CHAPTER 13

WILD YAMS OF THE AFRICAN FOREST AS POTENTIAL FOOD RESOURCES

Annette HLADIK and Edmond DOUNIAS

INTRODUCTION

Plants with tubers hidden below ground in the rain forest merit renewed attention as potential foods for forest people, both past and present. The only visible starch-rich foods in tropical forest capable of being a staple resource are sago palms (Kahn, 1993, this volume; Ulijaszek and Poraituk, 1993, this volume), and – for only a few weeks of the year's cycle – the seeds of certain trees, especially Leguminosae, for example those of *Gilbertiodendron dewevrei,* (Ichikawa, 1993, this volume).

Most hunter-gatherers presently living in tropical forest obtain their staple starch foods (cultivated tubers, plantain fruits, rice, etc.) through exchange with agriculturalists, but the role that wild tubers might have played in the past as staple starches remains a mystery.

Admittedly, assessing the production of spontaneous plants in a tropical forest is technically difficult, because individuals tend to be unevenly distributed and production is frequently unpredictable on a seasonal basis. However, assessing the production of tubers is even more difficult because they are often deeply buried in the forest floor and difficult to locate. The first survey of yam density and production in tropical humid forest (Hladik *et al.,* 1984) was conducted in Gabon and the Central African Republic, thanks to the expertise of the Aka pygmies who showed the research team how to locate and identify otherwise hidden yams. These results have been complemented by a study in south Cameroon by one of us (E. D., with the help of the Baka and Bakola Pygmies).

By analysing the results of these surveys together, in this chapter we examine whether or not the forest contains a large enough variety and quantity of yams – with adequate nutritional value – to serve as a staple food enabling forest populations to live independently of agriculture. We then discuss the spatial distribution patterns of yams, which result from forest dynamics, forest types, geographical areas and historical influences, and the possible connection between the density of yams in a forest and the presence or absence of hunter-gatherers.

Yams have also been domesticated for over 5 000 years (Coursey, 1976) and numerous cultivated forms are presently known. The various wild forms discussed in this chapter constitute a gene pool of great value for creating the new varieties necessary for future agroforestery systems in tune with the needs for sustainable development of humid tropical zones.

DIVERSITY AND ECOLOGY OF WILD TUBER SPECIES

Among the great diversity of tuberous plant species in central Africa, representing 13 families (Hladik *et al.* 1984), yams – a large group of *Dioscorea* species (Dioscoreaceae) presently under systematic revision – are the major edible form. Other tuberous plants are of less interest. For example, *Dioscoreophyllum* spp. (Menispermaceae) have a higher water content, and are mostly gathered by children, while Icacinaceae tubers in the humid zone are very fibrous and people never eat them.

The genus *Dioscorea* contains a large number of species distributed all over the world, and concentrated in the tropics, although the 600 species cited by Knuth (1924) is too high a figure. Despite Burkill's revision (1939) of the yams of the Congo (Zaire), which reduced the number of species from 40 to 20, and Miège's (1952, 1958) studies on yams of the Côte d'Ivoire, there remains a great deal of work to be done on the systematics of the genus. Presently the two authors recognize 15–17 species in the central African forest. Some of these plants, still unidentified, may need to be described as new species (thus we presently use local names and herbarium reference numbers). In Figure 13.1, these yam species of the African forest are grouped according to their toxicity (all species growing in closed forest being *edible*), whether the stem is annual or perennial and finally, whether they are found in closed forest or in open areas within forest.

Growth and reproductive patterns

Tuberous plants were once thought to be restricted to markedly seasonal environments, where the tuber could be a storage organ enabling the plant to survive severe seasonal drought, or some other seasonal stress, in the way that potatoes are adapted to cold winters. In fact, for the tuberous plants of

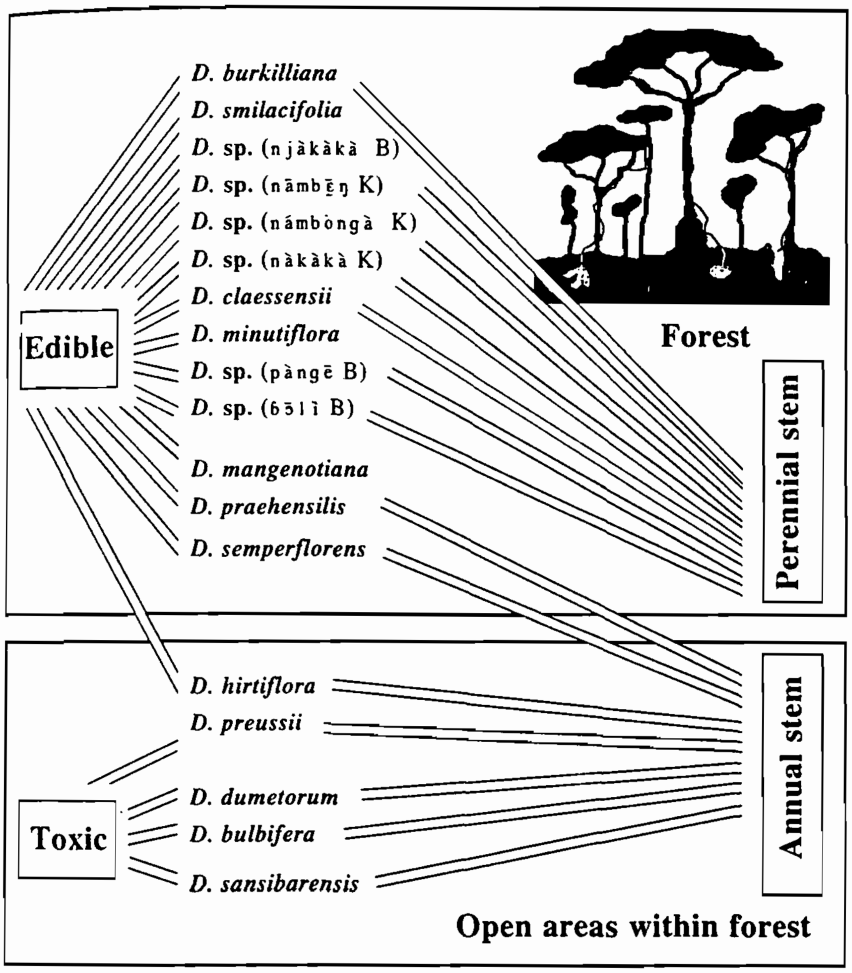

Figure 13.1 Wild yam species of the African forest and their major ecological characteristics. For some of these species of the *Dioscorea* genus presently necessitating systematic revision, the local names (in parentheses) have been used (B: Baka name; K: Kola name); see Appendix 13.1

the rain forest, which are mostly lianas, the resting tuberous phase is an adaptation enabling rapid growth (and then, reproduction) as soon as a fallen tree allows light to penetrate the closed forest (Hladik *et al.*, 1984). Furthermore, variable growth patterns (of tuber and/or stem) had not been thoroughly observed and described, and wild species were presumed to share the annual stem growth and annually renewed tuber characteristic of cultivated yams.

Burkill (1960), still the primary authority on the biology of yams, was the first to consider as a characteristic for classifying yams, whether tubers were annual or perennial, although he did not recognize the existence of perennial-stemmed forest species. Ironically, *D. burkilliana* falls into the group which have perennial stems[1]. This species – together with *D. smilacifolia*, *D. claessensii*, *D. minutiflora*, and three (four or five) unidentified species (see above) – are endemic in the African rain forest and form part of section Enantiophyllum. The phenological cycles of these species, longer than one year, are not known in detail. Cultivated in the greenhouse under conditions which differ from their natural environment (especially in daylength), these plants show irregular resting periods preceding the development of axillary shoots. In the forest, they have very long perennial stems, that can reach the canopy, up to 30–40 m above ground, where flowers and fruits can develop.

The tubers of these perennial-stemmed species have a particular morphology. Since we lacked scientific terminology for separating the three different parts of the tubers, we have introduced (Hladik *et al.*, 1984) the Aka terminology: (1) mbólò, perennial woody plate just below the soil surface which is extended into (2) mò.súɛ̀, fibrous processes developed from the plate from which develop (3) yɔ̃kɔ̃, terminal, starch-rich, fleshy swellings, the edible part of the tuber, whose growth cycle is unknown.

By contrast with species growing in mature forest, yam species found in large, open areas within forest have annual stems, with annual flowering and fruiting. The following species are restricted to this zone: *D. preussii*, *D. dumetorum*, *D. bulbifera*, *D. sansibarensis*. While the stems die in the dry season and regrowth occurs as soon as the rains begin, the below-ground tubers show two different growth patterns. (1) In *D. bulbifera*, after the stem dies, the small tuber lies in a resting phase until a new stem is produced from a specialized area on the tuber. The growth of the new stem is accompanied by the death of this tuber, and by the development of an entirely new tuber. In *D. dumetorum* and *D. preussii*, the tuber appears also to be annual. (2) In *D. sansibarensis*, the same tuber grows and follows a resting phase year after year and can reach a considerable size.

These four species are relatively small climbing herbs, 5–10 m high, adapted to the surrounding vegetation. Young plants which grow from seed may be able to flower and fruit from their first year, but natural vegetative propagation is very common, by numerous axillary bulbils (aerial tubers) which fall when the stem dies and develop into new individuals in the same place[2].

[1] Miège named this species after Burkill in 1958. *D. burkilliana* is a plant that many authors mistakenly refer to as wild *D. cayenensis*. The true *D. cayenensis* is a cultigen, described in 1789 from a cultivar brought from Africa to America with the slave trade. The African cultivated yams are currently considered to belong to a complex of *D. cayenensis* and *D. rotundata*, also a cultigen from Africa described in America in 1813.

[2] These four yam species, together with ecological characters, have particular morphological features (stems twining to the left and elongated capsules) belonging to the subgenus *Helmia*.

Between these two contrasting categories shown in Figure 13.1 (forest-perennial versus open area-annual) comes an intermediate group. These are the species *D. mangenotiana*[3] and *D. praehensilis* belonging to the section Enantiophyllum. The first species is found in the forest but has a biennial stem and a perennial tuber. Its biological cycle is known to the Aka and the Baka who use various terms for its different phases of growth (Dounias, 1993, this volume). The second species was previously known only from forest-edges but we have also observed it as a true forest species. Both stem and tuber are renewed annually.

Two other intermediate species, *D. semperflorens* and *D. hirtiflora*, belong to the section Asterotricha (with stellate hairs), a section of yams endemic in Africa. The first species, found in forest, has both stem and tuber renewed annually. The second species, found in natural open areas such as forest edges, has an annual stem and numerous clustered tubers, which are also annual. Although *D. hirtiflora* grows in open areas within the forest, where most yam species are toxic, it is in fact edible.

Nutritional value and toxicity

Cultivated yams are much more nutritious than manioc (Busson, 1965; FAO, 1968) and contain far more protein, but the composition of wild forest yams was not precisely known until our first survey (Hladik *et al.*, 1984). The

Table 13.1 Composition of African wild yam tubers (raw)

Species	Water %	Percent dry weight							
		Protein	Lipids	Reducing sugars	Hemicel-luloses	Cellulose	Lignin	Starch	Minerals
Edible forest yams									
D. semperflorens[a]	75	5.5	-	3.3	4.7	2.6	0.4	78.8	2.1
D. semperflorens[b]	65	5.3	0.1	1.2	5.0	1.6	0.3	81.3	1.7
D. mangenotiana	68	9.0	-	1.0	6.2	2.0	0.3	75.9	3.5
D. praehensilis	-	7.1	0.6	5.8	11.9	7.6	2.7	58.3	3.1
D. burkilliana[c]	67	6.8	0.2	1.7	12.8	1.8	0.5	69.9	2.5
D. burkilliana[d]	55	5.6	0.2	0.7	7.0	1.6	0.2	78.2	2.5
D. minutiflora	69	4.6	-	3.4	11.4	4.6	0.3	73.4	2.3
Open area yams									
D. dumetorum	-	9.1	1.0	2.9	5.9	6.6	1.5	68.2	2.3
D. preussii	82	9.4	0.2	4.6	21.6	5.5	2.2	48.4	6.1
D. bulbifera	68	5.8	0.5	3.1	7.7	6.7	2.7	57.6	2.9

a fruiting phase; b sterile phase; c sterile phase; d flowering phase (source: Hladik *et al.*, 1984)

[3] We presently maintain the species *D. mangenotiana* Miège, but a revision of the African yam species may establish a synonymy with *D. baya* De Wild.

different species presented in Table 13.1 vary greatly in water, protein and starch contents. Among the edible forest yams, *D. semperflorens* is the richest in starch in both its sterile and fruiting phases and is the most highly appreciated by the Aka. It is sometimes even eaten raw. *D. mangenotiana* is also rich in starch and, moreover, is among the richest in protein. The Baka are particularly fond of *D. praehensilis,* although it does not have a particularly high starch content. The two perennial-stemmed forms, *D. burkilliana* and *D. minutiflora,* are also nutritionally valuable.

The open area yam species (the lower group in Figure 13.1) include a highly toxic wild form, *D. dumetorum* (Bevan *et al.*, 1956) which is the richest of all the species in protein content and can be eaten after detoxification by cooking, soaking it in water and cooking for a second time. With its high protein content, this species is a potentially valuable food and there are non-toxic, cultivated varieties. The tuber of *D. preussii* does not appear to be eaten, probably more because of its dichotomous form which is deeply buried in the ground and thus difficult to extract, rather than any toxic component (the blue parts of the tuber tested negative for HCN content). The new shoots, however, are eaten, in Gabon, like asparagus. The small tuber of *D. bulbifera* is toxic and never eaten. Many non-toxic cultivated varieties of this last species have been developed for their large, edible bulbils and many toxic wild forms are still kept for medicinal and magical use. Another toxic tuber, *D. sansibarensis*, is not eaten but is nonetheless used as poison for fishing and cross-bow hunting.

We would like to suggest the intriguing possibility that all these toxic species may not in fact have originated in central Africa at all. For instance, the fact that fertile *D. sansibarensis* individuals are extremely rare in central and west Africa may mean that it was introduced here only as bulbils, probably from east Africa. The two other species, *D. bulbifera* and *D. dumetorum,* are also found in Asia *(D. dumetorum* is probably the African form of *D. hispida)* and may have been introduced to Africa as edible cultivated varieties and then have become naturalized there, reverting to toxic forms.

POPULATION DENSITY AND POTENTIAL PRODUCTION OF EDIBLE WILD YAMS

In the debate about the potential self-sufficiency of forest people in starch resources, quantitative data are crucially important, but difficult to acquire, as we have already noted.

Yam density was estimated by counting yam stems. In each place, the area surveyed was made up of several narrow transects, four metres wide and up to 2 500 m long. We chose such long, narrow transects (two metres either side of the observation line) because a survey over a long distance better accounts for the heterogeneity of the forest than a quadrat of the same area and because yam stems are difficult to locate. The first surveys were conducted with the help of an Aka family who showed us how to find and identify the fine, leafless stems which are tangled in the undergrowth.

These quantitative surveys of yam density were carried out in four different parts of the central African forest: (1) semi-deciduous Lobaye forest near Boukoko in the Central African Republic; (2) continental evergreen forest of M'Passa Biosphere Reserve, near Makokou in Gabon; (3) coastal evergreen forest in the Campo Reserve on the Atlantic coast of Cameroon; (4) semi-deciduous forest near Moloundou in south-east Cameroon. Along a few transects, particularly transects in forest areas with a high density of yam stems, the standing biomass was estimated by digging up the entire yam tuber and measuring the fresh weight of only the edible, fleshy part.

The results of both types of measurements in various forest types, presented in Table 13.2, enable the calculation of the mean number of edible yam stems per hectare and the mean weight of the fleshy tubers per hectare.

Densities of edible yams found in the Central African Republic and Gabon (45 stems ha^{-1} and 22 stems ha^{-1} respectively), suggested that semi-deciduous forest was richer in edible yams than evergreen forest. The fourteen new transects surveyed in Cameroon tend to confirm this result: the highest density was again recorded in the semi-deciduous forest (53 stems ha^{-1}). The evergreen coastal forest of Cameroon appears to be richer in edible yams than continental evergreen forest in Gabon, at least in stem density.

Table 13.2 Density of wild edible yams and their standing biomass in the African forest.

Forest types	Total area surveyed (number of transects)	Total stems	Stems ha^{-1} (min.-max.)	Standing biomass ha^{-1}
Semi-deciduous forest[1] (Central African Republic)	20 200 m^2 (7)	91	45 (16 -100)	1.0 kg
Continental evergreen forest[1] (Gabon)	13 400 m^2 (4)	29	22 (17-50)	-
Coastal evergreen forest[2] (Cameroon)	28 000 m^2 (9)	113	40 (10-100)	-
Semi-deciduous forest[2] (Cameroon)	20 000 m^2 (5)	106	53 (25-75)	3.0 kg

[1] Source: Hladik *et al.* (1984)
[2] Present study

The mean weight of edible tubers in the Lobaye forest (Central African Republic) where the Aka live, was 1 kg ha^{-1} whereas in the south-east Cameroon forest inhabited by the Baka, it reached 3 kg ha^{-1}.

Table 13.3 Density of wild edible yams and their standing biomass in forest edges and in fallows within the forest

Vegetation types	Total area surveyed (number of transects)	Total stems	Stems ha^{-1} (min.-max.)	Standing biomass ha^{-1}
Forest edges (Gabon)	400 m^2 (1)	7	175	-
Fallows within forest (Cameroon)	800 m^2 (2)	13	160 (125-200)	12.5 kg

Similar measurements (Table 13.3) have been made in a forest-edge zone in Gabon and two fallows in Cameroon, where we found respectively the highest yam density (175 stems ha^{-1}) and the highest standing biomass of tubers (12.5 kg ha^{-1}). In this case, the fallows left by agriculturalists allow the Baka to collect wild yam tubers which colonize the abandoned fields.

These two last tables (13.2 and 13.3) do not include some of our data (Hladik *et al.*, 1984) concerning yam densities in large open areas near villages which contain a tremendous number of toxic yams (up to 24 000 stems ha^{-1}), not used by the Aka and Baka Pygmies, who do not – to our knowledge – practise yam detoxification.

DISCUSSION

Yam density, forest types and forest dynamics

The fact that the highest yam density is found in semi-deciduous forest can be related to the occupation of these forests by hunter-gatherer populations. How can this association be explained?

The results show a highly heterogeneous distribution of wild yam populations in different forest types and, within a given site, in the various transects; both aspects have to be discussed.

In Figure 13.2, we present climatic diagrams of the different areas where yam surveys were conducted. To the four areas where quantitative data (presented above) were collected (Campo Reserve and the forest near Moloundou in Cameroon; the Lobaye forest near Boukoko in the Central African Republic, and the M'Passa-Makokou Biosphere Reserve in Gabon), we add information about three other areas where qualitative data on wild yams were gathered by colleagues (H. Pagezy, H. Sato and K. Takeuchi, pers. comm.) and by ourselves: in Gabon, the estuarine forest near Libreville; in Zaire, the Uele forest near Wamba and the seasonally-flooded forest near Lake Tumba. These seven sites are located within the main centre of endemism defined by White (1983), and characterized by generally low annual rainfall (often less than 2 000 mm) compared to that in the Amazonian basin.

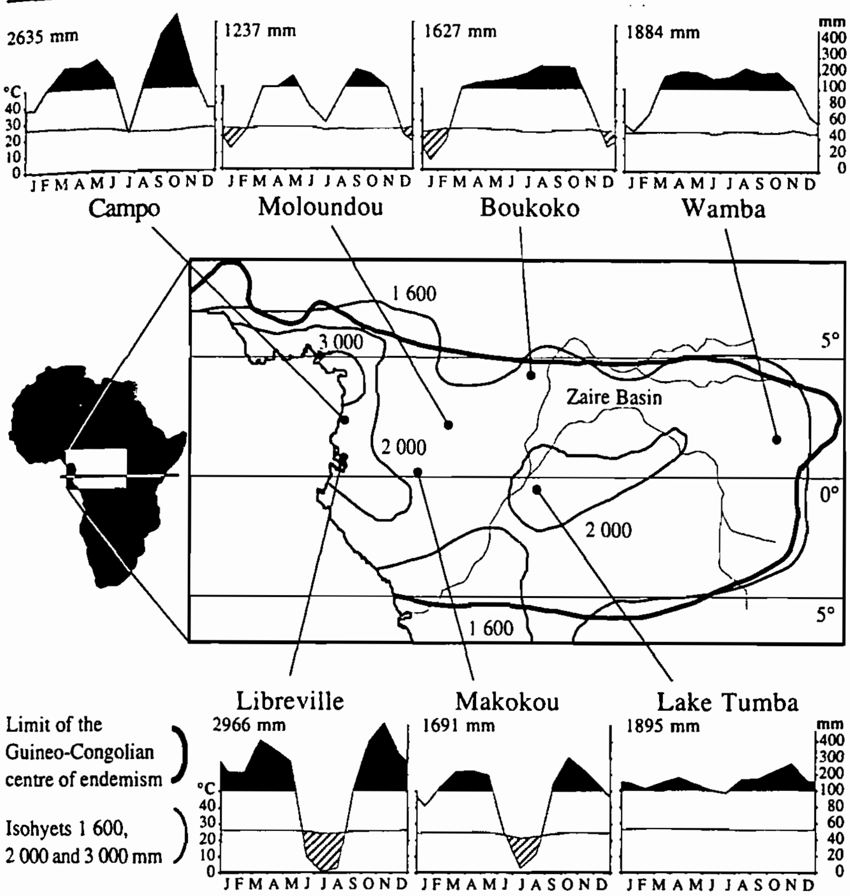

Figure 13.2 Climatic characteristics of forest sites where wild yams have been surveyed, including rainfall and monthly temperature (Sources: Anon., 1983; 1990; Bahuchet, 1985; Gérard, 1960; Pagezy, 1988), used to define the dry seasons (hatched)

Climatic diagrams are used to define the dry season (hatched); but the only sites with a "true" dry season lasting for about three months, are those of Moloundou and Boukoko. For Libreville and Makokou, the "dry season" shown on the diagram corresponds to a period of permanent cloud cover with high humidity and the year's lowest temperatures and level of evapotranspiration. The two sites in Zaire, Lake Tumba and Wamba in the Uele forest, together with Campo in Cameroon, have no clearly defined dry season.

According to phytogeographic studies and vegetation maps of Cameroon (Letouzey, 1968, 1985), the two sites with "real" dry seasons have semi-deciduous forest which has many species of deciduous tree, especially in the families Sterculiaceae and Ulmaceae.

Many of these deciduous tree species are associated with the presence of edible caterpillars which feed on their leaves. These caterpillars are very easy to collect during two clearly defined periods of the year when they crawl down the tree trunks by the thousand to reach the forest floor, where they pupate. They are a concentrated source of animal fat and protein (Ramos-Elorduy, 1993, this volume), and therefore an important element in the diet of both Aka and Baka (Bahuchet, 1988).

Thus, the type of forest which contains the highest density of yams is also a rich source of edible caterpillars, whereas in evergreen forest these host trees and their attendant caterpillars are much rarer. In the Ituri forest, for example, recent studies do not mention caterpillars being used for food (Hart and Hart, 1986; Bailey and Peacock, 1988). This is undoubtedly true for the monospecific *Gilbertiodendron dewevrei* forest which forms part of the Ituri region.

Concerning wild yams in the Ituri region, Hart and Hart (1986) recorded only their presence/absence, not the density of stems, and found yams only in secondary forest. The irregular distribution patterns of yams in various forest types are evident – for instance in Gabon, we recorded a density of 22 stems ha^{-1} near Makokou, but we found no yams at all in the Lopé reserve where forest and savanna meet.

The second aspect of heterogeneity – within a given forest type – is due to reproductive patterns of wild yams (see above) which result from tree gaps unpredictable in size and location. The structural mosaic of the forest, with mature phase and phases of sylvigenesis, explains why yams are so irregularly scattered. For instance, among the five transects surveyed in the semi-deciduous forest of south Cameroon, one was deliberately placed in an area of forest perceived by the Baka as a "yam-rich zone", where the mean weight of edible tubers was 6 kg ha^{-1}.

Yam density and forest hunter-gatherers

A controversial hypothesis has emerged on "the wild yam question" (Headland, 1987), which claims that present-day forest hunter-gatherer populations cannot represent residual palaeolithic forest populations because the forest has never contained sufficient carbohydrate resources to support human populations without recourse to cultivated plant products. Thus, modern hunter-gatherer populations could only have moved into the forest after cultivated plant resources became available in the region. Headland's hypothesis is based on food intake measurements rather than measuring the density of edible wild yams available to forest populations.

The same hypothesis was independently developed in the Ituri forest (Zaire) by Hart and Hart (1986) and taken up by Bailey and his colleagues on the basis of a thorough bibliographic review (Bailey and Peacock, 1988; Bailey *et al.*, 1989). Debate on this question continues without coming to any clear consensus (see *Human Ecology, Special Issue,* 1991). We are convinced that earlier data on yam consumption and density have not been adequately taken into account in this debate (Hladik and Hladik, 1990).

For example, Endicott (1984; Endicott and Bellwood, 1991) observed that *two tons* of wild yams were eaten by a group of 89 people in Malaysia (that is, 0.25 kg per capita per day) from at least 14 species in 93 days (during a nine month study). Similarly, Eder (1978) recorded that a group of 12 people in the Philippines consumed 200 kg of wild yam tubers in a little over a month (that is, about 0.45 kg per capita per day). In this case, only two species were consumed, of which one (*D. hispida*, probably synonymous with the African *D. dumetorum*) has to be detoxified before consumption. Furthermore, Eder (1988) explains the seasonality of tuber consumption by the increase of seasonal activities such as agriculture, rather than a seasonal tuber availability. Data gathered by Bahuchet (1988) from seven Aka families in the Central African Republic show no seasonal variation in the frequency of wild yam tubers in the diet (although they appear in only four per cent of meals). Data gathered by Hart and Hart (1986) also show that wild yams are available all year round in the Ituri forest zone.

Furthermore, measurements of wild yam standing biomass in forest have never been given the importance they deserve, due to errors of interpretation. For instance, among the data presented in Table 13.2, the figure of 1 kg ha^{-1} which corresponds to 5 000 kg for a pygmy territory of 50 km^2, was mistakenly cited by Vincent (1985) as 500 kg. This figure, which is ten times lower than the actual measurement recorded, was picked up by other authors and used as evidence *against* the potential self-suffiency of forest populations in yams, whereas the true figure might be used as evidence *for* potential self-sufficiency (all the more so, since our new findings in Cameroon give a figure of 3 kg ha^{-1}). In terms of potential self-sufficiency, it is also important to note that the population densities of hunter-gatherers are very low.

We still need to know how fast these tubers grow. Moreover, all the standing crops we quote were measured in forest which is highly heterogeneous, so we must be cautious in extrapolating to large areas. The Aka and Baka have a detailed knowledge of this heterogeneity, and use it to its full potential. If they chose only to gather yams in the richest zones we surveyed, they would benefit from a density of 6 kg ha^{-1}. Moreover, the Baka themselves manage wild yam populations to some extent, as is discussed elsewhere in this volume (Dounias, 1993). Further extensive studies of the effect of exploitation and management by the hunter-gatherers on the demography of wild yam populations might contribute to precise tuber availability on a scale including all parts of the forest mosaic. A "yam-rich zone" might result from long term management of the forest resources, since floristic composition as well as faunal composition has been influenced by human pressure (e.g. in Amazonian forests, Balée, 1989; in Malaysian forests, Rambo, 1979). In African forests, important "wild" populations of the oil palm *Elaeis guineensis* – the origin of which is uncertain – are located in the area of old abandoned settlements (Dijon,1986). Wild yam populations might have been managed by people as well.

Past and future of yams

The large range of adaptations of wild yam species to different environmental conditions within the forest, is of great importance for future improvement of domesticated yams. The origins and domestication of yams in Africa, discussed by Coursey (1976), focused on yams cultivated in countries *outside* the forests. This is his concept of the "yam zone", where the "yam civilization" occurs (Miège, 1954). We might even consider, with C.M. Hladik (1985), that wild forest yams could have been the staple food of early Hominids.

Forest yams are obviously ancestors of cultivated plants, such as *Dioscorea bukilliana*, whose cultivated form retained the perennial woody plate but which have larger edible fleshy parts than the wild form (Plate 13.1). Recent biochemical studies on the phylogeny of cultivated African yam varieties

Plate 13.1 Comparison of the wild form of *Dioscorea burkilliana* (left, sample A.H. 4287) and a cultivated form (right, sample A.H. 4245) collected near Makokou, Gabon (photos C.M. Hladik)

(Terauchi *et al.*, 1992) provide further evidence that at least some forest yams species were ancestors of the cultivated varieties. Indeed, the wild forest species represent a large genetic pool from which useful characters could be drawn in breeding programmes for cultivated yam varieties.

The growing patterns of the different species are variable and genetic variability is very high, partly because all *Dioscorea* species are dioecious. Several forest species are natural polyploids (a feature never found in savanna species) and they could be used as new perennial, cultivated forms, which would be suitable for regional agroforestry systems which may become the basis of sustainable development of tropical forest regions.

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Appendix 13.1 Checklist of the African forest yam species and, for the unidentified forms, of the Baka (B) and Kola (K) vernacular names, with reference to the corresponding herbarium specimens (in Paris Herbarium, Muséum National d'Histoire Naturelle)

Dioscorea bulbifera L.,
D. burkilliana Miège,
D. claessensii De Wild.,
D. dumetorum (Kunth) Pax,
D. hirtiflora Benth.,
D. mangenotiana Miège,
D. minutiflora Engl.,
D. praehensilis Benth.,
D. preussii Pax,
D. sansibarensis Pax,
D. semperflorens Uline,
D. smilacifolia De Wild. and Dur.,
D. sp. ɓɔ̄lì (B): E.D. 91.110
D. sp. nàkàkà (K): E.D. 90.192
D. sp. nāmbɛ̄ŋ (K): E.D. 90.158
D. sp. námbɔ̀ngà (K): A.H. 4823
D. sp. njàkàkà (B): E.D. 90.67
D. sp. pàngē (B): E.D. 90.56

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