CONSTRUCTING AFLORA: A DATABASE OF PLANT USE IN AFRICA

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ABSTRACT The AFlora (an abbreviation for "African Flora") project, "A study on the traditional use of plants in Africa," has been operated by the Center for African Area Studies at Kyoto University since late 1980s. This project has involved many researchers interested in the ethnobotany of tropical Africa. It aims to accumulate the ethnobotanical knowledge on plant use and nomenclature collected by field researchers working in Africa to provide an effective information-retrieval system. Since 1997, the AFlora database has been available to the public as a web-based database. In 2012, the system was updated, and it now relies on the most recent web technology. It currently contains more than 6,000 records. In this paper, I describe the structure, mode of operation, and benefits offered by this database. I also discuss issues related to the intellectual property rights with respect to ethnobotanical knowledge, which have become serious considerations in recent decades. Means of sharing scientific information are also addressed.

Key Words: AFlora; Plant use; Ethnobotany; Web database; Intellectual property rights.

INTRODUCTION

Since the inception of the field of African Studies in Japan during the late 1950s, Japanese scholars have enthusiastically tried to collect indigenous knowledge about natural resources in Africa. This domain of research is distinctive in terms of the geographic area in Africa that it targets, the semantic and pragmatic aspects of the details of its knowledge base, the long-term involvement at particular field sites that it entails, and its interdisciplinary approach to the study of human–nature relationships.

Ethnobotanical study is not exceptional in its focus on relationships between humans and nature. Indeed, ecological anthropologists in Japan have been studying the relationship between local people and environmental flora (e.g., Terashima et al., 1988),[(1)] resulting in the accumulation of a substantial amount of data from many areas of Africa, from arid regions to tropical rainforests. Unfortunately, however, most of these data have been stored on personal computers, rendering opportunities for comparative study[(2)] rare. Researchers associated with The Center for African Area Studies at Kyoto University (Mitsuo Ichikawa, Itaru Ohta, Hideaki Terashima, and Daiji KIMURA) began to gather these data in one database with the aim of establishing a permanent storage space for future work, enabling data sharing among researchers, and facilitating comparative research (The AFLORA and AFAUNA Committee, 1998). The databases were named "AFauna" and "AFlora" as abbreviations for "African Fauna" and "African Flora,"

respectively. We have already taken the initial steps in the construction of AFlora, and this paper discusses the history, structure, and characteristics of this project as well as several problems we have encountered. (AFauna has not yet been initiated and remains a challenge for the future.)

HISTORY OF AFLORA

The AFlora database was originally constructed in the late 1980s at the Data Processing Center of Kyoto University using the Facom Advanced Information Retrieval System (FAIRS) database software on a FACOM mainframe system. Although the Internet did not yet exist, the use of phone lines and computer networks among universities (known as the N-1 Network) enabled the database to be accessible from outside Kyoto University. During this period, interface with the database was character based, and the following is an example of a query. In this query, the user is trying to get information on Euphorbiaceae plants used for medical treatments in the lturi Forest of Zaire (currently DR-Congo). This is done in the interactive mode. The user enters a command after the 'RS>' prompt of FAIRS. The commands entered by the user appear in italics, and the explanation of the operation is provided in the angled brackets [ ].

RS> *SELECT AFLORA*	[selection of AFlora database]
RS> *SEARCH AREA = ITURI*	[restriction of the area searched]
281 RECORD(S) FOUND	[reply by AFlora]
RS> *AND FAMILY = EUPHORBIACEAE*	[restriction of the family]
13 RECORD(S) FOUND	[reply by AFlora]
RS> *AND UT =A?*	[restriction of the use type ('A?' stands for medical uses)]
7 RECORD(S) FOUND	[reply by AFlora]
RS> *OUTPUT REC(J) ELEMENT(ALL)*	[output of the first record with all data fields]

No. 1

KEY-NUMBER	P100001
IO-NUMBER	ADR0001
SPECIES	Bridelia micrantha (HOCHST.) BAILL.
FAMILY	EUPHORBlACEAE
COLLECT-DATE	1985.08.27
COLLECTOR	ICHIKAWA. M.; TERASHIMA. H.; SAWADA. M.
AREA	C. ZAIRE. ITURI. LF

LOCATION	around ANDIRl, 20 km NE of NDUYE (ca. N 2, E 29), SOUS REGION ITURI. REGION HAUT-ZAIRE.
SPECIMEN-INF	MUSEE ROYAL DE L'AFRIQUE CENTRAL. TERVUREN. BELGIQUE. No. 45223
IDENTIFIER	DECHAMPS. R. (M. R. A. C. TERVUREN, BELGIQUE)
LIFE-FORM	medium tree
ENVIRONMENT	secondary forest
	(continued)

To facilitate access, I incorporated AFlora into the Internet web system in 1997 using "Lotus Notes Domino" (AFlora Ver. 2, see Fig. 1). Thus, users from all over the world can use their own computers to search for needed information. When authorized by the AFlora Committee, researchers can even update the information by modifying an old entry or adding a new one from their own personal computer. This was an advanced database system for its time and was referenced by many ethnobotanical researchers in different areas of the world. It also enabled comparative ethnobotanical work (Terashima, 2003a; 2003b). However, the system aged, and the server stopped functioning.

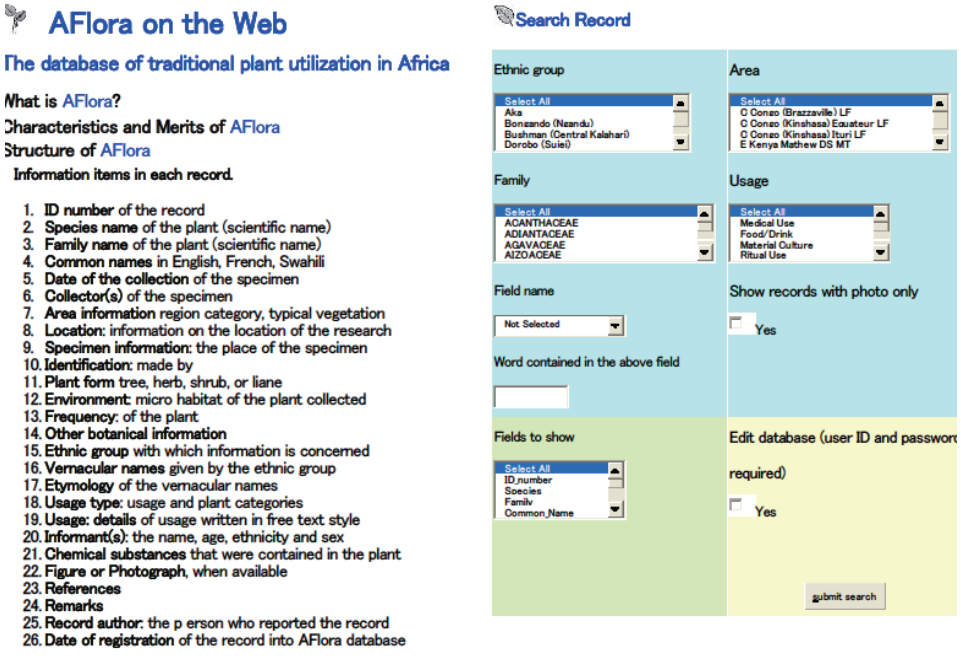


Fig. 1. AFlora Ver. 2

In 2012, the system was completely renovated using the "Ruby on Rails" framework, which is the most recent web technology (AFlora Ver. 3, see Fig. 2). Currently, more than 6,000 records are stored in the database.[3] (See the Appendix for details about research areas, ethnic groups, collector(s), collection dates, etc.) In the following sections, I will explain this system.

Fig. 2. AFlora Ver. 3

STRUCTURE OF AFLORA

Although the database system has been changed twice, the format of AFlora has remained stable. This format reflects the long history of ethnobotanical research at Kyoto University and can serve as a standard for research in this domain. (At the same time, however, it can be revised in the future according to needs of researchers.)

Each record contains the following information recorded according to the following rules. Capitalized words indicate the name of an item, and examples are italicized. Although as many as 25 items can be defined, contributors of ethnobotanical data do not have to provide data for all items.

1. **ID**: Identification number of the record assigned by the author of each record. This usually consists of three characters representing the research area plus the serial number.
   ADR0001
2. **SPECIES**: Species name of the plant (scientific name).
   Bridelia micrantha (HOCHST.) BAILL.
3. **FAMILY**: Family name of the plant (scientific name).
   EUPHORBIACEAE
4. **COMMON_NAME**: Common names in English, French, Swahili, or other common languages of the area.
   damudamu (sw)
5. **COLLECT_DATE**: Date the specimen was collected.
   1985.08.27
6. **COLLECTOR**: Collector(s) of the specimen.
   ICHIKAWA. M.; TERASHIMA. H.; SAWADA. M.
7. **AREA**: Region category (see Fig. 3), name of the state, name of the area, and vegetation category (see Fig. 4).
   C. ZAIRE. ITURI. LF
8. **LOCATION**: Detailed information about the location of the research.
   around ANDIRl, 20 km NE of NDUYE (ca. N 2, E 29), SOUS REGION ITURI, REGION HAUT-ZAIRE.
9. **SPECIMEN_INFO**: The place and state of the specimen.
   MUSEE ROYAL DE L'AFRIQUE CENTRAL, TERVUREN, BELGIQUE. No. 45223
10. **IDENTIFICATION**: The person or institute responsible for identifying the plant.
    DECHAMPS, R.(M.R.A.C.,TERVUREN,BELGIQUE)
11. **LIFE_FORM**: Plant form, such as tree, herb, shrub, or liana.
    medium tree
12. **HABITAT**: Microhabitat where the plant was found.
    secondary forest
13. **FREQUENCY**: General observation on the frequency of the plant.
    common

14. **BOTANICAL_INFO**: Other botanical information.
    A medium-sized tree (1–8 m, sometimes reaching 10–20 m high (FCBRU,8(1):46)), commonly seen in secondary forest; wild silkworms (Anaphe sp.) feed on the leaves, making a pouch-like nest with the cocoons in a united mass.
15. **PEOPLE**: Ethnic group with which the ethnobotanical information is associated.
    Efe
16. **VERNACULAR**: Vernacular names given by the ethnic group. Tone can be shown by 0 (low tone) and 1 (high tone).
    munjaku (001,BALESE)| muzau (001,EFE)
17. **ETYMOLOGY**: Etymology of the vernacular names.
    The name derives from the silkworms, called <munjaku>, that live on the tree.
18. **USE_TYPE**: Usage (shown by alphabetical characters) and plant part categories, shown by number. (See Table below.)
    A6 H3
19. **USAGE**: Details of usage written in freestyle text. Reliability of information is indicated in terms of by OBS1-3 (directly observed case; 1: frequent, 2: common, 3: rare), IFM1-3 (information form informants; 1: frequent, 2: common, 3: rare)
    (A6) A bark decoction is consumed for sore throat <kumbukumbu> or for cough <timba>; (IFM2). (H3) The tree serves as food for a kind of wild silkworm (Anaphe sp.) named <munjaku>; some hundred worms construct cocoons in a united mass in September and October.
20. **INFORMANT**: The name, age, ethnicity, and sex of each informant.
    LINGATA (30S, M, BALESE); LINGATA, E. (30S, M, BALESE); UKUKIDA (30S, M, EFE)
21. **CHEMICAL_SUBST**: Chemical substances contained in the plant.
    Chemical analysis shows them to be of high food value, with nitrogen content equal to that of the richest varieties of Voandzeia.
22. **FIGURE**: Figure or photograph, when available.
23. **REFERENCE**: References to the botanical information.
    UPWTA1:138; FCRB,8:49
24. **REMARK**: Other remarks.
    The silkworm is Anaphe sp. (FCRB,8:49); maybe Anaphe infracta (UPWTA1:138).
25. **RECORD_AUTHOR**: The person who filled out the record.
    H. Terashima, M. Ichikawa, M. Sawada

Region categories in item 7 (See Fig. 3):

N: North Africa
NE: North-East Africa
E: East Africa
SE: South-East Africa
C: Central Africa
S: Southern Africa
I: Indian Ocean Islands
W: West Africa

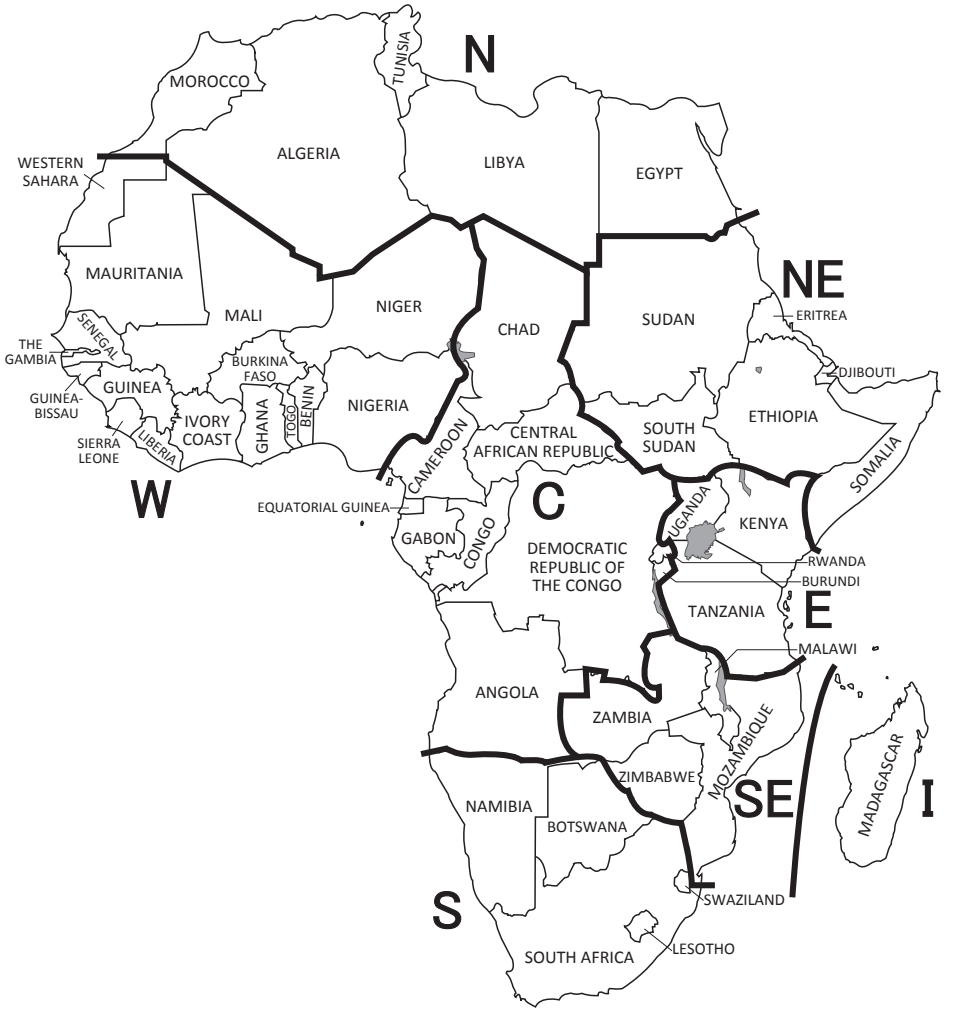


Fig. 3. Region categories

Vegetation categories in item 7 (See Fig. 4):

MT: Mountainous
LF: Lowland forest
MS: Moist savvanna
WL: Woodland
DS: Drier savanna, bush, and thicket
SD: Semi-desert
DT: Desert
MD: Mediterranean

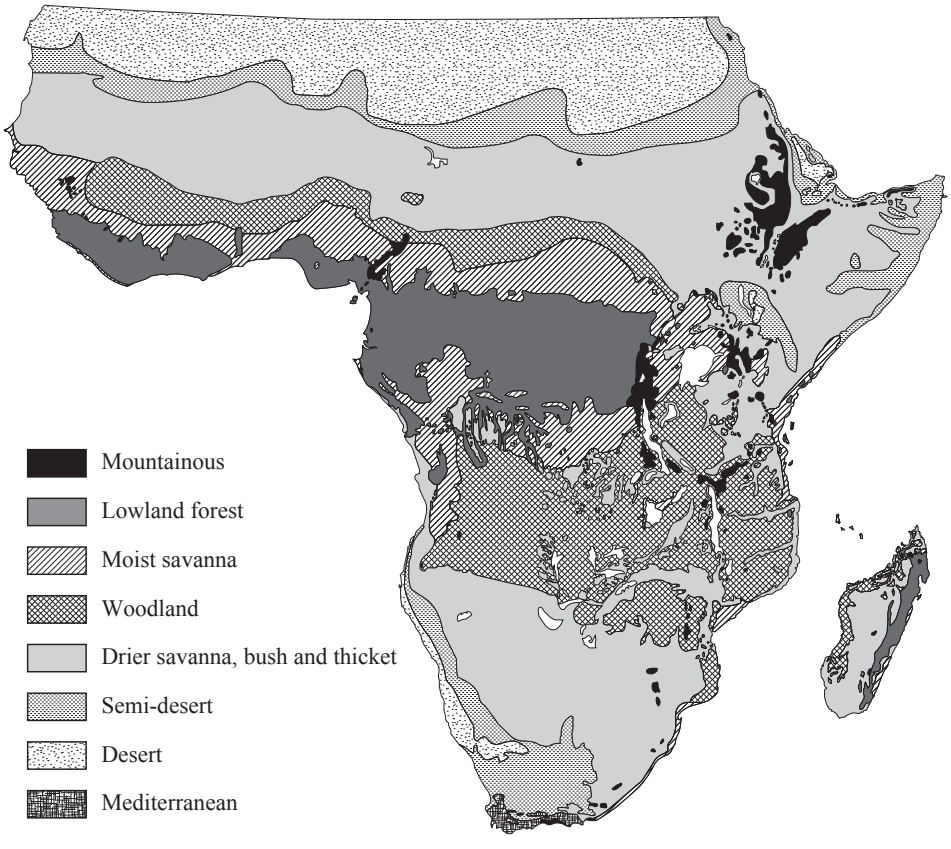


Fig. 4. Vegetation categories

Categories of plant use and plant parts (item 18):

Plant-use categories
A: Medical
B: Food and drink
C: Material culture
D: Ritual and magical

E: Poison
F: Narcotic, seasoning
G: Oral traditions, indicators of natural phenomena
H: Used by people in indirect ways, such as fodder, trap bait
I: Used by wild animals
J: Other

Plant part categories
0: Whole, or unspecified part
1: Fruit, seed
2: Flower, flower bud
3: Leaf
4: Stem (herb), stalk
5: Root, tuber
6: Bark, skin
7: Vine-stem, liana
8: Sap, juice, resin, gum
9: Trunk, wood, pith
x: Other parts

HOW TO OPERATE AFLORA

I. Page structure

The search results appear on the same page used to enter the search conditions, and each page can contain 10 records. (Initially, all possible results are shown, as no search conditions have been entered. At present, there are approximately 6,000 records). It is possible to move between pages using links such as those shown below.

<- Previous 1 2 3 4 5 6 7 8 9 … 371 372 Next ->

Records with no entries for a given field are not shown. For details on each record, see the "STRUCTURE OF AFLORA," above.

II. Search Procedures

The AFlora search procedures were carefully designed to facilitate comparative ethnobotanical study involving several areas. It is possible to combine as many as three search conditions using AND or OR. The format is as follows:

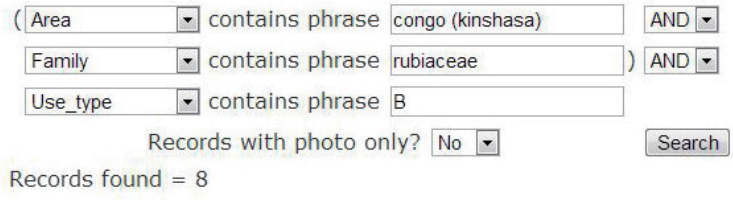
(*condition 1* AND/OR *condition 2*) AND/OR *condition 3*

Conditions 1 to *3* have the format "[field] contains phrase [phrase]." In other

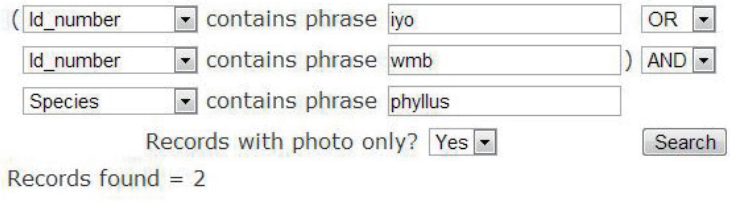
words, the search engine determines if a certain field (e.g., "Id number") contains a certain phrase (e.g., "ADR"). The term "contains" means the condition statement "[Species] contains phrase [rub]" will retrieve records such as "Rubus pinnatus Willd," "Acacia erubescens Welw," or "Tricilia rubescens Oliv." This is because all species listed include the string "rub." The search engine does not distinguish between upper- and lower-case letters. "RUBIACEAE," "RubiaCeaE," and "rubiaceae" will yield the same results. It is possible to combine up to three such search conditions using the operators AND and OR. As indicated by the parentheses in the format, the first combination of conditions using AND/OR is given priority over the next set of conditions.

Search examples

1. Plants from the Rubicacea family collected in the Democratic Republic of the Congo that are used for food.



2. Plants with "Id numbers" including IYO or WMB, and species names including the letter string "phyllus."



The number of records found is displayed below the search-condition entry areas. If more than 10 records are found, they will be displayed on multiple pages. If the search-condition area is left blank, it will be ignored. For example, if the user wants to search using only a single condition (e.g., records with "Id numbers" containing the letter string "WMB"), the second search-condition entry box can simply be left blank. In addition to these three search conditions, it is also possible to add the condition "Records with photo only." As data with images are often more appealing, clicking "Yes" to this menu item may be desirable.

Although this database is not able to achieve a full-scale refinement of the search results (i.e., to narrow the search results by adding search conditions), the search-condition entry boxes appear on the same screen as do the results. Thus

it is possible to narrow the search results by adding conditions to the results page and searching among the records returned in the previous search using new conditions. By so doing, one can narrow the search results in a manner that mimics the process used to refine search results.

III. Entering, Editing, and Deleting Data

It is possible to create new records and to edit or delete existing records. However, a password is needed to access the page where this can be done, and this password is not available to the general public. Single records may be entered manually, whereas multiple records can be entered simultaneously using a CSV file, which can be created with Excel.

IV. Image Data

Image data can be entered, one record at a time, from the entry page. One simply selects an image file on one's own hard disk for upload. In the present version, only one image can be entered per record. To enter multiple images, the user should combine them into a single image file using Photoshop or other photo-editing software.

V. Data Entry from CSV Files

Hundreds of records can be entered simultaneously using a formatted CSV file. (However, image files must be uploaded individually and manually.) Please contact aflora@jambo.africa.kyoto-u.ac.jp for specifications for CSV files.

CHARACTERISTICS OF AFLORA

Currently, we can use several other Web-based databases on plant use; these include "PROTA" (http://www.prota.org/) and PHARMEL. Compared with these, the AFlora database is unique in that it covers a wide range of utilization information provided by local people. Indeed, it includes not only information about the material uses of plants, such as food and medicine, but also information about their non-material uses, such as rituals and other spiritual purposes. This database also includes information about the use of the plant in oral traditions involving songs and proverbs, auxiliary uses of the plant (e.g., bee plants and fodder plants), and problems with the plants such as persistent weeds or their unsuitability for a specific purpose.

Thus, AFlora covers a wide range of human–plant relationships, as the database is the product of careful observation and the rich experiences accumulated by the African people over thousands of years. In other words, AFlora is a database focused on the cultural and intellectual heritage of the African people. It is, therefore, expected to be useful in various ways, from the study of the symbolic world of the African people to practical research on potential food and medicinal

resources. We also expect it to be useful for applied research on the conservation and sustainable use of the natural resources of Africa.

PROBLEMS WITH AFLORA AND PROSPECTS FOR THE FUTURE

I. Issues of Data Precision and Data Structure

Although AFlora is quite effective for research on ethnobotany in Africa, we have also identified several flaws in its construction.

One flaw involves variability in the precision of the data. For example, some datasets contain almost all the items in each record, whereas others contain information on only the vernacular name and usage. On the other hand, the exclusion of incomplete records would result in the availability of only a few complete datasets. We suggest that even rough datasets be inputted into AFlora and recommend that users restrict their analysis to data that are at an appropriate level of precision for their particular purposes.

Another problem concerns the unification of the data format. When we introduced AFlora, ethnobotanists frequently suggested new items to be added to the database. However, the increase in data resulted in difficulties with data retrieval by researchers. Items should be selected carefully to avoid unnecessary increases in the structure of the database.

II. Update Schedule

Thousands of pieces of data in the mainflame computer version of AFlora have not yet been transferred to the Web version. (In the Appendix, these datasets are marked with an asterisk (*).) Data from the literature, such as "The Useful Plants of West Tropical Africa (first edition)" by J. M. Dalziel (1937) should also be added if problems with the copyright are solved. More photographic data should be made available, and data collected by non-Japanese researchers should also be added (via the Internet).

Many functions of the AFlora website have not yet been implemented. We plan to work on the following:

- Enabling CSV data entry directly from one's personal computer.
- Implementing functions related to image handling: deleting images, reducing file size, displaying image thumbnails, checking to see if a file is an image file, providing a warning when a file is too large, and offering a drag-and-drop function.
- Ensuring that only the person who entered the data can edit the data.
- Facilitating international use by creating English and Japanese versions of the website and enabling the English or the Japanese version to be displayed by default based on the browser.
- Connecting to a geographical information system (GIS) and creating a map that

shows the location of each field site.
- Allowing for a universal search of all record content rather than just the content for a given item.
- Enabling the viewer to determine how many records are displayed per page.
- Enabling multiple searches using SQL commands.

III. Issues Related to Intellectual Property Rights

Another serious problem concerns the question of intellectual property rights with respect to traditional knowledge. A good example involves the plant known as "hoodia" in Namibia (Wynberg et al., 2009). This plant has been used by the San (Bushmen) of the Namib Desert as an appetite suppressant based on their indigenous knowledge about survival under desert conditions. When this knowledge was sold to a drug company to produce a diet supplement, the issue of ownership of the knowledge became a problem. (This kind of plagiarism is known as "biopiracy.") In 2003, the South African San Council entered into an agreement with the company whereby the local people would receive some revenue from the sale of hoodia products.

Issues such as this have been discussed since the 1980s, when research on genetic resources was initiated. The controversy was manifested in a "tug of war" between developing countries, who insisted on their rights to the genetic resources, and developed countries, who promoted biotechnology by using ethnobotanical knowledge. As a consequence, the Convention on Biological Diversity (CBD), ratified in 1992, established the following policy: "The objectives of this Convention ... are ... the fair and equitable sharing of the benefits arising out of the utilization of genetic resources."

This Convention stipulated the need for some kind of agreement between researchers conducting ethnobotanical research and local people. Academic communities have been earnestly discussing this matter in search of a middle ground between the rights of indigenous people and those of scientific researchers (e.g., Barton, 1994; Soejarto et al., 2005).

Web databases such as AFlora are very useful because they can be accessed by anyone working from anywhere. On the other hand, they are also subject to the risk of biopiracy. Although all the data in AFlora are used for academic purposes only and although commercial use is strictly prohibited, careful consideration should nonetheless be given to whether to open the database to the public.

NOTES:

(1) For example, my first research project in the Democratic Republic of the Congo (formerly Zaire), begun in 1986, yielded about 670 plant specimen.

(2) For example, plants of the genus *Vernonia*, known as *ndole*, are frequently eaten in Cameroon. In contrast, chimpanzee researchers in Tanzania found that the plant of the same genus is also consumed by chimpanzees, probably as medicine (Koshimizu et al., 1994), and local people in Tanzania also eat this plant. Thus, the comparative study of plant use sometimes results in unexpected findings.

(3) However, as described below, AFlora Ver. 3 is still not universally accessible due to problems concerning "intellectual property rights" with respect to knowledge about plants.

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APPENDIX:

The following are contained in the database (data marked with "*" have not yet been transferred to the Web version). Each group of data is headed by a three-letter abbreviation derived from the ID number given to each contributor for his/her records. (Some data groups are headed by the contributors' full names.)

ADR: The Efe Pygmies and the Balese farmers in the Ituri forest of northeastern Zaire, around Andiri village (N 1.55', E 29.10', alt. c. 1000 m), Zone de Mambasa, Reion de Haut-Zaire; collected by H. Terashima, M. Ichikawa, and M. Sawada, in 1985, and also by the second research project conducted by Terashima in 1990. 429 records.

AFN: The Nyindu farmers in eastern Zaire, around Kilimbwe village (S 3, E 29, alt. more than 1400 m), Zone de Mwenga, Region de Kivu; collected by T. Yamada in 1977–1978. 501 records.

BAN: The Bangando people living around Ngola125 village (N 3, E 15), Department of Boumba and Ngoko, East Region, Cameroon; collected by K. Shikata in 2005. 71 records.

BOY*: The Boyela farmers in central Zaire; around Yele village (alt. c. 500 m), Zone de Ikela, Region d'Equateur; collected by H. Sato in 1979.

HAT: The Baka Pygmies around Malea Ancien village (N 2, E 14), Department of Boumba and Ngoko, East Region, Cameroon; collected by S. Hattori in 2003. 653 records.

Ito Yoshimasa: The Mecha Oromo people around Secha kebere, Geeraa wereda, about 115 km west of Jimma., Ethiopia; collected by Y. Ito in 2004–2007. 122 records.

IYO: The Bongando (Ngandu) farmers in central Zaire, around Iyondje village adjacent to Wamba, the bonobo research base (N 0, E 22), Zone de Tshuapa, Region d'Equateur; collected by D. Kimura in 1986–1989. 678 records.

JTS: The Central Kalahari Bushmen (|Gui and ||Gana) in Botswana, collected by J. Tanaka in 1966. 105 records.

KIS: The |Gui (Central Kalahari San) people around =/KADE village, CENTRAL KALAHARI GAME RESERVE, Botswana; collected by K. Imamura in 1988–1989. 68 records.

KKY: The Nyiha people around Ibembwa village, Igamba village, Itepula village (S 8.58 E 32.55), Tanzania; collected by K. Yamamoto in 2004–2005. 71 records.

KOM: The Kako people living around Ngola125 village (N 3, E 15), Department of Boumba and Ngoko, East Province, Cameroon; Collected by K. Komatsu in 2005. 88 records.

LIK: The Aka Pygmies and the Bonjo farmers in the northern Congo, around Moumpoutou village (N 3, E 17), along the Ibenga River, District de Dongou, Region de Likouala; collected by K. Takeuchi in 1989 and 1990. 200 records.

LEG: The Lega farmers in eastern Zaire; collected by K. Ndumbo. 319 records.

LGM*: The Lega farmers in eastern Zaire, around Mwenga village (N 28.20', S 2.55', alt. c. 1300 m), Zone de Mwenga, Region de Kivu; collected by H.

Terashima, S. Kalala, and N. Malasi in 1988.

LGN*: The Lega farmers in eastern Zaire, around Nyamakombola village (N 28.10', S 1.45', alt. c. 600–700 m), Zone de Walikale, Region de Kivu; collected by H. Terashima, S. Kalala, and N. Malasi in 1989.

MKI: The Aka Pygmies in Linganga-Makaou village (N 2.6 E 17), Dongou District (Motaba river basin), Republic of Congo; collected by M. Ichikawa in 1992. 158 records.

MKK: The Aka Pygmies in Linganga-Makaou village (N 2.6 E 17), Dongou District (Motaba river basin), Republic of Congo; collected by K. Kitanishi. 134 records.

MWB: The Mbuti Pygmies in the Ituri forest of north-eastern Zaire, around Katala and Mawambo village (N 1.0', E 29.10', alt. c. 1000 m), Zone de Mambasa, Region de Haut-Zaire; collected by M. Ichikawa in 1987. 282 records.

NDY: The Efe Pygmies in the Ituri forest of Zaire, around Nduye village (N 1.45', E 29.0', alt. c. 1000 m), Zone de Mambasa, Region de Haut-Zaire; collected by M. Ichikawa in 1989 and 1990. 316 records.

OIS: The Baka Pygmies around Ndongo village (N 2, E 11), Arrondissement de MOLOUNDOU, Department de BOUMBA et NGOKO, REGION DE L'EST, Cameroon; collected by T. Oishi and F. Evariste in 2009. 138 records.

OTA: The Turkana people in Turkana district (N 3.3–4.5, E 34.3–35.2), Kenya; collected by I. Ohta in 1978. 516 records.

SBK*: The Baka Pygmies in the northern Congo, around Souanke (N 2.0', E 14.0'), District de Souanke, Region de Sanga; collected by H. Sato in 1987.

SGL*: The Songola fisher / farmers in eastern Zaire, around Elila village (S 2.43', E 25.53'), Zone de Kindu, Region de Kivu; collected by T. Ankei in 1978–1979.

SUI: The Suiei Ndorobo, hunter–gatherers in Mathew's Range of northern Kenya, collected by M. Ichikawa in 1976–1978. 590 records.

TAK*: The Aka Pygmies and the Bonjo farmers in the northern Congo, around Moumpoutou village (N 3, E 17), along the Ibenga River, District de Dongou, Region de Likouala; collected by K. Takeuchi in 1989 and 1990.

TBK*: The Bambenga Pygmies in central Zaire, around Dongou village (N 2.40', E 18.30', alt. c. 350 m), Zone de Kungu, Region d'Equateur; collected by Tanno in 1985 and 1987.

Teshirogi: The Damara people in Renosterkop settlement, 20°28' S, 15°16' E, Kunene Region, Namibia; collected by K. Teshirogi in 2008. 24 records.

TMI: The Dagomba people in Fihini village, ca. 5 km N of Tolon (N 9, W 2), Tolon-Kumbungu District, NR, GH, Ghana; collected by Y. Tomomatsu in 2008–2011. 20 records.

TTR: The Mbuti Pygmies and the Bira farmers in the Ituri forest of northeastern Zaire, around Mawambo and Teturi villages (N 1.0', E 29.10', alt. c. 1000 m), Zone de Mambasa, Region de Haut-Zaire; collected by T. Tanno in 1973 and 1976. 241 records.

WAM: The Bongando (Ngandu) farmers in central Zaire, around Wamba village, the bonobo research base (N 0, E 22), Zone de Tshuapa, Region d'Equateur; collected by T. Kano and other members of bonobo research team. 705 records.

Yamashina: The Subiya people in Muyako village, S 17.8, E 24.4, Caprivi Region, Namibia; collected by C. Yamashina in 2009. 77 records.

YFM: The Owambo people in Uukwangula village, S 17.7, E 15.6, Oshana Region, Namibia; collected by Y. Fujioka in 2002–2007. 27 records.