


SUSTAINABLE MEASURES IN THE MANAGEMENT OF EUTERPE EDULIS AVOID THE PROCESS OF EXTINCTION OF THE PALM TREE

 <https://doi.org/10.56238/arev7n2-286>

Submitted on: 26/01/2025

Publication date: 26/02/2025

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ABSTRACT

The exploitation of the palm tree or juçara (*Euterpe edulis* Mart.), due to the uncontrolled extraction of the heart of palm for fresh consumption and industrialization of preserves, resulted in a significant decrease in the seed bank of the species and its inclusion in the list of species at risk of extinction. *Euterpe edulis* plays a key role in the Atlantic Forest, as it requires a period of six to nine years to generate seeds. The practice of extracting hearts of palm from young plants that have not yet flowered or fruited interrupts the complete reproductive cycle of the tree. Therefore, the objective was to generate information on sustainable management of preventive practices of the species that can be applied in favor of improvements for conscious extraction avoiding its extinction. It was concluded that the correct handling of the palm tree, with the objective of producing fruits for the extraction of the pulp, is the most interesting production than removing the palm heart, since its cutting, in addition to exerting a negative effect on the most varied species of fauna, leads to the death of the plant after the incision of the strain.

Keywords: Extinction. Extractivism. Conservation. Juçara. Handling.

INTRODUCTION

The Atlantic Forest is one of the main biomes in Brazil, recognized for its high degree of endemism and biodiversity. At the end of the fifteenth century, the Atlantic Forest extended along the entire Brazilian Atlantic coast, covering approximately 15% of the territory of that country, about 1,300,000 km², that is, 102,012 km² (Oliveira et al., 2015). Since the beginning of the colonization process, the exploitation of the fauna and flora of the Atlantic Forest has been overwhelming, without a focus on the conservation of species or the balance of the ecosystem. The Atlantic Forest biome assumes significant ecological relevance because it has a high richness and diversity of species of flora and fauna (Oliveira et al., 2015; Garbin, 2011), however, the destruction of this ecosystem leads to extinction of several endemic taxa (Rocha et al., 2010). The areas covered with remnants of the Atlantic Forest, in 1990, already added up to less than 10% of the original extension in the country (SOS MATA ATLÂNTICA; INPE, 2013).

From the south of the northern coast of Rio Grande do Sul to the wetlands of the Northeast, it demarcates the limit of the Atlantic Forest, being declared a "Biosphere Reserve" by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and "National Heritage" in the Constitution of the Federative Republic of Brazil of 1988. The Atlantic Forest is the scene of socio-environmental conflicts, mainly due to environmental legislation limiting land use by the local population (Godoy et al. 2022; Cardoso et al., 2011).

In the Atlantic Forest biome, palm trees (*Arecaceae*) are found, recognized as components of importance, due to their abundance and significant interactions with other organisms (Araujo et al., 2024; Leitman et al., 2012). The *Arecaceae* family has approximately 240 to 252 genera and 2,522 to 2,700 species distributed. Brazil is home to 270 species distributed in 37 to 39 genera, of which 4 genera and 113 species are considered endemic in the country (Araujo et al., 2024; Leitman et al., 2012; Lorenzi et al., 2010).

The juçara plum, belonging to the *Arecaceae* family, occupies the middle stratum of the Sao Paulo family. The expression "juçara", of Tupi origin, means "that which gives splinters or splinters"; in other Brazilian regions it receives other nomenclatures such as içara, sweet palm, juçara palm, palmiteiro, ensarova, ripeira, etc. (Da Silva, Perez-Cassarino, Kersten, 2023).

Studies prove the existence of several species of birds, amphibians, reptiles, mammals and fish, in addition to showing a high diversity of tree species per hectare, demonstrating that in fact the Atlantic Forest has the highest diversity of trees in the world per unit area. Several of these species of animals and plants are threatened with extinction. The official total list states that 276 of the plant species of the Atlantic Forest are threatened, among them, *Euterpe edulis* Mart, popularly known as juçara palm, juçara palm, sweet palm, içara, ripeira or bata (Mortara, Valeriano, 2001; Campanili and Schaffer, 2010; Lutkemeier et al., 2008) (Figure 1).

From the sixth year of age, the juçara blooms, and can reach up to 20 meters in height and 30 centimeters in diameter at breast height (Maciel, Moura, Leonardi, 2019) (Figure 2). According to Mantovani and Morellato (2000) studies with juçara indicate that each plant is capable of producing up to five bunches in a year, and each infrutescence produces an average of 3,330 fruits.

Figure 1 – Juçara palm (*Euterpe edulis*)



Source: Godoy et al. (2022).

Figure 2 - - Juçara collection record



Source: Maciel, Moura, Leonardi (2019).

The main product of juçara is the heart of palm, which is obtained from the region near the apical meristem, from the inside of the leaf sheaths; it is a white cylinder that contains the leaf and vascular primordia, soft and not very fibrous, and much appreciated

(Cembraneli et al., 2009) (Figure 3). The stipe has already been used in constructions in wattle-and-daub houses, such as slats, supports and rafters (Favreto, 2010).

Figure 3 – Juçara palm heart

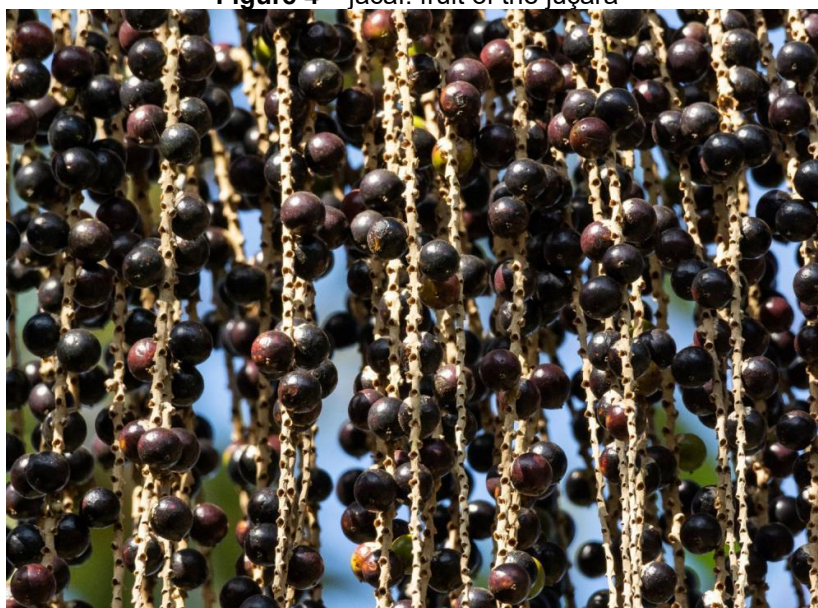


Source: <http://infograficos.estadao.com.br/.../cidad.../palmeira-juçara/>

E. edulis is monoecious, allogamous, evergreen, ombrophilous, mesophilic or slightly hydrophilic, of a straight and cylindrical strain, does not tiller at the base (non-stoloniferous), which causes the death of the plant when cutting, to remove the heart of palm (Guimarães, Souza, 2017). The juçara palm provides a significant amount of fleshy fruits throughout the year and commonly, in times of scarcity of resources by dozens of species of birds and mammals (Fadini et al., 2009), which is why *E. edulis* has an ecological role as a keystone species by feeding more than 48 species of birds and 20 mammals (Godoy et al. 2022; Cembraneli et al., 2009); therefore, changes in the ecological relationships of the juçara modify the processes of successional dynamics, since the predatory exploitation of the juçara has a negative impact on the species of fauna (Souza; Guimarães, 2017; Kings; Kageyama, 2000).

The fruits of the juçara, the jacaí, are globose drupes of green color and edible, when young, and black-violet, when ripe, measuring from 1 cm to 1.4 cm in diameter, formed in infrutescences originating from the inflorescences. From the fruits of palm trees of the genus *Euterpe*, açaí is obtained. The açaí juçara has a single seed, represents approximately 90% of the diameter of the fruit and up to 90% of its weight (Godoy et al., 2022; Maciel, Moura, Leonardi, 2019; Cardoso et al., 2018; Oliveira et al., 2015). (Figure 4).

Figure 4 – jacaí: fruit of the juçara



Source: <https://registrodiario.com.br/noticia/3998/jucara-o-fruto>

The flavor of the jackfruit is appreciated, refreshing; it is a source of energy, with a high carbohydrate and energy content, rich in vitamin A, lipids, iron and water. The fruit has nutritional properties and phenolic compounds, rich in antioxidant compounds and anthocyanins. The pulp has a quantity of mining elements close to or superior to açai (Araujo et al., 2024; Maciel, Moura, Leonardi, 2019; Mortara, Valeriano, 2001).

The induction of progressive rarity and the causes mentioned above, led to the species being included in the official list of the Brazilian Flora Threatened with Extinction, by MMA Ordinance 443/2014, classifying it in the category of danger of extinction (Cardoso et al., 2011; Garbin, 2011; Brazil, 2008, Tsukamoto Filho et al., 2001) and on the International Union for Conservation of Nature and Natural Resources (IUCN) red list (Godoy et al. 2022; Godinho et al., 2016).

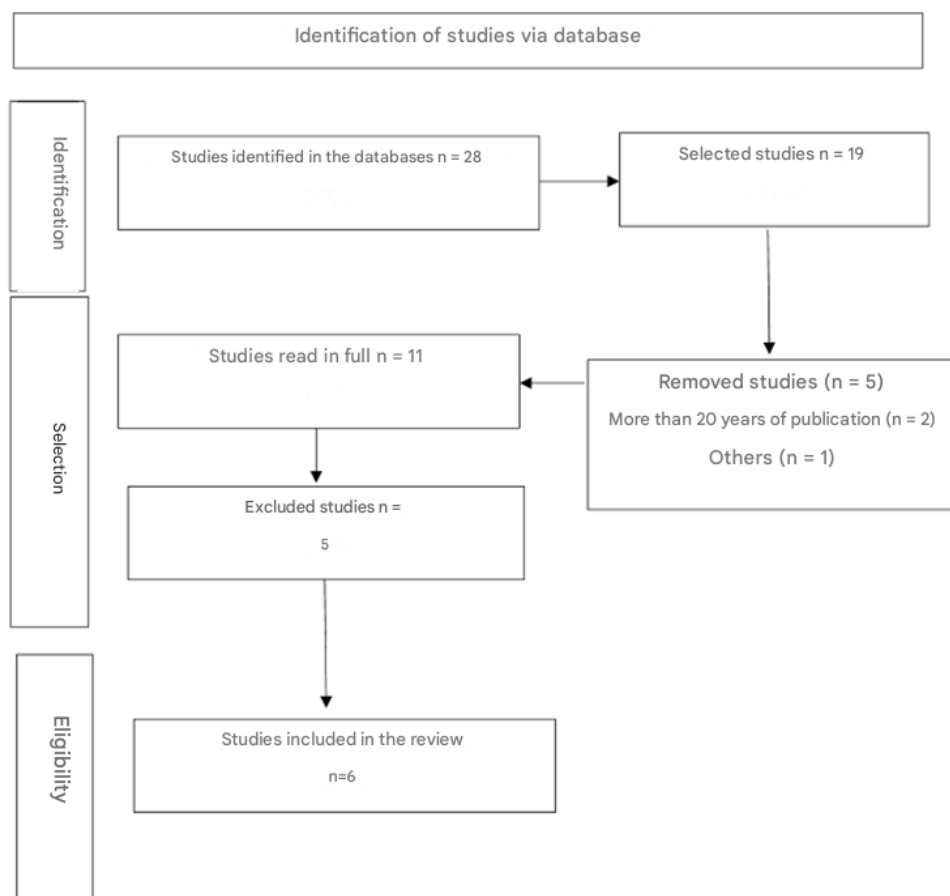
Considering that *E. edulis* is the keystone species of the Atlantic Forest and because it requires six to nine years to produce seeds, the removal of the heart of palm in young plants that have not flowered or fruited, prevents the tree from finishing its reproductive cycle. Concomitantly, the natural populations of the juçara palm have been fragmented and its area of occurrence has been reduced, as it is the target of cutting for the extraction of the heart of palm for fresh consumption and industrialization of preserves. In this sense, the present study aims to generate information on sustainable management of preventive practices of the species that can be applied in favor of improvements for conscious extraction avoiding its extinction.

MATERIALS AND METHODS

This is a systematic review, in which the search for scientific articles was carried out from April to May 2024. In the survey of publications, a maximum period of 20 years was stipulated from publication, using the following databases: Scielo, Springer and Science Direct. The keywords were related to the main term, namely: palm, açaí and *Euterpe edulis*, allocated in the search by applying the Boolean "OR" between them. To promote association with the other descriptors regarding the management of heart of palm, the Boolean "AND" was applied.

As a selection criterion, the condition was adopted that the descriptors should appear in the "title" and/or "abstract", and the language varied between Portuguese and English, in accordance with the database consulted. By means of reading, the results were evaluated with the objective of checking the relationship of the results to the research proposal, thus considered eligible the originals, which evaluated the improvements for conscious extraction of *E. edulis* avoiding its extinction. The Figure illustrates the selection of the articles included in the study, according to the eligibility criteria applied in the study:

Figure 5 – Flowchart of the selection of articles included in the review



Then, he tabulated the publications, illustrated in Chart 1:

Chart 1 - Synthesis of the main results of studies related to the sustainable management of preventive practices of *E. edulis* avoiding its extinction

Author/Year	Title	Goal	Methodology	Conclusion
Bourscheid et al., 2011	Native food species of the Southern Region of Brazil	Present the characteristics of <i>Euterpe edules</i>	Literature review	The change in the exploitation of <i>E. edulis</i> from the production of heart of palm to the production of açai has advantages and should be consolidated as a renewed hope for farmers and palm trees
Godoy et al., 2009	Juçara (<i>Euterpe edulis</i>): ecological and food importance	Highlight the ecological and food potential of the <i>Euterpe edulis</i> species, and expand the alternatives for agro-industrial use and improve the quality of final products and conservation.	Literature review	The use of products from juçara, whether pulp, preserved or minimally processed, needs to follow the recommended care, aiming to ensure that the products and handling are within the microbiological standards defined by Normative Instruction No. 60, of December 23, 2019.
Guimarães, Souza, 2017	Juçara palm: natural heritage of the Atlantic Forest in Espírito Santo	Promote the juçara palm as a flagship species of the intrinsic value of the Atlantic Forest Biome in Espírito Santo.	Literary review	The results of the research and rural development project, highlighting the importance of conservation and management for better economic use and conservation in natura.
Rocha et al., 2010	Foliar mycobiota of <i>Coussapoa floccosa</i> , a highly threatened tree of the Brazilian Atlantic Forest	Study the microbiota of the endangered species <i>E. edulis</i> , identifying mechanisms of prevention and conservation of the species.	Field study	The mycobiota may depend on its near-extinct hosts and consequently may be equally threatened with extinction and therefore merit consideration for in situ and ex situ conservation.
Souza, Guimarães, 2017	Juçara palm: a natural resource of great value	Present the main characteristics and importance of the juçara palm tree.	Literature review	The sustainable and safe use of the juçara palm can be done and has proven to be an economically viable and conservation alternative.
Souza, 2015	New management system conserves the juçara palm: The species, threatened with	The study covered the main types of vegetation where juçara is managed, secondary forests and agroforestry systems	Field research	It was observed that the new juçara management system can contribute to community strengthening by diversifying family production and increasing income. One of the challenges for the sustainability of the

	extinction, is managed to obtain fruits that yield pulp similar to that of açai.			management of native species is to ensure the reproduction of the species while producing and commercializing.
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RESULTS AND DISCUSSION

The natural populations of the juçara palm have been fragmented and its area of occurrence has been reduced, due to the combination of habitat destruction and predatory and illegal overexploitation, as it is the target of cutting for the extraction of palm hearts for *fresh consumption* and industrialization of canned goods (Rocha et al., 2010).

The slow growth and the fact that it does not resprout (as occurs with other species exploited for hearts of palm, such as peach palm and açai), leads to the death of *E. edulis* after the strain is cut to extract the heart of palm (Godoy et al. 2022; Garbin, 2011). Souza and Guimarães (2017) and Bourscheid et al. (2011) cite in their studies that the trunk or strain of the palm tree is not stoloniferous, that is, it has a single stem, therefore, it does not sprout at the base. Therefore, the collection of the heart of palm, which corresponds to the apical meristem of the plant, kills the palm tree. Thus, the extraction of the heart of palm causes a significant reduction in the natural population of the species.

Souza and Guimarães (2017) corroborate that the extraction of heart of palm from adult plants, in addition to causing their death, prevents the generation of new offspring, the authors warn that: "Buyers of stolen hearts of palm are considered sponsors of illegality. As long as there are those who buy it, there will be hearts of palm produced clandestinely, which also represents a danger to public health" (2017, p. 14).

Guimarães and Souza (2017) allude that the management of the juçara palm, with the purpose of producing fruits to extract the pulp, is more interesting than removing the palm heart, since the cutting of the palm tree has a negative effect on the various species of fauna that use the jackfruit as one of the main sources of food.

Naturally, these species propagate in the environment where they live. In order to make economic profitability and meet the legal standards for the exploitation of the juçara palm, the use of agroforestry systems has been taking place in natural regions where the species occurs, which needs shade crops because they do not tolerate full sun in the initial phase of development (Godoy et al. 2022; Guimarães, Souza, 2017).

A study carried out by Souza (2015), with the objective of leveraging the recovery and conservation of the juçara palm of the species, verified the demographic trends of the juçara using matrix models. Most communities are expected to remain stable over the next hundred years, but those where the adult mortality rate is highest may show a reduction of up to 3% annually. The results of the survey underscored the relevance of adult survival for population sustainability in the future.

From the stochastic simulations that increased the fruit harvest rate by up to 100%, it was observed that this did not have a significant impact on the population growth rate. Therefore, the harvest of juçara fruits is in line with the main management strategy recommended to ensure the health of the populations of the species, which is to promote the survival of adult palm trees (Souza, 2015).

Concomitantly, Normative Instruction No. 003/2013 of the Institute of Agricultural and Forestry Defense of Espírito Santo recommends the strategy for sustainable exploitation for the extraction of the *E. edulis* fruit, noting that it can be carried out by a qualified professional or by a collaborator of the Espírito Santo Institute of Research and Rural Extension (INCAPER) (Guimarães; Souza, 2017).

The aforementioned Normative Instruction recommends that, in the condition of exploitation in *forest in natura*, at least 1 (one) bunch must be preserved in each tree during the course of harvesting, it cannot be carried out in the case of a single bunch, per palm tree. In addition, after completing the harvest on each plant, three palm tree seedlings must be planted, and at least 20% of the seeds must be returned after pulping the fruits, in the form of sowing in the regions of occurrence, maintaining some natural plots close to the extraction sites without intervention (Godoy et al. 2022; Guimarães; Souza, 2017).

They are released to areas of use of various soils with the cultivation of the juçara palm for the extraction of the fruits, but they must be registered with the Institute of Agricultural and Forestry Defense of Espírito Santo (IDAF) and their exploitation correctly informed for the purpose of origin control, considering that the agency responsible for regularizing the production units in natural forests as well as in planted areas (Guimarães; Souza, 2017). From an environmental perspective, the action involving the manipulation of the juçara advocates the conservation and restoration of *E. edulis* in its ecological role as a keystone species, and it is essential to act with conservative actions aimed at the Atlantic Forest biome (Godoy et al. 2022).

CONCLUSION

The juçara is considered a species of ecological, natural and economic importance. The use of fruits values the survival of palm trees while the cutting of hearts of palm inevitably increases mortality. It is in line with the fact that the seeds generated from the processing process germinate, providing the recovery of the species.

The sustainable exploitation of its juçara fruits can represent an ecologically viable alternative, capable of leveraging job opportunities and income for rural communities, and stimulating the survival and recovery of the species, leveraging the recomposition of the Atlantic Forest. The proposal is to carry out the correct handling of the palm tree, with the objective of producing fruits for the extraction of the pulp, since this production is more interesting than removing the heart of palm, because its cutting, in addition to exerting a negative effect on the most varied species of fauna, leads to the death of the plant after the incision of the strain.

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