

Mangrove Reproduction by seeds and Nodes at La Rinconada Swamp in La Pacha, Magdalena¹

Reproducción de Mangle por Semilla y Nodo en la Ciénaga La Rinconada en La Pacha Magdalena

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**Felipe García, Duvis Villarreal, Orlando Patiño, Nereida Terraza, Uriel Sierra,
Gustavo Montero, Roberto Rojas, Riquelmer Avendaño, Yolima Rangel,
Jairo Turizo, Isabel Avendaño, Reidil Rojas, Wilmer Martinez and Libardo Martinez**
La Pacha School, San Sebastián, Magdalena (Colombia).
fegaros54@hotmail.com

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Abstract-- The project to plant mangrove seeds and nodes in the swamp is based on the study of mangrove forests. Its objective is to reproduce native mangroves by means of seeds and nodes in nurseries to repopulate the banks of the La Rinconada swamp at La Pacha, Magdalena, and to use it as a pedagogical tool on the conservation of water resources and wildlife once the plants have reached an adequate stage of development. The study was approached from a qualitative perspective. The instrument used in the initial stage was a structured interview performed with students at the La Pacha School. The main conclusion is that the student community is aware of the benefits that mangroves offer to biodiversity, and the main task ahead is to get them involved in the process and motivate them to do something with the knowledge they have acquired; in other words, to get them to plant mangroves.

Keywords-- Mangrove; seed; forest; swamp; conservation; vegetation.

Resumen-- El proyecto reproducción de mangle por semilla y nodo en la ciénaga, se fundamenta en el estudio bosque de mangle. Tuvo como objetivo reproducir mangle criollo por semilla y nodo en viveros para repoblar las orillas de la ciénaga La Rinconada en La Pacha Magdalena y como ideario pedagógico de la conservación de su fuente hídrica, su flora y su fauna, cuando el material vegetativo haya alcanzado su proceso germinativo adecuado. Para la ejecución del estudio se trabajó desde una mirada cualitativa. El instrumento aplicado en su fase inicial fue una entrevista estructurada aplicada a los estudiantes de la IED la Pacha. Como conclusiones se pudo evidenciar que ya la comunidad estudiantil está consciente de todos los beneficios que trae consigo el mangle a la biodiversidad, sin embargo, solamente falta involucrarlos en el proceso, es decir que ellos se motiven a hacer algo con ese conocimiento, es decir, que siembren.

Palabras clave-- Mangle; semilla; bosque; ciénaga; conservación; vegetación.

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I. Introduction

The research project on the reproduction of mangroves by means of seeds and nodes at the La Rinconada Swamp in La Pacha, Magdalena, was undertaken as a part a proposal to create knowledge through research. Consequently, the IEP Methodological Approach was used to find the relevance and need for conservation of the La Rinconada Swamp for the population of La Pacha and neighboring towns such as Venero, María Antonia, Ricaurte, Pedregosa, Bellavista and La Puntica, whose people have benefited over the years from the food it provides and its water resources during the dry seasons.

The project sparked curiosity about certain wildlife species that have been disappearing from the swamp, and it was discovered that one of them is the mangrove. Then an additional need was discovered upon studying the ecological function and importance of the mangrove as a hydro-biological resource (it prevents erosion and overflowing of the swamps because it helps fill and recover the land; its submerged roots provide habitat and shelter for certain native fish species, and its leaves provide protection for nesting for certain species of birds and reptiles, many of them endangered in the area). Because of the above, it was decided to engage in the reproduction of mangroves by means of seeds and nodes in nurseries located at the school's facilities, in order to repopulate the banks of the La Rinconada Swamp, with the aim of restoring and preserving it and its wildlife species, as well as to mitigate flooding that destroys buildings and crops.

It is important to highlight that the school uses a method called Research as a Pedagogical Strategy (IEP by its acronym in Spanish), which is a process to create knowledge based on research questions, combined with a broad socio-pedagogical component, which promotes the development of skills in children, youth and teachers, and which makes use of the valuable contributions from the local population, which has more knowledge and experience about fishing and agriculture in the area of influence of this body of water [1].

This project promotes the process of appropriation and use of a citizenship and democratic culture in C+T+I through IEP supported by ICT, which promotes the development of communities of practitioners, learning, knowledge and transformation, while raising awareness and educating the student community on the importance of this project [1].

Based on the above, the objective of the study is to reproduce native mangroves by means of seeds and nodes in nurseries in order to repopulate the banks of the La Rinconada Swamp in La Pacha, Magdalena, and to pedagogically promote the idea of preservation of its water sources and its wildlife, once the plants have reached an adequate point of development. The basis for the project is research on the mangrove forest, an ecosystem we must care for. The objective was to demonstrate the importance of mangroves and why we need to take care of them, because due to the failure of these lungs and kidneys, the Earth is experiencing such an intense climate change problem that it produces phenomena such as tsunamis, torrential storms, mudslides, erosion and flooding. These contributions enrich the project by providing the support of a theoretical framework.

In order to preserve the coastal ecosystem, the students, visitors and residents of the coastal area and other stakeholders must have more information about them. This need is even more pressing now, in face of the scenarios of climate change and natural disasters that affect people who live in coastal areas [2].

Raising the awareness of the population enables greater closeness between the citizens and nature, because a better informed public is more capable of participating responsibly and of taking measures to adapt to a changing world. It also enables understanding the importance of nature as protective ecosystems that benefit the population, and their importance for adapting to climate change [2].

Scientific texts tend to be too technical and are often in English, which makes them inaccessible to many basic and middle school students, professionals, government officials, residents of coastal areas, eco-tourists and eco-guides. Other types of texts have been written with content for children, but they leave out some information that is relevant, or fail to fully explain the issue [3].

A. Conceptualization of the Mangrove

The origin of mangrove is derived from the Guaraní indigenous word *mangle*, which means "twisted tree". "It refers mainly to the species *rhizophora mangle*, which has stilted roots that are submerged in the water, and there is a wide variety of wildlife associated with it." [4]

Mangroves are a type of swamp ecosystem that features woody trees of the same name.

They are generally associated with tropical coastal areas, marshy soils and calm waters. This type of vegetation is able to survive on both land and water by adapting to the terrain through its roots, leaves and trunk. It is able to grow on soft soils with low oxygen levels and with inflows of seawater [5].

[5]. Mangroves provide various services to the ecosystem, such as support for the formation of soil; serving as breeding, living and feeding grounds for animals; favoring water in coastal areas; providing shade in areas with strong solar radiation such as beaches, and they are important for the environment because they produce oxygen.

In the Colombian geography there are large extensions covered with mangrove forests, primarily in the Pacific and Caribbean regions, “the latter of which has smaller areas of cover, with 87,230 ha distributed in eight (8) departments. The department of Córdoba, with 8,862.2 ha, is in third place in terms of mangrove cover in the Colombian Caribbean.” Additionally, in recent years the water flows of the Sinú River on the coast have influenced its own estuary. [6]

B. Geography of the La Rinconada Swamp

The La Rinconada Swamp is located to the north-west of the municipality of San Sebastián, department of Magdalena, and is surrounded by 7 towns (La Pacha, Venero, María Antonia, Ricaurte, Pedregosa, Bellavista and La Puntica). Its shores feature very little native vegetation; it has an acceptable source of water, and it is inhabited by some animals. The current conditions of this swamp are alarming due to the erosion it displays and the visible de-population of its wildlife.

According to ecosystem studies that have been performed, it can be inferred that the main causes for deforestation are mining, cattle ranching, planting of illegal crops, and agriculture, in that order, not to mention growing populations and new models that have been implemented that have caused the deterioration of wildlife [7].

Based on the above, one of the best alternatives for mitigating the effects of environmental destruction is reforestation, specifically with plants from nurseries, which is one of the best and most sustainable solutions, and which will require the community’s intervention. Starting up a nursery enables planting in areas where it is difficult for plants to reproduce naturally.

[8]. Mangroves are one of the most important sources of natural protection, as well as a source for food for a large number of species of all types that permanently live there. Numerous benefits are derived from reproducing the mangroves, the most noteworthy of which is the protection against climate change and its consequences.

III. Methodology

This study is of a qualitative type, based on a socio-critical paradigm and with a descriptive scope, as it enables the identification of characteristics of the research environment and specific behaviors that enable discovering the relationships between the categories of the study [13]. Based on the proposed objectives, the researcher decides on the type of description to be performed. This study was carried out at the La Pacha School of the municipality of Sebastián, Magdalena, with the participation of thirty (30) basic high school students.

The research technique used was the structured interview. As explained by Hernández (2006), qualitative interviews should be open-ended, without pre-established categories, or using initial categories that may be subsequently reconfigured, so as to enable the participants to freely express their views. Another technique used was direct observation, the results of which were recorded in a field diary [14]. The procedure was carried out in the following stages:

Stage (1): Selection of the instruments to be used

Stage (2): Specification of the categories of the study

Stage (3): Selection of the data gathering instruments

Stage (4): Based on the categories of the study: Mangrove, environmental education, the interview with the participants was carried out, aimed at describing the studied phenomena based on the type of research (non-experimental), in which events are observed and analyzed as they actually occur.

Stage (5): Once the results of the structured interviews and observations are recorded, the results are interpreted in light of the theory that supports the research.

Stage (6): The results and findings are presented.

IV. Results

The following are the results from the data collection instruments, based on the categories of the study.

Study category	Leading question	Participants' views	Articulation and systematization based on the theory
Mangrove	How can you identify the native mangrove?	<p>"It is a tree that grows between 5 and 6 cm and its adult branches tend to grow towards the sides." "The stalk is dark green with a rough bark and green oval-shaped leaves." "By its leaves and twisted branches." "The mangrove can be recognized because of its elongated leaves, its hanging and twisted branches that grow between 5 and 6 cm tall." "It is a natural product of the earth, by its leaves and its twisted branches." "By its twisted branches and wrinkled leaves." "By the color of its leaves and branches and its hardness." "The native mangrove is a plant that has leaves, stalk and seeds." "As a plant that is essential for the preservation of the swamp and the fish." "This vegetation helps us preserve many species. It is a native plant that features long leaves and one of its benefits is that it helps prevent flooding." "Because it only grows on the banks of swamps, it has aquatic roots that grow depending on the level of the tides." "It is an aquatic species, especially of the swamps, with wide leaves."</p>	<p>From the interview results, it can be deduced that the students recognize the features of the native mangrove, because they know it is an aquatic plant that only grows in the swamp, and that it is different from other aquatic plants in that its leaves measure between 5 and 6 cm and are oval-shaped, wide and wrinkled, and the stalk is dark green. These and other characteristics make it ideal for the survival of all the species that live in the swamp.</p> <p>[4]. The origin of the term mangrove is from the word <i>mangle</i> of the Guaraní Indians, and it means "twisted tree." "It refers mainly to the species <i>Rhizophora mangle</i>, which has stilted roots that are submerged in the water, and it is associated with a wide variety of wildlife species."</p>
Mangrove	How does the native mangrove reproduce?	<p>"It reproduces by seed and by nodes." "It reproduces by seeds because nobody takes care of planting them." "It is known that they are born from seeds." "By seed because nobody has taken on the task of planting them." "By seeds." "By seed and by rhizome." "The most common ways are by seed and node, even though we locals have never taken on the task of repopulating it in any way." "By seed." "In nature itself, by seeds." "In this area the mangrove reproduces by seeds." "By what I've seen, it reproduces by seeds." "By seeds."</p>	<p>In view of what the participants said, we find that they all know how the mangrove is reproduced, by seed, node and rhizome; they also go further to say that the mangrove practically reproduces naturally because mankind has not intervened at any time to try to preserve the species.</p> <p>The answers to the interview are consistent with what is said by [4], who holds that it is feasible to plant the <i>Rizophora mangle</i> species by square meter, which leads to think that with good planning of mangrove planting, the swamp could be repopulated. It should also be noted that it is important to raise awareness, because if everybody already knows the benefits produced by these plants, and also know how to plant them, all they would need is to put this procedure in motion to save the mangrove [9].</p>
Environmental education	What are the advantages of promoting venues to create knowledge among the students of the La Pacha School, regarding the reforestation of the La Rinconada Swamp?	<p>"It would protect and preserve fish species, help prevent the swamp from overflowing, and the water would heat up less." "Because the mangrove helps protect the swamp and would help reverse low fish reproduction levels." "To protect and preserve the species." "To prevent erosion and attract rain." "Because then we could have more fish species and recover what was lost in the past, and be able to obtain benefits and advantages from all this." "To preserve the beaches and coasts." "It is important to reforest it because we would prevent the species from disappearing and it would also help us." "Because it improves the environment and helps the reproduction of the bocachico fish." "Because without these trees the swamp would dry out." "I think it's important because it helps us and benefits the community; it helps us prevent floods, it provides food (fish) and helps improve our consumption." "Because it prevents erosion and mangrove reforestation allow the fish to grow in their homes." "For the fish to have shelter."</p>	<p>The students answers reflect their belief that the native mangrove is important for the region and that it is relevant to reforest the swamp as soon as possible, because all the features offered by this species would cover many aspects of nature, because this tree not only offer shades, but also prevents many natural disasters and directly favors the ecosystems in which it grows.</p> <p>[4] confirms the students' conclusions by indicating that mangroves provide ecological services, serve as habitats, serve as feeding places, reduce risks from climate and atmospheric changes and generate oxygen, among others.</p> <p>Based on the findings, this species is highly beneficial for the swamp in the region, basically because the sole existence of the plant enables the survival of an entire ecosystem, which collaterally, or rather directly, benefits the community, because everything it provides is tradable, speaking solely in human terms.</p>

...

<p>...</p> <p>Environmental education</p> <p>What are the benefits of preserving and maintaining the ecological balance at the La Rinconada Swamp?</p>	<p>“We would learn to better interact with the environment around the swamp.” “It is very important for students to plant mangroves too.” “It is good for students to learn how to care for the environment.” “Planting seeds around the beaches.” “The advantages include good knowledge about mangrove projects, and we would know the entire process and how valuable this plant is for all of us and the benefits it offers us, etc.” “It is an investment in the future.” “The advantages are that the students would know more about the swamp and they would have greater sense of belonging for what we have.” “It would motivate them to preserve the native species and consequently reforestation.” “To raise the kids’ awareness about caring for the environment.” “The advantage is that it helps all of us to be informed about the problem of not having mangroves around and that we know we have the capacity to do good for the community.” “Because they are aware of the importance of caring for the swamp and that they too can take care of it.”</p>	<p>The students recognize the importance of raising the awareness of future generations on the importance of the mangrove, not only for the swamp but for the survival of the entire ecosystem they create. They also learn everything about them, so much that they can create mangrove nurseries and find the way for these to grow in other environments than the original one, and to be able to expand the benefits of this excellent plant to other parts of the region.</p> <p>It is also relevant to point out that the survey results directly reflect what was found in the mangrove forest research project: an ecosystem that must be cared for because of its importance, because due to the absence of these lungs and kidneys, the earth is experiencing the issue of intense climate change, which produces phenomena such as torrential storms, landslides, hurricanes, earthquakes, erosion and flooding. These contributions enrich people’s minds on the damage that is done to the planet, and also highlight and demonstrate the way this damage can be at least reduced, though not reversed, just by planting the native mangrove species.</p>
<p>Environmental education</p> <p>Do you believe that reforestation of the La Rinconada Swamp would help to preserve some fish species?</p>	<p>“It would ensure good conditions for the fish species and that the swamp remains free from pollution.” “We would preserve the rain, the species, the population, and we would all benefit.” “To protect the animals and the fish and to maintain constant rainfall.” “We would benefit by not exhausting the fish species and helping us to prevent floods that could cause many disasters.” “Greater wealth of fish.” “There are many benefits, one of which is to preserve the species.” “To improve the environment and the preservation of fish.” “Because it produces many fish species for us, Galapagos, turtles, that are useful for food.” “It prevents floods, the fish from dying or moving elsewhere, and helps us maintain good economic and food resources.” “The benefits are because they improve the economy with food in the area by taking care of the swamp.” “Because this would ensure permanent fish production.”</p>	<p>The main benefits from preserving the mangrove would be to the ecosystem, wildlife, and also benefits for food because fish production would increase, and this in turn is favorable for the economy because it provides families in the region income from fishing [10].</p> <p>[5]. Since the 1980s, perceptions on mangroves have been changing, because previously they were not given the importance they deserve. They were considered smelly places, they were not thought to be very useful and they were often chopped down and used as garbage dumps. Over the years, this has led to “the loss of approximately 250,000 ha of mangroves in Colombia. However, at present mangroves are considered very important because they enable communities to engage in business activities such as fishing, and for this reason they must be protected from deforestation.”</p>
<p>Mangrove and environmental education</p> <p>Would you like to participate in a reforestation project at La Rinconada Swamp?</p>	<p>“Yes, because reforestation creates a new natural habitat that protects the fish from enemies.” “Of course, because they help fish to breed.” “Yes, because it is a habitat for several species and they will be able to reproduce more.” “Yes, because the swamp is very necessary for the mangroves, the fish and the birds.” “Yes, because reforestation by planting mangrove provides a source of life both for animals and people, because it strengthens hunting of new species.” “Yes, because of the habitat.” “Yes, the mangrove provides food to the fish and keeps the water from overheating.” “Yes, because the mangrove is food for the bocachico fish.” “Yes, many fish species lay their eggs in the roots of these trees.” “Yes, because fish numbers will increase when they see they can live safely.” “Yes, because erosion would not be so bad and because the fish and other animals would have better living conditions.” “Yes, because the mangroves provide the fish shelter to lay their eggs.”</p>	<p>In view of what was said by the interviewees, we find that they all support the reforestation of the native mangroves in the region, with solid arguments in favor of the ecosystem, the survival not only of animal species (fish, birds and others) but also of human beings.</p> <p>In the municipality of San Sebastián de Buenavista, department of Magdalena, no studies or efforts to protect and preserve the mangrove ecosystem have been found. However, some local adults in La Pacha, Venero and María Antonia report that the amounts have dropped in a greater proportion in recent years, and that La Rinconada Swamp is de-populated and deteriorated. This allows us to conclude that even though the community is in favor of reforestation of the native mangrove, no one has ever taken up the task of planting this species, which is why no project of this type has been found in the region.</p>

Source: Authors.

V. Conclusions

The conclusion of the project is that in view of the deterioration experienced by the mangrove ecosystem, a positive effort towards its restoral, including different types of purposeful management arrangements, would help to partially restore the forest to its original conditions, which would be very positive for the environment [12]. It should be noted that the population of San Sebastián has always used the Mangrove, but they have not been educated on how to care for it and on its reforestation, which justifies the purpose of this project.

From the above we may infer that even though most students are aware of the procedures required to partially restore the mangrove forest to its original conditions at the swamp, all that would be needed is to encourage them not only to share their knowledge, but also to empower them and to set the example by planting, because it is of no use to have the knowledge if it is not used to change the world. Planting is what will not only help create an environmental culture, but will also help preserve the dwindling number of trees.

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