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An Ethnobotanical Examination of Traditional Medicine in Ngezi Forest Reserve

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Abstract

Traditional medicine is an important component of both the culture and health of communities worldwide. Ngezi Forest Reserve is a protected area on Pemba Island, one of the islands which make up the Zanzibar Archipelago. This forest is home to 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. By compiling information from interviews with 15 local healers, 98 species of medicinal plants were identified, as well as a wide variety of uses and preparations. Priority medicinal species -- those used frequently by healers but which appear to be decreasing in abundance -- include *Mjafari* and *Msoo*.

Keywords: Ethnobotany, Medicine, Forests of Zanzibar Archipelago

1. 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" [1]. 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, depend upon the ecological features and natural resources available locally, since the traditions began prior to the prevalence of international and intercultural trade. Thus, regionally specific medicinal plants have been identified and cultivated throughout the histories of most 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 the 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 add to the existing knowledge of medicinal plants used in Zanzibar, and will help construct a stronger argument and specific recommendations for the conservation and management of these important resources.

In Tanzania, the practice of traditional medicine is known as *uganga*. *Uganga mitishamba* is a sub-discipline of traditional medicine, which utilizes specific 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 known as *waganga mitishamba*.

2. Background

A territory of Tanzania located in the Indian Ocean, the island system of Zanzibar is home to a unique tropical marine environment that fosters a diverse population of medicinal plants with applications in traditional medicine (Figure 1). Some better-known indigenous medicinal plants include *Azadirachta indica* (neem tree), believed to be beneficial for malaria, digestive problems and other ailments, *Solanum incanum* (bitter apple), often used as an anticancer agent and antioxidant, and *Ocimum suave* (wild basil), known as an anti-microbial and ulcer healing agent [2]. Traditional healers provide the majority of health care to Zanzibaris, according to the Zanzibar Traditional and Alternative Medicine Policy [3]. 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 pharmaceutical drugs, Zanzibaris depend increasingly on traditional medicine [4]. Thus, more strain is put on the forests where traditional medicinal plants are collected. As Ernest Rukangira [5] , 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 at play is the increasing use of plant-derived "nutritional supplements" in *developed countries* for "daily maintenance of personal health" [6]. The popularity of these alternative and less expensive healthcare products 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.

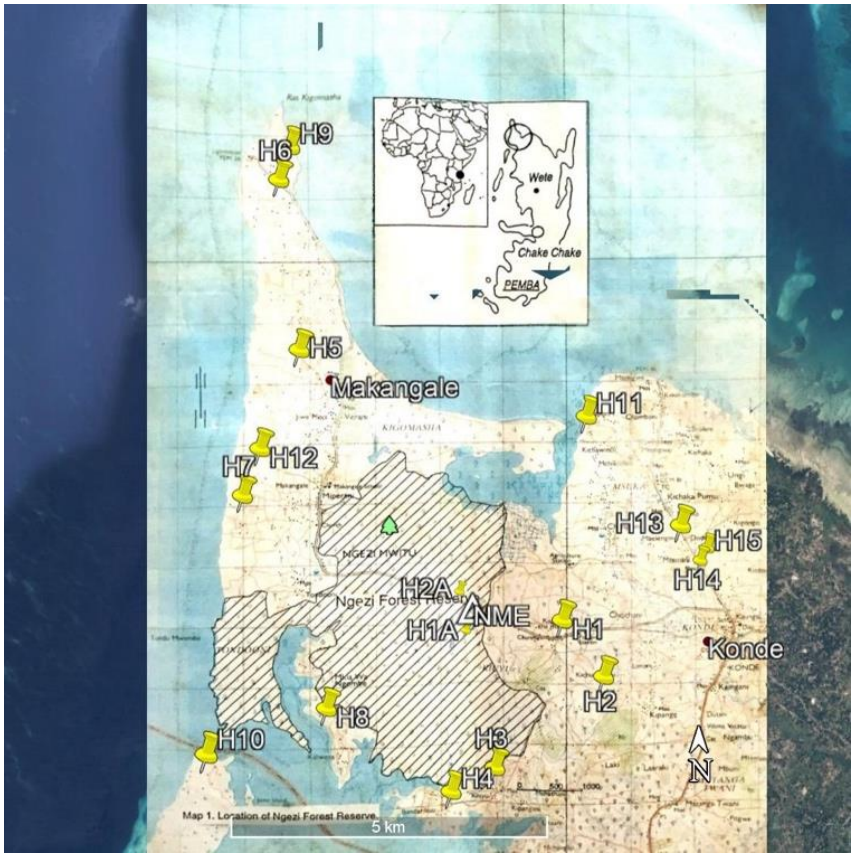

Figure 1- Map of observed medicinal plant collection around Ngezi Forest Reserve. NME = Ngezi Main Entrance (Google Earth 2017) [7]

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

Pemba is one of the largest islands in the Zanzibar Archipelago, which separated from the African mainland around 10 million years ago [8]. It was a part of the Eastern Arc Mountains, a unique environment supporting many endemic species of its own. Since the separation, speciation events have produced a number of endemic Pemban species as well. Pemba has a hillier and more topographically dynamic landscape than its sister island, Unguja. It used to be covered mostly in forest, but over the last 150 years, 95% of the forest has been cleared for agricultural and industrial purposes [9]. Ngezi Forest is considered the last major forest in Pemba. In the early 1920s, it was used as a site for commercial foresting [10]. 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 [11]. In more specific terms, it lies between E 39° 34', S 6° 16' and E 39° 45', S 6°28' [12]. Its 14.4 square kilometers consist mostly of moist forest and secondary bush. The combination of a coastal location and its association with the Eastern Arc Mountains makes Ngezi an area of rich biodiversity, but habitats for many of the species are decreasing [13]. As a result, Ngezi is a home to a number of plant species 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 that are threatened, according to the International Union for Conservation of Nature (IUCN) or the Convention on International Trade in Endangered Species of Wild Fauna and Flora (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 [14]. 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 collection of fuel wood, fruit, and medicinal plants. However, 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 upon 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 local resources. 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.

In addition to the ten villages immediately bordering Ngezi Forest Reserve, many more are supplied and influenced by the resources present in the Reserve. Fourteen villages were visited in this survey, as well as 17 different collection areas.

3. Methodology

3.1 Interviews Of Traditional Healers

Upon meeting each healer, standardized interviews were conducted via translator to obtain broad information about the healer's background. An initial set of questions 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.

3.2 Plant Identification Forest Excursions With Traditional Healers

One two-hour forest excursion was conducted with each healer as guide. The healers were instructed to identify as many known medicinal plant species as possible, as long as they had used the species. For aid in later identification, photographs were taken of each plant, including defining plant characteristics, such as leaves, fruits and flowers. Plant characteristics were recorded in a standardized table, one table per healer.

During each excursion, GPS coordinates of important waypoints were recorded. Most importantly, the GPS documented the general vicinity in which plants were collected, as well as the track taken. 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.

3.3 Medicinal Use Data Gathered From Healers

After each forest excursion, standardized interviews were held with individual healers in order to obtain information about preparations, uses and significances of the plants identified. Qualitative data — for example, stories, ideas and opinions — were recorded as notes and were not tabulated.

3.4 Plant Identification With Botanist

A recognized local botanist specializing in Pemban plants with a MS in botany from the University of Dar es Salaam, was consulted after the excursions to supply the scientific name of each species, and its threat status.

4. Results

4.1 Demographics: Who are the Traditional Healers of the Ngezi Forest Region?

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. Practitioners are generally similar in their demographic characteristics (Figure 2). All of them are from Pemba and were raised in the village where they live currently. Most are men, with one exception. 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, who had also been practitioners. In most cases, the information passed down from their parents was solely practical: plant identities and their uses. A few of those interviewed had apprentices, sometimes their own children. Years of experience ranged from two to 37 years, with an average of 24. Some claimed a degree of renown, having been flown to mainland East Africa to treat patients, or being sought out by patients from distant areas, who lined up to see them.

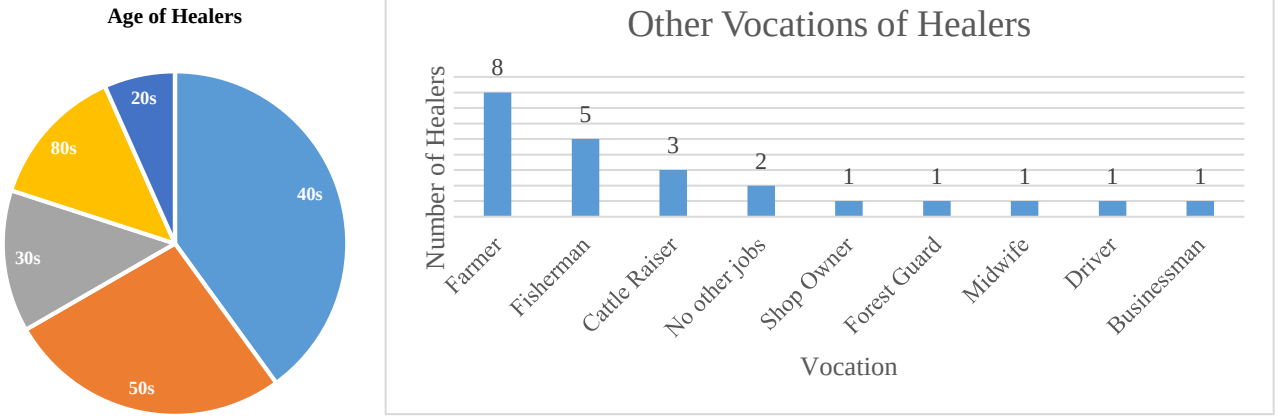

Figure 2- Demographic Data of Healers (n=15)

None of the healers claimed to be a specialist; they all 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, from fishing, to farming, to day care or taxi-driving.

4.2 Collection Practices By Healers

The *waganga mitishamba* interviewed for this study collect both inside and outside the core zone of the Ngezi Forest Reserve. The majority of their collection occurs in the areas surrounding their individual villages. Of the 15 healers spoken with, only two reported collecting in the core zone of the Forest Reserve with frequency. The remainder of the healers reported entering into the core zone for collection either never, or only a few times per month. 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 Reserve. 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.

For this reason, many healers have found ways to be independent of the core zone of the Forest Reserve as their main source for medicinal plants. This means collecting the majority of their plant material in the areas surrounding their villages. These areas are strikingly similar to each other even though they are spread out. The vegetation 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 (low bushes, grasses and vines growing on soil derived from eroded coral), 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 access medicinal plants.

Another way that these healers have avoided using the Forest Reserve is by cultivating 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 maintain small areas around their properties which contain mostly cultivated plants, almost like unfenced gardens (H11 and H14). A total of 18 different cultivated species were identified in the areas visited. 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 transplanted locally; 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 do not cultivate their own medicinal plants cite difficulties such as forest plants' preference for a moist forest environment, with lots of shade from trees. There is not much consistency in the species of medicinal plants that are being cultivated. The most common were *mjafari, shubiri/muolidera, and mrehani* (two healers). The other 15 species of cultivated plants were grown by one healer each.

The majority of the healers do not travel far to collect their medicinal plants, but a few routinely take long journeys to find their plants. H2 now actually collects most of his plants in an area distant from his home village. He noted that as population increases in Pemba, so does 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. Healers 8 and 9 both reported that they regularly travel by boat to the island of Njau to collect many of their plants.

Several healers were eager to discuss the importance of proper techniques for medicinal plant collection, which are conservation-minded. When harvesting useful parts (bark, roots and leaves) of trees and large shrubs, the healers understand that there is a limit to how much they can take before a plant dies. One said that he often reminds other people that if they cut too much, the plant will die. Another said that when he needs leaves from a tree, he only collects the ones that have dropped to the ground; he also described certain methods of cutting roots, so they can regenerate. Most of the healers said that they only collect plants when needed for a patient; only a few admitted to stockpiling.

4.3 Medicinal Plants used by Healers

Ninety-eight distinct medicinal plant species were identified over the course of the study. The most common types were trees and shrubs (Figure 3).

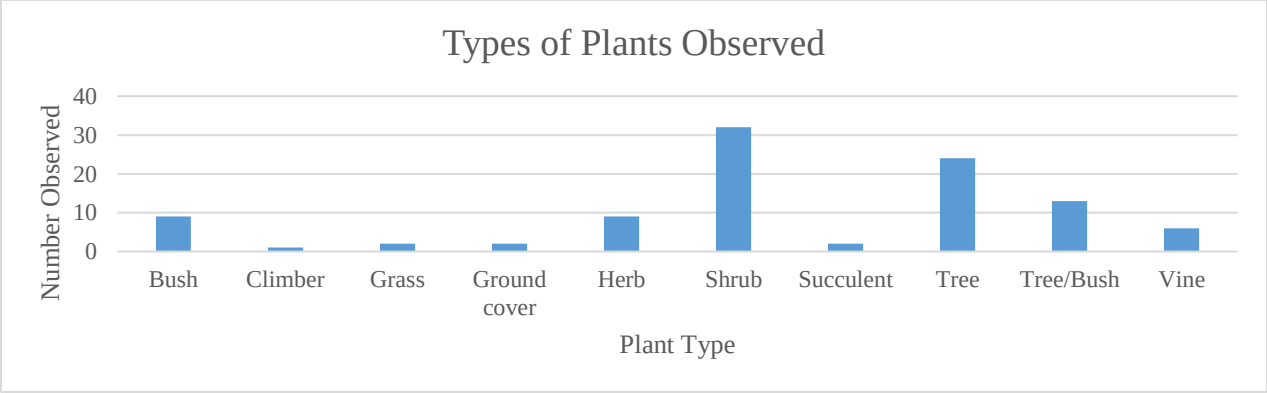

Figure 3- Cumulative account of plant types observed during forest excursions with healers.

Table 2- Medicinal Plants used by 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

Kivumbasi was the species identified the most often, by ten of the 15 healers. *Mvumanyuki/Mchekanambingu,* and *Msoo* were the second most commonly identified, each by nine healers. Sixty-one species were identified by only one healer.

Kivumbasi was also at the top of the list of "Most Commonly Used" medicinal plants, with five healers listing it among their favorites. This was followed by *Msoo, Mjafari* and *Msinduzi,* which each appeared on the lists of four healers. 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.

In the "Decreasing availability" plants category, *Mjafari* and *Msoo* appeared most frequently, each with four healers listing it as "decreasing in availability". Three healers agreed that *Mwendachasa/Mpatakuva* was also decreasing in availability. Outside of these species, there was no real consensus on which plants are becoming harder to find.

4.4 Uses of Medicinal Plants

The conditions most often treated by healers were: inguinal hernias in men, menstrual and pregnancy problems in women, and infant/child-specific illnesses (fever and weakness). There was significant variability between healers as to what specific plants should be used for, with agreements being the exception. *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*.

Regarding preparation, the vast majority of the plants were prepared by boiling roots and then drinking the resulting decoction. Another frequently used technique is boiling leaves to make a tea. More esoteric methods included creating a flour out of a plant and sprinkling on the door of a shop or house.

It was challenging to draw solid data 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. Some healers' plant use was oriented exclusively toward physical ailments. All of the conditions that they mentioned were purely physical: fever, knee injury, gum inflammation, pain during pregnancy etc. For other healers, treatments for physical ailments like high blood pressure, headache and stomach pain, were mixed equally with formulations to increase success in business, and of course, in romance as well.

A related challenging factor that became clear during the study was the important role played by spirits and the supernatural in Pemban traditional medicine beliefs. *Mashetani* are spirits that Pembans (including traditional healers) believe are the cause of most human afflictions. The most commonly mentioned include *Mgongwa Kiswahili,* in which a patient unconsciously yells and makes strange noises and may become paralyzed, and *Homa mdudu,* which causes a child to convulse and become unconscious. These spiritual phenomena are not regarded as myth, but are a reality for traditional healers, and addressing them makes up a large part of their work.

5. Discussion

Traditional medicine in Pemba is a rich and thriving component of the history and culture of the region. Since it relies on local plants, many of which are endemic, it ties the Pemban people to their natural environment and their geographic home in a way that modern pharmaceutical medicine does not. Traditional healers in the Ngezi region appear to be hard-working, thoughtful, and selfless members of their communities. They are preserving and growing a centuries-old part of their living culture. Most of them regard healing as a vocation passed down by their elders, and do not enjoy financial or social benefits from their practice. Their knowledge, and their motivation to improve the lives of their neighbors, are invaluable natural resources in themselves.

In Pemba, traditional medicine serves as the primary front-line source of health care, and prevents over-taxing of limited Western medical resources. In any region of the developing world with a rapidly rising population, health problems and need for health care are bound to increase as well. This is the case in Pemba, the rural region around Ngezi in particular. Crowding increases susceptibility, especially in infants, to the infectious diseases endemic to 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. Although this survey did not seek to

quantify this pressure, some species in wider use were noted by multiple healers to be growing more difficult to find, including Msoo (*Scutia myrtina*) and Mjafari (*Drypetes natalensis*).

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 Forest Reserve management and also by the villages that lie nearest. The buffer zone was intended for responsible use 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. 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 minor 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 [15].

In the core zone of the Reserve, the situation is different. Technically, no collection of plants is allowed in the core zone. Only after an Annual Allowable Cut Assessment has been performed, may healers collect, and only as limited by the Assessment findings [16]. Although no collection is officially allowed outside of these regulations, it does happen. Informal interviews with Reserve guards revealed that collection of medicinal plants by local healers is not considered as serious as illegal harvesting of firewood or timber. This makes for inconsistency in the Reserve's ground-level enforcement; at times, some officials will allow people to collect in the core zone, and at others, they will not.

The findings of this study suggest that this inconsistent and permissive approach may not be sustainable. Not surprisingly, the plants used most commonly by healers are also the plants that they recognize as threatened.

It is important to note that healers are generally a neutral, if not a positive, presence in the community with regard to environmental conservation. With proper collection techniques, plants usually regrow after collection. It is possible that pressure on certain species is not the result of collection for medicinal purposes, but clearing for agriculture and construction, climate change, or other factors.

Some of the healers even serve as unofficial forest guardians, advocating against over-collection, deforestation and brush clearing. Those with apprentices teach collection techniques that do not kill plants. Some even promote a theory that *mashetani* prefer to live in the forest, and that human destruction of the forest habitat is driving increased numbers of the evil spirits into villages.

An unexpected finding in this survey was the isolation and lack of communication between traditional healers in the region, even though some are separated by only a few miles. The broad variation in plant use and practice styles demonstrates a lack of cohesiveness and consistency in the healing traditions of the region. The healers themselves confirmed that they have no professional or social interaction with their colleagues in the region. Of course, traditional medicine is not based on "science" in the Western sense, and there is no body of experimental evidence guiding its practice. It relies heavily on the individual learning and experience of each healer, and variation is expected. Also, these healers are busy, with second jobs and families on top of their practices, and a few miles is not a trivial distance without a car. Still, it seems that some communication would be beneficial in several ways. First, it would allow the sharing and dissemination of medicinal experience and knowledge to benefit the patients. Remedies that are successful could be shared to help more people; those that don't work would be abandoned faster. Second, social interaction would be likely to improve job satisfaction for healers, whose stress level can't be helped by isolation. Third, professional affiliation would provide a mechanism to address the pressure on certain medicinal plant species. As a group, healers could discuss judicious stewardship of shrinking resources, advocate against forest clearing, join forces in cultivating pressured species, and share effective alternatives to reduce demand. With all of them acting in isolation, the natural outcome of the current situation may unfortunately be a "tragedy of the commons".

5.1 Limitations

The data collected was completely dependent on what the interview subjects knew, believed, and were willing to reveal. They may have been reluctant to identify certain more rare plants, out of a concern that the location would be revealed to others. Accounts of which conditions they treat with which plants may have been influenced by a desire to protect "trade secrets". Reports on which plants are becoming more scarce, were based purely on their subjective estimates.

The interview subjects were recruited as a convenience sample only. The list was assembled by the local Pemban botanist. It can be assumed that there are healers in the area who were not interviewed, and would provide differing lists and accounts.

The two translators employed for interviews were also employees of the Forest Reserve itself. They were not serving in that capacity, but it is possible that their official role was known to some interview subjects. Their presence may have influenced healers to under-report their collection activity in the core zone of the Forest Reserve.

Another concern is the inevitability that information is lost in translation. There were times when the translators evidently struggled to convey what the healer was trying to say. Professional translators were not available on Pemba, and it was felt that recording the interviews for later translation would have caused the interview subjects to be more guarded in their responses.

6. Conclusion

This study was intended not only as a survey of medicinal plants in the Ngezi region, but as an ethnobotanical study. Local experts were consulted to provide a perspective 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 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 those 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.

7. Acknowledgments

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