

NON-WOOD FOREST PRODUCTS

20

**Fruit trees and  
useful plants  
in Amazonian life**

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and plants  
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# Fruit trees and useful plants in Amazonian life

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# Contents

Acknowledgements.....	xiii
Authors.....	xiv
Contributors.....	xvi
Auhors and contributors: contact information.....	xviii
Glossary of Portuguese and forestry terms.....	xxi
Map of South America.....	xxiv

## Introduction



Map of the Amazon.....	2
Amazonian plant diversity.....	3
Health and nutrition: compliments of the forest.....	4
Compatible or conflicting use.....	5
The impact of seven generations.....	6

## Who will use this book and how?



Who will use this book and how?.....	11
How to play with this book .....	16
How to educate with this book: a knowledge network.....	19

## Trees and vines



Andiroba ( <i>Carapa guianensis</i> ).....	29
Bacuri ( <i>Platonia insignis</i> ).....	39
Brazil nut ( <i>Bertholletia excelsa</i> ) .....	49
Cat's claw ( <i>Uncaria tomentosa</i> and <i>Uncaria guianensis</i> ).....	65
Copaíba ( <i>Copaifera</i> spp.).....	71
Ipê-roxo, pau d'arco ( <i>Tabebuia impetiginosa</i> ).....	81
Jatobá ( <i>Hymenaea courbaril</i> ).....	91
Mahogany, mogno ( <i>Swietenia macrophylla</i> ).....	101
Piquiá ( <i>Caryocar villosum</i> ).....	109
Rubber tree, seringueira ( <i>Hevea brasiliensis</i> ).....	121
Titica ( <i>Heteropsis</i> spp.).....	129
Uxi, uchi ( <i>Endopleura uchi</i> ).....	139

## Palm trees and diverse other species



Açaí ( <i>Euterpe oleracea</i> ).....	157
Açaí (solitary) ( <i>Euterpe precatoria</i> ).....	169
Buriti, moriche palm ( <i>Mauritia flexuosa</i> ).....	175
Inajá ( <i>Attalea maripa</i> [syn: <i>Maximiliana maripa</i> ]).....	183

# 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

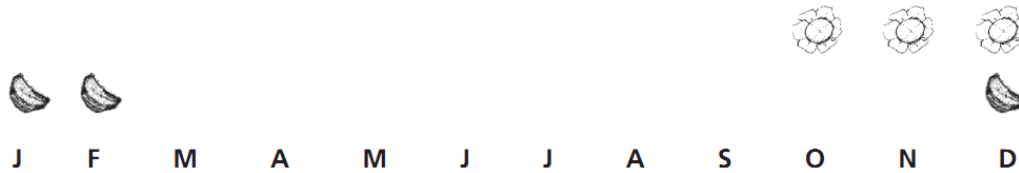
Karen Kainer, Margaret Cymerys,  
Lúcia Wadt, Valdirene Argolo

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.<sup>1</sup> Brazil nut trees occur in terra firme Amazonian forests in Colombia, Venezuela, Peru, Brazil and Bolivia, as well as in parts of Guyana.<sup>2</sup> 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.

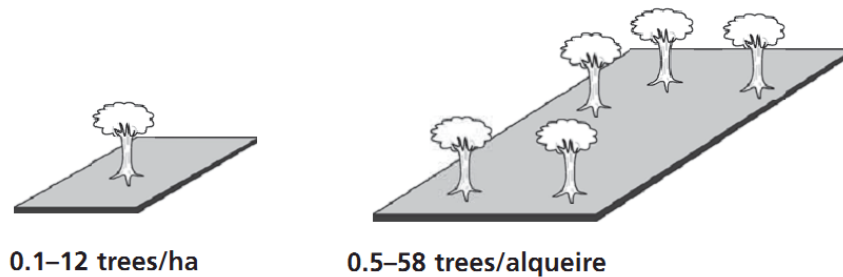
## ECOLOGY

### 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.

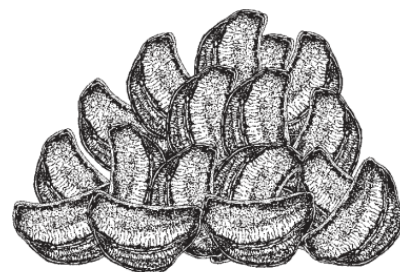
### Density



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.<sup>3</sup> Densities between 1.3 and 4.0 trees/ha were found in the Chico Mendes Extractive Reserve in Acre.<sup>4</sup> A study in southeastern Amazonia found 1.7 reproductive trees/ha.<sup>5</sup> 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.<sup>6</sup>

### 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.

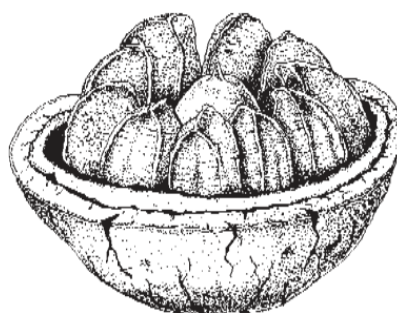


average of  
1 000 nuts/tree

Fruit production varies between trees, with some producing zero and some up to 2 000/tree.<sup>7</sup> A study in southeastern Amazonia found 103 to 270 fruit/tree and a mean of 17 nuts/fruit.<sup>5</sup> Another study at three sites in eastern Amazonia determined a fruit production of 63–216/tree.<sup>8</sup> 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.<sup>9</sup> 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.<sup>10</sup>

## 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.<sup>11</sup> 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.<sup>12</sup>






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.<sup>13</sup> 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.<sup>14</sup> 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.



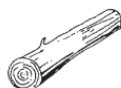
**Oil:** Brazil nut oil appears in  soap,  creams and  shampoo.



**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<sup>2</sup>, and like a giant sponge, absorb most impurities, leaving the water remarkably clean.<sup>15</sup>

## 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.<sup>16</sup> 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.<sup>17</sup> 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.

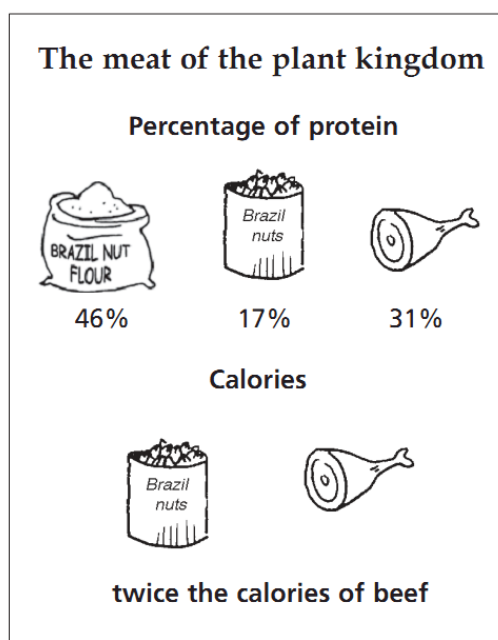


To ensure that you are getting enough selenium in your diet, doctors recommend a 200 mcg selenium supplement per day, the equivalent of about two shelled Brazil nuts. Because the nuts lose up to 75% of their selenium content after they are shelled, it is best to eat them immediately after removing their 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.<sup>18</sup> 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.<sup>19</sup>



## 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.<sup>5</sup>

### *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

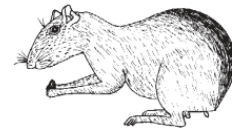


The Brazil nut tree demonstrates the important links between plants and animals in an intact rain forest. For example, there are two species of poisonous frogs (*Dendrobates castaneoticus*, *Dendrobates quinquevittatus*) that almost exclusively use the rain-filled hollow of Brazil nut fruits for their tadpoles.<sup>21</sup>

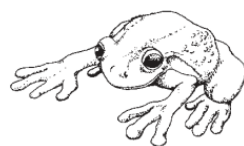


The Brazil nut flower has a closed hood and is pollinated efficiently only by large-bodied bees capable of pushing open the hood and entering the flower.<sup>2</sup> These bees of the genera *Bombus*, *Centris*, *Epicharis*, *Eulaema*, and *Xylocopa* live in the closed forest. A recent decline in Brazil 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.<sup>7</sup> 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.

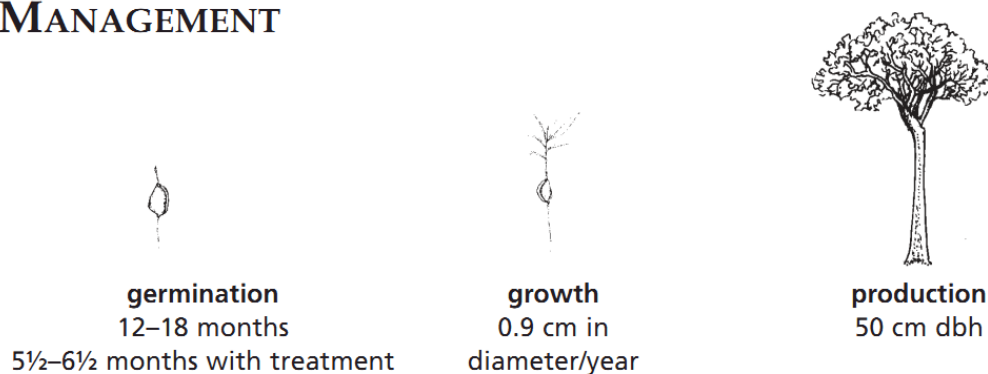
The agouti is a true friend of the Brazil nut as it is one of the only animals able to gnaw through the thick, hard husk of the Brazil nut fruit to reach the nuts inside. Primarily the agouti, but occasionally squirrels disperse Brazil nuts throughout the forest. The agouti scatter-boards the seeds up 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.<sup>7</sup> 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.<sup>22</sup>



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



Brazil nut trees live many years; three large trees were carbon dated to be more than 650 years old.<sup>23</sup> 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.<sup>3</sup> 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.<sup>24</sup> Similarly, a study at two sites in Bolivia found reasonable seedling densities despite the areas experiencing heavy Brazil nut harvest for several decades.<sup>6</sup> 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.<sup>25</sup> 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,<sup>26</sup> 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 Reça 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.<sup>25</sup> 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.<sup>27</sup> 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.<sup>6</sup>



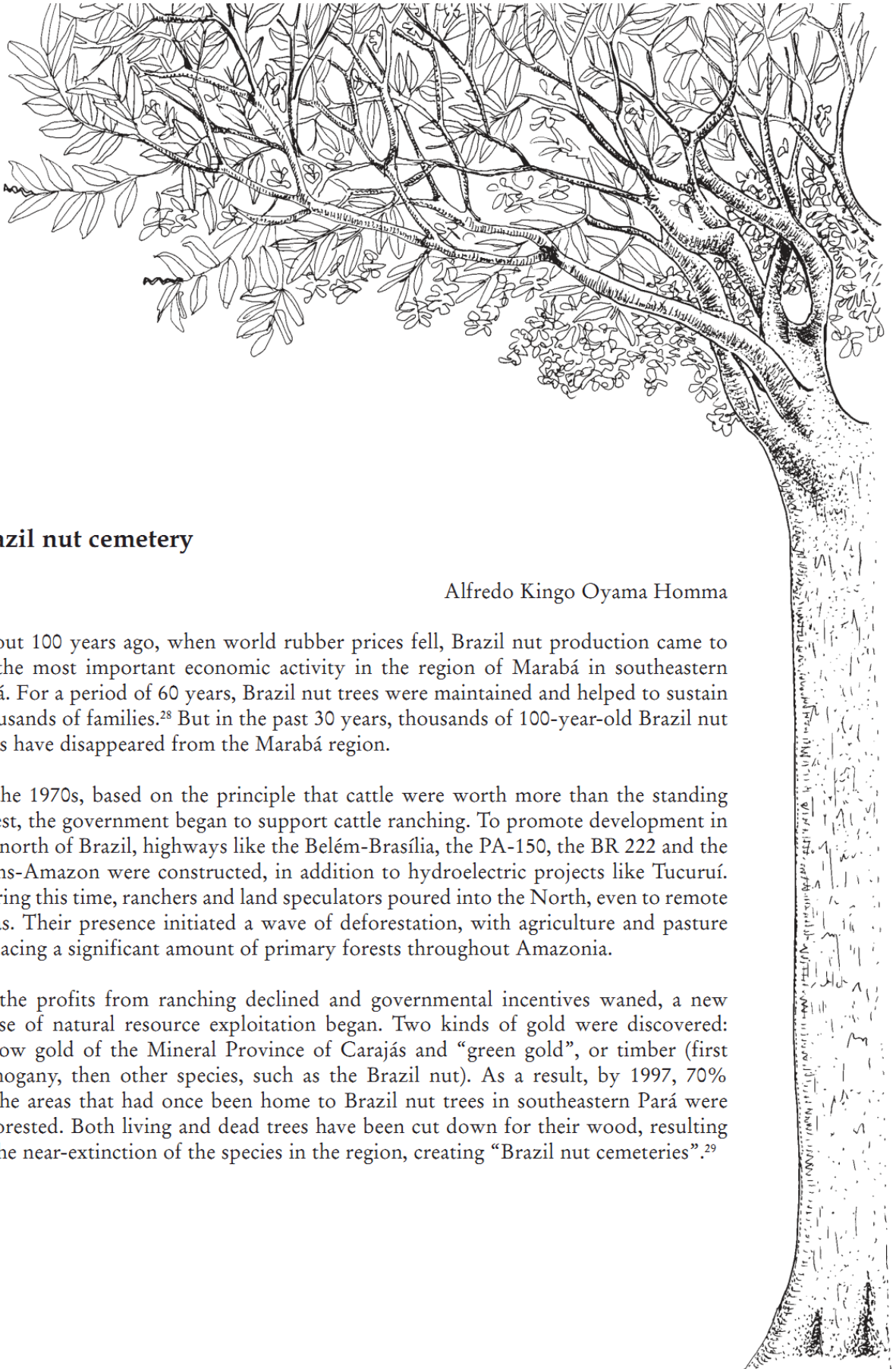
## Why plant Brazil nut trees?

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.





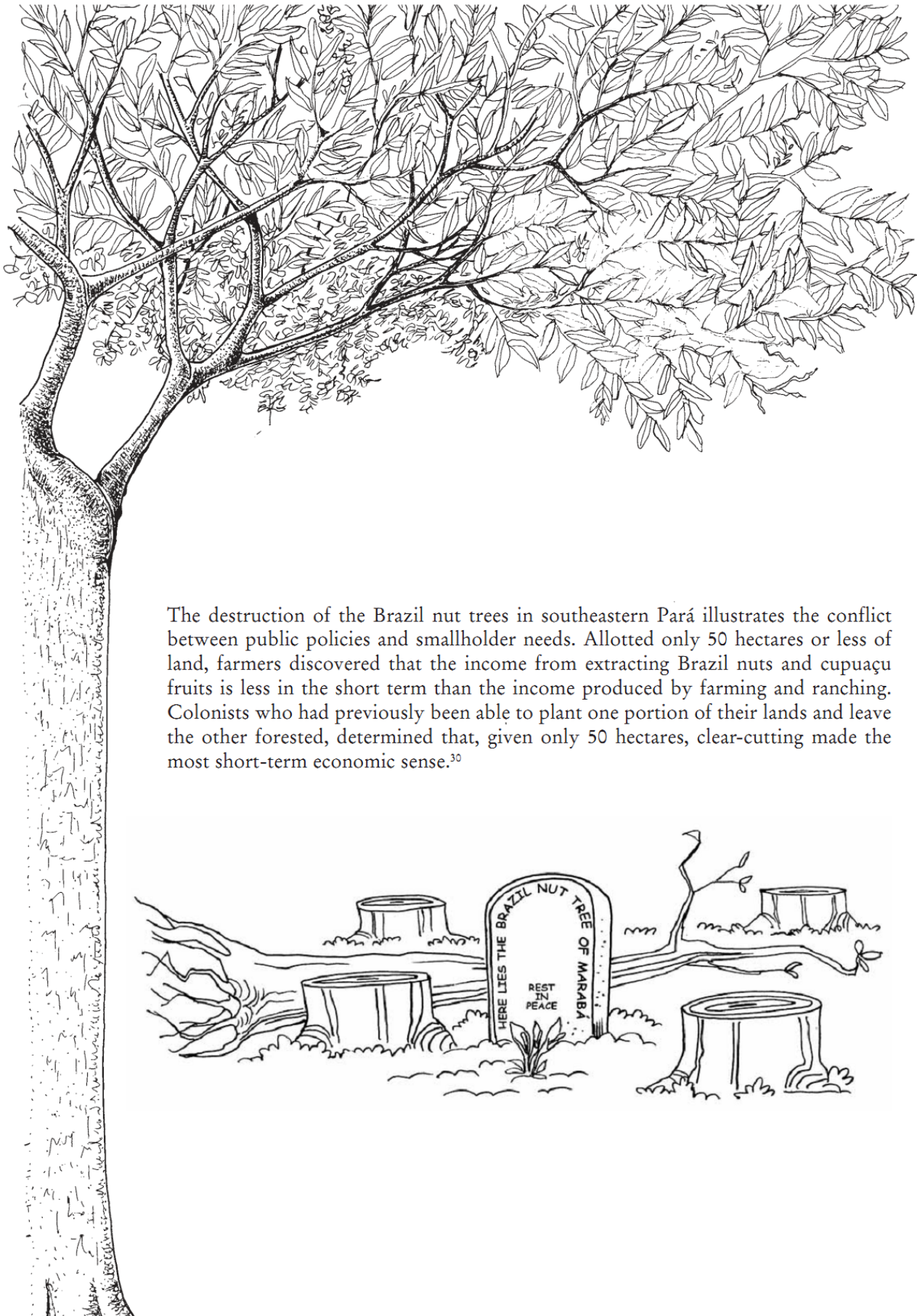
## Brazil nut cemetery

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.<sup>28</sup> 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”.<sup>29</sup>



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.<sup>30</sup>



## 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”.

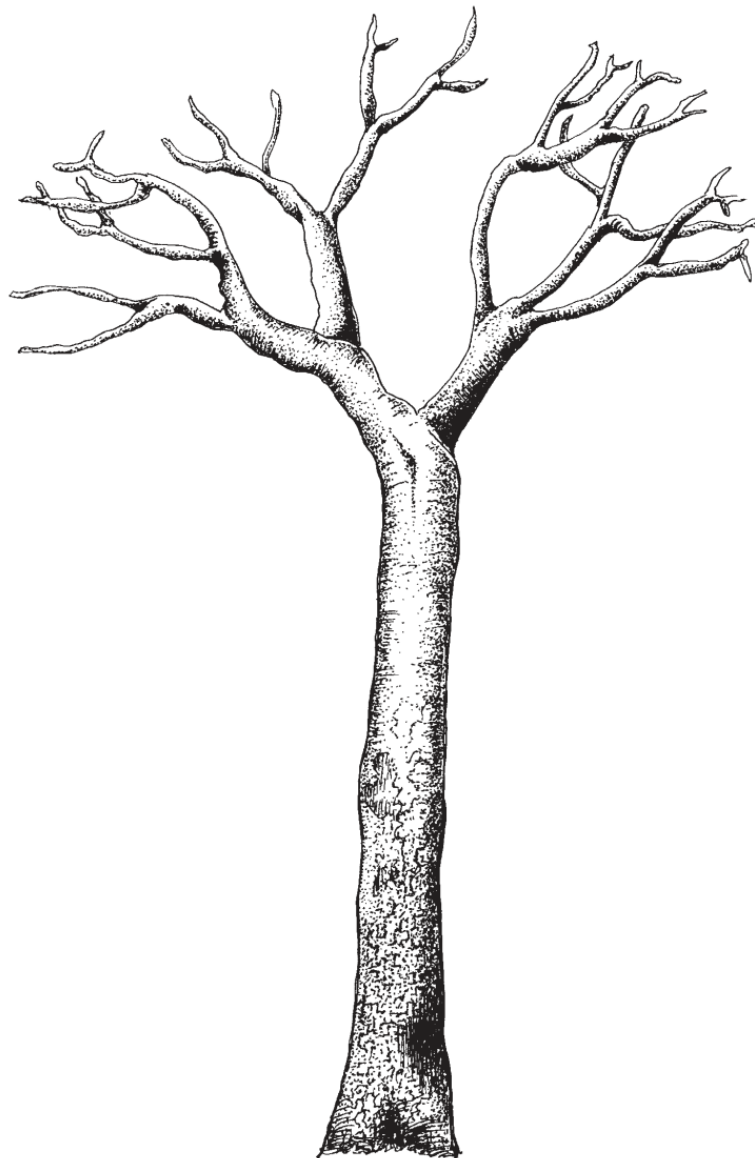
## “Social species”

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.<sup>31</sup> 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.<sup>32</sup>



- 
- <sup>1</sup> Salomão, R.P. 1991
  - <sup>2</sup> Mori, S.A. 1992
  - <sup>3</sup> Peres, C.A. *et al.* 2003
  - <sup>4</sup> Wadt, L.H.O.; Kainer, K.A. & Gomes-Silva, D.A.P. 2005
  - <sup>5</sup> Baider, C. 2000
  - <sup>6</sup> Zuidema, P.A. and Boot, R.G.A. 2002
  - <sup>7</sup> Ortiz, E.G. 2002
  - <sup>8</sup> Miller, C. 1990
  - <sup>9</sup> Kainer, K.A, Wadt, L.H.O. & Staudhammer, C.L.. 2007
  - <sup>10</sup> Assies, W. 1997
  - <sup>11</sup> IBGE, 2007
  - <sup>12</sup> <http://store.florestas.us/bo001.html>
  - <sup>13</sup> Newing, H. & Harrop, S. 2000
  - <sup>14</sup> FAO. 2009.
  - <sup>15</sup> For other experiments with Brazil nuts see Faria, L.J.G. & Costa, C.M.L. 1998
  - <sup>16</sup> Gross, D. 1990
  - <sup>17</sup> Chang, J.C. *et al.* 1995
  - <sup>18</sup> Ramos, C.M.P. and Bora, P.S. 2003
  - <sup>19</sup> Benton, D. 2002
  - <sup>20</sup> Balée, W. 1989 / Cotta, J.N. *et al.* 2008
  - <sup>21</sup> Caldwell, J.P. and Myers, C.W. 1990
  - <sup>22</sup> Balée, W. 1989
  - <sup>23</sup> Vieira, S. *et al.* 2005.
  - <sup>24</sup> Wadt, L.H.O. *et al.* 2008
  - <sup>25</sup> Kainer, K.A. *et al.* 1998
  - <sup>26</sup> Cotta, J.N. *et al.* 2008
  - <sup>27</sup> Muller, C.H. 1995
  - <sup>28</sup> Emmi, M.F. 1987
  - <sup>29</sup> Bentes, R.S. *et al.* 1988
  - <sup>30</sup> Homma, A.K.O. 2000
  - <sup>31</sup> Mello, R.A. *et al.* 1998
  - <sup>32</sup> Powell, A.H. and Powell, G.V.N. 1987