First Survey on the Edible Non-Wood Forest Products Sold in Uíge Province, Northern Angola

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Abstract — This study aimed to inventory, identify, characterize and valorize the various edible non wood forest products (NWFPs) sold in Uíge Province. Data for this study were collected between October 2016 and February 2020. A total of 156 edible NWFPs sellers were individually interviewed using semi-structured questionnaire at the 30 sales sites. 93.5% of edible NWFP sellers were female and 6.5% male. The main edible NWFPs sold in Uíge Province are animal products with 47 species, of which 48.9% are Mammals, 21.3% Insects, 12.8% Actinopterygii, 6.4% Birds, 8.5% Reptiles, and 2.1% Sarcophagidae. Plants represent 38.5% (35 species) of the edible NWFPs sold in the study area, of which 78.8% are Dicotyledones, 21.2% Monocotyledones, 2.9% Gnetophytes and 2.9% Pteridophytes. Besides, Mushrooms account for barely 9.9% of the edible NWFPs sold in this region. On the other hand, edible NWFPs are sold on formal and informal markets, in the bus parking lots, taxi rank, roadsides, restaurants and at the seller's homes. For the sale of edible forest products, the vendors use non-standardized measuring units. The income generated by the sale of NWFPs is used to solve socio-economic problems in the household, including the purchase of basic necessities, health care, clothing, cosmetics, school materials, well-being, etc.

Index Terms — Uíge Province, Angola, Surveys, Edible non-wood forest products, Systematic identification, Market information.

I. INTRODUCTION

Non-wood forest products (NWFPs) are defined as biological materials other than round wood or timber that may originate from natural ecosystems, natural forest plantations or agroforestry systems used in households, marketed or having socio-cultural or spiritual significance [1]. According to Food and Agriculture Organization of the United Nations (FAO), "FAO [2], NWFPs are non-wood biological goods derived from forests, other wooded land or trees outside forests. NWFPs can be harvested from the wild or produced and harvested from forest plantations, agroforestry schemes or trees outside forests". Also, according to FAO [1], NWFPs are all biological materials

other than wood that are extracted from the forest for human use; NWFPs include all tangible, natural, artisanal or processed products derived from forests or other lands with similar uses, other than wood. They also include foods, medicines, oils, resins, gums, tannins, bamboo, firewood, charcoal, and game sold and consumed locally, nationally, or internationally.

In this study, NWFPs are classified into three categories: plants and plant products; animals and animal products [3]. The last category consists of mushrooms [4].

In the most tropical countries, particularly in sub-Saharan Africa, NWFPs play an important role in daily life by ensuring the well-being of local communities. Not only used for local consumption, but NWFPs also function as commodities that can be traded on local, regional, national, and international markets. The sale of NWFPs is a response to daily needs, demand for employment, a source of income [1], [5] and economic diversification.

According to Grieg-Gran *et al.* [6], African economies are often anchored in abundant natural resources from the myriad ecosystems that span the continent. Forests are an integral part of Africa's economic fabric, providing for subsistence needs for food, energy and medicinal plants and providing key regulating and supporting ecosystem services of local, national and global importance.

Numerous studies in different parts of the African continent *e.g.* [7]-[11] have shown the importance of NWFPs, both commercial and non-commercial, as well as a source of livelihoods, wild foods, animal fodder and wood fuels for African people. On the other hand, FAO estimates [12] show the commercial importance of NWFPs, with an estimated value of gross production in Africa in 2011 placed at US\$ 5.3 billion, which represents 0.3 per cent of the region's GDP. As for Ndoye *et al.* [13], NWFP markets are also important at the regional and international levels, as they provide income to stockholders directly involved in a development project. Moreover, the importance of NWFPs is well established, as their development can generate added value for local populations [14]. On the other hand, NWFPs are emerging on the world scene as a tool for establishing sustainable forest communities. They represent jobs for various sectors of society and increase the benefits from forests, involving local expertise and culture [15].

Indeed, for centuries NWFPs have played an important role of food and trade in Africa [16]. More than half of the African population depends on natural forest resources [17]. The consumption and sale of NWFPs such as edible and medicinal plants and game are likely to contribute to the food and nutritional security of population [2], [9]. According to Brian *et al.* [18], NWFPs can provide sources

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of income and opportunities for poverty reduction in both rural and urban areas. Furthermore, according to Tinde van Andel [19], the most forest products never reach the market, only a small percentage is sold in local and regional markets, which is an important source of financial income. Similarly, Noubissie et al. [20] show that trade in NWFPs generates employment opportunities, substantial income and supports the livelihoods of communities living around the forest. Currently, approximately 75% of the world's poor depend on NWFPs for their livelihoods, while 80% of forest populations in developing countries use NWFPs daily. Moreover, according to Chidebere-Mark et al. [21], NWFPs are capable of providing food, health care and income to sustain livelihoods.

Despite numerous studies conducted worldwide on the commerce of edible NWFPs e.g. [1], [16], [2] data on Angola and particularly Uíge Province are still fragmentary [7]-[9] [22]-[25].

Besides, many edible NWFPs are sold daily on rural and urban markets in Uíge Province, so it would be appropriate to carry out a study on these forest products in order to know them better and add value to them.

To our knowledge, no scientific work has been carried out in this part of Angola that has dealt simultaneously with the inventory, characterization, and valorization of edible NWFPs (plants, animals and mushrooms) sold in the province of Uíge.

The present work focuses on three different types of edible forest products marketed in Uíge Province, namely: animals, plants, and wild mushrooms.

The objectives of this study are as follows: (1) To make an inventory of the three types of edible forest products sold in Uíge Province; (2) To identify and characterize them taxonomically; (3) To know the socio-economic profile of edible forest products sellers; and finally; (4) To know the marketing sites and methods of customer loyalty, sales methods, savings and income allocation. Despite the socio-economic importance of NWFPs, there is little information in the literature on edible forest products sold in Angola, particularly in Uíge Province. This work contributes to the existing data in Angola's NWFPs. The data from this study will be used for sustainable management and the development of market organization strategies for edible forest products to ensure the well-being of local communities in Angola. Also, the study will provide information to students, researchers, international organizations, policy makers and the general public.

II. MATERIALS AND METHODS

A. Description of the study area and selection of respondents

The Uíge Province, located in the north of Angola, covers an area of 58,698 km² and has a population of more than 1.4 million [26]. Uíge has a tropical savannah climate with a dry season (Sivu or Mbangala in the Kikongo language) [8] from May to September and annual rainfall of 900 to 1500 mm; the average annual temperature of the capital of Uíge is 23 °C [27], [28]. The province of Uíge enjoys excellent edaphoclimatic conditions (extensive arable land and regular

rainfall) and also has a dense hydrographic network that waters the region (7). The economy of Uíge province is mainly based on subsistence agriculture, livestock, hunting, small trade [9], [29] and traditional fishing.

Data for this study were collected between October 2016 and February 2020. The choice of the study area was made after a pre-survey that confirmed the existence of edible NWFPs for sale in the markets of the province of Uíge. Field visits were carried out in 15 of the 16 municipalities of the province (Fig. 1). Respondents were selected based on their availability and socio-economic activity, sale of edible NWFPs. The method adopted for data collection was the ethnobiological and socio-economic survey applied by Monizi et al. [7], [8]. It first consists of drafting a questionnaire that allows for a better understanding of the different types and uses of edible NWFPs sold in the Study Area. Also, data collection was carried out through direct field observation and individual interviews with sellers of edible NWFPs.

Fig. 1. Location of the study area and edible NWFP sales sites in Uíge Province, Republic of Angola.

B. Biological Material

The biological material to be studied consists of edible animals, plants and mushrooms. For taxonomic identification, several books and works have been used: Monizi et al. [7], Lautenschläger et al. [25], [30]-[34].

C. Questionnaire

The survey questionnaire was divided into three sections: (1) Vendor's data (age, gender, education, marital status and main source of income); (2) Biological material (scientific and vernacular name(s), the origin of NWFPs, conservation status, uses of plant organs); (3) Market information (sales, pricing and customer loyalty patterns, sales locations, sales methods and units of measurement, savings and income allocation). In addition, the study was based on targeted sampling. Eligibility criteria were the sale of edible NWFPs and the availability of respondents in anthropological surveys. The semi-structured questionnaire was submitted

orally to the various informants.

D. Ethnobiological and Socio-economic Surveys

Biological information on the species of plants, animals and fungi listed in this study was obtained from the edible NWFP vendors interviewed in the province of Uíge. The purpose of this study is to learn about the different types of edible NWFPs sold in this province, as well as their methods and locations of sale, among others. A total of 156 informants were involved in this study, including 149 women and 7 men. The individual anthropological interviews were conducted in Kikongo or Portuguese, depending on the language spoken by the respondent.

E. Statistical Analyses

The ethnobiological and socio-economic data from this study were analyzed using Statistical Package for Social Sciences (SPSS, Inc., Chicago, USA) version 25.0.

III. RESULTS AND DISCUSSION

A. Socio-economic Profile of NWFP Sellers

A total of 156 vendors from 30 edible NWFP marketing sites were interviewed in Uíge Province. Of all the edible NWFP vendors surveyed, women are in the majority (93.5 %) than men who represent only 6.5 % of the vendors. The results of this study attest to previous studies that the sale of edible NWFPs is a women's domain. Besides, Monizi et al. [7] who worked in the same region and showed that, the sale of edible NWFPs is mostly (92 %) practiced by women. Similarly, Monizi et al. [8] report that 83 % of the Raphia wine sellers in this part of Angola are women. According to FAO [1], in Southern Africa, women are particularly involved in the collection and sale of NWFPs. Also, these observations are similar to those reported by FAO [2] that the commercial NWFP sector in Central Africa is more than 80 % dominated by women.

The results of this study also show that the average age of edible NWFP sellers in the study area is 35 years. Referring to this average age, it shows that the profession of edible NWFP sales in this region is exercised by young people who will ensure its continuity for a long time. These results are close to those of Monizi et al. [7], [8] who found in their work an average age of 36 and 38 years, respectively among sellers of Raphia wine and Dracaena Cameroonian leaves in the same region. The study also revealed that the average number of people per household of forest product vendors is 5.8 people. This result is higher than the general national average of 4.6 persons per household obtained in the general population and housing Angola's 2014 census conducted [26].

In addition, the results on anthropological parameters from this study show that, trade is the main (55.3%) source of income and employment for edible NWFP sellers in the Study Area. Besides, agriculture and other activities (sale of labour force, public service, etc.) account for 30.6 % and 14.1 % respectively. Regarding civil status, married people predominate with 58.4 % of the people surveyed. People living in separation or divorce represent, 25.5 %. On the other hand, the single (8.7 %) and widows (7.4 %) are in the minority among the vendors of forest food products in Uíge.

Also, literate people predominate (92.4 %) among vendors of NWFPs for food use than those who have never been to school (7.6 %). These results are similar to those of Monizi et al. [8] who showed that 95 % of the stockholders in the wine value chain of Raphia in Uíge province are literate. In the same vein, Monizi et al. [7], also showed that edible NWFPs with Dracaena Cameroonian leaves attract both educated and never attended school with 75.7 % and 24.3 % respectively.

Finally, the results of this study show that sellers of edible NWFPs in Uíge Province have an average of 5 years' experience in their business. Trade in edible NWFPs seems to be relatively beneficial, as 63.7 % of the sellers have more than 5 years of experience in the sale of these products. On the other hand, those with less than five years of experience represent 36.3 %.

B. Biological Characterization of Edible NWFPs

Three types of edible NWFPs (animals, plants and mushrooms) available for sale in Uíge Province were identified in this study. The biological diversity of these NWFPs is documented in Tables 1 to 3.

1. NWFPs of plant origin

1.1. Systematic description

A total of 35 species of plant NWFPs were identified from edible NWFP vendors in the Study Area, divided into 29 genera and 23 botanical families (Table 1). Analysis of the numerical importance of the families in the floristic list (Table 1) shows that the botanical families best represented in number of species are:

Apocynaceae (4 species), Fabaceae and Zingiberaceae with 3 species. On the other hand, the families Annonaceae, Arecaceae, Asteraceae, Burseraceae, Euphorbiaceae, and Loganiaceae each have two species. The least represented families are those of Anisophylleaceae, Asparagaceae, Bombaceae, Celastraceae, Cucurbitaceae, Dennstaedtiaceae, Gnetaceae, Malvaceae, Moraceae, Myrtaceae, Piperaceae and Verbenaceae each with only one species. In addition, Angiosperms constitute 94.3 % of the food plant NWFPs sold in the province of Uíge with a predominance of Broadleaf (74.3 %) and 20.0 % of Monocotyledons. Finally, Gymnosperms (Gnetum africanum) and Polypodiopsida (Pteridium aquilinum) only have one species each, representing 5.7 % of all edible plant NWFPs identified in this study.

1.2. Used edible parts of plants

The results of this study on edible parts of plants used (Table 1) reveal that fruits and fruit pulps are the majority of plant parts (44.2 %) sold in the province of Uíge as NWFPs for food use. Also, leaves and seeds occupy 20.9 % and 14.0 % respectively. Finally, the other edible organs of the plants are shoots and stems (7.0 %), saplings (4.7 %), bark (4.7 %), roots (2.3 %) and inflorescences (2.3 %). In addition, Mawunu et al., [9] recorded 7 edible parts sold in the municipality of Ambuila (Uíge Province), of which 25 % of the leaves, 25 % of the beans and 50 % of the fruits and seeds, respectively.

1.3. Uses of edible plant organs

Examination of the results of this study on the food use of plant organs (Table 1) shows that fruits and fruit juices are the most widely used (38.5 %). In addition, the other food

uses identified are leafy vegetables (20.5 %), spices (17.9 %), tea (10.3 %), palm oil and wines of *Elaeis guineensis* and *Raphia spp* (7.7 %) and nibble/amuse-geuele (5.1 %). On the other hand, Mawunu et al. [9], identified 6 uses of the edible parts of plants sold in the municipality of Ambuila (Uíge Province), beverages (33.3 %), vegetables (16.7 %), snacks (16.7 %), teas (16.7 %) and spices (16.7 %).

2. Animal NWFPs

2.1. Systematic description

The results of the inventory in Table 2 show that 47 species of wild animals sold in the province of Uíge belong to 30 zoological families. The zoological families of Bovidae, Sauriniidae, Muridae and Viverridae are the most represented with 5, 4, 3 and 3 species respectively. And the rest of the families have only one or two species. These are Varanidae, Testudinidae, Termitidae, Apidae, Cercopithecidae, Channidae, Cichlidae, Clariidae, Curculionidae, Cyprinidae, Gryllinidae, Hystricidae, Leporidae, Manidae, Muridae, Nesomyidae, Noctuidae, Numididae, Passeridae, Phasianidae, Protopteridae, Pteropodidae, Pythonidae, Sciuridae, Termitidae and Testudinidae. Mammals occupy 48.9 % (23 species) of the NWFPs of animal origin sold in the province of Uíge. Furthermore, in this class of mammals, rodents dominate with 10 species, followed by Artiodactyls (6 species), Carnivores (4 species), Pholidotes (1 species), Chiroptera (1 species), and Primates (1 species). In addition, Insects occupy 21.3% (10 species) of the edible NWFPs sold in the study area, including 6 species of Lepidoptera, 1 species of Blattodea, 1 species of Coleoptera, 1 species of Hymenoptera, and 1 species of Orthoptera. Finally, the other inventoried classes of animals are Actinopterygii (12.8 %, 6 species), Birds with (6.4 %, 3 species), Reptiles (8.5 %, 4 species), and Sarcopterygii (2.1 %, 1 species).

3. Mycological NWFPs

3.1. Systematic description

The results of this study (Table 3) show that the 9 species of wild edible fungi recorded in the province of Uíge all belong to the class Agaricomycetes and are distributed in 4 different mycological families. The family Lyophyllaceae is the best represented with 5 species (*Termitomyces microcarpus*, *Termitomyces titanicus*, *Termitomyces aurantiacus*, *Termitomyces mammiformis*, *Amanita loosii*). In addition, the family Auriculariaceae occupies the second position with 2 species (*Auricularia spec.*, *Auricularia cornea*). In addition, the rest of the families each have one species, the Cantharellaceae (*Cantharellus sp.*) and the Russulaceae (*Lactarius edulis*).

C. Market-related Information

A total of 91 edible NWFPs were inventoried at markets and restaurants in the Study Area. 95.6% (84 species) of the NWFPs marketed in the province of Uíge are local products. In addition, the other (2) edible NWFPs sold in this province come from exclusively abroad, the Democratic Republic of Congo (DRC). These are Nzombo (*Protopterus dolloi*) and Mungusu (*Parachanna obscura*). Furthermore, most of Nsafu (*Dracryodes edulis*) and Nkuati (*Cirina forda*) sold to Uíge and Luanda (capital of Angola) comes from RDC. These four forest food products are part of the cross-border

trade between Angola (Uíge province) and DRC (Kongo Central province).

D. Units of Measurement and Methods of Sale of Edible NWFPs

The results of this study revealed that there are no standardized units of measurement used in the marketing of edible NWFPs in Uíge Province. As a result, the local population uses an improvised variety of local units or measuring instruments (Tables 1, 2 and 3) used for the sale of forest products. These instruments are adapted according to the nature or physical state (liquid or solid) of the edible NWFPs on sale in the study area. For example, stems (*Crassocephalum montuosum*, *C. rubens*, *Lippia multiflora*) (Fig. 2a), leaves (*Gnetum africanum*) (Fig. 2b), *Dracaena camerooniana*, *Mondia whitei*, *Salacia pynaertii*, shoots (*Pteridium aquilinum*) (Fig. 2c), inflorescences (*Cymbopogon densiflorus*) (Fig. 2d) and roots (*Mondia whitei*) are sold in bunches. Fruit pulp (*Adansonia digitata*) is sold in heaps, buckets (Fig. 2e) or plastic basins, or even in 50 kg bags. Also, fruits (*Afromomum albo-violaceum*, *A. angustifolium*) (Fig. 2f), *Anisophyllea quangensis*, *Canarium schweinfurtii*, *Dacryodes edulis*, *Landolphia lanceolata*, *Strychnos cocculoides*), seeds (*Cola acuminata*, *Monodora angolensis*, *Piper guineense*, etc. (Fig. 2g), *Treculia africana*) and bark (*Ochna afzelii subsp. mechowiana*, *Scorodophoeus zenkeri*) are sold in heaps or small plastic basins or even in metal cans, commonly called kilos (*Canarium schweinfurtii*, Fig. 2h). In addition, liquid edible NWFPs such as honey, forest wines (wine from *Elaeis guineensis* and *Raphia spp.*) and red palm oil (*Elaeis guineensis*, Fig. 2i) are sold in transparent bottles of 0.5 or 1 liter or in plastic cans of 5 or 20 liters. Also, edible NWFPs of animal origin, such as Seke (*Passer spp.*), Cricket (*Brachytrupes membraceus*) (Fig. 2j), Catfish (*Clarias angolensis*) (Fig. 2k), Nkusu (*Lemniscomys Griselda*) and Mbende (*L. striatus*) (Fig. 2l), Sheatfish (*Chanallabes apus*), etc. are sold in skewers. Python (*Python sebae*) and outers game, Cane-rat (*Trhyonoms swinderianus* (Fig. 2m), Antelope (*Tragelaphus spekkii*) (Fig. 2n)) including some large fish such as Mungusu (*Parachanna obscura*) (Fig. 2o) and Nzombo (*Protopterus dolloi*) (Fig. 2p) are also sold in heaps of small pieces; in large pieces or whole. Finally, mushrooms are sold in heaps (*Auricularia cornea*) (Fig. 2q), buckets or small basins (*Termitomyces aurantiacus*) (Fig. 2r) or even as a rosary, as in the case of Mvumbu (*Lactarius edulis*).

E. Price Determination Methods

Selling prices are generally set according to market habits. Prices are determined according to seasonality, the law of supply and demand, the appearance of the buyer (belonging to a given social class), the quality of the product (state of perishability), the size or thickness of the product, and also other factors such as the cost of production. Besides, it was noted that there is almost no labelling or price display (99.3 %) on food NWFPs on sale in Uíge Province. This is a deliberate practice that protects the seller from competition and guarantees the seller a good margin of manoeuvre when it comes to determining the price according to the appearance of the customer.

TABLE 1: LIST OF EDIBLE VEGETAL NWPFS SOLD IN UÍGE PROVINCE, ANGOLA

Local Names	Scientific name	Family	Edible parts	Uses	Units and Modes of sale	Conservation status
Bulukutu	<i>Lippia multiflora</i> Moldenke	Verbenaceae	Leaf, stem	Tea	1	N. R
Bungudi, Bungudia	<i>Crassocephalum montuosum</i> (S. Moore) Milne-Redh.	Asteraceae	Leaf	Vegetable	1	N. R
Bungudi, Bungudia	<i>Crassocephalum rubens</i> (Juss. Ex Jacq.) S. Moore	Asteraceae	Leaf	Vegetable	1	N. R
Kikaya	Non ident.	Non ident.	Leaf	Tea	1	N. R
Kumpidi/kampidi	<i>Piper guineense</i> Schumach. & Thonn.	Piperaceae	Seeds	Spice	2	N. R
Mabumi, Kalankonki	<i>Strychnos cocculoides</i> L.	Loganiaceae	Fruit	Fruit	2; 3	N. R
Mahata/Maata	<i>Landolphia lanceolata</i> (K. Schum.) Pichon	Apocynaceae	Fruit	Fruit	2; 3	N. R
Makanzu	<i>Cola acuminata</i> (Beauv.) Schtt & Endl.	Sterculiaceae	Nuts	Snacks	2	N. R
Malombwa	<i>Landolphia owariensis</i> P. Beauv.	Apocynaceae	Fruit	Fruit	2; 3	N. R
Mampodia	<i>Aframomum stanfieldii</i> Hepper	Zingiberaceae	Fruit	Fruit	2; 3	N. R
Mansansa ma mfinda	<i>Aframomum angustifolium</i> (Oliv. & D. Hanb.) K. Shum.	Zingiberaceae	Fruit	Fruit	2; 3	N. R
Mansunja/ mansansa ma londe	<i>Aframomum albo-violaceum</i> (Ridl.) K. Schum	Zingiberaceae	Fruit	Fruit	2; 3;	N. R
Matombe/mavusu	<i>Raphia spp</i>	Arecaceae	Fruit, Seve	Fruit, wine	4; 5; 6	N. R
Mbidi	<i>Canarium schweinfurtii</i> Engl.	Burseraceae	Fruit	Fruit	2; 7	N. R
Mbonde/mbondi	<i>Salacia pyraetii</i> De Wild.	Celastraceae	Leaf	Vegetable	1	N. R
Mfumbwa	<i>Gnetum africanum</i> Welw.	Gnetaceae	Leaf	Vegetable	1	Vul.
Mfungu/loengo	<i>Anisophyllea quangensis</i> Engl. Henriq.	Anisophylleaceae	Fruit	Fruit	2	N. R
Mitekua tekua	<i>Pteridium aquilinum subsp. Africanum</i> (L.) Kuhn	Dennstaedtiaceae	Shoot	Vegetable	1	N. R
Mpeve	<i>Monodora angolensis</i> Welw.	Annonaceae	Seeds	Spice	2; 7	N. R
Mungoma ngoma	<i>Erythrina abyssinica</i> DC.	Fabaceae	Bark	Tea	1	N. R
Munkula	<i>Pterocarpus angolensis</i> DC.	Leguminosae	Leaf	Vegetable	2; 3	Vul.
Ngo nti, Nkosi nti	<i>Ochna afzelii subsp. mechowiana</i> (O. Hoffm.) N. Robson	Ochnaceae	Bark	Tea	1	N. R
Ba dia Ngazi	<i>Elaeis guineensis</i> Jacq.	Arecaceae	Fruit, Seve	Oil and palm wine	2; 4; 6	N. R
Nkasu	<i>Plukenetia conophora</i> Müll. Arg.	Euphorbiaceae	Fruit	Spice	2	N. R
N'kizu	<i>Syzygium guineense subsp. macrocarpum</i> Engl.	Myrtaceae	Fruit	Fruit	2; 3	N. R
Nkondo, Mucua	<i>Adansonia digitata</i> L.	Bombacaceae	Fruit, Pulp	Jus	2; 3; 8	Vul.
Nkuwa nkuwa, N'sanu	<i>Xylopia aethiopica</i> (Dunal) A. Rich	Annonaceae	Fruit, seed	Spice	2	N. R
Nlondo nlondo, kimbiolognua	<i>Mondia whitei</i> (Hook.f.) Skeels	Apocynaceae	Leaf, root	Snacks, vegetable	1	N. R
Nsafu	<i>Dacryodes edulis</i> (G. Don) H. J. Lam	Burseraceae	Fruit	Fruit	2; 3	N. R
Nsala bakala	<i>Dracaena camerooniana</i> Baker	Asparagaceae	Leaf	Vegetable	1	N. R
Nsungu, tsongo	<i>Treculia africana</i> Decne. ex Trécul	Moraceae	Seeds	Spice	2	N. R
Pepino	<i>Cucumis metuliferus</i> E. Mey	Cucurbitaceae	Fruit	Vegetable	2	N. R
Sangu sangu	<i>Cymbopogon densiflorus</i> (Steud.) Stapf	Poaceae	Leaf, inflorescence	Tea	1	N. R
Tu menga menga	<i>Landolphia lecomtei</i> Dewèrè	Apocynaceae	Fruit	Fruit	2; 3	N. R
Wayi, mukubi	<i>Scorodophloeus zenkeri</i> Harms	Fabaceae	Bark, fruit	Spice	2	N. R

Legends: N.R = Nothing to report concerning the species for which there is no identified risk; Vul = Vulnerable species; Mex = Species threatened with extinction Units and modes of sale: 1: Bundle; 2: Pile/heap ; 3: Small plastic basin ; 4 : Bottles ; 5 : Plastic canister ; 6 : Liter ; 7 : Kilogram ; 8 : Bag of 50 kg.

TABLE 2: LIST OF EDIBLE ANIMALS NWPFS SOLD IN UÍGE PROVINCE

Local names	Scientific name	Family	Units and Modes of sale	Conservation status
Cacuso/tilapia	<i>Tilapia sp.</i>	Cichlidae	Heap	Inv.
Kamba	<i>Chanallabes apus</i> (Günther 1873)	Clariidae	Brochettes	N. R
Kimpiti	<i>Cephalophus castaneus</i> (Thomas 1892)	Bovidae	Entire, chunks	N. R
Kusu	<i>Lemniscomys griselda</i> (Thomas 1904)	Muridae	Brochettes	N. R
Lunsua	<i>Macrotermes subhyalinus</i> (Rambur, 1842)	Termitidae	Kilo	Vul.
Mansende	<i>Gonimbrasia (Nudaurelia) dione</i> (Fabricus 1793)	Saturniidae	Kilo, Heap	N. R
Mansende	<i>Imbrasia obscura</i> (Butler 1878)	Saturniidae	Kilo, heap	N. R
Mbala	<i>Genetta genetta felina</i> (Linnaeus, 1758)	Viverridae	Entire, chunks	N. R
Mbende	<i>Lemniscomys striatus</i> (Linnaeus 1758)	Muridae	Brochettes	N. R
Mboma	<i>Python sebae</i> (Gmelin 1788)	Pythonidae	Entire, chunks	N. R
Nzimbula	<i>Apis mellifera adansonii</i> (Latreille 1804)	Apidae	Litre	N. R
Mfuge	<i>Genetta tigrina</i> (Schreber, 1778)	Viverridae	Entire, chunks	Vul.
Mfulu tutu	<i>Kinixys erosa</i> (Schweigger 1812)	Testudinidae	Entire, chunks	N. R
Milenda	<i>Sciatta inconcisa</i> (Walker 1869)	Noctuidae	Kilo, heaps	N. R
Minzundu/Minzunzu	<i>Anaphe panda</i> (Boisduval, 1847)	Notodontidae	Kilo, heaps	N. R
Mpakasa	<i>Syncerus caffer nanus</i> (Boddaert, 1785)	Bovidae	Chunks	M.ex
Mumfungua	Non ident.	Channidae	Heap, Brochettes	N. R
Munguela	<i>Imbrasia epimethea</i> (Drury 1773)	Saturniidae	Kilo, heap	N. R
Mungusu	<i>Parachanna obscura</i> (Teugles & Daget 1984)	Channidae	Entire, heap	N. R
N'kanka	<i>Funisciurius pyrrhopus</i> (Cuvier, 1833)	Sciuridae	Entire	N. R
Ngandu	<i>Crocodylus niloticus</i> (Laurenti, 1768)	Crocodylidae	Heap	Vul.
Ngembua	<i>Epomops frangueti</i> (Tomes 1860)	Pteropodidae	Heap, Brochettes	N. R
Ngola	<i>Clarias angolensis</i> (Steindachner 1866)	Clariidae	Brochettes	N. R
Ngone	Non ident.	Muridae	Brochettes	N. R
Ngulu a mfuta	<i>Potamochoerus porcus</i> (Linnaeus 1758)	Suidae	Heap	N. R
Ngulu a nzimba	<i>Hystrix africae australis</i> (Peters, 1852)	Hystriidae	Entire, chunks	N. R
Ngumbe	<i>Fracolinus afer</i> (Statius Müller 1766)	Phasianidae	Entire	N. R
Nkaka	<i>Phataginus tricuspis</i> (Rafinesque 1821)	Manidae	Entire, chunks	N. R
Nkayi	<i>Tragelaphus scriptus</i> (Pallas, 1766)	Bovidae	Entire, chunks	N. R
Nkelele	<i>Nimida meleagris</i> (Linnaeus 1758)	Numididae	Entire	N. R
Nkima	<i>Cercopithecus ascanius</i> (Audebert 1799)	Cercopithecidae	Entire, chunks	N. R
Nkuati	<i>Cirina fonda</i> (Westwood 1849)	Saturniidae	Entire, chunks	N. R
Nkumbi	<i>Cricetomys emini</i> (Wroughton 1910)	Nesomyidae	Entire	N. R
Nkumbi	<i>Cricetomys ansorgei</i> (Thomas 1904)	Nesomyidae	Entire	N. R
Nlumba a londe	<i>Lepus sp.</i>	Leporidae	Entire	N. R
Nsekele	<i>Atherurus africanus</i> (Gray 1842)	Hystriidae	Entire, chunks	N. R
Nsengui, mbambi	<i>Varanus niloticus</i> (Linnaeus 1766)	Varanidae	Entire, chunks	N. R
Nsesi	<i>Cephalopus monticola</i> (Thunberg 1789)	Bovidae	Entire, chunks	N. R
Nsizi, cambuige	<i>Thryonomys swinderianus</i> (Temminck, 1827)	Thryonomyidae	Entire, heap	N. R
Nsombe	<i>Rhynchophorus phoenicis</i> (Fabricius 1801)	Curculionidae	Brochettes, heap	Vul.
Ntoto	<i>Mungos mungo</i> (Gmelin 1788)	Herpestidae	Entire	N. R
N'vanda, Mvudi	Non ident.	Bovidae	Chunks	N. R
Nzenze	<i>Brachytripes membraceus</i> (Drury 1770)	Gryllidae	Brochettes, heap	N. R
Nzima, kombe	<i>Civettictis civetta</i> (Schreber 1776)	Viverridae	Entire, chunks	Vul.
Nzombo	<i>Protopterus dolloi</i> (Boulenger 1900)	Protopteridae	Entire, chunks	N. R
Nzonzi	<i>Enteromys sp.</i>	Cyprinidae	Brochettes, heap	N. R
Seke	<i>Passer spp.</i>	Passeridae	Brochettes, heap	N. R

Legend: N.R = Nothing to report concerning the species for which there is no identified risk; Inv = Invasive species, Vul = Vulnerable species; Mex = Species threatened with extinction.

TABLE 3: LIST OF EDIBLE MYCOLOGICAL NWPFS SOLD IN UÍGE PROVINCE

Local names	Scientific name	Family	Edible parts	Units and Modes of sale	Conservation status
Kuete kuete, Wunkulu nkulu	<i>Cantharellus sp.</i>	Cantharellaceae	Hat	Heap	N. R
Mvumbu, Mvubu	<i>Lactarius edulis</i> (Verbeken & Buyck 1994)	Russulaceae	Hat, stem	Rosary/chapelet	N. R
Nsempedia	<i>Termitomyces aurantiacus</i> (R. Heim 1942)	Lyophyllaceae	Hat, stem	Heap, small basin	N. R
Wunguvu, Unguvu, Nguvu	<i>Termitomyces tianicus</i> (Pegler & Pearce)	Lyophyllaceae	Hat, stem	Entire, heap, small basin	N. R
Unzenga nzenga, Nkutu bala	<i>Auricularia sp.</i>	Auriculaceae	Hat	Heap	N. R
Nkaka matu, bukutu kutu	<i>Auricularia cornea</i> (Ehrenb. 1820)	Auriculaceae	Hat	Heap, small basin	N. R
Mbala ntoto	<i>Termitomyces mammiformis</i> (R. Heim 1942)	Lyophyllaceae	Hat, stem	Heap, small basin	N. R
Unzawu, Nzawu	<i>Termitomyces microcarpus</i> (Berk. & Broome) R. Heim (1942)	Lyophyllaceae	Hat, stem	Heap, small basin	N. R
Ntumbudia	<i>Termitomyces mammiformis</i> (R. Heim 1942)	Lyophyllaceae	Hat, stem	Heap, small basin	N. R

Legend: N.R = Nothing to report concerning the species for which there is no identified risk.

Fig. 2. Photographs of the few edible NWFPs sold in Uíge Province. **a.** *Crassocephalum rubens*; **b.** *Gnetum africanum*; **c.** *Pteridium aquilinum*; **d.** *Cymbopogon densiflorus*; **e.** *Adansonia digitata*; **f.** *Aframomum angustifolium*; **g.** *Piper guineense*; **h.** *Canarium schweinfurtti*; **i.** *Elaeis guineensis*; **j.** *Brachytripes membraceus*; **k.** *Clarias angolensis*; **l.** *Lemniscomys striatus*, *L. griselda*; **m.** *Trhyonomys swinderianus*; **n.** *Tragelaphus scriptus*; **o.** *Parachanna obscura*; **p.** *Protopterus dolloi*; **q.** *Auricularia cornea*; **r.** *Termitomyces aurantiacus*.

F. Sales Sites and Customer Loyalty Methods

Analysis of the data from this study shows that edible NWFPs are sold in various locations in Uíge Province. Forest beverages (*Elaeis guineensis* and *Raphia* spp. wines) are sold in markets or in makeshift “barracas”, roadside stands and even in homes. Also, game is sold at roadsides, market stalls and restaurants.

Finally, plants (fruit, seeds, vegetables, roots, and bark) and mushrooms are sold on roadsides, in markets, bus parking lots and even in homes. The work of Monizi et al. [7], [8] shows that the trade of edible NWFPs in Uíge province takes place in rural, peri-urban, and urban markets, roadsides, bus parking lots and even in homes.

As for customer loyalty, the results of the socio-economic surveys showed that sellers of edible NWFPs in the study area use several techniques, including selling on credit to loyal customers and granting a discount (reduction on the selling price) and a bonus to the buyer, i.e. a surplus of the purchased product. This practice is commonly known as *ntelo* in Kikongo language or *esquebra* in Angolan Portuguese.

G. Savings and Income Allocation

The majority (70.7 %) of edible NWFP sellers in Uíge Province save their money at home. On the other hand, 29.3 % practice a kind of tontine locally called *Dikelemba* or *Temo* in Kikongo language. These results corroborate those of Monizi et al. [7] who showed that the income from the sale of NWFPs with *Dracaena camerooniana* leaves is kept in a kind of local tontine called *Quixikila* in Angolan Portuguese or *Dikelemba* in Kikongo language. Finally, it is necessary to note that this income generated by the sale of NWFPs helps to solve some specific and unpredictable problems of the household (assistance to parents in particular). In terms of income allocation, the money generated from the sale of edible NWFPs is used to solve several specific household problems, such as: the purchase of basic necessities, health care, bereavement, marriage, rent, clothing and beauty products, school supplies, telecommunications, etc. The results of this study corroborate those of Monizi et al. [7], [8] who worked in the

same region and showed that income support contributes to the strengthening of food security, purchase of school materials, health care, basic necessities, purchase of clothes, offering to the church, cosmetics, funerals, weddings, etc. On the other hand, Lautenschläger et al. [25], have shown that the collection and sale of some edible insects is part of the livelihood diversification strategy in northern Angola and provides multiple income opportunities for households.

H. Conservation Status of Edible NWFPs Sold in Uíge Province

The fauna and flora species of Angola are classified according to their statutory categories. In 2018, the Ministry of the Environment of Angola drew up a list of extinct (Extinct), endangered (Endangered), vulnerable (Vul) and invasive (Inv) plant and animal species, now called the Red List of Angolan Species. The results of the surveys of edible NWFP sellers in Uíge Province identified 8 of the 91 species on the Red List. The 8 species surveyed are *Gnetum africanum*, *Rhynchophorus phoenicis*, *Adansonia digitata*, *Crocodylus niloticus*, *Civettictis civetta*, *Genetta tigrina*, *Pterocarpus angolensis* (Vul), *Tilapia* sp (Inv) and *Syncerus caffer nanus* (M. ex). When questioning sellers of edible NWFPs in Uíge about the existence of a red list of plant and animal species in Angola, the answer to this question showed that none of them had ever heard of the existence of this list. Based on this answer, it is clear that the ignorance of this section of the population about the existence of the red list of species of wild flora and fauna in Angola is due to a lack of information. Furthermore, respect for the conservation of the environment would only be possible if the information provided by the Ministry of the Environment reaches the population in general and the sellers of edible NWFPs in particular through TV, newspapers, workshops, etc., promptly.

IV. CONCLUSIONS

This study allowed the inventory, characterization, and valorization of some edible NWFPs marketed in Uíge Province. The results obtained reveal that the sale of forest products for food use is an activity carried out mainly by women. In addition, the study inventoried three types of

edible NWFPs on sale in the study area, including 47 animals, 35 plants and 9 fungi. Also, edible NWFPs are sold at roadsides, bus parking lots, markets, restaurants, and vendors' homes. On the other hand, NWFPs are sold using non-standardized units of measurement. And most sellers of edible NWFPs do not display the price on their merchandise. The study also found that the income generated from the sale of NWFPs is used to solve specific household problems such as health care, weddings, clothing, school supplies, etc. The study also found that NWFPs are sold in a variety of ways. The results of this study constitute a database providing additional information on Angola's edible NWFPs, especially those sold in Uíge province. That this work be complemented by economic studies aimed at quantifying the volume of activities in this sector.

Finally, this work has just contributed to the creation of a database essential for sustainable management and the development of strategies for the organization of the edible NWFP market that will guarantee the socio-economic.

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