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Species diversity and threats to conservation of domesticated flora in the upper west region-Ghana

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Abstract

Relying on survey research design the study systematically sampled 13 communities in Upper West region taking into consideration, natural resources endowments such as fertile agricultural lands for cultivation. By means of simple random sampling, the study selected 160 domesticated food crop cultivators for an interaction through questionnaire administration. Other data collection methods were direct observation, photography and key informant interviews. The study identifies that diverse domesticated flora species are cultivated in Upper West region with their importance ranging from income, food, and raw materials to pleasure. It is also apparent in the study that modern scientific and traditional methods are used in conserving domesticated flora species with threats to conservation ranging from pest to diseases. The study concludes that, irrespective of threats to conservation of domesticated flora species, modern scientific and indigenous methods of conservation are instrumental in trying to promote sustainability.

Keywords: Species diversity, Threats, Conservation, Domesticated Flora.

Introduction

Farming evolved some 12000 years ago due to the advent of agriculture emanating from an elaborated knowledge on biodiversity[1]. Agriculture which is often considered as an impediment to biodiversity is dependent on diverse biologically rich resources. This is an emphasis of the fact that agriculture entails a wide range of managed agro ecosystems or ecosystems that derive benefits from natural resources.

Agro biodiversity therefore entails a variety of genetic resources, species as well as methods of exploiting biodiversity by farmers in order to ensure the production and management of crops, water, land, as well as biota and insects[2]. Agro biodiversity entails species outside farming systems and habitats but provides benefits to agriculture and also enhances the functioning of ecosystems[3].

The origin of the majority of cultivated and consumed staple crops globally are Africa, Latin America and Asia. These areas are earmarked as ‘‘centres of diversity’’[4].

Diversity was been maximized by traditional farming methods such as ‘‘home gardens’’ that are still found today in Sub-Saharan Africa with the inclusion of Upper West Region, South East Asia, central America, and some parts of Europe. Numerous studies have shown that traditional forms of shifting cultivation are agro ecologically diverse and also consist of plant species in abundance. This is sustainable in locations of the world where demographic and economic pressures are relatively minimal[5].

In the past two decades, agrobiodiversity has been very instrumental in contributing to sustainable production[6-10]. Also, in the light of Beaglehole and Yach[11], agrobiodiversity is crucial in providing enhanced nutrition.

The Upper West region is one of ten regions in Ghana where diverse domesticated food crops ranging from cereals, legumes, vegetables to roots and tubers are grown on subsistence and commercial basis. It is however noted that researches in contemporary times tend to focus on some other aspects of agro biodiversity to the neglect of species diversity and threats to conservation of domesticated flora. For instance, Benneh[12] looked at small scale farming systems in Ghana. Also, Drechsel and Keraita[13] focused on Irrigated Urban Vegetable Production in Ghana with emphasis on characteristics, benefits, and risk mitigation. By implication, a scanty attention has been given by researchers on species diversity and threats to conservation of domesticated flora species. The article in question aims at filling the identified knowledge gap on species diversity and threats to conservation of domesticated flora species in the Upper West Region of Ghana by focusing on species diversity of domesticated flora in Upper West region, their importance, methods of conserving domesticated flora species in Upper West region, and threats to conservation of domesticated flora species in Upper West region.

Methodology

Location, landmass and population size of the study area as well as methodology of the study are presented as follows:

Location, Landmass and Population Size: The Upper West Region is one of the ten regions in Ghana. It is located in the North-Western corner of Ghana with latitude of 9.8^0-11.0^0 North and longitude of 1.6^0 to 3.0^0 West. It shares a boundary with Burkina Faso to the North and republic of cote d Ivoire to the west. It has a landmass of 18,476 square kilometers which represent 12.7% of the total land area of Ghana. It also shares a border with the Upper East and Northern Region to the East and Northern Region to the south. It is the seventh largest region in the country with 11 districts. It has a potential for international and inter-regional trade by virtue of its position. According to the 2010 population and housing census of Ghana, the Upper West region has a population of 702,110 with a population density of 38 per square kilometers[14]. Figure-1 and 2 are maps of Ghana indicating Upper West region and study communities.

Methodology: Methodologically, the study is organized into research design, sources of data, sampling techniques, data collection methods, as well as techniques of data analysis and presentation. The study relied on survey research design. The survey research design was appropriate in this direction as the research objectives took into consideration the views, opinions, characteristics and expectations of the respondents. Neuman[15] contents that survey is appropriate for research objectives and questions that are about self-reported beliefs or behaviors and could even be stronger when answers sought by these research objectives and questions measure variables.

The research undertaken confirmed this notion. Also, the study relied on primary and secondary sources of data. In other words, apart a review of relevant literature, the study generated first-hand information from the field. The study communities namely Samanbaw, Sambisi, Wollembelle, Silbele, Naro, Nanga, Somboro, Gumo, Bielepong, Tanina, Motigu, Bugu, and Nanguri were systematically sampled taking into consideration endowment of natural resources such as fertile agricultural lands for cultivation. The study sampled 160 domesticated food crop cultivators by means of simple random sampling. Data collection methods were questionnaire administration, key informant interview, photography and direct observation. Data analysis was done by means of descriptive statistics as a component of Statistical Package of Social Sciences. Data presentation was done by means of tables, photographs, and charts.

Results and discussion

Findings in line with the objectives of the study are discussed as follows:

Types of Domesticated Food Crops Cultivated in Upper West Region: Table-1 and Figure-3 are illustrations of types of domesticated food crops cultivated in Upper West region as outlined by sampled domesticated food crop cultivators.

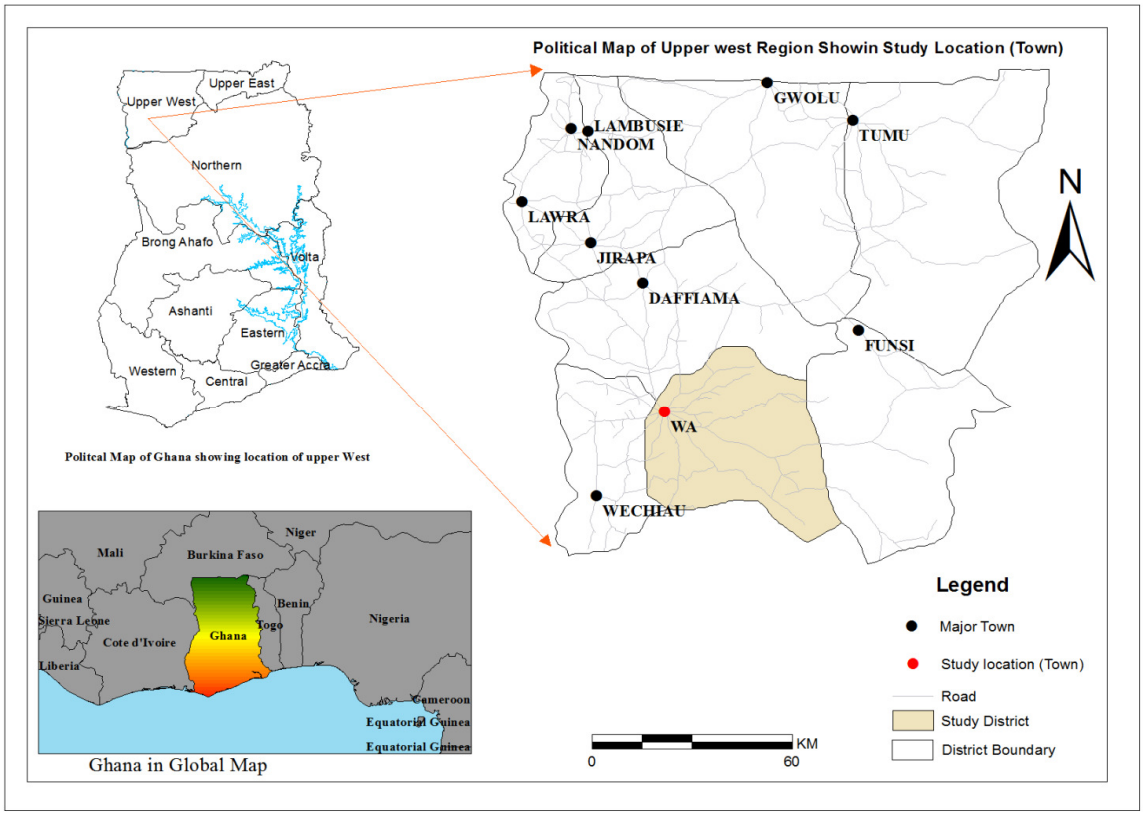

Figure-1: Map of Ghana Indicating Upper West Region. (Source: Constructed from Arc GIS).

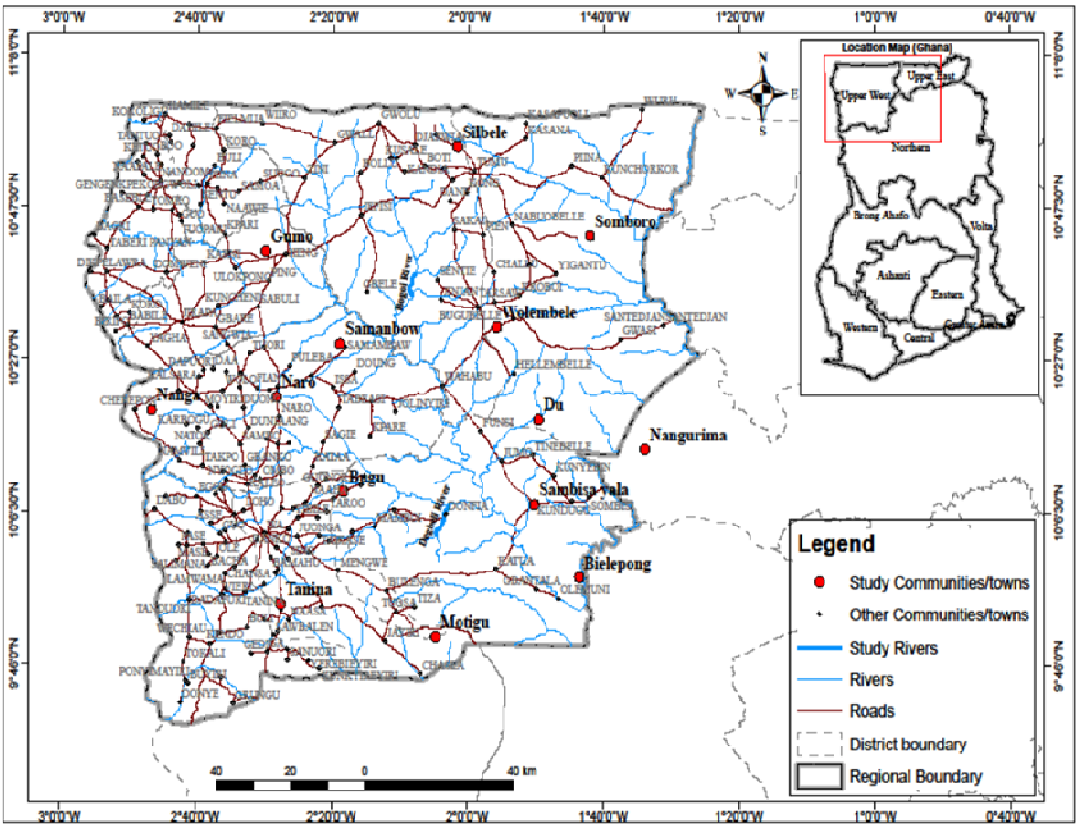

Figure-2: Map of Upper West Region Indicating Study Communities. (Constructed from Arc GIS).

Table-1: Sampled Study Community * Types of Crops Cultivated Cross tabulation.

Count								
		Types of Crops Cultivated						Total
		Rice, Maize, Millet, and Beans	Yam, Groundnuts, Maize, and Rice	Soybeans, Cassava, Tomatoes, and Pepper	Soybeans, Onion, Sweet potatoes, and Pepper	Onion, Sweet Potatoes, Tomatoes, and Pepper	Okro, Groundnuts, Pepper, Tomatoes	
Sampled Study Community	Samanbaw	2	2	1	3	2	1	11
	Sambisi	4	3	2	4	4	1	18
	Wellembele	3	2	2	3	2	1	13
	Silbele	3	2	2	2	1	1	11
	Naro	2	0	2	4	1	0	9
	Nanga	3	1	3	1	0	1	9
	Somboro	3	3	2	3	3	1	15
	Gumo	3	1	1	3	1	1	10
	Bielepong	3	2	2	3	2	1	13
	Tanina	1	2	2	3	2	1	11
	Motigu	6	2	2	3	2	1	16
	Bugu	0	2	2	3	2	1	10
	Nanguri	4	2	2	3	2	1	14
Total		37	24	25	38	24	12	160

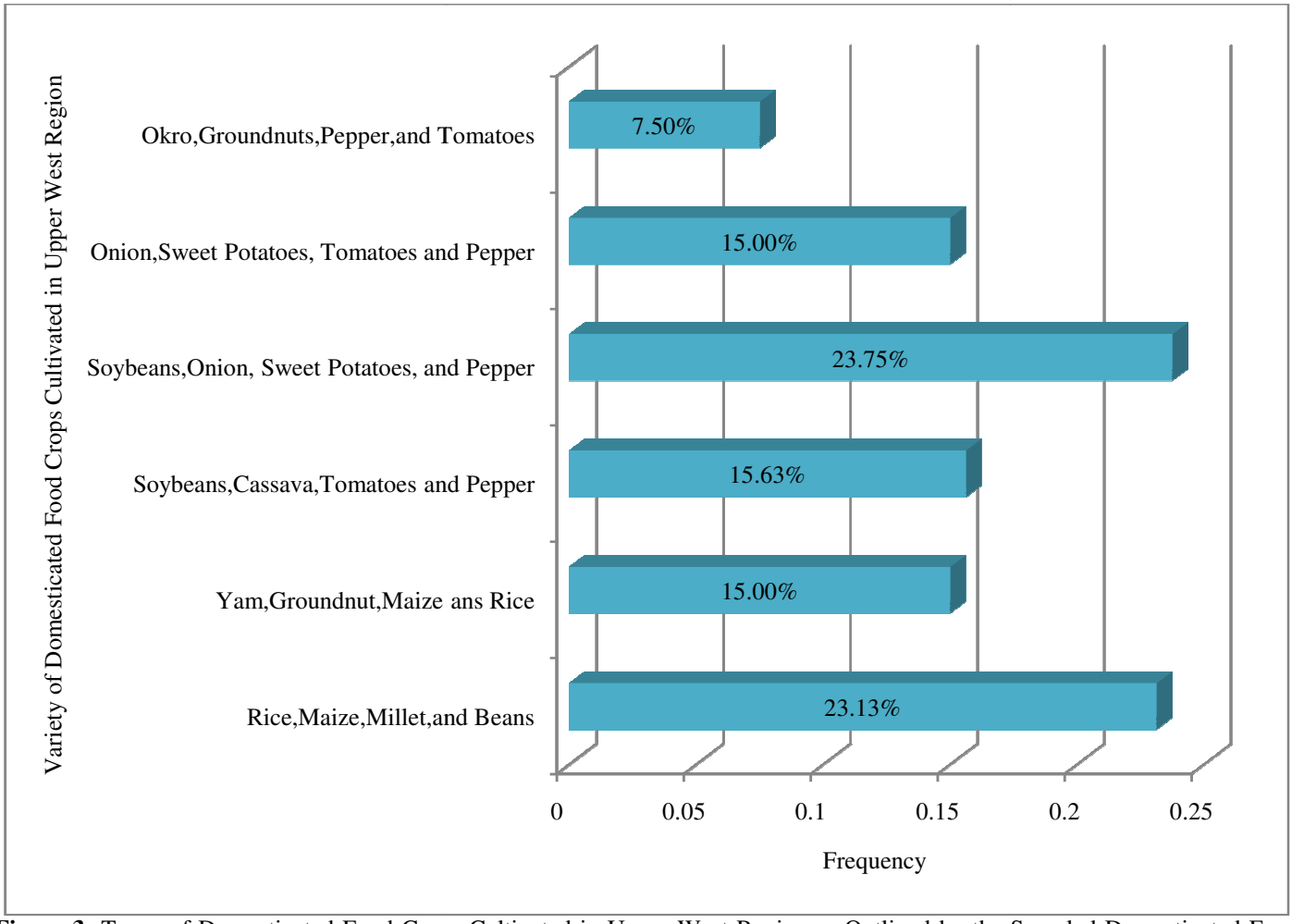

Figure-3: Types of Domesticated Food Crops Cultivated in Upper West Region as Outlined by the Sampled Domesticated Food Crops Cultivators.

It is clear from Table-1 and Figure-3 that out of 160 sampled domesticated food crops cultivators from 13 communities namely Samanbaw, Sambisi, Wollembelle, Silbele, Naro Nanga, Somboro, Gumo, Bielepong, Tanina, Motigu, Bugu, and Nanguri who are practicing domesticated food crops cultivation, the majority of the respondents with an absolute value of 38 and a percentage of 23.75% indicated that domesticated food crops cultivated in Upper West region are soybeans, onion, sweet potatoes, and pepper. Also, 37 respondents representing a percentage of 23.13% indicated rice, maize, millet and beans as domesticated food crops cultivated in the Upper West region of Ghana. More so, 25 respondents representing 15.63% mentioned soybeans, cassava, tomatoes, and pepper as domesticated food crops cultivated in the Upper West region. 24 respondents representing 15% also indicated yam, groundnut, maize and rice as domesticated food crops cultivated in the Upper West region. In addition, 24 respondents representing 15% also mentioned onion, sweet potatoes, tomatoes, and pepper as domesticated food crops cultivated in the Upper West region. However, minority of the respondents with absolute figure of 12 and a percentage of 7.5% indicated okro, groundnuts, pepper, and tomatoes. Conclusively, responses from the 160 sampled domesticated food crop cultivators from 13 selected communities indicate that domesticated food crops cultivated in the Upper West region are rice, maize, millet, beans, yam, groundnuts, soya beans, cassava, and sweet potatoes. In the light of the United Nations World Summit on Sustainable Development (UNWSSD, 2002)[16], crop diversity which is an essential part of biodiversity is instrumental in ensuring food security. A physical count confirmed the identified cultivated domesticated food crops. The identified domesticated food crops are illustrated in Table-2, taking into consideration their English names, scientific names, as well as order, family and class names.

The domesticated plants in Table-2 are illustrated from Figure-4 to 16 as follows. However, the identified domesticated plant species have not yet been evaluated by the International Union for the Conservation of Nature (IUCN), as such, their conservation status is not known.

Table-2: The identified domesticated food crops.

S/N	Common Name of Species	Order	Family	Class	Scientific Name of Species
1	Maize	Poales	Poaceae	Monocots	*Zea mays*
2	Millet	Poales	Poaceae	Monocots	*Pennisetumglaucum*
3	Rice	Poales	Poaceae	Monocots	*Oryza sativa*
4	Groundnut	Fabales	Fabaceae	Dicots	*Arachishypogaea*
5	Soybean	Fabales	Fabaceae	Dicots	*Glycine max*
6	WhiteYam	Dioscoreales	Dioscoreaceae	Monocots	*Dioscorearetundata*
7	Cassava	Malpighiales	Euphorbiaceae	Dicots	*Manihotesculenta*
8	Sweet potato	Solanales	Convolvulaceae	Dicots	*Ipomoea batatas*
9	Tomato	Solanales	Solanaceae	Dicots	*Solanum lycopersicum*
10	Hot Pepper	Solanales	Solanaceae	Dicots	*Capsicum frutscens*
11	Okro	Malvales	Malvaceae	Dicots	*Abelmoschusesculentus*
12	Onion	Asparagales	Amaryllidaceae	Monocots	*Allium cepa*
13	Beans	Fabales	Fabaceae	Dicots	*Phaseolus vulgaris*

Figure-4: *Zea mays* (Maize Plant).

Figure-6: *Oryza sativa* (Rice Plant).

Figure-5: *Pennisitumglaucum* (Millet Plant).

Figure-7: *Arachishypogaea* (Groundnuts plant).

Figure-8: *Glycine max* (Soybeans plant).

Figure-11: *Ipomoea batatas* (Sweet Potatoes plant).

Figure-9: *Dioscorearetundata* (WhiteYam Plant).

Figure-12: *Solanum lycopersicum*(Tomato plant).

Figure-10: *Manihotesculenta* (Cassava Plant).

Figure-13: *Capsicum frutscens* (Hot Pepper plant).

Figure-14: *Abelmoschusesculenta* (Okro plant).

Figure-15: *Aliumcepa* (Onion plant).

Figure-16: *Phaseolus vulgaris* (Beans Plant).

Importance of Domesticated Flora Species: The importance of domesticated food crops according to the survey ranges from food, income, and raw materials to pleasure. Figure-17 is an illustration of the importance of domesticated food crops cultivation in the Upper West region as outlined by the sampled domesticated food crops cultivators.

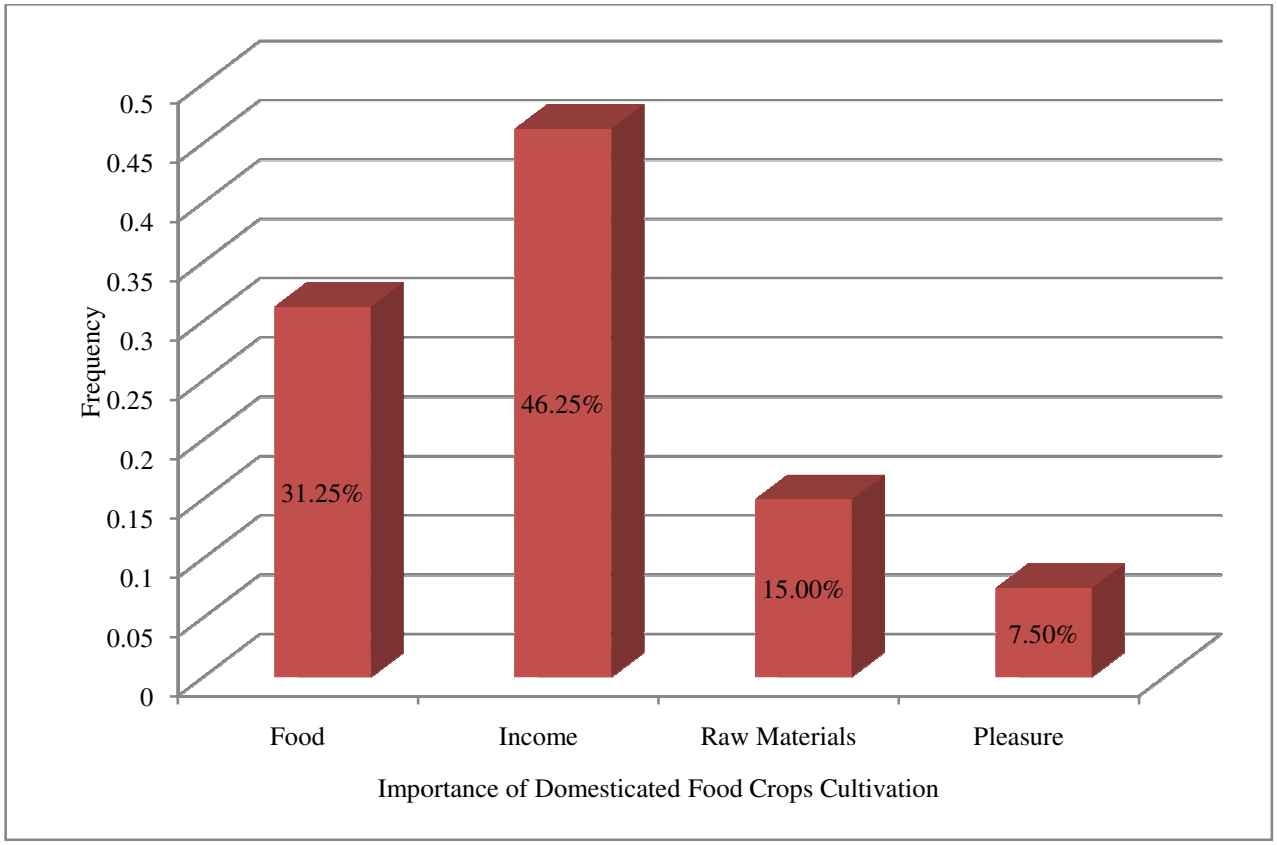

Figure-17: Perceived Importance of Domesticated Food Crops Cultivation in Upper West Region as outlined by Sampled Domesticated Food Crops Cultivators.

It is clear from Figure-17 that, the majority of the respondents representing 46.25% indicated that they obtain income from domesticated food crops cultivation, followed by 31.25% of the respondents who mentioned that they obtain food from the cultivation of domesticated food crops. Also, 15% of the respondents indicated that they obtain raw materials from domesticated food crops cultivation for agro-industries. However, 7.5% of the sampled domesticated food crop cultivators representing the minority indicated that they cultivate domesticated food crops for the sake of pleasure. From the ongoing discussion on the importance of domesticated food crops cultivation, it is an established fact that domesticated food crop cultivation in the Upper West region is an avenue for the provision of food, income, raw materials, and pleasure. The International Conference on Technical Cooperation with specific reference to the International Atomic Energy Agency held in 2017 [17], argue that a safe, reliable, and nutritious supply of food is a common need for people around the globe. The conference also added that agriculture is crucial to developing countries because a well-functioning agricultural sector is an avenue for ensuring food security and obtaining national income.

Methods of Conserving Domesticated Food Crops: The survey reveals two broad classes of methods for conserving domesticated food crops. They are indigenous methods and modern scientific methods. Figure-18 is an illustration of indigenous methods of conserving domesticated food crops in Upper West region as outlined by the sampled domesticated food crops cultivators.

It is clear from Figure-18 that out of the 160 sampled domesticated food crops cultivators from 13 sampled communities, 23.75% of the respondents indicated bush fallowing as an indigenous method of conserving domesticated food crops, additional 23.75% of the respondents mentioned composting as an indigenous method of conserving domesticated food crops, 15% of sampled domesticated food crop cultivators indicated manure application as an indigenous method of conserving domesticated food crops, 22.50% of the respondents mentioned organic farming as an indigenous method of conserving domesticated food crops, 7.50% of the respondents indicated slash and burn agriculture as an indigenous method of conserving domesticated food crops, whereas the remaining 7.50% of the respondents mentioned indigenous fire belt creation as an indigenous method of conserving domesticated food crops. By implication, indigenous methods of conserving domesticated food crops in Upper West Region are bush fallowing, composting, manure application, practice of organic farming, practice of slash and burn agriculture, and indigenous fire belt creation. Quansah et al[18] argue that the major strategies used by farmers in Ghana in maintaining organic matter in soil are mulching with crop residues, manure application, slashing weeds without burning, shifting cultivation (natural fallow), and composting. Figure-19 is an illustration of modern scientific methods of conserving domesticated food crops in Upper West Region.

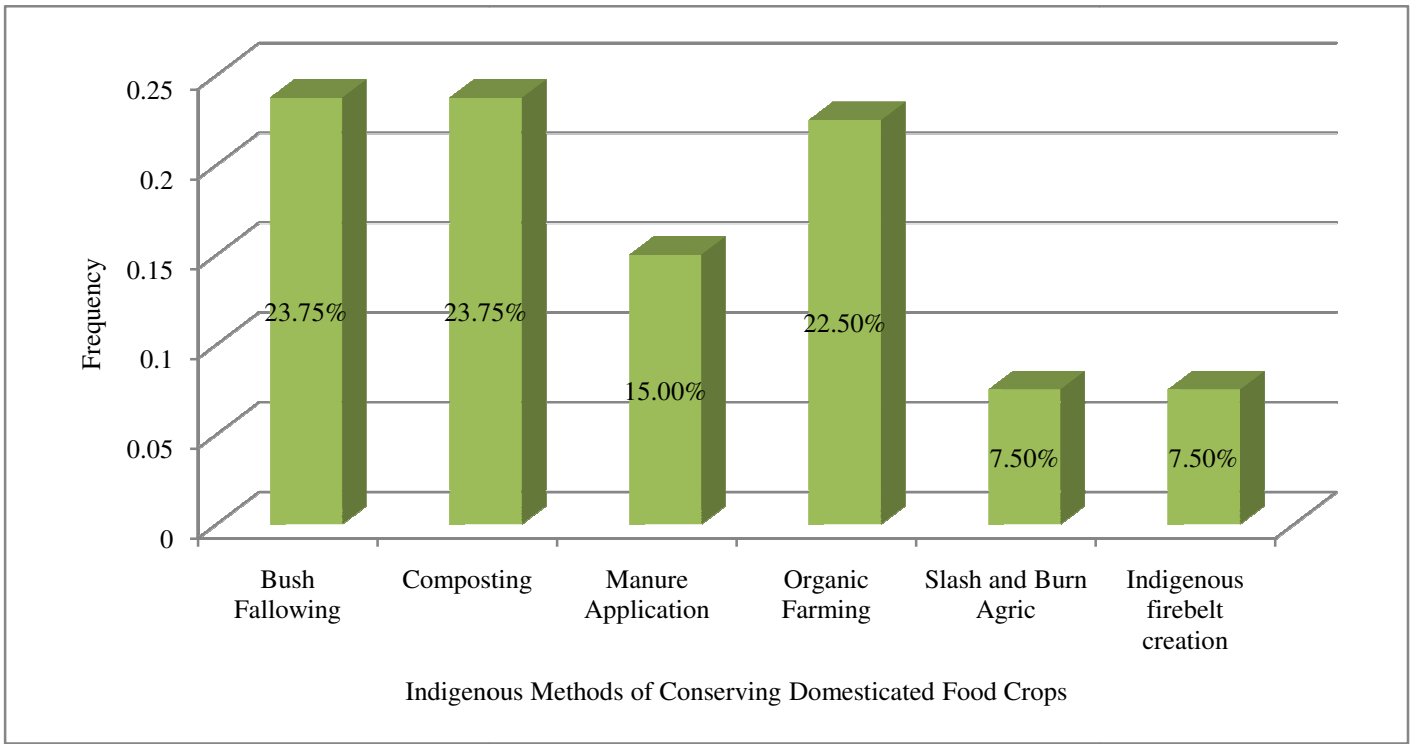

Figure-18: Indigenous Methods of Conserving Domesticated Food Crops in the Upper West Region as outlined by the Sampled Domesticated Food Crops Cultivators.

It is clear from Figure-19 that out of the 160 sampled domesticated food crops cultivators from 13 sampled communities who are practicing domesticated food crops cultivation, 23.13% of the respondents indicated application of chemical fertilizer as a modern scientific method of conserving domesticated food crops, 30.63% of the respondents mentioned application of herbicides as a modern scientific method of conserving domesticated food crops, 23.75% of the respondents indicated application of insecticides as a modern scientific method of conserving domesticated food crops, whereas 22.50% of respondents indicated resorting to genetic modification as a modern scientific method of conserving domesticated food crops. By implication, modern scientific methods of conserving domesticated food crops in Upper West region are application of chemical fertilizer, application of herbicides, application of insecticides, and resorting to genetic modification. Wasim et al[19] are of the view that pest control and agricultural output were greatly enhanced in the 1970's and 1980's as a result of introduction of herbicides and fungicides. Also, Gizaki et al[20] are of the opinion that, there has been a drift of world agricultural system, in terms of reliance on chemical fertilizer and this has contributed to sustainable food supply.

Threats to Conservation of Domesticated Food Crops in Upper West Region: The survey reveals that pest and diseases are threats to conservation of domesticated food crops in Upper West region. Figure-20 and 21 are illustrations of pest and diseases respectively serving as threats to conservation of domesticated food crops in Upper West region.

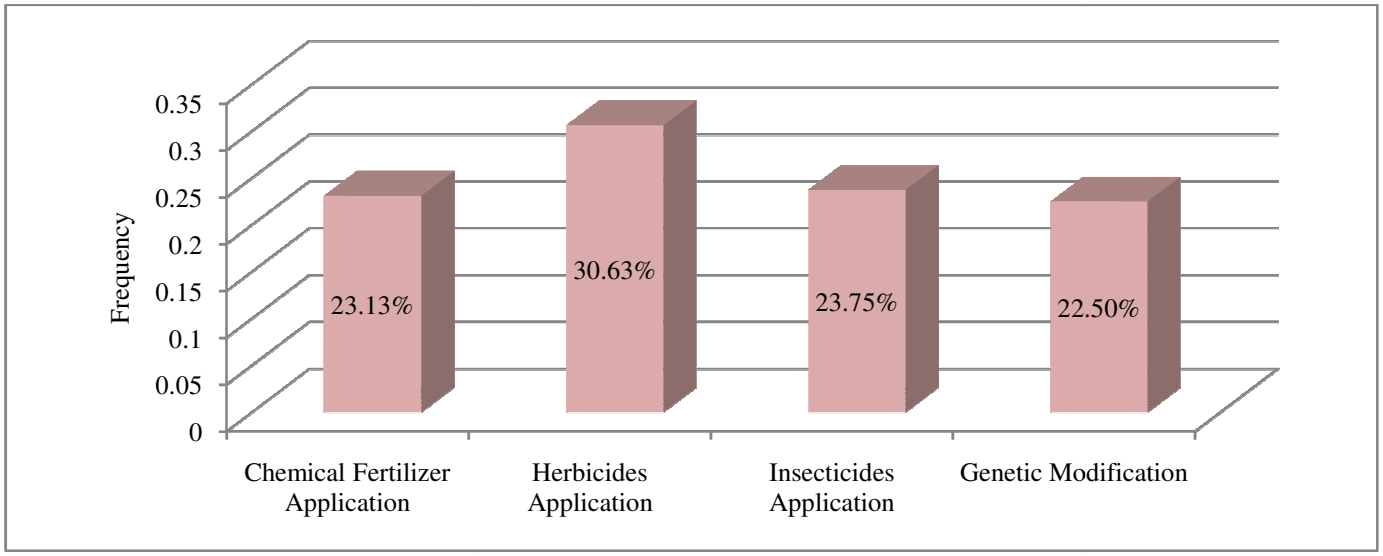

Figure-19: Modern Scientific Methods of Conserving Domesticated Food Crops in Upper West Region as outlined by the Sampled Domesticated Food Crops Cultivators.

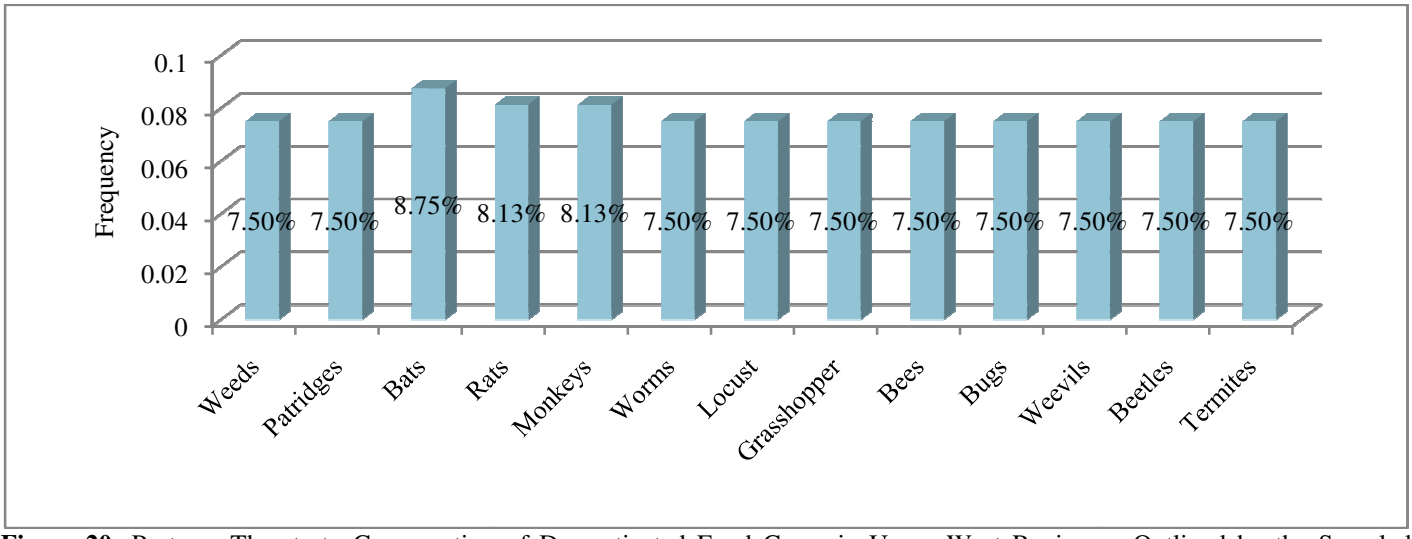

Figure-20: Pests as Threats to Conservation of Domesticated Food Crops in Upper West Region as Outlined by the Sampled Domesticated Food Crops Cultivators.

From Figure-20, it is revealed that 7.50% of respondents each identified weeds, patridges, worms, locust, grasshopper, bees, bugs, weevils, beetles and termites respectively as pests threatening the conservation of domesticated food crops in Upper West region. Also, 8.75% of respondents identified bats as a pest threatening the conservation of domesticated food crops in Upper West region. More so, 8.13% of respondents each mentioned rats and monkeys respectively as pests threatening the conservation of domesticated food crops in Upper West region. By implication, pests threatening the conservation of domesticated food crops in Upper West region are weeds, partridges, bats, rats, monkeys, worms, locust, grasshoppers bees, bugs, weevils, beetles and termites. Figure-21 is an illustration of diseases threatening the conservation of domesticated food crops in the Upper West Region.

From Figure-21, 7.50% of respondents each identified early blight, bacteria canker, bacteria wilt, corn smut, dumping off, blossom end rot, brown rot, leaf spot, and mosaic virus respectively as diseases threatening the conservation of domesticated food crops in Upper West region. Also, 8.75% of respondents indicated downy mildew as a disease threatening the conservation of domesticated food crops in Upper West region, more so, 8.13% of respondents mentioned anthracnose as a disease threatening the conservation of domesticated food crops in Upper West region. However, 15.63% of respondents representing the majority indicated potato scab as a disease threatening the conservation of domesticated food crops in Upper West region. Conclusively, diseases threatening the conservation of domesticated food crops in Upper West region are early blight, downy mildew, bacteria canker, anthracnose, bacteria wilt, corn smut, dumping off, blossom end rot, brown rot, leaf spot, mosaic virus, and potato scab. Table-3 is an elaboration of diseases threatening the conservation of domesticated food crops, as well as their causes and symptoms.

Conclusion

The study concludes that domesticated flora species cultivated in Upper West region are diverse. They consist of cereals, legumes, vegetables, as well as root and tubers with their importance ranging from food, income, and raw materials to pleasure. The study also reveals two broad methods of conserving of domesticated food cropsin the pursuit of sustainable development. They are modern scientific methods and indigenous knowledge. More so, pest and diseases according to the study are threats to the conservation of domesticated food crops.

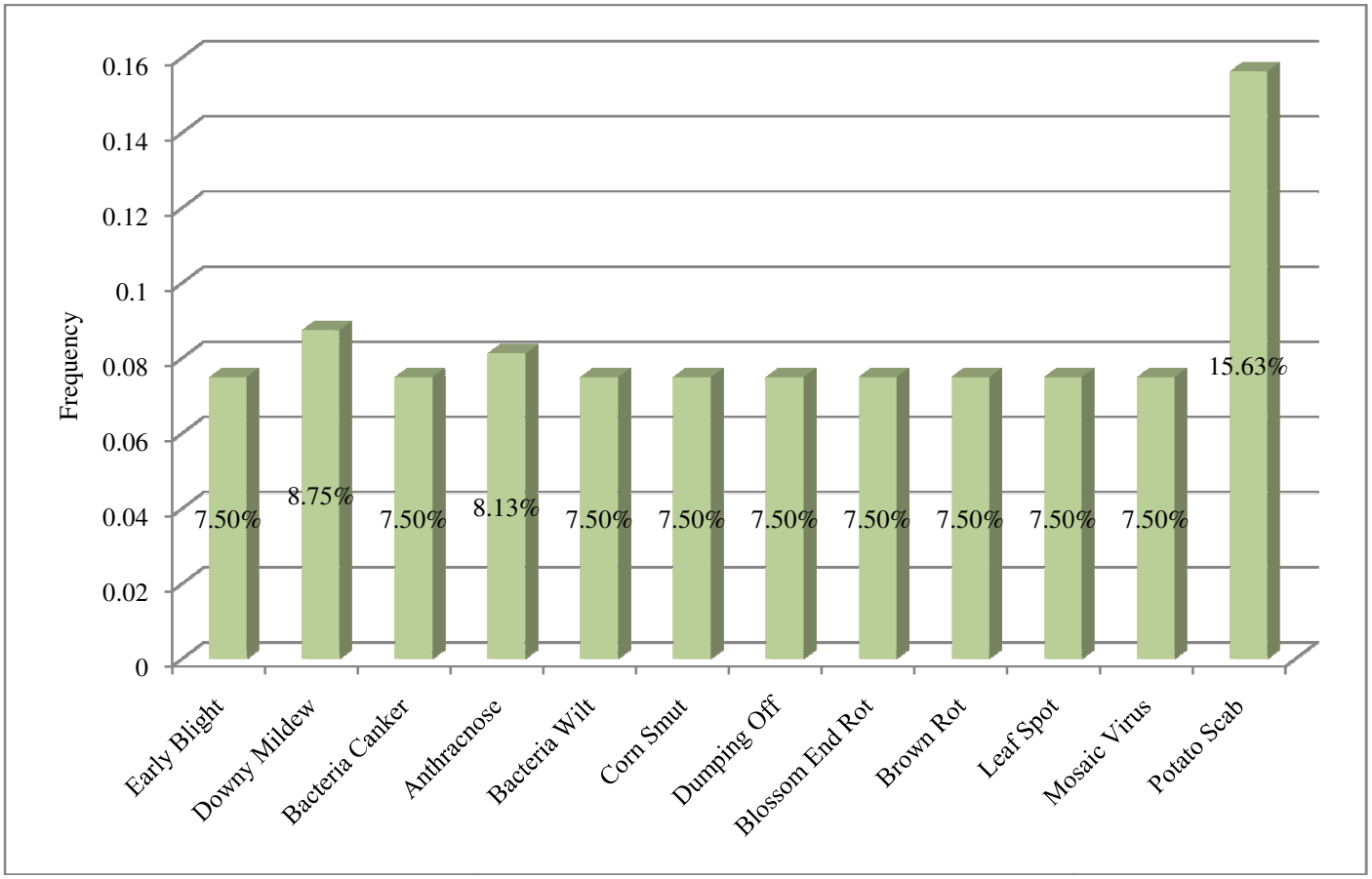

Figure-21: Diseases Threatening the Conservation of Domesticated Food Crops in Upper West Region as Outlined by the Sampled Domesticated Food Crops Cultivators.

Table-3: Elaboration of Diseases Threatening the Conservation of Domesticated Food Crops in Upper West Region.

Disease	Caused by	Symptoms	Crops Affected
Mosaic Virus	Virus	Speckled Appearance on Leaves	Tomatoes, beans, potatoes
Early Blight	Fungus	Small brown spots	Tomatoes and potatoes
Downy Mildew	Fungus	White and grey discoloured areas on upper leaf surface	Onion and beans
Bacteria Canker	Bacteria	Wilting discoloration of the leaf veins	Tomatoes
Anthracnose	Fungus	Darkening of plant leaves	Tomatoes and onions
Bacteria Wilt	Bacteria	Wilting of Plant Leaves	Tomatoes and pepper
Corn Smut	Fungus	Mushroom-like structure on the ears of corn	Corn
Dumping Off	Fungus	Dumping off of seedlings	Tomatoes and pepper
Blossom End Rot	Fungus	Rotting of fruits at the ends	Tomatoes and pepper
Leaf Spot	Fungus and Bacteria	Spots on plant leaves	Tomatoes and Pepper
Potato Scab	Bacteria	Scabs on potatoes	Potatoes

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