

## **BRYOPHYTES FROM CHAPADA DO ARARIPE: AN ACTION OF POPULARIZATION OF SCIENTIFIC KNOWLEDGE**

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### **ABSTRACT**

A sustainable relationship between man and the environment is known to be fundamental for the conservation of natural environments, to maintain the diversity of species and the services offered by them. To this end, implementing activities to make scientific knowledge accessible to the lay population strengthens the efforts to conserve natural ecosystems. This project aimed to popularize the knowledge generated in a master's thesis about the environmental problems that affect the humid forest of Chapada do Araripe - CE and the bryophyte flora in this region, in order to make scientific and sociocultural knowledge more familiar to the human population that resides in the vicinity of the forest. To this end, dialogues were developed in public environments, such as squares and parks, and residences were visited; expository and didactic material, banners and booklets were presented and distributed; and a theoretical-practical mini-course was held for the local scientific community. These strategies were tailored to each public served, that is, the general population, lay people, and the academic community, in order to enhance the accessibility to scientific knowledge. In this project, it was possible to understand the perception of people about the importance of the forest in social life and expand the knowledge about the human-environment relationship and the learning through the exchange of experiences.

### **INTRODUCTION**

Making scientific knowledge accessible to all and disseminating it, that is, popularizing it, is still a challenge for those who produce science, however promoting the inclusion of the lay population should be a duty (CANDOTTI, 2002). The practice of popularizing and disseminating science and educating the population on

environmental issues allows the formation of critical, active and conscientious citizens to seek common good actions. The act of popularizing scientific knowledge also implies the recognition of the importance of each citizen in the solution of socio-environmental problems. The circulation of scientific ideas is fundamental to assess their social and cultural impact, as well as to identify, through

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free debates and confrontation of ideas, the values that the discovery of new information can expand or break down (CANDOTTI, 2002).

Thus, as science and technology advance, a growing need for environmental education actions aimed at the sustainable development of society emerges (UNESCO, 1999). The Cariri region in Ceará, in Chapada do Araripe (Araripe plateau), is an example of a scenario in which human populations depend on natural resources for subsistence or trade, which is a very common scenario. Chapada do Araripe is an important vegetation complex of humid and dry forests, home to endemic species, whose environmental quality is compromised by activities related to agriculture and exploitation of plant and water resources (SILVA; LINHARES; GUIMARÃES, 2011).

As a way to encourage the local lay and academic population to adopt more conservationist attitudes towards biodiversity and natural resources, this work aimed to popularize and disseminate the scientific knowledge produced during the development of a master's thesis on the environmental quality status of the humid forest of Chapada do Araripe and the consequences of the loss of habitat quality over sensitive plants such as bryophytes and the maintenance of biological diversity.

## **MATERIAL AND METHODS**

The project was carried out in the municipalities of Missão Velha, Barbalha and Crato, which comprise the humid forest of Chapada do Araripe. Activities to disseminate the scientific knowledge generated in the study of Batista (2018)

regarding the potential use of bryophytes as bioindicators of environmental quality were conducted in urban spaces near the humid forest of Chapada do Araripe. The first phase of the project involved the population of the region in general, especially the people living in the vicinity of the forest. The activities were developed in communities, involving visits to residences, and also in public spaces of urban centers, mainly in the city of Crato.

The second phase was aimed at professionals of Biological Sciences and the activities were carried out at the Regional University of Cariri – URCA, located in the municipality of Crato. Altogether, the project served approximately 86 people (66 in Phase 1 and 20 in Phase 2), including children, adults, and older adults (Figure 1).

In Phase 1, to start the dialogues, there was an explanation with expository and didactic material through banners and booklets and a moment to visualize bryophyte species with the aid of optical equipment. In this phase, public opinion questionnaires were applied pre- and post-action to assess the people's perception of the topics covered and their decision making after the action.

The topics discussed and questioned were the following: 1) The importance of the forest in daily life; 2) Threats that compromise the quality of the forest; 3) What are bryophytes? 4) Consequences of anthropogenic disturbances on bryophytes; 5) Implications for forest conservation; 6) Suggestions on how to preserve the forest. In the Phase 2, a theoretical-practical mini-course on the

use of bryophytes as bioindicators of environmental quality was held for the URCA scientific community.

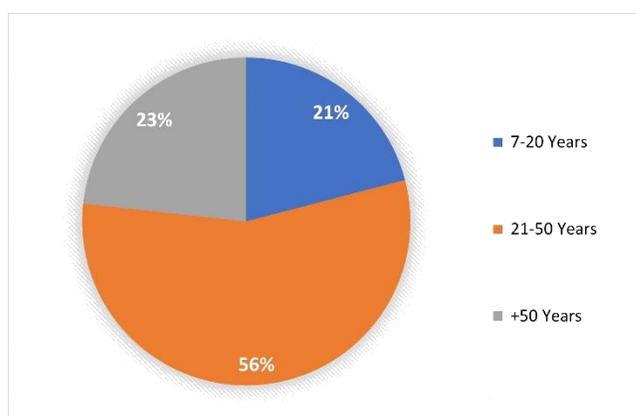
The strategies adopted were an expository and dialogued class followed by a practical activity of identification of bryophyte species and group work to analyze and present a diagnosis of environmental quality based on a bryophyte database. Finally, the course was concluded with an evaluation of the mini-course. These strategies were tailored to the different publics, namely, the general population, lay people, and the academic community, in order to enhance the accessibility to scientific knowledge.



**Figure 1.** Photographic records during the Phase 1 of the project in public spaces in the city of Crato (A) Barbalha (B) and Missão Velha (C), and during the Phase 2 in the mini-course presented at URCA (D).

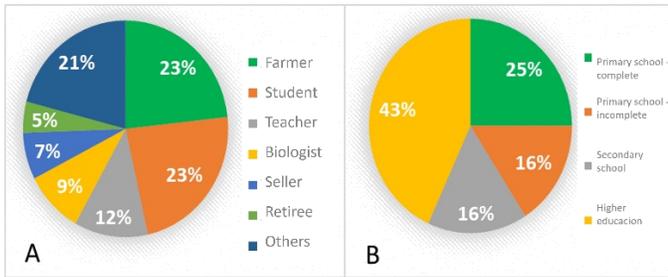
## RESULTS AND DISCUSSION

In general, all participants were interested in the contents and in learning about the bryophyte flora during the practical activities, making questions and exchanging experiences. With respect to the main results obtained in Phase 1, regarding the profile of the population served, most participants were adults (56%) aged between 21 and 50 years (**Figure 2**).



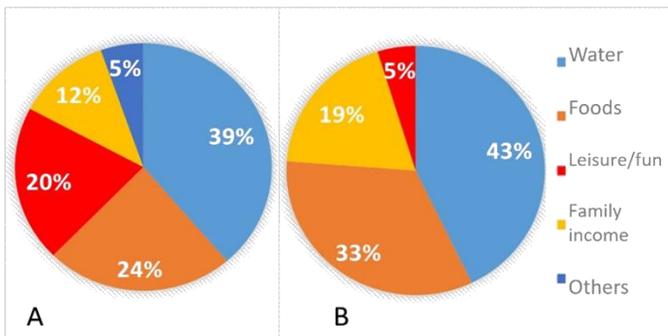
**Figure 2.** Age group of participants during the Phase 1 of the project.

The professional occupations of the participants consisted of 16 types, the most representative being that of farmer (**Figure 3**). As for the level of education, 46% had completed higher education and 25% (mainly farmers) had incomplete elementary school (**Figure 3**). In Brazil, in general, farmers have a lower level of education compared to people with non-agricultural occupations, and this contributes to the lack of sustainable development in the sector and the persistence of problems related to rural poverty (HOFFMANN and NEY, 2004).



**Figure 3.** Occupations (A) and education level (B) of participants.

As for people's perception of the importance of the Chapada do Araripe forest in the daily lives of the population, the main aspects mentioned were a source of water (39%) and food (24%) followed by a space for leisure and fun (20%). In the specific case of farmers, the forest was mentioned not only as relevant for family subsistence, but most importantly as a source of income (**Figure 4**).



**Figure 4.** Perception of the general population of the importance of the humid forest of Chapada do Araripe for their lives (A); perception of farmers (B).

Regarding the individual contribution of people to ensure the preservation of the forest, 63% reported that they contribute positively, although some sometimes the participants did not understand whether they contributed or not, or did not feel responsible for preserving the forest. Some studies conducted in the region addressing the

environmental perception of people of the importance of preserving the fauna showed that people knew the animals presented, but few knew the importance of preserving the species (MELO, 2013; LINHARES and SILVA, 2015).

Therefore, assessing the environmental perception of the society analyzed reflects the way in which people observe, understand and interact with the environment in which they live, including cultural values. Thus, by understanding the environmental perception of society, it is possible to plan strategies that contribute to conservation actions. It is possible to show society that humans depend on the environment, but the environment does not depend on humans. As for knowledge of the local flora, especially of bryophytes, most people had not heard of the name bryophytes (70%). Those who knew what bryophytes are (23%) were professionals in the field of Biology, teachers and students.

Bryophytes are not a plant group popularly known. One of the main explanations for this is the fact that these plants are tiny small, and thus cannot be easily seen with the naked eye. The diversity of bryophytes goes unnoticed by the vast majority of people (SANTOS et al., 2015).

Finally, after the application of the questionnaire, it was observed that 98% of people can contribute more than they presently do for the conservation of the forest and its biodiversity with daily actions. Furthermore, 99% understood what bryophytes are and their role in the environment. This result is one of the indicators of the importance of popularization of scientific knowledge: if all this content about the humid forest of the region and the

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bryophyte flora were discussed only in scientific articles, certainly more than 50% of these people would not have been reached. The act of popularizing scientific knowledge allows society to think based on science, opening spaces for discussions and exchanges of experiences, and for this it is increasingly necessary that scientific information is present in people's daily lives, that is, disseminated in public spaces, such as the streets, giving everyone the opportunity to discuss science (MOURA, 2003; SILVA et al. 2023).

In the Phase 2, undergraduate students of Biology evaluated the mini-course with grades above 8, indicating their satisfaction in learning more about the use of bryophytes in a theoretical and practical way, but they also pointed out the need to combine field classes with the course to learn more about collection and observation techniques.

## CONCLUSIONS

The actions of popularizing scientific knowledge regarding the conservation of the humid forest of Chapada do Araripe and the ecological importance of bryophytes had very satisfactory outcomes. On one hand, it provided new knowledge, especially to people less familiarized with the subject such as farmers in the region, and on the other hand, it expanded the knowledge of professionals in the area of Biology about the use of environmental bioindicators in the region.

Finally, it is possible that this intervention contributed to raising people's awareness of the need to conserve natural environments and their biodiversity. More similar actions are still needed to

increase environmental awareness. Only effective and permanent environmental education will be able to change people's behavior regarding their role as protagonists in the conservation and sustainable use of natural resources, consequently generating a more participatory and sustainable society in relation to the environment.

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## REFERENCES

- Araújo, G. C. de; Bueno, M. P.; Bueno, V. P.; Sproesser, R. L.; Souza, I. F. de. Cadeia Produtiva da Avicultura de Corte: Avaliação da Apropriação de Valor Bruto nas Transações Econômicas dos Agentes Envolvidos. **Revista Gestão & Regionalidade**, v. 24, n. 72, p. 6-16, 2008.
- Batista, W. V. S. **Assembleias de briófitas em florestas úmidas da chapada do Araripe, CE: montagem de comunidades e potencial bioindicador**. Dissertação de Mestrado (Mestrado em Biologia Vegetal). Universidade Federal de Pernambuco, Recife, 2018.
- Candotti, E. **Ciência na Educação Popular. In: Ciência e Público: Caminhos da divulgação científica no Brasil**. Massarani, L., et al. (orgs.). Rio de Janeiro: Casa da Ciência – Centro Cultural de Ciência e Tecnologia da Universidade Federal do Rio de Janeiro, 2002.

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Linhares, K.V.; Silva, W.A.G. Soldadinho-do-Araripe, símbolo da conservação das águas e florestas úmidas do Cariri Cearense. **Caderno de Cultura e Ciência**, v. 13, p. 37-50, 2015.

MOURA, D. O. A popularização da informação científica na Sociedade de Risco: em busca do diálogo. **Comunicação e Espaço Público**, v. 6, n. 1-2, p. 52-64, 2003.

Hoffmann, R.; Ney, M. G. Vista da desigualdade, escolaridade e rendimentos na agricultura, indústria e serviços de 1992 a 2002. **Economia e Sociedade**, v. 13, n. 2, p. 51-79, 2004.

Melo R. S. **Conhecimento e utilização de mamíferos por duas comunidades em uma Área de Proteção Ambiental (APA/Araripe): uma abordagem etnomastozoológica**. Dissertação de Mestrado (Mestrado em Ecologia) Universidade Federal Rural de Pernambuco, Recife, 2013.

Santos, N. D.; Silva, N. F.; Oliveira, T. P. O que ensinamos sobre as primeiras plantas terrestres: análise de livros didáticos do ensino médio. **Pesquisas, Botânica**, v. 67, p.321-334, 2015.

Silva, A. P. T.; Moraes V. S.; Portugal, A. S. "Jardins sensoriais e ensino no Brasil: uma revisão bibliográfica." **Revista Valore**, v. 8, e-8032, 2023.

Silva, W. A. G.; Linhares, K. V.; Campos, A. A. (orgs.). **Plano de ação nacional para a conservação do Soldadinho-do-Araripe**. ICMBio, Brasília. 2011. 73 p.

UNESCO. Organización de la Naciones Unidas para la Educación la Ciencia e la Cultura. **Conferencia Mundial Sobre la Ciencia Para el siglo XXI**. Budapest (Hungria). 1999.