



# History and conservation of wild and cultivated plant diversity in Uganda: Forest species and banana varieties as case studies



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## ABSTRACT

The history of wild and cultivated plant diversity in Uganda is reviewed, taking forest species and bananas as examples. Palynological research into past human influences on forests is reassessed. The evidence suggests that crops were first introduced into the country at about 1000 BCE, farming communities practicing slash and burn agriculture started to significantly influence the floristic composition of forests during the 1st millennium BCE and there was a major episode of forest reduction at about 1000 CE related to socio-economic change. Bananas were probably introduced in the early centuries CE. The colonial era from 1894 saw the introduction of new concepts of land ownership and the establishment of forest reserves and agricultural stations. Forests and banana diversity are currently under threat, Uganda having a very high rate of deforestation and endemic banana varieties proving susceptible to introduced pests and diseases. It is suggested that, under these circumstances, conservationists take an opportunistic approach to field engagement, making use of favourable local conditions as they arise. Partnerships should be sought with elements of society concerned with sustainable use, provision of ecosystem services and cultural survival to widen the social base of plant conservation. International organisations involved in conservation of plant genetic resources and wild plant species should collaborate with one another to develop the conceptual basis of plant conservation, to make it more relevant to countries like Uganda.

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## 1. Introduction

This paper presents an overview of the history of wild and cultivated plant diversity in Uganda, providing a platform for advancing suggestions for its conservation. Indigenous plant diversity is under great threat in Uganda today, with conservation hampered by many constraints. Uganda shares features with many other countries and hopefully the suggestions offered will be useful for them too.

The Green Revolution of the 1950s and 1960s dramatically increased the yields of some major crops, helping to forestall an anticipated global shortage of food. The introduction of genes resistant to pests and diseases from traditional varieties of crops was critical to this development, which, in turn, drew attention to

the rapid rate of decline in the number of such varieties. It is estimated that 75% of the genetic diversity of agricultural crops was lost during the 20th Century (FAO, 1998; Hawkes et al., 2001). The International Board for Plant Genetic Resources (IBPGR) was founded in 1974 to coordinate an international programme to conserve plant genetic resources, concentrating initially on the landraces of major crops and the expansion of gene banks, notably seed banks and field collections (FAO, 1992).

The scope of the conservation movement concerned with plant genetic resources has widened over the years, coming to embrace wild relatives of crops, minor agricultural crops and other uses of plants additional to food (Prescott-Allen and Prescott-Allen, 1988). More emphasis is being placed on *in situ* conservation. Consequently, this branch of plant conservation has moved closer to the other school of plant conservation that has been developing over the same period, founded on concern about loss of species of wild plants, and associated with tools such as Red Data Books, protected areas and *ex situ* collections (Given, 1994; Hamilton and Hamilton,

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2006). It is estimated that 20% of the world's 380,000 species of plants is threatened with extinction (Kew, 2012). The number of species of actual or potential conservation concern (from the perspective of the plant genetic resource movement) has thus been dramatically expanded, for instance now theoretically including the 50,000–70,000 species of plants estimated to be medicinal (Lange, 1997; Schippmann et al., 2006).

Greater specificity is provided here by paying special attention to species living in one particular type of plant community (rain-forest) and to one particular crop (the banana). Forest species and forests (as collective entities) provide a wide range of useful products and ecosystem services in Uganda. The latter include regulatory services (such as climatic amelioration and soil stabilization), provisioning services (such as delivery of water supplies) and cultural services (having significant symbolic value) (Hamilton, 1984; Ray, 1991). Uganda has the highest per capita consumption of bananas in the world and is a secondary centre of genetic diversity for the crop (Daniells and Karamura, 2013–2014; Gold et al., 2002; Karamura et al., 2010; Karamura and Mgenzi, 2004). Bananas in Uganda are eaten steamed, roasted and raw, as well as brewed for beer. *Matooke*, a dish prepared by steaming and mashing cooking bananas, is the staple food of millions of people (Vernacular terms used here are from Luganda, an indigenous language).

Uganda is a medium-sized country (area 236,000 km<sup>2</sup>) straddling the equator in the heart of Africa. It lies within the Great Lakes region of the western part of East Africa, with Lake Victoria to the south and Lakes Albert and Edward in the Albertine Rift to the west (Fig. 1). The population (36 million in 2012) is growing rapidly (3.27% p.a.) and becoming more urbanized (growth rate 4.4% p.a.). Despite urbanization, the primary means of livelihood for most people remains farming (73% of households in 2006–9), complemented by extensive use of wild plants for construction, crafts, fuel, medicines and other purposes. Much of the economy is centrally related to plants. The gross domestic product (GDP) was US \$1404 in 2012 with most people financially very poor. Uganda is a culturally diverse country, having 42 indigenous languages classifiable into 4 major language groups. Many types of polity were present prior to the establishment of the Uganda Protectorate by Britain in 1894. English and Swahili are the official languages.

Uganda is a signatory to the International Treaty on Plant Genetic Resources for Food and Agriculture (2004), the Convention on Biodiversity (1992) and the Global Strategy for Plant Conservation (2002). Official conservation tools include protected areas, *ex situ* collections and special legislative protection for some species.

## 2. Plant diversity, plant resources and agriculture in Uganda

Uganda offers an exceptionally wide range of habitats available for human exploitation (Schoenbrun, 1998). Rainforest is the natural vegetation in higher rainfall areas (about 20% of the land area), which lie mostly towards the west and north. Lowland rainforest grades into montane forest at higher altitudes, with woodland, bushland and other types of savannah in drier parts (Langdale-Brown et al., 1964). Forest clearance over the years has resulted in once continuous stretches of forest being reduced to scattered remnants embedded within matrices of cropland, secondary vegetation, swamps and urban areas. Much of the country outside forests and settlements is frequently burnt and grazed by livestock. Small-scale farmland covered 43.5% of the land area in 2005, large-scale farmland 4.8% and built-up areas 4.8% (FAO, 2010b).

The indigenous flora contains about 5000 species of higher plants (Davis et al., 1986). Tree floras report many species as having uses (Eggeling, 1952; Hamilton, 1991; Katende et al., 1995) and local inventories of medicinal plants can yield extensive lists (Adia et al., 2014; Galabuzi et al., 2015; Katuura et al., 2007; Lye et al., 2008;

Tabuti, 2008; Tabuti et al., 2003). Intensive studies sometimes reveal uses for unsuspected species, suggesting that much ethnobotanical knowledge remains undocumented. The small forest trees *Rytigynia kigeziensis* Verdc. in Bwindi Impenetrable Forest and *Belanophora coffeoides* Hook. f. in Mpanga Forest were apparently unknown to scientists to have specific uses before research revealed that the first yielded a vital medicine used as a dewormer (“without this we will die”) (Cunningham, 1996) and the second to have been harvested methodically (carefully differentiated from several similar-looking species) for construction purposes (Taylor et al., 2008).

Many systems of plant use and management exist, embracing both cultivated and wild plants, and varying according to location, ethnicity, household wealth, and ownership of land and livestock. A farming household in the Central Region might, for instance, rely on a home garden (*lusuku*) to supply its staple food of cooking bananas, outfields (*emisiri*) for sweet potatoes, forest (*ekibira*) for firewood, taller grassland for fodder (*essubi*), swamp (*ekisenyi*) for papyrus (used in making mats) and sandy valley areas for the many products obtained from the wild date palm, including termite-resistant poles. Wild plants are often collected to sell. Unsustainable harvesting of wild plants is frequently reported, the most obvious problem being the cutting of trees to supply the Kampala market with fuel (firewood and charcoal). At least 90% of people in Uganda rely on woodfuel, 90% of trees cut for products being harvested for this purpose (Kabogozza, 2011).

Tasks in the supply and management of plant resources tend to be gender-related, with men more involved where money is to be made or when the end-product is alcoholic (Karamura et al., 2004). The collection of firewood for home use is overwhelmingly by women and children, but men dominate the commercial trade in charcoal. The *lusuku*, which serves mainly to supply subsistence products to the household, is almost exclusively the preserve of women (Karamura et al., 2004). Women also take the lead in the provision of food for the family and in maintaining its health, and are responsible for most craft-making, so are the main holders of indigenous knowledge of plants. A continuing interest in indigenous botanical knowledge is apparent from the retention of a diversity of local varieties of crops by some farmers (Mulumba et al., 2004; Zawedde et al., 2014) and the widespread use of herbal medicine (Cunningham, 1993; Hamilton and Aumeeruddy-Thomas, 2013; Lwanga, 1992). Anecdotal reports suggest that an interest in indigenous botanical knowledge is declining among the young, especially those from richer families.

The *lusuku* (commonly translated as ‘banana garden’ in English) is a type of indigenous agroforestry system that forms a key component of farms in the Central Region. It typically covers 22% of the 0.7 ha of cultivated land on an average farm (area 1.4 ha) (Edmeades et al., 2007). Bananas form a key component, but many other species can be present, having a variety of life forms, uses, degrees of domestication and intensities of management. Types of plants can include: (1) large trees, such as *Albizia coriaria* Welw. ex Oliv. (*omugavu*, timber, wood used to smoke barkcloth); (2) medium-sized trees, such as *Spathodea campanulata* P. Beauv. (*kifabakazi*, decorative and medicinal); (3) small trees and bushes, such as *Coffea canephora* Pierre ex A. Froehner (*mumwanyi*, producing coffee beans for the market); annual crops, such as kidney bean *Phaseolus vulgaris* L. (*ebijanjaalo*); (4) perennial crops, such as cocoyam *Colocasia esculenta* (L.) Schott (*ejjuuni*); (5) herbaceous plants, some semi-cultivated, such as spinach *Amaranthus dubius* Mart. ex Thell. (*doodo*) and (6) climbing and scrambling plants, such as *Dioscorea* yams (*balugu*, *kyetutumula*, etc.). The *lusuku* can have horizontal as well as vertical structure, for instance with types of bananas containing the B genome typically placed around the periphery and newly acquired varieties of bananas planted near the

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