NON-WOOD FOREST PRODUCTS

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Fruit trees and useful plants in Amazonian life

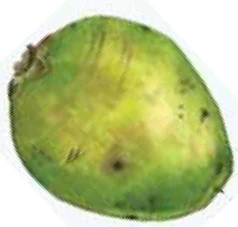
People and Plants International

FAO FIAT PANIS

CIFOR

ISSN 1020-3370







Fruit trees and useful plants in Amazonian life

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Published by the
Food and Agriculture Organization of the United Nations,
the Center for International Forestry Research and
People and Plants International

ISBN 978-92-5-107007-9

JOEL SARTORE

"I have never planted here; I am guarding these woods.
There is piquia in this forest.
I am protecting it for my children and grandchildren."

Senhor Braz
Traditional Healer

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Support

Production of the English version of this book was made possible by support from the Food and Agriculture Organization of the United Nations, People and Plants International, the Center for International Forestry Research and the Melza M. and Frank T. Barr Foundation. Generous support towards research and collaboration in Brazil came from the Overbrook Foundation, Tinker Foundation, Christensen Fund and Woods & Wayside International. Research which gave rise to an earlier edition of this book in Portuguese was supported by: the Institute of Man and the Environment (IMAZON); The Woods Hole Research Center; USAID; International Center for Research on Women (ICRW); the International Development Research Center (IDRC); the Educational Foundation of America; Earth Love Fund; Rainforest Alliance; and IUCN Netherlands.

PATRICIA SHANLEY

Dedicated

To the people of the Amazon who are nourished by the fruits and plants of the forest.

COVER OF THE 2010 PORTUGUESE VERSION

(available from www.mma.gov.br/estruturas/sbf_agrobio/_publicacao/89_publicacao08072011032100.pdf
or www.cifor.org/nc/online-library/browse/view-publication/publication/1732.html)

Preface

This book features the uncommon quality of bringing together original scientific knowledge on fruits and useful plants of the Amazon forest and the sensibility to detect the deep interaction between life, traditional knowledge of our forests and folk culture. With its language at the same time accessible, pleasant and practical, the book has become a vehicle to disseminate information that is fundamental to the future of the Amazon and to bring alive the dream of a development model that is economically and socially fair, and that respects the environment.

In this book, we from the State of Acre have the privilege of seeing our flora in a dialogue of experiences from eastern, central, and western Amazon. Mahogany, solitary açaí palm and rubber – which are part of the history of our region as well as part of our struggles – along with the songs, the gestures full of local culture and universal spirit are all in the book.

I would like to draw the reader's attention to three important aspects of the work of Patricia, Margaret and Gabriel. The first one is related to the impact of this work on collective health, by strengthening the use of plants capable of substantially improving the nutritional value of our diet and, consequently, preventing the so called "illnesses of the poor". The studies developed by the authors correlated the seasonal availability of fruits in the forest with the incidence of diseases, showing that during periods of scarcity the number of cases of some diseases is highest.

The second aspect is related to a powerful characteristic of the Amazon, still under-explored and poorly documented: the role of women in the knowledge and use of the non-timber forest patrimony. The advancement of sustainable experiences in the Amazon has witnessed a strong contribution of women – especially in the reinforcement of community actions and creativity to guarantee the social and material survival of the family. Women may be the strategic leverage to provide both the cement and scale needed to create a new paradigm in the region. In this new edition, the Articulated Movement of the Amazon Women (MAMA) from Acre is studied as a personification of this role.

The third aspect I would like to highlight is the ability to associate forests and development – a true one, which instead of throwing us into the vortex of limitless competitiveness and selfishness, leads us to community, to solidarity, and to human and spiritual values as mediators of each one's goals. The reader will also find studies on community management (Center of Amazonian Workers, CTA, project, Acre), environmental education (Health and Happiness Project, Santarém – Pará State; and SOS Amazon, Acre) and other tracks that lead to integral sustainability, in which it makes sense to take care of the environment since this is the way to take care of life itself, of children and our future.

I want to again express my gratitude for this book, which is an extraordinary poem to the Amazon, which touches our emotions with the truths expressed in the simple and powerful figures of our animals, our plants, our aromas, our flavours. A sentiment arises within us, finally, and for our lives, simply and so proudly Amazonian.

Marina Silva
Former Minister of the Environment, Brazil

FAO preface

Since the early 1970s, FAO has been working to support the efforts of forest communities to improve their lives by involving them in the decisions which affect their very existence. Today, an estimated 1.6 billion people around the world use forest resources to meet some of their needs for food, shelter, medicine and cash income. In fact, some 80 percent of people living in the developing world rely on non-wood forest products (NWFPs) such as fruits and medicinal plants for nutritional and health needs. These communities possess a deep knowledge of forests and their products, as well as their benefits to humankind and the environment. They are active caretakers of the forest. Today, more than ever, in the face of the multiple challenges facing the sector, FAO continues to stress the importance of involving forest communities in development initiatives.

Nevertheless, a weakness in exchange of information between the scientific community and local populations continues to hinder development outcomes. Local knowledge and indigenous taxonomy is underrepresented in development practice, where Linnaean nomenclature and scientific data reign. Often, scientists visit local communities and learn about their traditional knowledge but only report their findings to other researchers/ scientists in a scientific manner. For this reason, research continues to speak its own language – one hardly accessible to local communities.

In light of this, FAO's NWFP Programme – which has long been dedicated to highlighting and disseminating information on the importance of NWFPs and the vital role they play in forest communities – was pleased to accept a proposal by CIFOR to collaborate with them on an updated and translated version of the innovative illustrated book *Frutìferas e Plantas Úteis na Vida Amazônica*. This publication is an example of how research and development can and should be respectful and inclusive. In a way that is also accessible to local people, it synthesizes ecological, market, management and cultural information of key Amazonian species in an effort to help expand the knowledge base of traditional forest communities about the value of forest resources. The updated English version, *Fruit Trees and Useful Plants in Amazonian Life*, serves two main purposes: it provides rich information on Amazon fruits and Amazon communities and shows how scientific information can be presented in an innovative and more inclusive way, one that can be adapted accordingly by other actors worldwide. This publication is particularly timely given the land-use changes affecting the forest sector in the Amazon – the most extensive tropical forest in the world – as well as in other areas. Local people are in dire need of reliable and, above all, accessible market and scientific information that can help them make informed decisions.

FAO is a knowledge organization and, as such, its Forestry Department is especially committed to making sure its technical expertise reaches forest communities in order to enable lasting impacts for future generations through improved livelihoods today. With this in mind, FAO gladly contributed to a publication that is a culmination of local and scientific expertise on forest fruits and related aspects, and above all an example of how it is possible for "science" to share complex ecological and market information effectively with local communities, even in the absence of a common language.

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Editors' preface

Should science stay in the ivory tower? Do scientists have a responsibility to turn knowledge into action? Scientists are trained to present their research to a select segment of society – readers of peer-reviewed journals. But as scientists build their reputations publishing for narrow audiences, forests fall, and people and their ecosystems become more impoverished.

If there is one message this book seeks to convey it is this: scientific results can and should be shared with local people. New models of conducting research reevaluate with whom and how researchers share their findings, and reconstruct the process itself, from research design to dissemination of results. The goal is to increase the equity and effectiveness of research, and recognize that all people are creators of knowledge – forest villagers alongside scientists.

This book grew out of an earlier volume, written in 1997, to share research results with semi-literate communities along a tributary of the Amazon River. Positive response to this modest publication gave rise to a request from the Brazilian Government for a more extensive work including species from across the Amazon basin. This required the collaboration of scores of experts willing to present their research to rural villagers in alternative formats including jokes, recipes and pictures. Such a publication would not boost professional standing based on peer-reviewed journal articles, and could possibly damage their reputations. Would anyone agree to participate?

To their credit, 90 Brazilian and international researchers participated, sharing their decades-long work in simple language. In addition, scores of farmers, midwives, hunters and musicians contributed their insights and experience. Their stories reveal what numbers overlook – the struggles and joys of the people living within Amazonian forests.

The reception by Amazonians has been extraordinary with housewives, taxi drivers, students, villagers, loggers, policy makers, rubber tappers and indigenous groups, seeking copies. To meet demand, various sectors of the Brazilian government are now joining forces to print and distribute 20 000 copies, free of charge, to small producers.

This book is an updated and revised translation of its Portuguese predecessor, and is produced in order to impart to others our efforts to integrate and share traditional knowledge and scientific findings. Science should not be the territory of the well educated few. Science should be a common good, the value of which increases with each person that uses it to make more informed decisions. We offer this book as one way to bring knowledge out of the academy and into the community.

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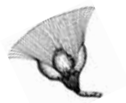

Who will use this book and how?

Trees and vines

Palm trees and diverse other species

Forests for the people

Acknowledgements

This book was made possible through the support of 90 Brazilian and international collaborators who joined forces to communicate their research results to farmers and forest communities. We thank the hundreds of forest-reliant families who patiently worked alongside scientists and shared their valuable knowledge and experiences. In Brazil, enthusiasm for the book from Marina Silva, Carlos Vicente, Tasso Rezende de Azevedo, Aldaberto Verissimo, Fatima Cristina da Silva and the National Council of Extractive Populations (CNS)* helped to initiate the new edition. The Brazilian Government, particularly the Ministry of the Environment (MMA) and the National Agricultural Research Institute (Embrapa), are currently ensuring that the Portuguese version is printed and distributed free to small holders. The work underlying this book also benefitted from steadfast support from Professor Sir Ghillean Prance and Daniel Katz. We thank the Food and Agriculture Organization of the United Nations, particularly Tina Etherington and Chrissi Redfern, for their perseverance and commitment to publish this book in English so that lessons on communicating research more broadly can be shared.

* Formerly the National Council of Rubber Tappers. The name was changed to represent a broader spectrum of forest extractivist populations, including women.

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Glossary of Portuguese and forestry terms

alqueire – A term often used to describe a measure of land area by communities in the Amazon. One alqueire is the equivalent of 4.8 hectares, or 48 000 m^2.

apical meristem – The growing tip of the plant, or apical meristem, emerges as a new bud or growing point of a root. The meristem tissue is composed of undifferentiated cells where growth occurs. Palm hearts are the inner core growing bud (apical meristem) harvested from certain palm species.

Amazonia – The Amazon rainforest or biome is known as Amazonia and includes territories from nine countries: Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, Guyana, Suriname and French Guiana (see map on page xxiv).

Bolivia – Bolivia is used to designate the South American country named Plurinational State of Bolivia.

caboclo – Caboclos are native inhabitants of the Brazilian Amazon. Caboclos emerged from the detribalization of the Amerindians and the subsequent syncretisation of African, Portuguese and Indian peoples. The term came to be used for disenfranchised populations of mixed descent inhabiting the flood plains and terra firme regions of the Brazilian Amazon. (for more information see Brondizio 2008)

capoeira – Secondary forest that grows up after primary rainforest has been cleared. The Brazilian martial art got the name capoeira because the early practitioners trained in the capoeira to hide from the view of their owners.

carimbó – Carimbó is a rhythmic drum-based dance and music from Belém and Marajó Island regions of Pará, Brazil.

cerrado – Cerrado is a tropical savannah region in the interior of Brazil, extending into parts of Paraguay and Bolivia. It is characterized by tall dense grass cover with some isolated low trees and gallery forests along streams and rivers.

crème – Frozen desserts called crèmes are commonly made with local fruit from the Amazon, the most well known being crème de cupuaçu. Generally, fruit pulp is blended with sweetened condensed milk and cream. The mixture is spread in a tempered glass pan and placed in the freezer for several hours before serving.

Curupira – Curupira is a mythical creature of Brazilian folklore taking the shape of a boy with his feet on backward. He is often portrayed riding a wild boar through the jungle. He is said to protect the rainforest from those wishing to harm it by leading them in circles.

dbh – Diameter at breast height is a standard forestry measure used to express the diameter of a tree trunk. The dbh is usually taken at 1.3 m above the ground, approximately at an adult's breast height.

dendê – Oil made from the fleshy pulp of the African oil palm (*Elaeis guineensis*) is known as dendê. This strong-flavoured, deep orange-red oil is commonly used in West African and African influenced Brazilian recipes.

endocarp – Endocarp is a botanical term for the inside layer of a fruit that directly surrounds the seed. It is often hard as in the pit or stone of the peach, olive or cherry, and the shell of walnuts, but may be a membrane as in citrus fruits. For example, in the Brazil nut the endocarp is the hard shell directly covering the edible nut.

farinha – The common term for *farinha de mandioca,* farinha is a flour produced through an elaborate process of soaking and roasting the tuberous roots of manioc (*Manihot esculenta*). Farinha is processed, eaten and sold as a principal source of income by most rural Amazonian families. Community or individual family work shacks called *casas de farinha* are built beside residences as places to process the roots. Manioc leaves and roots contain varying quantities of cyanogenic glucosides, which are converted into cyanide. The dangerous compounds are removed from the roots through a lengthy soaking and cooking process.

frugivorous – Frugivorous means fruit-eating. Fruit makes up a substantial portion of a frugivorous animal's diet. Many frugivores serve as dispersers for the fruit they eat.

ganzá – The ganzá is a Brazilian percussion instrument, a type of cylindrically shaped rattle, often made out of a hand woven basket or metal canister filled with beads, pebbles or seeds.

hectare – A hectare (ha) is a metric measure of area, 1 000 m by 1 000 m or 10 000 m^2. One hectare equals about 2.5 acres.

igapó – Igapó is used to describe lowland Amazonian rain forest on permanently flooded land, with roots of the vegetation always submerged.

jutaicica – Exudates from various species of the *Hymenaea* form a hard resin called jutaicica. Jatobá (*Hymenaea courbaril*) is the most common source for jutaicica, often collected in a semi-fossilized form at the base of the tree.

Mapinguari – The Mapinguari is a legendary three-meter tall slothlike creature believed to roam in the remote reaches of the Amazon. The monster is described as having one eye and producing a strong unpleasant odor. Many believe that the myth has been passed down from ancient encounters with the giant ground sloth, now thought to be extinct. Others believe that a giant sloth may still be surviving in the more isolated regions of the Amazon jungle but no one has been able to document its existence as of yet.

mateiro (woodsman) – Mateiros are timber cruisers who do field searches for timber species. They locate trees that can be logged, sometimes leaving a system of lightly cut trails and markers indicating to logging crews where trees are located, what species, and how many by cutting notches on palm leaf stems.

measurement abbreviations – The standard measurement abbreviations used in the book are: mg = milligram, g = gram, kg = kilogram, mm = millimetre, cm = centimetre, m = metre, m^3 = cubic metre, ha = hectare, ml = millilitre, oz = ounce

NWFP or NTFP – Non-wood forest products (NWFP) or non-timber forest products (NTFP) refer to resources or services other than timber (NTFP) or wood (NWFP) utilized from forests, other wooded lands and trees outside forests. Fruit, seed, nuts, fibres, resins, gums, latexes, medicines, fish and game are often classified as NWFPs.

raceme – A raceme inflorescence has a single axis containing alternating or spiralled flowers on short stalks of about equal length. The new flowers are borne towards the tip of the raceme as the central axis shoot grows.

spathe – Spathe is a large bract, modified leaf, that subtends a spadix or other inflorescence. In palms, the spathe is generally a woody, boat-shaped bract that ensheaths the flowers and subsequent fruit. Some other monocotyledons have showy less woody spathes.

swidden agriculture – A system of shifting cultivation plots often involving clearing and burning before planting, also referred to as slash and burn.

terra firme – Terra firme refers to lower elevation Amazonian rain forest growing on higher, solid ground that does not flood.

tipiti – The tipiti is a hand woven, long, narrow sieve used to squeeze the liquid and toxins out of grated manioc root in the production of farinha. The resulting liquid, called tucupi, is used in regional cuisine, as well as the starch, tapioca, which separates out of the extracted liquid.

várzea – Várzea refers to lowland Amazonian rain forest that floods seasonally when rivers are at their highest during or following the wet season. Várzea is also used to describe the floodplain forests which are flooded daily due to the influence of the tides.

Venezuela – Venezuela is used to designate the South American country named Bolivarian Republic of Venezuela.

Map of South America showing Amazonia and the major rivers in the area

[1] Bolivarian Republic of Venezuela
[2] Plurinational State of Bolivia

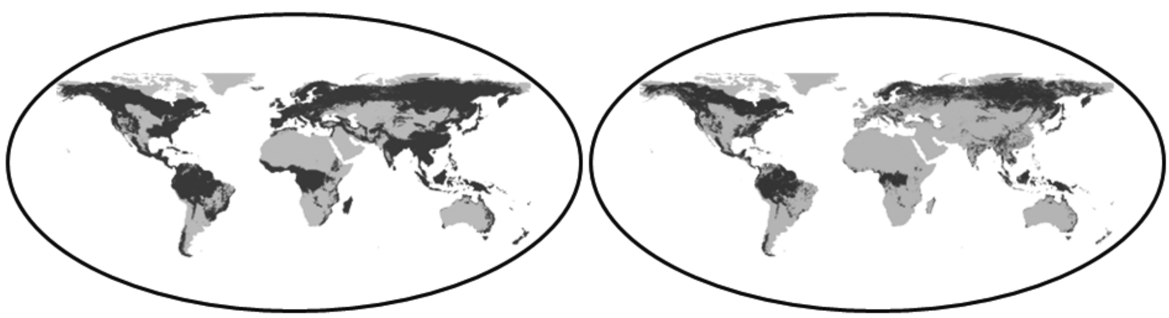
Introduction

Global impacts of forest loss in Amazonia earn front page headlines, but what of local consequences? Do rural families have access to scientific findings that their forest home will not be standing by 2030?[1] Do they have any notion that their children will no longer climb the tree to pick the fruit that has fed their family for generations? Do statistics about deforestation turn into action for local people?

If there is one message this book means to convey it is this: science rarely reaches the people who need it most, but it can. Scientists and forest-reliant communities are geographically and conceptually distant. Scientific findings are rarely shared with local people and locals are infrequently consulted regarding the species and landscapes they have known for generations. To bridge this divide, this book weaves together the voices of farmers and scientists; hunters and policy makers; midwives and musicians.

Appreciating different perspectives on forest value is critical as although tropical forests cover only 7% of our planet's surface, they contain 60% of the earth's species.[2] The Amazon is the largest contiguous tropical forest remaining in the world, with 25 million people living in the Brazilian Amazon alone.[3] However, it is being deforested at an increasingly rapid pace; deforestation, fire and climate change are predicted to destabilize the region and result in the forest shrinking to one third of its size in 65 years.[4] Among the species being extracted by the timber industry in eastern Amazonia are 15 of the fruit and medicinal tree species most valued by local people.[5] If the current rate of deforestation and the incidence of fire continue, the forest will disappear so swiftly that the grandchildren and great-grandchildren of people living in the tropical forest today will no longer be sustained by its fruits and medicines and will never know it as it once was.

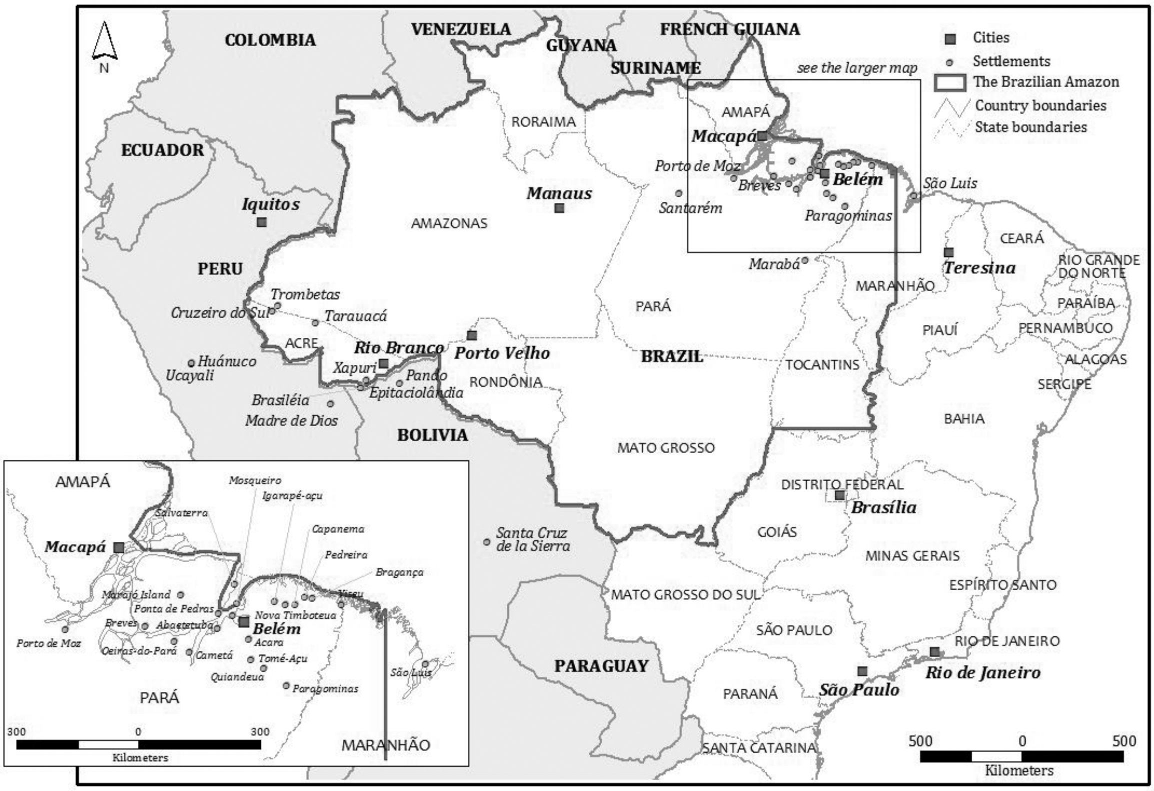
Original forest distribution[6] Remaining forest



The Earth has lost close to half, almost 3 million hectares, of its original forest cover.

What will remain in the wake of this wave of deforestation? Forest villagers in Amazonia say that the forest never returns to what it was. Scientists agree. A study in Peixe-Boi, in the Brazilian state of Pará, demonstrated that about 65% of native trees do not regenerate well after repeated cycles of slash and burn.[7] The solitary Brazil nut trees along the roadsides have garnered the nickname "the living dead", because they cannot reproduce without specialized pollinators from the forest.[8] Among the vulnerable species that have difficulty recuperating after logging and fire are copaíba, ipê-roxo, amapá and uxi. Barks, fruits and exudates from these species are used to treat wounds, tumours, respiratory diseases and nutritional deficiencies. Such unique rain forest species are vital to the health and nutrition of Amazonians and to the world; they have no substitutes.

The aim of this book is to integrate scientific and traditional knowledge in a form that is accessible and appealing to the people who need it most – rural villagers. Because products from the forest, such as wood, food and medicines, and ecosystem services sustain not only rural but also urban people, the book has also found an audience in cities. Urban consumer habits and demands for forest goods have enormous consequences for the forests. Thus, each of us is responsible for the health of the forest. Our actions will determine if forests perish or continue to be part of Amazonian life.



Map of the Amazon region showing the legal Brazilian Amazon, Brazilian states, and location of places mentioned in this book.

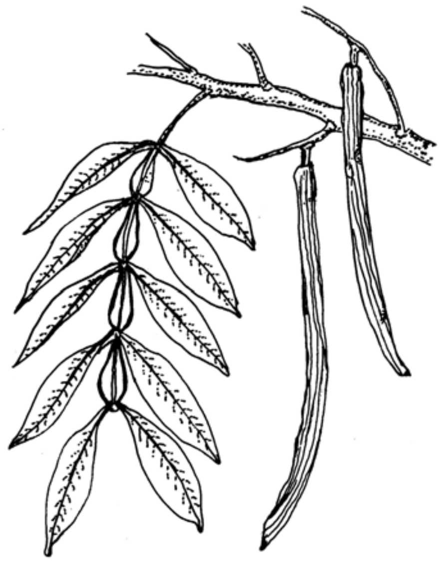
Amazonian plant diversity

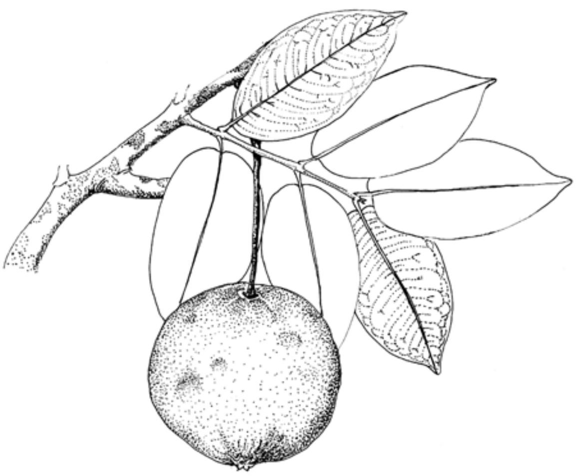
Douglas C. Daly

Those who travel in the Brazilian Amazon will encounter hundreds of plants that offer fruits, nuts, fibres, remedies and resins. This is in part because of the sheer enormity of the Amazon: its basin covers 5 million km^2 in Brazil alone. However, the profusion of plant resources cannot be explained merely by the size of the region. We also consider that at any given site in Amazonia, 1 ha usually contains between 125 and 300 species of mature trees, and that the diversity and abundance of species vary greatly from one part of Amazonia to the next.

The unique natural wealth of each region is owed to a distinct set of factors, such as geographic location, environmental conditions and geological history. Each piece of the puzzle holds a clue to the mystery of biological diversity. Taken together, we assemble a series of mosaics on varying scales, from region to landscape and from landscape to parcel of forest.

The occurrence of species found in a geographic location is influenced by the surrounding flora, by migrations, and by the evolution of new species over time. Scientists do not yet know the reason why, but certain groups of plants have diversified rapidly in Amazonia in recent times. These include important groups of fruit trees. There are some 130 kinds of ingás (*Inga* spp.), more than 50 each in the states of Pará in eastern Amazonia and Acre in the southwest. There are also more than 100 types of *Pouteria*, the principal genus of abiu and abiorana trees, of which 52 have been registered in Pará and more than 30 in Acre.





The states of Acre and Pará are good examples of the divergent mosaics that make up the delicious biodiversity of Amazonia and as a result their floras include different fruit trees and other resources. Northern Pará especially shares a large number of species with the neighbouring Guyana and French Guiana, while Acre's flora is closely related to that of western Amazonia, specifically with the southwestern Amazon in Peru and Bolivia, and much less so to the rest of the Brazilian Amazon.

Health and nutrition: compliments of the forest

Throughout Amazonia, abundant benefits come from the tropical forest – fruit, fibres, wood, game and medicine, as well as ecosystem services such as pollination, seed dispersal, fresh air and clean water. The value of these services and of Amazonian products such as açaí, bacuri and copaíba is growing quickly. But often it is not possible for people who live in rural areas to bring forest products to the marketplace or to be compensated for conserving the forest's ecosystem services. Even without earning any money, however, people earn a substantial "invisible income" from forest goods that enrich family health and nutrition. As one Amazonian mother says, "My family saves our meagre income by eating free from the forest."

Forest fruits provide essential nutrients, minerals and anti-oxidants that keep the body strong and resistant to disease. Rural families recount that during the season of forest fruits and nuts they do not catch colds, coughs or the flu. Common deficiencies in the Brazilian diet, such as a lack of vitamin A, can be combated with forest foods. For example, buriti palm fruit contains the highest known levels of vitamin A of any plant in the world.[9] Açaí fruit is being hailed as a superfood for its high antioxidant and omega fatty acid content.

Preventing disease through good nutrition can save income and lives. Even excellent sources of protein can be obtained from the forest for free. Brazil nuts are rich in a complete protein similar to the protein content of cow's milk, which is why they are known as the "meat" of the plant kingdom. Families with game on their lands, particularly wildlife with high reproductive capacity such as rodents, can meet their protein needs without ever setting foot in a meat market. If a family member does become ill, cuts, fevers, skin ailments and coughs can often be treated with the remarkable array of Amazonian medicinal leaves, oils and barks.

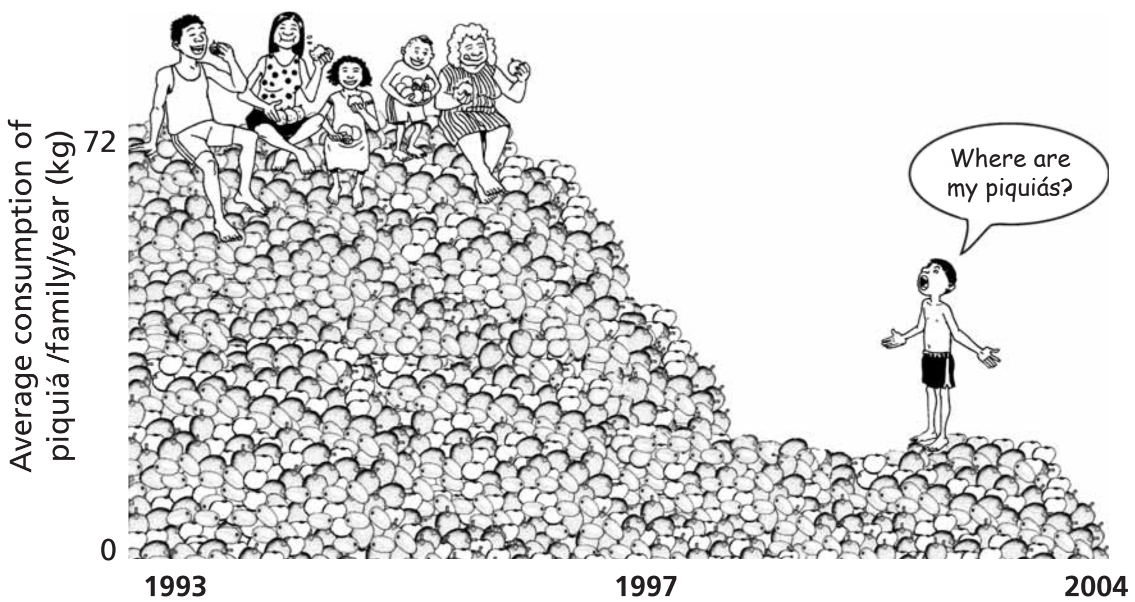
Forest pharmacy: a secure health care plan

Medicine

Protein

Irreversible losses:

Consumption of piquiá by one community in Pará after 13 timber sales



Compatible or conflicting use

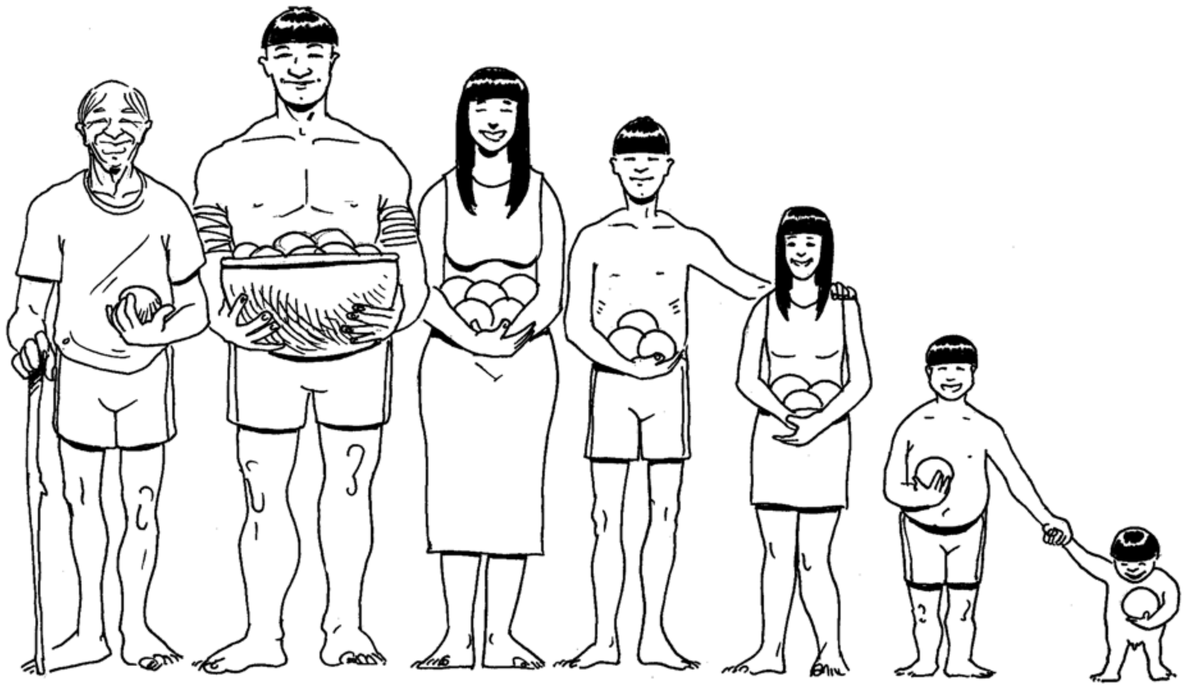
In spite of the high value of forests, rural people all over the world sell their forest goods for what represents only a fraction of the product's actual worth. When children are sick or the manioc crop is poor, immediate cash can offer food and medicine. Sometimes, the first few timber sales go well: few species are extracted, the damage to the forest is limited and the community can still harvest fruit and vines, and hunt. But when the frequency and intensity of the extraction overtakes the forest's ability to recuperate, the availability of non-wood forest products (NWFPs) can fall significantly. In addition, during timber negotiations, future fruit harvests are often forgotten and left out of the calculation. When loggers extract one fruit tree, the gain may be the equivalent of a few dollars, while the loss signifies thousands of fruit over the life of the tree. Furthermore, under normal logging techniques, for each tree that is extracted for timber, another 27 die or are damaged in the process.[10] When forest impoverishment reaches a certain point, the risk of fire increases and additional species are destroyed.

In eastern Amazonia, 200 tree species are extracted for wood, half of which produce useful fruits, flowers and seeds, leaves, barks, and roots or oils, latex and resins.[11] Some species that have strong medicinal traditions, such as ipê-roxo, amapá, copaíba, cumaru and jatobá, are found only in low densities in old-growth forests and are not cultivated. This means that they are naturally rare and vulnerable to exploitation. Of the 12 medicinal plants most widely sold in eastern Amazonia, five are harvested for wood.[12] Currently, most commercial collectors in search of the most powerful medicinal barks, search not in forests, but in sawmills.

The impact of seven generations

Scientists previously believed that much of the Amazonian forest was pristine and unaltered by humans. More recently they are discovering that many forests were managed and transformed by local people.[13] With thousands of years of knowledge and practice, indigenous peoples have modified the abundance and distribution of select trees according to their preferences. For example, Brazil nut and piquiá trees are found in higher densities near old Indian villages.

Indigenous management practices enriched the concentration of useful trees, but agri-business, logging and fire are significantly reducing the numbers of species locally valued and used. It is always important to evaluate the costs and benefits of changes to our Earth. Some changes that appear to be positive in the short term have grave consequences in the long term. The Iroquois Indian tribe, from North America, created a wise law:



"We must consider the impact of each of our decisions on the next 7 generations."

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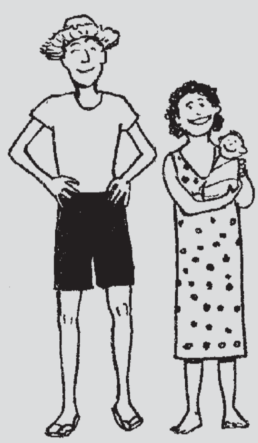
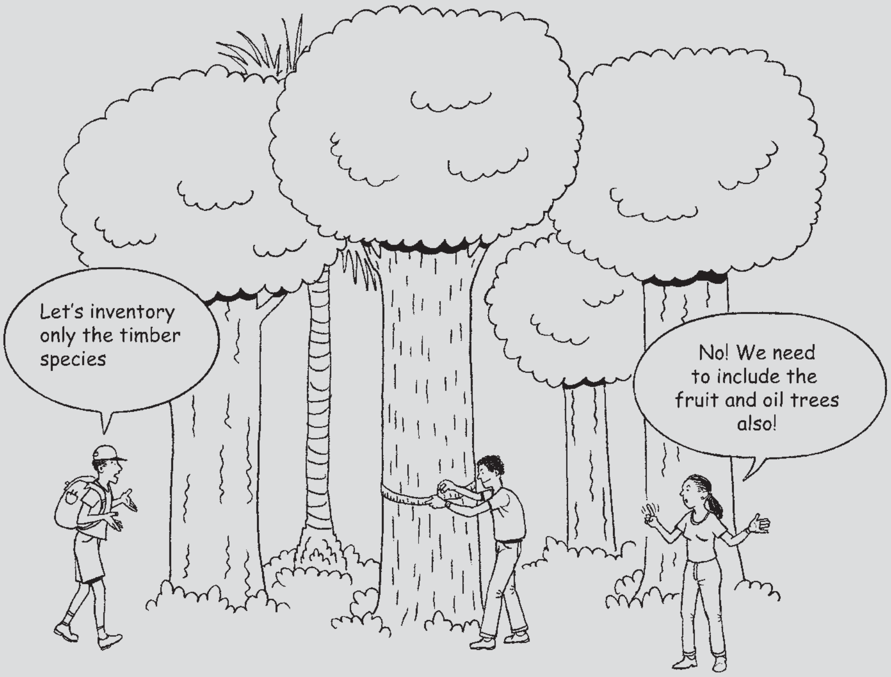
Who will use this book and how?

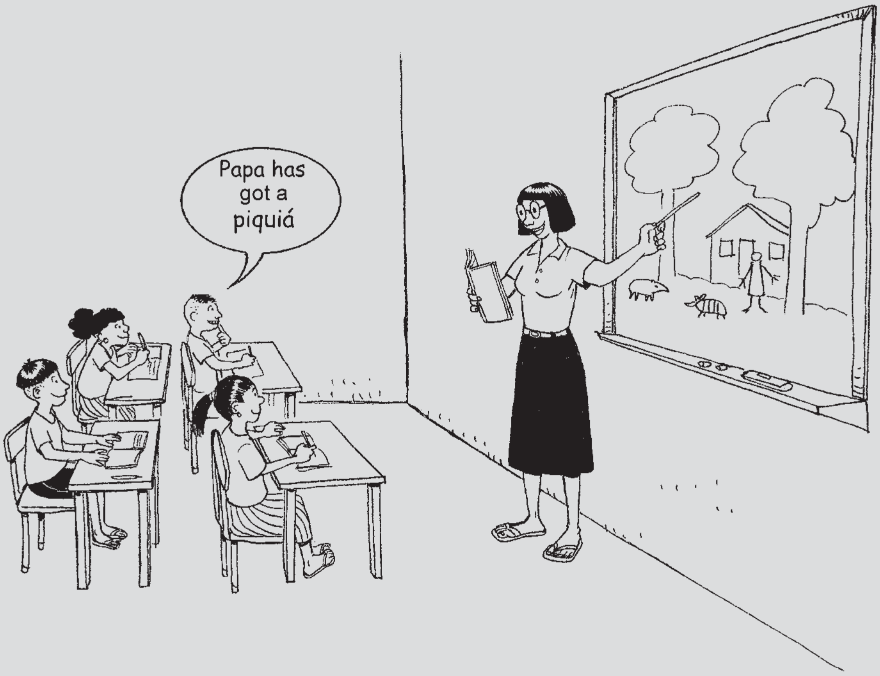


Foresters and extensionists

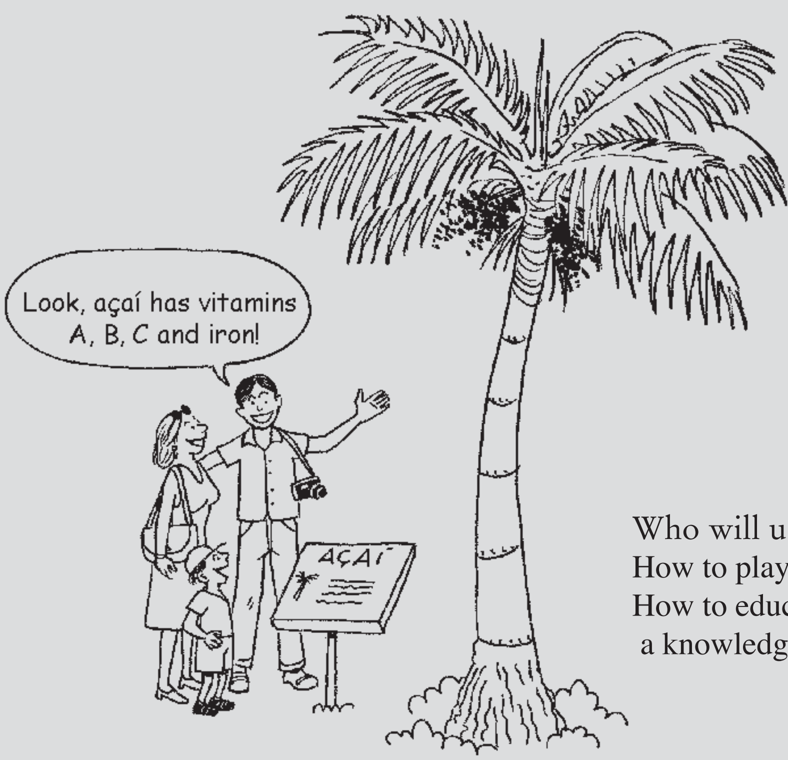


Local people

EDUCATORS



CITY FOLK



Who will use this book and how?

The Portuguese version of this book has been made available in English for two main purposes. One is to demonstrate how it is possible to make science relevant and accessible, and to show how scientific publications can be prepared with and targeted to a broad public, including marginalized populations. Twenty five percent of the world's youth and adults in developing countries are functionally illiterate[1] as well as a quarter of 16-65 year olds in the world's richest countries.[2] In rural communities this figure can reach close to 40%, particularly among the elderly, the poor and women. The descriptions below and the chapters that follow were laid out to allow rural and urban audiences lacking formal education to extract information from pictures and numbers while more detailed information is given for others.

Why is it important to communicate to people lacking formal education? First, persons schooled in the forest as opposed to a classroom may be particularly knowledgeable about forest resources; their insights and experience are extremely valuable. Second, local and national decision making processes require understanding of complex information. Without information, urban and rural people can be at a gross disadvantage in negotiations with the private sector and participation in governance processes. Furthermore, all elements of civil society need to understand the value of forests and the connections between nutrition, family health care, culture, the arts and the environment.

Another purpose of the book is to share information regarding Amazonian species, which urban and rural families depend upon for their livelihoods, with a worldwide audience. Some of the trees are well known and used throughout the world, like the rubber tree and Brazil nut. Other species, much like the people the book is meant to serve, are invisible to policy makers. These include species such as uxi, ipê-roxo, jatobá and andiroba. It is important that the full range of species serving both global and local needs is recognized and appreciated.

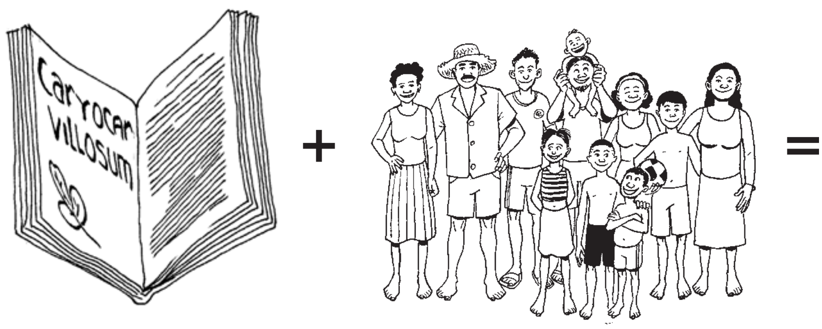
Enhancing comprehension while maintaining rigour

Illustrations, language, font and layout

Abundant visual representations are used to make concepts comprehensible to a broad audience. The Portuguese edition uses large font with ample space around the text and illustrations. The language of the Brazilian text is farmer-friendly, written in conversational Portuguese. Given the expanded audience for the English version, the colloquial nature of the language is diminished and the font reduced in size. To assist comprehension for non-readers, quantities in the text are generally conveyed as numbers instead of words.

Integrating scientific and traditional knowledge

Perhaps most importantly, the voices of local people are found throughout the book, over 100 farmers, community members and rural women collaborated by helping to generate or share information. Armed with diverse knowledge and experiences from various people in the region, our hope is that local communities can make more informed decisions in the face of the opportunities and challenges the future will bring.



a public better informed to make decisions

How to use this book

Each chapter of the trees and palm sections represents one species and is divided into six topics: ecology, economic value, uses, nutrition, wildlife and management; each of these is described below. The common names of species vary from place to place. We place the scientific name for each species below its common name so that people from different regions can recognize it. For example, Uxi is the common name for the tree with the scientific name of *Endopleura uchi* Cuatrec. The scientific name is composed of the genus (first name) and the species (second name). The final name refers to the person who published the first scientific description of that species. The illustrations of the species can help to identify the plants as well.

Ecology

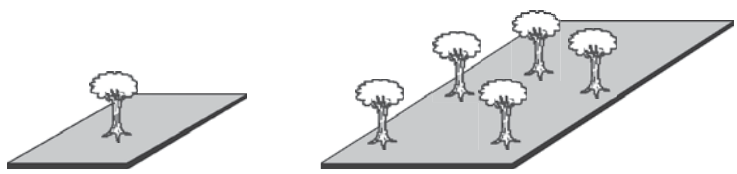
This topic is divided into three parts:

Flower and fruit seasons: The flower and fruit seasons are depicted using a calendar diagram that illustrates the time of year when flowering and fruiting occurs. The letters below the illustration represent the months of the year. However, the seasons often vary from region to region within the Amazon. The text cites regional differences, while the illustration highlights only one of the areas described in the text.

J F M A M J J A S O N D

Density: Density refers to the number of a particular species of tree found in a certain sized area of forest. It is a measure of the size of the population in a unit area. The density will depend on the measurements used for the inventory. Often only individuals above a certain diameter are counted. Likewise, since tree distribution is not uniform, the total area inventoried may affect the resulting average density. Communities and foresters often use different measures to denote spatial areas of forest. Foresters often use a hectare (equivalent to 100 x 100 m, or 10 000 m^2, about 2.5 acres) while forest communities in Amazonia often use alqueire (equivalent to 4.8 hectares).

Some inventories include all trees equal to or above 10 cm in diameter (approximately 30 cm circumference) taken at breast height (DBH). Loggers generally take an inventory of all trees above 60 cm DBH (180 cm circumference), which are considered large enough for harvesting. The density and distribution of trees (grouped or spread out) in the forest are related to numerous factors, including: the ecology of the species, the type of soil and climate, and the use and management history of the species. The data presented in this book indicate only the average density according to a few forest inventories. When the density varies significantly for a species in terra firme versus wetland areas, an illustration is given for each.



0.5 to 1.5 trees per hectare

2 to 7 trees per alqueire

average number of fruits per tree

Production: The production of a tree is the average number of fruits grown per tree and the variations in that number. Production varies greatly from tree to tree and from year to year. For example, a piquiá tree can produce 1 000 fruits one year and none the next. Through scientific studies that involve collecting samples from various trees over a period of years, it is possible to arrive at a good estimate of fruit tree production. For a few species, this information is readily available in books; however, for many species important to rural livelihoods, no studies exist. An illustration of a pile of fruits shows the best information available on average production for a particular fruit tree. The average production of a palm tree is represented by a basket of palm fruits.

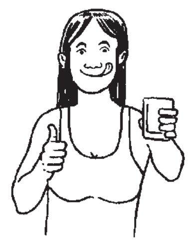
Economic value

Local, national and international economic data is provided in this section. Because even species that are widely traded may have few market studies, the economic values included come from site specific research that may be several years old. Market prices depend upon many factors, such as place of purchase, seller, time of year and the time of day that sales are made. Likewise, the exchange rates and even currencies vary over time. Brazilian reais are converted to US dollars using the 2009 exchange rate or the rate from the time period when the economic data was collected.[3] The dollar amount is often rounded off to the whole dollar.

Rural landowners can estimate the economic value of the fruit produced in their forest by multiplying the density of fruit trees in a specific area by the average annual fruit production and then by the value per fruit. However, people living in remote areas encounter many difficulties in bringing their products to market. Obstacles include: distance to market, lack of transportation, high product variability, perishability of fruit and lack of marketing skills. In addition to market value, it is also important to remember that fruit trees have a substantial, but often "invisible", subsistence value and that they can produce for many years. Fruiting and flowering trees also have the advantage of attracting game and supporting wildlife. Thus, the many values of a fruit tree can exceed the comparative earnings from market sales of its timber.

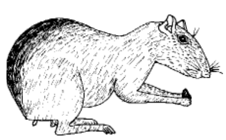
Uses, nutrition and recipes

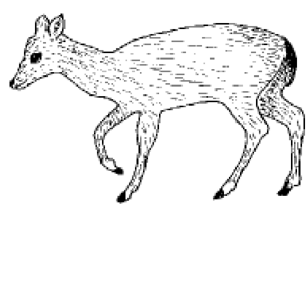
This section includes a list of the traditional uses of the species, often incorporating various parts of the tree, such as fruit, leaves, bark, seeds, flowers, resin and wood. The nutritional value of each fruit is explained and sometimes recipes are shared. The weight of the fruits represented in the text is the weight of the fresh fruit. Note that some of the uses (especially the medicinal uses) are limited to a few regions, and many are not yet proven scientifically.



Wildlife

Without wildlife, the forest would not exist. Fruit trees are an essential source of nutrition for wildlife as well as people, and game is an excellent source of protein for rural families. Animals act as pollinators and seed dispersers, carrying out a crucial function for the ecology of the forest. In this section, we point out a few of the wildlife species that interact with the plant. The emphasis is on traditional game animals, but other interesting interactions are also highlighted.





Management

For centuries the forest has been managed by indigenous peoples, often to increase the number of useful trees. Agronomists also perform germination, growth and production experiments so that trees grow more rapidly and produce larger fruits. In this section, the illustration shows the average time for germination and production to take place and the average growth of the young tree. Variations in the averages and management techniques are further explained in the text.

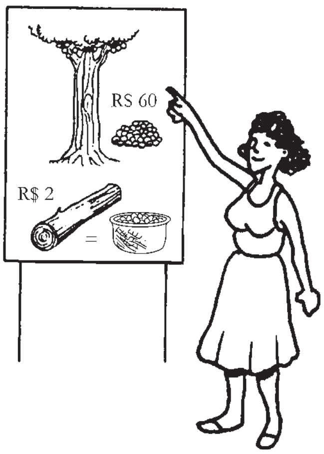
References

Local people, who have the most extensive experience with Amazonian fruit trees, rarely publish their knowledge. This book seeks to weave together the insights and knowledge of farmers, artisans, scientists, policy-makers and homemakers. To ensure rigour, 90 specialists and highly knowledgeable researchers for individual species have collaborated as authors and contributors. In addition, over 200 seminal scientific publications, gray literature, theses and dissertations focusing on Amazonia were reviewed and cited so that interested readers can consult the original references

Endnote numbers are used to cite literature that is referenced in the chapters. The authors and dates of the publications are listed at the end of each chapter, and the complete citation can be found in the bibliography.

How to play with this book

Attention: This book is designed to be lived with and ripped up – not kept neatly on a shelf! In schools, communities and associations in the city and the country, you can use this information in participatory workshops and through posters, theatre, songs, videos, maps and discussions. While readers find that the book is instructive when read, the information becomes even more powerful when shared in informal discussions and participatory workshops.



Posters

The more we draw, the more we learn. Posters can easily be made based on illustrations from the book. Many of the diagrams in this book came from posters designed during community workshops.

Theatre, music, video and radio

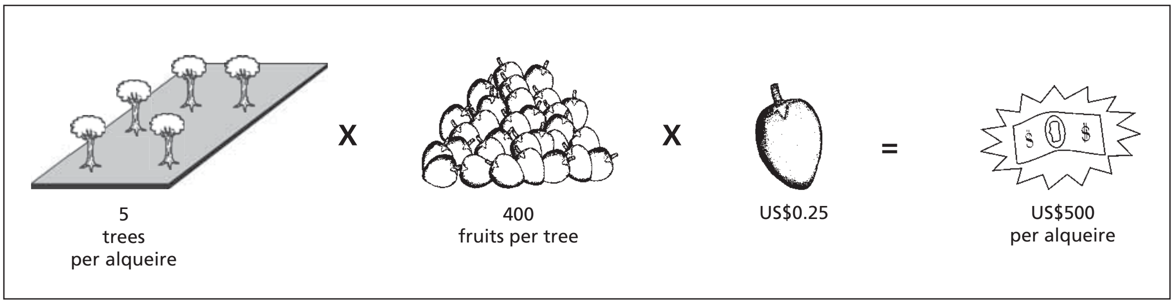
Stories from the book and from village life are being used to create plays, radio programmes and videos. These can be entertaining as well as convey critical messages. Timber negotiations are an especially pertinent theme for role playing in frontier communities.. Some members of the community can pretend to be persuasive loggers attempting to buy timber from susceptible members of the community. Invariably, some may succumb to the lure of petty cash while others hold out and protect the forest or negotiate better deals.

During workshops, ecological songs animate the crowd and raise awareness. Music composed by farmers and rubber tappers convey deeply felt sentiments about the human consequences of forest loss as well as the role of women in conflicts over forest resources. A documentary film, *Daughters of the Canopy*, based, in part, on the story of rural women who contributed to the book, highlights the struggle of women in logging frontiers and has stimulated intense discussions between men and women.[4] Through radio, nationally renowned Brazilian broadcaster, Mara Regia produced a series of programmes based on various chapters, celebrating Amazonian flora throughout Brazil.

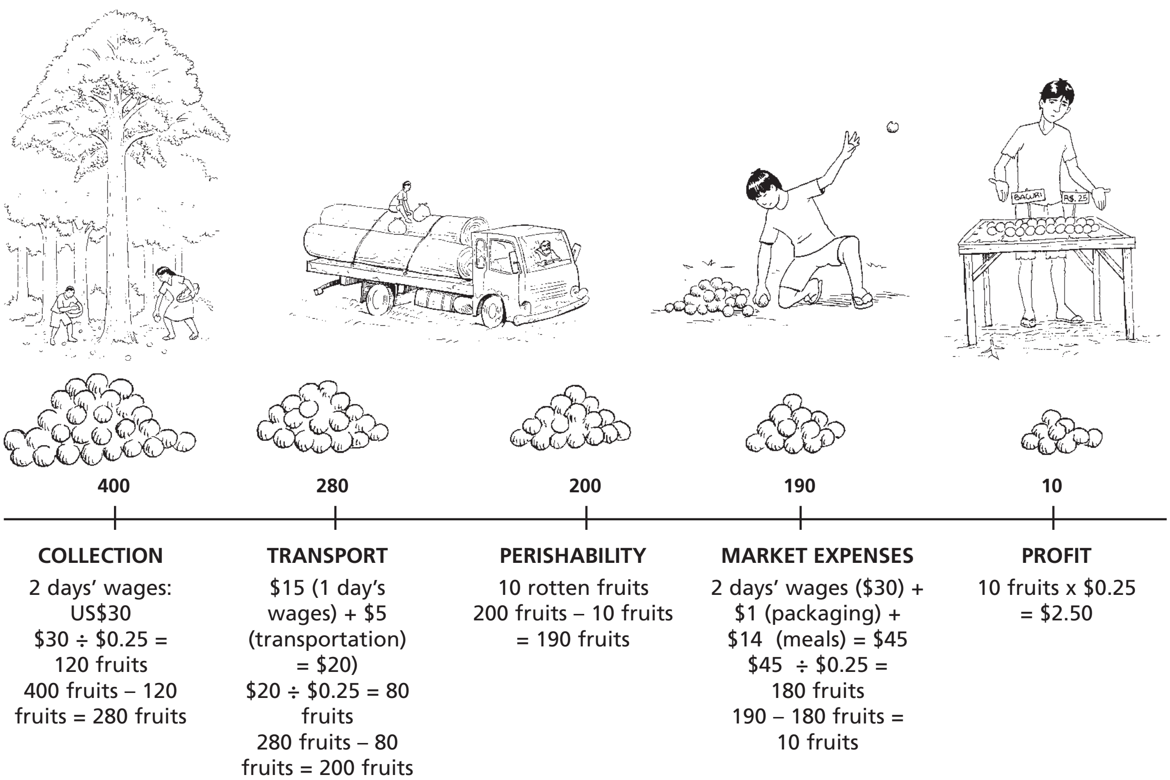
Community decisions and cost-benefit analyses

Some communities form groups to discuss key themes of the book, weaving their life experiences into the dialogue. If representing a cross section of the community, such groups can, over time, become decision-making bodies for the management of natural resources.

Many of the species in the book are valued for both their timber and NWFPs, such as fruit, fibres, medicine and/or game, attracting value. The NWFPs in an area may have more long-term value than the timber. To calculate the value of NWFPs, multiply the density of a species in a given area by the average production of one tree and the price of one fruit. By doing so, it is possible to calculate the value of the forest area for that species per year. Adding up the values of all of the useful species gives the total annual economic value of a given area. This information will enable you to evaluate the relative economic value of your area for NWFPs as compared to timber, agriculture or ranching.



It is important to include in the calculations the cost of labour hours, transportation, possible loss or damage to the product, as well as packaging, meals and expenses. These costs are generally high and the long distances to the market from remote forest communities can make it difficult to sell the products effectively. João's story is an example of what can happen without proper planning or marketing experience. João scouted the forest for bacuri fruit, and after 2 days he collected 400 fruit to sell in the Paragominas



open air market, in Pará, Brazil. Mud and holes in the road on the way to market held him up an additional day. However, he was fortunate because bacuri fruit have thick rinds and are tough; he only lost 10 fruits along the way. But food and other expenses used up much of his profit, leaving João with only US$2.50 – not even enough to get a ride back home. Forest people need to be realistic about the market opportunities in their area, and weigh the benefits of taking forest goods to market against the benefits of using them as food or resources for the family. Nonetheless, opportunities often exist for making supplemental income while conducting other family chores or business in the city.

Measuring impact: workshop preparation

Before a workshop, it can be useful to ascertain how many hectares of a community's surrounding forest are intact, and how many have already been exploited or altered. What quantities and types of fruit or other forest products does the community use and sell? Are the women or the elderly a part of the decision-making process regarding forest management and/or timber sales? How many times has timber been sold, and at what price? Has a forest reserve been created? After some time, a return visit can help to determine if resource management has changed and, more specifically, if the forest has been degraded and if and how it is being managed.

The book hits the rubber trails

Cristina da Silva

Workers from National Council of Rubber Tappers (CNS) in Brazil have used this book to work with approximately 70 000 families living in Extractive Reserves (RESEX) in the 9 Brazilian Amazonian states. These families are responsible for the management, use, and protection of some 15 million hectares.

"The book expresses the diverse realities of the Amazon," noted Manuel Cunha, president of CNS who was brought up in a family of Rubber Tappers in the Extractive Reserve of the Middle Juruá, in the state of Amazonas. *Frutíferas*, as the book is know locally, is being utilized by community health workers, professors, and communty leaders to explain the nutritive powers of the forest through its various products. Users of the book explain that it helps community workers illustrate that the forest is a source of extraordinary food and can be a living pharmacy when necessary. A professor who teaches with the book noted that piquiá trees are no longer cut down in certain community forests due to the intervention of villagers who have had access to the book or workshops.

Community workers often infuse their own cultural experiences into the book's stories leading to lively conversations in classrooms, workshops, or meetings. The songs, popular theater, and recipes promote local culture which can help retain traditional knowledge for future generation. Galo, an extractivist from RESEX Mapuá, on Marajó Island, explained Amazonians' reaction to Frutíferas, "I believe in this book because it has our look, our things".

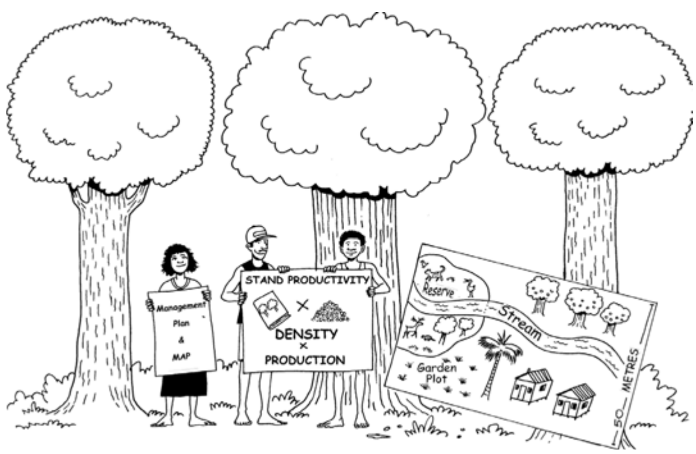
How to educate with this book: a knowledge network

As one collaborator indicated, "Only 50% of the work is writing the book, the other 50% will be disseminating it effectively". Given that rural people receive scant information, the dissemination strategy of an earlier Portuguese edition was designed to ensure that the majority of copies were distributed free to rural people and organizations working in remote regions. Health, education and extension networks have been excellent disseminators. Over time, the book has been used by forestry and agrotechnical schools, rural workers' unions, indigenous tribes, rural and urban schools and universities and homemakers. It has also been used as a tool for the literacy training of adults, who learn to read while improving their ability to negotiate for their community's forest resources. The following examples show how the book has been used in a variety of settings.

Training future foresters: integrated forest management

Philippe Waldhoff

In the professional Forestry Certification course of the Federal Agrotechnical School of Manaus, the book is used to help students create and analyse hypothetical field situations. The professors simulate situations in which the students must propose management options, adding value through the processing, use and marketing of certain species. Here is how it's done:



Choose species: In small groups, students select a few species from the book to work with.

Manage the property: Each group of students is allotted an imaginary forest of 50 hectares. This land includes 40 hectares of forest reserve, where the species of their choice can be found. The students determine the distribution of the trees within the reserve, according to the unique characteristics of each (density, habitat, flowering and fruiting season).

Draw a map: The group makes a map of the lot and establishes the different land uses within the property: wildlife conservation area, agricultural field, garden, stream, etc.

Design a management plan: The students design a management plan for the lot. The plan contains (1) *introduction*, in which the group emphasizes the importance and unique value of each forest product; (2) *description of the species*, their characteristics, as well as examples of other species of the same family; (3) *calculation of the productivity of the lot in relation to each species*, using the production per individual, density and area; (4) *forms of marketing and income;* and (5) *presentation of the plan*. To conclude, students and professors review each other's work and offer comments and suggestions as to the management plan.

Building rural capacity: learning from mistakes and achievements

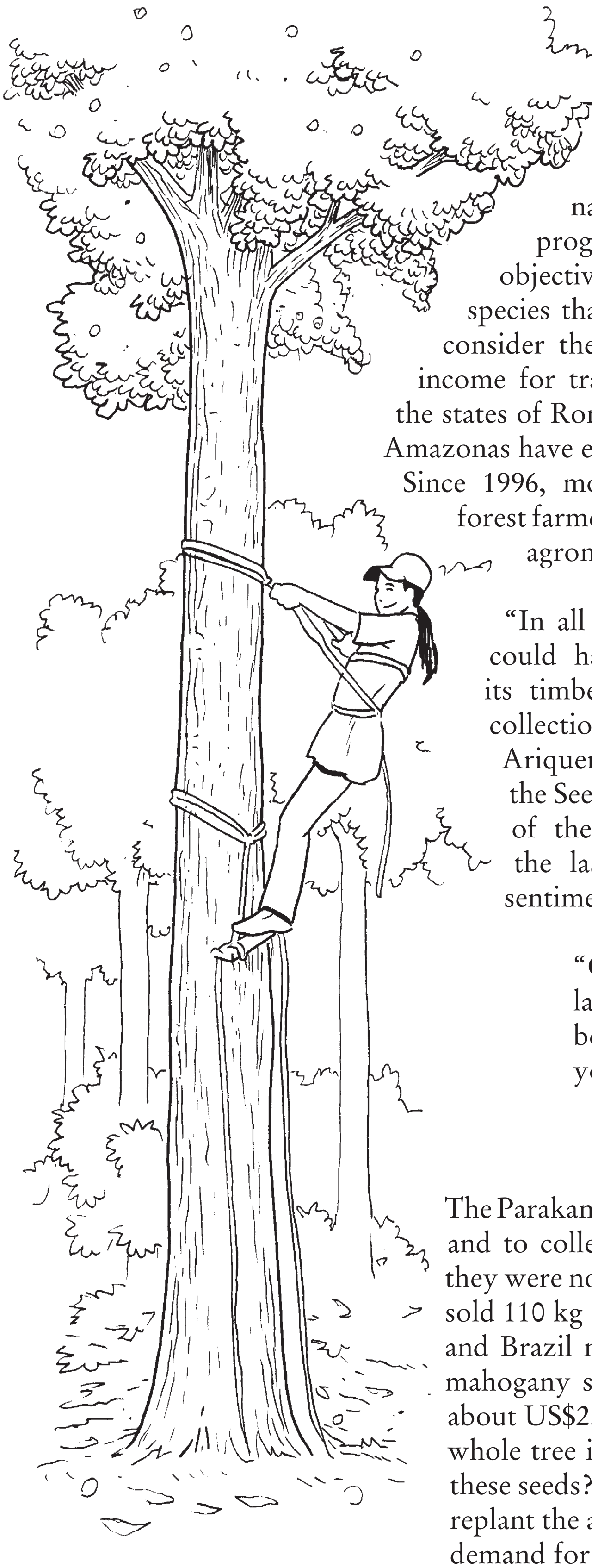
This book contains accounts of people who lost their forest and regretted their decisions, and stories of people who maintained reserves to sustain their families with fruit, fibres, game and medicinal plants. Sharing of both negative and positive experiences has catalysed communities to inform others about the various options for forest use. Extensionists and scientists are now using these and other examples as well in workshops and trainings. Consider these two scenarios:

One community with roughly 3 000 hectares of forest sold timber to logging companies 13 times over a 20-year period. A neighbouring landowner maintained a reserve for the future. The community came to lament its decision because it no longer had fruit or game to eat. In 1993, average consumption was 392 fruits per family in the community. By 1999, this number had fallen to 156 fruits. Up river, Senhor Mangueira's family guarded a large forest reserve and ate thousands of fruits per year. He and his family note that they remain healthiest during the season of uxi. Their consumption during the four-month fruiting season shows why: in 1993, they ate 3 779 fruits, and in 2001 consumption continued high at 2 500.

This book has also been utilized by the boat builders' professional qualification course in Igarapé Miri, in Pará. It inspired the students to build a timeline for species used in naval construction. The group made a map and established a scale of ten-year intervals beginning in 1960. They specified the species used in each decade and where they occurred. This exercise enabled the builders to visualize the process of species loss more clearly, revealing that a few of the most prized woods no longer exist in the area and can now only be found in another municipality 120 km away.

Climbing high to collect and sell seeds

Noemi Vianna Martins Leão
Selma Toyoko Ohashi



The seed laboratory at Embrapa (the Brazilian National Agricultural Institute), together with various partners in Amazonia, offers courses on the collection and storage of seeds from native tree species to be used in reforestation programmes. The course has two principal objectives: (1) to conserve forests with native species that produce high quality seeds and (2) to consider the seeds as an NWFP that can generate income for traditional communities. Communities in the states of Rondônia, Roraima, Acre, Amapá, Pará and Amazonas have enthusiastically participated in the course. Since 1996, more than a thousand people, including forest farmers, foresters, horticulturists, students and agronomists have taken the 40-hour course.

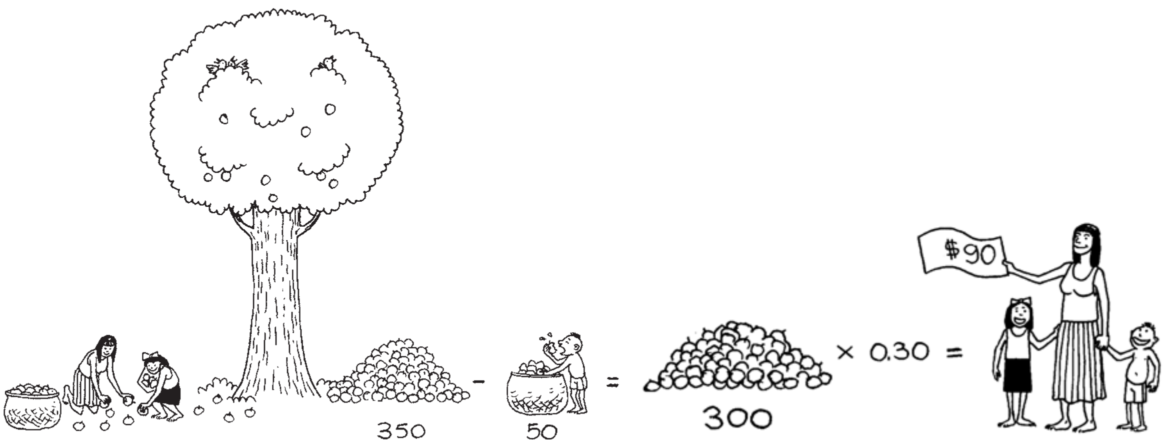
"In all my life I never thought that the forest could have so much value without extracting its timber," noted one participant in the seed collection course offered by Embrapa in the Ariquemes Reserve in Rondônia, supported by the Seed Network of Amazonia, of the Ministry of the Environment. The shirt he wore on the last day of the course summarized his sentiments:

> "Only after the last tree has fallen, the last fish has died and the last river has been poisoned, will you perceive that you cannot eat money."
>
> \- Cree Indian Proverb

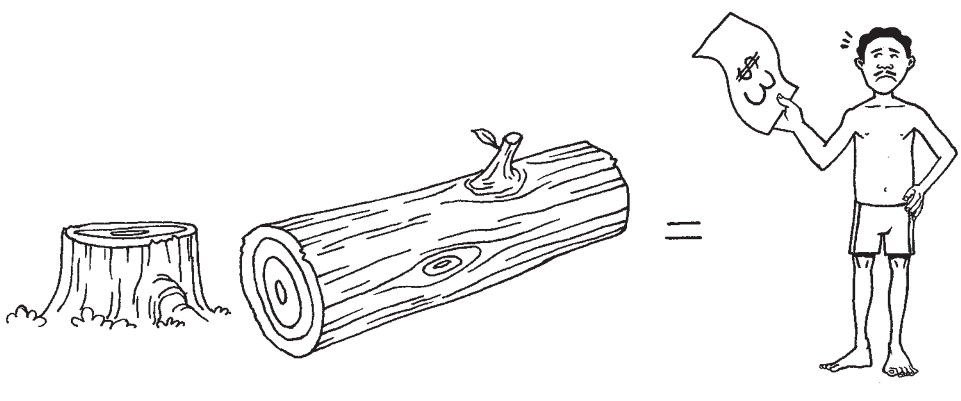
The Parakanã Indians learned to climb trees with ropes and to collect valuable seeds for sale. Even though they were not able to store the seeds successfully, they sold 110 kg of mahogany, tatajuba, andiroba, copaíba and Brazil nut seeds. In 2003, for each kilogram of mahogany seeds, around 1 600 seeds, they received about US$23 – more than they would be paid for the whole tree if they sold it to loggers. Who purchases these seeds? There is a law in Brazil that loggers must replant the areas they cut, and so there is a significant demand for forest seeds.

Reviving Amazonian culture in schools

When Amazonian children learn to read in school do you think they prefer, “See Spot run” or “Mummy picked a piquiá”? Because the majority of scholastic materials are produced in the south and southeast of Brazil, schools in Amazonia lack culturally appropriate material. Rural and urban schools in Amazonia are now using this book to teach biology, math, history, nutrition, environmental education and music while celebrating Amazonian forest culture. In addition, the Adult Literacy Program (Pronera) run by the federal government has incorporated the book into their innovative curriculum which teaches thousands of rural families throughout the Amazon basin to read.



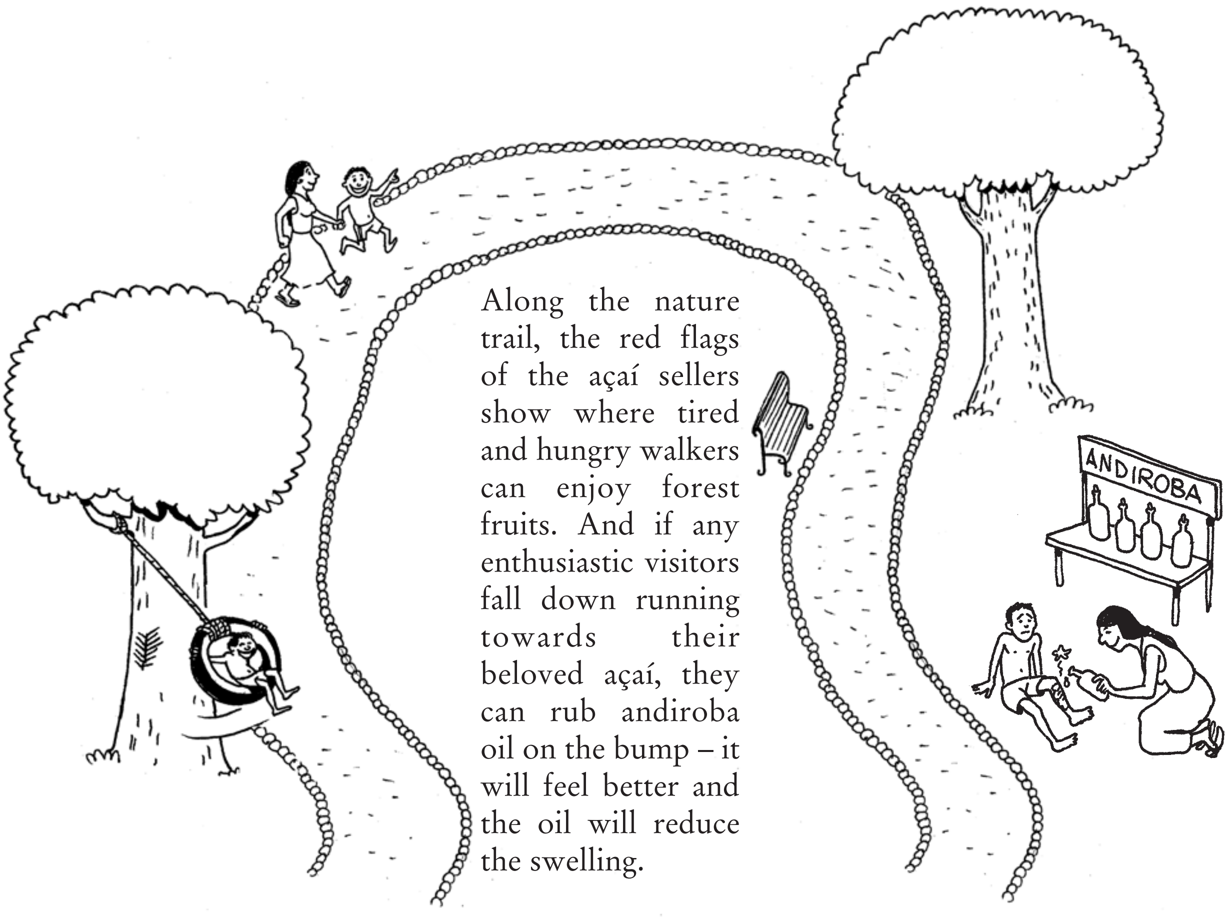
Professors can create math problems based on data in the book. A sample problem could look like this: “A piquiá tree produced an average of 350 fruit per year. After he let his children eat 50 fruit, Maroca sold the remaining fruit at a farmer’s market for 30 cents a piece. How much did he make from his tree this year? A friend of his from another community thought he would earn more if he sold his tree for $3.00. Which of them earned more?”



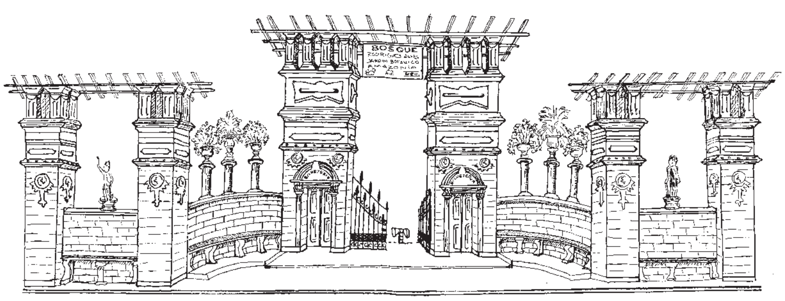
Raising awareness in cities

Murilo Serra

Many of the beautiful parks, theatres, municipal buildings and stately homes in Belém were constructed with money earned from the sale of latex tapped from rubber trees. Visitors to the historic Rodriques Alves Park (the Bosque) in Belém learn about the history and uses of native plants along the nature trail. Here they have created guided trails and illustrated plaques based on this book to awaken the people of Belém to the beauty and riches of the forest.

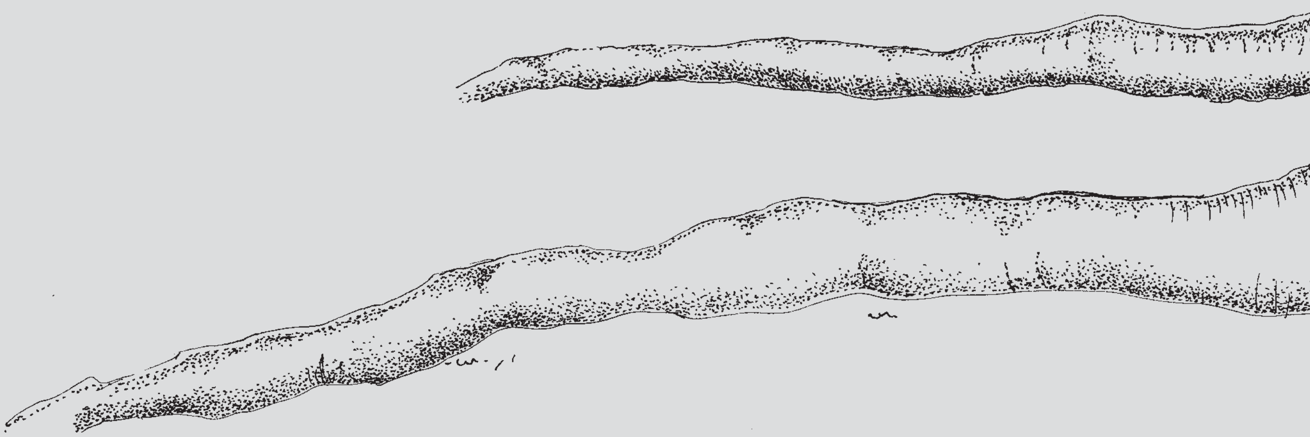


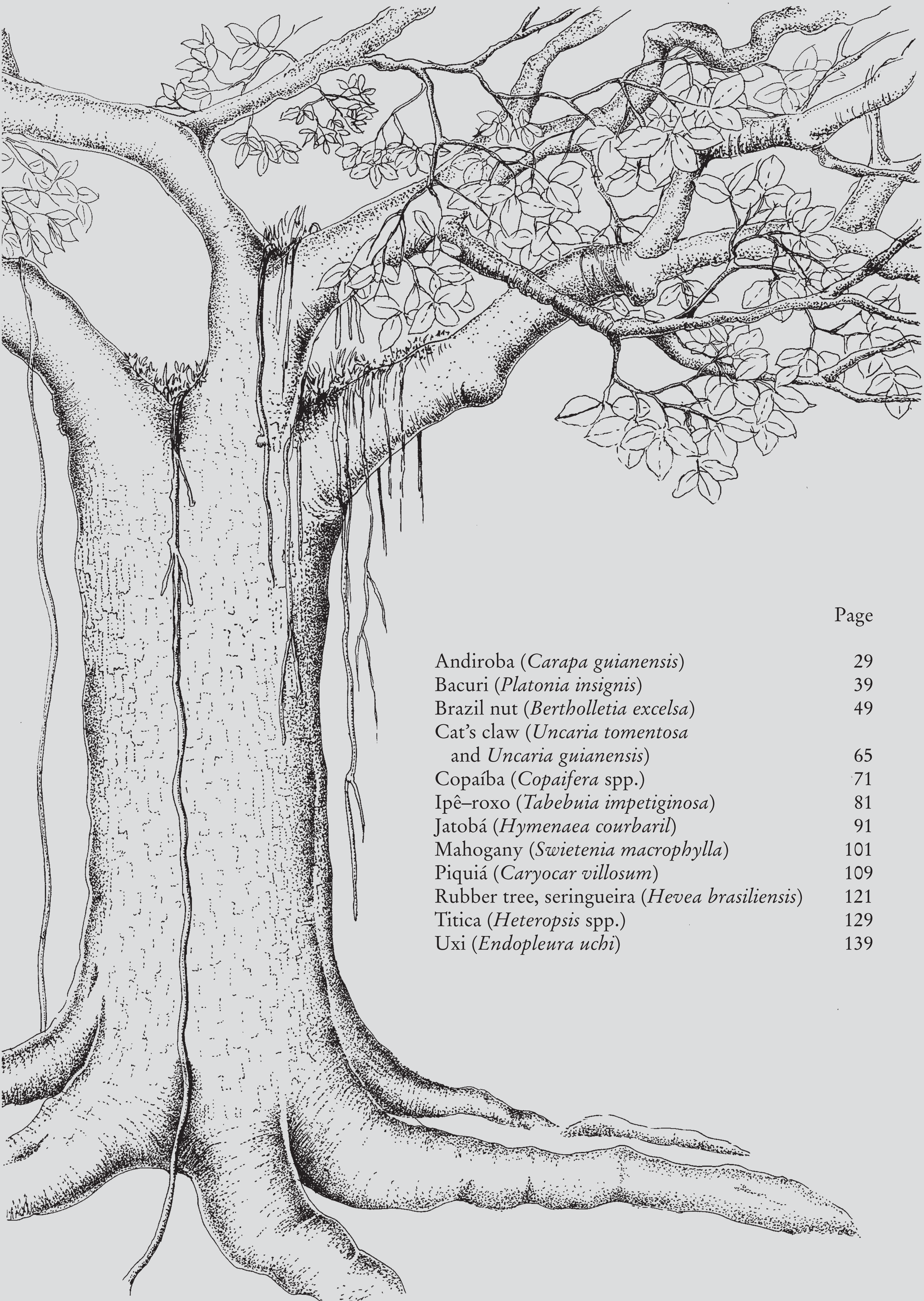
Along the nature trail, the red flags of the açaí sellers show where tired and hungry walkers can enjoy forest fruits. And if any enthusiastic visitors fall down running towards their beloved açaí, they can rub andiroba oil on the bump – it will feel better and the oil will reduce the swelling.



[1] Richmond, M., Robinson, C. & Sachs-Israel, M. 2008
[2] Credaro, A. 2004
[3] www.data360.org/dsg.aspx?Data_Set_Group_Id=59, June 11, 2008
[4] MacDonald, T. 2004

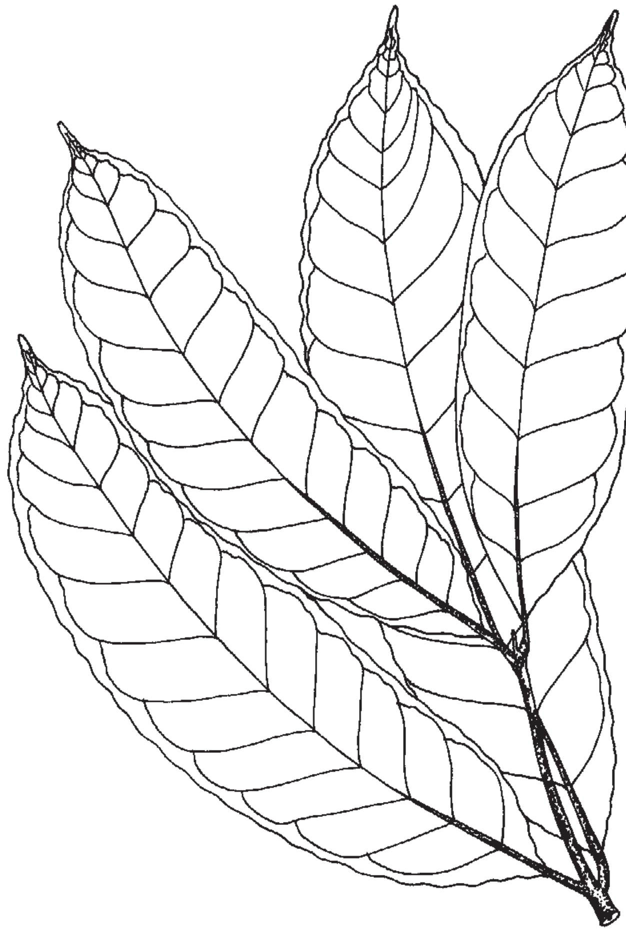
Trees and vines

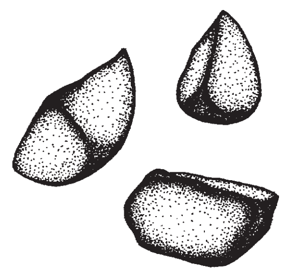




Andiroba

Carapa guianensis Aubl.





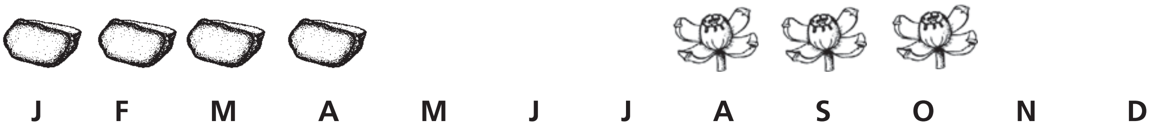
Patricia Shanley
Marina Londres

A powerful anti-inflammatory medicinal oil extracted from the seeds of andiroba is one of the most widely used natural remedies in the Amazon. Andiroba oil can mend badly sprained ankles, repel mosquitoes and is used in veterinary medicine to cure the infected cuts of animals. Indigenous groups in Brazil have traditionally painted their skin with a mixture of andiroba oil and the bright red pigment from the seeds of urucu (*Bixa orellana*). Andiroba is also valued for its bark and wood. The bark can be made into a tea to fight fevers, worms, bacteria and tumours. In addition to its lightness and durability, andiroba wood is bitter and oily, deterring attacks by termites and caterpillars. Because the deep, golden-hued wood is of superior quality, andiroba is considered on a par with mahogany. For this reason, andiroba is increasingly difficult to find in logged areas.

Andiroba trees have straight trunks that can reach 30 m in height, often with buttress roots. Growing throughout the Amazon basin, Central America and Africa, andiroba prefers seasonally flooded forests and the margins of rivers, but it is also found in terra firme forests.

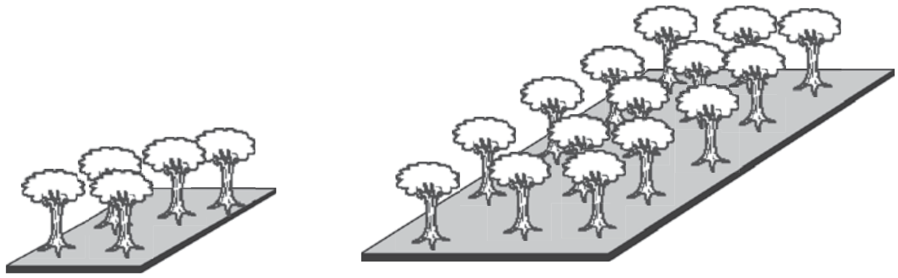
Ecology

Flower and fruit seasons



Andiroba's flowering and fruiting seasons vary by region. In eastern Pará, andiroba flowers from August through October, and its fruits mature from January through April. In Manaus, andiroba trees produce fruit between March and April.

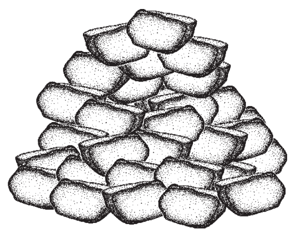
Density



1 to 8 trees/ha 5 to 38 trees/alqueire

Andiroba trees grow in terra firme forests, but they are most commonly found in várzea.

Production



**an average of
4–10 kg in várzea
0.3–3.4 kg in terra firme
of seed/tree/year**

The mysteries of andiroba fruit production are still unfolding. Some years a tree may bear hundreds of fruits, and others none at all, but the factors that drive this phenomenon remain unknown.[1] Likewise, we lack the long-term studies necessary to recognize patterns of fluctuation in production for an andiroba population, but one study observed three years of low fruit production followed by two years of plentiful production.[2] Moreover, every year there is a percentage of trees within a population that produces zero fruit, and these percentages also vary drastically between years. A study conducted in the Amazon estuary region[3] found that, for a given year, 23% of the adult andiroba trees did not produce any fruit, and a study in Acre[2] found that 82% of the trees did not produce in one year compared to 35% of the trees the following year. For those trees that do produce seeds in a given year, scientists have also measured very divergent levels of annual seed production: from as low as 0.02 kg of seed/tree to as high as over 100 kg of seed/tree. Although production among individual trees seems to be extremely variable, recent studies have reported that averages of fruit production (including adult non-producing trees) within a given population vary between 4.4 and 10 kg of seed/tree[3] in várzea and between 0.3 and 3.4 kg of seed/tree[2] in terra firme. Each kilogram contains about 55 seeds, and each fruit contains from 12 to 16 seeds. The seeds are composed of approximately 26% shell and 74% nut.

The table below shows some of the ranges in production numbers documented by researchers. Variation in production can be due to numerous biophysical factors such as whether the population occurs in várzea or terra firme. The methods used to determine production estimates in the following studies may differ, particularly the sample size and the number of years the study was conducted. It is important to emphasise that the ranges represent the amplitude (maximums and minimums) of production among individuals within a population. However, averages are the appropriate estimate to be used if managers are to extrapolate production from inventory data.

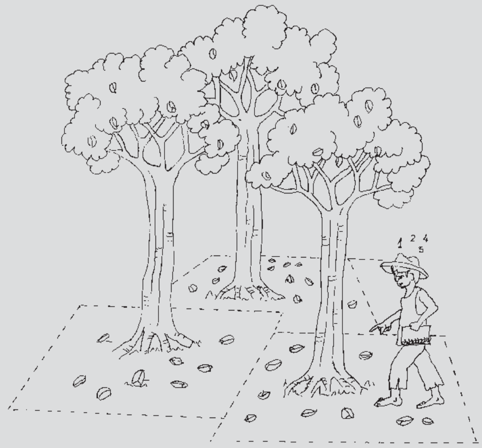
Location	**Habitat (may include different forest types within the "general" habitat)**	**Annual production/tree (note if average or range)**
La Selva, Costa Rica[1]	terra firme	Range of 750–3 900 seeds approx. 15–79 kg
Alto Rio Guama, Pará, Brazil[4]	terra firme	Average of 1.2 kg
Santarem, Pará, Brazil[5]	terra firme	Range of 0–50 kg
Gurupá, Pará, Brazil[3]	várzea	Average of 4.4–10 kg, Range of 0–155 kg
Acre, Brazil[2]	terra firme	Average of 0.3–3.4 kg, Range of 0–16 kg

How many fruit? A method to estimate production

André Dias

Scientists do not yet know the productivity of many species of tropical trees, even those, like andiroba, that have extensive markets and valuable uses. However, to make good use of forest resources it is important to know which trees are in a particular forest, where they are located and how much they can produce. In the community of Pedreira, Pará, a study was undertaken to estimate the average number of fruit an andiroba tree produces per year. Researchers counted all the andiroba trees in a given area and all the fruit that fell beneath a sample of 100 trees.

To estimate production rapidly, they grouped fruit productivity into categories from low to high. The results showed that 37 trees produced little or nothing; 43 trees produced up to 15 kg, 13 trees produced between 15 and 50 kg and 7 trees produced greater than 50 kg.[5] Extrapolating to the larger forest, the community calculated that their forest could produce a little over 1 200 kg of seeds/year. Thus they were able to estimate the labour required to produce the oil, as well as their potential annual earnings.



Economic value

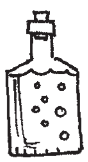
Andiroba oil is one of the most widely sold natural remedies in Amazonia. The oil industry has its origins in the city of Cametá, in the state of Pará, and its commercialization generates significant employment and income throughout Amazonia. In Cametá, children eagerly collect and sell andiroba seeds. Street kids relate that 4 kg fetch them US$0.10 – enough to buy a pack of crackers. In Salvaterra, on Marajó Island, which lies in the mouth of the Amazon River, unemployed men, women and children comb the beach for seeds washed down from inland rivers. In 2004, they could sell 1 kg, about 55 seeds, for US$0.07 to companies in São Paulo. In 2009 in the Belém market, 1 litre of andiroba oil cost, on average, US$6. Stores often buy the oil during the harvest when prices are low, hold on to the oil and sell it out of season at a higher price.

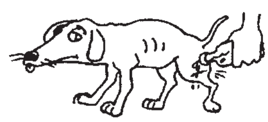
The oil is also in demand internationally and is exported to Europe and the United States of America. From 1974 to 1985, between 200 and 350 tonnes of oil were exported annually, mainly from the states of Maranhão, Pará and Amapá. In 2009, in the United States of America, an 8-oz bottle of andiroba oil can be purchased over the Internet for between US$23 and US$40.[6] One proof of andiroba's popularity is the number of soaps, creams, oils and candles made from andiroba on the market in the Amazon region and throughout the world. In the supermarkets of Belém, the soaps can cost from US$1.50 to US$5, while body oil (50 ml) costs US$3. A 150-g bag of andiroba bark costs US$1.

Whereas supermarkets, pharmacies and corner vendors sell andiroba in Belém, in the western Amazonian state of Acre andiroba oil is hard to find in the market: few communities in Acre produce andiroba oil, and those that do generally produce it for local consumption.

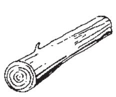
The wood from andiroba, called 'false' or 'bastard' mahogany, is also in high demand for export. In 2004, it could be found in Pará sawmills for US$68/$m^3$ sawn. For export, 1 m^3 did not sell for less than US$170. While in the United States of America, 20 board feet (0.05 m^3) of andiroba is sold for US$157.[7]

Uses





Oil: Andiroba oil is widely used as a medicine for bruises, sore throats, inflammation, arthritis and worms, as well as to help heal umbilical cords. In the countryside, andiroba is commonly applied on the skin to promote the growth of scar tissue and to repair skin damage. But one must use caution – it can create scar tissue on the surface before the internal wound has properly healed. The oil also works as an insect repellent and is an ingredient in soap production. Rubber tappers take advantage of andiroba oil for lamp fuel. Indians mix smelly andiroba oil with the bright red pigment from the seeds of urucu to paint their skin.



Wood: The wood is of excellent quality, a brilliant honey-brown in colour, and resistant to attacks from insects and caterpillars. Shingles are often made out of andiroba, and builders rely on it for civil construction.

Bark: Thick and bitter, the bark can be removed easily in large pieces. It is used to make tea to prevent fevers and worms, to fight bacteria and to treat tumours. Ground into powder, it can be used to treat wounds, skin ailments and to promote the growth of scar tissue.

"Remedy of the saints"

In Brazil, plants that are extremely effective at curing ills, such as garlic, copaiba and andiroba, may be called "santo remedio" or " remedy of the saints". Rubbing andiroba on serious injuries can speed recovery. Apart from helping a sprain or wound to heal, andiroba keeps mosquitoes and other insects from landing on the wound. The oil is also useful for animal injuries. Horses often develop serious saddle sores. Andiroba oil soothes and heals their skin and helps to promote hair growth.

Lost knowledge

In the community of Pedreira, Pará, one farmer noted, "In the 1940s there weren't more than eight houses here. We lived by hunting, selling andiroba oil, animal skins and breu resin (*Protium* spp.). In the 1950s we began to tap rubber, selling the latex of maçaranduba (*Manilkara* spp.). Now we produce farinha and work less in the forest. Today, the young don't even know how to extract andiroba oil. The trees are there, but they are going to waste."[5] In other regions, knowledge regarding the uses and ecology of plants and animals is not being passed on simply because the trees and wildlife no longer exist. When flora and fauna vanish from the local landscape, ecological knowledge of those species also fades.

Backwoods processing: the key to andiroba's curative power?

With a group of ecologists, Gloria Gaia, a forest farmer from the countryside, visited the Department of Chemical Engineering of the Federal University of Pará (UFPA). She and an esteemed phytochemist exchanged ideas about how to produce andiroba oil. She explained, "My mother left the seeds covered with green leaves for 30 days to ferment, then worked an additional week or two to extract the oil." Gesturing to the machines around him, the phytochemist swiftly replied, "Guess how much time it takes me using solvents and presses? Only one hour!" Sceptical, Gloria asked him if the chemical substances that cure people also occur in the rapidly produced oil. He responded that scientists do not yet know; but they have discovered that some of the components of the traditionally-produced, fermented oil do not appear in the swiftly-produced industrial oil. Might these components be responsible for the medicinal properties of the oil?

Traditional techniques for extracting oil

Gloria Gaia

There are many ways to extract andiroba oil. One process is referred to as making “board oil”. The oil made from this process is called virgin because it’s absolutely pure and of the best quality. Making “sun oil” is faster and less work-intensive. Both processes begin in the following way. Boil the seeds until they are soft. Break a few open and use your fingernails to test if the flesh is thick and oily, seeing if your nail can pass easily through it. Take the seeds out of the water, spread them on the ground, cover them with green leaves and let them sit for 40 days. After 40 days, open all the seeds with a knife and remove the flesh. Knead the pulp and make small balls. In Cametá, women first soften the pulp with their feet, and then later with their hands.

Board oil

Place the balls in a trough made of wood or metal, an old canoe, or two pieces of wood joined long-ways in a V shape, with one end of the trough leaning towards the ground. Place a fine strip of cotton from the edge of the pulp to the end of the inclined trough; this way, the oil will run directly from the trough into the container. Knead the pulp every day. After four to six days, the pulp will become hard and dry. To obtain more oil, place it in the sun. You can also use a *tipiti* (fibre sieve) to extract the remaining oil.

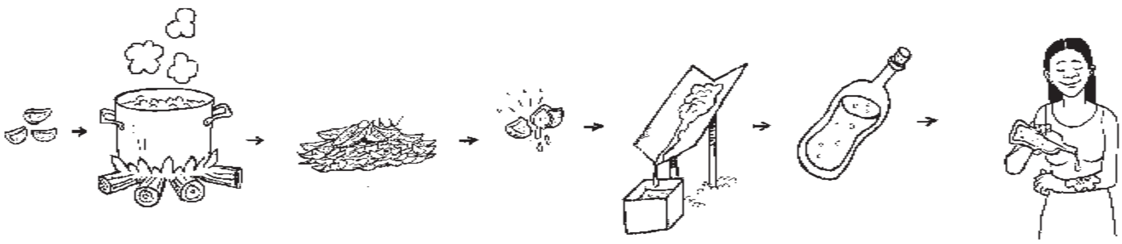
Sun oil

Leave the pulp in the sun for two days, turning it over every two hours throughout the day. At the end of the second afternoon, take the pulp inside and shape it into softball-sized balls. Place them on inclined boards to allow the oil to drip out. On the third day, heat the pulp in the sun again for three hours, and then place the pulp in a *tipiti* for two days to extract the rest of the oil. The sun process produces more oil, but many believe that some of the oil’s potency is lost. The dry pulp of the andiroba seeds can be used to make soap or tossed into the fire to repel mosquitoes.

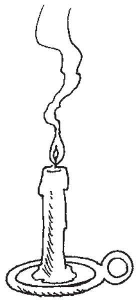
Variation in oil yields

André Dias

In Amazonia, production varies greatly depending on the mode of extraction. Production with the use of a press has been estimated at between 8 and 12 litres/40 kg of seeds.[8] Sometimes collectors do not have time to boil the seeds the day they are harvested, or they cannot retrieve the pulp before it starts to rain. Communities often extract the oil without a press, or with only a homemade sieve, and therefore produce less than by the industrial method. The table below compares production and summarizes how Dona Maria and Dona Rita from Santarém and Dona Glória from Cametá make the oil.



Dona Rita	Dona Marita	Dona Glória
40 kg of seeds were boiled 4 days after they were collected.	40 kg of seeds were boiled the same day they were collected.	40 kg of seeds were collected and stored in a container with water so as not to lose moisture, and then they were boiled.
The boiled seeds were stored in a sack for 26 days.	The boiled seeds were stored in a sack for 15 days.	The boiled seeds were covered and stored for between 30 and 40 days in a dark corner of the house.
The pulp that was removed from the seeds was placed in the sun the same day.	The pulp spent 5 days in the shade.	The pulp spent 3 days covered in a pan.
For 19 days the pulp stayed in the sun, was kneaded once in a while and kept out of the rain.	The pulp stayed in the sun for 14 days, was kneaded every day and was always kept out of the rain.	The pulp was kneaded and left in the sun for the oil to run out.
40 kg of seeds produced 1 litre of oil.	40 kg of seeds produced 3 litres of oil.	40 kg of seeds produced 4–5 litres of oil.



Mosquito repellent and dengue fever

Andiroba oil can be used as a repellent against gnats and mosquitoes. It also reduces inflammation caused by insect, snake and bat bites. Studies by the Amapá State Research Institute (IEPA) discovered that candles made from the dry remnants of andiroba seeds repelled the mosquito that carries dengue, *Aedes aegypti*.[9]

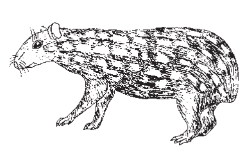
Women earn respect and income

The Tapajós National Forest has an abundance of andiroba and other NWFPs that sell briskly at good prices in local markets. Due to the richness of forest resources in their villages, a group of resourceful women from the communities of São Domingo, Nazaré and Pedreira decided to start an andiroba oil business together. To sell the oil legally, they had to surmount numerous legal and logistical obstacles. These included developing a management plan and securing permission from the Brazilian Environmental Protection Agency (IBAMA) to transport the oil. Through perseverance and hard work, the women's endeavour has met with success and enables them to contribute to their families' incomes while earning them respect among their peers. One of the secrets of the business's success is the participation of older women; it is only the elders that still know the best techniques for extracting andiroba oil.

Recipe for soap

Place 1 litre of andiroba oil in a pan to boil with 4 kg of melted cow tallow. Boil for 30 minutes and add 250 g of silicate or caustic soda if you have it. If you would like scented soap, try adding various fragrant herbs. Boil until thickened. Allow the mixture to cool and place in a mould. Finally, cut the soap into pieces and store. In the countryside, it is customary to add ashes from cacao shells mixed with water to the tallow and andiroba oil. This kind of soap is used to wash clothes, to clean itchy skin, or to treat skin infected with ringworm or fungal infections. To make the cacao ashes, simply burn the dry skins of the fruit. The best ash is white (very strong and acidic) and should be stored in a jar in a dry place.

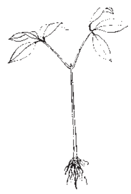
WILDLIFE



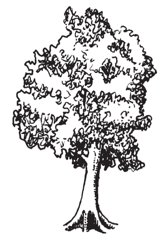
The bitter andiroba seeds are appreciated by paca and agouti. Just as squirrels collect and hoard acorns, agoutis sometimes eat the seeds beneath the trees; other times, they bury the seeds to eat later. Fortunately, they do not always remember where they hid them, and new trees spring up.

Management

germination
10 days



growth
1.6 m/year



production
10 years

Neuza Boufleuer and Cristina Lacerda

Andiroba has great potential for agroforestry because it produces both excellent wood and medicinal oil. Germination begins in the first six days and ends after two or three months with 85–90% of the seeds sprouted. Andiroba grows rapidly, even in degraded areas, both in sun and shade. For this reason, planting andiroba is a good way to enrich secondary forests and other degraded areas. But be careful with the seeds because rodents like to eat them. Although andiroba grows best in flooded forests, it can also be planted in terra firme. Scientists do not yet know if it is better to plant seedlings close together or spread apart, in full sun, in partial shade or in mostly shade. It seems that in the initial phase the trees grow well in the shade, but light is important for rapid development over time. When andiroba trees are in full sun, the trunks increase in diameter rather than gain height[8], and when they are close together, they are more susceptible to insect attacks.

Women for sustainability: rethinking timber vs. seed extraction

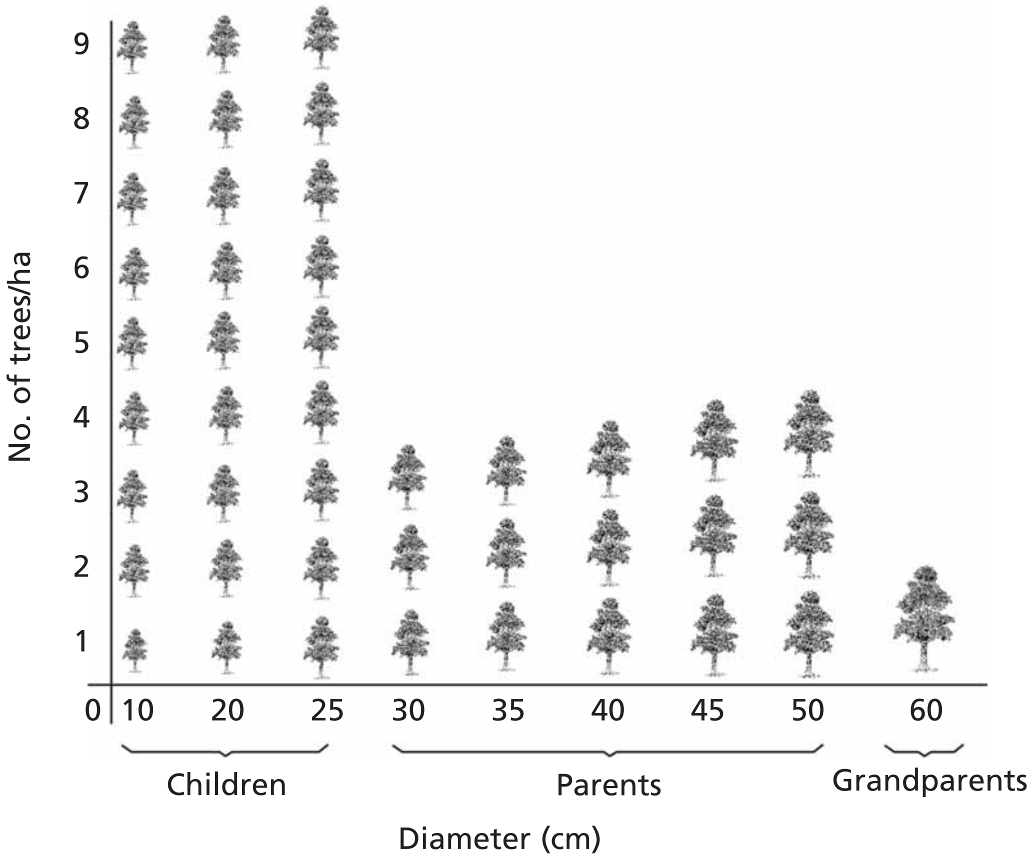
Carlos Augusto Ramos and Marina Londres

An extended family of healthy trees demonstrates a wide variety of ages, including many children, a number of parents and a few grandparents. This means that the family will continue to reproduce well into the future. When there is not a sufficient distribution of generations, the species could have difficulty maintaining the population.

One study in the São João do Jaburu community in Gurupá, Pará, illustrated that the andiroba population had many grandchildren, few parents and almost no grandparents. No trees over 60 cm diameter were found. Why? The locals had been accustomed to selling big trees for timber. Thus, many of reproductive trees were lost to the timber trade.

Through the initiative of village women, the communities are now rethinking their use of andiroba to focus on oil production. To ensure that seed collection did not further decimate the andiroba population, community members have been working together with ecologists[3] to count and monitor andiroba seed production. They fenced off the ground below the crowns of andiroba trees using nylon fishing nets and monitored the fruit fall weekly. From the 2006 monitoring results, it was possible to estimate the total seed production of andiroba populations within the community forest lands, and compare production with the total amount of seeds harvested by the community. The contrast was stark: the community was collecting less than 1% of the total seeds produced in the forest. This illustrated that the community can increase seed extraction and oil production without significantly affecting andiroba regeneration; increased oil production in turn promises to increase family incomes and improve the prospects of preserving both the community and its forests.

Where are our parents and grandparents?
Andiroba diameter classes



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[2] Klimas, C. 2010
[3] Londres, M. 2009
[4] Plowden 2004
[5] Dias A.S. 2001
[6] www.grasshuttreasures.com/amazonoils.html and www.rain-tree.com/andirobaprod.htm
[7] http://www.woodworkerssource.com/Andiroba.html, July 15, 2008
[8] Clay, J.W., Sampaio, P.d.T.B. & Clement, C.R. 1999
[9] O Liberal 1998

Bacuri

Platonia insignis Mart.

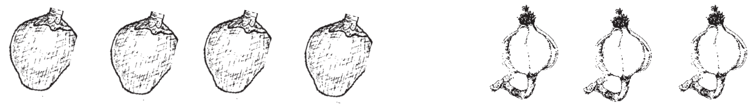
Patricia Shanley
José Edmar Urano Carvalho
Gabriel Medina
Socorro Ferreira

In the quiet, early morning hours before dawn, village children walk barefoot for kilometres to arrive at the base of bacuri trees. They brave the dark woods to beat their friends to the chase. Under the branches of these magnificent trees, they crack open the thick green rinds of the bacuri fruit to taste the soft white, aromatic flesh within, then carry home as many as they can. The popularity of the fruit has increased in cities as well, giving rise to a variety of products in the market, such as yoghurt, jam, liquor, cake and sweets. The name bacuri comes from the indigenous language Tupi-guarani, where "ba" means fall and "curi" means soon. Bacuri is the fruit which falls as soon as it ripens.

This beautiful tree can reach 15 to 25 m in height and 1.5 m in diameter, or almost 5 m around. It has a straight trunk, which exudes a yellow latex, and opposing branches that form a "V" that can be recognized from a distance. Its shiny leaves are opposed, and it has large, lovely flowers with pink petals. The bacuri tree is native to the state of Pará, and the area of greatest concentration is the estuary of the Amazon River, particularly in the Salgado region, and the island of Marajó.[1] It grows in the states of Maranhão, Piauí and other areas,[1] but rarely in western Amazonia.[2] Bacuri is also seen in parts of Colombia, Venezuela, Guyana, Suriname and French Guiana. Bacuri is found in primary forest but also occurs in secondary forest. Because it re-sprouts from the stump when felled and responds well to fire, it can regenerate in degraded areas of various soil types, except dry soils.

ECOLOGY

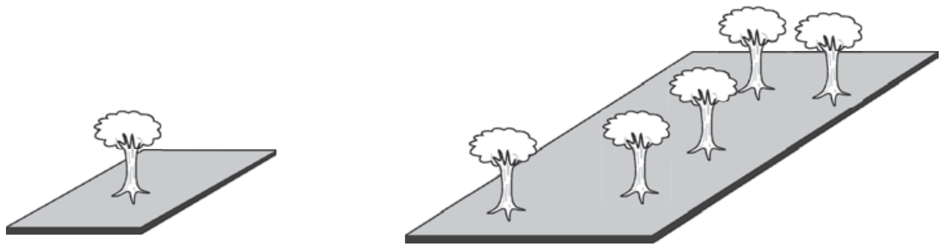
Flower and fruit seasons



J F M A M J J A S O N D

The bacuri flowers from June to August and appears in the markets of Belém during the rainy season, from January to April. Luckily, the timing of the harvest of this delicious fruit varies by region, prolonging its availability in the market. Early in the season, the island regions like Marajó supply Belém; later, the fruit is supplied by the Bragantina area. In recent years, collectors in the state of Maranhão are also supplying bacuri fruit to vendors in Belém.

Density



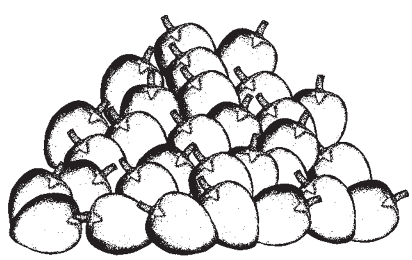
0.05–1.5 trees/ha **2–7 trees/alqueire**

Density varies from region to region. Bacuri occurs in low densities in primary forest, about one tree per hectare. In tall secondary forest of ten years or more, it is possible to find 1 800 bacuri saplings/ha.[3] The bacuri tree is fire resistant. Some say the more it is burned, the more it buds. If a bacuri tree is cut and burned in the process of preparing an agricultural field, various shoots emerge from the trunk and the roots. If these are protected, they will grow into trees, forming large bacuri stands.

Production

A bacuri tree can produce up to 2 000 fruits in a year, but the average is about 400. Many bacuri trees do not produce fruit every year; they rest from one year to the next. In a five-year study with a sample of 16 trees, an average of nine trees were productive per year.[4] Potentially, 50 trees in 1 hectare can produce:

9.5 tonnes of fruit
= 1 tonne of pulp
= 6 tonnes of peel
= 2.5 tonnes of seed, which can be used as animal feed[5]

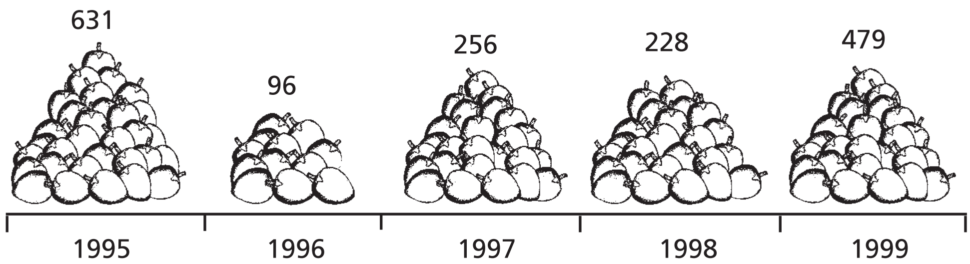


an average of 400 fruit/tree/year

The fruit normally has a thick rind and two seeds and is 10% pulp by weight. New research has discovered fruit without seeds, which have 18% pulp.[6] Some bacuri fruit with thin skins can have 28% pulp.[6]

How many fruits per year?

Because bacuri is so delicious, it is worth the effort to know exactly how many fruits the trees produce. Look at the average production of 16 trees over a five-year period:



Some people hit the tree with a machete, believing the impact will make the tree produce more. But be careful, this practice may only encourage the fruits to fall prematurely.

Economic value

According to one vendor, "Bacuri is turning to gold in the market"[4]. Recent prices reflect this popularity: in February 2003, in the Ver-o-Peso market, one bacuri fruit cost between US$0.10 and US$0.25 each, depending on its size. In 2008, the fruit ranged from US$0.30 to US$0.60. In January 2009, in the same market, bacuri cost from US$0.40 to US$0.65 each. One kilogram of pulp, which sold for US$2.60 in 2003, fetched US$5.90 in 2008. A sack with 100 fruit sold for from US$18 to US$41. In 2009, a chocolate filled with bacuri cost US$0.40. In 2003, a litre of Bacuri liquor cost US$4 in the supermarkets.

In February 2001, approximately 4 000 fruits/day were sold at the Bragança outdoor market alone.[3] That market increased threefold in five years. In the ten main open air markets in Belém, more than 491 000 bacuri fruits were sold in 2004, with 178 000 sold in the Ver-o-Peso market alone. The commercialization of bacuri generated more than US$74 800 in 2004. In one morning, more than 10 600 bacuris arrived at the Açaí Fair, coming from Soure and Ponta de Pedras on Marajó Island.

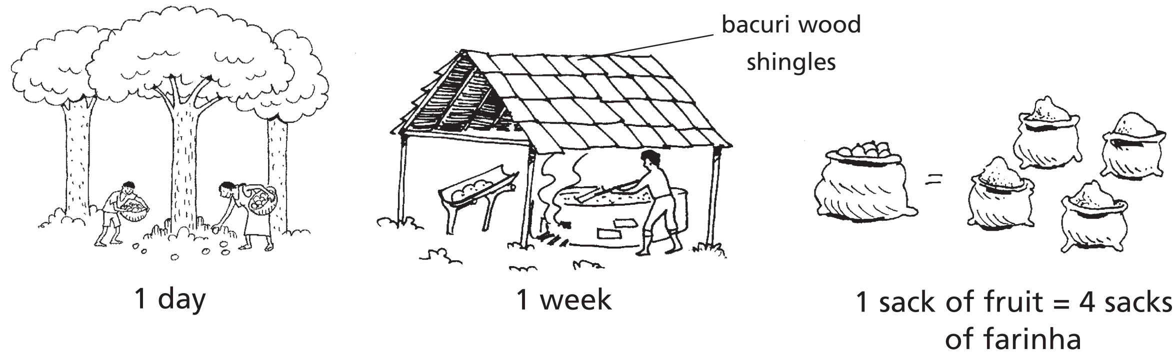
Bacuri is one of the most popular fruits in the wholesale markets of São Luís, Teresina and Belém.[7] Its sweet pulp is used in puddings, ice creams and juices. In areas close to markets, women, children and the elderly collect bacuri. Near Bragança, during the harvest, each collector earns approximately US$4 for three hours of work.[3]

Fruit or farinha?

During the 1995 harvest, when Curumim and Antonino from the Rio Capim region sold bacuri, one sack of fruit (150 to 200 pieces) was approximately equal to the value of four sacks of farinha. They estimated it took one day to collect US$40 worth of fruit (200 fruits at US$0.20 each).

To produce the same US$40 worth of farinha, it would have taken approximately one week. An advantage of marketing bacuri rather than other forest fruits is that its thick skin protects the pulp on the journey to the market, and the fruit stays good for up to seven days under the tree.

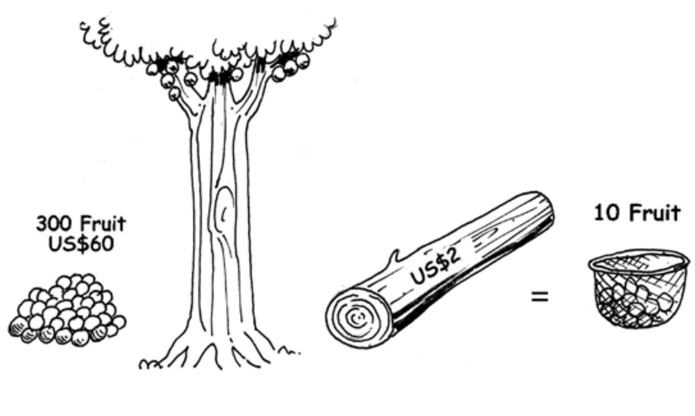
Labour for US$40 worth of bacuri and farinha



Fruit or wood?

Similarly, Curumi and Antonino compared the value of the fruits of the bacuri tree to the value of its wood. One tree trunk in the forests of some communities in this region of Pará was sold for US$2. In the same period, ten bacuri fruit were worth the same amount (ten fruit at US$0.20/fruit). Being hunters from Rio Capim, they thought about this. Their experience indicated that one bacuri tree produces an average of 400 fruits/year. They estimated that their families, the neighbours and the animals in the forest ate 100 of those, leaving approximately 300 fruit on the ground.

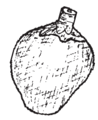
Curumi and Antonino decided to collect those fruit and send them to market. With about two days of labour, they were able to collect and sell the fruit. Even with the fluctuation of prices during the harvest, they earned US$40 for the 300 fruits from this one tree in one year. The sale of a tree for its wood can only be done once, but its fruit can be sold every year that the tree is productive. To earn the same money from lumber sales, they would



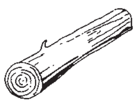
have to sell 20 trees. Curumi and Antonino understand that a standing tree is much more valuable to them than if it were sold to loggers or cut down to make way for agriculture.

Of course not everyone is able to sell his or her fruits. Many lack transport, are unable to secure a stand in the market, need to work in the fields or have an illness in the family. But even without selling a single fruit, it is important to remember the invisible profits from the bacuri tree. The fruit is an excellent source of nutrition for the whole family and can also be used to make liquor, juice and sweets.

USES



Fruit: The fruit pulp is used in juice, frozen crèmes , ice cream, jam, sweets, flan, cakes,  yoghurt,  frozen ice treats and liquor. In Belém, chefs are creating dishes incorporating bacuri, and businesses are canning pulp to sell to other states.



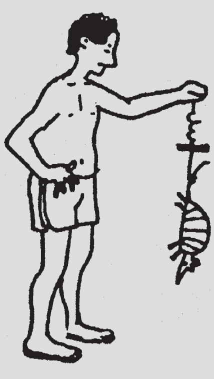
Wood: Bacuri wood is of excellent quality and is used in construction, in boatbuilding  and for making furniture. In the interior of Pará, the wood is used to make shingles.

Oil: Bacuri oil appears in soaps and is recommended by some to treat skin diseases and to heal cuts on animals.[8]

Latex: The yellow latex produced by the tree is used in a few regions to treat eczema, herpes and other skin problems.[8]

Invisible income

Leda Luz, Margaret Cymerys and Patricia Shanley



To measure the importance of the forest in the household economy, 30 families in three communities along the Capim River weighed all of the forest products they extracted during 1994. The results showed that over the course of one year the vines, game and fruit that an average family extracted were equivalent to 25% of their average annual income. Expert hunters catch game for their families with a value equivalent to half the average annual income. Buying fruit, fibres and meat would be exorbitantly expensive for many rural families whose main source of income is the sale of farinha and timber. The primary forest provided 85% of the vines, 87% of the fruits and 82% of the game extracted. It is advantageous that communities consider this invisible income before selling wood or forested land. Communities can negotiate with loggers to conserve areas of forest that have many useful tree species as well as conserving patches of forest which may serve as corridors for wildlife, linking them with other wooded areas. Villagers can also plan to preserve areas adjacent to the forests of neighbouring communities or ranchers allowing for a higher biodiversity throughout. With planning, it is possible to manage the forest to extract wood as well as fruit, vines, oil and game.

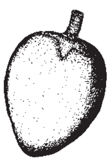
Nutrition

Bacuri pulp is an important source of minerals that can be eaten by growing children to strengthen their bones and teeth. It is high in fibre and provides some protein. Every 100 g of pulp offers 105 calories, more than cupuaçu and less than uxi and açaí, as well as 7.4 g of fibre, 33 mg of vitamin C, 20 mg of calcium, 1.9 g of protein, 36 mg of phosphorous and 2.2 mg of iron.[9]

A large percentage of a fruit's weight is its rind. Each fruit differs, but by weight: approximately 10–12% of the fruit is pulp, 18–26% is seed and the rest, rind (exocarp).[10,11] The rind also has a delicious flavour and with the proper preparation can be eaten. To make the bacuri rind palatable, it must be cooked to eliminate the heavy resin content. It also becomes more delicious when you mix in 20% to 30% pulp. There are a number of other recipes that are made with milk and sugar. Experiment!

Recipes

Bacuri rind marmalade



Peel six bacuris, remove the seeds and set the pulp aside. Wash and boil the peels until soft. Pour out the boiled peels into a colander and remove the outer skin. Mix in 250 g of sugar and 1 litre of water. Boil until it becomes syrupy. When the syrup begins to thicken, add the pulp. Continue boiling and stirring for 30 minutes, taking out any residue of resin. Turn off the flame when the mixture begins to pull away from the bottom of the pan.

Frozen crème of bacuri rind

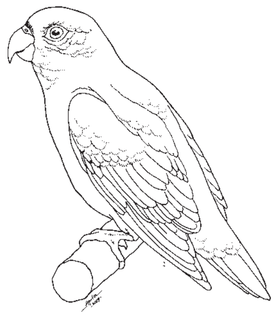
The bacuri rinds should be cut, washed and boiled until they are soft. Next, scrape the inner rind away from the outer skin with a spoon. For five or six rinds, mix in one can of condensed milk, one can of cream, ¼ cup of sugar and ¼ cup of pulp. Put the mixture in a glass cake pan and place it in the freezer. It will be ready to serve in about one hour.

Juice of bacuri peel

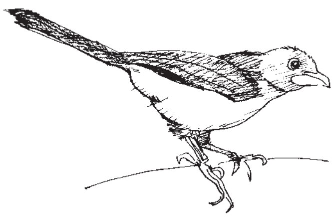
Grate the peel of three medium-sized bacuris. Let it soak in 1 litre of water for 24 hours. Strain the mixture. Add sugar and drink.

NOTE: Cooking oil can be used to remove the bacuri latex from pans and utensils.

Wildlife

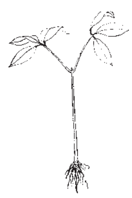


It is likely that fruit-eating animals enjoy the large bacuri fruit, but little research is available on its consumption by wildlife. Animals such as rodents and monkeys that are able to gnaw through the thick rind should be able to attain the sweet pulp inside. Bacuri is unique as it is one of the few trees in the neotropics known to be pollinated by large perched birds. Many trees in Amazonia are pollinated by hovering birds, like hummingbirds, but few have flowers designed to attract parrots. Bees enter bacuri flowers to collect pollen, but only birds such as the white-bellied parrots, and golden-winged parakeets successfully pollinate the flower.[12] Other birds observed pollinating bacuri fruits in central Amazonia include the white-eyed parakeet, yellow-rumped cacique, purple honeycreeper, silver-beaked tanager, blue-grey tanager and palm tanager.



Management

germination
1–2 years



growth
fast in the sun,
50 cm to 1 m/year

production
8–10 years

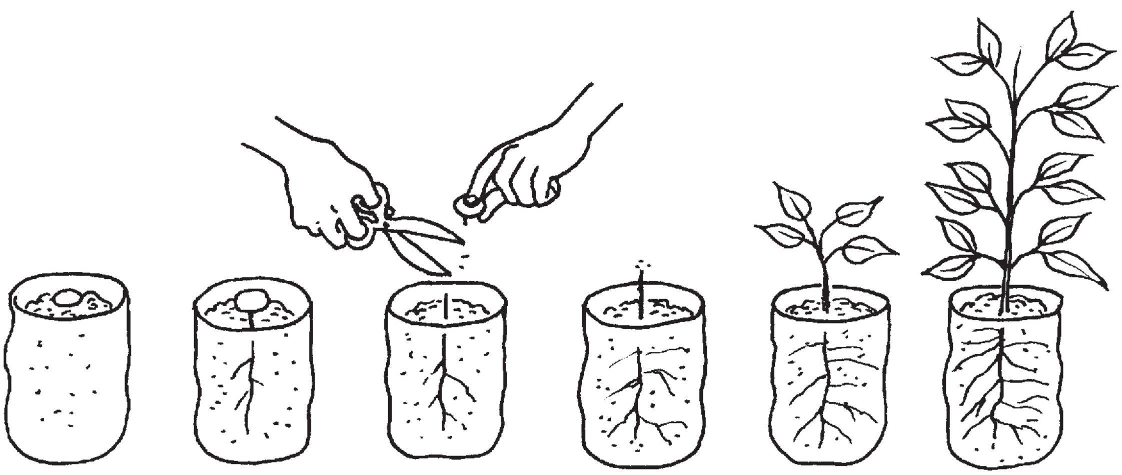
The bacuri is a tree with multiple uses (fruit, wood and resin) and a high economic value. As we have seen, it is more valuable standing than sold as timber. For this reason, bacuri trees should be preserved in their environment, as well as planted and managed in degraded areas. The bacuri tree grows well in poor soil, with best production in open areas with a lot of sun. Because of the high value of the fruit at the beginning and the end of the harvest, those who have trees that produce between seasons should maintain them carefully.[13]

In areas of secondary forest where bacuri sprouts easily from the roots of old trees, as is the case in the Bragantina region in Pará, farmers are implementing management plans. Taking advantage of the proximity of markets and the high price of the fruits, some farmers are reserving a few areas to grow bacuri trees. For example, in the community of Taquandeua, after harvesting manioc from their shifting cultivation plot, families let the forest grow back. After one year, bacuri trees dominate the area. The best trees are selected and maintained at a distance of 4–8 m between them, while the rest of the area is cut and farmed. After ten years of selective cutting, many families are already eating and selling bacuri from their managed plots.[3] In these areas, people only cut a bacuri tree in cases of extreme necessity.

Speed your seeds

If bacuri does not grow in your area on its own, you can plant it. You can do this in one of two ways: by planting the seeds, which take two years to germinate, or by planting grafts and sprouts that produce earlier. A good way to get sprouts quickly and cheaply is to plant a seed and wait 70 days for the roots to grow. Then cut the seed and leave the root in the ground. From the severed root, after two months, a small yellow sprout will grow, which requires a few more months to develop. You must wait about four or five months until the sprout reaches about 40 cm and is ready to be transplanted. A seed with a small piece of root can be used to form new sprouts. Just repeat the process. From one seed it is possible to obtain three or four sprouts. The recommended space for this planting is 10 x 10 m, reaching up to 115 plants/ha. Using this method you can have sprouts ready in less than one year.[14]

Be careful not to use seeds from the same tree. To produce, a bacuri tree needs a few birds, like the golden-winged parakeets, to bring the pollen of other bacuri trees that are a good match for it.[15] Scientists recommend that it is better to use fruits from up to ten different trees to avoid genetic incompatibility among the saplings, which can cause mature trees to be unproductive.



Other bacuris

Douglas C. Daly

Bacuri has many relatives. Normally they are small- or medium-sized trees that grow beneath the canopy in terra firme forest and have yellow bark and fruit. The pulp that surrounds the seeds is white, sweet, acidic and refreshing. Become familiar with the relatives of this favourite tree:

Species	Fruits	Occurrence	Adult tree size
Bacuripari liso *Garcinia (Rheedia) brasiliensis* Mart.	Yellow, round, approx. 3 or 4 cm in diameter, smooth, containing 1 to 3 seeds.	Primarily in flooded forest, most commonly in Central Amazonia, but also reaching as far as Bolivia, Paraguay, southwest Peru, Guyana, French Guiana and the Atlantic forest.	Small, between 5 and 8 m.
Bacuri, bacuripari *Garcinia (Rheedia) macrophylla* Mart.	Yellow, oval, from 6 to 8 cm in diameter, with a short stem on the end, smooth, with 4 seeds. Sold in many markets.	An ecologically flexible species, growing in terra firme forest, seasonally flooded forest, permanently flooded forest (*igapo*), and secondary forest. Probably native to Amazonia but with ample distribution in the northern region of South America. Widely cultivated.	Size varies, generally between 12 and 15 m.
Bacuri mirim *Garcinia (Rheedia) gardneriana* (Planch. & Triana) Zappi	Hanging, yellow, more or less oval with a long stem at the end, only 3 or 4 cm long in total, with 2 seeds.	In forests, distributed primarily in eastern Brazil, extending to the south of Pará, Minas Gerais, Matto Grosso, and Bolivia (Santa Cruz). The flavour is well liked, but it is considered only a snack because of its small size.	Small, from 5 to 8 m.
Bacuri de espinho *Garcinia madruno* (Kunth) B. Hammel	Sold on the streets of Santa Cruz de la Sierra in Bolivia, yellow, round or ovular, 5 to 6 cm in diameter, rough because it is covered in wrinkles, containing 1 to 3 seeds.	In terra firme forest, widely distributed in Amazonia. It can also be found in Central America, western parts of Venezuela (Barinas and Táchira), the Pacific coast of Colombia and Ecuador.	From 8 to 15 m.

[1] Calzavara, B.B.G. 1970 / Cavalcante, P. 1991
[2] Clay, J.W.C.; Sampaio, P.B. & Clement, C.R. 2000
[3] Medina, G. & Ferreira, S. 2004
[4] Shanley, P. 2000
[5] Villachica, H. 1996
[6] Carvalho, J.E.U., *et al.* 2002
[7] Souza, V.A.B., *et al.* 2000
[8] Braga, R. 1976
[9] http://www.hort.purdue.edu/newcrop/morton/bakuri.html
[10] Barbosa, W.C., Nazaré, R. F. R. & I. Nagata. 1979
[11] Cruz, P.E.N. *et al*. 1984
[12] Maués, M.M. & Venturieri, G.C. 1997
[13] Lima, M.d.C. (ed.). 2007
[14] Carvalho, J.E.U.; Nascimento, W.M.O. & Muller, C.H. 1999
[15] Maués, M.M. & Venturieri, G.C. 1996

Brazil nut

Bertholletia excelsa Bonpl.

The noblest trees in the forests of Tauaú were the Bertholletia, and one specimen was perhaps as large a tree as I have anywhere seen on the Amazon valley.

R. Spruce 1853

Karen Kainer, Margaret Cymerys,
Lúcia Wadt, Valdirene Argolo

The Brazil nut tree – valued for its nutritious nuts and for the herbal medicines made from other parts of the tree – is so essential to the livelihoods of Brazilians that it is a felony in Brazil to cut one down. Brazil nuts are one of the few internationally marketed rain forest products that are harvested primarily from wild trees. The large fruit fall more than 40 m from the top of these giants rising out of the Amazon forest. The fruit contain 10–25 nuts (which are botanically classified as seeds) that have long been noted for their vegetable protein content. More recently, Brazil nuts have been identified as an excellent source of selenium, which helps to fight cancer, boost the immune system and enhance general well-being by reducing anxiety and lifting energy levels, confidence and mood.

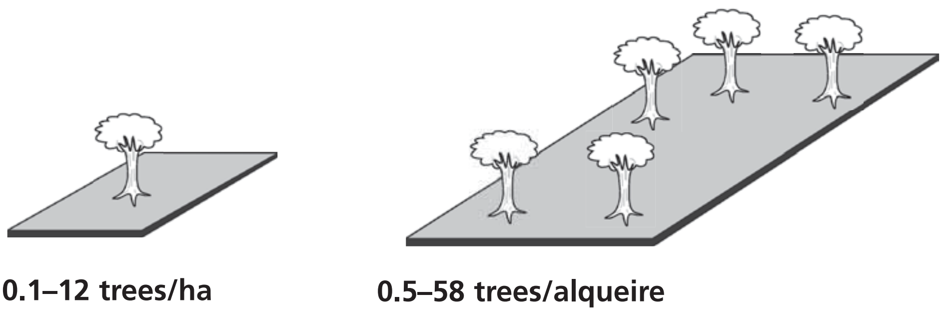
The Brazil nut and the piquiá are akin in that they possess the most massive trunks of all the trees in Amazonia. In Pará, there is one Brazil nut tree with a trunk over 15 m in circumference.[1] Brazil nut trees occur in terra firme Amazonian forests in Colombia, Venezuela, Peru, Brazil and Bolivia, as well as in parts of Guyana.[2] In Acre, they are found only in the eastern portion of the state but remain a species of utmost importance for local people in that region.

Ecology

Flower and fruit seasons

In Acre, flowers of the Brazil nut tree begin to open at the end of the dry season, when the fruits from the previous season are almost ready to fall. The flowers appear from October to December, and the fruits mature in 14–15 months, falling from December to February. In Pará, the flowers appear from September through February, and the fruits fall from January to April.

Density



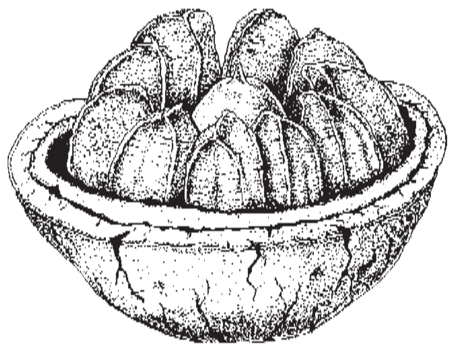
Brazil nut trees may occur in stands called *castanhais* or *bolas,* sometimes separated by kilometres of forest with no Brazil nut trees. A study of over 20 sites across the Amazon basin revealed widely varying densities, from 0.1 trees/ha in sites at the edge of the Brazil nut range in Madre de Dios, Peru, to 12 trees/ha in Amapá, Brazil.[3] Densities between 1.3 and 4.0 trees/ha were found in the Chico Mendes Extractive Reserve in Acre.[4] A study in southeastern Amazonia found 1.7 reproductive trees/ha.[5] In the National Forest of Caxuanã there are from 10 to 12 Brazil nut trees/ha and in Trombetas, from 0 to 15 trees/ha. A study in the Bolivian Amazon found densities of 1 to 5 adult trees/ha.[6]

Production

Brazil nut trees have extremely hard-shelled woody fruits the size of a grapefruit that encase 10–25 nuts. It is difficult to estimate the average production of a Brazil nut tree because the number of fruits produced varies greatly from year to year. Production is related to the size of the tree. But this is not a firm rule, as some large trees do not produce any fruit at all.

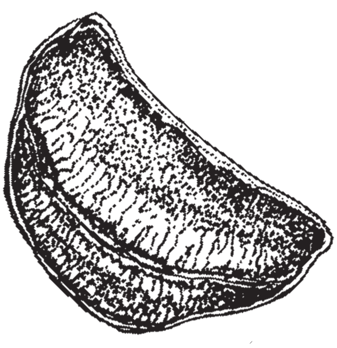
Fruit production varies between trees, with some producing zero and some up to 2 000/tree.[7] A study in southeastern Amazonia found 103 to 270 fruit/tree and a mean of 17 nuts/fruit.[5] Another study at three sites in eastern Amazonia determined a fruit production of 63–216/tree.[8] In addition, one study of 140 large trees (larger than 50 cm dbh) found that in any given year approximately 25% of the trees produced 75% of the nuts from these stands.[9] Until the end of the 20th century, Brazil was almost the exclusive producer of Brazil nuts in the world. Bolivia has since edged ahead of Brazil to become the world's largest Brazil nut producer.[10]

Economic value

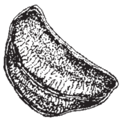


In 2008, harvesters in Acre were paid US$5.90 for a can of Brazil nuts (11 kg). This value has fluctuated considerably over the past decade, from a low of US$1.20 in 2001 to a high of US$7.40 in 2005. In 2007, Brazil produced more than 30 000 tonnes of Brazil nuts for sale, generating over US$23 million.[11] Brazil nuts can be purchased in the markets of Rio Branco, the capital of Acre, for US$2.70 for a 250-g package. In Belém, in 2009, a litre of shelled Brazil nuts sold for US$4.20 and unshelled for US$1.30. Brazil nut oil is being used in the production of shampoos, facial masks and other health and beauty products in Brazil, as well as by international companies. A 100 ml bottle of Brazil nut oil can be purchased on the Internet for about US$9.[12]

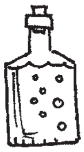
The rich and fragrant Brazil nut is immensely popular in England and the United States of America, and almost all of the Brazil nut production is exported to satisfy those markets. However, data from the Brazilian Minister of Development, Industry and Commerce show that exports have been falling since the 1970s, though not necessarily because the nuts have diminished in popularity. In 1998, European regulation reduced the acceptable level of toxic substances (aflatoxins) produced by fungi that contaminate Brazil nuts. This change disrupted global commerce of the nut.[13] In July 2003, the European Union shut its doors to the trade of the Brazil nut in its shell. Removing the shells is a meticulous process that adds significant time and expense to Brazil nut production, making it a less viable source of income for many harvesters in Brazil. Since the 1960s, it is estimated that the international export of Brazil nuts from the Amazon is between US$18 million and US$126 million/year.[14] However, more importantly, the collection, processing and sale of Brazil nuts generate money and jobs for thousands of Amazonian families.



Uses

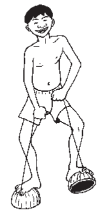


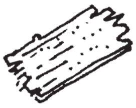
Nut: Brazil nuts are usually shelled and eaten fresh, but they also appear in  sweets and  ice cream. They can be made into a sweet spread, ground into  flour, or used as "milk" to season food.



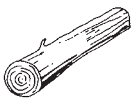
Oil: Brazil nut oil appears in  soap,  creams and  shampoo.

Fruit: The hard shell of the fruit is used to make crafts and toys. It also serves as a medicine and for making coal. Because of its shape, it can act as a mortar and pestle or be used as a bowl to collect latex.





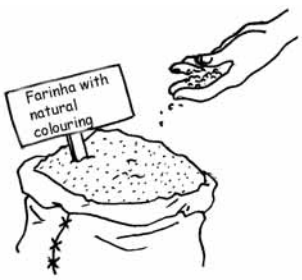
Bark: The bark can be made into tea, which is used as a medicine for diarrhoea.



Wood: Although historically used for fence posts and construction, the wood is now rarely used because it is illegal to fell Brazil nut trees.

Healthy farinha and purified water

Lênio José Guerreiro de Faria



In Asia, people look forward to the steaming bowls of rice that accompany every meal. In Amazonia, a meal is not a meal without farinha, a coarse and fragrant flour made from manioc root. Rural and urban Amazonians alike eat several cups of farinha daily. When choosing from the dozens of sacks of farinha produced both industrially and by local farmers, customers consider texture and colour to be the most important signs of quality. Most urban consumers prefer yellow farinha to the traditional white, and some businesses add artificial dyes to make the flour more appealing. However, these chemical additives have caused serious allergies, especially in children. The problem became urgent enough that the Laboratory of Chemical Engineering of the Federal University of Pará (UFPA) began studies on potential natural colourings. University researchers discovered that curcuma of the ginger family, is an excellent colouring, but it has an odour and a flavour that do not combine well with farinha. They persevered and discovered that charcoal made from the Brazil nut fruit shell is extremely effective in removing the flavour and odour of curcuma. Picking up on this idea, a researcher from the University of French Guiana visited UFPA to see if and how charcoal from Brazil nut shells could be used to purify water in rural areas. They discovered that 1 g of charcoal made from the large Brazil nut fruit can cover a surface area of 250 m^2, and like a giant sponge, absorb most impurities, leaving the water remarkably clean.[15]

A luxury product

Virgin Brazil nut oil, produced in Amapá, is being exported to Europe, where it is available in Parisian supermarkets. The oil has the advantage of being rich in selenium. Brazil nut oil from Laranjal do Jari in Acre is being sold with a "green seal", as it is made by a traditional population in a protected area.

Selenium: a miracle mineral

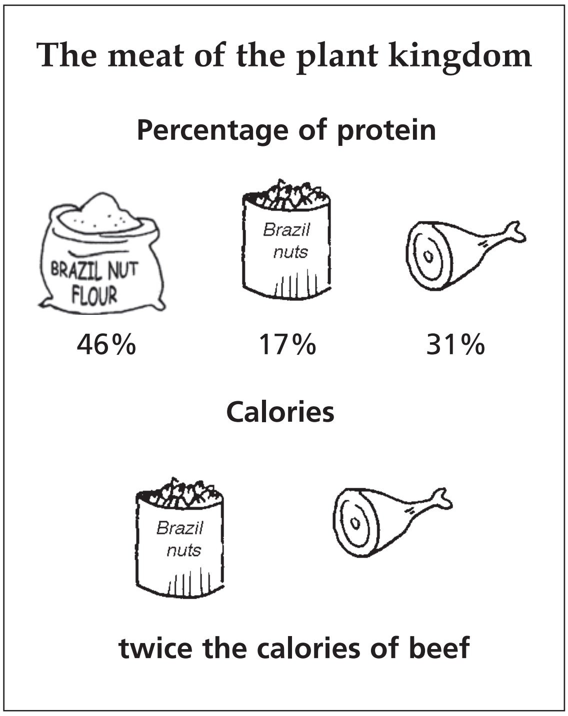
An increasing number of people in Western society suffer from cancer as well as from stress-related disorders such as anxiety, fatigue, depression and memory loss. Eat Brazil nuts! Studies recently conducted in the United States of America and Europe showed that Brazil nuts contain selenium, a trace mineral that has the power to prevent cancer and combat certain viruses.[16] In addition, this mineral provides energy, lifts the spirit and reduces the chances of catching common, chronic illnesses.

Studies show that bad moods are sometimes linked to a low level of selenium in the body and that consumption can contribute to boosting confidence. Selenium proteins have also been discovered to be an important source of antioxidants. Oxidization has a role in premature aging, Parkinson's disease and Alzheimer's disease.[17] The quantity of selenium in the Brazil nut is linked to the presence of this mineral in the soil. Due to lower concentrations of selenium in the soils of Acre, the Brazil nuts from that state reflect slightly lower levels of selenium. Brazil nut trees do not grow in North America and Europe, and research indicates that American diets contain only 20% of the recommended daily dose of selenium.

To ensure that you are getting enough selenium in your diet, doctors recommend a 200 mcg selenium supplement per day, the equivalent of about two shelled Brazil nuts. Because the nuts lose up to 75% of their selenium content after they are shelled, it is best to eat them immediately after removing their shells. But do not get carried away, because eating more than 25 nuts/day is considered to be unhealthy. If Brazil nuts are hard for you to find, another delicious food that strengthens the body, prevents many diseases, combats cancer and is a good source of selenium is garlic. Eating two or three cloves/ day has tremendous health benefits.

Nutrition

Rich in protein, vitamins, minerals and calories, the Brazil nut is considered the meat of the plant kingdom. The nuts are from 12% to 17% complete protein with all the essential amino acids. The flour made by grinding the nuts is approximately 46% protein, with no fat.[18] In comparison, beef is 26% to 31% protein. The Brazil nut has about half of the protein content of beef and twice as many calories. It has almost as much protein as cow's milk, and provides complete amino acid content. Brazil nut "milk" is delicious, and you can use it as a substitute for cow's milk in cooking. To make the milk, simply grate the nuts and add water, squeezing the mixture through a cheesecloth or strainer. Brazil nuts contain minerals, such as phosphorous and potassium, and vitamin B. In addition, 100 g of Brazil nuts comprises 61 g of fat, 2.8 mg of iron, 180 mg of calcium and 4.2 mg of zinc. The Brazil nut also has great quantities of the amino acid methionine, which is considered by some nutritionists to be one of the elements most lacking in Amazonian diets.[19]

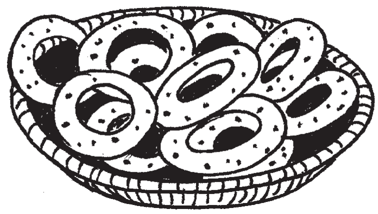


Recipes

Brazil nut sweet biscuits by the famous Brazilian cook Maria Cosson

Ingredients:
- 2 cups of grated Brazil nuts
- 4 cups of flour
- 1½ cups cornstarch
- 2¼ cups butter
- 1 cup of sugar

Preparation:
Mix all of the ingredients until the dough is firm. Roll out the dough with a rolling pin and cut the biscuits into the desired shapes. Dust the biscuits with flour before baking at 350 °F for 12–15 minutes.

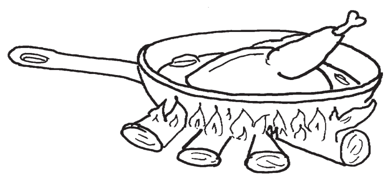


Chicken in Brazil nut milk

Ingredients:

- 4 teaspoons of butter or oil
- 1 whole chicken
- juice of 1 lemon
- 1 tomato, peeled, chopped
- 1 onion, chopped
- 1 bunch of cilantro
- chili pepper, garlic and salt to taste
- Brazil nut milk using 1 cup of grated Brazil nuts

Preparation:
Cut the chicken in pieces and season with salt and garlic. In a pan, sauté the onions, tomatoes, cilantro, lemon juice and chili pepper in the butter or oil. Add the chicken and let it simmer. Next, remove the chicken from the pan and allow it to cool. Remove the bones from the chicken and cut the meat into large pieces. Add the nut milk to the broth remaining in the pan and mix in the chicken pieces.



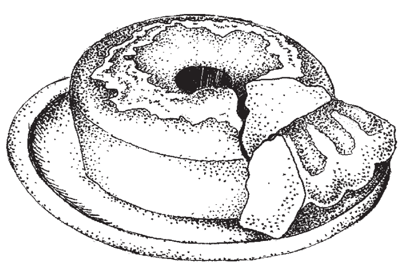
To make Brazil nut milk: grate the nuts or pound them with a mortar and pestle. Next, place the grated nuts in a pan with a little hot water and mix well. Squeeze the mixture through a cheese cloth or a strainer to extract the milk. The remaining Brazil nut pulp can be used as animal feed.

Marajó cake

Ingredients:

- 2 cups of sugar
- 1 cup of butter
- 4 eggs
- 1 cup of grated Brazil nuts
- 1 cup of condensed milk (with a little water)
- 1 cup of flour

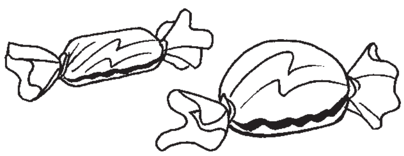
Preparation:
Cream the butter and sugar, add the eggs and continue to mix until smooth. Stir in the grated Brazil nuts and the condensed milk and mix. Then add in the flour and stir well. Pour the mixture into a cake mould and bake in the oven.



Cupuaçu and Brazil nut bonbons

Ingredients:
- 1 large cupuaçu
- 1 kg of sugar
- 1 plate full of grated Brazil nuts
- 1 plate of chopped Brazil nuts toasted in a pan with butter to taste

Preparation:
Remove the cupuaçu pulp from the shell and cut the pulp away from the seeds with scissors. Place the pulp in a pan with water and bake it to reduce the acidity. Rinse the pulp in a colander. Mix the cupuaçu, sugar and grated Brazil nuts in a pan and place over a flame. Allow it to simmer until the mixture pulls away from the bottom of the pan. Spread the mixture on a greased baking sheet or carving board. Sprinkle the toasted Brazil nut pieces over the mixture and roll it into short sticks. Wrap in coloured cellophane or aluminium foil.



Beautiful hair

For silky smooth hair, mix one cup of Brazil nut oil with one cup of honey and one egg yolk. Apply to clean hair and rinse after a few minutes.[5]

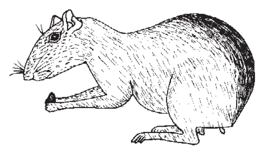
Treatments for hepatitis and morning sickness

In various regions of Amazonia, the Brazil nut fruit shell is considered to be an effective remedy for hepatitis, anaemia and intestinal problems. A large fruit is thoroughly cleaned and filtered water placed in its centre to soak for two or three hours, or until the water becomes blood-coloured. The water is drunk daily, like a tea, until symptoms subside. Some pregnant women beleaguered with morning sickness state that eating one or two Brazil nuts/day alleviates their symptoms.

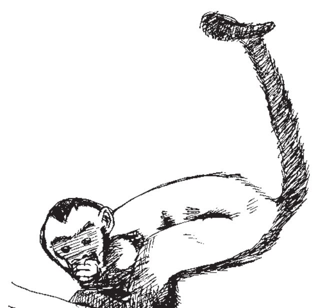
Wildlife

Agouti, monkey and frog

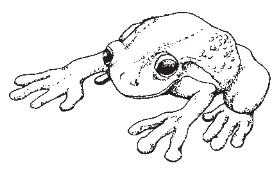
The Brazil nut tree demonstrates the important links between plants and animals in an intact rain forest. For example, there are two species of poisonous frogs (*Dendrobates castaneoticus*, *Dendrobates quinquevittatus*) that almost exclusively use the rain-filled hollow of Brazil nut fruits for their tadpoles.[21] The Brazil nut flower has a closed hood and is pollinated efficiently only by large-bodied bees capable of pushing open the hood and entering the flower.[2] These bees of the genera *Bombus*, *Centris*, *Epicharis*, *Eulaema*, and *Xylocopa* live in the closed forest. A recent decline in Brazil nut production has been linked to pollination deficiency, possibly owing to the smoke from forest fires reducing bee abundance or to the reluctance of some bees to visit fragmented landscapes.[7] The creamy, pale yellow flowers are also a favoured food of paca, peccary, armadillo and deer. Hunters often build platforms near Brazil nut trees, where they wait for game to come and devour the thousands of meaty flowers scattered on the forest floor.



The agouti is a true friend of the Brazil nut as it is one of the only animals able to gnaw through the thick, hard husk of the Brazil nut fruit to reach the nuts inside. Primarily the agouti, but occasionally squirrels disperse Brazil nuts throughout the forest. The agouti scatter-hoards the seeds up to 1 km away from the mother tree, burying and reburying them at depths of 1–2 cm to dig up and eat during the leaner times between fruit seasons.[7] Like squirrels, the agoutis may forget some of their buried seeds, allowing the seeds to germinate. Given their key role in dispersing seeds, it is important not to overhunt agoutis, so that there is no shortage of Brazil nut trees in the future. Scientists think that both the work of agoutis and the work of people following indigenous management practices have been responsible for creating high concentrations of Brazil nut trees in certain areas.[22]



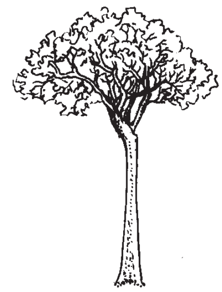
Rubber tappers in Acre say that capuchin monkeys have also figured out how to open Brazil nut fruits when time has softened their hard husks. The monkeys blow into the small opening of the pod and then beat it on a branch until it breaks. But the monkey often loses out to clever friends waiting below, who are quick to grab any nuts that may fall. A monkey may also try to retrieve the fruit with his hand, but the opening is so small that its hand can be injured. Older monkeys have learned to delicately remove the seeds with a finger tip, one at a time. They say that observations of this practice led to the proverb: "An old monkey never places his hand inside a gourd."



Management

germination
12–18 months
5½–6½ months with treatment

growth
0.9 cm in
diameter/year



production
50 cm dbh

Brazil nut trees live many years; three large trees were carbon dated to be more than 650 years old.[23] The late Murça Pires, distinguished botanist from the Goeldi Museum in Belém, thought that the Brazil nut tree could possibly live for 1 000 years or more. But lately some researchers have expressed concern that there are not enough young trees. One study of the Amazon basin reported that young Brazil nut trees were limited or non-existent in some sites where the Brazil nuts had experienced decades of heavy harvest.[3] Another study at three sites in Acre found that all sites had sufficient seedlings and young trees to maintain the population given current nut harvest levels.[24] Similarly, a study at two sites in Bolivia found reasonable seedling densities despite the areas experiencing heavy Brazil nut harvest for several decades.[6] Monitoring to make sure there are enough young trees coming up in the forest to maintain future generations is always a good idea.

How might Brazil nut harvesters increase their production? One option is to plant seedlings. A study of Brazil nut trees in Acre compared their survival and growth in forest clearings (where they grow naturally), in shifting cultivation plots and in pastures.[25] These three potential sites for planting Brazil nut trees were all surrounded by a larger landscape of relatively undisturbed forest. Results illustrate that Brazil nut trees do well in forest clearings, although their growth is slow. Pastures offer all the conditions needed for the Brazil nut tree to grow well, including full sun; however, it takes a lot of work to construct protective fences and clear away weeds. This study showed that the best place to grow Brazil nuts in the rubber tapper communities is in their shifting cultivation plots, planted together with rice and corn, before the plots become secondary forest. This way they grow rapidly and it is not necessary to do a lot of work to keep the area weed-free. Brazil nut trees can grow at least 1 m/year in height. In general, several years after abandonment of shifting cultivation plots, higher densities of seedlings and saplings are present,[26] making these types of secondary forests efficient sites to tend naturally regenerating Brazil nut seedlings to increase productive densities in the long term.

Colonists, mostly migrant farmer families from Southern Brazil, in the Reca Project on the frontiers of Acre and Rondônia states, have also had success planting Brazil nuts in agroforest systems. But it is critical to have some forest nearby so that the trees can be pollinated and produce fruits. Brazil nut trees planted in fields far from forests probably will not produce. Old Brazil nut plantations do not give fruits, possibly because the large bees that pollinate the trees need areas of forest to survive, or perhaps because the trees in these plantations are of similar genetic material, precluding necessary cross-pollination.

Breaking seed dormancy

Brazil nuts have a few germination secrets. The seeds, which we commonly refer to as nuts, have a dormancy period such that they will not germinate just after the fruit falls from the tree. One way to shorten the dormant period is to collect newly fallen nuts and store them in a container with moist sand.[25] Always keep the container in a dry, shady spot, with good air circulation. After five months, extract the seeds from their seed coats (which are now soft and loose), throwing out any seeds that have been damaged. Sow the seeds in a spot where they will not be attacked by ants or rats. In two weeks some will begin to germinate; the majority will germinate within six weeks. Transplant the newly germinated seedlings into plastic planting bags or in a home nursery. After they have reached 25 cm, or grown 16 leaves, plant them permanently in a sunny spot.[27] Brazil nut trees can grow quickly with sufficient sun and are able to reach reproductive size, generally 40–50 cm dbh, in 10–12 years. Trees growing in the forest under lower light conditions generally will take 60-70 years to reproduce. In Bolivia, the age of first reproduction was estimated at 120 years and emergent trees that receive greater sunlight had the highest reproductive percentage.[6]

Why plant Brazil nut trees?

Johannes van Leeuwen

In addition to nuts, Brazil nut trees also supply high-quality wood. The law allows only specially planted Brazil nut trees to be cut for timber. Many species like piquiá and ipê do not grow straight when they are planted out in the open, and when they are planted in groups they are susceptible to illness. However, Brazil nut trees grow straight and rapidly in plantations. Until they are ready to be planted, care must be taken that the saplings are not dug up by agoutis or rats.

It is best to plant the Brazil nut tree seedlings on a rainy day. If they do not get enough rain, the saplings will drop all their leaves. And when it is not possible to make a deep hole, cut the last bit of the root. The Brazil nut root will quickly grow deep into the soil, which is why it is called a pivotal root. The root should never be allowed to double over in the plantation as the deep root prevents the tree from being blown over by the wind when it grows tall.

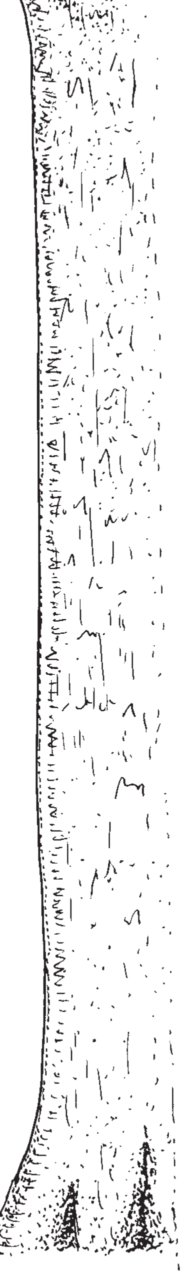
Brazil nut cemetery

Alfredo Kingo Oyama Homma

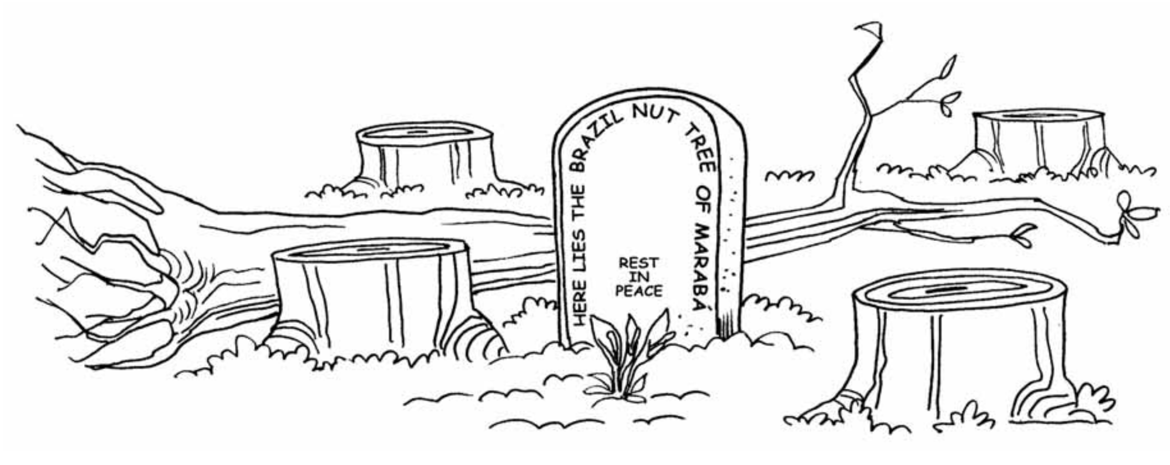
About 100 years ago, when world rubber prices fell, Brazil nut production came to be the most important economic activity in the region of Marabá in southeastern Pará. For a period of 60 years, Brazil nut trees were maintained and helped to sustain thousands of families.[28] But in the past 30 years, thousands of 100-year-old Brazil nut trees have disappeared from the Marabá region.

In the 1970s, based on the principle that cattle were worth more than the standing forest, the government began to support cattle ranching. To promote development in the north of Brazil, highways like the Belém-Brasília, the PA-150, the BR 222 and the Trans-Amazon were constructed, in addition to hydroelectric projects like Tucuruí. During this time, ranchers and land speculators poured into the North, even to remote areas. Their presence initiated a wave of deforestation, with agriculture and pasture replacing a significant amount of primary forests throughout Amazonia.

As the profits from ranching declined and governmental incentives waned, a new phase of natural resource exploitation began. Two kinds of gold were discovered: yellow gold of the Mineral Province of Carajás and "green gold", or timber (first mahogany, then other species, such as the Brazil nut). As a result, by 1997, 70% of the areas that had once been home to Brazil nut trees in southeastern Pará were deforested. Both living and dead trees have been cut down for their wood, resulting in the near-extinction of the species in the region, creating "Brazil nut cemeteries".[29]



The destruction of the Brazil nut trees in southeastern Pará illustrates the conflict between public policies and smallholder needs. Allotted only 50 hectares or less of land, farmers discovered that the income from extracting Brazil nuts and cupuaçu fruits is less in the short term than the income produced by farming and ranching. Colonists who had previously been able to plant one portion of their lands and leave the other forested, determined that, given only 50 hectares, clear-cutting made the most short-term economic sense.[30]



Brazil nuts: managed by Indians?

Rafael P. Salomão

If you take a walk through the forest of the Trombetas region, you will find Brazil nut trees in great densities and varieties. In an area of 789 ha, there are approximately 1.5 Brazil nut trees/ha, with some hectares having as many as 13 trees. These concentrations are known as *bolas* or *castanhais*. In contrast, in a nearby forest of 1 500 ha there were only seven Brazil nut trees. The two areas are only 30 km apart and have the same rainfall, light and soil type.

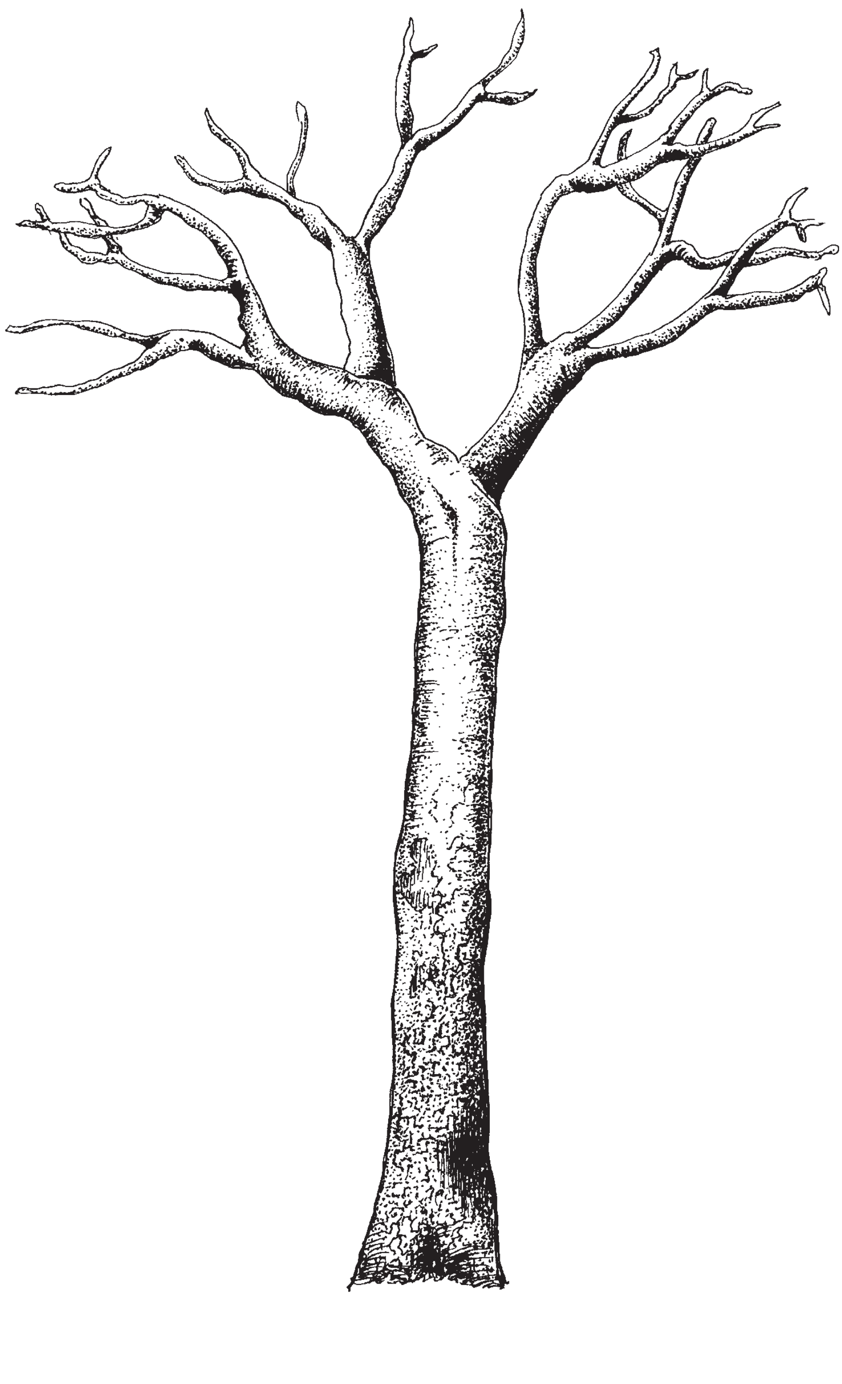
Archaeologists are working together with ecologists to explain these *bolas*. Many people believe these areas were managed by Indians hundreds of years ago. These *bolas* are well known by the locals, who even give them names like “Big Deer”, “Small Deer” and “Chico’s Bola”.

“Social species”

In addition to having an abundance of Brazil nut trees, Trombetas is also rich in minerals that are mined by large industries. In severely degraded areas, Brazil nut trees are being replanted and are growing well. The Brazil nut tree is an excellent species for recuperating degraded areas. After two decades, trees planted in 1984 had already attained diameters of 60 cm. The scientists responsible for reforestation have not forgotten the local population. Instead of only planting species that are valued for their timber, they are also planting what are known as “social species,” trees like the Brazil nut that offer nutrition and health benefits for local people.

Protected trees: the living dead

Along lengthy highways throughout Amazonia large expanses of pasture exist where one can see only a few enormous, white, skeletal trees standing dead on their feet. These are Brazil nut trees. Brazil, Peru and Bolivia appreciate the Brazil nut tree so much that they created laws incurring fines or jail time for anyone who cuts one down. However, the law is clearly not effective in preserving the Brazil nut trees. Studies in Acre show that, 20 years after the creation of pasture, 80% of the Brazil nut trees die without ever having reproduced.[31] Persistent burning of the pastures takes a toll on the trees, probably leading to premature death. Even if they survive, fruit production is diminished because these isolated trees are far away from other Brazil nut trees, which hinders cross-pollination since the large bee pollinators generally do not venture into open areas.[32]



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[2] Mori, S.A. 1992
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Cat’s claw

Uncaria tomentosa (Willd. ex Roem. & Schult.) D.C. and
Uncaria guianensis (Aubl.) J.F. Gmel.

Elias Melo de Miranda

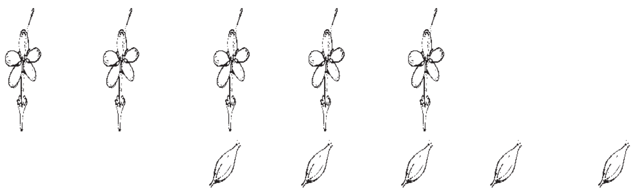
Thousands of years ago, indigenous Peruvians discovered the medicinal power of a spiny Amazonian forest vine: cat’s claw (unha-de-gato). However, this locally well-known vine only gained widespread popularity in Peru after it first became famous in Europe.[1] Studies of the bark, roots and leaves have established the presence of alkaloids that stimulate the body’s immune system against tumours, inflammations, viruses and ulcers. Today, cat’s claw is used throughout Amazonia and has growing domestic and international markets.

There are a great variety of species known as cat’s claw. The two most famous belong to the genus *Uncaria*. The main characteristics of these vines are the claw-like spines from which the name is derived. The cat’s claw climber, *U. tomentosa,* is large and has semi-curved spines, which enable it to wind its way up tree trunks. The creeper, *U. guianensis,* is smaller and has difficulty climbing because it has sharply curved spines, like goat’s horns, which do not easily grip onto other plants. Both are found in the tropical regions of Brazil, Peru, Venezuela, Colombia, Bolivia, Guyana and Paraguay.

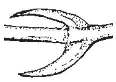
Ecology

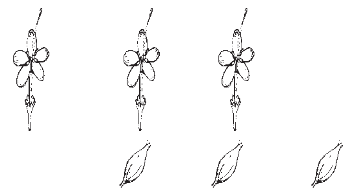
Flower and fruit seasons


creeper (*U. guianensis*):



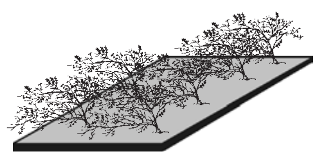
J F M A M J J A S O N D


climber (*U. tomentosa*):

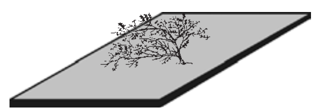


The two species have different fruiting seasons. The creeper, *U. guianensis,* flowers first, from February to June, and produces fruit from April to August. The climber, *U. tomentosa*, flowers from September to November, and produces fruit from October to December.[2]

Density



33 plants/ha in várzea for *U. guianensis*



1.7 plants/ha in terra firme for *U. tormentosa*

A study of the two species in the state of Acre, Brazil determined that cat's claw occurs more frequently in várzea (33 vines/ha) and in secondary forest (11 vines/ha) than in terra firme (1.7 vines/ha).[3] But the two species exhibit differences in the habitats they prefer. The climber, *U. tomentosa*, prefers closed forest or forests with small openings and generally occurs in low densities. The creeper, *U. guianensis*, develops best in secondary forest, along riverbanks or roadsides where it can form large concentrations.

Production

On average, it is possible to extract about 0.5 kg of bark/m of vine. Creeping cat's claw reaches between 5 and 10 m in length, and in 1 ha it is possible to find 15 individuals over 5 cm in diameter that can furnish approximately 60 kg of bark. In contrast, climbing cat's claw grows from 10 to 30 m in length but occurs in low densities, approximately 1 vine/ha, yielding approximately 10 kg of bark. Since the climbing *U. tomentosa* individuals provide more bark, collectors in Peru tend to concentrate their collection efforts in the upland forest. In order to satisfy demand in 1995, Peruvians collected vines from a 20 000 ha area.[2]

Creeper 4 kg of bark/vine

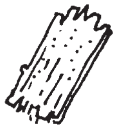
Climber 10 kg of bark/vine

Economic value

In Peru, the world's largest producer of cat's claw, exports peaked in 1995 at 726 tonnes. From 1996 to 1998, between 275 and 350 tonnes were exported.[4] Peruvian export businesses can purchase 1 kg for US$0.90 and sell it for US$3.90. In the United States of America, 1 kg transformed into capsule form is worth between US$200 and US$500. Brazil exports less, but it is easy to find cat's claw in Amazonian markets. In 2008, at the Ver-o-Peso market in Belém, 150 g of bark sold for between US$1.20 and US$2.40. For US$1.20, a packet of 50 g of powdered cat's claw, 20–30 g of leaves, or 50 g of the vine could also be purchased.

1 kg of bark: the value for the collector, the exporter, and the price in the United States of America (in 2003)

Uses

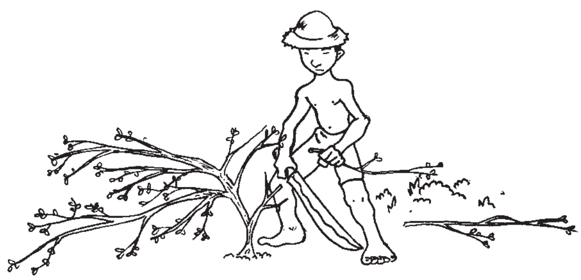


Bark: The bark of cat's claw is used to make teas as it possesses properties which stimulate the immune system and, in a few tests, demonstrated antiviral and anti-inflammatory effects.[3]

Roots and leaves: The roots and leaves can be used in medicinal teas.

Vine: Fresh, drinkable water is released when the vine is cut. Rattan-type furniture is also produced from the vine.

Preparing the vine for market



After harvesting the vine, scrape off the moss and dirt using a large knife. The moss on the climbing cat's claw is often black, while the moss on the creeping cat's claw frequently has an off-white colour. To remove the bark, simply tap one piece of vine against another until it comes loose. Set the bark in a shady spot to dry for three to five days during the dry season. Next, cut the bark into sizes preferred by the consumers. To protect the bark from humidity and to make the product more attractive to customers, place the bark in labelled bags.

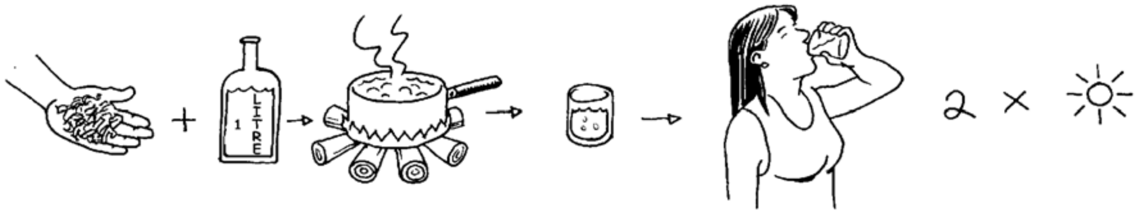
Know the differences between the two principal types of cat's claw

	Climbing (*U. tomentosa*)	**Creeping (*U. guianensis*)**
Length	10–30 m	5–10 m
Diameter	5–40 cm	4–15 cm
Spine	semi-curved	curved
Habitat	openings in the primary forest	secondary forest, riverbanks and roadsides
Occurrence	high altitudes, 400–800 m	low altitudes, 200 m
Density	few/ha	can be found in great numbers

The different types of cat's claw also vary in their chemical composition. The level of alkaloids, for example, appears to be different from species to species. Within the same species, the levels can also vary significantly, depending on the age and the habitat of the plant.[2] The effects of the tea may also vary from person to person and plant to plant.

Recipe for medicinal tea



To brew tea, using the bark or root, local users offer the following recipe: Boil 20–30 g of bark or root of cat's claw cut in small pieces in 1 litre of water for 20–30 minutes. This tea can be taken every eight hours, between meals. If using the leaves, boil 15–20 g in 1 litre of water for 15–20 minutes; strain and drink every six hours.

Is cat's claw truly medicinal?

Because of its strong history of traditional use, the sale of cat's claw took off prior to scientific confirmation of its effectiveness. Some researchers maintained that the medicinal properties of cat's claw had not been adequately proven, but recent phytochemical studies have identified beneficial properties in the bark.[5] In Peru, together with copaíba (*Copaifera* spp.) and sangre-de-grado (*Croton lechleri*), cat's claw continues to be among the most widely sold medicinal plants. In the remote rural areas of Pará, Brazil, it is known as jupindá, and many families use it to make a tea to strengthen the body against malaria. In 2001, of 30 families with cases of malaria, only two used medicine from the national health service, SUCAM. All the other villagers utilized cat's claw tea mixed with species such as veronica (*Dalbergia* spp.), cedro (*Cedrela odorata*), pau d'arco (*Tabebuia impetiginosa*) and escada-de-jabuti (*Bauhinia guianensis*).

The efficacy of other plants of the genus *Uncaria* has been confirmed in other regions of the world, including China, Taiwan Province of China and Africa. The flavonoids (antioxidants) found in a number of *Uncaria* species have also been used by the pharmaceutical industry to treat vascular diseases.[2]

Management

germination	growth	production
5–20 days	1 cm/year	5–10 years

Seeds germinate in 5–20 days, and the seedlings can be planted from six months to two years later.[2] When the vine is cut, the finer shoots can also be stuck in the ground and grown (the same way manioc is planted). Cat's claw has the advantage of being fire-resistant, and it grows well in open areas. The vine can reach 5 cm in diameter in five years, and it is ready to be harvested in 5–10 years.[2] Both the vine and the root are used frequently by local populations in the Amazon. However, it is better to collect only the vine, cutting it after it bears fruit, while leaving about 50 cm to 1 m of vine so that the plant can regenerate. Covering the cut with clay will help to keep the vine from losing water. Since the vines of the forest-dwelling *U. tomentosa* are large and provide substantial quantities of bark, it is worthwhile to take special care when harvesting them because these vines are less abundant. Plantations in open areas produce many thin vines along the ground, but scant bark.

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Copaíba

Copaifera spp.

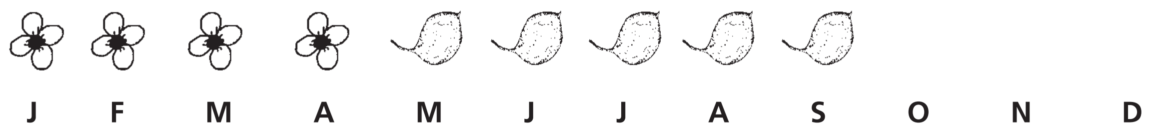
Arthur Leite
Andrea Alechandre
Onofra Cleuza Rigamonte-Azevedo

Copaíba, known as the antibiotic of the forest, is one of the medicinal trees most widely used in the Amazon to treat inflammations and wounds. The Indians discovered the curative power of copaíba oil, and since then it has healed the minor as well as the life-threatening injuries of thousands of people. Rural people contend that far from the hospital or the pharmacy, copaíba oil is your best remedy.

The copaíba tree is also known as the "oil wood", "miracle tree" and "diesel oil tree" because it produces a thick, yellow, sticky medicinal oil that is extracted by making incisions in the trunk. The filtered oil can also be used as a biodiesel fuel. Copaíba trees reach about 36 m in height, 140 cm in diameter and up to 3 m in circumference. The trees are found throughout the tropics, but with the greatest incidence in Brazil, where 16 different species are well distributed throughout the country.[1]

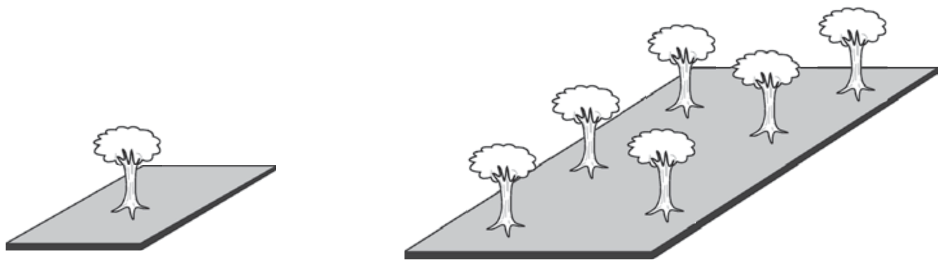
Ecology

Flower and fruit seasons



In Acre, as in Pará, the copaíba tree flowers in the raining season, from January through April, and fruits from May to September. Bees are the tree's principal pollinators.[2]

Density



0.1 to 2 trees/ha 0.5–10 trees/alqueire

In the Amazon, the copaíba tree occurs in terra firme forests, and on the margins of lakes and streams. It also grows in the forests of the Cerrado of Central Brazil. The municipality of Tarauacá, in the state of Acre, is known to have large areas in which one or more copaíbas can be found per hectare. In some regions, such as the southern part of Pará, their numbers are diminishing because of the timber trade.

Production

The annual production of oil from copaíba trees varies from 100 ml to 60 litres/tree, though not all trees produce oil. Oil production also appears to vary depending upon soil type and the age of the tree. In the area of Pedreira, Pará, out of a sample of 114 trees, 22% did not produce oil, 50% had low production (fewer than 3 litres), 23% had regular production (from 3 to 9 litres) and only 1.7% produced more than 10 litres.[3] Another study in the state of Amazonas illustrates that in sandy soils 75% of trees are productive, while in clay soils only 45% are productive.[4] Data from 62 trees in Acre indicate that 41% produce in the first extraction, while the second extraction reached 72%, with better production in terra firme forest.[5] Scientist Dr. Alencar conducted a long-term study in Manaus and discovered that after repeated tapping, production diminished.[5] To ensure a consistent supply, scientists in Acre suggest extracting only 1 litre/tree, every three years.[6]

average of 1 litre of oil/tree

ECONOMIC VALUE

In 2009, in the medicinal plant shops in Belém, a litre of copaíba oil cost between US$11 and US$15. Oil sold in glass bottles fetched a higher price, as a 50-ml vial cost US$4.20 and in the United States of America copaiba oil can be purchased over the Internet at US$40 for 8 oz.[7] Copaíba bark is also used as a medicine; in 2008, 1 kg of copaíba bark cost US$8 and each 150 ml sack sold for US$1.20. Soaps were also in demand, costing between US$2.00 and US$2.40 apiece.

Copaíba oil was widely exported during the rubber era and after the Second World War. In 1947, for example, Brazil exported 94 tonnes. Today, the oil is sold to France, Germany and the United States of America. In 2006, Brazil sold 523 tonnes of copaíba oil, earning revenues in excess of US$1.9 million.[8] Because of deforestation in Pará, copaíba oil is increasingly scarce in Belém. It is now coming from distant regions like Manaus, in the state of Amazonas. Considering that in the national market 1 litre of copaiba oil is worth more than 15 kg of rubber, rubber tappers in Acre are investigating harvesting copaíba oil as a potential option for diversifying production.[2] In 2004, in the sawmills of Tomé-Açu, Pará, 1 m^3 of copaíba wood cost US$68. In 2008, 1 m^3 of sawn copaíba timber had a market price of US$206.[9]

Prices vary

Those who extract copaíba oil should pay attention to the variation in price according to who is selling the oil, where it is being sold, how it is processed and what kind of packaging is used. Notice the difference in price of the litres of oil sold in different situations:

Price of 1 litre of copaíba oil – 2004

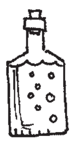
Vendor	Price in US$
Caboclo from Capim River, Pará	0.70
Medicinal plant shop, Belém	9
Logger, Paragominas	10
Sawmill owner (from Paragominas to São Paulo)	17
Ver-o-Peso, Belém (20 ml bottles, US$0.52 each)	26
Belém airport (20 ml bottles, US$1.54 each)	77

Oil: various colours, scents and textures

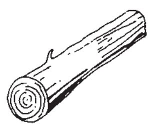
Rubber tappers are familiar with various types of copaíba trees: red, white and yellow.[2] However, researchers were surprised by the variety in colour, scent, flavour and density of the oils; together with the local people they discovered more than ten types. The clear oils tend to be favoured by medical industries and the darker oils tend to be used to make soap and to treat injured animals.[5]

Uses

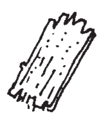
Oil: A metabolic product of the tree, created by canals which secrete the oil from the medulla or centre of the trunk, the oil has antibacterial and anti-inflammatory properties. It is used to promote the growth of scar tissue for wounds and ulcers, as well as to treat serious and chronic skin diseases, such as dermatosis and psoriasis.[10] In Rio Branco, the capital of Acre, it is most commonly taken for throat infections. Acre's largest consumers are the elderly.[6] In contrast, in Pará, all ages and social classes consider copaíba one of the most important natural remedies in Amazonia.



Industrial use for the oil: The oil is utilized as a fixer in the manufacture of varnish, perfume and paint. It can also be used in photographic development. More recently, copaíba oil can be found in natural beauty and personal care products, including soaps, creams and shampoos. Rural folk continue to use it as lamp oil, and it is being planted in some areas as a source of biodiesel.[11]



Wood: The copaíba tree produces a superior timber that is highly sought after because it is resistant to insects, particularly termites. It is used in civil construction and the manufacture of boards.



Bark: In some regions, the tea of the bark is used as an anti-inflammatory. In Belém, because of the high price of the oil, tinctures made from the bark are often used as a substitute.

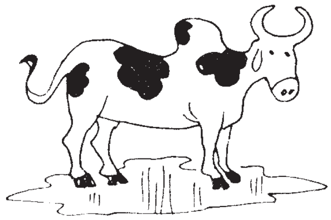
Remedy for a sore throat

Mix one or two drops of copaiba oil with a tablespoon of honey. Take twice a day.[12]

Forest lantern

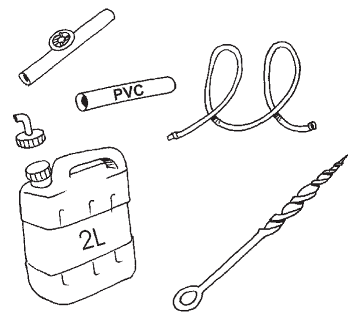
Without costly flashlights, how do villagers make their way across pitch black forests? Copaíba oil is used as fuel to light up the night. Place a wick in an oil container and set it alight. During years of low income and/or economic downturns, home-crafted technologies, such as rustic lamps, often return in use.

Hoof protection



In southern Pará, copaíba is commonly used by ranchers. They pour oil on the ground near salt licks. When the cattle approach to eat the salt, their hooves become covered in oil, which prevents foot-and-mouth disease.

Tools of the trade



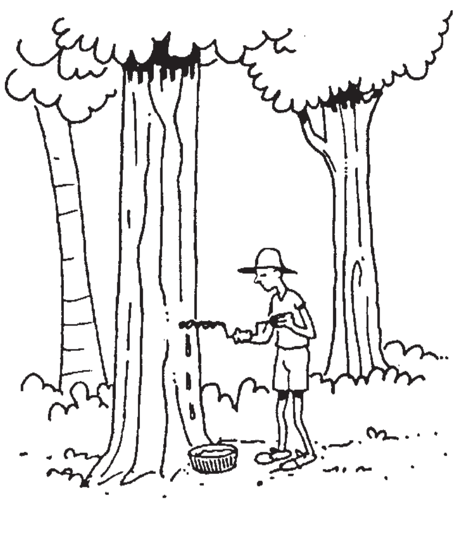
- 1 drill, 1.20 m in length and 1.9 cm in diameter;
- 1.27 cm plastic tubing to place in the hole in the tree, and a plug for the tube or hole;
- 1.9 cm rubber hose, 1.5 m in length;
- 2-litre soda bottles or other jug to collect the flowing oil. To store for long periods, glass bottles are recommended.

The tools needed to remove the oil cost about US$51, approximately one month's earnings from rubber collection in 2004. In Acre, the Secretariat of Forests and Extractivism (Sefe) paid for the kit and thus enabled the collectors to become self-sufficient.

Extracting the oil

Copaíba occurs in low densities in the forest, and for this reason great care must be taken in its extraction. In some places, people fell the trees or cut them deeply with a machete so that they may obtain higher volumes of oil than they can in a careful extraction. However, a deep cut wounds the tree and may lead to a fungal or insect infection from which it may not recover. When it suffers from a severe infection, a tree can die in as little as three years. A tree's bark is similar to a person's skin, protecting it from illness.

With the correct method, it is possible to extract oil year after year with no ill effects. Use a small drill to puncture the centre of the trunk, from 20 to 50 cm deep, depending upon the width of the trunk. Next, insert plastic tubing or a piece of metal pipe beneath the hole to let the oil drip out into a container either suspended from the tree or on the ground. The oil can be left to drain for a few days. After removal, close the container to prevent insects from entering and plug the hole in the tree. It is advantageous to carefully extract the oil, as it has a high economic value, can be preserved for long periods and is easy to transport.[6]



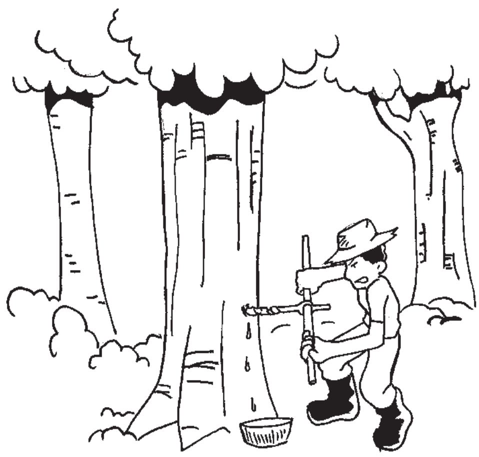
The process of extracting oil varies greatly from region to region. In Acre, they say that the best time to harvest the oil is during the rainy season, while in Pará many prefer to harvest during the dry season. Some also say it is best to tap the trees during the new moon, perhaps because the moon affects the circulation of the oil.

Diary of a rubber tapper: 1906–1916

One hundred years ago, rubber tappers avidly seeking the sticky exudate of rubber trees, "white gold", also sought out the healing, golden oil of copaiba trees. A rediscovered diary from that era reveals that tapping copaiba trees was a dangerous occupation: "We had to tap around 100 trees, walking in the woods and worrying about snakes and wild animals the whole time. We had to find our way around large areas of forest and keep careful track of which trees we had tapped. Out of 100 trees, only half would produce some oil. For food, there were only a few Brazil nuts and small game to eat. At night, we had to be sure we had found a high place to tie our hammocks so the jaguars could not reach us."[13]

Tips for oil extraction

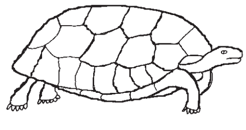
- It is important to choose trees with a circumference greater than 150 cm. Hollow trees generally do not produce oil.[6] If the first hole does not provide oil, try the other side of the tree, or drill at a different height.



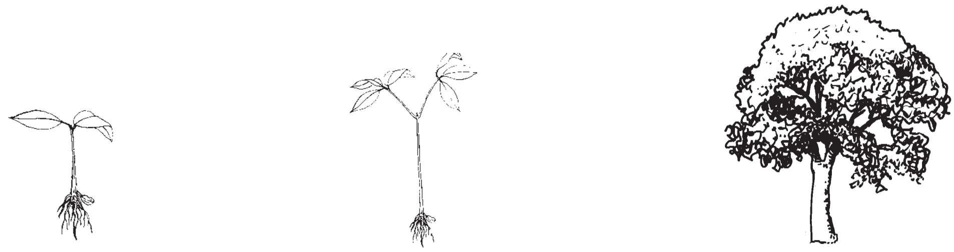
- If the oil does not come out, some people light a fire at the base of the tree to heat the resin; however, fires can damage the tree and potentially get out of control.
- Many trees do not produce oil immediately after being tapped. In this case, leave the hose in place, or plug the hole, and come back in a couple of days.
- In addition to tapping near the base of the tree, people sometimes tap farther up (10–20 m) to potentially extract more oil.

WILDLIFE

Copaíba fruits are appreciated by deer, tortoises, agouti, birds, pacas, monkeys, peccaries, squirrels and tapirs. Over a one year period, hunters in a community along the Capim River captured 63 kg of game beneath copaíba trees. Wounded animals lick and rub themselves with the oil that runs down the trees.[6]



Management



germination
35 days

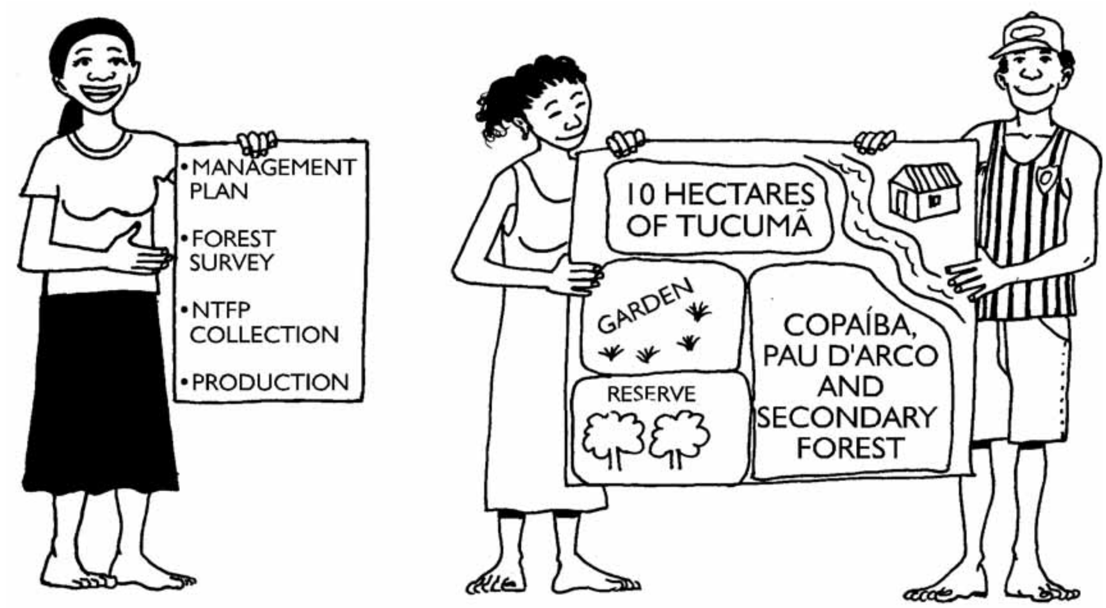
growth
50 cm/year

production
larger than 40 cm
in diameter

The seeds take 35 days to germinate. Ninety percent of seeds germinate when sown, immediately after falling, and about half of the remaining seeds will germinate after 30 days. The copaíba tree seems to grow best when it is not interplanted with other species. It prefers partial shade during the seedling phase and full sun when planted out for the growth period.[14] However, little is known about ideal soil types and growing conditions for this tree. Because of its high value and powerful medicinal uses, it is well worth the effort to conserve and plant copaíba.

The makings of a management plan

There are no government restrictions on the extraction of copaíba oil for domestic use. However, in order to sell the oil, a management plan is a legal requirement. The plan must define what area is to be utilized, how many trees are to be tapped and what technique will be used to extract the oil. In addition, it is necessary to make a map indicating the location of each of the copaíba trees to be tapped. In Acre, collectors use maps of roads opened by rubber tappers to find copaíba trees. When they find a copaíba tree, they clear a small trail leading to it and mark its location on the map.[6]



Mapping trees: use the rubber roads

Andrea Alechandre,
Foster Brown,
Valério Gomes

Throughout the world, forest inventories generally survey only timber species, omitting useful vines, fruit and medicinal trees that are an essential part of local livelihoods. Some forest inventory methods sample quadrangles at random. But to map useful trees much of the effort of opening new forest paths could be saved by using "rubber roads", created by rubber tappers to access rubber trees. Researchers at the Zoological Park in Acre developed a simple method for rubber tappers to map copaíba trees in their areas. It is fast, easy and inexpensive; it offers reliable results and is well liked by communities. As researcher Andrea Alechandre says, "If you want to identify copaíba trees, go with a rubber tapper. He always knows."

Many local people and hunters who spend time in the forest already know where the valuable species are. However, taking the time to draw a map is helpful to systematize information. If local stakeholders are involved in a land dispute, or want to sell wood or copaíba oil, a map can be a useful tool for explaining the location and quantity of their resources. In addition to making use of existing trails and local knowledge, mapping involves the understanding of a compass and the measurement of an individual's pace.[15]

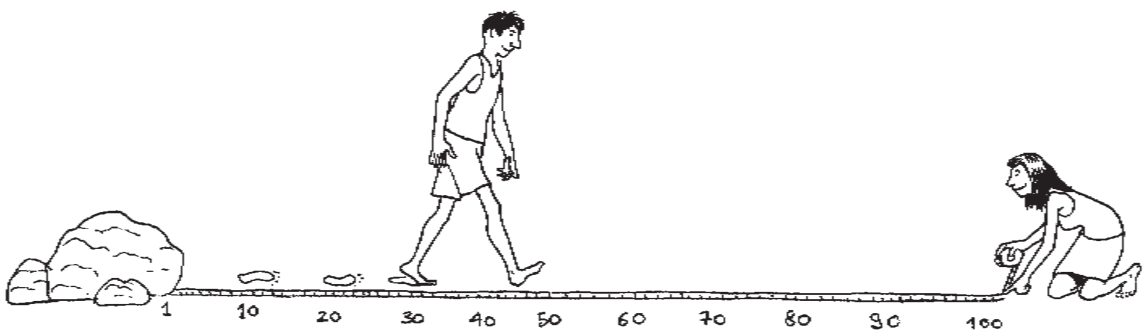
To measure your pace:

1) Measure a line on the ground of 100 m with a tape measure.

2) Walk the line three times and count your steps each time.

3) Add up the number of steps needed each time and divide by three. This gives you the mean number of steps per 100 m.

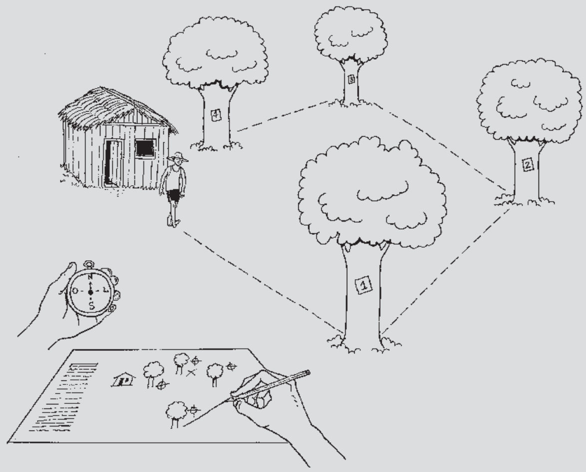
4) Divide the mean number of steps by 100. The result is the size of your step in metres (step/metre).



Mapping

Foster Brown, Andrea Alechandre, Carlos Campos

It is possible to measure not just one species, but the fruit trees, medicinal plants and fibres important to your community as well. Let's test the methodology with adult copaíba trees.



1) Choose a good starting point that will never change location, like your house or a bridge. Mark it on a piece of paper.

2) Draw a compass on the paper and mark the direction it is pointing. Next draw a line in that direction to the closest copaíba tree from the starting point.

3) Walk from your starting point to the first tree and count your steps. Divide the number of steps by the size of your step and mark the distance of the line on the map.

4) Draw another compass next to the first tree on your map. Draw a line in the direction of the next tree. Walk to the next tree counting the distance with your steps and repeat the process for all the trees.

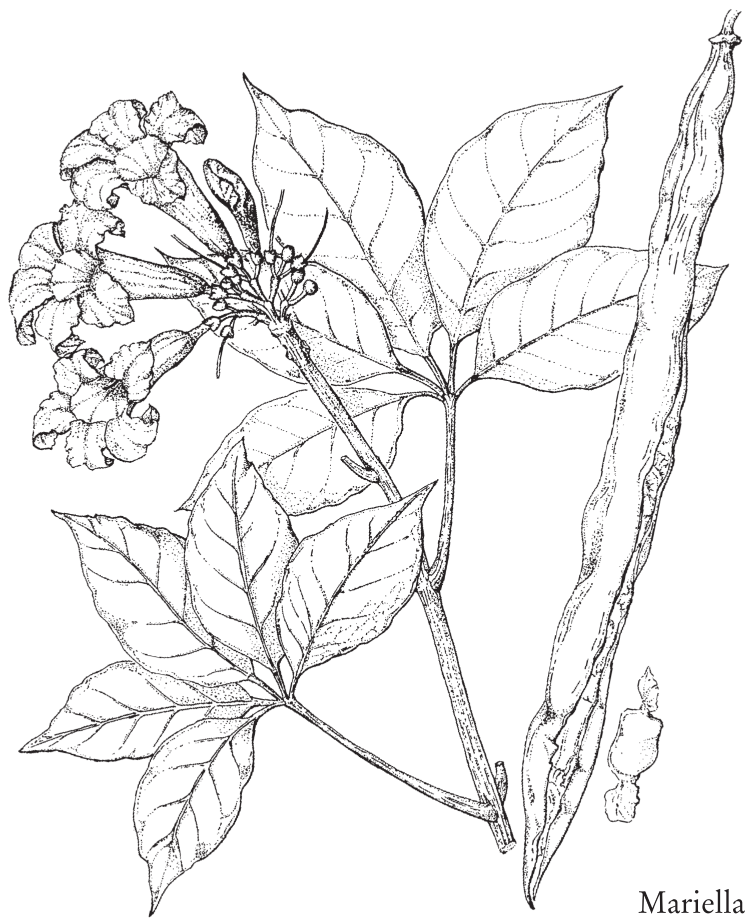
5) Number each tree on your map and measure the circumference of each. It is a good idea to identify each of your mapped trees with a numbered plaque.

When you finish, you will have a map of copaíba trees. With a compass and the map, anyone wanting to find the copaíba trees should be able to do so. They orient themselves in the direction noted on the map and walk the distance indicated. Using this method, three communities mapped 512 copaíba trees with more than 150 cm in circumference. They were then able to calculate that their 31 holdings contained more than 1 100 copaíba trees.[6]

[1] FAO 1987/Clay, J. and Clement, C. 1993/Rocha, A.A. 2001
[2] Rocha, A.A. 2001
[3] Dias, A.S. 2001
[4] Ferreira, L.A. 1999
[5] Alencar, J.C. 1981
[6] Leite, A. *et al.* 2001
[7] http://www.rain-tree.com/copaibaprod.htm, accessed March 2009
[8] IBGE, 2007
[9] Secretaria de Estado da Fazenda. 2008
[10] Estrella, E. 1995 / Ming, L.C.; Gaudêncio, P. and Santos, V.P. 1997
[11] Sydney Morning Herald September 19, 2006
[12] Shanley, P.; Hohn, I. and Silva, A.V. 1996
[13] Yungjohann, J.C. 1989
[14] Varela, V.P., Vieira, M.G. & Melo, Z.L 1995
[15] Amorex (unpublished) / Alechandre, A.; Brown, I.F. and Gomes, C.V. 1998

Ipê-roxo, pau d'arco

Tabebuia impetiginosa (Mart. ex. DC) Standl.

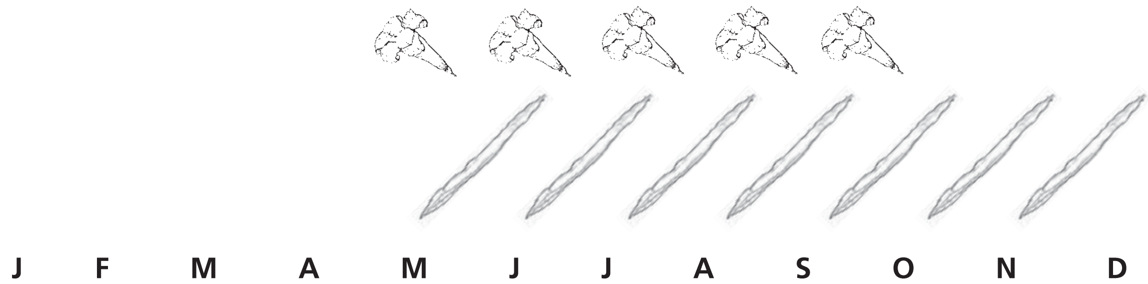


Mariella Mendes Revilla
Alexandre Dias de Souza
Mark Schulze

Ipê-roxo, also known as pau d'arco, is highly prized throughout Brazil and beyond, both for its high quality and attractive wood and for its bark, which has powerful medicinal properties. The bark of ipê is a renowned medicine, containing lapachol and other potent chemical substances. Sold under the name of "pau d'arco", it is used in home remedies to treat inflammation, allergies and tumours and to promote the growth of scar tissue. Ipê's extremely durable wood was used in the reconstruction of the famous Atlantic City Boardwalk in New Jersey, United States of America. Ipê does not need to be treated to resist rot, touting the environmental advantage of being chemical free. Over the last two decades, as ipê-roxo has become increasingly difficult to encounter in the forest, most medicinal plant collectors head directly to sawmills to harvest the bark from trunks waiting to be sawn. But some loggers are catching on and are beginning to sell this valuable bark, which has a vibrant market in Brazil, Europe and the United States of America. During the flowering season, ipê-roxo's canopy explodes with exquisite flowers and the petals fall like rain, leaving a soft lilac-coloured carpet on the forest floor. The tree can reach 40 m in height and 4.5 m in diameter. Ipê-roxo occurs throughout Amazonia but in relatively low densities, particularly in the state of Acre where it is considered rare. Ecological studies of ipê indicate that current extraction levels are placing this valuable species at risk.[1]

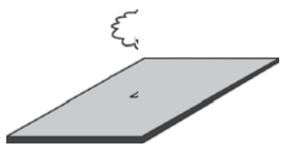
Ecology

Flower and fruit seasons

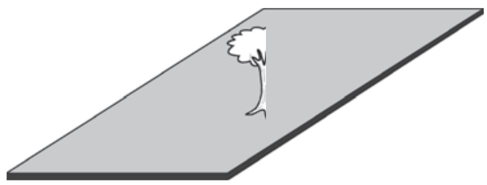


Ipê-roxo flowers from May through September and produces fruit between June and November. Shortly after the petals fall, the leaves fall, leaving the tree bare. About ten days later, fruit appears. However, this lovely spectacle does not occur every year; production varies and trees may not flower for two years in a row.

Density



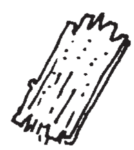
0.04–1 tree/ha



0.5–1.5 trees/alqueire

The density of ipê-roxo is less than 1 tree/ha and its distribution is irregular. It grows in terra firme forests, and in Acre it favours forests with bamboo.[2] Ipê-roxo is rarely found in the várzea or wetland areas. Rising demand for ipê-roxo has made it increasingly scarce in Amazonia. In a 2004 survey, ipê-roxo timber was no longer being extracted from forests around many sawmill centres in the eastern Amazon where it previously had been one of the primary timber species.[3] Brazilian export data for ipê timber suggest that since 2004 at least 650 000 ha of forest were logged annually for ipê.

Production



300 g of bark/tree/year (estimated)

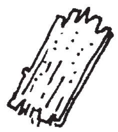
Sixty percent of the bark is composed of water, signifying that every 100 kg of bark harvested will result in 40 kg of dried medicinal bark. The quantity of bark that can be sustainably collected from a living tree is not well known, as few studies have been undertaken on sustainable bark extraction. Among other factors, the amount that can be extracted without harming the tree will likely depend upon the tree's age, vigour and dbh. At present, most of the bark traded regionally is collected from logged trees at sawmills.

Economic value

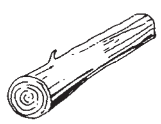
Ipê-roxo is sold under the name "ipê" for its wood and "pau d'arco" for its medicinal bark. Therefore, many people do not realize that the prized timber species also possesses powerful medicinal properties. The demand for ipê-roxo bark by homeopathic pharmacies, healers and the cosmetic industry is growing daily. In the herbal shops in Belém in 2009, 1 kg of bark was sold for US$3. In 2004, average sales of bark from one fair and four of the largest herb shops in Belém, totalled 250 kg/week. In Belém, a small bag with 200 g of bark sold for US$1.20–1.80. In addition, there are many herbal medicine laboratories that are grating ipê-roxo bark to make capsules.

Ipê-roxo is highly sought after by loggers because of the excellent quality of its wood. In areas where mahogany no longer exists, as in Tomé-Açu in the state of Pará, ipê-roxo is the most expensive timber species. In 2007, the selling price/m^3 of sawn wood in the domestic market was US$510 and in 2008 the price jumped to US$867.[4] Export prices in 2008 have averaged US$1 188/$m^3$ of sawn wood.[5] Consumers of both the wood and bark are generally uninformed that current levels of extraction of the tree for its prized timber, marketed as "green mahogany" in the United States of America, may be placing the species at risk.

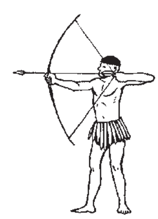
Uses



Inner bark: Tea, syrups, infusions and cough drops are made from the inner bark. In some areas it is used to combat serious diseases such as diabetes, leukaemia, cancer, anaemia, arterioscleroses, arthritis, bronchitis, cystitis, parasites, gastritis, cuts and inflammations. It is important to note that lapachol, an active ingredient in pau d'arco, is a napthoquinone and contraindicated for people on certain medications. Early cancer studies were stopped because of its toxicity at high doses; therefore, it is recommended pau d'arco be used under the supervision of a health professional. Sold in health food stores and pharmacies, in the United States of America it is used frequently for allergies.[6] In addition, many rural communities in the Brazilian Amazon use it to treat malaria.



Wood: Ipê wood is of excellent quality – heavy, with a density of 1.3 g/cm^3. Used in construction and in the fabrication of posts, boats and coal, the wood is also commonly used to make floors, boards and planks, becoming the preferred wood in the United States of America for decking. Native Amazonians who use traditional hunting methods use ipê to make bows.



Delicious tea

Tea made from the inner bark of ipê-roxo, often referred to as pau d'arco, contains a combination of substances that many users contend combat cancer as well as help in the growth of red blood cells and in the improved oxygenation of the body.[7] Unlike many medicines, ipê-roxo (pau d'arco) tea tastes delicious!

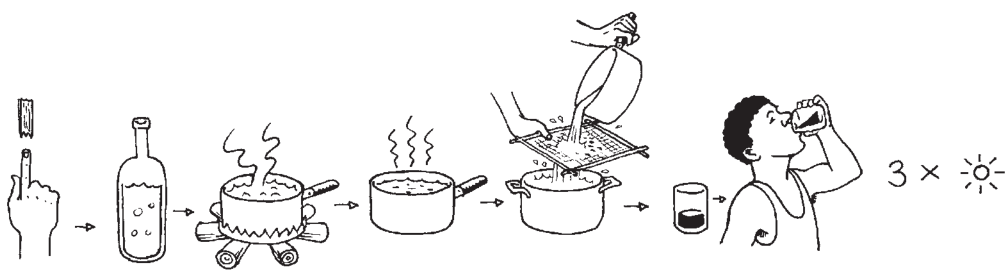
The secret to brewing pau d'arco

- Never boil or keep pau d'arco tea in containers made from aluminium, tin, lead or plastic. These substances cause a chemical reaction with various components of the tea when boiled, altering its medical effect. Containers of glass, ceramic, porcelain, clay, cast iron or stainless steel are better.

- Do not store the tea in the container in which it was prepared, because the particles of the bark can become bitter.

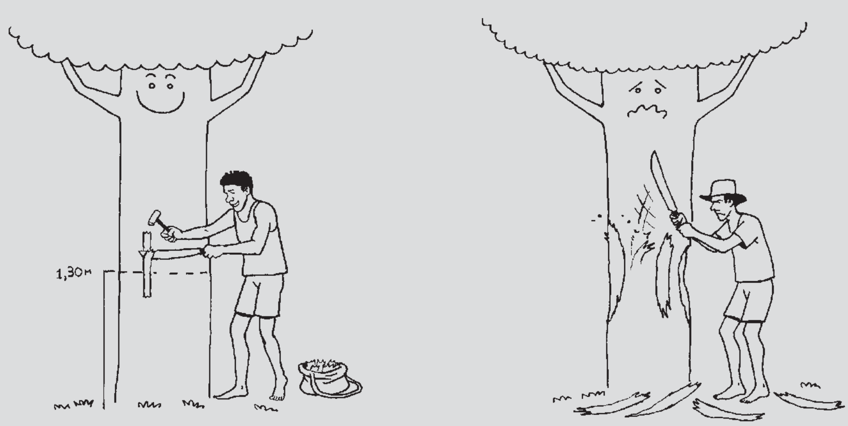
- Do not let the tea steep for very long because its aroma can become overpowering.

- Use 5–10 g of bark for each litre of water, cover and let simmer on a low flame. Take the pan off the stove and let the tea steep for 15–20 minutes. Strain the tea directly into the container in which it will be stored to be taken a little at a time.



Extraction of ipê-roxo bark

Ipê-roxo trees are principally threatened because of ranching, logging and fire. However, in remote regions or in regions where logging pressure is not yet high, trees can be threatened by a lack of knowledge regarding adequate techniques for harvesting the bark in a sustainable manner. Although the use of ipê-roxo bark has increased in recent years, there are few studies evaluating the impact of bark collection on the health of the trees. To generate basic information about the extraction of ipê-roxo bark, the Acre government undertook a study of its regeneration. The objectives were to learn how the bark regenerates and whether larger trees regenerate bark faster. Initial observations indicated that ipê-roxo has a potentially good capacity for regeneration: in two years, 40–50% of the extracted bark had grown back.



The forest pharmacy

Patricia Shanley and Lêda Luz

Even with pharmacies on every street corner stocked with modern medicines, Brazilians from upper, middle and lower social classes continue to buy medicinal roots, barks, leaves, oils and resins from native forests. Consumers say that traditional forest remedies are reliable, inexpensive and effective in treating sicknesses such as rheumatism, arthritis, herpes and nervous system disorders for which there are still no adequate medicines available in the pharmacy.[8]

Eighty percent of the people in the world regularly use plants to treat common illnesses. In addition, many medicines sold in pharmacies contain substances that were originally discovered in a plant. Considering the proven effectiveness of some traditional medicines, it is curious that scientists have not transformed more medicinal plants into pill form. The reason is that scientists simply lack the expertise to isolate the active substances in these chemically complex substances, such as copaíba oil, amapá and sucuúba latex, jatobá resin and pau d'arco bark.

Ranching, logging, farming and more recently soy plantations have transformed the Amazonian landscape, reducing forest cover and changing species composition in the forests that remain. To ensure that remedies continue to be available in the future it is essential to know which medicinal plants are most important, where they grow and in what frequency.

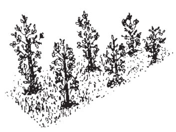
Below are some valuable medicinal tree species extracted by loggers in Pará.

Common name	Scientific name	Uses
Copaíba	*Copaifera* spp.	deep wounds, natural antibiotic
Andiroba	*Carapa guianensis*	sprains, rheumatism, insect repellent
Cumaru	*Dipteryx odorata*	rheumatism, muscular pain
Sucuúba	*Himatanthus sucuuba*	worms, herpes, uterine infection
Jatobá	*Hymenaea courbani*	tonic, colds, expectorant
Amapá, bitter	*Parahancornia fasciculata*	respiratory illnesses, tonic
Pau d'arco	*Tabebuia impetiginosa*	inflammations, tumours, ulcers
Ucuúba	*Virola michelii*	fever, hepatitis, generates scar tissue

What landscape possesses the most powerful medicinal plants?

There is an ongoing debate about whether the most powerful natural remedies are found in the primary forest, secondary forest or growing like weeds by the wayside. Some scientists argue that the most effective medicinal plants are those that grow in tough conditions, found in secondary growth forest or as invasive weeds.[7] Others believe that the trees of tropical forests, which struggle in warm climates against virulent insects and fungi, contain the most powerful remedies. To collect medicinal barks today, most eastern Amazonian collectors in logging frontiers frequent sawmills rather than forests. In Belém, a nine-year study of plants in the local markets showed that of the 211 medicinal plants being sold, 95 are native to Amazonia. Of the 12 most popular plants sold from 1994 to 2000, seven are native to the forest, and of these seven plants, five are currently harvested by the timber industry.[9]

Where the 12 most popular medicinal plants in eastern Amazonia originate



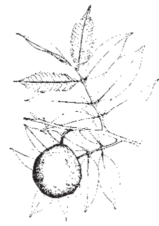

Plantations	Fields and roadsides	Secondary growth forest	Terra firme forest
1 guaraná (*Paullinia cupana*)	3 amor-crescido (*Portulaca pilosa*), mastruz (*Chenopodium ambrosioides*), quebra-pedra (*Phyllanthus niruri*)	1 sacaca (*Croton cajucara*)	7 andiroba (*Carapa guianensis*), barbatimão (*Stryphnodendron barbatiman*), copaíba (*Copaifera* spp.), pau d'arco (*Tabebuia impetiginosa*), marapuama (*Ptychopetalum olacoides*), sucuúba (*Himatanthus sucuuba*), veronica (*Dalbergia subcymosa*)

Where did our medicines go?

Because of the increasing incidence of fire and logging, some medicinal species are getting harder to find, not only in the forest but also in the market. Species with high medicinal value are increasingly being extracted for their timber. Some species, such as ipê-roxo, amapá, copaíba and jatobá only occur in mature forest, in low densities and are not domesticated. Rare in some areas, they are vulnerable to exploitation. A long-term study of the ecology and effects of logging on ipê indicates that this species is at risk and belongs on the CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) list like mahogany.[10]

Amapá: Amazonian invigorator

Silvia Galuppo
Campbell Plowden
Murilo Serra



Another powerful remedy used by both rural and urban populations is the bitter white latex which exudes from the amapá tree. Like pau d'arco, there is a strong need for more ecological, phytochemical and ethnobotanical research on this popularly used medicinal tree. It is traditionally used to treat respiratory conditions, gastritis and promotes the growth of scar tissue. Amapá is also used as an invigorating tonic, often by women after giving birth. Recent studies have demonstrated the analgesic and anti-inflammatory properties of two species of amapá (*Parahancornia fasciculata* and *Brosimum parinarioides*).[11] Amapá's powerful medicinal properties are widely known among Amazonians, and in 2005 it was one of the most widely used natural medicines in Belém, with a total of 10 560 litres being sold.[12]

There are two groups of Amazonian trees with edible latex that are called amapá: bitter amapá and sweet amapá. The bitter group is composed of a few species from the botanical family Apocyanaceae. Species from this family normally contain many types of alkaloids - strong chemical substances which can be effective in fighting illnesses. The most common species of bitter amapá is *Parahancornia fasciculata*. Some indigenous tribes in eastern Amazonia also use the latex from the species *Couma guianensis*. The sweet amapá group is composed of species from the genus Brosimum (from the Moraceae family). Nutritional analysis of *Brosimum parinarioides* demonstrates the presence of calcium, iron and magnesium.[13] Even though it is strong and widely used, many of its specific actions remain unknown.

Some collectors demonstrate a detailed knowledge of the ecology and anatomy of the tree and are using the same tool used to extract rubber from the rubber tree for the purpose of extracting amapá latex. The use of this tool results in greater latex production and less damage to the trees. A distance of 32 cm between cuts and a minimum tree diameter of 27 cm for initial extraction also correlate with higher productivity over the long term.[12]

A number of different species of amapá are relatively tall trees that are found in upland dry and flooded forests where the average density may reach 26 trees/ha. Because the different varieties of trees and latex may look similar, it is sometimes difficult to ascertain which species of amapá is being used. Dishonest merchants may take latex from a similar species and sell it as if it were the valued, medicinal species of amapá. To untangle the confusion, some key differences between the species are listed below.

Sweet or bitter amapá

	Family	Species	Common name	Leaves	Flavour of latex
	Apocyanaceae	*Parahancornia fasciculata*	bitter amapá	small, opposed	very bitter, taken with honey
	Apocyanaceae	*Couma guianensis*	black amapá	round	bitter
	Moraceae	*Brosimum rubescens*	muirapiranga	various types, alternating	not used
	Moraceae	*Brosimum potabile*	amapáí	small, slender, alternating	unpleasant
	Moraceae	*Brosimum parinarioides*	sweet amapá	large, thick, alternating	good, taken with cow's milk

Harvest with care

Campbell Plowden

As with pau d'arco, there are few studies about the ecology and physiological effects of extracting latex of amapá. In one study in the indigenous area of Tembé, in Pará, the two main varieties of amapá (*Parahancornia fasciculata* and *Couma guianensis*) had a combined density of 3 trees/ha. The fruits of the amapá tree are big, have a thick rind and are adored by monkeys. To harvest the latex, trees were wounded with a 1 cm wide diagonal cut twice a week for five weeks during two successive years near the end of the rainy season. In 1999, *C. guianensis* (called "black amapá") yielded an average of 100 ml of latex during the first cut, but the harvest declined to an average of 22 ml by the end of the experimental harvest. *P. fasciculata* yielded an average of 19 ml during the first cut, rose to a peak of 43 ml/tree then declined to an average of 28 ml/tree during the tenth and final harvest. Some Tembé said that latex should not be collected when the trees are bearing fruit since the latex is toxic then.[14]

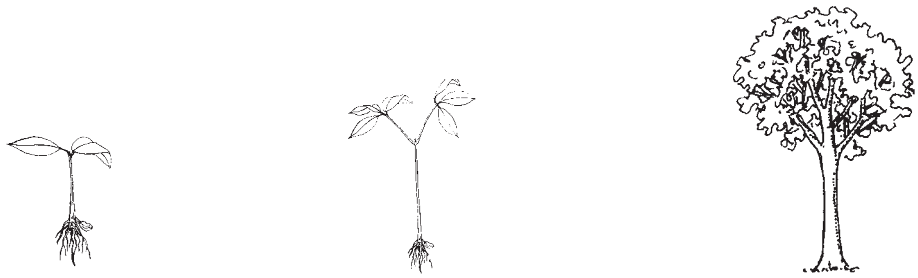
In the cities and the countryside

Gloria Gaia

In the lively outdoor medicinal market in Belém, stalls display barks, roots, foliage and a brilliant array of colourful liquids, oils and resins. Some of the bottles of white liquid are amapá. The merchants sell two types: bitter and sweet. In 2008, a bottle of 500 ml of bitter amapá cost between US$6 and US$9. The bitter amapá is used by many people to treat malaria, worms, uterine infections, gastritis, anaemia, respiratory problems and even tuberculosis. Recently, people have begun to use amapá to treat cancer.

People in rural areas take a small teaspoon of amapá milk first thing in the morning before eating, for eight days. Afterwards they wait one week without taking it and, if needed, repeat the treatment. Children always take only half the dosage, a half teaspoon. Amapá milk is never taken pure. It is always mixed with water, milk, porridge or coffee. Sweet amapá is used to restore the energy of malnourished children. Usually, one tablespoon of sweet amapá is given twice a day.

Management



germination
2 weeks to
1 month

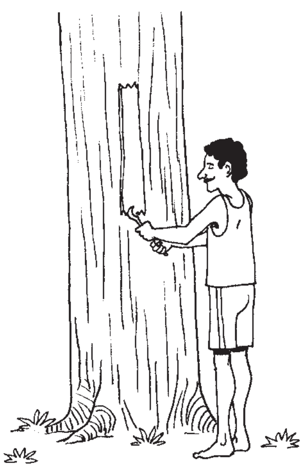
growth
seedlings: 5–75 cm
height/year
trees: < 1–5 mm
diameter/year

seed production
at 30–50 cm
in diameter

Ipê-roxo seeds are brown and have slender wings. The fruits are like green beans and need to be collected when they change from green to almost black, before they open and disperse their seeds. The seeds do not go through a dormant period; it is recommended to plant them within the first 20 days after collection. Seeds germinate in two weeks and the seedlings grow 5–75 cm/year in height. Once they are planted in the shade and the trees reach more than 10 cm in diameter, their growth slows to 1–5 mm/year in diameter. One study illustrates that if left in the shade, the majority die within the first year and the rest die in the second year.[15] When cultivated, ipê-roxo develops very well in full sun, both in single-species and mixed-species plantations.[16] However, when not tended, ipê-roxo saplings can be overwhelmed by vines and competing trees, so periodic clearing of competing vegetation is recommended for successful plantings.

Some people believe that the active medicinal substances of ipê-roxo are encountered in significant quantities in the bark when the tree is over 40 years old. Therefore it is worth the effort to look after older trees. When harvesting the bark, a few techniques to protect the tree's vigour should be employed:

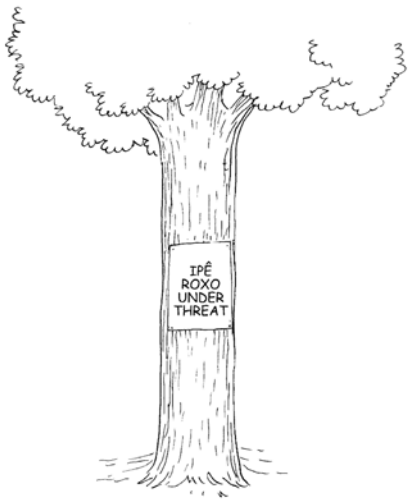
- Do not remove the bark from young trees with diameters of less than 30 cm.
- Do not remove a ring of bark around the trunk. This will kill the tree because the sap that feeds the tree needs to pass through the bark.
- The thinner the tree, the thinner the piece of bark that should be extracted, varying from 2 to 4 cm thick.
- Avoid extraction during the reproductive cycle (flowering and fruiting). It is preferable to extract the bark after the seeds are dispersed; this way, you will avoid interfering with the tree's reproductive cycle and allow new trees to grow.
- Remove rectangular pieces of bark in a vertical line going up the trunk: the long sides of the rectangle along the length of the tree, the short sides along the width of the tree. The bark should be removed at chest height and above.
- After extraction, be careful to avoid contaminating the section where the bark was removed with fungi, termites and other types of insects that interfere with its regeneration. It is worthwhile to observe and evaluate the regrowth of the bark each year to see how the tree reacts to the cut.



Banking on ipê

Timber from the ipê-roxo is so valuable that the ipê would seem to be the ideal species to manage. Indeed, ipê accounted for 9% of all timber exports from Brazil in 2004 and is the most common tropical species in the US$3 billion residential decking market in the United States of America.[17] However, it is one of the trickiest species to harvest from forests in a sustainable manner. Ipê-roxo presents two major obstacles for managing: first, saplings grow sparsely in the forest and thus cannot replace the adults which are extracted; and second, the growth rate is relatively slow: one plant can take up to 100 years to grow into an adult. Because ipê-roxo trees grow less than 2 mm/year in diameter on average, a 2-m (2 000-mm) diameter giant is likely to be many centuries old.[18]

Logging operations typically cut down all of the adult trees in the forest, leaving few parent trees to produce seeds for the next generation and few young trees to take the place of the adults that were cut. The method used for harvesting ipê-roxo makes about as much sense as taking all of the money out of a savings account and hoping that in 30 years the balance of zero will somehow have generated enough interest to permit another withdrawal. There is no chance of this happening. For this reason, ipê-roxo is one of the most threatened species in Amazonia. Before cutting it down it is vital to consider the many benefits this tree can offer over the long term.



1 Schulze, M. *et al.* 2005 / Schulze, M. 2008
2 Oliveira, A.C.A. 2000
3 Lentini, M., Pereira, D., Veríssimo, A., 2005/ Schulze, M. *et al.* 2008a
4 Secretaria de Estado da Fazenda, 2008, www.sefa.pa.gov.br
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10 Schulze, M. *et al.* 2008a
11 Souza, M.C.L. *et al.* 2003 / Projeto Dendrogene, Embrapa-Amazonia Oriental.
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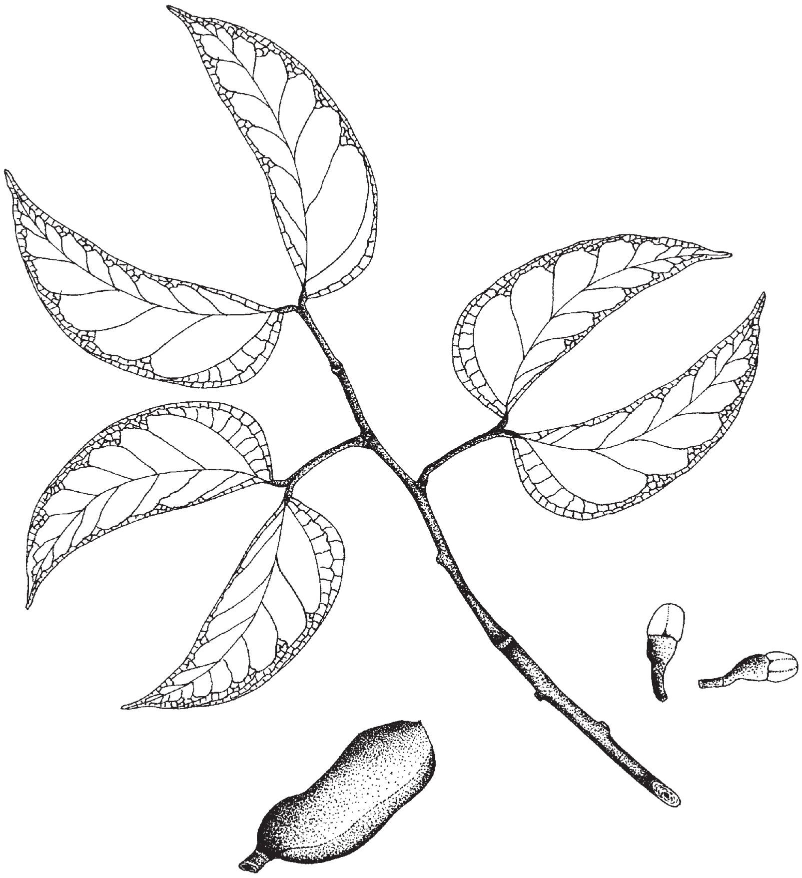
15 Schulze, M. 2003
16 Schulze, M. 2008
17 SECEX, 2005 / USDA-FAS 2008
18 Schulze, M. *et al.* 2008b

Jatobá

Hymenaea courbaril L.



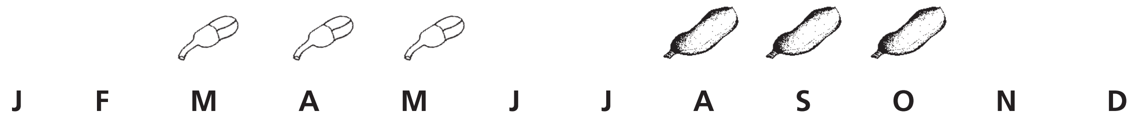
Patricia Shanley
Mark Schulze

The first-rate wood, curative bark, edible fruits and golden resin of the jatobá tree offer an outstanding assortment of uses for rural and urban families. The bark contains properties that fight the common cold, bronchitis and diarrhoea, and tea from the bark serves as a tonic to strengthen the body after an illness. The wood is extremely durable and for this reason it was used to make railroad ties for the Carajás mine in Pará, which carried some of the heaviest loads of iron in South America. Jatobá's resin, known as jutaicica, can also be used as medicine. During times of conflict, Indians used the resin on the points of their arrows to set fire to enemy villages. And finally, jatobá produces edible fruits that are beloved by local people, though little known outside of forest communities.

Jatobá is a tall tree, from 30 to 40 m, and has a straight trunk, reaching approximately 2 m in diameter (about 5 m in circumference). The bark can grow up to 3 cm thick. Jatobá is widely distributed throughout Mexico, Central and South America, extending all the way to Paraguay. It grows in terra firme forests and occasionally in tall várzea forests, and can also be found in poor and sandy soils.

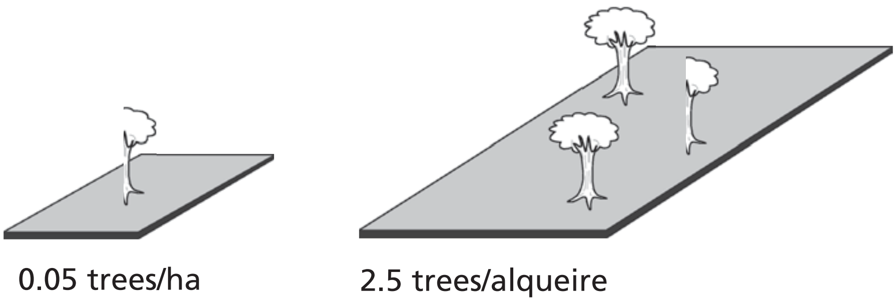
Ecology

Flower and fruit seasons



The jatobá tree flowers in the dry season and bears fruit 3–4 months later. In Pará, jatobá flowers from March through May and bears fruit from August through October. In Central Amazonia, it produces fruit from February to September[1] and in Acre, from May to September.[2]

Density



Jatobá is widely distributed but rare (less than 1 tree/ha) throughout most of its range. Its abundance is diminishing because of the timber trade. It is exported as well as used domestically.

Production

Production varies greatly. Jatobá does not usually produce fruit every year; it often rests one year and produces the next. While some trees produce very little, others can produce up to 2 000 fruits, with each fruit containing 2–4 seeds. In any given year, 15–90% of the adult trees in a population may produce fruits.

an average of about 800 fruits/tree

Jatobá bark is approximately 40% water. Of 100 kg of bark, roughly 60 kg will be dry material. One tree typically produces about 15 kg of resin.

Economic value

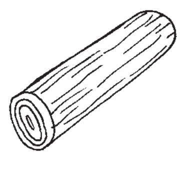
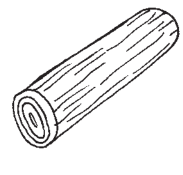
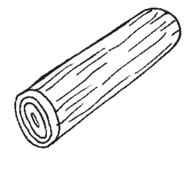
In 2009, in the Ver-o-Peso market in Belém, one jatobá fruit was sold for US$0.10, as opposed to US$0.03 in 2004. A litre of resin now costs US$3 and 1 kg of bark US$2, whereas in 2004, these cost US$1.50 and US$1 respectively. In Rio Branco, in 2002, the municipal market and the medicinal plant shops sold a 100 g bag of jatobá bark for US$0.70. Jatobá wood is one of the most prized on the international market. In 2008, 1 m^3 of sawn jatobá timber sold for US$336 domestically.[3] Sawn wood sold for export can fetch much more and in 2004 was almost US$400/$m^3$.[4]

Seeds for sale

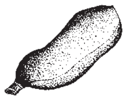
Rocio Ruiz and Nívea Marcondes,
CTA, Acre

Not only can timber and fruit make money, but also forest seeds. With the rise in deforestation in Brazil, there has been a corresponding rise in demand for hardwood seeds to assist companies who need to meet federal reforestation regulations. A study in Rio Branco in 2005 illustrated that 1 kg of jatobá seeds (300 seeds) was sold for US$4. It is revealing to compare the price of a standing tree to the price of its seeds: at US$3/m^3, the average tree is worth less than US$21 in Acre, far less than a single crop of seeds, which may yield 10–15 kg. In addition to seeds from the jatobá tree, seeds from many other species like cerejeira (*Amburana acreana*), copaíba, cumaru (*Dipteryx odorata*), ipê-amarelo (*Tabebuia serratifolia*) and maçaranduba (*Manilkara huberi*) also fetch high prices at the market. In Acre, the Technology Foundation (Funtac) markets 11 seed varieties, with plans to increase this number. Seeds are a particularly useful commodity in more isolated regions, as they are easier to transport than timber.

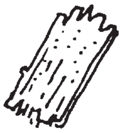
The price of forest seeds vs the price of wood

	Jatobá (*Hymenaea courbaril*)	**Ipê-amarelo** (*Tabebuia serratifolia*)	**Maçaranduba** (*Manilkara huberi*)
Price paid to collector/kg of seeds	US$4 	US$25 	US$4 
Price paid/m^3 of timber (standing trees)	US$3 	US$3 	US$3 

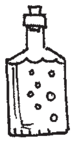
USES



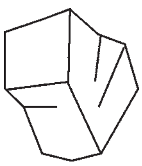
Fruit: The fruit can be eaten raw or used to make flour. It is believed to alleviate pulmonary problems.



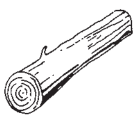
Bark: A tea made from the bark is used in certain areas to combat the common cold, diarrhoea, bronchitis, cystitis, pulmonary congestion, worms, weakness, bladder infections and cramps, as well as to aid in digestion and to treat prostate cancer. In addition, the bark and fruit can be used to fight coughs: just suck and chew on a piece like a lozenge.



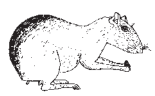
Sap: When cut, jatobá excretes a valuable red sap. It can be used as fuel, medicine, vegetable varnish and sealant for canoes. Care should be taken when extracting the sap with a machete, as this can damage the tree. Liquid sap turns into solid resin (locally called jutaicica) upon contact with oxygen.



Resin: Called jutaicica, this golden resin is usually found at the base of the tree, oozing from holes in the bark made by insects, or forming in hard, transparent balls on fallen trees. Farmers sometimes find chunks of jutaicica in their fields where jatoba trees once grew. These are gathered and chewed to alleviate gas and stomach aches.[5] Jutaicica can be burned and used as an inhalant for colds and headaches. Jutaicica is also an excellent varnish, particularly for clay pots.



Wood: Hard, heavy and highly valued in the export market, jatobá wood is used in civil construction in the cities and used for making canoes in the country. It has outstanding value because of its durability, which is comparable to maçaranduba, jarana (*Lecythis lurida*) and other hard and resistant woods. Jatobá is exceptional because it does not splinter.



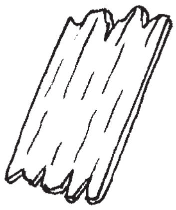
Game: Hunters wait for game (such as tapirs, pacas and monkeys) beneath the jatobá when the fruits are falling.

Leaves: The leaves possess a terpenoid, a chemical substance that kills fungi and repels ants and lizards. The leaves merit further study.

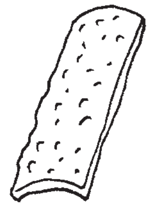
Secrets for making tea

To make jatobá tea for colds or as a tonic, boil three fingers of bark (20 g) in 1 litre of water for 15 minutes. Take one cup of tea three times a day.[6] The bark can also be used to make tinctures, lozenges or syrups.

Beware: jatobá is different from jutaí



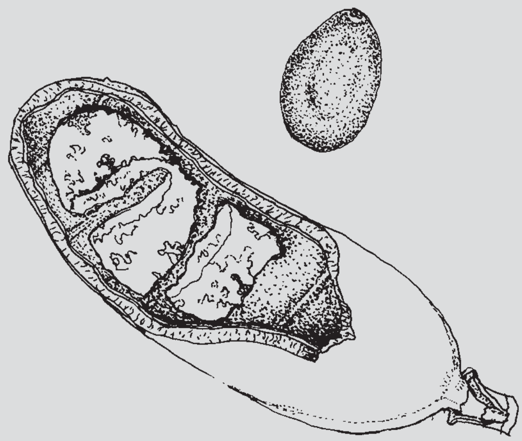
Be careful! Jatobá bark is very similar to other barks that are extremely toxic. Jatobá is often confused with jutaí (*Hymenaea parvifolia*) and the jutaí-da-folha-grande (long-leaved jutaí) (*Hymenaea oblongifolia*). However, there are noticeable differences: common jutaí has hard, leathery leaves, its trunk is less red and its bark is finer than that of jatobá. It is easier to differentiate big-leaved jutaí because its leaves are much larger and its trunk is redder than jatobá.



Jatobá advances rubber technology

Lênio José Guerreiro de Faria

Researchers from the Laboratory for the Engineering of Natural Products, at the Federal University of Pará, discovered that powder made from jatobá fruits can be used as a coagulator in the process of transforming latex from the rubber tree (seringa) into solid rubber. The standard process for removing the liquid from latex uses centrifuges, which require large quantities of energy. In contrast, using jatobá powder does not require any energy, as the powder concentrates the liquid and separates it from the rubber. A few communities have already tested the use of jatobá for making rubber.



Nutrition

The fruit is composed of 2–4 seeds (25–40% of its weight), surrounded by a sticky white pulp (only 5–10%) encased in a pod (50–70%). The protein value of jatobá flour is similar to corn and superior to farinha. One hundred grams of the fruit supplies 115 calories, 29.4 g of glycides and 33 mg of vitamin C.[7]

Recipes

Jatobá flour

Scrape the seeds with a knife to obtain the pulp. Next, grind the pulp with a mortar and pestle or blender and then sift. The flour that is produced can be used to make cakes, biscuits, breads and liquors.

Jatobá porridge

Ingredients:
– Milk, pulp, sugar, cinnamon

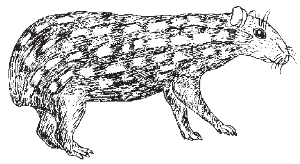
Preparation:
Remove the pulp from the seeds. In a pan, mix the pulp and the milk. Add sugar and cinnamon to taste and heat the mixture over a stove until it thickens. Serve warm.

Jatobá bread

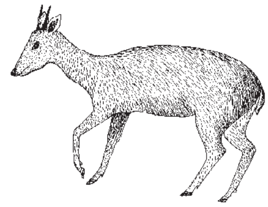
Ingredients:
– 2 cups jatobá flour
– 3 cups wheat flour
– 2 tablespoons yeast
– 1 tablespoon sugar
– 3 tablespoons oil
– 1 teaspoon salt
– 2 cups warm water

Preparation:
Dissolve yeast in warm water in a large bowl for 10 minutes. Gradually add the wheat and jatobá flour. Knead the mixture well on a cutting board or table. If necessary, add more flour until the dough becomes firm. Return the dough to the bowl and cover for two hours in a warm place without draughts, like an oven. Next, return the dough to the cutting board and knead well. Leave the bread to rise for another 30 minutes in a bread pan. Bake in a hot oven for 30 minutes.

WILDLIFE



Deer, paca, agouti and monkeys eat jatobá fruits. Monkeys are capable of knocking down quite a few fruit when they are in the trees. Just like us, they bang the fruit on the branches or exposed roots to open it. Tapir[8] and paca eat the fruits and scatter the seeds throughout the forest, helping to disperse the species to new areas.

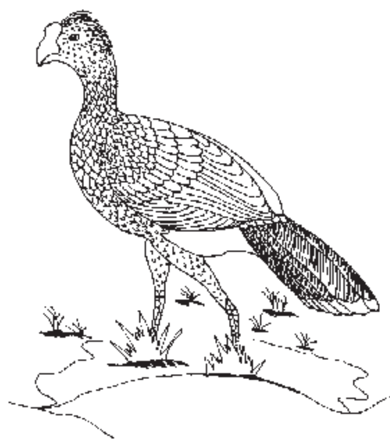


Wildlife habitat: primary and secondary forests

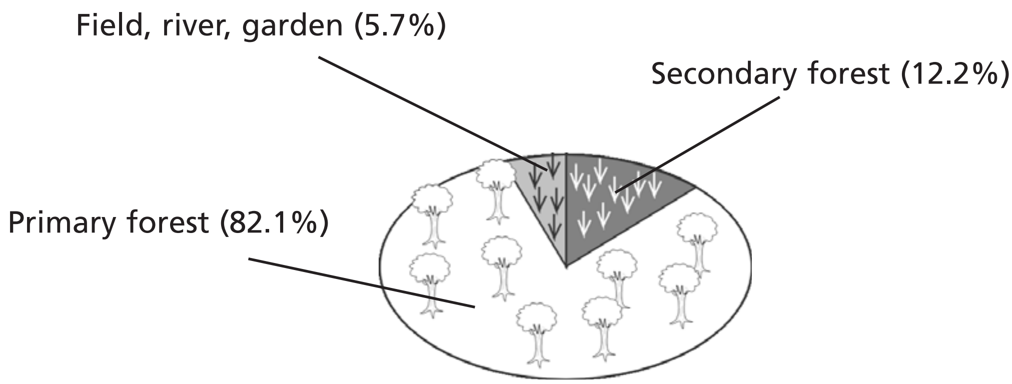
Margaret Cymerys

Forests are critical ecosystems for wildlife, offering them food and shelter; as forests are destroyed, wildlife habitats are threatened. Some species of animals can survive in logged and burnt over secondary forests, while others cannot. For example, tapirs, white-lipped peccaries and some primates are generally not found outside tall primary forests. Many birds including the large razor-billed curassow (*Mitu tuberosum*) that eat fruit and seeds are also only seen in the primary forest.

Other animals like paca, agouti, sloth and deer can live in secondary or primary forest and tend to remain in logged, farmed areas and areas that have suffered fires. The pie chart below shows where animals were captured by hunters in a community along the Capim River in Pará. The majority of the game animals were captured in primary forest (82%), demonstrating the importance of this habitat to wildlife and local livelihoods.[9] Without primary forests, wildlife diversity will diminish and it will no longer be possible to witness magnificent Amazonian wildlife like the harpy eagle (*Harpia harpyja*) and the ocelot (*Felis pardalis*).



Percentage of captures/habitat



Management

germination
20–180 days, or one week when scarified

growth
0.5 m to more than 1 m/year

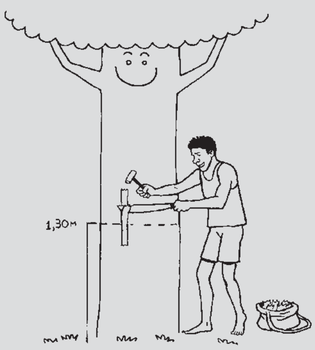
production
40 years in forest gap

Jatobá regeneration is exceedingly limited, perhaps owing to high predation of its seeds or because the majority of seedlings die within a few months in the shaded forest understorey.[10] However, given the multiple values of this tree, it is worthwhile to care for standing trees and to plant new ones. Growth and fruit production of standing trees, particularly smaller individuals, can be increased by cutting vines that compete for light in the tree crown and cause broken limbs, and by selectively removing trees of less valuable species that are directly competing for resources.[11] To plant, remove the pulp from the seeds and place them in pans in a shady, well-ventilated place. Seed dormancy can be broken by scraping their exteriors or by dropping them quickly in hot water and then transferring them immediately to cold water. After scarification, seeds germinate in one week. Cans, baskets or plastic bags with small holes in them can be used as receptacles for the seeds. Plant one seed per receptacle, 5 cm deep in the soil. Place the receptacles in the sun and water twice daily.

When the plant reaches 25 cm, transplant it to a permanent location that receives a lot of light (at the forest edge or in gaps in the forest canopy), preferably in the rainy season. Mix chicken manure, horse manure or corn husks in the soil around the hole where the plants are to be placed, making sure the planting holes are large enough for the growing roots to breathe comfortably.[12] When transferring the seedlings, be sure not to break the clump of soil that surrounds the roots. Alternatively, scarified seeds can be planted directly in forest openings and tended by periodically cutting back competing vegetation.[10] Because of their high value, many farmers take care not to disturb jatobá sprouts in the ground when they tend their crops. They protect the seedlings until they are large enough to be transplanted.

Removing bark with care

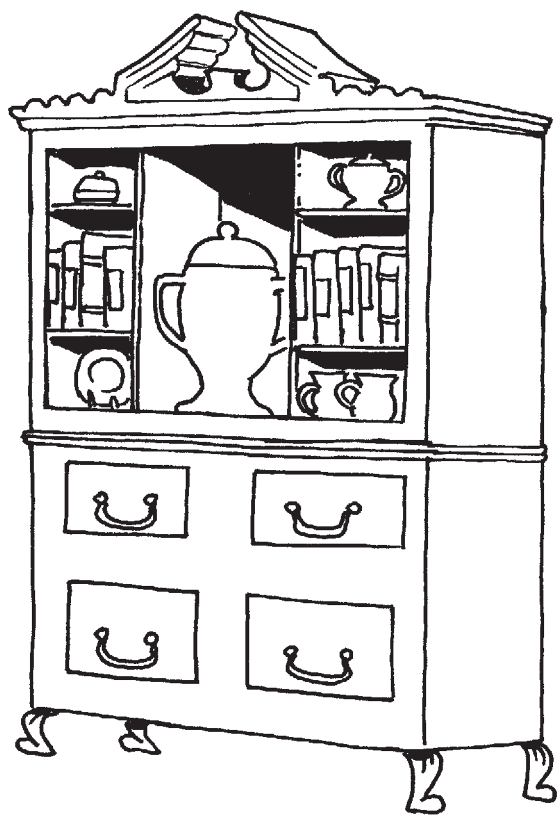
Mariella Revilla
Alexandre Dias de Souza



Take care when removing jatobá bark. A study in Acre showed that the bark has limited potential for regrowth. Although 40–50% of ipê bark regenerates after two years, only 10% of jatobá bark grew back. Jatobá bark regenerates slowly because it is attacked by insects, primarily bees, which feed on its resin. Most bark collectors throughout the state of Pará now frequent sawmills where they are able to collect substantial quantities of bark from the jatobá timber that is being processed.

Furniture or medicine?

In 2003, mahogany was recognized as a species threatened with extinction by predatory logging in the majority of areas where it occurs. Mahogany extraction is now regulated by legislation that specifies how the species is to be managed and the quantity of timber that can legally be harvested. The mature populations of jatobá and mahogany are equally threatened by predatory logging, and neither regenerates well in disturbed forests. Recovery of jatobá populations from a single timber harvest may take more than 100 years, even under the best of conditions.[13] Because few small trees and seedlings of mahogany and jatobá are present in a typical forest, when 90% or more of the adults are logged in a typical operation, it has an enormous effect on the populations of mahogany and jatobá alike.[14] However, jatobá differs from mahogany in that it has medicinal as well as timber value. Unfortunately, jatobá is still not legally protected and continues to be threatened by overexploitation in the majority of Amazonia. In addition to affecting the long-term supply of wood, unsustainable harvesting will also reduce the availability of jatobá's irreplaceable medicinal products.



Although jatobá was little known outside the Amazon until recently, the wood is increasingly marketed to the United States of America and Europe (sometimes as 'Brazilian Cherry') for use in furniture and flooring. In the mid-1990s, the 'discovery' of jatobá timber by importing countries caused it to jump from the class of a low-value species, only worth harvesting from forests near sawmills, to the class of an export species in high demand. By 2004, jatobá had become one of the more valuable timbers in the Amazon, intensively harvested from forests across the basin.[3] In the United States of America market alone, the value of jatobá imports exceeded US$13 million in 2007 – the first year jatobá lumber imports were recorded separately from other tropical species – and are on pace to surpass US$40 million in 2008.[15] With this market accounting for 30% of timber exports from the Amazon, total exports may well exceed US$100 million. In contrast to the globally marketed timber, medicines derived from jatobá bark and sap are primarily marketed and used locally. However, local populations often benefit more from jatobá medicines than from selling logging rights to timber companies, which pay only a tiny fraction of the timber value to the landowner (a tree sold to loggers for as little as US$50 can yield more than US$600 worth of sawnwood).[3] While Jatobá flooring and furniture is of high value to consumers, and jatobá logging can be enormously profitable, the jatobá tree may bring more value to local communities when left standing.

[1] Clay, J.W.; Sampaio, P.B. & Clement, C.R. 1999
[2] Almeida, S.C.B. 1999
[3] Secretaria de Estado da Fazenda 2008
[4] Lentini, M., Pereira, D. & Veríssimo, A. 2005
[5] Levi-Straus, C. 1997
[6] Shanley, P.; Höhn, I. and Silva, A.V. 1996
[7] IBGE, 1999
[8] Oglethorpe, J *et al.* 1997
[9] Cymerys, M., Shanley, P. & Luz, L. 1997
[10] Schulze, M. 2008.
[11] Schulze, M. 2003.
[12] FAO 1987
[13] Schulze, M *et al.* 2005.
[14] Schulze, M. *et al.* 2008b.
[15] USDA-FAS 2008

Mahogany, mogno

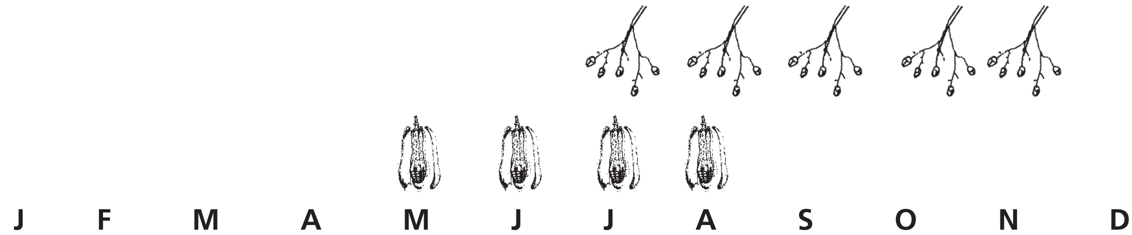
Swietenia macrophylla King

James Grogan

Perhaps more than any other tree, mahogany connects Amazonian forests to the world outside through its gorgeous, durable wood. Many loggers have penetrated the heart of the forest in search of this valuable wood, often referred to as 'green gold'. Mahogany trees are easy to identify from the ground owing to their massive buttresses, up to 5 m high. Mahogany forms a broad crown from a few large branches, with leaves that shine like no others in the forest. It is distributed in southern and western Amazonia and in the forests along the Atlantic coast of Central America. Mahogany should be treated well as its timber is valued at four times the price of any other wood.

Ecology

Flower and fruit season



Mahogany flowers in the Amazon between July and November, from the middle of the dry season until the beginning of the rainy season. Fruit reach full size in the crown by the middle of the rainy season, but the seeds inside are mature only at the beginning of the following dry season, from May to August. Fruit capsules pop open as the tree drops some or all of its leaves early in the dry season, and the wind disperses the winged seeds.

Density

Mahogany occurs at low densities in South America compared to Central America and Mexico. In southwest Amazonia, in the Brazilian state of Acre, Peru, and northwest Bolivia, densities are typically one tree in 5–20 ha where mahogany occurs, or on average about 0.1 tree/ha. It occurs more frequently in southeast Amazonia in the Brazilian state of Pará, along the banks of seasonal streams and smaller rivers at densities up to 2.5 trees/ha and even up to 6 trees/ha in local groups. But these populations were nearly completely logged out during the 'mahogany rush' of the 1980s and 1990s.

A whale of a species

Viewing a map of South America, mahogany's distribution looks like a great whale with its head starting in Pará, Brazil, its body passing across southern Amazonia and its tail rising up west and north towards the Atlantic Ocean, covering parts of Brazil, Bolivia, Peru, Ecuador, Colombia and Venezuela. In Central America, mahogany can be found along the Atlantic coast, from Panama to Mexico. Some researchers believe that it is widely distributed in Mexico and Bolivia because hurricanes and floods have allowed mahogany to flourish in these regions by opening large swaths of forest for regeneration.[1]

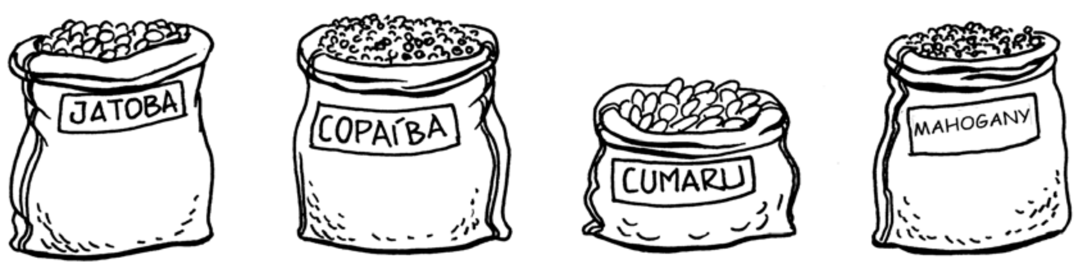
Production

an average of 3 000 seeds/tree

Mahogany produces two valuable commodities: extremely beautiful wood (easy-to-work and prized by people all over the world) and seeds.

Mahogany trees begin to flower and fruit annually when they are about 30 cm in diameter, though even smaller trees are capable of producing fruit. The rate of fruit production generally increases as the tree grows in diameter, though some small trees are capable of producing many fruit, and some large trees rarely produce fruit at all. High fruit production for a tree 30–70 cm in diameter is around 50 fruit capsules. Trees larger than 70 cm in diameter may produce up to 200 fruit in a single year, though this is rare (the most fruit ever counted on a single tree were 780 on a 132 cm diameter tree in Acre). Fruit production by individual trees and by groups of trees varies widely from year to year, as trees often "rest" between years with heavy fruit set.

A single fruit contains up to 60 large, winged seeds, but on average only 35–45 of these will germinate. Fruit size may vary considerably, both within a tree's crown and among different trees. Larger fruit produce larger seeds that are more likely to germinate and will produce larger seedlings. Even though most seeds fly less than 100 m from the parent tree, they are difficult to collect on the ground once dispersed, and they quickly lose the ability to germinate once exposed to the elements. The seeds are best collected from the crown, before the fruit capsule bursts open, by using proper tree-climbing equipment and an extendable pruning pole to sever the fruit where it attaches to the tree's smallest branches. The larger branches should not be cut just to bring down a few fruit – this will reduce fruit production in years to come.



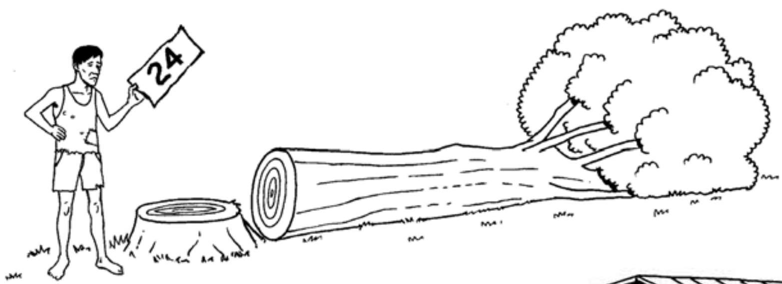
300 SEEDS US$4	2 360 SEEDS US$2	56 FRUITS US$4	2 500 SEEDS US$50

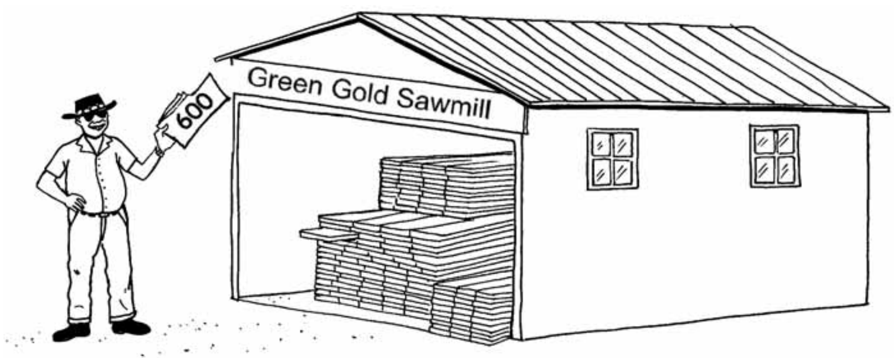
A cooperative of communities near Brasiléia in Acre, called Nossa Senhora da Fátima, collects mahogany seeds and seeds from other valuable timber species to sell profitably throughout Amazonia. The cooperative employs community members who are trained as tree climbers and collectors. One kilogram of mahogany seeds contains between 2 000 and 3 000 seeds after the wings have been removed. It takes about 50–75 fruit capsules at 40 seeds/capsule to produce 1 kg of cleaned seeds. In 2000, this cooperative earned about US$50/kg for the mahogany seeds that they collected, dried and packaged for sale.

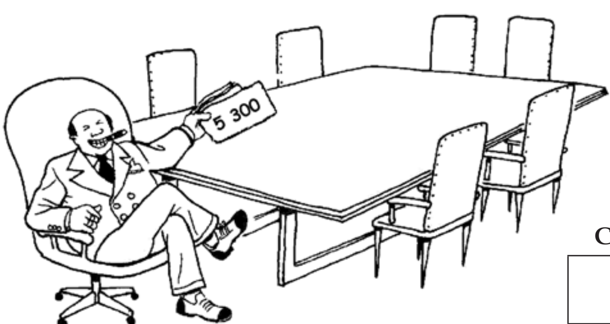
Economic value

Mahogany is the most valuable timber species in the Brazilian Amazon, worth up to four times the value of its nearest competitor. One cubic metre of first-quality sawn mahogany – imagine a solid cube of stacked mahogany planks, 1 m wide by 1 m long by 1 m tall – is worth about US$1 800 when it departs the docks of Belém or Paranaguá for the United States of America or Europe. A single large tree, 80 cm in diameter or a bit larger than 250 cm in circumference, on average can produce more than 2 m^3 of sawn timber worth about US$4 100 if the wood is of high quality. However, smallholder farmers and Indigenous Peoples who sell mahogany trees to loggers rarely receive more than US$6–24/tree, if they receive any money at all. Similarly, mateiros (woodsmen) who search the forest for mahogany, chainsaw operators who fell the trees, and logging crews who drag the trees out of the forest and transport them to the nearest sawmill are poorly paid. In fact, most of the tree's value goes to the middlemen who finance mahogany's harvest, processing and resale to foreign buyers.[2]

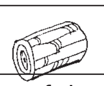
Earnings from a typical mahogany tree (2.4 m^3) along the production chain





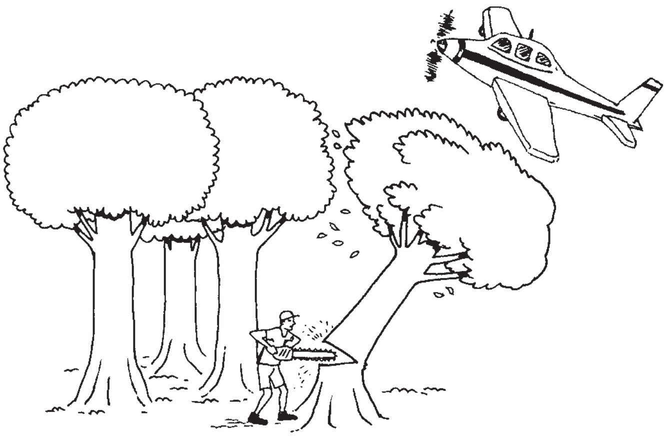


Costs and earnings from one mahogany tree (US$)

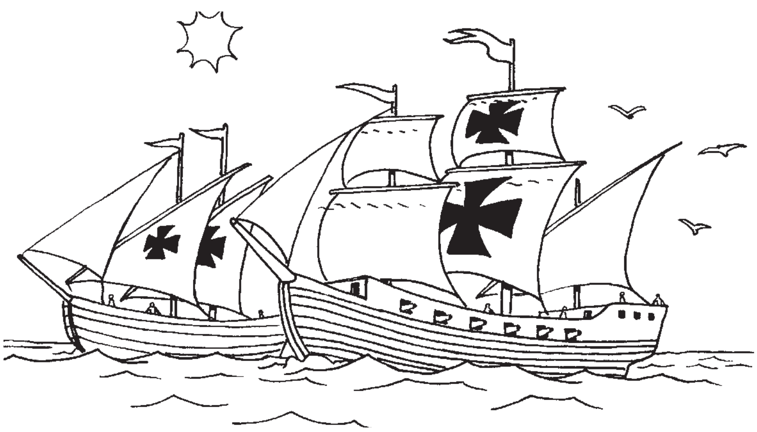
	Farmer	Logger	International buyer
Value of the sale	24	1 400	17 700
Costs	0	800	12 400
Earnings	**24**	**600**	**5 300**

Uses

Mahogany is highly valued because its wood combines many rare qualities. It has a beautiful colour and grain; it is lightweight yet exceedingly strong and resistant to rot; and it has excellent workability – just ask any carpenter. For these reasons, it is a luxury wood used throughout the world for producing high-priced furniture, panelling, musical instruments and yachts. Mahogany's extraordinary value has pushed loggers into the heart of Amazonia where people have never heard a chainsaw before. The loggers fly in, using small planes to spot mahogany crowns in forests far from the nearest road or settlement. Loggers will try to buy trees cheaply unless landowners learn to negotiate fair prices.

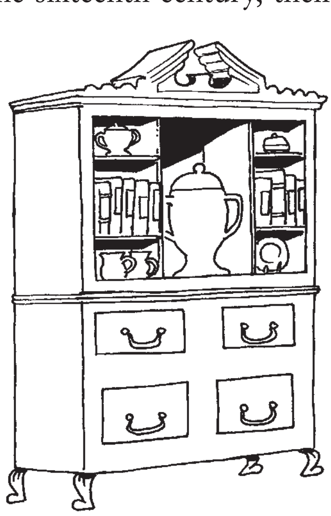


The cannonball test



In the sixteenth century, after the Spanish arrived in Central and South America, they discovered that mahogany was a superior wood for shipbuilding than the European timbers used up until that time. It resisted rot in warm, tropical waters and had the enormous advantage of not splintering when hit by cannonballs, absorbing the impact without shattering and injuring sailors with flying wooden shrapnel. When the English defeated the Spanish Armada in a great naval battle in the sixteenth century, their main prize was the Spanish fleet, built largely out of mahogany.

The English are primarily responsible for the modern-day use of mahogany as a luxury wood in furniture. They discovered in the eighteenth century that mahogany's great strength allowed massive bureaus and wardrobes to be built on legs so thin and delicate that they looked insufficient to bear their weight. This style was so popular that even the royal family insisted on having furniture built from mahogany.[3]



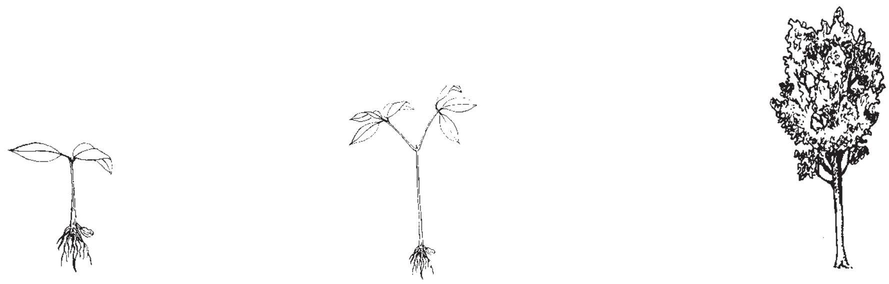
Consumers, communities and conservation

By shopping for and requesting certified sustainable forest products, consumers can help communities and governments maintain functioning forest ecosystems. Although nearly every North American and European has heard of mahogany, how many consumers know where this timber comes from, and at what cost? Since the 1970s, mahogany has been under intense exploitation pressure to supply international consumers, leading to commercial extinction across most of its range in South America. Mahogany received additional protection when it was listed on CITES (Convention on International Trade in Endangered Species) Appendix II in 2003, but this is no guarantee that significant natural populations will survive in the wild.[4] More than any other Amazonian resource, including gold, mahogany has catalysed the invasion of previously unexploited forests and Indigenous Areas across Amazonia by loggers, ranchers and industrial farmers.

The majority of mahogany is logged illegally, extracted from uninhabited government lands and indigenous areas hundreds or even thousands of kilometres from the nearest legally registered management plan. Often loggers fell every mahogany tree they can find, including trees too small to harvest legally and large hollow trees with no commercial value (but that still flower and produce seeds each year). Predatory logging ignores sustainable management guidelines that require the retention of small trees to provide future harvests and large 'mother' trees to produce and disperse seeds representing future generations of mahogany trees.[5]

Yet mahogany could also represent the vanguard of positive change in Amazonia. If consumers demanded certified forest products, foresters and governments alike would have an incentive to sustainably manage their forests. By far the most valuable timber tree in Amazonia, mahogany could provide great incentive for management plans that allow for continued commercialization while maintaining healthy populations of trees in the forest, thus ensuring harvests for generations to come.

MANAGEMENT



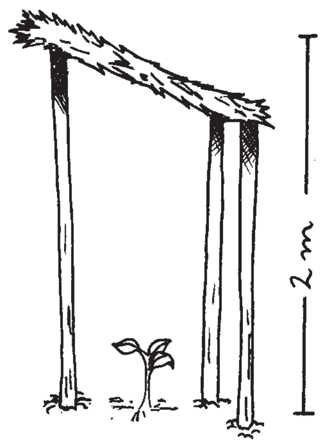
germination
2–4 weeks after
wetting the seeds

growth
1–2 m/year
in the first years

seed production
when the trunk reaches
30 cm in diameter

Seeds and seedlings

Mahogany seeds will germinate within 2–4 weeks once they have been watered. Break off the wings and plant the seeds tip down in well-draining soil (for example, sandy soil), nearly but not quite buried. In the nursery, use black polyvinyl planting bags 10–12 cm in diameter by 30 cm deep to allow the seedling to root deeply. It's best to try to use the same kind of soil in the nursery that the seedling will encounter in the forest after planting. Keep the soil damp, but not too wet, or else seeds will catch fungal infections and die. The best overhead cover is half shade using a single layer of babaçu or inajá leaves suspended about 2 m over the plantings.



Once the seeds begin to germinate, the seedlings will sprout leaves quickly, standing 15–25 cm tall, with 4–8 simple leaves. They will rest for about a month before producing new leaves again – some of these will be compound leaves, and if the seedling is healthy, it can grow 10–15 cm during the second flush. The best time to plant seedlings into forest gaps or into agricultural clearings is after the second batch of leaves has sprouted. Prune off all but the highest four or five leaves to reduce heat and water stress when planting in bright sun. Dig a hole the exact size of the seedling bag with a posthole digger and slide the seedling soil core into this hole intact, making sure to re-establish soil contact between the seedling and the forest soil.

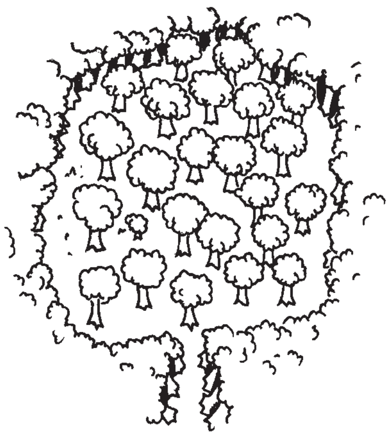
It is also possible to plant mahogany seeds directly into gaps and agricultural clearings, especially in areas that have been cleared by burning, as the burned areas offer reduced root and above-ground competition. Keep seeds dry after collecting them, because there is a tendency for moulds and fungi to damage them without any sign of attack.

Wait until after the rainy season has begun to plant seeds, so they will germinate more quickly. This will reduce the time they are exposed to forest animals, like rats and agoutis, and to insects that eat or damage seeds. If possible, loosen the soil before planting to about 30 cm depth with a posthole digger, refill the hole, and then plant the seed at the soil surface. Plant two or three seeds per site to make sure at least one survives to germinate and grow. Later, if necessary, weed out the small or less vigorous seedlings. Mahogany grows especially well beside dead trees or palm stumps that do not sprout.

Growing and tending

Mahogany seedlings prefer a lot of light – the more the better. Plant seeds or seedlings as near as possible to clearing centres, at a spacing of 8–10 m. It is best to orient a long clearing east-to-west so that the sun will pass overhead longer during the day.

Mahogany is capable of growing very fast under the right conditions – in a clearing with lots of sunlight, in fertile soil and without vines smothering its crown. Some seedlings can grow up to 2–3 m/year during the first years. Secondary vegetation growing near the seedlings can help them hide from the shoot borer moth, whose larval caterpillars eat expanding stem tissues and destroy the sapling's straight-as-an-arrow form. It is also good to plant mahogany at low density and widely spaced, so that one fast-growing seedling does not attract the shoot borer to its slower-growing neighbours.



Mahogany needs care, but not too much. Once mahogany is growing well in small- to medium-sized clearings, it needs tending only every two or three years. Vines should be cut if they've climbed onto its crown, and competing trees can be cut if they are casting too much shade on the mahogany trees. In the long term, these efforts may be well compensated. Mahogany is likely to be much more valuable by the time the next generations – your children, and their children – wish to cash in.

1 Snook, L.K. 1996 / Gullison, R.E. *et al.* 1996
2 Veríssimo, A. *et al.* 1995
3 Raffles, H. 2002
4 Blundell, A.G. 2004 or Grogan, J. & Barreto, P. 2005
5 Grogan, J., Barreto, P. & Veríssimo, A. 2002

Piquiá

Caryocar villosum (Aubl.) Pers.

The Indians wander three or four miles back from the bluff looking for piquiá fruits... Forest monarchs, these are; the branches, contrary to the rule of forest-trees, are spreading and rough, like an oak, but vastly larger than any oak I ever saw.

Herbert H. Smith, 1879

Patricia Shanley
Jurandir Galvão
Margaret Cymerys

The piquiá is a majestic tree that can reach astonishing heights of 40–50 m. It has a trunk of up to 2.5 m in diameter (over 5 m in circumference) and an enormous crown that is easily spotted in the forest. It can be found throughout Amazonia, with the greatest concentrations in upland forests of the large estuary region.[1] The grapefruit-size, tawny fruit fall freely from the tree. Children scoop them up to bring home, as the yellow, oily, rich pulp of piquiá must be boiled before eaten. Although not sweet, the savoury fruit are appreciated by Amazonian families who delight in their unusual scent and flavour.[2] The wood's interlaced fibres provide extra resilience, giving it a superior quality and making it a favourite for boatbuilding. Rich in carbohydrates and protein, piquiá flowers are a prized food source for forest animals. When the tree is in flower, avid hunters place small hunting stands near the tree to wait for game to arrive and nibble at the thousands of large golden yellow flowers scattered on the ground.

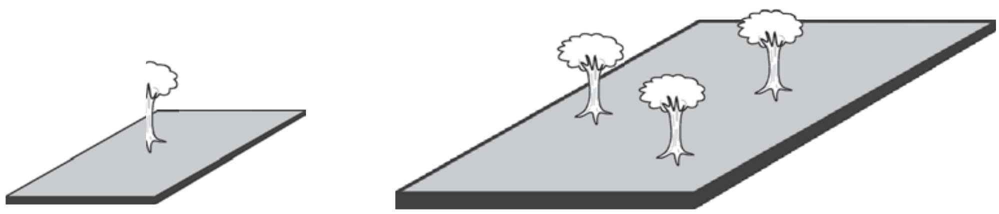
Ecology

Flower and fruit seasons

J F M A M J J A S O N D

In Pará, the piquiá tree produces flowers in the dry season, from August until October, and fruit during the rainy season, from February until April. The leaves may fall either in the beginning of the flowering season or as the fruit begin to appear on the tree.

Density



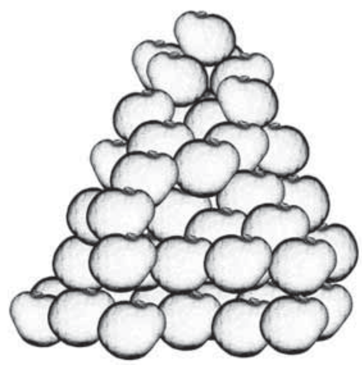
0.4–0.6 trees/ha 2–3 trees/alqueire

Higher densities, from 2–7 trees/ha, occur in some regions, possibly because of indigenous management.

Production

Most piquiá trees do not produce fruit every year. Many trees rest one year and produce the next. Over a five-year period along the Capim River (1993–1998), between 20% and 33% of 100 piquiá trees produced fruits each year.[3]

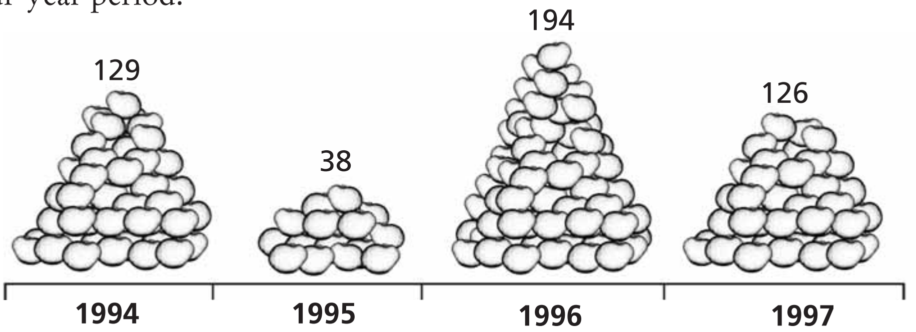
In Boa Vista, a 45-minute boat ride from Belém, locals have managed piquiá and other fruit trees for generations. One grand old tree there is called Queen Piquiá for the exceptionally flavoursome fruit she produces. Piquiá trees are renowned for producing both bitter and "sweet" fruit. Consumers warn that it is useful to know your fruit merchant so that you can be sure to purchase delicious piquiá.



an annual average of 350 fruits/tree

How many fruits per year?

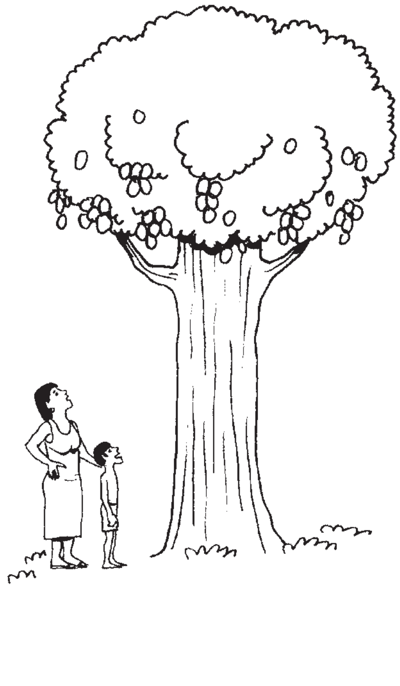
During the flowering season, piquiá trees blanket the earth below them with thousands of lovely yellow flowers, encircling the tree and mirroring the crown above. Each flower has a bouquet-like centre with hundreds of long, thin stamens. During one season, a tree in the Capim region tossed 14 000 flowers/day, approximately 120 000 flowers over the whole season. However, a multitude of flowers does not necessarily indicate that a tree will produce a multitude of fruit. This impressive flower production resulted in approximately 400 fruit. Another individual tossed 2 600 flowers and produced only 45 fruit, while a different tree with 1 700 flowers produced 40 fruit. Yet another tossed 10 261 flowers and produced 300 fruit. Still, scouting out which trees are producing flowers each year can offer a good idea as to which trees may bear fruit. But anticipating how many fruit is difficult. As Antonino from the Capim River region says, "Piquiá has a secret that no one is able to discover." The average fruit production of 100 piquiá trees varied substantially over a four-year period.[3]



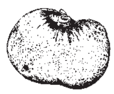
ECONOMIC VALUE

At the beginning of the harvest in January 2009, piquiá fruit in the Ver-o-Peso market was selling for US$ 0.40 each. During the same time frame in 2008, one small fruit at this market cost US$0.30 and a large one cost US$0.50. In 1998, one piquiá fruit in the Belém outdoor market fetched between US$0.13 and US$0.40. In 2004, in Belém's 28 major open air markets, about 343 000 piquiás were sold; in Ver-o-Peso alone, 108 000 piquiás were sold. During 2004, the sale of the fruit generated approximately US$47 300[4]. In 2008, a litre of piquiá oil sold for US$21.

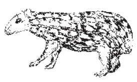
Piquiá wood is exceptional for boatbuilding. Consequently, the occurrence of piquiá trees near boat factories has declined. Piquiá is also favoured by rural communities for building canoes and is often cut down along riversides. To ensure a supply of fruit without a long walk to the forest, it is useful for rural families to conserve some trees near the village. One Capim family keeps a big piquiá about 500 m from their house. The children of the family, Neca, Antônia, Simeão and Jaime, know when the fruits are in season and run through the forest to be the first to collect them. In the month of March alone, the family ate 868 piquiá fruits. If they had bought these in the closest farmers' market of Paragominas, the fruit would cost about US$400.



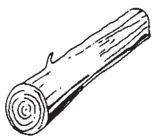
Uses



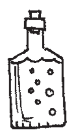
Fruit: The pulp can be boiled in salted water. The most delicious piquiá are fragrant with bright yellow pulp. Underneath the pulp, there is a layer of slender, sharp spines, so it is critical to be careful when biting into a fruit. To attract customers, merchants sometimes open the thick brown rind of the piquiá to reveal the golden pulp inside.



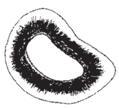
Wildlife: The flowers attract many species of animals, especially paca, agouti, deer, coati and armadillo.



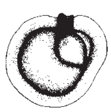
Wood: The wood of the piquiá is of high quality – compact, heavy, slow to decompose and useful for pieces with large dimensions. Piquiá wood is prominent in the construction and boatbuilding industries and is often used for reinforcing the internal structure of riverboats. In rural villages, canoes carved of piquiá have the advantage of lasting up to ten years. A canoe of piquiá can be packed full of forest fruits, sacks of manioc flour, bananas and a large family without trepidation, owing to both its stability and the reliability of the natural paraffin sealant typically used as a finish. Fences and gates to corral cattle may be constructed of piquiá because it is water resistant and does not splinter easily.



Oil: The oil from the pulp of piquiá can be used in cooking and is especially good for frying fish.



Seed: The seeds are an excellent source of nutrition; the seed's oil has potential utility in the cosmetics industry.



Rind: The rind is rich in tannins. It can be used as a substitute for the oak gall in the making of ink as well as to dye hammocks and yarn. The rind can also be used to make soap.

Nutrition

Piquiá is an excellent source of calories and energy. The fruit is composed of 65% rind, 30% pulp and 5% seed. The pulp is 72% oil, 3% protein, 14% fibre and 11% other carbohydrates. Piquiá flowers are also rich in nutrition, offering wildlife an excellent food source. The flowers are composed of 71% carbohydrates, 8% protein and 3% fat.

Piquiá oil

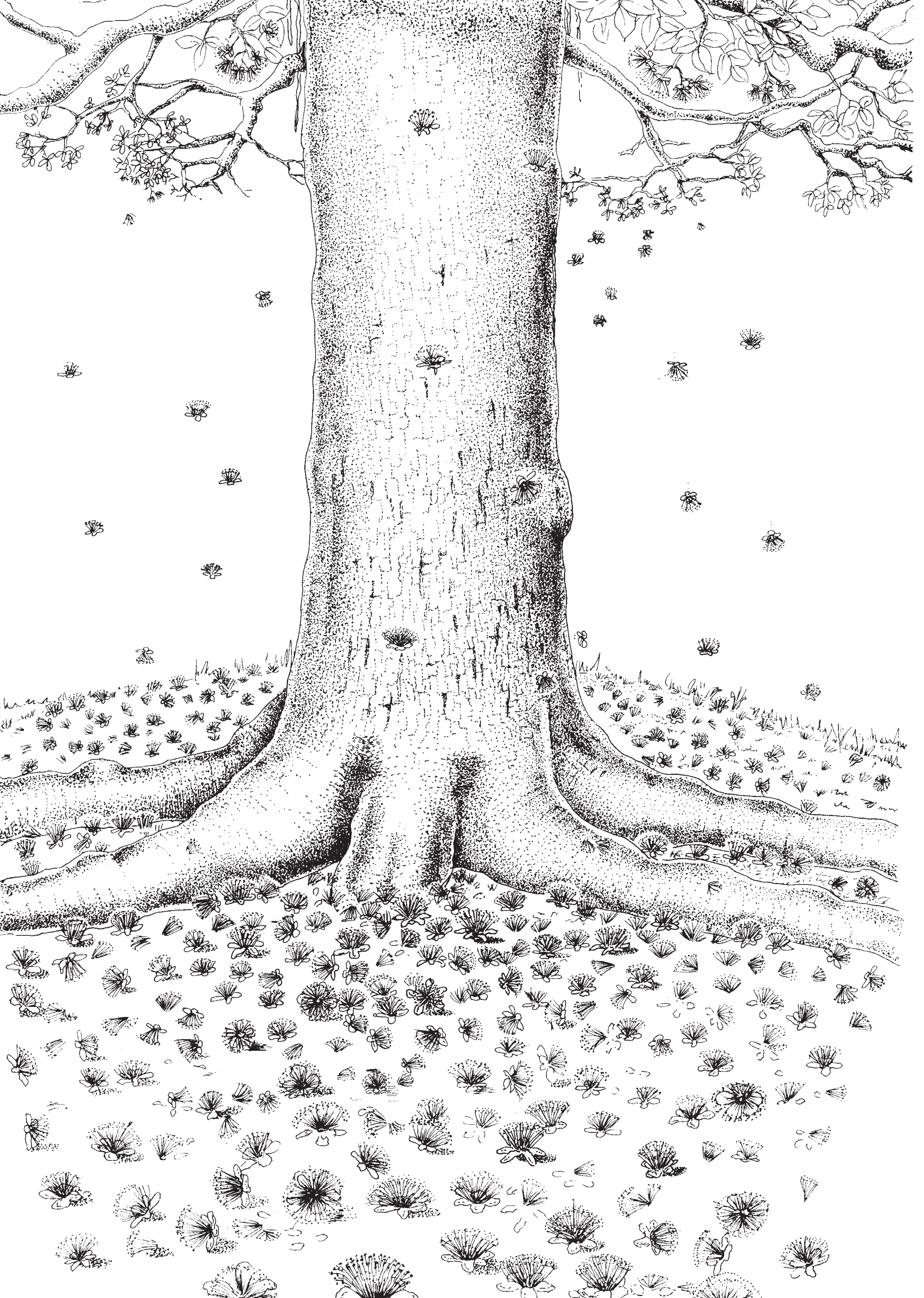
During a good harvest year, Senhorinha of the village of Nanaí, Pará, was able to gather so many fruits that she could extract all the oil she needed for the entire year. "Making our own piquiá oil means that we don't spend money that we don't have," she explains. To extract the oil, Senhorinha suggests the following: Let the fruits ripen for three or four days. When soft, boil them for one hour and pour out the water. The next day, grate and knead the pulp well, cooking over a low flame without water. Finally, take the pulp out bit by bit as the oil melts. Three dozen piquiá can produce approximately 2.5 litres of oil.

Recipes

Piquiá soap

Ingredients:
- 1 18-litre can of peeled piquiá
- 5 litres of water
- 500 g of caustic soda
- 50 g of paraffin or silicate
- linen sacks
- 1 large empty can
- 1 wooden spoon
- several wooden boxes

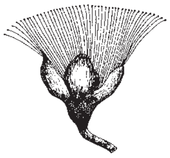
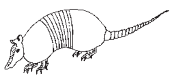
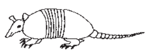
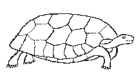
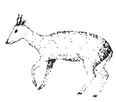
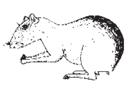
Preparation:
Dissolve the caustic soda in water. Leave the piquiá fruit to soak in this mixture for 12 hours. Next, remove the rinds with a wooden spoon. Mix the piquiá, water and caustic soda together until they form a dough-like texture. Add the paraffin bit by bit. When the soap is a good consistency, spoon it into the wooden boxes and wrap the boxes within linen sacks. Let the soap rest for 12 hours, and then cut it into bars. Always remember that the caustic soda is toxic and direct contact should be avoided. The can used to contain the caustic soda and water should not be reused for other purposes.

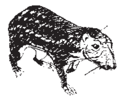
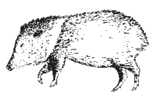
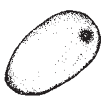
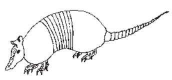


WILDLIFE

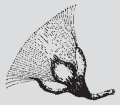
Food fest for wildlife

The amount of game captured beneath fruit trees during one season (September 1993–August 1994) in the Capim Region of Pará shows how important flowers and fruit are for the nourishment of wildlife and people.

Tree	Number of animals			Total weight
Piquiá 	18		pacas	232 kg
	4		red brocket deer	
	4		nine-banded long-nosed armadillos	
	1		seven-banded long-nosed armadillo	
	1		agouti	
Copaíba 	1		red brocket deer	63 kg
	1		yellow-footed tortoise	
Tatajuba 	7		yellow-footed tortoises	60 kg
	1		red brocket deer	
	1		agouti	

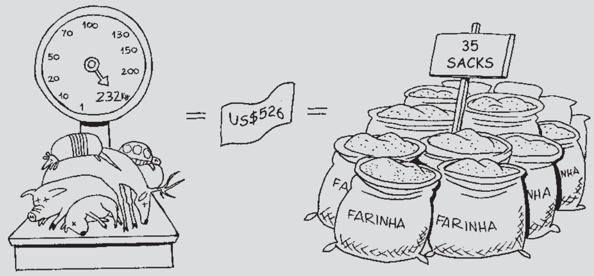
Inga 	2 	pacas	40 kg
	2 	agouti	
	1 	collared peccary	
	1 	brown-throated, three-toed sloth	
	1 	mealy parrot	
Uxi 	3 	nine-banded long-nosed armadillos	38 kg
	1 	paca	
	1 	red brocket deer	
	1 	agouti	
Maturi, Matamatá 	5 	pacas	31 kg

The local meat market



The piquia tree is the favourite of many hunters as they say her flowers "call" game animals. For example, in the flowering season, Raimundo builds a blind near a piquiá tree and waits for his dinner to arrive. In 1995, during only two months of the flowering season, he was able to catch 67 kg of game underneath the piquiá trees. About 40% of the game's weight is inedible parts, such as bone, skin and hair.[5] Sixty percent is edible, resulting in about 40 kg of game meat. If Raimundo bought an equivalent quantity of beef in the nearest meat market, he would have paid US$151, about the same value he would earn selling ten sacks of farinha. At the local community store where you can only find the more expensive dried beef, he would have paid US$222, about the value of 15 sacks of farinha.

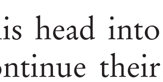
During three months of piquiá flowering, seven hunters from one community along the Rio Capim in Brazil caught 18 pacas, 4 deer, 4 armadillos and 1 agouti beneath the piquiá trees. This game weighed 232 kg. The community caught four times more game under the piquiás than any other tree. This game provided about 139 kg of edible meat that would have cost US$526 in the Paragominas markets, which is the equivalent of the price earned from 35 sacks of farinha. Managing fruit trees and wildlife make it possible for rural villagers to continue to obtain needed sources of protein from common and rapidly producing species such as rodents, while protecting more vulnerable wildlife and forest biodiversity.



Piquiá forever?

Dendrogene Project[6]

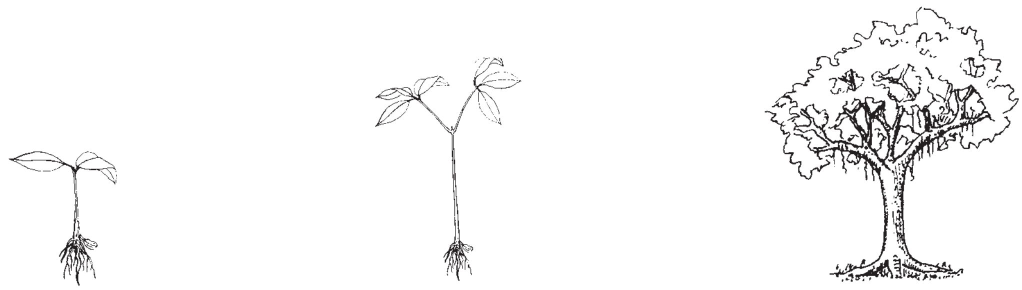
Pau-rosa (*Aniba rosaeodora*) trees have been harvested for perfume since the colonization of Brazil. For this reason, it is now difficult to find them in Amazonia. This same fate could befall the piquiá tree as it is highly valued for its wood as well as its fruit.



Piquiá trees reproduce and bear fruit through pollination. The piquiás depend on a nectar-eating bat, Thomas's nectar bat (*Lonchophylla thomasi*), to carry pollen from one tree to another. In the dark of night, this tiny bat, weighing only 8–15 g, visits the crown of the piquiá tree and buries his head into the flowers to lap the sweet nectar within. For the bats to survive and continue their pollinating function, it is important to leave enough piquiás in the forest.[7]

Predatory logging and fire has reduced the piquiá population, making it less likely that there will be several nearby piquiá trees flowering at the same time. The greater the distance between the piquiás, the less chance that the little *Lonchophylla thomasi* will be able to successfully pollinate them.

Management



germination
2 months to 1 year

growth
fast initially, then 1 m each year for 10 years

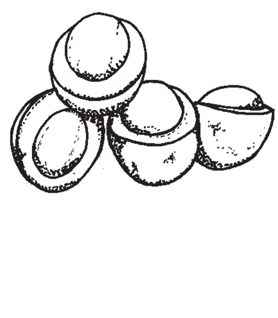
production
after 10–15 years

It is difficult for a piquiá tree to take root and grow in the deep forest because its seedlings do not grow well in shade. If you want a forest full of piquiá, it is best to plant seeds in clearings in the forest or openings in the canopy where light can penetrate. In the community of Nanaí, Pará, Paulo planted 70 piquiá trees nine years ago. Today, they are over 8 m high. In a few years, Paulo will have far more piquiás than he could ever eat, and he plans to sell the surplus in the local market. Due to its rapid growth, the piquiá tree can be effectively integrated into agroforestry systems.

Domingos Meireles, who makes his living producing fruit in the Transcametá region of Pará, says that a piquiá tree that re-sprouted close to his house produces between seasons. Nightly, the family tosses its organic food waste out of the window and onto the roots of the tree. Domingos declares, "Recycling our compost through the roots and into the body of the piquia tree has given it added strength and has sweetened the flavour of its fruit."

To enrich secondary growth forest, plant 50 piquiás/ha. With an estimated 200 fruits/tree, this could yield six tonnes of fresh fruit/ha, or:

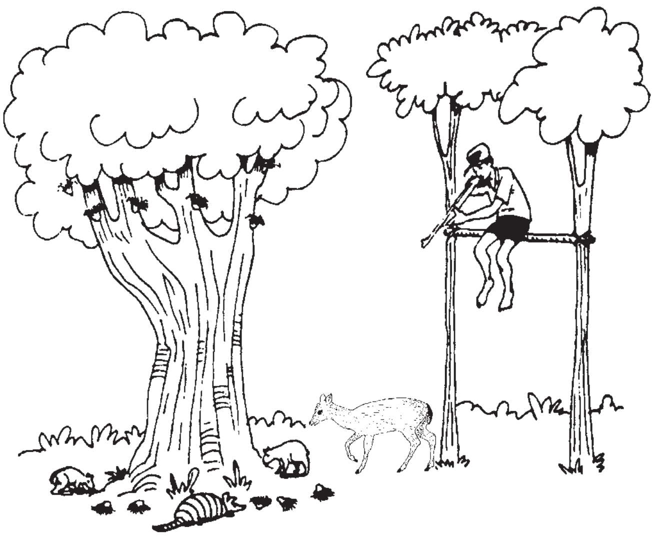
– 1 tonne of pulp
– 90 kg of seeds
– 330 kg of tannins
– 105 kg of pulp oil
– 30 kg of seed oil.



Connections between wildlife, people and fruit

Many species of wildlife survive by eating fruit.[8] For example, in the rain forest, a grey brocket deer's diet consists of 87% fruit, and the larger red brocket deer consumes 81% fruit. Fruit makes up 59% of the diet for the collared peccary from western Amazon, 66% for the white-lipped peccary and 34% for tapirs. Paca, agouti, monkeys, parrots, macaws and other wildlife also depend on fruit for their survival. Likewise, most of these trees depend on the animals to disperse their seeds. Forests with various trees that flower and bear fruit at different times of the year are able to support more frugivorous animals. To ensure that there is a continuous supply of game in their forests, some communities conserve and manage fruit tree species, especially those that wildlife most enjoy. The composition and quantity of game are key indicators of a forest's health and abundance.

Certain fruit trees, such as bacuri, uxi and piquiá, are also favoured by loggers, making them "conflict of use species". To ensure a fair deal, villagers need to negotiate well and to remember the "invisible income," – fruit, game and medicine – which some species provide when determining the sale price of a log. It is also instructive to note that for each tree extracted, up to 27 trees can be damaged during the logging process.[9]



[1] Prance, G. & Silva, M.F. 1973
[2] Cavalcante, P.B. 1991
[3] Shanley, P 2000
[4] Serra, M. *et al*. unpublished manuscript.
[5] Silvius, K, Bodmer, R.E. & Fragoso, J.M.V. 2004
[6] Kanashiro *et al*. 2002
[7] Albuquerque, D. 2002
[8] Bodmer, R.E. & Ward, D. 2006
[9] Johns, J., Barreto, P. & Uhl, C. 1998

Rubber tree, seringueira

Hevea brasiliensis (Willd. ex A. Juss.) Müll. Arg.

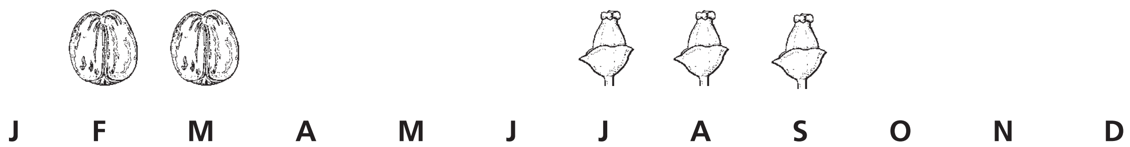
Alexandre Dias de Souza
Renaxon S. de Oliveira
Edson Luiz Furtado
Paulo Yoshio Kageyama
Raimundo Graça S. Freitas
Pedro de Albuquerque Ferraz

One hundred years ago, when the rubber industry was strong, there were thousands more rubber tappers in the Amazon region than there are today. In those days, latex production generated a substantial amount of cash. Rubber barons wanting to impress the world with their wealth and sophistication attempted to transform sleepy jungle towns like Manaus and Belém into elegant, cultured cities, with parks and fountains, opera houses and public buildings in the grand European style. For poor farmers from northeast Brazil, the false promise of riches from rubber extraction offered a chance to escape grinding poverty, and a large part of that population migrated to the region to attempt to make their fortune tapping rubber. But the rubber tappers often had to fight for their rights and for the rubber tree forests. The state of Acre only belongs to Brazil because the rubber tappers fought Bolivia for possession of it at the end of the nineteenth century.[1] In the 1980s, the concept of extractive reserves, where large tracts of forest are set aside for exclusive use by non-indigenous forest-dependent populations, grew out of the rubber tappers' ongoing struggle to halt the advance of loggers and cattle ranchers into their areas.

The rubber tree became an extremely important species for the modern, industrial world. When latex is transformed into rubber, it can be used to make many useful products, such as tyres and surgical gloves. Rubber trees are native to Amazonia, but today there are many rubber plantations around the world, principally in Southeast Asian countries such as Malaysia and Indonesia. In Amazonia, most latex continues to be extracted by hand in the traditional manner by more than 100 000 rubber tappers and their families. Rubber trees naturally occur in Brazil, Peru, Venezuela and Bolivia, and various species of the genera Hevea are dispersed throughout the region. Of all the species, *Hevea brasiliensis* produces the largest quantity and best quality of latex and is the primary source of rubber production by rubber tappers in Brazil.

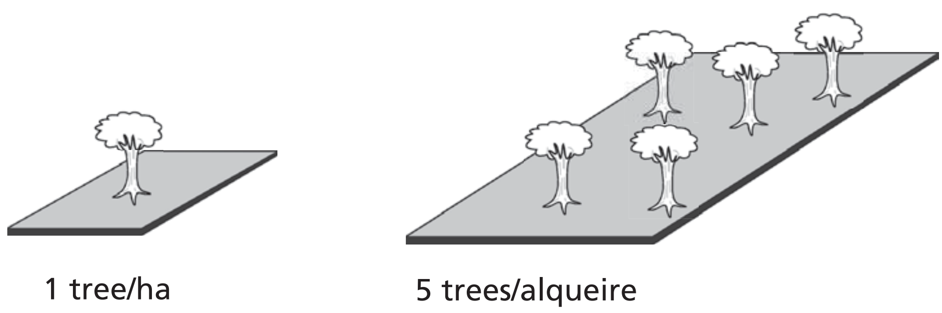
Ecology

Flower and fruit seasons



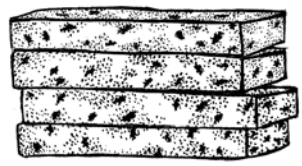
The rubber tree flowers from the end of July through September and produces between 250 and 500 fruits (from 1 to 2 kg) that release their seeds in February and March. The fruits normally break open and the seeds are dispersed by animals, rivers and streams. The latex tapping season begins after the fruits fall, in the early dry season. In the Tapajós region, in Pará, latex is extracted only in the wet season due to low production during the summer.[2]

Density



The rubber tree is found in low densities in the forest, as there are only 0.07–3 individuals/ha. In conventional plantations, there are between 250 and 600 rubber trees/ha. In the Tapajós region, farmers have a long tradition of planting rubber tree seeds and other seeds in their fields, creating agroforestry plantations which have densities of up to 700 rubber trees/ha.

PRODUCTION



an average of 1.5 kg of dry rubber/tree/year

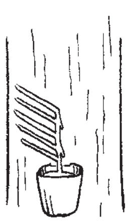
A rubber tapper working in a native forest can tap between 140 and 160 trees/day, collecting between 15 and 20 litres of latex. Each tree produces an average of 4.5 litres of latex/year, which is transformed into 1.5 kg of dry rubber.[3] The rubber tappers take two breaks in the rubber harvest: once to collect Brazil nuts when they are in season, and again when the rubber trees lose their leaves. A rubber tree lives up to 200 years and, if managed properly as outlined below, latex can be harvested for many decades. In the Tapajós region, a large number of rubber trees were planted in agroforestry plantations, increasing the number of trees that can be tapped each day.

ECONOMIC VALUE

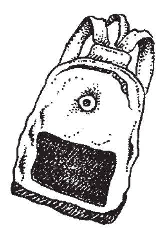
After harvesting the rubber, a rubber tapper uses an acid (in Acre they often use the milk of gameleira, *Ficus dendrocida*) to coagulate the latex and make a thick blanket of rubber called "raw smoked sheet". This sheet is stored and sold. The government of Acre is helping with the commercialization of raw, natural rubber. With the Chico Mendes law, rubber tappers receive US$0.41 from the government in addition to the market price of rubber (which in 2008 was US$0.77–0.94/kg), which means that a rubber tapper earns US$1.18–1.35/kg. Extracted natural rubber is still highly sought after. In 2006, Brazil produced more than 175 723 tonnes of coagulated rubber, with a minimum of 3 942 tonnes produced by rubber tappers, generating more than US$4.7 million in revenue. The states of Amazonas and Acre are the largest producers of rubber latex in Brazil, with 51.9% and 35.7% respectively.[4] Some latex extracted by rubber tappers is sold to factories outside the region for processing.

Extractive cooperatives in Acre are adding value to rubber, increasing its price and production. In Xapuri, the cooperative is on its way to founding the first latex factory to produce concentrated latex used in the production of condoms. There are also several cooperatives in Amazonia working in the production of vegetable leather, a leather-like finished product, used in bags, backpacks and other products.

USES

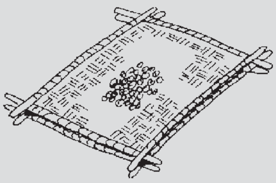


Latex: Natural rubber is an elastic material called latex obtained from the sap of the rubber tree. Rubber is used extensively in the production of tyres, and various other components and accessories of cars and motors. It is also used to make waterproof fabrics, shoes, backpacks, toys and condoms. Liquid latex is used extensively in the manufacturing of flexible masks, for clinical uses and for special effects in feature films.



Seed: Long ago, the Aztec Indians used rubber tree seeds as money. They are used today as jewellery.

A blessing from above



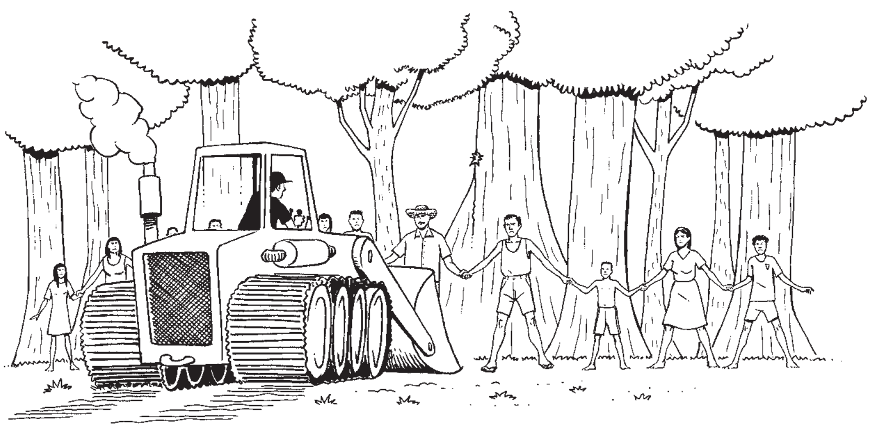
Once upon a time, an Indian warrior was punished by the chiefs of his tribe and obliged to carry water in a basket made of wild vines. The gods of the tribe took pity on the great warrior and taught him to coat the bowl with latex from the rubber tree. When the chiefs saw that the warrior succeeded in carrying water in the basket, they decided to forgive him.[5]

How to extract latex

Rubber trees are usually divided into areas worked by individual families. One area covers between 400 and 600 ha, containing between 450 and 600 trees distributed along two to four rubber trails Before dawn, the rubber tapper gathers his headlamp, knife and a rifle in case some game is spotted, and heads off to the rubber trail. The rubber tapper works one looped trail per day. He makes diagonal cuts in the bark of the trunk, one below the other, using a knife called a *cabrita*. After the last cut, he places a bowl or cup on the tree to collect the latex as it drips from the incisions. Along the way, the rubber tappers may hunt wild game for lunch, arriving back home at about 11 a.m. In the afternoon, he follows the same route to collect the latex that has accumulated in the bowl, walking between 6 and 10 km/day.

Standoff: ranchers vs. rubber tappers

In the 1970s and 1980s, the Brazilian government granted a number of incentives to cattle ranchers to open up the Amazonian frontier. Many rubber tappers were expelled from their areas so that the forest could be transformed into pasture. In Acre, under the leadership of activist Chico Mendes and others, they devised a way to protect their forests. When loggers arrived to clear an area for cattle, a large group of rubber tappers and their families would gather together side by side holding hands, sometimes circling trees, thus preventing the tractors from entering the forest. Often the tractors would turn back, leaving the forest intact. These confrontations became known as “empates”, which in local terms means a standoff.

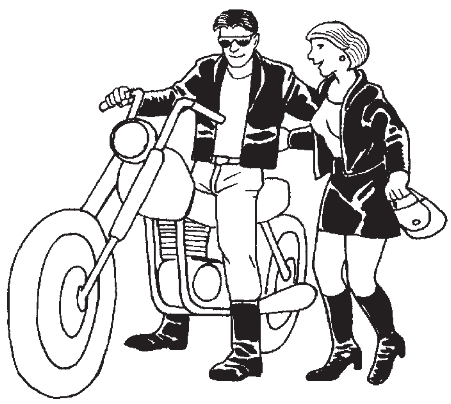


FLORA fashion

Since 1994, rubber producers in Acre have had the benefit of the Forest Products Market (FLORA) at which they can sell directly to consumers or negotiate larger deals with companies.[6] In 2004 and 2005, between 25 000 and 30 000 people visited the event annually, resulting in about US$22 780 in sales each year. Here the communities, cooperatives, local artisans, women's associations and small businesses come to sell their goods.

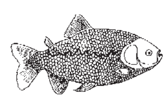
Rubber is sold in its original form, or transformed into inexpensive sandals, toys or figurines of birds and other forest animals. Next to the stand selling low-cost traditional products, a new, pricey, chic product called "vegetable leather" can be found. Vegetable leather is made from cotton fabric coated in latex, smoked and vulcanized so that it resembles animal leather. Many of these products are shipped to upscale stores in the United States of America and France.

An unusual assortment of shoppers display interest in the vegetable leather booth, including well-to-do women searching for the latest fashions, environmentalists eager to be ecologically correct and motorcyclists seeking to swap pieces of their animal attire with vegetable wear.

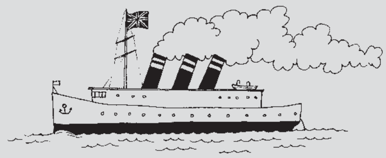


WILDLIFE

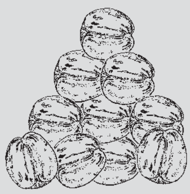
Rubber seeds are large, 2.5–3 cm long, and can provide nutrition for many forest and river animals. Peccaries will crush the shell and eat the seed. In the flooded forests where rubber trees grow, many fish feast on the seeds. Black-finned pacu, locally known as tambaqui, use their strong jaws to crack open rubber seeds and feast on them. Black piranha use their razor-sharp teeth to open the shell and consume the rubber seeds.



Travelling seeds: Asia supplants Amazonian production



Visitors to Brazil, wanting to experiment with planting rubber trees in other countries, dispatched seeds to Europe. The first seeds that were sent did poorly, and it was only in 1876 that the Englishman Sir Henry Wickham succeeded in bringing 70 000 healthy seeds from Boim, on the Tapajós River, near Santarém, to the Royal Botanical Gardens in Kew, England. The seeds were carefully wrapped in banana leaves and survived the journey to form the basis of rubber plantations in the British colonies in Asia. Since the fungus that attacks the seeds in Brazil is absent in Asia, the seedlings grew well, and the cultivation and improvement of rubber made the countries of that region the greatest plantation producers in the world. It was a crushing blow to the Brazilian rubber market and it spelled the end of the dream of infinite wealth in Amazonia.[7] This dream was revived briefly during the Second World War, when Brazil supplied the Allies with rubber for the war effort.



Cruel fortunes

When the Portuguese arrived in Brazil, they saw the Indians playing with a heavy black ball made of rubber. This centuries old discovery of the Indians, anticipated the later invention of the rubber tyre, which transformed the industry and spurred a feverish rubber boom around the world. From 1880 to 1911, the demand for Amazonian rubber was enormous, with Brazil exporting 80 000 tonnes annually. This led to such extravagances as the construction of the Manaus Amazon Theatre, an opera house located mid-way up the Amazon River and at the time only accessible by river. But such riches rarely reached the rubber tappers, who toiled on in wretched conditions.

To increase production and retain labourers in this difficult work, the rubber barons imposed a system of debt peonage on the Indians and caboclos who collected and processed latex. In this system, rubber tappers could buy household products sold by the barons, but prices were inflated. The rubber tappers could never earn enough to purchase everything they needed, so they would fall into debt and in this way were forced to work indefinitely for the barons as virtual slaves.

Management

germination
10 days

growth
1 m/year

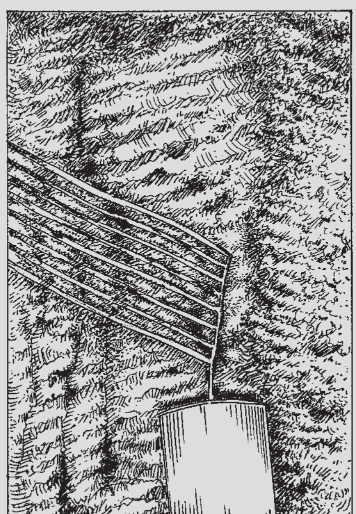
production of latex
after 25 years in the forest
after 10 years in plantations

Rubber seeds need to be planted quickly; within 30 days of being collected, half the seeds will fail to germinate and, after 45 days, only 10% will still germinate. Once planted, the fertile seed will begin to germinate in ten days. In the forest, a rubber tree needs light to grow. As competition for light is intense among the various species, the great majority of seedlings are unable to develop. In lower Acre, less than 20% of the rubber trees are greater than 60 cm in diameter, and they begin to flower only after 25 years.[7] In plantations, the maximum production of latex is attained at around 20 years and this level of extraction continues for another 40–50 years.

When it is time to tap the tree, it is important not to cut very deeply. Ideally one should cut no more than 2–3 mm deep. Do not tap thin trees as this greatly reduces the trees' growth. Mature rubber trees produce little latex the first time they are tapped, but production increases over time. Rubber tappers say that rubber trees which have not been tapped before are stubborn, but that they become tame after a while.

Agroforestry in the rubber grove

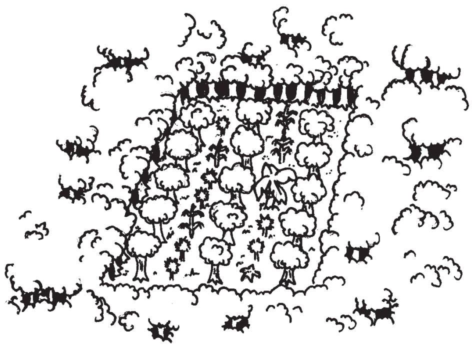
Götz Schroth



In the Tapajós region, where the fungus *mal-das-folhas* is less prevalent, rubber tappers have enriched their agricultural fields by planting rubber trees together with other fruit- and wood-producing species. For over a century, these plantations have evolved into real agroforests as they have been extensively managed. When prices have fallen, however, management has ceased and the forests are temporarily abandoned.[2]

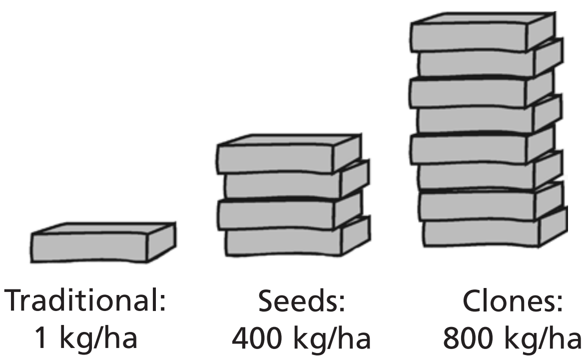
When prices were low in the 1980s and 1990s, a few rubber tappers cut down their rubber forests to plant crops. Others refused to do this, saying that these forests were meant to live forever. With recent increases in rubber prices in Brazil, many who traded their forests for fields are regretful. As one rubber tapper said, "Even if your rubber forest isn't useful to you today, it may be useful for your children tomorrow."

New extractivism



For 40 years people have been trying to plant rubber trees in Amazonia in order to increase production. In plantations, trees are much closer to one another, facilitating the rubber tapper's work. However, rubber trees in plantations in Brazil are vulnerable to *mal-das-folhas*, or leaf blight. This fungus moves rapidly from one tree to another.

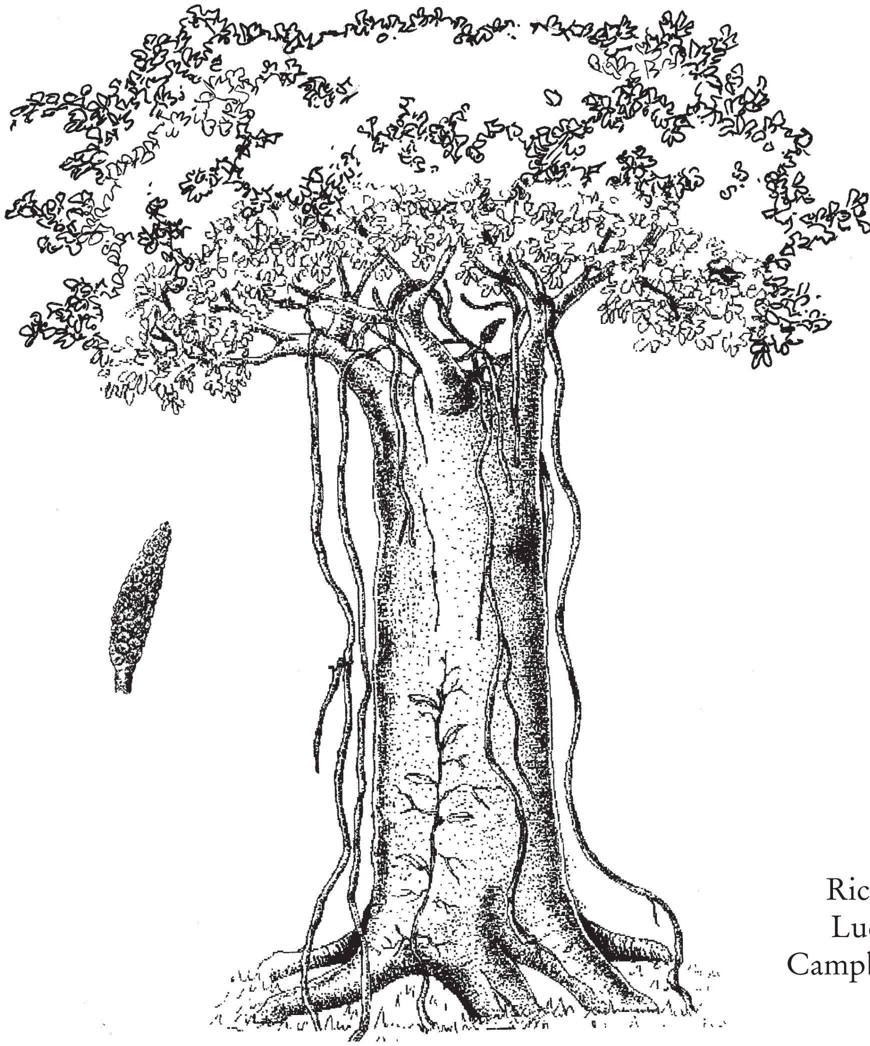
In Acre, mixed plantings are being experimented with in small clearings in the forest. Rubber trees are planted together with other species like manioc, coffee, banana and orange. Each tree is planted in a 4 x 20 m area. In these areas of plantings, called Islands of High Productivity (IAP),[8] researchers believe it is possible to extract between 400 and 800 kg of rubber/ha/year.[9] In native rubber forests, a rubber tapper extracts an average of 1 kg of dry rubber/ha/year. There are two kinds of IAP: those from seeds and those from clones. In seed IAPs, seeds are taken from the most productive rubber trees and planted in the ground, protected from animals by pieces of bamboo. In clone IAPs, new trees grow from sprouts that have been bred to produce more and to have a greater resistance to *mal-das-folhas*.



1 Tocantins, L. 1979 / Dean, W. 1989 / Moro, J. 1993
2 Schroth, G. *et al.* 2003
3 Vasconcelos, S.S. 2001
4 IBGE 2006
5 Neves, C.A. 1981
6 Wallace, R.H. *et al.* 2008
7 Dean, W. 1989
8 Fadell, M.J.S. 1997
9 Maciel, R.C.G.; Saldanha, C.L. & Batista, G.E. 2000

Titica

Heteropsis spp.



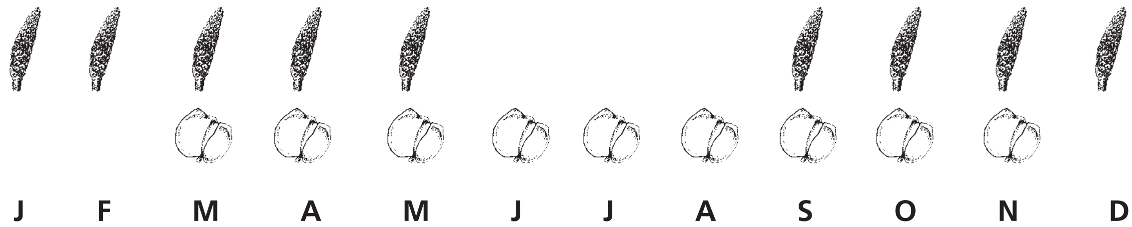
Richard Wallace
Luciano Pereira
Campbell Plowden

During a dark, rainy night in the forest, a small house covered with palm fronds is struck by gusting winds and pelting rain. Inside, seven worn out hammocks hang. Wrapped tightly inside, like cocoons, six children and their parents sleep soundly. In spite of the raging weather, the house will not collapse in the night. Like thousands of Amazonian homes, it is stitched together with the strong and flexible aerial roots of a forest vine locally called *cipó titica*. Tremendously versatile, titica roots are used to tote game home from the hunt, to make strainers for producing manioc flour and to weave baskets to carry fruit. Titica is also used to make hats, furniture and sturdy pack baskets for horses. The availability of titica has declined in areas of heavy harvest and where logging and fire are prevalent. This scarcity has required rural people to travel ever-greater distances to collect it.

Titica is a secondary hemi-epiphyte, a vine that germinates on the ground and climbs to the canopy where the mother plant establishes itself. From high up the trunk of its host tree, a few aerial roots descend from the mother plant in search of the soil. These aerial roots, also referred to as vines, are harvested for use. Titica vine refers to numerous species of the genus *Heteropsis* which produce aerial roots, 13 of which occur in Brazil, Guyana, Venezuela and Peru, preferring terra firme forest.

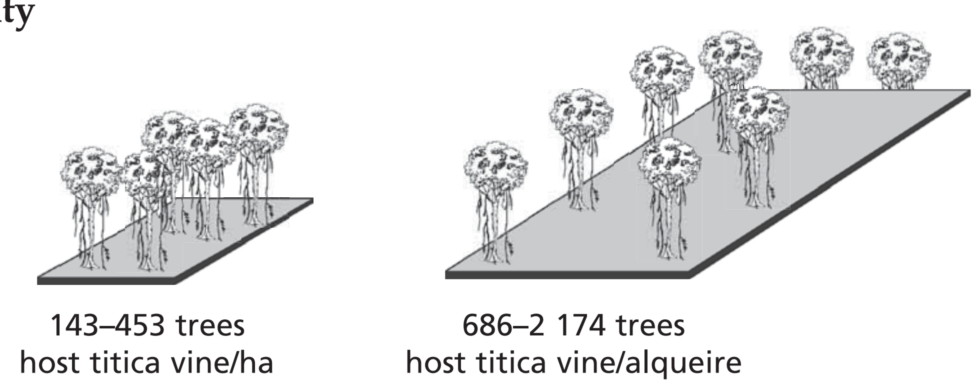
Ecology

Flower and fruit seasons



The flowering and fruiting period of the vine varies greatly throughout Amazonia. However, in most of the Brazilian Amazon, the vine flowers between September and May, and fruits from March through November. In Suriname, titica fruits between April and July.[1] The aerial roots of titica may be collected throughout the year.

Density



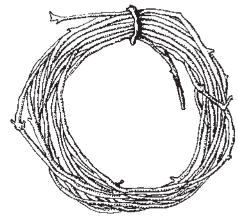
The density of trees hosting titica vines varies considerably, from one tree to over 400 trees/ha (see table below). Titica grows best in mature closed forest. It can thrive on a wide variety of host trees, but is rarely found on certain palm trees and pioneer species, as the trunk and bark of some of these trees are generally unfavourable to climbing vines. Unlike many vines, titica does not climb to the tallest and sunniest parts of a host tree canopy. This apparent aversion to strong light may explain its virtual absence in secondary forests. One study in Pará found only 2 titica plants/ha in an area recovering from a fire 20 years earlier.[2]

The number of mature vines/ha – those that are ready for harvest – also varies. In one study of trees hosting titica vine, 36% of the roots had the potential to be commercially exploited, because the roots were long, thick and had few knots – desirable characteristics for making crafts.[3]

Variation in the density of titica vine in Amazonia

Location	Number of trees hosting titica/ha	Number of mature roots/ha
Tembé Reserve, Pará, Brazil[3]	143–453	554–1 748
Jaú National Park, Amazonas, Brazil[4]	1–5	–
Guyana[1]	61–232	997–1 175
Porto de Moz, Pará, Brazil	36–176 (mean 85)	180–944 (mean 457)

Production



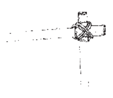
average of 50 kg fresh root and 13 kg dried root/ha

The production of titica varies greatly from place to place – both the number of roots/tree as well as the number of trees hosting the vine. A study in Pará found an average of 3 roots/plant. One root weighs an average of 175 g. On average, 0.5 kg of titica root is collected from each tree, so the plant yields about 36–88 kg of fresh roots/ha. Once the bark and the unusable sections of root have been removed and the roots dried, 7–18 kg remain ready for sale. An average of 350 kg of titica roots/ha have been extracted from Amapá state, but this high yield may be related to the recent start of commercial harvest there.[5]

Economic value

In cities close to Belém, in Pará, the price of dried titica in the 1990s varied between US$1 and US$2/kg. In 2004, 1 kg fetched an average of US$1 without bark. In 2008 in Rio Branco, 1 kg with bark sold for US$1.18 and without bark for US$1.77. Because it requires intensive labour not only to collect titica from the forest but also to remove the bark, some collectors prefer to sell the vine with the bark still on the plant.

Uses

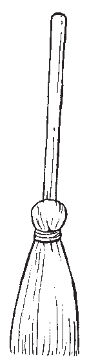


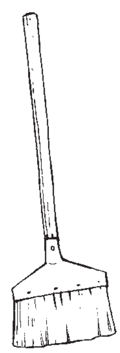
Construction: Titica roots are used to bind housing frames, to construct fencing and as a substitute for nails in rural areas.

Domestic utensils: Baskets, bags, brooms, strainers, saddlebags and wicker furniture are made with titica roots.

Which broom lasts longer?

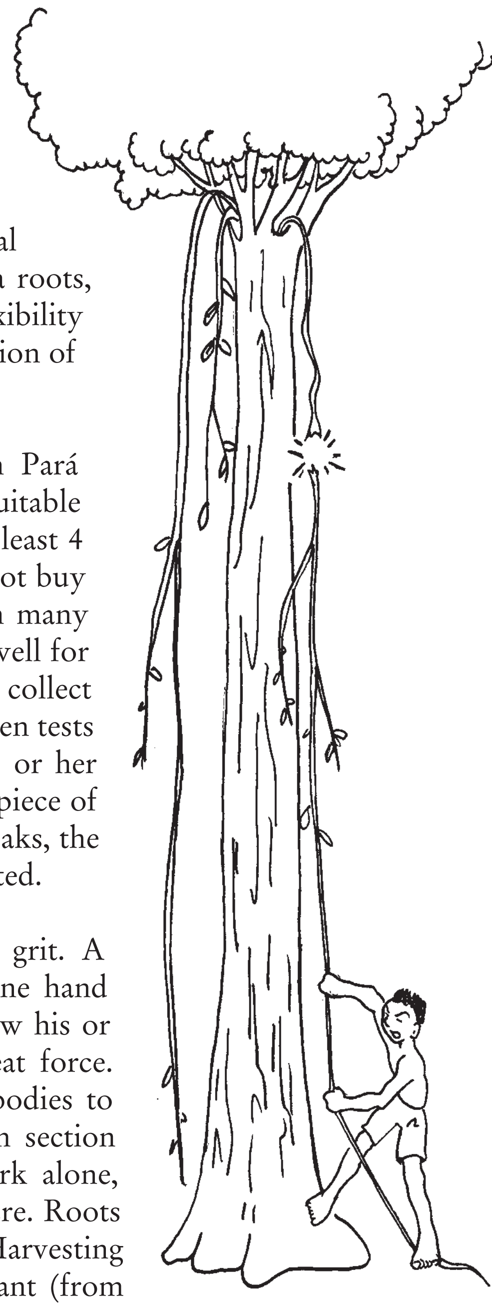
The African and Amazonian tradition of sweeping the ground in the front of your home to keep the area free of plants and debris is rough on brooms. When there is no titica available, women grumble that scrawny plastic brooms are costly and last but a scant while as compared to the robust, hand-crafted titica brooms.





	Titica	Plastic
Cost	US$2.20	US$4.50–6.70
Durability	1 year	6 months

How to collect titica vine



A collector needs to know not only how to identify titica but also where it grows, which roots are best to harvest and how to extract them from high in the canopy. It takes an experienced eye to identify titica correctly because there are often many types of hemi-ephiphytic vines hanging on the trees. The aerial roots of other vines may look similar to titica roots, but they lack titica's unique strength and flexibility and may break when bent during the construction of baskets or furniture.

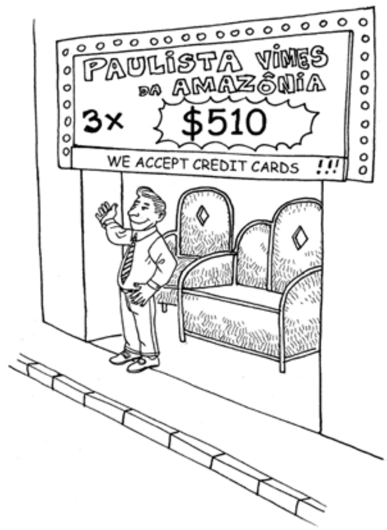
Before harvesting a titica root, harvesters in Pará consider three factors to determine if it is suitable to use and sell. First, collectors select roots at least 4 mm in diameter because furniture makers do not buy very thin ones. Second, they avoid roots with many knots or nodes as these sections do not work well for lashing and weaving. Finally, harvesters only collect tough and flexible mature vines. A collector often tests the readiness of a root strand by scraping his or her fingernail across the bark and bending a small piece of the root in half. If it is green underneath or breaks, the strand is too young and not ready to be harvested.

Harvesting titica requires strength, skill and grit. A collector usually grabs the aerial root with one hand just above his or her head, and the other below his or her shoulder, and jerks sharply and with great force. Some collectors use the full weight of their bodies to help break a root by standing on the bottom section of a taut root. Although most collectors work alone, working in pairs is common in Amapá and Acre. Roots generally break at 5–10 m from the ground. Harvesting rarely dislodges the well-anchored mother plant (from which branches with roots, leaves and flowers emerge), but when pulling on a root finally forces it to break, a hail of leaf debris and branches – and sometimes spiders, biting ants and snakes – can rain down on the collector.

After a root is brought to the ground, harvesters remove any knots, which form weak spots in the vine and reduce its usefulness. Collectors carry the vines home where they generally remove the bark using a knife. Although drying and bark removal lessen the weight by half, most customers prefer debarked vine and the bark is much easier to remove soon after harvest than if it dries and hardens on the vine. Once the bark has been removed, the pale golden roots are tied in long bundles of several hundred strands or rolled into a large doughnut shape until they are sold or used. Artisans store the bundles in a cool, dark place so the roots do not buckle or become stained by fungus.

Prices of sofas: São Paulo vs. Amazonia

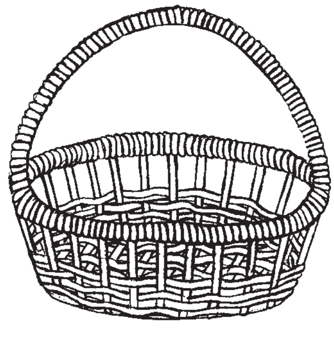
In Amazonian cities, artisans traditionally make sofas, chairs and baskets from titica roots. In addition, roots of titica and other vines have long been extracted in large quantities for shipment to industrial furniture manufacturers in São Paulo and other southern Brazilian cities. Even the seats in the first class cabins on the trains in Rio de Janeiro and São Paulo are made with titica.[6] In Macapá, Amapá, a handcrafted chair of titica cost US$119 in 2004. During the same time frame, in the metropolis of São Paulo, one titica chair manufactured industrially cost US$1 530. Although forest peoples may not always be able to sell fine crafted products, it may be possible for them to engage these markets by providing managed, fair-trade raw material.



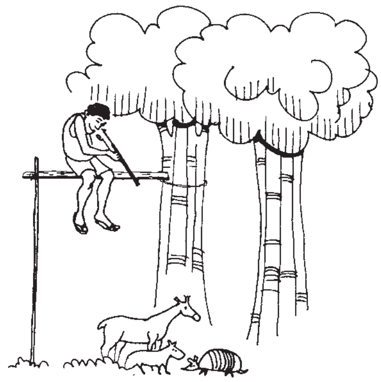
Craftsmanship adds value

Transforming raw fibres into crafts greatly adds to their value. Some people who harvest titica have increased their income by learning to shape it into finished products. In 1997, in Rio Branco, Acre's state capital, 1 kg of titica without bark sold for US$2. In one hour and with less than 1 kg of titica roots, a craftsperson could make a bread basket that sells for US$17. One skilful artisan from Rio Branco said that he had a list of orders from his neighbours and that his clients prefer handcrafted goods because they often are of better quality than manufactured goods. And if a handmade product breaks or wears out, consumers know where to go to get it fixed.

In Rio Branco, artisans carefully process titica roots before fashioning them into products. Dry roots are first soaked in water to make them less brittle and easier to bend and shape. They use a file to smooth and reduce the roots until they are the right thickness to make baskets, serving platters, flower vases, magazine holders or chairs. Fibre crafts are now found in supermarkets, snack shops and restaurants, as well as available by individual order for custom-made products. The diverse assortment of fibre crafts now available can be seen at the city's open air Sunday market and at Acre's Annual Forest Products Fair.[7]

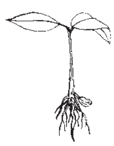


Titica: a tool for hunters

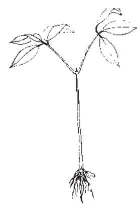


Many hunters use titica to construct hunting blinds in trees. The roots are used to tie a wooden pole or plank between two trees, or to a tree and a standing support pole. The hunter sits on top of the plank to wait for unsuspecting game to pass by below. To boost their chances, hunters place hunting stands on or nearby trees with falling fruits or flowers which attract game animals.

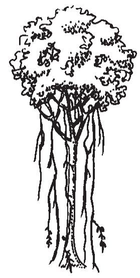
Management



germination
9 months



growth
cut roots, when they survive, grow about 1–2 m/year



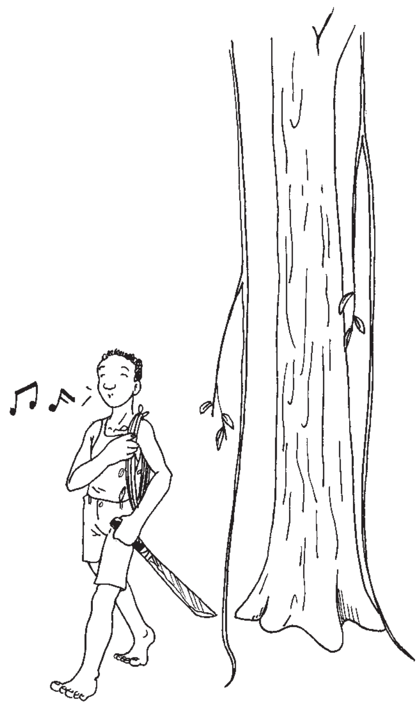
production
20–66 years

Even under ideal circumstances, titica grows very slowly and is vulnerable to intensive harvesting. It takes up to 66 years for titica to grow, from the climbing stage to when the first root reaches maturity in the ground.[1] Several studies in Brazil and Guyana have shown that most of the roots that were severed in experimental harvests died within six months. Taking too many roots can kill the plant itself. Heavy harvesting has virtually wiped out titica populations in some regions. In areas where only a portion of mature roots had been collected, the total combined growth of all surviving harvested roots was 0.8–2.4 m/year.[2] This slow growth rate means that it will take many decades for titica to recover before roots may be commercially harvested again. A study on *Heteropsis flexuosa* in Amapá found that if the growing tip of the root is not damaged the root can grow up to 1 m/month during the rainy season, but roots that have been cut or broken during collection stop growing.[6] Thus it is necessary to leave some roots intact to nourish the plant and allow new roots to grow for a minimum of four to five years. For successful successive extractions, it is important to take a few management precautions when harvesting titica vine.

Management tips

Per tree:

- Avoid collecting more than half of the roots from any individual titica plant, being sure to leave at least two thick roots intact. Harvesters in Guyana only take roots hanging down from a branch; they leave all roots wrapped around the trunk of the host tree.
- Take extra care when harvesting during the dry season. Titica mortality is higher when water is scarce.



- Only harvest mature roots because immature ones are not strong.
- Leave roots which have less than 1.5 m between knots because artisans and furniture makers only use stems that are free of these bulges.

Per area:

- Establish zones of extraction where roots are collected in rotation systems.
- Extract the maximum possible number of vines in heavily logged areas, and from trees that are going to be harvested.
- Once a year, in Porto de Moz, Pará, women in the Emanuela Women's Asociation clean between the root strands, removing the dead ones and anything else that might impede their healthy growth.[8] The debris from the cleaning is spread on the ground, maintaining soil humidity and discouraging undergrowth.

Legislation: challenges for small producers

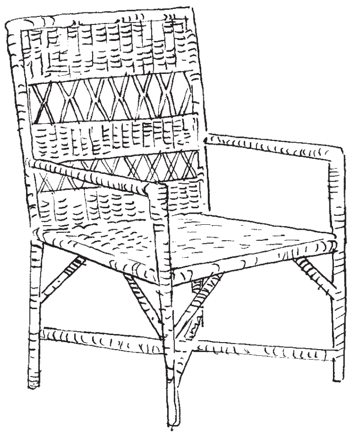
Titica is an important resource for Amazonian extractors and artisans, both for home use and for bringing important cash income into the household. However, increasing demand for this durable and multi-use aerial root for industrial-scale production has raised new concerns regarding the future sustainability of titica extraction and placed in question continued local access. A major challenge now facing extractors is the sustainable management of titica, and the development of management initiatives that provide local peoples' continued access while regulating unsustainable extraction. This, in turn, brings up new questions: How can local communities engage larger regional and national markets? How can extractors achieve long-term sustainable management of this valuable and important forest resource?

Since small-scale extractors provide fibres and fibre-based crafts to local markets, they now compete for their raw materials with large-scale enterprises that harvest – and frequently over-harvest – titica for industrial-scale production. For example, as titica populations in southeastern Amazonia declined, large industries transported scores of workers from these regions to harvest the roots in the northeastern Amazonian state of Amapá. Teams of 60 men mounted on mules scoured the forest and extracted all the titica they could find. Artisans from Amapá protested, as they were left with little material to ply their trade.

In 2001, the government of Amapá responded to complaints from these artisans and passed the first state law in Brazil requiring management plans to extract titica. The law defines the period, the quantity and the location of legal harvests, as well as establishing norms to obtain a harvesting license. Local collectors, however, have difficulty in navigating the state bureaucracy for management plan development and approval. A better approach might include a system that allows local people to harvest small amounts of titica for subsistence and commercial activity, but closely regulates and manages large-scale harvesting. The process to develop legislation could be participatory and could bring together diverse stakeholders, including local communities, artisans, industry players and government agencies. An example of this might be found in the state of Amazonas, which went through an extensive process of consulting with a wide range of people who had experience studying and working with titica before passing their regulations of titica harvest.

Rural women manage titica

Maria Creuza
Maria Olivia



With so many forest management specialists, why is it that no one knows how to manage titica vine? The Emanuela Women's Association, in Porto de Moz, Pará, discovered this when they began to research the production potential of titica. Finding no professional forester or botanist to advise them, they went into the forest to experiment and to discover for themselves the secrets of this mysterious plant.

They developed methods for inventorying, managing and extracting the vine. Each woman in the Association, composed of 35 women from seven communities, was responsible for researching the production of titica in her own plot of forest. The inventory was conducted along a 250-m transect where plants were counted within 5 m on both sides of the centre line. The women recorded the number of trees that had titica growing on them, the number of aerial roots hanging from each tree, and lastly, they identified the green and the mature roots. Based on their initial inventory, they estimated that they could harvest and produce 150 kg of titica roots without bark from a forest area of 50 ha. Next, they estimated that each woman could harvest enough roots to bring 5 kg of roots to a furniture making workshop sponsored by the Association. A longer-term study would be necessary to actually determine sustainable yield; however, the social network the women developed to regulate harvest is a crucial step towards ensuring sustainability.

At the workshop, each strand of dry root was separated into three thinner strands that included one central and two outer parts. Each of the three strands is scraped with a knife and then sanded smooth. Next, the women apply one layer of sealant and three layers of varnish. If the root's bark had been removed days after it was collected and had left marks on its surface, the women discovered that three washings in caustic soda turned it white again.

Using this home-grown technique, the women of Porto de Moz began making chairs, baskets, mirror frames, trunks, suitcases, jewellery boxes, shelves and fruit display vessels. Prices in 2004 ranged from US$3.40 for a mirror frame to US$34 for a chair, using 1–5 kg of titica for each object. Even considering the time needed to make the crafts, the women noted it was far more profitable to sell finished products than either unprocessed roots for US$0.50/kg or roots with bark removed for US$0.85/kg. For the first time in their lives, the women of Porto de Moz have been able to walk around town with their own money in their pockets.

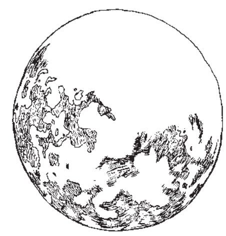
Contrasting collection styles: women and men

In Porto de Moz where titica extraction is relatively new, women are more experienced in collecting titica and making crafts from their roots than men. Women note, "He sees the vine and straight away hacks down many strands on the tree. When we come to a tree, we are more careful; we first test the vines and then only collect the mature ones that are useful for making things."

Titica and Amazon folklore

As with many plants that are widely used by forest people in the Amazon, there are many popular beliefs about the biology and harvesting of titica. Since titica has small flowers and knobby green fruits that are well hidden in the canopy of the host tree, several legends relate to the plant's reproduction. In Amapá, some caboclos believe that if someone sees the flower or fruit of this plant, the world will end. Many indigenous people believe that titica regenerates from the legs of dying tucandeira ants (*Paraponera* spp.). Although this may seem like a strange connection, observations of these ants attacked by *Cordyceps* fungus show that the fruiting bodies that emerge from the dead ants resemble the tiny anchor roots that secure a climbing titica stem to its host tree.

Collectors in Porto de Moz adamantly assert that the phase of the moon must be considered when collecting titica. Although a full moon may act as a torch, lighting one's way to the trees, there is no sense in trying at that time. They say that during full moons titica is brittle, weak and pale and breaks when doubled over. Therefore, they prefer to harvest titica in the new or quarter moon when the roots are strong and flexible.



As commercial demand for products like titica increases, there is a need to appreciate indigenous and other forest people's knowledge about the biology and harvesting of these plants. These lessons should be combined with research-based studies of harvesting effects and sustainable management to offer economic opportunities for forest-based communities and to ensure long-term conservation of the species.

1 Hoffman, B. 1997
2 Plowden, C., Uhl, C. & Oliveira, F. de A. 2003
3 Plowden, C. 2001
4 Durigan, C.C. 1998
5 Pereira, L.A. 2001
6 de Carvalho, A.C.A. & de Queiroz, J.A.L. 2008
7 Wallace, R. & Ferreira, E. 1998
8 Emanuela Women's Association, 2003

Uxi, uchi

Endopleura uchi (Huber) *Cuatrec.*

Patricia Shanley
José Edmar Urano Carvalho

Until recently, uxi was known disparagingly by the middle class as the “fruit of the poor” because it was so inexpensive. Today its rich, woody flavour has gained popularity and the green egg-sized fruit fetches a good price in the market. Uxi’s large oval pits are covered with a thin oily pulp which can be eaten raw, but it is most loved in ice cream, in addition to being a widely sold popsicle flavour in Belém. Other parts of the tree are also used: the bark has medicinal properties, and artisans cut and polish the star-patterned pits into unique amulets that are believed to bring good fortune and to protect the wearer from ill.

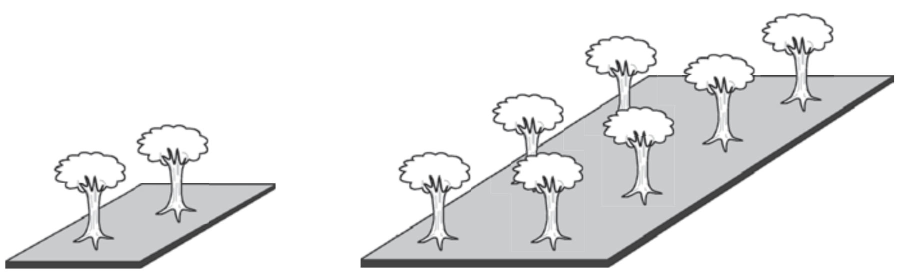
Uxi is native to the Brazilian Amazon. The uxi tree is quite large, reaching from 25 to 30 m in height, 1 m in diameter and 3 m in circumference. It can typically be found in terra firme forests, frequently in the region of the Pará river estuary and the regions of Bragantina, Guamá and Capim, on the western side of Marajó near Breves.[1]

Ecology

Flower and fruit seasons

In Pará, the uxi tree flowers from October through November and bears fruit from February through May. In managed areas near Belém, like Boa Vista, Viseu and Mosqueiro, some trees produce between seasons, in the months of July and August.

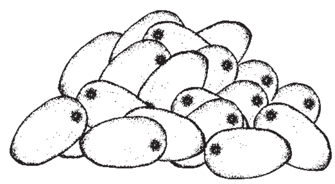
Density



0.03–3 trees/ha   1.4–14 trees/alqueire

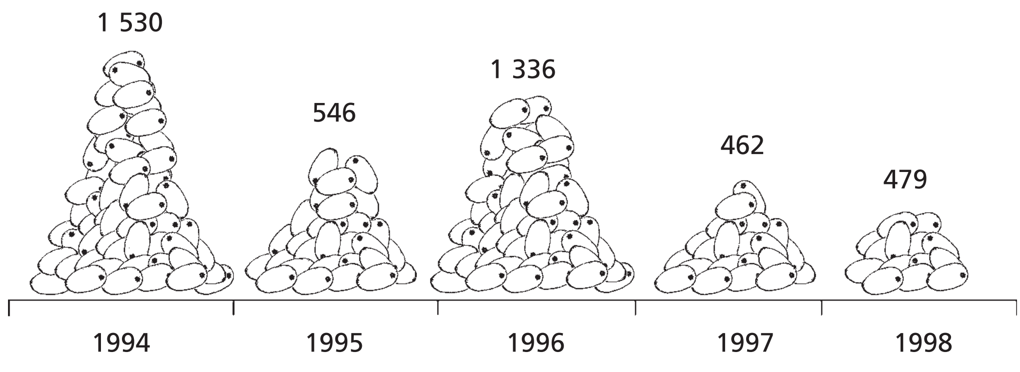
Uxi can be found in densities of less than 1/ha; however, in some forests up to 9 uxis/ha may occur. In intensively managed areas, such as on the islands close to Belém, as many as 35 mature uxis can grow in 1 ha.

Production

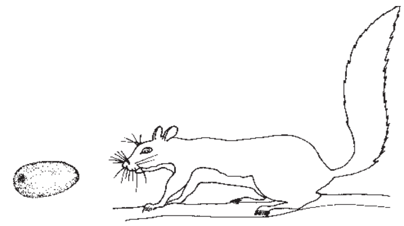


an average of 1 000 fruits/tree

Many uxi trees produce fruit every year, but the number of fruit varies. For example in 1994, the average production out of a sample of 24 trees was about 1 530 fruits/tree. In 1995, the average production for the same group of trees fell to 546 fruits/tree. A tree can bear as many as 3 500 fruits in a good year, with the majority of trees producing between 700 and 2 000 fruits. In years when the tree rests, average production falls to between 400 and 500 fruits. Over a five-year period, 80% of a sample group of 24 trees produced every year. Below is the average production of these 24 uxi trees.



If a villager intends to produce uxi to sell, he or she must be sure to reach the tree before the armadillos, paca, agoutis and deer, who love the savoury fruit as much as people do. Squirrels can even gnaw through the extremely hard endocarp to eat the small seeds. And one must be careful, because the macaws and parrots knock down the fruits even when they are green. Along the Capim River, in Pará, some villagers never look up to the top of the uxi tree. They believe that if they spot an uxi fruit on the upper branches, they will depart from this life that same year. Fortunately, the small, egg-shaped fruit are well camouflaged and difficult to discern in the lofty crown.

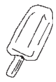


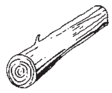
ECONOMIC VALUE

In 2004, in the ten major Belém fairs, about 477 000 uxis were sold, generating more than US$22 100. In Belém in 1995, one uxi went for US$0.05, and in 1998 one uxi cost US$0.07. In 2008, each uxi cost an average of US$0.12. In Ver-o-Peso in 2008, you could buy five uxis for US$0.59. In between fruiting seasons, the price of the fruit is highest. The pulp of uxi is also increasingly in demand; in 2003, 1 kg of pulp cost US$1.30, and by 2009, pulp prices had risen to US$3. Uxi powder, found inside the seed, is another valuable product in today's market; it is used for its medicinal and cosmetic properties, and 1 kg costs US$7.

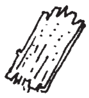
As recently as the 1980s, when there were plenty of uxi trees close to Belém, dozens of boats used to land at the "rock" (as the Ver-o-Peso market was known), piled high with thousands and thousands of uxis. Today, it is rare to see a boat loaded exclusively with uxi, and sometimes buyers complain that there is insufficient supply to meet the demand. Fortunately, there are estuarine communities near Belém that manage, plant, prune, clean and protect uxi and in this way are able to supply the markets in the city. Some families earn 20% of their annual income from selling uxi fruit.[2] Communities in the municipality of Acara supply the Porto do Açaí market each Wednesday and Saturday with about 25 000 uxis. Uxi has risen in value in recent years, appearing in the large supermarkets and becoming a popular ice cream flavour. Furthermore, one uxi sapling, which is difficult to find for sale, can cost up to US$9.

USES

Fruit: The fruit is used to make  frozen ice treats,  ice cream, juice, and oil.



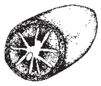
Wood: The wood of the uxi is of average quality, extracted by the timber industry and used in carpentry.



Bark: Teas made from the bark are used to treat high cholesterol, diabetes, rheumatism and arthritis. In 2001, a Brazilian TV programme showed how tea made from uxi bark could be effective in lowering high cholesterol and in healing rheumatism and arthritis. After the programme aired, many medicinal plant shops began to sell the bark.

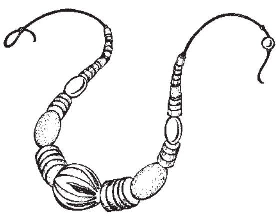
Wildlife: Numerous species, such as paca, peccary, tapir, squirrel, deer and macaw feast on the fruit of uxi.

Oil: Uxi produces good quality oil, used both for frying food and for its medicinal properties.

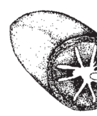


Seed and endocarp: Squirrels eat the small (2–3 cm) seeds hidden deep inside the hard, fibrous endocarp (pit). Artists use the egg-shaped, star-like endocarp in crafts and to make amulets. Powder produced from the endocarp relieves itching and is also used as a cosmetic foundation. When the endocarps are burned, they produce smoke that deters insects.

Cosmetics, jewellery and a talisman



Cut an uxi endocarp and within it you will find a powder used to cover skin blemishes and relieve itching. To discourage mosquitoes or ward off evil spirits, broken uxi seeds are lit on fires inside a can. The smoke does the trick!



When the endocarp is cut through the middle, various star shapes are revealed. These can be used as beads to make beautiful necklaces, earrings and belts by cutting the seed into thin discs.

In the Macapá fair, in the Brazilian state of Amapá, a small, elderly woman carefully appraised a variety of seed necklaces for sale. She showed most interest in a particular one. The craftsperson, Delomarque Fernandes, commented that the large, central bead was uxi. Delighted, the woman placed her weathered hand firmly over the uxi pit and proclaimed, "Then this necklace is mine, as uxi has a special power!"

In Belém, Delomarque makes beautiful jewellery (necklaces, rings, bracelets and earrings) usings parts from various regional trees. The palm trees she uses are tucumã, inajá, babaçu, dendê, murumuru, mucajá, jupati, mumbaca, açaí branco, regional açaí, bacaba and coconut. In addition to palms, Delomarque likes to use uxi, uxirana, tento, cedro and Brazil nut. She says, "The jupati is our discovery, no one worked with jupati or uxi before. It's a marvellous discovery that makes unique pieces." Some small Amazonian seeds, such as açaí, are being purchased in bulk at low prices and shipped to São Paulo to be industrially processed into jewellery. But jewellery from hard-to-work, unique fruits such as uxi and jupati are still hand crafted in Belém.

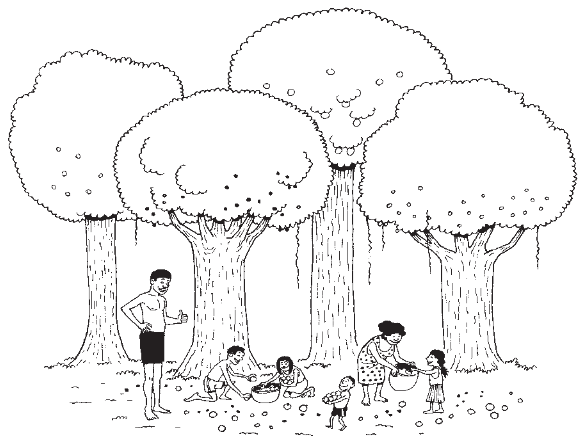
New clothes from fruit sales

As an experiment, a Mothers Club of a village along the Capim River gathered about 400 fruits (uxi, piquiá and bacuri) and for the first time ever, took them by boat to the fruit market in Paragominas. The mothers sold almost all of the fruit and bought enough used clothing for ten families, caustic soda to make soap and a little pig to rear. Walking through town on Sunday, after Mass, girls and boys proudly wore their "fruit clothes". The little pig grew fat and was eventually sold.

One family, one hectare, ten years

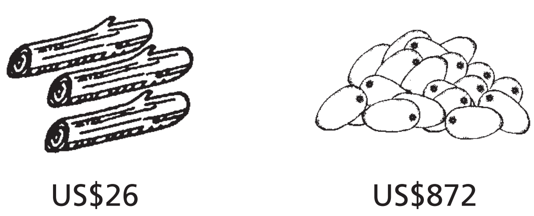
Mangueira, Maria, Neca, Simeão, Marcidia and Poca

Mangueira's family marked off 1 ha of forest containing one piquiá, one bacuri and two uxi trees. For ten years, they counted and weighed all the fruit and game they had caught on this piece of land. With these data, they were able to perceive the invisible income they had earned from this 1-ha plot. They compared this value with the money they would have earned had they sold the trees on this hectare to loggers.



They noted that the quantity of NWFPs extracted from the hectare varied from year to year. For example, in 1993 the family ate 2 544 uxis. In 1994, they ate 3 654 uxis, but in 1995 and 1997, not a single one. Did they get sick of eating uxi? No! The uxi trees on that hectare simply did not produce in 1995 or 1997. Consequently, some years they caught a lot of game under the uxi trees, and others not.

Income from 1 ha over ten years (timber vs. fruit)



Mangueira's family consumed 14 248 fruits from that 1-ha plot during a ten-year period. These fruits could earn US$1 307 if they were sold in the Paragominas fair. If we discount the substantial costs associated with collection, transport, time and perishability, the net profit would be approximately US$872. If sold to a logger, Mangueira would earn US$26/ha (US$129/alqueire) and all the trees of commercial value would be extracted, including the fruit and medicinal trees.

Like many fruiting trees, uxi, piquia and bacuri produce fruit for many decades. Having learned to see the "invisible income" that the forest has to offer and the important contribution fruit trees make to the health and nutrition of his family, Mangueira decided to conserve his forest for his grandchildren and great-grandchildren. The initiative of Mangueira's family has helped to teach other forest families in the region about the value of the standing forest.

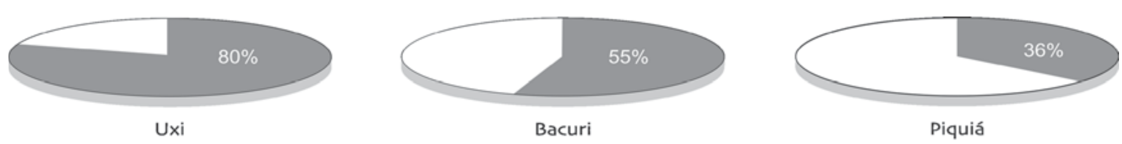
Fruit consumed by Mangueira's family from a 1-ha plot

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	No. fruit	US$/ fruit	Income US$
Piquiá	937	0	0	430	0	0	0	0	0	208	1 575	0.13	205
Bacuri	298	417	0	618	0	0	0	0	0	814	2 147	0.17	365
Uxi	2 544	3 654	0	1 321	0	0	2	0	2 500	505	10 526	0.07	737
Total	**3 779**	**4 071**	**0**	**2 369**	**0**	**0**	**2**	**0**	**2 500**	**1 527**	**14 248**		
											Gross income		**1 307**
											– Est. costs (33%)		435
											Est. profit		**872**

Which tree species is the most productive?

A distinguishing characteristic of tropical trees is that many forest species produce fruit only every other year. Between uxi, bacuri and piquiá, which do you think produces more often? A five-year study demonstrated that uxi is the species which produces most consistently, as many uxi trees produce annually. On average, 80% of the 24 uxi trees studied produced every year. In contrast, 55% of the 16 bacuri trees and 36% of the 68 piquiá trees produced each year.

Average percentage of trees producing per year 1994–1998, Capim River area



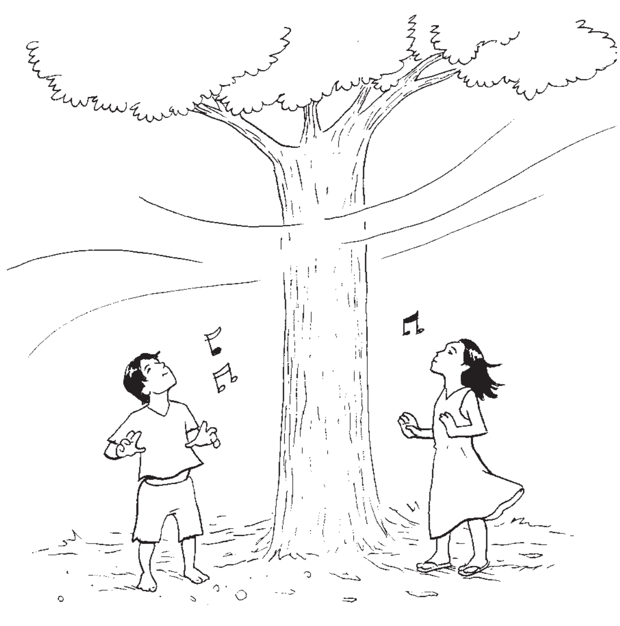
Fruit or timber?

In 2001, a community upriver from Mangueira's family sold 140 alqueires (672 ha) of forest for US$3 010, receiving US$22/alqueire. From each alqueire, the loggers took ten trees, each one for US$2.15. In one of these alqueires, there was an uxi tree that produced an average of 1 000 fruits each year. If the community had access to the Paragominas fruit market, 120 km away, they could have sold each fruit for US$0.03 and earned US$34. Subtracting the costs of transportation and labour, they may have earned US$22, the same value received from the loggers for the alqueire. By leaving the trees standing, they might have eaten fruit from the hectare every year instead of realizing only one timber sale.

Whistling to call the wind and fruit

Ronaldo Farias

Sometimes, a group of hungry kids in my neighbourhood with a craving for fruit would gather and whistle together. My mother had taught us a special whistle to call the wind that would then bring down the fruit. We were taught to whistle and wait, whistle and wait. Then we would chant: "Send the wind, Saint Lorenzo!" The more children who whistled, the stronger the wind blew. The more we believed, the more we whistled. When we believed, the wind came, the fruit fell and we ate.



Nutrition

Composition of uxi pulp[3]			
Protein:	1%	Lipids:	15%
Carbohydrates:	4%	Fibre:	21%

Uxi is an excellent source of calories: each 100 g of pulp contains 284 calories, six times more than oranges. The fruit pulp is low in sugar and high in fibre. Uxi also strengthens the body with important vitamins, contributing close to the World Health Organization's recommended daily allowance of vitamin C (with 22 mg/100 g) and vitamin E (with 6.8 mg/100 g). Uxi has more vitamin B than many fruits, with 0.13 mg of vitamin B_1 and 0.10 mg of vitamin B_2 /100 g of pulp.[4] Each 100 g of uxi pulp also has 7.8 mg of iron. In addition, 100 g of uxi pulp has between 10 and 21 g of fibre; fibre helps to maintain a healthy intestinal track.

Uxi is also rich in minerals: each 100 g of pulp has 460 mg of potassium, 64–96 mg of calcium, 53–70 mg of magnesium, 30–46 mg of phosphorus and 22 mg of sodium. Furthermore, the oil is rich in phytosterols (1.4 mg/100 g of oil) more than double that of soybean oil. The presence of phytosterols in food reduces the level of cholesterol in the blood and has possible anticarcinogenic effects. Uxi oil is also a good choice to use in cooking because it is high in oleic acids (7.4%), similar to olive oil and avocado oil.

In the community of Nazaré in the Rio Capim region, Nenzinho and his family ate 1 123 uxis in just one month. His neighbours, the João Brito family, ate around 6 000 fruits! If they had had to purchase these, the estimated value would have been between US$177 and US$413. Caboclos say that during the uxi season, no one gets a cold or a cough. Other villagers proudly remark that they gain weight. Neusa do Limão is happy to say she gains 2 kg during uxi season.

Uxi crème

Ingredients:
pulp of 15–20 ripe uxis or 300 g of frozen pulp
1 can of condensed milk (395 g)
1 can of cream (300 g)
sugar to taste

Preparation:
Wash the fruits and remove the peel with a knife. Scoop out the pulp with a spoon. Beat the cream, the condensed milk and the pulp by hand or in a blender for three minute). Pour the mixture into a mould and place in the refrigerator for two hours. Decorate as you please.

Uxi sweets

Ingredients:
500 g of uxi pulp
500 g of sugar
1/2 cup water

Preparation:
Mix the sugar, the pulp and the water until smooth. Heat the mixture over a medium flame, stirring constantly, until the mixture easily pulls away from the pan. Remove from the stove, cool, cut and serve.

Uxi oil by Senhorinha

Senhorinha of Nanaí is one of the few villagers who recall how to extract uxi oil. She related that uxi oil is of high quality and can be used both in cooking and as medicine. Senhorinha recommends uxi oil to treat sinusitis in children (rub warm oil on their noses) and for intestinal gas in adults (rub the warm oil on the belly).

To extract the oil, select 500 ripe fruit and wash them carefully. Grate them and put the pulp and the rind in a basin with water. Place the mixture over a flame and mix with a spoon while it boils. The oil is ready when the water evaporates. If you are using only a small amount of pulp, it requires approximately one hour to extract the oil; with 500 fruit it takes about two hours. Five hundred meaty fruit can potentially yield 2.5 litres of oil.

Fresh skin with uxi soap

Gloria Gaia

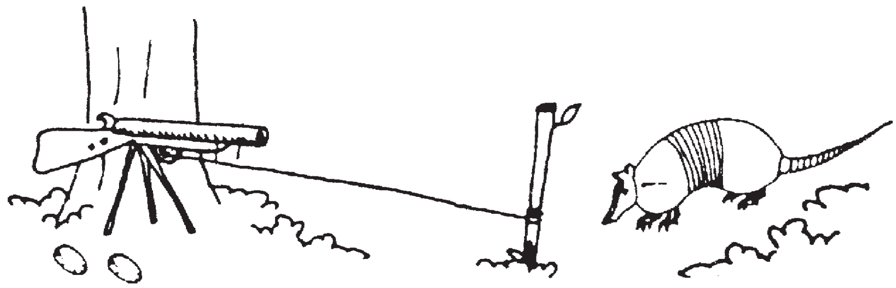
Ingredients:
200 grated uxis yields approx. 2 kg of pulp
1 small can of caustic soda (250 g)
1 litre of water
500 g of glycerine
150 g of breu jutaicica (The breu jutaicica – a tree resin – adds fragrance and binds with the soap.)

Preparation:
Dissolve 250 g of caustic soda in 1 litre of water. Add the uxi pulp and place over a low flame, simmering for 20 minutes. Next, add the glycerine and the breu jutaicica. The soap will acquire a very thick consistency. Place the soap in moulds to cool.

Wildlife

Uxi fruit has an important role in the diet of wildlife. In one study on uxi production, animals consumed up to 80% of the fruit that fell from the trees. Deer, tapir, collared peccary, white-lipped peccary, armadillo, paca, agouti, coati, monkeys, macaw and other birds eat uxi. Tropical squirrels patiently gnaw the hard, thick endocarp until they reach and eat the small seeds within.

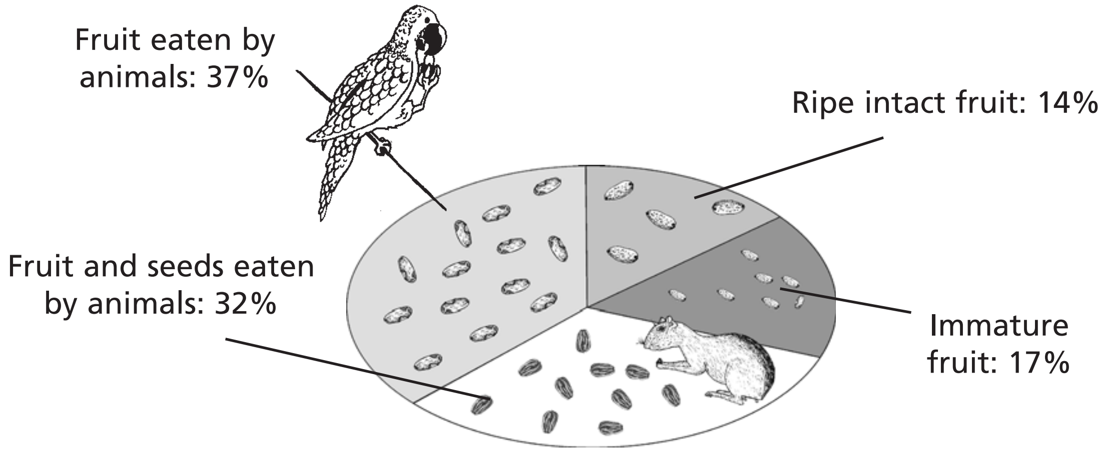
Sometimes hunters place loaded guns with tripwires along wildlife paths near the uxi trees to catch agoutis and armadillos. During the rainy fruit season, a hunter named Chuva from a village along the Capim river, often placed these traps near uxi trees. At this time of the year it was as if Chuva had a meat market alongside his home because he and his family caught and ate an armadillo almost every day. Although hunters generally place warning signals made of plants nearby traps, it is wise to use caution when walking in areas where hunters use tripwires.



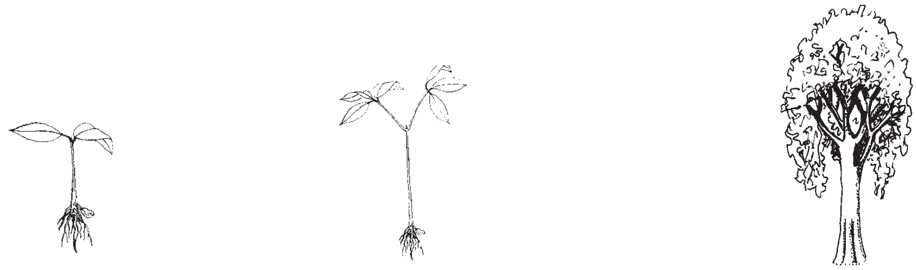
Sharing the pie with wildlife

Destiny of the uxi fruit from 24 trees in the Capim region

Let's look at what happened to the fruit production of 24 uxi trees in three Capim River communities. Only 14% of the fruit was left over to eat or to sell.



Management



germination
10–16 months

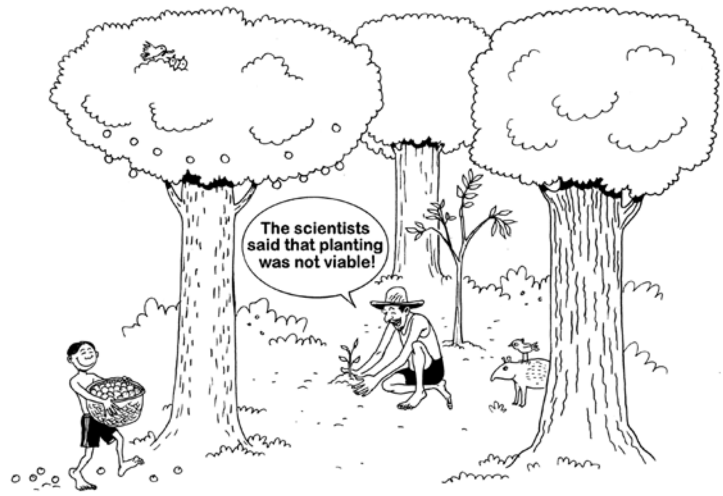
growth
slow in the shade,
up to 1 m/year in the sun

production
in plantations,
begins from 7–15 years

In 1972, the distinguished Brazilian authority on edible fruits, Paulo Calvacante, published in his classic work *Frutas Comestíveis da Amazônia* that uxi is hard to manage and, unless the fruit prices improved, would be economically unviable to domesticate.[1] Indeed, in the following three decades, the increasing value of uxi fruit has incentivized peri-urban communities to work on improving the productivity of uxi. Today, there are scores of families near Belém that are planting, managing and transporting millions of fruit to market. In the municipality of Acara, practices for increasing the density and improving the production of uxi include: enriching the area to be planted, cutting the vegetation that competes for nutrients and light, fertilizing with natural compost, using fire to control ants on the trunk and the branches and cleaning beneath the trees every six months to make it easier to spot fallen fruits. As Senhor Roxinho says, "when we rake the leaves and clean the forest floor, we always push the compost towards the uxi trees."

When uxi fruit fall from the tree and become bruised, villagers leave them on the ground. In this way they ensure a substantial number of good seeds are available for natural regeneration the following year. To enrich the forest with uxi trees, wise producers say, "You have to move the young ones carefully because uxis are tricky." Caboclos only select the saplings that have sprouted naturally and choose saplings from trees that produce the plumpest and tastiest fruits. When an uxi tree begins to age and fruit production declines, it is cut down to offer space and sunlight for younger trees to grow.[2] The wood does not go to waste, but is valuable for construction.

Wise caboclos



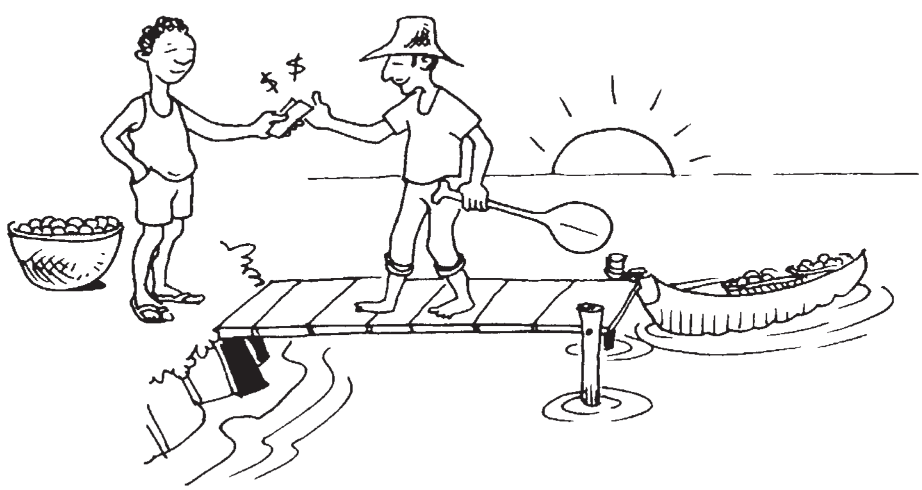
Income from the "fruit of the poor"

Sr. Roxinho

Roxinho's peri-urban home in the municipality of Acara, a 40-minute boat ride from Belém, initially had 6 uxis on 1 ha. After 30 years, he has 60 uxis on 10 ha. Sometimes he even cuts down a cupuaçu or another fruit tree in favour of an uxi. To discover the economic value of uxi, Roxinho and a group of researchers marked off 1 ha of his property and kept track of all the fruits that were sold from this hectare. During the harvest of 1996, in only two months (February and March), Roxinho earned US$475 selling uxis from that hectare. Even discounting the costs of transportation and labour, uxi is more profitable than other fruits because it produces large quantities. In one year, an average of 20% of Sr. Roxinho's and his neighbours' income originated from the sale of uxi fruit.[2]

Apart from uxi, Roxinho has many other fruit trees on his land, like biribá, pupunha, piquiá and cupuaçu. The diversity of productive fruit trees on his property is due to his hard work, experimentation and innovative management practices. Without discounting all the expenses, he earned US$1 181 in 1996 from fruit sales from that one hectare alone.

To ensure production into the future, Roxinho is careful to choose the best seeds from the most productive trees to plant. The harvest of uxi supplies most of his income and his neighbours' incomes as well. His family waits for the uxi season to be able to buy extra things for the house or for the children, such as clothing, books, notebooks, tools and pans. And guess what kind of wood he uses to build his house?

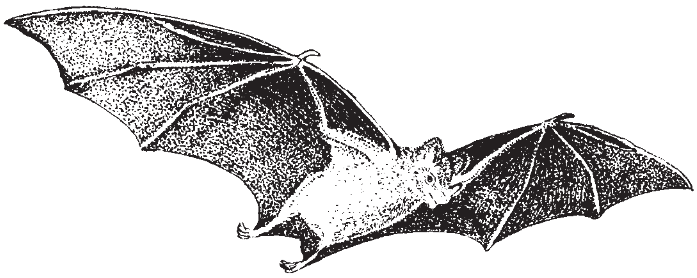


Uxi dispersers

Enrico Bernard

Uxi is a favourite food of some fruit-eating bats. Through sight and smell they are able to locate the ripest fruits on the trees. The bats grab the fruits and twist them until they are released from the tree. With the fruit in their mouths, they fly to a safe place to savour their treat. Bats don't eat the whole fruit; they just nibble the thin layer of tender and delicious pulp and drop the large fibrous seed. When they are done, the bats will either race back to the same tree or search for another one with more fruits until they are satisfied. Rarely will they stay in the same tree while they eat because there are often predators around the tree, such as owls, falcons, opossum and even other carnivorous bats. The wise bat will fly far away to escape being attacked.

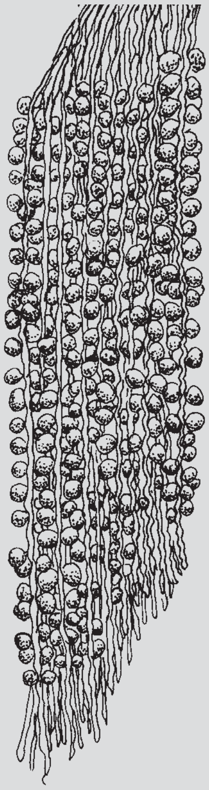
The bats that eat uxi are generally large. One common species called the great fruit-eating bat (*Artibeus lituratus*) weighs between 40 and 80 g and can be up to 70 cm long from wing to wing. When a bat grabs an uxi and takes it far from the mother tree, it is acting as a seed disperser. In this way, new uxis can grow far from the shade of the mother tree where no uxis had existed before.



[1] Cavalcante, P.B. 1991
[2] Shanley, P. & Gaia, G. 2004
[3] Marx, F. *et al*. 2002
[4] IBGE 1999
[5] Carvalho, J.E.U., Müller, C.H. & Benchimol, R.L. 2007

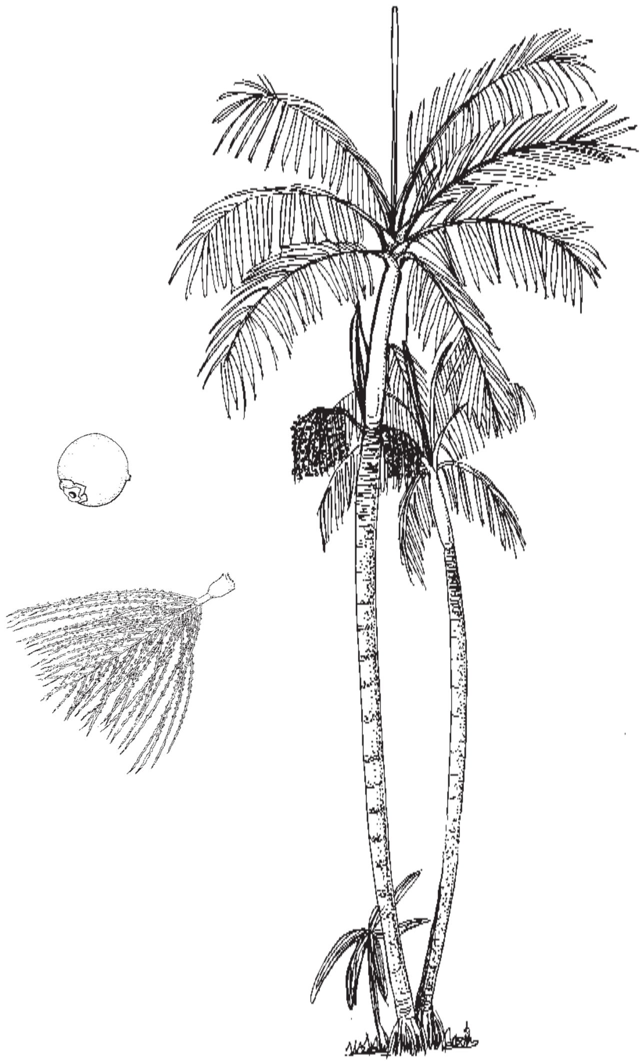
Palm trees

and diverse other species



Açaí

Euterpe oleracea Mart.



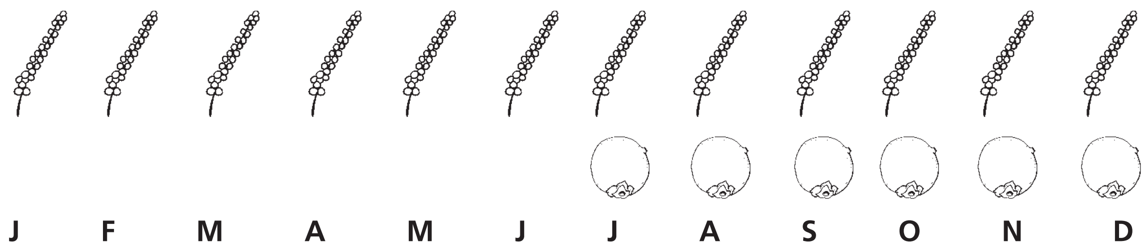
Margaret Cymerys
Nathan Vogt
Eduardo Brondizio

In the darkness before dawn, thousands of Amazonian river dwellers fill their large woven baskets with purple, pebble-sized açaí fruit and make the trip in small canoes or large boats to the scattered outdoor markets of the city of Belém. As the boats near Ver-o-Peso, the largest market at the mouth of the Amazon River, a seller shouts, "blood of the cow!" Buyers run to the boat, pressing their nails into the fruits to see if they are of good quality. "Blood of the cow" is a local reference for the meaty açaí fruit with wine-coloured pulp. From an age of six months, children of eastern Amazonia drink açaí juice. As one fairgoer says, "At a young age, the intestines of the Paráense natives are already accustomed to açaí." And with great benefits – açaí is being touted as a "super fruit" for its anti-inflammatory, antioxidant and anti-cancer effects. Because of its growing reputation, demand for açaí is expanding around the world.

Açaí is a multi-stemmed palm native to eastern Amazonia, with the greatest occurrence in the estuary of the Amazon River, where it occupies most of the floodplain forest of the region. The palm is also found in the Brazilian states of Amapá, Amazonas and Maranhão, as well as in Guyana, French Guiana and Venezuela. Açaí palms grow at various densities in both seasonally flooded forests and permanently flooded forests. Birds, monkeys, people and water are responsible for the dispersal of the açaí seeds. The açaí fruit grows best in open areas with substantial sun, such as floodplain forests where canopy trees have been thinned. The palms can reach a height of over 25 m, with trunks between 9 cm and 16 cm in diameter. The palms generally grow with 4–9 stems per clump, but up to 25 stems is possible.

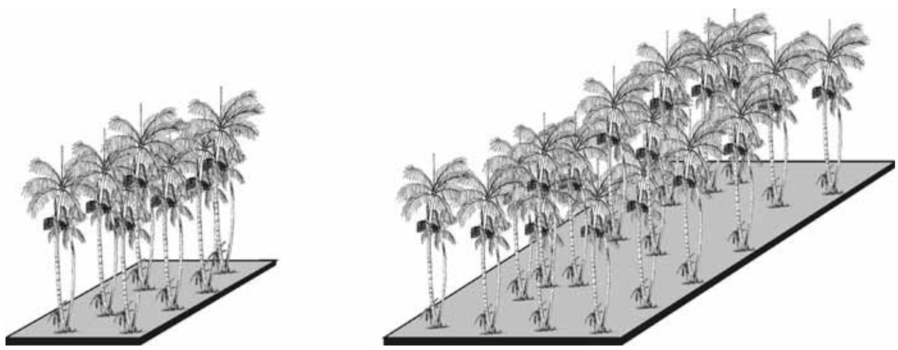
Ecology

Flower and fruit seasons



Flowers and fruit grow all year long, but there are periods when production peaks. These peaks vary across the açaí's region, thus lengthening the number of months the drink is available to supply enthusiastic consumers. In general, the period of the greatest fruit abundance occurs during the dry season, from July through December. When mature, the fruit becomes hard and blackish, like a pebble.

Density

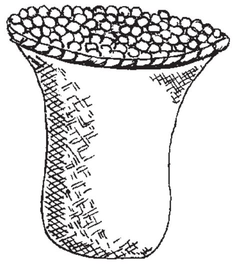


170 clumps/ha in unmanaged forest **820 clumps/alqueire in unmanaged forest**

In one Marajó municipality, clumps of açaí in unmanaged floodplain forest varied between 128 palms and 208 palms/ha.[1] In the flooded forests of the estuary of the Amazon River, there are between 300 and 400 adult açaí trees and an average of 800 juveniles/ha. Intensively managed forests can reach densities of 1 200 clumps/ha. In poorer soils, it is common to find densities of 100–200 clumps/ha.

Production

During the peak season, between 10 000 and 20 000 baskets of açaí fruit, weighing 14–15 kg each, arrive at the Açaí Fair each day.[2] Pará is the largest producer of açaí juice; in 1997 alone it produced more than 1 million litres.[3] Each adult açaí stem produces 4–8 fruit bunches/year. Each bunch contains 4 kg of fruit, giving a total of about 120 kg of fruit/açaí palm/year. On the island of Onças, where the river dwellers manage açaí for the markets of Belém, an average production of 1 160 kg/ha/year was produced on control plots. The palms, which are managed by pruning most of the young stems and thinning other plants that grow up around them, can produce 10 000 or 12 000 kg/ha/year in terra firme forest and up to 15 000 kg in flooded forest.[1]



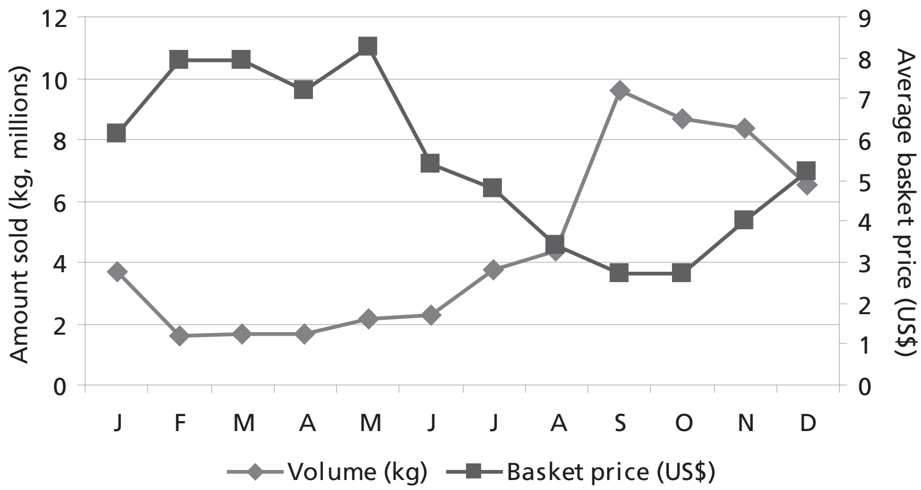
an average of 120 kg of fruit/palm/year

Economic value

In the early hours of the morning, 70–120 sellers arrive at the Açaí Fair in Belém; by 8 a.m., all the açaí has been sold – disappearing into the trucks, carts, and sacks of willing customers and large firms that fan out into the city. Guess how many açaí home shops and street vendors there were in Belém in 1995? More than 2 000! Imagine how many there are now. Most of the açaí consumed in Belém is produced on the neighbouring islands of Marajó, the island of Onças, and in the region of Acará. The majority of that production comes from *Euterpe oleracea*.

The amount of açaí sold at the ports of Belém varies throughout the year, with prices rising when the fruit is scarce and dropping during peak fruit production. During the 2007/2008 harvest in the municipality of Ponta de Pedras, two producers recorded the farm gate price of a basket to be US$3.50 at the beginning of the season (in August) and US$9 at the end of the season (in January). Not surprising, the price is slightly below that sold at the ports of Belém because the transporters take their share.

Açaí prices and the quantity of açaí consumed have both skyrocketed in recent years. In 1995, a 14-kg basket of açaí sold in Belém for between US$1 and US$5, a fraction of its current price. In April 2003, that basket of açaí sold for an average of US$4, and by April 2008, with growing international and national markets, one basket sold for more than US$30. However, this is not the reality for most producers around Belém where production rarely stretches through April. Only occasionally they strike it lucky with a small amount of off-season harvesting. Traders, on the other hand, usually bring açaí from distant regions to capture these opportunities. Producers from the state of Amapá who harvest açaí during Pará's off season are increasingly sending their product to Belém and surrounding regions.



Source: SECOM

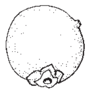
Mean monthly price and volume of açai sold in ports of Belém 2004/05

In 2008, the price of one litre of açaí juice in Belém ranged from US$2 for thin juice and up to US$5 for very thick juice. Pressure from export markets has influenced the quality of açaí juice sold to those who consume açaí as a fresh staple food. When açaí fruit prices are high, processors who sell it fresh for daily consumption increase the amount of water and, in some cases, add thickening and colouring products. This way they can keep prices accessible to low income consumers, but at the expense of quality. While most Amazonians only consume it fresh, those who like smoothies and açaí desserts can ensure they have it out of season by purchasing frozen pulp for US$5/kg.

National and international consumption of açaí has grown dramatically in recent decades. In the Amazonian city of Macapá in 1998, people consumed between 27 000 and 34 000 litres a day, and the açaí industry earned more than US$15 million/year.[4] In Belém, consumption has risen from 90 000 litres/day in the late 1980s to an estimated 400 000 litres/day in the late 1990s.[5] In 2006, the Brazilian national statistics estimated that more than 101 000 tonnes of fruit were sold, for a value of US$47 million[6], but that misses much of the regional production vastly underestimating the actual trade.[1]

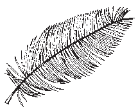
Açaí has become less important as a source of palm hearts as producers focus on supplying fruit to this growing market. Likewise, technological advances providing ice or refrigeration on cargo boats allow more remote producers to manage their açaí stands for the perishable fruit but palm hearts can be collected during stand thinning. Over 99% of the palm hearts harvested in the Amazon region come from açaí. In 1996, more than 86 000 tonnes of palm hearts were produced from açaí, at a value of more than US$13 million.[6] In 2006, palm heart production in the Brazilian Amazon had dropped to around 6 100 tonnes, still generating almost US$3.9 million[7] in supplemental income for riverine communities.

USES

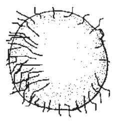


Fruit: Açaí fruit is sold as  frozen pulp,  jam and juice. It is used to flavour  ice cream and other frozen treats, cakes, porridges and bonbons. It is also sold as powder and pigments.

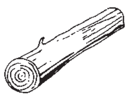
Palm hearts: The palm hearts are eaten fresh or canned.



Leaves: The leaves are constructed into houses, baskets, carpets, fans and ropes for climbing trees. They also provide fertilizer and animal feed. The spathe that covers the fruit bunch can be taken by children to make toy boats or utilized by parents to make hammocks for babies.

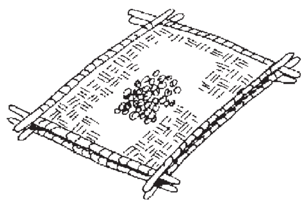


Seed: The seeds make excellent fertilizer and, when dry, are crafted into jewellery.



Trunk: The trunks are used for framing in the construction of rural houses and to make bridges across small streams.

Young roots: When made into a medicinal tea, the young roots help to get rid of worms.



Fruit stem: The stem remaining after the fruit are removed is used as a fertilizer or as a garden broom. When burned, the stem serves as an insect repellent.

Scientists learn from caboclos

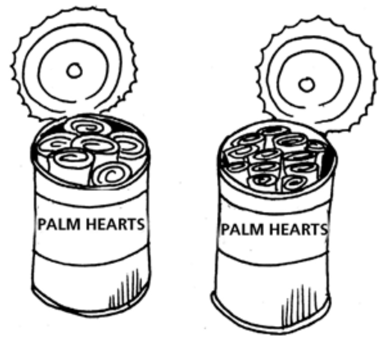
Mário Jardim

Black, purple, tinted, speckled and white – who can recognize so many types of açaí? Although scientists have only one name for açaí, people who live along the rivers identify distinct varieties. Black and purple açaí are considered the most common, while other varieties are distinguished by the characteristics of their fruit and palm. Some scientists are incorporating such local knowledge into their botanical identifications and are calling these differences “ethnovarieties”.[7]

Palm heart extraction

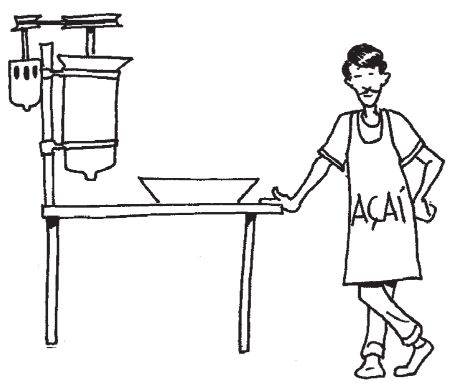
In the 1970s, when the palm heart industry began in Pará, extraction was intense, often destroying the açaí palms and leaving disgruntled people without açaí fruit juice. In the 1980s, the açaí stands started to show signs of unsustainable exploitation, and in 1989 IBAMA, the Brazilian federal environmental institute, created a law that only permitted the managed cutting of açaí palms. Today, the açaí merchants closer to the city can earn more through the sale of açaí fruit; and palm hearts are extracted from stands farther from metropolitan areas, but there are still cases of illegal açaí cutting.[9]

How many palm hearts per can?



In managed açaí palm groves, 700 large açaí palms grow on each hectare, translating to 190 kg/ha of palm hearts for each harvest. Palm hearts can be harvested repeatedly from the same plant, as the açaí forms shoots off numerous stems. This way, smaller stems can be left and a few larger stems removed without killing the tree. However, extracting a substantial number of palm heart stems from one tree can diminish the number of valuable fruits a palm is able to produce. Consumers can judge if the canned palm hearts in their house were harvested sustainably or not. A simple technique to monitor the pressure on açaí palms from the palm heart industry was developed by Harrison Pollak, Marli Mattos and Chris Uhl: count the number of palm hearts in the can. When there are more than 17 palm hearts in a can, you know this came from an area of overextraction as it indicates too many small stems are being harvested. A 1 kg can containing 17 palm hearts or less indicates a sustainable practice of harvesting larger stems and only a few smaller stems.[9]

Happy Açaí Sunday



When the açaí harvest is at a peak, people in some cities in eastern Amazonia, like Abaetetuba, Cametá, Ponta de Pedras and Moções, have an Açaí Festival. Street competitions include: the largest variety of foods made from açaí; the largest or smallest bunch of fruit; the person who can drink the most juice; and folk dancing. Revellers in the streets stroll by with something in common, their lips stained purple by the fruit of açaí, singing an açaí-inspired song, "It's the plant that feeds the passion of our people…."

Treatment of cuts and worms

If someone has an accident in the woods, cut the top of an açaí palm heart and squeeze the juice over the wound. This should stem the bleeding. Also, in riverine areas an extract prepared from açaí roots as a tea or tonic is often used as an anthelmintic to expel parasitic worms from the body.

Attention orchidophiles!

João Batista da Silva, an orchidophile at the Goeldi Museum, in Belém, made a handy discovery regarding the cultivation of orchids and açaí seeds. After the pulp is removed from the seeds of açaí, the seeds are normally tossed aside as garbage. However, this garbage is a rich planting mix for orchids and ornamental plants. Açaí seeds can even serve as a substitute for expensive fertilizers found in the market. To make the fertilizer, gather together the açaí seeds, wash them and boil them to prevent germination. Let them dry before using them. Joao's discovery has become a widespread practice – seed sellers now sell açaí fertilizer door to door.

Legend of açaí

There are different legends associated with the açaí palm. A popular one goes as follows.

In ancient times, there was an indigenous tribe of Pará that passed through a long and difficult hunger season. To save some of his people, the chief felt that he had to order that all the children of the village be killed, including his own daughter Iaça. The daughter was heartbroken and set off for a walk through the woods. The chief went to look for Iaça and found her standing near a palm. The chief walked closer to his daughter and found her embracing a palm full of small black fruits. The chief prepared a drink from the fruit and brought it to his tribe to relieve their hunger. In homage to the palm tree that still feeds people today, the chief inverted her name and called the tree "açaí".

NUTRITION

People from Pará cannot live without açaí juice. The table can be laid with roast beef, salad, fish or barbeque, but without açaí, it just is not a meal. In some Amazonian caboclo communities, açaí was found to make up 42% of their daily intake by weight.[10] Some people in Belém drink up to 3 litres of açaí/day. In the 1990s, an average person from Belém consumed 60 litres of açaí/year.[5] An estimated 180 000 tonnes of açaí are consumed each year in the city.

It's good and good for you

Açaí tastes good and is also good for you. The pulp has a high number of calories, up to 247 calories/100 g. Açaí juice is rich in calcium, iron, phosphorous and vitamin B_1. It is also high in the beneficial fatty acids omega-6 and omega-9. The level of vitamin A is higher than many other tropical fruits. One hundred grams of açaí contains 2 g of protein, 12.2 g of lipids, 11.8 g of iron, 0.36 g of vitamin B_1 and 9 mg of vitamin C.[12] The level of protein in açaí is similar to milk. The palm heart of açaí has few calories, but is a good source of minerals, containing sodium, potassium, magnesium, iron, phosphorus, copper and silicon. Riverine caboclos indicate that it is not advisable to eat açaí with milk, alcohol or fruits such as cupuaçu, mango, cacao and watermelon. Scientists confirm that acidic fruits should not be eaten together with açaí, although this is a common practice outside the region where açaí consumption became popular in fruit smoothies.

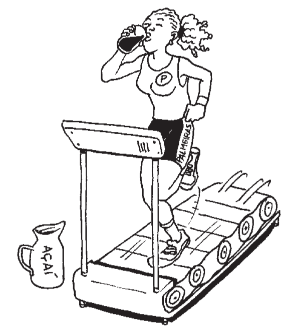
Nutrition facts

	Quantity/100 g	% of daily intake*
Calories	80	-
Total fat	6 g	9
Saturated fat	1.5 g	7
Omega 6	860 mg	-
Omega 9	3 360 mg	-
Cholesterol	0 mg	0
Sodium	10 mg	0
Total carbohydrate	7 g	2
Fibre	1 g	5
Sugars	0 g	-
Protein	2 g	-
Vitamin A 15%	**Calcium 4%**	
Vitamin C 8%	**Iron 6%**	

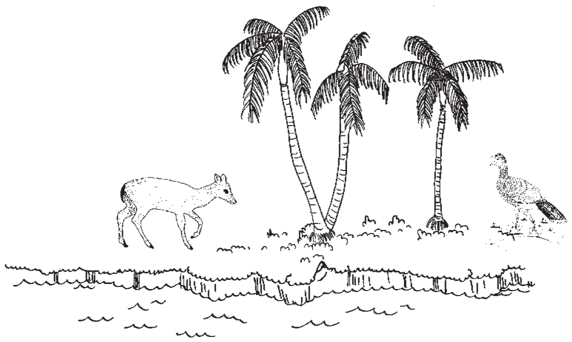
* Daily values are based on a 2 000 calorie diet. [11]

Açaí is being marketed in the United States of America and Europe as a "super food". In 2006, a study found that extracts from açaí berries initiated a self-destruct response in up to 86% of the leukaemia cancer cells tested in the lab.[13] These effects have not yet been demonstrated on cancer in humans. Açaí is rich in flavonoids, which give it its dark purple colour and provide a high dose of antioxidants.

Açaí pulp has become a fad in gyms in the south of Brazil. Athletes enjoy açaí mixed with guaraná and oats to give them a burst of energy. Dona Maria is one of the people in Belém who exports frozen pulp. She said she sent açaí to a snack shop in Rio de Janeiro for the first time in 1980. Twenty years later, she was sending up to 800 tonnes per year to different cities throughout Brazil.

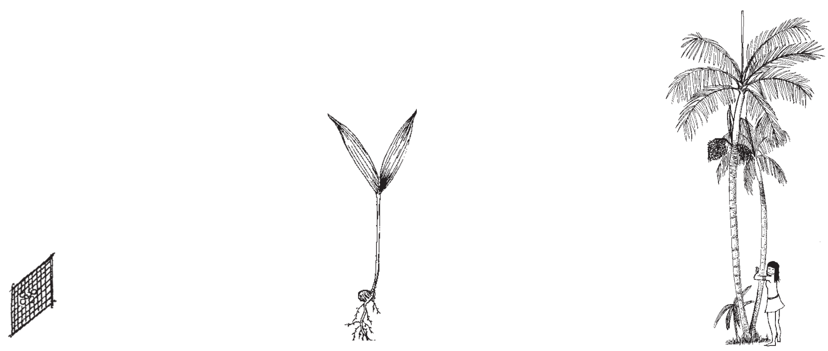


Wildlife



Açaí is important in the diet of many mammals and birds, such as toucans, tinamous, chachalacas, spider monkeys, capuchin monkeys, deer, tapirs, peccaries and agouti. Fish and turtles also like açaí. Guans enjoy both the fruit and the leaves of the açaí tree. People from the Kayapó Indian group place açaí fruit on their fields to attract and feed wildlife.

Management



germination 30–40 days

growth 2 m/year

production 4–6 years

Açaí palms regenerate easily in the seasonally flooded forests of the estuary of the Amazon River, where the seeds are spread by people, animals and water. In the terra firme forests, the palm is cultivated by planting sprouts. The seeds germinate quickly (in 30–40 days in humid conditions) and in four or five months (at 30 cm in height) the sprouts are ready to be planted. In the natural environment, less that 50% of the seeds germinate. Light is the principal requirement for rapid growth. Açaí agroforestry systems in the estuary floodplains are developed primarily by the planting of açaí seedlings in swidden agriculture plots after planting of annual and biannual crops or by the management of native floodplain forests, or a combination of the two.[1]

Estuarine producers increase açaí productivity in floodplain forests by managing both the entire forest stand and the individual palm tree. To increase the productivity of the entire stand, it is necessary to thin the large canopy trees shading the açaí palms, but many producers keep the economically important species, such as andiroba, ucúuba and rubber trees. It is also wise to cut the vines and branches of neighbouring trees so they do not interfere with the crowns of adult açaí palms. But do not throw them away; they make good fertilizer.

For the individual palm, some families who manage açaí have discovered that removing some of the stems of the clump for palm heart extraction can also increase fruit production.[14] They remove the older stems that are too tall for fruit collection, as well as some of the smaller stems to take advantage of their inner, tender palm hearts. Experienced harvesters leave both the productive and nonproductive medium-sized stems. In one highly productive Marajó municipality, managed açaí groves contained an average 500 palms/ha, with some containing more than 870 palms/ha.[2]

Açaí fruits last between 36 and 48 hours without refrigeration. In areas where the fruits cannot be sold because of the long distances to markets, managing for palm hearts is an important alternative. To avoid harming the açaí palms, remove only three stems per cluster of the larger palms (those 10 cm or more dbh) every three or five years.

When your açaí fruit season is over, do not worry; açaí farmers have been experimenting with ways to extend the production season of açaí fruit. To encourage production out of season, they pick the flowers when they are still young as a way to alter the season when the tree gives fruit.

Small fruit makes a big splash

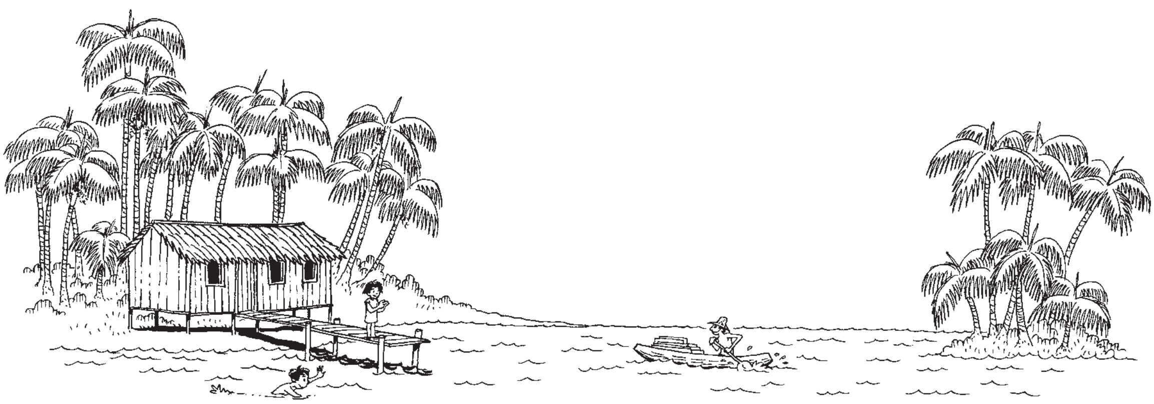
When rural families began establishing urban residences in large numbers in the 1960s, they brought their habits and their cultural preference for açaí fruit with them, creating a demand that has grown during the past 50 years.[15] In addition to contributing to cultural continuity regarding food preferences, açaí fruit has provided affordable nourishment and remains a caloric staple particularly important to low-income urban residents.[16] How did this regional demand, and later the national and international craving for açaí fruit, impact the estuary? Let's take a look.

From the air, the floodplains of the Amazon estuary appear as a continuous blanket of homogenous forests, sometimes misinterpreted as pristine. From the ground, forest landscapes reveal the legacies of past economic booms, with large areas increasingly dominated by intensively managed patches of açaí agroforestry, a process some have called the "acaization" (açaização) of the Amazon estuary. Up closer, we see clearly defined forest farms where careful managers take up unmanaged forest patches (producing an average of 1 400 kg/ha/year, or 200 açaí clumps/ha) and intensify production to as high as 12 000 kg/ha/year, or 1 200 palms/ha. Although the productivity is modified year to year, the extent of these intensively managed patches has spread across the region in recent decades and is now the dominant land use, all done without external capital or agricultural extension agents.

Widely available throughout urban stalls and restaurants in the 1990s, açaí came under the radar of food companies who saw the potential to sell it as an energy and health drink in national and international markets, where products deemed both socially and environmentally responsible are fashionable and may reach astounding prices. For instance, pills and vitamin supplements claiming the health and anti-aging benefits of açaí can reach US$50 for a 60-capsule container. The combination of international interest, national consumption and regional urban demand of açaí as a staple has caused the overall demand for açaí fruit to skyrocket in recent decades.

Ironically, companies and many Brazilian agencies, both new to the açaí business, and the media at large, still give the impression that açaí is extracted from native forests. They often believe that they need to guide the riverine caboclos in intensifying production. In reality, the production systems being developed by companies and government institutions are built upon those designed over the years by riverine caboclos. The new management and planting techniques, such as the agronomically sophisticated "roçados de várzea," (floodplain gardens), are based on local knowledge of the floodplain forests. The initiatives and efforts of the riverine caboclos to intensify production since the 1970s are responsible for the present high-density açaí "native" forests. Caboclo ingenuity has allowed production to reach its current levels in national and international markets.

However, with the expansion and industrialization of açaí, these same producers are the ones that receive an ever-decreasing proportion of this enormous and growing economy. The story of açaí fruit and its producers demonstrate an important lesson for sustainable development of the Amazon. It is possible to value the forest and increase production by improving on local techniques, but merely exporting unprocessed resources is not enough to generate local development. The region needs a "transformative economy" where the value of the fruit (and other products) can be aggregated locally. Incentives towards a transformative economy could help increase the economic return for those who produce as well as encourage the creation of regional businesses and create jobs for both rural and urban people.



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4 Poulet, D. 1998
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12 Calzavara, B.B.G. 1987
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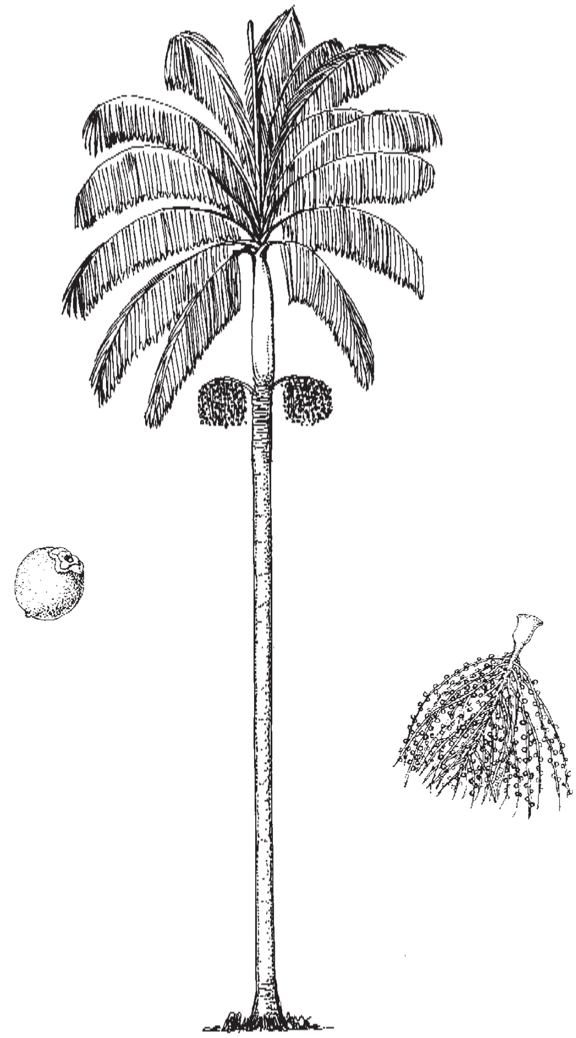
Açaí (solitary)

Euterpe precatoria Mart.



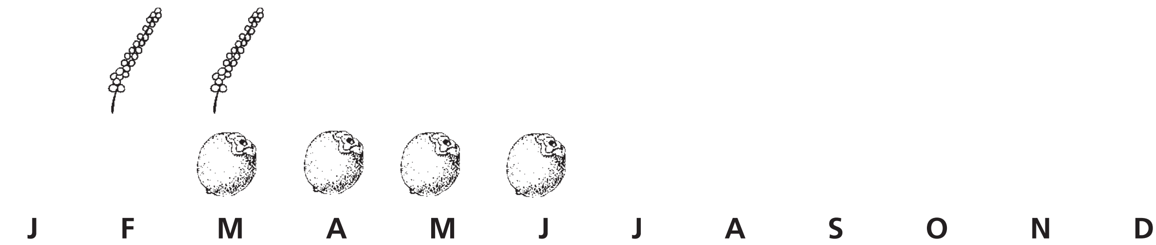
Evandro Ferreira

Indians and rubber tappers in Acre have loved the rich, purple juice made from the berries of this palm for generations, but it has only recently begun to appear in the markets. Urbanites have also discovered açaí and are becoming accustomed to serving it – sometimes as a sweet, and sometimes as a savoury – at every meal. The solitary açaí that grows in Acre is different from the multi-stemmed açaí that is found in Pará. As its name would indicate, solitary açaí grows a single stem, or trunk, and is generally taller than the açaí from Pará, reaching heights of more than 23 m. It is native to the western Amazon and generally found in mature forests, occurring in wetlands, flooded forest and terra firme forest. Solitary açaí is only slightly resistant to fire and is rarely found in deforested areas. The heart of this palm is a great delicacy, which, sadly, has led to a massive reduction in its native population.

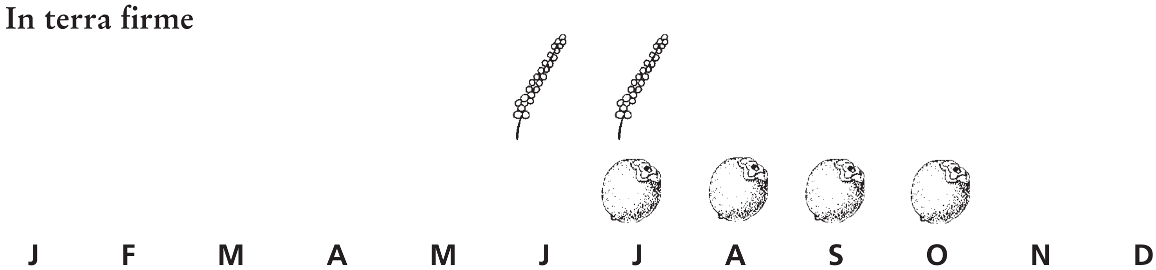
Ecology

Flower and fruit seasons

In wetlands

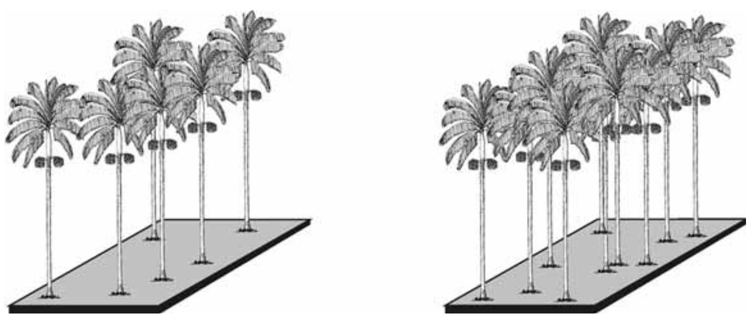


In terra firme



The flowers and fruits can be found throughout the year, but there are seasonal peaks of production. In Acre, the solitary açaí growing in flooded areas produce first, from March through June, then the palms growing on terra firme start to produce, from June through October.[1]

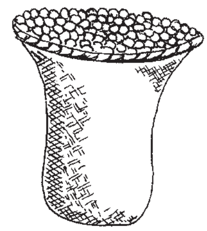
Density



39 palms/ha in terra firme **57 palms/ha in wetlands**

The greatest density of palms occurs in swampy areas. For example, in wetland areas of Epitaciolândia, 57 productive individuals were found per hectare,[2] while in the terra firme forest there were only 39/ha.[3] Another study in Acre found adult densities of 23 palms/ha in terra firme forest and 60 palms/ha in flooded forests.[4] It is possible to find up to five times as many solitary açaí palms in the flooded areas as in the terra firme.

Production



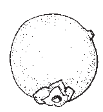
8 kg of fruit/palm

During the year, each palm produces between 2 and 6 bunches of fruit. One hectare of terra firme forest can produce more than 140 kg of fruit, and in flooded forest the production can reach more than 270 kg/ha.[5] Despite this, the large, meaty berries of the terra firme palms are more sought after than the smaller and more abundant variety that grows in the flooded forest. A palm from the flooded forest produces an average of 7.5 kg of fruit, while a palm from the terra firme produces 8.5 kg of fruit. The perfect time to collect açaí is when the fruit are almost black and beginning to fall. After being harvested, the fruits should be kept out of the sun. They can last for up to three days before they begin to turn.

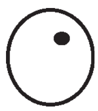
Economic value

In Rio Branco, the capital of the state of Acre, the berries from solitary açaí were sold in 2005 for US$2–2.50/12-kg can. In August 2002, there were 19 places to buy açaí equipped with machines to extract the juice from the seeds; these sold a total of 7 500 litres/week, for between US$0.54 and US$0.72/litre. Based on the sale of açaí juice, we can deduce that 22 tonnes of açaí fruit were sold each week in Rio Branco during that year. Solitary açaí has a lovely white seed that is in high demand by local artisans for jewellery-making. Half a kilogram of polished and punctured açaí seeds sold for US$3.40 in 2004. Necklaces made from guaraná, coconut and açaí are being sold as far away as New York City. The most elaborate and spectacular of these necklaces can cost as much as US$167.

Uses



Fruit: Palm berries are used to prepare açaí juice, ice cream and other frozen ice treats, and chicha, a fermented drink loved by local indigenous people. The juice can be served as a cold soup; thick, unsweetened and with farinha added, or thinner with sugar as a beverage.

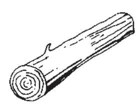


Seeds: Jewellery made from pure white açaí seeds has become a fad across Brazil, and the most popular seed is from single açaí. Multi-stemmed açaí seeds are violet.

Palm heart: Palm hearts can be eaten fresh, alone or in salads.

Oil: In Peru, some Indians use the oil as a beauty product for hair.[6]

Leaves and roots: The juice obtained from pressing new roots and new leaves is used to cure snake bites, as well as to treat anaemia.[7] In Bolivia, the leaves are used by Indians to make brooms and as roofing for houses.[8] In Peru, the root is used to cure liver and kidney disorders.[9]

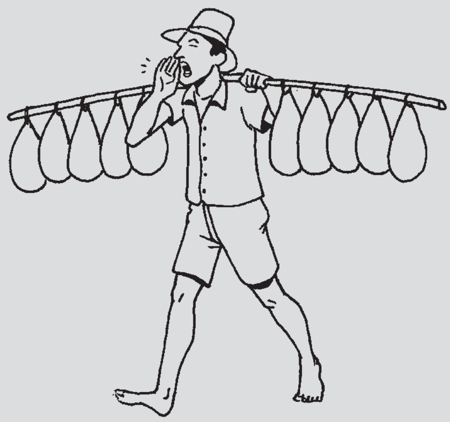


Trunk: The trunks are used as beams for house construction in rural areas.

Nutrition

Since the rubber era, single açaí has been adored and consumed in great quantities by rubber tappers, who after a long day of walking through the forest look forward to large gourds of açaí juice with their meals, often accompanied by farinha, seasoned with pieces of fried meat or salted shrimp. Açaí continues to be very important in today's diet: the 111 families in the Acre community of São Luiz do Remanso consume approximately 1 665 kg of fruit/year.[10] Many people in Acre drink up to one litre/day of açaí, which is impressive considering that açaí juice is loaded with calories: from 80 calories/100 g of the thin, commercial type, to 265 calories/100 g for the thick kind.[11]

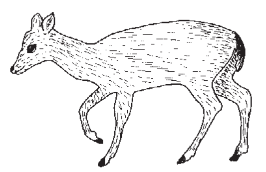
Fresh açaí on every corner



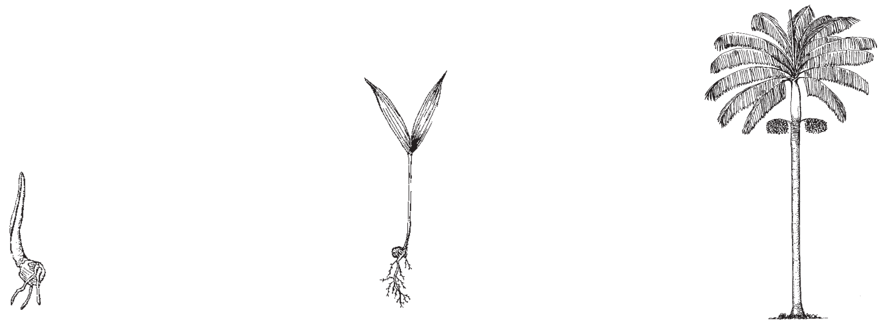
These days you do not have to be concerned about drinking açaí in the streets of Rio Branco. The majority of açaí vendors use clean "de-pulping" machines and mineral water to extract the juice and store it in refrigerators. You can also find açaí juice for sale in the supermarkets. This is a recent improvement, however. In the past, açaí pulp was removed from the seed by hand. The vendor would then tie 15 to 20 bags of freshly squeezed juice on a pole to carry on his shoulders as he walked through the streets under the blazing equatorial sun, calling out, "Açaí! Açaí!" The juice would bake all day inside plastic bags and was often spoiled by the time it reached the table.

Wildlife

According to the locals who live in the communities of Dois Irmãos and Caquetá, parrots, macaws, toucans and curassows are the primary dispersers of solitary açaí seeds throughout the forest. Scientists agree and discovered that açaí composes 59% of the red brocket deer's diet and 80% of the grey brocket deer's diet.[5]



Management



germination
30–40 days

growth
5 m/year

production
4 years

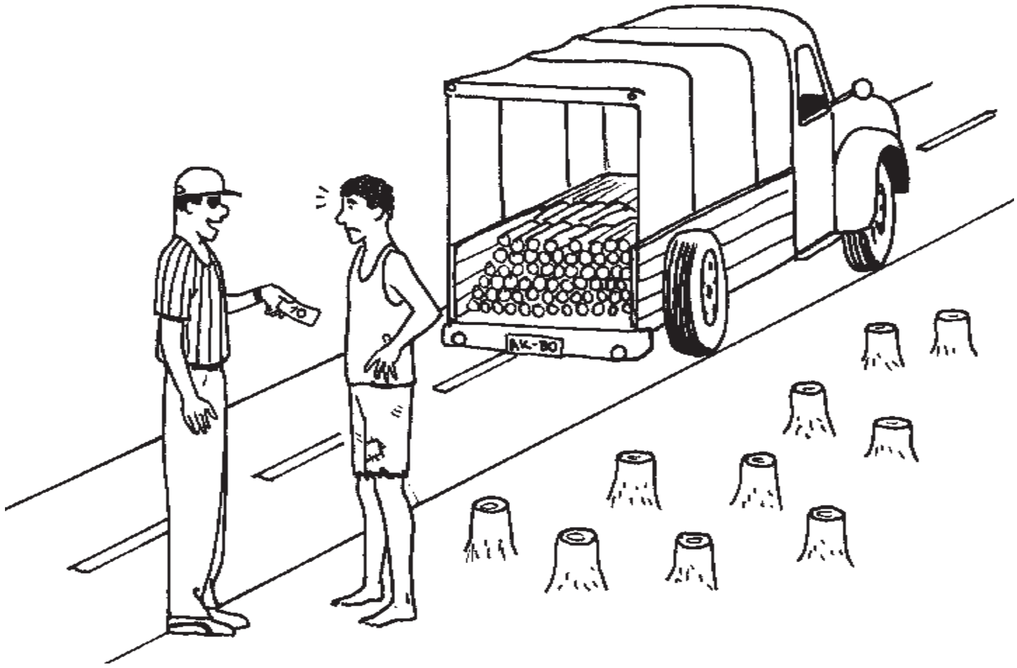
In comparison to multi-stemmed açaí, there are few studies about the management of solitary açaí. However, scientists do have one important tip: If you collect solitary açaí bunches at the height of the season and let them fall the rest of the year, everyone wins – the animals can eat, the açaí can reproduce and people can have their beloved juice.[2]

Downward spiral: prices and açaí stands

The process of extracting palm heart results in the death of solitary-stemmed palm trees. There are no examples of sustainable palm heart harvesting in the whole state of Acre.

Along the road that links Acre to the state of Amazonas (BR-317), extraction of palm heart destined for the cities of Rio Branco and Senador Guiomard practically destroyed the solitary açaí population by the end of the 1990s. In those days, palm heart merchants travelled along the back roads in the countryside convincing local farmers to sell their açaí palms. In 1994, the going price was US$0.22/palm stem, already extracted and prepared for sale. If the merchants extracted the palm themselves, however, the price fell to US$0.11. The owners of those palms have had to wait many years for them to grow back to a reasonable size.

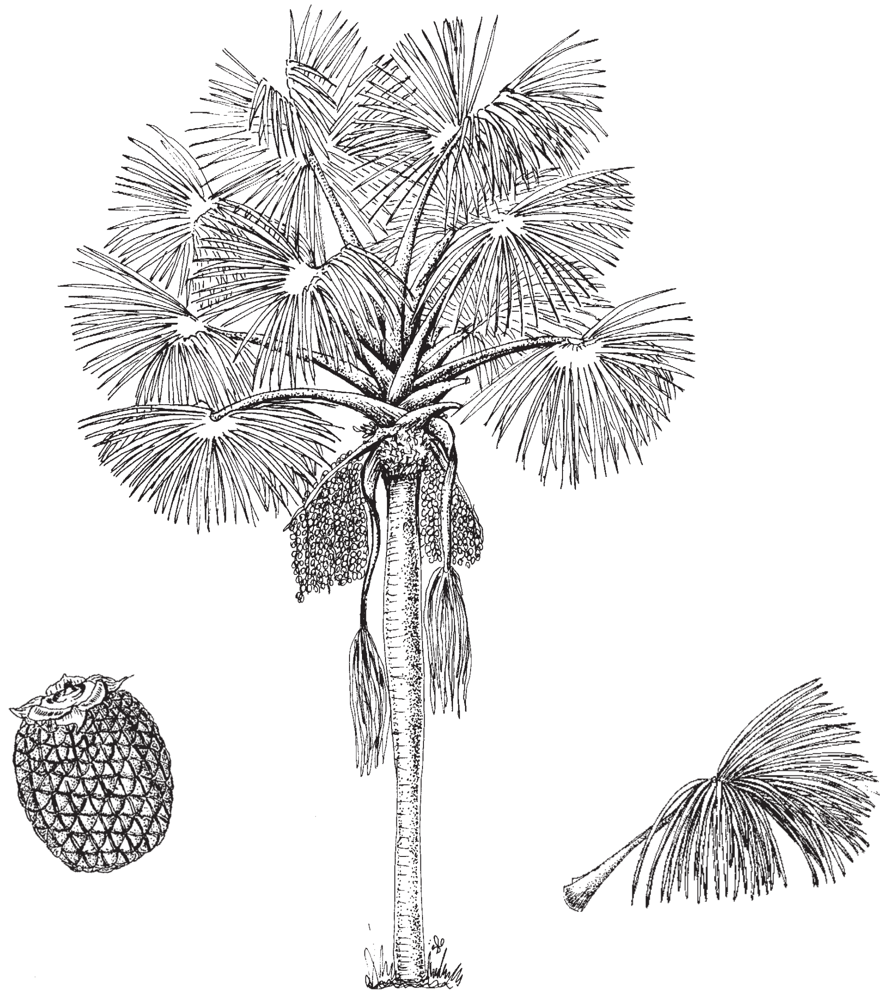
In Bolivia, predatory exploitation threatens the regional extinction of açaí.[12] Palm heart producers in Bolivia should take a lesson from Acre, where the palm heart companies went out of business because the stock was decimated. The increasing popularity of açaí juice is making the managed harvest of pulp from this marvellous palm more and more attractive.



1 Costa, J.A. 2001 / Denslow, J.L. 1980
2 Costa, J.A. 2001
3 Denslow, J.L. 1980
4 Rocha, E. 2004
5 Rocha, E. 2001
6 Bodley, J.H. & Benson, F.C. 1979
7 Ming, L.C.; Guadêncio, P. & Santos, V.P. 1997
8 Boom, B.M. 1987
9 Mejia K. 1992
10 CTA 1997 / CNS 1993
11 Bovi, M.L.A & De Castro, A. 1993
12 Zuidema, P.A. & Boot, R.G.A. 2000

Buriti, moriche palm

Mauritia flexuosa L.f.



Among the varieties of palm species in Amazonia, buriti present the most elegant and lovely specimens… the buriti has such noble and poetic lines that distinguish it above all others.

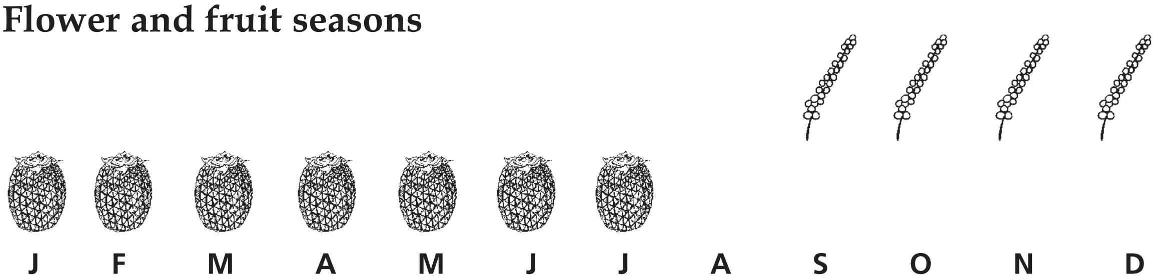
A. Lustosa, Archbishop of Pará, 1930

Margaret Cymerys
Nivia Maria de Paula Fernandes
Onofra Cleuza Rigamonte-Azevedo

The buriti is one of the largest and heftiest palms in Amazonia, reaching 20–35 m in height and 30–50 cm in diameter. The trunks are so massive that when felled they are used as bridges. People, as well as a wide assortment of animals, enjoy its nutritious fruit. The leaves, stems, seeds and oil are also used for a plethora of products. The buriti palm plays a celebrated role in many of Amazonia's popular festivals, when adults and children alike parade through the streets with brightly painted figurines carved from the buriti stem. Buriti is distributed throughout Amazonia, from the north of South America extending to the northeast and central south of Brazil. This palm prefers wetland areas, seasonally flooded forests, stream banks and riversides, where it is found in abundant concentrations.[1]

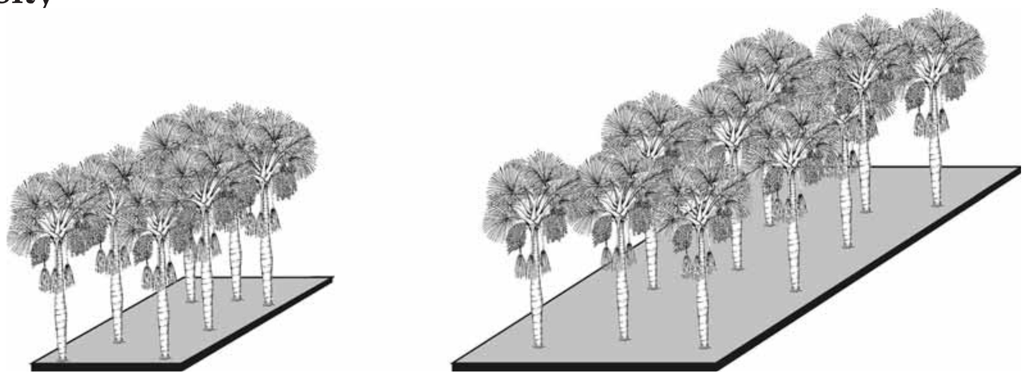
Ecology

Flower and fruit seasons



The buriti is a dioecious species, having both male and female plants. The male palms flower in the same months as the female, but without producing fruit. Near Belém, buriti flowers in September through December and produces fruit from January through July, sometimes producing again in November or December. The buritis in Acre flower from April through October. Fruit maturation can be heterogeneous in the same plant, varying from 7 to 11 months. Ripe fruits can be found from March through October.[2]

Density

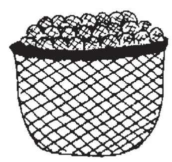


60–70 fruiting palms/ha

290–335 fruiting palms/alqueire

The buriti occurs with greater frequency in wetland areas. It is common to find approximately 60–70 female buritis and 75–85 male buritis/ha.[2] Extrapolated to alqueires, this density becomes 290–335 female buritis and 360–410 male buritis/alqueire.

Production



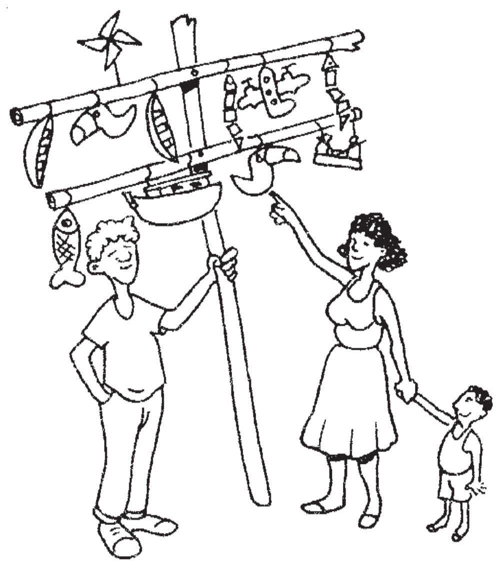
average of 200 kg/palm

Buriti palms are extremely productive: one buriti palm can produce between 40 and 360 kg of fruit/year. If a hectare of buriti is managed, it can produce between 2.5 and 23 tonnes of fruit/year. Based on forest inventories in Acre, it has been estimated that annually a female buriti palm produces between 1 and 9 bunches of fruit, and each bunch has from 600 to 1 200 individual fruits.[2] Considering an average of 64 female palms/ha and an average production of 200 kg of fruit, it is possible to obtain 384 kg of oil and pulp/ha. A buriti palm lives a long and fertile life – production declines only after 40–60 years.

Economic value

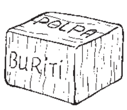
Street corners in Iquitos, Peru, are dotted with women selling buriti frozen ice treats. In 1985, it was estimated that these sellers earned about US$11/day. By the end of the month, the women's salary was eight times the minimum wage.[3] In the western Amazon, the people of Iquitos enjoy eating buriti as much as people from the eastern Amazonian state of Pará enjoy açaí. In Belém, in 2007, 1 kg of pulp cost US$2.60 and a bunch of 15 fruits cost US$0.52. A small basket of cooked buriti fruit, sold from January through May, costs US$5. One litre of buriti juice costs from US$0.52 to US$1, and a 5-kg bag of grated buriti for preparing juice costs up to US$8. Prices for toys made from buriti vary from US$0.30 to US$300.

Fanciful toys of buriti

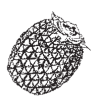


During the second Sunday of October each year, fantastically coloured animals made from buriti adorn the streets, parks and sidewalks in the city of Belém. It is Círio de Nazaré, one of Brazil's most renowned religious festivals, in which millions of people line the streets to see the "Saint", a small wooden statue of Mary and the infant Jesus. As the Saint passes, they make promises and wishes for the year to come. Traditionally, vendors parade around the streets with large crosses made of buriti on which hang scores of buriti folk toys. In 2006, an estimated 36 000 buriti toys were sold, generating over US$349 600. In 2007, there were more than 90 different kinds of buriti toys for sale during the Círio de Nazaré, such as boats, canoes, animals and even radios, computers and airplanes. Sales rose to 51 000 pieces that year, earning over US$520 000 in revenue. In the area of Bacarena, hundreds of families are involved in the production and sale of these hand-crafted figurines. The toys are very popular in other regional festivals as well, especially the Muritifest, in Abaetetuba, Pará, a festival devoted exclusively to the celebration of this colourful craft. In recent years, their fame has spread across Brazil, and stores as far away as São Paulo and Rio de Janeiro have begun to commission buriti crafts for sale.

Uses

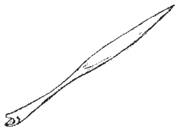


Pulp: The pulp is used in  juice, sweets,  ice cream and  other frozen ice treats.

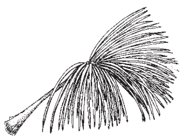


Seed: The seeds appear in buttons, crafts and jewellery (with gold and silver), in addition to having a role in the production of alcohol fuel.[4]

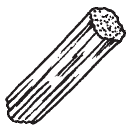
Oil: The oil is used to fry fish and to make soap and cosmetics. It also acts as lamp fuel. Buriti oil is said to have purifying and detoxifying qualities.



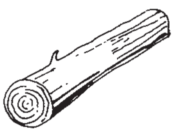
New leaves: When they are still closed, the new leaves are called "eyes". These are used to make cords, baskets, belts, purses, mats, hats, sandals, book covers and hammocks. In the Bragança region of Pará, many leaves are extracted to make tobacco pouches. Leaves are also used as organic fertilizer.



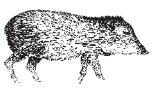
Adult leaves: In Acre, the stalks are often used to make kites. In Pará, the leaves are used to weave colanders and sieves (tipiti) for extracting tucupi liquid from manioc root used in regional cuisine. In the past, the Tupinambá Indians boiled buriti leaves to obtain a tawny brown powder used as a salt substitute.[5]



Stems: The stem supplies a light, soft material used in crafts. The "branch" has a spongy inner part that is used in the manufacture of toys, toilet paper and birdcages. Stems can reach up to 4 m in length.

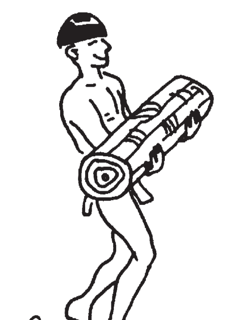


Trunk: The trunk is used for bridge construction and, because it floats, the trunk can be used to transport other logs along rivers. Male buritis are often selected so as not to destroy fruiting trees. Rotten buriti palms are also highly prized. Children and adults scout out logs decaying in the water to collect wood eating mollusks called turus. Containing a high concentration of protein, these marine bivalves also known as shipworms are considered a delicacy both raw and cooked.

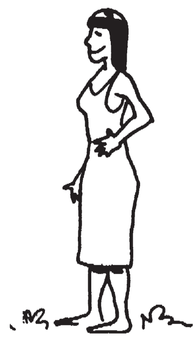


Wildlife: The fruit of buriti is an important source of nutrition for many animals, including tapir, peccaries and deer.

Buriti in Apinayé Indian weddings



Husbands and wives to be in the Apinayé Indian tribe await and greet the fruiting of the buriti palm with great happiness, as this is the season during which the Apinayé hold their finest parties and weddings.[6] When a man from the Apinayé Indian tribe wants to marry, he must pass a tough test. To prove himself worthy of his bride, he publicly demonstrates his vigour by carrying a 1-m (or more) long buriti trunk from the forest to the centre of the village. When, and if, he arrives in the village with the buriti trunk, the sister and godmother of the bride proudly escort him to the bride. The contented husband and cheerful bride then share a meal to consummate the marriage.[7]

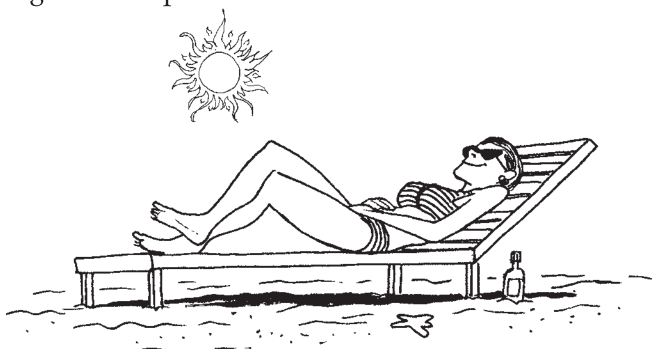


Sunscreen, deodorant and electricity

Palm researchers discovered that the buriti fruit produces two types of oil widely used in the chemical and food industries. Oil extracted from the palm seeds are high in lauric acid, a saturated fatty acid often used in the production of soaps and shampoos. The oil extracted from the fruit pulp is high in oleic acid, a monounsaturated omega-9 fatty acid found in many vegetable oils. It is estimated that with a density of 150 female plants/ha, the buriti can produce 3.6 tonnes of vegetable oil/ha. This yield is far superior to the production of the most commonly used vegetable oils in the world, such as soy, sunflower and peanut, though it is less than the yield from the palm oil, dendê.[8]

Buriti vegetable oil can also be used to produce sunscreen because it absorbs electromagnetic radiation between the wavelengths of 519 nanometres (green) and 350 nanometres (ultraviolet), rays which are harmful to human skin.[9] Currently, cosmetic companies are selling buriti oil over the Internet to re-hydrate and revitalize the skin for US$23 for 8 oz and US$256 for a gallon[10] and also utilizing it in the production of natural deodorants.

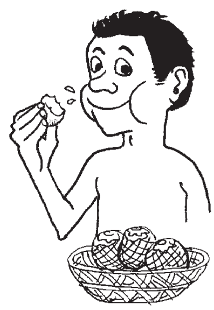
For remote communities in Amazonia, buriti oil could represent a source of alternative electricity. In Rondônia, buriti oil is used in the production of efficient and low-cost electric energy in a pilot project developed by the Federal Universities of Brasília and Rio de Janeiro.[6]



NUTRITION

Buriti for healthy eyes and body

Apinayé Indians commonly walk through the forest with woven baskets full of buriti fruit. When they feel like a snack, they remove the skin with their teeth and suck on the pulp.[11] They are clever to do so as the nutritional richness of buriti fruit is far greater than most supermarket snacks. Buriti possesses one of the highest quantities of carotene among all the plants of the world;[12] it has 30 mg of carotene per 100 g of pulp[13] – 20 times more than the amount in the equivalent weight of carrots.



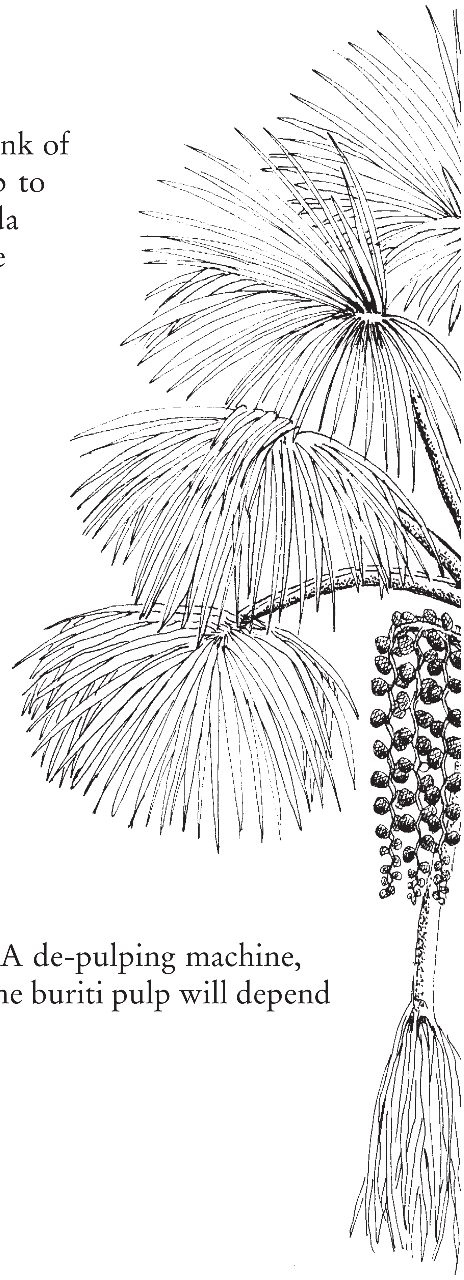
However, in certain regions of Brazil, vitamin A deficiency is a frequent problem, leading to illnesses, such as eye and mouth infections, toothaches and poor night vision. In northeast Brazil, children are able to combat these deficiencies by eating sweets – buriti sweets. One group of undernourished children was given buriti sweets for 20 days. In a short while, the symptoms caused by vitamin A deficiency disappeared.[14]

The pulp of buriti also offers good quality protein. Almost equivalent to corn for nourishment, the pulp of buriti is composed of 11% protein. Due to its outstanding nutritional value, the fruit is now being used in the recuperation of malnourished children.

Oil: How do you extract it?

Buriti oil has many uses. It is expensive to purchase, so it is worthwhile to know how to express the oil at home. To extract buriti oil, mash each fruit with a spoon or a piece of wood. Place the fruit in a drum or can filled with water and cover it with green leaves. Place the can over a fire or in the sun for four or five hours, without stirring, until the fruit softens (do not allow the water to boil). When very soft, remove the fruit and scrape the pulp off the skin with a spoon. Place the pulp in water and heat; when the oil begins to rise, remove it with a spoon. This oil is great for frying fish, and the leftover fibres and pulp are an excellent fertilizer for the field or garden.

Recipes



Buriti sugar

In certain regions of Pará, people bore holes in the trunk of the male buritis and collect from 8 to 10 litres of sap to produce a light yellow sugar. Don Antonio de Almeida Lustosa, Archbishop of Pará, wrote in the 1930s: "The caboclo cuts down the male palm and punctures its trunk to reach the sap." The sap is thickened by evaporation, transforming it to honey.[9]

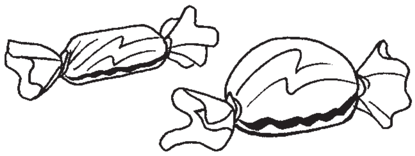
Buriti sago

The interior of the buriti trunk can be ground up to form starchy flour used to prepare porridge similar to sago, a staple food for many people in Papua New Guinea. The Native Amazonians call this ipuruna flour.[7]

Buriti pulp

Buriti pulp can be made at home. Place the fruits in warm filtered or boiled water. Once soft, squeeze the pulp out through a sieve or mash it with your hands. A de-pulping machine, like those used for açai, works well. The thickness of the buriti pulp will depend on the amount of water used.

Buriti sweets

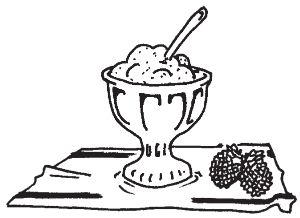


Ingredients:
– 10 cups of buriti pulp
– 10 cups of sugar
– 1/2 cup of water
– ground cloves to taste

Preparation:
Mix the pulp with the sugar, adding water while it is cooking. When the sweets are close to ready (when the mixture begins to pull away from the bottom of the pan), add powdered clove. If you prefer the sweets in tablets, remove the batter from the pan, spread it on a clean cutting board and when cool, cut it into pieces.

In the Northeast of Brazil, these delicious buriti sweets are sold in small boxes made from buriti branches. In Teresina, capital of the state of Piauí, the sweets are commonly found in markets, sold in small packets or in large cans.[8]

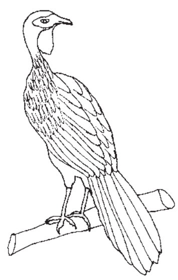
Buriti frozen crème



Ingredients:
– 700 g of buriti pulp
– 2 cans of sweetened condensed milk
– 2 cans of thick cream
– 1/4 cup of lemon juice

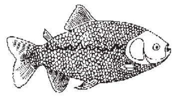
Preparation:
Place the pulp, condensed milk and cream in a blender. Bit by bit, add lemon juice to give consistency to the cream. Mix until it acquires the desired consistency. Pour the mixture into a bowl, and cool it in the refrigerator for several hours.

WILDLIFE

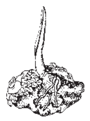


Large birds, such as chachalacas and guans, eat the flowers of the buriti, and dead standing buriti serve as important nesting spots for some parrots. A study in southeastern Peru found that 47 of 50 known nests of blue and yellow macaws (*Ara ararauna*) and all the observed red-bellied macaw (*Orthopsittaca manilata*) nests were in buritis.[15] Fork-tailed palm swifts (*Tachornis squamata*) on the other hand make their nests in the dead leaves hanging from the buriti palm.

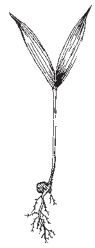
The fruits are sought after by a multitude of other wildlife. Knowing this, cunning hunters set up rifles with trap lines beneath buriti to capture the deer, peccaries, tapirs, pacas or coatis that visit the palm for fruit. Monkeys, tortoises and even fish also dine on buriti. A valuable study in Peru ranked the importance of different forest fruits in animal diets.[16] Buriti came first for the Brazilian tapir, 5th for the white-lipped peccary, 10th for the collared peccary, 16th for the grey brocket deer and 18th for the red brocket deer. To improve fruit production and attract game, Amazonians cut back the plants encircling the buriti and place organic material at the base of the palm.



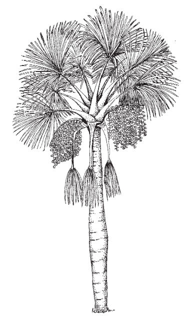
Management



germination
1–4 months



growth
in shade initially, then sun



production
7–8 years

To increase the rate of germination, seek out the seeds of mature bunches of fruit that are still attached to the palm. They should be the colour of red wine. After removing the skin and pulp from these fruit, leave the palm seeds to soak in water for at least 12 days. Next, place them in the sun to dry for one day. Bury the seeds 2 cm down in the sand and wet them at least twice a day. After 24 days, the seeds will begin to germinate, and after 42 days, 95% of them should have sprouted.[2]

The buriti sprouts can be planted in flooded soils, but they will not survive if they are always submerged in water. The seedlings also require plenty of sunlight; in the beginning, the sprout uses nutrients from the seed to grow and can tolerate shade, but it requires sun to grow into adulthood. To develop, the buriti benefits from organic fertilizer that can be obtained from the palm itself.[2]

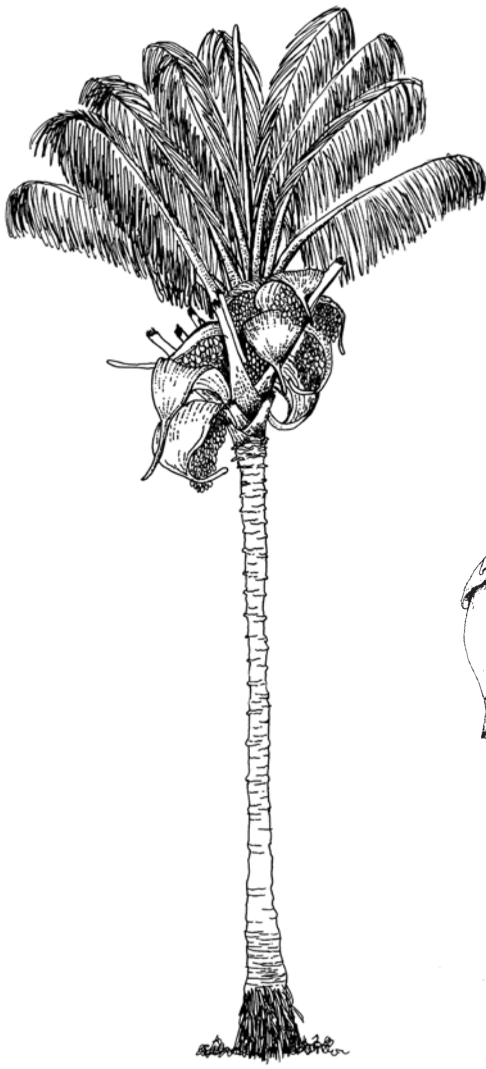
Near Iquitos, Peru, the tremendous popularity of the fruit has caused some collectors to cut down many of the buriti palms surrounding the city to collect the fruit rapidly. Consequently, to fill the high demand of Peruvians in Iquitos, the fruit must now come from long distances, up to three days by canoe. As the subsistence and market value of the fruit is substantial, it makes sense to collect them without harming the tree so as to guarantee production year after year.

Managers of buriti palm offer the following suggestions to help them grow. Cut back the plants without economic value to provide more space and sunlight for the productive buriti to grow. It is possible to cut down some of the male buriti palms in order to harvest the sap, utilize the wood and make other products, but be sure that at least 15–20% of the remaining palm trees are male to pollinate the females. To improve the quality of the fruit, collect the seeds of the best specimens and seed them in open areas.[11]

[1] Henderson, A. 1995
[2] Paula-Fernandes, N.M. 2001
[3] Padoch, C. 1988
[4] Pesce, C. 1941
[5] Levi-Straus, C. 1997
[6] Castro, A. 2000
[7] Cavalcante, P. 1991
[8] Lleras, E.E. & Coradin, L. 1988
[9] Moreira, G.C.; Morais, A.V. & Matias, J.G.N.S. 1998
[10] http://www.grasshuttreasures.com/amazonoils.html 2008
[11] Balick, M. 1986 and 1988b
[12] Santos, L.M.P. 2005
[13] Lima, M.C.C. 1987
[14] Pio Correa, M. 1926
[15] Brightsmith, Donald J. 2005
[16] Bodmer, R. 1993

Inajá

Attalea maripa (Aubl.) Mart.
[syn.: *Maximiliana maripa* (Aublet) Drude]



Margaret Cymerys
Evandro Ferreira

The inajá palm is common in Amazonia and occurs in abundance in terra firme with poor sandy soils. Extremely resistant to fire, inajá is often found in pastures, secondary forests and on community lands, sometimes in conjunction with other palms, such as babaçu (*Attalea speciosa*), uricuri (*Attalea phalerata*) or jaci (*Attalea butyracea*). Inajá is easily distinguished from these similar palms by its coated fruit, the long thin stalks of the fronds and the spathe, which has a long pointed tip. Inajá can reach 14 m in height and 69 cm in diameter.

In the past, many houses and farinha work sheds were covered with palm fronds from inajá. The fruit is sought out by wild and domestic animals alike, and for this reason hunters often use it as bait. Those who protect this palm are increasing the amount of food available for wildlife.

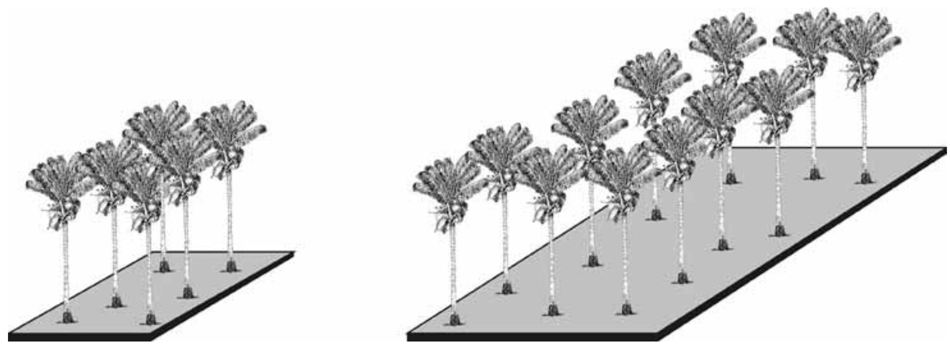
Ecology

Flower and fruit seasons

J F M A M J J A S O N D

In the eastern Amazonia, inajá flowers from October through March. The fruit mature from January through March of the following year. In the western Amazonia, inajá flowers around July and starts to bear fruit in November.

Density

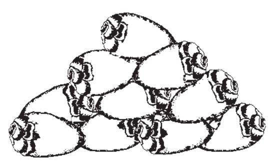


60 palms/ha **300 palms/alqueire**

In primary forests, inajá occurs in low densities and prefers areas of terra firme. Pastures in the state of Acre were found to contain between 16 and 100 palms/ha.

Production

One palm normally produces 5 or 6 bunches of fruit/year, with 800 to 1 000 fruit/bunch.



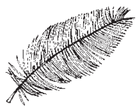
An average of 5 000 fruit/palm

Economic value

There is not a large market for inajá fruit, but it is sold at the street fairs of the city of Belém at the start of the year. In March 2004, 30 fruit could be purchased for US$0.34 at the large Ver-o-Peso market. During the height of the season, it was possible to find 20 fruit for US$0.20 at other open air markets. By 2007, 20 fruit sold for more than double what it was four years earlier costing US$0.52. In the Praça da Rupública, a central square in the city, jewellery utilizing inajá seeds is often sold, fetching high prices. In 2008, a 60 kg sack of seeds for artisans sold for US$89. In 2004, a ring sold for US$0.34, earrings cost US$1.36, bracelets sold for US$2 and necklaces cost US$5. By 2008, necklaces were selling for US$2–18.

USES

Fruit: The fruit provides food for people, livestock and wildlife. In the past, the fruit was also used as fuel in the smoking of natural rubber latex. The pulp of the mature fruit was also used to prepare a rustic soap, but this practice has subsided owing to the availability of commercial soaps.



Fronds: Inajá fronds are used as roofing for temporary houses. Depending on the size of the structure, 120–250 leaves may be needed. Leaf steams are used to make fish traps.

Palm hearts: People enjoy eating the palm hearts, and they are also fed to cattle to fatten the animals, increasing milk production.

Spathe: The bract surrounding the inajá fruit cluster is used as a container that can last up to three months. It is used to collect water and to hold rations for pigs, chickens or horses. Children also like to play with them.

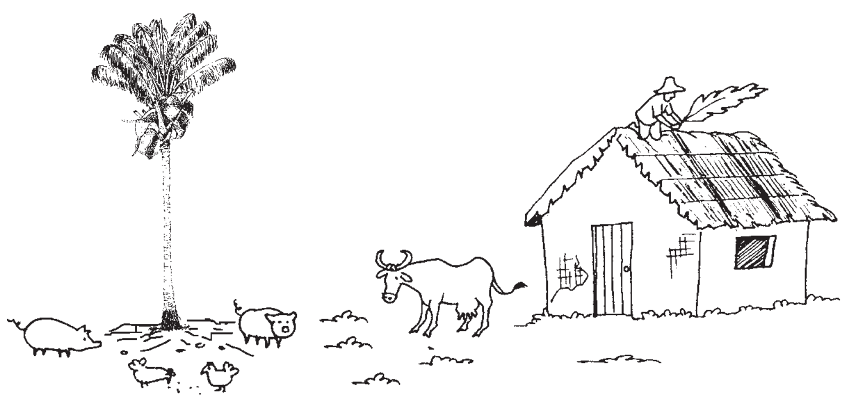
Inflorescence stalk: The inflorescence stalk is the stalk connecting the fruit or flower cluster to the tree. It can be used like a feather duster once it is cut from the tree and the fruit is shaken off.

In contrast to its use in the eastern Amazonia, inajá is rarely utilized in Acre. This palm is less accessible to rubber tappers or communities along the rivers because of its low density in the forest; it is only abundant on cattle ranches. Still, inajá palms are important for these groups as a source of food for game species in the area. The fronds are not used much by the rubber tappers because they find the leaves deteriorate too quickly.

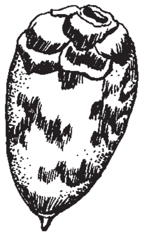
House of straw

Jurandir Galvão

As recent as the 1980s, almost all of the houses in the rural areas of Belém were covered with fronds from inajá palms. Today, the inhabitants use a mixture of roofing tiles, wooden shingles and palm fronds to build their houses. The traditional folks say that the best time to collect the fronds is during the time of the new moon or when the nights are darker. That way the leaves break down more slowly and are less susceptible to insects. However, the palm frond roofs remain vulnerable to fire, a significant disadvantage.



Nutrition



Inajá fruit can be eaten straight from the tree or cooked. Most people like to eat the raw fruit with farinha. Mature fruit have a 15% oil content. The pulp, light and sweet in flavour, is also used to prepare a mush that is given to individuals suffering from general weakness. Inajá pulp is a good source of protein and calories, thus it has become an important part of the life of the rural people of the Amazon.

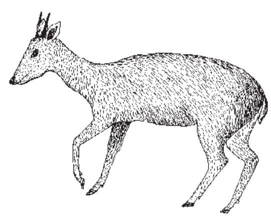
Oil extraction

Inajá fruits have an oil similar in quality and use to that of the babaçu palm. The red-orange oil's spicy taste makes it desirable for cooking. The oil can also be used to produce soaps. However, inajá oil is really only used when other types of oils are scarce.[1] Mechanical equipment can extract up to 23% of the oil from the inajá. The process involves heating bunches of fruit in steam for eight hours and then kneading the fruit to remove the pulp. The pulp is then heated to more than 90ºC and pressed to extract the oil.

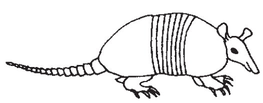
Recipe for inajá fruit drink

Peel the fruit, scrape the pulp off with a spoon, mash it up with water and add sugar to taste.

Wildlife



Inajá fruit are used as bait to attract animals. The mature fruit are spread on the ground by hunters for two or more days, after which they return to wait in a hide for the game to arrive. In Bragança, the hunter João Lima would travel 50 km to visit his parents in Capanema. During these visits, he always brought bunches of inajá fruit to spread in the forest near their house. Six days later, his friends enjoyed a good meal of game. Inajá fruit is well liked by agoutis, pacas, peccaries, deer, armadillos, coatis and monkeys and is one of the fruits most frequently consumed by tapirs. They also eat the seeds.[2] Cattle, pigs, squirrels and opossums also feast on inajá. The seeds are dispersed by rodents and other mammals. Pigs and cows swallow the fruits during the day and regurgitate the seeds at night. Rodents serve an important role because they bury the fruits for later use but often do not retrieve them. These fruit form a dormant seed bank that can later germinate.



Invisible income from game

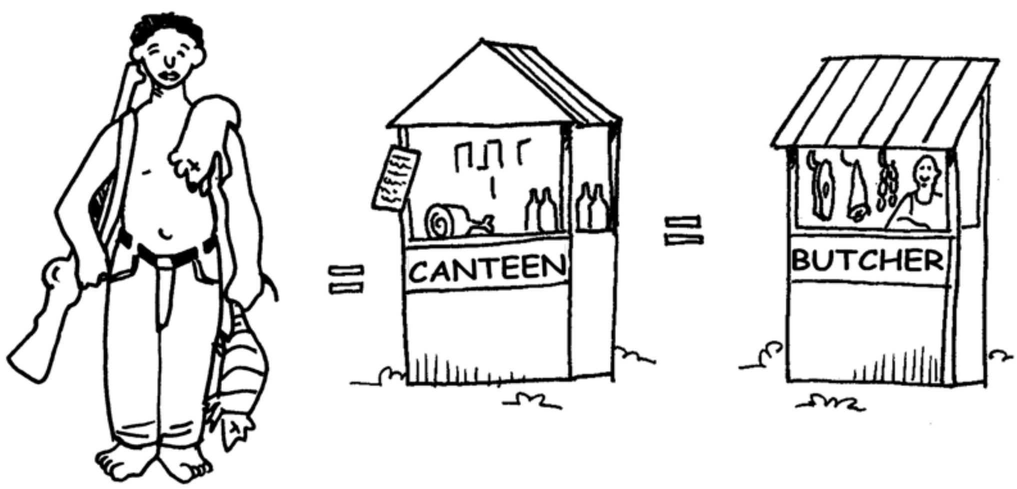
Even though it is illegal to hunt in Brazil, subsistence hunting – a necessity for many rural families – is tolerated. But commercial hunting of any type is not permitted. Even if subsistence game is not sold, it can be seen as a source of income because it frees up money that would have been used to purchase meat. A family that has game available on their land can have food in their stomach and money in their pockets.

The majority of the families living in the rural river community of Rio Capim, Pará, will buy meat at some point during the year. But families with hunters do not need to use their earnings on store-bought meat, thus saving on their food bills. Most families make their income by growing and processing the local staple, farinha. So the forest farmer can assess how much less farinha the family would need to produce if the family's diet is supplemented by game.

In 1995, an expert hunter from the region was able to catch about 35 kg/month of game. About 40% of the game weight is inedible (such as bone, skin and hair), leaving an equivalent of 21 kg of game meat. If he had purchased the same 21 kg of meat for his family at the town butcher's shop, he would have paid US$3.75/kg. Thus, it is as if he earned US$79/month from his forest. Or, if instead of meat, he had purchased dried beef, which can usually be found locally in the community canteen, it would have cost him US$115/month, or nearly US$1 400/year. This family saved the same amount of money that they could have earned from the sale of eight bags of farinha per month.

The cost of game compared to the price of meat or dried beef

Expenses/month for 21 kg of meat



US$22 game { buckshot, gunpowder, time

US$115 dried beef

US$79 beef

Of course, not all the families in the Rio Capim community have hunters and not all the hunters catch a lot of game. Thus, not everyone gains as much as this family with a skilled hunter. But based on the consumption of game in the entire community, we can calculate the amount an average family saved on food because of game, and how much the community as a whole gained from their forests.

The forest's gift of game

Group	Time period	Game (kg)	Meat from game (kg)	Beef US$3.75/kg (US$)	Dried beef US$5.50/kg (US$)	Farinha US$15/sack (no. of sacks)
Hunter's family	month	35	21	79	115	8
	year	420	252	945	1 386	92
Average family	year	94	56	210	308	20
Community	year	2 808	1 685	6 319	9 267	618

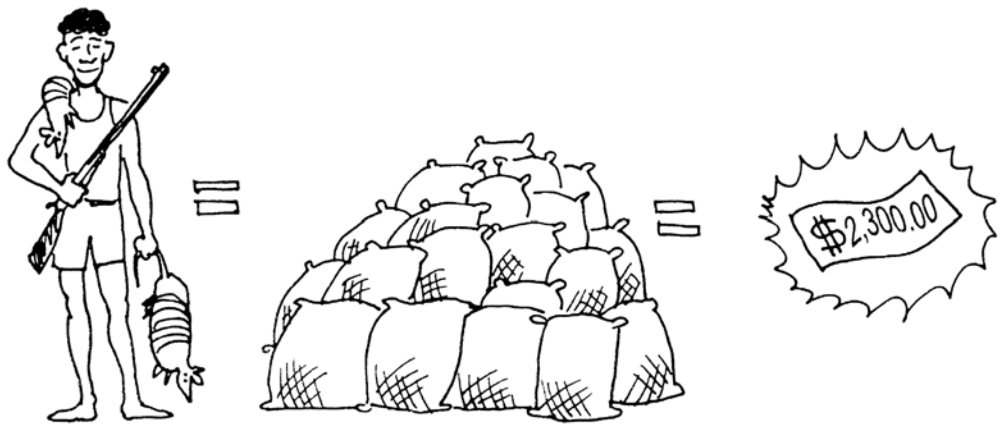
Money in your pocket and food in your stomach

In one year, 30 families living in a community along the Capim River captured a total of 2 808 kg of game. An average family caught 94 kg of game in a year and were able to consume about 56 kg of game meat. Purchasing this meat at the closest meat market would cost US$210/year, or about US$17/month. If the family could not make the trip to town and had to purchase dried beef from the community store, it would cost about US$308/year, or the equivalent of 20 bags of farinha. Due to the forest wildlife, the entire community gained the equivalent of 620 bags/year, almost 52 bags of farinha/month.

The villagers were able to save a lot of money thanks to the animals that live in their forest. And this is not a unique case. In Chino, a community in the Peruvian Amazon near a community forest reserve, 34 families captured on average 54 kg/month of game, or more than 600 kg/family/year.[3] Also, a hunter in a neighbouring community caught more than 700 kg of game in a year. At the time, this quantity was equal to about 155 bags of farinha, or US$2 300 for dried beef.

But the forest can only offer these great benefits if it is protected. Forests are the home and food source of game animals. If the forest is cut down in an unsustainable manner, it becomes poorer and cannot support as many animals. The greater the area of forest, the greater the amount of game that can live there. Many wildlife species need a large expanse of forest so they can search for food throughout the year. Some trees will only bear fruit for one to four months out of the year. With this in mind, some communities work together to protect their patches of forest, uniting them into larger community forest reserves or connecting them using forest fragments as corridors. Part of the reserves may be designated free of hunting as a refuge for animals to reproduce. They work out community agreements so that only secondary forests are cleared for agricultural plots. The more resources that are available in the primary forest, the less slashing and burning is necessary to produce farinha.

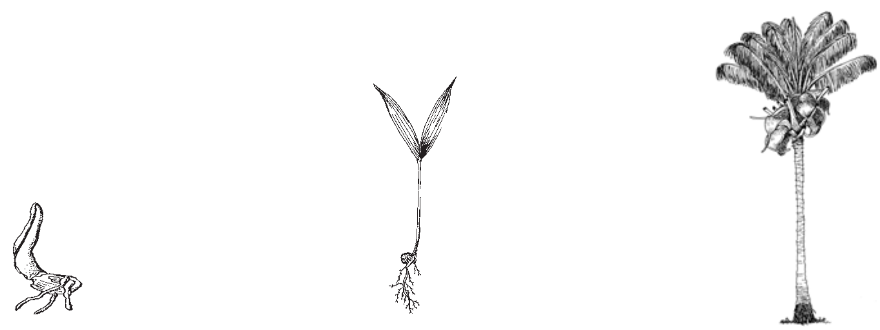
Value of game and the equivalent value of farinha



700 kg of game = 155 sacks of farinha = US$2 300

Some animal populations are sensitive to hunting and may disappear with increased pressure. Animals that reproduce slowly, such as tapirs, howler moneys and other primates, macaws and parrots, should be captured rarely if at all. Other animals that have large litters each year (armadillos, agoutis, pacas, and collared peccaries) can be hunted more regularly.

Management



germination
90–180 days

growth
slow

production
after 4 or 5 years

Inajá is a slow-growing palm that starts to fruit only after four or five years, but both animals and people assist in dispersing it. To hasten the sprouting of inajá, leave the seeds in the creek for 30 days then they can be planted out in the fields. Generally, inajá is left standing in cleared garden patches to attract game and thus tends to be abundant in areas of swidden agriculture. These palms survive swidden agriculture and then spread in the secondary forest during the fallow period. Thus inajá can be managed to supplement food for wildlife in secondary forest and degraded pastures.

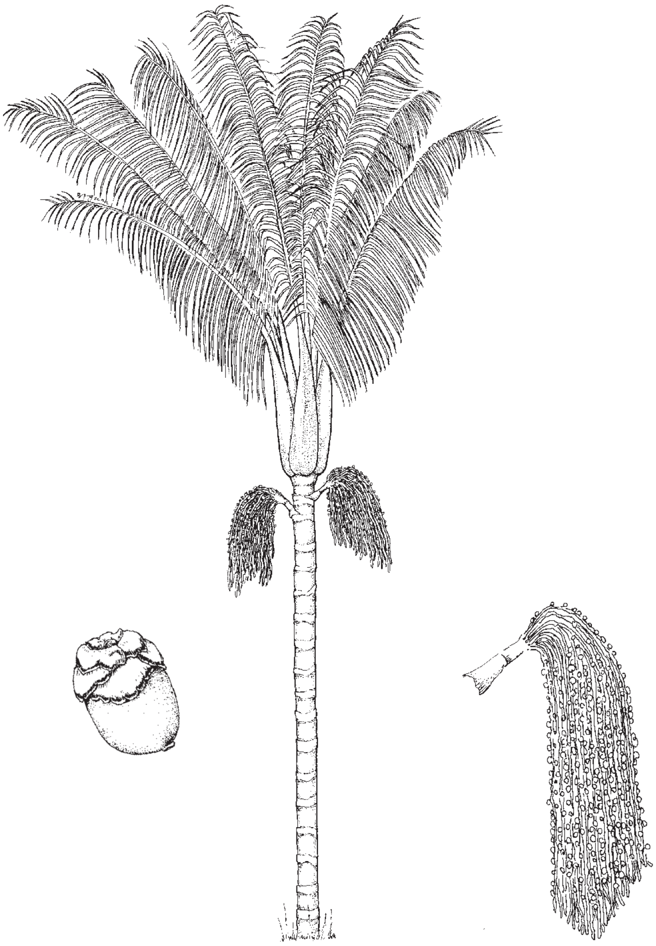
How palms survive fire

Throughout the Amazon it is possible to find various palm species mixed within pastures and in agricultural areas. Inajá, babaçu, jaci, uricuri and tucumã often form large stands and become invasive in farmlands due to the mature plants' natural resistance to fire. Their stems are very thick and hard. Their thick bark forms an effective barrier to the heat, protecting the inner part of the plant. Initially the plant grows down into the soil and the new leaves appear only after some time. Because the apical meristem, the part responsible for producing the new leaves, remains buried, it is protected from the fire. Therefore, when people burn the land, it encourages the development of these palms and eliminates other competitive plants. If fires are set annually, it stimulates seed germination, and with time the land will be covered with large quantities of palms, generally of a single species. That is how we now find the large concentrations of palms in the Amazon region. In the forest, where the fire cannot penetrate, palms occur in much lower densities and grow more slowly.

[1] Blaak, G. 1984
[2] Oglethorpe, J *et al.* 1997
[3] Bodmer, R.E. 1989

Patauá

Oenocarpus bataua Mart.



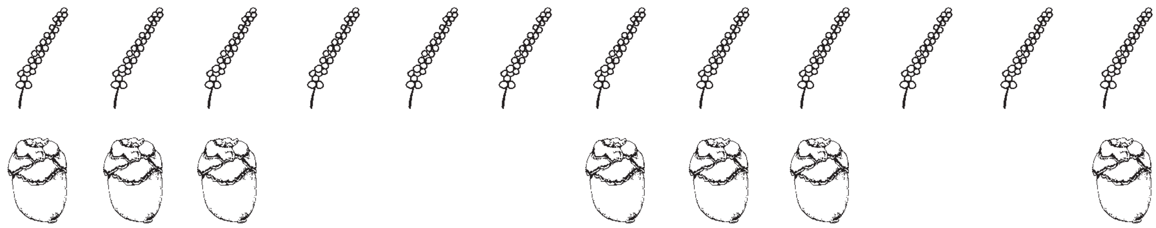
Daisy A. Pereira Gomes-Silva

The scientific name for patauá (*Oenocarpus*) means "wine fruit". *Oeno* is the Greek goddess of wine and *carpus* means fruit. *Bataua* is the common name used for patauá in a few countries. Patauá is most loved by caboclo communities, who use it to make juice and oil. The juice is consumed with game meat and farinha, and the oil is used to fry fish. Only the juice is sold in cities, but if you find the delicate and delicious patauá oil, it can be used instead of olive oil in salads and sautés, as its scent and flavour are similar.

The patauá tree is a palm that prefers humid soils. It grows for many years in the shade of the forest. As an adult, however, it needs light. Patauá palms can be found in Peru, Bolivia, Colombia, Ecuador and Venezuela. In Brazil, they grow in the states of Acre, Amazonas, Pará and Rondônia. Patauá can grow up to 25 m in height, possessing only one stem with very large leaves that can extend up to 10 m in length. The small white flowers and fruit are arranged in a horse tail and can have up to 350 racemes on which the fruit are attached.

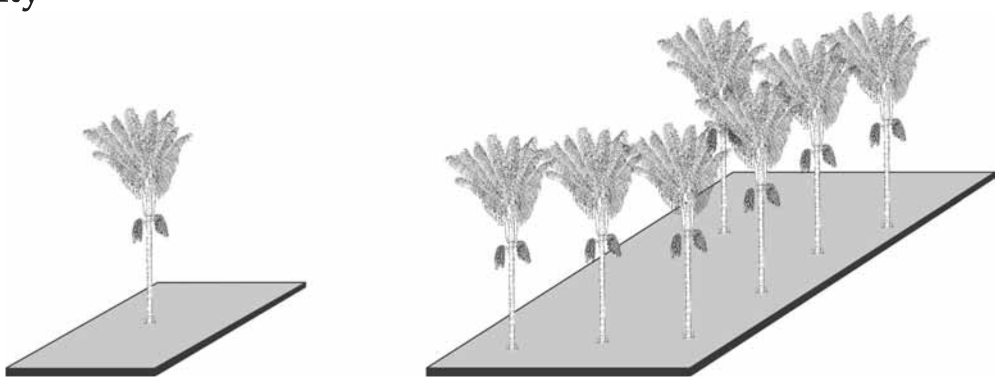
Ecology

Flower and fruit seasons



In Acre, patauá's fruit season is more intense from December through March, which are rainy months, but fruit can also appear from July to September. The fruit takes from 10 to 14 months to ripen and mature. For this reason it is not difficult to find plants with both flowers and fruit at the same time.[1]

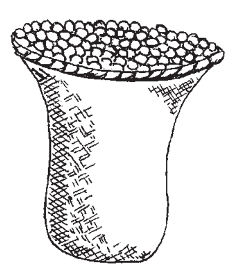
Density



The patauá occurs both in upland dry forest, swamp forests and along streams. It is found sparsely in upland dry forest, with 1–2 palms/ha,[2] but in lower elevations it can become a dominant species with up to 100 species/ha. In Acre, patauá occurs throughout the state, and in the Chico Mendes Extractive Reserve, 48 palms/ha were found in the marshier areas, while 16 palms were found in dry forest. In Pará, in the past, the patauá was overexploited and nearly disappeared in some locales. But in other areas, like the lower Tocantins, it is possible to find large patauá palms that are used both for their juice and their oil.

Production

The patauá takes from 8 to 15 years to bear fruit[3] and produces up to three bunches of fruit/year, with about 16 kg of fruit/bunch.[4] A study in Ecuador found that the production of patauá palms varied from approximately 500–7 000 fruits biennially.[5] Patauá fruit, as with the fruit of other palms, is measured in 18-litre cans. About 13 kg of fruit fit into one can. In Colombia, the collectors go on a special diet before they go in to harvest patauá, and only women who refrain from certain foods are allowed to extract the oil.



an average of 32 kg/tree/year

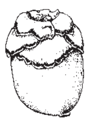
Economic value

In Rio Branco, in Acre, it is common to find patauá for sale together with açaí and buriti, both in the informal markets and in the supermarkets. A can of fruit (18 litres) costs about US$2 when purchased directly from collectors. A litre of juice is sold for about US$0.80. In Belém there is also a market for patauá. If you like, stop by the Ver-o-Peso market and pick up a litre of juice for about US$1.

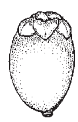
The seeds can also be used to make jewellery. In 2008, necklaces and earings made with patauá sold for US$2–6. Bracelets sold for a bit less, US$2–3. And in 2007, 500 g of the seeds sold for US$1.

These days, in Brazil, sales of patauá juice exceed those of oil. During the Second World War there was a global shortage of olive oil, and Brazil exported more than 200 tonnes of patauá oil/year.[6] Unfortunately, during this period, the palms were cut to harvest the fruit, which killed off a large percentage of them. When the war ended, the sale of patauá oil fell. In Brazil it is rarely found for commercial sale, but in Peru sales are strong. You can buy the oil in Brazil from herb sellers for about US$2 or US$2.50/litre, but it is hard to find.

Uses

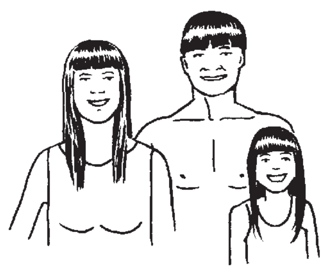


Fruit: The fruit is used to make juice and oil. The fruits are round, almost oval-shaped, and have a pulp that can be white, green or purple.

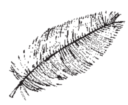


Seeds: The seeds are used to make necklaces, bracelets and earrings.

Oil: The oil is used as a laxative and as a remedy for tuberculosis, asthma and other respiratory problems. The oil also acts as a hair softener. A famous researcher who lived in a Kayapó village said that the Indians became more beautiful, sleek and healthy in the patauá fruit season.[7] Residents of the Chico Mendes Extractive Reserve say that purple patauá contains more oil.



Heart of palm: The hearts of palm are eaten raw and served in salads.



Leaves: The palm leaves are used in construction. They provide a good covering, but last only two or three years because insects attack them. The fibres are used in the manufacture of hunting implements, cords and weaving.

Trunk: The trunks are useful for making bridges and garden fences. Indians also leave the trunks to rot so that *tapurus*, a type of edible larvae, will grow.

Fruit stalks: Once the fruit has been removed from the bunch, the remaining stalks can be roasted and ground up as a salt supplement for cattle.

Nutrition

Patauá oil and olive oil contain similar fats. For this reason, patauá oil can be used as a substitute for olive oil.[3] Both these oils contain large quantities of healthy, monounsaturated fats and are increasingly sought after by consumers. For every 100 g of oil, patauá has 317 calories and 47 g of carbohydrates. Both patauá oil and juice have high concentrations of important proteins, comparable to milk and beef.[4] Patauá juice is oilier than açaí and bacaba (*Oenocarpus bacaba*), and is highly nutritious.[2]

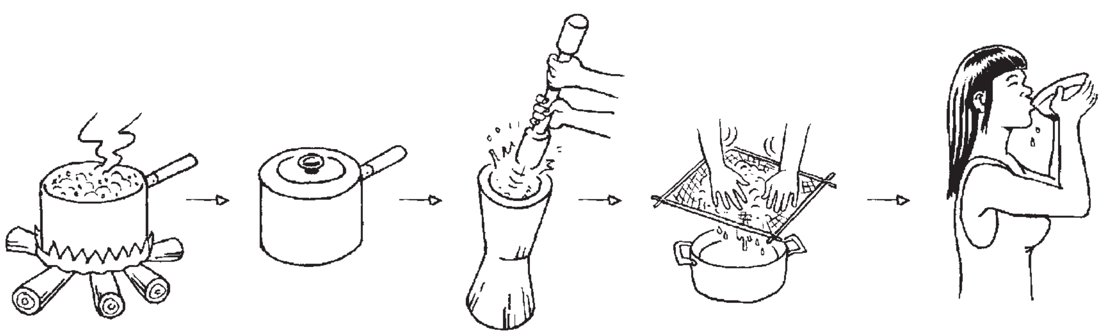
How does patauá oil compare with milk and beef?

Nutritional value	Milk (100 ml)	Beef (100 g)	Patauá oil (100 g)
Fat	3.5 g	10.8 g	12.8 g
Protein	3.1 g	27.5 g	3.3 g
Carbohydrates	5 g	0 g	47.2 g
Calories	120	235	317.2

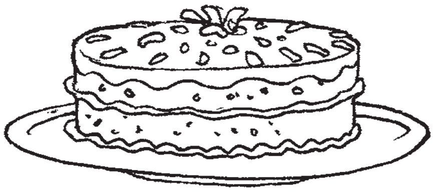
Recipes

Making juice – the slingshot test

Patauá juice looks like chocolate milk and is prepared in the same way as açai juice. First, select the mature fruits. A good way to test if the fruits are mature is to hit the basket with a slingshot; if a few fruits bounce out, it is a good basket of fruit. Soak the mature fruit in hot water over a low fire to soften. Remove the pan from the fire, cover and let stand for ten minutes. Crush the fruit with a mortar and pestle until the pulp separates from the seed. Finally, strain the fruit in a sieve to separate the remaining seeds. The juice is now ready to drink. In the city, the juice is sometimes made swiftly with an electric depulper.



Fabiana's cake

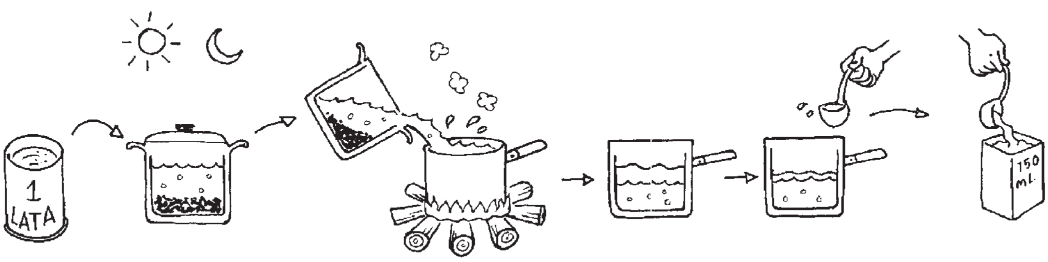


Ingredients:
- 2½ cups of flour
- 1½ cups of sugar
- 1 cup of patauá juice
- 3 egg whites, beaten stiff
- 1 teaspoon yeast

Preparation:
Mix all the ingredients well. Place the batter in a cake pan and bake in a hot oven. The patauá juice is used in place of milk and butter. The cake will look like chocolate, and is even better if you add some grated Brazil nuts.[8]

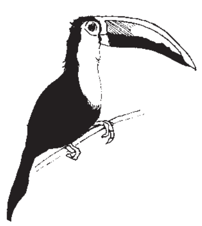
How to make oil

Everyone has his or her own recipe for extracting patauá oil. One basic recipe is to leave the juice to sour for a day so that the water will separate from the pulp. Some insist on keeping the container closed during this process, while others prefer to leave it open. The next day, the pulp is put in a pan and heated until the oil appears. It is also possible to use a *tipiti* (a strainer made of natural fibres commonly used to separate *tucupi* from manioc) to squeeze the pulp and remove the oil.[2] Using traditional methods, about one can of fruit produces approximately 150 ml of oil. But do not be too curious! Villagers from Acre say that only the person making the oil can look in the pan, otherwise the oil will not appear.



WILDLIFE

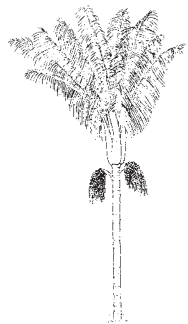
Hunters note that a lot of animals, like tapir, deer, white-lipped peccary, the Brazilian porcupine and various types of monkeys eat patauá. One study in Colombia found that the white-bellied spider monkey (*Ateles belzebuth*) relied heavily on patauá fruit.[9] Large birds, such as white-throated toucans, aracaris, macaws, guans, curassow and larger parrots, most appreciate this fruit. Other animals, such as Brazilian porcupines and monkeys, eat the fruit but not the seed, dispersing the seeds intact throughout the forest where they have the potential to germinate. But there are also seed predators, like peccaries, who crush the seeds when eating the fruit and in doing so eliminate their reproductive potential. People also help to disperse patauá seeds; after making juice, they often scatter the seeds onto the ground.[10]



Management

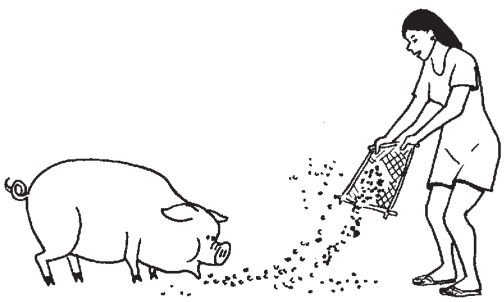
germination
14–52 days

growth
14–72 cm/year



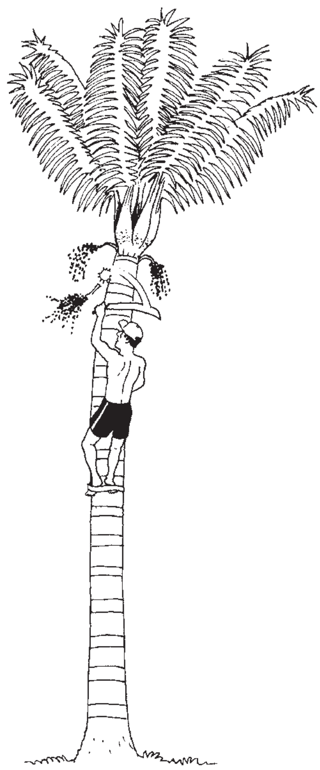
production
5–15 years

In the forest, the patauá palm grows slowly for the first few years. It can take more than five years for the first fruits to appear. Farmers say that you are guaranteed to get fruit within five years if patauá is planted out in the yard in full sun. The patauá palm can produce fruit two years after stem formation.[3] To collect the fruit, you need a climbing strap to secure yourself around the trunk of the palm while you shimmy up.



To manage patauá, it is important to leave some of the fruit behind for wildlife. As a general rule, it is best not to remove more than two bunches/ palm. Because it is a slow-growing species, avoid cutting the leaves of the young palms.

After making juice or oil, spread the seeds near your house or anywhere you might like to start a plantation. Some river folk believe that to get the best oil, the leaves of the palm should be closed when you collect the fruit.



1 Pedersen, H.B. & Balslev, H. 1993
2 Balik, M.J. 1986 and 1988a
3 Gomes-Silva, D.A.P. 2001
4 Clay, J.W.C.; Sampaio, P.B. & Clement, C.R. 2000
5 Miller, C. 2002
6 Pereira, P.G. 1951
7 Balik, M.J. 1988a
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Pupunha, peach palm

Bactris gasipaes Kunth

Margaret Cymerys
Charles R. Clement

The pupunha palm was one of the first plants domesticated by Native Amazonians in pre-Columbian times,[1] probably in southwestern Amazonia. It is believed that pupunha was domesticated primarily for its durable, striped wood, which is still valued for handicrafts, and only later for its fruit. The original fruit was oily, but with advancing domestication acquired more starch. Over time, the spiny palm, with its brightly coloured nutritious fruit, spread throughout the lowland humid tropics of South America and southern Central America, gaining new names along the way. It is called pupunha in Brazil, *pijuayo* in Peru, *chontaruru* in Ecuador, *chontaduro* in Colombia, *gachipaes* in Venezuela, *pejibaye* in Costa Rica, and peach palm in English. The tender leaves above the growing point of the stem are also extracted to supply the national and international demand for palm hearts.

The pupunha palm reaches 20 m in height. The plant grows in multi-stemmed clusters containing up to 15 spiny stems, each attaining approximately 10 to 25 cm in diameter and crowned with 15 to 20 pinnate leaves. The shiny-skinned fruit comes in a multitude of vibrant colours: red, yellow, orange, white and even striped. The size of the fruit varies greatly, weighing from 10 to 200 g, with the smaller fruit containing more oil and the larger fruit more starch. Seedless types also exist.

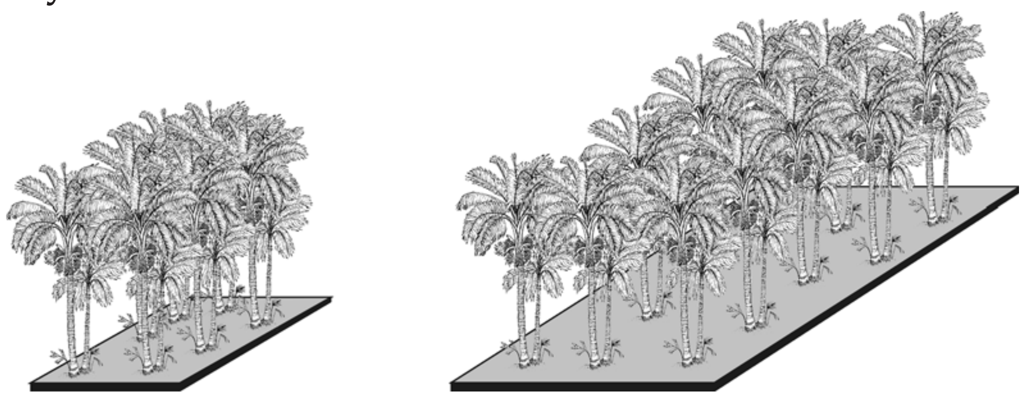
Ecology

Flower and fruiting seasons

J F M A M J J A S O N D

In Central Amazonia, pupunha generally flowers from August through October, and produces fruit from December through March, occasionally until April. In other regions, the flowering and fruiting season varies according to local climate. Some trees produce fruit between the main seasons, especially in nutrient-rich soils or in years with heavy rainfall. During the flowering season, pupunha's small cream-coloured flowers are visited and pollinated by thousands of weevils, a kind of very small beetle.

Density



100 palms/ha 500 palms/alquiere

The high density of pupunha in agricultural systems directly reflects the demands of people for the palm and their use and management of it. Typically, a few plants are interspersed with other fruit trees in agricultural fields or in home gardens. Commercial plantations for fruit generally have 400 palms/ha, requiring fertilizer and intensive management. Commercial plantations for palm heart generally have between 5 000 and 10 000 palms/ha and require even larger inputs of fertilizer and more intensive management. In addition, operators must have significant business experience to ensure that the plantations run smoothly.[2]

Production

The pupunha palm produces between 5 and 10 bunches of fruit per year. However, some palms growing in rich soil may produce up to 25 bunches in a year of heavy rain. Each bunch weighs between 2 and 12 kg and contains between 100 and 400 fruits/bunch. A single pupunha palm can produce from 10 to 120 kg of fruit. The harvest from 1 ha can vary between 4 and 10 tonnes/year. Low production can be caused by insufficient pollination, lack of rain, lack of fertilizer, compacted soil, or a combination of these conditions.

500 to 1 000 fruit/palm

A plantation of 5 000 palms/ha for palm heart production can produce 1.2 tonnes of export quality palm heart/year. In addition to palm heart, the pupunha produces from 2 to 3 tonnes of tender stem, which is the part just below the palm heart.

Economic value

Pupunha fruit is enjoyed not only by Native Amazonians but also by rural and urban people throughout its region. Bunches of colourful pupunha fruit are sold in open-air markets, at roadside stands and in supermarkets. Cooked pupunha is sold as a nutritious snack in cafés, on street corners and along local beaches. In the Belém market in 2008, 1 kg of pupunha sold for US$1.20–2.40. Prices have remained stable since 2004. Prices in Manaus are somewhat lower, and pupunha is sold by the bunch, not the kilogram. A bunch costs between US$2.40 and US$12, depending upon the size. Production is often higher than demand. In the state of Amazonas, the pupunha harvest in 1999 was double the market sales, representing a large excess, which though unsold was often used as feed for pigs, chickens, ducks and fish. Pupunha commands a much higher price in Colombia, perhaps because in Colombia it is reputed to have aphrodisiacal properties.[3]

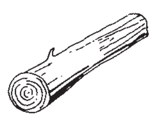
The demand for palm heart is very strong in southeastern Brazil, the national and world centre of consumption. Processing plants send teams to harvest palm heart in the farmer's field and pay as much as US$3.50/stem. In Amazonia, however, demand is much lower, and the price for a stem varies between US$0.30 and US$0.60 at the farm gate.

USES

Fruit: Cook with salt for 30 minutes in a pressure cooker or 60 minutes in a pot. The cooked fruit is also made into a jam for sale. Pupunha pulp can also be ground into a flour and used to make bread, cake, or as domestic animal feed.

Palm heart: Pupunha is cultivated for palm hearts in southeastern Brazil, especially in Bahia, Espirito Santo, Rio de Janeiro, Minas Gerais, Mato Grosso do Sul, São Paulo, and Paraná, as well as in Costa Rica and Ecuador.

Oil: The oil is used to beautify hair. In Oeiras-do-Pará, the oil is used as a cure for earaches and sore throats.



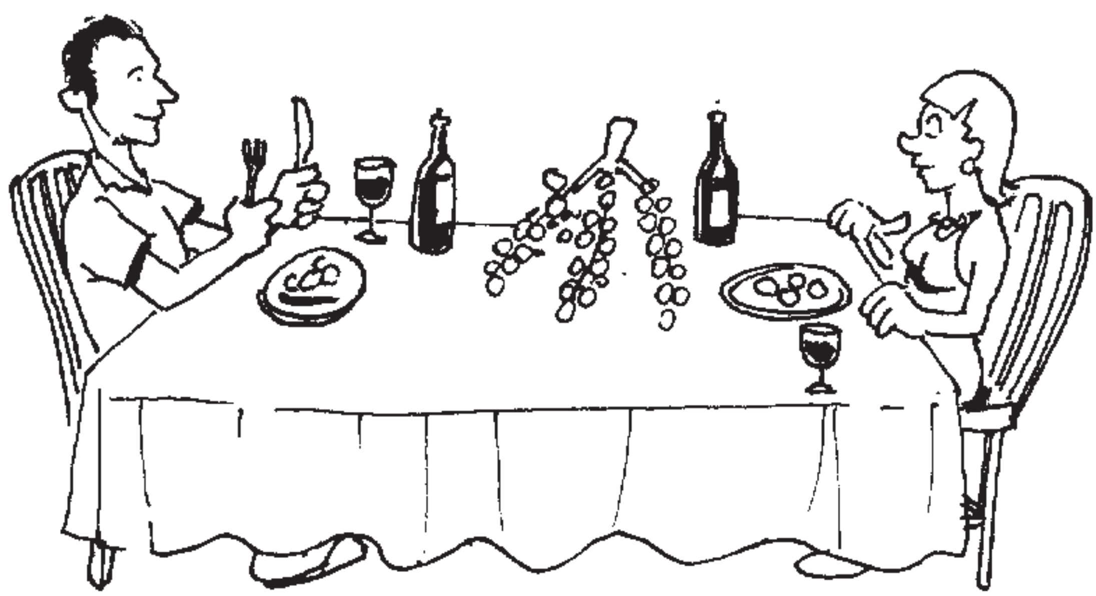
Wood: The wood is black, with yellow streaks, and attractive when it is well worked, and is used for furniture and handicrafts.

Pupunha palm heart

The advantage to using pupunha for palm heart production in relation to other palms in the same genera is that pupunha forms high quality palm hearts quickly and is a multi-stemmed palm, which allows the palm hearts to be harvested without killing the palm. The initial palm is cut after 12–18 months in the field, and new stems that can be harvested for palm hearts are produced 6–9 months later.

Nutrition

The large pupunha fruit consists of 90–95% pulp and 5–10% seed. The colour of the pulp varies from creamy to orange, depending upon the amount of beta-carotene, the main ingredient of vitamin A. The pulp varies in texture depending upon the amount of water, starch and oil. The fresh pulp has between 1% and 9% protein, 2% and 30% oil and 10% to 40% carbohydrates, principally starch. The nutritional value varies among the different fruit types; for example, the redder the pulp, the more carotene it possesses, contributing to good eyesight as well as healthy hair, skin and nails. Pupunha also contains the mineral elements potassium, selenium and chromium, respectively corresponding to 12%, 9% and 9% of daily recommended allowances.[4]



Recipes

Pupunha purée[5]

Ingredients:
– 500 g cooked pupunha
– salt to taste
– butter or oil to fry the onions
– 250 ml milk
– 1 medium onion
– 1 tomato
– 1 bunch of cilantro

Preparation:
Cook the pupunha in water with salt for 30–60 minutes, remove the skin and mash the pulp with a fork. Fry the chopped onion in butter and add the tomato, cilantro and salt. Mix together. Finally, add the pupunha and the milk, and let them simmer until they form a puree.

Fried pupunha

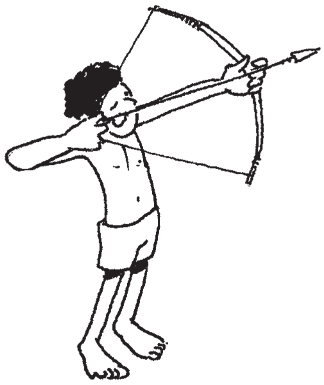
Pupunha can also be prepared like French fries. Cut the boiled fruit into thin slices, fry the slices in hot oil, and eat them with salt.

Pupunha cake

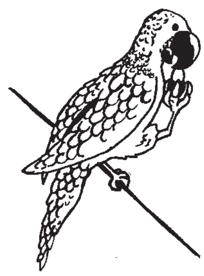
Ingredients:
– 2 cups cooked mashed pupunha
– 2 cups coconut milk or cow's milk
– 5 eggs
– 1 tablespoon butter or margarine
– 2 cups sugar
– wheat flour as needed
– pinch of salt

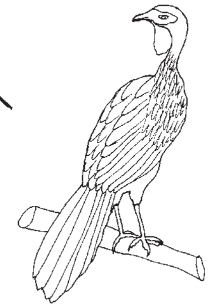
Preparation:
Beat the pupunha and milk in a blender for five minutes. Place butter, sugar and egg yolks in a bowl and beat them well. Beat the egg whites in a separate bowl. Next, mix all the ingredients together with the beaten egg whites and add the wheat flour until the dough becomes stiff. Place the dough in a buttered cake mould and bake for 30 minutes or until the cake becomes golden brown and a toothpick comes out dry.

Wildlife



Many wild animals enjoy pupunha fruit. Deer, agoutis and large birds, such as guans, eat the fruit when it falls from the palm. By attracting game, the pupunha tree helps to sustain the people who live nearby. Because various parrot species love to feast on the fruit, the trees also help to maintain these often endangered birds.

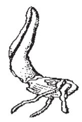




Pupunha festivals

The Native Amazonian tribes of the upper Solimões and Negro rivers, in the Brazilian state of Amazonas and nearby Peru and Colombia, have celebrations during the pupunha harvest. The festival is replete with foods made with pupunha flour and boiled pupunha fruit. A special drink, called *caissuma* in Brazil and *masato* in Peru, is made from fermented pupunha fruit. It has the scent of fresh ripe peaches and the alcoholic content of beer. When sniffing freshly brewed *caissuma*, the naturalist and explorer Alexander Von Humboldt detected a familiar aroma and identified it as peach. Thus the European names for pupunha all mean ‘peach palm’: *palmeira de pêssego* (Portugal), *palmera de melacotón* (Spain) and peach palm (England).

Management



germination
30 days to 2 years

growth
1 m/year

production
7 years

The pupunha palm is native to the humid tropics, where it grows in a variety of soils in various climates. It grows best in rich volcanic soils along the Andes and in Central America, as well as in soils created by Native Amazonians, called Amazonian dark earth *(terra preta)*, but can also produce well on the poorer clay soils typical of Amazonia in the first years after clearing and burning. In southeastern Amazonia, pupunha produces fruit with only 1 700 mm of rainfall, but more abundant harvests occur in northwestern Amazonia, where over 3 000 mm of rain is common. Extreme droughts, such as those occurring during El Niño events, can eliminate fruit production.

Planting pupunha

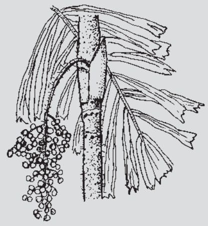
To plant pupunha, first wash the seeds to eliminate any pulp residue. Next, place the seeds in a shady, well-ventilated place to dry for 24 hours. Plant the seeds inside plastic bags or in beds with sandy organic soil. When planted this way, germination takes place in 1–3 months, in contrast to the couple of years it can take in the wild. The seedlings are ready to be transplanted to nursery bags when the first leaf opens. The nursery bags should have 1–3 kg of organic, rich clay-sand soil. After 6–9 months, the seedlings are ready for planting in the ground. They should be planted at the beginning of the rainy season. Pupunha generally begins to produce fruit after the third year and produces regularly after 6 years.

Pupunha palms grow in multi-stemmed clusters. Considering that pupunha's stems re-grow rapidly, its management consists of removing old or excessive stems and those that are too high for collecting fruit easily. Thus, while renewing the vigour of the palm cluster, farmers can take advantage of the palm heart for food by pruning off young offshoots. Likewise, they can use the trunks of the palm for wood when they remove older tall stems. This management technique, known as thinning, encourages the production of more vigorous and productive plants by catalysing the growth of new stems. For best results, only the four best young stems should be left to grow during annual management.

Native Amazonians often plant pupunha in manioc fields. After the manioc is collected, the pupunha is left to attract game, as well as to offer a source of food for the family. Agroforestry systems such as this illustrate the success in planting pupunha in association with other products, such as pineapple, passion fruit or herbs.

Wild pupunha (chica-chica)

Douglas C. Daly

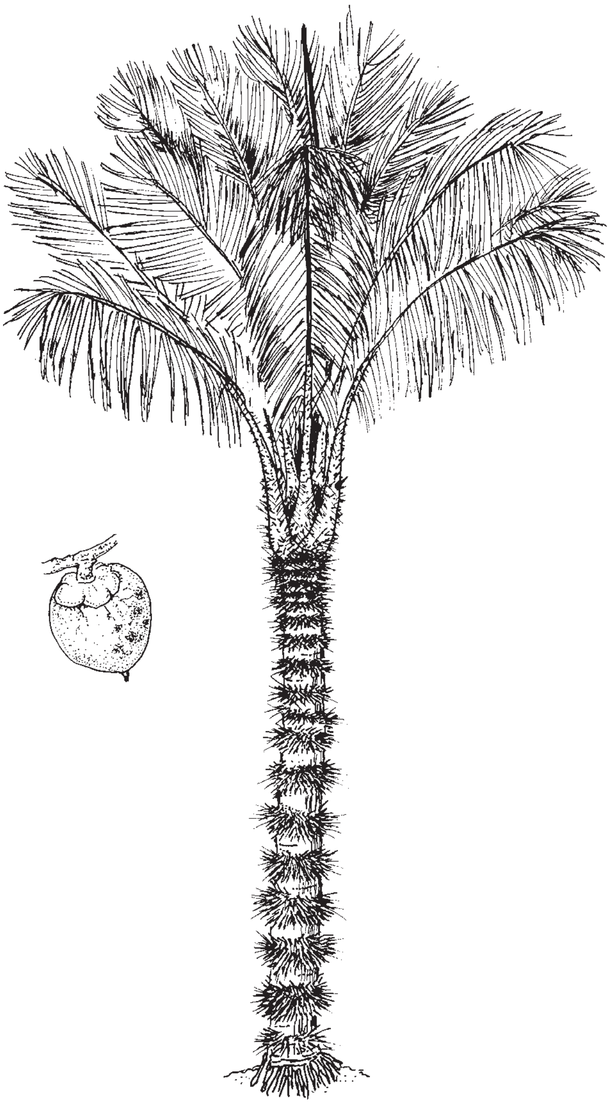


Wild pupunha (*Aiphanes aculeata*) also seems to have economic potential, as its pulp is sweeter than pupunha. In addition, its seed is also edible. The fruits of the wild pupunha are sold in Colombia, both for the seeds and for the pulp, which is used to make sweets. Wild pupunha grows 3–10 m in height. Its fruits are red, orange or white, with orange pulp, suggesting the presence of carotene. The species occurs in upland dry forests and other open forest types. The native distribution accompanies the Cordillera de la Costa, in Venezuela, and the eastern foothills of the Andes, from Colombia to Bolivia, including Acre in Brazil.

[1] Mora Urpí, J.; Weber, J.C. & Clement, C.R. 1997
[2] Mora Urpí, J. & Gainza Echeverria, J. (Eds.) 1999
[3] Clement, C.R. 2008
[4] Yuyama, L.K.O. *et al.* 2003
[5] Kerr, L.S. *et al.* 1997

Tucumã of Amazonas

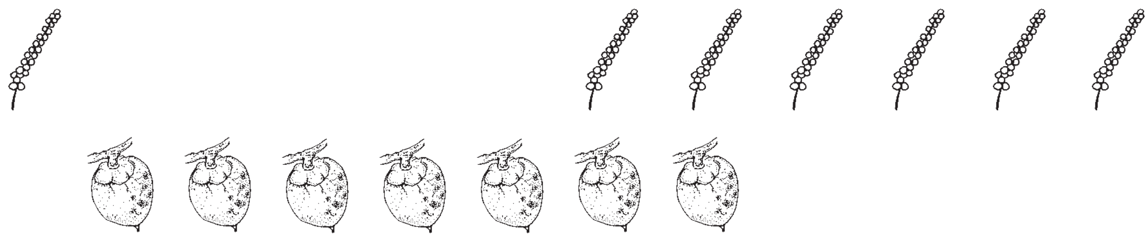
Astrocaryum aculeatum G. Mey



Joanne Régis da Costa
Johannes van Leeuwen
Jarbas Anute Costa

Tucumã of Amazonas is among the larger palms, reaching up to 25 m. It is covered with long, nasty spines to discourage visitors who would climb its trunk to reach the large, meaty and nutritious fruits loved by people and animals alike. Tucumã of Amazonas grows easily in the poor soils of the terra firme where it can produce, without fertilizer, for years. Its high tolerance to fire and its abundant seed production make it a common sight in disturbed areas like agricultural fields, pasture and secondary forest. Tucumã of Amazonas occurs primarily in the Brazilian states of Amazonas, Acre, Rondônia and Roraima, but also in a few parts of Pará, Brazil, in Peru and in Colombia. This palm is also known as *Astrocaryum tucuma*.

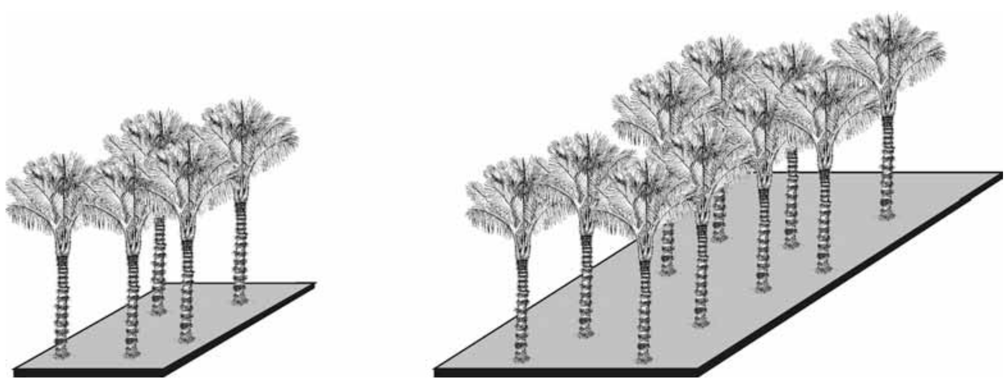
Ecology



Flower and fruit seasons

J	F	M	A	M	J	J	A	S	O	N	D

Near Manaus, tucumã of Amazonas usually flowers from June to January, and produces fruit from February to August.[1] There are palms that produce out of season, however, and in Manaus, there are tucumã of Amazonas fruits for sale all year long.

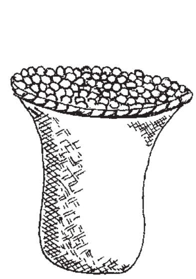


10 reproductive palms/ha in the forest **50 reproductive palms/alqueire in the forest**

Density

In primary forest there may be up to 10 adults/ha.[2] In secondary forest and pastures, where the original forest may have had only a few scattered palms, agouti and fire help in the formation of new groups of tucumã of Amazonas palms. Farmers sometimes plant large groves exclusively of tucumã of Amazonas, numbering in the hundreds per hectare. Generally, the density of this species is twice as high in secondary forest than in terra firme.[2] A study in the area of Manaus found an average of 30 palms/ha in disturbed areas, with the highest densities (43/ha) in secondary forests.[3]

Production



an average of 720 fruits/palm (12 kg)

One palm produces on average 3–4 bunches of fruit/year, though some palms produce only two bunches while others produce up to seven. The size of the bunch varies; an average bunch contains about 240 fruits, but there are bunches that contain from 35 to 700.[1] The weight of a single fruit also varies greatly, from 20 to 100 g.[4] In a two-year study on a population of tucumãs in Manaus, the average productivity per palm was 12 kg/year.[3] Ten percent of the most productive palms produced over 28 kg/year. An exceptionally good tree can produce up to 50 kg/year.[5] And although, in the Manaus study, tucumã had a greater density in the secondary forest, the percentage of productive palms was highest in pastures (93%) and home gardens (88%) versus fallow plots (66%) and secondary forest (50%). Fructification begins late, when the plant is close to seven years old and is between 6 and 9 m tall.

Tucumã inventory: indigenous knowledge complements scientific

Researchers working jointly with an indigenous tribe wanted to help them calculate how many productive tucumã palms were in their area. They used a mapping method with an excessively complicated name: "Post-exploratory systematized forest inventory with multiple beginnings". The researchers discovered that in an area where there should have been about 400 tucumã palms, their survey only located 16! While they asked themselves where the others were, a hard rain began to fall. As they stood around looking at each other and getting drenched, they decided that their method with the complicated name was worthless. One of them decided to inquire of the Indians: "Do you know where the tucumãs are?" The Indians swiftly proceeded to identify and map every tucumã palm in the project area.

The researchers planned to study how much each palm produced per year and multiply this amount by the number of tucumã palms in the area. The indigenous artisans would use this information to calculate how much material they would have to work with for the year and how much they could earn selling it at the market.

Scientists complicate, Indians elucidate!

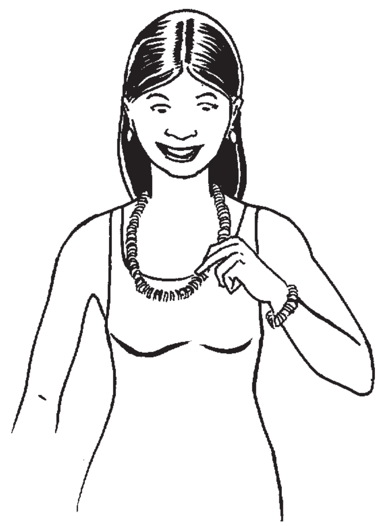
Economic value

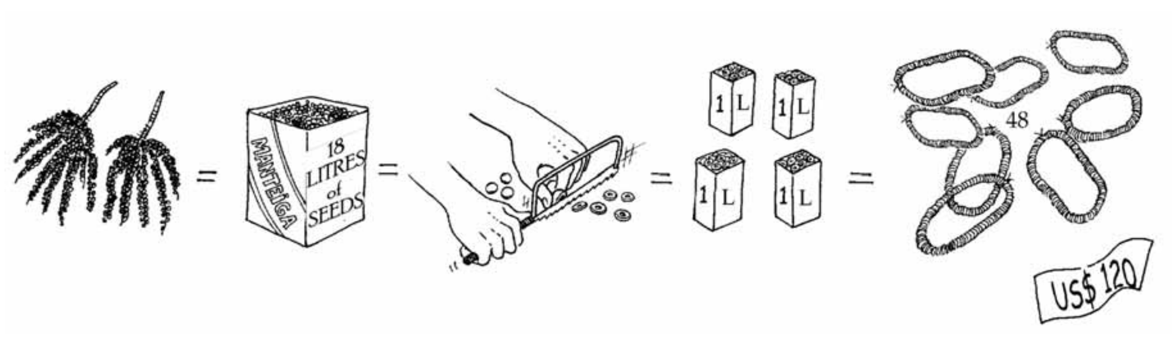
Tucumã of Amazonas has always sold well in Manaus, but since local cafés started serving sandwiches with tucumã instead of cheese, it has become even more popular. During the fruit season of 2003, the fruit sold in the street markets of Manaus for about US$0.70/dozen, US$1.30–3.30/100, and from US$4–26/50- to 60-kg sack. Out of season, 100 fruits are never sold for less than US$2.60, or a sack for less than US$13 and up to US$33. One kilogram of pulp sells for about US$7 all year round. A complete regional breakfast, including a tucumã sandwich, costs from US$1.50 to US$3. In the lower Tocantins region, in Oeiras, Pará, where it is known as *jabarana*, people adore tucumã of Amazonas and use it in place of dried meat in some traditional dishes. You will see people lining up to buy *jabarana* in these parts, and many families support themselves exclusively on the sale of this delicious fruit.

Vendors in Manaus distinguish three qualities of tucumã of Amazonas: bad, good and excellent. A sack of good tucumã sells for up to five times the value of a bad sack. Tucumã of Amazonas is widely sold in the cities of Porto Velho (Rondônia) and Rio Branco (Acre), where you can buy a little basket of 12 fruits for US$0.30.

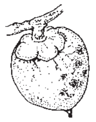
Crafts of the Apurinã

In Acre, the Apurinã Indians make beautiful necklaces of tucumã. To make 48 necklaces, they use about two bunches of fruit, or one can (18 litres) of seeds, which, after they are cut, make 4 litres of beads. In 2005, each necklace fetched from US$2 to US$3. Each tucumã season the Apurinã are careful to collect only enough seeds to produce their crafts and in so doing assure their families' income and the conservation of the forest.

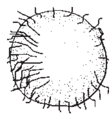




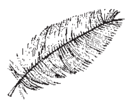
Uses



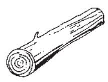
Fruit: The fruit pulp is famously eaten in the tucumã sandwich and also as a filling for tapioca pancakes.



Seed: The seeds are used to feed domestic animals, smoke rubber and make necklaces and bracelets. The Apurinã Indians say that the black skin of the fruit contains energetic properties and wards off evil spirits. The seed cannot be used to make rings as its diameter is too large; however, another species found in Amazonas and Acre called tucumã-i (*Astrocaryum acaule*) is smaller and perfect for ring making.



Leaves: Tucumã leaves are woven into mats.



Trunk: The trunk is very sturdy and ideal for rural construction.

Differences between tucumã of Amazonas and tucumã of Pará

	 **Tucumã of Amazonas (*A. aculeatum*)**	 **Tucumã of Pará (*A. vulgare*)**
Number of stems	1	2–20
Stem diameter	15–33 cm	15–20 cm
Colour of bark and fruit	green, yellow	orange
Length of fruit	4.5–6 cm	3.5–4.5 cm
Diameter of fruit	3.5–4.5 cm	2.5–3.5 cm
Colour of pulp	orange or yellow	orange
Consistency of pulp	compact, firm	pasty and oily, a bit fibrous

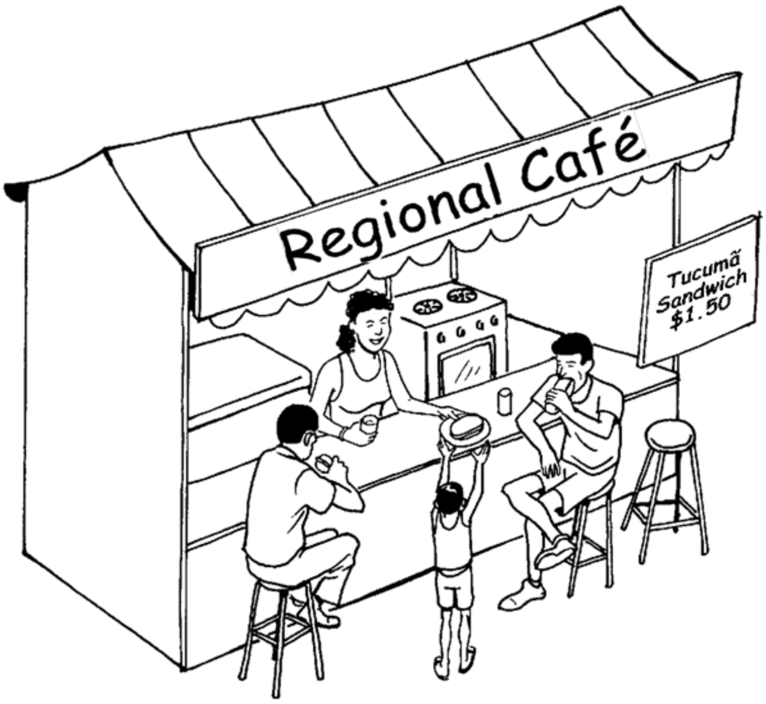
Nutrition

Tucumã pulp is loaded with calories, protein and vitamin A. Fresh pulp contains 3.5 mg of carotene/100 g.[4] Vitamin A is created in the process of digesting carotene, which strengthens the eyes to help you spot tucumã fruits way up near the top of the palm. The pulp represents 22% of the fruit's weight[6]; it is 9% protein and 55% oil.[4]

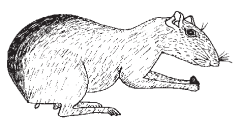
Tucumã sandwiches: the rage in Manaus

The first regional café opened in Manaus in the 1980s. It served a special weekend brunch with traditional Amazonian foods like manioc, corn, sweet potato, cará (a yam), pupunha, banana, Brazil nuts, eggs, fruit, sandwiches and a variety of juices. More and more regional cafes started to pop up and today you can find a fair number, both in Manaus and in other cities, some of which are quite chic and expensive. These cafes are always trying new recipes, one of which is the tucumã sandwich in which tucumã replaces cheese. Customers also enjoy the tucumã tapioca pancake, which is made from tapioca gum and filled with tasty tucumã pulp. Tucumã sandwiches represent from 60% to 80% of all the sandwiches sold in regional breakfasts, while between 16% and 30% of all tapioca pancakes sold are filled with tucumã. This trend spiked sales of tucumã pulp, as many wanted to enjoy the sandwiches and tapioca pancakes at home.

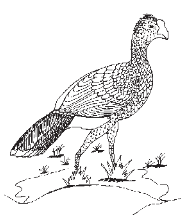
For a long time, only older, experienced people would buy tucumã in the market. How to tell which fruits were ripe was considered something of a family secret, handed down from parents to their children. Tucumã was never considered to be good for a quick snack, and most visitors from out of town never tried it. But the recent fad of tucumã sandwiches has changed that, and now you can see all kinds of people snacking on tucumã everywhere you go, addicted to its rich, savoury flavour. Who knows if tucumã's newfound celebrity status will last, but for the older folks from the region, tucumã eaten straight off the seed will always be a favourite.



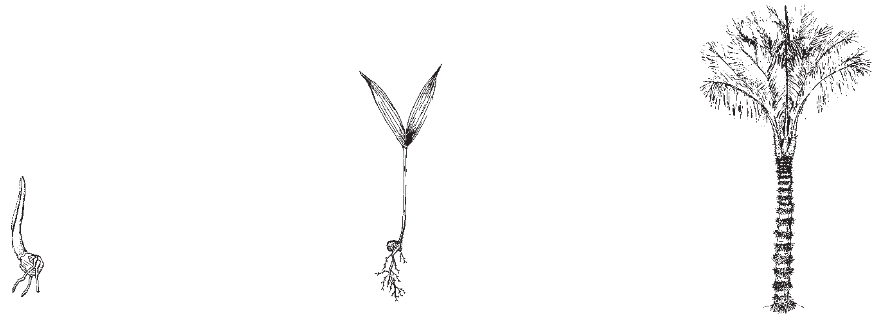
Wildlife



Many wild animals, like macaws, parrots, curassows, deer, peccaries, agouti, paca, armadillos and monkeys, eat tucumã. Agouti are the principal dispersers of tucumã seeds. Like squirrels, they bury the seeds for later and some of these seeds end up germinating. Other animals also like to eat tucumã seeds. If you want to help animals survive lean times between fruit seasons, save your tucumã seeds and break them open for the forest animals when there are few fruits available.



Management



Farmers mainly tend tucumã palms that grow naturally without being planted. When they burn a piece of land to prepare agricultural fields, the heat helps tucumã seeds to germinate. There are people who plant tucumã as well. It is simple – just follow the agouti's example: open a little hole in the earth with a knife and drop the seed inside, then cover it up. Germination takes up to two years. In the beginning, the plant grows slowly and tolerates shade well. Choose the largest and most delicious fruits to plant from palms bearing substantial quantities of fruit.

How to encourage your plant to sprout

Sidney Ferreira

You don't have to wait around for years while your seed decides when it wants to grow. When the fruits are ripe, or even a bit overripe, remove the pulp, wash the pits and dry them in the shade for a week or two. Shake the pits to see if the seeds are loose inside them, then break the pits open and remove the seeds. Soak the seeds for 3–5 days, taking care to change the water each day to prevent them from rotting. Finally, plant the seeds in a raised flowerbed; within 30 days they will begin to germinate. When the sprouts have 4–5 leaves, they can be transplanted to a permanent location.

Tucumã management plan

Götz Schroth, Maria do Socorro Mota,
Ricardo Lopes, Aurélio Freitas

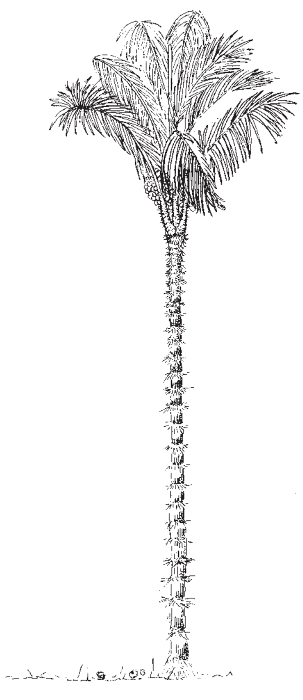
Eighty kilometres from Manaus, on the Pindorama ranch along the Preto da Eva River, a group of researchers managed and monitored 272 tucumã palms over a two-year period. The objective of the study was to increase the production of high-quality fruits to expand their markets. The management of spontaneous populations of palms that grow freely in pastures and secondary forest (in situ domestication) does not require financial investments and helps to improve the native population. The management plan called for the following steps:

1) Check the palm population for mature bunches every 10–14 days.

2) Clear away vegetation from around the base of the fruiting palms to facilitate fruit collection and monitoring. This will also reduce the density of palms. There should be at least 2 m between individual palm trees.

3) Monitor the productivity and quality of the fruits; identify individuals that combine high quantity and quality.

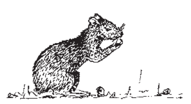
4) Eliminate palms that produce fruits of inferior quality (bitter or without flavour) but maintain unique individuals that can be marketed for other ends. For example, keep some of the trees that produce smaller fruits useful for making crafts.



5) Collect all of the bunches, including the small ones, so as not to promote the regeneration of unsuitable individuals. Take care to eliminate excessively high palms whose fruits are difficult to collect, with the exception of the ones which produce lots of tasty fruits.

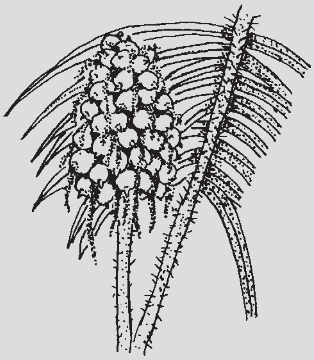
6) Use a rotating system of fruit collection, excluding a part of the collection area each year in order to facilitate the natural regeneration of the palms and preserve the fauna that feeds on the fruits (agoutis, pacas and others).

7) Eliminate individuals of the species tucumã-i (*Astrocaryum acaule*) that form hybrids with tucumã.



Murumuru: cousin to tucumã

Douglas C. Daly

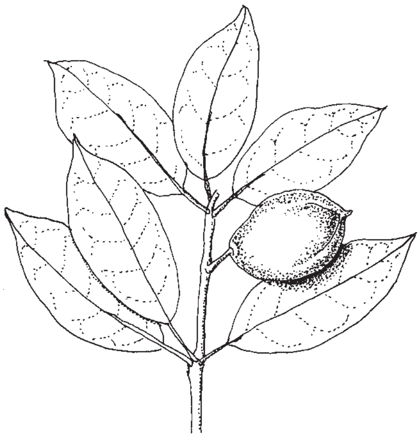


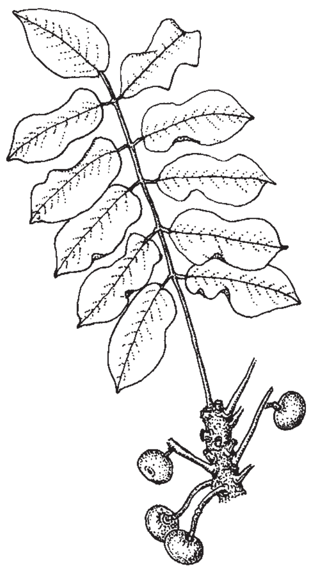
The murumuru (*Astrocaryum murumuru* Wallace) is another palm of the same genus as tucumã. It is native to almost all of Amazonia. The pulp of the fruit is delicious and contains an oil with marvellous hydrating properties. Murumuru oil is being sold in Acre. One entrepreneur with a small factory in Cruzeiro do Sul is buying the fruits from Indians and producing soaps and other products in addition to selling the pure oil to cosmetic companies.

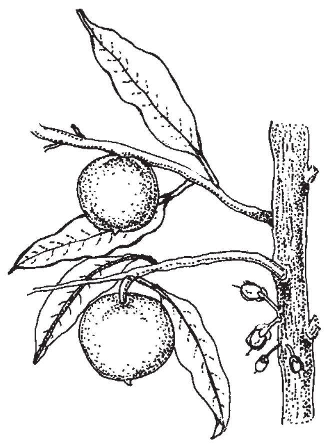
There is a single-stemmed and multi-stemmed murumuru, ranging between 1.5 and 15 m in height. The fruits are yellow with brown fur or with short black spines. The pulp is meaty and slightly fibrous, covering a hard pit which protects the oily seeds. The murumuru is an understorey palm from the terra firme, but likes to be near flooded areas like riversides, lakes and streams. In the forest of Alto Purús, a spineless murumuru can be found, a characteristic which would be valuable in domestication.

[1] Kahn, F. & Moussa, F. 1999
[2] Costa, J.A.; Duarte, A.P. and the Indigenous Community of Apurinã 2002
[3] Schroth, G. *et al.* 2004
[4] FAO 1987
[5] Milliken, W. *et al.* 1992
[6] Cavalcante, P.B. 1991

Diverse other species



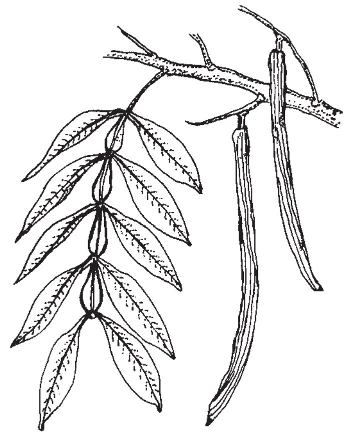




Douglas C. Daly

Relatives of some of the best-known species of fruit trees also produce valuable fruits that should be more widely appreciated, and some parts of Amazonia are particularly rich in fruits. In the southwestern Amazon, the state of Acre constitutes a centre of diversity for various groups of fruit trees: in addition to the many ingás and the abius and abioranas, there are the cacaus (more than 7 species), the biribás and ata brava (more than 7 species), the cajás and cajaranas (5 species and 1 hybrid), the apuruís (8 species) and the araçás and azeitonas da mata (more than 23 species).

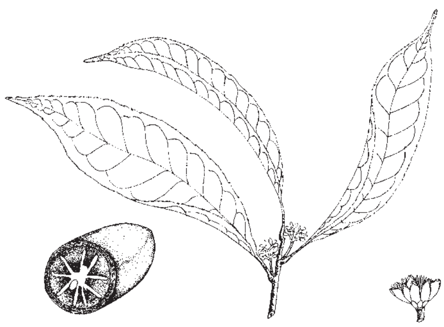
Some fruit species are unknown outside parts of southwestern Amazonia, like cajarana or cajá de jaboti (*Spondias testudinis*, known only in Acre, in Huánuco and Ucayali/Peru, and in Pando/Bolivia), envira caju (*Onychopetalum krukovii*, in Acre and Madre de Dios, Peru) and 2 atas bravas (*Rollinia calcarata*, only in Acre, and *R. mammifera*, in Acre and in San Martin/Peru). Finally, the so-called bacuri da várzea (a species of *Tovomita*), whose delicious fruit is common in the várzea or floodplain of the Purus river and a few smaller tributaries, has not yet been identified and may even be a species unknown to science. This highlights the importance and urgency of accelerating the inventory of the Acre flora.



At the eastern end of Amazonia is the state of Pará. As in the rest of Amazonia, the floodplains of Pará are rich in fruit trees, principally palms like açaí, buriti, patauá and murumuru, but also trees such as bacuripari (*Garcinia [Rheedia] brasiliensis*, a few araçás (e.g., *Eugenia feijoi*), the famous camu-camu (*Myrciaria dubia*) and a few ingás (for example, *Inga cinnamomea* and *I. nobilis*).

The people of Pará value several fruits with an oily pulp, among them uxi (*Endopleura uchi*), most common in Guyana and French Guiana, eastern and central Amazonia, and southern Venezuela, and two species of umari (*Poraqueiba paraensis* and P. *guianensis*), apparently nonexistent in western Amazonia. In contrast, *P. sericea*, very popular in Iquitos, Peru, occurs only in western and central Amazonia[a].

The following tables show some of the many species of great importance to Amazonian people that have been studied little or not at all.

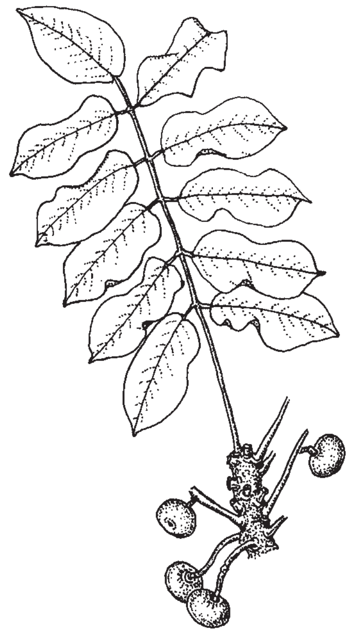


Abiorana, abiu, maparajuba and pariri (*Pouteria* spp.)

Amazonia has abiorana fruits of various sizes, shapes and colours – all edible. Abiorana trees contain white latex throughout, and many are large and valued for their wood. The majority of these species are not common; the best-known are *Pouteria caimito*, *P. glomerata* subsp. *glomerata*, and *P. macrophylla*, all known as abiu, and *P. pariry*, known as pariri. See the specific characteristics of each species below[1].

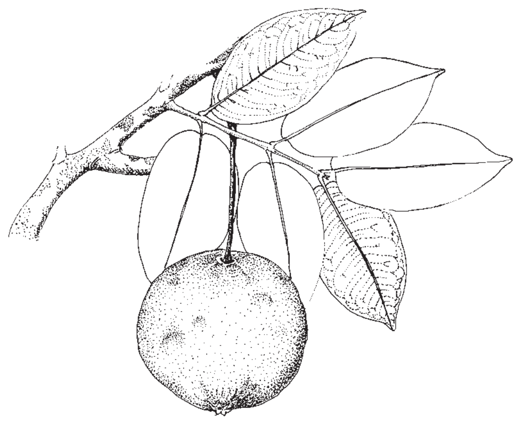
Species of *Pouteria*	Fruit	Occurrence	Tree size/fruiting season
Abiu *P. caimito* (Ruiz & Pavón) Radlk.	Elongate or globose, 2.7–7.5 cm long; apex sharp or rounded, base rounded or truncate; skin with or without hairs; smooth; 1–4 seeds	Various environments; widely cultivated in the Neotropics	Up to 30 m tall, but fruits from a young age / sporadic
P. glomerata (Miq.) Radlk. subsp. *glomerata*	Globose, 2.5–9 cm in diameter; apex and base truncate	River margins and várzea forests; widely distributed in Amazonia and Central America	Up to 30 m tall / sporadic
P. macrophylla (Lam.) Eyma	Flobose or slightly elongate, 2.5–3.5 cm long; apex and base rounded; smooth	Primary and secondary terra firme forests and semi-deciduous forests in Suriname, French Guiana and the Amazon of Brazil, Peru and Bolivia	Up to 30 m tall; has small buttress roots/ from October to February
Pariri *P. pariry* (Ducke) Baehni	Globose but slightly flattened, 9–10 cm in diameter; smooth; 2–3 seeds, each 3–4.5 cm long; pulp consumed fresh or in juices	Terra firme forests in the Brazilian Amazon	Up to 30 m tall / from December to April

Ameixa or jacaiacá (*Antrocaryon amazonicum* [Ducke] B.L. Burtt & A.W. Hill)



The ameixeira or ameixa tree is 25–37 m tall and up to 80 cm in diameter, normally with large buttress roots. The fruit is yellow or orange, globose but slightly flattened, smooth, 6 cm in diameter. The skin is thin and the sweet pulp surrounds the hard pit. It is found infrequently in terra firme forests in Acre, Pará and Roraima. It fruits in October and November, or in March. Ameixa is highly valued where it occurs; the pulp is used to make juices.

Araçá (*Eugenia* spp.) and azeitona da mata



In Acre, besides the araçá-boi *(Eugenia stipitata)* – a tree native to Peru but widely cultivated in Amazonia – there are wild relatives that also have edible fruits, including the following:

Species of *Eugenia*	Fruit	Occurrence	Tree size/fruiting season
Azeitona brava *E. egensis* DC.	Black and red, globose, about 1 cm diameter	Terra firme and várzea, in South and Central America, Amazonia, and northern Paraguay; widely distributed in Acre	Shrub or small tree, 3–6 m tall / November
Araçá *E. feijoi* O. Berg	Floats; orange and globose; 2.5 cm in diameter; rind similar to tangerine; pulp soft and sweet	Flooded areas (várzea and river margins), but also in bamboo thickets	Shrub or small tree, 3–4 m tall / November to March

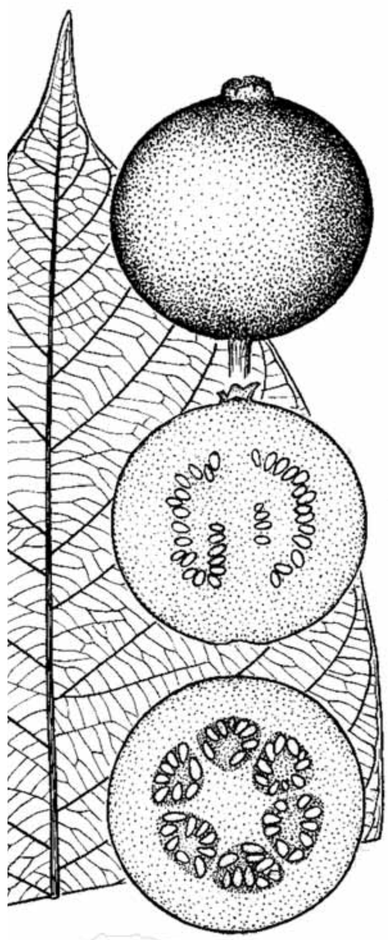
Apuruí and puruí or puruí grande (*Alibertia* spp.)

Piero Delprete

Alibertia (now including *Borojoa*) is a genus with about 21 species that occur in humid forests in Central and South America. Most of the species produce edible fruits that are consumed fresh or in some cases used to make juices and ice creams. The fruits, which vary in size from 5 to 15 cm in diameter, have a fleshy pulp. The genus is represented by shrubs and trees 4 to 25 m tall.

There are various other species of *Alibertia* in Acre, but the two that produce the most popular fruits are *Alibertia sorbilis* and *Alibertia claviflora*. These species are not available in the market, but they are well loved by locals, who know the locations of apuruí trees and when they fruit. Because these species grow in the shade of the canopy in seasonally flooded forests, an area to which few Amazonian crops are adapted, they could be domesticated with minimal impact on the natural vegetation.

Species of *Alibertia*	Fruit	Occurrence	Tree size/fruiting season
A. sorbilis J. Huber ex Ducke	Globose, 12–15 cm in diameter	Understorey of seasonally flooded forests	4–7 m/July to November
A. claviflora K. Schum.	Globose, 5–7 cm in diameter, with a fleshy mesocarp 1–2 cm thick	Understorey of seasonally flooded forests; mostly southwestern Amazonia	5–12 m/March to June



Biribá, biribá brava and ata brava (*Rollinia* spp.)

Most kinds of biribá fruits have large, soft 'scales', as in the true ata (*Annona* spp.), while others are smooth and irregularly lobed when the seeds are mature. In some, the scales are sharply pointed but never very hard. Of the seven known species of biribá, three are found only in Acre and small parts of adjacent Peru or Bolivia[2].

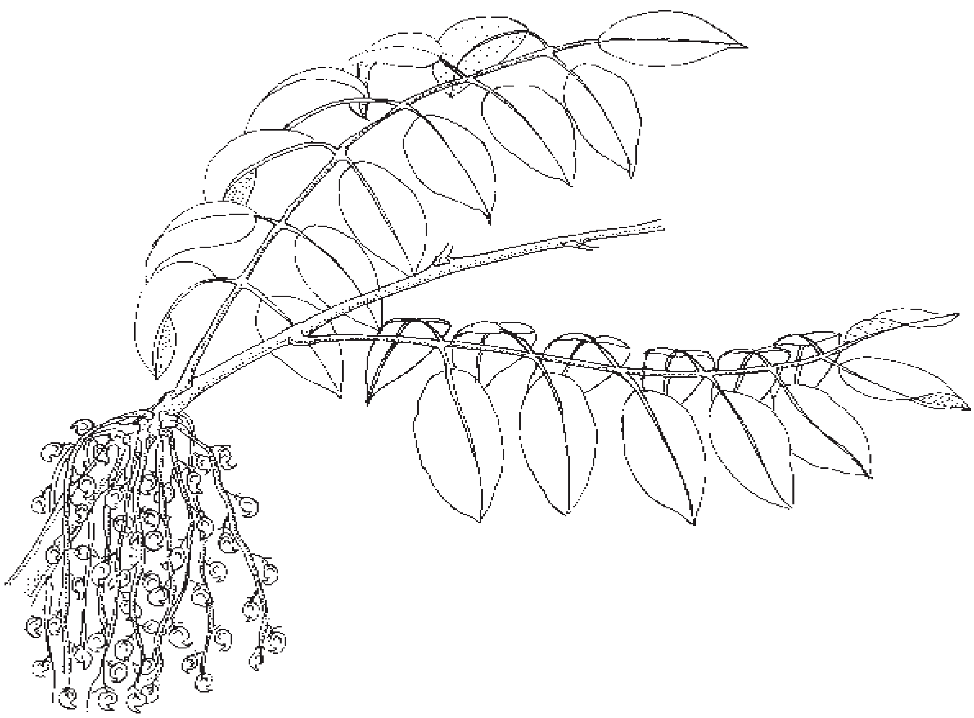
Species of *Rollinia*	Fruit	Occurrence	Tree size/fruiting season
Ata brava *R. calcarata* R.E. Fries	Globose	Rare, found in terra firme forests but also in low-lying areas, apparently restricted to Acre	About 25 m tall / end of the year
Biribá brava, ata brava, ata preta *R. mucosa* (Jacq.) Baill.	Yellow; egg-shaped, 2–20 cm long and 2.5–15 cm in diameter; covered with brown hairs; scales smooth or with curved 'spines' near the tip	Terra firme forest on rolling terrain, bamboo forest, and sometimes várzea forest. Well distributed throughout tropical America	Up to 20 m tall / much of the year
R. peruviana Diels	Green to yellow, globose but slightly flattened, 1.5–2 cm long and 2–2.5 cm in diameter; when immature densely covered with brown hairs, scales with a curved tip 1–3 mm long	Primary or secondary terra firme forest; restricted to western Amazonia	Up to 15 m tall / October to February

Breu (*Protium* spp.)

The Brazilian Amazon is home to five genera in the Burseraceae family—*Crepidospermum, Dacryodes, Protium, Tetragastris* and *Trattinnickia*—with some 100 species, a few of which produce fragrant resins used as medicine and insect repellent, for illumination and to caulk boats. In the indigenous reserve of Tembé, in Pará, the average abundance of mature breu trees that produce such resins is 1 tree/ha, but can be up to 10 trees/ha. The resin is produced in special conducting tissues under the bark and is exuded in response to various kinds of injuries. In some species of breu, insect attacks provoke release of resin.

Dacryodes has some 36 species in the American tropics, at least 21 occurring in Amazonia. The fruits of most are olive-shaped, some reach the size of olives, and like olives they have an oil-rich pulp around the stone. At least two Amazonian species are known to be managed by indigenous groups.

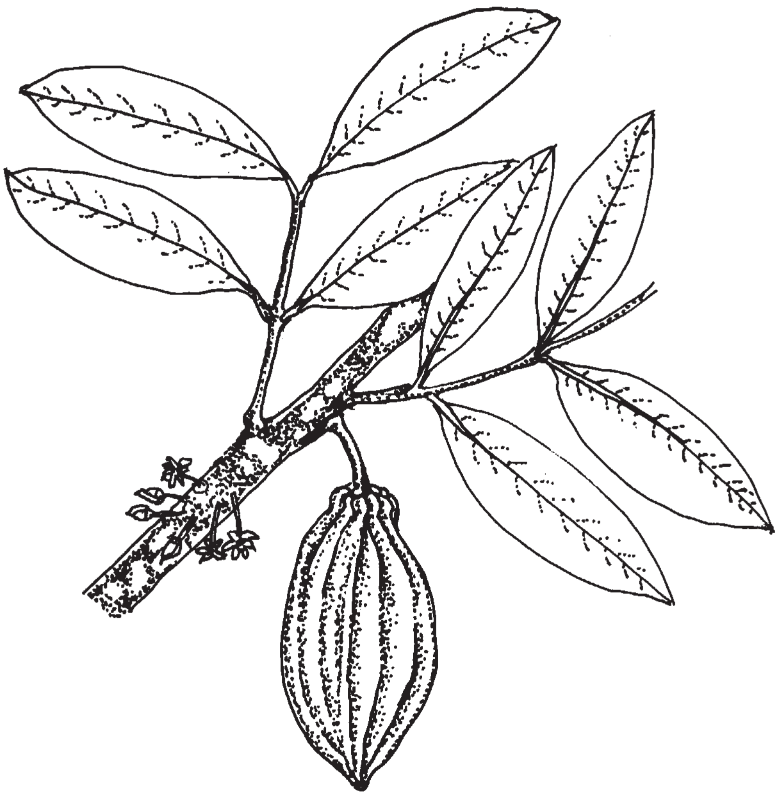
The fruits of *Protium, Tetragastris* and *Crepidospermum* are generally red, opening at maturity to expose a stone with a sweet white covering that attracts animals like pacas, peccaries and tortoises, which disperse some seeds throughout the forest. Many hunters build platforms and wait near breu trees to hunt game animals, and forest people snack on the white pulp when the stones fall.



Cacau, cacauí, cacaurana and cupuí (*Theobroma* spp. [cacau jacaré: *Herrania mariae* (Mart.) Decne. ex Goudot])

Besides the universally known cacao and the well-known cupuaçu, there are at least five additional species of this same group in the Brazilian Amazon that deserve attention. The fruits of all these trees grow either on the trunk or on the principal branches; inside the fruit are five columns of seeds along a central axis, each is surrounded by a sweet, succulent pulp. The roasted seeds of some of these species produce chocolate, while those of *Theobroma bicolor* are roasted or grilled and salted to make 'nuts'.

It is a genus with approximately 20 species of understorey trees[3]. The pulp of the fruits is used to make juices, sweets, frozen ice treats, ice creams, jams and other products.



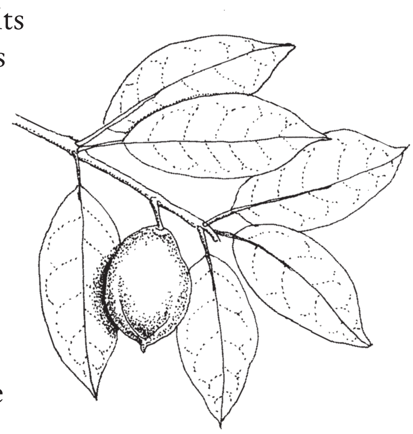
Species	Fruit	Occurrence	Tree size/ fruiting season
Cacao *Theobroma cacao* L.	Yellow or multi-coloured (yellow, red, purple), egg-shaped or elongate, variable in size, with 10 grooves. Contains 40–60 seeds, each 2–4 cm by 1.2–2 cm, that can be roasted to make chocolate. The seed pulp is used to make a delicious drink	Widely cultivated in tropical America, but also occurring spontaneously in the understorey of terra firme forests in parts of Amazonia	10–12 m tall/ various times of the year, depending on the region
Cacao jacaré *Herrania (Theobroma) mariae* (Mart.) Decne. ex Goudot, *H. nitida* (Poepp.) R. E. Schultes	Green or yellow, egg-shaped to slightly elongate, 10–12 cm by 5–7 cm diameter, with 10 longitudinal ridges and (in *H. nitida*) fibrous ribs between the ridges; when the fruit is ripe, the rind is covered in irritating hairs; contains 30–40 seeds	Small understorey tree in terra firme forests, never abundant, but widely distributed throughout Amazonia	Shrub or slender tree not taller than 10 m, normally with few branches / sporadic
Cacau de macaco, cacaurana, cabeça de urubu *T. obovatum* Klotzsch ex Bernoulli	Brownish yellow, inverse egg-shaped, slightly elongate, the apex round, 5–7 cm by 3–4 cm diameter; the rind is bumpy	Restricted to terra firme forests in western Amazonia	Up to 15 m tall / between October and June
Cacaurana *T. microcarpum* Mart.	Egg-shaped and elongate, greenish yellow, up to 12 cm long	Rare in terra firme forests of western Amazonia, including Colombia (caquetá), also along the Tapajós river; cultivated in Trinidad and Tobago	Up to 18 m tall / various times of the year
Cacauí *T. speciosum* Willd. ex Spreng.	Yellow, slightly elongate-globose, about 10 cm by 7–8 cm diameter containing 20–26 seeds; the rind is smooth, slightly velvety and hard; some make chocolate from the seeds	Normally in terra firme forests, sometimes found in secondary forests but never abundant; widely distributed in Amazonia with the exception of the northeast of the region	7–15 m tall / September to November in the majority of the region, November to March in Pará
Cupuaçu *T. grandiflorum* (Willd. ex Spreng.) K. Schum.	Green but covered with brown hairs, oblong or elongate-oblong, 12–25 cm long by 10–12 cm diameter; weighing up to 1.5 kg and containing 20–50 seeds; the rind is smooth; among various other products, the pulp can be mixed with Brazil nuts and coconut to make the 'cupuaçu salami' of Pará	Native to southern pará and western maranhão, but widely cultivated throughout the Brazilian Amazon and in Colombia, Costa Rica, Ecuador and Venezuela	4–10 m tall, reaching 18 m / first semester of the year

Cajá, cajarana, cajá de jaboti and taperibá/taperebá (*Spondias* spp.)

The genus *Spondias* is represented by at least ten species of fruit trees in tropical America, half of them found in Amazonia. All produce great quantities of fleshy, orange or yellow fruits. The skin of the fruit is relatively thin, and the pulp (same colour as the skin) is acidic, sweet, aromatic and flavourful. Fallen fruits can be collected and eaten right beneath the tree, but most people take them home to remove the skin and separate the pulp with a sieve. In small communities, people usually consume them as juices. In the cities, ice cream and frozen pulp are made for sale. A few riverine communities in Acre make a spicy pepper sauce with the fruits of cajá de jaboti. In the forest, the native species serve as 'waiting trees' for hunters because the fallen fruits attract various animals like peccaries, tapirs and tortoises.

species	Fruit	Occurrence	Tree size/fruiting season
Cajarana, cajá de jaboti *S. testudinis* J.D. Mitch. & Daly	Greenish-brown, oblong, 5–6.5 cm by 2.5–3 cm diameter; rough with raised spots	Restricted to Acre; Huánuco and Ucayali in Peru; and Pando in Bolivia	Up to 38 m tall and 65 cm in diameter / March to April
Cajá *S. mombin* L.	Yellow or orange, usually egg-shaped, 2–4 cm by 1.8–2.7 cm diameter	Widely distributed in tropical America and cultivated in the rest of the tropics	Up to at least 28 m tall and 56 cm in diameter; the trunk can have thick nodules or ridges when it grows in the sun / November to May
Taperibá, taperebá, cajá *S. globosa* J.D. Mitch. & Daly	Yellow; globose, 3.5–4 cm in diameter; less sweet than mombin	Temporarily flooded areas in western Amazonia and Venezuela	Canopy tree up to 40 m tall and 105 cm in diameter / March to June
Cajarana *S. dulcis* Parkinson	Yellow or orange, oblong, 5–10 cm by 3–8 cm in diameter, stone spiny	Tree native to Asia but cultivated throughout the humid tropics	Cultivated, reaching 25 m tall / August and September
Cajá-açu *S. "mombin x testudinis"*	Like the cajá de jaboti but larger (the largest fruit of the group)	Tree apparently restricted to Acre, in terra firme forest	Likely a hybrid of cajá with cajá de jaboti / February

Castanha de porco, castanhola, castanhinha (*Caryodendron amazonicum* Ducke)



The castanha de porco, also called castanhola and castaninha, is cultivated on a modest scale in Venezuela for the sale of its oil-rich edible seeds, which are normally roasted. It fruits from October to November and in April, when it serves as a hunting site for game such as peccaries.

It is a medium- to large-sized tree 15–40 m tall. It grows in terra firme forest, often in rolling terrain. It is primarily a western Amazonian species, but it can also be found along the Jari River in Pará.

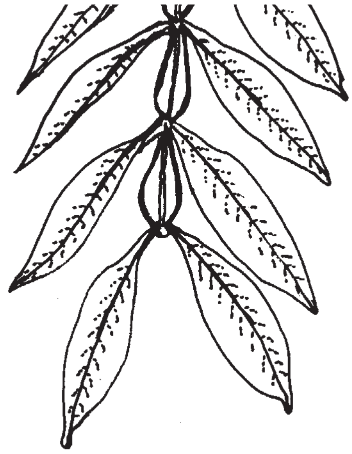
The essentially globose fruit is approximately 4 cm in diameter; it has three lobes and opens in three parts. The seeds are about 3 cm long.

Cocão (*Attalea tessmannii* Burret)

The cocão is a single-stemmed palm that occurs, however, in dense clusters of individuals. Oil extracted from the cocão seed is used in the preparation of various foods. Rubber-tappers burn the woody endocarp or stone of the fruit to smoke rubber. This species merits special attention because it is native and seems to be abundant where it occurs, and at least one of its products, the oil, is not immediately perishable, making it a good market product.

Each plant is robust, reaching a height of 8–19 m. The fruits are brown, elongate egg-shaped, and 12–13 cm long by about 7 cm diameter. The outside of the fruit is hard and fibrous, while within a fine layer of starch covers a woody pit or stone containing 2–3 oil-rich seeds. It occurs in the understorey or in the canopy in terra firme forest. The cocão is native to western and southwestern Amazonia, occurring in Peru and in Acre in the upper Juruá River basin.

Envira caju [*Onychopetalum periquino* (Rusby) D.M. Johnson & N.A. Murray]



The sweet pulp of the envira caju tree is highly prized by traditional communities, which know the species well. We still lack detailed knowledge of certain key characteristics of the fruit in order to evaluate its market potential in the region. For example, the fruits are astringent until they are completely ripe; moreover, the local abundance of the trees, and the quantity and consistency of production per tree, are unknown. The envira caju has a red, globose fruit about 4 cm in diameter. The tree is 8–28 m tall, and it is found frequently in terra firme forests, often on hilly terrain. It is apparently restricted to Acre and the Department of Madre de Dios in Peru. In Acre, it occurs only from Tarauacá to the east. Envira caju fruits in October and November.

Ingá (*Inga* spp.)

Ingá is one of the most important tree groups in Amazonia. In addition to its diversity (approximately 130 species in the region), it possesses characteristics that increase its potential as a resource for agroforestry systems, recuperation of degraded areas, and fruit commercialization. The genus is abundant in various environments and various ingás occur in secondary forests or in várzea. Many of the trees are small, fast-growing, and highly productive. As legumes (the bean family), they contribute to soil fertility, which in the tropics is normally poor. Both Acre and Pará have more than 50 species of ingá each.

Depending on the species, ingá fruits can measure from 5 cm to 1 m long. Though they do not open spontaneously, they are easy to open by hand. The seeds of most species are surrounded by a sweet, white, fluffy pulp, and the fruits of some of these species are sold in the markets of Belém, Manaus, Iquitos (Peru) and other Amazonian cities, but the majority are collected and consumed in the forest; few species are cultivated.

The following table summarizes the natural geographic distribution for a few ingás, as well as the environments in which they are found[4].

Species of *Inga*	Distribution	Habitat
I. alba (Sw.) Willd.	Southern Mexico, Central America, northern South America	Terra firme
I. cayennensis Sagot ex Benth.	Northern South America south to Peru, also northeastern Brazil	Terra firme
I. capitata Desv.	Costa Rica; northern South America south to Bolivia; Atlantic Forest of Brazil	Terra firme and várzea
I. chartacea Poepp.	Southwestern Amazonia and southern Pará	Terra firme
I. cinnamomea Spruce ex Benth.	Widespread in Amazonia	Várzea; cultivated
I. edulis Mart.	Northern South America east of the Andes; Atlantic Forest of Brazil	Clearings in terra firme
I. grandis T.D. Penn.	Restricted to southwestern Amazonia	Terra firme
I. ingoides (Rich.) Willd.	Northern South America, Bolivia, Central Brazil, Atlantic Forest of Brazil, northeastern Brazil, Lesser Antilles	Terra firme and várzea
I. laurina (Sw.) Willd.	Northern Mexico south to northern Argentina; Caribbean	Often in dry forests
I. macrophylla Humb. & Bonpl. ex Willd.	Amazonia and Pacific coast of northwestern South America	Secondary and disturbed forests; cultivated
I. nobilis Willd. var. *nobilis*	Amazonia, Guyana, French Guiana, central and southern parts of Venezuela, Central Brazil	Várzea
I. stipularis DC.	Amazonia, Guyana and French Guiana	Terra firme and river margins
I. velutina Willd.	Amazonia	Terra firme and várzea

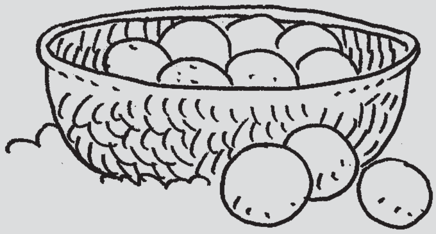
Sapota or sapota do Solimões (*Matisia cordata* Bonpl.) and sapota macho (*M. bicolor*) Ducke

Sapota and sapota macho are large trees up to 40 m tall in terra firme forests. The sapota fruit is slightly egg-shaped or sometimes globose, smooth, 7–15 cm long by 5–15 cm in diameter. The *sapota macho* fruit is smaller, round, wrinkled, and up to 7 cm in diameter. The fruits of both species are yellowish brown or orange, with firm leathery skin (thinner in *M. bicolor*). The orange pulp that surrounds the hard pit or stone resembles that of a mango and is fibrous and sweet.

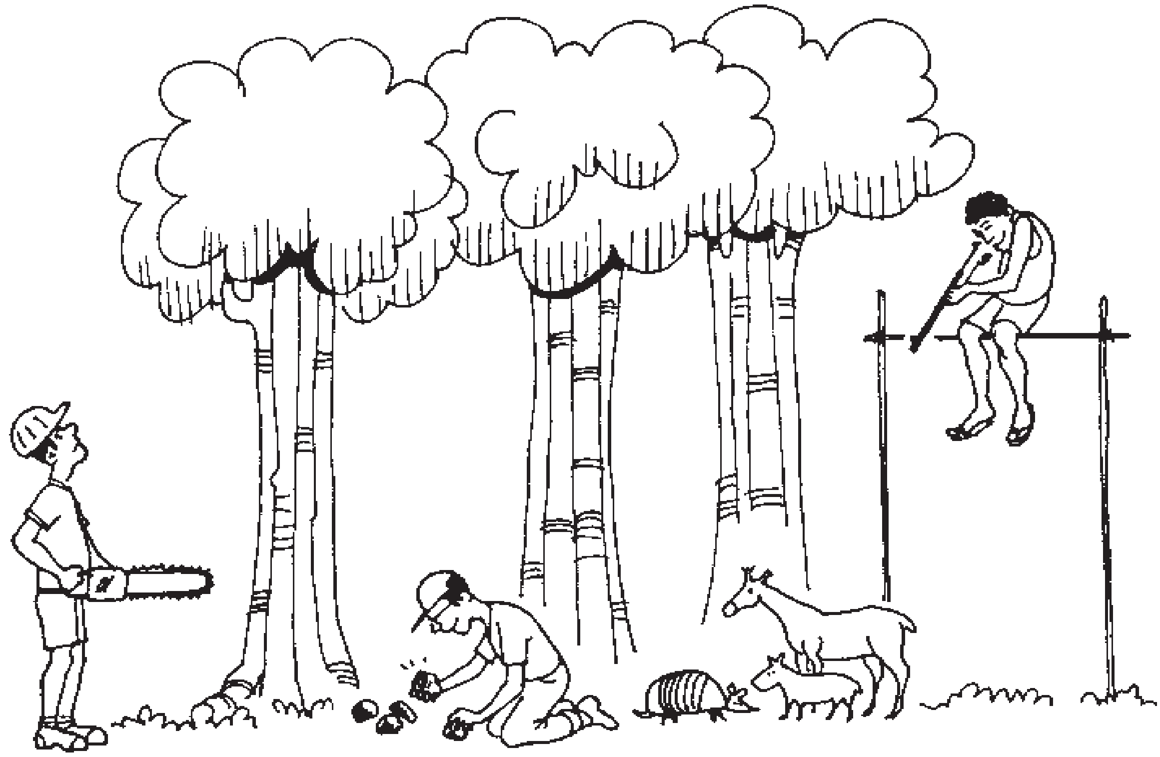
Species of *Matisia*	Fruit	Distribution
Sapota *M. cordata* Bonpl.	Cultivated trees are smaller but can produce 700–1 000 fruits / year; fruit matures between February and May and is sold in the markets of Iquitos, Peru	Native to western and possibly central Amazonia, but also widely cultivated there, in Belém, and on both sides of the Andes in Colombia and Ecuador
Sapota macho *M. bicolor* Ducke	Not cultivated, but it can be frequent where it occurs; fruits October–November	Restricted distribution, recorded only in the south-western corner of Amazonia (Acre and south-eastern Peru) and in the Xingu River basin

[1] Pennington, T. D. 1990
[2] Maas, P. J. M., Westra, L.Y. Th. and collaborators 1992.
[3] Cuatrecasas. J. 1964
[4] Pennington, T.D. 1997

Forests for the people



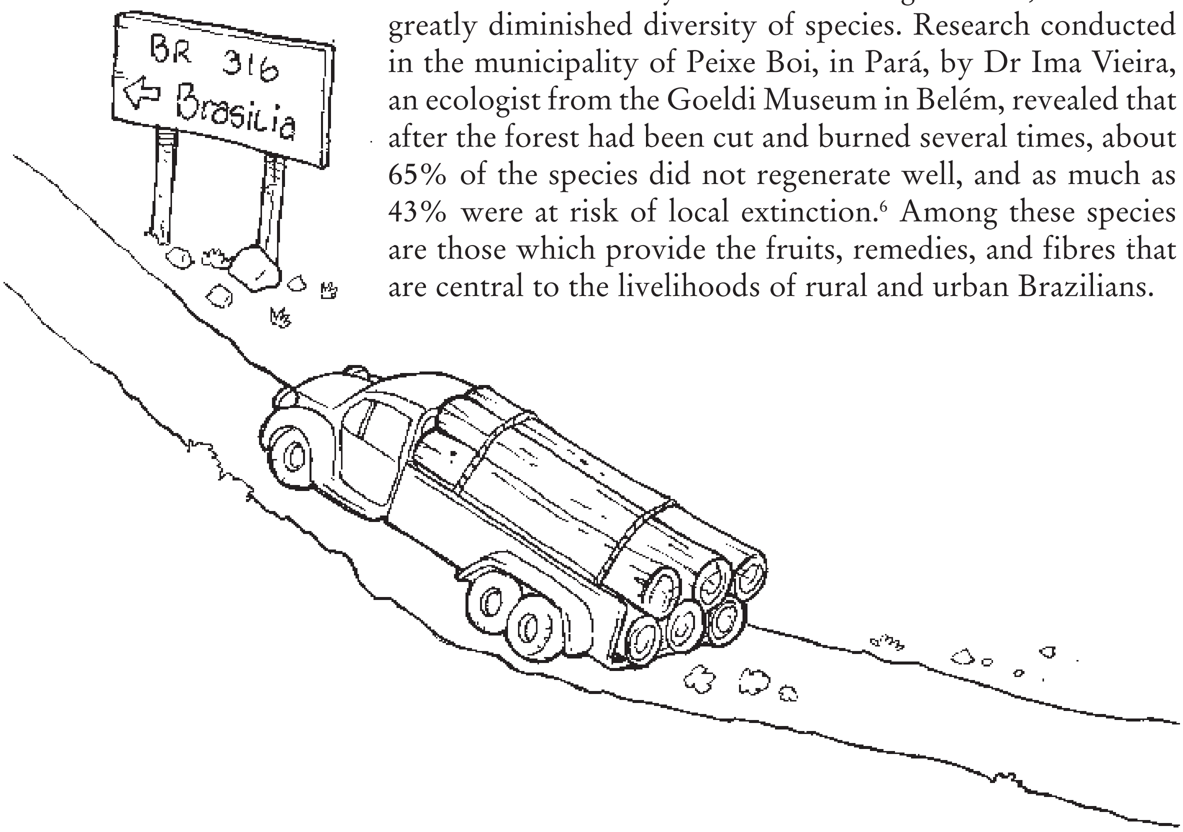
Conflicting uses: diverse perspectives of forest value



Patricia Shanley
Murilo Serra
Margaret Cymerys
Gabriel Medina
Lêda Luz

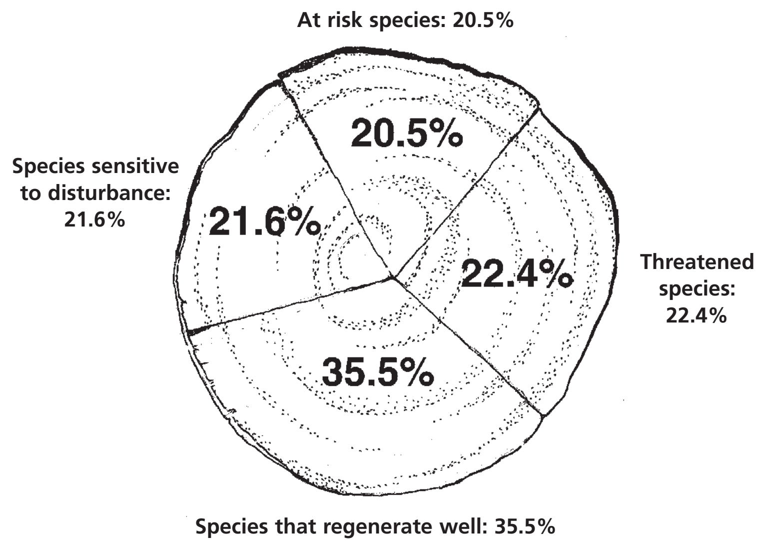
The forest offers different goods and values for each person. For instance, a hunter enters the woods and scans the ground for armadillo tracks. A logger eyes the high-quality wood of ipê, a midwife seeks andiroba's oily seeds, while a geologist searches for rocks and minerals. The forest offers something for everyone, but to maintain its abundance over time it must be managed, keeping in mind this great diversity of needs. There are substantial conflicts over forest use in Amazonia today. In the 1960s and 1970s, new roads opened up areas that had previously been accessible only by boat. Ranchers, loggers and landless peasants from throughout Brazil were drawn to the Amazon by government incentives to take advantage of the seemingly limitless land and timber resources.[1] The divergent interests of these various stakeholders have frequently resulted in bloody conflicts that have claimed hundreds of lives over the last three decades.[2] International consumption of Amazonian beef, grain and ethanol is one of the drivers of these conflicts.[3] And while the majority of timber sales are currently domestic, external demand is rising sharply.[4] Forests in Asia and Africa are swiftly disappearing, with the Amazon potentially poised to become the centre of timber production for the world.

Studies have demonstrated that the blame for the loss of forests in Amazonia cannot be laid at the door of any specific group; rather it is the frequency and intensity of combined activities that make forests vulnerable.[5] For example, secondary forests return after various cycles of swidden agriculture, but with a greatly diminished diversity of species. Research conducted in the municipality of Peixe Boi, in Pará, by Dr Ima Vieira, an ecologist from the Goeldi Museum in Belém, revealed that after the forest had been cut and burned several times, about 65% of the species did not regenerate well, and as much as 43% were at risk of local extinction.[6] Among these species are those which provide the fruits, remedies, and fibres that are central to the livelihoods of rural and urban Brazilians.



Changes in land use, such as the introduction of logging, swidden agriculture, intensive hunting and ranching, act as a sieve through which vulnerable plant species may be eliminated. Scientists are only now discovering what forest people have known for some time. As Senhor Marcelo of the village of Ananim said, after various cycles of ranching, logging and fire, "The forest never returns to what it was."

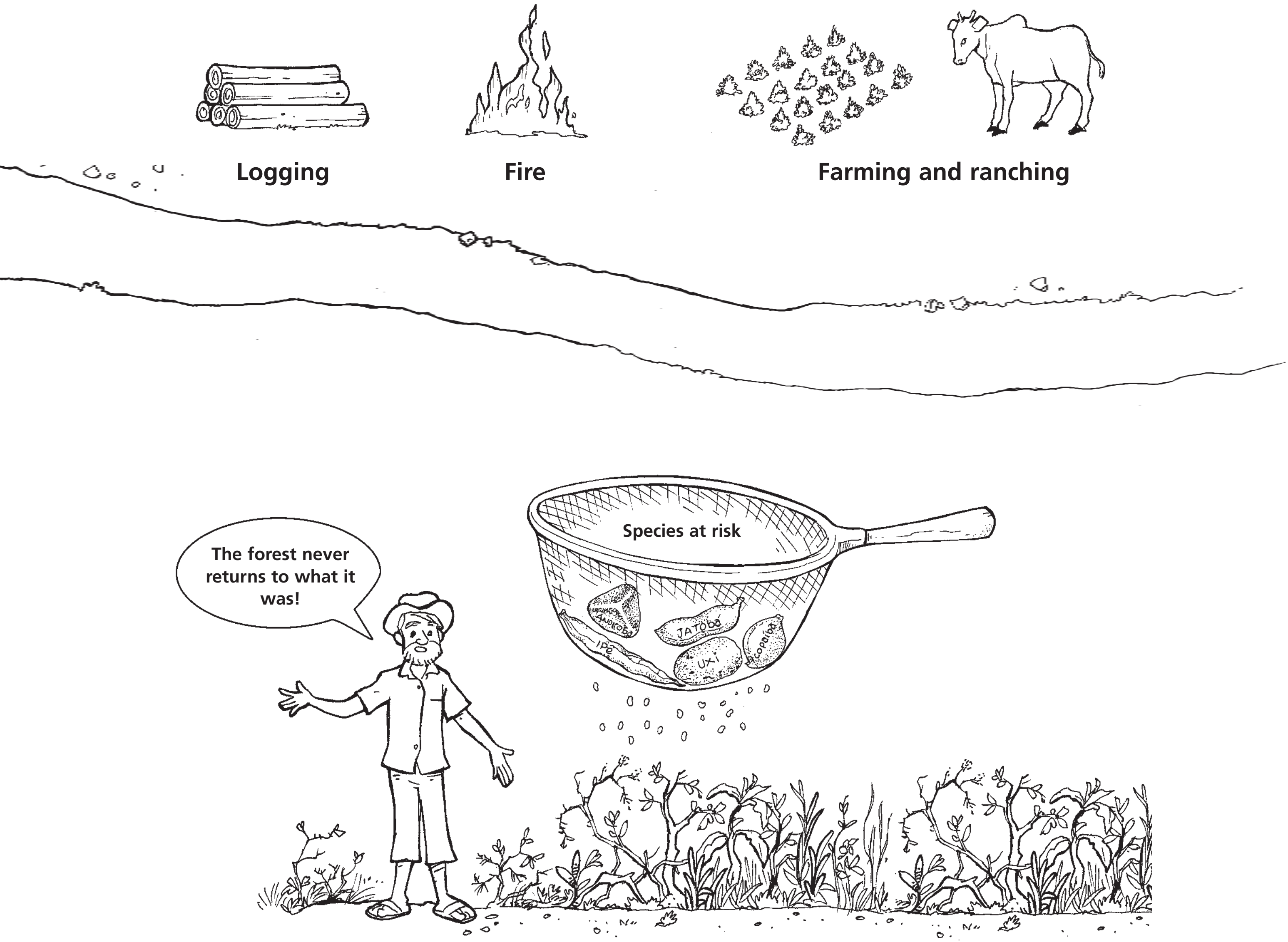
Regeneration of forest species after swidden agriculture[6]



Future of the forest

Present forest

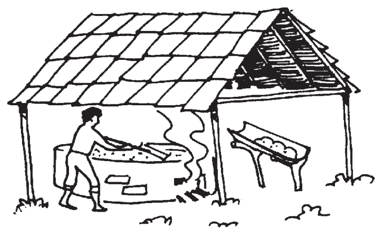
Changes in land use



Timber: fair trade

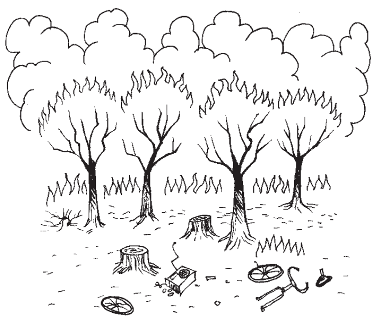
Even when villagers understand the value of forest products for their families' incomes, they often still sell timber for a relatively low price. This scenario happens all over the world. Cash poor families perceive timber as a source of quick cash. But the money generally goes as easily as it comes, leaving families without a free supply of fruit and medicine, and no funds to buy them. Some villagers who have lost their forests, have shared their stories to help others better evaluate the advantages and disadvantages of selling timber. Below are the stories of villagers who sold their forests for cheap, villagers who negotiated for a better price and others who conserved their forests.

Wood for an oven



Senhor Sebastião traded 5 alqueire*s* (24 ha) of pristine forest for an oven that cost US$146. He quickly regretted it. However, two years later, a new buyer entered and he sold 20 alqueires (96 ha) of virgin forest for US$156 each, which was about US$3.12 to US$4.16 a tree. The logger paid only the first portion of what he owed, left and never returned.

Wood for bicycles



At the end of 1997, a neighbouring community sold 148 alqueires (710 ha) of forest for US$104 an alqueire. The loggers took everything, including spindly sticks; soon after, fire took the rest. And what happened to the earnings? The remains of broken radios and burnt bicycle parts lie scattered upon the ground.

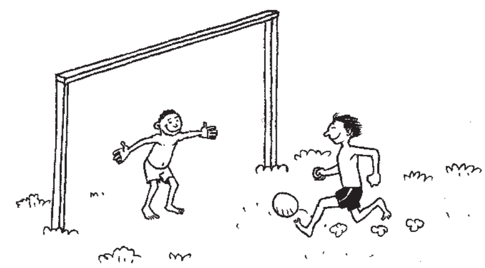
Wood for medicine

In many cases, parents of sick children sell timber out of desperation. For example, feeling the pain of his sick child, a father in Baixo Tocantins sold five piquiá trees to pay for one injection for his sick son. There was a little money left over to buy a plate of food on the roadside in front of the hospital. If these trees had been sold at the sawmill, they would be worth US$204. Asked if a logging sale has ever saved the life of a child, community members routinely relate "no".

Watch out for Zé the logger

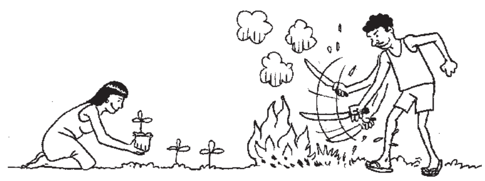
One of the neighbouring villagers, Senhor Zé, preferred to work for cash; he did not like to work in the field, to hunt or to collect forest fruits. A logger arrived and said to him, “If you convince your community to sell their forest, I will pay you well.” The logger put US$176 in his hand and made a payment of US$1 760 to the community. The community quickly agreed to sell 180 alqueires (864 ha) for US$10 588 divided into 6 payments. But after the wood was taken out, how many payments do you think they received? Only one, and to get it, the spokesperson for the community had to travel 150 km three different times, leaving his fields for seven days. In the end, each of the 30 families in the community received US$117. The money quickly disappeared and it became harder and harder to access forest fruits and vines. Senhor Zé moved to the city, but everything there had to be purchased and was expensive. Out of money, he went back to work with the loggers, convincing other communities to sell their wood. Beware, because a man named Zé could come knocking at your door. If you do plan to do business with loggers, be sure to check out prices first so that you get a fair deal for your wood.

A soccer field – and what else?



In Baixo Tocantins, a few communities negotiated with loggers to receive a better price for their timber and to protect the fruit trees, the medicinal oil trees and other useful species in their forest. Communities can also identify the parts of the forest richest in game and in this way draw the boundaries of a reserve or corridor where no logger can enter. Loggers typically offer to create a soccer field in exchange for timber, which is a welcome sports area for everyone to enjoy. Communities that negotiate well, however, can play soccer without sacrificing the andiroba oil they will need to treat the bumps and bruises they inevitably suffer after the games.

Reserve for the future



The community of Muruteuazinho, on the Guamá River, recognized the huge loss of forest that they suffered from timber sales and shifting cultivation and decided to preserve an area of old growth forest and to plant their swidden fields only in the secondary forest. They increased the productivity of the secondary forest by planting orange and coconut trees and passion fruit. In addition, they mapped the reserve and created a cleared area around the forest to keep fires from entering. To further supplement their income from the land, they began to raise bees for honey.

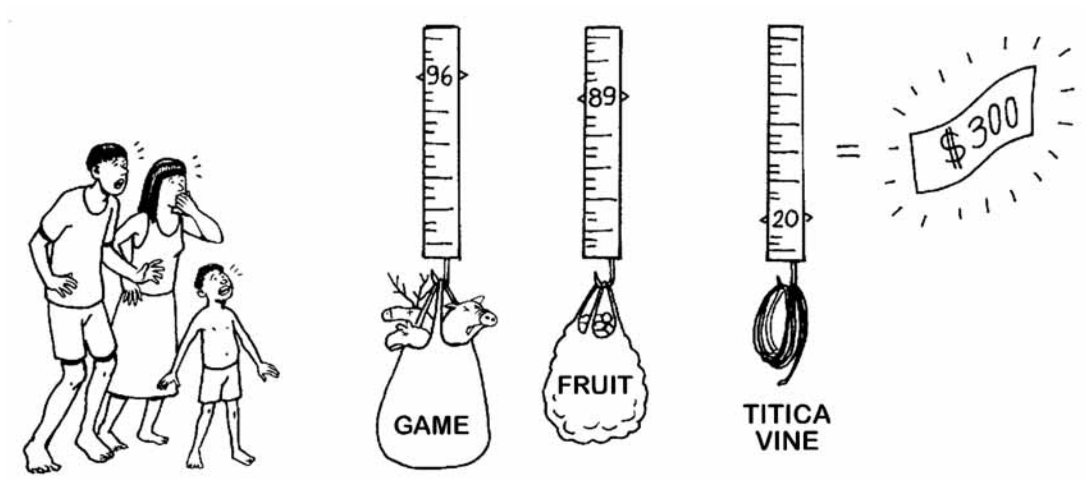
Free from the forest

The Farmers Union of Paragominas, in Pará, together with three communities along the Capim River, asked researchers which was more valuable: the money raised by selling wood, or the value of the fruit, game and vines that families consume over the long term. The question seems simple, but the answer depends on a lot of factors, such as the particular species of tree, its abundance in a given area, its production, the distance of the nearest market and its selling price.

The research team studied the forest, the market and local consumption of forest products. Most of the data was gathered by the community, which counted and weighed all of the fruit, fibre and game each family consumed in 1993. When the research began, wood from 3 000 hectares of forest had already been sold five different times. In these cases the sales were made selectively; only ten species were sold. The results showed that even after these sales, although families had to walk farther to find forest products, they still consumed an average of 96 kg of game, 20 kg of vine and 89 kg of fruit per family that year. If a family had to purchase all of those resources, it would have cost them US$300.

Invisible income

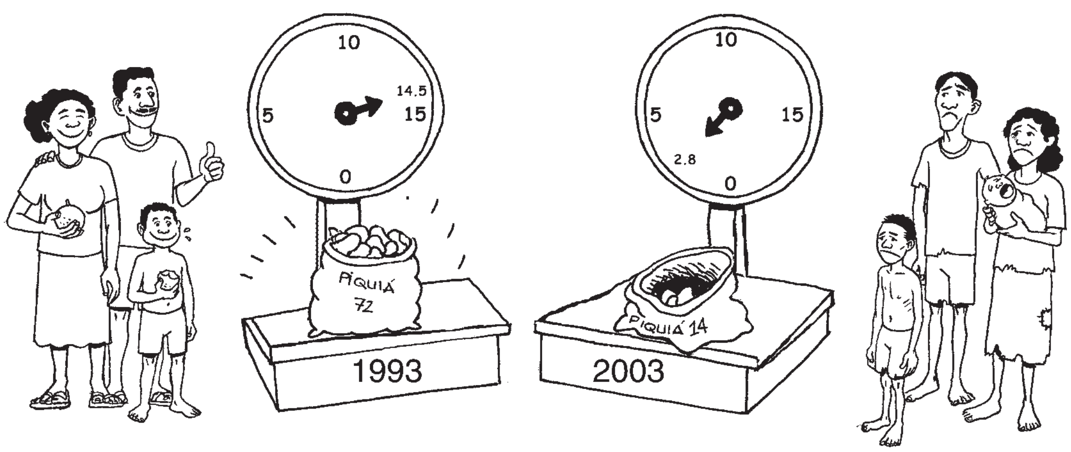
Average consumption per family after 5 timber sales (1993)



From compatibility to conflict

In 1993, each of the families of the three villages studied in the Capim River region consumed an average of 383 fruits. By type of fruit, this signified an average of 161 bacuris, 150 uxis and 72 piquiás per family. But even with a solid understanding of the value of the standing forest, it is easy to sell wood or land cheaply. From 1993 to 2003 the Capim villagers sold wood eight more times.[7] When sales became frequent and intense, involving more than 50 species, the availability of fruits and other forest products diminished significantly.[8]

Consumption of piquiá after 13 timber extractions



after 5 selective logging extractions

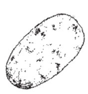
after 8 additional predatory logging extractions

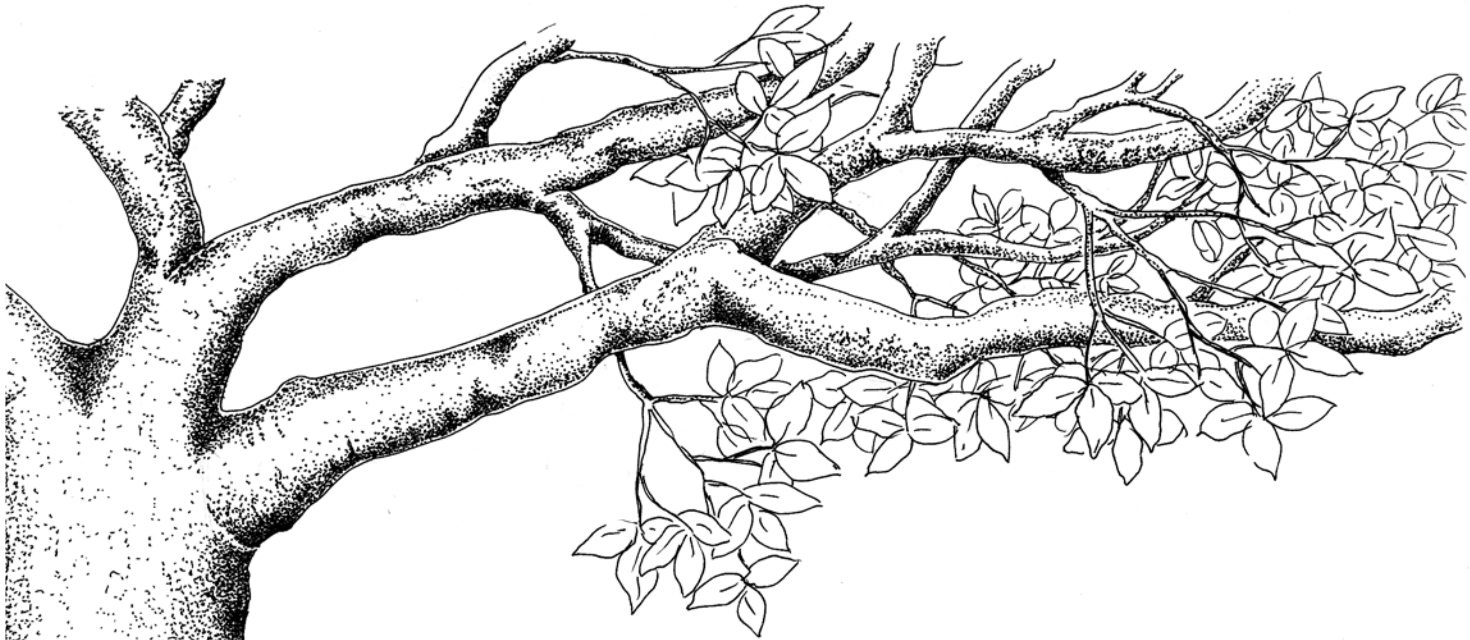
Furthermore, studies have shown that for each tree extracted for wood, an additional 27 either die or are damaged in the process.[9] As the structure of the forest changed with more extensive logging, fuel loads increased on the forest floor and the forest became prone to fire.[10] After multiple logging events in the Capim region, fire raged through the forest in 1997, lasting weeks. After the forest fire, the average consumption of piquiá fell from 72 fruits (14.5 kg) to 14 fruits (2.8 kg) per family – an 80% drop. At this point, conflict ensued between the industrial harvest of wood and the communal harvest of non-timber forest products.

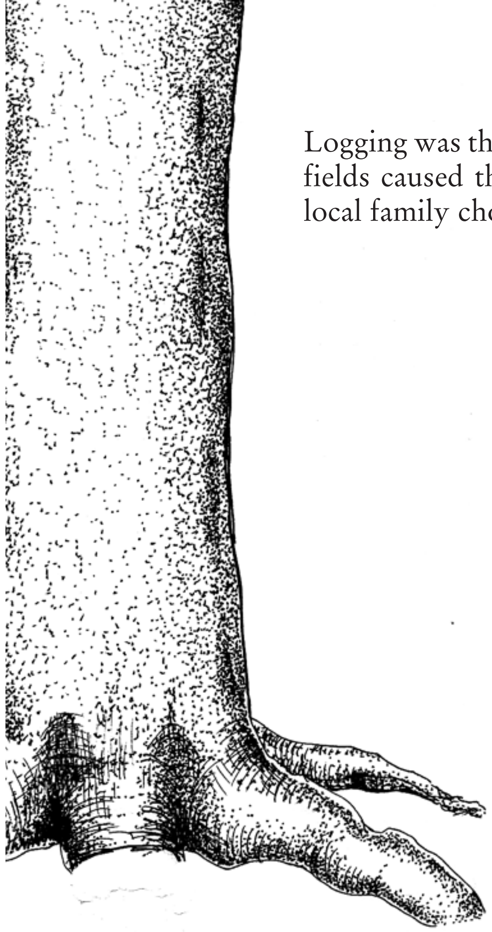
Loss of fruit trees

Why did the consumption of piquiá fruit fall so dramatically? Because of the 109 piquiá trees the community collected fruit from in 1993, only 41 survived in 2003 – a loss of 63%. During the first few sales, loggers only took out the few highest-quality timber species, and the fruit trees were spared. But after 1996, the number of species logged escalated to over 50. In the last few decades, the number of species extracted by loggers has shot up from 12 to more than 300. A third of these are valued sources of food, medicine, gum and resin.[11] In 1996, the 15 species most valued by the Capim communities for the game they attract and the fruit and remedies they produce began to be logged, and piquiá was among them.[12]

Number of piquiá, bacuri and uxi trees and percentage lost, 1993–2003

Fruit tree	1993	1998	2003	% lost
 Piquiá	109	98	41	63
 Bacuri	16	14	3	81
 Uxi	24	12	4	83





Causes of death

Logging was the cause of mortality for 80% of the piquiás (55 trees). Fire in agricultural fields caused the death of another ten trees, wind knocked down another two and a local family chopped down one to make a boat.

Number of piquiá, bacuri and uxi trees lost, by cause of death, 1993–2003

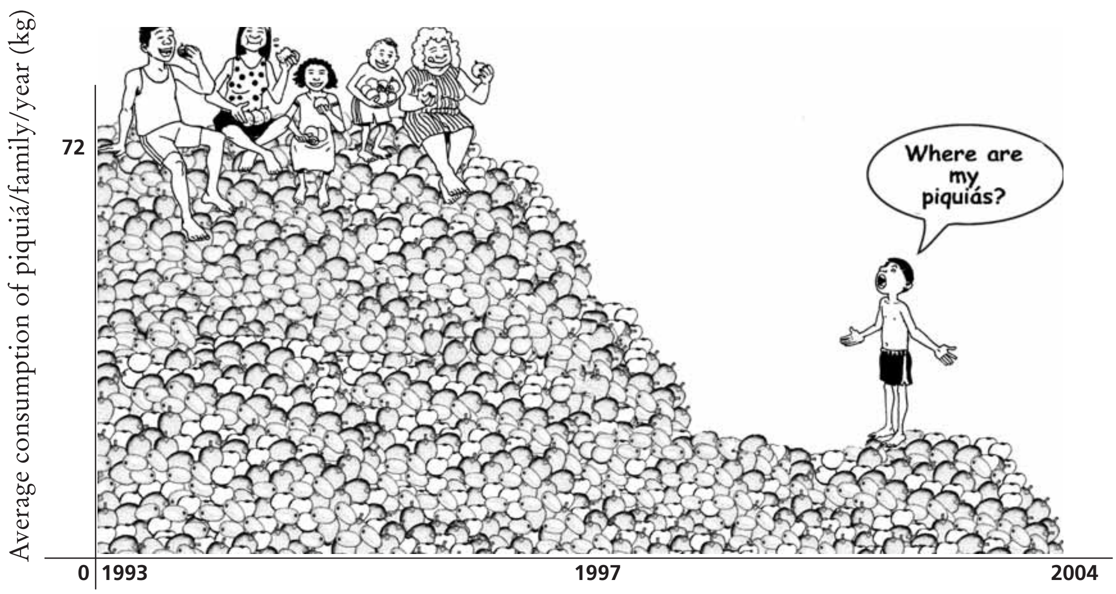
Fruit tree	Timber extraction	Agricultural field, fire	Wind	Construction
Piquiá	55	10	2	1
Bacuri	2	4	2	0
Uxi	3	12	4	0

Threshold

There are three types of timber sales in the Capim region, with each successive type having an increasingly dramatic impact on forest communities. In the first type of sale, the logger extracts only the most valuable species. In the next, the logger takes out a much larger number of species, including the fruit and oil producing trees. And finally, the loggers buy wood by area (alqueire), extracting all the trees they want that are left. When the rate of extraction of timber surpasses the ability of the forest to regenerate, the production of fruit declines, medicinal plants are less available and animals become scarce. This story is repeated continually throughout the Amazon. However, if communities are aware of the costs and benefits of logging, they can sell wood conscientiously and maintain the trees they want to meet their needs.

Multiple use turns into conflict of use

Consumption of piquiá by families in the Capim region after 13 timber extractions



The Capim River example illustrates that:

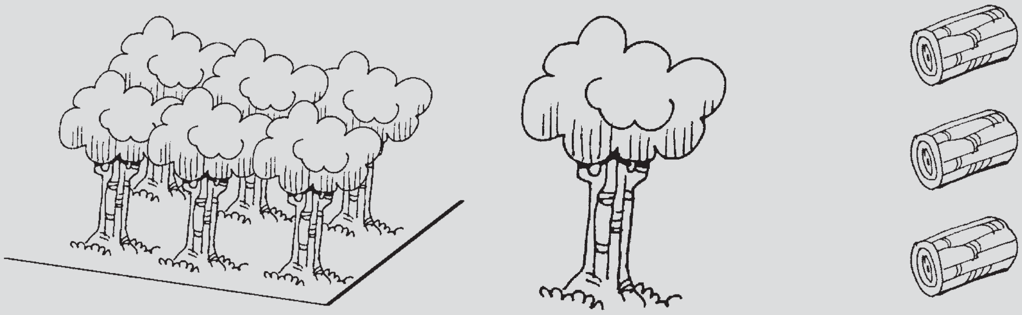
- The use of timber can be compatible with the use of other forest products, depending on the frequency and intensity of extraction. Logging events by outside companies occurred in the Capim communities from approximately 1988 until the present. During the initial decade, only a few adult trees were extracted from a limited number of species.
- There is an irreversible point after which a forest does not readily recover from losses due to logging. In 1997 in the Capim region, a large number of trees from a variety of species were extracted and then an accidental fire burned one-quarter of the area surrounding the communities. After that, fruit consumption dropped significantly.
- To evaluate the costs and benefits of selling wood, communities and industries need ecological, economic and cultural information. In addition, villagers need planning and training to manage their forests for lowest impact and multiple uses.
- In addition to market values, it is important to consider the local importance and invisible income of non-timber forest products (fruit, game, medicine and vines).

Tree, alqueire or cubic metre?

If a community or individual plans to sell timber, what is the best way to go about it? Is it preferable to sell by the tree, by alqueire (4.8 hectares) or by cubic metre? Remember that if a villager sells wood by alqueire, a logger can take out as many trees as he wants. Generally, loggers extract between 25 and 50 trees when the timber deal is selective and up to 200 using conventional methods.

Selling timber by tree rather than by area gives a greater measure of control to communities over what is harvested. Selling timber by cubic metre is more profitable, earning many times what could be made by alqueire. Using the example of what people from the Capim River were paid by loggers, we can determine which method is most lucrative. In the mid-1990s, the price for a tree when sold per alqueire varied between US$2 and US$6 (US$100–150 total per alqueire). At the time, individual trees were being sold for between US$11 and US$27. Whereas, selling wood by cubic metre to a sawmill, it is possible to make between US$21 and US$48/tree (US$7–16/m³).

The value of a tree depends on the type of sale: Capim River region 2002

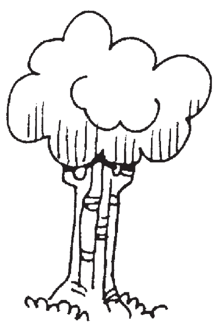


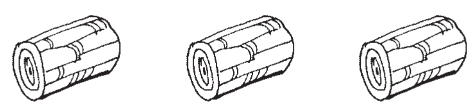
Value of 1 tree sold by alqueire: US$1–2.50

Value of 1 tree sold individually: US$4–11

Value of 1 tree sold per cubic metre: US$9–19

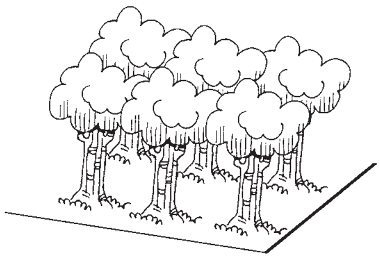
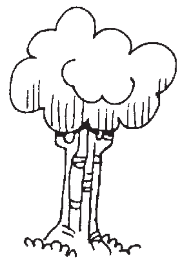
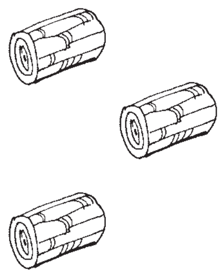
Reviewing these prices, it is clear that a producer can earn more selling timber by tree and by cubic metre than by alqueire. In Pará, communities feel pressured to sell by alqueire. In Mato Grosso, on the other hand, they often sell by cubic metre, valuing the product and earning more.





When broken down mathematically, the difference in price is clearly significant. In 2004, one piquiá tree went for US$1 when sold by alqueire. When it was sold individually, the price jumped by more than 400% to US$4 per tree. When a piquiá tree was sold by cubic metre, it earned approximately US$9 (US$3/m^3), 900% more than if it were sold by alqueire. In the case of maçaranduba, the difference is even more extreme. One maçaranduba tree was worth US$1 when sold by alqueire; individually it was worth US$7; and finally when it was sold by cubic metre it fetched US$12 (US$4/m^3).

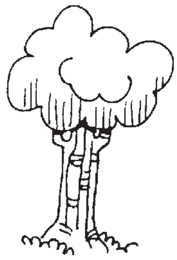
Prices of trees sold by the community, Paragominas, 2004

	Value of 1 tree sold per alqueire	Value of 1 tree sold individually	Value of 1 tree sold per cubic metre
Piquiá	US$1	US$4	US$9
Maçaranduba	US$1	US$7	US$12
Ipê-roxo	US$1.50	US$8.50	US$15

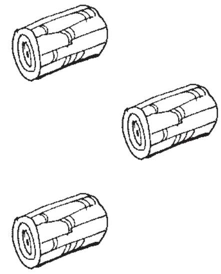
It is useful to try to find out how much sawmills pay for each species and how much they sell wood for after it has been sawn. One maçaranduba tree is purchased in the Capim region for US$1.40. The logger resells it to the sawmill in Tomé-Açu for US$51, or US$17/m^3. Real costs will discount extraction, transportation and management expenses, reducing net profit by half to about US$8.50/$m^3$.[13]

Gross earnings per maçaranduba tree sold in 2004



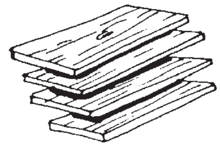
US$1.40

Sold by community



US$51

Sold by logger



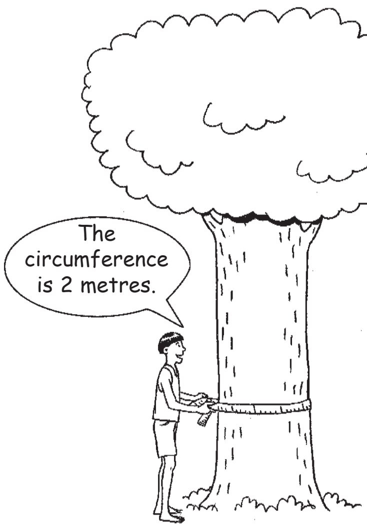
US$510

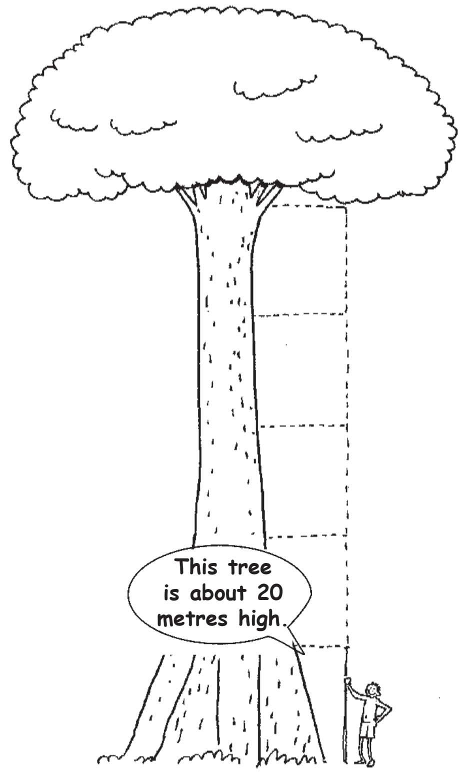
Sold by the sawmill

Caboclos learn the language of loggers

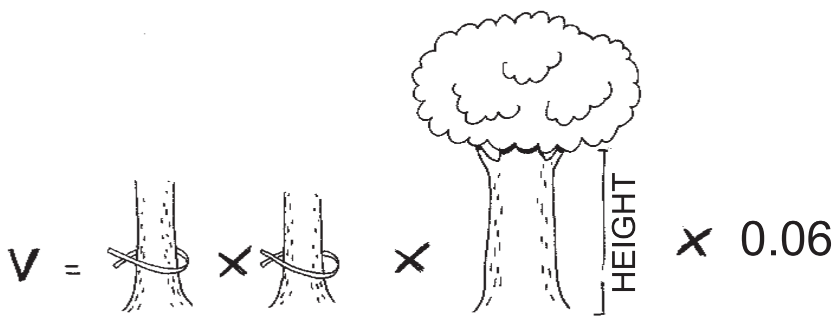
André Dias and Marli Mattos

To find out the amount of wood a tree contains, loggers calculate its volume in cubic metres. In order to negotiate effectively with a logger, communities need to learn the language of logging. To calculate the volume of a standing tree, loggers use a geometric volume equation similar to the volume of a cone, which takes into account the tapering nature of the tree's trunk. For the equation, you need to know the distance around the tree (its circumference) and its height. The circumference is measured at chest level (approximately 1.3 m from the ground) using a metric measuring tape. If the tree has low buttress roots, it is better to measure the trunk just above them. If the tree has high buttress roots, you just have to eye it. The length of the trunk can be estimated using a 4-m stick. As planks sawn at the mills are about 4 m long, it's possible to calculate how many 4-m planks you can get from the trunk. Just hold the stick alongside the trunk to estimate how many times higher the tree is than the stick. The height and circumference should be calculated in metres.





If you know the circumference and the height of the tree, it is easy to calculate its volume. Just multiply the terms using the formula below:[14]



For example, a tree that is 2 m around and has a 20-m long trunk has 4.8 cubic metres of timber:

Volume = circumference x circumference x height x 0.06
Volume = 2 x 2 x 20 x 0.06
Volume = **4.8 cubic metres**

The volume of cubic metres in a tree can also be calculated using the table below. To use the table you need to locate the tree's circumference in the top row of the table and then locate the tree's height in the first column. Then simply connect the circumference's column with the height's row to find the number of cubic metres of the tree.

CIRCUMFERENCE

HEIGHT	1.4	1.6	1.8	2	2.2	2.4	2.6	2.8	3	3.2	3.4	3.6	3.8	4	4.2	4.4
4	0.5	0.6	0.8	1.0	1.2	1.4	1.6	1.9	2.2	2.5	2.8	3.1	3.5	3.8	4.2	4.6
6	0.7	0.9	1.2	1.4	1.7	2.1	2.4	2.8	3.2	3.7	4.2	4.7	5.2	5.8	6.4	7.0
8	0.9	1.2	1.6	1.9	2.3	2.8	3.2	3.8	4.3	4.9	5.5	6.2	6.9	7.7	8.5	9.3
10	1.2	1.5	1.9	2.4	2.9	3.5	4.1	4.7	5.4	6.1	6.9	7.8	8.7	9.6	10.6	11.6
12	1.4	1.8	2.3	2.9	3.5	4.1	4.9	5.6	6.5	7.4	8.3	9.3	10.4	11.5	12.7	13.9
14	1.6	2.2	2.7	3.4	4.1	4.8	5.7	6.6	7.6	8.6	9.7	10.9	12.1	13.4	14.8	16.3
16	1.9	2.5	3.1	3.8	4.6	5.5	6.5	7.5	8.6	9.8	11.1	12.4	13.9	15.4	16.9	18.6
18	2.1	2.8	3.5	4.3	5.2	6.2	7.3	8.5	9.7	11.1	12.5	14.0	15.6	17.3	19.1	20.9
20	2.4	3.1	3.9	4.8	5.8	6.9	7.3	9.4	10.8	12.3	13.9	15.6	17.3	19.2	21.2	23.2
22	2.6	3.4	4.3	5.3	6.4	7.6	8.9	10.3	11.9	13.5	15.3	17.1	19.1	21.1	23.3	25.6
24	2.8	3.7	4.7	5.8	7.0	8.3	9.7	11.3	13.0	14.7	16.6	18.7	20.8	23.0	25.4	27.9
26	3.1	4.0	5.1	6.2	7.6	9.0	10.5	12.2	14.0	16.0	18.0	20.2	22.5	25.0	27.5	30.2
28	3.3	4.3	5.4	6.7	8.1	9.7	11.4	13.2	15.1	17.2	19.4	21.8	24.3	26.9	29.6	32.5
30	3.5	4.6	5.8	7.2	8.7	10.4	12.2	14.1	16.2	18.4	20.8	23.3	26.0	28.8	31.8	34.8

Volume of wood in management plans

Natalino Silva

Forest engineers calculate the volume of standing trees for forest inventories using a formula with constants specially designed for the tree species being harvested. It is called geometric volume, and it is used by IBAMA, the Brazilian Environmental and Renewable Resource Institute, as a basis to determine authorizations for loggers seeking permission to harvest wood.

When the trees have already been cut and transformed into logs, their volume can be calculated in one of two ways: the cylindrical volume or the Francon volume. The cylindrical volume is calculated on the deck holding the cut logs to estimate volume harvested. The logs are measured as if they were cylinders. In this case the circumference is measured in the centre of the log.

In contrast, the Francon volume tells you how many cubic metres (transformed into planks) can be obtained from each log. In this method, all parts of the trunk that are not used by the mill are discounted, including the bark and any internal defects (such as knots and rot). The accounting of logging operations done by IBAMA uses the Francon method.

Francon volume

Francon volume is roughly 78% of cylindrical (or geometric) volume. To transform the cylindrical volume (Vc) into Francon volume (Vf), just multiply the cylindrical volume by 0.7854, as shown in the formula: Vf = Vc x 0.7854

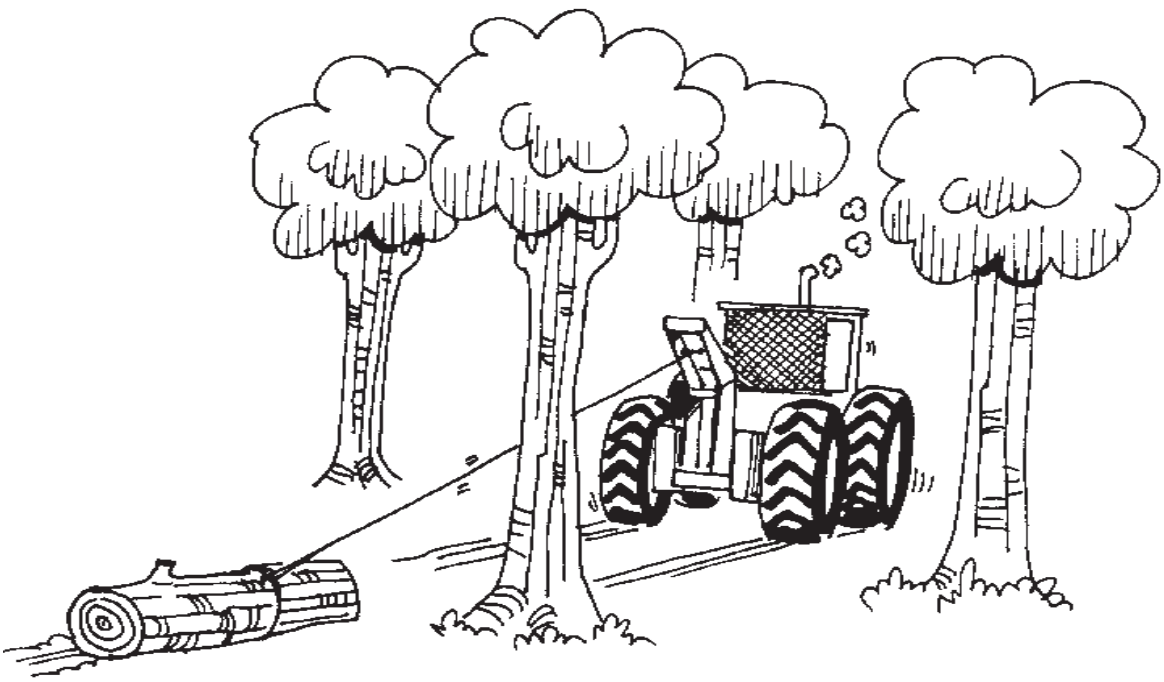
For example, a tree with a cylindrical volume of 4.8 would have:

Vf = 4.8 x 0.7854

Vf = **3.77** cubic metres of wood planks.

Tips for negotiating the sale of wood

- Research the prices. In 2003, the Capim communities sold the right to log on their lands for US$33/alqueire (US$7/ha).
- Identify and mark the useful trees that should not be taken out (fruit trees, game-attracting trees and those which supply oils and resins).
- Create a forest reserve based on the density and distribution of useful trees and the presence of game. Mark and show the boundaries of the reserve to the logger.
- The logger should contract a forest engineer to oversee the operation. The engineer makes a map based on the distribution of trees he or she plans to harvest and creates a management plan based on this map, showing where the roads and the clearings should be. This practice avoids the opening of unnecessary roads that destroy a larger area of forest.
- Sell wood only to loggers that remove logs with a skidder instead of a tractor. Skidders that use a cable system are able to remove logs without getting close to the area where they fell, causing less damage to the forest.
- Ask the logger to build a road after the harvest. This is more likely to happen if you ask before the last load of wood is extracted.
- Insist on being paid on a specific day and renegotiate if the work takes longer than one year.
- Accompany the extraction and note the volume that is being extracted from the forest.
- Have a written and signed contract that includes all of the important points.



"He tricked me!" It happens all over the world

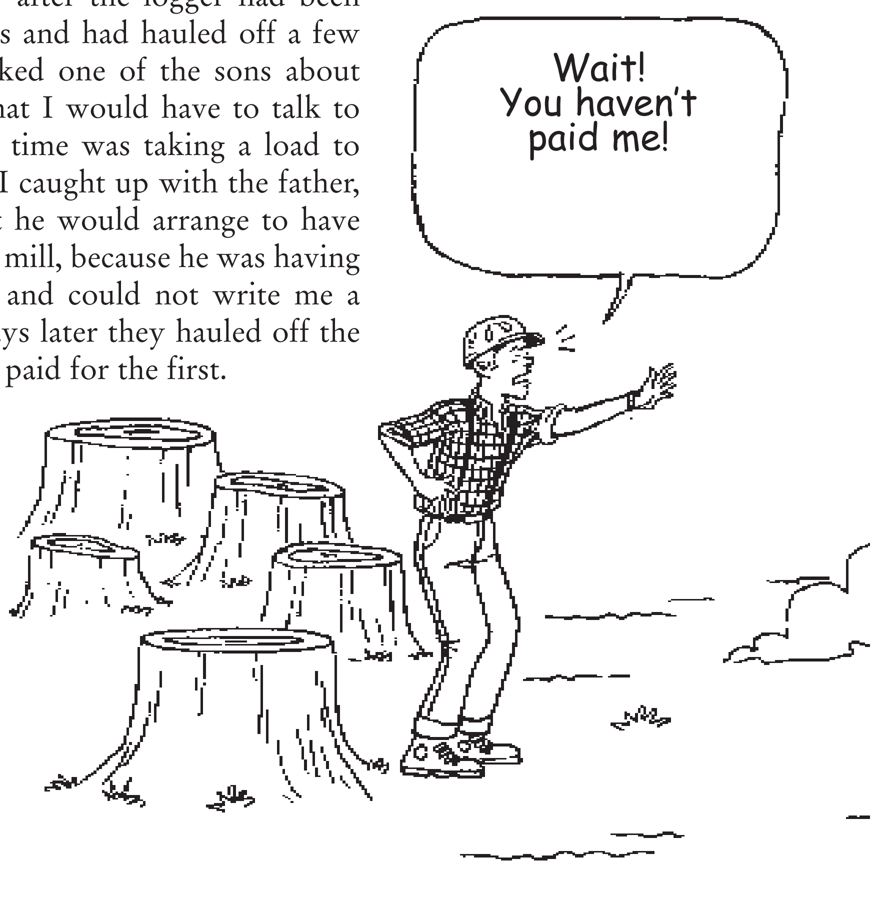
Francis E. Putz

This autobiographical story by a well-known forester shows how easy it is to be fooled all over the world.

As a forestry researcher and ardent advocate of forest management for conservation and income generation, it does my reputation little good to admit that in selling timber from my own property, I was cheated not once, but twice. Granted that my second venture into timber marketing failed for different reasons than the first, but in both cases I did not receive all of the income I deserved. What makes these experiences even more painful, is that close colleagues have written extensively on marketing timber, but I did not take advantage of their readily available publications on the topic.[15]

I own about 50 hectares of pine-dominated forest outside Gainesville, Florida. Early in 2000s an outbreak of Southern pine beetles threatened my unthinned stands, so I hired a local logger to harvest some pulpwood logs. When we met to negotiate the deal, the logger drove up in one of the most dilapidated pickup trucks I have ever seen. I had considered asking him for an advance or to post a performance bond, but did not bother given his obvious financial limitations. We agreed that he would pay me for the timber as he sold the logs to the mill. About a week later he returned with his two sons in another beat-up old truck, this one with a winch for loading logs. I was occupied with teaching at the time and could not supervise the logging operation very closely.

I started to wonder about when I was going to be paid for my timber after the logger had been working for a few days and had hauled off a few truckloads. When I asked one of the sons about getting paid, he said that I would have to talk to his father, who at that time was taking a load to the mill. The next day I caught up with the father, who promised me that he would arrange to have me paid directly by the mill, because he was having trouble with his bank and could not write me a check himself. Two days later they hauled off the last log without having paid for the first.

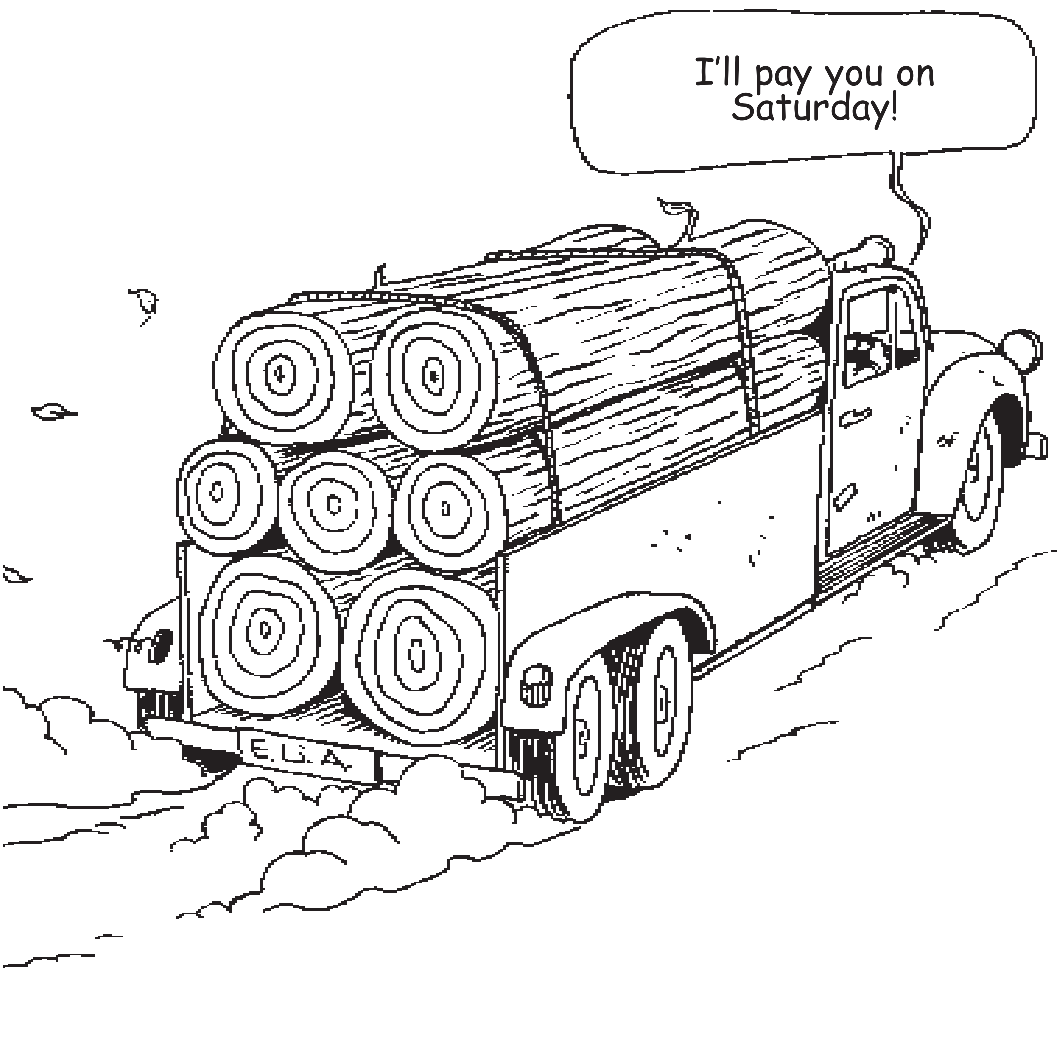


Realizing that I was unlikely to be paid unless I took some action, I considered the courses of action open to me. Unfortunately, the best approach I came up with was to hire a lawyer and take the logger to court. Because lawyers cost a lot of money and I could not expect to get much from the logger anyway, I decided that I would accept the loss and learn from my mistake.

In 2003, it was dry again and the beetles were on the rampage, so despite low prices for saw timber and pulpwood, it was time to hire another logger. This time I chose to hire a more reputable company. Because the market was bad and getting worse, no loggers in my region were willing to buy timber in advance, so again I was locked into a pay-as-cut deal. This time I was careful to cordon off areas that I did not want the logger to enter and flagged trees that I wanted protected during felling and extraction operations.

Unfortunately, my elaborate environmental protection requirements, which made it more difficult to log, coupled with plummeting pulpwood prices resulted in my contractor going elsewhere for his logs. He paid for what he hauled off site and followed the guidelines I set, but ended up harvesting only about half of what I needed to be removed, which meant that my profit was much lower than expected.

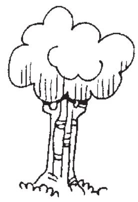
What these experiences taught me is that arranging timber sales is not a trivial undertaking and that there are a multitude of ways a deal can go sour. In the future, I will follow the advice available on various web sites[16] or hire a professional to broker the deal.



Helpful hints on how to sell your fruit

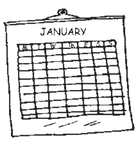
When you negotiate a good timber sale, you can conserve the fruit and oil trees that are useful to your family. As it isn't easy for producers who are far from the market to sell their fruit, let's have a look at some tips from communities who have learned from trial and error how to make a good sale.

Select and protect



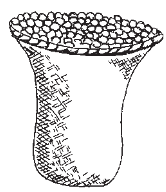
Identify the fruit trees that the community likes best and that produce well. When you know a tree is going to produce a lot, clear the brush out from beneath the tree so that you will not lose any fruit.

Pay attention: production varies



Fruit trees often rest on alternating years. Remember where they are, and be aware of their cycles of production so that you can plan to collect, eat and sell during productive seasons. Making note of the flowering of your trees will help you remember when they will come into season. If you have trees that produce between seasons, you can often get a better price (2–6 times higher).

Packaging

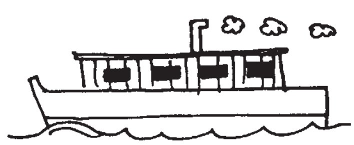


After you collect and carry a bunch of heavy and perishable fruit, think carefully about how you will package them to take to market. If you throw all the fruits in a sack, they can easily spoil. Use a sack only for the fruits with a thick rind. For the others, use ventilated containers such as baskets.

Research the price and join a cooperative

Research the market prices so that you don't end up losing money. And to get a good spot at the market, be sure to get there early. In addition, if you sell your products together with your neighbours or in the cooperative, it is possible you will earn more.

Transportation



For many communities, reaching the market is difficult. The fact that the harvest often takes place in the rainy season makes matters even more complicated. That's why it is important to plan well before the harvest. Negotiate with people who have transportation (boat owners, mayors, loggers and ranchers). Allow for extra travel time due to mud and bad weather.

Profits for partying or paying the bills?

If you send someone to sell your product in the market, make sure you know whom you are dealing with. If he or she is not a trustworthy person, you may see your profits quickly transformed into a bottle of booze.

Processing: make more money

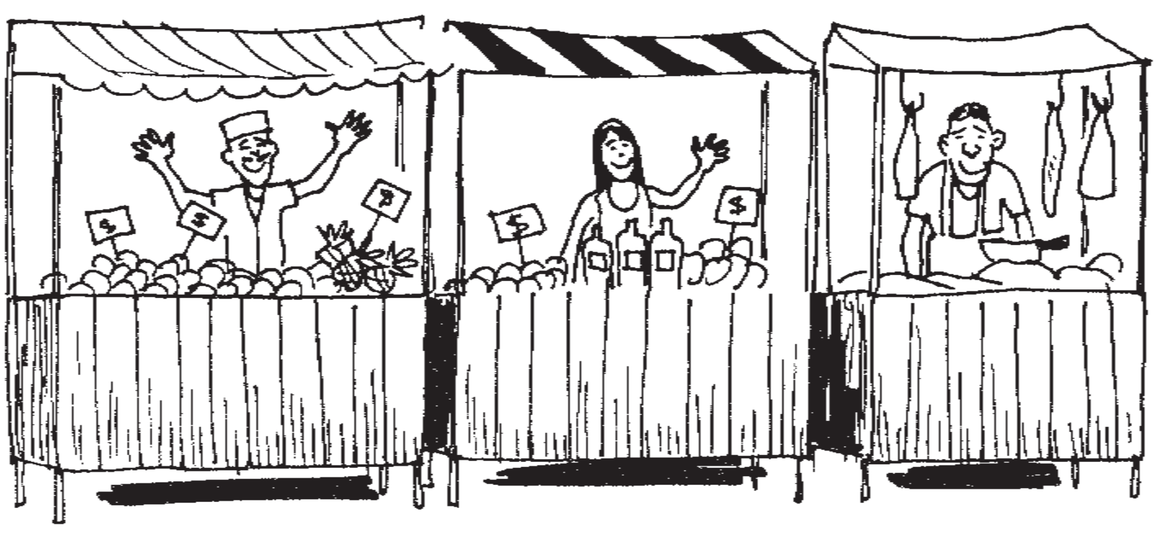
Do you want to increase your profit from fruit? Make sweets , jam , frozen ice treats, pulp or soap. The more products you make, the more you may earn. But remember: to make these products you first need to train people well in hygiene and quality control and consider issues such as storage and preservation.

Green seal

Various seals of quality exist which guarantee to the consumer that your product was made in a sustainable way adhering to rigorous standards of quality. This can increase demand for your product and, subsequently, your profit. Adherence to the standards of certification is often more easily accomplished if the producers are organized into cooperatives or associations.

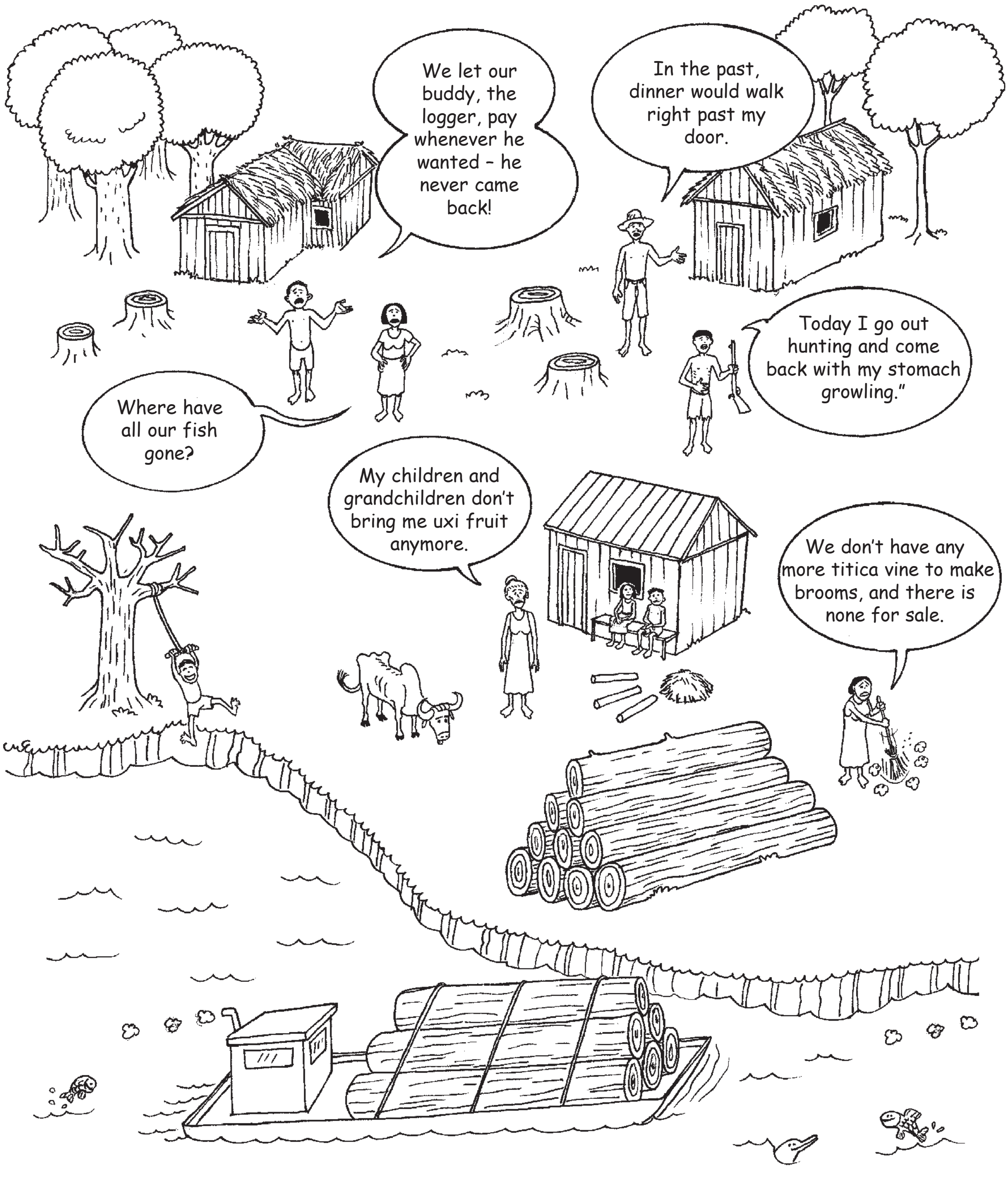
Diversification – less risk, more gain

When the fruit seasons are over, what then? A few women hold onto the pulp, sweets and jam to sell between seasons. In addition, they make home remedies, products from vines and hammocks, all for sale. Instead of dividing the total profit between them, some prefer to use at least 20% for the association to buy more primary material (fabric, line, fruit, etc.). They are intelligent: they are following the rules of big businesses – diversify to run less risk and earn more money.



As a farm woman from the Tocantins relates: **"The best way to save money for the whole family is being able to eat without having to go to the store."**

Ten years later:
Communities reflect on their timber sales



Capim Region, community members (Dona Ana Mendes, Benedito de Souza, João Brito, José Maria Pantoja)

Contract for selling wood

Date
Period of extraction (beginning and end)
Boundaries of the area to be logged
Number of trees to be extracted
Number of hectares or alqueires to be logged
Trees that cannot be cut
Form of payment (amount of down payment and the other instalments)
The complete name of the buyer, ID number, telephone number and address
Name of company
Signature of two people from the community (witnesses)
Always remember to keep a copy in a safe place.

1 Schmink, M. & Wood, C.H., 1992
2 Simmons *et al.* 2007
3 Nepstad, D.C.; Stickler, C.M. & Almdeida, O.T. 2006
4 Nepstad, D. *et al*. 2004
5 Cochrane, M.A. & Laurence, W.F. 2002 / Nepstad, D. *et al.* 1999
6 Vieira, I.; Nepstad, D. & Roma, J.C. 1996
7 Medina, G. 2004
8 Shanley, P.; Luz, L. & Cymerys, M. 2002
9 Johns, J.; Barreto, P. & Uhl, C. 1998
10 Nepstad, D. *et al.* 1999
11 Martini, A.; Rosa, N. A. & Uhl, C. 1998
12 Shanley, P. & Rosa, N. 2004
13 Amaral, P. *et al.* 1998
14 Mattos, M.; Nepstad, D. & Vieira, I.C. 1992
15 Demers. C. & Long, A. 2006
16 Savelle, W. & Eshee, W.D. 2002

Multiple-use management

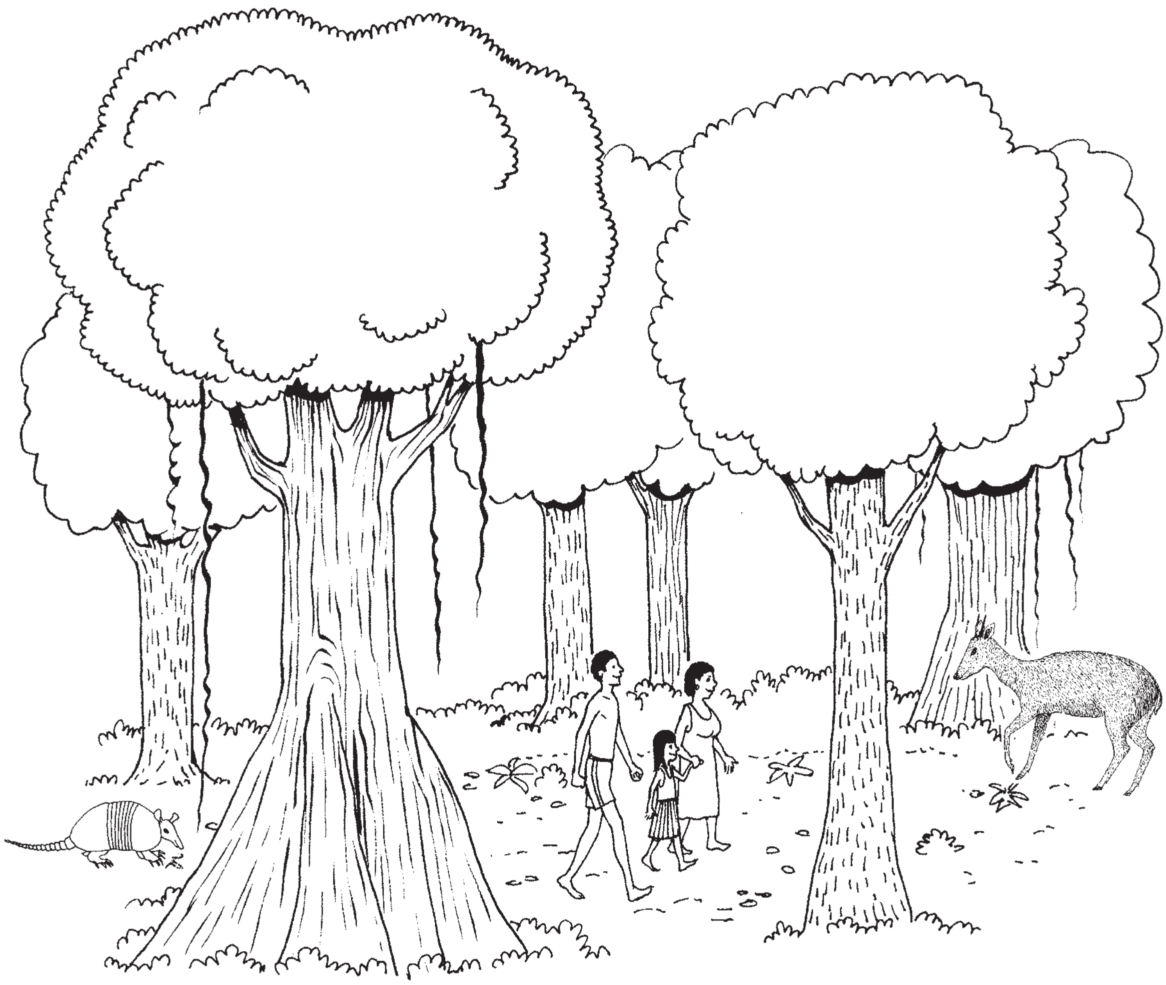
Murilo Serra
Gabriel Medina

Managing the forest means using it with care. Many rural communities, especially traditional ones, have a long history of using their forest management skills and practices to guarantee the availability of certain resources. Community forest management should generally encompass the multiple uses of the forest and take into account the diversity of forest resources, including not only wood but also fruit, fibre, game and medicinal plants, collectively known as non-wood forest products (NWFPs).

Community forest reserves

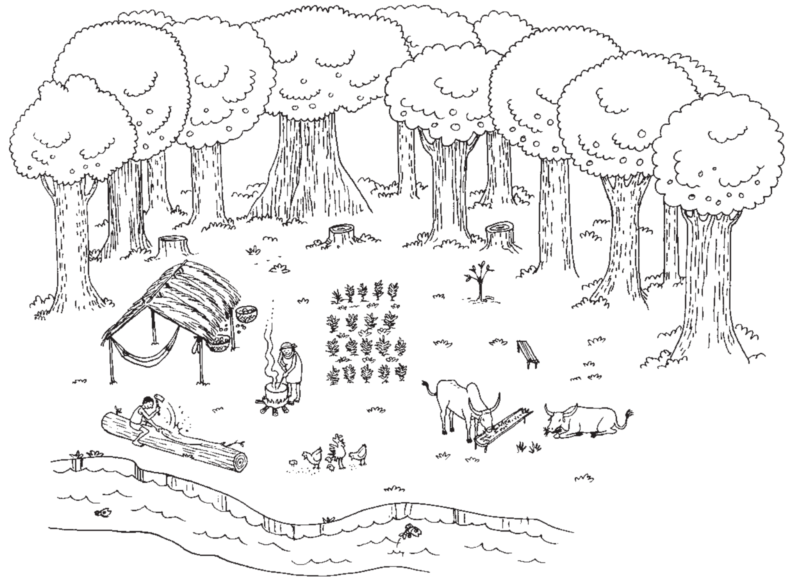
A few communities and ranchers put the needs of their families first and create forest reserves where game can reproduce. By creating reserves, they guarantee the good nutrition of their grandchildren and great-grandchildren. They have not sold their forests for short term gain because keeping the fruit trees ensures that no one will go hungry. Having a community forest is like having money in a savings account: its value always goes up.

Forest reserves are of greater value to a community if the people know what kind of trees and animals live there. To maintain a community forest, it is necessary to establish a few rules about the use and management of its resources, such as whether to allow logging or where to place shifting cultivation plots. Part of the land can be set aside as a forest reserve for the reproduction of plants and animals, where limited or no extraction takes place. To ensure fruit production, an area with a high number of fruit trees favoured by the community and animals can be set aside. To maximize the reproductive potential of reserves, it is useful to plan carefully and to choose an area connected to other forests, creating a corridor that permits the movement and reproduction of wildlife.



A dynamic reserve

M. Almeida, E. Costa, S. Dewi, M. Pantoja,
A. Postigo, A. Puntodewo, M. Ruiz



The first extractive reserve, created in Brazil in 1990, was the Extractive Reserve of Alto Juruá, in Acre, with half a million hectares and approximately 5 000 people. Rubber has been their principal cash crop for the last 100 years. The crash in rubber prices, however, challenged the local population's livelihood. In response, they developed new sources of income to supplement the subsistence income they have always earned from farming and extractivism.

During the 1990s, part of the population moved to the centre of the reserve, where the concentration of rubber trees is greatest along the margins of the rivers. The movement of the population resulted in greater pressure on the forest along the riversides and a decrease in pressure in the terra firme areas. Altogether, deforestation in the reserve has reached only 0.2%, and 98.5% of the reserve has maintained its forest cover.

By 2004, only 21% of families harvested rubber. This shift has resulted in a decrease in rubber production by 82%. Among the new sources of income are NWFPs, such as soap made from murumuru, bags and clothes made of natural rubber and brooms made from piaçava. In addition, beans grown along the margins of the rivers have replaced rubber as the primary cash crop. Forty-one percent of families are involved in the rearing of cattle, with, on average, two cows/family. However, a small number of residents have gathered their herds and created ranches in the interior of the reserve.

Municipal salaries, pensions and administrative positions in the reserve are transforming the local economy, contributing to greater stability for families. Following global trends, the economy of the reserve is shifting from the agricultural sector to the service sector.

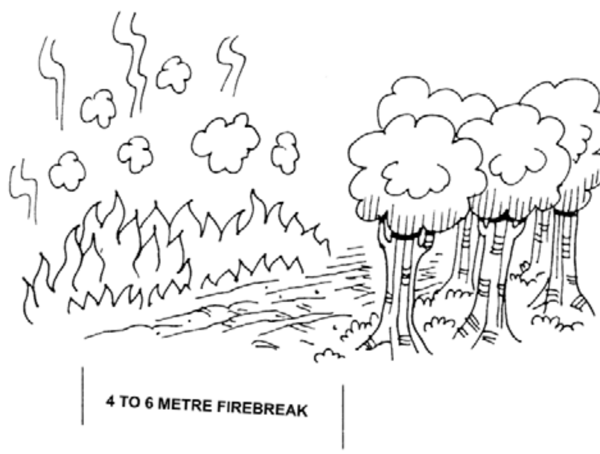
During the first decade of the reserve, the community adapted to changing economic conditions, keeping a relatively stable population and maintaining forest cover. New trends will bring new challenges for the residents of the reserve. Among these are the expansion of cattle ranching, the increased presence of the state, political changes and the influence of other countries.

João recreates a forest

Unfortunately, for some communities it is too late for a reserve: they don't have any forest left. People are living in the middle of the scrub without maçaranduba to make shingles, bacuri to eat or tortoises to capture. This happened to Senhor João Paulo. He lived on a beautiful farm with Brazil nuts, mangos, cashews and bacaba, but one day he received a visit from a rancher, and guess what happened? João sold his farm and moved with his family into the shrublands, with no trees and no water. But even at 60 years old, João was on top of things and started planting again. He enriched the secondary forest with trees that produced fruit, resins, wood and other valuable products, both for his family and for the market. Today, he has trees like ipê-roxo, mururé, cedro, sucupira, ameixa, graviola, uxi, piquiá and many other species.

Tips for protecting a forest

Firebreaks



About 12% of the Amazonian forest was destroyed by deforestation and fire between 1970 and 2002. In addition to the huge loss of plant and animal life, the burning causes local fluctuations in temperature and rainfall patterns, and contributes to global climate change. Hence it is increasingly important to create barriers against fire. To create a firebreak, you must clear all the vegetation from the forest floor along a strip. Anything that could possibly catch fire, like trees, bushes, dry branches and grass, must be removed. Because there is nothing to burn in the firebreak, the fire should stop when it reaches it. Generally, barriers are from 4 m to 6 m wide. The wider they are, the lower the risk of fire jumping the firebreak and spreading into the forest. In planning when and how to burn your fields, pay attention to the air temperature, the force and direction of the wind, the time of year the burning takes place, the kind of vegetation and the inclination of the terrain, in addition to respecting any agreements you may have with your neighbours.

Agricultural fields in the capoeira

Remember to plant your fields in the secondary forest. In this way you avoid destroying the more valuable primary forest. Using the secondary forest is a wise way of reducing deforestation while obtaining useful products. But be careful with the fire: burning a field for planting in secondary forest is like dropping a match on gunpowder.

Managing secondary forests can yield good fruits

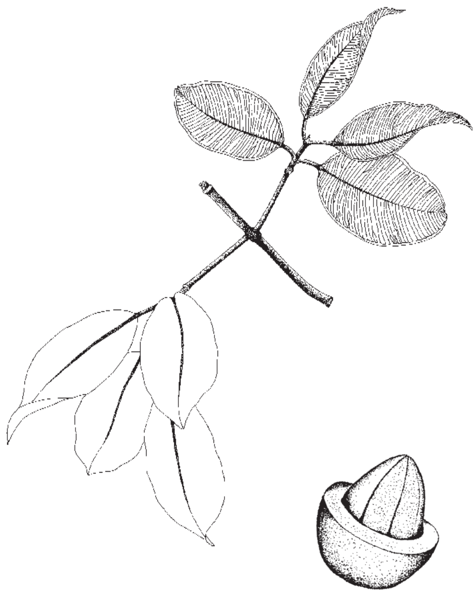
Socorro Ferreira, Marli Mattos and Cesar Sabogal

Secondary forests generally grow on agricultural fields left fallow after cultivating the soil for crops. The farmer allows the forest to grow back so that the ground can rest and recuperate for 4–10 years, when it can be cultivated again. While the secondary forest is "resting the earth," it serves many useful purposes: producing wood for houses, boats, fences and pigsties; keeping the air cool; and sheltering birds like tinamous and quail-doves and many other animals including paca, armadillos and agoutis.

Many farmers also leave part of their property as forest reserves, allowing the forest to fully mature and thereby offer more products. Research conducted in the northeast of the state of Pará revealed that more than 20% of secondary forests on farmers' lots are middle to advanced in age. Secondary forest more than ten years old can be managed to encourage the production of favoured species useful for construction and valuable for fruit, medicine, fibres and resins.

Some of the species encouraged in secondary forests managed by agricultural families are:

- ***Medicinal uses***
  - Açoita cavalo (*Lueheopsis duckeana*)
  - Paricazinho (*Stryphnodendron guianense*)
  - Sucuúba (*Himatanthus sucuuba*)
- ***Wood for various uses***
  - Amaparana (*Thyrsodium paraense*)
  - Anani (*Symphonia globulifera*)
  - Cumaru (*Dipteryx odorata*)
  - Cumatê (*Myrcia atramentifidera*)
  - Cupiúba (*Goupia glabra*)
  - Ingá vermelho (*Inga alba*)
  - Jarana (*Lecythis lurida*)
  - Louro prata (*Ocotea guianensis*)
  - Parapará (*Jacaranda copaia*)
  - Pau jacaré (*Laetia procera*)
  - Sapucaia (*Lecythis usitata* var. *paraensis*)
- ***Edible fruits***
  - Bacuri (*Platonia insignis*)
  - Bacuripari (*Garcinia (Rheedia) macrophylla*)



Bacuri is one example of a tree species that can be managed in secondary forest. When natural regeneration begins, knowledgeable farmers select the more vigorous bacuri saplings and thin the surrounding vegetation. When the secondary forest is formed, farmers eliminate the plants and vines competing for light and nutrients with the desired bacuri saplings. By giving bacuri sufficient room to grow, the young trees can develop straight trunks and form canopies.

By managing the secondary forest, farming families can develop and produce desirable plant species more quickly, making useful products available for consumption and sale in local and regional markets.

Benefits of plants in secondary forest

Montserrat Rios

Scientists estimate that 30% of forest cover in Amazonia is now secondary forest. In the northeast of Pará , after a century of swidden agriculture, secondary forest represents the predominant vegetation in the region. Ecological and ethnobotanical research reveals that, historically, secondary forest has been used by many human populations that lived in Amazonia. Secondary forests at various stages of growth are capable of providing plants for nutrition, medicine, construction and fuel, helping with the daily sustenance of families.

A study in the community of Benjamin Constant, in the municipality of Bragança, in Pará, shows that the families of small farmers know and use approximately 135 species from secondary forests. These many plants provide a variety of useful products. Amapá (*Parahancornia fasciculata*), for example, produces latex which is used in the treatment of anaemia, worms, liver diseases, diarrhoea, stomach inflammation, and gastritis. In addition to its medicinal power, amapá's high-quality wood is used in construction. As the extent of secondary growth increases, it is important to encourage research about the potential of plant products found in secondary forests, developing sustainable management programs for these areas and disseminating scientific knowledge to communities in practical and productive ways.

New uses for dead wood

Antônio José , David McGrath and Charles Peters

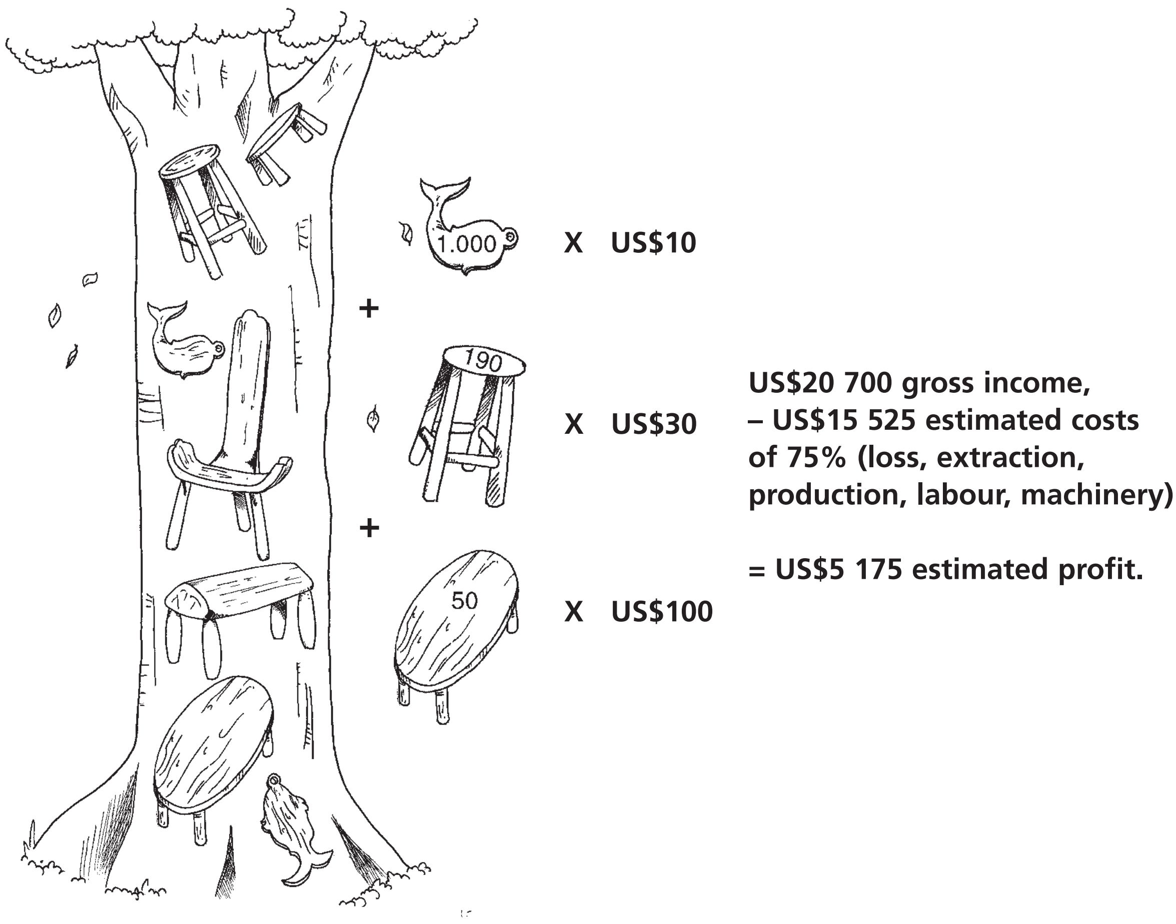
On the margins of the Tapajós River, in Pará, artisans have formed six community workshops that make use of the wood of downed trees from forests and agricultural fields to create simple, rustic furniture (benches, chairs and tables) that brings out the natural beauty of Amazon hardwoods. The defects and variations in the wood are incorporated into the furniture's design, contributing to the unique beauty and utility of each piece. The artisans have formed a cooperative, Oficinas Caboclas do Tapajós (Caboclo Workshops of the Tapajós), which now has over 50 members.

Groups began using dead wood to avoid felling trees from prospective community reserves until a management plan could be put into action. To develop management plans for sustainable extraction of wood from community forest reserves of 100 and 200 ha, the artisans inventoried a wide variety of tree species. Forest inventories were conducted to determine the number and location of commercial size trees and the volume of timber for each of some 40 species or species groups, though in practice most groups use only part of this diversity. The artisan groups also monitor the growth of each species of tree to determine the volume of wood that can be taken out without affecting the original stock.

Installed in simple sheds, artisans use saws, hammers, chisels, planes and chip axes to carve stools, benches, chairs and tables. Each workshop produces an average of 80 pieces per year. For each large tree (with about 3 m^3 of wood) they can produce about 1 000 cutting boards, 190 stools, and 50 coffee tables. Many of the bench designs are based on animals from the surrounding forests and rivers, such as peccaries, caiman, anteaters, boa constrictors, and aquatic species such as river turtles, pirarucu, tambaqui and stingrays. Artisans are also using titica vine, to weave seats for benches and shelves for coffee tables. In 2008, the price of the pieces varied from US$10 per carving board to US$177 for a large animal bench. The following diagram shows how one tree may generate the equivalent of US$10 if sold to a logger or the profit that can be generated from working one dead tree of 3 m^3 into cutting boards, benches and coffee tables.

Increasing value: one tree can generate either US$10 or US$5 000

Tree of 3 m^3



Because the workshops use only small volumes of timber, 3-6 m^3 per year, forest reserves provide far more timber than they currently need, there is great potential for expanding production in response to demand. The limited volume of timber combined with the use of simple, readily available hand tools means that this system is well suited to the rural conditions of traditional peoples surrounded by primary forest and even colonists whose forests have been exploited by commercial loggers. In fact, exploited forests provide an abundance of useful wood because the kinds of trees that loggers reject: hollow, split or twisted, are the most interesting from the artisan's perspective. As a result, this approach is being adopted by caboclo and colonist communities throughout the region.

What is certification?

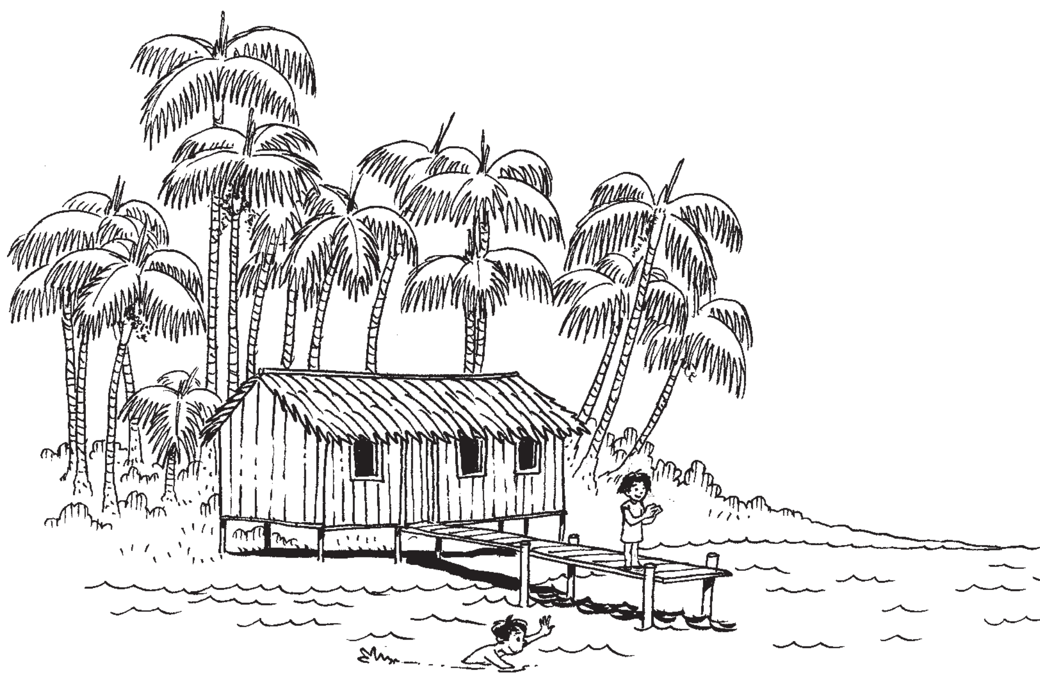
Tasso Rezende de Azevedo

When people buy forest products, they like to know that they are helping to conserve the forest in addition to supporting small producers. Perhaps the consumer could be assured of this by visiting the production site. However, it is impossible for consumers to visit all of the factories and workplaces where the various products they purchase are made and where the raw materials are collected. And even if they could visit the production sites, many people still wouldn't know whether or not the purchase of a certain product benefited a community or promoted forest conservation.

The certification system was created to help the consumer make good decisions at the time of purchase by guaranteeing that a product was made in a sustainable manner. In this system, a third-party independent team goes to a producer and evaluates the work that is being done. The team determines if the company is following the norms of sustainability that were developed by a working group involving consumers, producers, technical organizations, unions, companies, governments and researchers.

If the producer complies with these regulations, he or she receives a certification that permits him or her to put a seal on the product. The seal guarantees buyers that the product was constructed or extracted following the rules of good forest management. There are three main kinds of certification for NWFPs.[1]

- The Forest Stewardship Council (FSC) certification guarantees that the forest and harvest is being sustainably managed, the producers are benefiting from the sales, and the production is able to continue over the long term.[2]
- Organic certification guarantees that the products are grown without the use of pesticides or chemical fertilizers thus are not contaminated by agrotoxins generally making them healthier.
- Fair trade certification ensures workers' rights, decent working conditions and an equitable sharing of profits among producers.



Certified products

On the island of Marajó, in Pará, a food company works together with the riverine community to produce açai (both heart of palm and pulp) using sustainable management techniques. Sustainable management guarantees that the harvesting of heart of palm and the production of açai pulp can be maintained, using a form of extraction that does not destroy the forest. Furthermore, it benefits the producers. Saying that a product is certified by the FSC means that it "comes from forests that are managed to meet the social, economic and ecological needs of present and future generations".[2]

Management of açaí on the island of Marajó

The açai palm is the main source of nutrition for the families of Marajó Island. For many years, however, the açai palms were threatened by excessive cutting of palm stems for heart of palm production. Care was not taken to see that new palms grew to replace those that were harvested. In response, communities and companies jointly developed a management plan to extract only a number of stems from each palm cluster, allowing the palm to continue to produce. In this plan, palm stems are harvested every four years. In each harvest, only the adult stems are taken, leaving the young ones to grow for future harvests and to produce fruit to establish new palms. Using this system, the fruit can also be collected every year to be consumed and marketed by the community.

This system of management has transformed many forests into plantations of açai, causing shortages of other valuable products such as medicinal plants, game, fronds and oils. To avoid the loss of biodiversity, companies and communities are working together to maintain a minimum and maximum number of açai palms/ha, so that other flora and fauna can continue to survive.

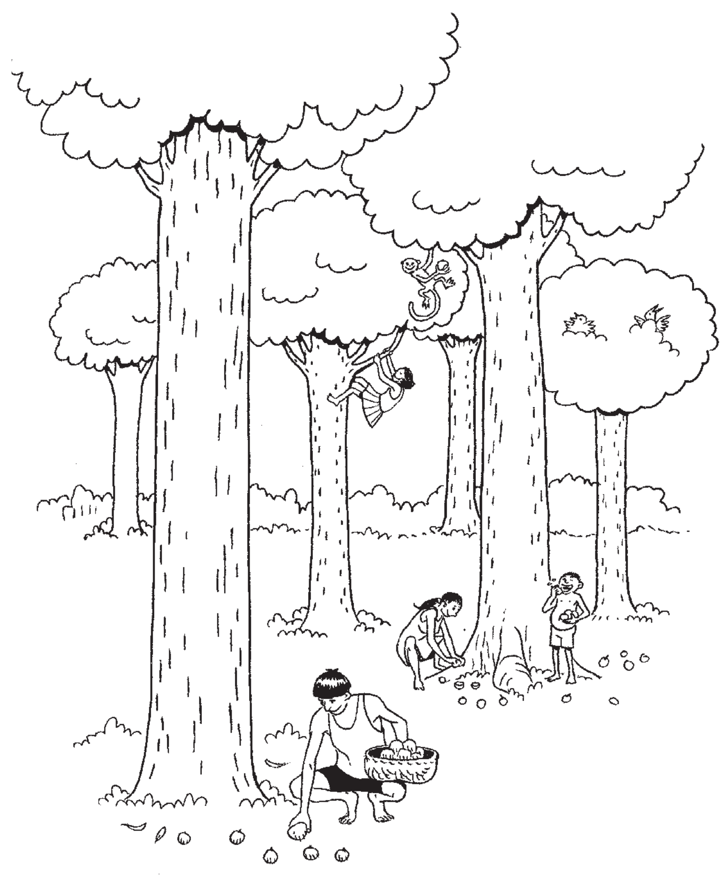
But it is no use to only take care of the forest; people also need to benefit from the conservation of forests and wildlife. A company must include in its business plan health care and education programmes for its employees, and for the people living adjacent to the managed forests. Unless businesses pay attention to social concerns and provide some services, it is difficult for them to receive FSC certification.

Managing the forest to fill the pocket and the belly

Paulo Amaral and Manuel Amaral Neto

The Amazonian forest is so big that, in the past, loggers, politicians and communities never imagined that it could one day disappear. Exploiting the forest with no thought to the future led to losses, both for small communities and big businesses. In the 1990s, the public, the government and researchers all began to realize that forests could be managed for the local consumption of goods and for the sale of forest products. Initially, the focus was on managing the forest for timber sales, but soon thinking shifted to multiple-use management.

In Amazonia, 18 formal Community Forest Management (CFM) initiatives with external financial support of a nationally developed project for the Amazon region existed by 2001.[3] Because of these initiatives, a great part of the forest in the region remained in the hands of populations that have traditionally managed it. In addition, other communities were already receiving project assistance from certain institutions. However, although numerous communities naturally practice multiple-use forest management, many new CFM projects still focus only on timber extraction. Among the obstacles to successful community management are: unfavourable public policies, lack of credit and weak technical assistance. In 2000, of the 14 projects that existed, 45% were planned by NGOs, 44% by donors and 11% by technical extension workers.[4] The difficulties are greatest when the inspiration for forest management comes from outside the community. The following table details the challenges and opportunities of community forest management. It is important to remember that in the process of establishing this type of management, both the government and the community have essential roles.



Opportunities and difficulties	Possible solutions
For communities *Opportunities* • Knowledge of the forest and interest in management • Labour available in the community • Assistance from NGOs *Difficulties* • Lack of local infrastructure for production and marketing • Low educational level and technical capacity • Limited knowledge of regulations	• Discuss and implement long-term proposals for CFM • Promote local capacity and strengthening of institutions • Recognize and document locally crafted management innovations
For local organizations *Opportunities* • Some communities have informal organization and internal rules for forest use • Local institutions strengthened by linking with social movements demonstrating interest in conservation *Difficulties* • Lack of access to information • Long delay in benefits of CFM • Partnering institutions have insufficient management capacity	• Promote the social organization of local communities • Clearly define the responsibilities and benefits of management • Empower community members involved with management activities • Develop entrepreneurial spirit
For the government *Opportunities* • Government supports Conservation Units in Amazonia • Possibility for community participation in conservation • Interest on the part of national and international partners in CFM *Difficulties* • Many areas are not legally defined • Long delays in the legalization of management plans • Lack of funds and no access to credit for CFM	• Promote incentives for forest management, such as educational programs, credit programs, information and legalization of land titles • Support forestry training and technical programs in multiple-use management • Promote gender-sensitive programs to ensure the participation of women in community forest management

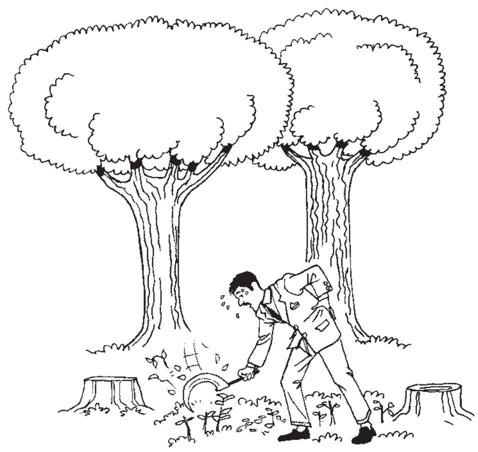
Challenges for communities

Magna Cunha

Community forest management for timber is being increasingly recognized and supported. Many financing agencies recognize the importance of sustainable forest management in the conservation of Amazonia. However, the complexity and the dynamic nature of the technical management models present a few risks and uncertainties, especially when you analyse their sustainability.

A few of the challenges include:

- **Understanding nature** – The various timber species have different ecological characteristics that need to be understood in order to manage them effectively.
- **Sales risk** – Even though wood has a high one-time value in comparison to other forest products (such as açaí, Brazil nuts and other fruits), its immediate commercialization and price are not guaranteed.
- **Inattentive consumers** – Only some buyers pay attention to the origin of forest products. It is necessary to educate the consumer regarding the importance of purchasing community-managed sustainable wood products.
- **Technical difficulties** – The search for unique, high-quality timber species makes projects difficult. In some cases, the extraction costs can outweigh the benefits.
- **Farmer or administrator?** – It is difficult for a farmer to become an administrator from one day to the next. When administrators try to learn about forest management, they encounter similar difficulties. It takes time. While a forest farmer needs to take care of the fields, collect fruit, hunt and fish, other projects demand that he or she abandon the hoe and pick up a pen to write a management plan and market study. If farmers develop these planning skills, however, they gain greater control over their businesses.



Diversity is security

Decisions about the best way to manage natural resources in communities depend on the knowledge of the function and interrelationship of various traditional production systems. As the risks and uncertainties of community forest management for timber production are many, one option is to integrate non-timber forest products into this system. In this way, the community continues to have a security net – game, fruit, fibre and medicinal plants – while learning how to negotiate timber sales.

1 Shanley, P *et al.* 2008
2 http://www.fsc.org/
3 Rios, M. *et al*. 2001
4 Smith, J. *et al.* 2000

Forest culture

Gloria Gaia
Patricia Shanley

Nature is generous, supplying medicine, vines, game, fruit, water and wood. But nature is more than the sum of its parts. Nature can also help to restore our vigour and improve our health as it lowers blood pressure and calms nerves. When some Indians get tired after walking a long ways in the forest, they sit down on roots or touch a tree to replenish their strength so they can continue their journey. All over the world, people also protect sacred trees, forests and gardens for spiritual and health benefits. It is easy to forget, especially for urbanites, but all of our actions affect the natural world and the natural world affects us. Compelling myths, stories, legends and songs were created, in part, to protect nature from humankind's insatiable appetite. Sadly, these tales are being lost from many cultures, even though their messages are more crucial than ever. In the past, legends were passed from parent to child. As even remote villages gain access to television, the oral storytelling tradition is fading, and today few young people are able to recount the legends. Elders will gladly share stories like those of the Curupira, the great snake, the jaguar, matita pereira, saci, the mapinguari and the hunter if they are asked. We dedicate this chapter to remembering some of the best-known tales from the forests of the Brazilian Amazon.

Legends: respecting nature

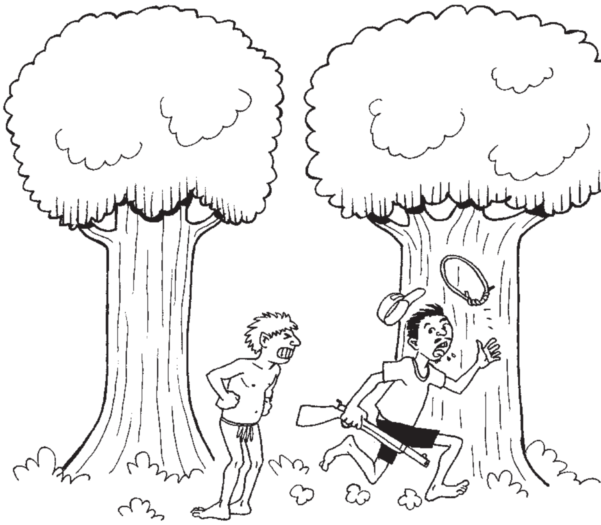
Carla Panzer and Eliete Timóteo, SOS Amazonia

In the dark of night all over the world, adults tell scary stories that make children tremble with a delicious terror, and go run and hide under the blankets of their beds. What do the legends and myths of Amazonia signify? Are they merely entertainment, or, as in many lands, do these myths hold a deeper psychological and ecological meaning?

Together with her students, Professor Eliete Timóteo studied some Amazonian legends and discovered that most of them had ugly, frightening and vengeful characters. According to the professor and her students, these stories were invented by people who live in the forest and are meant to intimidate anyone who might through ignorance or greed threaten the forest, the river and the animals that the forest peoples depend on to survive. These stories are not just for children; in Amazonia, many hunters, professors and scientists listen to and respect these stories as well.

The professor tells us that community forest preservation has been going on since the early days of human habitation. Long before Extractive Reserves existed, the people of Acre had already developed their own systems of natural resource conservation. Who knows how much forest has been protected, due to the many beliefs and mysteries that surround this immense wilderness of green?[1]

Curupira: guardian of the forest



The Curupira is well known by all city and country folk in Amazonia. He has curly hair and feet turned backwards; he is the guardian of the forest. Whenever someone gets lost in the woods, walking in circles and ending up in the same spot, this is the trickery of the Curupira. They have surely done something to make him angry. Curupira's feet are turned backwards to trick terrified hunters fleeing from him in the wrong direction and to make them lost.[2] To get on the right track again, leave a cigarette for him, or wrap a vine into a tangled knot, hiding the point within. Toss the knotted-up vine over your left shoulder and run like mad. While the Curupira tries to unravel the complicated knot, you will have time to find your way again. The Curupira protects the trees, the plants and the animals in the forest, so those who show disrespect or take more than their share of forest goods, beware: he will seek his revenge and you may never find your way out again.

Mapinguari: friend of the forest

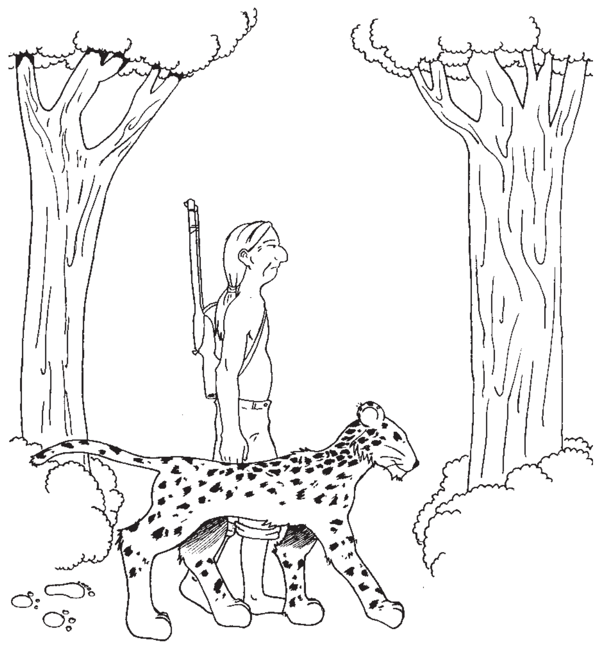
Mapinguari is the name of a monstrous, mysterious animal that lives in the wilds of Amazonia, known to rubber tappers, Indians and hunters of olden times. Like the giant sloths who roamed the forests long ago, he is considered a terror by the people who live in the jungle. He is enormous, has a mouth in his navel and one eye in the middle of his forehead. Wherever he goes, his tracks are recognized. The Mapinguari makes bloodcurdling howls, his breath can knock down a tree, and his stench can kill.

Where the Mapinguari roams, there are always stories of people who pee in their pants or run naked through the forest in terror. Sr. José Paraíso, a rubber tapper in Santarém, tells his story[3]:

> *I was sleeping alone one night when I heard a voice in my dream saying, "Wake up! Wake up! The beast is coming!" I woke up, it was pitch black and I could just hear his footsteps. Then I head that howl, "iiiiiiiiii". I was petrified and remembered that I was all alone in that place. If that monster got me, who would know? His scream grew louder; he was coming closer. "UUUUUUUUuuuuuuuÉégh." If the beast was really on his way, my only resort was to climb high in a tree. The horrible cry came closer, it was right behind me. It was like a tempest. "Rouoooou-rouoooouuu!" He rustled the leaves in the woods and snorted like a giant boar. I looked for a tree to race up. And suddenly, that smell: a repulsive, fetid, animal funk. I felt his power up close. I was desperate. I thought it was the end of me. But then the noise grew more distant. I heard, "Uuuuuuu" farther off. Then, "uuuu". Thank goodness, he went away. If I wasn't so lucky, maybe I wouldn't be here, to tell you this story.*

Nature spirits

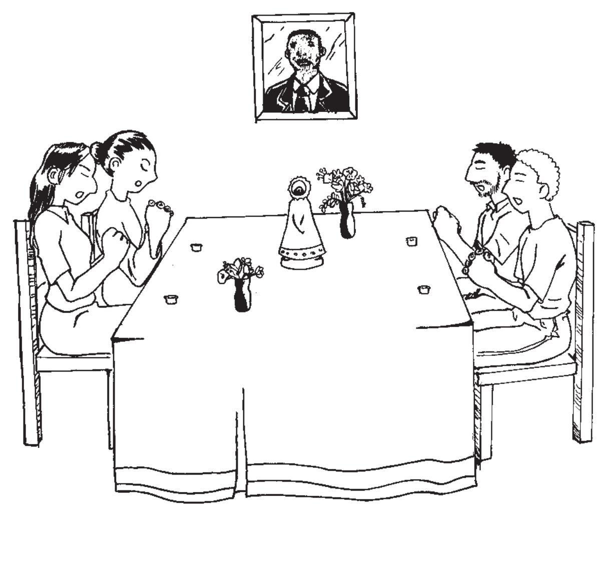
Gabriel Medina



The Indians have various customs and celebrations designed to facilitate communication with their gods. To hear the gods more clearly, some tribes discovered a special tea, called ayahuasca. The tea is made from a mixture of the jagube vine (*Banisteriopsis caapi*) with leaves of a shrub called chacrona (*Psychotria viridis*). The most common negative side effects of the tea are vomiting, tremors and dizziness. When the power of the tea is at its height, it inspires fantastic visions that can be profound and even frightening. People seek this tea to gain personal insight and come to a greater understanding of the meaning of life and their relationship with nature.

Traditionally, ayahuasca was used only in tribal rituals associated with health and religion. Giving thanks to nature formed a part of these rituals, respecting the links among the plants and animals of the forest. The Maku Indians, in the far reaches of the Negro River, use it as medicine and to consult ancestors in the selection of names for newborns. And when the elderly begin to lose their vision and strength to hunt, they go alone to a hunting camp and take the tea. Under its effects, they enter the body of a jaguar and go hunting in the forest. This is why it is dangerous to hunt jaguars and considered taboo.[4]

In the last few decades, use of the tea has increased dramatically. The consumption of ayahuasca is legal in Brazil and is taken regularly by practitioners of the religious sects Santo Daime, União Vegetal, and Barquinho, which include more than 10 000 people.[5] Practitioners say ayahuasca inspires a spiritual awakening that brings them closer to God. More recently, middle- and upper-class urbanites are taking it as a psychedelic drug that they believe helps them to grow spiritually and come into closer communion with nature.[6] In recent years there has been an explosion in the ayahuasca tourist industry in Peru, Ecuador and Brazil, as people from around the world seek its transformative powers for both spiritual and recreational purposes.[7] To ensure a reliable supply of the tea, some religious groups plant and manage jagube and chacrona. Because these plants are potent and potentially toxic,, extreme caution should be used in their preparation and consumption.



Women's participation

Lygia Constantina da Silva
Maria Inês S. Evangelista
Sisters of the Good Shepherd

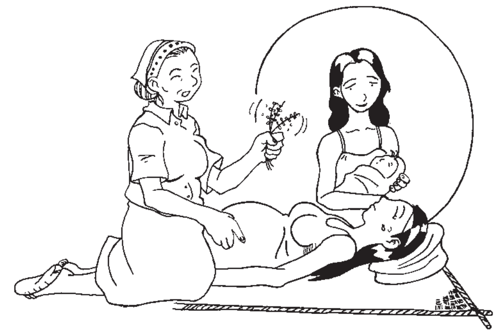
In rural Brazil, women are generally responsible for the health care and nutrition of their families, and for this reason they often feel the effects of forest loss more acutely than men. In addition to having the techniques and beliefs necessary to care for the forest and its fruit trees, the communities which often function best are those which have women who are united, organized and active. When women participate and express their ideas, they can bring different perspectives and draw attention to diverse aspects of the importance of the forest.

Women rubber tappers, who have a history of struggle and resistance, have broken down old stereotypes and shown that women's activism benefits the community as a whole.[8] In degraded areas in Pará, the Margarita Barbosa Women's Association of Nova Timboteua took the initiative to replant native species like andiroba, copaíba, mahogany, pupunha and sapucaia (*Lecythis* spp.). Through reforestation, seminars on health, adult literacy classes and various other workshops, these women are establishing new familial, social, political and economic relationships. Through these groups, women from Acre to Maranhão are using various materials from their forests to make crafts, to earn money selling these products, and to attend to the nutrition and health care of their families.

Guardians of the forest: midwives' perspective from Alto Juruá

Concita Maia and Luciana Pinheiro

Midwives can signify the difference between life and death for mothers and for the infants who are born in rural forest communities. The forest's near-isolation from the rest of the world helps make it possible for midwives to assume a position of respect within their communities. They are often the only skilled practitioners available to assist a woman during pregnancy and childbirth. They conduct their work with deep care and respect.



In Acre, the age-old wisdom of midwives incorporates the knowledge, experiences and improvisations of a culture that arose out of the interactions of northerners and Indians. The great majority learned the art of midwifery from a mother, grandmother, mother-in-law or aunt, very often out of necessity. They also know the "medicines of the forest", the "plants that cure" and the prayers and the incantations that help a birth along. She who has "caught many babies" and knows how to deal with a "dangerous woman" is called a "fine midwife", and usually is also a "prayer-giver" and a "healer".

Dona Zenaide from Marechal Thaumaturgo, Acre, tells her story:

> I was ten years old when I assisted my first birth. I did it out of necessity! And I decided at that young age that I would become a midwife. I learned from my grandmother, Maria Correla. She was my mother's midwife. I spent most of my time training with her. The midwife works practically from dawn to dusk. Works in the fields and works at home. Sometimes she stays awake for three days running, accompanying a woman when the birth takes a while.

In Acre, the midwives are beginning to organize themselves. The struggle for recognition by the midwives in Alto Juruá began in 1996.[9] The empowerment project for midwives is growing and there have already been meetings in indigenous communities in the municipalities of Sena Madureira and Freijó, in Acre, and Pauini in Amazonas.

Babassu breakers

Gabriel Medina

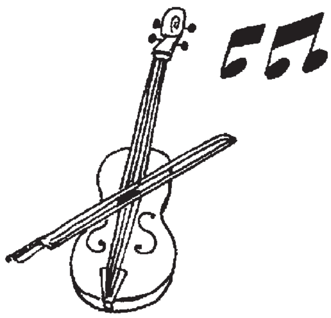
Traditionally in the state of Maranhão, the babassu trees (*Attalea speciosa*) grew on public lands and everyone could collect the palm nuts to make oil and other products, because "the palm nuts were free". But as time went by, state land passed into private hands and a few people ended up with most of the babassus. By 1985, 14 private ranches possessed twice as much land as all the small farmers in Maranhão combined. The ranchers cut down most of the babassus to make pastures, and the rural people who needed the oil ended up with scant access to the palm. As a result, there were more than 100 protests for the right to collect babassu in 1985 alone.

The babassu breakers came to be identified as a movement during this period and became intensely organized in defence of their right to access the palms which formed the centre of their livelihoods. The majority of babassu breakers are women, and consequently the movement has become one of the largest and most powerful women's movements in Latin America. The heart of the movement is in Maranhão, in which babassu occurs on 71% of the land. In 1991 there was a huge meeting of the babassu breakers, including those from the states of Pará and Piaui. The movement has continued to grow and recently expanded beyond areas that have babassu trees to incorporate resource-dependent communities throughout Maranhão.

Today, with oil produced from the white flesh of the babassu coconut, the movement is making bars of soap, which in 2002 were sold for US$0.22 each. The outer skin of the fruit is made into flakes and powder used in a nutritious porridge. The fibrous husks are used to make animal feed, and families use the outer shell of the coconut as fuel for kitchen fires. The movement of the babassu coconut breakers receives strong political support, and the day-to-day cooperation of friends that live and work together also remains strong. Women go in groups to the babassu trees and sit in a circle, breaking the babassus and talking, always close to one another.[10]

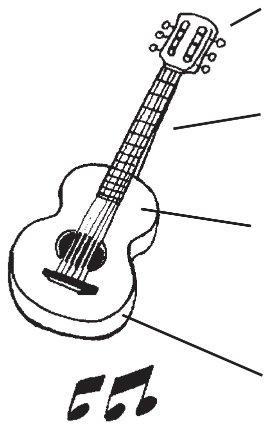
Music of the forest

Rubens Gomes



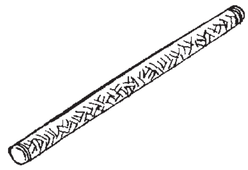
Without trees we would not have many of our best-loved instruments like the guitar, the ukulele or the mandolin, and we would never know the enchanting music that they inspire. The wood needed to make instruments is unique, not just any tree can be used. The colour, texture, density, shape and direction of the wood's grain must have certain qualities to be suitable for making instruments. Different parts of diverse species are used in the fabrication of various parts of a stringed instrument. For example, the weight of the wood used for the front has to be less than the wood used for the back. In addition, instruments traditionally have certain colour combinations. For the front, light colours are generally used; for the back and the sides, dark brown; and for the neck, black.

The species typically used to make an instrument like the guitar are Brazilian ebony (*Diospyros* spp.) for the fretboard, jacarandá-da-Bahia (*Dalbergia nigra*) for the back and the sides, and mahogany for the neck. In some regions, all of these species are being logged intensively. In Manaus, the Workshop School of Instrument Making of Amazonia is searching for Amazonian species for the manufacture of stringed instruments. They are comparing the physical characteristics, the mechanics and the acoustics of each wood to discover which species can substitute the now rare woods that were used traditionally (Brazilian ebony, jacarandá and mahogany). A few of the Amazonian species that are currently being used are shown below.

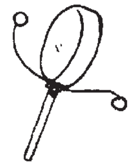


Use	Common name	Scientific name
Headstock	Cedro	*Cedrela odorata*
	Breu branco	*Protium* spp.
Fretboard	Preciosa	*Aniba canelilla*
	Louro preto	*Ocotea fragrantissima*
Body: Top	Marupá	*Simarouba amara*
	Freijó	*Cordia goeldiana*
	Morototó	*Schefflera morototoni*
Body: Back/Sides	Pau-rainha	*Brosimum rubescens*

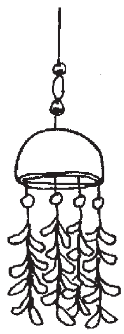
Messengers of the forest



Wood is not the only material used from the Amazon to make music. The forest is a treasure trove of seeds, barks, pods and shells that make wonderful sounds. For 15 years, the musician and artist Ronaldo Farias, from Pará, has walked through terra firme and flooded forests looking for materials to make musical instruments. Like a magician, he transforms seeds into musical rattles that sound like rain, a stream or birds taking flight. Using different combinations of seeds, pods and wood, Ronaldo can imitate the call of dozens of animals in the forest. He is always searching for ways to make new sounds, which he uses to compose carimbó songs about Amazonian culture.



For instruments like the maracas and the rainstick, he uses a combination of gourds, nuts and seeds such as: cuia, imbaúba, coconut, pregos de acapu and buffalo leather. For the shakers, he uses sapucaia, Brazil nut, imbaúba, jatobá, rubber or rubber tree, uxirana, buiuçu and mata-matá seeds.



"Looking for seeds is part of my work all year round. I have to go after the inajá and the tucumã seeds right after they fall because they rot quickly. Jupati and murumuru are in the swamp, and I have to walk in the mud and search with my hands, being careful to avoid the spines of the murumuru. Sometimes it's more practical to use gloves. After collecting the seeds, it's important to wash them. With the tucumã and the inajá, soak them for a week and then scrub them with sand so that the fibres come off more easily. The next step is to cut them with an electric saw. Finally, I sterilize, pierce, mould and sand the seeds three times until they are done."

In addition to making instruments, Ronaldo works to revive Amazonian culture by offering workshops in instrument building and regional rhythms.

Songs

Music reflects the lives and dreams of each person. A song can be a rallying cry for the oppressed, a cautionary tale to help others avoid tragic mistakes and a way to keep the links to history and culture alive. In Portuguese, the songs below carry rhyme and rhythm, inspiring people to dance and sing; however, even in English, their sentiment can be felt. Here we share the lyrics of a few classic Portuguese folk songs, written by Brazilian farmers, rubber tappers, and activists, to show the power of regional music to communicate the rich experiences of Amazonian people today.

Ecological logic

Author unknown

There goes the paca, the agouti, the chachalaca.
Go, go deer, your past was so beautiful,
Tomorrow is so sad.
There goes the macaw, the piquiá, the capybara.
There goes the opossum,
Humans are destroying the dark forest,
And the small game are disappearing.

I want to see the jaguar!
Only if it is painted.
I want to see the owl!
Only if it is stuffed.
And where are all the animals?
They are escaping from the fire.
They are escaping from the rifle.

The Tocantins River is in danger.
Be brave; don't allow the dam to hold you back.
And there the forest lies down upon the ground.
Forest without legs, you are rooted down
And cannot escape.

I want to see the jaguar!
Only if it is painted.
I want to see the owl!
Only if it is stuffed.
And where are all the animals?
They are escaping from the fire.
They are escaping from the rifle.

There the man is being forced off of his land.
The cattle, the money and the fences have come to take over.
And now the locals live on the periphery.
So many people, hungry and sick,
Tasting the bitterness of pain.

Ecological brega
By Limoeiro de Ajuru

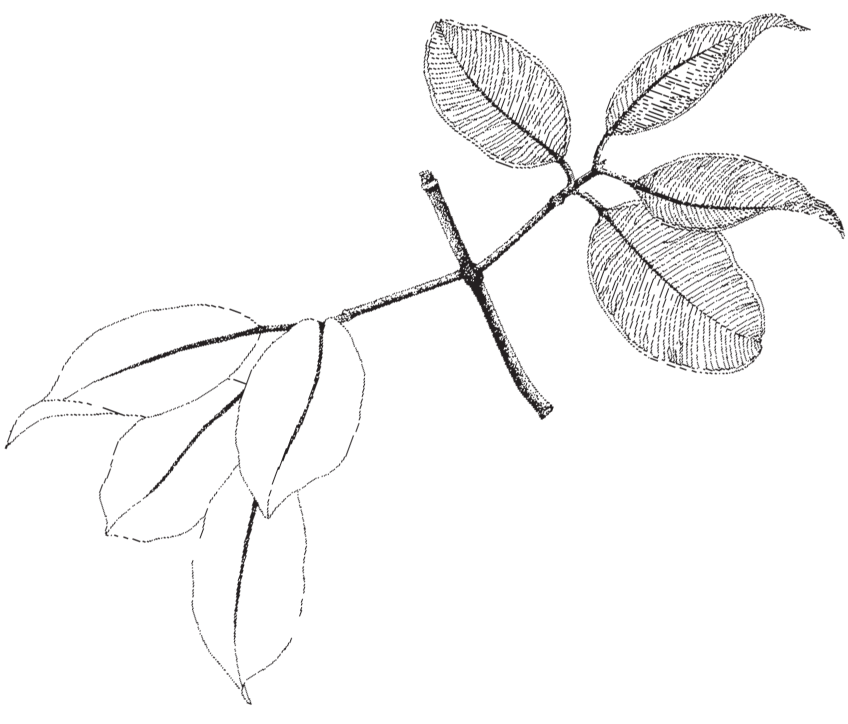
Where have all our fish gone, that used to live in the sea?
And where is the bacuri, sweet fruit of Pará?
Already the wood is gone, nothing left to take.
And while everything has disappeared, only hunger comes to stay.

Everything is different than in years past.
I remember it well. It was another story – everything has changed.
They talk of abundance, but only greed increases.
Before there was fine quality wood, today there is no more.

Where have all our fish gone, that used to live in the sea?
And where is the bacuri, sweet fruit of Pará?
Already the wood is gone, nothing left to take.
And while everything has disappeared, only hunger comes to stay.

I am already worried, looking at the past and considering the future.
I see that nature – the source of beauty and pure air –
Is being attacked by fire and dams.
It is so sad to see the Earth lose her beautiful landscapes.

Where have all our fish gone, that used to live in the sea?
And where is the bacuri, sweet fruit of Pará?
Already the wood is gone, nothing left to take.
And while everything has disappeared, only hunger comes to stay.



The farmer sold his land
By Pedro Gaia from Oeiras, Pará

The farmer sold his land,
And went to live in the city.
His poor children are suffering.

> *When he lived with them,*
> *On this piece of land,*
> *He planted rice and corn, manioc and beans.*
> *Now he sold the land – it's in the hands of the baron.*
> *Now he can't go back.*

The farmer sold his land,
And went to live in the city.
His poor children are suffering.

> *Now the money is spent –*
> *The money from this land.*
> *His wife fights with him.*
> *The house is a battlefield.*
> *He is full of regret, thinking about returning.*
> *His wife says, "Over my dead body!"*

The farmer sold his land,
And went to live in the city.
His poor children are suffering.

> *His wife tells him, "You have to find a way.*
> *First thing in the morning, go talk to the Mayor."*
> *But the Mayor says he has no work to give.*
> *The job we had was to weed by the roadside.*

Ecological xote
By Aguinaldo Batista and Luiz Gonzaga

I can't breathe, I can't swim anymore!
The earth is dying, it's impossible to plant!
And if you plant, nothing grows.
And if it grows, it doesn't give fruit.
Even good liquor is hard to find!
Where are the flowers –
Pollution consumed them!
The fish in the sea –
Pollution consumed them!
Where is the green –
Pollution consumed it!
Not even Chico Mendes survived!

Without fear to be a woman
Author unknown

To change the world,
The way people want to,
Can only happen through participation,
Without fear of being a woman.

> *Because without women, the fight is only half fought.*
> *When we participate without fear of being a woman.*
> *We strengthen popular movements*
> *When we participate without fear of being a woman.*

To change the world,
The way people want to
Can only happen participating,
Without fear of being a woman.

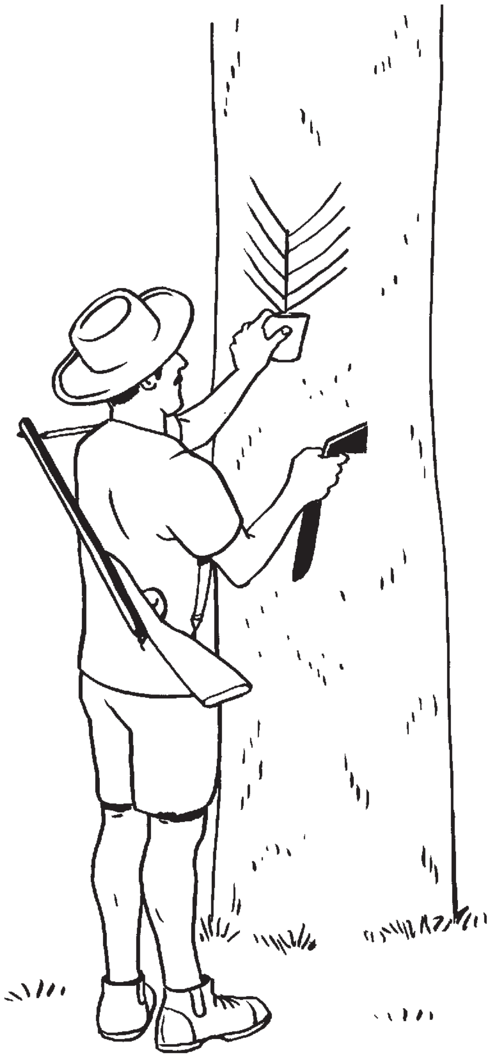
> *Because the struggle does not only belong to men,*
> *When we participate without fear of being a woman.*
> *We stand firm without making a secret of it,*
> *When we participate without fear of being a woman.*

To change the world,
The way people want to
Can only happen through participation,
Without fear of being a woman.

> *In the workers' alliance of the countryside,*
> *When we participate without fear of being a woman.*
> *Because victory will be ours without a doubt,*
> *Participating without fear of being happy.*

Anthem of the rubber tappers

Author unknown



Let us be proud of our rubber tappers.
Let us be proud of our nation.
Because it is the work of these people
That gives us the wheels of cars
And the wheels of planes.

They make little sandals.
They make big sandals.
They make boots that the snake can't bite through.
So many things are made from rubber,
I can't begin to tell you.
I even found some on my pressure cooker!

Let us be proud of our rubber tappers.
Let us be proud of our nation.
Because it is the work of these people
That gives us the wheels of cars
And the wheels of planes.

Bicycle tyres aren't made from soft cheese.
It isn't leather on airplane tyres.
You can't use cattle horn as an eraser.
These are rubber products made by our own hands.

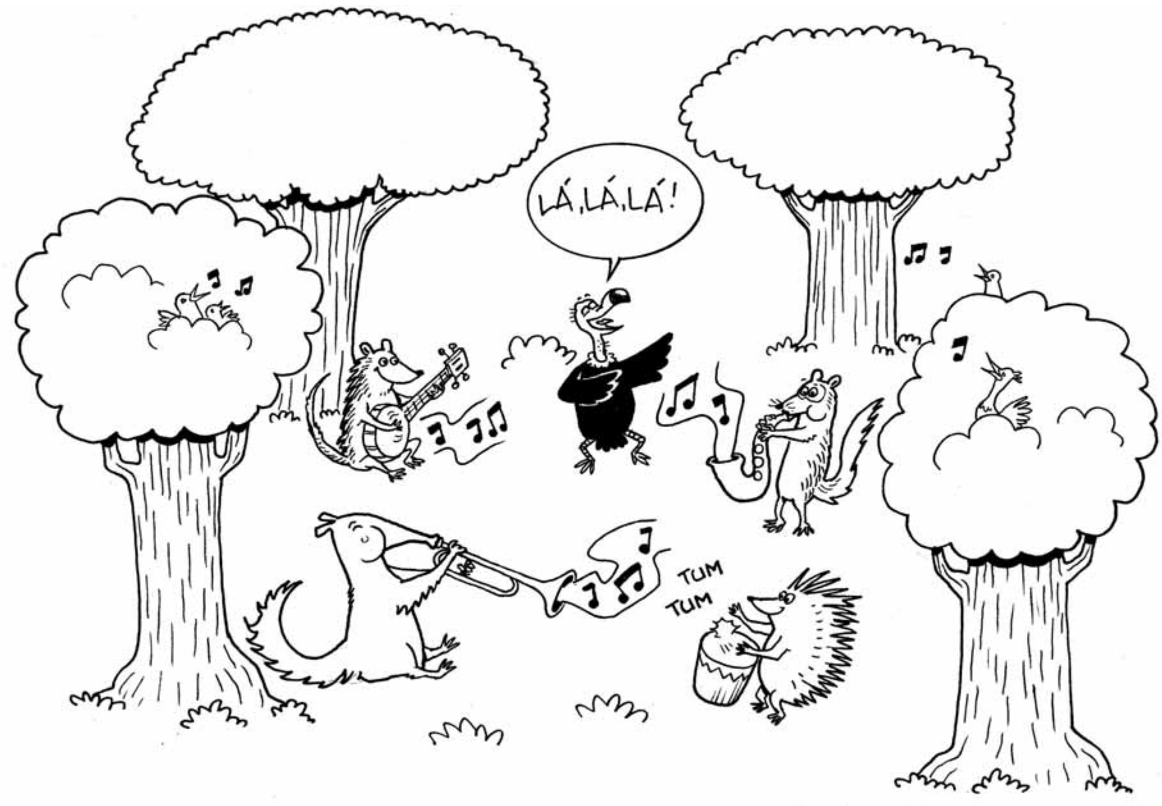
Let us be proud of our rubber tappers.
Let us be proud of our nation.
Because it is the work of these people
That gives us the wheels of cars
And the wheels of planes.

Bicycle tyres aren't made from soft cheese.
It isn't leather on airplane tyres.
You can't use cattle horn as an eraser.
These are rubber products made by our own hands.

The vulture's carimbó
By Originais de Peixe-Boi

The opossum formed a carimbó group to play.
She played the banjo herself.
On the drum was the anteater
Coati was on the saxaphone.
Porcupine on the ganzá.

After the group was assembled, she called a vulture to sing
Just like this: chem chem chem.
Vultures are useless.
The vulture was invited to sing, not to gossip about anyone.



The way we are

By Ronaldo Farias and José Felix, Grupo Curuperé

I wake up early in the morning,
Take the path to the stream.
I look in the mirror of the water,
Flowers of mururé.

Singing about the forest fruits,
I hear a bird sing.
Sowing seeds in the field and várzea,
Before life wanes.

In the spirit of the day, I take a canoe
And go out with the tide.
To happily say –
This is the way we are.

Hunting

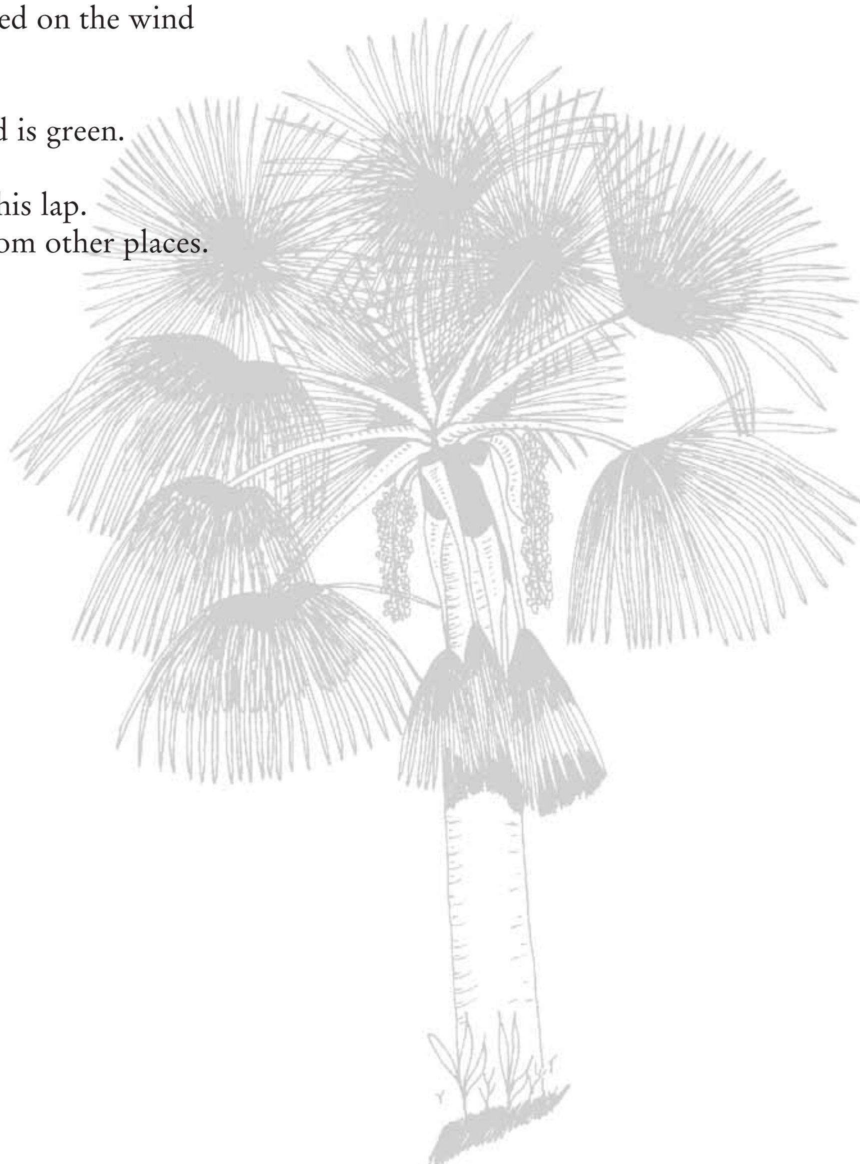
By Ronaldo Farias, José Félix and Negro Rai

When I arrived at the hunting blind by the stream,
Saci said, "Come see how it is."
Curupira showed up, wanted to hypnotize me..
The mother of the water went up the Maguari and Guamá rivers
Far away the Matita Pereira began to whistle.
From out of the forest the Mapinguari spied.
In the footprints of the sunbeams,
And the scent of the moonlight,
Sitting beside the stream, enjoying the moonlight,
Admiring these infinite things and the creator,
I don't know where they are going to stop.
The evil dissapears because I know
What is my place and what is mine to sing.

Besides delighting our stomachs, fruit trees, herbs and vines feed our imaginations. Life would be cheerless and sombre without the magnificence of nature. See how insightful this classic Brazilian verse about buriti palms is:

The great hinterland: paths
By João Guimãraes Rosa

"…It made me long for the buriti groves,
Coming along the path through the grass,
It has you, that green, that local jargon.
I miss the ones who respond to the wind.
I long for Minas Gerais; God is carried on the wind
In the fronds of all the buriti palms,
When it is threatening to storm.
Someone could forget this? The wind is green.
There, during the calm,
God takes the silence and puts it on his lap.
I am from where I was born. I am from other places.



[1] Zannini, I. C.C. 1989
[2] Smith, N.J.H. 1996
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Subject themes[1]

[1] This list of subject themes was used as the index in the original book directed at a local semi-literate audience. An index of this type proved useful for community groups and educators to locate sections on similar themes throughout the book.

Economics: invisible income and safety nets

Forest reserves and management plans

Forest seeds

History

Hygiene and cosmetics

Legislation and policy

Management

Medicinal plants and remedies

NTFPs vs timber (or agriculture)

Nutrition and health

Processing

Recipes

APPENDIX A

Trees and palms with a complete chapter

Comon name(s)	Scientific name	Family	Page
Açaí	*Euterpe oleracea* Mart.	Arecaceae	157
Açaí (solitary)	*Euterpe precatoria* Mart.	Arecaceae	169
Andiroba	*Carapa guianensis* Auble.	Meliaceae	29
Bacuri	*Platonia insignis* Mart.	Clusiaceae	39
Brazil nut	*Bertholletia excelsa* Bonpl.	Lecythidaceae	49
Buriti, moriche palm	*Mauritia flexuosa* L.f.	Arecaceae	175
Cat's claw, unha-de-gato	*Uncaria tomentosa* (Willd. ex Roem. & Schult.) D.C. and *Uncaria guianensis* (Aubl.) J.F. Gmel.	Rubiaceae	65
Copaíba	*Copaifera* spp.	Leguminosae (Caesalpiniaceae)	71
Inajá	*Attalea maripa* (Aubl.) Mart. [syn.: *Maximiliana maripa* (Aublet) Drude]	Arecaceae	183
Ipê-roxo, pau d'arco	*Tabebuia impetiginosa (*Mart. ex. DC) Standl.	Bignoniaceae	81
Jatobá	*Hymenaea courbaril* L.	Leguminosae (Caesalpiniaceae)	91
Mahogany, mogno	*Swietenia macrophylla* King	Meliaceae	101
Patauá	*Oenocarpus bataua* Mart.	Arecaceae	191
Piquiá	*Caryocar villosum* (Aubl.) Pers.	Caryocaraceae	109
Pupunha, peach palm	*Bactris gasipaes* Kunth	Arecaceae	197
Rubber tree, seringueira	*Hevea brasiliensis* (Willd. ex A. Juss.) Müll. Arg.	Euphorbiaceae	121
Titica	*Heteropsis* spp.	Araceae	129
Tucumã of Amazonas	*Astrocaryum aculeatum* G. Mey. (syn.: *A. tucuma* Mart.)	Arecaceae	205
Uxi, uchi	*Endopleura uchi* (Huber) Cuatrec.	Humiriaceae	139

Appendix B

Other trees and palms mentioned in this book

Common name	Scientific name	Family	Page
Abiu, abiorana	*Pouteria* spp.	Sapotaceae	3, 215, 217
Amapá amargo (bitter Amapá)	*Parahancornia fasciculata* (Poir.) Benoist [syn.: *P. amapa* (Huber) Ducke]	Apocynaceae	87. 88
Amapá preto (black Amapá)	*Couma guianensis* Aubl.	Apocynaceae	87, 88
Amapá doce (sweet Amapá)	*Brosimum* spp.	Moraceae	87, 88
Ameixa, jacaicá	*Antrocaryon amazonicum* (Ducke) B.L. Burtt & A.W. Hill	Anacardiaceae	218, 258
Amor crescido	*Portulaca pilosa* L.	Portulacaceae	86
Apuruí	*Borojoa [Alibertia]* spp.	Rubiaceae	215, 219
Araçá	*Eugenia feijoi* O. Berg	Myrtaceae	215, 216, 218
Araçá-boi	*Eugenia stipitata* McVaugh	Myrtaceae	218
Ata	*Annona* spp.	Annonaceae	220
Ata brava	*Rollinia calcarata* R.E. Fries and *Rollinia mammifera* Maas & Westra	Annonaceae	215, 220
Azeitona brava, Azeitona da mata	*Eugenia egensis* DC.	Myrtaceae	218
Babaçu, babassu	*Attalea speciosa* Mart. ex Spreng.	Arecaceae	107, 142, 183, 186, 190, 272
Bacaba	*Oenocarpus bacaba* Mart.	Arecaceae	142, 194, 258
Bacuri da várzea	*Tovomita* spp.	Clusiaceae	216
Bacuripari	*Garcinia [Rheedia] brasiliensis* Mart.	Clusiaceae	47, 216, 259
Barbatimão	*Stryphnodendron barbatimam* Mart.	Leguminosae (Mimosaceae)	86
Biribá, biribá brava	*Rollinia* spp.	Annonaceae	150, 220
Breu	*Protium* spp.	Burseraceae	33, 147, 221, 273
Cacao, cacau,	*Theobroma cacao* L.	Sterculiaceae (Malvaceae)	36, 164, 222, 223

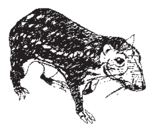
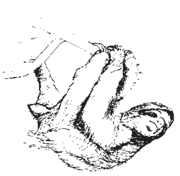
Common name	Scientific name	Family	Page
Cacau jacaré	*Herrania [Theobroma] mariae* (Mart.) Decne. ex Goudot, *H. nitida* (Poepp.) R.E. Schultes	Sterculiaceae (Malvaceae)	222
Cacau de macaco, Cacaurana, cacau do Peru	*Theobroma obovatum* Klotzch	Sterculiaceae (Malvaceae)	222, 223
Cacaurana	*Theobroma microcarpum* Mart.	Sterculiaceae	222, 223
Cacauí	*Theobroma speciosum* Willd.	Sterculiaceae (Malvaceae)	222, 223
Cajá	*Spondias mombin* L.	Anacardiaceae	216, 224
Cajá-açu	*Spondias "mombin x testudinis"*	Anacardiaceae	224
Cajá de jaboti	*Spondias testudinis* J.D. Mitch. & Daly	Anacardiaceae	216, 224
Cajarana	*Spondias testudinis* J.D. Mitch. & Daly and *Spondias dulcis* Parkinson	Anacardiaceae	216, 224
Camu-camu	*Myrciaria dubia* (Kunth) McVaugh	Myrtaceae	216
Castanha de porco, castanhola, castanhinha	*Caryodendron amazonicum* Ducke	Euphorbiaceae	225
Cedro	*Cedrela odorata* L.	Meliaceae	69, 142, 258, 273
Cerejeira	*Amburana acreana* (Ducke) A.C. Sm.	Leguminosae (Fabaceae)	93
Chacrona	*Psychotria viridis* Ruiz & Pav.	Rubiaceae	270
Cocão	*Attalea tessmannii* Burrett	Arecaceae	225
Coconut	*Cocos nucifera* L.	Arecaceae	142
Cumaru	*Dipteryx odorata* (Aublet) Willd.	Leguminosae (Fabaceae)	5, 85, 93, 259
Cupuaçu	*Theobroma grandiflorum* (Willd. ex Spreng.) K. Schum.	Sterculiaceae (Malvaceae)	44, 56, 61, 150, 164, 222
Dendê, African oil palm	*Elaeis guineensis* Jacq.	Arecaceae	xxi, 142
Ebony, Brazilian ebony	*Diospyros* spp.	Ebenaceae	273
Envira caju	*Onychopetalum krukovii* R.E. Fries	Annonaceae	216, 226
Escada-de-jaboti	*Bauhinia guianensis* Aubl.	Leguminosae (Caesalpiniaceae)	69
Freijó	*Cordia goeldiana* Huber	Boraginaceae	272
Gameleira	*Ficus dendrocida* Kunth and other *Ficus* spp.	Moraceae	123
Graviola, soursop	*Annona muricata* L.	Annonaceae	258

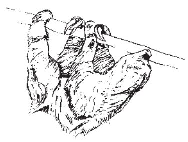
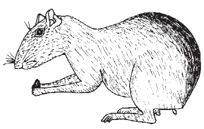
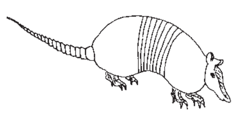
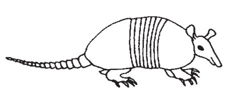
Common name	Scientific name	Family	Page
Guaraná	*Paullinia cupana* Kunth	Sapindaceae	86, 165, 171
Imbaúba	*Cecropia* spp.	Moraceae (Cecropiaceae)	274
Ingá	*Inga* spp.	Leguminosae (Mimosaceae)	3, 116, 216, 226, 227, 259
Ipê amarelo	*Tabebuia serratifolia* (Vahl) G. Nicholson	Bignoniaceae	93
Jacarandá da Bahia, Brazilian rosewood	*Dalbergia nigra* (Vell.) Allemão ex Benth.	Leguminosae (Fabaceae)	273
Jaci	*Attalea butyracea* (Mutis ex L.f.) Wess. Boer	Arecaceae	181, 190
Daime, jagube vine	*Banisteriopsis caapi* (Spruce ex Griseb.) C.V. Morton	Malpighiaceae	270
Jarana	*Lecythis lurida* (Miers) S.A. Mori	Lecythidaceae	94, 259
Jupati	*Raphia taedigera* (Mart.) Mart.	Arecaceae	142, 143
Jutaí	*Hymenaea parvifolia* Huber	Leguminosae (Caesalpiniaceae)	95
Jutaí-da-folha-grande (long-leaved jutaí)	*Hymenaea oblongifolia* Huber	Leguminosae (Caesalpiniaceae)	95
Louro preto	*Ocotea fragrantissima* Ducke	Lauraceae	273
Maçaranduba, massaranduba	*Manilkara huberi* (Ducke) Chevalier	Sapotaceae	33, 93, 94, 244, 258
Marapuama	*Ptychopetalum olacoides* Benth.	Olacaceae	86
Marupá	*Simarouba amara* Aubl.	Simaroubaceae	273
Mastruz, wormseed	*Chenopodium ambrosioides* L.	Chenopodiaceae	86
Morototó	*Schefflera morototoni* (Aubl.) Maguire, Steyerm. & Frodin	Araliaceae	273
Mucajá	*Acrocomia aculeata* (Jacq.) Lodd. ex Mart.	Arecaceae	142
Mumbaca	*Astrocaryum gynacanthum* Mart.	Arecaceae	142
Mururé	*Brosimum acutifolium* Huber	Moraceae	258, 282
Murumuru	*Astrocaryum murumuru* Wallace	Arecaceae	142, 213, 216, 257, 274
Pariri	*Pouteria pariry* (Ducke) Baehni	Sapotaceae	217
Pau-rainha	*Brosimum rubescens* Taub.	Moraceae	273

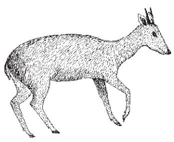
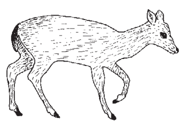
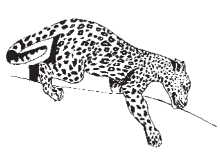
Common name	Scientific name	Family	Page
Piaçava, piassava	*Attalea funifera* Mart. ex Spreng.	Arecaceae	257
Preciosa	*Aniba canelilla* (Kunth) Mez	Lauraceae	273
Puruí, puruí grande, apuruí	*Borojoa* or *Alibertia* spp.	Rubiaceae	219
Quebra-pedra	*Phyllanthus niruri* L.	Euphorbiaceae (Phyllanthaceae)	86
Sacaca	*Croton cajucara* Benth.	Euphorbiaceae	86
Sangre de grado	*Croton lechleri* Müll. Arg.	Euphorbiaceae	69
Sapota, sapota do Solimões	*Matisia [Quararibea] cordata* Humb. & Bonpl.	Bombacaceae (Malvaceae)	228
Sapota macho	*Matisia bicolor* Ducke	Bombacaceae (Malvaceae)	228
Sapucaia	*Lecythis* spp.	Lecythidaceae	259, 271, 274
Sucupira	*Bowdichia virgilioides* Kunth	Leguminosae (Fabaceae)	258
Sucuúba	*Himatanthus sucuuba* (Spruce) Woods.	Apocynaceae	85, 86, 259
Tatajuba	*Bagassa guianensis* Aubl. (for SW Amazon *Maclura tinctoria* (L.) D. Don ex Steud.)	Moraceae	21, 115
Tento	*Ormosia* spp.	Leguminosae (Fabaceae)	142
Tucumã do Pará	*Astrocaryum vulgare* Mart.	Arecaceae	209
Tucumã-í	*Astrocaryum acaule* Mart.	Arecaceae	209, 212
Ucuúba	*Virola michelii* Heckel	Myristicaceae	85, 166
Umarí	*Poraqueiba* spp.	Icacinaceae	216
Uricuri, aricuri	*Attalea [Orbignya] phalerata* Mart. ex Spreng.	Arecaceae	183, 190
Urucu, annatto	*Bixa orellana* L.	Bixaceae	29, 32
Uxirana	*Sacoglottis* spp.	Humiriaceae	142, 274
Pupunha brava ("wild pupunha")	*Aiphanes aculeata* Willd.	Arecaceae	204
Veronica	*Dalbergia subcymosa* Ducke and *Dalbergia monetaria* L.f.	Leguminosae (Fabaceae)	69, 86

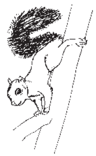
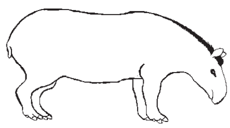
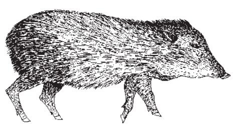
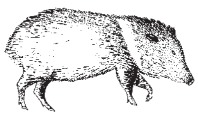
APPENDIX C

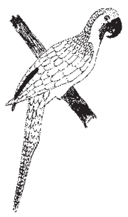
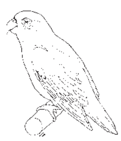
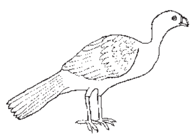
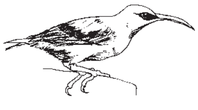
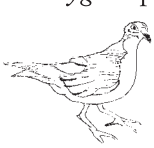
Wild animals mentioned in this book

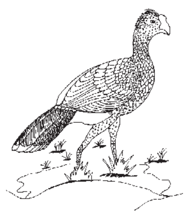
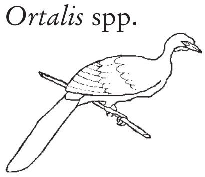
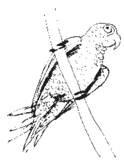
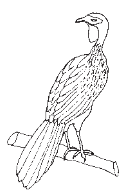
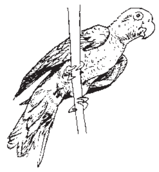
Scientific name	English common name	Portuguese common name	Diet	Habitat	Page
MAMMALS					
Agouti paca 	paca	paca	fruit, flowers, nuts, seeds, tubers	primary and secondary forest, gardens and plantations	36, 57, 76, 94, 97, 112, 115, 116, 119, 141, 142, 148, 181, 186, 189, 210, 212, 227, 259, 275
Alouatta spp. 	howler monkey	guariba	leaves, fruit, and seeds	primary forest, várzea	189
Artibeus lituratus 	great fruit-eating bat	morcego de cara listrada	fruit, some insects, pollen and leaves	forests, plantations and gardens	151
Ateles belzebuth 	white-bellied spider monkey, long-haired spider monkey	macaco aranha, coatá	fruit, rarely leaves, flowers, honey or insects	primary forest	165, 195
Bradypus tridactylus 	pale-throated three-toed sloth	preguiça bento	leaves	primary and secondary forest	97
Bradypus variegatus 	brown-throated three-toed sloth	preguiça branca	leaves	primary and secondary forest	116

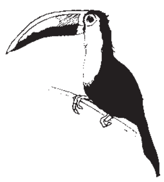
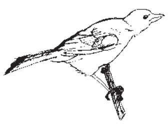
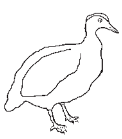
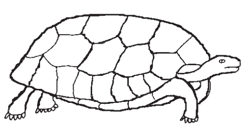
Scientific name	English common name	Portuguese common name	Diet	Habitat	Page
Cebus apella 	brown capuchin, black-capped capuchin, tufted capuchin	macaco prego	fruit, palm nuts, insects, small vertebrates, nectar	primary and secondary forest	57, 165
Choloepus didactylus 	southern two-toed sloth	preguiça real	leaves, fruit	primary and secondary forest	97
Coendou prehensilis 	Brazilian porcupine	quandu, coendu, porco espinho	fruit, seeds, leaves, bark	primary and secondary forest, gardens and plantations	195, 281
Dasyprocta spp. 	agouti	cutia	fruit, nuts, seeds, flowers, roots	primary and secondary forest, gardens and plantations, dry forest, cerrado	36, 57, 59, 76, 97, 108, 112, 115, 116, 117, 119, 141, 142, 148, 149, 165, 186, 189, 202, 206, 210, 212, 259, 275
Dasypus novemcinctus 	nine-banded armadillo, nine-banded long-nosed armadillo	tatu, tatu branco, tatu galinha	ants, termites, other insects	primary and secondary forest	57, 112, 115, 117, 141, 148, 186, 189, 210, 259
Dasypus septemcinctus 	seven-banded armadillo, seven-banded long-nosed armadillo	tatu pretinho, tatuí	insects, fruit	primary forest, cerrado	57, 112, 115, 117, 141, 148, 186, 189, 210, 259

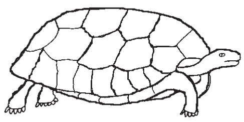
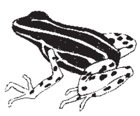
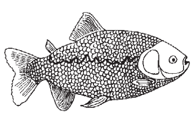
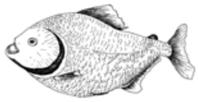
Scientific name	English common name	Portuguese common name	Diet	Habitat	Page
Leopardus pardalis, Felis pardalis 	ocelot	gato do mato, jaguartirica	rodents, some birds, snakes, lizards and other small vertebrates	primary, secondary and mangrove forests, pastures, savannah, cerrado	97
Lonchophylla thomasi 	Thomas's nectar bat, Thomas's long-tongued bat		nectar, pollen, some insects, fruit	primary and secondary forest	117
Mazama americana 	red brocket deer	veado vermelho, veado mateiro, veado capoeira, veado pardo	fruit, fungi, leaves	primary and secondary forest, plantations, forest edge	57, 76, 97, 112, 115, 116, 117, 119, 141, 142, 148, 165, 172, 178, 181, 186, 195, 202, 210
Mazama gouazoubira 	grey brocket deer	veado branco	fruit, flowers, leaves	forests, cerrado, open areas	57, 76, 97, 112, 117, 119, 141, 142, 148, 165, 172, 178, 181, 186, 195, 202, 210
Nasua nasua 	coati, coatimundi, South American coati	quati, quatimundé	fruit, invertebrates, small animals	primary forest, cerrado	112, 148, 281
Panthera onca 	jaguar	onça pintada, onça preta	large mammals, also turtles, tortoises, caimans, birds, fish, smaller mammals	primary, secondary, and flooded forest, grassland, scrub forest often near water	267, 270, 275

Scientific name	English common name	Portuguese common name	Diet	Habitat	Page
Sciurus spp. 	squirrel	quatipuru, esquilo	fruit, seeds, bark, nuts	primary and secondary forest, gardens and plantations	36, 57, 76, 141, 142, 148, 186
Tapirus terrestris 	Brazilian tapir, lowland tapir	anta	fruit, leaves, roots, other vegetation	primary closed forest	76, 94, 97, 119, 142, 148, 178, 181, 186, 189, 195
Tayassu pecari 	white-lipped peccary	queixada, porcão	fruits, roots, tubers, palm nuts, invertebrates	primary forest, cerrado	76, 97, 119, 142, 148, 165, 178, 181, 195, 210
Tayassu tajacu 	collared peccary	catitu	fruits, palm nuts, roots, tubers, invertebrates, small vertebrates	forest, secondary forest, cerrado, desert	76, 116, 119, 142, 148, 165, 178, 181, 210
BIRDS					
Amazona farinosa 	mealy parrot	papagaio moleiro	fruit, seeds, nuts, flowers, leaf buds	primary and secondary forests, plantations	116
Amazona spp. 	parrot, Amazon parrot	papagaio	fruit, seeds, nuts, flowers, leaf buds	primary and secondary forests, plantations, várzea	119, 172, 195, 210
Ara ararauna 	blue and yellow macaw, blue and gold macaw	arara canindé	fruit, seeds	primary and secondary forest, várzea, cerrado	142, 181

Scientific name	**English common name**	**Portuguese common name**	**Diet**	**Habitat**	**Page**
Ara spp. 	macaw	arara	fruit, seeds	primary and secondary forest, várzea	142, 148, 119,172, 189, 195, 210, 275
Aratinga leucophthalma 	white-eyed parakeet, white-eyed conure	periquitão maracanã	flowers, seeds, fruit, nuts, insects	primary and secondary forests, várzea, cerrado, plantations	45
Brotogeris chrysoptera 	golden-winged parakeet	periquito de asa vermelha, periquito de asa dourada	nectar, fruit, seeds	primary and secondary forest, savannah, parks	45, 46
Cacicus cela 	yellow-rumped cacique	xexéu	insects, fruit, nectar	várzea, plantation, secondary forest	45
Crax spp. 	curassow	mutum, mutum branco, mutum de penacho	fruit, seeds	primary forest	97, 172, 195, 210
Cyanerpes caeruleus 	purple honeycreeper	Saí de perna amarela, saí púrpura	nectar, insects, fruit	primary and secondary forest, várzea	45
Geotrygon spp. 	quaildove	juriti, pariri	fruit, seeds	primary and secondary forest, plantations	259

Scientific name	English common name	Portuguese common name	Diet	Habitat	Page
Harpia harpyja 	harpy eagle	gavião real	medium-sized mammals, some large birds	primary forest, tall secondary forest	97
Mitu tuberosum 	razor-billed curassow	mutum preto, mutum cavalo	fruit, seeds	primary forest	97
Ortalis spp. 	chachalaca	aracuã	fruit, flowers, seeds	secondary and primary forest	165, 181, 275
Orthopsittaca manilata 	red-bellied macaw	maracanã do buriti	palm fruit and other fruit	várzea, igapó. secondary forests with buriti	181
Penelope spp. 	guan	jacu, japassaro	fruit, seeds	primary forest	181, 195
Pionites leucogaster 	white-bellied parrot	marianinha de cabeça amarela	seed, fruit	primary forest	45
Pteroglossus spp. 	aracari	araçari	fruit, some insects and small vertebrates	primary and secondary forest, plantations	195

Scientific name	English common name	Portuguese common name	Diet	Habitat	Page
Ramphastos tucanus 	white-throated toucan, Cuvier's toucan	tucano grande de papo branco	fruit, some invertebrates, bird eggs, and small vertebrates	primary and secondary forest	165, 172, 195
Ramphocelus carbo 	silver-beaked tanager	pipira, pipira de máscara	fruit, insects, nectar	várzea, primary and secondary forests, gardens, plantations	45
Tachornis squamata 	fork-tailed palm swift	tesorinha, andorinhão do buriti	insects	várzea, open areas	181
Thraupis episcopus 	blue-grey tanager	sanhaçu da amazônia	fruit, insects, nectar	gardens, plantations, secondary and primary forests	45
Thraupis palmarum 	palm tanager	sanhaçu do coqueiro, saí açu pardo	fruit, nectar, insects	gardens, plantations, secondary and primary forests	45
Tinamus spp. *Crypturellus* spp. 	tinamous	nambu, inhambu	fruit, seeds	primary and tall secondary forest	165, 259
REPTILES					
Geochelone carbonaria 	red-footed tortoise	jabuti, jabuti-do-pé-vermelho, jabuti carumbé	fruits, vegetation	primary and secondary forest, savannah	76, 181

Scientific name	English common name	Portuguese common name	Diet	Habitat	Page
Geochelone denticulata 	South American yellow-footed tortoise, Brazilian giant tortoise, forest tortoise	jabuti branco, jabuti-do-pé-amarelo, jabuti-carumbé	fruits, flowers, vegetation	primary and secondary forest, savannah	76, 115, 181
AMPHIBIANS					
Dendrobates castaneoticus, Adelphobates castaneoticus 	Brazil-nut poison frog		ant, termites and other small insects	primary forest	57
Dendrobates quinquevittatus, Adelphobates quinquevittatus 	Amazonian poison frog		insects	primary forest	57
FISHES					
Colossoma macropomum 	black-finned pacu	tambaqui	fruit, seeds, grain, zooplanton, insects, snails	fresh (black) water, flooded forest of Amazon, Orinoco river basins	125
Serrasalmus niger, Serrasalmus rhombeus 	black piranha, red-eyed piranha	piranha negra	fish, fins, seeds	fresh water of Amazon, Orinoco river basins	125

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Pagination in **bold** refers to main entries for plants and trees.

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Fruit trees and useful plants in Amazonian life, a collaboration between CIFOR and FAO, serves two main purposes: it provides rich information on Amazon fruits and Amazon communities, illustrating how local peoples have adopted and adapted to the plant kingdom around them to distil vital nutrients, medicines and other products fundamental to their survival; it also shows how scientific information can be presented in an innovative and more inclusive way, one that can be adapted accordingly by other actors worldwide.

The publication is a testament to the enormous potential that integrating traditional and scientific knowledge can have for both local communities and academic and development professionals alike. It also serves as a reminder to the scientific community that science should be shared with local people and not confined to journals and closed circles of technical experts. From Brazil nuts and Cat's claw to Copaiba and Titica, this publication shares a wealth of information on a wide range of plant species that only close collaboration between local peoples and researchers could possibly breed.

We must consider the impact of each of our decisions on the next seven generations.

INTERNATIONAL YEAR OF FORESTS · 2011

ISBN 978-92-5-107007-9 ISSN 1020-3370

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I2360E/1/09.11