrub		Mute from shetani	Chew up and spit out	H14
		Mpilipili manga	Shrub		Paralysis	Mix fruit with honey and ginger and touch mixture to tongue	H14
Triumphetta rhomboidea		Mchoma ndovu	Bush		Children vomiting	Mix roots with banana leaves and ubani and boil together	H14
Cremaspora triflora		Mkanja	Herb		Mshipa	Boil whole plant and drink and wash	H14
Cassia didymobotrya		Utupa	Vine	"decreasing"	Baby stomach pain (mshipa)	grated roots of utupa, mtunguja, mchnga, mvunjashoka, mjafari, dry in sun to get flour - put in breast milk for baby	H5
Gossypium hirsutum	Cotton	Mpamba	Tree		Boil roots, fruits and honey and drink	Asthma	H15
Cinnamon zeylanicum	Cinnamon	Mdalasini	Tree		Stomach pain (mshipa)	Boil roots with orange and lemon and drink water	H15

Harungana madagascariensis		Mgonengone/Mdamudamu/Mkekundu	Bush		Diarrhea	Mix roots of Mgonengone with whole plant of Mnamiaziwa, grind, boil and drink	H15
Abelmoschus sp.		Mnamiaziwa	Bush	marsh	Diarrhea	Mix roots of Mgonengone with whole plant of Mnamiaziwa, grind, boil and drink	H15
Unidentified		Mpacha/Mjengafufu	Bush		Children's fever	Pound leaves with water and wash body OR burn leaves for smoke and cover body in it	H15
Ricinus cummunis		Mbono	Shrub	planted	Knee (and other joint) injuries	Put leaves into boiling water, take out and press against skin	H11
Bryophyllym pinnatum		Mpovupovu	Ground cover		Baby is lazy and lethargic	Leaves mixed with leaves from young banana, Mfuu, Kivumbachi, grind with water and wash body	H8
Pamphis acidula		Moto wa jiwe/Mjoma	Tree	next to beach	Mgongwa Kiswahili (Shetani)	Put leaves into fire and the smoke out Shetani	H10
Mimosa sp.		Kijogoo	Ground cover		Weak child	Pound whole plant and mix with coconut oil to form a lotion - rub on child's body	H10
Euphobia tirucali		Mchongochongo	Tree/Bush	own micro island, green beans, white fluid	1) Balding 2) Calf (baby cow) disease called "Matukwi)	1) Rub white fluid from leaves into bald spot (be careful because it will blind you) 2) Rub white fluid over calf's skin	H10
Unidentified		Msambaa	Shrub	planted	Gum inflamation	Grate roots, use as a paste on teeth	H11
Lobelia fervens		Kikwayakwaya	Herb		Burn treatment	Grind roots and use like a lotion	H6
Syzygium cuminii		Mzambarau	Tree		Diabetes	Cut bark up and boil-drink wate AND/OR dry fruit's seeds, make a flour to put in tea	H7

Ormocarpum kirkii		Mlambuzi	Herb		Stomach pain	Boil roots and drink	H7
Corchorus sp.		Kombotumwa	Shrub		Excessive blood loss during period	Boil leaves and drink	H7
Mallotus oppositefolia		Mbunduki	Vine	extremities are Vines, but main stem is bark	Fumbatu (children)	Grate leaves with water and spread over hands	H8
Euclea racimosa		Mchakachaka/Msiliza	Tree		Gas and bleeding from anus (baa asili), bloody diarrhea	Grind roots, then boil and drink	H6
Opuntia vulgaris		Mshubiri mwitu 2	Succulent		Acne	Squeeze out juice from segment and spread over acne	H13
Unidentified		Mshubiri mwitu 1	Vine	purple flowers	Ngiri	1 small piece of root, grate, mix with water, and drink	H4
Vitex doniana		Mfuu	Tree	For timber	Prep female for having baby	Roots Mfuu (21 pc), roots mpachapacha (20 pc), boil and drink water	H4
Allangium Salviifolium		Mchawanya ukumbi/Mmavi mavai	Climber	climbing Mfuu	Children's fever, protection from bad wizard	Grate leaves with water, spread over body	H4
Syzgium aromatica	Clove Tree	Karafuu	Tree		Stomach pain or Pneumonia	Put cloves in bottle of water, let sit until water color change- drink	H4
Vernonia sp.		Mpachapacha	Vine	under Tree	Prep female for having baby	Roots Mfuu (21 pc), roots mpachapacha (20 pc), boil and drink water	H4
Jatropha curcas		Mbonokaburi	Tree/Bush	planted (father buried under)	Baby stomach pain (mshipa)	Grated roots of utupa, mtunguja, mchnga, mvunjashoka, mjafari, dry in sun to get flour - put in breast milk for baby	H5
Psidium guajava		Mpera	Tree		Aphrodesiac	Roots of this and of mpapai dume, mbonokaburi, mchafuo, boil and drink water	H5

Tamarindus indica	Tamarind	Mkuwaju	Tree		Asthma	grate leaves with salt, drink fluid produced	H3
Adansonia digitata	Baobob	Mbuyu	Tree		Malnutrition	Boil fruits in water- drink water	H3
Ocimum sp.		Mbainisiri	Shrub		Bloody diarrhea	Root (11 pieces) + Peleka siri roots (10 pieces) + Ubani (3 pc), boil, drink	H4
Helianthus annuus	Sunflower	Alizeti/Mpamba mwitu	Shrub		veins hurt (mshipa)	Use opened fruits to massage body	H3
Cymbopogon citratus		Mchaichai	Grass	H3 planted	headache, diarrhea	Catch steam with contraption- drink distilled fluid	H3
Unidentified		Mkusanya ndugu/Mahari ya paka	Tree/Bush		good luck in business	Create root bundle (1 of this plant, 1 mg'ang'a, 1 of mchowi), with mvumba in middle, paint red, black and white and bury vertically under front of shop on Sunday at 3pm	H9
Antidesma venosum		Msisimizi	Shrub		7 mix - homa mdudu (devil fever)	(7 mix) roots msisimizi, ubugu, mjafari, mchongoma, muhinamwitu, msoo, mpilipilidoria - boil and drink	H2
Magnifera indica	Mango	Mwembe	Tree		teeth	Boil bark- swish water in mouth	H1
Ethulia sp.		Mrenda	Shrub	sides of cassava, pink flowers	children fever	Boil leaves, wash child in water	H1
Ocicum suave	Mtule Basil	Mtule	Shrub		gas	Boil roots with Kivumbachi roots and drink	H1
Moringa oleifera		Mronge	Tree		diabetes	boil roots and drink water	H1
Sida acuta		Mgaragarapaka	Shrub	used a lot	to wake up people who have fainted	rub leaves in hands- to smell	H1
Zyzpus sp.		Mkunazi	Tree/Bush		Bad circulation	Boil roots (7 pc) and drink	H9