

**BROADENING THE WAYS OF INTEGRATING THE SOCIAL COMPONENT
("S") IN LONG-TERM SOCIO-ECOLOGICAL RESEARCH (LTSER) SITES:
THE OMORA ETHNOBOTANICAL PARK'S SUBANTARCTIC
BIOCULTURAL RESEARCH, EDUCATION AND CONSERVATION
PROGRAM**

**AMPLIANDO LOS MODOS DE INTEGRAR EL COMPONENTE SOCIAL ("S")
EN LOS SITIOS DE INVESTIGACIÓN SOCIO-ECOLÓGICA A LARGO PLAZO
(ISELP): EL PROGRAMA DE INVESTIGACIÓN, EDUCACIÓN Y
CONSERVACIÓN BIOCULTURAL SUBANTÁRTICA DEL PARQUE
ETNOBOTÁNICO OMORA**

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Abstract. Scientists, decision makers and the general public are increasingly aware that the world's environmental problems involve multiple geographical scales, from local to global, and that these problems include complex and interrelated ecological and social dimensions. Long-Term Socio-Ecological Research (LTSER) sites have the potential to address these challenges, and to help achieve the goal of socio-ecological integration at diverse scales and socio-cultural dimensions. Within the LTSER site located in Omora Park, we introduce a methodology that integrates ecological and philosophical research into biocultural education and conservation. It consists of a four-step cycle interrelating (i) biological and ecological research, (ii) metaphorical communication, (iii) field philosophy and ecology guided activities, and (iv) *in situ* conservation. This methodology has been developed based on the experience gained from the first ten years of the biocultural research, education and conservation program at the Omora Ethnobotanical Park (OEP) in the Cape Horn Biosphere Reserve (CHBR) at the southern end of the Americas. The four step cycle is being used as a structured methodology for the Master's of Science in Conservation Program at the University of Magallanes, thereby educating a new cohort of professionals who are developing novel educational and ecotourism activities such as "tourism with a hand-lens" and "ethical birding" at the OEP and the CHBR. Our approach also has defined distinct, but complementary and synergistic functions of the OEP at different scales. Locally, the park functions as a scientific center for the CHBR and provides three well defined eco-social services: a) conserving the watershed of the world's southernmost town, b) protecting a priority site for the conservation of subantarctic biodiversity, and c) offering a natural reserve for field philosophy and ecology courses and research projects, which allows working directly with diverse social actors, including government authorities, teachers and indigenous people. Nationally, OEP is a founding member of Chile's first LTSER network, and internationally it has led the creation of an "alliance" of institutions that make up the *Subantarctic Biocultural Conservation Program* (www.chile.unt.edu). By broadening the concept and application of LTSER, integrating multiple approaches and scales in biocultural conservation, OEP provides potentially useful models that could be tested and adapted at other Chilean and international LTSER sites.

Manuscript Excerpts

Key words: Cape Horn, ecotourism, environmental philosophy, Man and the Biosphere Programme, Sustainable Biosphere Initiative, subantarctic, UNESCO, biocultural conservation

Introduction

Scientists, the general public and decision-makers are increasingly aware that the world's environmental problems span local to global scales and that these problems include ecological and social dimensions (Rozzi et al. 2006a, Anderson et al. 2008). Furthermore, the link between ecosystem integrity and the well-being of humans and other living organisms has become increasingly evident (e.g., Rozzi & Feinsinger 2001, Millennium Ecosystem Assessment 2005). As a result, interdisciplinary academic programs have developed around socio-ecological concepts, such as ecological restoration (Jordan et al. 1987, Elliot 1994, Palmer et al. 2007) and ecological economics (Daly & Townsend 1993, Daily 1997, Farber et al. 2006). These interdisciplinary fields have successfully generated novel metaphors such as “ecosystem goods and services” and “ecosystem health and rehabilitation,” stimulating scientific research, policy development and conservation strategies that have meaning to both the public and researchers.

Nonetheless, the integration of broader cultural and philosophical approaches is still required in order to better understand biological, linguistic and cultural diversity to achieve effective biocultural conservation and sustainable development at different regions of the world. While ecological studies are often able to depict human and nature dynamics, such studies do not necessarily address the ethical and social implications of ongoing incidents. In contrast, cultural and philosophical studies may focus on such issues, but often remain conceptual or theoretical without testing “in the field.” An integration of ecology and environmental philosophy is just one example of possible socio-ecological interdisciplinary research, and such integrations demand new partnerships between ecology and the humanities, particularly the integration of ethical values, ecological empiricism and conservation (Rozzi 1999, 2001, Callicott et al. 2006). However, academics find themselves tasked not only with effectively incorporating multiple ecological and social concepts and variables in their research, but also applying their work to real world situations and articulating their research at local, national and international levels in an ever changing world (Holling 2004, Jax & Rozzi 2004). Further, academic research often remains one-directional in nature, where the academic

“experts” inform the general public of the “correct information”. Such one-way directional flows of information prevent adaptive responses to real-time social and ecological events, by isolating the local community’s perspective as informal and carrying little or no weight in comparison to the “expertise” of the authorities.

To confront these challenges, long-term socio-ecological research (LTSER) sites can play a central role beyond mere research platforms by also broadening the frequent “case study” approach towards a “partnership methodology.” Such as partnership as practiced as a *methodology* involves networking from the site-level to national and international scales to more fully integrate research with social processes, specifically education and biocultural conservation (Rozzi et al. 2008b).

To advance methodologies that will help to achieve the former goals, in this paper we address two essential questions:

- How to integrate long-term ecological research into broader socio-ecological, theoretical and practical domains?
- How to integrate local, national and international scales into transdisciplinary long-term socio-ecological research programs?

We address the former two questions based on the approaches developed and experience gained during the first ten years of the program that integrates biocultural research, education and conservation at the Omora Ethnobotanical Park’s (OEP) in the Cape Horn archipelago region (Fig. 1). Today, the OEP also forms part of the nascent Chilean LTSER Network discussed in this special issue of the *Revista Chilena de Historia Natural* (RCHHN). At the national level, OEP represents the southernmost and least anthropogenically disturbed site of the Chilean LTSER network. OEP is located in the sub-Antarctic Magellanic rainforest ecoregion (Fig. 1), and at a global scale it is particularly important because it monitors and conducts research programs at the southernmost forests of the world. OEP scientific leadership in collaboration with the Chilean Government has created the Cape Horn Biosphere Reserve to protect these forest ecosystems which are embedded in a remote region that still hosts a relatively small

human population (2,300) and vast terrestrial and marine areas with low human impact. However, these pristine areas are subject to rapidly growing pressures of development, tourism, aquaculture and exploitation of natural resources (Rozzi et al. 2006). In this context, the OEP research team has undertaken proactive conservation actions, and in this article we present the methodologies that have proven to be effective for the development of this long-term initiative at the southern end of the Americas that is able to address both social and ecological issues that remain key to future environmental and social well-being. OEP's approach can also prove useful for integrating social and ecological dimensions at various scales in other Chilean and international LTSER sites...

Section II. The four step cycle: a methodology to integrate biocultural research, education and conservation

The life of the OEP program depends in large part on the work of academics and students with an interest in developing research that encompasses the ecological, social and political arenas involved in decision-making. To integrate social and ecological research, at the theoretical as well as the practical level, into educational and biocultural conservation programs we had, however, the big challenge of designing new curricula and methodologies that allow graduate students to achieve this integration in a formal and systematic way.

II.1 Synthesis of the four step cycle

Based on the experience gained during the first decade of developing a biocultural research, education, and conservation approach, the OEP has defined, *a posteriori*, a simple cycle of four steps that include: i) transdisciplinary ecological and philosophical research, ii) communication through metaphorical expressions, iii) field ecology and philosophy guided activities, and iv) implementation of *in situ* conservation areas. These four steps permit graduate students to investigate theoretical questions, and to integrate their research into innovative educational and/or conservation activities. Below, we provide a brief synthesis of the concepts and activities involved in this research, educational, and conservation approach. We further illustrate the general concepts of the four step cycle with two exemplary cases that are part of ongoing master's theses at the University of Magallanes (UMAG; see Appendix I and II).

Step 1: Transdisciplinary ecological and philosophical research.

LTSER sites permit the development of transdisciplinary programs where diverse institutions, cultural traditions and disciplines participate. For a decade, the OEP has studied subantarctic biological and cultural diversity researching the various ways of perceiving this biodiversity and ways of inhabiting this ecoregion by diverse socio-cultural groups. Research has principally been developed in the areas of ecology and environmental philosophy, and experimentation in methodologies to integrate ecology

and philosophy into education and biocultural conservation so that both lines of inquiry inform the other (Rozzi et al. 2006a). For instance, ornithological research has included studies on indigenous Mapuche and Yahgan, as well as scientific and Spanish and English common names of birds, which have developed an awareness of the influence of language and cultural perspectives on how birds are observed by different socio-ecological groups. This has in turn influenced the development of the trails throughout Omora Park, where the names of the species are provided in four languages (Yahgan, Spanish, English and Latin). Visitors to the park are then engaged in perceiving the species through the connotations of each of these languages and associated worldviews. Long-term ecological and philosophical research has centered on three main thematic areas of inquiry summarized in Table 1.

Step 2: Communication through metaphors and narratives.

The OEP's approach requires graduate students to conduct a creative or poetic work of conceiving metaphorical expressions and narratives that integrate the discoveries derived from their ecological and philosophical research. Recovering the Greek meaning of *poiesis* (= generation, production) makes explicit two essential poles of scientific work: invention and discovery. The composition of metaphors and simple narratives permit the students to achieve the double goal of:

- integrating the results of ecological and philosophical research into an analogical thought process that leads to a conceptual synthesis of facts, values and actions; and
- providing communicative figures for the general public.

In contrast to a traditional vision that maintains that metaphors cannot form part of the scientific discourse, it has been recently proposed that metaphors constitute cognitive-linguistic figures that form part of our daily conceptual schemes and provide an incisive thought process for clarifying the abstract (Pickett and Cadenasso 2002, Díaz 2006). Under this perspective, metaphors do not constitute a purely linguistic expression, but rather carry with them a cognitive structure of human beings. During the past decade

it has been widely documented that they can play a central role in the development of scientific thought (Lakoff & Johnson 1980, Rozzi 1999, 2001, Díaz 2006). For example, at the OEP we have noted how in the development of his theory of evolution by natural selection, Charles Darwin used two essential metaphors: the *tree of life* and the *web of life*.

These two Darwinian metaphors have become “cultural messengers” that synthesize central concepts of ecological-evolutionary sciences and environmental ethics (Rozzi 1999). In the first metaphor, the common trunk in the evolutionary tree provides a visual representation of the Darwinian theory of evolution, which emphasizes the common biological origin that humans share with other living species. This notion stimulates a feeling of kinship that challenges traditional Western morality by demanding the extension of ethical respect beyond our own species, thereby providing one of the foundations for the notion of intrinsic value of non-human life. On the other hand, the metaphor of the web of life is an image that clarifies the notions of ecological interactions in biotic communities and ecosystems. This ecological understanding provides one of the foundations for the notions of instrumental value of biodiversity, and ecosystem services for human survival.

The Darwinian metaphors of the *tree of life* and the *web of life* have continued to stimulate the imagination of scientists, writers, and conservationists. Specifically, in the OEP program, they have helped to conceive the integration of ecological and ethical notions through the composition of new metaphors and activities. The *tree of life* provided a starting image to learn about kinship between humans and birds by looking at the eyes of birds, leading to the development of a novel ecotourism activity named *face-to-face encounters with the caracara* (Appendix II). In turn, the web of life inspired the creation of another metaphor: *the miniature forests of Cape Horn*. This metaphor facilitates the appreciation of the web of interactions among mosses, lichens, insects and other small organisms through the activity of *tourism with a hand lens* (Appendix I). The composition of metaphors such as *the miniatures forests of Cape Horn* and *tourism with a hand-lens* requires and facilitates interdisciplinary interactions among graduate students, ecologists, philosophers, and other participants such as artists, journalists, school children, teachers and other citizens in education and ecotourism workshops.

Step 3: Environmental philosophically- and ecologically-guided field activities.

The OEP's program emphasizes "direct encounters" with mosses, lichens, birds, algae, rivers and other beings that compose ecosystems (Rozzi et al. 2002, 2005). The educational experiences of field ecology and environmental philosophy are designed to stimulate the perception and valuing of biological and cultural diversity in specific sites and moments (Rozzi et al. 2006a). Through direct encounters with biocultural diversity, we recover the awareness of co-existence with a multiplicity of living beings with whom we co-inhabit in our regional habitats (Rozzi et al. 2008a).

In order to recover the awareness of co-inhabitation in biologically and bioculturally diverse regions, OEP distinguishes two types of barriers that need to be overcome in order to achieve the re-encounter with diverse humans and other beings. First, today we need to overcome *physical barriers* that prevent everyday "face to face" encounters with diverse human and other ecosystem components. Since 2008, over 50% of the world's population lives in urban environments. Hence, most people's knowledge about biological and cultural diversity is acquired in a predominately physically detached context. Second, today we also need to overcome *conceptual barriers* that inhibit the understanding of biological and cultural diversity. Most knowledge acquired in urban settings is further distanced from the unique nature of the diverse living beings and cultures because it is mostly learned through the "conceptual lenses" of books, computers, televisions and other audio-visual media that are based on a very few languages, and mathematical models (Rozzi et al. 2006a). Exposure to natural habitats, their beauty and diverse inhabitants has become an increasingly rare experience in formal education in Chile (Rozzi et al. 1997), and worldwide (Leopold 2004, Louv 2004, Smith 2004). The experiences of field ecology and field environmental philosophy compensate for the excess of detached information that prevails in formal and informal education programs, which are nationally and frequently globally uniform (Rozzi et al. 2008). In this way, the approach of the OEP attempts to overcome both *physical and conceptual barriers* that mediate and bias the understanding of biological and cultural diversity. Instead, OEP's program promotes "direct encounter" experiences with the terrestrial and marine habitats, which not only broaden the knowledge about biocultural diversity, but

also transform the ethics of inhabiting and living together in regional ecosystems (Rozzi et al. 2005, 2006a).

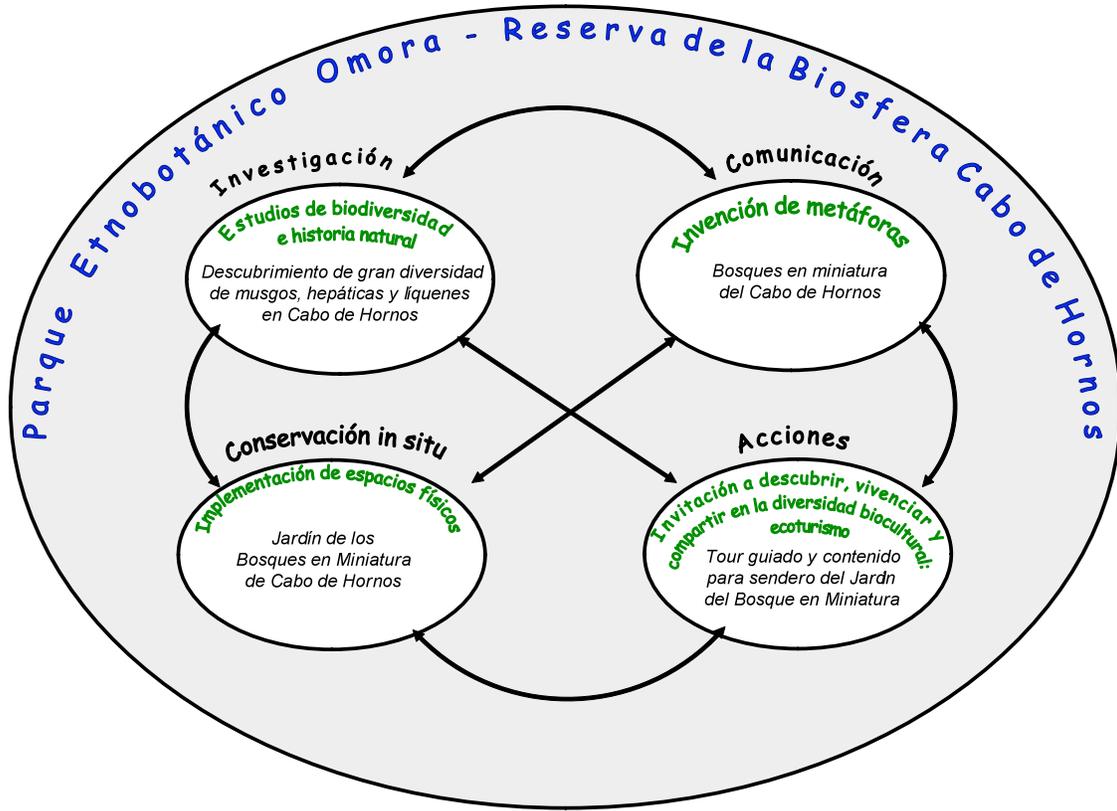
Step 4: Implementation of in situ conservation areas.

In situ conservation is an indispensable condition for the former steps, and the deep meaning of the four step cycle. In order to achieve biocultural conservation, it is necessary but not sufficient to conceptualize the integration of biological and cultural diversity. We also need to preserve the habitats, where the habitats of the co-inhabitants take place. An understanding of the integration among habitats, habits, and inhabitants is found in ancient Greek and Amerindian, as well as in contemporary scientific ecological worldviews. This understanding emphasizes the importance of conserving the habitats and their communities of co-inhabitants, including human beings (Rozzi et al. 2008). In this way, the OEP program recovers the original meaning of ethics that is rooted in the Greek term *ethos* (Rozzi et al. 2008).

The word *ethics* originates from the Greek term *ethos*, which in its most ancient form meant the den of an animal. By expanding the use of this word, its meaning came to include the dwelling places of human beings, and later this noun also was used as the verb to dwell. This double interpretation of the Greek *ethos* as a noun and a verb is expressed subsequently by two Latin words: *habitat* and *inhabit*. At the same time, from the recurrence of the action of *inhabiting* recurrent actions emerge that become *habits* or customs, which define the *ethos* of the animal and human *inhabitants*.

The life experiences made possible by *in situ* conservation spaces, such as the Miniature Forests of Cape Horn Garden (Appendix I), permit the recuperation at the beginning of the 21st century of an ethical concept that integrates *habitat*, as well as *habits* that arise from ways of co-inhabiting in regional ecosystems (Rozzi 2009). Through the work of creating these *in situ* conservation areas, the students and participants acquire a sense of responsibility that will remain with them beyond their experience in the park, as ecologically and ethically-educated citizens (Rozzi et al. 2008).

Appendix I. *Tourism with a Hand Lens* in the Miniature Forests of Cape Horn



Step 1 – Scientific research: inventories of non-vascular flora.

For a decade now, an interdisciplinary team at the OEP has developed floristic inventories in the CHBR. This line of inquiry has determined that the most diverse flora in the region can be found in bryophytes, which include at least 450 moss and 368 liverwort species making a total of 818 for the Magellanic subantarctic region (Rozzi *et al.* 2008b). This number supersedes the total of 773 vascular plant species registered for the ecoregion, and at the world level this is very striking for two reasons: i) 300,000 vascular plant species have been identified at present on earth, but only 15,000 non-vascular (bryophyte) species are known to science. In the majority of the planet’s ecoregions, the diversity of vascular plants is approximately 20 times greater than that of bryophytes. ii) The Magellanic subantarctic ecoregion represents 0.01% of the earth’s

surface area. However, in this relatively small archipelago, we find 5% of the known species of bryophytes on the planet. Additionally, it is estimated that the degree of endemism of these taxa is greater than 50% (Engel 1978, Matteri 2000, Villagrán *et al.* 2005). For these reasons, the Magellanic subantarctic ecoregion has been identified as a global “hotspot” for bryophyte diversity (Rozzi *et al.* 2008b).

Step 2 – Communication via metaphor: Miniature Forests of Cape Horn.

The previous results grabbed the attention not only of the scientific community, but also authorities, decision-makers, tourism operators and the general public. However, the scientists were challenged with transmitting and communicating about the high diversity of bryophytes, given that frequently these small plants lack common names and are completely unknown by the majority of the public. To overcome this difficulty, the invention of a metaphor proved useful, and by working together with students in the primary school in Puerto Williams, scientists began to refer to the “*Miniature Forests of Cape Horn*” to denote the biotic community formed by the diverse species of mosses, liverworts, lichens, mushrooms and invertebrates (Rozzi *et al.* 2002).

This metaphor arose in part as a comparison with the communities formed by the large trees, vines and epiphytes inhabited by better known birds and other large organisms, but it helped greatly for the general public to understand the ecological interactions and processes taking place in the small formations of bryophytes, lichens, fungi and associated bacteria and fauna. At the same time, the metaphor gave rise to educational activities that included pre-school and primary school students. For example, the project “*Little Explorers of the Miniature Forests of Cape Horn,*” which is carried out in the OEP with the financing of EXPLORA-CONICYT, Chile’s official science education initiative, has contributed not only to pre-school and primary school education in Puerto Williams, but also motivated EXPLORA to create a new educational line at the national level called the “*Little Explorers Clubs*”. The clubs formally integrate pre-schoolers into science education for the first time in Chile. In this way, the use of the metaphor demonstrated its appeal to a broad spectrum of age and socio-cultural groups,

for whom the existence of bryophytes was previously unknown (Medina et al. in preparation).

Step 3 – Ecological-oriented field activities: Tourism with a Hand Lens.

Through another metaphorical name, “*Tourism with a Hand Lens*”, the floristic discoveries and the experience of exploring the *miniature forests of Cape Horn* have been translated into an innovative scientific tourism activity. This activity invites visitors, hand lens at the ready, to observe, enjoy and value the beauty, diversity and ecological importance of small organisms like lichens, mosses, mushrooms, insects and other invertebrates that usually pass by unnoticed and which were previously not incorporated into tourism offerings in Chile (Rozzi 2005). The graduate students in this case act as guides themselves or train other local guides by sharing their scientific knowledge in a didactic, entertaining and interactive way, using interpretative trails in the OEP and accompanied often by authorities, teachers, members of the local community, reporters and ecotourists.

Tourism with a hand lens constitutes today a new scientific tourism activity for the Magallanes and Chilean Antarctic Region that permits: a) getting to know the beauty, diversity and ecological important of the non-vascular flora at the extreme tip of the Americas; b) inviting the visitors to stop, slow their pace and re-connect with other living beings; and c) generating new opportunities to develop environmental tourism that is economically sustainable for the local community of the CHBR, as well as the regional, national and international community. This innovation has been developed with the support of the government of Chile through the financing of training courses and publications about bryophytes and lichens (Goffinet *et al.* 2006).

In the past decade, tourism and the number of tourists has increased annually at a rate of 7.7% in Chile, a figure which is greater than the world average (Chacón 2002). In the Magallanes and Chilean Antarctic Region, the number of visitors surpassed the one million mark in 2008, a figure which is an order of magnitude higher than the previous two decades (SERNATUR 2009). In this scenario, *tourism with a hand lens* represents a diversification and strengthening of the region’s tourism offering, which in an

administration coordinated with authorities and public services offers a revenue source that is environmentally and economically sustainable for the local community of the CHBR and which could be replicated in other parts of the country and the world. The sustainable character of this activity is principally the result of the fact that *tourism with a hand lens* is:

- i) Year-round, in contrast to other nature tourism activities such as bird and whale watching which are highly summer-oriented.
- ii) Low environmental impact, given that it requires a small area where the tourist can observe a great diversity of species.
- iii) A way to prolongs the stay of tourists in the area, given that it requires a calm attitude and time to observe this discovery and appreciate the flora of each rock, trunk and other substrates.
- iv) “Unique” to the subantarctic region, given that it is a singularity that the Magallanes Region possesses, due to its subpolar character, and can stand out compared to other latitudes; as a result, the practice of *tourism with a hand lens* and its attention to the “miniature forests” could be transferable also as a concept to other subpolar and polar regions of the planet that also present a flora dominated by mosses, liverworts and lichens.
- v) Of high educational, aesthetic and ethical value because it discovers, enjoys and appreciates the value of unperceived organisms by the average person and that awe with their beauty and life forms upon being discovered.
- vi) A contribution to regional identity because it makes apparent the most diverse and idiosyncratic flora of the Magallanes and Chilean Antarctic Region.

Step 4 – *In situ* conservation: *Garden of the Miniature Forests of Cape Horn*

The discovery of the high diversity of austral bryoflora and the development of tourism with a hand lens stimulated an interdisciplinary group of scientists, architects and artists to design and implant a “*Miniature Forests of Cape Horn Garden*” in the OEP.

With a network of trails that extends approximately 2 km with 20 interpretative stations implemented with sculptures, hand lenses and signage, this garden protects bryophyte species *in situ* and maintains ecological interactions that can be observed by visitors in their native habitats. Across the globe, the *Miniature Forests of Cape Horn Garden* is the first botanical garden of its kind, dedicated to bryoflora with criteria of conservation, education, ecotourism and field environmental philosophy (Rozzi *et al.* 2005).

From the perspective of tourism and other visitors, the Garden does not only permit us to observe difference worlds, but also the activity of *tourism with a hand lens* carries with it a way of living and acting that diverges from the globalized habit of “that which is easy and fast”. This type of tourism activity requires a change of pace, to be willing to concentrate and take time to allow the foliar textures to emerge before one’s eyes, as well as the plants’ pigments and colors and the movements of small invertebrates in this micro-forest. The discovery of the miniature forests carries with it the necessary disposition of calm and attention to perceive expressions of life that remain ignored if we pass walking rapidly, “wanting to see it all and seeing nothing”. This way of living re-invigorates the visitor, who also discovers through the *miniature forests of Cape Horn* that small is beautiful. These events provoke and awe the tourist who comes from a world dominated by rapidity and quantity, where “more is better” and it is customary to praise the grand. In the act of inquiry with respect to the micro-biodiversity, calmness to observe with a hand lens that which is small carries with it also an attention to observe ourselves, with our respiration, emotions and wonder. In this way, an ethical and recreational ecotourism experience is achieved via information education in the chains of biological and cultural diversity (Rozzi 2005).

From the point of view of the social impact of conservation and the incorporation of a new environmental ethic at the regional, national and international levels, the practice of cultivating perceptions of the unlimited diversity of life’s expressions is urgently needed to liberate ourselves from the mechanism characteristic of the accelerated everyday life in the city. Only stopping to observe is it possible to discover the diverse forms of life that have been denied under a uni-dimensionality of a globalized society. The discovery and observation of these “invisible” beings feeds our consciousness about how little we know about our surroundings. The observations of the

constant variations and interactions, and the aesthetic experiences and the wonder that arises having stopped to look through the lens (or the zoom of a camera) invite us to revise our limitations of the prevailing modes of knowing with a marked bias towards learning based on a single alphabet and numerical system (Rozzi *et al.* 2005, 2006a). The consciousness of our ignorance with respect to the diversity of beings that co-inhabit with us should invite us to act more cautiously, and in this context, tourism with a hand lens represents a practice that contributes to the respectful co-existence and co-living with biocultural diversity in which we are immersed.

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