

# Wild edible mushrooms and their marketing potential in the Selous-Niassa Wildlife Corridor, Tanzania

*Second study (28/2 – 21/3/09)*

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## Executive summary

A first field study was carried from 21/1 to 31/1/08 including a) a preliminary assessment of wild mushrooms of the Selous-Niassa Wildlife Corridor which are edible or having medicinal uses, b) the description of the mushroom growing habitats, and c) a first investigation about the marketing of wild edible mushrooms (species, conditioning, existing local markets) in profit of the local communities.

This second more in depth analysis is based on further fieldwork realised from 28/2 – 21/3/09. This field trip was carried out later in the rainy season what allowed to assess a wider range of edible mushrooms since the fructification and collection period of many mushrooms is highly seasonal. The second study completes the wild edible mushroom inventory of the Corridor and the current use of mushrooms by the locals, and mainly focusses on the local and regional marketing potential of wild edible mushrooms and its constraints.

In addition, a first assessment of the potential of wild edible fruits in the Corridor and their valorisation potential has been carried out. Moreover, opportunistic collection and observations of tree, shrub and ground floras throughout the fieldwork completed the plant checklist.

The mushroom fructification period is strongly seasonal depending on the rainfall pattern. In total 69 mushroom species from 23 genera belonging to 16 families were recorded whereof 10 were only mentioned by the locals but not found in the field. Out of the 69 recorded species, 30 could be identified at species level and 35 at genus level only. 39 species are eaten by people. All interviewed people valued mushrooms as food very highly. *Amanita loosii*, Upoa/Uboa (*Lactarius edulis*), and four chanterelles (*C. isabellinus*, *C. cf. floridula*, *C. platyphyllos*, and *C. symoensii*) are preferred to any other kind of food, even meat. Usually the people from the Corridor are drying the surplus of the mushroom harvest for the consumption during the dry season. The powder of some polypore fungi is used for treating cough and asthma.

According to the mushroom sellers, the most commonly sold mushroom species at Songea and Mbeya is *Cantharellus isabellinus*. Other species sold at Songea are *Amanita loosii*, *Cantharellus platyphyllos/symoensii*, *Lactarius edulis*, and *Russula cellulata*. The most common species in the markets of Iringa are *Cantharellus sp* *Amanita loosii*. In the Uhindini market at Mbeya, cultivated *Pleurotus sp.* were sold at a price about three times higher than that of wild edible mushrooms.

The development of appropriate preservation techniques will not only be in profit of marketing mushrooms but also of self-consumption during the dry season of properly dried mushrooms what will improve the quality of the diet of the locals.

A mushroom flyer with coloured photographs of the most important edible mushrooms of the Corridor was elaborated. The flyer aims to support the promotion of mushroom having a high nutritional value by documenting and illustrating the rich potential of wild edible mushrooms in the Corridor. It includes also instructions regarding sustainable harvesting, proper picking techniques, identification of mushrooms, containers for the foray, and appropriate drying techniques. The flyer will be translated in easy Swahili for the local communities of the Corridor who will be the main beneficiaries of the mushroom project.

## 1. Introduction

A first mushroom study was mandated by the project SNWC-UNDP/GEF/GTZ-IS and the Selous – Niassa – Beekeeping Support Programme (SNBSP) of the Swiss NGO ADAP, carried out from 21/1 to 31/1/08 (Bloesch & Mbago 2008). The first mushroom study focussed a) on a preliminary assessment of wild mushrooms of the Selous-Niassa Wildlife Corridor which are edible or having medicinal uses, b) the description of the mushroom growing habitats, and c) first investigation about the marketing of wild edible mushrooms (species, conditioning, existing local markets) in profit of the local communities. The first study clearly demonstrated the high potential of wild edible mushroom in the extensive miombo woodlands of the Corridor and their importance for the diet of the local communities during the rainy season. The study showed also the high interested of the locals to be involved in the commercialisation of this highly priced food.

The second mushroom study was principally mandated by ADAP; SNWC financed exclusively the elaboration and printing of the mushroom flyer. The study was realised from 28/2 – 21/3/09 (see Itinerary and people met in Annex C). It emphasis on a) the completion of the wild edible mushroom inventory of the Corridor and the current use of mushrooms by the locals, and in particular b) on the local and regional marketing potential of wild edible mushrooms and its constraints (see TOR in Annex B). In addition, a first assessment of the potential of wild edible fruits in the Corridor and their valorisation potential has been carried out. Moreover, opportunistic collection and observations of tree, shrub and ground floras throughout the fieldwork completed the plant checklist.

Due to financial constraints, the realisation of the mission was doubtful at some time but owing to the goodwill of all parties involved, the study could be finally carried out as foreseen. Mainly thanks to the quick and unbureaucratic support from SNWC the major logistical problems could be rapidly resolved.

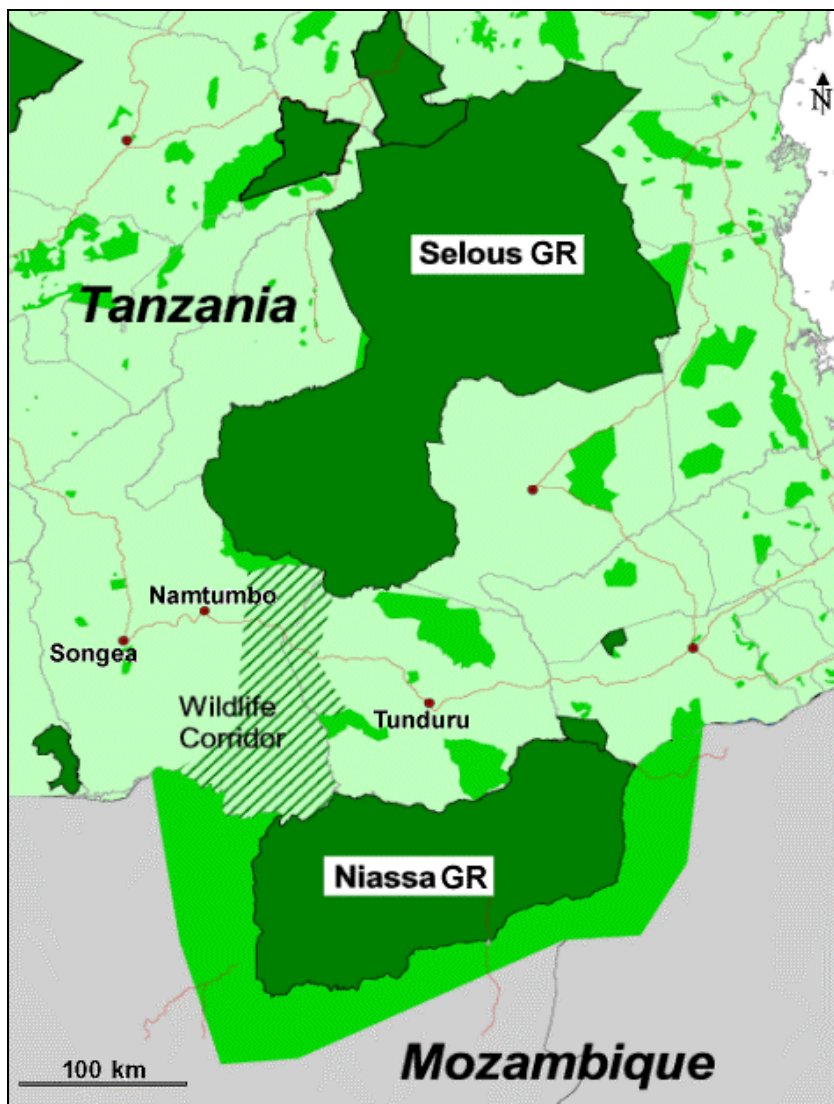
In this second study we mainly present results which are new or differ in relation with the first study. We therefore invite the interested reader to consult also first report (Bloesch & Mbago 2008) to the full picture of the wild edible mushroom assessment in the Corridor.

## 2. Study area

The Selous-Niassa Wildlife Corridor (*Ushoroba*) in Ruvuma Region of Southern Tanzania has an area of about 10,000 km<sup>2</sup> (see Fig. 1) extending approximately from 10° S to 11°40' S. The larger part of the Corridor is located in Namtumbo District while a smaller part in the east incorporates Tunduru District. The Corridor borders the Selous GR (North East Undendeule FR) in the north and the Niassa GR in Mozambique along the Ruvuma River in the south.

The northern part is generally hilly while the area towards the Ruvuma River is slightly undulated to flat with isolated hills, some of them having prominent rock outcrops (inselbergs). Mtungwe Mountain (1284m a.s.l.) in the centre of the Corridor is the highest elevation. The plateau slightly slopes to the Ruvuma River which reaches its lowest level of about 460m a.s.l. in the south-eastern corner of the Corridor. The soils are generally very sandy and washed-out. Two drainage basins exist in the SNWC. North of the watershed, located roughly along the main Road Namtumbo-Tunduru, the rivers drain into the Rufiji River while the area south of the watershed is part of the Ruvuma drainage basin. Some of

the major tributaries like Mbarangandu, Lukimwa, Luchulukuru, Luego or Msanjesi are usually permanent watercourses.



**Fig. 1.** Map of the Selous-Niassa Wildlife Corridor connecting the miombo woodland ecosystems.

The Corridor has the typical unimodal rainfall system of the miombo woodland ecosystem (Bloesch 2002). The southeast monsoons, bearing moisture from the Indian Ocean, are responsible for the rainy season chiefly occurring from mid-November to mid-May, however inter-annual variations are important. Northeast winds prevail in the dry season and there is usually no measurable rain for at least five months but fog may sporadically occur at higher elevations.

The mean annual rainfall at Suluti Agricultural Sub-research Station (about 8 km west of Namtumbo town) is about 1220 mm (average over 16 yrs, see Annex D). The rainfall in the Corridor generally decreases from the northern part with about 1200-1300 mm rainfall per year towards the south having a mean annual rainfall of about 800 mm along the Ruvuma River. The aridity of the sites towards the Ruvuma River is further enhanced by higher evapotranspiration due to lower altitude and more sandy soils. The variability of mean annual



rainfall is quite high with 24 % using the coefficient of variation defined as standard deviation expressed as % of the mean (Norton-Griffiths et al. 1975). The coefficient of variation is an indicator for the predictability of rainfall and therefore an important factor for crop production. Maximum rainfall per rainy season occurred 1997/98 with 1708 mm, followed by 2006/07 with 1691 mm. Mean monthly rainfall is highest in March with 304 mm having also the highest reliability of all months regarding rainfall. The mean annual temperature is about 21°C and the climate type following the Köppen system is Aw (Köppen 1931).

Namtumbo District is sparsely populated having only 11 people per km<sup>2</sup> according to the population census 2002. The dominating ethnic groups within the 29 villages participating in the management of the Corridor are Yao people followed by Ndendeule people who are mostly settled in the northern part. The economy within the two districts depends on agricultural crop production. Maize, beans and paddy are mainly cultivated for subsistence while in some areas cashew-nuts, sesame and tobacco are grown as cash crops. In contrast to other miombo woodlands, livestock keeping is poorly developed and the Corridor area is not used for cattle ranching. The vegetation types of the Corridor are described in detail by Bloesch & Mbago (2006, 2008).

### 3. Methods

This study was conducted in the first half of March 2009, while the first field study was carried out in the second half of January 2008. This approach allows assessing a wider range of edible mushrooms since the fructification and collection period of many mushrooms is highly seasonal. This time, in addition to the first field study, villages and mushroom sites within the Corridor were sampled along a central transect including the villages of Hulia, Darajambili and Namwinyu in Tunduru District and along a southern transect including the villages of Lusewa, Ligunga and Likusanguse in Namtumbo District and Mislaji in Tunduru District.

The assessment of a site was done as in the first field study in two steps: interviews in the village and subsequent field visit together with the mushroom hunters. First we introduced ourselves to the village authorities as far as possible on the previous day what allowed them to mobilise the key informants. 22 key informants were interviewed, whereof 8 women and 14 men (see Fig. 2). The questionnaire focussed on the recognition and use of wild mushrooms, including vernacular name, fructification period, edibility, medicinal uses, habitat of mushroom sites, consumption, mushroom picking and preserving techniques, marketing, and villagers suggestions (see questionnaire in Swahili in Annex E, slightly modified from Bloesch & Mbago 2008). The interviews were led by Irene Mbonde and Issa Ndomondo (Frank Mbago). At the same time a group discussion (*open-ended-questions*) with key informants not busy with the interview and other interested villagers were animated by the teamleader. We used the colour photographs in the book from Härkönen et al. (2003) to obtain more vernacular names and people's knowledge about a particular species. These group discussions allowed us to check and complete some of the information received from the questionnaires. After the interviews/group discussions the key informants brought us to some of their usual mushroom picking sites.



**Fig. 2.** Interview with key informants at Amani (interviewer Ndomondo Issa).

All mushrooms mentioned by the locals and/or found in the miombo woodlands were recorded including vernacular (Ndendeule and/or Yao and sporadically Ngoni and Hehe). The edibility of each eatable mushroom was evaluated by the locals in comparison with other mushrooms. For the edibility rating we followed Härkönen et al. (2003):

- \* = edible species
- \*\* = good edible species
- \*\*\* = edible, delicious

The book from Härkönen et al. (2003) was very helpful in the identification of the mushrooms since it gives also the vernacular names of the mushrooms. Representative fruit bodies of all found mushrooms were systematically photographed.

For facilitating the identification of unknown species we produced exsiccates. We cut thin slices along the cross section from good specimens which we immediately put in a small hermetic plastic bag. We added silica gel with moisture indicator (Merck silica, orange gel) in an approximate proportion of 10 grams silica per one gram of mushroom. Samples dried within a few hours and were periodically checked for re-hydration (if necessary more silica gel was added). In addition, we took notes about important taxonomic characteristics including substrate, consistency, smell and taste, colour changes, latex (colour and possible colour changes) and spore print. Mrs S. Feusi and Messrs A. Gindrat and G. Meyer, mycologists from Switzerland, helped in the identification of unknown species.



The most common and edible mushrooms are mycorrhizal. In order to estimate their abundance in the Corridor we need to better know their specific host trees. Therefore, we started to record the three nearest trees of mycorrhizal mushrooms (noting tree species, height and distance from the mushroom as well as the coordinates of the specific mushroom). Once the tree-mushroom species dependency and the range of distribution of the common miombo trees are known, we could approximately assess the abundance of a specific mycorrhizal mushroom within the Corridor.

After the first part of the field study (southern transect) a feedback workshop was organised in Namtumbo inviting representatives from local authorities, technical services from Namtumbo, CBO's, and project staff from SNWC and ADAP.

In addition, a first assessment of the potential of wild edible fruits in the Corridor and their valorisation potential has been carried out. All wild edible fruits seen in the field have been recorded and included in the previously established plant checklist of the Corridor (Bloesch & Mbago 2006). Interviews have been conducted in the same villages as for the mushroom survey focussing on the recognition and use of wild edible fruits (see second part of questionnaire in Swahili in Annex E), including vernacular name, growing habitat, domestic use, selling, preserving techniques, marketing, and villagers suggestions. In total 22 persons were interviewed (same interviewees as for the mushroom questionnaire).

Moreover, opportunistic collection and observations of tree, shrub and ground floras throughout the fieldwork completed the plant checklist. Uncertain plants were identified at the herbarium of the Department of Botany, University of Dar es Salaam.

Market studies were carried out a) in Manzese market and the *soko mjinga* near Ruvuma Regional Hospital (see Fig. 3), both in Songea, b) in central, SIDO, Soweto and Uhindi markets of Mbeya town, and c) in central, Makubirini and Mashine tatu markets of Iringa town. The questionnaire focussed mainly on the species sold, season, source of supply, purchase and selling price (see Annex F).



**Fig. 3.** Interview with mushroom sellers at informal market (*soko mjinga*) near Ruvuma Regional Hospital at Songea.

## 4. Results

### 4.1 Species inventory and fructification period

Table 1 lists all mushroom species found during the two fieldtrips and/or mentioned by the locals during the interviews (and identified with the book from Härkönen et al. 2003) including their scientific and vernacular names, edibility and locality. The growing habitat is miombo woodland if not otherwise stipulated. In total 69 mushroom species from 23 genera belonging to 16 families were recorded whereof 10 were only mentioned by the locals but not found in the field.

Out of the 69 recorded species, 30 could be identified at species level, and 35 at genus level only. 4 species found in the field could not yet been identified. During the socio-economic study over 50 vernacular names (Yao, Ndendeule, Nindi, Makua, Ngoni) were given by the local communities representing about 25 edible species.

The update of the **most common families** in the Corridor is as follows:

***Amanitaceae*:** The cup-like remnant of universal veil surrounding the stipe (the volva) is characteristic for this genus. Only 3 out of 9 species have been named scientifically (see Fig. 4).



**Boletaceae:** Typical of *Boletaceae* is that instead of gills they have tubes. Only 3 of 11 species could be identified with a scientific name. The collected exsiccates may help in the identification.

**Cantharellaceae:** Chanterelles are the prominent species of the miombo woodlands of the Corridor and very abundant, in particular *C. isabellinus* (see Fig. 5). In total six species have been identified.



**Fig. 4.** *Amanita tanzanica* at Kirundunda near Namwinyu. The fungus emerges like a white egg, before splitting at the apex to reveal the cap.

**Table 1. Recorded mushroom species**

Mushroom species	Ndendeule	Yao	Edibility	Locality
Agaricaceae <i>Macrolepiota dolichaula</i>	Urindi		(**)	Amani (termitaria); Hulia
Amanitaceae Amanita loosii	Ulelema	Utenga	***	Hulia; Iringa/Amani Kaunde; Marumba
Amanita masasiensis	Kagongoro	Nakajongoro	*/**	Iringa/Amani
Amanita tanzanica	Kagongoro <sup>8</sup>	Nakajongoro <sup>8</sup> , Nakasou <sup>8</sup>	*/**	Kirundunda/Namwinyu; Kitonye H./Marumba
Amanita sp. 1		Nakajete <sup>2</sup>	*	Ubueti/Milonji; Iringa/Amani
Amanita sp. 2				Magemani/Magazini
Amanita sp. 3		Lindotindoti	*	Magemani/Magazini
Amanita sp. 4				Nambecha
Amanita sp. 5				Amani
Amanita sp. 6				Kirundunda/Namwinyu
Boletaceae Afroboletus luteolus	Kajete	Nakatunu, Nakakong'o	*/**	Darajambili; Kitonye H./ Marumba; Iringa/Amani; Namwinyu
Boletus pallidissimus		Maoloko		Kirundunda/Namwinyu; Marumba
<i>Boletus spectabilissimus</i>		Magoma ya karunga	(*)	Marumba
Boletus sp. 1		Magoma ya karunga	*	Kitonye H./Marumba
Boletus sp. 2		Magoma ya karunga	*	Kitonye H./Marumba
Boletus sp. 3				Daraja mbili
Suillus sp. 1	Ngoma ya nyani <sup>3</sup>	Magoma ya majani	*	Nambecha fallow; Mabanzini/Matapw.
Suillus sp. 2	dito	dito	*	Ubueti/Milonji
Suillus sp. 3				Kitonye H./Marumba Mihaane/Hulia
Suillus sp. 4	Ngoma ya nyani <sup>3</sup>	Magoma ya majani		Mihaane/Hulia
Suillus sp. 5	Ngoma ya nyani <sup>3</sup>			Daraja mbili
Cantharellaceae Cantharellus congolensis	Langakora mwinyo	Chipatwe che piliu	**	Hulia, Kitonye H./ Marumba; Namwinyu
Cantharellus cf. floridula	Unguyugu mdogo	Nakachejwa, Kunguro kwetiti	***	Chuma mbili; Kaunde Camp; Kitonye H./ Marumba; Mihaane/Hulia
Cantharellus isabellinus	Unguyugu	Upatwe, Chipatwe cha njano	*** b&d	Kitonye H./Marumba Mabanzini/Matapw; Mihaane/Hulia; Nambecha; Ubueti/Milonji
Cantharellus platyphyllus		Nakachejwa <sup>6</sup> , Kunguro kwetiti <sup>6</sup>	(***)	Mihaane/Hulia; Marumba
<i>Cantharellus ruber</i>		Nakacheju <sup>9</sup>	(***)	Daraja mbili (market Iringa)
Cantharellus symoensii	Unguyugu	Kunguro kwetiti,	** b&d	Kitonye H./Marumba; Naheno/Likuyu S.

Mushroom study (2009)

		Chipatwe cha Njano		Ubueti/Milonji
Coriolaceae				
Gloeophyllum sp.				Sasawala R.: wooden board
Pycnoporus sanguineus				Sasawala R.; fishpond
Pycnoporus sp.				Mkongo: wooden board Naheno/Likuyu Seka; on dead wood
Clavariaceae				
Clavaria sp.				Kitonye H./Marumba
Clavulinaceae				
Clavulina wisoli		Ndenzya lamu		Ubueti/Milonji Mabanzini/Matapw. Marumba
Ganodermataceae				
Ganoderma sp. 1 <sup>5</sup>				Katoto/Magazini, on Pericopsis angolensis
Ganoderma sp. 2 <sup>5</sup>				Darajambili, on Brachystegia spiciformis
Ganoderma sp. 3 <sup>11</sup>	Lindeka Walele <sup>12</sup>			Corridor
Humphreya eminii				Amani; Darajambili, on roots
Lycoperdaceae				
Bovista sp. 1				Katoto/Magazini
Bovista sp. 2				Kitonye H./Marumba
Pluteaceae				
Pluteus sp.				Daraja mbili
Polyporaceae				
Microporus sp.				Hulia
Pleurotus sajor-caju		Utanda zima	* young	Marumba
Pleurotus sp.	Ulundi	Nakazohuu	*	Amani; on roots
Russulaceae				
Lactarius edulis	Upoa, Masikio ya jeuri <sup>10</sup>	Uboa <sup>10</sup>	***	Mihaane/Hulia; Marumba; Naheno/Likuyu S.
Lactarius gymnocarpoides		Nakasuku	**	Iringa/Amani, Marumba
Lactarius kabansus	Kambalakata	Nakambalakata	(*)	Marumba
Lactarius cf. volemoides				
Lactarius volemoides	Chaundila	Nakandanga Nakasuku	* b&d	Magemani/Magazini Kaunde; Kilimasera; Magemani/Magazini
Russula cellulata	Uhinda <sup>7</sup>	Usinda <sup>7</sup>	** d	Likuyu Seka; Mihaane/Hulia; Nambecha fallow
Russula ciliata (to verify)		Nakajongolo, Nakatelezya	** b&d	Daraja mbili; Kirundunda/Namwinyu; Marumba
Russula compressa		Lipalapi	(* b&d)	Marumba
Russula congoana	Unguwala	Chikoko	*/not eaten	Kaunde; Chuma mbili
Russula sp.?	Likangan-chunela		* only dry	Naheno/Likuyu S.
Russula sp. 1		Nakatandi		Marumba Guest H.
Russula sp. 2		Lindelemule		Namwinyu

Mushroom study (2009)

Russula sp. 3		Nakatereza	*	Daraja mbili
Russula sp. 4		Namaidi	*	Daraja mbili
Sclerodermataceae				
Scleroderma verrucosum?				Marumba Guest H.
Rhizopogonaceae				
Rhizopogon sp.	Litongo la huruku <sup>4</sup>		* <sup>1</sup>	Hulia; Naheno/Likuyu S.; Mabanzini/Matapwende; Ubueti/Milonji
Thelephoraceae				
Cymatoderma sp.		Unguyugu mkubwa		Ubueti/Milonji
Tricholomataceae				
Clitocybe sp.				Amani
<i>Termitomyces eurrhizus</i>	<i>Nakakuho</i>	<i>Nakazohu</i>	**	Amani, Marumba; Mislaji; agric. fields
<i>Termitomyces letestui</i>		Utembo, Uzawi wachimatila	***	Amani; Marumba; Mislaji; agric. fields
<i>Termitomyces microcarpus</i>		<i>Urundi</i>	**	Marumba
<i>Termitomyces singidensis</i>		<i>Namajete</i>	**	Marumba; agric. f.
<i>Termitomyces tyleranus</i>		<i>Ujonjwe</i>	(**)	Mislaji
Family not known				
		Chikoko Nakam-barakata (verify name)	* b&d	Iringa/Amani Iringa/Amani; on dead wood
		Hairy fungus		Fishpond Mkongo; Katoto/Magazini Kitonye H./Marumba Kitonye H./Marumba
		Livangwe	***	

**Total species: 69 species whereof 39 edible**

Locality: miombo woodlands when not otherwise specified; mushrooms written in *italic*: not seen in the field; (\*) edibility rating according to Härkönen et al. 2003; b = boiling; d = also eaten dried.

1) Cooked or roasted over a fire without skin; often eaten by children

2) Swahili: *Chumir*

3) also Swahili

4) Swahili: *Mpumbu za ngorombwe*

5) Powder used against cough and asthma

6) Ngoni: *Kalungeju*

7) Ngoni: *Uwinda*

8) Ngoni: *Mbawara*

9) Hehe: Wisigolo

10) Hehe: Wisimba

11) Powder used against skin diseases

12) Ngoni: Liketanjwili





**Fig. 5.** Giant *Cantharellus isabellinus* at Mihaane near Hulia.

**Russulaceae:** This family is the richest in species with 5 *Lactarius* species and 7 *Russula* species.



**Fig. 6.** *Termitomyces letestui* found in a maize field at Mislaji. Note the underground pseudorrhiza, a root-like extension of the stipe, connected to the fungus comb in an underground termite nest.

***Tricholomataceae:*** Only at Mislaji we found several species of the conspicuous termite mushroom *Termitomyces letestui* in agricultural fields nearby termite mounds (see Fig. 6). This tropical genus is typified by its symbiotic life together with termites. The local communities recognised four *Termitomyces* species according to Härkönen et al. (2003).



## 4.2 Edibility

39 species out of 69 species are eaten by people (see Table 1). All interviewed people valued mushrooms as food very highly. *Amanita loosii*, Upoa/Uboa (*Lactarius edulis*), and four chanterelles (*C. isabellinus*, *C. cf. floridula*, *C. platyphyllos*, and *C. symoensii*) are preferred to any other kind of food, even meat. In addition, also the pinkish chanterelle *C. ruber* which is sold at the markets at Iringa is highly priced but we did not find this species the Corridor. The fleshy *Cantharellus isabellinus* is very common throughout the miombo woodlands of the Corridor. *Boletaceae* and *Russulaceae* are not eaten anywhere and mostly only taken when more priced mushrooms are not abundant. All *Termitomyces* are edible and most are considered superior to all other mushrooms but they are rare in the Corridor.

## 4.3 Medicinal uses

In addition to the powder of the polypore *Ganoderma* sp. which is used in the Magazini area for treating cough and asthma (see details Bloesch & Mbago 2008), we found another polypore during the second fieldtrip which is used for the same medicinal purposes (see Fig. 7). Moreover, the staff of the SNWC Project showed us a third species of *Ganoderma* sp. from the Corridor from which the people are using its powder to treat skin diseases. In addition, one villager from Huria told us the mushroom called Ndongamo is used to treat teeth problems.



**Fig. 7.** Powder of this *Ganoderma* sp. growing on trunk of *Brachystegia spiciformis* at Darajambili is used by the locals for treating cough and asthma.

#### **4.4 Habitat of mushroom sites**

We have started to record the nearest trees of about 20 mycorrhizal mushrooms and much more data is needed.

#### **4.5 Mushroom picking**

Mushroom picking is also very popular amongst the local communities sampled during the second fieldtrip. Mostly immigrants are not picking mushrooms because they are not familiar with the mushrooms of the Corridor.

#### **4.6 Consumption and preserving techniques**

Usually the people from the Corridor are drying the surplus of the mushroom harvest for the consumption during the dry season. The mushrooms are first boiled and then sun-dried. Due to the pre-boiling the mushrooms become very hard and have to be soaked before cooking. The quality of the drying is often imperfect including mushrooms which are dirty and/or not fully dried thereby decaying rapidly (see Fig. 8). Villagers are interested to get trained in appropriate preservation techniques for keeping the mushroom for own consumption and for selling.



**Fig. 8.** Woman at Hulia village is showing her dried mushrooms. Mould fungi (white spots) are visible on the dried mushrooms.

#### **4.7 Marketing**

Few mushroom hunters are selling mushroom when they have the opportunity. More people would be interested to sell mushroom in town but they are lacking transport means. They are motivated to build mushroom groups for facilitating regular picking, stocking and transport.

During the second study, few wild edible mushrooms were sold in the markets at Songea and none were available in the markets of Mbeya at the time of our visit. This again was due to dry spell which occurred prior to our visit.

According to the mushroom sellers, the most commonly sold mushroom species at Songea and Mbeya is *Cantharellus isabellinus*. Other species sold at Songea are *Amanita loosii*,



*Cantharellus platyphyllus/symoensii*, *Lactarius edulis*, and *Russula cellulata*. The most common species in the markets of Iringa are *Cantharellus* sp *Amanita loosii*. In the Uhindini market at Mbeya, cultivated *Pleurotus* sp. (see Fig. 9) were sold at a price about three times higher than that of wild edible mushrooms (!).



**Fig. 9.** *Pleurotus* sp. sold at Uhindini market at Songea.

The mushrooms in the markets of Songea are coming from different places within the District. The sellers are either buying the mushroom from villagers who transport them to town or they buy the mushrooms at the village level. The consumers are usually live within the Songea District. According to the seasonal availability, the mushroom price (all species) varies between 200 to 500 TSh per 200 to 400 g in Songea what may results in a benefit of the sellers of 5000 to 7000 TSh for one bag of mushrooms of about 20 to 25 kg.

Fresh and dried mushroom species are sold at Iringa markets including mainly a mixture out of *Amanita loosii*, *Cantharellus isabellinus*, *C. platyphyllus/symoensii*, and the conspicuous pink *C. ruber* (see Fig. 10). Contrary to the preservation techniques used by the locals of Namtumbo and Tunduru Districts, the mushrooms sold at Iringa market are only sundried without boiling them first. All species are sold at the same prices at an average of 300 to 500 TSh per 200 to 300 g. Mushrooms from Iringa markets are frequently sold to dealers from Dar es Salaam.





**Fig. 10.** Mixture of *Amanito loosii* and *Cantharellus* spp. sold in the Soko Mashine market at Songea. The pinkish chanterelle is *C. ruber*.

A mushroom flyer in English with coloured photographs of the most important edible mushrooms of the Corridor was elaborated together with the design office Zone 2 in Switzerland and printed by Graphic Solutions in Dar es Salaam (Bloesch 2009). The flyer aims to support the promotion of mushroom having a high nutritional value by documenting and illustrating the rich potential of wild edible mushrooms in the Corridor. It includes also instructions regarding sustainable harvesting, proper picking techniques, identification of mushrooms, containers for the foray, and appropriate drying techniques. This first English version targets the English spoken audience (authorities, technical services, private sector, hotels, developing agencies, donors...). The English version will be translated in easy Swahili for the local communities of the Corridor who will be the main beneficiaries of the mushroom project.

## 5. Discussion

### 5.1 Species inventory and fructification period

The mushroom fructification period is strongly seasonal. Certain species are found in early season only, while others are late-comers. But the second fieldtrip also revealed that the fructification period of mushrooms also highly depends on the rainfall pattern. Due to a dry spell of about ten days very few mushrooms were found during the first part of the field study

along the southern transect. This clearly showed that any prediction of the abundance of mushrooms during the rainy season is hardly reliable since our experience demonstrated that a dry spell can even occur at the peak of the rainy season thereby stopping the growth of any mushroom.

Out of the recorded 69 species 39 could not be identified at species level. However, out of the highly priced edible mushrooms all species could be identified with a scientific name. The only doubt remains between *Cantharellus platyphyllos* and *C. symoensii*, two species which have very similar colours. For taxonomic reasons, it would be interested to engage further investigations for the identification of the unknown species. The use of exsiccates help in the identification by consulting dry mushroom collections from universities and research institutes.

Termite mushrooms (*Termitomyces*) were only found at Misjlaji during the second fieldtrip. It seems that this highly priced mushroom only occur sporadically in the Corridor, mainly in agricultural fields.

## **5.2 Edibility and nutritional and energy values**

Edibility and nutritional and energy values has been dealt with in detail in the first mushroom report (Bloesch & Mbago 2008) and in the flyer (Bloesch 2009).

## **5.3 Medicinal uses**

In total only four mushrooms are used for medicinal purposes. There is certainly a scientific interest to make further investigations but the marketing potential in profit of the local communities is certainly low.

## **5.4 Habitat of mushroom sites**

The data are too limited for identifying the specific host tree of a given mycorrhizal mushroom species. All the more since tropical mycorrhizal mushroom may have several host trees (Buyck 1994). Therefore, it is uncertain at this stage if this method will allow to approximately assess the abundance of a specific mycorrhizal mushroom within the Corridor knowing that the abundance is also highly depending on the season.

## **5.5 Mushroom picking**

Careful picking and transport is a prerequisite of a successful marketing of mushrooms and has been dealt with in detail in Bloesch & Mbago (2008) and in the flyer (Bloesch 2009). A technical training of the producers is very necessary (see below).

## **5.6 Consumption and preserving techniques**

Fresh mushrooms have to be consumed rapidly in order to avoid deterioration of their quality. However, there are quite big differences between species. For example, termite mushrooms have to be consumed the day they were picked. On the other hand, chanterelles in general can be preserved in good quality for several days if stored properly.

The development of appropriate preservation techniques will not only be in profit of marketing mushrooms but also of self-consumption during the dry season of properly dried mushrooms what will improve the quality of the diet of the locals.

## 5.7 Marketing and next steps

The feedback workshop allowed presenting the marketing potential of wild edible mushrooms and to obtain the suggestions of the participants regarding the organisation of the market chain and their constraints.

The mushroom flyer in English will help to promote the use of wild edible mushrooms by the English spoken stakeholders. The Swahili version will be needed to facilitate the preparation of the operation at the community level and help to promote the campaign at the market level (salesmen). The flyer includes basic rules for the identification, picking, transport and preservation of mushrooms.

In contrast to Europe, wild edible mushrooms are sold at quite lower price than cultivated mushrooms (mostly *Pleurotus* sp.). In terms of profit it could be more profitable to cultivate mushrooms. However, the required equipment for cultivating mushrooms is quite expensive and therefore barely accessible for poor people.

### **The following steps are proposed for the next mushroom season November 2009 – April 2010:**

#### **a) technical training of producers in proper handling of mushrooms**

Few motivated villages should be selected for starting the mushroom activities as pilot project including the following training activities:

- *Mushroom foray*: Careful picking is very important to meet high quality and hygiene standards for a successful marketing of mushrooms. Mushroom should be cut off near the ground (instead of plucking) and remaining soil from the base of the stipe should be cut off to keep the mushrooms clean in the container thereby avoiding any later washing. Every mushroom should be split into two halves to see if there are no maggots inside. Unknown mushrooms should be kept away from edible ones which are known.
- *Container*: Weave basket out of organic material should be used for picking mushrooms. Closed containers like plastic bags or buckets accelerate the decomposition of the mushrooms. Stacking layers of mushrooms should be avoided since mushrooms are very delicate and risk to be spoiled quickly. The same principle should also be applied for packaging of the mushrooms for its transport from the collection centres to the market.
- *Sun drying*: Mushroom should be cut in slices of 3-4 mm of thickness before drying in the sun. Fully dried mushroom break very easily. Dried mushrooms should be preserved in a covered container to prevent them from absorbing air moisture what would accelerate spoiling of the mushrooms by microorganisms. Proper drying will also promote the domestic consumption during the dry season of this highly priced food.
- *Storage facilities*: Construction of well aerated depot at the collection centres.
- *Entrepreneurship*: Training of producer groups.

#### **b) Organisation of producer groups of the mushroom marketing chain**

- Encouragement of creating producer groups.
- Identification of collection centres.
- Discussion and definition of role of CBOs.

- Evaluation of active participation of some producer groups in the transport of mushrooms from the collection centres to the market.
- Consideration of gender equity.

### c) Promotion of mushroom marketing

- Assessment of quantity and type of mushrooms sold at Songea per season and of the potential demand (involvement of salesmen) and possibly also at Tunduru market and in Mjinga markets.
- Define the stakeholders along the market chain for selling mushrooms from the Corridor starting with Songea (Tunduru).
- Organisation of a promotion mushroom sale booth at Songea (with posters, distribution of leaflets...) by a dynamic producer group.
- Organisation of media campaigns (radio Maria, possibly ITV...) concerning the socio-economic potential of wild edible mushrooms for the livelihoods of local communities.
- Discussion of marketing chains and role of different stakeholders with experienced organisations (Tanzania Chamber of Commerce, Industry and Agriculture, SIDO, private sector...).
- Discussion with Tanzania Food & Drugs Authority about the quality criteria for selling wild edible mushrooms.
- Assessment of the demand (quantity and species) of wild edible mushrooms in high standard hotels in Dar es Salaam and Bagamoyo and in markets of Dar es Salaam.
- Assessment of appropriate preservation techniques and conditioning of mushrooms (sun drying, solar drying, freeze drying, curing, preserving in vinegar, canning...).
- Carry out a feasibility study of a local small-scale industry for preserving mushrooms in tins.

In the mid to long run, the exportation of fresh chanterelles or e.g. preserved mushroom in tins to Europe could be an option. The importation rules, however, differ from one country to another (Schmid, personal communication). For example, in Switzerland only mushroom included on a restrictive list may be imported in Switzerland. Related to chanterelles, only the indigenous *Cantharellus cibarius* can be imported but not the similar *C. isabellinus*.

## 6. Addendum: Wild fruits

46 wild edible fruits in the Corridor have been identified with their scientific names. During the socio-economic study the locals named 41 wild edible fruits with their vernacular names (Yao, Ngoni, Ndendeule, Makuwa and Nindi). So far, locals collect wild fruits opportunistically when they see them. Only for the fruits of *Uapaca kirkiana* they go out purposely for collecting them. They use them exclusively for own consumption and usually eat them fresh. Only people from Huria und Kilimansera are producing juice from the fruits as a result from a campaign organised by ADAP in 2007. No preservation method exists within the local communities of the Corridor.

Wild fruits like *Flacourtia indica* (Ndawa tawa<sup>1</sup>), *Hexalobus monopetalus* (Mkungumwale<sup>2</sup>, see Fig. 11), *Syzygium cuminii*, *Tamarindus indica* (Mkwaju<sup>3</sup>), *Uapaca kirkiana* (Mhuko mkurunga<sup>2</sup>), and *Ximenia americana* (Mbingiping<sup>2</sup>) may have an important marketing potential and more specific investigations are needed to identify appropriate preservation

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<sup>1</sup> vernacular name in Ndendeule

<sup>2</sup> vernacular name in Yao

<sup>3</sup> vernacular name in Swahili

techniques for producing e.g. jam or juice and to carry out market study at regional and national level.

In addition, opportunistic sampling of the vegetation throughout the second fieldtrip allowed us to collect and identify new plants for completing the plant checklist of the Selous-Niassa Wildlife Corridor. The checklist includes now more than 500 plant taxa whereof 6 endemic species, 14 orchids and two new species to science (see also Bloesch & Mbago 2008).



**Fig. 11.** *Hexalobus monopetalus* at Likusanguse village.

## **7. Recommendations for marketing wild edible mushrooms**

- 1) The mushroom flyer in English should be translated rapidly in Swahili and printed by Graphic Solutions for the local communities of the Corridor.
- 2) ADAP staff should be actively involved in preservation tests of freshly picked chanterelles (all four species) to assess their storage life; own drying tests to assess possible changes in the flavour of dried mushrooms (including chanterelles) are necessary to gain practical experiences.
- 3) ADAP should install a proper monitoring system for all field activities; the filled out forms of the socio-economic studies should be stored and classified.

- 4) Buy or produce weave baskets out of organic material for the producers (picking in the field and transport to the markets).
- 5) The inventory of nearest trees of mycorrhizal mushrooms has to be complemented to detect the specific host tree dependency for each mycorrhizal mushroom.
- 6) The elaboration of a vegetation map would be very helpful to assess approximately the abundance of a specific mycorrhizal mushroom within the Corridor.
- 7) Identify and exchange information with development projects dealing with the marketing of wild edible mushrooms in Africa.

## 8. Other recommendations

Further assess the marketing potential of wild edible fruits. In this context a flyer with coloured photographs of the most important wild edible fruits of the Corridor should be elaborated for the promotion of wild fruits.

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## **Annex A: Acronyms & Abbreviations**

ADAP	Association pour le Développement des Aires Protégées
CBO	Community based organisations
GEF	Global Environment Facility
GTZ-IS	Deutsche Gesellschaft für Technische Zusammenarbeit, International Services
SNWC	Selous-Niassa Wildlife Corridor
TOR	Terms of Reference
UNDP	United Nations Development Programme

## Annex B: Mission Terms of Reference

### Wild edible mushrooms and their marketing potential in the Selous-Niassa Wildlife Corridor

#### *Second study*

Mushrooms are abundant in the miombo woodlands because almost all of the trees are ectomycorrhizal: their roots live in symbiosis with mushroom mycelia. Many of the mushrooms are edible and have a high nutritious level. Mushrooms are frequently collected in Tanzania by the local population mainly for own consumption. Fresh, but also dried mushrooms are sold at market places and along roadsides. We believe that there is a considerable commercialisation potential at regional, national and international level which could contribute to improve the livelihoods of the local communities.

In general the entire study will focus on the following results:

- Inventory of wild edible mushrooms and the vegetation description of their habitat within the Selous Niassa Wildlife Corridor.
- Assessment of current use of mushrooms by local communities (species, conditioning, sale...).
- Identification of uncertain mushrooms (digital photos) and plants at the Botany Department of the University of Dar es Salaam.
- Evaluation of the marketing potential of the edible mushrooms in Tanzania (Songea, Mbeya, Iringa, Dar es Salaam) and Europe and possible constraints; elaborating a strategy for promoting the marketing of mushrooms by the local communities.

The first part of the study was mandated by the project SNWC-UNDP/GEF/GTZ-IS and the project Integrated Beekeeping Management Selous-Niassa Corridor of ADAP, Switzerland and carried out from 21/1 to 31/1/08. This second part of the study will be financed by ADAP, SNWPC-KfW and SNWC-UNDP/GEF/GTZ-IS.

#### Part two of the study will focus on the following topics:

Topic	Time required intern. expert (days)	Time required nat. expert (days)
Elaboration of a concept and a draft text and figures of a mushroom demonstration leaflet before the second mission	8	-
Guidance / monitoring of ADAP preparatory activities before the second mission (identification of fructification period of certain mushrooms, complement of local market studies, preservation and drying tests of mushrooms, organisation of local communities...)	6	-
Complementary inventory of wild edible mushrooms (distribution and abundance) and vegetation description of their habitat (SNWC)	3	3
Complementary assessment of current use of mushrooms by local communities (species, conditioning, market species...) (new localities within SNWC)	3	3
Organisation of local mushroom associations (SNWC)	3	3
Identification of the potential of wild fruits and their valorisation potential (SNWC)	4	4
Evaluation of commercialisation potential in Tanzania (Songea,	8	-

### Mushroom study (2009)

Mbeya, Iringa, Dar es Salaam) and Europe (this part will be mainly done by Mr. Couturier) and assessment of possible constraints		
Elaboration of a joint strategy for promoting the marketing of mushrooms by the local communities (workshop)	2	2
Identification of uncertain mushrooms (plants) at the University of Dar es Salaam	-	5
Evaluation of commercialisation potential in Europe and assessment of possible constraints (this part will be mainly done by Mr. Couturier)	5	-
Analysis of data and report writing (CH)	6	-
Finalisation of the mushroom leaflet in English (translation in Swahili by project staff)	6	-
Total time required	54	20

The fieldwork (SNWC and national markets) of the second part of this study includes 23 days and will be carried out end of February/first half of March 2009 (complementary mushroom fructification period to the first part of the study). The fieldwork will be carried out together with ADAP staff. According to the results of the study, a Swiss student could possibly complement the findings by carrying out additional investigations for a MSc/BSc diploma work under the supervision of Adansonia-Consulting.

**Annex C: Itinerary and people met**

<b>Date</b>	<b>Itinerary and people met</b>
28/2/09	Travelling Dar es Salaam-Morogoro; visit of market
1/3/09	Travelling Morogoro-Songea
2/3/09	Travelling Songea-Namtumbo; joint briefing in Namtumbo with SNWC: Ngomello Kassim (Project Manager), Kiyungi (DNRO), Issa Ndomondo, acting DGO) and ADAP: Irene Mbonde (Community Development Officer); organisation and planning of field trip
3/3/09	Namtumbo: preparation field trip
4/3/09	Travelling Namtumbo-Ligunga-Lusewa; contact Mwenye kiti at Ligunga
5/3/09	Travelling Lusewa-Ligunga-Likusanguse; interviews and mushroom picking site at Ligunga; contact Mwenye kiti at Likusanguse
6/3/09	Travelling Likusanguse-Mislaji-Lusewa; interviews at Likusanguse & Mislaji; mushroom picking site at Likusanguse
7/3/09	Travelling Lusewa-Namtumbo; plant and mushroom identification
8/3/09	Feedback workshop at Namtumbo
9/3/09	Travelling Namtumbo-Hulia; contact Mwenye kiti at Hulia
10/3/09	Travelling Hulia-Mahaane-Hulia; interviews and mushroom picking sites at Hulia (Mihaane)
11/3/09	Travelling Hulia-Daraja mbili-Namwinyu; interviews and mushroom picking sites at Namwinyu (Kirundunda) and Daraja mbili
12/3/09	Travelling Hulia-Namtumbo-Songea
13/3/09	Debriefing SNWPC (KfW): Wayne Lotter (International Team Leader); mushroom market study at Songea (Manzese and <i>soko mjinga</i> near Ruvuma Regional Hospital)
14/3/09	Travelling Songea-Mbeya
15/3/09	Visit of markets at Mbeya
16/3/09	Travelling Mbeya-Iringa
17/3/09	Visit of markets at Iringa
18/3/09	Travelling Iringa-Morogoro; visit of main market
19/3/09	Travelling Morogoro-Dar es Salaam; debriefing with SNWC (Technical advisor Rudi Hahn)
20/3/09	Dar es Salaam: debriefing with Project Manager SNWC; discussion with restaurant manager Golden Tulip; discussion leaflet with Graphic Solutions ltd
21/3/09	Dar es Salaam: debriefing with William Swai, Project Manager ADAP; travelling Dar es Salaam-Zurich
24/3/09	Debriefing ADAP in Geneva with Yves Hausser (Co-ordinator) and Jean-Félix Savary,

**Annex D: Rainfall at Suluti (1993-2008)**

10°34'36" S; 36°7'36" E; 909 m a.s.l.

Suluti	Monthly rainfall (mm)												Annual total (mm)
	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
1993	146.6	286.9	294.4	298.4	71.8	1.2	0.0	0.0	0.0	0.0	51.2	108.2	<b>1258.7</b>
1994	285.9	177.4	402.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	159.8	<b>1030.1</b>
1995	338.7	215.0	414.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.0	158.9	<b>1171.8</b>
1996	193.7	258.8	251.2	50.1	46.3	0.0	0.0	0.0	0.0	0.4	0.0	133.3	<b>933.8</b>
1997	314.1	846.7	153.7	13.5	6.2	14.9	0.0	0.0	0.0	0.0	0.0	320.6	<b>1669.7</b>
1998	332.0	494.0	336.0	111.9	113.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<b>1386.9</b>
1999	280.0	181.0	494.0	299.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	32.5	<b>1295.5</b>
2000	301.8	148.5	398.5	184.0	13.9	0.0	0.0	0.0	0.0	0.0	185.6	237.2	<b>1469.5</b>
2001	445.1	237.5	267.8	33.0	27.0	0.0	0.0	0.0	0.0	0.0	0.0	34.3	<b>1044.7</b>
2002	433.3	333.8	397.6	262.8	0.0	0.0	0.0	0.0	0.0	20.6	153.7	189.8	<b>1791.6</b>
2003	263.8	196.8	165.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	257.0	<b>883.3</b>
2004	209.8	99.8	276.6	171.8	0.0	0.0	0.0	0.0	0.0	15.6	11.2	212.7	<b>997.5</b>
2005	196.8	217.8	305.7	127.5	15.4	2.3	0.0	0.0	0.0	0.0	0.0	46.3	<b>911.8</b>
2006	113.4	240.3	198.4	214.1	0.8	0.0	0.0	0.0	0.0	30.8	44.3	569.9	<b>1412.0</b>
2007	384.3	229.2	199.8	216.1	16.5	0.0	0.0	0.0	12.4	8.7	0.0	177	<b>1244.0</b>
2008	332.4	233.2	207.6	75.6	0.0	0.0	0.0	0.0	0.0	0.0	68.4	100.6	<b>1017.8</b>

<b>Mean</b>	285.7	274.8	297.7	128.6	20.0	1.2	0.0	0.0	0.8	4.8	35.2	171.1	<b>1219.9</b>
<b>Minimum</b>	113.4	99.8	153.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<b>883.3</b>
<b>Maximum</b>	445.1	846.7	494.0	299.0	113.0	14.9	0.0	0.0	12.4	30.8	185.6	569.9	<b>1669.7</b>
<b>Standard dev.</b>	95.5	175.7	101.3	108.6	31.9	3.7	0.0	0.0	3.1	9.4	57.5	138.7	<b>293.7</b>
<b>Variability (%)</b>	<b>33.4</b>	<b>63.9</b>	<b>34.0</b>	<b>84.5</b>	<b>159.3</b>	<b>323.5</b>	–	–	–	<b>198.0</b>	<b>163.2</b>	<b>81.1</b>	<b>24.1</b>

## Annex E: Questionnaire villagers

### USIMAMIZI WA MAENDELEO YA MALIASILI YA USHOROBA SELOUS-NIASSA TANZANIA

Dodoso kuhusu upatikanaji wa uyoga unaoliwa kwenye enjy la miombo la ushoroba wa Serous- Niassa Tanzania.

Dodoso la key formals

#### Sehemu ya kwanza

##### Utambulisho

1. Jina .....
2. Jinsi  
Me ( )  
Ke ( )
3. Umri wako  
15-29 ( )  
30-44 ( )  
45-54 ( )  
55-64 ( )  
65-74 ( )  
75-84 ( )  
85-94 ( )
4. Kazi yako.....
5. Mahali unapoishi
  - a) Mtaa .....
  - b) Kijiji.....
  - c) Kata.....
  - d) Tarafa.....
  - e) Wilaya.....
  - f) Mkoa.....

Sehemu ya pili  
Dondoo ya uyoga.

6. Unaoufahamu kuhusu uyoga?  
Ndiyo ( )  
Hapana ( )
7. Kama ndiyo unaoufahamu kama kitu gani na ni uyoga wa aina gani?  
a) Chakula

Taja majina ya uyoga wa chakula

.....  
.....



.....

**b. Uyoga waa aina gani ni unaradha nzuri kuliko uyoga mwingine?**

.....  
.....  
.....

**c. dawa**

**Taja majina ya uyoga unaotumika kama dawa.**

.....  
.....  
.....

**8. Je unawezaje kutambua aina ya uyoga?**

.....  
.....  
.....

**9. Unaezaje kutofautisha uyoga unaoliwa na usioliwa?**

.....  
.....  
.....

**10. Je unafahamu maeneo ambayo uyoga unapatikana?**

Ndiyo ( )  
Hapana ( )

**11. Kama ndiyo yataje maeneo hayo na umbali wake au unatumia masaa angapi kufika hapo**

a).....  
b).....  
c).....  
d).....

**12. Unawezaje kulinganisha aina za upatikanaji wa uyoga na miti iliyopo?**

.....  
.....  
.....

**13. Kuna njia zozote ambazo unazotumia kuhifadhi kiasi cha uyoga unachokipata?**

Ndiyo ( )  
Hapana ( )

**14. Kama ndiyo nitajie njia ambazo unazitumia kuhifadhi uyoga huo**

a).....  
b).....  
c).....

**15. Ni muda gani uyoga unaweza kuhifadhika baada ya kuchuma?**

.....

**16. Unauza uyoga ambao unaupata?**

Ndiyo ( )  
Hapana ( )

17. Kuna mtatizo yoyote ambayo unayapata katika biashara ya uyoga?

Ndiyo ( )

Hapana ( )

Kama ndiyo yataje?

a).....

b).....

c).....

18. Unadhani kuwa unaweza kupatikana uyoga mwingi zaidi kuliko unapatikana sasa kama kutakua na soko?

.....  
.....  
.....

19. Endapo utapatikana uyoga mwingi zaidi na kukawepo na soko la uhakika unadhani mtatizo gani ambayo utayapata?

.....  
.....  
.....

20. kutokana na majibu uliyatoa hapo juu unadhani kuwa juhudi gani zifanyike ili uyoga upatikane kwa wingi na kuwe na uendelevu mzuri wa biashara hii ya uzoga ?

.....  
.....  
.....

Sehemu ya tatu

Dondoo ya matunda ya porini

1. Je unaoufahamu kuhusu mtunda ya porini yanayoliwa?

Ndiyo ( )

Hapana ( )

2. Ni aina gani ya matunda ya porini ambayo unayafahamu na huwa yanapatikana kipindi gani cha mwaka?

.....  
.....  
.....  
.....

3. Matunda ya porini unayoyavuna unayatumia kama nini?

.....  
.....  
.....  
.....

3. Je nayafahamu maeneo muhimu gaina ambayo matunda ya porini yanapatikana?

Ndiyo ( )

Hapana ( )

4. Kama ndiyo yataje maeneo muhimu ambayo matunda ya porini hayo yanapatikana.

.....  
.....  
.....

5. Ni nani hasa wanahusika katika kuvuna matunda ya porini?

.....  
.....  
.....

6. Je matunda ya porini ambayo unayapata yanatosheleza kwa matumizi ya nyumbani /unauza/kugawia wengine?

.....  
.....  
.....

7. Kuna njia zozote ambazo unazotumia kuhifadhi kiasi cha matunda ya porini ambayo kinachopatikana ?

Ndiyo ( )  
Hapana ( )

8. Kama ndiyo nitajie njia ambazo unazitumia kuhifadhi hayo matunda ya porini?

a).....  
b).....  
c).....

9. Pamoja na matumizi mengine ya matunda ya porini je umewahi kufanya biashara ya matunda ya porini?

Ndiyo ( )  
Hapana ( )

10. Kama ndiyo uliuza au ulinunua wapi matunda ya porini, na ni ya aina gani?

a).....  
b).....  
c).....

11. Je wapo wateja wa kutosha wanaonunua matunda ya porini?

Ndiyo ( )  
Hapana ( )

12. Kama ndiyo wateja hao wanapatikana wapi?

a) Ndani ya kijiji ( )  
b) Nani na nje ya kijiji ( )  
c) Nje ya kijiji ( )

13. kutokana na majibu yote hayo juu unadhani nini kifanyike ili kuboresha matumizi ya matunda?

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.....  
.....  
.....

## Annex F: Market study

### USIMAMIZI WA MAENDELEO YA MALIASILI YA USHOROBA SELOUS-NIASSA TANZANIA

Dodoso kuhusu upatikanaji wa uyoga unaoliwa kwenye enjoy la miombo la ushoroba wa Serous- Niassa Tanzania.

Dodoso kwa ajiri yawafanyabiashara wa sokoni.

#### Sehemu ya kwanza

##### Utambulisho

1. Jina .....
2. Jinsi  
Me ( )  
Ke ( )
3. Umri wako  
15-29 ( )  
30-44 ( )  
45-54 ( )  
55-64 ( )  
65-74 ( )  
75-84 ( )  
85-94 ( )
4. Kazi yako.....
5. Mahali unapoishi
  - a. Mtaa .....
  - b. Kijiji.....
  - c. Kata.....
  - d. Tarafa.....
  - e. Wilaya.....
  - f. Mkoa.....

#### Sehemu ya pili

##### Dondoo

6. Unaouza uyoga wa aina gani?  
.....  
.....  
.....

7. **Uyoga unaouza huwa unautoa wapi?**  
.....  
.....  
.....
8. **Kwa siku unauza uyoga kiasi gani?**  
.....
9. **Ni kipindi cha muda gani huwa unauza uyoga hapa sokoni?**  
.....
10. **Unatumia kifaa cha aina gani kupimia yoga ambao unauza na ni shilingi ngapi?**  
.....
11. **Kwa kukisia tu je huwa unapata faida kiasi gani ya biashara hii ya uyoga ukilinganisha na bei ambayo unanunulia?**  
.....
12. **Wateja wa uyoga wako ni akina nani na wanatoka wapi?**  
.....
13. **Je unatumia mbinu gani kuhifadhi kiasi cha uyoga ambacho kinabaki?**  
.....
14. **Ni matatizo gani ambayo unayoyapata kwenye biashara hii ya uyoga?**  
.....  
.....  
.....
15. **Unadhani nini kifanyike ili kuboresha bishara hii ya uyoga?**  
.....  
.....  
.....