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Biodiversity Exploitation for Traditional Healthcare Delivery in Montane Forest Communities: Case of Belo and Njinikom Sub-Divisions in Cameroon

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Abstract— *Biodiversity exploitation in montane highlands remain an important source of raw materials for traditional healthcare delivery, survival and sustenance of the population in communities that are reliant thereof. Belo and Njinikom Sub-Divisions on the fringes of the Ijim Montane forest stronghold are rich in biodiversity resources though under degradation. The exploitation of the biodiversity have thrived a spectre of traditional healing practices hatched by indigenous knowledge. The edgy perception of being socially irrelevant, illusory and ill-suited by the state and modern hospitals are sullying this practice. This study was based on the premise that traditional healing practices are the major ways in which biodiversity is exploited and used for traditional healthcare provision. The methodology uses correlational and comparative research designs of field investigations. Purposive random sampling technique was used to administer 250 questionnaires to selected key respondents from the entire population. Findings reveal that the practice of traditional healing is enshrined in the mysteries of indigenous knowledge which is methodical in concoctions, decoctions, injections, ritual practices and incantations, which to an extent have bestowed effective healthcare to contemporary communities through resources they find it hard to stay aloof. This study posits that if the state, modern hospitals and tradi-practitioners holistically find common ground through collaborative agreements, such issuant and commonplace signatures would continue to support the current shady healthcare tragedy. It shall provide the communities with solutions to some indigenous diseases still portraying dreadful hallmarks and being a nuisance to the population where general welfare of all and sundry ought to be esteemed and primeval.*

Keywords— ***Biodiversity, Belo and Njinikom, diseases, Traditional healthcare, tradi-practitioners.***

I. INTRODUCTION

Biodiversity exploitation in montane highlands on earth often epitomizes mutual prerequisites for traditional healthcare deliver. They serve as a source for survival and sustenance of the population in adjacent communities (Jean, 2019). The practice of exploiting biodiversity for traditional health care delivery is as old as human indigenous societies (Senai *et al.*, 2010). This is anchored on the human perceptions of folk dogmas founded on the concept of traditional medicine and healthcare accessibility (Ajay, 2009). These human beliefs are concerned with the relationship between provision of traditional medicine and utilization for health services as the oldest most tried and tested form of medication (WHO, 2002); (WHO, 2010). In a strict sense, using biodiversity resources for traditional health care delivery is not an alternative to modern medicine but forms the bases of all original medicine, conventional drugs as well as Chinese medicine. This is deeply rooted in anthropological philosophies that the exploitation and use of plant and animal diversity for traditional medicine remains the cradle of human civilization (Egharevba, 2012).

Today, hundreds of millions of people, mostly in developing countries, derive a significant part of their healthcare by exploiting and using plant and animal products, (Vinayak *et al.* 2014). It is estimated that 80% of

the global population still depends upon the exploitation of biodiversity resources for herbal medication for their health care. This is more evident in the resident population in developing countries. Approximately 3.9 billion people are making use of biodiversity resources for traditional healthcare (Van, 2015). The WHO (2013) pointed to the fact that 370 million indigenous peoples living across mountainous communities in the world in at least 70 countries have been reputed for the exploitation of biodiversity resources for their traditional health care delivery. The exploitation of basic biodiversity resources can contribute to the healthcare delivery of humans as it provide medicines and balanced diets; providing genetic information as a raw material for medical research and keeping people healthy by contributing clean water and air (IUCN and EU, 2010).

Globally, there has been much empirical evidence on how plants, trees and species exploitations play a vital role in providing healthcare as western medicines do. The demand for botanical products for healthcare has been increasing and most of the products are harvested from the wild. The exploitation of some prominent medicinal plants like *Taxus brevifolia, Rauvvolfia spp and Prunus Africana* reveal that biodiversity remains a prerequisite for health care delivery for the rural people. Since the 1970s, the environment has been considered 'the common heritage of mankind'. The use of traditional indigenous knowledge to exploit biodiversity for traditional health care delivery has been very significant in reducing disease prevalence in rural and urban areas of developing countries (Sofowora, 2008).

This strong adherence to biodiversity exploitation for traditional health care delivery is testimony of its easy access and efficacy in treating chronic diseases and other ailments common in the population. The local herbs are processed based on indigenous knowledge and practices for curative propensities (Fidel *et al.*, 2013). In Asia, India is a blessed country in the world that is enriched with golden treasures of biodiversity exploitation from diverse cultural expressions and associated with traditional knowledge on a variety of subjects especially medicinal properties of the plants. The plants, more specifically its genetic resources do wonders by curing serious types of illnesses. Since the ancient times, India has possessed a rich traditional knowledge of methods and means of harnessing biological resources to treat diseases affecting people and to cure ailments (UNO, 2014).

In Cameroon, more than 85% of the population hinge on the exploitation of biodiversity resources for their traditional healthcare. Traditional health care delivery in Cameroon is founded on signing and ratifying most of the international and regional instruments as well as enacting laws on access to and exploitation of genetic and biodiversity resources for traditional medical services (MINSANTE, 2020). The practice have been intensified as the legal framework of the higher education system emphasizes on the development and integration of traditional medicine and traditional healthcare curricular into the teaching programmes of higher education training establishments. This reflects enormous successes due to a magnificent and diverse floral biodiversity comprising high medical properties. This is more common in forest zones and the montane ecumenes in the Bambotous and Kilum/Ijim where the most exploited plants are *Prunus africana, Dracaena Fragrans, Ker Gaul, Ageratum Conyzoides , Annona Muricata Picrabimanitida* (Muweh, 2011).

Adjanohoum *et al* (1996) cited in Ndenecho (2010) pointed to the fact that 414 medicinal plants belonging to 95 plant families are used in Cameroon for traditional healthcare delivery. Areas citadel of biodiversity resources in Cameroon are endowed with indigenous knowledge and innumerable prospects associated with the treatment of diverse diseases (Ngwa, 2010). This is plausible on the collaboration between traditional and modern practitioners in traditional health care delivery for the healing of diseases anchored on referral cases to both parties. There have been workshops organized between traditional and modern practitioners aimed at addressing pertinent health issues in different communities (Mbenkum, 1991); (Fokou, 2018).

Belo and Njinkom Sub-Divisions (BNSDs) are montane ecumenes of difficult ecological traits sited at the fringes of the biologically rich Ijim Mountain Forest Reserve. They are symptomatic living spaces that throughout history have offered flourishing biodiversity resources of diverse species. This has procured long customary traditional healthcare tunes based on strict customary values and ancestral ethics (Bung, 2019). The increase in the exploitative activities of biodiversity resources has left some ugly signatures on the environment. This explains why the population has been developing medicinal gardens, rearing diverse animal species besides the natural biodiversity in the Ijim Mountain Forest Reserve rich in medicinal properties. The people living at the precincts of this Montane Forest originated from Tikari ancestral background and have ever lived and practiced traditional medicine in a perfect symbiosis with their natural environment. Sustainable interaction with the forest has permitted them to harness "*green gold*" out of plant tissues to sign their cultural signatures in the national and even international golden books of biodiversity resources for traditional health care

delivery in this region (Whinconet, 2007); Adjanohaum *et al*., 1996) cited in Bung (2019).

This area with particular villages like Anyajua, Aboh, Tumukuh, Muloin, Anjin, Abuh and Mbessa has become almost synonymous to traditional healing in the North West Region of Cameroon. The traditional healing venture has gained the perception and appellation of *"small India of Cameroon"* since India has one of the richest plant medical traditions in the world. (Fogwe and Kwei, 2015). This is in admiration to its traditional health care delivery competences, marvels, diversities and remarkable results that transcend its geographical bounds (Ndenecho, 2010). The study aims to determine the various ways in which biodiversity is exploited for traditional health care delivery in BNSDs. It is based on the premise that Traditional healing practices are the major ways in which biodiversity is exploited and used for traditional health care delivery. This is founded on the fact that inhabitants of these areas are increasingly soliciting biodiversity for traditional medicine as an option for healthcare delivery as they perceive it to be physically and economically accessible.

II. MATERIALS AND METHODS

2.1 Description of the study area

The study area falls between latitude 6º4' and 6º20' North and longitude 10º11' and 10º30' East for Belo Sub Division and latitude 6º20' and 6º30' North and between longitude 10º11' and 10º30' East for Njinikom Sub Division (Fig 1). It is a double administrative community with a surface area of 519Km^2. The populations of the two Sub-Divisions are 88,664 inhabitants for Belo 43296 inhabitants for Njinikom with a growth rate of 2.8%. (Projected from BUCREP Statistics, 2005). Generally, the climate is the cold tropical Sudan climate with two distinct seasons. Mean annual temperatures range from 14ºC to 28ºC. Rainfall is generally heavy, ranging from1800-3200mm per annum (Fogwe, 1997). This climate has given rise to the growth and rapid replacement of the Montane Forest Reserve and gallery forests that harbor plant and animal species of high medicinal value exploited for traditional health care delivery.

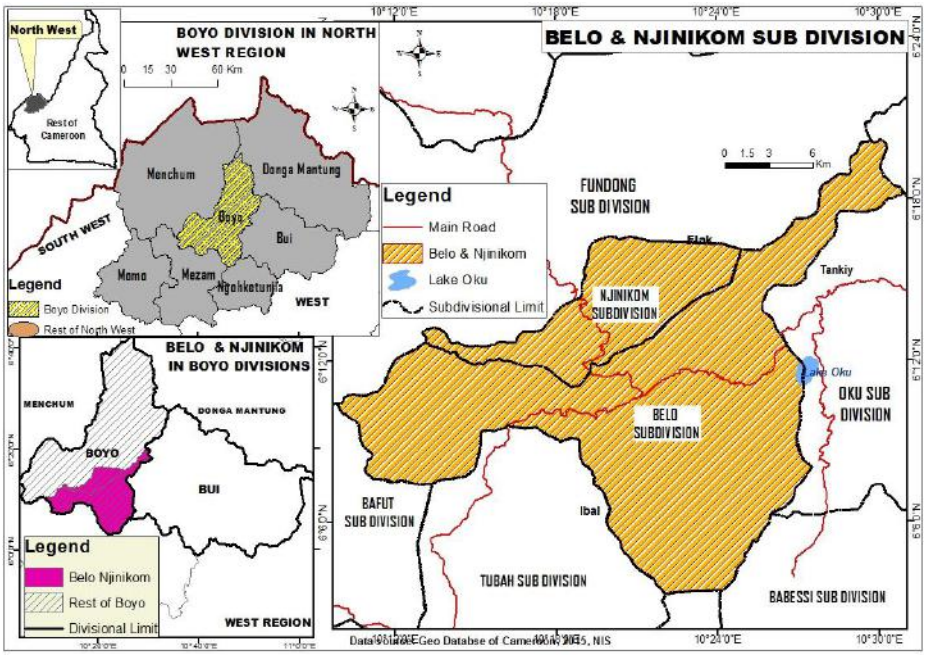

Fig.1: Location of BNSDs in the North West Region of Cameroon

This study was carried out using a survey and comparative research designs to make an inventory of the biodiversity exploitation methods for traditional health care delivery practices by the various stake holders. The study was conducted in seven biodiversity zones (Ijim forest, Belo, Mbessa, Njinikom, Anyajua-Mulion, Mejang-Mbueni, and Afua zones) with each contributing a representative sample using the purposive random sampling procedure. Primary data was collected from the field through three complementary techniques involving questionnaires, formal and informal interviews and direct observation of biodiversity resources sites, exploitation methods and traditional health care delivery methodologies. A total of 250 questionnaires were administered to 60% of the population accessing traditional healthcare services and 32% of Tradi-

Practitioners (among which included herbalists, priests, plant peddlers and traditional pharmacists). This was complemented by secondary data obtained from published and unpublished sources. Institutions such as the Sub-Divisional Offices for BNSDs were also visited to obtain information on the population statistics and number of registered traditional practitioners. Hospitals like Mbingo Baptist Hospital, Njinikom Catholic Hospital and Health Centers in Belo and Njinikom were visited to collect data and information on the relationship and collaboration between traditional healthcare clinics and modern hospitals in terms of service delivery.

III. RESULTS AND DISCUSSIONS

3.1 Legal Framework for biodiversity exploitation and traditional health care delivery in BNSDs

Under Cameroon's environmental and public health laws, the country has made efforts through the putting in place of a number of legal instruments that provides an enabling ground for the exploitation of biodiversity resources for traditional health care delivery. Law N° 96/12 of 5th August 1996, states clearly that environmental resources including biodiversity resources should be managed sustainably for human welfare. Law N° 94/01 of 20th January 1994 lays down the rules and regulations on the exploitation of the different genetic and biodiversity resources. Decree N°. 2001/718/PM 3rd September 2001 modified by Decree No. 2006/1577/PM of 11th September 2006 organized the functioning of the inter-ministerial committee on exploitation and use of biodiversity resources. Decree N° 98/405/PM of 1995 created the National Office in the Ministry of Public Health to regulate and reinforce laws required to register traditional practitioners for the legal practice in traditional medicine. In September 2015, the medical school circular review instituted the development and integration of traditional medicine curricular into the teaching programmes of higher education training establishments.

The contextualization of this legal framework in BNSDs has resulted in the issuing of administrative authorizations for the practice of traditional medicine. Traditional practitioners are already recognized and given authorizations to carry out the practice. Some are given attestations of congratulations for their meritorious services in the domain. The legal framework for the practice of traditional health care delivery through the exploitation of biodiversity resources has been implemented in these zones with national and Sub-Divisional authorizations and registration certificates. This has led to a number of authorizations for the legal practice of traditional health care providers (Table 1).

Table 1: Traditional health care-practitioners in Belo and Njinikom Sub-Divisions

Zone	N° with national authorizations	N° with Sub-Divisional authorizations	N° without authorizations
Njinikom	27	89	45
Mejang-Mbueni	10	30	40
Anyajua-Muloin	23	45	56
Belo	11	23	25
Afua	/	05	07
Mbessa	6	10	17
Total	**77**	**202**	**200**

Source: Boyo Association of Traditional Doctors (2019); Fundong Health District (2019); Field Survey (2020)

There are a total of 479 traditional-Practitioners in Belo and Njinikom with 279 registered. This is proof of the legal framework for the practice of biodiversity exploitation for traditional health care delivery. Njinikom has a greater number of 27 and 89 tradi-practitioners respectively as opposed to Afua with zero and 05 tradi-practitioner respectively registered. This is linked to the modernization of practice of traditional medicine in Njinikom than Afua which is far remote. This is consistent with Egharevba (2012) who remarked that the increasing modernization of traditional health care delivery in Nigeria is linked to accessibility to the legal framework. Traditional doctors and other practitioners have been heeding to the fervent calls repeatedly from the government of Cameroon for a harmonious and frank collaboration in the public health sector.

3.2 Distribution and typology of biodiversity resources for traditional health care delivery in BNSDs

BNSDs are located in a Montane highland area and at the peripheries of the Ijim Montane forest. This forest and many other community forests, gallery forests and individual gardens are abodes to a large variety of biodiversity species. These species contain an intrinsic value that is seen on its services to human health. Their distribution reflects the floristic diversities in the different ecological zones (Fig. 2).

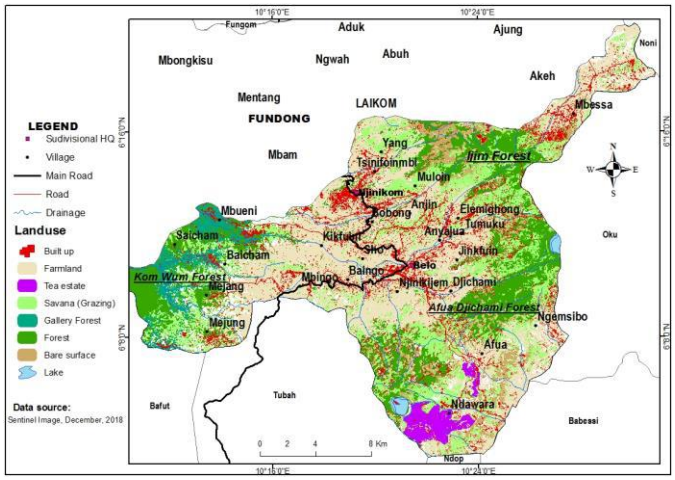

Fig.2: Floristic resource distribution in Belo and Njinikom Sub-Divisions

Source: Fieldwork (20120), CDP (2012).

Most of the biodiversity resources are concentrated in the upland montane forest of Ijim mountain, Ndawara, Mejang and Mughom (Fogwe, 1997) (interms of extent) which is a protected reserve with a high concentration of most of the wild and very valuable species. The lowland community forests of the Kom-Wum forest, the Afua- Djichami forest and much other man-made plantations and herbal gardens developed in and around the compounds also harbour high concentrations of biodiversity resources. Majority of the fauna diversity is concentrated in the Ijim forest zone. This is the only area that can provide most of the habitats for these resources since it is a protected area from many land uses. The destruction of vegetation zones in many other zones and hunting have made these areas not suitable to harbour these species. These resources vary in their proportions in the different ecological zones (Fig 3).

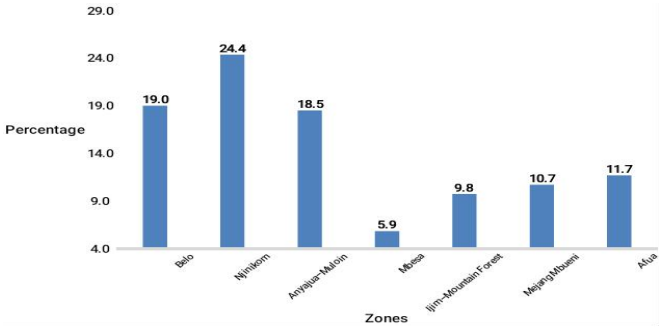

Fig.3: Spatial variations in the rate concentration of BDRs for THD in BNSDs

Source: Divisional Delegation of Forestry and Wildlife Boyo (2020); Field Survey (2020)

In terms of proportion, the Njinikom zone is richer in biodiversity resources for traditional healthcare delivery. The 24.4% of the resources in this zone is accounted for by the fact that areas in this zone like Yang are very close to the Ijim forest which harbours most of these resources. This area also has a greater proportion of medicinal gardens around the compounds planted by traditional health practitioners. The Catholic Hospital and the Fuanantui healthcare services have a practice of traditional healthcare delivery services leading to a high development of modern medicinal gardens with many biodiversity resources. It should however be noted that these resources in the modern gardens are mostly dominated by plant species imported from other continents as echoed by Rômulo and Ierecê (2007). The 19.0% and 18.5% for the zones of Belo and Anyajua-Muloin zones respectively is due to the high proximity of these areas to the Ijim forest reserve managed by the community. This reserve provides enormous biodiversity species for traditional health care delivery in this area. Mbessa ecological zone has the lowest percentage (5.9%) explained by the fact that only a smaller portion of Mbessa is closer to the forest. This is supported by Bailack (2018) who pointed out that out of the 84.73km^2 total surface area of the Kilum-Ijim Montane Forest, the Mbessa zone harbours only 6.3km^2 out of its total surface area of 37.29km^2. The montane forest in this area is undergoing severe degradation due to overexploitation (Mbanga and Bailack, 2019).

The classification of biodiversity resources for traditional health care delivery in BNSDs is based on the fact that, of all the total biological diversity, not all are exploited and used for traditional medicine. The species diversity and major traditional healthcare delivery matrix is very significant with varied roles played by biodiversity resources through their exploitation and use in the traditional health care system (Table 2).

Table 2: Biodiversity resource typology and use in traditional health care delivery practices in BNSDs

Scientific name	Local name (Kom dialect)	Use in healthcare
Prunus Afericana,	Sola	Stomach complaints and fevers, prostate cancer
Rhapia mambillensis	Aluuh	Compliment for concoctions and a major resource for divination and ritual practices.
Hypoestes forskaolii	Fukagn	Blood builder
Pentarrhinum abyssinicum	Ijim ense	Anti-poison and for divination
Lobelia columnaris	Tong Idzi	Active in cancer treatment
Kigela africana	Athem	Blood purifier, epilepsy
Maytenu buchananii	Alamse	Paralysis
Uebelinia abyssinica	Eghang	Carving statues used for medicines and divination
Acmella caulirhiza	Fesus fe ngang	Paralysis and hemorrhoids
Kalankoe crenata	Ayuh ajang	Ear infection
Leucas deflexa	Fingii Fungwor	Children's related illnesses
Plectranthus punctatus	Ijim	Anti-poison and divination
Rauvolfia vomitoria	Eptong	Bark contains inedolic alkaloids and has medicinal uses for psychiatric patients.
Aframomum sp.	Achoh	Stems and leaves used for enemas
Dracaena diesteliana	Keng	Used for incantations and to drive away evil spirits
Bidens pilosa	Funsehinuh	Widely used for anti-influenza, diabetic control and treatment of gastroenteritis; anti-inflammatory.
Ricinus communis	jaang	Used as traditional oil to mix concoction
Prottea elliottii	Mbom fesinghe	Studies indicate it is anti-hyperglycemic, anti-ulcerogenic, immuno-suppressive.
Platysteira laticincta	Ingeng	Burnt into medicine, attached to medical preparations
Panthera pardus	Anyamni	Skin for medicine bags
Chloratalpa spp.	Fii nse	Important ingredient used in divination
Atelerix albiventris	Nyam ngum	Pines for Divination and anti-poison medicines
Cercopithecus patas	Ngeladzi	Skin for medicine bags

Source: Whincnet *et al.* (2007), Fogwe and Kwei (2015); Bailack (2018); Field Survey (2020); Bung (2019)

These biodiversity species have 90% concentration in the Montane Forest. *Prunus Africanna, Plectranthus punctatus, Leucas deflexa* and *Acmella caulirhiza* are more concentrated in Ijim Montane Forest. Raphia is common mostly around Mbingo, Mejang, Mejung and the Fuanantui areas. *Hypoestes forskaolii* thrive more in Belo, Afua, Njinikom, Anyajua-muloin and Mbessa neighborhoods. *Pentarrhinum abyssinicum* is found only in Ijim. *Lobelia columnaris* is found around the zones of Ijim, Anyajua-muloin, Afua and Mbessa. *Kigela Africana* is seen in zones of Afua, Anyajua-muloin, Ijim and Mbessa. *Maytenu buchananii* is common only in Mejang-

Mbueni. *Uebelinia abyssinica* is found in Anyajua-Muloin and Ijim. *Kalankoe crenata* is common in Anyajua-muloin, Ijim, Afua and Mbessa. All these zones are located at the fringes of the montane forest. There are also a variety of herbs mostly used in traditional health care delivery like *Carapa grandiflora Syzygium staudtii, Dovyalis sp nov, Newtonia camerunensis ebvuen, Kebey, Fegei, Antongtong, Feewu a Wu, Ebwos kebongelengos* and *Ntang fesus*. Fauna diversity is enormous with high concentrations plant habitats. Most of the animal species used in today's traditional medicine practice are domesticated species mostly fowls, sheep and goats. This is due to the high extinction of wildlife in the areas blamed on anthropogenic influences. Some wild animal species also common and worth mentioning here include *Chlorotalpa, Mysorex okuensis, Tragelaphus scriptu, Paraxerus cooperi, Lamprophis fuliginosus, Xenopus longipes* and *Chameleo quadricornis.* Supplementary biodiversity resources like honey, casto oil and palm oil are also used for traditional health care delivery. These resources constitute an important aspect of concoctions decoctions. These biodiversity resources are of high medicinal value and are concentrated in the highland zones (Ndenecho, 2007); Fokou (2018).

3.3 Methods of exploitation and use of biodiversity resources for traditional health care delivery in BNSDs

The methods of exploitation of biodiversity resources for traditional health care delivery depend on disease prevalence, resources available, their sources, expertise and indigenous knowledge of the people (Table 3). The population has diverse acuities on the major aspects of exploitation and use of biodiversity resources for traditional health care delivery in BNSDs.

Table 3: Population perceptions of biodiversity resource exploitation for traditional health care delivery

Major determinants	**Frequency**	**Percentage**
Biodiversity resources for Traditional healthcare		
Plants only	58	28.3
Plants & animals	147	71.7
Total	205	100.0
Sources of medicinal plants		
Ijim Forest	58	28.3
Around the compound	58	28.3
Herbal gardens	89	43.4
Total	205	100.0
Indigenous knowledge on Disease prevalence		
Common illnesses	115	56.1
Rare diseases	90	43.9
Total	205	100.0

Source: Field Survey (2020)

The population (71.7%) accepted that a combination of plants and animals are exploited and used for traditional health care delivery. This is due to the fact that most of the herbalists produce medications concocted with plants and animal parts for the healthcare purposes. On the aspect of the sources of these resources, 43% is gotten from medicinal gardens. This is seen in the increase of modern practice and involvement of multiple persons engage in the development of their medicinal gardens since proximity to the Ijim forest is difficult. On the indigenous knowledge on disease prevalence, 56.1% of practices are to treat the diseases common in the population. With the involvement of external actors, more species have been discovered. There are different ways in which these plants and animal resource are exploited and used in traditional healthcare delivery. This is in line with Harold (2015) who attested that biodiversity resources are exploited from the wild, processed in different ways and used in the healing of diseases through decoctions, concoctions, incantations and sorcery as well as ritual practices. These practices vary in the study area (Fig. 4).

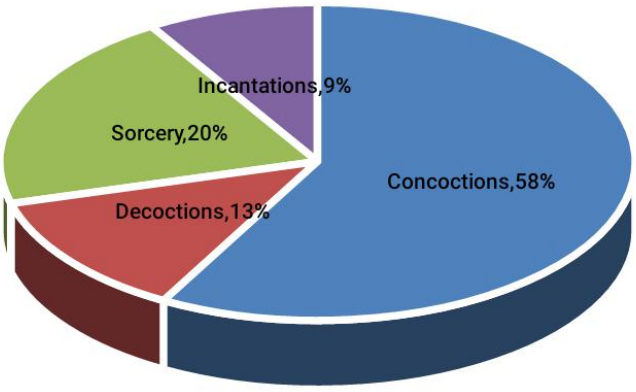

Fig.4: Methods of BE and use for THD in BNSDs

Source: Field Survey (2020)

Concoction is the highly (58%) used method implored in the exploitation of biodiversity resources for traditional health care delivery. This is accounted for by the fact that it is a tradition of the indigenous people of these areas that a single herb or animal part cannot provide the required services in the healing of a particular disease.

It must be combined and concocted with other ingredients before it is up to the standard of delivering the required traditional health care delivery services. All the traditional health care practitioners and other stakeholders in the sector believe that the strong owners of traditional medicine in the study area possess magical powers and rich indigenous knowledge. This is reflected in concoction practices of diverse plant and animal ingredients to deliver healing services to the population. Incantations is the least proportion (9%) due to the fact that this method is reserved for some particular herbalists who are noted for handling spiritual problems with mystical powers of sorcery to commune with their gods to intervene for spiritual diseases. These methods are used by different traditional health care Practitioners in different ways (Table. 4).

Table 4: Activities of traditional health care practitioners in the exploitation methods of biodiversity resources for THD

Method used	***Category of practitioner***
Concoction, decoctions	Plant peddlers, traditional pharmacists
Rituals and incantations	Priest and pretests
Concoctions, decoctions, Rituals	Plant peddlers ,traditional pharmacists ,priest and pretest
Rituals	Priest and pretests

Source: Field Survey (2020)

Apart from spiritual attacks and mental disorder which is managed exclusively by traditional priests using rituals, most of the diseases are cured by plant peddlers and traditional pharmacists using decoctions and concoctions. These practitioners of herbal medicine use mainly herbs and medicinal plants parts like roots, stems, leaves, tree barks, flowers, fruits, and seeds in their treatments. Some herbalists sometimes add animal parts (small whole animals or parts, and insects) and mineral substances. Such herbal preparations are prepared in different forms. They can be in powder form for internal and external applications, liquid form as infusion or decoction, pastes and sauce. This was mentioned by Safowora (2008) that the exploitation of biodiversity for traditional medicine practice take the forms of therapies in herbal medicine, massage, homeopathy, mud bath, music therapy, wax bath, reflexology, dance therapy, hydrotherapy, mind and spirit therapies, dieting, spinal manipulation, psychotherapy, bone setting, delivery by traditional birth attendants, circumcision by traditional surgeons and traditional medicinal ingredient dealers.

3.3.1 Exploitation and use of biodiversity resources through concoctions

This is a method used by herbalists which involves the use of a combination of medicinal plants and animals and minerals that are cooked together to extract the medicinal properties. Most diseases handled are those associated with internal problems such as stomach problems, delivery complications, infertility problems, dietary, stress and sanitation. The patients are healed after drinking the concoctions by respecting a particular prescription in quantity daily evaluated in terms of glass cups. Most prescriptions respect the three times daily order after each heavy meal and abstinence from alcoholic drinks. Water borne diseases like typhoid is treated with the consumption of two or three containers of a 5 litres concoction made from a mixture of several boiled herbs. Many patients diagnosed with typhoid in laboratories of modern hospitals avoid the modern treatment and consider it as a waste of time since they believe only the traditional health care delivery can treat it to the full. These concoctions can be applied to patients through inhaling. Through this method, the patient is covered with a thick blanked and the vapour from the boiled herbs is inhaled by the patient leading to healing since it facilitates sweating. Malaria is one of the diseases that is healed through this method. In some cases, fried concoctions are mixed with castor oil and are injected into the patient with the use of a razor blade. This is very common with diseases that are linked to the bone as well as swollen parts of the body, spiritual attacks general body pains, side pains and body fortification from evil forces. This method is highly criticized based on the unhygienic nature. The herbalists who mostly use it do it in dirty environments without cleaning their hands or sterilizing the blades. This can to an extent contribute in the transmission of diseases like HIV/AIDS. The modern hospitals testified to the high prevalence of this disease in this area.

3.3.2-Exploitation and use of biodiversity resources through decoctions

Decoction is a method used by herbalists where extracts from plants and animals are dried, fried, pounded or grind and is used for the healing of several diseases. There are modern and indigenous methods of preparing decoctions in BNSDs. The modern method is used by the St. Ann's Sisters of Fuanantui Convent. These sisters in their department of traditional medicine, hygienically process herbs cultivated in their medicinal gardens to cure illnesses like Pile, sexual weakness, skin care products,

stomach disorders and reproduction problems. Their method consist of grinding the well selected and dried plants parts in a modern grinding mill and then package the mixture in powder form for distribution. In the indigenous method, the herbs are harvested and dried. After drying, it is fried in a clay pot preserved in a container. These decoctions are then injected into patients' bodies using a blade. This is to empower the person traditionally against spiritual attacks and evil forces. In many cases, it is mixed with red oil or castor oil and consumed to cure stomach problems.

3.3.3-Exploitation and use of biodiversity resources through sorcery and incantations

The practitioners in this method are diviners or fortune tellers, who may be soothsayers and priests. They use supernatural or mysterious forces, incantations and rituals associated with the communities' ancestral beliefs. They receive telepathic messages, consult oracles, spirits guides and intervene where other traditional healers and modern medicine failed. Their activities include evoking of spirits, citing and singing of incantations, making invocations and preparing fetish materials to appease their gods. The guide to treatments used by these practitioners includes magic stones, cowries, kola nut, divining rods, key or sticks which are usually thrown to the ground for interpretations. Sounds or shapes produced are read and interpreted. Some take replies of messages in a pool or glass of water and palm wine. In this method the exploitation of biodiversity resources are used in illnesses associated with spiritual attacks and protection manifested by traditional doctors in their healing sanctuaries. Some of the diseases cured through this methods include curses resulting from acts like theft, problems of sterility and spiritual attack. The different components of the biodiversity resources when put together and incantations and sorcery are performed on them, can determine the exact cause of an illness. This traditional method of determining illnesses is very common among the herbalists in the zones with differences based on the experience and sources of inspirations.

IV. ANALYSIS OF TRADITIONAL HEALTH CARE PRACTITIONERS AND TRADITIONAL HEALTHCARE DELIVERY

The traditional health care practitioners are unequally distributed. The spatial distribution of tradi-practitioners depicts high percentages in Njinikom and Anyajua (Fig. 5).

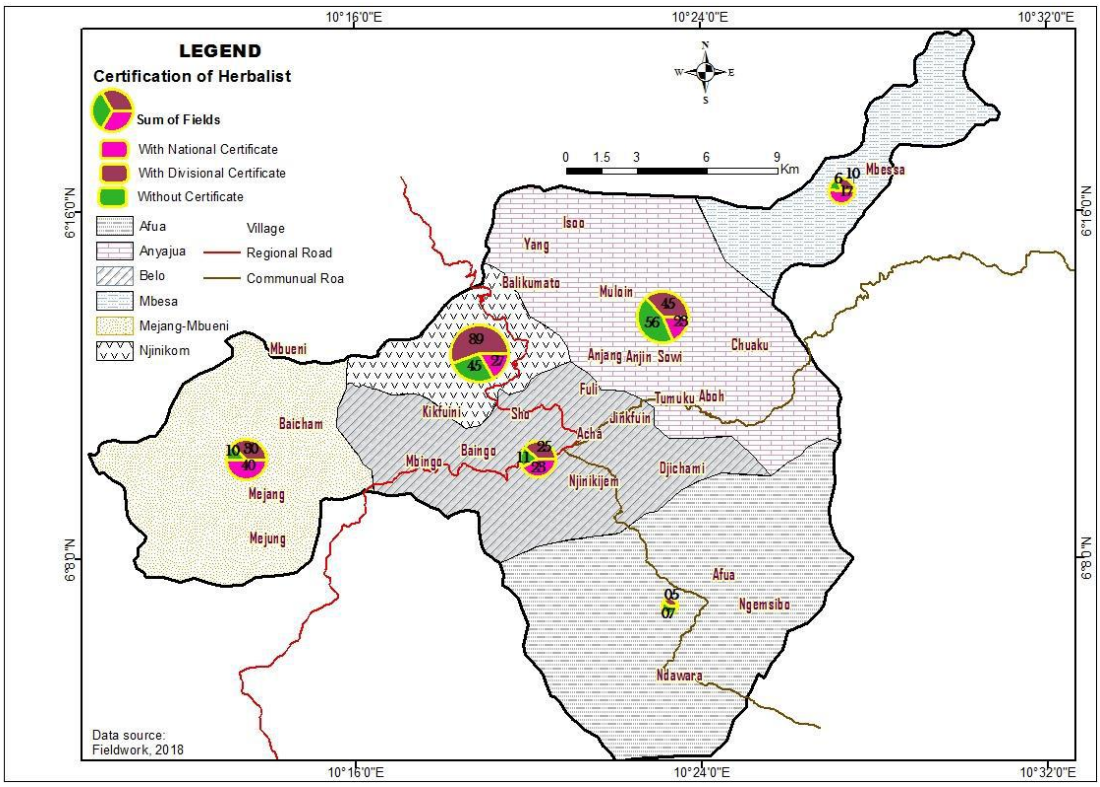

Fig.5: Distribution of the tradi-practitioners in Belo and Njinikom Sub-Divisions

Source: Field Survey (2020)

The high degree of concentration in the Njinikom zone is due to the high population and demand for health care delivery services. There is a Modern Catholic Hospital whose services offered are considered very expensive by the local population. They prefer the cheap traditional health care delivery services known for treating diseases like typhoid which the modern hospitals do not treat fast and fully according to the local population. The case of Anyajua is accounted for by the fact that this zone is closer to the Ijim montane forest reserve. This has contributed to high proximity and easy accessibility to this reserve where most of the resources exploited for traditional health care delivery are highly concentrated. Apart from the distribution of the traditional health care practitioners, there are institutions practicing traditional medicine using modern and conventional practices presented in table 5.

Table 5: Local institutional framework in the exploitation of biodiversity resources for traditional health care delivery in BNSDs

Name of institution	Year of creation	Mission (Scope of Activities)
BERUDA	1997	Treatment of Typhoid, Haemorrhoids and honey production
MIFACIG	2013	Cultivation and sale of Medicinal Plants. Production and sale of honey and bee wax.
CDVTA Herbal Ointment Group	1998	Production of Herbal ointment for the treatment of Arthritis, joint pains and swollen legs
Dr. Mbukibam's clinic	2008	Haemorrhoids, Malaria, Typhoid, Gynaecological problems
Dr. Nkainmbong's clinic	2007	Treats Cancer, Gynaecological problems and Hernia
St.Ann's Herbal Medical Centre Fanantui	2005	Treats cancer, sexually transmitted infections, trains tradi-practitioners
Njinikom Wellness Centre	2007	Treats cancer, Typhoid, Haemorrhoids, Swollen legs, malaria, Musong.
Dr. Ngong's	1985	Treatment of Cancer and
Herbal Clinic		Musong.
BERUDA Njinikom	1997	Treatment of malaria, and honey production
CDVTA Herbal Ointment Group	1998	Production of Herbal ointment for the treatment of Arthritis, joint pains and swollen legs, production and sale of Honey and bee wax and train practitioners

Source: Field Survey (2020)

These institutions are mostly concerned with the treatment of indigenous illnesses and health complications in the population. Some of them are involved in the training of practitioners in modern traditional medicine practice like BERUDA, CDVTA and the St. Ann's Medical Centre that have trained interested persons in the production of herbal ointment especially women. Some are trained to cultivate medicinal gardens and work in collaboration with other structures and tradi-practitioners coordinated by the St Ann Sisters of Fuanantui and the Franciscan Sisters of Njinikom. Considering that the exploitation of biodiversity resources for the treatment of diseases is an important source of health care for the populations of these areas, a large variety of diseases are treated in varied zones (fig 6).

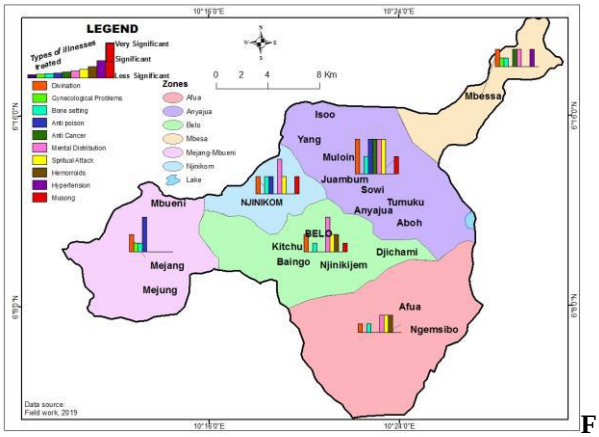

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Fig.6: Patterns of diseases treated through traditional healthcare services in BNSDs

Source: Field survey (2020)

Illness linked to spiritual attacks, internal disorders and body complications top the list of diseases in BNSDs. This is common especially in Mbingo, Mujung, Mejang-Mbueni Njinikom, Muloin, Anyajua, Yang and Belo areas. Spiritual attack is linked to the high prevalence of black magic, cultic societies and the breaking of

ancestral laws. This is also attributed to a strong attachment of the people to their tradition and custom. Internal problems linked to infertility are also attributed to deviations from some traditional norms and lack of modern health care attention to birth related problem in the community. Some diseases like asthma and pile are diseases that members of the community do not attribute to be related to biological prescriptions. They have artificial causes that can easily be managed at home without visiting a traditional doctor. Other health problems easily cured include snake bite, stomach problems, headache, diarrhoea, dysentery, typhoid and broken bones. The traditional health care practitioners are unique in the methods of biodiversity resources exploitation for traditional health care delivery, modern or orthodox and certified or non-certified as confirmed by Ajay (2009). However, their differences lie in the interests, level of education, hygiene practices and the state of their medication. There are variations in the number of patients that visited the modern traditional health care delivery institutions from 2012 to 2018 (Table 6).

Table 6: Patients treated in modern traditional healthcare institutions from 2012-2018

Name of institution	2012	2013	2014	2015	2016	2017	2018	Total
St. Ann's Herbal Centre	800	1150	1012	1163	1500	1540	400	7565
Njinikom Wellness Centre	-	-	275	304	323	355	205	1462
Dr. Ngong's Clinic	260	273	375	460	465	490	50	2373
BERUDA-Njinikom	305	319	308	411	348	364	257	2312
CDVTA's Belo	635	685	700	710	747	750	600	4827
BERUDA- Belo	750	763	775	801	845	800	1000	5734
MIFACIG	111	123	125	143	145	150	/	806
CDVTA's Njinikom	710	783	800	827	855	875	950	5800
Dr. Mbukibam's Clinic	315	345	362	383	401	520	665	2991
Dr. Nkainmbong's Clinic	305	319	308	411	348	364	286	2341
Total	4191	4760	5040	5613	5977	6008	4413	36211

Source: Field Survey (2020); St Ann's Sisters of Fuanantui (2018) and BATHAFAA (2019).

A total of 36211 patients visited the modern traditional medicine institutions in BNSDs for healthcare from 2012 to 2018. The temporal trend indicates most of the patients visited these institutions in 2017 (6008 patients). The highest number of visits recorded this year was due to the increasing number of human casualties brought about by the deepening Anglophone crisis. The difficulties brought by this crisis made the inhabitants to be unable to afford for modern healthcare services thereby soliciting traditional medication which is considered less costly. However, there was a drop from 6008 patients in 2017 to 4413 patients in 2018. This drop in accounted for by the fact that the Socio-political crisis has seriously affected this area making movement very difficult for people to access these facilities. The least number of patients (4191 patients) visited these institutions in 2012. This low visit is explained by the fact that some of these traditional clinics were not yet renowned and people were not aware of the services they offered (MINSANTE, 2020). This is the reason for the steady increase in the number of visits of the patients till 2017.

The St Ann's Herbal Medical Center received the highest number of patients (7565 patients) compared to MIFACIG with only 806 patients. This is still linked to the socio-political crisis in these areas. The former facility is found in Njinikom Sub-Division while the latter is found in Belo Sub-Division. This crisis negatively impacted Belo first by grounding all the activities in the area including the activities of MIFACIG which had long closed its services to the public. For the case of Njinikom, the St Ann's Medical Herbal Centre offers a variety of modern healthcare services that the populations highly solicit. It should be noted that this is the best modern traditional herbal institution in the study area in terms of laboratory, sanitation, effectiveness and the number of services offered.

V. CONCLUSION

The exploitation of biodiversity resources for traditional health care delivery in BNSDs is considered as a major healthcare delivery system to the entire population

of the different zones. Considering the varied biodiversity resources in BNSDs and the fact that traditional medicine is as old as these communities themselves, several methods are used for the curing of different illnesses. Traditional healing practices through concoctions, decoctions and ritual practices are the major activities through which biodiversity resources are exploited and used for traditional health care delivery in BNSDs as supported by Rayan (2014); Tara (2015); Lewis and Mayor (2007). This is founded in the interactive and holistic national and local legal and institutional frameworks for the practice of traditional medicine. The diseases treated by the traditional health practitioners (orthodox and modern medicine) and particularly herbalists are those linked to epidemiological patterns, distribution of biodiversity resources and indigenous knowledge. The traditional health care delivery services are determined by healthcare accessibility hinging on the natural environment, cultural beliefs, level of education and the level of incomes of the population. This study posits that if the state, modern hospitals and traditional health care practitioners holistically find common ground through collaborative agreements, such issuant and commonplace signatures would continue to support the current shady health care tragedy which is as a result of the standard of living of the population and certain local beliefs. It shall be beneficial to advantaged communities where some indigenous diseases still portray dreadful hallmarks and remain a nuisance to the population. The people are so attached to the traditional health care delivery systems whose results is recorded in the communities over several decades such as the successful treatment of diseases like typhoid. Even in purely urban areas where modern health care services dominate, patients avoid modern hospital treatment of diseases like typhoid. Traditional health care delivery remains a very important complement to modern health care and vice versa. Today several traditional health care practitioners demand modern health laboratory test results before making prescription to their patients. The proof of treatment is also done through a modern health laboratory test recommended at the end of the treatment period. This is an important aspect of collaboration which cannot be neglected.

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