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The Herbarium Technique for Some Selected Plants Species in Damaturu Local Government Area, Yobe, Nigeria

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Abstract
Preservation of plant materials is a huge subject; techniques differ for different groups or habits of plants and are also related to the purpose of preservation. Herbariums are the natural history museums storing and are displaying specially mounted dried and poisoned plant specimens meant for numerous scientific and social benefits. This project discussed the methods of herbarium preparation starting from plant collection leading to the final storage, maintenance, and utilization. In this project, the important of herbarium has been let known by the respondents. For this study, 150 questionnaires were distributed and retrieved within three institutions within Damaturu metropolis (Yobe state university, Federal polytechnic Damaturu, Yobe state college of Agriculture). 47% of the respondent's response shows that lack of herbarium within the study area is such a same for such a community. Deforestation was found out to be one of the major problems affecting the conservation of plant species within the study area. The study also recommends that there is a great need to increase funding for meeting current and future herbarium functions, an herbarium should be considered a national facility, the government within the study area should put on more effort towards the conservation of plant species.
Keywords: Herbarium, Technique, Selected, Plants, Damaturu LGA.

Introduction

Herbarium is a store house. Collection of dried and pressed plant specimens collected from different places, arranged according to some known system of classification, to facilitate identification, nomenclature and preservation of the records are kept in the herbarium [1]. These collected specimens are kept in pigeonholes of steel or wooden cupboards specially prepared for such purpose. Herbarium is like a library but differs in that the information is stored in a biological form as pressed, dried, and annotated plant specimens [2]. Collected individual plant specimens are dried by taking care of all essential parts for identification and pasted on a well-defined sheet, this individual sheet is also called Herbarium (Plural: Herbaria [3]. The specimens may be whole plants (herbs, grasses) or plant parts, which are properly dried and pressed. Some plants, which are either succulents are unsuitable for pressing and drying techniques, are preserved in specimen bottles using suitable liquid preservatives such as Formaldehyde or F.A.A. solution (Formalin-Acetone-Alcohol). Gymnosperm cones and palm fronds are stored dry in labelled glass boxes. Small specimens, such as seeds, floral parts, bark, roots mosses, ferns etc. are air dried and packed in small paper/polythene envelopes [4].

The "Herbarium" has two meanings one is a repository or storehouse of collected plant specimens and second is a plant specimen according to accepted international standards. If the term "Herbarium" followed by a code assigned by an "Index Herbarium (IH)" authority in the parenthesis [1]. It shall be considering as repository and the plural is "herbaria". If the term "Herbarium" is not followed by the code in parenthesis we shall be consider it as a "plant specimen" and plural is "herbarium specimens". It is believed that the first established Herbarium is in 1570 in Bologna, Italy, by Luca Gini. It is now estimated that there are nearly 350,000,000 specimens that are documented from the world's vegetation. These herbarium specimens are available at approximately 3,000 herbaria in the world, with approximately 12,000 associated curators and plant specialists. It shall be noted that those collections that are permanent scientific repositories are included in IH, and the new registrants must demonstrate that their collection is accessible to scientists and is actively managed. Herbarium collections can have great significance and value to science, and have many uses [5] Herbaria have long been essential for the study of plant taxonomy, the study of geographic distributions, and the stabilizing of nomenclature. Linnaeus's herbarium, which contains over 4,000 types, now belongs to Linnaeus's Society in England[6]. Modern scientists continue to develop novel, non-traditional uses for herbarium specimens that extend beyond what the original collectors could have anticipated [5]. Since plants are very important part of our environment, as the rate of habitat destruction increases and climate change precipitates rapid changes in species ecology. Herbarium document the world's flora a thereby provide a constant and permanent record of botanical diversity. This role is increasingly important in showcasing the value and role in which our plants play in the survival and maintenance of our healthy environment. The purpose of this research is to analyze various herbarium techniques for some plants within Damaturu LGAs. To assess the relevance of herbarium collections as tools for conservation biology, in providing an insight on purpose and importance of herbarium in our locality and through investigate problems affecting the effectiveness of the herbarium techniques for some plants within the study area.

Materials and Methods

The data for this study were collected in Damaturu town where information on respondent's personal data and infrastructural facilities were collected by both primary and secondary sources. The primary method was basically observations and personal interviews to appraise the pattern of herbarium techniques on various plants. The Secondary sources were obtained from various agencies including books, published govt. documents and conference proceedings.

Study Area

Damaturu is located between latitude 11° 39' 30" – 11° 47' 00" N and longitude 11° 54' 00" – 12° 02' 00" E. The town has been the district headquarters of the then Borno province. It was later made the headquarters of Damaturu Local Government in 1976, and in 1991 it became the capital of Yobe State and headquarters of Damaturu Emirate in northeastern Nigeria. The town is covering a land area of 206, 241 Km^2. Damaturu was founded in 1813 and it is multiethnic with the Fulani and Kanuri as the dominant ethnic groups. Others are the Hausas, Karai-Karai, Bade and other minority tribes of the state. With the creation of Yobe state in 1991, Damaturu is a local government area in Yobe state, it has an area of 2,366 KM_2 (914 sq. mi) [7].

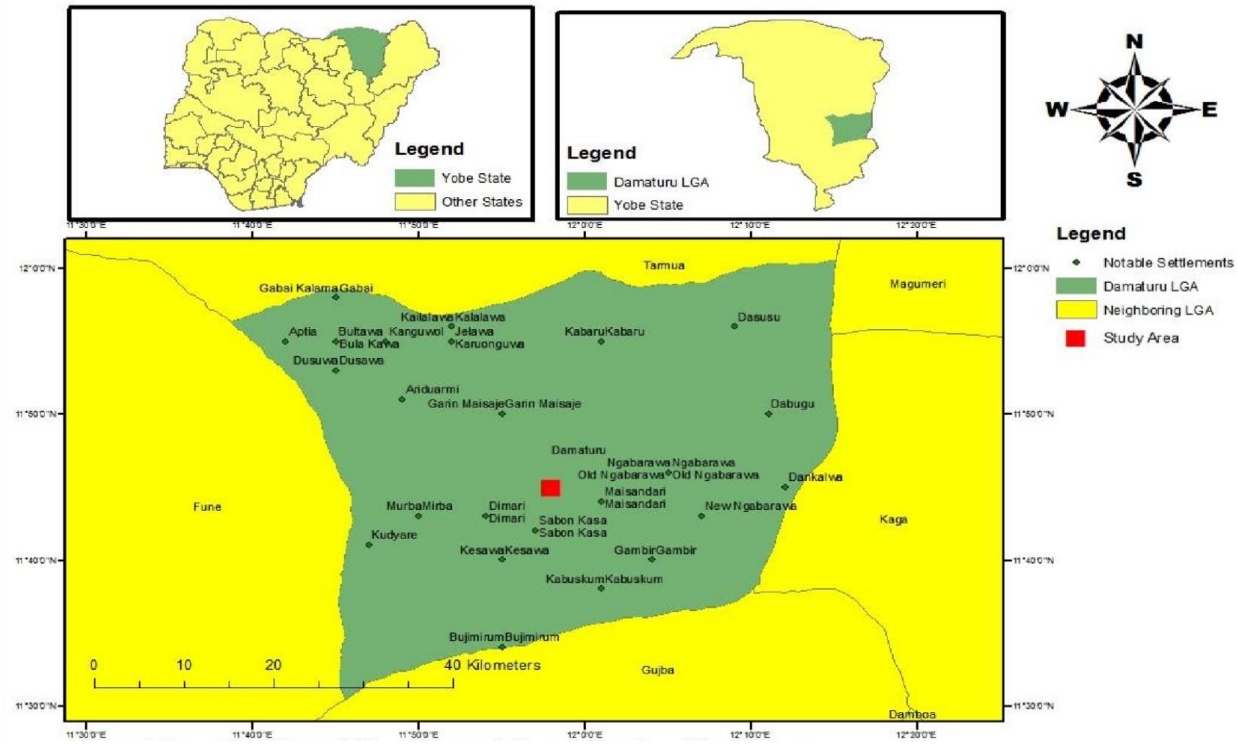


Fig 1: Yobe State Showing Damaturu (Arc GIS 2.0)

Technique Used in Preparing an Herbarium Sheet

Preparing a herbarium sheet is a meticulous process used to preserve plant specimens for scientific study and reference. The step-by-step guide and materials/tools needed for the techniques used in preparing an herbarium sheet are as followings: Fresh plant specimen, Cardboard or stiff paper for mounting, Herbarium sheet or heavy paper for mounting, blotting paper, Plant press or newspaper, drying paper or newspaper, Scissors or pruning shears, Labels, Pencil or archival pen, Clear plastic sleeves (optional, for protection). While the procedure may be as followings: Collection: Collect a fresh plant specimen. It should include leaves, stems, flowers, and if possible, roots. Choose a representative specimen that shows key characteristics of the plant. Pressing: Place the plant specimen between sheets of blotting paper or newspaper to remove excess moisture. Arrange the specimen as flat as possible. Press the specimen between cardboard or stiff paper inside a plant press. Apply even pressure and secure with straps or bolts. Leave the specimen in the press for a few days to several weeks until it is thoroughly dried. Mounting: Once the specimen is completely dried, remove it from the press. Carefully arrange it on a herbarium sheet or heavy paper, ensuring that all parts of the plant are visible and not overlapping. Use archival glue or tape to secure the specimen to the sheet. The label should be placed at the bottom right corner of the sheet. Labelling: Prepare a label with important information about the specimen. Include the following details: Date of collection, Collector's name, Location (latitude, longitude, altitude, habitat), Plant's common name (if applicable), Plant's scientific name (genus and species), Additional notes about the specimen. Attach the label to the herbarium sheet near the bottom right corner, ensuring it does not cover any critical parts of the specimen. Protection: To protect the specimen from damage, you can place it inside a clear plastic sleeve or use a clear adhesive sheet to cover it. This helps keep the specimen clean and prevents it from deteriorating due to handling. Storage: Store the herbarium sheet in a cool, dry, and dark place, such as a herbarium cabinet or archival box. These conditions will help preserve the specimen for future reference. Cataloguing: Record the specimen's information in a catalogue or database,

including the accession number, so it can be easily retrieved for research purposes. Maintenance: Periodically check the herbarium sheets for signs of deterioration or pests. Replace any damaged or deteriorating sheets as needed to ensure the long-term preservation of the specimen [8].

Remember that preparing a herbarium sheet requires attention to detail and a commitment to preserving the specimen accurately. Properly curated herbarium collections are valuable resources for botanical research and education.

Result and Discussion

This chapter deals with data collected and were presented and analyzed to proffer answers to research question from the respondents on various knowledge regarding herbarium techniques within the study area.
One hundred and fifty (150) open ended structure questionnaires were distributed within the students of three selected institutions (Yobe state university, Federal polytechnic Damaturu, and Yobe state college of agriculture). The one hundred and fifty (150) copies of questionnaire administered were properly filled and returned. Below is the presentation of data in frequency table and figures.

Characteristics of the Respondent

Table 1: Characteristics of the Respondents

S/N	VARIABLE	FREQUENCY	PERCENTAGE (%)
1.	**Sex**		
	Male	90	60
	Female	60	40
	Total	**150**	**100**
2.	**Age of the Respondents**		
	Below 20 years	50	33
	21-30 years	79	53
	31-40 years	20	13
	50 years and above	1	1
	Total	**150**	**100**
3.	**Marital Status**		
	Married	16	10
	Single	130	87
	Divorce	4	3
	Widow	0	0
	Total	**150**	**100**
4.	**Educational Status**		
	Primary	0	0
	Secondary	98	65
	Tertiary	50	33
	Non-formal education	2	2
	Total	**150**	**100**
5.	**Occupation**		
	Civil servant	25	17
	Trader	56	37
	Farmer	46	31
	Self-employed and housewife	23	15
	Total	**150**	**100**

Source: Field Survey, 2022

Table 1 above shows that males have the higher percentage of participation with 60% while the remaining 40% were female. Likewise, in age distribution, 20-31 years with 53% have the highest percentage among the others. Moreover, the respondent in educational status shows those with secondary school's certificate have the highest with 65% compared to their counterparts. In the Marital status, single household has 87% On the matter of occupation, most respondents with 37% were traders, farmers within the respondents constitute 31%, while respondents with least percentage were either civil servants or self-employed with 17% and 15% respectively.

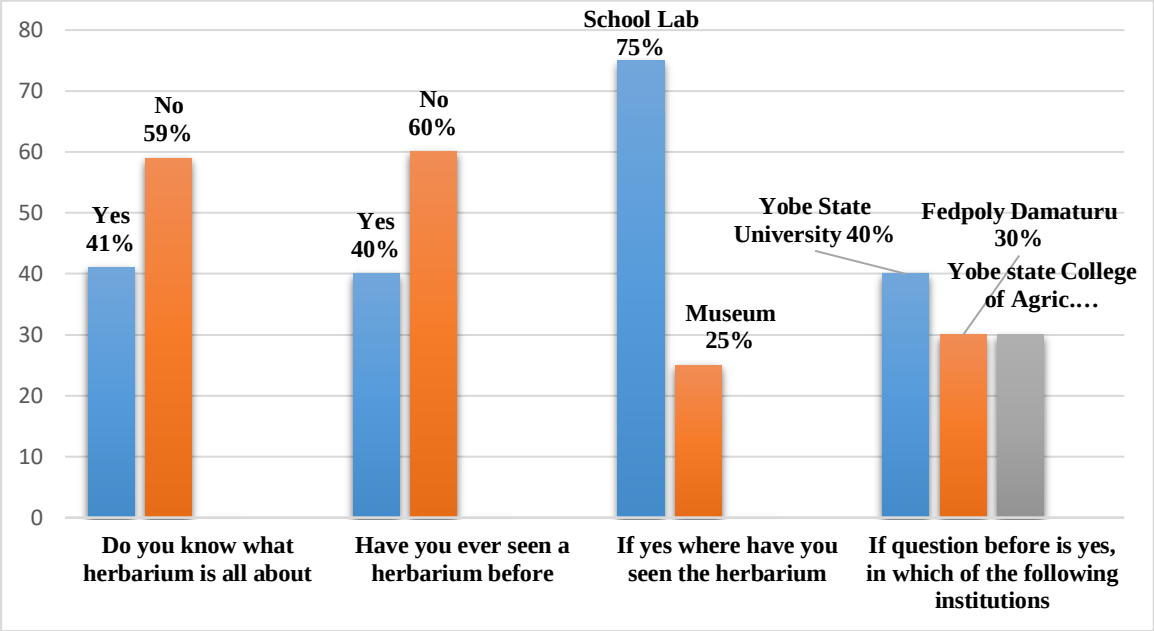


Fig 2: Information about what herbarium is all about

Fig 2, centered on the question about respondent knowledge on herbarium and the response was 41% of the respondents answered yes, while the remaining 59% response no. The next question was on the whether the respondents have ever seen a herbarium before, were 40% of the respondents acknowledge ever saw it, and 60% of the respondents have never seen a herbarium before. This further continues by asking the respondents places in which they have ever seen a herbarium. 75% of the respondents explained been seen in their school laboratory, while 20% of the respondents said in the museum, while the least respondents with 5% said in other places. Further question was on in which of the following institutions within the study area they have seen the herbarium. 40% of the respondents indicate Yobe state university, while Federal polytechnic Damaturu and Yobe state college of agriculture with 30% respectively.

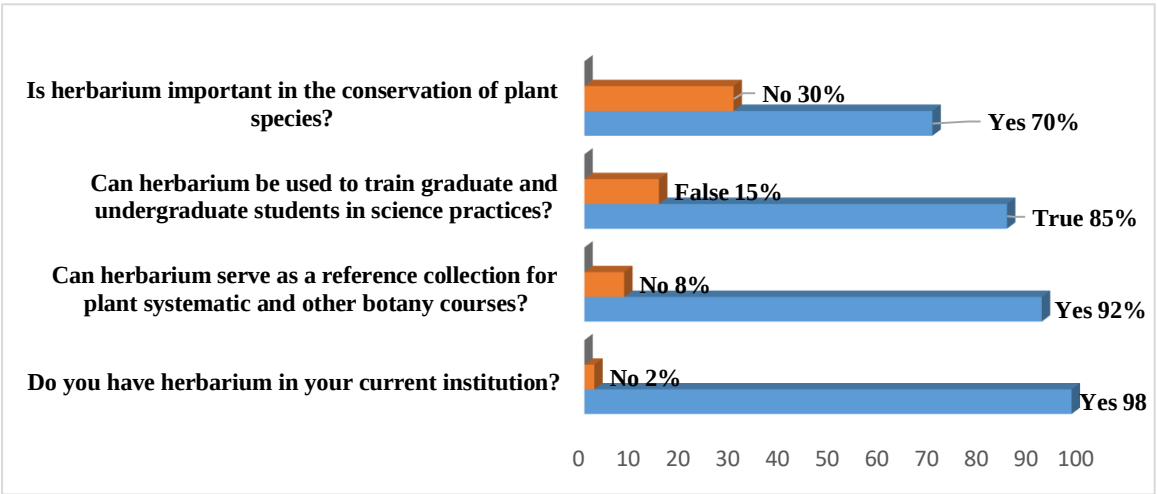


Fig 3: Importance of herbarium in the conservation of plant species.

Figure 3 shows the respondents response on the important of herbarium in the conservation of plant species, were 70% of the respondents said yes, while the remaining 30% of the respondents said no. The figure further illustration the ability of using herbarium in teaching and learning in both graduate and undergraduate studies within the study area, were 85% of the respondents said yes a herbarium can be a key tool in training graduate as well as undergraduate students in science practices, while the remaining respondents of 15% said no. A herbarium is very important in the conservation of plants and can serve for many references purpose in botany courses with 92% of the respondents said yes, while the remaining 8% of the respondents said no. Finally, on whether their current institution has a herbarium, 98% of the respondents said yes, while 2% of the respondents said no.

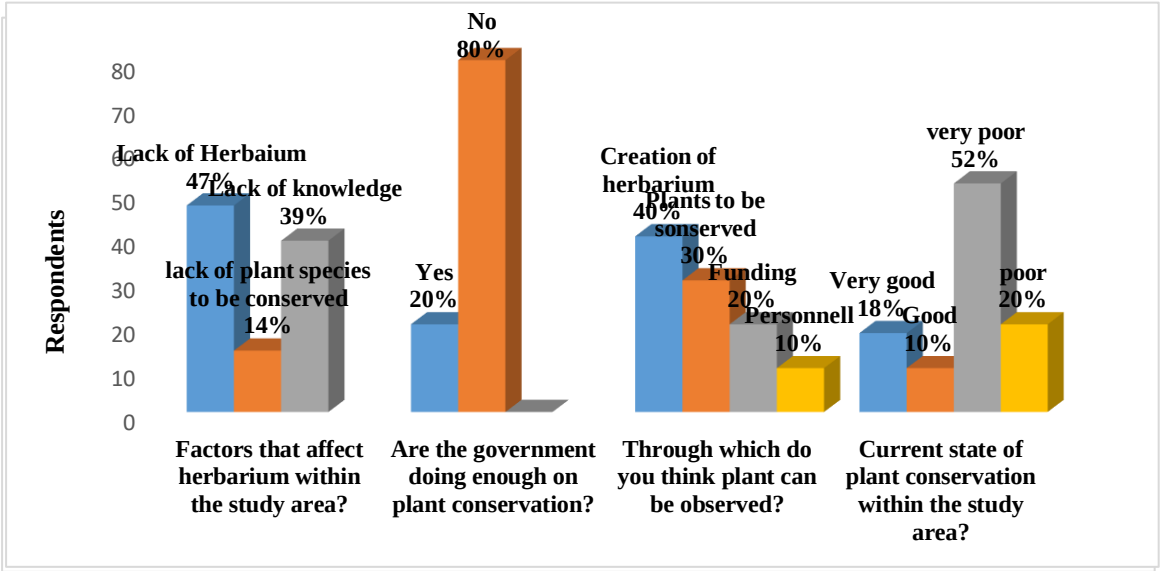
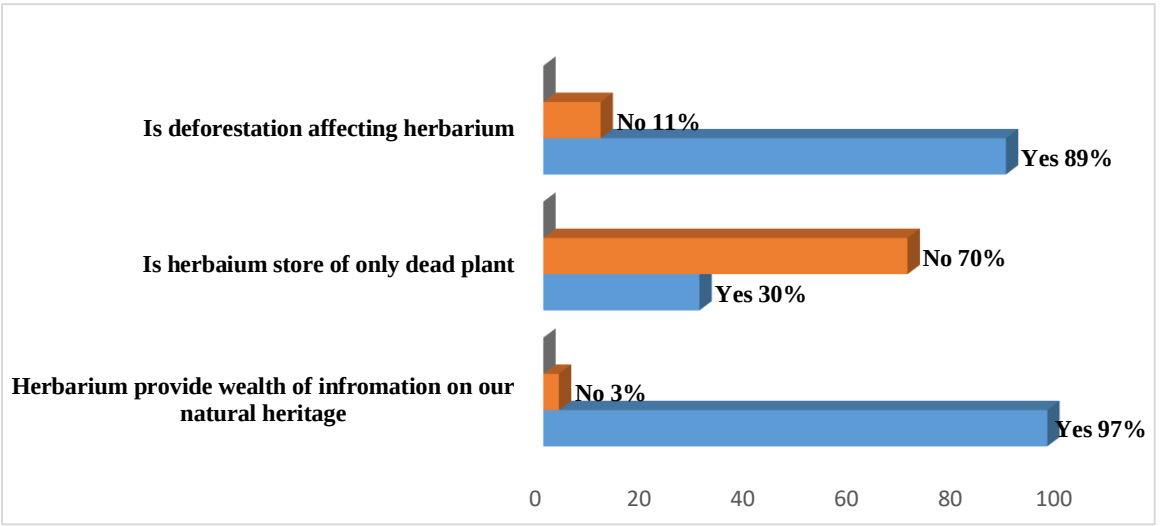


Fig 4: Factors that affects conservation of plant within the study area?

Figure 4 indicates the factors affecting conserving plants within the study area as shows by the respondent's, were 47% of the respondents agreed that lack of herbarium is one of the main factors that affects conserving plant, while 39% of the respondents said lack of adequate knowledge on plant conservation and the least respondents with 14% said lack of species to be conserved is the main factor that affect the conservation of plants within the study area. remaining 20% of the respondents said yes, the government are doing enough on the issue of plant conservation within the study area. The figure further questioned if there are other alternative ways or methods preserving plant species, 40% of the respondents said through creation of herbarium within the study area, 30% of the respondents said through provision of plants to be conserved, while provision of adequate funding and



h 20% and 10%

Fig 5: Respondents perception on herbarium

The figure 5 shows the response of the respondents on whether government within the study area are doing enough to ensure plant are being conserved, where majority of the respondents with 80% said no, while the respectively. Finally, the perception on the current state of plant conservation within the study area, 52% of the

respondents indicate it was very poor, 18% said it was very good and finally, the perception of the respondents with the highest to be very poor with 52%.

Figure 5 expatiate on whether deforestation is affecting the availability of plant species to be conserved, 89% of the respondents said yes it greatly affects the rate of plant conservation, while 11% of the respondents said no. The figure similarly shows the perception of respondents as what they perceive herbarium, 70% of the respondents said they do not affirm herbarium as store house of only dead plant, while the remaining 30% agreed to herbarium as store house of dead plants. Finally, the further provide information on herbarium collection provide wealth of information on our natural heritage, and the responses were 97% yes, while 3% of the respondents disagree. Findings from this study indicate that respondents within the study area lack knowledge about herbarium with only 41% out of 100% know about herbarium. Out of the total population studied, 40% have ever seen herbarium in their lifetime. This shows lack of knowledge on herbarium which is a setback in the issue on the conservation of plant species which has great important in one way or the other. The current state of plant species conservation within the study area is very poor because of deforestation as one of the major factors contributing to plants reduction. The study also concluded that government shows little or no effort towards plant conservation within the study area.

Conclusion

As conventional taxonomic research remains important, herbaria are also increasingly relevant in the fields of ecology, biogeography, and conservation biology. Specimens are also valuable for building public appreciation of plants and of botany in general. Botanical collections and herbarium preparation form the foundation of all botanical studies. Voucher specimens and herbarium collections are essential components of any well-designed research and academic studies. The main objective of herbaria is to document, identify and describe 'plant' diversity, however herbaria contain a huge potential for cutting edge research in other disciplines as well. The study further recommends that it seems desirable that herbarium goals and practices be reviewed, particularly in the light of the recent developments in the plant science in general and taxonomy. Moreover, herbaria should also employ business like methods and computers be used for much of the laborious retrieval work needed and demanded by scientists and laymen. There is a great need to increase funding for meeting current and future herbarium functions. Herbaria should be considered as National facilities and their maintenance should be a national responsibility. There is also an urgent need to educate the policy makers, the experimental biologists and other key persons who matter much for development herbaria in the country about the essentiality' of an herbarium.

Declaration of conflicting interests

The author declared no potential conflicts of interest

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Appendix I
Sample questionnaire
Questionnaire on Herbarium Technique for Plants in Damaturu, Yobe State

Please kindly tick (√) or write answer as appropriate in the space provided.

Section A. Social Demographic Characteristics of Respondents.

i. Gender
   a) Male [ ]
   b) Female [ ]

ii. Age of the respondent
   a) Below 20 years [ ]
   b) 21-30 years [ ]
   c) 31-40 years [ ]
   d) 50 years and above [ ]

iii. Marital status
   a) Married [ ]
   b) Single [ ]
   c) Divorce [ ]
   d) Widow [ ]

iv. Educational status
   a) Primary [ ]
   b) Secondary [ ]
   c) Tertiary [ ]
   d) Non-formal education [ ]

v. Occupation
   a) civil servant [ ]
   b) trader [ ]
   c) farmer [ ]
   d) self-employed and housewife [ ]

SECTION B

1. Do you know what herbarium is all about?
   a) Yes [ ]
   b) No [ ]
2. Have you ever seen an herbarium before?
   a) Yes [ ]
   b) No [ ]
3. If yes, where have you seen the herbarium?
   a) School Laboratory [ ]
   b) Museum [ ]
   c) Other specify…….
4. If question 7 above yes, in which of the following institutions?
   a) Yobe State University [ ]
   b) Federal Polytechnic Damaturu [ ]
   c) Yobe State College of Agriculture [ ]
   d) Other specify…….
5. Is herbarium important in the conservation of plant species?
   a) Yes [ ]
   b) No [ ]
6. Can Herbarium be used to train graduate and undergraduate students in science practices?
   a) True [ ]
   b) False [ ]
7. Can herbarium serve as a reference collection for plant systematics and other botany courses?
   a) Yes [ ]
   b) No [ ]
8. Do you have a herbarium in your current institution?
   a) Yes [ ]
   b) No [ ]
9. What do you think among the following is one of the factors that affects conservation of plant within the study area?
   a) Lack of herbariums
   b) Lack of plant species to be conserved
   c) Lack of adequate knowledge on plant conservation
   d) Other Specify……
10. Do you think the government are doing enough to ensure plant are being conserved?
   a) Yes
   b) No
11. If no above, through which of the following options?
   a) Through creations of herbarium in the institutions within the study area
   b) Provision of plants to be conserved
   c) Adequate funding
   d) Qualified personnel's

12. What is the current state of plant conservation within the study area?
   a) Very good
   b) Good
   c) Very poor
   d) Poor

13. Do you think the rate of deforestation within the study area has greatly impacted the availability of plant species to be conserved?
   a) Yes
   b) No

14. Do you consider a herbarium as the store house of only dead plant?
   a) Yes
   b) No

15. Herbarium collections also provide a wealth of information on our natural heritage?
   a) Yes
   b) No

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