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Original article

Exploitation and potential uses of Carludovica palmata Ruiz & Pav. as a non-timber forest product

Aprovechamiento y potencialidades de usos de Carludovica palmata Ruiz & Pav. como producto forestal no maderable

Exploração e usos potenciais de Carludovica palmata Ruiz & Pav. como produto florestal não madeireiro

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ABSTRACT

The alternatives associated with generating economic income in rural communities arise from the utilization of Non-Timber Forest Products. The objective of this research is to evaluate the utilization and potential uses of *Carludovica palmata* Ruiz & Pav. as a non-timber forest product in the Pile community, Montecristi Canton. Interviews were conducted to investigate the uses of the species, its location, harvesting period, and purpose. In order to analyze ecological aspects, including species diversity, population density, and other relevant attributes characterizing palm communities, transects measuring 5 m in width by 100 m in length (500 m²) were established. The category of crafts turned out to be the most significant with 167 citations (97.66%). The plant part most used is the leaf, with hats being the primary products crafted from toquilla straw (166 citations). Both thick and fine weavings are extensively used (79 and 83 citations, respectively). Among the factors influencing product quality, the maturity state of the toquilla straw and the time of year stand out, with 110 and 55 citations respectively. 90.29% of the interviewees affirmed that the use of *Carludovica palmata* is low and that they only use the terminal bud of the stem to make handicrafts. The perception regarding the species abundance is very low. However, information obtained from the transects revealed 2 503 individuals/ha, reflecting the absence of silvicultural management practices in the habitat of *Carludovica palmata* in the Pile community. The *Carludovica palmata* species is not used and managed properly, its potential uses are limited.

Keywords: Handicrafts, *Carludovica palmata* , diversity, uses, rural, transects.

RESUMEN

Las alternativas asociadas a la generación de ingresos económicos en comunidades rurales nacen de la utilización de los Productos Forestales No Maderables. El objetivo de esta investigación es evaluar el aprovechamiento y las potencialidades de usos de *Carludovica palmata* Ruiz & Pav. como producto forestal no maderable en la comunidad Pile, Cantón Montecristi. Se realizaron entrevistas para indagar sobre los usos de la especie, ubicación,

época y objeto de cosecha; para analizar aspectos ecológicos, incluyendo la diversidad de especies, la densidad poblacional y otros atributos relevantes que caracterizan a las comunidades de palmas se establecieron transectos de 5 m de ancho por 100 m de longitud (500 m²). La categoría de artesanías resultó la más importante con 167 citaciones (97,66 %). La parte de la planta que más utilizan es la hoja; los sombreros son los productos más fabricados con paja toquilla (166 citaciones); los tejidos gruesos y finos son los más usados (79 y 83 citaciones), respectivamente. Entre los aspectos que influyen en la calidad de los productos resaltan el estado de maduración de la paja toquilla y la época del año, 110 y 55 citaciones, respectivamente; el 90,29 % de los entrevistados afirmaron que el aprovechamiento de *Carludovica palmata* es bajo y que solo utilizan la yema terminal del tallo para confeccionar artesanías. La perspectiva sobre la abundancia de la especie es muy baja, sin embargo, la información obtenida en los transectos reveló 2 503 individuos/ha, lo que refleja la carencia de prácticas de manejo silvicultural donde habita *Carludovica palmata* en la comunidad Pile. La especie *Carludovica palmata* no es aprovechada y manejada adecuadamente, sus potencialidades de usos son limitadas.

Palabras clave: artesanías, *Carludovica palmata*, diversidad, usos, rural, transectos.

RESUMO

As alternativas associadas à geração de renda econômica em comunidades rurais surgem da utilização dos Produtos Florestais Não Madeireiros. O objetivo desta pesquisa é avaliar o aproveitamento e as potencialidades de uso de *Carludovica palmata* Ruiz & Pav. como produto florestal não madeireiro na comunidade de Pile, Cantão de Montecristi. Entrevistas foram realizadas para investigar os usos da espécie, localização, período e propósito da colheita; para analisar aspectos ecológicos, incluindo diversidade de espécies, densidade populacional e outros atributos relevantes que caracterizam as comunidades de palmeiras, foram estabelecidos transectos de 5 m de largura por 100 m de comprimento (500 m²). A categoria de artesanato se mostrou a mais importante, com 167 citações (97,66%). A parte da planta mais utilizada é a folha; os chapéus são os produtos mais fabricados com palha toquilla (166 citações); os tecidos grossos e finos são os mais usados (79 e 83 citações),

respectivamente. Entre os aspectos que influenciam a qualidade dos produtos, destacam-se o estado de maturação da palha toquilla e a época do ano, com 110 e 55 citações, respectivamente; 90,29% dos entrevistados afirmaram que o aproveitamento da *Carludovica palmata* é baixo e que utilizam apenas a gema terminal do caule para fazer artesanato. A perspectiva sobre a abundância da espécie é muito baixa; no entanto, as informações obtidas nos transectos revelaram 2 503 indivíduos/ha, refletindo a falta de práticas de manejo silvicultural onde *Carludovica palmata* habita na comunidade de Pile. A espécie *Carludovica palmata* não é utilizada e manejada adequadamente, seus usos potenciais são limitados.

Palavras chave: artesanato, *Carludovica palmata,* diversidade, usos, rural, transectos

INTRODUCTION

In the summary version of the state of the world's forests 2022, published by the Food and Agriculture Organization of the United Nations (FAO, 2022), it is ensured that, "forests and trees provide essential ecosystem goods and services, but they are undervalued in economic systems".

For its part, in the global action plan for the conservation of forest genetic resources (Food and Agriculture Organization of the United Nations [FAO], 2014), in its strategic priority 16, it states that: In addition to wood, forests provide many other products that are important to local communities and national economies. The importance of medicinal plants, fodder plants and food plants is becoming increasingly recognized and taken into account in many country reports.

The use of products derived from wood or Non-Timber Forest Products (PFNM) represent an alternative to avoid the degradation of the biodiversity of ecosystems and ensure the quality of life and food for people, a fact based on objective 13 "Action for the climate", listed in the 2030 agenda for sustainable development, raised by the United Nations Organization.

Carludovica palmata Ruiz & Pav. It is a species that provides materials that are used to make handicrafts in rural communities; according to Cetzal *et al.* (2018) in the Yucatan Peninsula - Mexico "there are few Mayan communities that maintain the production of the well-known Jipijapa palm hats (Carludovica *palmata).* "On the other hand, in Colombia the commercial interest of this palm, according to Pulecio and Cabrero (2021) "is *related to the production of fibers for the production of crafts, mainly the Suaceño hat as cultural heritage.*"

In Ecuador, as cited in De la torre *et al.* (2008), one of the groups of plants with the greatest potential are plants for obtaining materials that are used to make handicrafts and are sold in the different markets of the country. The importance of the species lies in the products it offers (Palacios *et al.* 2016). Two of the species with the greatest commercialization on an international scale and with the greatest studies of ethnobotany and economic botany are the toquilla straw (Carludovica *palmata*) and the tagua (*Phytelephas aequatorialis* Spruce), which exists in all the provinces of the Coastal region.

The problem in the diversity of toquilla straw palms in the community of Pile, in the Montecristi Canton in Ecuador, lies in the decrease of this diversity. The species *Carludovica palmata* is being overused and poorly managed. The excessive use for making toquilla straw hats and other artisan products, together with the lack of adequate silvicultural management practices, has led to low abundance and a potential loss of genetic diversity within the population of these palms in the community.

The lack of a sustainable approach in the exploitation of this species and the limited diversification of its uses contribute to the decrease in the diversity of toquilla straw palms in the community of Pile. Furthermore, concentration on a single type of product and use of a specific part of the plant for crafts negatively affect the overall health of palm populations and the species' ability to regenerate. For all the above, the objective of evaluating the exploitation and potential uses of *Carludovica palmata* as NTFP is presented.

MATERIALS AND METHODS

Characterization of the study area

Pile is a rural community belonging to the Montecristi Canton of the province of Manabí, located 30 km from the city (Figure 1), covering an area of 734 km². This sector, as described by the Territorial Development and Planning Plan of the Municipal Autonomous Decentralized Government of Montecristi (GADM, 2016), is where the raw material for the production of toquilla straw hats is mainly extracted.

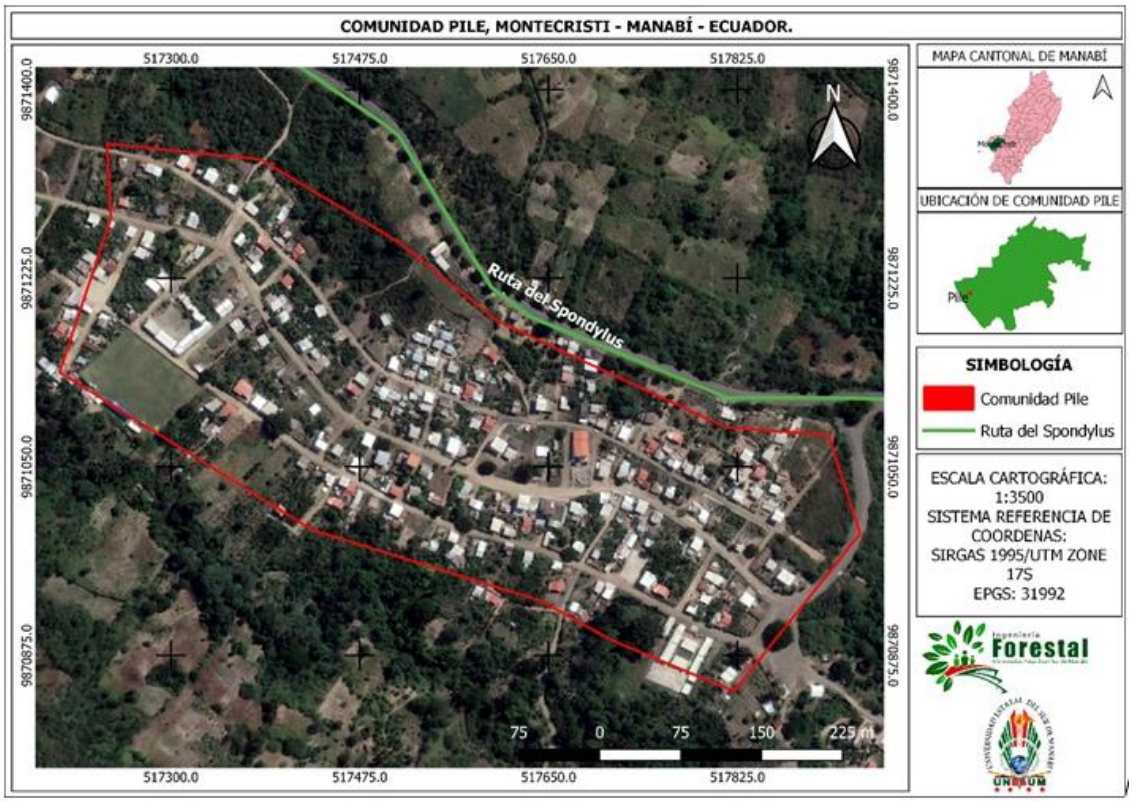

Figure 1. - Georeferencing of the Pile community, Montecristi Canton, Manabí, Ecuador

Methodology

To analyze the use and potential use of *Carloduvica palmata* (toquilla straw) as PFNM was worked in the Pile community of the Montecristi Canton, between January 12 and July 20, 2022; In this sense, visits to the field were carried out, talks were also held with the president

of the community and the respective residents with the purpose of collecting key information that facilitated the interview process, in addition to requesting the respective permits to carry out the investigation.

The semi-structured interview approach was used, supported by the descriptions of Jiménez *et al.* (2017), Aguirre *et al.* (2019) and Jiménez *et al.* (2021a). The sample selected to carry out the ethnobiological interviews was made up of the residents of the Pile community, in the Montecristi Canton.

A total of 171 interviews were carried out with the inhabitants of the Pile community with the purpose of investigating the various uses and the way in which they take advantage of this species, as well as to inquire about the production of toquilla straw hats that are made in area.

Statistical procedure

Population and sample for interviews

To calculate the sample size in this case, when the size of the sample is unknown population, Equation 1 and Equation 2 was used:

$$n = \frac{Z_{\alpha}^2 * p * q}{d^2} \qquad [1]$$

Where:

Z = confidence level,

P = probability of success, or expected proportion

Q = probability of failure

D = precision (maximum allowable error in terms of proportion)

Security = 95%;

Precision = 3%;

Expected proportion = it is assumed that it can be close to 5 %.

$$n = \frac{1{,}96^2 * 0.05 * 0{,}93}{0.03^2} \qquad = 171 \text{ interviews (2)}$$

So:

Z_a^2= 1.96 [2] (since the security is 95 %)

p = expected proportion (in this case 5 % = 0.05)

q = 1 p (in this case 1 0.05 = 0.95)

d = precision (in this case we want 3 %)

In this same order of ideas, there is no record of the people who harvest toquilla straw, because sometimes this raw material is extracted by people who do not live permanently in the community.

Vegetation sampling

For sampling, the transect method was used, taking into account the approaches proposed by Balslev *et al.* (2010) and Ramírez and Galeano (2011) , these allow analyzing the richness, abundance and other ecological traits that palm communities have in a certain forested area.

In the 5 mx 100 m transects, the center line of the transect is marked, using numbered stakes every 5 m. Then, when the data is collected, a 2.5 m long rod is used to identify all individual palms within this distance of the line, so the width of the transect will be 5 m. For this reason, seven transects were carried out in the Pile community.

Due to the fact that the populations of palms are not distributed uniformly in the area, a preferential sampling was carried out according to the criteria of Matos and Ballate (2006), who affirm that, in this type of sampling, the samples are located in places considered typical or representative. In the case of the Pile community, traditional land use practices have modified the composition and structure of populations and plant communities, aspects that justify the selection of the sample. The sampled area was 0.35 ha.

According to Aguirre (2015) after having the collection of information on the uses of the plants, the prospecting and quantification was carried out through inventories; according to this author, plots or transects can be used to evaluate tree, shrub or herb products present in forests. The aforementioned author also refers to the fact that prior information on the existence of NTFPs should be considered.

For all of the above and with the information obtained from the interviews, density and abundance parameters of the species *Carludovica palmata* in the Pile community were calculated; for which Equations 3 and Equation 4 were used:

$$Densidad\ (d) = \frac{Número\ de\ individuos\ de\ la\ especie}{Total\ de\ área\ muestreada} \qquad [3]$$

$$Abundancia\ (a) = \frac{Número\ de\ individuos\ de\ la\ especie}{Número\ total\ de\ individuos} * 100 \qquad [4]$$

In the case of the calculation of equation 2, it has been supported by what was stated by Aguirre (2015), who states that the management of non-timber resources depends on the calculations of the density of the distribution and abundance of the different potential species. On the other hand, the same author states that inventories provide the base data required to monitor the impact of harvesting. Without knowledge of initial density and size class structure, the population could slowly become extinct with each successive harvest without being noticed.

Instrument description

When developing the semi-structured interview, the FAO (2000) criteria related to the evaluation and monitoring of NTFPs in a given country were taken into account. Likewise, this method considered what was proposed by Wong *et al.* (2001) cited in Jiménez *et al.* (2018), referring to social science techniques as an effective tool for collecting information and obtaining inventories of NTFPs.

The interview addressed to 171 residents of the Pile community about NTFPs addressed questions such as: how long have you lived in this town? Do you know the palm from which toquilla straw is extracted? Does the toquilla straw palm exist in your locality?, what products do you generate from toquilla straw?, what parts of the plant do you use?, how do you use the part of the plant that you have indicated? mark with an "x", environment where the toquilla straw palm grows (habitat), how often do you go to the forest in order to collect the toquilla straw palm?, perception of use, to what extent is toquilla straw used?, perception of abundance, to what extent do you consider that the toquilla straw palm thrives

in your locality?, distance in km from the house to the forest where they collect the toquilla straw palm, object of harvesting this product, time of collection of toquilla straw, what aspects do you consider can damage the quality of the toquilla straw product to make a good hat? And if you are a manufacturer, what characteristics should toquilla straw have to make a quality hat?

The percentage of uses of the species and citations by categories was calculated based on the considerations of Molares (2009), Jiménez *et al.* (2010), Jiménez *et al.* (2017); Aguirre *et al.* (2019) and Jiménez *et al.* (2021b), through the following Equation 5.

$$\%\ de\ uso\ de\ una\ especie = \frac{fn}{N} * 100 \qquad [5]$$

Where:

fn = % use of NTFP species (%)

N = Total number of people interviewed.

RESULTS AND DISCUSSION

Determination of the use of Carludovica palmata Ruiz & Pav. as NTFP, Pile community, Manabí, Ecuador

Table 1 describes the percentages and frequencies of uses by category that the species *Carloduvica palmata* has as a NTFP in the area of interest (Table 1).

Table 1. - Percentages and frequencies of uses of Carludovica palmata in the Pile community

Community		Construction	Craft	No.
Pile	Citations/frequency of use by category	4	167	171
	fn = % use of NTFP species (%)	2.33	97.66	

In the Pile community, the category of handicrafts stands out as the main way of using *Carludovica palmata* as an NTFP, which encompasses both economic and cultural aspects. From an economic point of view, this craft activity, mostly focused on the production of

toquilla straw hats, represents a significant source of income. At the same time, from a cultural perspective, this ancestral practice carries with it knowledge passed onto the new generations, covering the various uses of the species and the processes involved in harvesting, weaving, and making handicrafts. In line with this, Wong *et al.* (2001) established that *anthropological* aspects related to the use of plants are addressed by ethnobotany.

I accordance with what was previously described, the use of *Carludovica palmata* in construction occurs to a lesser extent. These categories of use (handicrafts and construction) have been corroborated by previous research such as that of Jiménez *et al*. (2018), Aguirre *et al*. (2019) and Carrión *et al*. (2019). These studies agree that these various ways of harnessing NTFPs are a crucial source of income for residents of rural areas and near-forest environments. Although Pile is not a common practice in the community, a report by Bennett *et al.* (1992) points out that *the fruits, like the bases of the unopened leaf buds, are edible in indigenous communities such as the Shuar, Achuar and Quichua.*

Assessment of the potential uses of Carludovica palmata Ruiz & Pav. as NTFP, Pile community, Manabí, Ecuador

Table 2 details the density and abundance of individuals inventoried in each transect of 0.05 ha (500 m²) and its equivalent for 1 ha, respectively (Table 2).

Table 2. - Abundance of Carludovica palmata in the sampling sites in the Pile community

transects	Absolute abundance/0.05 ha	Abundance Individuals/ha	Density Individuals /0.35 ha	Density Individuals /ha
1	40	800	114	327
2	210	4200	600	1714
3	170	3400	486	1388
4	160	3200	457	1306
5	90	1800	257	735
6	76	1520	217	620
7	130	2600	371	1061
Total	876	17,520	2 503	7 151

Note. Absolute abundance/0.05 ha: Number of individuals per transect of 0.05 ha; Abundance Individuals/ha: Number of individuals per ha; Density Individuals /0.35 ha: Quantity of individuals/total area sampled; Density Individuals/ha: Number of individuals/ha.

As observed in Table 2, the highest abundance was 210 individuals corresponding to transect 2; in transect 1 only 40 individuals were inventoried. The density was 2,503 individuals in the sampled area (0.35 ha), which represents 7,151 individuals/ha, an aspect that exceeds the estimated average according to the distance at which the plants are distributed (3 mx 3 m). however, it should be considered that this species is characterized by being distributed in groups of individuals.

In relation to the question related to how long they have lived in the Piles community, the interviewees stated that they had lived in this place for more than 21 years. In relation to the knowledge and presence of *Carludovica palmata*, all those interviewed confirmed that this species indeed exists and develops in the town of Pile.

The results of the question about the parts of the plant that they use, as well as the purposes of use, show that 171 interviewees in the Pile community stated that they use the leaves to make handicrafts, particularly the apical bud, from which they extract the fiber used as the main raw material for the elaboration of toquilla straw hats and other artisan creations. This result is supported by Palacio *et al.* (2016) and Pulecio and Cabrero (2021), who assure that of this species only the terminal bud of the stem (part of the mature leaf) is used.

The rest of the interviewees (4) stated that they use the sheet as a construction material for roofing, although they stressed that this use is infrequent in the community. Figure 2 presents a photograph indicating the part of the plant used by the residents of the Pile community (Figure 2).

Figure 2. - Terminal bud of the stem (mature top) of the Carludovica palmata palm, in the piedmont seasonal evergreen forest of the Equatorial Pacific Coastal Range adjacent to the Pile community

Regarding the objective of harvesting the species *Carludovica palmata,* the results indicated that 98 % (168) of the inhabitants of Pile use the product for sale and consumption, while less frequently 2 % (4) are dedicated to the sale of the raw material as such, that is, they distribute it among artisans and associations. These activities are carried out through associations, namely: Pile Hats Artisan Production Association (ASOPROPILEHAT), Toquilla Straw Hat Weavers Artisan Association (ASOARTE), Mana Fine Hat Weavers Artisan Production Association (ASOMANAPILE) and Elicia Anchundia Artisans Association.

Table 3 shows the results related to the products generated from *Carludovica palmata* (Table 3).

Table 3. - Products generated from toquilla straw in the Pile community

Products	Citation Frequency	%
Hats	125	73.2
Bracelets	9	5.0
Mats	3	1.7
Earrings	4	2.2
Portfolios	10	6.1
Keychains	7	3.9
Baskets	9	5.0
Sneakers	5	2.8
Total	171	100

According to the information obtained from the inhabitants of the Pile community, different handicrafts are made, with toquilla straw hats being the products that are made most frequently due to the income they generate for the producers.

Likewise, the interview data reveals that other handicrafts such as bracelets, purses, baskets, earrings, rugs, key chains, and slippers (jewellery) are made (less frequently); The types of products that artisans make generally depend on the associations to which they belong.

Figure 3 shows an image with objects made with the fiber of the species *Carludovica palmata* (toquilla straw). In the Pile community, the process of infusing or bleaching consists of taking the toquilla straw to a wooden box and placing a container with sulfur and lit charcoal under it, so that the smoke takes effect and gives color to the toquilla straw fiber, as mentioned in Toro (2016), cited by De La A Rodríguez and Garzozi Pincay (2023).

Once the toquilla straw fibers have been bleached, they are prepared for dyeing, which may include the washing procedure and the treatment to improve their color absorption. Once the fibers are ready, they are immersed in dye baths. These baths may contain different types of natural or chemical dyes, depending on the desired colors and the traditional techniques used in the community. The fibers are carefully dipped and stirred to ensure uniform color distribution.

After the fibers are dyed, they are usually rinsed to remove any excess dye and left to dry in the sun. Once dry, the dyed fibers can be used to make various handicrafts, such as hats, baskets, and other products. It is important to note that the dyeing process can vary based on local tradition, available resources, and the preferences of the artisans in the Pile community (Figure 3).

Figure 3. - Handicrafts made from Carludovica palmata fiber, Piles community, Manabí, Ecuador

Table 4 describes the types of fabrics used by the inhabitants of the Pile community, to make the aforementioned handicrafts (Table 4).

Table 4. - Fabrics used to make crafts according to those interviewed in the Pile community

fabrics	Citation Frequency	%
Thick	52	30.15
Superfine	15	8.78
Superfine	21	12.21
Breakup	29	17,18
Fine	54	31.68
Total	171	100

For the elaboration of handicrafts derived from the palm of the toquilla straw, the fabrics must be considered; depending on the fabric applied, the level of porosity could increase or decrease, that is, the space between fabrics, this fact adds additional value to the final product. According to the information collected, about 32 % of the interviewees use a type of fine fabric and about 30 % use thick fabric. Generally, these fabrics are used to make toquilla straw hats.

Additionally, fabrics such as extrafine, superfine, entrefino middle-fine and fine are used less frequently, they are generally used in the manufacture of crafts related to jewelry. Figure 4 shows images of the process of artisan weaving of toquilla straw hats by an expert artisan (Figure 4).

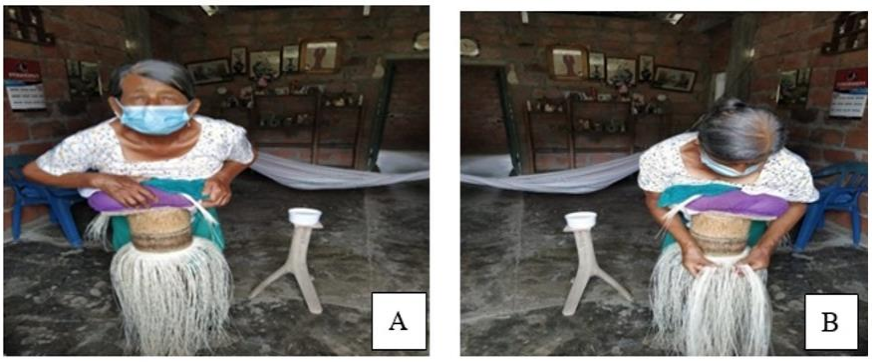

Figure 4. Handmade weaving of the toquilla straw hat (A and B), Pile community. Weaver Lady Guadalupe de las Fuentes

Like other raw materials, the fiber extracted from the terminal bud of the *Carludovica palmata* stem must have certain characteristics or requirements to obtain quality products. According to the data obtained in the interview, the toquilla straw must be dry and have a white or yellow coloration. These features, according to the inhabitants of Pile, indicate that the toquilla straw is a high-quality product.

On the other hand, Table 5 mentions some of the aspects that influence the quality of handicrafts (Table 5).

Table 5. - Aspects that damage and influence the quality of toquilla straw products

Aspects	Citation frequency	%
Transport	0	0.00
Harvest	10	5.71
Time of the year	54	31.43
physiological age	0	0.00
Toquilla straw maturation stage	107	62.86
Total	171	100

According to the results of the interview, 62.86 % of the interviewees ensure that the state of maturation of the fiber obtained from the leaves is the factor that most affects the quality of the products (a fact that coincides with what was previously described). On the other hand, the time of the year influences the quality of toquilla straw, according to 31.43% of the interviewees, in the rainy season any harvesting and production activity damages the raw material, turning it black, consequently, it loses the economic value. Less frequently, those interviewed stated that the type of harvest that is carried out also affects the quality of the product.

According to the place where *Carludovica palmata* palm grows, the results of the interview reflected that 100 % of the residents assure that it develops in a forest area, in this sense, according to the visits made to the field and the criteria of the MAE (2013), it was determined that it is a seasonal evergreen piedmont forest of the Coastal Mountain Range of the Equatorial Pacific. Likewise, inhabitants of Pile go to the forest for harvesting activities very

frequently, in periods of one to three months (100 % of the interviewees affirmed this criterion).

Within the framework of the previous observations, both results are related to the collection season, according to 100 % of the interviewees, the collection activities are carried out throughout the year considering that the distance between the community and the harvesting site is 6 km.

The answers about the inquiry made in the interview about the frequency with which the inhabitants of Pile go to the forest to carry out activities of collection and use of the raw material of *Carludovica palmata* is from one to three months, which corresponds to the time between harvests. This result diverges from the research of Muñoz and Tuberquia (1999) who affirm that, *in order to obtain a sustainable use of the species, cuts of 50 % of the total number of leaves present in each individual must be made, with a periodicity of twelve months.* However, in the studies by Vega *et al.* (2001) indicate that, because this plant is monocotyledonous, it is born with one leaf, two days after the second, six days later the third, 16 days later the fourth, 26 days ahead the fifth and so on, like this for example, from a culture of 100 plants of the same age, 100 terminal buds can be cut each month.

This frequency of incursions into the forest is related to the distance between the Pile community and the sites (Toquillales), according to the results obtained there is an approximate distance of 6 km. The mobilization to obtain natural resources has been essential for human beings, in ensuring their survival, considering that they tend to move to places where there is the greatest availability of resources; this fact has been supported by authors such as Aguirre *et al.* (2019); Jimenez *et al.* (2021).

In relation to the environment where the *Carludovica palmata* species grows, 100 % (171) of the people interviewed assured that it develops in humid areas, according to the criteria for the classification of ecosystems of the MAE (2013) and based on visits to the field and the observed characteristics, it was determined that it is a seasonal evergreen forest in the foothills of the Equatorial Pacific Coastal Range, this assertion is supported by the MAE (2013), who describes *Carludovica palmata* among its diagnostic species. According to these

authors, this plant formation is *forests that are located in the foothills of the Equatorial Pacific Coastal Range, between lowland semideciduous forests and low montane seasonal evergreen forests.*

Table 6 shows information regarding the perception of use and abundance that the residents of Pile have in relation to the species *Carludovica palmata* (Table 6).

Table 6. - Scale of perception of utilization and abundance of Carludovica palmata

Scale	Perception of use	Abundance
1	0	171
2	155	0
3	16	0
4	2	0
5	0	0
Total	171	171

Note. *1: Very Low; 2: Low; 3: Medium High; 4: High; 5: Very High*

According to the results, it was recorded that around 90.29 % of the interviewees affirmed that the use made of *Carludovica palmata* is low considering that they only use the terminal bud for activities related to handicrafts, neglecting the other uses it has; and in less frequency the interviewees assured that the use of this species is moderately high.

The perception of use, presented in Table 6, indicated that the interviewees consider that the use of *Carludovica palmata* is low (155), because according to their perspective, only the terminal bud of the palm stem (young leaves of the palm) is used (where the fiber is extracted) for making handicrafts, neglecting other uses that would benefit the community and medium high (16); this fact is supported by De la torre *et al.* (2008), who indicate other types of use of this species because the leaf is also used in natural and traditional medicine, the palm heart is extracted from the stem, which is edible, in this sense the extraction of the palm heart harms the entire plant and it makes the use unsustainable, an aspect described by Aguirre (2015); on the other hand the seeds are used to extract edible oils.

In relation to the perception of the abundance of *Carludovica palmata*, residents indicate a very low perspective (171). This perception originates in part from the constant use of this plant. However, during the field visits, it was observed that the access areas to the Toquillales present a lower abundance compared to other areas. According to the 171

interviewees, these areas are not used due to a lack of management, which includes practices such as cleaning, weeding, and thinning.

According to the information collected from the transects (Table 2), the number of individuals of *Carludovica palmata* is low at the entrances to the toquillales, these values are related to the perception of abundance that the inhabitants of Pile have regarding the species (data presented in table 7), who affirmed that the abundance is very low, however, this fact is due to the fact that only the area with the greatest access is used, therefore, the interviewees have such an appreciation but the methods used, including the observation showed that in areas few frequented by humans there is a greater abundance of the species.

Consequently, the vegetation cover or density of *Carludovica palmata* presented in Table 2 is justified based on the planting distance, the Toquillales de Pile are distributed at a distance of 3 mx 3 m in groups of individuals, which means that in one hectare will have approximately an average of 1,111 individuals and the density increases due to the lack of silvicultural management.

These considerations are supported by Bennet *et al.* (1992) in their preliminary study for the sustainable management of *Carludovica palmata* in Cabo Corrientes, Colombia, who affirm that there is a: *grouped distribution of the species dependent on the particular conditions of the habitat, since in each of the sampled areas there are sites with low light radiation where Carludovica palmata is not found.*

Likewise, the aforementioned coincides with the considerations of Palacios *et al.* (2016) who affirm that in Ecuador in the province of Santa Elena the crops were established in sites without tree cover and free of weeds. The vines were located at a spacing of 3.34 m x 3.34 m (approximately 885 plants per hectare). Currently, when it is necessary to cover empty spaces between the Toquillales, it is planted at 2.51 m x 2.51 m (approximately 1,575 plants per hectare) and the potato or strain is barely buried, obtaining up to 90 % yield.

CONCLUSIONS

The use of *Carludovica palmata* Ruiz & Pav. As a Non-Timber Forest Product in the Pile community, it is based on the use of the terminal bud of the palm to obtain fibers from which different crafts are made and the rest of the palm is allowed to develop naturally, contributing to the conservation of the species.

Carludovica palmata Ruiz & Pav) are not fully exploited, despite the fact that it generates economic income for a part of the population dedicated to making handicrafts. Other relevant aspects are neglected, such as the categories of uses such as medicinal, food and construction material.

BIBLIOGRAPHIC REFERENCES

AGUIRRE, Z. 2015. Guía para estudiar los PFNM. Documento para estudiantes de la Carrera de Ingeniería Forestal. Loja, Ecuador. 44 p. Disponible en:http://www.academia.edu/7802645/Guia_para_estudiar_los_productos_forestales_no_maderables_de_Ecuador.

AGUIRRE, Z.; RIVERA, M. & GRANDA, V. 2019. Productos forestales no maderables de los bosques secos de Zapotillo, Loja, Ecuador. *Arnaldoa*, v 2 n. 62, pp. 575-594. Disponible en: https://dx.doi.org/10.22497/arnaldoa.262.26204

BALSLEV, H., HUGO N., NAREL, P., PEDERSEN, D., EISERHARDT, W., & THEA K. 2010. El Uso de Transectos Para El Estudio de Comunidades de Palmas. *Ecologia En Bolivia.* Vol. 45 n3: pp. 812. Disponible en: https://ecologiaenbolivia.com/documents/HenrikFinal453.pdf

BENNETT, B. C., ALARCÓN, R. Y CERÓN, C. 1992. The Ethnobotany of *Carludovica palmata* Ruíz & Pavón (Cyclanthaceae) in Amazonian Ecuador. Economic Botany vol. 46 n. 3: pp. 233-240. Disponible en: https://www.researchgate.net/publication/225880747_The_ethnobotany_of_Carludovica_palmata_Ruiz_Pavon_Cyclanthaceae_in_Amazonian_Ecuador

CARRIÓN, J., HURTADO, S., ULLOA, L & HERRERA, C. 2019. Productos forestales no maderables (PFNM) de la zona de amortiguamiento del Parque Nacional Yacuri, Espíndola, Loja, Ecuador. Bosques Latitud Cero vol 9 n 1. Disponible en: https://revistas.unl.edu.ec/index.php/bosques/article/view/589

CETZAL-IX, W., NOGUERA-SAGUELLI, E., Y ZÚÑIGA-DÍAZ, D. 2018. Plantas tintóreas y su uso en las artesanías de palma jipijapa (Carludovica palmata Ruiz & Pav.) en el norte de Campeche, México. Centro de Investigación Científica de Yucatán. Desde el Herbario CICY 10: 1724. Disponible en: https://www.cicy.mx/Documentos/CICY/Desde_Herbario/2018/2018-02-01-WCetzal-Plantas-tintoreas.pdf

DE LA A. RODRÍGUEZ, J. H. Y GARZOZI PINCAY, R. F. (2023). Diagnóstico socioeconómico de las familias vinculadas al proceso produtivo de paja toquilla en la comuna Barcelona. Maestro y Sociedad, vol. 20 n.3. pp. 595-605. Disponible en: https://maestroysociedad.uo.edu.cu

GOBIERNO AUTÓNOMO DESCENTRALIZADO DE MONTECRISTI. 2016. Plan de Desarrollo y Ordenamiento Territorial de Montecristi. Disponible en: http://app.sni.gob.ec/sni-link/sni/PORTAL_SNI/data_sigad_plus/sigadplusdocumentofinal/1360001010001_PDOT%20-%20GR%20Montecristi_30-12 -2016_20-48-10.pdf

JIMÉNEZ, A.; GARCÍA, M.; SOTOLONGO, R.; GONZÁLEZ, M. Y MARTÍNEZ, M. 2010. Productos Forestales no Madereros en la Comunidad Soroa, Sierra del Rosario. Centro Universitario Municipal San Cristóbal. Pinar del Río. Cuba. Cuba. Revista Forestal Baracoa, v. 29 n. 2: pp. 83-88 Disponible en:

https://www.researchgate.net/publication/316360319_PRODUCTOS_FORESTALES_NO_MADEREROS_EN_LA_COMUNIDAD_SOROA_SIERRA_DEL_ROSARIO_NON-WOOD_FOREST_PRODUCTS_IN_THE_COMMUNITY_SOROA_SIERRA_DEL_ROSARIO

JIMÉNEZ, A., PINCAY, F.A., RAMOS, M.P., MERO, O.F., CABRERA, C.A. 2017. Utilización de productos forestales no madereros por pobladores que conviven en el bosque seco tropical. Revista Cubana de Ciencias Forestales; sept. dic. 2017 Vol. 5 n. 3: pp. 270-286. ISSN: 19962452 RNPS: 2148. Disponible en: http://cfores.upr.edu.cu/index.php/cfores/article/view/264/html

JIMÉNEZ, A., SALTOS, E., RAMOS, M., CANTOS, C., & TAPIA, M. 2018. Aprovechamiento y potencialidades de uso de *Phytelephas Aequatorialis* Spruce como Producto Forestal No Maderable. Revista Cubana de Ciencias Forestales v 6 n. 3:31126. Disponible en: https://cfores.upr.edu.cu/index.php/cfores/article/view/349/pdf

JIMÉNEZ, A., ROSETE, S., CANTOS, C. G., TAPIA, M. V., CASTRO, S. I., GRAS, R. & CABRERA, C. A. 2021a. Componentes de la diversidad biológica empleados por las familias manabitas en la medicina natural y tradicional (Primera ed.). Quito, Ecuador: MAWIL. Disponible en: doi: https://doi.org/10.26820/978-9942-826-71-8

JIMÉNEZ, A., MORA, K., ROSETE B., & CABRERA, C. 2021b. Utilización de plantas medicinales en cuatro localidades de la zona sur de Manabí, Ecuador. Siembra, v. 8 n. 2. Disponible en: https://www.redalyc.org/journal/6538/653868341013/html/

MUÑOZ, R & TUBERQUIA, M. 1999. Estudio preliminar para el manejo sostenible de *Carludovica palmata* R. Y P. Como materia prima en la producción de papel artesanal en Cabo Corrientes, Chocó, Colombia. *Actual Biol*, *v 21 n* 71 pp. 87-96. Disponible en: https://revistas.udea.edu.co/index.php/actbio/article/view/329737

ORGANIZACIÓN DE LAS NACIONES UNIDAS PARA LA AGRICULTURA Y LA ALIMENTACIÓN (FAO), 2014. Plan de acción mundial para la conservación, la utilización sostenible y el desarrollo de los recursos genéticos forestales. Comisión de recursos genéticos para la alimentación y la agricultura. Organización de las Naciones Unidas para la Alimentación y la Agricultura.

ORGANIZACIÓN DE LAS NACIONES UNIDAS PARA LA ALIMENTACIÓN Y LA AGRICULTURA (FAO), 2000. Productos Forestales no Madereros. Informe principal. Organización de las Naciones Unidas para la Agricultura y la Alimentación. [en línea]. Roma; Italia: Autor. [Consulta: 27 febrero 2017]. Disponible en: ftp://ftp.fao.org/docrep/fao/005/y1997s/y1997s11.pdf.

ORGANIZACIÓN DE LAS NACIONES UNIDAS PARA LA AGRICULTURA Y LA ALIMENTACIÓN (FAO), 2022. Versión resumida de El estado de los bosques del mundo 2022. Vías forestales hacia la recuperación verde y la creación de economías inclusivas, resilientes y sostenibles. Roma, FAO. Disponible en: https://doi.org/10.4060/cb9363es

PALACIOS, W. A., PINZÓN, A., SUÁREZ, E., SUÁREZ, S., NORTE, T., ELENA, S., & EC-, C. 2016. *Manejo de la paja toquilla Carludovica palmata*. *Cinchonia vol 14*, n 1. pp. 137-150. Disponible en: https://revistadigital.uce.edu.ec/index.php/CINCHONIA/article/download/2372/2350/9238

PULECIO, I. Y CABRERO, N. 2021. Estudio preliminar de *Carludovica palmata* como materia prima en la producción del sombrero suaceño Huila, Colombia. *Revista de Investigaciones Agroempresariales*, *8*, 21-29. Disponible en: https://doi.org/10.23850/25004468.4734

RAMÍREZ, G., & GALEANO, G. 2011. Comunidades de Palmas En Dos Bosques de Chocó, Colombia. *Caldasia* vol 33 n2. :31529. http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0366-52322011000200002

TORRES, M., PAZ, K., Y SALAZAR, F. 2006. Tamaño de una muestra para una investigación de mercado. Universidad Rafael Landívar: Boletín electrónico [en línea]. Guatemala. Disponible en: http://www.tec.url.edu.gt/boletin/URL_02_BAS02.pdf

WONG, J., THORNBER, K., & BAKER, N. 2001. Evaluación de los recursos forestales no madereros (13.ª ed.). Organización de las Naciones Unidas para la Alimentación y la Agricultura. [Libro Electrónico]. Roma. IBSN: 92-53046147. Disponible en: http://www.fao.org/3/y1457s/y1457s.pdf

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