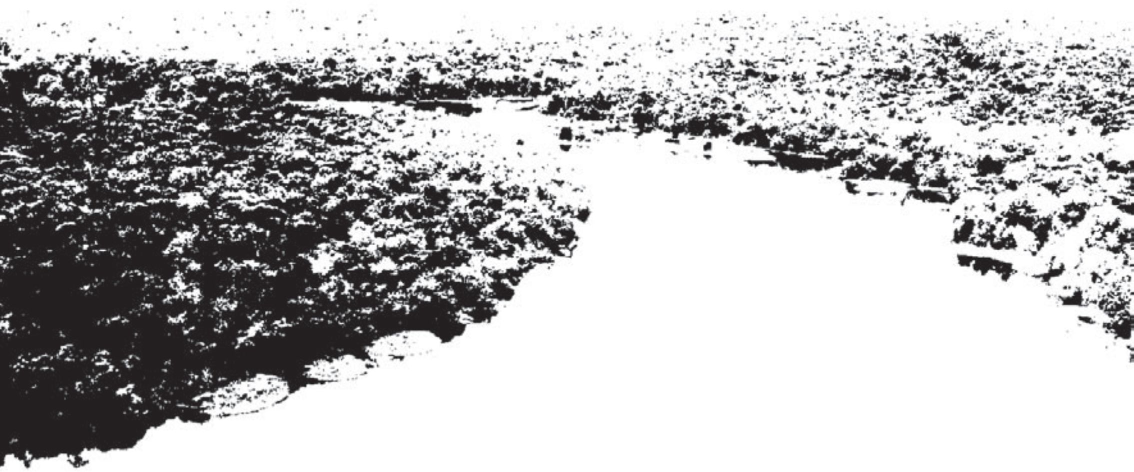


Environmental History, Traditional Population and Paleo-territories in the Brazilian Atlantic Coastal Forest

Rogério Ribeiro de Oliveira

Much of our everyday life is based around concepts and categories that control and direct us. For example, within the classic dichotomy between nature and culture, few ecosystems are considered to be as *natural* as tropical forests. These *natural* forests, placed on one extreme of the culture-nature axis, are idealized as almost sacred spaces totally free of human influences. The corollary of this is the myth of the purity of the forest inhabitant. This view only applies to *natural forests*, something wholly distinct from *cultural forests*. This "commonsensical" approach is used for many current environmental questions, principally those related to sustainability. Within a historical perspective, it is evident that our present environmental heritage is a product of the relationships of past populations with their environments. However, some biologists and ecologists still view many ecological systems as *natural* and disassociated from the human activities that have impacted them over different time scales. But all forest landscapes show human influences, both in material and non-material forms, so there is a very real need for studies in forest ecology to take human activities into account, and accept that the interpretation of the structure and function of tropical forests cannot be formulated from an exclusively "natural" point of view.[1] The question of whether the South American landscapes first encountered in the 16th century by European explorers were primarily "natural" or were largely anthropogenic artifacts molded by the native Amerindians is still problematic.[2] The role of humans in the creation of ecosystems has been more readily accepted in the longer-settled (and better documented) lands of Europe than in the more recently settled areas of America.[3] The associated remains of charcoal, ceramic, and pollen found over vast areas of the Central and South American tropics constitute a clear demonstration that human agency has been transforming the tropi-

[1] D. García-Montiel, *El legado de la actividad humana en los bosques neotropicales contemporáneos*, in M.R. Guarigauta, M.R. and G.H. Kattan (eds), *Ecologia y conservación de bosques neotropicales,* Ediciones LUR, Cartago 2002, pp. 97-112.

[2] For example: D.A. Posey, "Ethnoecology as Applied Anthropology in Amazonian Development", in *Human Organization*, 43, 1985, pp. 95-107; W.L. Balée, "Cultural Forests of the Amazon", in *Garden*, 11, 6, 1987, pp. 12-14. Clark proposed abandoning the term "undisturbed forest" in his article *Abolishing Virginity*. (D.B. Clark, "Abolishing Virginity", in *Journal of Tropical Ecology*, 12, 1996, pp. 435-439).

[3] M. Williams, "An Exceptionally Powerful Biotic Factor", in *Humans as Components of Ecosystems: the Ecology of Subtle Human Effects and Populated Areas*, M.J. McDonnel, Steward T.A. Pickett (eds), Springer, New York 1993, pp. 24-35.

cal landscape for millions of years.[4] In spite of the growing general interest in environmental questions, the importance of human influences on the natural environment is not always fully taken into consideration. The evolutionary trajectory of the landscape is often disassociated from the anthropogenic interventions that have occurred there over wide scales of space and time. This article attempts to provide a historical view of the consequences of the use of the forest environment by traditional populations.

Environmental History and Tropical Forests

The study of environmental history combines the methodological tools of history, archaeology, ecology, and geography, and offers an alternative for ecosystem analysis that integrates the physical and biological attributes of an ecosystem (composition, structure, and functioning) with its human dimension (the history of the populations that interacted with that ecosystem). It is a relatively recent field of knowledge, first appearing in the 1970's, at the same time as the first environmental movements and world conferences on environmental crises. Roderick Nash, one of the first authors to employ the expression "Environmental History", suggested that landscapes should be interpreted as historical documents.[5]

The study of environmental history, in its attempt to understand the processes that transform landscapes, stands on two principal pillars: culture and territory. The first concerns the manners in which societies appropriate natural resources over time, and can be understood as the transmission of knowledge and experience concerning material

[4] R.L. Sandford Jr., K.E. Sakdaruga, C. Clark, R. Herera "Amazon Rain Forest Fires", in *Science,* 227, pp. 53-55.; A.C. Roosevelt, R.A. Housley, M. Imazio, S. Maranca, R. Johnson, "Eight Millennium Pottery from Prehistoric Shell Midden in Brazilian Amazon", in *Science*, 154, pp. 1621-1624; A.C. Roosevelt, "Ancient and Modern Hunter-Gatherers of Lowland South America: an Evolutionary Problem", in *Advances in Historical Ecology*, W. Balée (ed.), Columbia University Press, New York 1998, pp.190-212.

[5] R. Nash, *Environmental History*, in H.J. Bass (ed.), *The State of American History*, Quadrangle Press, Chicago 1970, pp. 249-260.

relationships with the environment.[6] The concept of territory embraces multiple dimensions, such as the symbolic and the jurisdictional ones, and designates the geographic space in which a given group is encountered and in which they engage their struggle for shelter and survival. As such, a territory can be understood as a true physical space (with its constituent natural attributes) that is appropriated (or occupied) by a social group, and as the space in which a population has its cultural roots and develops its cultural identity.[7]

The history of human activity within an ecosystem can be approached from different angles, and at different time and spatial scales. However, studies on this theme must all take into account the fact that forests (considered here as part of the geographical space of those cultures) are perceived as territories – occupied spaces appropriated by the cultures that utilize them (or utilized them at earlier times). It is the quest for survival that constitutes the driving force for this appropriation, identification, and transformation of forested areas. Territories are the "riches of the poor", and represent potential access to spaces otherwise denied by the surrounding societies.

A paleo-territory constitutes the spatialization of the influences of past ecosystem usage by a specific traditional population or economic cycle. The successive use of these lands leaves distinct marks over time that makes them recognizable as paleo-territories. Thus, a paleo-territory is the result of an anthropogenic influence within the web of biotic and abiotic factors that mediate the processes of forest regeneration, wherever the culture of traditional populations and the manners in which the ecosystem was used have played decisive roles in determining the ecosystem's structure.

Paleo-territories often overlap in a given geographical region, triggering a chain of effects. Each overlapping use in time would be expected to produce distinct ecological influences, according to the

[6] C.L. Crumley, "Historical Ecology: Cultural Knowledge and Changing Landscape", in *School of American Research Press*, Santa Fé 1993, pp. 1-16.

[7] M.L. Souza, "O território: sobre espaço e poder, autonomia e desenvolvimento", in *Geografia: conceitos e temas*, I.E. Castro, P. C. C. Gomes, R.L. Corrêa (eds), Bertrand Brasil, Rio de Janeiro 2003, pp. 35-58.

type of transformation imposed on each territory. Since large parts of the landscapes containing remnants of neotropical forests (especially the Central American forests, the Amazon, and the Atlantic Coastal Forest) have been heavily influenced by the cumulative effects of human activities in different epochs, the identification and investigation of paleo-territories in tropical forest areas constitutes an important tool for interpreting the present *composition*, *structure*, and *functioning* of these ecosystems. It is evident that the historical occupation of forests has altered the *composition* of those ecosystems and their patterns of biodiversity. The question of the genesis of the high species diversity observed in tropical forests has inspired many attempts to explain the mechanisms involved.[8]

The study of paleo-territories also contributes to the understanding of the *structure* of forest environments (the spatial arrangement of the constituent biotic communities). Forest occupation and transformation by traditional populations alter forests' structural patterns. In many cases, the allocation of biomass within the ecosystems is modified, with woods of lower density and a lower overall biomass replacing the climax species. The large-scale historical use of forest resources may have been responsible for the generation of extensive areas of secondary forests, or for complete forest eradication in some cases. According to estimates derived from historical documents, sugar production at one mill in Rio de Janeiro during the 16th century required the felling of 10 to 20 hectares of forest per year in order to supply the fuel necessary to process a single sugar-cane harvest.[9]

The *functionality* (interactions between the fluxes of energy and matter within the components of ecosystems, which in secondary forests are mediated by time and the anthropic factor) of forest eco-

8 Examples: M. Gadgil, F. Berkes, C. Folke, "Indigenous Knowledge for Biodiversity Conservation", in *Ambio,* 22, 1993, pp. 151-157; C. Adams, "As florestas virgens manejadas", in *Boletim Museu Paraense Emilio Goeldi*, 10, 1994, pp. 3-20; García-Montiel, *El legado de la actividad humana* cit., p. 98.

9 C. Engemman, "Consumo de recursos florestais e produção de açúcar no período colonial - O caso do Engenho do Camorim, RJ", in *As marcas do homem na floresta: História ambiental de um trecho urbano de Mata Atlântica*, R. R. Oliveira (ed.), Ed. PUC-Rio, Rio de Janeiro 2005, pp. 119-140.

systems is an important field of investigation for environmental historians. There is significant evidence that the agricultural practices of traditional populations can favor sustainable agriculture.[10]

Traditional populations, agriculture and the formation of paleo-territories

The concept of "traditional population" is often beset by stereotypes about the use of simple technologies with low-impact environmental effects. The classification of a population as "traditional" does not necessarily imply the ecological sustainability of the system being managed; nor does it necessarily imply, however, that the environmental management practices employed by these traditional populations will eventually lead to resource depletion. This study uses the notion of "traditional populations" to designate human groups with distinctive cultures. The notion refers to national population segments (both past and present indigenous populations) that developed particular modes of existence adapted to their specific ecological niche. These relatively isolated populations have proven to historically reproduce similar lifestyles based on social cooperation and their respective nature.[11] Because of the immense cultural diversity of these traditional populations, distinctly different ecological situations have resulted in each of the different ecosystems they have come to manage. Thus, one should not speak of the effects of traditional populations in general, but be specific as to cultures and periods. From an empirical point of view, it is possible to define traditional populations as being based on the family workforce and working principally to guarantee their sustenance (although they may also be linked to the market system at some level). Another distinctive characteristic of these communities is the utilization of

[10] C.L. Redman, *Human Impact on Ancient Environments*, The University of Arizona Press, Tucson 1999.

[11] A.C. Diegues, *Os saberes tradicionais e a biodiversidade no Brasil,* Núcleo de Pesquisas sobre Populações Humanas e Áreas Úmidas Brasileiras, Universidade de São Paulo, São Paulo 2000.

so-called low-impact technologies, such as harvesting, fishing, and small-scale farming. Other relevant characteristics include: a) knowledge of regional natural resources, reflected in the developing of use and management strategies that are transferred orally from generation to generation; b) the notion of "territory", where the group is active socially and economically; and c) the use and occupation of this territory for numerous generations.

Due to the ecological characteristics of tropical forests (and specifically the Atlantic Coastal forest), the cultural knowledge acquired by these populations undergoes a true natural selection, and frequently exhibits a convergence of cultural processes even though they may be separated by significant distances and time scales. Populations that have lived for hundreds or thousand of years within the same ecosystem have consolidated a vast repertoire of knowledge concerning its management, independently of the human cultural diversity otherwise observed. Perhaps the best example is slash-and-burn agriculture, which has essentially been practiced in an identical manner for a very long time all over Brazil. This method has been so successful because it provides a solution to the problem of the lack of soil fertility in forests.

Although it is not possible to describe a "typical" tropical forest, due to the great variation inherent in these ecosystems, their lack of available nutrients is a hallmark characteristic, and a critical factor in their functioning. The majority of the soils of the Amazon and the Atlantic Coastal Forest are highly weathered, which results in a predominance of colloidal clays with low cation exchange capacity and low natural fertility. How then can the ecological sustainability of slash-and-burn agriculture be explained under these circumstances?

The majority of the tropical soils used in shifting agriculture are deficient in phosphorus. The small quantities present are naturally recycled within an almost perfectly closed circuit that is efficient enough to prevent total lack of this mineral. The use of fire is therefore fundamental in shifting agriculture, as it frees the phosphorus and other nutrients accumulated in the living biomass. Although these agricultural systems may appear primitive, inefficient, and environmentally inadequate, under the appropriate circumstances they can be highly productive, relatively neutral in terms of their long-term ecological effects, and sophisticated in terms of their adaptations and ecological strategies.[12]

In addition to the natural adaptive forces that mold the forest structure, human actions also strongly influenced the ecological functioning of the Atlantic Coastal Forest. Evidence of agricultural use of the Atlantic Coastal Forest goes back more than 3,000 years. Physical evidence of human-driven alterations can be encountered in most of the foothill and montane areas of this biome. This evidence includes charcoal layers in soils at varying depths, as well as the alteration of forest structure and composition.

The use of fire drastically amplifies the control that a society exercises over its territory and heavily influences its natural resources. Fire is a fundamental tool for land management. Slash-and-burn agriculture involves opening a clearing in the forest, drying the cut vegetation, and then burning it. Fire has produced immense landscape transformations on our planet, resulting in fire adaptations that drive significant modifications in all the constituent elements of the affected ecosystems. These changes can be observed at a local scale in terms of species composition, and at a regional scale in terms of alterations of ecosystem structure and functioning. The banning of fire in a tract of temperate forest in Yosemite National Park (Usa) resulted in strong changes in forest structure after seventy years. The native Americans had routinely burned the forest floor, whereas European settlers did away with this practice, and swatted out any fires that occurred in the mistaken belief that they would thereby protect the sequoia groves.[13]

The paleo-territories formed as a result of these agricultural practices may constitute the single most important ecological factor responsible for the present physiognomy of many lands in South American forests. The widespread use of slash-and-burn agriculture

[12] D.G. McGrath, "The Role of Biomass in Shifting Cultivation", in *Human Ecology*, 15, 1987, pp. 221-242.

[13] S.J. Pyne, "Forged in Fire: History, Land, and Anthropogenic Fire", in *Advances in Historical Ecology*, William Balée (ed.), Columbia University Press, New York 1998, pp. 64-103.

among traditional and indigenous populations have led some authors to believe that a very significant fraction of the forests considered "virgin" may have in fact passed through various cycles of cutting and regeneration.[14] The use of fire to open subsistence agricultural areas may well have been responsible for the generation of the dominant forest form in south-eastern Brazil, as the majority of the remaining areas of Atlantic Coastal Forest are the result of past cultivation. These secondary forests normally exhibit low floristic diversity in comparison with climax forests. Sucessional processes are characterized by the appearance of species with ephemeral life cycles that may appear as prominent members of the plant community at one moment, but later exhibit only low levels of abundance (or even disappear). Viewed within a wide temporal and spatial framework, the shifting agriculture practiced by various traditional populations appears to select for species or eco-types specializing in the occupation of disturbed (open) areas, and to lead to the formation of a large pool of pioneer and secondary species within the ecosystem.

Culture, forests and paleo-territories in the Atlantic Coastal Forest

As we have seen, the historical occupation of the Atlantic Coastal Forest severely altered the area's patterns of bio-diversity. Regions that have been subjected to traditional agricultural practices generally exhibit a reduction in the number of arboreal/shrub species, and a predominance of pioneer and secondary species. On the island of Ilha Grande along the coast of Rio de Janeiro State one finds many examples of forests that have been managed by traditional populations (*caiçaras*) employing slash-and-burn agriculture. The *caiçaras* and their agricultural techniques also spread along the southeast littoral of Brazil. The life strategy of these people is based on both maritime and terrestrial resources, and their production system is assumed to be communal.

[14] W. Dean, *With Broadax and Firebrand: The Destruction of the Brazilian Atlantic Forest,* University of California Press, Berkeley 1995.

Ecological surveys undertaken in secondary forests that had been farmed and subsequently abandoned showed that even 50 years after the cessation of farming activities the number of arboreal/shrub species was 47 percent less than that observed in a climax forest area (fig. 1).[15] These paleo-territories are characterized by a relatively low floristic richness and a reduced volume of accumulated biomass. The ecological alterations observed in areas that have been used for shifting agriculture can last for quite a long time, significantly affecting the composition, structure, and functioning of the forests that subsequently develop there. One arboreal species plays a particularly important role in secondary succession in the forests growing on the paleo-territories (old fields) of traditional populations (*caiçaras*) in Ilha Grande. *Jacatirão*, a pioneer species that quickly colonizes abandoned farming sites, can live for more than one hundred years.[16] This species does not commonly colonize natural clearings in forests in south-eastern Brazil. It has only been observed occupying abandoned agricultural sites. As such, it is an excellent indicator species of previous land-use, and its density (number of stems per hectare) and weight of biomass (indicated by the cross-sectional area of all the stems – the "basal area") is a good measure of the time period since abandonment (see fig. 2).[17]

The leaves of this species have been found to play an important role in forest regeneration. The authors of the study cited at the previous note examined a farm site abandoned for 25 years, determining that the fallen leaves of this species represented 19.1 percent of the total number of leaves in the leaf litter layer, and 13.9 percent of the total mass of this decomposing layer. These numbers are even more significant when the recycling of forest nutrients is considered.

[15] R.R. Oliveira, "Ação antrópica e resultantes sobre a estrutura e composição da Mata Atlântica na Ilha Grande, RJ", in *Rodriguésia*, 53, 2002, pp. 33-58.

[16] *Miconia cinnamomifolia* of the family Melastomataceae.

[17] P. Delamonica, D.P. Lima, R.R. Oliveira, W. Mantovani, "Estrutura e funcionalidade de populações de *Miconia cinnamomifolia* (DC.) Naud. em florestas secundárias estabelecidas sobre antigas roças caiçaras", in *Pesquisas Botânica*, 52, 2002, pp. 125-142.

The fallen leaves of *jacatirão* are responsible for 65 percent of the nitrogen, 15 percent of the magnesium, and 19 percent of the total potassium found in the leaf litter.

In some cases, the establishment of paleo-territories for even very short times can significantly affect the floristic heterogeneity of an area. During the decades of 1930 to 1950, many hill-forest areas near the city of Rio de Janeiro were cleared to provide charcoal for household use. Charcoal was produced *in situ* in hearths built on small areas of level ground (either natural or man-made) on the hillsides. Such sites are commonly found along all the Atlantic Coastal forest region as well as in many other localities throughout Latin America.[18] These sites usually occupy from 100 to 200 m^2 and can be easily identified by the presence of charcoal fragments in the soil, often to a depth of 60 cm or more. Fig. 3 shows a charcoal hearth in a forest area at Maciço da Pedra Branca, near Rio de Janeiro, in the 1930's.[19]

These small level sites disseminated over a vast geographical area mark the paleo-territories previously occupied by charcoal makers. With the end of commercial production of charcoal in this region towards the end of the 1950's, the forests began to regenerate. A study was undertaken in an area of approximately 700 hectares of secondary forest that had previously been used for charcoal production in the region around Maciço da Pedra Branca. Seventy-two 100 m^2 plots, for a total surface of 0.72 ha, were used to sample the vegetation, yielding a total count of 860 trees belonging to 120 species.[20] In order to indirectly measure the diversity of arboreal vegetation in this paleo-territory of charcoal producers, a species accumulation curve was prepared.[21] If the curve tends to stabilization, it means that the number

[18] D.G. García-Montiel, F. N. Scatena, "The Effect of Human Activity on the Structure and Composition of a Tropical Forest in Puerto Rico Forest", in *Ecology and Management*, 63, 1994, pp. 57-78.

[19] From A.M. Corrêa, "O Sertão Carioca", in *Revista do Instituto Histórico e Geográfico Brasileiro*, 167, 1933, pp. 1-312.

[20] The results can be found in F.V. Santos, A. Solórzano, R.R. Guedes-Bruni, R.R. Oliveira, "Composição do estrato arbóreo de um paleoterritório de carvoeiros no Maciço da Pedra Branca, RJ", in *Pesquisas Botânica*, 57, 2006, pp. 181-192.

of species found in the area is proportional to the sample effort. If not, the forest has a heterogeneous pattern of vegetation. The data on vegetation gathered in plots spread over a vast area indicated a spatially heterogeneous distribution of species, as the curve did not stabilize (fig. 4). Thus, even though the Atlantic Coast Forest was felled more than 50 years ago in this region, the result was a spatially diverse paleo-territory in terms of the composition of its trees and shrubs.

The religious beliefs of traditional populations show another facet of the present-day ecology of paleo-territories. Cultural taboos are common among these populations and may even interfere with the course of ecological succession. Among the *caiçaras* and other traditional populations, certain trees of the genus *Ficus* are spared for strictly cultural reasons when the rest of the forest is cleared for planting.[22] This taboo, found in many cultures, may have originated with the biblical citation of Christ wilting a fig tree that gave no fruit (Mathew 21, 18-22). Additionally, in the Afro-Brazilian belief system (which represents a confluence of at least four African traditions), the native Brazilian fig trees substituted the African species as the incarnation of the tree-god *iroco*.[23] Thus, it is very common to come across very large individuals of these fig trees in areas of secondary forest, or even forests in the very first stages of succession. The presence of these enormous trees imposes structural modifications on woodlands (principally secondary forest formations), for they generally exhibit high Cover Values (a phytosociological parameter that rates the spatial distribution of all the species in a given area). This Cover Value is calculated by summing Relative Dominance (the area occupied by the trunks of a given species in relation to the other species) with Relative Density (the number of individuals of

[21] S.A. Cain, "The Species-Area Curve", in *The American Midland Naturalist,* 119, 1938, pp. 573-581.

[22] The most frequent species in the lands of the caiçaras are *Ficus ciclophylla, F. insipida, F. glabra, F. gomeleira* and *F. alba.* The edible fig (*Ficus carica*) does not grow wild in Brazil.

[23] *Clorophora excelsa*, according to D.P. Fonseca, "A marca do sagrado", in *As marcas do homem na floresta: História ambiental de um trecho urbano de mata atlântica*, org. R.R. Oliveira, Ed. PUC-Rio, Rio de Janeiro 2005, pp. 11-22.

a given species in relation to the other species). Table 1 presents the Cover Value rankings of species of the genus *Ficus* in relation to all the other species in a number of phytosociological studies undertaken in south-eastern Brazil.

Unlike the fig tree in the biblical citation, the Brazilian *Ficus* constantly produces large numbers of fruits and is considered a keystone species, providing resources to animal species such as the *chauá* parrot, various toucans, the black howler monkey, and others.[24] In a cultural sense, these trees lend a symbolic aspect to the local landscape, expressing the beliefs, values, and myths of a population. This symbolic dimension of the paleo-territories translates into concrete ecological influences and is a significant aspect of the management of these ecosystems by traditional populations.

The past use of forests greatly influences their present structure and constitution. In this sense, what we call the "Atlantic Coastal Forest" may actually be the result of the homogenization of a more complex landscape originally composed of a larger number of distinct formations, such as Dense Ombrophilous Forests, Seasonal Ombrophilous Forests, Semi-deciduous Forests, etc. It would appear that wide-ranging anthropogenic action, by selecting for numerous pioneer and secondary species (such as the *carrapeteira*, *angico*, *jacatirão*, and *embaúba* trees, as well as many others), made these forests more similar in terms of their general physiognomy.[25] In classifying these landscapes under the generic heading of "Atlantic Coastal Forest", we are also referring to the transformations that each of these formations have been subjected to over the centuries, which have led to the appearance of secondary forests and homogenized landscapes throughout large regions of South America.

[24] The scientific names of the species cited are: papagaio chauá: *Amazona rodocorytha*; tucano: *Ramphastos vitellinus ariel*; araçarí: *Selenidera maculirostris* and the macaco-bugio: *Alouatta fusca*. The concept of keystone species was developed in T.C. Whitmore, *An Introduction to Tropical Rain Forests,* Claredon Press, Oxford 1984.

[25] *Guarea guidonia, Piptadenia gonoacantha, Miconia cinnamomifolia* e *Cecropia glaziovii,* respectively.

Figure 1. The number of arboreal-shrub species and their basal areas in four areas used by traditional populations (caiçaras) in Ilha Grande, Rio de Janeiro, Brazil

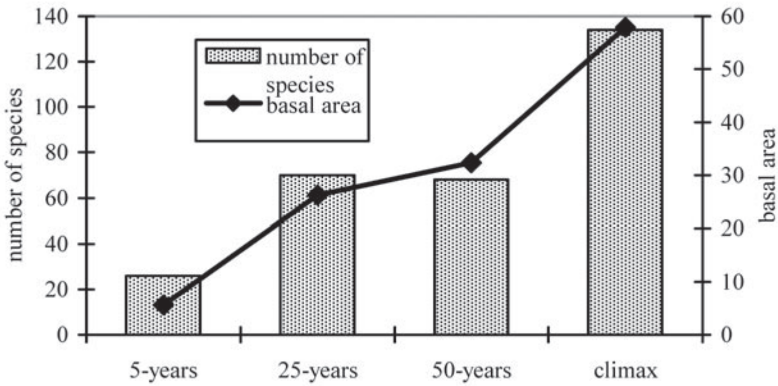


Figure 2. Density (number of stems per hectare) and basal area (square meters per hectare) of the arboreal species jacatirão in forests of different ages in Ilha Grande, Rio de Janeiro, Brazil

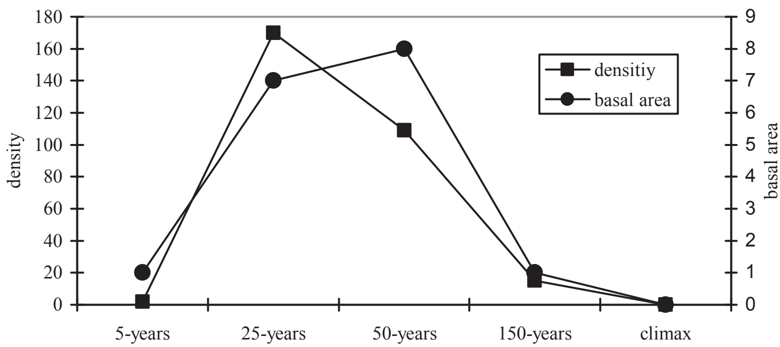


Figure 3. Charcoal hearth in the Atlantic Coastal Forest near Rio de Janeiro, Brazil

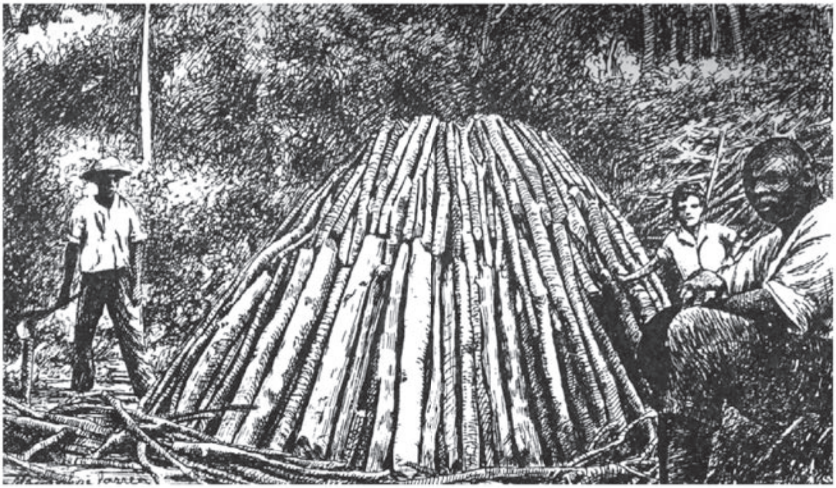
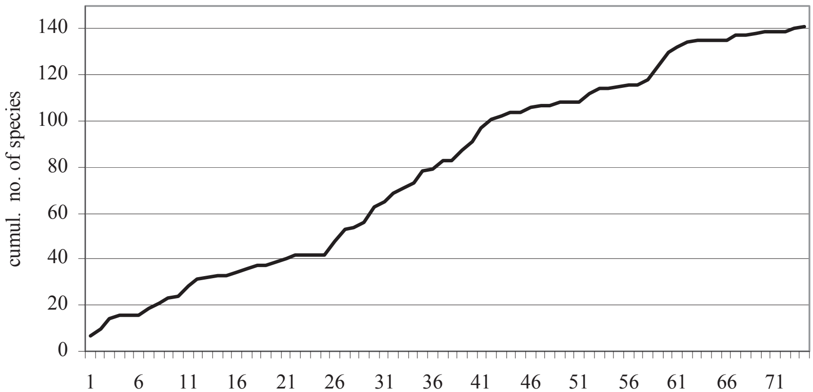


Table 1. Cover Values (CV) of species of the genus Ficus encountered in a number of phytosociological studies undertaken in the Atlantic Coastal Forest in south-eastern Brazil[26]

species	locality and state	CV ranking
Ficus glabra	Mambucaba, RJ	1st among 25
Ficus ciclophylla	Ilha Grande	1st among 65
Ficus gomelleira	Grumarí, RJ	3st among 26
Ficus insipida	Camorim, RJ	3st among 92
Ficus gomelleira	Pariquera-Açu, SP	5st among 112
Ficus gomelleira	Ilhéus, BA	8st among 41
Ficus clusiaefolia	Guapimirim, RJ	11st among 138
Ficus pulchella	Guapimirim, RJ	13st among 138

[26] The references concerning the vegetation structure cited in Table 1 are: for Mambucaba and Ilha Grande: R.C. Svorc, *Figueiras centenárias na Mata Atlântica e resultantes ecológicas* (unpublished data); for Grumari: M.M. Freitas, *Funcionalidade hidrológica dos cultivos de banana e territorialidade na paisagem do Parque*

Figure 4. Cumulative number of species sampled in plots in a paleo-territory where charcoal was produced in Maciço da Pedra Branca, RJ, Brazil



Municipal de Grumari - Maciço da Pedra Branca - RJ, Rio de Janeiro, Universidade Federal do Rio de Janeiro, 2003, pp. 85-124; for Camorim: A. Solórzano, *Composição florística, estrutura e História Ambiental em áreas de Mata Atlântica no Parque Estadual da Pedra Branca, RJ*. Rio de Janeiro, Escola Nacional de Botânica Tropical, 2006, pp. 33-66; for Pariquera-Açú: M. Sztutman, R.R. Rodrigues, "O mosaico vegetacional numa área de floresta contínua da planície litorânea, Parque Estadual da Campina do Encantado, Pariquera-Açu, SP", in *Revista Brasileira de Botânica*, 25, 2002, pp. 161-176; for Ilhéus: R.H.R. Sambuichi, "Fitossociologia e diversidade de espécies arbóreas em cabruca (Mata Atlântica raleada sobre plantação de cacau) na Região Sul da Bahia, Brasil", in. *Acta Botanica Brasílica*, 16, 2002, pp. 89-101; for Guapimirim: B.C. Kurtz, D.S.D. Araújo, "Composição florística e estrutura do componente arbóreo de um trecho de Mata Atlântica na Estação Ecológica do Paraíso, Cachoeiras do Macacú, RJ, Brasil", in *Rodriguésia*, 51, 2000, pp. 69-112.