UNDERUTILIZED SPECIES

POLICIES AND STRATEGIES

Analysis of existing national policies and legislation that enable or inhibit the wider use of underutilized plant species for food and agriculture in Ghana

Report

Presented by

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Council for Scientific and Industrial Research
Ghana, 2007

Commissioned by
Global Facilitation Unit for Underutilized Species (GFU)
Via dei Tre Denari, 472/a, Maccarese (Fiumicino), Italy

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Abbreviations and Acronyms

AAGDS	Accelerated Agricultural Growth and Development Strategy
AgSSIP	Agriculture Services Subsector Investment Project
AVRDC	Asia Vegetables Development and Research Centre
ADRA	Adventist Relief and Development Agency
AFRONET	African Forest Network
ARI	Animal Research Institute
ARS	Agricultural Research Station
BARADEP	Bamboo and Rattan Development Programme
BARNET	Bamboo and Rattan Network of Ghana
BNARI	Biotechnology and Nuclear Agriculture Research Institute
BRRI	Building and Road Research Institute
CSIR	Council for Scientific and Industrial Research
CBD	Convention on Biological Diversity
CRI	Crops Research Institute
CRIG	Cocoa Research Institute of Ghana
EDID	Export Development and Investment Fund
FASDEP	Food and Agriculture Sector Development Policy
FAO	Food and Agriculture Organization of the United Nations
FC	Forestry Commission
FSD	Forestry Services Division
FORIG	Forestry Research Institute of Ghana
FRI	Food Research Institute
FRNR	Faculty of Renewable Natural Resources
GDHS	Ghana Demography Health Survey
GDP	Gross Domestic Product
GFU	Global Facilitation Unit for underutilized species
GPRS II	Growth and Poverty Reduction Strategy
GSBA	Globally Significant Biodiversity Area
GTA	Ghana Timber Association
GTMA	Ghana Timber Millers Association

IFAD	International Fund for Agricultural Development
IGF	Internally Generated Fund
IITA	International Institute of Tropical Agriculture
ILCA	International Livestock Centre for Africa
IPGRI	International Plant Genetic Resources Institute
IRRI	International Rice Research Institute
ITTO	International Tropical Timber Organization
KNUST	Kwame Nkrumah University of Science and Technology
LUS	Lesser Used Species
MoESS	Ministry of Education, Science and Sports
MoFA	Ministry of Food and Agriculture
MLFM	Ministry of Lands Forestry and Mines
NARS	National Agricultural Research System
NGO	Non- governmental organization
NTFP	Non-Timber Forest Products
OPRI	Oil Palm Research Institute
PGR	Plant Genetic Resources
PGRRI	Plant Genetic Resources Research Institute
RELC	Research and Extension Linkages Committee
RTIP	Root and Tuber Improvement Programme
SARI	Savannah Agricultural Research Institute
STEPRI	Science and Technology Policy Research Institute
TIDD	Timber Industry Development Division
UG	University of Ghana
UPS	Underutilized Plant Species
VIP	Village Infrastructure Project
WARDA	West Africa Rice Development Association

ABSTRACT

This study was conducted to analyze existing national policies and legislation that enable or inhibit the wider use of underutilized plant species (UPS) for food, agriculture and industry in Ghana. The specific objectives were to review, screen and ascertain whether the policies support or inhibit the broader use of underutilized plant species, and to recommend strategies for policy formulation.

A literature search was conducted and a questionnaire developed to gather information on UPS for analyses. Six official documents were reviewed and fifteen responses were received out of twenty nine. Examination of the information obtained showed that currently in Ghana there is not a single comprehensive policy document on UPS. Mention has been made, however, of some UPS in some of the official documents consulted.

The majority of the organizations that responded have strategies and activities on UPS but they are not coordinated, due to the lack of a holistic policy on these species. Respondents were of the view that UPS can contribute to food security, improved nutrition, health and sustainable livelihoods.

The study is therefore recommending the formulation of a clear policy by the relevant sector ministries on the inventory, identification, research and conservation of UPS as the basis for the development and promotion of these species. Government should enact laws and formulate policies relating to education and training – both formal (schools, colleges and universities) and informal (farmers) - to create awareness as to the value and importance of production and consumption of UPS as import substitution plants for food, agriculture, industry and medicine. Government, the private sector and development partners should provide the necessary financial support for research, development and promotion of UPS in Ghana.

ANALYSIS OF EXISTING POLICIES THAT ENABLE OR INHIBIT THE WIDER USE OF UNDERUTILIZED PLANT SPECIES IN GHANA

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1. INTRODUCTION

In recent times, the issue of underutilized plant species (UPS) has become a subject for discussion in international, national and academic circles. Underutilized plant species can be defined as those species that are of minor importance in terms of production, consumption and utilization, and are not fully exploited to contribute to the national economy. These species are of considerable potential benefit to man in agriculture, medicine and industry and have the potential to reduce poverty and alleviate hunger. However, they have not been given the necessary attention in terms of policies and legislation that would address the multifaceted problems hindering their effective use.

Globally, mankind is dependent on a handful of crops which provide proteins and calories (FAO, 1996). Studies have also shown that, worldwide, more than 7,000 species are cultivated and harvested from the wild (Rehm and Espig, 1991; Wilson, 1992). These species contribute significantly to agro-biodiversity, food security, nutrition and household income. There is a strong linkage between the cultural heritage and the places of origin of the plant species. Local and traditional information on their distribution, biology, agronomy and uses are poorly documented. These underutilized plant species are being threatened, due to several factors including neglect on the part of science, technology, research and development – and, more importantly, their displacement by improved plants, mining activities, bush fires, infrastructure development and overgrazing.

In Ghana, only a few crops are being used as food, fiber or timber. There is a need, therefore, to identify and analyze policies that hinder the utilization of underutilized plant species and to make recommendations that would serve as the basis for policy formulation by the appropriate institutions.

In the above context, the Plant Genetic Resources Research Institute (PGRRI) of the Council for Scientific and Industrial Research (CSIR), in collaboration with three other sister CSIR – institutions namely the Science and Technology Policy Research Institute (CSIR-STEPRI), the

Forestry Research Institute of Ghana (CSIR-FORIG), and Crops Research Institute (CSIR-CRI), were asked by the Global Facilitation Unit (GFU) for Underutilized Species, to undertake an analysis of national and institutional policies on UPS that enable or inhibit its use food and agriculture in Ghana.

The purpose of this study was to identify, review and screen existing policies that promote or hinder the effective use of underutilized plant species and to make appropriate recommendations for national policy formulation that would enhance effective conservation and sustainable use of underutilized plant species for food, agriculture and industry.

Ghana, its agriculture and underutilized species
Ghana abounds in indigenous plant species, comprising forest species, food crops, medicinal and ornamental plants, plantation and industrial crops. The forest species consist of timber, medicinal and non-timber species, such as rattan and raffia. These resources are conserved in 280 forest reserves and 15 protected areas. Some of Ghana's wild plants include *Vigna reticulata*, wild yams, wild oil palm, and medicinal plants such as mahogany and *Rauwolfia vomitoria*.

Landraces of other crops are: *D. cayenensis, D. dumetorom*, *D. rotundata*, D *esculenta*, *D. praehensilis, D. alata* and *D. bulbifera*. Legumes include *Vigna unguiculata*, *Vigna subterranean,*, *Arachis hypogaea*, *Kestingiella geocarpa*region, *Sphenostylis sternocarpa* and *Mucuna pruriens*.

Ghana's agriculture is determined fundamentally by its climate and ecology. Rainfall is the most important climatic element influencing agriculture. Ghanaian soils vary considerably in fertility. They can be broadly divided into two groups: forest soils and savannah soils. The forest soils are more fertile by virtue of their high organic matter. Ghana's total land area is 23.9 million hectares and there are six major ecological zones: the rainforest, deciduous forest, transition zone, coastal savannah, Guinea savannah and the Sudan savannah. Farming is based on the bush fallow or land rotation system in all the ecological zones. The population of the country is estimated to be 20 million.

Table 1 (below) presents some of Ghana's underutilized plant species. These include: vegetables, indigenous leafy vegetables, legumes, cereals, edible wild fruits, medicinal plants, timber species and root and tuber crops.

Table 1 List of underutilized plant species in Ghana

Vegetables	*Tricizanthes cucumeria, Colocynthis edulis, Sechium edulis, Telfaria occidentalis, Lagenaria cicerasia, Cucumeropsis edulis*
Indigenous leafy vegetables	*Celocia argenta, Cochorus olitorious, Cleome gynandra,Solanum macrocarpum, Talinum triangulare, Vernonia hybridus, Amaranthus cruentus, Basella alba*
Root and tuber crops	*Dioscorea cayenensis, Dioscorea bulbifera, Dioscorea dumetorom, Dioscorea praehensilis, Solenostemon rotundifolius*
Cereals	*Digitaria exilis, Eleusine coracana, Oryza glaberrima, Sorghum bicolor, Pennisetum americanum*

Legumes	*Kestingella geocarpa, Cajanus cajan, Vigna subterranea,, Mucuna pruriens* var. *utilis, Canavalia ensiformis, Canavalia gladiata, Phaseolus lunatus, Dialium guineenses Willd, Parkia clappertonia Parkia biglobosa, Centrosema pubescens, Pueraria phaseiloides.*
Edible wild fruits	*Morinda morindiodes, Salacasia pyriformis, Dacryodes klaineana, Diospyros vignei, Chrysophyllum albidum, Heisteria parvifolia, Irvingia gabonensis, Drypetes chevalieri, Diospyros soubreana, Salacia cornifolia, Cola milenii.*
Medicinal and timber species	*Afromomum melegueta, Albizia zygia, Alstonia boonei, Baphia nitida, Khaya ivorensis, Monodora myristica Morinda lucida, Mallotus oppositifolius, Newbouldia laevis, Omphalocarpum procerum, Petersianthus macrocarpus, Picralima nitida, Pycnanthus angolens, Tetrapleura tetraptera, Xylopia aethiopicum*

II. GOVERNMENT POLICIES AND STRATEGIES

Growth and poverty reduction strategy II (GPRS II)

The Government of Ghana's Medium Term Development Strategy (2006-2009), otherwise referred to as the Ghana Growth and Poverty Reduction Strategy (GPRS II), is the main planning document for national development. This document contains comprehensive agricultural policies to support growth and poverty reduction, intended to help in managing the economy effectively and in making it possible to accumulate wealth for the benefit of all Ghanaians. This would be accomplished by transforming the country's agricultural and production system to achieve accelerated growth and poverty reduction within a decentralized and democratic environment. The main objective is to become an agro-industrial economy by the year 2010. This will require the development of the rural economy. Actions to be taken include:

Reform land acquisition, to ensure easier access and more a efficient land ownership and title process;
Serve as a catalyst to assist the private sector in increasing the production of grains, legumes, vegetables, roots and tuber crops to achieve food security. This will include extension and research services, irrigation facilities and affordable credit to support farmers;
Encourage the production of cash crops, such as cashew and pineapples;
Support the private sector to add value to traditional crops, such as cocoa.

Although underutilized crops were not specifically mentioned as one of the means for achieving food security, research and extension activities to support the production of lesser-known crops, such as African yam bean, Kestingiella groundnut, *Solenostemon rotundifolius* and lesser-known yam species (*Dioscorea bulbifera, Dioscorea esculenta* and *Dioscorea praehensilis)* for increased productivity, is encouraged. These foods are also sources of income in the informal sector.

Science and Technology Policy

The principal thrust of the National Science and Technology Policy document of 2001 is to ensure the integration of science and technology in the national development process as envisaged in the vision 2020 document. The policy document's main objectives for the

agricultural sector are those of strengthening the development, application and transfer of agro-based technologies to support sustainable agricultural production. The specific objectives are to:

> Sustain and improve agriculture-related research competence of the national agricultural research system (NARS) to raise the productivity of crops, livestock, fish resources, production tools and implements with due regard being taken of the impact on the environment. Special reference was made to agriculture in dry and arid regions of Ghana.
>
> Promote research and application of new technologies such as biotechnology, including genetic engineering, which hold potential for increasing productivity;
>
> Enhance research on pre- and post–harvest losses in agricultural production;
>
> Promote and develop food preservation and processing techniques, through participatory technology development; and
>
> Strengthen the production of non-traditional export commodities to enhance the foreign exchange earning power of the country.

Food crops

There are many food crops that are underutilized or are used only in localities where the crops are found. The irony is that these food crops could be cultivated on a broader scale and harvested to help solve acute food shortages and near famine in certain parts of the country. The type of food most people eat, or do not eat, has historical antecedents. Very few food crops from the country have been added to what were handed down to us by our forefathers. Moreover, the methods of preparing local dishes have not changed much since independence.

Currently there is not a single comprehensive policy on UPS. However, mention has been made of the promotion of UPS in some policy documents, such as the FASDEP (2002) and GPRS II (2005). There are many food crops including leafy vegetables that are edible and very nutritious but are not consumed on a wide-scale because of cultural differences. The consumption of these crops on a broader scale could enhance the country's food security, income generation and livelihood sustainability.

Research Orientation

The country's agricultural research orientation has not seen any significant changes. However since 1990, some improved crop varieties and production technologies have been developed and transferred. Current research orientation is towards demand-driven and participatory research. Two main reasons could be at the root of this: i) to obtain funding and ii) to enhance the adoption of technologies generated. Earlier, the orientation had been mainly towards traditional agricultural research, such as crop genetic improvement, pest and disease control, livestock genetic improvement, and post harvest losses. A major factor militating against research and development has been inadequate funding which hampers the completion of research activities. As a result the intended output are not realized and transferred to end users.

Production Systems

A critical review of agricultural production systems in the country reveals a myriad of problems militating against the growth of the agriculture sector. These problems include policy, institutional, infrastructure, financial, social, environmental and technological capabilities. The GPRS II (2005), and the Food and Agriculture Sector Development Policy (FASDEP) (2002) of the Ministry of Food and Agriculture, aim at modernizing the country's agriculture sector in line with Ghana's determination to become a leading agro-industrial country in Africa by the year 2010. The main goal of the country's agricultural policy is to ensure:

(i) Food and raw material security;
(ii) Higher employment;
(iii) Reduction in poverty and the creation of wealth; and
(iv) Greater contribution of the sector to GDP, foreign exchange earnings and government revenue.

Effective implementation of these policies will result in the realization of the objectives of FASDEP and GPRS II.

Commodity focus

There are about 20 major crops[1] in Ghana on which the Ministry of Food and Agriculture (MoFA) provides annual statistical data (Obirih-Opareh, 2006). These crops are of immense importance to the country's socio-economic development. Added to these are cocoa and timber, which are part of the country's major export products. In fact, these latter, which are often referred to as 'traditional export crops', have been the country's main export products, besides gold and other mineral resources, and they receive comparatively higher commodity focus in terms of agricultural research. Most of these produce are for domestic consumption, even though there are strong efforts underway to export them under the 'non-traditional exports' category, such as pineapple, banana, yam and plantain. There are also efforts to process some of these items into industrial raw materials – for example, industrial starch from cassava, or into finished products such as orange and pineapple juice, tomato paste and other vegetables and fruit juices. The more a commodity is processed and patronized, the higher its focus, both in terms of research and production. The intensification of policies to diversify the country's agricultural export base has led to focusing on other non-traditional export crops such as pineapple, banana, and spices (pepper, ginger, black and pepper). This diversification policy should also embrace underutilized plant (crops and tree) species.

Education, awareness creation and other sensitization programmes should be organized for underutilized plant species; this would help promote their use on a broader scale. In most cases the problem is due to lack of information about them and their nutritional and medicinal properties, as well as lack of knowledge as to their availability and affordability. These issues must be addressed in order to find solutions to the problems of underutilization of certain food crops.

Tree species

[1] Rice, maize, millet, sorghum, cassava, cocoyam, yam, plantain, groundnut, coconut, oil palm, beans, tomatoes, pepper, okra, garden eggs, banana, orange, pineapple, and sugar cane

There are also many tree and tree-like species that are underutilized, such as Bamboo, *Petersianthus macrocarpus* and *Sterculia oblonga*. These are normally referred to as lesser-used species (LUS). Their limited use is due, in part, to lack of information on their technological properties, their uses and also market availability. There are many tree species, normally referred to as non-traditional timber species. The bamboo is one of these tree-like plants. Known as 'the wonder grass' in South East Asia, including Japan and China, bamboo is used intensively there in the building and construction industry and the fresh leaves are used for food. Series of documentaries on Bamboo and its cultivation, use and value, clearly show the extent to which the people of South East Asia use this plant. The opposite might be true for Ghana, where there is limited use, in spite of its abundance and the appropriate climatic and vegetative conditions for its cultivation. If legislation is enacted that prevents people from using *Triplochiton scleroxylon* boards as supporting frames during construction works, it would enhance the use of bamboo in the building/construction sector to the extent that many people would start cultivating the plant wherever possible. This would lessen the pressure on the forest, and the logging of young *Triplochiton scleroxylon* trees for boards. Studies by the Building and Road Research Institute (BRRI) of the CSIR show that bamboo is a better material than *Triplochiton scleroxylon* boards for use as supporting frames in the building construction sector particularly when casting concrete. In an era of increasingly high cost of building materials, the need to have a policy to ban the use of *Triplochiton scleroxylon* boards as supporting frames in building construction would go a long way towards minimizing the cost of building a house.

Government should come up with clear policy directives on underutilized plant species. These should include programmes, projects, strategies, activities, measures, and also targets and funding regimes/mechanism. All of the foregoing must be put in place to promote the use of underutilized species.

Food species

The FASDEP (2002) identified certain major commodities of economic importance and were given priority, due to their importance for food security and export diversification. The maize varieties with local names include: *Aburotia*, *Dobidi*, *Obaatanpa*, *Dadaba* and *Mamaba*, depicting certain characteristics and farmer preferences, such early maturing and enhanced protein content. In addition, new varieties of cassava have been developed and given local names: *Afisiafi*, *Gblemo Duade* and *Abasa Fitaa*. In the FASDEP, for instance in the short term, the emphasis is on commodities that are considered to be of priority for the country's food self-sufficiency, especially cereals, starchy crops, legumes and vegetables. In the medium and long-term, the emphasis is on commodities such as soybeans, exotic vegetables, coconut, shea nut, oil palm, mango, citrus, pawpaw and banana, without due regard to UPS in the face of its potential for food security.

Information and marketing of underutilized plant species

There are quite a number of plant species that have tremendous nutritional and medicinal value but do not have wider utilization because of lack of knowledge and information about them, their inaccessibility due to localization, and their unaffordability. Indeed localization of UPS has led to its poor marketing. Lack of information and publicity on their use, availability of their planting materials, nutritional and medicinal values, is also responsible for their underutilization. Whilst creating awareness, there should also be strong efforts to create a market for underutilized species products so as to enable farmers reap the benefits from their toil. Information should be gathered

and packaged on all the potential underutilized plant species in the country. Promotion, popularization, development and distribution of improved planting materials through research and development, provision of market, and market access would go a long way towards ensuring additional benefits to the country. Once people get to know of the importance of these plants, they would patronize them. A case in point is *Moringa* which until recently was an underutilized plant species. Now its consumption is overwhelming. If farmers were to realize that there is a market for a product, they would cultivate them in response to the demand.

Education
Even though agriculture as a subject is taught from basic to tertiary level in Ghana it does not cover UPS per se. Currently, agriculture is taught in all five public universities in Ghana. In particular the University of Education, Winneba (Mampong Campus) offers a Bachelor of Education and Diploma in Agriculture to train teachers for the secondary schools. Even though there is no course on underutilized plant species, some universities in Ghana have been requesting germplasm of some UPS from PGRRI for their research (Aboagye, 2003). These include *Sphenostylis sternocarpa*, *Voandzeia subterranea* and *Phaseolus lunatus*. In recent past the PGRRI has trained students from the Agricultural Colleges and the Universities in PGR management, including the UPS listed in Table 1.

III. Food Security

The Food and Agriculture Sector Development Policy (2002) defines food security as good quality nutritious food, hygienically packaged and attractively presented, available in sufficient quantity all year round and located at the appropriate places at affordable prices. This definition makes it possible for the state of food security to be measured and assessed from time to time. A detailed analysis of food security strategies for Ghana has been carried out and documented (FASDEP, 2002 and GPRS II, 2005). These policy documents were developed in response to concerns over the level of food imports, poor post-harvest management, poor marketing and their resultant effects on the long term sustainability of national food security. The preparation of these policy documents involved a review of existing food and agricultural related policies, development strategies and programmes, projects and activities in food crops, livestock, fisheries and forest derived foods, marketing, processing, preservation and utilization.

FASDEP 2002 and GPRS II 2005 intended to build on the five key elements of the Accelerated Agricultural Growth and Development Strategy (AAGDS). These elements include promotion of selected products through improved access to markets, development of and improving access to technology for sustainable natural resources management, improved access to agricultural financial services, improved rural infrastructure and enhanced human and institutional capacity. FASDEP 2002 builds on the five key elements of AAGDS with a focus on strengthening the private sector as the engine of growth. It provides a broad framework for agricultural development out of which detailed projects and programme implementation plans and activities would be developed to deal with specific issues, such as the promotion of underutilized crops. It aims at improving productivity and diversifying food crop production in view of the fragile nature of the ecosystem and global warming. The GPRS II 2005 document outlines strategies to achieve greater self sufficiency and food security at both national and household levels. Among these strategies are affordable credit schemes for vulnerable groups, such as women and youth, market information and access to credit, tariff reduction on agricultural inputs, improved access to land, nucleus and block farming schemes, affirmative action on gender and the vulnerable groups, rural infrastructural development, as in the case of the Village Infrastructural Project (VIP) under

MoFA, efficient and effective research and extension linkage as implemented by the Research and Extension Linkages Committee (RELC) of Agricultural Services Sub-sector Investment Project (AgSSIP) coordinated by CSIR and MoFA, among others.

Ghana produces sufficient maize, cassava, yam and fruits such as mangoes, oranges, pineapples and vegetables to satisfy domestic demand (and exports during bumper harvests) but it imports rice, wheat, meat and fish products. Substituting some of these products with local production would create jobs for the teeming youth, and improve farmers' livelihoods. This would address rural-urban migration with it attendant social vices like armed robbery, drug addiction, teenage pregnancy and indiscipline. Declining soil fertility, desertification, drought, bush fires and lack of infrastructural development leads to food insecurity, especially for the vulnerable in society. Most of the underutilized crops are well adapted to marginal environments. A policy to encourage their production, promotion and utilization would go a long way towards enhancing food security and sovereignty. It will also broaden the genetic base of food crops since most of the underutilized crops are sources of tolerance to biotic and abiotic stresses.

The main components of food security are influenced by production, processing and marketing. All of these components require effective and efficient research and development support for meaningful impact. There is a need for sustained commitment and serious emphasis on strengthening and adequately supporting the existing national agricultural system as well as the technical support system.

IV. Nutrition and Health

The state of people's health in terms of the nutrients in their diet is essential for their well-being. Malnutrition, defined as any nutritional disorder whether due to dietary deficiency or excess, is a major problem in Ghana. Malnutrition may be caused by insufficient food intake, unbalanced diet or inefficient use of the foods consumed. Excess nutrition may also result in health problems such as obesity (Malnutrition, 2007). Malnutrition is a public health problem, and a major challenge to nutritionists, agriculturalists, food scientists and social scientists (Andre Briend *et al*., 2006). The human resource of every nation is the greatest asset to that nation. Combating all forms of malnutrition should be the priority of the government of Ghana (Plahar, 2003). Underutilized plants when properly harnessed and utilized can be a panacea to malnutrition. Malnutrition impacts negatively on the health and well being of pregnant women, lactating mothers and children. Poor nutrition results in morbidity, mortality and poor growth in children, which eventually affects their education (Ghana Demographic Health Survey GDHS, 2003). Malnutrition in children in Ghana may be due to chronic food shortages as evidenced by the fact that the three northern regions, with bushfires, drought and poor soil fertility, consistently recorded the highest levels of stunting (GDHS, 2003).

The major problems of malnutrition and excess nutrition include:

- Protein - energy malnutrition i.e. food availability, access to cash, role of women, custom, ignorance, knowledge and lack of education
- Nutritional anemia – low dietary iron, calcium, malaria and intestinal parasites.
- Non-communicable diseases – obesity, high blood pressure, heart diseases, diabetes and certain cancers.
- Iodine deficiency disorders – primarily a problem of iodine-deficient soils.

Table 2 nutrition recommendations for pregnant women, lactating mothers, babies, school children is based on FAO recommendations

NUTRIENT	AMOUNT PER		
	100 g	**100 Kcal**	**100 KJ**
Protein	15	5.2	1.2
Fat (g)	10	2.6	0.6
Crude fibre (g)	5	1.3	0.3
Vitamin A (as retinol) (µg)	400	100	24
Vitamin D (as cholecalcifero) (µg)	10	2.5	0.6
Vitamin E (as alpha-tocopherol) (mg)	5	1.25	0.3
Ascorbic acid (mg)	20	5.2	0.12
Thiamine (mg)	0.5	0.12	0.03
Riboflavine (mg)	0.8	0.2	0.05
Niacin (mg)	9	2.2	0.57
Vitamin B6 (mg)	0.9	0.22	0.06
Folic acid (µg)	100	27	6
Vitamin B12 (µg)	2	0.52	0.12
Calcium (mg)	800	200	48
Phosporus (mg)	800	200	48
Iron (mg)	10	2.7	0.6
Iodine	70	18	4.5

Source: The Processed Cereal-based Foods and Baby Foods For Infants and Young Children. Codex Alimentarius Commission Amendment Regulations, 2000.

In Ghana, nutrition recommendations for pregnant women, lactating mothers, babies and school children is based on FAO recommendations as indicated in Table 2. There is no policy per se on nutrition. However there are currently programmes by government to address malnutrition in Ghana. Basically, strategies aimed at improving diets and intakes, monitoring, awareness creation

through the Information Services Department should be accorded topmost priority. Specific strategies aimed at minimizing the issue of malnutrition include:

- School feeding programme to improve nutrition in school children. More schools should be included in this laudable programme using locally available foods which may include UPS.
- Improving access to income and services for vulnerable communities with chronic nutritional problems.
- Improve marketing of foodstuffs produced locally by providing credit to brokers to purchase food from farmers and store in properly constructed facilities.
- Support research and development of easily affordable, high quality nutritious foods, including underutilized crops.
- Facilitating farming systems aimed at the marginal areas, with a view to addressing low productivity, access to land, improved marketing and small scale agro-processing to add value to food crops. This would minimize post harvest losses and improve incomes and livelihoods of farmers and consumers.

It is suggested that local foods be promoted through education and awareness creation. Hotels, restaurants, schools, hospitals and prisons should be targeted with a view to promoting the utilization of local foods including underutilized crops. In view of the serious nature of malnutrition on the socio-economic development of Ghana, there should be collaboration between the Ministries of Food and Agriculture, Education, Science and Sports, Health and Local Government, Rural Development and Environment. This would facilitate the improvement of the quality of food and nutrition education. The Women in Agricultural Development in collaboration with the Nutrition Department of the Ministry of Health and the Food Research Institute of CSIR should develop recipes for use by the general public. Effective research and development efforts in processing and utilization of locally-produced food crops are needed to address the challenges that limit their usage. This would facilitate resolving issues relating to protein energy malnutrition. The transformation of raw agricultural produce for value addition is food processing. This is a priority for the Government of Ghana. The advantages of food processing include reduction in post harvest losses for increased income, food availability for a longer period of time, enhances diversification of uses of food crops including underutilized crops. There is a need for the enactment of safety and quality standards to ensure food safety analysis of health risk in traditional food processing, assessment of the safety of street food, and the prevention of contamination of food and agricultural produce.

V. The Ghana Council for Scientific and Industrial Research (CSIR)

The CSIR was established by acts NLCD 293 of 1968 and CSIR Act 521 of 1996. The objective of the establishment of CSIR was to provide the vehicle for accelerated transformation of the Ghanaian economy through practical application of modern science and technology. Currently, the CSIR has thirteen research institutes, of which seven are agriculture and forestry related. The mandate of the agricultural and forestry related institutes is to undertake research on food and tree crops, minor or emerging cash crops, forestry resources and management. Emphases on the research are development of technologies for medium and small holder farmers who constitute over 60% of the population.

The vision of CSIR is striving to become a centre of excellence in Research and Development (R&D) by generating appropriate technologies that are responsive to demands of the private sector and for social-economic development. Its mission is to generate and apply innovative technologies which efficiently and effectively exploit Science and Technology (S&T) for socio-

economic development in the critical areas of agriculture, industry, health and the environment, as well as improved scientific culture of the civil society. Technologies developed will be commercialized for private sector development in Ghana and abroad. In addition to the CSIR vision and mission, the institutes under the CSIR have their vision, mission and strategic plans, which they use for the execution of their work.

Ghana abounds in rich biodiversity. This includes neglected and underutilized species of plants for food and agriculture, both cultivated and wild plants which have been domesticated. The current research activities of the agricultural- and forestry-based institutes of CSIR include work on genetic resources and their sustainable management by PGRRI; development of improved crop varieties of cereals – maize, rice, sorghum and millet, legumes – cowpea, soybean, groundnuts, bambara groundnuts, and pigeon pea by CRI and SARI; root and tuber crops – cassava, sweet potato, yam, Colocasia taro; fruit trees - citrus, avocado, mango, cashew, papaya, pineapples; horticultural crops - tomato, pepper, okra, egg plant and leafy vegetables by PGRRI, CRI and SARI; and oil palm and coconut by Oil Palm Research Institute (OPRI). The strategic plans of most of the institutes, especially CRI and FRI, include those on post harvest technology, and agro-processing to add value to the varieties developed. PGRRI is assiduously pursuing programmes for collection, characterization, evaluation, conservation and utilization of the diversity within the local food crops, vegetable crops, medicinal plants and tree species of economic value. The genetic resources strategy includes rationalization, enhancement and maintenance of plant and animal germplasm collections for efficient utilization. Although the CSIR places emphasis on client-driven research, funding has been a major constraint to their effective conduct of research and development. This is due to the fact that most of the intended beneficiaries are the resource poor farmers who do not want to spend money to buy improved technologies. They want them free of charge. Other constraints include inadequate resources in personnel (high attrition rate due to poor remuneration, lack of recognition and motivation), inadequate laboratory and field equipment for effective and efficient research. Lack of irrigation facilities for an all year round agriculture undermines their efforts to facilitate the evaluation of technologies and the production of seeds for use by farmers. Given the needed financial support and recognition, the CSIR research system is strategically positioned to develop innovative technologies to enhance the socio-economic development of Ghana.

VI. FORESTRY

Species and coverage

Ghana has two major ecological zones: the high forest and the savannah. At the turn of the century (19^{th}-20^{th}), the area of high forest was 8.2 million ha, but this has been reduced to about 2 million ha as at 1995 (Ebregt, 1995). Most of the remaining forest is located within the 216 gazetted forest reserves in the high forest zone. The deforestation rate in Ghana is about 220 km^2 per year (FAO, 1986).

More than 3,600 plant species have been identified in both the high forest and savannah woodlands of Ghana, with over 2,100 found in the forest zone (Sayer *et al.*, 1992). In the high forest, about 680 tree species with a diameter of 5 cm or more are known to occur (Hawthorn and Abu-Juam, 1993). Of these, about 420 species have been identified and recorded in the 1988 forestry inventory. Within this (high forest) region, 125 plant families have been identified and species diversity of about 300 plants has been recorded on a single hectare (World Bank, 1986).

Of the endemic plant species in the country, 23 are known to exist in the forest zone and seven in the wet evergreen forest zone, which is the most prolific in its floral diversity.

The ownership of the Forest Reserves is vested in the President of the Republic of Ghana, in trust for the land owners (stools, skins[2], clans, individuals and communities). However, the communities are granted community rights, such as collection of Non Timber Forest Products (NTFPs) and Farming Land Rights (demarcated areas for individuals or groups of individuals, for farming).

The high forest zone covers roughly one third of the country and supports two thirds of the population. Most of the economic activities (cocoa, oil palm, rubber, timber and mining) are concentrated in this zone. The forest resources play a significant role in the livelihoods of the people, especially the rural poor, as well as being one of Ghana's major foreign exchange earners for the country. The forests are important sources of fuel wood, poles, timber, hunting grounds, and numerous non-timber forest products (NTFPs). The sector is basically dominated by the timber industry and since the early 1970s accounts for about 5-6% of the total Gross Domestic Product (GDP). It also ranks third behind cocoa and the minerals (gold, bauxite and diamond) among commodity exports (Ebregt, 1995).

In the last decade, the forest potential to supply these resources and thus contribute to the socio-economic development of the country is constrained by a reduction in the resource base, caused by a number of factors – notably, over-exploitation of the resources as well as annual bush fires.

Institutions involved in the forestry sector and their roles

The forestry sector is made up of both government and private institutions or entities, involved in administering the development and utilization of the forest and wildlife resources. The sector also includes wood-using industries and related activities. The key government institutions are the Ministry of Lands, Forestry and Mines (MLFM), responsible for policy direction and monitoring of programmes towards achieving the national goal; the Forestry Services Division (FSD); responsible for managing the forest estate, the Forestry Commission (FC), which is responsible for advising the sector Minister on policies to regulate the management and utilization of forest and wildlife resources; and the Timber Industry Development Division (TIDD), responsible for certification of product standards in the timber industry, marketing intelligence and the promotion of improved industrial processing. The Forestry Research Institute of Ghana (FORIG) is responsible for undertaking research and development activities towards solving problems relating to the forestry sector. The private institutions or entities consist of the land owners, communities, clans and individuals on whose behalf the government manages the forest and wildlife resources. Others are the logging companies that operate timber concessions to supply raw materials to sawmills, and other wood processing companies that convert the timber into secondary products mainly for the export markets.

Current and past policies affecting underutilized species within the forestry sector

Utilization of forest resources in Ghana has generally been influenced by the Forest and Wildlife Policy (1994). The policy provided for the creation and management of the permanent forest

[2] In Ghana, Stools and skins are the symbols of traditional authority for chiefs in the southern and northern respectively.

estates, the maximum utilization of areas not dedicated to permanent forestry and for undertaking research in all branches of forestry. It also agitated for selective felling and consequently the selection of other non merchantable species (Dwumfour, 1997). In spite of the policy, the timber trade continued with the few traditional species, such as the *Mahogany spp,* the *Entandrophragma* spp, *Milicia spp*, *Pericopsis* spp and *Terminalia* spp which has resulted in the economic extinctions of some species.

The Forest and Wildlife Policy of 1994 has been a notable achievement for Ghana because it aimed at the conservation and sustainable development of forest and wildlife resources to maintain environmental quality and the perpetual flow of optimum benefits to all segments of Ghanaian society. To ensure greater sustainability in the management of forest resources, this policy adopted a strategy for the promotion of Lesser Used Species (LUS). The Forest Sector developed a Master Plan (1996-2020) that was to help implement the 1994 Forest and Wildlife policies, and mandated FORIG and TIDD to be the lead agencies.

Consequently, over the years FORIG has been conducting research on the technological properties (physical, mechanical, processing characteristics, and others) and the ecology (ecological impact on the forest after extraction of various LUS) of certain LUS, notably, *Antiaris toxicaria, Petersianthus macrocarpus*, *Clylicodiscus gabonensis*, *Sterculia oblonga, Celtis mildbraedii,* and *Pycnanthus angolensis*. These research works have been funded by both the Government of Ghana and international funding institutions – notably, the International Tropical Timber Organization (ITTO) which, in 1994, awarded a research grant to FORIG to work on 14 LUS. The project generally aimed at encouraging the forest products industry to better utilize the forest in order to aid the sustainable development of Ghana (Addae-Mensah, 1998). TIDD has also promoted the marketing of these species, especially on the international markets.

As part of the activities of the forestry development master plan (1996-2020), opportunities were to be created to improve access to other non timber forest products, such as rattan and bamboo. Bamboo is an NTFP that is currently underutilized in Ghana. The potential for this species is generally acknowledged and was demonstrated in the 1960s through the establishment of bamboo cottages and small-scale industry in some parts of the country, although these industries no longer exist. The most common Bamboo species in Ghana is the *Bambusa vulgaris,* constituting some 95% of the total Bamboo resources in Ghana and found mostly in the forest zone (Ebanyenle *et al*., 2005). The species was introduced about 70 years ago and has become naturalized and considered as native (Kigomo, 1997). The only native bamboo species in Ghana, to be found mostly in the savannah, is *Oxytenanthera abyssinica*. These plants are generally owned by individuals and are located mostly on farmlands. There is currently no official government policy or legislation on harvesting and marketing of the species but a permit would have to be obtained from the Forestry Commission (FC) to harvest bamboo from the forest reserves. Efforts are aimed at promotion of the species, including training, research and awareness creation to improve the knowledge and skills in processing bamboo. Notable institutions involved in these efforts include the Ministry of Lands, Forestry and Mines, through its Bamboo and Rattan Development Programme (BARADEP), Bamboo and Rattan Network of Ghana (BARNET) and FORIG - with support from the Republic of China and African Forest Research Network (AFORNET) which is currently funding a research project being implemented by FORIG on “sustainable development of bamboo resources in Ghana and Togo”. In spite of these efforts, the level of bamboo processing and usage in Ghana continues to be low. This is attributed to the social perception of its use, lack of expertise and inadequate scientific knowledge, among other reasons.

VII. BIODIVERSITY CONSERVATION OF FOREST SPECIES

A portion of Ghana's high forest zone forms part of one of the world's biodiversity "hotspots": the Upper Guinean forest zone. This is also the region where the forest is rapidly disappearing (Poorter *et al*., 2004) and contributing to the alarming rate at which the world is losing biological resources. Factors leading to biodiversity loss include habitat loss, invasive species, and the overuse of biological resources being attributed to increasing world population. Efforts at international level have culminated in the signing and ratification of the Convention on Biological Diversity (CBD) which has placed biodiversity conservation on political agenda of many countries including Ghana. The CBD recognizes three main objectives, namely, conservation of biodiversity, sustainable use of its components and equitable sharing of benefits through the use of genetic resources.

In the past, attempts to conserve Ghana's biological resources have included the establishment of Protected Areas, Forest Reserves, Zoos and Botanical Gardens for both conservation and educational purposes, and the conduct of research on species diversity in some of the vegetation zones of Ghana, both by Government and by non-governmental institutions. However, there has been inadequate policy and legislation in the past on biodiversity conservation in Ghana. Most of the legislation marginally covered the conservation of biological resources. For example legislation on trees placed emphasis on protection of timber rather than conservation of forest resources. One of the major achievements of the Forest and Wildlife Policy (1994) is an objective that seeks to "manage and enhance the permanent estate of forest and wildlife resources for the preservation of vital soil and water resources, conservation of biological diversity and the environment, and sustainable production of domestic and commercial produce" The guiding principles of this policy includes Ghana's own conviction and the provisions of most international conventions to which Ghana is a signatory, notably the CBD.

Consequently, various attempts have been made to conserve Ghana's biological resources. These include a protection strategy recommended by Hawthorne and Abu Juam (1995), following a botanical survey to help in the conservation of threatened and endangered plant species in the forest reserves. The strategy included identification and categorization of vulnerable areas, provenance protection areas, specific location of the country's "hot spots" and prioritization of each species for conservation. Vulnerable areas include areas designated as hill sanctuaries (forest reserve areas with steep slopes) and convalescence areas (forest reserves that have been degraded through over exploitation and bush fires and have now been taken out of production to allow them to recover). 'Hot spot' areas are areas with High Genetic Heat Index. These are now designated as Globally Significant Biodiversity Areas (GSBAs).
Provenance protection areas refer to areas with species going towards economic extinction, such as *odum* (*Milicia* spp.) as a result of pressure from exploitation. In addition, each species has been assigned a star (black, scarlet and gold) based on its rarity locally and internationally, which gives it priority for conservation. For example, black star species means species that are rare internationally or uncommon in Ghana and should be given priority for conservation (Hawton and Abu-Juam, 1995). This strategy recommended urgent attention to the black star species Ghana has also developed a National Strategy on Biodiversity Conservation Plan that is geared towards the achievement of the objectives of the Convention. It stresses awareness creation, building of capacity and an improved information base in Ghana, among others, to ensure biodiversity. However the implementation of the national strategy has been slow, due to a lack of resources and continuous political will.

The FSD also uses a reduced formula for yield allocation of highly degraded or convalescence areas, and the acquisition of special permits to log certain species that are becoming extinct or rare. The Global Environmental Facility (GEF) funded a project which demarcated and assessed these areas and designated them as GSBAs, as well as the development of management plans to ensure effective management of such areas for conservation purposes.

Despite the efforts that have been made to ensure conservation of biodiversity and sustainable use of its components, there are still a number of issues that need to be addressed. There is a need for the government of Ghana to come up with a policy on funding of biodiversity conservation issues. Capacity development in the country should be pursued vigorously, especially in ecology and taxonomy.

VIII. BIODIVERSITY CONSERVATION OF FOOD AND OTHER CROPS

The main institute concerned with the conservation of food crops, fruit trees and medicinal plants is the Plant Genetic Resources Research Institute, which is mandated to collect, characterize, evaluate, distribute and document plant genetic resources in Ghana. It has a field gene bank for conserving tree crops, forestry species and root and tuber crops. It also has a cold storage facility to conserve cereals, vegetables and legumes. Other institutes that maintain some working collections are:

Savannah Agricultural Research Institute (SARI)
SARI is mandated to carry out agricultural research, particularly as it relates to food and fibre crops in northern Ghana, in order to improve agricultural productivity and promote food security in the northern sector of the country. SARI maintains a working collection of cowpea, soybean, groundnut, bambara groundnut, pigeon pea, rice, sorghum and millet and groundnut. It has collections of yams, cassava, *Solenostemon rotundifolium* and cotton.

Crops Research Institute
This Institute is mandated to carry out research on all crops except cocoa, kola, coffee, shea butter, cashew, oil palm and coconut. It has a museum of oil palm citrus and mango. It has a tissue culture laboratory for the multiplication of Banana, yam, plantain, sweet potato and pine apple. It also maintains a working collection of cowpea, soybean, groundnut, bambara groundnut, rice and cassava.

Oil palm Research Institute (OPRI)
The OPRI maintains a group of elite palm trees and coconut, which are used as germplasm improvement in the oil palm and coconut.

Agricultural Research Station (ARS)
The ARS conserves and distributes a wide range of plantation crops which include cocoa, kola spp., coffee, rubber, avocado, plantains and banana (Ahiekpor and Afreh Nuamah, 1992).

Animal Research Institute (ARI)
The ARI maintains a museum of both local and exotic forage plants, for example: *Cajanus cajan, Leucaena leucocephala, Brachiaria brizantha, Centrosema pubescens* and *Stylozanthes guinensis*.

Biotechnology and Nuclear Agriculture Research Institute (BNARI)
The BNARI has tissue culture facilities for the multiplication of yam, cassava, pineapple and plantain germplasm.

Cocoa Research Institute of Ghana (CRIG)
CRIG maintains a museum of cocoa, cola, coffee, shea butter and cashew including both cultivated and wild relatives of the various crops.

IX. PLANT GENETIC RESOURCES ACTIVITIES

The Plant Genetic Resources Research Institute (PGRRI) in mandated to collect and conserve the plant genetic resources of Ghana, to prevent them from extinction. To date, the Plant Genetic Resources Research Institute has collected, characterized, evaluated and documented information on 8,026 accessions of legumes, cereals, vegetables, medicinal plants, forest species, fruit trees and spices. The materials collected and conserved are available to the scientific community, farmers and non-governmental organization for their exploitation, to provide good planting materials to meet the needs of users for increased agricultural production. Plant genetic resources of utilized, underutilized and non-utilized plant species abound in Ghana. Many of the species are being lost through natural and human activities. The germplasm must therefore be collected, conserved and used to develop crops for sustainable food security, income generation and improved livelihoods.

Table 3 shows the quantity of the some materials under conservation.

Table 3 List of some germplasm under conservation

SPECIES	**Number of accessions under conservation**
Legumes	
Sphenostylis sternocarpa	30
Voandzeia subterranea	77
Vigna unguiculata	531
Phaseolus vulgaris	30
Arachis hypogaea	99
Canavalia ensiformis	12
Kestingiella	16
Phaseolus lunatus	44
Cajanus cajan	9
Canavalia gladiata	8
Psophocarpus tetragonolobus	12
Mucuna pruriens var utilis	17
Yams	
Dioscorea alata	103

Dioscorea bulbifera	11
Dioscorea cayenensis	25
Dioscorea dumetorom	18
Dioscorea esculenta	12
Dioscorea rotundata	496
Others	
Zea mais	545
Oryza	564
Sorghum bicolor	65
Pennisetum purperum	5
Manihot esculenta	755
Xanthosoma sagittifolium	79
Colocasia esculenta	183
Solenostemon rotundifolium	102
Ipomea batata	178

Plant Genetic Resources Strategic Plan

A five-year strategic plan for plant genetic resources conservation and use has been developed (2004-2008). This plan has as its goal the development of a system for enhancing effective conservation and sustainable use of Ghana's PGR towards food security and sustainable livelihoods. The key objectives are:

1. To advance the conservation and use of PGR in Ghana, in an effort to alleviate poverty, attain food security, promote environmental conservation and maintain the country's spiritual and cultural values;

2 To establish functional national PGR networks and coordination, serving as mechanisms for supporting collaborative activities among programmes and promoting national and regional dimensions of PGR conservation, management and use;

3. To create awareness in the Ghanaian populace of the nature, use and importance of PGR for the perpetual sustenance of mankind; and

4. To ensure that decision-making on PGR conservation and use in Ghana is well-informed and that data and information on PGR are well-managed and disseminated. In this document, the main thrust would be to ensure the maximization of use of PGR, their availability for future generations through the development of short, medium and long-term conservation strategies, ratification of regional and international treaties, agreements and conventions and the creation of awareness of PGR management and its potential for the country and the survival of the human race.

PGR management is not given the necessary impetus it deserves in Ghana and is lagging behind other disciplines. A few research institutions are managing their collections (mainly working collections) with modest facilities, such as CRIG, OPRI, SARI, CRI, and ORIG. These institutes concentrate on their mandate crops at the expense of indigenous crops. It is very necessary, therefore, to develop the capabilities of the various institutions in order to preserve the underutilized but potential crops in Ghana.

A number of institutional and political factors could influence the future of the country's PGR management. These factors include:

the growing significance of organizations providing guidance, support and collaboration among agricultural research institutions for strengthening agricultural and forestry research in Ghana. The organizations could provide potential avenues for strengthening PGR conservation and natural resources management in the country.

inconsistencies in some government policies with respect to PGR, leading to differences in some genetic resources policies in national and international fora and discussions.

X. THE ROLE OF NON-GOVERNMENTAL ORGANIZATIONS (NGO) IN UNDERUTILIZED PLANT SPECIES

The role of NGOs in the promotion of underutilized species is not very clear, although most are involved in one or other forms of agricultural production and agro-forestry. One such example is the case of the Adventist Development and Relief Agency (ADRA), which has established 152 sustainable production agro-forestry systems throughout the country, tree planting of teak, neem, cashew, cassia, *albizia*, *lucaena*, mangoes and guava. ADRA, in collaboration with the US Peace Corps and the Forestry Department, started up the Collaborative Community Forest Initiative to raise tree seedlings for the establishment of woodlots and others, including food security and environmental protection. Other NGOs in Ghana are Conservation International, Action Aid and Care International. They are not involved in the promotion and utilization of underutilized plant species and must be sensitized.

XI. RESPONSES TO THE QUESTIONNAIRE

The questionnaire (Appendix 1) was developed and administered. Fifteen responses were received (Appendix 2).

Many institutions and organizations are involved in the promotion of underutilized plant species (Table 4). These include: the agricultural related institutes of the Council for Scientific and Industrial Research (CSIR) such as the Crops Research institute (CSIR-CRI), the Plant Genetic Resources Research Institute (PGRRI), the Forestry Research Institute (CSIR-FORIG), the Food Research Institute (CSIR-FRI); the Animal Research Institute (CSIR-ARI); and the Science and Technology Policy Research Institute (CSIR-STEPRI); Department of Geography and Resource Development and the Department of Botany, at the University of Ghana (UG); the Faculty of Renewable Natural Resources of the Kwame Nkrumah University of Science and Technology (KNUST), the Timber Industry Development Division (TIDD), the Ghana Timber Association (GTA) and the Ghana Timber Millers association (GTMA). Other institutions include: the Ministry of Education, Science and Sports (MoESS); Crop Services Directorate of the Ministry of

Food and Agriculture (MoFA) and Conservation International, a Non-Governmental Organization.

Table 4: Institutions involved in the promotion of underutilized plant species

Institutions/Organisation	UPS Promoting
The MoESS (Science Division)	*Dioscorea cayenensis and other lesser yams*
Crop Services Directorate (MoFA)	*Solenostemon rotundifolius*
CSIR-PGRRI	*Corchorus olitorius, Moringa olifera, Solanum macrocarpon, Occimum viridus, Cleome gynandra*, Bread fruit, Jack fruit.
CSIR-FORIG	*Antrocaryon micraste, Rhodognaphalon brevicuspe, Rhodognaphalon buonopozense, Petersianthus macrocarpus, Clylicodiscus gabunensis, Sterculia oblonga, Albizia zygia, Sterculia, rhinopetala, Amphimas pterocarpoides, Alstonia boonei, Antiaris toxicaria, Celtis mildbraedii, Pycnanthus angolensis, Canarium schweinfurthii*
CSIR-FRI	*Moringa oleifera*
CSIR-ARI	*Moringa oleifera*
CSIR-CRI	Frafra potato, bambara groundnut, cowpea, cocoyam, taro, cashew, and leafy vegetables.
CSIR-STEPRI	Formulating policies and strategies to promote underutilized plant species
Department of Geography and Resource Development	Medicinal plants Those that combine well with field crops or promote such crops
Botany Department. (UG)	*Solenostemon rotundifolius*
BNARI	*Dioscorea esculenta, Dioscorea bulbifera*
KNUST, Faculty of Renewable Natural Resources	*Sterculia oblonga, Sterculia rhinopetala, Antiaris toxicaria, Amphimas pterocarpoides, Albizia feruuginea, Canarium schweinfutthii, Celtis mildbraedii, Blighia sapida.*
Ghana Timber Association	*Canarium schweinfurtii, Parkia bicolor, Klainedoxa gabonensis.*
Timber Industry Development Division	*Sterculia spp* (yellow), *Blighia sapida, Sterculia oblonga, Dialium Aubraevillei, Altonia boonei, Abizia zygia, Parkia bicolor, Klainedoxa gabonensis, Ongokea gore, Antrocaryon micraster, Canarium schweinfurthii*
Conservation International	Medicinal plants

Table 4 shows the UPS being promoted by the respondents. According to the organizations, there is no policy *per se* on underutilized plant species. However, some strategies and activities that promote or support the utilization of underutilized plant species are being undertaken. The CSIR-PGRRI, which is mandated to collect and conserve the plant genetic resources of Ghana, has no policy in place. However, plant genetic activities are being carried out on underutilized legumes, medicinal plants and root and tuber crops. The Crops Research Institute (CRI) is currently working on bambara groundnut, leafy vegetables, cashew and root and tubers while the Food Research Institute is working on *Moringa oleifera*. The Ministry of Education, Science and Sports (Science Division) is promoting the multiplication of lesser-known yam planting materials in southern Ghana. Some institutions, such as BNARI, KNUST, CRI, FORIG and CRIG, are in involved in tissue culture for conservation of UPS. The Department of Geography and Resource Development uses participatory approaches that draw from local, indigenous or traditional knowledge of some indigenous underutilized plant species. Two NGOs - Conservation International and the Adventist Relief and Development Agency - are undertaking activities related to medicinal plants and agro-forestry.

The respondents indicated that some linkages exist between them and other organizations. The strategies of the Ministry of Education, Science and Sports are linked with other organizations especially the research institutes - both the secondary and tertiary institutions. A study conducted by PGRRI showed that universities are the main bodies requesting germplasm from the Institutes (both underutilized and most utilized) for use in their research activities (Aboagye, 2003). Strong collaboration exists between the research institutes and farmers from whom germplasm of indigenous materials are collected, characterized, evaluated and conserved. The linkage among CSIR institutes must be strengthened. There are also strong linkages, internationally, between research institutes in Ghana and the International Centres such as IITA, AVRDC, IRRI, WARDA and ILCA. The development, selection and release of crops is a joint effort among the research institutions, universities, farmers and extension staff of MoFA, and farmer-based organizations such as seed growers association who constitute the varietal release committee.

Most of the institutions face a number of constraints. Principal among these is finance. Most of the institutions are funded by the Central government which faces annual budget deficits with cuts in funds allocated to research. Not much information is available on the nutritional status of the species. Respondents suggested that the Ghana Export Promotion Council should identify and provide market information, both on local and international markets, to meet the requirements.

Respondents were emphatic that underutilized plant species can contribute to food security, and improve nutrition and health. However, some of these species are becoming extinct, due to genetic erosion brought about by natural hazards and by urbanization. Collection and conservation will provide the needed genetic resources for their development and use, which will diversify the commodity base of our non-traditional exports.

XII. RECOMMENDATIONS

Research and Development (R&D): Research should precede all other programmes aimed at promoting underutilized plant species. There is a need to identify all underutilized plant species, know their locations, distribution, agronomic characteristics, nutritional and medicinal properties, and the potential negative effects of their use, particularly with regard to consumption and marketing. Government and development partners should support research and development of easily affordable, high quality nutritious foods, including underutilized crops.

Identification of all underutilized plant species: Research Institutions (such as the Plant Genetic Resources Research Institute, Food Research Institute, Forestry Research Institute of Ghana, Crops Research Institute), in collaboration with Ministries, Departments and Agencies (MDAs), development partners, and non-governmental organizations should identify all underutilized food crops and tree species, their properties and - in the case of the food crops - their nutritional and medicinal values. They should also identify and provide market information, both on local and international markets, to meet requirements.

Collection, characterization, evaluation, conservation and use of UPS: Research Institutions, particularly the PGRRI, CRI, SARI, FORIG, FRI and the Universities, should take the lead to collect, characterize, evaluate, conserve and use of underutilized plant species.

Generation of information to increase the knowledge base of UPS: Institutions involved in the promotion of UPS should make conscious efforts directed at generating information to increase

the knowledge base of UPS. Improved and better communication of information generated through research and development, and indigenous traditional knowledge (ITK) would help to raise awareness and build capacity of people to make informed decisions. This will equip them to influence policies at all levels to address UPS.

Utilization of research technologies: MoFA and MLFM should facilitate the transfer and use of technologies developed. RELC should be strengthened to facilitate the adoption of improved technologies.

***Policies*:** Even though many of the institutions involved in underutilized plant species in one way or another had strategies for promoting of UPS, there is not one comprehensive policy document at the national level, from which these institutions derive their programmes and strategies. However, without policy it is difficult to determine the success or failure of an exercise. In view of this, the relevant sector ministries should take up the challenge to develop a comprehensive national policy on UPS.

Education: The government, through the Ministry of Education, Science and Sports (MoESS), should modify curricula of primary, secondary and tertiary education to include studies on underutilized plant (food crop and tree) species. This would help educate and create the awareness for underutilized plant species.

***Health*:** The medicinal properties of underutilized plant species must be identified and documented through research and use of indigenous knowledge. The use of medicinal plants is associated with mystics and incantation. This calls for intense public education to demystify information on medicinal plants, through the media, workshops and fora.

Public education and awareness creation: Awareness-raising initiatives should be undertaken to inform the people about the values and use of underutilized plant species, and a clear policy formulated and legislation enacted to back all underutilized plant species activities in Ghana. Under the FASDEP, there was a component to strengthen agricultural education, including modification of the agricultural curricula to include Agribusiness, which was to be implemented by MoESS and MoFA. Whether or not UPS was given the needed attention is not known. An awareness-raising process should start with the children from the basic school. Modification of school curricula and introduction of new course for tertiary and secondary education on UPS would go a long way towards providing information and knowledge that might promote their wider usage.

Conservation and management of forest. Strategies to protect rare species and species threatened with economic extinction should be enforced. For example, all laws on forest exploitation including felling of timber species, must be adhered to, to the letter. In addition, designated areas for special protection, as well as specific species whose conservation is of priority to Ghana, should be protected.

Conservation in-situ and ex-situ/Research farmers' linkages: Research institutions and other organizations and individuals involved in *in-situ* conservation of UPS should ensure that the requisite ecological and climatic conditions are provided for proper conservation. These require considerable financial resources in terms of equipment and laboratory facilities as well as human capital/expertise. *Ex-situ* conservation should be carried out in collaboration with farmers on-farm. It should encourage farmers to use their traditional methods to conserve the forest.

Protect local traditional conservation practices: Indigenous traditional knowledge (ITK) should be researched into, developed and preserved, to protect traditional conservation practices.

Market development:
The government and the private sector should put marketing strategies in place to promote underutilized plant species. Entrepreneurial training should be provided for producer groups of UPS, organization of buyer and supplier fora, market surveys for consumer preferences, partners, prices and marketing strategies. The Ghana Export Promotion Council should identify and provide market information, both on local and international markets, to meet the requirements of UPS producers and marketers.

Multiplication of underutilized species & resource development: One of the best ways of ensuring increased cultivation of underutilized plant species is to multiply the seedlings and provide conditions for a high percentage survival of seed and seedlings when sown, transplanted or propagated. Resource development should aim not only at ensuring conservation but also at improved quality of crop and tree species. The promotion of underutilized plant species could lead to resource development through increased cultivation, and utilization. Any crop or tree plant that eventually gets high cultivation and consumption would tend to get more attention and research focus.

Rural investment: Diversification policies of the country's agriculture towards underutilized plant species might promote rural investment as government and the people would invest in the cultivation, production, processing and the marketing of underutilized plant species. Rural financial institutions (Rural Banks) should develop appropriate financial products to make credit accessible to farmers.

Education of farmers: This should be accomplished through public education, awareness creation and particularly agricultural extension officers and farmer based organizations (FBOs), NGOs and District Assemblies.

Value addition: Creation of market demand and encouragement of farmers to increase cultivation should be pursued vigorously. Processing of underutilized food crops and tree species would add value to them. This might promote wider usage.

Consumption of UPS: Government, District Assemblies, Farmer based organizations (FBOs), and NGOs should put in measures or programmes to increase consumption. This will lead to more market demand which will trigger the supply of UPS. Sensitization programmes, public education and awareness creation, including the use of video documentaries, are needed to promote the consumption of UPS.

Nutrition
Although there is no policy on nutrition, *per se*, there are current government programmes to address malnutrition in Ghana. The strategies which aim at improving diet and intake, monitoring, and awareness creation through the Information Services Department, should be accorded topmost priority. They should also include the promotion of underutilized food crop species. The reasons why some food crops are underutilized require further investigation.

The School Feeding Programme (SFP) could be used to kill two birds with one stone. Whilst helping to solve the acute malnutrition problems for many pupils, it should also explore the possibility of promoting a broader use of underutilized but highly nutritious and medicinally valued food crops to feed the children. In so doing, they would be helping to inculcate in the pupils the benefits of these food crops.

Role of the media: Both the print and electronic media have significant roles to play in promoting public education, awareness creation, and sensitization programmes for underutilized plant species. The media should be included as frontline stakeholders in these programmes. Video documentaries on UPS should be produced and broadcast on radio and television in the country. In addition, the information vans of the Ministry of Information and National Orientation should publicize these documentaries throughout the country. This would help provide not only the requisite information but also help remove some of the negative perceptions about UPS.

Funding: Both public and private sectors should collectively and individually assist in the development and promotion of underutilised plant species. Lack of funding is a major limiting factor for the institutions involved in the research, development, popularisation and sensitisation of the species. For instance, the Plant Genetic Resources Research Institute should be well-funded to carry out its mandate of collection, characterization, evaluation, multiplication and conservation of such crops. The same applies to other institutions involved in the promotion of underutilized plant species. Also, funding for underutilized plant species activities may come from the organization's own resources, such as internally generated funds (IGF). Adequate financial resources must be committed to these species in the field of education, training, awareness-raising, research capacity building and product development. The Export Development and Investment Fund (EDIF) should fund export development of underutilized plant species in Ghana.

Since for most of the subventioned organizations, the main source of funding UPS is through Government of Ghana's (GoG) budgetary allocations and through Ghana's development partners, these two main sources should increase their level of financial support in order to make any significant impact. Funding programmes are very crucial for the successful development, popularization and utilization of underutilized plant species. It is important for the government, the private sector, and donor agencies to help such programmes. It is also important to initiate strategies to help increase funding for research institutions and provide funding and scholarship for post-graduate research in underutilized plant species. This would ensure the generation of future expertise in the subject area which would help in providing knowledge and information to promote wider cultivation and utilization of UPS throughout the country.

Combating bush fires: Bush fires are a menace to all plants including underutilized plant (crops and tree) species. The government, through its agencies, should embark upon stringent enforcement of laws against bush fires. The protection of the forest through the FSD and community based fire volunteers, individual efforts of farmers, would help to reduce the spate of bush fires and the consequential destruction of vegetation, including UPS.

A summary of proposed strategic framework for the promotion of underutilized plant species is presented in Table 5.

Table 5: Strategic framework for the promotion of underutilized plant species

Policy/Strategy	Organization/Location	Responsible Organization
Identify all underutilized plant species	All over the country	Research institutions, MoFA
Promote multiplication	Where suitable	Research institutes, MoFa
Promote consumption/use	In Ghana	Government, MoFA, and research institutions
Awareness creation	Throughout the country	Various stakeholders and district MOFA directorate
Resource development	Schools, communities	Basic and tertiary institutions
Market	National, district, local	EDIF, Export Promotion Council
Conservation	Institutional, communities	PGRRI, Community gene banks
Modification of School curriculum	Ministry of Education, Science and Sport	GES, National, districts
New course for tertiary and secondary education	Ministry of Education Science and Sport (MoESS),	GES, National, districts
Conservation and managing forest	Forestry	Forest managers, districts, environmental management committee
Value addition	National, District, and Local	Government-led, private sector
Modify educational curricula	National	Ministry of Education Science and Sport (MoESS), Educational institutions
Protect local traditional conservation practices	Locals, community level	Farmers and local institutions
Ex-situ conservation	Ex-situ facilities	PGRRI
Increased funding and scholarship for post-graduate research in UPS	Research institutions, tertiary institutions	Government, private sector, donor agencies
Collection, characterization, evaluation and conservation of the use of UPS	All over the country	Research Institutions, particularly the PGRRI, CRI, SARI and FRI
Initiate strategies to help increase funding for research institutions	Research organizations and institutions	Government Donor agencies
UPS in educational curricula	All schools throughout the country	Government, MoESS, GES, Educational institutions
Education of farmers	Throughout the country	Government, Research Institutions, Extension Services of MoFA
Obtain research results	From all sources both private and public	Policy makers
Generation of information to increase the knowledge base of	Throughout the country	Research Institutions/ Communities

UPS		
Improved and better communication of this information in order to raise awareness and build capacity	Throughout the country	Stakeholders
Influence policies at all levels to address UPS	Throughout the country	Stakeholders
Identify and provide market information, both on local and international markets, to meet the requirements.	Throughout the country	Ghana Export Promotion Council should
Combat bush fire menace	Through out the country	Government, district Assemblies, Fire services Department, Community-Based Fire Volunteers, etc

XIII. CONCLUSIONS

National policy on UPS

There is no single comprehensive national policy that enables or inhibits the wider utilization of plant species in Ghana, although there are general references to them in different policy documents issued by the various sector ministries. However there may be other policies that can indirectly affect UPS. Most of the key national agricultural and forestry development policies, programmes and projects make little provision for underutilized plant species. In fact, there are few national programmes, projects, or activities worth mentioning in relation to these species, such as BARADEP. The absence of a comprehensive national policy on underutilized plant species seriously undermines their development, including research, education, awareness creation, sensitization, market, availability, information and utilization.

The absence of a comprehensive national policy on underutilized plant species does not necessarily mean that their wider use is neither promoted nor inhibited. For example, credit facilities are accessible only to farmers who grow staples or export crops but not to the small-scale farmers who constitute the majority of farmers in Ghana and also cultivate some potentially useful underutilized plant species. This is a clear case of a policy that inhibits the wider production of underutilized plant species. In Ghana the school feeding programme is based on major staples, such as maize, rice and cowpea. This is another policy that does not encourage the use of locally available but nutritious underutilized plant species, for example, bambara groundnut and some indigenous leafy vegetables such as *Amaranthus lividus*. Many omissions and commissions on the part of policy-makers seriously undermine efforts at ensuring increased and wider use of UPS.

Attainment of goals

In order to achieve the goal of promoting underutilized plant species, a number of programmes and strategies are being implemented by various institutions, such as BARADEP, GPRS II. This requires vigorous research. The policy direction, particularly in terms of allocation of resources among various lines of agricultural research, tells much about the research orientation over a period of time. For example, under the Root and Tuber Improvement programme sponsored by IFAD, only a few root and tuber crops were selected, namely white yam, cassava and sweet potato, and within these crops there was differential allocation of resources. However, the issues concerning underutilized plant (crops and tree) species do not feature in the scheme of things. Security of food and raw materials requires the country to make an inventory of all plants (crops and tree) species which are currently underutilized and fashion out programmes to promote their cultivation and utilization as food and raw materials, respectively. Their cultivation and processing would provide greater employment opportunities for the people, particularly in the areas where they are to be found. It would also help in creating wealth and reducing poverty, and make greater contributions on the part of the sub-sector to the country's GDP, foreign exchange earnings, and government revenue.

The fact that underutilized species are cultivated locally and survive on poor soil, and that there is very little available information pertaining to their biology, use and marketing, are major contributory factors to their underutilization. Vigorous sensitization, awareness raising, and public education is required to overcome this situation; the public needs to receive more details about the biology, nutritional and medicinal values, uses and marketing of these plant and crop species in order to make informed decisions. Consequently, these crops and plants should be promoted. The Food Research Institute must establish an inventory of all food crops eaten in Ghana, which should indicate those with nation-wide and localized consumption. It should also explain why some foods are consumed nation-wide, whilst others have very limited and localized consumption. The document should also indicate which new food crops have been added to the menu at national or local levels, and why they have particular characteristics. It should also indicate the health and nutritional values as well as medicinal properties, where possible. It is worthy of note that as a result of on-going studies on some UPS and the information that will be obtained on the agronomy and nutritional values, in the case of food crops, and the physico-chemical properties of lesser-used timber and non- timber species, several species currently classified as UPS will not be classified as such in the future.

The existing generalized and scattered policies, contained in various national agricultural policies, hinder or do not promote an effective utilization of underutilized plant species. On the national scale very little effort is being made to promote the use of such species. It is imperative, therefore, to formulate national policies and laws that would enhance the effective conservation and sustainable use of currently underutilized crop species for food and agriculture and the contribution of underutilized species in overcoming poverty, hunger, malnutrition, income generation and thus poverty reduction - especially in rural areas.

In view of their potential, the country needs to focus more on underutilized plant species, through concise and comprehensive government policies, education/awareness creation and sensitization programmes through the print and electronic media. Government should come out with a clear-cut policy on underutilized plant species in which it spells out in concrete terms its policy, projects, strategies, activities, measures and funding regimes for the development and utilization of these species. The policy should put in place a monitoring and evaluation mechanism to ensure the success of the policy on these species.

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APPENDIX 1

The Questionnaire

ANALYSIS OF EXISTING POLICIES THAT ENABLE OR INHIBIT THE WIDER USE OF UNDER UTILIZED PLANT SPECIES IN GHANA

1. Is your Institute or organization involved in the promotion of underutilized plant species?

   YES { } NO { }

2. If yes, what species are you promoting?

3. Does your organization have any policies, strategies or activities which promote or support the utilization of currently under utilized plant species?

4. Are your strategies linked to other organizations?

5. What are the constraints facing the promotion of underutilized plant species?

6. What additional activities should be taken to support the promotion of under utilized plant species in Ghana?

   a. Your institution

   b. Ghana as a whole

7. What have been your sources of funding for the promotion of under utilized plant species?

8. What support should be given to the appropriate institutions to promote under-utilized plant species?

9. What are some of the possible negative impacts on how underutilized plant species have been promoted in Ghana?

10. In your opinion what account for the under utilization of some plant species?

11. Could or should Ghana in general do more to promote or support further utilization of these under utilized plant species?

    Yes { } No { }

    a) If yes why?

    b) If no why not?

12. Please suggest any policies, strategies or actions that might be undertaken

(Use the table below)

Strategy/Policy	Where	Whom

13. Please give any other general comments that would help to promote underutilized plant species in Ghana?

APPENDIX 2

Respondents to Questionnaire (15)

The Chairman, Ghana Timber Association

The Coordinator, Conservation International

The Dean, Faculty of Renewable Natural Resources, Kwame Nkrumah University of Science and Technology

The Director, Animal Research Institute

The Director, Biotechnology and Nuclear Agriculture Research Institute

The Director, Crops Research Institute

The Director, Crop Services, Ministry of Food and Agriculture

The Director, Food Research Institute

The Director, Forestry Research Institute of Ghana

The Director, Science Desk, Ministry of Education, Science and Sports

The Head, Agriculture and Medicine Division, Science and Technology Policy Research Institute

The Head of Botany Department, University of Ghana

The Head of Department of Geography and Resource Development, University of Ghana

The Head, Timber Industry Development Division, Forestry Commission

The Scientific Secretary, Plant Genetic Resources Research Institute