

La conservación de la biodiversidad desde las prácticas de campo de la carrera Biología

The conservation of the biodiversity from the field practices of the Biology career

Gladimir Valle Rodríguez**Daisy Echemendía****José Alfredo León Méndez**

University “José Martí Pérez”, Sancti Spíritus, Cuba.

University “José Martí Pérez”, Sancti Spíritus, Cuba.

University “José Martí Pérez”, Sancti Spíritus, Cuba.

Emails:

gvalle@uniss.edu.cu

dmarrero@uniss.edu.cu

jleon@uniss.edu.cu

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Resumen: Se ofrecen acciones para fomentar el tratamiento a la conservación de la biodiversidad desde las prácticas de campo en la carrera Licenciatura en Educación Biología. En la investigación se emplearon métodos cualitativos; del nivel teórico analítico – sintético, inductivo –deductivo, histórico-lógico y del nivel empírico: observación participante, análisis documental y la entrevista. La propuesta posibilita el mejoramiento del desempeño profesional de los estudiantes en formación, favoreciendo el desarrollo de una cultura ambientalista dirigida a la protección del medio ambiente y desarrollo sostenible, fomenta la conservación de la biodiversidad en el Parque Nacional Caguanes y evalúa el cumplimiento de la Tarea Vida.

Palabras clave: acciones, biodiversidad, conservación de la biodiversidad, práctica de campo

Abstract: Actions are offered to promote the treatment of biodiversity conservation from field practices in the degree in Biology Education. In the research, qualitative methods were used; from the analytical-synthetic-theoretical, inductive-deductive, historical-logical and empirical level: participant observation, documentary analysis and the interview. The proposal makes possible the improvement of the professional performance of the students in formation, favoring the development of a directed environmental culture to the protection of the environment and sustainable development, promotes the conservation of biodiversity in the Caguanes National Park and evaluates the fulfillment of the Life Task.

Keywords: actions, biodiversity, conservation of biodiversity, field practice

Introduction

Attention to the conservation of biodiversity is one of the environmental priorities, currently recognized in international and national policies, which is why it is contemplated in the National Environmental Strategy (EAN) and Provincial of Sancti Spíritus 2016/2020, in the

Program of Science, Technology and Innovation related to the sustainable use of the components of biological diversity in Cuba, within the Goals of the Strategic Plan 2011-2020 or Aichi Targets, considered as a Strategic Axis regarding natural resources and environment in the Project National Plan for Economic and Social Development until 2030 approved at the recent 7th Party Congress; and it is an important cross-cutting issue in the 2030 Agenda for Sustainable Development.

Its study in the context of Higher Education and more specifically in the initial training programs of the education professional, is not only a necessity, but a condition in the commitment to Environmental Education aimed at protecting the Environment and sustainable development. To respond to this challenge, the university must design alternatives that guarantee the study of biodiversity considered as an indicator of the state of conservation of ecosystems.

In effect, Biology teachers can develop actions in this direction of work from the study plans and in their links with field practices, as a type of study practice, within the forms of organization of teaching in Higher Education, in particular, in the methodological conception of each subject.

According to Armiñana and Olivera (2011), field practices are important from a pedagogical point of view because it allows to link and apply the skills and knowledge acquired to new situations found in the environment, by developing observation in the natural environment, contributing to the organization and consolidation of knowledge. In the educational aspect, it contributes to developing in students love and protection of nature, aesthetic and patriotic education.

The research works, from different angles, have been carried out to learn about biodiversity in all regions of our planet, the threats it faces and possible solutions; (Alcolado, 2008; Berovides, 2007; De Armas, 2008; Domínguez, 2012), do not fully satisfy the answer to this problem. The experiences and investigations of the authors allowed us to consider that the treatment of biodiversity conservation from field practices constitutes a strength to address the following limitations:

- Insufficient pedagogical understanding of the need to incorporate treatment into the conservation of biodiversity as a way to specify the comprehensive training of new generations and the identity of nations in field work.

It is not enough to take advantage of the potentialities related to the conservation of biodiversity, which limits its ability to develop pedagogical and didactic processes more effectively, based on direct contact with nature and its updating and interrelation.

- It is not always considered that environmental education, particularly the treatment of this problem, is part of culture as one of the essential elements in the historical analysis of evolution in the treatment of the man-nature relationship.
- It is not part of the integral diagnosis that is developed in each school year if you want to generate new pedagogical knowledge or plan actions that guarantee the protection of the protected areas of the territory and fulfillment of the "Life Task" from field practices.
- The pedagogical treatment of the content, sometimes not very flexible, does not always correspond to the real situation in the environment, basically aimed at aspects of knowledge and not at the development of skills, including those that are carried out during the development of internship countryside practices.

For this reason, the objective is to propose actions to promote the treatment of biodiversity conservation from field practices in the Bachelor of Biology Education degree at the University of Sancti Spíritus José Martí Pérez.

This topic constitutes a science response to the project "The improvement of pedagogical theory based on the solution of prioritized educational problems in the province of Sancti Spiritus: Alternatives for its solution"

Development

1.1 Present and future of biodiversity

The loss of biodiversity is not a new phenomenon, it has been occurring for many years nowadays; with the appearance of Homo Sapiens sapiens. In the 20th century, Fidel Castro

Ruz, at the United Nations Conference on Environment and Development, Rio de Janeiro, 1992, raised some of the manifestations of the problems that put an important species at risk of disappearing: man, pointing out: *"The forests disappear, the deserts extend, billions of tons of fertile land go to the sea every year. Many species become extinct."* (Castro, 2007: 13).

This Conference recognized the global need to reconcile the future conservation of biodiversity with human progress according to criteria of sustainability promulgated in the International Convention on Biological Diversity (CIBD). The beginnings of the 21st century have also been characterized by the increase in neoliberal globalization. Bériz, (2007) considers that this globalization has meant the generalization of multiple problems, including those of the terrestrial environment that have led to the so-called ecological crisis, indisputably contributing to the loss of biodiversity.

In 2015 globally, 40 bird species are at increased risk of extinction. After this update, in the Americas region there are a total of 583 species in global threat categories (Critically Endangered (CR), Endangered (EN) and Vulnerable (VU), which represents slightly more than 42 % of all threatened species in the world (Díaz, 2015). Estimates from the Organization for Economic Cooperation and Development (OECD) (2012), warn that by 2050 the decline in biodiversity will continue, especially in Asia, Europe and South Africa.

In the V National Report to the Convention on Biological Diversity of the Republic of Cuba (2014), it is noted that of 2,236 new categorized taxa of seed plants, 47% have some degree of threat, of them 683 with insufficient data, 165 species Registered vertebrates have some degree of threat, of which 52 in (CR), 42 in (EN) and 63 (VU). In relation to the group of invertebrates it is expressed that molluscs constitute the group most threatened with 34 species (VU), 31 (CR) and 9 (EN); insects with 7 (VU), 10 (CR) and 4 (EN); and arachnids with 3 (VU), 5 (CR) and 1 (EN). Of 108 fungi and myxomycetes of categorized species, 20 are found (CR), 20 (EN) and 34 (VU).

Climate change can have important consequences for biodiversity. In 2017, the Minister of Science, Technology and Environment of Cuba, points out that the rise of the mean sea level constitutes the main threat facing Cuba, it is estimated that it rises about 27 centimeters by

the year 2050, and 87 centimeters by 2100, causing the reduction of the Earth's surface and the salinization of the underground aquifers. Other effects are related to the accumulated deterioration in the main coastal protection elements, such as sandy beaches, wetlands - mangroves, swamp forests and grasslands- and coral reef ridges, which in an integrated way cushion the impact of the waves caused by these natural phenomena (Granma, 2017).

Sancti Spíritus is not excluded from the situation that has been analyzed, studies express that there are five threatened species in the “endangered” category _ Cuban Red Vascular List, 2005 that inhabit the Sierra de La Canoa, Yaguajay. In relation to fauna, there are 31 threatened species, which are found in some of their categories; 18 of them have been evaluated (VU), 12 (EN) and 1 (CR), according to the International Union for Conservation of Nature (IUCN). (Domínguez, Torres and Puerta, 2012). It currently has 245 records of infrageneric taxa of vascular flora threatened with extinction. Of these, 77 in (CR), 46 (EN), 19 (VU), 103 preliminarily categorized as threatened and 29 as Near Threatened (García, 2017, p.11).

1.2 Policy for the conservation of biodiversity in Cuba

A pesar de la situación expuesta en Cuba se ofrece especial esmero a la salvaguarda y preservación de la biodiversidad. Concluido y publicado el Estudio Nacional de la Diversidad Biológica de la República de Cuba en 1998, se elaboró en 1999 la Estrategia Nacional sobre la Diversidad Biológica (ENBIO) con su Plan de Acción Nacional para garantizar que se aborden los objetivos del Convenio a todos los niveles y sectores. The Ministry of Science, Technology and Environment formulated the 2012 National Policy for the Integrated Management of Biodiversity and its Ecosystem Services, within which the Biodiversity Action Plan is developed.

In response to one of the commitments contracted with the Convention on Biological Diversity and in representation of the mechanism to integrate conservation actions and their sustainable use in the country, with relevant, defined, achievable and strategically important goals and objectives, Cuba has the Program National on Biological Diversity (PNDB) 2016-

2020, main platform of action for the implementation of the strategic objectives defined in the national environmental policy to face the loss of biodiversity.

According to (Peláez, (2017) this Plan is essentially based on the Guidelines for the Economic and Social Policy of the Party and the Revolution approved at the VI Congress of the Communist Party of Cuba, the policies approved for certain natural resources, as a consequence of the process of implementation of the Guidelines for the Economic and Social Policy of the Party and the Revolution, National Reports to the Convention on Biological Diversity, in particular the 5th Report developed in 2014, the Economy Plan, experiences and results of the implementation of the Environmental Strategy National in the periods 2007 - 2010 and 2011 - 2015, results in the implementation of other specific strategic frameworks, such as the National Forest Program; the National System of Protected Areas Plan and the National Biosecurity Action Plan and in the pertinent actions for the implementation of the international commitments assumed by Cuba in environmental matters 1, particularly on issues of biological diversity.

Given the scope of the initial training process for the Bachelor of Biology Education professional, its direct link with natural phenomena, which allow not only knowing, promoting and defending biodiversity as a resource, but also establishing its social, economic and cultural interrelationships. To assume critical positions and alternatives of sustainable use that allow overcoming the emerging situation to which it is being subjected, it is necessary to prioritize its study in each of the disciplines, especially in field practices.

1.3 Materials and methods

The study area is located in the Caguanes National Park to the north of the Sancti Spíritus Province, Yaguajay Municipality, considered the core area of the Nueva Vista Biosphere Reserve and as one of the most important protected areas of national significance in Cuba; it includes the Caguanes Natural Reserve and the Cayos de Piedra Ecological Reserve. It is made up of 10 keys. Its varied floristic, vegetal, fauna and microorganism composition allow the study of the contents addressed in the biological disciplines that have a practical treatment in the field practices.

In the present work, a qualitative research was chosen. Various theoretical methods such as analytical - synthetic, inductive - deductive and historical - logical were combined, allowing the theories that support the treatment of biodiversity conservation in field practices to be reviewed separately, integrating the dispersed components of the object of study in its definition, its scope and limitations; construction of the theoretical framework; analysis and reporting of results; drawing up the conclusions and writing the report. In addition, delve into the stages of appearance and development of the object of study.

In the methods and techniques of the empirical level, participant observation, analysis of documentary information and interview were used, which allowed collecting information from many different fields related to the treatment of biodiversity conservation from field practices.

The study population is made up of 7 second-year students from the Biology degree program at the José Martí Pérez University. The 7 students in the population representing 100% are taken as a sample. The general research procedure allowed a logical sequence to be followed to achieve the elaboration of the necessary actions to guarantee the sustainable use and conservation of biodiversity from the Field Practice I, II and III disciplines based on the potential offered by its content. An evaluation of the main environmental problems affecting the Caguanes National Park was made, which allowed some general considerations to be made that contributed to preparing the proposal.

It is important to consider that the goal of these actions, some of them expressed in a general way in documents prepared collectively (López, Montenegro, Liévano, 2014), but adjusted here to the specific needs of the discipline's study area and programs, is the realization of effective studies that guarantee that in the immediate future our students propose strategies for the conservation of the areas where they carry out their field practices, which have high biological richness and uniqueness.

"Advance representations are objectives or ends, which are conscious and that process aimed at obtaining them is what is called action." (González, 1995: 92).

Planning and obtaining biodiversity measures are essential elements that must be considered before carrying out the study work in order to face an inventory or monitoring, here it is clearly defined what the objectives are. In order to conserve biodiversity, it is necessary to recognize its components and the carrying out of inventories facilitates this process. In other cases, it is required to know how that diversity changes over time, either by natural processes or as a result of human actions. In that case, monitoring can be used.

1.4 Actions to promote the treatment of biodiversity conservation from field practices.

Action No1: Planning and obtaining biodiversity measures. Objective: Define the objectives that are sought in the study of biodiversity during the development of field practices.

Actions.

- o Selection of practice polygons. Determine biotopes and other characteristics of the area. Recognize its natural resources. This step requires an examination of cartographic materials (maps, images, plans, etc. that allow regional appreciation of the characteristics of the area and its heterogeneity and topographic maps, scales and coordinates to determine the geographical distribution of biodiversity).

- o Estimate the time and resources necessary to carry out the inventory and / or to plan subsequent monitoring. If the interest is the number of species in a place, we must first investigate what is previously known about the area and plan the time required to obtain the information directly in the field. Precise definition of the inventory objective, which in turn determines the level, scale and intensity of the sampling.

- o Establishment of the geographical scale. It consists of defining what is local and what is regional to associate it with the alpha, beta and gamma measurements.

- a) Number of species or alpha diversity, (Local level) coexistence of species in a community in space and time. Beta diversity (Degree of change or replacement in the composition of species between different communities). Gamma diversity. Total species richness. (Plant taxa, groups of invertebrates (insects), groups of vertebrate fish, amphibians, reptiles, birds, mammals, and rare, exotic, and invasive species).

o Determination of sampling methods and techniques. It is important to combine several methods aimed at the group of interest to capture a greater amount of information about the species present. At the study site, information on the presence of species can be recorded by direct methods (observation, and / or taking of specimens, photos, among others) so that the results can be verified, or subsequent studies can be carried out or indirect (use of footprints, traces, recordings of vocalizations or other evidence of the presence of the species in the area of interest).

- Methods of collection, identification and conservation of soil, flora and fauna samples. Universe of study and sample, sampling site, sampling unit and subunit, quantifiable variable, determining which elements are to be quantified and instruments and procedures to be used.
- Analyze the tasks and strategic actions of the University for the "Life Task" that can be implemented in the practice area.

Organization and analysis of information. Once the information has been collected in the field and the collected specimens have been processed, the information should be organized and analyzed. Such an analysis generally implies the use of diversity indices which seek to have estimates from samples taken in the field and allow comparisons between locations. In addition, it must:

- a. Establish and improve actions, strategies to reduce the loss of biological diversity in the study area, as well as conserve biological material during the development of activities related to field practices, considering not causing an impact on the ecosystem where it is carried out the practice. Promote the use and management of the information and project the work in order to carry out other actions in subsequent years.

Observation: These actions are proposed from the second year of the degree program, which is where the study of practical field discipline begins.

Action No. 2. Measuring the biodiversity of microorganisms, flora and fauna.

Objective: Evaluate or predict potential impacts on the biodiversity of microorganisms, flora and fauna.

Actions.

- Study of microorganisms, flora and fauna of the selected area. Species present. Sample qualitatively and quantitatively, which implies:
- Plant formations of the territory, identification of plant and animal taxa. Acquisition of floristic and fauna data in the field and in the laboratory, as well as measurement and interpretation of the variability of plants and animals.
- Use appropriately printed or digital dichotomous keys and other identification resources that facilitate the recognition of different taxonomic categories.
- Characterization of the relief, vegetation and soil of the study area and influence on biodiversity.
- Determine if there are protists in the area (the foraminifera). Observation through the microscope of different shells of foraminifera.
- Obtaining samples of marine and freshwater plankton to identify different microorganisms.
- Identification of fungi with the use of dichotomous keys or another identifier. It is necessary that in this activity photos of the observed fungi are taken.
- Carrying out collections to use in the teaching-learning process, considering not to cause harm to these communities.
- Precise status of their populations to determine if the increase in small populations and control of problematic populations (Exotic and Invasive Species) and their impact on vulnerable Cuban ecosystems are required.
- Analysis of population management for productive purposes. Impact on biodiversity and determination of spatial or temporal patterns. Endemic species. Rare species.
- Influence of the atmosphere, atmospheric weather, temperature, radiation, climate, hydrology, precipitation, relative humidity, pressure, wind, cloudiness and the fundamental geological processes that are linked to the formation and transformation of minerals on biodiversity.

- Determination of the conservation status of ecosystems. Link the acquired knowledge with the rational use of natural resources, the protection of nature and pedagogical and investigative practice.
- Compare two different ecosystems, or the same ecosystem at different times and know the geographical distribution of certain species and external and internal migratory movements.
- Determine changes that this distribution may undergo and consequences of loss of biodiversity.
- Preparation of final report.

Observation: This action is proposed for the second and third year. In 2nd year, fundamentally linked to the Botany and Microbiology subject. In the 3rd year, it will be carried out with content specific to the discipline General Zoology. However, it is important to consider an integrating axis, the plant-animal relationship.

Action No 3. Estimation of the richness (or number) of species.

Objective: To get to know a representative sample of the species richness of the fauna of the site.

Actions

- Calculate ecological indices: species richness, which is only the number of species, either plants or animals: the abundance that is the total number of individuals (N) of each species, and the diversity (S) using the Simpson's formula:

S- Diversity (Simpson index).

N1- Number of individuals by species. N- Total number of individuals.

In this action it must be considered that the specific wealth indices are based on:

- The number of species of the locality that we sample, the number of individuals found in each one.

- Evaluate if the samples taken reveal all or most of the species present in an area or if, on the contrary, greater sampling efforts are required using the species accumulation curves.

Observation: It can be used in the second and third year.

Action No 4. Rapid inventories by taxonomic groups.

Objective. Recognize the structure and function of different hierarchical levels that make up biodiversity, for its application in the use, management and conservation of resources.

Actions.

- Selection of the biological groups and implementation of the appropriate sampling methods and techniques for each one.
- Determination of the ranges of geographic distribution of species and changes in the distribution of organisms in space and time.
- Determine the presence of endemism and the relationship with the impact generated by human activity. Exploration of possible uses of the species.
- Preparation of floristic catalogs, biogeographic analysis, technical reports associated with environmental impact studies, delimitation of protected areas.
- Preparation of floristic and fauna records aimed at estimating the efficiency of the samplings, quantifying and comparing the composition of species and evaluating the conservation status of the study area. (This includes data obtained periodically to detect long-term changes, or to understand the dynamics of the biodiversity component of interest.
- Generation and organization of data. Recommendations for conservation actions.

Observation: These actions are carried out in the second and third year.

Action No. 5. Monitoring.

Objective: To know the changes occurred in biodiversity over time, either by natural processes or as a result of human actions in the study area.

Actions

- Starting from an initial inventory carried out in the second and third year, from which some species are chosen either because they allow to easily detect changes over time or because they are subject to management and conservation. Periodically record data to detect long-term changes, or to understand the dynamics of the biodiversity component of interest.
- Final evaluation of the changes that occurred in the populations during these 3 years of study and determination of the composition, changes in the structure - function and proportions of ages.

- If the interest is an animal population, the dynamics of that population must be considered, perceiving if it increases or decreases with time, demographic processes responsible for these changes.

Health status, movements and use of resources.

- Identify climatic factors that affect the components of biological diversity, especially those that affect the adaptability of populations and the effects of anthropogenic action and influence of biotic and abiotic factors on ecosystems.
- Evaluate the magnitude of the effect of such processes.
- Influence of the physical-geographic components (geology, relief, hydrography, climate, soil, and biogeography) and the economic-geographic and social components (land use, services, population, industry, history, culture, and others) on biodiversity .
- Final evaluation of the state of the communities. Determination of how the abundance of each species fluctuated over time.
- Assessment of ecosystems and how ecological processes varied over time, how the magnitude and shape of the coverings that make up the studied area changed over time.
- Determination of the Indicators of the state of some components of the ecosystem. These would allow us to measure if our monitoring object is in a "good", "regular" or "bad" state.

- Establish and improve actions, strategies aimed at the conservation of biodiversity and reduce its loss in the study area. Preparation of final report.

Observation: The field practice of the Ecological Genetics discipline will be carried out at the end of the first semester of the 4th year and has as its integrating axis the relationship between society and nature.

1.4 Results and Discussion

When carrying out the analysis of the program and methodological orientations of the Field Practices subject and the disciplines fundamentally related to it, such as: Botany, Microbiology, General Zoology and Ecological Genetics, aimed at students of the Bachelor of Biology Education course conceived in the Study plan E, it is verified that they have gradually incorporated various essential contents that favor a deep integrative study and knowledge of biodiversity.

For example, in the program designed for the meeting course, for four years content related to Invasive Exotic Species and their impact on vulnerable Cuban ecosystems, study of the flora of the localities, interaction of animals with the environment and the need for its protection and anthropic action in ecosystems.

The program of the Field Practice I subject, fundamentally linked to the discipline of Botany and Microbiology aimed at the students of the daytime course, constitutes the object of study of Invasive Exotic Species and their impact on vulnerable Cuban ecosystems, study of the flora of the localities, interaction of plants with the environment and the need for their protection, anthropic action. Even so, these programs and methodological guidelines are not sufficiently guiding in terms of the objectives and abilities to achieve the conservation of biodiversity in practice areas, from the content offered by each subject.

However, in Chapter VII article 50 of Law 81 on the Environment; it is proposed that the Ministry of Higher Education will guarantee the introduction of the environmental dimension, based on professional models and undergraduate and postgraduate study plans, extension, and teaching and extra-teaching activities, aimed at training and improvement of professionals from all branches. (National Assembly of People's Power, 1997).

The biological disciplines offer potentialities to integrate dispersed knowledge in the study plan in different subjects, reaching to establish essential generalizations about the biological picture of the living world. Therefore, one of the general objectives that the graduate of the Bachelor's Degree in Biology Education must fulfill in the Model of the Education Professional, (2016) is to demonstrate in a responsible way, his love of nature, protection of nature biodiversity and care and conservation of the environment.

In the application of the participant observation method to the field practice activities, in correspondence with the objectives that were pursued, it is verified that no actions are planned methodologically that favor the treatment of the conservation of biodiversity in the polygons, especially in areas considered protected. The knowledge acquired in the disciplines related to field practice is not used to fulfill this purpose.

It is verified that the treatment given to environmental problems that affect biodiversity is insufficient, sometimes they are not approached correctly from an environmental point of view. Studies on the biodiversity of microorganisms, flora and fauna of the selected area are scarce. Actions are not considered to fulfill the "Life Task". Insufficient improvement of the cloister on environment and sustainable development.

Field Practices acquire a special value in the teaching and learning of Biology as they allow students to approach their object of study, "the living", as close as possible to their natural conditions, with a systemic and holistic perspective that allows them to understand the relationships that make up the living phenomenon in conjunction with its environment: trophic networks, adaptations, inter and intra-specific relationships, biodiversity, ecosystems, etc. But they also offer high-value educational opportunities related to procedural and attitudinal aspects, such as appreciation of the meaning of nature, valuation, conservation, sustainable enjoyment of natural resources, etc. (Amórtegui, Mayoral, Gavidia, 2017: 8).

In an interview, the students showed interest and motivation to develop actions that contribute to the conservation of biodiversity from field practices. A certain mastery of the concepts of biodiversity and conservation was evident. Most answer why it is important to conserve biodiversity, but not the identification of the main problems that affect biodiversity, the causes

that have generated it, the number of existing species, the benefits we obtain from it, the causes of its loss and actions to preserve it.

Guzmán, (2001: 37), defines field practices as the form of organization of the educational teaching process, which takes place in nature, in an area that meets the requirements to achieve the proposed objectives and that contributes to developing in students' skills that allow broadening, deepening and integrating knowledge, perfecting working methods, protecting the environment and aesthetic student education.

In the training of the Biology career professional, it is essential to link theoretical knowledge with practice due to the particular characteristics of the area of knowledge in which it is formed, which requires the incorporation of aspects of nature and society to the pedagogical process as an effective way that aims to achieve comprehensive student training.

Conclusions

The field practices are a training scenario that is of great importance in the treatment of biodiversity conservation, since they allow the student to deal in a special way with the living phenomenon in natural environments, specifically from a systemic and holistic perspective that lead to the improvement of professional pedagogical performance in the cognitive, behavioral, favoring the formation of an environmentalist culture.

The actions carried out from the field practices contributed to promoting the conservation of biodiversity in the Caguanes National Park and deepening the conceptual, methodological and integration approach of different disciplines in the conservation of biodiversity.

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