

Two ways of looking at a botanic garden: Science and education as activating forces

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Introduction

México is one of the 12 megadiverse countries that together contain about half of the world's biodiversity. Nearly 10% of known vascular plant species can be found in México, owing to its intricate topography that leads to numerous microenvironments, and to the convergence of Neartic and Neotropical biotas in this country (Neyra González & Durand Smith 1998). México is also a culturally rich country. The presence of more than 50 indigenous groups provides us with a long history of human interaction with environment.

In the context of the current environmental crisis, we consider important to relate Mexico's biological and cultural values to the work developed within scientific institutions. The interaction between scientific knowledge and the natural and social capital should generate new forms of interaction between society and the environment. These interactions should help to conserve the portion of planet under our custody. This is one of the goals of the Centre for Ecosystems Research (CIEco, from its Spanish acronym).

The Centre for Ecosystem Research is a recently created entity of the National Autonomous University of México (UNAM). CIEco was created by a group of academics interested in developing interdisciplinary, applied research that can contribute to sustainable development. As a research centre, CIEco's main functions are the production of scientific knowledge, teaching and professional training of scientists and technicians. Communication of science to non-scientific audiences and environmental education were acknowledged from the beginning as important activities to be conducted. In this sense, we conceive an adaptive interaction with non-scientific audiences, where the audience has the capacity to respond and demand the knowledge that is been shared between all the actors involved.

CIEco is working to foster an open relationship between scientists, scientific knowledge and society. Raising environmental awareness and promoting the participations of citizens in solving environmental problems is an important part of this strategy. The creation of a Botanical Garden is a key element to achieve this aim.

In this contribution our main objective is to share our experience in developing a proposal to create a Botanical Garden in the state of Michoacán, located in west central México. A team of plant taxonomist who also has experience on management of plant collections initiated the proposal. As the project developed, CIEco's unit of science communication and outreach got involved in order to include an educational perspective. What we describe here is a reflection on the process of work to generate a common project for the botanical garden. Our goal is to develop a strategy to create a botanical garden that can work as a window that CIEco could use to communicate with society in order to promote the construction of sustainability.

A botanical garden in West México

The state of Michoacán in west central México is among the five more biologically diverse states in the country. More than a dozen vegetation types can be found and, unfortunately, all of these communities present some form of transformation or degradation due to human activities such as agriculture, cattle ranging, urban growth, or invasion of secondary vegetation after abandonment. This generates an urgency to implement ways to rescue, restore and conserve the plant diversity of Michoacán (Carranza 2005).

In the last few decades, botanical gardens have become important centres for biodiversity conservation, playing a role in integrating conservation and development (Wyse & Sutherland 2000). On the other hand, education is also recognized as a valuable instrument to promote the study, conservation and raising of awareness regarding the importance of ecosystems and the role of plant diversity in human survival. We consider that environmental problems have their roots in the nature of interactions that societies have with natural systems. Public places such as the museums, zoos and botanical gardens can become important centres for education for sustainable development (Willison 2006).

There are 89 botanic gardens registered in México by the Botanic Gardens Conservation International. Many of them, nevertheless, are not in function or have just started to be developed. In the state of Michoacán, and in spite of the recognition of its rich plant diversity, there are no botanical gardens. Is in this context that CIEco is developing its proposal to generate the first botanical garden in the state.

CIEco's Botanical Garden Proposal

In 2005, authorities of UNAM assigned CIEco the responsibility to develop a proposal for the creation of a botanic garden at its campus in Morelia. An experts committee of CIEco was formed and initiated the development of the initial plan for the botanical garden.

This first version of the botanic garden proposal had as objectives to develop some botanical collections where scientists could develop research, take action in conservation and exhibit Michoacán's plant diversity. These objectives also considered an environmental education plan and the creation of some ecosystems goods and services in the Morelia region. Another important part of the original proposal was a series of well-detailed technical considerations. The technical staff thought about physical and geological aspects of the area where the botanical garden will be. They also considered physical facilities, types of plant collections and botanical garden maintenance, management, and administration. However, some important elements of a botanical garden were overlooked in the proposal: an integrated education master plan that considers specific objectives related to communication, public participation and awareness on biodiversity and conservation according to the Global Initiative on communication, education, and public awareness that the Convention on Biological Diversity is developing.

Integrating the educational perspective

The experts committee in charge of developing the botanical garden creation proposal presented it to the entire academic community of the Centre. In this first meeting, it became clear to some researchers and to the members of the CIEco's Unit of Science Communication and Outreach the need to develop not only an educational proposal but to include this perspective since the beginning of the project. The experiences carried out in public educational places such as

museums tell us of the relevance to recognize and educational purpose when constructing and exhibition. This purpose, nevertheless, should be clearly stated in the mission of an exhibition, or in our case, in a botanical garden project.

After discussing different points of view, we concluded that the mission of CIEco's botanical garden is "to contribute to the study and conservation of Mexican flora, and to promote among the public an interest to know, conserve and use in a sustainable way the plants and ecosystems of México." As a research institution our interest is also that the botanical garden will serve as a window through which we can share with society the scientific work that we conduct and all the activities that CIEco implements to contribute with the construction of sustainable development.

From this perspective, we worked together also on the main objectives, which include:

1. To conserve seeds, propagules and Mexican plants *ex situ*.
2. To support CIEco's research and teaching activities.
3. To show visitors Mexico's native plant diversity.
4. To share with visitors knowledge about plants, ecosystems and regarding the human interaction with nature generated at CIEco.
5. To promote an environmental culture through the raise of awareness on environmental issues.
6. To offer a cultural place for the joy and recreation of the local community.
7. To be an important place in the city of Morelia which reflects UNAM's cultural richness and academic activity.

After agreeing on the mission and new objectives, a new team was conformed by botanical garden staff and members of the Unit for science communication and outreach. It has been a challenging experience to work in the search for an integrated master plan, which considers equally important technical aspects of the plant collections and the need to develop an education perspective essential for the future visitors.

An aspect that was difficult to address, was the identification of the main messages that we want the public to take with them. We came up with three main conceptual themes that we consider the botanical garden should be build around:

- Mexico's plant and ecosystems diversity: to show visitors the plant diversity of the country and its importance through its eco-regions.
- CIEco's research activity and its role in the search of sustainability: to share with visitors our passion for scientific research and the relevance of the knowledge we generate that contribute to explain the structure and functioning of ecosystems and their relationship with society.
- Awareness about our planet's environment situation. - To see the botanical garden as a space through which society can recognize some goods and services that ecosystem provide to us, to promote their participation and action on proposals that solve environmental problems and help the maintenance of life sustaining processes.

With the purpose of using the experience to reflect, discuss and construct better ways of interdisciplinary work, we constructed the following table that shows the main differences in the initial conception of CIEco's Botanical Garden.

	Technical point of view	Education point of view
Mission	Lack of explicit mission	Includes: ex situ conservation, research and docent activities, diversity of visitors, environmental education, cultural site
Messages	Human activities viewed as threat Plant extinction Emphasis on negative aspects of human interaction with plants	Mexican plant diversity CIEco's research activity Environmental Awareness Emphasis on positive aspects of human interaction with plants view
Education	Viewed mainly as family recreation	Focused on identifying target audiences, constructing communication processes, Emphasis on visits as learning experiences for the public
Infrastructure	Services Maintenance Research Plant exhibitions Some areas to attend visitors Shop, classroom space	Specific areas to develop education activities Areas for enjoyment and contemplation of panorama
Type of plant collections	Focused on: plant problematic, uses and biological processes Arboretum, Threatened plants Thorn scrub Agaves collection Mexican traditional orchard Mexican fruit collection Palmetum Aquatic and riparian vegetation Pollinators garden Epiphyte collection Vines Weeds Medicinal flora Microcosms Graminaceous plants	The same groups of plants organized according to Mexico's eco-regions. Emphasis on the arrangement of plant collections in terms of constructing messages to the public. These messages will help visitors understand the ecosystems and plant diversity, as well as the relations with people's everyday lives.

Final Remarks

Scientists and authorities at our institution are aware of the relevant role that botanical gardens play in supporting environmental awareness, public education, and the need to promote participation of society in solving environmental problems. They are also enthusiastic about the opportunity that the botanical garden can give to our institution for sharing with society the scientific activities that are developed at CIEco.

Our experience so far, has been challenging, particularly in relation to giving an equal importance to the technical and educational aspects of the botanical garden. The technical team had put much emphasis in the development of plant collections for research and conservation purposes, while educators strongly emphasize the role of the garden as a public place where people go to learn and enjoy nature. Equilibrium in the function of CIEco's botanical garden has been reached and will be implemented during the garden construction and operation.

We are convinced that botanical gardens affiliated with research institutions are considered ideal places to relate scientific activities with society. These botanical gardens may be places to develop strategies focused on communication, education, and participation of scientists, technicians and non-scientific audiences. Finally, botanical gardens are places that inspire visitors, the local community, and scientists to take action towards conserving plant diversity.

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Biography

Ana Claudia Nepote

I am a Mexican biologist whose main interests are ecosystem studies, environmental education and science communication. Since 2005, I work at The Centre for Ecosystem Research of the National Autonomous University of México (UNAM). I am part of a team that is developing a proposal for the creation of a Botanical Garden in the city of Morelia, Michoacán.