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USE OF FOREST HARVEST RESIDUES IN THE PRODUCTION OF BROOMSTICKS

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ABSTRACT

Through existing research data on the use of waste in native forests, the economic advantage of using waste for the manufacture of broom handles was investigated. The results showed that the use of forest residues for the manufacture of broom handles is economically viable, since the product does not present high complexity, and can be made of various types of species and with relatively adequate relative humidity through drying at time, without the need for drying in an oven. It should be noted that despite the low sale value, it was found that the production of broomsticks from forest residues compensates with the production in large quantities. The low value of the acquisition of the raw material, combined with a new proposal for the extraction of waste, guarantee competitiveness to the proposed product.

Keywords: Native Forest. Forest Residues. Broom Handles. Economic Viability.

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INTRODUCTION

This article consists of a proposition with the objective of making use of residues from the logging forest operation, in areas of public forest concession, in order to foster the creation of a sustainable business model. The intention of carrying out the article was motivated by the possibility of using forest exploitation residues (logs, top and tree antlers) for the production of wooden clubs to subsidize the creation of broom handles. In this perspective, the study will cover the concession area of the company Samise Florestal Ltda, located in the Federal Forest of Saracataquera, in the municipalities of Faro and Terra Santa, state of Pará.

Sustainable forest management is an activity model that allows the rational exploitation of wood products, which provides for the multiple use of the forest, in order to make the most of the resources it offers, without necessarily causing environmental impacts. According to Nolasco and Viana (2004), one of the main problems of forest management is waste in the use of wood, which results in a large volume of waste.

In the state of Pará, the forestry sector has always had great importance in the economic area, especially in terms of job creation, however, due to the lack of legalized areas for the realization of forestry activity, this fact is not always possible, because the legal aspect of the sector constitutes an obstacle to its development, given the existence of doubts about the long term of the activities, which in a way reduces the volume of investments in the sector. But, in this sense, the offer of public forests through forest concessions, with contracts ranging between 30 and 40 years in duration, emerged as a way to transform forests into places conducive to the generation of employment and income, as well as to make the sector more attractive.

In 2006, with the institution of Law 11.284 (2006) – Public Forests Law – dealing with the protection of public forests, regulatory mechanisms for access to these areas were established, in order to generate socioeconomic and environmental benefits. Also through this law, the forest concession process arises, which, according to the law, consists of the onerous delegation to the legal entity of the right to practice sustainable forest management for the exploitation of products and services in a management unit, through bidding, in a consortium or not, provided that it meets the requirements of the bidding notice. So much so that as a condition for compliance with the clauses of the forest concession contract, the concessionaire must demonstrate the capacity to perform it, at its own risk and for a fixed

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period, and it is up to it to carry out the activities necessary for the maintenance of the management unit and its infrastructure.

In Brazil, according to data from the Brazilian Forest Service – SFB (https://www.florestal.gov.br) and the Institute for Forest Development and Biodiversity of Pará – IDEFLOR-Bio (https://ideflorbio.pa.gov.br) there are more than one million and eight hundred thousand hectares of forests in operation under the forest concession regime.

In the management plan, in general, not only in the concession areas but also in private areas, it is possible, in addition to the exploitation of wood logs, to make use of the exploitation of forest residue, which are parts of the trees discarded in the harvesting process or in the processing of the trees that are operationalized in the forest management process. Nolasco and Viana (2004) report that forest residues are related to a series of environmental, economic and social problems, due to the large quantity, spatial dispersion and difficulty of management; Hakilla (1989) presents the excess of residues in the forest as an additional source for the generation of forest fires, therefore, such reasons, by themselves, would already justify the use of forest residues, on the other hand, combining this with an economic gain, the need for use grows even more.

In the area of sustainable forest management, from the company Samise, the concession contract, when a relationship is made between the price of the wood in logs and the price of the residue, the data is obtained that the cost of the raw material of waste corresponds between 10% and 15% of the value of the wood in logs. Therefore, if the waste is used to make wooden blocks to subsidize the creation of broom handles, the cost of raw material for these types of products will correspond in most cases to the value of the wood, so we will have a product, with a low cost, which can be extremely competitive compared to the same item produced from the wood log.

LITERATURE REVIEW

There are numerous studies involving the use of waste, however they focus on the use of waste for the generation of small wooden artifacts or on the generation of energy and the measurement and valuation of waste, such as the research of Bispo (2017), Amaral (2018), Donato and Takenaka (2016) and Ribeiro et al (2019).

According to Bispo (2017), the pruning service and the suppression of urban areas generate waste that can be used in the manufacture of wooden toys; the research conducted by Amaral (2018) proposes the use of waste in furniture shops for the

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manufacture of small handicraft objects, in the research of Donato and Takenaka (2016) it is proposed to use waste in the production of briquettes for energy generation, while the research by Ribeiro et al (2019) presents that there is feasibility of using forest residues for the production of sawn wood, However, the equipment used for the "extraction" of the waste is the same used for logging forestry.

The importance of all the research analyzed is emphasized, as it shows the possibility of using forest residues. However, despite proposing the use of waste, they do not focus on such use in terms of service at scale, enabling the formation of a value chain, which can generate the possibility of constancy in the use of forest residues. Thus, this article proposes the creation of a systematization of procedures to be carried out for the use of forest exploitation residues in favor of the manufacture of broom handles.

With the use of waste, it is proposed to make wooden blocks to subsidize the creation of broom handles. It is worth mentioning that this is a widely used and widely used product, which in itself already demonstrates the perenniality nature of the project, since it will not be permanently linked to a product that there is no demand for or that is necessary to create a market, but to an existing market that demands a lot of this product, thus generating the greatest possible use of waste.

OBJECTIVES

The general objective and the specific objectives elaborated for the article are presented below.

GENERAL OBJECTIVE

Create a model of production process for the use of waste for the manufacture of wooden blocks to subsidize the creation of broom handles of different species in order to maximize such use.

SPECIFIC OBJECTIVES

Based on the general objective, the article will have the following specific objectives:

i. Analyze the economic and financial feasibility.
ii. Define the process for obtaining the waste.
iii. Create systematization for the use of waste for different products.

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MATERIAL AND METHODS

The data used were collected from the article by Ribeiro et al (2019) that was carried out in a community forest management area in the Tapajós National Forest, all monetary values were corrected by the index indicated by the Brazilian Forest Service – SFB for the correction of its forest concession contracts, the use of these data was deliberate since it is a forest extract similar to what is present in the Saracataquera National Forest, place where the Samise company holds its PMFS.

The collected waste was logs with a diameter greater than 10 cm and a length greater than 120 cm, since the broom handles have an initial length of 1.2 meters. It should be noted that currently the activities are carried out with the same equipment already used for the extraction of logs in native forests, and the proposal of the article is to use different equipment to lower the cost of acquiring the waste.

The dimensions of the logs that are used are similar to the dimensions of logs from planted forests, not to mention that as it is waste, the roads and trails have already been carried out by the forest exploitation for timber logs, which makes it possible to use equipment similar to those used in the exploitation of planted forest trees.

Figure 1 – Antlers of already exploited tree being used

The proposed methodology consists of using planning to reduce costs and maximize the volume to be used, the waste to be used will be indicated through the analysis of the trees that have been operationalized, in order to ensure the use of waste that can generate maximum use. It should be noted that part of the activities will be carried out inside the forest, reducing logistical costs with the toretes, that is, only toretes that can be used will be transported. The logs will be transported to the central yard in order to be operationalized,

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in addition to reducing costs in relation to the movement of loads, since in the central yard there is already a measuring and loading team that can be used to carry out the activities of handling and cubing the sawn pieces.

The waste processing activity also allows the use of waste from shavings, ribs and sawdust. Being chopped for the production of wood chips that can be sold, beds that are used for the production of chickens by the community members and or for the generation of organic compost to be used as fertilizer in family farming areas also within the communities surrounding the sustainable forest management project of the Samise company.

Chart 1 – Comparison of current x proposed extraction activities.

WASTE EXTRACTION		
ITEM	CURRENT METHOD	PROPOSED METHOD
Location and Preparation	- Locate and clean the waste that will be used; - Trees with a larger diameter are considered for operation, since they have larger antlers; - Pickup truck or truck to take assistant and chainsaw operator; - The cut and drag maps already operationalized are used with the indication of the trees that will be used.	- Locate and clean the waste that will be used; - Trees with a larger diameter are considered for operation, since they have larger antlers; - The use of two motorcycles is proposed, one of which is adapted to be able to carry the equipment of the motorcycle operator; - The cut and drag maps that are in the Avenza application are used in order to facilitate the location of the waste to be operationalized.
Drag	- Chainsaw operator, assistant (acts as cable looper) and machine operator are used; - Executed with Skidder type Forestry Tractor with winch.	- Chainsaw operator, assistant (acts as cable looper) and machine operator are used; - Traceability of the waste made at this time, the markings will be made with chalk and/or fixed ink pen; - Executed with agricultural tractor with mini skidder grab and winch attached.
Internal Yard Operations	- Cubing operation and traceability of the waste; - Performed by a meter and an auxiliary. - Stacking operation, with loader, performed by machine operator; - Truck loading operation.	- Cubing operation to be carried out in a central yard; - Truck loading operation, using the mini skidder, using the agricultural tractor operator himself.
Waste Processing	- Processing of waste using horizontal band saw for the production of sawn wood boards; - Operation performed by an operator and an assistant; - Parts for furniture and sawn wood;	- Processing of waste using horizontal band saw for the production of sawn wood boards; - Operation performed by an operator and an assistant; - Sawn wood for making broom handles; - Time drying, multisawing and cable turning, activities use one operator and two assistants.

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DATA ANALYSIS

According to data from Jankaukis (1983), in studies carried out at the experimental unit of Curuá-Una, the ratio between the operationalized roundwood and the volume of waste to be exploited reaches a percentage of use of 35.8%, with the specifications of diameter and average length to be exploited giving: ≥ 10 cm for the diameter and ≥ 50 cm for length, different from the scope we are presenting in this article, where although we propose the same parameter for diameter, our proposal for length is much higher, since we have the length restriction of broom handles.

This length restriction only reduces the total volume of waste used, so we will consider a use of only 25% for logs above 1.2 meters, which means that the percentage of general use of waste with the established restrictions is 8.95%.

UPA 08 of the Samise company is composed of the following species for exploitation:

Figure 2 – Forest Exploitation Authorization – UPA 08 Forest Samise

IBAMA MMA

Sistema Nacional de Controle da Origem dos Produtos Florestais
Superintendência do Ibama no Estado do Pará - PA

Autorização de Exploração - POA (Amazônia Legal) Pleno			
Número da Autorização	**Registro Sinaflor**	**Área autorizada**	**Validade**
1015.2.2022.76537	10118685	2.494,1284 Ha	09/05/2022 a 09/05/2023
Detentor da autorização		**Autorização vinculada**	**CPF/CNPJ do Detentor**
SAMISE IND. COM. E EXPORT. LTDA. - EPP		1015.2.2018.00143	05.334.363/0002-68
Município de referência		**Coordenadas de referência**	
FARO / PA		-1,753097561 | -56,878442998	
Outros municípios associados			
Não se aplica.			

Responsáveis Técnicos			
Nome	**Atividade**	**Cons. Classe**	***ART***
FARID PINHEIRO ABDUL MASSIH	Elaborador/Executor	1502866129	20180280484

Dados dos imóveis rurais
Não se aplica.

Volumetria autorizada				
Produto	**Indivíduos**	**Volume por Ha**	**Volume total**	**Unidade**
Tora(m³)	8908	21,4767	53.565,3962	m³

Detalhamento da volumetria autorizada	
Tora(m³)	
Tora(m³) / Bowdichia nitida / Sucupira-amarela / 19,4314 m³	Tora(m³) / Hymenaea courbaril / Jatobá / 100,7645 m³
Tora(m³) / Dipteryx magnifica / Cumaru / 1.836,1766 m³	Tora(m³) / Zygia racemosa / Angelim-rajado / 24,5140 m³
Tora(m³) / Ocotea cymbarum / Louro-amarelo / 56,5748 m³	Tora(m³) / Manilkara huberi / Maçaranduba / 5.379,2388 m³
Tora(m³) / Hymenolobium excelsum / Angelim-pedra / 3.614,3450 m³	Tora(m³) / Enterolobium schomburgkii / Orelha-de-macaco / 82,2525 m³
Tora(m³) / Diplotropis racemosa / Sucupira-pele-de-sapo / 92,8656 m³	Tora(m³) / Dinizia excelsa / Angelim-vermelho / 19.651,5430 m³
Tora(m³) / Endopleura uchi / Uxi / 583,8082 m³	Tora(m³) / Dipteryx odorata / Cumaru-amarelo / 4.473,5190 m³
Tora(m³) / Diplotropis purpurea / Sucupira-preta / 14,2198 m³	Tora(m³) / Lecythis pisonis / Castanha-sapucaia / 38,8304 m³
Tora(m³) / Peltogyne paradoxa / Roxinho / 30,5578 m³	Tora(m³) / Sextonia rubra / Louro-vermelho / 619,1054 m³
Tora(m³) / Astronium lecointei / Muiracatiara / 767,7203 m³	Tora(m³) / Handroanthus serratifolius / Ipê / 152,8777 m³
Tora(m³) / Bagassa guianensis / Tatajuba / 131,7197 m³	Tora(m³) / Caryocar villosum / Pequiá / 2.170,7854 m³
Tora(m³) / Manilkara bidentata / Maparajuba / 1.100,8643 m³	Tora(m³) / Brosimum rubescens / Muirapiranga / 492,0711 m³
Tora(m³) / Pouteria pachycarpa / Goiabão / 62,2230 m³	Tora(m³) / Ocotea canaliculata / Louro-pimenta / 282,3836 m³
Tora(m³) / Buchenavia parvifolia / Tanibuca-amarela / 826,2352 m³	Tora(m³) / Hymenaea reticulata / Jutaí / 911,0973 m³
Tora(m³) / Newtonia suaveolens / Timborana / 805,0839 m³	Tora(m³) / Sarcaulus brasiliensis / Guajará / 923,9975 m³
Tora(m³) / Mezilaurus itauba / Itaúba / 2.010,9934 m³	Tora(m³) / Goupia glabra / Cupiúba / 2.762,8354 m³
Tora(m³) / Ocotea fragrantissima / Louro-preto / 280,2650 m³	Tora(m³) / Vochysia guianensis / Quarubatinga / 609,3245 m³
Tora(m³) / Qualea paraensis / Mandioqueira / 1.010,5288 m³	Tora(m³) / Clarisia racemosa / Oiticica / 1.192,9287 m³
Tora(m³) / Aspidosperma eteanum / Araracanga / 453,7146 m³	

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The total volume foreseen for exploitation for this annual production unit is 53,565.39 m³ of wood logs, and if we use our percentage of waste use, we will have a total volume of 4,794.102 m³ suitable for the production of broom handles, it is worth mentioning that the choice for the broom handle product is due to the fact that we can use the various forest species and some quality problems are acceptable, such as: white, closed knot and small animal holes.

The cost of obtaining the waste will be extracted based on data from the last price proposal presented by the winning companies of the public forest bidding notice of the Amapá National Forest, the last bidding process carried out by the Brazilian Forest Service – SFB held in 2020. It should be noted that because it is about obtaining waste, the felling of trees, the construction of roads and drag trails are already ready, so the cost of obtaining the waste will be limited to the activities of dragging, loading and internal transfer, so we find the values ranging from R$ 75.00 to R$ 95.00 per cubic meter Explored (https://www.florestal.gov.br).

To correct the value of forestry activities, we will use the Extended National Consumer Price Index (IPCA), the same index used by the SFB to update prices in its forest concession contracts. As the bidding process for the Amapá National Forest took place in 2020, it will be necessary to make the correction for the years 2021 to 2023, considering that the proposals delivered to the SFB were carried out in November/2020, the accumulated IPCA should be from December 2020 to March 2023. In this way, we will have a value of 18.72% (https://www.ibge.gov.br/estatisticas/economicas/precosecustos/9256indicenacionaldeprecosaoconsumidoramplo.html?t=downloads), with this we will have the value of the exploitation of the waste ranging from R$ 89.04 to R$ 112.78.

The cost for transforming the logs into sawn wood will be extracted based on data from the last price proposal presented by the winning companies of the public forest bidding notice of the Amapá National Forest, the last bidding process carried out by the Brazilian Forest Service – SFB held in 2020. It should be noted that the activities that will make up this transformation process are: log/block processing, shipping (handling, cubing and packing of parts) and administration, so we will have a cost ranging from R$ 345.00 to R$ 365.00 per cubic meter of transformation (https://www.florestal.gov.br). To correct the value, we will also use the accumulated IPCA for the period from December 2020 to March 2023,

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which is 18.72%, so we will have the corrected value, which varies from R$ 409.58 to R$ 433.33.

Also according to data from the SFB bidding process of the Amapá National Forest, the average conversion rate from wood to logs to sawn wood is 45%, which is the same rate that we will use for the conversion of the antler log.

Then the cubic meter of sawn wood for the manufacture of clubs that will subsidize the manufacture of broom handles:

Table 1 – Table Legend

ITEM	LOWER VALUE	HIGHER VALUE
1 Waste Cost (m³)	R$ 11,62	R$ 17,43
2 Extraction Cost (m³)	R$ 89,04	R$ 112,78
3 Transformation Cost (m³)	R$ 409,58	R$ 433,33
Total	R$ 510,24	R$ 563,54
M³ Transformed Lumber (45%)	R$ 1.133,87	R$ 1.252,31

Considering that we will dry over time, we will not have drying costs, in the same way that we can infer that the cost of transforming the sawn cubic meter for the manufacture of broom handles is equal to the cost of transforming the torete to sawn wood, we will have the following costs already corrected, which varies from R$ 409.58 to R$ 433.33. Considering that the process losses for the transformation of blocks and the manufacture of handles is around 30%, that is, we will have a use of 70%, a very similar value for the transformation of sawn wood into Deck.

Soon the cubic meter of the broomstick handle:

Table 2 – Table Legend

ITEM	LOWER VALUE	HIGHER VALUE
1 Cost of Lumber (m³)	R$ 1.133,87	R$ 1.252,31
2 Transformation Cost (m³)	R$ 409,58	R$ 433,33
Total	R$ 1.543,45	R$ 1.685,64
M³ Broomsticks (70%)	R$ 2.204,92	R$ 2.408,06

Considering that the volume of a standard broom handle of 1.20 meters in length, we have a volume of 0.00075 m3, therefore, we will have a cubic meter the amount of 1,334 broom handles, that is, we will have wooden handles that will vary their price between R$ 1.65 to R$ 1.80 per unit of the handle.

In research carried out on internet sites, we found the variation in the price of the broom handle from R$ 3.44 to R$ 4.82 to buy at retail, it should be noted that the proposed cables have some peculiar characteristics that in checks on internet sites were not identified

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in the cables that are for sale on the market, these peculiarities are traceability, That is, they are broom handles that have origin and legality and forest certification, that is, these cables, in addition to legality, have a certification that guarantees that the process complies with environmental, social and economic principles.

CONCLUSION

The proposed data show that there is feasibility for the manufacture of broom handles from forest residues, it is noteworthy that the values were overvalued, since the activities being carried out by the new proposed model were not considered, and these are one of the limitations of the work but which may generate future work. The results obtained confirm the possibility of using forest residues to obtain broom handles, a fact that will provide opportunities to generate employment and income for the communities surrounding the concession area, with the use of the systematization of procedures and the operationalization of the system.

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