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Articles

- 1 Tourism as a development tool:
the case of Belize *Louis A. Woods, Joseph M. Perry
& Jeffrey W. Steagall*
- 20 Montserrat kitchen gardens: social
functions and development potential *David A. Thomasson*
- 32 Jamaica's settlement vegetation,
agroecology, and the origin of agriculture *John Rashford*
- 51 The Cayman Islands: economic growth and
immigration in a British Colony *John Connell*
- Geography in the Caribbean Classroom**
- 67 Tainos not Arawaks: the indigenous peoples
of Jamaica and the Greater Antilles *Basil Reid*

Reviews

- 72 The sugar cane industry: an historical geography from its origins to 1914
(reviewer *David Barker*)
- 74 Climate Change in the Intra-Americas Sea: Implications of future climate
on the ecosystems and socio-economic structure in the marine and coastal
regions of the Caribbean Sea, Gulf of Mexico, Bahamas, and the northeast
coast of South America
(reviewer *Duncan McGregor*)
- 76 Trinidad Ethnicity
(reviewer *Carolyn V. Prorok*)

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Jamaica's settlement vegetation, agroecology, and the origin of agriculture

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Summary *This paper uses Jamaica as a point of reference in identifying the human selective pressures that are responsible for the development of settlement vegetation. An understanding of settlement vegetation and the human selective pressures that produce it provide an overall framework for explaining systematically the relationships between people and plants in Jamaica and around the world. Such an understanding is essential to any comprehensive effort to explain the origin of agriculture.*

Key Words

SETTLEMENT VEGETATION AGROECOLOGY JAMAICA

Introduction

This paper explores how humans intentionally and unintentionally select the plants in the environment in which they live, and which produces a distinctive settlement vegetation that is an expression of the historical development of their way of life. The concept of settlement vegetation includes all the plant communities of herbs, vines, shrubs or trees in the human environment that are directly or indirectly the result of human activities and of the physical structures associated with these activities. These plant communities are the ones with which people are in regular contact and upon which they depend for the wide variety of products necessary for their health, and for the success of their economic, reproductive, recreational and religious activities. All cultures produce a distinct settlement vegetation based on the nature of their physical environment and on the historical development of their way of life. Although Jamaica's settlement vegetation is used to illustrate these ideas, the aim here is to provide a general framework that explains systematically the relationship between people and plants in all cultures.

This paper, which is divided into five parts, is based on the author's experience growing up in Jamaica and ongoing field research which began in 1982. The first part identifies the two fundamental human selective pressures that produce settlement vegetation and the second part introduces the settlement vegetation of Jamaica. Parts three and four examine the introduction of plants to Jamaica from around the world, and how this process of introduction has contributed to the many different plant communities that now compose the island's settlement vegetation. The last part summarizes the points made in this paper and discusses the implication of the concept of settlement vegetation for theories concerned with the origin of agriculture.

Human selective pressures producing Settlement Vegetation

The deliberate and unintentional human selection of plants that form a distinctive settlement vegetation occurs in a variety of ways and for a variety of reasons. Nevertheless, these human selective pressures are exerted in two fundamental ways.

The first process involves the impact on wild plants wherever humans settle and build structures. Wild plants are those that are spread in the human environment by physical processes such as wind, water and gravity; by biological means such as their own contrivances for self-dispersal or by dispersal in association with animals, especially birds and bats; or by human influences such as when advantageous growing conditions are created by the unintended consequences of the built environment and its associated activities (Ridley, 1930; van der Pijl, 1969; Morton, 1976).

There are three common human responses to wild plants growing in the settlement environment: they are destroyed to make space, remove interference and create useful products; they are tolerated when they do not interfere with human activities; and they are preserved, protected or cultivated when they are valued. It is useful here to differentiate wild plants into weeds and naturals, a distinction implied by Bailey and Zoe (1976:1,170). An effort is made to eliminate weeds because they generate costs which can be measured in time, money, energy, productivity, yield, profit, comfort, health, or aesthetics. Naturals do not cause trouble and are tolerated. Many of Jamaica's most useful native and exotic fruit trees, for example, are wild in the settlement environment and some show weedy tendencies. Their seedlings are tolerated, protected or cultivated when they arise in favourable places, or are destroyed or transplanted to preferred locations when they do not. In addition to other means of dispersal, these trees are frequently incidentally spread by humans and are often described as 'volunteers', or as trees that are 'self-sown', 'half-wild', 'semi-cultivated' or 'spontaneous'.

Human incidental dispersal of fruit trees and other plants may result from harvesting, adhesion, and mediation. With harvesting, dispersal can occur when seeds are spat out, discarded, defecated, or lost (as, for example, between the time of collection and use). With incidental dispersal by adhesion, plants or seeds become attached to people, their equipment, or their animals, and are thus spread in the human environment. And with incidental dispersal by mediation, human settlement as a built environment, together with the activities associated with it, affects animals and other natural agents that in turn have an impact on the dispersal of plants.

In addition to the responses to wild plants, the second fundamental way in which human selective pressures determine the development of settlement vegetation is through the cultivation of wild plants and domesticates. Cultivation is simply the deliberate assistance given to plants such as preparing the soil, fertilizing, irrigating, weeding and protection from predators. Whether grown from seeds or vegetatively, wild plants become domesticated when, by cultivation, they have been genetically modified to the point of dependence on human activity for their successful reproduction and dispersal (Ucko & Dimbleby, 1969; Rindos, 1984).

Thus, cultivation and the unintended selective impact of the whole range of human activities on the reproductive success of wild plants are the two essential processes that produce settlement vegetation. The following discussion represents only a very general outline of the development of Jamaica's settlement vegetation to illustrate a process that is inevitable wherever humans settle.

Jamaica's Settlement Vegetation

Figure 1 is adapted from Swabey's (1949:60) classification of the vegetation types of Jamaica. Swabey's work, based on that of Burt-Davy (1938), makes a basic distinction between climax and successional vegetation. Of the successional types, he identifies primary successional vegetation and secondary successional vegetation. Primary successional vegetation refers to plant colonization of disturbed land, such as land affected by landslides and newly formed mud banks and sand bars. With respect to secondary successional vegetation, Swabey notes:

'Into this group will come the bulk of the vegetation of Jamaica. Man and grazing animals have in one way or another altered most of the natural vegetation of the island. This may range from complete destruction of the original plant cover, for the purpose of cultivation or other development, to the selective felling of scattered trees in otherwise natural woodland. The use of fire, the cutting of firewood, the grazing of stock have all played their part'.
(Swabey, 1949:60)

What Swabey considers secondary successional vegetation is termed settlement vegetation in this paper.

Asprey and Robbins (1953:403) offer a classification of Jamaica's vegetation types that generally resembles that of Swabey (Figure 2). Their classification has the added advantage of identifying the kinds of human-induced successional plant communities that have resulted from the transformation of much of Jamaica's natural forests which 'now only occur in the wet limestone country of the interior, the higher elevations of the Blue Mountains in the east, the dry limestone hills and the mangrove swamps' (Asprey & Robbins, 1953:360). It is important to realize that the transformation of Jamaica's natural vegetation into settlement vegetation is a microcosm of a process that is occurring in human settlements around the world (Heizer, 1955; Thomas, 1956; Montgomery *et al.*, 1973; Baker, 1984).

Plant introduction and the development of Jamaica's Settlement Vegetation

Most of the great variety of useful plants commonly associated with the human environment in Jamaica have been introduced from elsewhere. These plants now form a settlement vegetation that is distinctly Jamaican. In contrast to many of the world's peoples who have traditionally depended on grasses for their basic nutrition, Jamaicans, in common with other groups in humid equatorial and tropical marine environments, have depended upon an assemblage of herbaceous root crops and tree crops (Webster & Wilson, 1973; Grigg, 1977).

The Arawaks were among the first to transform Jamaica's natural forests into settlement vegetation by their response to native wild plants and their cultivation of largely introduced domesticated and wild plants. The Arawaks depended on a complex of roots and fruits which many scholars believe originated between 3,000 and 7,000 years ago in South America's tropical lowlands. They brought these plants to Jamaica as they migrated north through the Caribbean archipelago (Grigg, 1977).

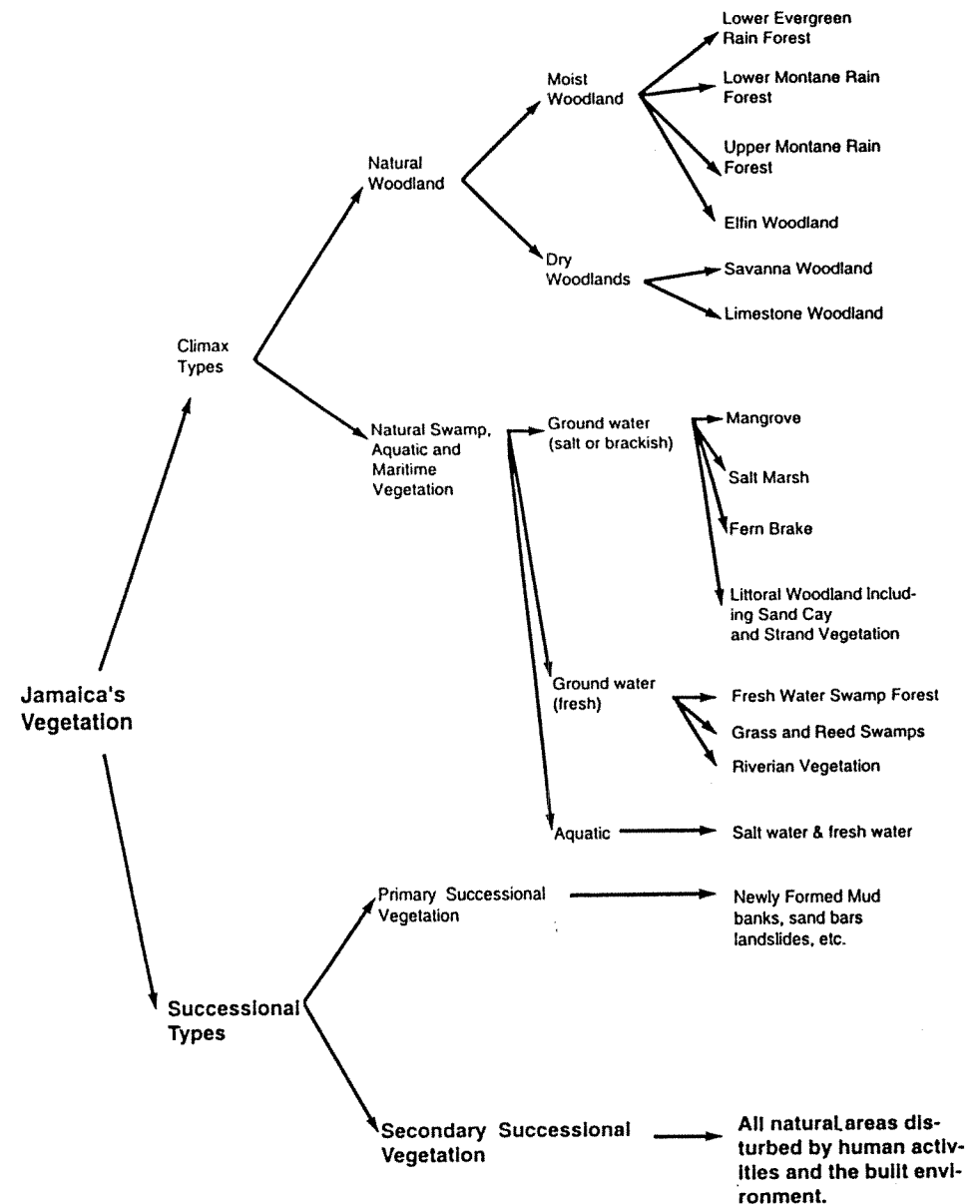


Figure 1: Jamaican Vegetation types according to Swabey
Source: Swabey (1949:55-61)

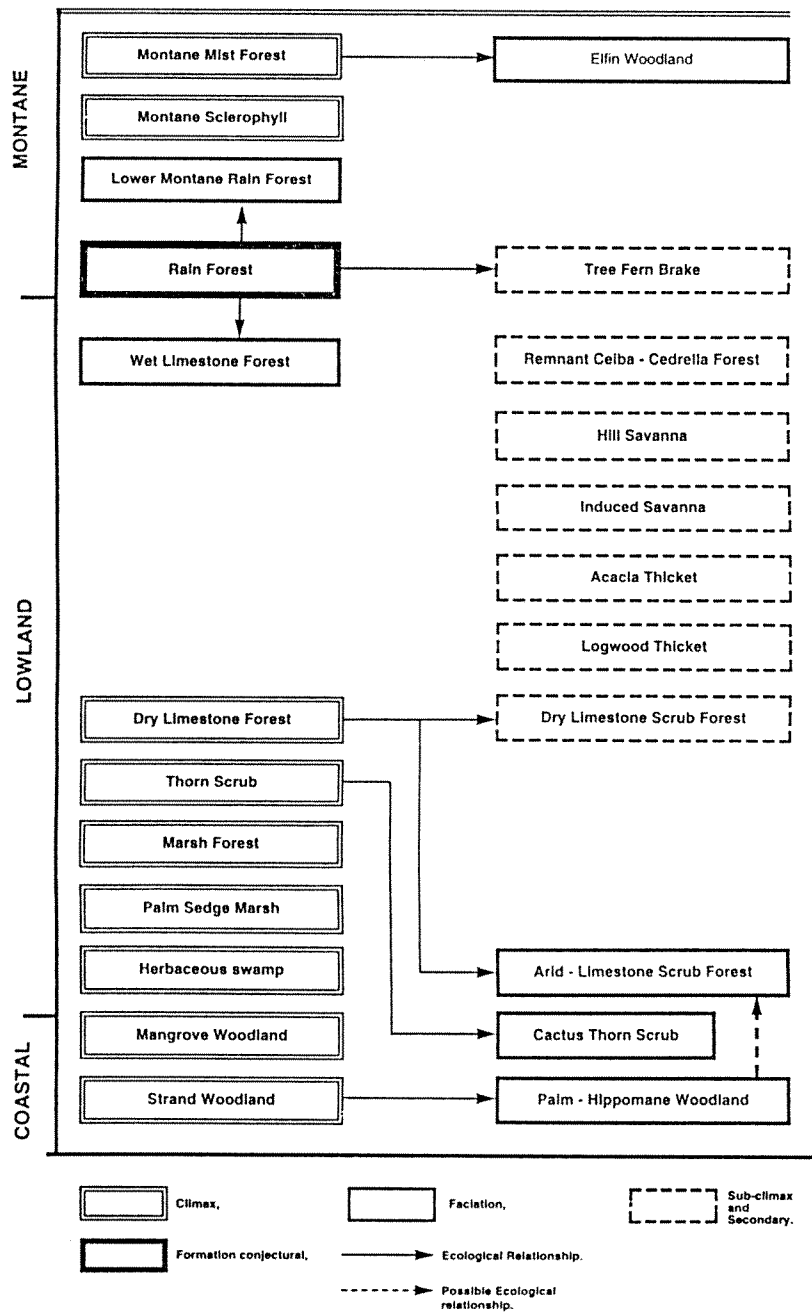


Figure 2: Jamaican vegetation types according to Asprey & Robbins
 Source: Asprey & Robbins (1953:403)

The next groups to contribute significantly to the development of Jamaica's settlement vegetation were the Spanish and the Africans whom they enslaved. This process began in 1492 when Columbus stumbled across the Americas in his effort to demonstrate the possibility of reaching the wealth of the 'Indies' by sailing west. At that time, the worldwide distribution of wild and domesticated plants was unaffected by any significant exchange between the Old World and the New World. This was also true of people, their domesticated animals, and of the pests and diseases associated with both. Columbus initiated a biological and cultural exchange between the Old and the New Worlds that, in effect, doubled the plant resources of both hemispheres and contributed greatly to the development of the present world system (Crosby, 1972; 1986; Hobhouse, 1987; Viola & Margolis, 1991; Rashford, 1993). Adams (1971:85) estimates 'that some five hundred of the familiar common, useful, ornamental and weedy plants were not [in Jamaica] . . . when Columbus arrived.'

The third and last great influence on the development of Jamaica's settlement vegetation came after the British captured the island from the Spanish in 1655. By the eighteenth century, Jamaica emerged as one of the leading sugar-producing plantation colonies, and, as with the Spanish, the success of the island's sugar economy during the early British colonial period was based on forced African labour. The worldwide search for plantation crops and food crops was facilitated when the British established Jamaica's botanic gardens which operated in cooperation with other botanic gardens and related institutions around the world. This resulted in the large-scale introduction of plants to the island from all parts of the world (Parry, 1955; Eyre, 1966; Powell, 1972; 1973; Brockway, 1979).

At the beginning of the twentieth century, William Harris, who was sent from Kew Gardens to Jamaica to be Superintendent of the island's Public Gardens, was able to conclude:

'Jamaica may be described as the garden and or orchard of the West Indies. There is probably no tropical colony which has benefitted to such a large extent by the introduction of the fruit, economic and ornamental trees and plants of other lands as this island'.
 (Harris, 1910:181).

The Arawak, European and African influences are now evident in the many different plant communities that make up Jamaica's settlement vegetation. Some of the areas of Jamaica's settlement that are associated with distinct plant communities will be examined briefly, beginning with the home environment, agricultural lands, and landscaped public and private grounds. In these areas of settlement, a systematic effort is made to eliminate wild plants, especially those that are considered weeds. Following this, other areas of settlement where wild plants are especially significant will be examined. Such areas include roadsides, waste areas and abandoned sites. There are clearly environmental, economic, regional and historical differences which influenced the development of settlement vegetation in different parts of Jamaica, especially when we consider plants in the home environment. In the interest of brevity, however, this paper presents only a very general account of the plant communities that make up Jamaica's settlement vegetation.

Although there are no similar studies for Jamaica, some sense of the range of variation expected to occur in the content and structure of the island's residential

vegetation, especially as it is determined by social and economic differences, can be found in the works of Kimber (1966; 1973; 1988), Wilhelm (1975) and Westmacott (1992). And an example of the changes that occur in Jamaican yards when transformed from being primarily concerned with tree cultivation largely for household use (as with multi-storied intercropping) to the production of vegetables and other herbaceous crops for their commercial value (which require the destruction of the traditional tree crops) is discussed by Eyre (1972:96).

Residential Vegetation

The residential environment refers to dwellings and the land around them, that is, yards. Residential vegetation may consist of one or more gardens in the yard along with other kinds of plant communities that are determined by the economic, reproductive, recreational and religious activities of the household, and by the physical structuring of the dwelling space. In Jamaica, the residential environment is typically demarcated by live plants that serve as boundary markers for the yard. By pointing out the way and directing movement, these plant borders help to define paths, walks and driveways. They frame trees and shrubs as well as ornamental beds that, when placed in the centre of a lawn, rise like islands from a sea of grass. Plant borders also occur along the foundation of buildings, usually at the front, but sometimes all around the building. Although on some occasions they provide protection in one way or another as barriers and screens, plant borders are often created just for their beauty (Rashford, 1989).

Some of the plants commonly cultivated to form borders are the croton (*Codiaeum variegatum* L.), cat tail (*Acalypha hispida* Burm. f.) and dragon blood (*Cordyline terminalis* (L.) Kunth) from the East Indies; copperleaf (*Acalypha wilkesiana* Mull. Arg.) from the South Sea Islands; hibiscus from Asia (*Hibiscus rosa-sinensis* L.) and East Africa (*Hibiscus rosa-sinensis* L. var. *schizopetalus* Mast.); Turk's cap (*Malvaviscus arboreus* Cav.) from Mexico; and poinsettia (*Euphorbia pulcherrima* Willd. ex Kl.) and shower-of-gold (*Galphimia gracilis* Bartl.) from Mexico and Central America. Other familiar tropical American plants used for borders include bougainvillea (*Bougainvillea* spp.), May pole (*Agave sobolifera* Salm-Dyck), bread-and-cheese (*Pithecellobium unguis-cati* (L.) Benth.), roast pork (*Euphorbia lactea* Haw.), dildo (*Cereus peruvianus* F. & R.) and pingwing (*Bromelia pinguin* L.). The common and very beautiful Barbados pride (*Poinciana pulcherrima* L.) is of unknown origin.

Borders associated with the dwelling, especially fences and walls, provide a niche for wild vines like the cerasee (*Momordica charantia* L.), a well known Jamaican medicinal plant, which Adams (1972:504) describes as growing in 'the subtropics and tropics of both hemispheres'. They also provide a niche for naturalized species such as the familiar John Crow bead (*Abrus precatorius* L.) of the Old World tropics whose conspicuous glossy red and black seeds have been used to make personal ornaments, tourist trinkets and many other things; the blue pea (*Clitoria ternatea* L.), also from the Old World tropics; and the ubiquitous bleeding heart or coral vine (*Antigonon leptopus* Hook. & Arn.) from Mexico which, despite its showy flowers and its medicinal uses, is regarded as a noxious pest.

Ornamental gardens which are most often associated with front yards are frequently overlooked in discussions of cultivated plants in the residential environment. In many Jamaican front yards, we find lawns or other kinds of open spaces dominated by

herbaceous plants, especially pantropical grasses such as crab grass (*Paspalum conjugatum* Berg.) and, of course, Bahama grass (*Cynodon dactylon* (L.) Pers.) which Adams (1972:166) describes as 'a weed of roadsides, pastures and waste places.' Zoysia grass (*Zoysia tenuifolia* Willd.) from Japan is now the preferred lawn grass in Jamaica.

Many front yard ornamental gardens also contain flower beds that are often adjacent to the house, especially to the veranda. They also occur by the front fence and along walkways, and they form colourful 'islands' in lawns or in swept dirt clearings. In addition to plants already mentioned in the making of borders, these front yard ornamental gardens frequently include peregrina (*Jatropha integerrima* Jacq.), a native of the Caribbean, as well as other species of *Jatropha* from other parts of the world; agapanthus (*Agapanthus africanus* (L.) Hoffmgg.), gerbera (*Gerbera jamesonii* Bolus ex Hook. f.) and bird-of-paradise (*Strelitzia reginae* Ait.) from Africa; periwinkle (*Catharanthus roseus* (L.) G. Don) from Madagascar; red ginger (*Guillainia purpurata* Vieill.) from the South Pacific, as well as other species of *Alpinia* from India and the East Indies; and the firecracker plant (*Russelia equisetiformis* Cham. & Schlecht.) from Mexico. Other tropical American plants are the allamanda (*Allamanda* spp.), heliconia (*Heliconia* spp.), Indian shot (*Canna indica* L.), Queen's wreath (*Petrea volubilis* L.), pinguin (*Bromelia pinguin* L.), candle bush (*Cassia alata* L.), and many aroids that include caladium (*Caladium bicolor* (Ait.) Vent.), ceriman (*Monstera deliciosa* Liebm.), dumb cane (*Dieffenbachia maculata* (Lodd.) G. Don), and anthurium (*Anthurium* spp. Schott).

Some of the plants mentioned above, especially the different genera of the Bromeliaceae and many of the aroids, are also grown in pots which appear in the yard, on the veranda, and indoor. Other familiar potted plants include various ferns, the sansevieria (*Sansevieria trifasciata* Prain) and spider plant (*Chlorophytum* spp.) from Africa; crown-of-thorn (*Euphorbia milii* Ch. des Moulins) from Madagascar; endemic begonias (*Begonia* spp.) and begonias introduced from other parts of tropical America and elsewhere. Some ornamental plants like the periwinkle, agave, and bread-and-cheese frequently escape cultivation and become established in other areas of the settlement.

In contrast to ornamental front yards, backyards, and sometimes other parts of the residential environment, often contain herbaceous gardens of native and exotic vegetables and plants that provide beverages, spices, seasonings and medicines. Also associated with these gardens are shrubs such as the gungo (*Cajanus cajan* (L.) Millsp.) from Africa, a very important food plant.

In Jamaica, as in other parts of the humid tropics, one of the most important categories of plants in the residential environment are trees (Edwards, 1961:114; Blaut, 1959:89; Clarke, 1957:28; Berleant-Schiller & Pulsipher 1986; Suah & Nicholson, 1986). They are usually found in backyards, but they also occur in side yards and front yards and along fence lines where they grow singly or scattered, or in groves, orchards and especially multi-tiered intercropped communities. In some cases, trees contribute to the physical structuring of the settlement environment by serving as live fence-posts. Some examples are the Spanish machete or mountain immortelle (*Erythrina poeppigiana* (Walp.) O. F. Cook), hog plum (*Spondias mombin* L.), and the grow stick (*Gliricidia sepium* (Jacq.) Kunth ex Griseb.), which are all tropical American.

To Jamaican home owners and small farmers, trees, especially those surrounding their dwellings, have a special meaning that is specifically related to the economic, social and political context within which intercropping has developed (Rashford, 1982; 1984).

Most discussions of multi-storied intercropping in Jamaica and around the world have been concerned in one way or another with its efficient production of a diversity of products for household use, gift-giving, and sale (Innis, 1961; Edwards, 1961; 1965; 1972; Barker & Spence, 1988; Brierley, 1991). The efficiency of multi-storied intercropping represents the optimal use of all resources allocated to cultivation, including human energy, mutually beneficial crops, and the physical conditions present such as space, soil, light, shade and water. Efficiency is also concerned with such things as the continual availability of products for use and sale and protection against the risks of pests, diseases, theft, and fluctuating market demands. Although the economic and agronomic dimensions of multi-storied intercropping attracts increasing attention, little effort has been made to examine this kind of intercropping within the political context in which it has developed in Jamaica and elsewhere. From a political perspective, intercropping as an efficient system of cultivation allows home owners and small farmers to achieve a relatively independent way of life free from exploitative relations with estates, small farmers and others, and free from dependance on charity and state welfare.

In this context, trees in Jamaica are a symbol of land ownership and security of tenure. Their existence in yards and fields reflect a lifetime investment based on a concern for the future when old age reduces the capacity for hard physical work (Edwards, 1961:105-109). In their youth, home owners and farmers 'save' or plant young trees that require care but provide no products. In their old age, they expect to be supported by these trees with little or no outlay of labour. Trees also reflect a concern with the welfare of succeeding generations, and a desire to be free of relationships of dependence and exploitation. Preserving, protecting and planting trees in yards and fields, then, is an essential part of a fully developed system of intercropping characterized by a multi-tiered plant community identified as 'artificial woodlands' by Adams (1971:5-7) and as a 'food forest' by others (Agriculture Census Unit, 1973:8; Rashford, 1982; Hills & Iton, 1983; Suah & Nicholson, 1986; Hills, 1988).

One tree that is an important part of Jamaica's residential vegetation is the ackee (*Blighia sapida* Konig.) from West Africa, the source of the island's national fruit. The ackee, which produces many weedy seedlings, is an indicator species for the presence of Jamaicans when one considers its distribution in other Caribbean islands, Central America and Florida in association with Jamaicans and those with Jamaican connections. Other important African trees include coffee (*Coffea arabica* L.), tamarind (*Tamarindus indica* L.), and bissi (*Cola* spp. (Beauv.) Schott & Endl.). The baobab (*Adansonia digitata* L.), one of Africa's most famous trees, also occurs, but rarely (Rashford, 1987).

Tropical American contributions to the residential environment of Jamaica include familiar trees like the naseberry (*Manilkara zapota* L.), sweetsop (*Annona squamosa* L.), soursop (*Annona muricata* L.), custard apple (*Annona reticulata* L.), star apple (*Chrysophyllum cainito* L.), Barbados cherry (*Malpighia punicifolia* L.), seagrape (*Coccoloba uvifera* L.), guinep (*Melicoccus bijugatus* Jacq.), stinking toe (*Hymenaea courbaril* L.), pawpaw (*Carica papaya* L.), cashew (*Anacardium occidentale* L.), mamee (*Mammea americana* L.), annatto (*Bixa orellana* L.), calabash (*Crescentia cujete* L.), pimento (*Pimenta dioica* (L.) Merr.), avocado (*Persea americana* Mill.), cocoa (*Theobroma cacao* L.) and guava (*Psidium guajava* L.).

From India has come the ubiquitous mango (*Mangifera indica* L.), one of the island's most important fruit trees, and the jackfruit (*Artocarpus heterophyllus* Lam.).

Other Asian plants include jimbling (*Phyllanthus acidus* (L.) Skeels) and the citruses, especially the lime (*Citrus aurantiifolia* (Christm.) Swingle), sour orange (*Citrus aurantium* L.), sweet orange (*Citrus sinensis* (L.) Osbeck), tangerine (*Citrus reticulata* Blanco), and grapefruit (*Citrus paradisi* Macf.). Important additions to the Jamaican home environment include the nutmeg (*Myristica fragrans* Hoult.) from the East Indies and the litchi (*Litchi chinensis* Sonn.) from southern China.

The Pacific component of Jamaica's residential vegetation includes the coconut (*Cocos nucifera* L.), June plum (*Spondias dulcis* S. Parkinson), breadfruit (*Artocarpus altilis* (S. Parkinson) Fosberg), Otaheite apple (*Syzygium malaccense* (L.) Merr. & Perry), jimbling (*Phyllanthus acidus*), rose apple (*Syzygium jambos* (L.) Alston) and barge (*Averrhoa bilimbi* L.). The almond (*Terminalia catappa* L.) and the coolie plum (*Ziziphus mauritiana* Lam.), common in yards and in other areas of Jamaica's settlement environment, should also be mentioned here. Adams (1972:452) describes the coolie plum as a native of the 'warm parts of the Old World' and the almond as a native of southeast Asia, northern Australia, and the Pacific (Adams, 1972:511). Writing of south Florida, where many plants in the human environment are the same as those found in Jamaica, Julia Morton notes that:

'The great increase in [the] . . . naturalized flora is attributable mainly to the escaping from cultivation of trees, shrubs, vines and other plants deliberately imported as ornamentals or as sources of food, timber, fiber or forage.' (Morton, 1976:348)

Among the trees that are incidentally dispersed in Jamaica's settlement environment by humans (some more frequently and more extensively than others) are the ackee, sweetsop, star apple, stinking toe, pawpaw, calabash, avocado, guava, sour orange, lime, Barbados cherry, naseberry and jimbling. Other such human incidentally dispersed species that are especially common along roadsides are the mango, guinep, tamarind, tropical almond, coolie plum and poinciana (*Delonix regia* (Boj. ex Hook.) Raf.).

Agricultural fields of small farmers and estates

Beyond residential areas of the settlement is the vegetation associated with the agricultural fields of small farmers and large estates. With small farmers, many plants found in their yards, especially trees, are also found in their fields. Nevertheless, with fields, special attention is given to root crops of tropical America including the cassava (*Manihot esculenta* Crantz), sweet potato (*Ipomoea batatas* (L.) Lam.), yampi (*Dioscorea trifida* L.), arrowroot (*Maranta arundinacea* L.) and coco (*Xanthosoma sagittifolium* L.) Schott). Root crops of Africa (*Dioscorea* spp.) and the Pacific (*Colocasia esculenta* L.) Schott) are also common. In addition, special attention is given to herbaceous plants grown for market, such as the familiar vegetables, seasonings, and spices. Some useful wild plants that occur in fields as well as in yards, along roadsides, and in other areas of the settlement include the bird pepper (*Capsicum frutescens* L.) of tropical America and the gully bean or susumber (*Solanum torvum* Sw.) which Adams (1972:656) describes as '[g]eneral in the tropics.'

Plants associated with the fields and pastures of large estates have dominated the landscape of Jamaica's settlement environment. Foremost is the sugarcane (*Saccharum officinarum* L.) from Southeast Asia. Next are the banana (*Musa X paradisiaca* L.) and

the citrus, also from Southeast Asia; the coconut (*Cocos nucifera* L.) whose origin is controversial, though Southeast Asia and the Pacific seem likely; coffee (*Coffea arabica* L.) from Africa, the cultivation of which has transformed large areas of the Blue Mountain; cocoa (*Theobroma cacao* L.), a tropical American species introduced to Jamaica either by the Arawak or the Spanish or both; and the native pimento (*Pimenta dioica* L.), commonly a wild plant in the settlement environment in those parts of the island where growing conditions are suitable.

Public and Private Grounds

Lawns are a common feature of the landscaping of public and private grounds in Jamaica. Associated with lawns are a wide range of ornamental plants, many of which have already been mentioned in the discussion of front yard gardens. Other ornamentals, some of which are also found in the residential environment and in other areas of the settlement, include trees such as lignum vitae (*Guaiacum officinale* L.), a native of the Caribbean; flamboyant (*Delonix regia* (Boj. ex Hook.) Raf.) from Madagascar which, in addition to front yards and landscaped grounds, is now found naturalized along roadsides and in marginal areas; African tulip tree (*Spathodea campanulata* Beauv.) from West Africa which is also naturalized in the wetter parts of the island; golden shower tree (*Cassia fistula* L.) from tropical Asia which is commonly planted in Kingston; poor man's orchid (*Bauhinia purpurea* L.) also from tropical Asia which spreads locally wherever planted; bottle brush (*Callistemon citrinus* (Curt.) Stapf) from Australia; and royal palm (*Roystonea* spp.), frangipani (*Plumeria* spp.) and angel's trumpet (*Datura candida* (Pers.) Safford) of tropical America. The distribution of the tall, stately royal palm in Jamaica's settlement environment is a remnant of the island's colonial history when it was used to structure public and private spaces. It was planted singly, or in small groups, at railway stations and other public areas and in lines or double rows along roads, driveways and the entrances of some of the island's botanic gardens and old estates. Also from tropical America are giant herbaceous ornamental plants that are tree-like in size, including several kinds of *Heliconia* such as the lobster claw, false bird of paradise, and wild plantain.

Common ornamental shrubs found in front yard gardens and landscaped grounds are the sweetly scented jasmine or lady-of-the-night (*Cestrum nocturnum* L.), a native of the Caribbean; the poinsettia (*Euphorbia pulcherrima* Willd. ex Klotzsch) and shrimp plant (*Drejerella guttata* (Brandege) Bremek.) from Mexico; the yellow and purple allamanda (*Allamanda cathartica* L. and *Allamanda violacea* Gardn.) and the candlestick or candle bush (*Cassia alata* L.) which are also from tropical America; the oleander (*Nerium oleander* L.) from the Mediterranean; the ixora (*Ixora coccinea* L.) from southern Asia; the June rose (*Lagerstroemia speciosa* L.) Pers.) from India through southern China; and the mussaenda (*Mussaenda erythrophylla* Schumach.) from Africa.

In addition to the bougainvillea and queen's wreath, which were previously mentioned in the discussion of borders and front yard ornamental gardens, other beautiful vines found in ornamental areas of Jamaica's settlement are *Thunbergia grandiflora* Roxb. from India; jade vine (*Strongylodon macrobotrys* A. Gray) from the Philippines; and the flame vine (*Pyrostegia venusta* Ker-Gawl.) and garlic vine (*Pseudocalymma alliaceum* (Lam.) Sandwith) from tropical America.

Other areas of Jamaica's Settlement Vegetation

With the exception of most aquatic environments and areas of tree cropping, much of Jamaica's settlement vegetation consists of plant communities in various stages of succession, ranging from invasive pioneer herbaceous weeds on bare earth, to plant communities where fast growing vines, shrubs and trees assume increasing importance. In contrast to highly cultivated environments, including landscaped grounds, where an ongoing effort is made to remove all weeds and naturals, areas of Jamaica's settlement vegetation dominated primarily by natural succession are composed of plant communities that are increasingly determined by the competitive success of wild plants. Such places include some paths, walkways, roadsides and driveways; waste places and marginal areas; and agricultural and other lands temporarily or permanently abandoned by people. In these areas of the settlement environment, we are especially likely to encounter Jamaica's 25 worst weeds (see Table 1) as well as such familiar roadside plants as lantana (*Lantana trifolia* L.), castor oil plant (*Ricinus communis* L.) and *Leucaena leucocephala* (Lam.) De Wit. Also common in some of these areas are many useful trees that are incidentally dispersed by humans.

Jamaica has long been famous as an island of 'wood and water' because of the different forests communities which at one time characterized much of the island's natural vegetation (Thompson *et al.*, 1986). By 1953, however, Asprey and Robbins (1953:360) reported that only 18 percent of the island's land area was in forest, 47 percent was in agricultural use, and the remaining 35 percent was in what is locally described as ruinate (i.e., second growth scrub), thorn scrub, mangrove swamp and so on. On the southern plains where the land is still subject to clearing, burning and grazing, a savannah has developed in association with several species of *Acacia* and *Pithecellobium dulce* (Roxb.) Benth. as common trees. Where human influence ceases or is severely restricted, these trees form thorn thickets.

An important West African plant naturalized in many parts of the island is the Guinea grass (*Panicum maximum* Jacq.). Not long after its accidental introduction as bird feed, Guinea grass became one of the most important sources of feed for domesticated animals and was described in the 1886-1887 *Handbook of Jamaica* as a 'valuable and now indispensable' grass. Guinea grass interspersed with Asian bamboo (*Bambusa vulgaris* Schrad. ex Wendl.) is now common on hillsides and along roadsides in the wetter parts of the island, especially in the Wag Water Valley. Asprey and Robbins (1953) also identify areas of the dry southern plains as 'induced savanna of Guinea grass' that occur in association with guango trees (*Samanea saman* (Jacq.) Merr.) from Central and tropical South America. Seymour grass, *Andropogon pertusus* (L.) Willd., found throughout the tropics, is one of the most common grasses in the dry parts of the southern parishes, while Wynne or molasses grass (*Melinis minutiflora* Beauv.) from tropical Africa, 'unknown [in Jamaica] . . . until about 1925 . . . has taken over vast areas in the mountains of the parish of St Andrew to the almost complete exclusion of native species' (Adams, 1971:90). Woman's tongue (*Albizia lebeck* L.) Benth.), a naturalized, fast-growing, wind-dispersed tree from tropical Asia, is also a familiar element of the secondary successional vegetation in the dryer parts of the island.

Other components of Jamaica's settlement vegetation that deserve mentioning here are recreational areas such as the plant communities associated with golf courses, playing fields and beaches, especially those beaches that are central to the island's tourist

TABLE 1: The 25 worst weeds in Jamaica

Weeds that interfere with the growth of crops

- | | |
|--------------------------------|--|
| 1. Bahama Grass | <i>Cynodon dactylon</i> |
| 2. Bracken (true) | <i>Pteridium caudatum</i> |
| 3. Bracken or Net-fern | <i>Gleichenia</i> spp. |
| 4. Broomweed | <i>Sida carpinifolia</i> and related spp. |
| 5. God-bush or Scorn-the-earth | <i>Species of Oryctanthus, Dendrophthora Phoradendron</i> and <i>Phthirusa</i> |
| 6. Guava | <i>Psidium guajava</i> |
| 7. Hogmeat or Wild Potato | <i>Ipomoea tiliacae</i> and related spp. |
| 8. Mallow | <i>Urena lobata</i> |
| 9. Marigold | <i>Wedelia trilobata</i> |
| 10. Love-bush or Dodder | <i>Cuscuta</i> spp. and <i>Cassytha</i> sp. |
| 11. Nut-grass | <i>Cyperus rotundus</i> |
| 12. Spanish Needle | <i>Bidens pilosa</i> and related spp. |
| 13. Water-grass | <i>Commelina diffusa</i> and related spp. |
| 14. Wild hops or Jamaica hops | <i>Flemingia strobilifera</i> |

Weeds that cause chemical injury

- | | |
|--------------------------------|---------------------------|
| 15. Cow-itch | <i>Mucuna pruriens</i> |
| 16. Guinea-hen weed | <i>Petiveria alliacea</i> |
| 17. Scratch-bush or Cow-nettle | <i>Urera baccifera</i> |
| 18. Wild leek | <i>Allium</i> sp. |

Weeds that cause mechanical injury

- | | |
|---|--|
| 19. Burr-grass | <i>Cenchrus echinatus</i> and related spp. |
| 20. Burr-weed | <i>Triumfetta semitriloba</i> |
| 21. Devil's Horsewhip | <i>Achyranthes indica</i> |
| 22. Macca Kalalu | <i>Amaranthus spinosus</i> |
| 23. Police macca | <i>Kallstroemia maxima</i> |
| 24. Razor-grass | <i>Scleria</i> spp. |
| 25. Shame-bush, Shamey Lady
or Sensitive Plant | <i>Mimosa pudica</i> |

SOURCE: *The Jamaica Agricultural Society (1954:574-593)*

industry. To the native tropical American species like sea grape (*Coccoloba uvifera* L.), and widely dispersed tropical strand plants like the sea bean (*Canavalia maritima* (Aubl.) Urb.) and seaside mahoe (*Thespesia populnea* (L.) Solander ex Correa), has been added the coconut, casuarina (*Casuarina equisetifolia* J. R. & G. Forst), hog apple (*Morinda citrifolia* L.) and pandanus (*Pandanus dubius* Spreng.) from the old World tropics. The

barringtonia (*Barringtonia asiatica* (L.) Kurz), also from the Old World tropics, was introduced into the Bath Botanical Garden in the parish of St Thomas and is now naturalized along the shores of the northeast (Rashford, 1989). Mention should also be made of the settlement vegetation associated with nurseries which play an important part in the dispersal of plants; the plant collections of orchid growers and other enthusiasts who specialize in particular groups of plants; the experimental plots of educational and research institutions; the island's parks and public gardens; churchyards and cemeteries; and landscaped walkways and roadsides (Rashford, 1988; 1989).

Settlement Vegetation as a concept for further analysis

It is evident from this brief sketch of Jamaica's settlement vegetation that the ordered distribution of native and exotic plants such as found in yards, fields and landscaped grounds is a consequence of the island's natural environment coupled with the history of Jamaicans and their built environment. The value of the concept of settlement vegetation is that it widens the context for analyzing and explaining the relationship between people and plants in Jamaica and around the world. In addition to economic plants associated with yards, small farms and large estates, the concept of settlement vegetation broadens the range of concern to include plants cultivated for such things as their beauty, shade and medicinal value, and for their uses in religious, artistic and recreational life. By adopting this wider perspective, it becomes easy to see the full social basis of the ordered distribution of plants in different areas of the settlement. This is essential because the number and variety of uses for a plant are important factors determining its distribution throughout the human environment. The importance of this wider perspective of settlement vegetation is evident when we consider that the botanic gardens established in Jamaica distributed plants to a variety of places for a variety of purposes. Economic plants (including timber trees, forage crops and dye plants) were important, but so were ornamental and shade trees. These were not only sent to farmers, but also to such institutions as schools, churches, hospitals, and the constabulary. The botanic gardens were playing a central role not only in the development of farming, but in the overall development of the island's settlement vegetation (Fawcett, 1895; Eyre, 1966; Webster, 1965; Powell, 1972; 1973).

An understanding of human selective pressures and the way they give rise to settlement vegetation is central to discussions concerned with the origin of agriculture. Human selective pressures affect plants not only because they belong to a particular species, but also – and especially – because of their growth form. The basic trend of human evolutionary history is to destroy trees to create space and to provide food, beverage, fuel, wood, dye, fibre and other products. They are also destroyed by deliberate or unintentional fires. The elimination of trees results in what is frequently described as a 'disturbed', or 'open' environment especially beneficial to herbaceous plants and to the seedlings of fast growing shrubs and trees (Anderson, 1969). Some researchers have argued that it was the human-induced changes in the natural environment, especially the creation of 'open' spaces in association with weeds, that resulted in the domestication of plants and the rise of agriculture (Anderson, 1956; 1969; Harris, 1969:9; Hawkes, 1969; Lewis, 1972; Lathrap, 1977; Kimber, 1978; Rindos, 1984). Although botanists stress that there are no species of weeds and that weed is not a botanical concept but an agricultural one, some researchers interested in the origin of agriculture have adopted a bioevolu-

tionary approach, in which weeds are defined in ecological terms (Bunting, 1960; Harlan & de Wet, 1965; Hawkes 1969:18; Robertson & Gooding, 1973). Many weeds are also domesticates. They differ from cultivated crops by being the unintended result of human activities. For some researchers, domesticated weeds are the progenitors of many cultivated crops.

A number of theories for the origin of agriculture imply the concept of settlement vegetation. They do so when they refer to the environmental impact of human activities that produce 'disturbed', 'modified', 'unstable', 'open', or 'enriched' areas; or when they refer to a human-based or man-mediated ecosystem identified as an agroecology, or as an anthropogenic, humanized, or artificial environment. They do so also in references to plant communities associated with dump heaps and toilet areas, or with particular locations defined by their relationship to the residential environment (home, dooryard, kitchen, house, household, and backyard gardens). The nature of settlement vegetation and its origin by human selective pressures provides a unifying framework within which we can make explicit the connections between these different concepts. The idea of settlement vegetation is implicit in these concepts and it summarizes their significance.

David Rindos (1984), in one of the promising developments in contemporary anthropology, applies modern biological evolutionary theory to the seemingly intractable problem of the origin of agriculture. His line of thought originates, in part, with Darwin and Mendel. It developed through the works of cultural ecologists like Netting (1971), and the contributions of such scholars as Anderson (1956; 1969), Harlan (1975) and Kimber (1978). Rindos argues that the process that ultimately results in domestication and agriculture represents a natural co-evolved relationship between people and plants. This relationship began with what he calls 'incidental domestication' resulting from humans feeding on the fruits of wild plants whose seeds were then unwittingly dispersed in the 'general [human] environment.' This spontaneously produced a human-modified environment Rindos calls an agroecology which, in turn, provided the conditions that resulted in full domestication, leading to agriculture based largely on the cultivation of domesticated crops.

The present paper contributes to Rindos's line of thought by suggesting that, although feeding behaviour is of major importance, human-based selection *also* occurs as the unintended consequence of the whole range of human activities and of the physical structures of the settlement, in relationship to which these activities occur. Although this paper shares Rindos's evolutionary perspective on the origin of agriculture, the concept of agroecology, central to his whole approach, is here rejected in favour of settlement ecology (and settlement vegetation) precisely because 'agroecology' misleadingly focuses our attention (whether intended or not) solely on agriculturally related processes.

The origin of settlement vegetation then is an important dimension of the origin of agriculture, but the origin of agriculture – that is, cultivation as deliberate assistance given to plants – is not synonymous with the origin of settlement vegetation. Long before cultivation, hunters and gatherers were inadvertently creating settlement vegetation based on the selective pressures resulting from such things as human incidental dispersal, the creation of space, the use of fire, the making of products, and the influence on other species that themselves affect the dispersal of plants (Iversen, 1949; Heizer, 1955). The concept of settlement vegetation allows a deeper, richer, more complete understanding of agriculture, for within the framework of this concept agriculture becomes only one

component – albeit an important component – of how human activities in a physically structured space determine the ordered distribution of plants in the human environment. The concept of settlement vegetation transcends the limitations of a strictly agricultural perspective, and it unites our interest in agriculture to other seemingly unrelated topics such as graveyards, flower gardens, and the vegetation associated with roadsides, waste places, marginal areas and abandoned sites.

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The Cayman Islands: economic growth and immigration in a British Colony

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Summary Economic change in the small British dependent territory of the Cayman Islands has resulted in growing financial and tourist industries. In a quarter of a century, the island economy has gone from dependence on emigration to substantial immigration. An initial demand for skilled labour has given way to a more generalised demand for labour and increasingly, unskilled labour, as Caymanians disdain some forms of employment. Full employment has led to wage pressures, slowed the pace of localisation, emphasized the role of immigration (now from more than a hundred states), discouraged political change and challenged the notion of a Caymanian identity. Uneven development has become more apparent. Economic growth has incorporated these remote islands into a global migration system.

Key Words

POPULATION GEOGRAPHY

COLONIES

CAYMAN ISLANDS

'It is an inescapable fact of economic life that an economy so well integrated into the global economic and financial system as that of the Cayman islands must confront the inevitability of mobility of human capital across national frontiers, for once an economy becomes a player on the global stage, the rules of the game dictate the cross-border movement of all forms of capital, including human capital'. (Rudyard Robinson, *Cayman's Newstar*, May 1993:29).

Since the early 1970s the Cayman island archipelago has been transformed: remittances (from migrants in the United States) and fishing were the twin mainstays of the impoverished economy; now tourism and offshore finance have become the bases of an expanding economy that has generated high incomes. This paper examines the impact of this transformation on migration, especially the growth of immigration into the Cayman Islands, and the social consequences of migration for the colony. Contemporary economic change has resulted in even a small, fragmented island state becoming incorporated into the global economy – and thus the global labour market – illustrating the manner in which the migration context in an isolated microstate experiencing economic growth is not dissimilar to that in very much larger states.

Economic Growth