MANAGEMENT OF *Amburana cearensis* var. *acreana* IN ACRE STATE, BRAZIL

MANEJO DE *Amburana cearensis* var. *acreana* NO ESTADO DO ACRE, BRASIL

Evaldo Muñoz Braz¹ Fabio Thaines² Patrícia Povoa de Mattos³ Luís Cláudio Oliveira⁴ Luciano Arruda Ribas⁵ Marcus Vinicio Neves d’Oliveira⁶ Andréia Aparecida Ribeiro Thaines⁷

ABSTRACT

This work has as its objectives: a) to assess the geographical distribution and population structure of *Amburana cearensis* var. *acreana*; b) to calculate sustainable cutting rates, according to stipulated cutting cycles, and c) to simulate the projected recovery potential in volume based on the calculated cutting rate. It was used data from sustainable forest management plans, and the results will contribute for future decisions about its endangered condition. The results did not corroborate the information that *Amburana cearensis* var. *acreana* is endangered in Acre state. However the management sustainability will only be feasible if considered the ideal remaining population structure and the estimative of the optimal cutting rate according to the cutting cycle.

Keywords: forest management; sustainable cutting cycle; sustainable cutting rate.

INTRODUCTION

Sustainable forest management of tropical forests is a major challenge for the maintenance of biodiversity in these environments. Advances in scientific knowledge of sustainable forest management have shown significant improvement over the last decades, as developing technologies to reduce damage to the environment, to support local development and to implement adaptation or new

---

¹ Engenheiro Florestal, Dr., Pesquisador da EMBRAPA Florestas, Caixa Postal 319, CEP 83411-000, Colombo (PR), Brasil. evaldo.braz@embrapa.br
² Engenheiro Florestal, Coordenador da TECMAN – Tecnologia e Manejo Florestal, Rua Copacabana, 148, Sala 204, Village Maciel, CEP 69.914-360, Rio Branco (AC), Brasil. fabiothaines@tecman.eng.br
³ Engenheira Agrônoma, Drª., Pesquisadora da EMBRAPA Florestas, Caixa Postal 319, CEP 83411-000, Colombo (PR), Brasil. povoa@cnpf.embrapa.br
⁴ Florestal, MSc., Pesquisador da Embrapa Acre, Caixa Postal 321, CEP 69908-970, Rio Branco (AC), Brasil. luis.oliveira@embrapa.br
⁵ Florestal, Dr., Pesquisador da Embrapa Acre, Caixa Postal 321, CEP 69908-970, Rio Branco (AC), Brasil. laribas@cpafac.embrapa.br
⁶ Florestal, Dr., Pesquisador da Embrapa Acre, Caixa Postal 321, CEP 69908-970, Rio Branco (AC), Brasil. mvno@cpafac.embrapa.br
⁷ Engenheira Florestal, TECMAN – Tecnologia e Manejo Florestal, Rua Copacabana, 148, Sala 204, Village Maciel, CEP 69914-360, Rio Branco (AC), Brasil. ribeirothaines@hotmail.com
techniques. Beyond this, it is known that there is still a lot to be done to achieve control of the main variables involved in forest management planning and implementation of new technologies. An important point to be considered is to manage only species that have potential to recover for the next cycles.

Some information to consider a species as threatened of extinction is: geographic distribution, logging and use pressure, among others. The Brazilian Ministry of Environment (MMA) stipulated in a normative instruction (IN 06/2008) that endangered species are those with high risk of disappearance from nature in the near future, considering available scientific data. The list of endangered species was published in Annex I of IN 06/2008 and the species with insufficient data are listed in Annex II of the same normative instruction (BRASIL, 2008). However, this classification can be reviewed and the species can be withdrawn from the endangered species list by specific plans constructed by government researchers among others, coordinated by Chico Mendes Institution and Rio de Janeiro Botanical Garden. Some conservation measures would be: manage (in natural environments), monitor, set aside habitat as protected areas, and carry out studies for understanding the biology and ecology of the species.

Amburana cearensis is a very important species to State of Acre economy (ACRE, 2009). It occurs in Brazil in the states of Acre, Rondônia, Mato Grosso, Pará and Amazonas (CAMARGO et al., 1996). According to Funtac (1999), Amburana cearensis var. acreana has a wide distribution and high occurrence plasticity, and has been observed in six of eleven forest typologies recognized along the 750 km of the BR-364 road, which crosses the state of Acre from south to northwest.

In state of Acre there are regions with phytocological features of Dense and Open Tropical Rain Forest (ACRE, 2006). The total area of Acre state is over 16 millions of hectares and the state presented 12% of deforestation from 1997 to 2007. The deforested areas are along the highways and roads (ACRE, 2008). The state of Acre has presented barriers against predatory occupation of its territory. According to the document of the Ecological Economic Zoning from the State (ACRE, 2006), 14.6% (2,234,265 ha) are indigenous areas, 9.5% (1,560,399 ha) are Conservation Units of Total Protection and 21.6% (3,544,124 ha) are Conservation Units of Sustainable Use. All together, the protected areas are a mosaic consisted of Conservation Units, as the National and State forests and Extractive Reserves in addition with indigenous lands. These protected areas represent more than 46% of the state, which is covered by forests highly diversified and with high economic potential.

The remaining areas are potentially exploitable. They are regulated by environmental legislation which determines that 80% of each farm should be maintained as a “legal reserve” (obligatory conservation forest area defined by Brazilian forest legislation) beyond the conservation of riparian areas, springs surroundings or slop limits, among others (obligatory preservation forest areas defined by Brazilian environmental legislation). Logging trees within legal reserves is allowed only under a sustainable forest management plan (FMP).

This study aims to evaluate current logging rates of Amburana cearensis, considering its geographical distribution and its population structure; to calculate sustainable cutting rates, according to cutting cycles of 25, 30 and 35 years and simulate the projected recovery potential in volume based on the calculated cutting rate, using the data available in the sustainable Forest Management Plans (FMP) registered at the Institute of Environment of Acre (IMAC), thus contributing to the definition about its endangered status.

MATERIAL AND METHODS

The species Amburana cearensis var. acreana (Ducke) J. F. Macbr. (MOBOT, 2009) is deciduous and can reach sizes close to 40 m high and 150 cm in diameter at breast height (DBH). The trunk is upright to slightly sinuous, with up to 25 m (CARVALHO, 2006).

The areas considered in this study were those under management of Amburana cearensis var. acreana in Acre state, include 14 counties (municipalities), covering all regions of the state: upper and lower Acre state, Jurua, Purus and Tarauacá Envira (figure 1). The surveyed area was 58,828 hectares, from 66 FMP. The FMP were selected in IMAC (Institute of Environment of Acre) with logging activities between 2004 and 2008 with management of Amburana cearensis var. acreana. The location, number of plans and the total logging area of the FMPs are presented in Table 1.
TABLE 1: Proportion of the counties covered by the FMP of this study, number of annual operational plans (AOP) and the sum of their forestry areas.

The following assessments were considered:
A) Analysis of FMP (forest management plans) registered at IMAC, considering the variables: volume, number of trees and basal area, area under logging operation and location;
B) Statistical analysis of the FMP data;
C) Characterization of the species distribution in the state of Acre.

To analyze the FMP, it was determined a diameter class center range of 10 cm. Table 2 presents the DBH class center varying from 25 cm to over 135 cm, with their respective number of individuals, estimated to 1,000 hectares. As the FMP forest surveying are above 55 cm
DBH class center as the lower including commercial diameter (complete enumeration forest inventory) the data for tree classes 15, 25, 35 and 45 were obtained from different forest diagnostic surveys in the state (FUNTAC, 1992ab, 1997, 1999; THAINES, 2008; OLIVEIRA and SANT’ANNA, 2003). The trees in 15 cm of diametric class were considered as samplings, and they were used only to adjust the equation of diametric distribution. The volume was calculated using the trees with diameter equal or superior to 25 cm of diameter class.

To evaluate the diameter structure of the Amburana cearensis var. acreana, Meyer’s equation was used, which is traditionally applied to fit hyperbolic distribution, characteristic of native forests (SCHNEIDER and FINGER, 2000).

\[ N_i = k \cdot e^{-a \cdot d_i} \]  

Where: \( N_i \) = frequency per diameter class center, \( d_i \) = diameter class center; \( K \) and \( a \) = coefficients; \( e \) = basis of natural logarithm.

And “q” was calculated as:

\[ q = e^{b_1 \cdot (x_i - x_{i+1})} \]  

Where: \( x_i \) = diameter class center.

D) Sustainable allowable cut

The diameter increment of Amburana cearensis var. acreana was based on periodic annual increment (PAI), obtained from the average values achieved in 20 permanent plots (PP) of 1 ha each (100 m x 100 m) measured in a 5 years period.

As a first approach, the volume able to recover the forest stock in a cutting cycle of 25 years was determined. So, the PAI data were transformed to PAIv% and adjusted according to the methodology presented in Braz et al. (2012), establishing the correlation of the increment to the DBH class centers, using the equation:

\[ \ln \text{PAI} = b_0 + b_1 \cdot \text{DBH} \]  

The intensity of sustainable cutting was determined according to Schneider and Finger (2000), by the expression:

\[ \text{CI} = (1 - (1/1.0i^{cc})) \cdot 100 \]  

Where: CI = Cutting intensity, as percentage of commercial volume of the stand, in cubic meters, \( i \) = periodical annual increment (in percentage of volume); \( cc \) = cutting cycle, in years.

The sustainable allowable cut of Amburana cearensis var. acreana was obtained through the expression:

\[ \text{SAC} = (\text{Vc. CI/100}) \]  

Where: \( \text{SAC} = \) sustainable allowable cut; \( \text{Vc} = \) commercial volume of the stand, in cubic meters and \( \text{CI} = \) cutting intensity.

The evaluate cutting cycles were 25, 30 and 35 years and cutting intensity was projected on the average commercial volume to 1,000 ha of forest production stand (annual standard compartment in Amazon FMP).

A new distribution was projected based on the PAI and the diametric remnant structure of the species, to verify the recover capacity of the species under the used cutting intensity. The used system was the class projection model indicated by Alder (1995):

\[ O = t \cdot i / \Delta W \]  

Where: \( O = \) outgrowth in the classes; \( t = \) time in years; \( i = \) increment for a diameter class; \( \Delta W = \) class width.

The mortality considered in this projection was 1.3% per year, for each DBH class. The mortality was simulated for 25, 30 and 35 years, as follows:

\[ (1-0,0i^n) \cdot N, \]  

Where: “i”= mortality rate; \( n = \) cutting cycle, in years; and \( N = \) number of trees outgrowing the classes.

RESULTS AND DISCUSSION

The number of trees (NI), basal area (Gm²), and volume (Vm³) are presented in Table 2. In the 58,828.7 hectares surveyed under 100% tree inventory map, 10,794 trees of Amburana cearensis var. acreana were registered, with diameter class center above 55 cm, with an average of 0.2 trees per hectare. The species was observed in 100% of the FMP analyzed, varying from 0.018 trees ha⁻¹ in Rio Branco to 0.799 trees ha⁻¹, in Acrelândia. The average basal area was 0.073 m² ha⁻¹, and the average volume was 0.753 m³ ha⁻¹.

Purus region presented the highest volume.
TABLE 2: Statistical analysis in the 66 forest inventories, considering *Amburana cearensis* var. *acreana*.

| Forest inventory | Number of trees (N/ha<sup>1</sup>) | Basal area (m<sup>2</sup>/ha<sup>1</sup>) | Volume (m<sup>3</sup>/ha<sup>1</sup>) |
|------------------|----------------------------------|----------------------------------|----------------------------------|
| Average per hectare | 0.213                            | 0.073                            | 0.753                            |
| Standard deviation | 0.1634                           | 0.0537                           | 0.5804                           |
| Variance          | 0.0267                            | 0.0028                           | 0.3369                           |
| Mean variance     | 0.0004                            | 0.0000                           | 0.0051                           |
| Standard error of the mean | 0.0201                        | 0.0066                           | 0.0714                           |
| Variation coefficient (%) | 9.43                              | 9.08                            | 9.49                             |
| Confidence limits (inferior) | 0.173                            | 0.060                            | 0.610                            |
| Confidence limits - (superior) | 0.253                            | 0.086                            | 0.895                            |
| Total number of trees | 10,794                           |                                  |                                  |

Em que: <sup>1</sup> = Total area surveyed: 58,828.7 hectares; Sampling intensity: 66 Forest management plans.

TABLE 3: Average wood volume of *Amburana cearensis* var. *acreana* in different regions of Acre state.

| Region            | Average volume per unit of 1,000 ha (V m<sup>3</sup>/1,000 ha<sup>1</sup>) |
|-------------------|--------------------------------------------------------------------------|
| Alto Acre         | 654.26                                                                   |
| Baixo Acre        | 722.03                                                                   |
| Juruá             | 662.92                                                                   |
| Purus             | 1,060.32                                                                 |
| Tarauacá/Envira   | 849.09                                                                   |

*Amburana cearensis* var. *acreana* shows occurrence and dominance values similar to that obtained for other timber species (Table 4). The presence of *Amburana cearensis* var. *acreana* over Acre State was also described by several authors (FUNTAC, 1992ab, 1997, 1999; THAINES, 2008; OLIVEIRA and SANT’ANNA, 2003) also indicates wide distribution over Acre state.

**Diameter distribution pre and post-logging**

The frequency distribution of pre-logging, represented in Figure 2, shows that *Amburana cearensis* var. *acreana* is present in all classes studied (considering 15 cm DBH class center and above), in a negative exponential distribution. The calculated “q” quotient was 1.87, within the expected range for natural tropical forests (ALDER, 1995). There is a decrease over 25 DBH class center. However, to O’Hara (1998), the high number of small trees estimated by the adjustment due to the high “q” quotient, are justified due to the high competition and mortality expected in these smaller classes. Small decreases do not necessarily mean that there will be irregularities in the forest structure after the next cutting cycle.

The diameter structure frequency of pre-
logging (Figure 2) also shows a potential for exploitation in the commercial classes above the DBH class center of 55 cm. The curve of the diameter distribution adjusted for the population of *Amburana cearensis* var. *acreana* pre-logging ($b_0 = 7.4411$ and $b_1 = -0.0627$), based on the FMP, was satisfactory ($R^2 = 0.94$, $CV = 24.6\%$, $Syx = 0.5973$).

All DBH classes remain represented post-logging in the forest management plans evaluated (figure 2). The quotient “q” average of the remaining population was 2.06. The increase in “q” was a result from the reduction of larger trees. The curve of the diameter distribution adjusted for the population of *Amburana cearensis* var. *acreana* pos-logging ($b_0 = 7.3657$ and $b_1 = -0.0722$), based on the FMP, was also satisfactory ($R^2 = 0.96$, $CV = 14.8\%$, $Syx = 0.3948$). It can be observed that the frequency curve pos-logging was not interrupted, indicating a potential of the remaining population to recover. It does not ensure the sustainability of forest management plans, but shows a tendency of classes balance (Figure 2).

In the state of Acre, the estimate logging of *Amburana cearensis* var. *acreana* in the commercial classes (55 cm DBH class center and above) was 57.9% of commercial volume (corresponding to 44.9% of commercial trees, and 56.7% of basal area) (Table 5).

It is important to highlight that these numbers represent the scenario of the initial planning. In practice, there may be variations due to the existence of damaged or trees with non-commercial trunk or even trees located in preservation areas, including also the retention of 10% as seed production trees, as determined in the Brazilian forest legislation. Thus, the real logging scenario would be less intense than presented. Analyzing the data from the...
forest management plans individually, the estimated logging values in commercial classes varied from a minimum of 7% up to a maximum of 84%, and in seven areas the species was not considered to be logged because it was “rare” or “not exploitable”. Usually, small volumes are left unexploited if they are non-economical to be logged. However, even if those trees do not represent an immediate exploitable potential, they represent the trees potential distribution as source of pollen, seed production and genetic maintenance.

It can be observed in Table 6 the logging intensity values, in percentage, for each commercial diameter class in average stands of Acre state. In practice, logging of Amburana cearensis var. acreana occurs usually above the 65 cm DBH class center, with logging intensity exceeding 70%. In the 55 cm DBH class center, the intensity is usually less than 25%. This occurs due to the high “sapwood / heartwood” proportion, as trees with smaller diameters present more sapwood, reflecting in low income for industrial sawing. However, this class represents a great increment potential for future cut cycles.

**Calculation of the sustainable cutting rate**

In the Figure 3 it is presented the periodic annual increment in percentage of volume (PAI%) and the adjusted PAI% of volume, according to the different diameter class.

The adjusted equation of the percentage of PAI in volume ($R^2 = 0.8746$, $CV\% = 18.4286$; $Syx = 0.1844$), resulted a $b_0$ of 2.1651 and $b_1$ of - 0.02328. The average increment was similar to that obtained by Brienen and Zuidema (2006) in Bolivia. The percentage on the periodic annual increment in volume was calculated as 2.56%. The average logging intensity of Amburana cearensis var. acreana used in the region of the studied FMP (57.9% on commercial classes) was higher than the rate of growth and recovery of the species. The management of Amburana cearensis var. acreana will be sustainable when applied the correction of the rate in combination with the cutting cycle.

**TABLE 6**: Extraction, in percentage, according to the diameter distribution in number of trees.

| Diameter class center (cm) | Range     | Remaining Commercial structure (%) | Removed Commercial structure (%) |
|----------------------------|-----------|-----------------------------------|---------------------------------|
|                            |           | NI      | G        | V        | NI     | G        | V        |
| 55                         | 50.1-60   | 79      | 78       | 77       | 21     | 22       | 23       |
| 65                         | 60.1-70   | 30      | 29       | 28       | 70     | 71       | 72       |
| 75                         | 70.1-80   | 21      | 21       | 20       | 79     | 79       | 80       |
| 85                         | 80.1-90   | 21      | 21       | 20       | 79     | 79       | 80       |
| 95                         | 90.1-100  | 19      | 19       | 18       | 81     | 81       | 82       |
| 105                        | 100.1-110 | 17      | 17       | 16       | 83     | 83       | 84       |
| 115                        | 110.1-120 | 29      | 28       | 26       | 71     | 72       | 74       |
| 125                        | 120.1-130 | 20      | 20       | 18       | 80     | 80       | 82       |
| 135                        | > 130.1   | 23      | 21       | 19       | 77     | 79       | 81       |

*Em que: Considering: (NI 1000 ha$^{-1}$), basal area (G 1000 m$^2$ ha$^{-1}$) and volume (V 1000 m$^3$ ha$^{-1}$).*
The simulation of increment in a 25 years cycle in the different forest structures is shown in figure 4. It is possible to observe that the structure resulted from the logging does not recover the original volume. However, the structure left by the sustainable rate permit the recovery in the considered cycle. The simulation indicates that the cut rate used today implies a recovery of 72% of the commercial volume in the 25 years cycle. It could be even worse if the exploitation were of all the commercial volume in the DBH class center over 55 cm. In this case, the recovery would be only 48% of the exploited volume (Figure 4).

FIGURE 4: Volume increment considering real and calculated cutting rate.

The optimum remaining structure, compared to the structure pre-logging and the average structure pos-logging is shown in Figure 5. Considering the sustainable distribution, simulated logging was appropriate, what means that the volume logged will be recovered considering new distribution after 25 years observed in the simulation.

Sustainable cutting intensities calculated for *Amburana cearensis* var. *acreana*, considering this average of annual increment should be of 36.54%, 41.46% and 45.8% for cycles of 25, 30, and 35 years, respectively.

It can be observed that the cycles may suggest higher logging intensity if they are longer. However, it is recommended more studies about growth prognosis of the remaining population, as a different diametric distribution was observed in different regions of Acre state. On the other hand, the optimum remnant distribution will vary with different weight of logging applied in the different DBH class center (BRAZ et al., 2011). So, it is important to consider that there are different structures in the Amazon Forest typologies and subtypologies, implying in a higher or smaller number of trees in each DBH class center (BRIENEN and ZUIDEMA, 2006).

CONCLUSIONS

The state of Acre has only 12% of deforestation, with annual increase rate of 1.05%. The State has 46% of its territory of conservation areas and indigenous lands. The remaining area represents 42% of the state, where 33.6% are “legal reserves” and only 8.4% can be converted to other land use, in agreement to the environmental regulations. The results do not corroborate the information that *Amburana cearensis* var. *acreana* is endangered in the state of Acre according to land use;

*Amburana cearensis* var. *acreana* is present in all tree diameter classes analyzed, since 15 cm of DBH class center, with a wide distribution, present in 100% of the forest management plans reviewed;

The structure of the *Amburana cearensis* var. *acreana* distribution shows evidence that the species could be managed, aiming future cycles;

It is recommended a cutting intensity on commercial classes (above 55 cm DBH class
center) of 36.5% for a cycle of 25 years, 41.5% for a cycle of 30 years and 45.8% for a cycle of 35 years, reflecting a reduction of at least 20% over the current logging rate;

REFERENCES

ACRE, Governo do Estado do Acre. Política de Valorização do Ativo Ambiental Florestal. Rio Branco: SEMA, 2008. 354 p. Apresentação – Versão Curta.

ACRE, Governo do Estado do Acre. Programa Estadual de Zoneamento Ecológico-Econômico do Estado do Acre. Zoneamento Ecológico-Econômico do Acre Fase II: documento síntese – Escala 1:250.000. Rio Branco: SEMA, 2006. 354 p. ACRE. Secretaria de Estado de Planejamento. Acre em números 2009. In: ACRE. Governo do Estado. Portal de Informações do Governo do Estado do Acre. Rio Branco, 2010. 181 p. Disponível em: <http://www.ac.gov.br/index.php?option=com_docman&task=cat_view&gid=32&Itemid=165>. Acesso em: 1 jun., 2010.

ALDER, D. Growth Modelling for Mixed Tropical Forests. Oxford: Oxford Forestry Institute, 1995. 231 p. (Tropical Forestry Papers, n. 30).

BRASIL. Instrução Normativa nº 6, de 23 de setembro de 2008. Diário Oficial da União, Brasília, DF, n. 185, 24 set. 2008. Seção 1, p. 75-83, 2008.

AMARO, M. A. Análise da participação da Seringueira (Hevea brasiliensis), Castanheira (Bertholletia excelsa) e das principais espécies madeireiras na estrutura da floresta, no trecho Rio Branco-Cruzeiro do Sul – Fronteira com o Peru. 1996. 78 f. Dissertação (mestrado) - INPA/FUA. Manaus. 1996.

BRAZ, E. M. et al. Taxa de corte sustentável para manejo das florestas tropicais. Ciência Florestal, Santa Maria, v. 22, n. 1, p. 137-145, jan./mar. 2012.

BRAZ, E. M. et al. Otimização da distribuição diamétrica remanescente da espécie Cedrela odorata no estado do Acre, visando o novo ciclo. In: SIMPÓSIO LATINO-AMERICANO SOBRE MANEJO FLORESTAL, 5., 2011, Santa Maria. Sustentabilidade florestal: [anais]. Santa Maria: UFESM, Programa de Pós-Graduação em Engenharia Florestal, 2011, p. 183-193.

BRIENEN, R. J. W.; ZUIDEMA, P. A. The use of tree rings in tropical forest management: Projecting timber yields of four Bolivian tree species. Forest Ecology and Management, v. 226, p. 256–267, 2006.

CAMARGO, J. A. A. et al. Catálogo de árvores do Brasil. Brasília: IBAMA, Laboratório de Produtos Florestais, 1996. 887 p.

CARVALHO, P. E. R. Espécies arbóreas brasileiras. Brasília, DF: Embrapa Florestas, 2006. p 173-179. (Coleção Espécies Arbóreas Brasileiras, v. 2).

FUNTAC – Fundação de Tecnologia do Acre. Inventário florestal e plano de manejo em regime de rendimento sustentado do Seringal Nova Olinda. Rio Branco: 167p. 1992a. (Relatório Técnico).

FUNTAC – Fundação de Tecnologia do Acre. Inventário florestal da área de influência direta da BR-364 no trecho Rio Branco – Cruzeiro do Sul – Fronteira com o Peru. Rio Branco: Funtac, 97 p. 1992b.

FUNTAC – Fundação de Tecnologia do Acre. Manejo florestal sustentável da produção de uso múltiplo da reserva São Luiz do Remanso. Rio Branco: Funtac. 1997. (Projeto ATN/TF – 3934 – BR/BID Apoio às Reservas Extrativistas do Estado do Acre).

FUNTAC – Fundação de Tecnologia do Acre. Inventário do potencial florestal. Zoneamento Econômico-Ecológico. Rio Branco: Funtac, 162 p. 1999. v. 1

MOBOT. Missouri Botanical Garden. Tropicos - Acervo virtual. Amburana cearensis var. acreana (Ducke) J.F. Macbr. http://www.tropicos.org/Name/13068595. Visitado em junho de 2009. 2009.

O’HARA, K.L. Silviculture for structure diversity: a new look at multiage systems. Journal of Forestry, v. 96, p. 4-10, 1998.

OLIVEIRA, M. V. N. d’, SANT’ANNA, H. Inventário florestal e avaliação do avanço do desmatamento no Projeto de Colonização Pedro Peixoto. Rio Branco, AC: Embrapa Acre, 47 p. 2003. (Embrapa Acre. Documentos, 83).

OLIVEIRA, M. V. N. d’, SANT’ANNA, H. Inventário florestal e avaliação do avanço do desmatamento no Projeto de Colonização Pedro Peixoto. Rio Branco, AC: Embrapa Acre, 47 p. 2003. (Embrapa Acre. Documentos, 83).

OLIVEIRA, M. V. N. d’, SANT’ANNA, H. Inventário florestal e avaliação do avanço do desmatamento no Projeto de Colonização Pedro Peixoto. Rio Branco, AC: Embrapa Acre, 47 p. 2003. (Embrapa Acre. Documentos, 83).

SCHNEIDER, P. R.; FINGER, C. A. G. Manejo Sustentável de Florestas Inequiâneas Heterogêneas. Santa Maria: Universidade Federal de Santa Maria. Departamento de Ciências Florestais, 2000.

THAINES, A. A. R. Inventário florestal diagnóstico. Associação Agroextrativista São José - PAE Porto Dias. Rio Branco, 2008. 54 p. (Relatório Técnico).