SHORT COMUNICATION

HOW OLD ARE LARGE BRAZIL-NUT TREES (*Bertholletia excelsa*) IN THE AMAZON?

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ABSTRACT: The age of a large Brazil-nut tree (*Bertholletia excelsa*) is measured by radiocarbon dating, and a discussion is made about their importance in the Amazon rain-forest ecosystem.
Key Words: Amazon, Brazil-nut, radiocarbon age

QUE IDADE PODEM ALCANÇAR AS CASTANHEIRAS (*Bertholletia excelsa*) DA AMAZÔNIA?

RESUMO: A idade de uma castanheira (*Bertholletia excelsa*) grande é medida por datação radiocarbônica e uma discussão é feita a respeito de sua importância no ecosistema da floresta amazônica.
Descritores: Amazônia, castanheira, idade radiocarbônica

INTRODUCTION

Brazil-nut trees (*Bertholletia excelsa H. & B.*), known in Brazil as *castanheiras*, are among the tallest trees in the Amazon forest. Their fruits, Brazil-nuts (*castanha-do-Brasil*), are one of the main products collected and sold by extractivists. A significant part of the nut harvest is exported to developed countries were they are added, for instance, to ice-cream, chocolates and other sweets. Advertisements on resulting Brazil-nut products imply that some of the profit is used to improve life quality of extractivists. Due to its importance for the local and regional economy, *B. excelsa* is protected by law; the cutting and selling of nut tree wood has been forbidden since 1987, however, in spite of these facts, destruction of nut trees continues (KITAMURA & MÜLLER, 1984; SILVA BENTES et al., 1988), leading to a decrease in Brazil-nuts national production from 47,976 tons in 1970 to 40,456 tons in 1980 and 25,672 tons in 1990 (IBGE, 1992).

In addition to its social-economic importance, it was recently shown that large trees play an important role in the tropical forest ecosystem. Although rare, large trees account for a significant part of the forest biomass; a recent non published study demonstrated that large trees (3% of the trees with diameter of breast height - dbh >10cm) were responsible for 50% of the total biomass in 1 ha sampled at the Samuel Ecological Reserve, Rondônia State, Brazil.

Nutrient reserves follow the same pattern found for biomass, i.e., a small number of large trees contains most of the nutrients in rain forests. Consequently, it is logical to assume that the loss of such trees will significantly affect the ecosystem structure and function. Bearing this in mind, it becomes very important to know how old large *castanheiras* are, i.e. what age can they reach. Their ages will give an indication on how much time the system needs to recover its pristine conditions following cutting and, indirectly, estimate the social-economic impact caused by the loss of such trees and their fruits.

MATERIAL AND METHODS

B. excelsa occurs naturally in groups, mainly in the eastern part of the Amazon (SALOMÃO, 1991). Areas with high density of these trees are locally called *castanhal*. The only available sample for the analyses in this study was taken from a tree of a 9 ha *castanhal* located near the city of Marabá at the Rio Doce Forest Reserve (5°45'S and 49°02'W) with a total of 45 *castanheiras*, yielding a tree density of 5 individuals per hectare (SALOMÃO, 1991). For radiocarbon dating the tree with the largest dbh (233 cm) was selected, using the inner most part of the main trunk, assumed not exchanging carbon with the environment. The restriction of having one single sample is a serious limitation since this implies that the tree is representative of the community. The difficulty of obtaining Brazil-nut tree samples made authors to accept this limitation.

To eliminate fulvic and humic acids, the sample was treated with HCl 6N for 8 hours at room temperature, followed by NaOH 1:1 for 12 hours at 90°C. Finally, HCl 0.5N was used for 8 hours at room temperature to eliminate the contamination by atmospheric CO_2, according to de VRIES & BARENDSEN (1954). Following this treatment, the sample was combusted at 900°C in a quartz tube for 8 hours. The evolved CO_2 after stripping the water vapor, was transferred to a Pyrex tube with Zn, Co and TiH_2. This tube was heated to 550°C, and the reaction produced graphite, whose ^{14}C activity was measured by accelerator mass spectrometry at the Lawrence Livermore National Laboratory, Livermore, CA, USA (VOGEL, 1992).

The conventional radiocarbon age (t), expressed as years before present (BP) ± standard-deviation, was estimated using the following equation, assuming a ^{14}C half-life of 5568 years:

$$t = -8033 \ln\left[\frac{A_{sample}}{A_{standard}}\right]$$

where A_{sample} and $A_{standard}$ are the radiocarbon activity of the sample and the standard, respectively (STUIVER & POLACH, 1977). The calibrated radiocarbon age was then obtained from published tree ring calibration records (STUIVER & PEARSON, 1986).

RESULTS AND DISCUSSION

The estimated radiocarbon age of the selected *B. excelsa* was equal to 440 ± 60 years BP. The annual average increment of the trunk circumference at breast height was estimated using the radiocarbon age and the trunk diameter ratio. A value of 0.6 cm/year was estimated considering a constant growth rate, which is almost half of the increment initially assumed by J.M. Pires for Amazon trees (SALOMÃO, 1991). With the exception of the class of dbh < 10 cm, the frequency distribution for the other *castanheiras* was higher in the dbh 140-150 cm class (SALOMÃO, 1991), and using the average annual increment found here (0.6 cm/year), an age of 270 years BP is estimated for this dbh class. Several larger trees of *B. excelsa* than the selected one have been reported in the literature. PIRES (1976) reported a tree with 446 cm of diameter, and one of the largest reported trees had a dbh of 525 cm (SALOMÃO, 1991), both found in the eastern Amazon. Using the same assumption used above the age of these giant trees is estimated to be approximately 800 and 1000 years BP, respectively.

B. excelsa has been destroyed in the Amazon either by burning or in the selective logging process (KITAMURA & MÜLLER, 1984; SILVA BENTES et al., 1988). In the later process generally only the largest 3 to 4 trees are selected per ha. Nevertheless the overall damage to the forest is significant, both in terms of mechanical destruction (UHL & VIEIRA, 1989) and as a loss of a large portion of the biomass. As a consequence, the recovery of the ecosystem to its original stand is a very slow process. The development of large trees like the one analyzed here, would take about four centuries.

The findings reported in this short comunication should be taken as an alert in front of the problem of mantaining forest ecosystems. If the recent deforestation rates persist, large Brazil-nut trees might never be replaced, bringing along all social and ecological implications.

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