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Digitization of indigenous knowledge on forest foods and medicines

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Abstract

This paper discusses the digitization of indigenous knowledge on forest foods and medicine for the effective management of Ghana's forest resources. The paper is based on a survey conducted in nine communities in Ghana where primary data were obtained from 606 respondents using in-depth face-to-face interviews. The aim of the study was to assess what knowledge local communities had about products of the forest especially indigenous forest foods and medicine. The findings reveal that local communities have an in-depth knowledge of indigenous forest foods and medicines. They are conversant with what foods and medicines are available in the forests, how they are consumed and when they mature. The study reveals that consumption of indigenous forest foods is on the decline, while the use of traditional medicine is on the ascendancy. The study recommends the promulgation of laws and legal instruments to protect communities from bio-piracy.

Keywords

Digitization, forest foods, indigenous knowledge, indigenous knowledge systems, traditional medicine

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Introduction

Indigenous knowledge (IK) refers to the knowledge belonging to a specific ethnic group that is unique to that ethnic group, society or culture (Boven and Morohashi, 2002: 12). According to Grenier (1998: 6), indigenous knowledge is understood to be the traditional knowledge of indigenous peoples which is oral in nature, usually transmitted from one generation to the other and exists mostly in the minds of local people. The medium of transmission is usually through personal communication and demonstration and can be from tutor to the pupil, or to the apprentice and/or from parents to children (Christian, 2009: 3).

IK is an essential resource for the developmental process. Its application plays an essential role in

the lifestyle of members of the local community (Christian, 2009: 6). Christian (2009: 9) reports in his study on digitization of traditional medicine in Nigeria that IK is predominantly tacit and is embedded in the practices and experiences of its holders. He explains further that within the local environment, IK forms the basis for decisions pertaining to food security, human and animal health, education, natural resource management and other vital activities. In Ghana very little attempt has been made to

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collect, process and digitize indigenous knowledge by libraries. Ghana therefore stands the risk of losing its traditional indigenous knowledge if no effort is made to preserve it.

This paper reports on a study undertaken by some researchers of CSIR-Forestry Research Institute of Ghana (CSIR-FORIG) to assess the level of knowledge of local people on forest foods and medicines in some local communities in Ghana and discusses the digitization of the foods and medicines identified. The aim of identifying this knowledge was to document and digitize it in order to preserve and make this valuable local knowledge accessible to all. The study was undertaken in forest fringe locations where most of the populations depend on the forests for their livelihoods and general well-being.

Digitization of indigenous knowledge

Because IK is the knowledge of an indigenous community that has accumulated over generations of living in a particular environment (Gorjestani, 2000), it is important for researchers to pay attention to its preservation for posterity. This becomes more critical when one considers the fact that this knowledge includes all kinds of scientific, agricultural, technical and ecological knowledge, including cultigens, medicines and the rational use of flora and fauna (Daes, 1993).

Battiste (2005: 5) in a study on aboriginal life and education in Canada, reported that indigenous knowledge of the environment was being lost in communities around the world, giving rise to the urgent need to conserve and help develop mechanisms to protect the earth's biological diversity. The need to protect IK was also recognized by the United Nations Convention on Biological Diversity. This UN agency recognizes IK as a valuable contributor to the sustainable development of local communities which needs to be preserved (Clarkson et al, 1992: 77).

The rapid loss of IK within communities is therefore a cause for concern and failure to find solutions to this could actually compound the problem of knowledge loss. Reasons adduced for the rapid loss of knowledge within communities are that IK is always passed on by word of mouth from one generation to the other and disappears once the older generation passes away (Grenier, 1998: 6). Also, IK is being lost as a result of changes in taste that are being introduced from other cultures (Mohamedbhai, 2013). For these reasons, it is imperative for IK Systems in Africa and elsewhere to be studied, collected, documented, and protected where necessary and then widely disseminated to promote development (Mohamedbhai, 2013).

In recent times, there has been a growing tendency for governments in the Sub-Saharan Africa region to pay close attention to indigenous knowledge systems and to develop mechanisms to incorporate them into sustainable development initiatives (Jaya, 2006: 2). For these programmes to be effective and provide the necessary impact, there is the need to develop a framework within which these digital initiatives are implemented (Jaya, 2006). According to Swanepoel, (2008) digitization initiatives are driven by a variety of motives, two of the most common being for preservation and enhanced access. The digitization of indigenous knowledge on forest foods and medicines which is the key focus of this study is situated within the framework of digital preservation of local knowledge (Parry, 2014:3–4) with the aim of preserving the knowledge and enhancing its access. Within this framework, the scope, standards and responsibilities for creating and maintaining the digital collection has been defined.

Scope

The collections to be digitized consist of knowledge residing in the minds of local people and do not include any other resource from any other source. In addition the digitized knowledge is limited to IK gathered from the selected communities only and covers only plant foods and medicines.

Standards

The digitization process takes cognizance of digital standards available such as metadata, database architecture and software standards.

Responsibilities

The database group which is part of the research team has oversight responsibilities of the digitization process and endeavours to follow all rules and regulations that may be developed to manage the process.

Knowledge exchange

Contribution of knowledge by researchers is encouraged but all local knowledge contributed must be validated.

Libraries are currently faced with the difficult task of managing IK material, storing them and making them available to users (Parry, 2014: 2). It is important for libraries to consider the use of digitization to preserve IK in order to prevent it from becoming extinct. This study considers digitization as an option for the preservation of traditional knowledge on forest foods and medicine which is considered to be a global

Intellectual Property (IP) issue (WIPO International Bureau, 1999: 2). IK can only be protected intellectually if it has been identified, collected, documented and preserved.

Digitization is the process used to capture an analogue signal into a digital form (Bandi et al., 2015: 333). It involves the making of an electronic version of a 'real world' object or event, enabling the object to be stored, displayed and manipulated on a computer and disseminated over networks and/or the World Wide Web (Bandi et al., 2015: 333).

According to Akinwale (2012: 4), digitization processes are often based on two main perspectives which are library-oriented and cultural heritage-oriented approaches. He espouses that the first perspective portrays digitization in terms of the system of knowledge in relation to digital libraries, while the second perspective is primarily based on communication of memory. No matter the perspective selected, IK is still treated as a literary material, even though it differs greatly from western knowledge (Anyira et al. 2010). The processing of IK as a literary material within library and information circles especially in Africa is almost a new phenomenon. In Ghana, the processing of IK as a literary material is almost non-existent. However in some countries such as Australia, major efforts have been made to preserve IK in accessible forms through the recording and documentation of the knowledge, so as to assist in its easy retrieval (Nakata and Langton, 2006: 10). With advancement in the use of information and communication technologies (ICT), a range of new opportunities is now available for processing this unique form of knowledge. The major challenge for library and information professionals is usually with the ability to recognize traditional knowledge as a distinct system of knowledge that requires handling and management regimes for its materials that are different from those applied by the western system of knowledge management (Nakata and Langton, 2006: 7).

There are many types of IK systems, but one of the most familiar systems is typically referred to as the Indigenous Ecological Knowledge (IEK) system. In this system of knowledge, locals have an intricate understanding of their environment which includes the land, its plants and animals. The local people live off the resources of the land, many of which are located in forests. The importance of forests to these people can therefore not be undervalued.

Forests worldwide are storehouses of ecological treasures (Arnold et al., 2011: 259) and in Ghana local people living in forest fringed communities depend on the treasures stored in these forests for their survival. The World Bank Group (2013: 2) reports that an

estimated 1.6 billion people around the globe depend on the forests to some degree for their livelihoods. In Ghana, forests provide livelihoods to 15% of the population (3.6m people out of 20m people in 2012) (Kpelle, 2012: 5) who depend on them for food, medicines, fuel wood, snails, mushrooms, local building materials and many others. Indeed out of 3725 higher plants known to grow in Ghana, about 2300 are found in the high forest zone, including 730 tree species (Ministry of Lands and Natural Resources, Ghana, 2012: 3). This rich biodiversity has a wide variety of uses including foods and medicines. Forest foods are important in the diets of people because they are rich in micronutrients and fibre but low in fats and sugars (Arnold et al., 2011: 259). Their consumption according to Arnold et al. (2011) can play a major role in food security and human health. The forests also harbour medicinal species that are used in treating various ailments by local people. In fact many companies exploit the knowledge communities have on medicinal properties of forest species for economic benefit. Forests and tree-based agricultural systems also provide direct and indirect ecosystem services that make essential contributions to human livelihoods and well-being (Knowledge and Learning Group, 2004). Many of the people who depend on these forests for their well-being live in rural communities.

Benefits of documenting and digitizing forest foods and medicine

Several benefits of digitization have been identified worldwide (Holmes, 2015; Sabbagh et al., 2013). One major advantage of documenting, digitizing and preserving this delicate knowledge is that through digitization, wider dissemination of the knowledge is ensured (Christian, 2009: 11). More people can therefore gain access to this knowledge than previously. Also, it is easier to search through digitized content than it is to search through print media thereby reducing the time used in conducting such searches. Documentation and digitization of IK is also an effective tool for defensive protection from bio-piracy as well as the reduction in the misappropriation of indigenous knowledge without compensation by multi-national entities (Christian, 2009: 11; Nakata and Langton, 2006: 48). Several examples exist on the bio-piracy of indigenous knowledge by multinational entities worldwide in India, South America and South Africa (Avantika et al., 2015: 80; Bhattacharya, 2014: 50;).

Documentation provides evidence that a particular knowledge has developed in a particular local community, thereby vesting the community with claim

over such knowledge as well as the right to share in any profit resulting from the commercialization of the knowledge (Christian, 2009: 11). Other benefits include the long-term preservation of the resource, reduced costs of handling and storing the digitized material, and the ability to index and store the material in a document retrieval system.

Research problem

IK has caught the attention of policy makers and governments as well as international agencies worldwide due to its valuable contribution to rural development. IK is the knowledge base of any community and harnessing it is essential in the developmental process (Akinwale, 2012: 5). Ghana's forests are storehouses of valuable plant species that can be used for food, medicines and timber, just to name a few. However, in Ghana, the knowledge accumulated by local communities over many years is beginning to dwindle. So despite the value attached to IK, it risks becoming extinct in Ghana due to a lack of policy on it and inadequate methods of preservation in a complex and dynamic world. Policy makers, scientists and local communities in Ghana have made very little effort at comprehensively documenting indigenous knowledge, especially on indigenous foods and medicines. Neither has there been any comprehensive policy or attempts at digitizing this knowledge using ICTs. Some documentation has however been made on some herbal drugs in Ghana (Ministry of Health, n.d.). In order to prevent the extinction of IK in Ghana, it is important to assess the knowledge that local people have on indigenous forest foods and medicines, collect, document, digitize and store them appropriately. We can learn from countries such as Venezuela, India and China that have compiled digital databases, inventories or registries of traditional knowledge over many years (Nair, 2006: 3; Swanepoel, 2008: 7).

Objectives of study

The main objective of the study was to assess what knowledge local communities had about products of the forest especially indigenous forest foods and medicines. The specific objective was to identify, capture, document and digitize indigenous knowledge on forest foods and medicines in nine communities in Ghana.

Research methodology

Study area

The forest area of Ghana is estimated at 9.17m ha accounting for about 40% of the total national land

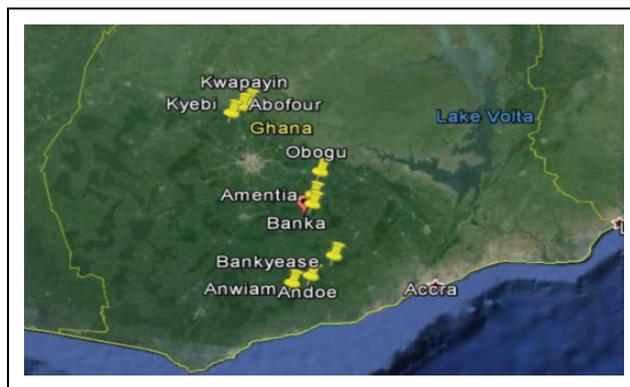


Figure 1. Map of Southern Ghana showing the study communities (Source: Google Earth, 2015).

(Agyarko, 2001: 6). The forests have been classified on the basis of ecological conditions which put the Closed Forest Zone area at 8.1342m ha, Transitional Forests at 1.036m and the Savannah Forest Zone at 14.66m ha (Agyarko, 2001: 6). The original closed forest cover of approximately 8.2m ha which the country had at the beginning of the 20th century, has due to several factors including unsustainable agricultural practices, illegal logging, illegal mining and deforestation among many others dwindled and only an estimated 1.5m ha of 'intact' closed forest now remain (Agyarko, 2001: 6). The vegetation is divided into the high forest zone in the south, which accounts for roughly 30% of the land area and the savannah zone in the north, accounting for the remaining 70%. The high forest zone is well known for the high value of wood species and non-timber forest products of commercial importance that it stores (Agyarko, 2001: 6). To ensure that the research team would have access to information on as many species as possible, the study was confined to the southern sector of the country where a greater majority of the forest reserves are located.

The study was conducted in one municipality and two districts of Ghana, namely Offinso Municipal, Asante Akim South District and Assin South District respectively. The municipality and districts were purposively selected to represent different ecological zones. The ecological zones represented were the dry semi-deciduous, moist semi-deciduous and the moist evergreen vegetation zones in the southern sector of the country. A total of nine communities, three in each forest zone, were randomly selected and surveyed (Figure 1). The communities studied were Kwapanin, Kyebi and Abofour in the Offinso Municipality; Amantia, Obogu and Banka in the Asante Akim South District and Bankyease, Anwiam and Andoe in the Assin South District.

Data collection methods

Data for this study was collected by conducting in-depth interviews through the administration of questionnaires. In addition to this, three validation workshops were organized in the three ecological zones studied, while the observation method was used during all stages of the study.

In-depth interviews

Primary data were obtained from in-depth face-to-face interviews conducted among 606 respondents resident in the nine communities using questionnaires. Bio-data of respondents were collected in addition to information on forest foods and medicines they were familiar with. The questions posed were open ended and sought their knowledge on the type of forest foods and medicines available in their locality. Other information sought included the phenology of the plants, quantities available, period of availability, uses of the species, parts used and ways of preparing the different species for food or medicine. After collection, the data were processed in the office and validated using published literature and expert knowledge from researchers at CSIR-FORIG. After that the processed and partially validated data were sent back to the communities where very knowledgeable members of the nine communities participated in a validation process.

Validation workshops

Three validation workshops were organized for key informants and knowledgeable participants in the three selected districts/municipality. One workshop was organized in each zone and consisted of participants from all three communities studied within each zone. The aim of the workshops was to validate the data that had been collected by bringing the key informants from each zone together so that collectively they could certify if the data that had been collected were correct.

In the Asante Akim South District, a total of 42 participants participated in the workshop whilst 28 participated in the Offinso Municipality and, finally, in the Assin South district 34 participants were selected from the three communities.

A PowerPoint presentation which included all the species named, their uses, parts used either for food or medicine and their images was shown to participants. Participants in these communities were asked to confirm whether the uses that had been listed for each of the different species were correct and to certify whether the images captured duly represented the species. Feedback from participants indicated that the

project was on course as over 95% of information we had gathered was correct. Additions and omissions were noted and corrected at a later date. The whole process proved to be a learning process for both the researchers and participants. Participants attended the workshops out of their own free will and spent the greater part of the day responding to queries and making valuable suggestions to improve the data. The workshops were cordial and relaxed, full of goodwill and camaraderie from both participants and researchers.

Findings of the study

The findings reveal that 25% of respondents consume forest foods on a regular basis, being a significant component of their diets, while 34% use them less regularly and about 41% consume them occasionally. These figures represent a gradual decline in consumption in the communities because many of the trees that yield these foods have been cut down by illegal timber operators, and are therefore not available for collection. The few that are available are also located so far away that respondents have to walk long distances in order to gain access to them. Also the decline in consumption could be attributed to the changing culinary tastes of local people, especially the younger generation. The opposite is however true of medicinal plants where the percentage of those who use traditional medicines is higher than those who do not. About 60% of respondents use it regularly, 30% use it occasionally, and only 10% use it sparingly.

Species identified

A total of 289 different species were identified in the study. Of these 90 species were identified as forest foods and 199 as medicinal plants. However, the scientific names of seven out of the 90 species could not be identified in the laboratory. Of these 90 species 43 were identified as food products only, while 47 species were identified as foods that had medicinal properties. There were some differences in knowledge and use of forest foods among the study communities with respondents from Asante Akim mentioning the highest number of species of 73, followed by Offinso Municipal with 63 species and Assin South District which had the least number of 61 species. Images of some species are shown in Plate 1.

Though 90 species were identified in the nine communities as forest foods, it is possible that more species may have been overlooked, forgotten or unavailable at the time of the survey. Inadequate time and finances were some reasons why more communities could not be surveyed to unearth more species.

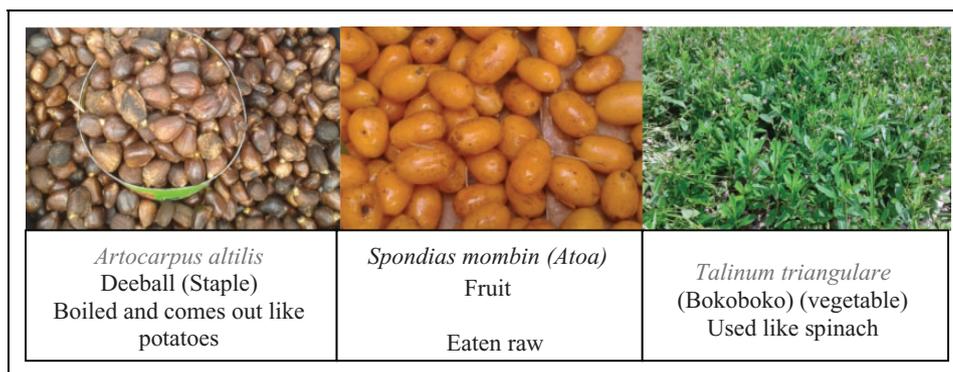


Plate I. Images of some food species.

Source: Field survey.

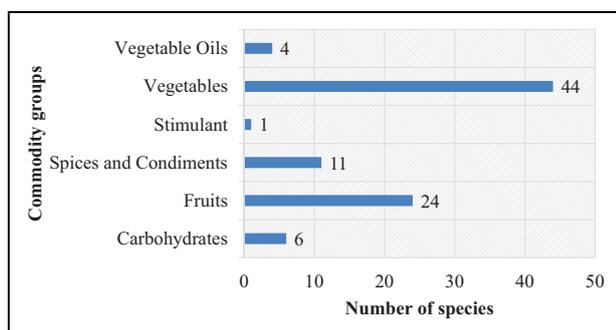


Figure 2. Categorization of forest food species into commodity groups using Plant Resources of Tropical Africa categorization (PROTA).

The plant commodity group categorization used by Plant Resources of Tropical Africa (PROTA) together with the FAO food categorization was adapted and used to group the forest foods. The adapted groups used were ‘fruits’, carbohydrates, vegetables, vegetable oils, spices and condiments and stimulants (Figure 2). The results show that the forests of Ghana harbour valuable resources that need to be assessed and promoted for livelihood development.

An impressive 199 species were identified as medicinal plants (Figure 3). Information received from the respondents revealed that these medicinal plants can be used to treat 121 different types of ailments ranging from skin diseases, snake bites, malaria, coughs and headaches just to mention a few.

Creation of an online database

An online database has been created using DRUPAL a free, open-source web content management platform. The database is online and can be found at <http://csir-forig.org.gh/tikfom/>. The site is still under construction but will be fully published in the shortest possible time. The database presents valuable information on the species identified. All the food

categorization groups are duly represented in the database. In essence, users will be able to find those species that are fruits or those that produce fats and oils, carbohydrates, spices and condiments. For each record on a species, the following fields are included: local/traditional name(s), scientific name, family name, and uses of species, as well as brief information on the seasons when they are available. A digital image of each species is also included in the database. Users can search for particular species in the database by querying the scientific or local name. Alternatively users can browse through the listed species and click on the species of interest. See Plate 2 for a screenshot of the database.

Challenges in preserving indigenous knowledge

Challenges identified by the research team in the collection and management of IK include language barriers, funding, technological challenges, and intellectual property rights.

Language

Language is a major factor in the collection and preservation of IK (Settee, 2008: 2). It is at the heart of culture and knowledge retention and can either be a barrier or a unifier depending on how it is used. In this study, though all the communities visited were Akan (a local language in Ghana) speaking communities, differences existed in dialect resulting in specific plant species having different local names in different localities. Gathering or collecting indigenous local knowledge is an expensive enterprise but it is more expensive when translation from a local language into English or identifying the appropriate scientific names for the local plant species to enable preservation has to take place. It becomes even more costly when errors occur during the translation process and also when considerable time and effort have

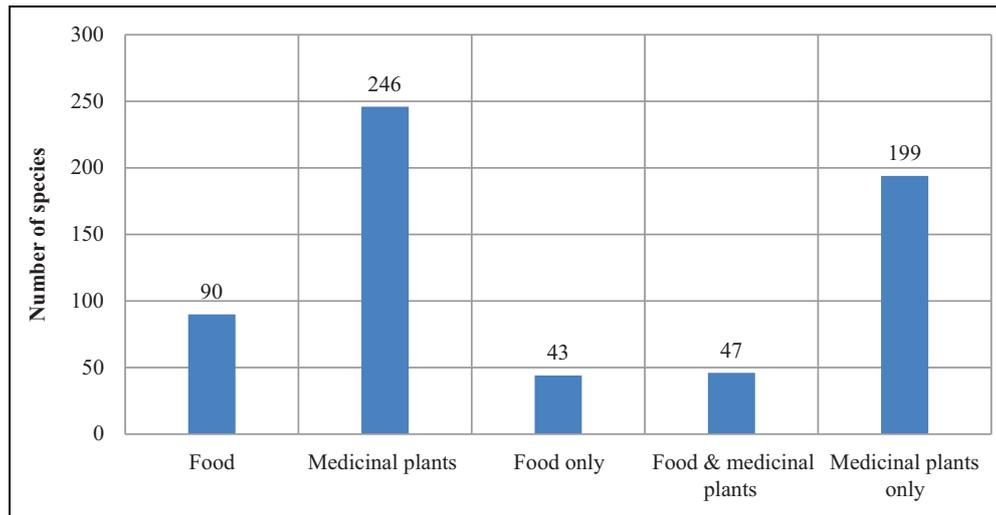


Figure 3. Number of species that can be used for forest foods and medicinal plants.

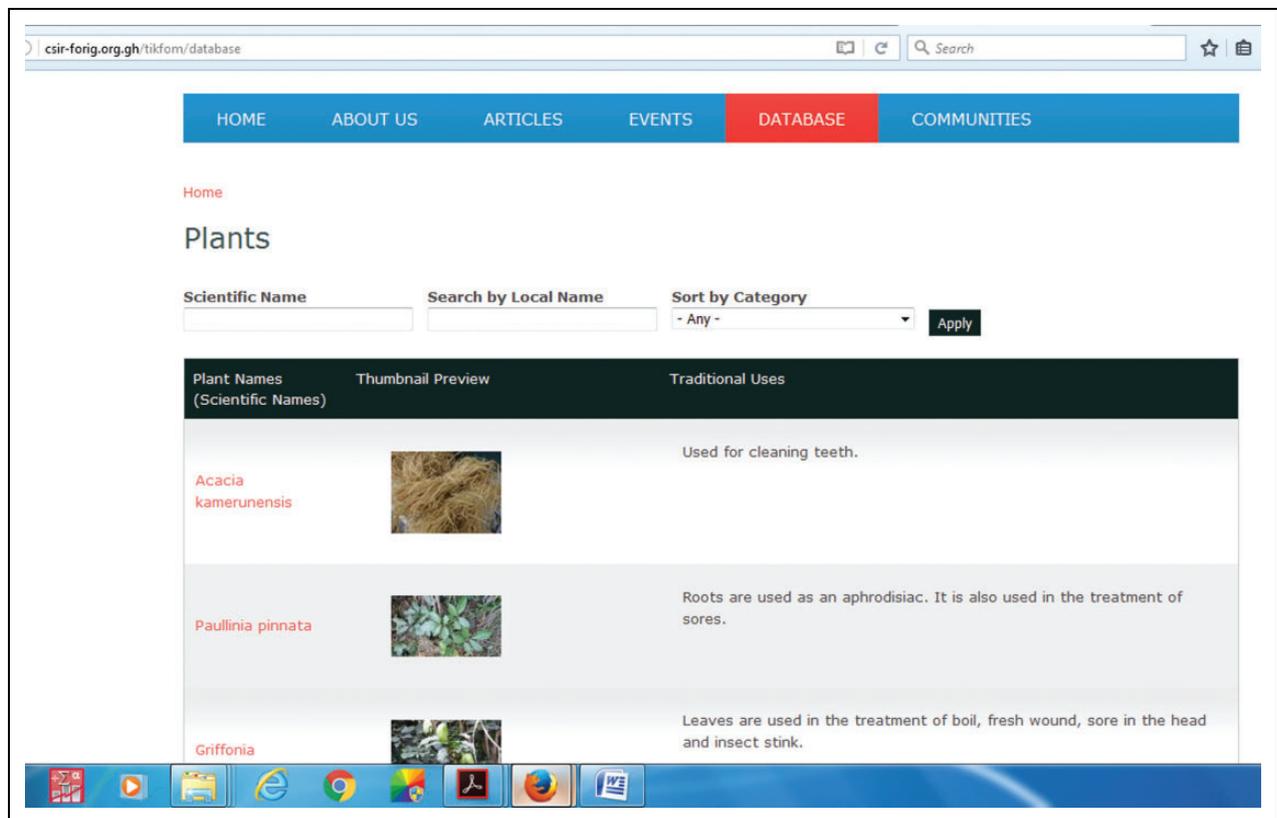


Plate 2. Screen shot of indigenous knowledge database.

to be used to correct it. Language is the most fundamental way that cultural information is communicated and preserved so getting enumerators who understand the local language is an important factor that needs to be determined. When using the local language to transmit IK, it may be helpful to manually record it in order to avoid adulteration of the original information. Some interactions with the local community (focus group discussions) were recorded. The research team in this study did not

come across any documented evidence aimed at preserving IK in any of the nine communities.

Funding

Funding is a significant factor in the collection, processing, digitization and storage of indigenous knowledge. The major hurdle encountered and which was partially overcome during this study was the ability to fund the survey in all nine communities. Costs

incurred included but were not limited to transportation, accommodation and development of research instruments. This project fortunately had the financial support of Elsevier Foundation thereby reducing the financial burden. Funding is also an important factor in the recruitment and training of required staff. In fact, it is important for staff to be well trained when executing a digitization project such as this and for them to have access to the right equipment which comes at a high cost. The research team agreed on the creation of a database which would be made available online – also at a cost, since there was the need to pay for the services of a web/database developer, pay for Internet hosting and also subscribe to high speed internet access.

Technological challenges

Recent advances in technology have transformed the way information is managed and made accessible to relevant stakeholders. Digitization which is one option in the preservation of IK is the process of capturing analogue signals into a digital form (Bandi et al., 2015: 333). It is often used when diverse forms of information, such as text, sound, image and video need to be converted into a single binary code (Plockey, 2014: 28). Attempting to digitize IK is basically an attempt to create digital collections of oral knowledge that resides in the memories of elders, healers, midwives, farmers, fishermen and hunters throughout the world (Plockey, 2014: 27). Several challenges have been identified in the use of information and communication technologies for the management of information in general and IK in particular. The use of modern technologies comprising hardware, software and data formats used to create and store these digital collections are expensive due to the fast rate at which they become outdated. It is difficult therefore to keep up to date with the technological changes. There is the need to have up-to-date equipment – good scanners and cameras for image capture, fast and reliable Internet access and a registered domain for hosting the site. Also, human capacity to execute the project needs to be developed. Different categories of staff working on the project needed to be well trained so that they could operate professionally and competently. In line with this therefore, a three-day training workshop was organized for 13 librarians and information managers as part of capacity building.

Intellectual property and ethical rights

The preservation of IK comes with challenges such as intellectual property rights (IPR) and the ethics governing their use. IPR are mechanisms that are used to

protect individual and industrial “inventions” and which give patent-holders exclusive monopoly over their invention for a specified period of time (Grenier, 1998). IK on biodiversity however does not necessarily fall within the category of inventions described above. Thus communities are often on the losing side when it comes to the use of their biodiversity. Communities that live with and depend on biodiversity for their survival often do not have much choice in the appropriation of their IK. They often feel cheated and therefore refuse to co-operate with researchers when they approach them for support in their research endeavours. This study has shown that local people are vulnerable when it comes to the appropriation of their rich biodiversity. They have very little knowledge on how to protect their knowledge from exploitation neither do they have the resources to do so. It has also revealed that communities are losing their knowledge due to lifestyle changes and the inability to transmit information from the elders to the younger generation. In spite of the importance attached to IK worldwide, there is still no international consensus about how indigenous peoples’ rights on the protection of their cultural knowledge systems can be secured legally, promoted ethically and used resourcefully (Anderson, 2010: i). In spite of the considerable interest shown and concerns about the use of IK by external groups, there is still no consensus about how indigenous people’s rights to the protection of their knowledge systems can be secured, either within an intellectual property regime or through some other legislative or policy framework at the international or local level (Anderson, 2010). In Ghana, no legislation has been passed or developed to protect indigenous local knowledge. Local people must therefore be involved in developing appropriate frameworks for access and use of local knowledge in Ghana (Anderson, 2010: ii).

Conclusions and recommendations

This study has opened up significant gaps in the collection, processing and storage of indigenous knowledge in Ghana with special reference to forest foods and medicines. It is envisaged that indigenous local knowledge will be preserved digitally so that it does not become extinct. It is expected that the database will be consulted as the first point of call in the design and execution of relevant research work. It will be a useful tool in identifying and selecting forest species to be worked on by researchers, students, lecturers and civil society.

In countries like Canada and other developed economies, IK is being applied in such complex areas

as scientific, genetic and medical research and natural resource management in managing forests, coastlines and water bodies (Brascoupe and Mann, 2001; Grenier, 1998). This can also be done in Ghana, but only when the knowledge has been collected, processed and stored in an appropriate format.

This study has unearthed various valuable species that are beneficial to local people in particular and the wider community in general. However, knowledge on the uses of these plants resides in the memory of local people who disappear with this huge knowledge when they die. To prevent this from happening the following recommendations are being made.

1. It is important to harness the local IK within communities in Ghana and ensure their continuous existence through digitization. Indeed, apart from forest foods and medicines, there are a host of other benefits that can be derived from the forests of Ghana and so the necessary attention needs to be placed on other disciplines such as traditional building materials, traditional art and craft. The Ghana Government must systematically task relevant institutions to develop similar databases that would preserve the knowledge in the various disciplines for posterity.
2. The process of collection, processing, and digitization and storage of IK also comes along with some challenges. Some of these include funding. This study covered only nine communities in three ecological zones but was done at considerable cost. It is recommended that other communities be studied in ecological regions that were not covered in this study. Government must commit funding for any future study.
3. It is also important to be assured of the cooperation of local people when conducting the study. Once one has their confidence and they are certain the research is not for personal enrichment, they will open up on the knowledge they have. This can be done by establishing a working relationship with them, sensitizing them on the importance of the knowledge and educating them on the importance of negotiating with entities who may approach them for their information.
4. There are prospects for the development of livelihood activities based on natural resource development in Ghana. Future studies should therefore concentrate on the categorization of these natural resources in the various regions of the country and assess their potential for

development into livelihood activities. The livelihoods of local people can actually be improved if local resource that is prevalent in that local community is harnessed for development.

5. It is also important to bring out issues that need to be addressed by central government in the execution of such projects. So far, no legislative instrument has been identified in Ghana's laws concerning the management of IK. This research therefore recommends that the Government of Ghana should develop a policy document on IK usage and preservation that would address issues such as how local people can be protected from the exploitation of their knowledge and resources; what measures to put in place to ensure that local people are compensated for the information they provide; and how IK should be preserved and stored so that all stakeholders can have access to and benefit from it (Brascoupe and Mann, 2001: 6). The development of such a policy document should include but not be limited to government representatives, members of parliament, researchers, university lecturers and traditional people.

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Declaration of Conflicting Interests

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