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A Biocultural Triad to Promote Sustainable Cultures

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1 Introduction

We prefer to refer to *sustainable cultures* rather than to a singular culture of sustainability, in order to make explicit the plurality of languages, ecological worldviews and practices that unfold in contrasting ecoregions. The shift helps to acknowledge the existence of diverse sustainable communities around the world, and highlights the need to integrate both biological and cultural diversity into the concept of a global, still heterogeneous mosaic of forms of ecological knowledge, ethics and cultures of sustainability. In this chapter we emphasize that sustainable cultures co-evolve while inhabiting specific habitats, developing idiosyncratic behaviours or ways of inhabiting. The biocultural units formed by unique *habitats* where *inhabitants* develop recurrent ways of inhabiting or *habits* that shape their identities constitute triads of systemic interrelations that are core to a sustainability *ethos*. We argue that better understanding about these biocultural interrelations, and the specificity of each triad of habitats, habits, and inhabitants, can help implement educational, administrative, and economic systems that better support the well-being of the human and non-human participants in these biocultural units, which provide a foundation for achieving global sustainability.

Focusing on biocultural diversity also contributes towards the assessment of a major driver of global environmental change: biocultural homogenization. This process often undermines regional sustainability because it entails simultaneous losses of native biological and cultural diversity, and their replacement by cosmopolitan species, languages, and cultures. This substitution entails both the extinction of native languages, cultures, and biological species, and the loss of interrelation between cultures and their habitats, which are essential for the sustainability and well-being of regional communities of human and other-than-human co-inhabitants. In spite of its widespread character and its detrimental effects on regional human communities, their traditional habits, and habitats, biocultural homogenization remains largely unaddressed by conservation and sustainability sciences (cf. Rozzi/Feinsinger 2006). While losses of biodiversity are widely recognized, less is known about the threat to

the world's linguistic and cultural diversity, and even less understood are the interrelations between biological and cultural diversity (cf. Ericksen/Woodley 2005; Krauss 1991; Maffi 2005; Rozzi et al. 2008).

The idea of the interconnectedness of human habits and the habitats they inhabit has been widespread in the worldviews of many indigenous and traditional societies, and is also substantiated by comparative philosophical critiques, anthropological studies, and the ecological and evolutionary sciences (cf. Brown et al. 2005; Callicott 1997; Harmon 1996, 2002; Hunn 2007; Posey 1999; Prance/Kallunki 1984; Rozzi 2001; Wilcox/Duin 1995). But this notion is only incipiently incorporated in most circles of academic and decision-makers (cf. Maffi 2001). However, recently the United Nations Environmental Programme (UNEP) has highlighted that biodiversity also incorporates human cultural diversity, which can be affected by the same drivers as biodiversity, and which has impacts on the diversity of genes, other species, and ecosystems (cf. UNEP 2007, p. 160). We hope that our focus on the habitat-habit-inhabitant interrelations contributes to better integrating biological, linguistic, and cultural diversity into concepts, policies, and practices that enhance our capacity to

(1) conserve biocultural diversity;
(2) identify responsible agents and victims of losses of biocultural diversity that disrupt environmental, economic, and socio-ecological sustainability;
(3) frame questions about the socio-ecological contexts of sustainability (i.e., sustainability for whom? where? how?).

To introduce our biocultural approach, we begin by offering a concise characterization of the concept of biocultural diversity.

2 Biocultural Diversity: Interrelations of Human Languages, Cultures, and Regional Ecosystems

Human language, culture, and the environment have been interrelated throughout the evolutionary history of *homo sapiens*. During the last two decades, numerous studies have demonstrated correlations between biological and linguistic diversity, derived from processes of co-evolution of human groups with their local ecosystems (cf. Loh/Harmon 2005; Maffi 2005). Over time humans interact with their environment, modifying it and developing specialized knowledge about it (cf. Toledo 2000). In order to convey ecological knowledge and practices, humans have also developed specialized ways of talking about the environment. In some cases, these ecolinguistic relationships have developed through the course of thousands of years. The continued use of these local, co-evolved languages promotes, in turn, the continuity of local ecological knowledges and practices. Relationships between local languages and their

socio-ecological environments are particularly apparent in indigenous communities that maintain close material and spiritual ties with their regional ecosystems and biodiversity (cf. Maffi 2005). We highlight that biological and cultural diversity are unavoidably interwoven in all cultures for at least two reasons (cf. Rozzi 2001):

(1) *Homo sapiens*, like other biological species, is a component of ecosystems and biodiversity, and participates in the structure and processes of ecosystems.
(2) Human perceptions and understanding of biodiversity are influenced by language, culture, and technology.

2.1 Humans as Components of Ecosystems and Biodiversity: Cultural Landscapes

According to ecological and evolutionary sciences, *homo sapiens* is an animal species which, like other biological species, participates in the structure, processes, and composition of ecosystems (cf. McDonnell/Pickett 1994). Our species forms part of biodiversity and, with its diverse ethnicities and cultures, humans generate networks of biocultural relations that diversify, and are diversified by, the heterogeneity of ecosystems and landscapes where they unfold. Indeed, novel biocultural approaches in anthropological and ecological research have helped to understand that many landscapes previously depicted as a pure, pristine expression of nature are in fact *cultural landscapes*, either created by humans or modified by human activities.

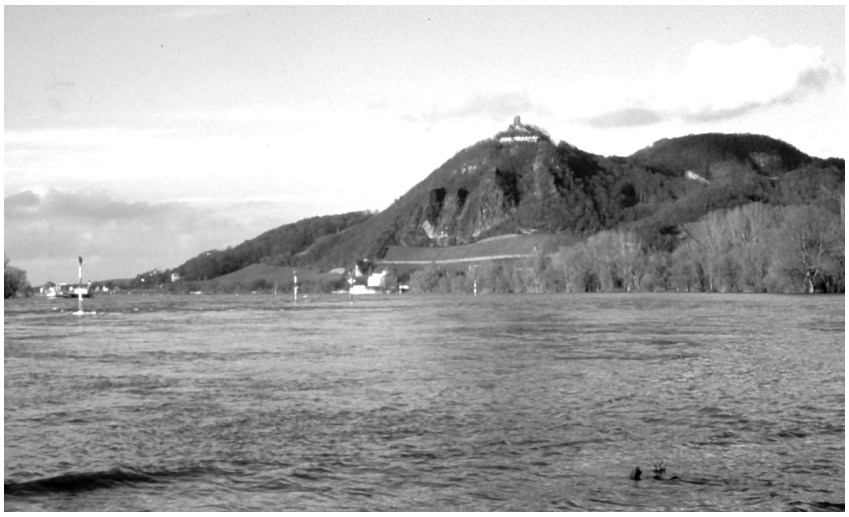
Some remarkable, recently "discovered" cultural landscapes are found in Amazonia. Since the 1970s scientists have begun to distinguish vegetation patterns in vast tropical forest areas that were the result of extensive plantations of fruit and nut trees, such as the *apêtê* "forest islands" (see Figure 1a). Through indigenous use of fire, forest management, planting and transplanting practices within and between many ecological zones of Amazonia, indigenous people have created a mosaic of forest islands and corridors that also attract useful animals. These discoveries within the world's most extensive forested region have forced scientists to re-evaluate what have erroneously been considered "natural" Amazonian landscapes, and to reinterpret them as "cultural forests", including large agricultural areas, open parklands, hills built with clay, managed wetlands and forests (cf. Heckenberger et al. 2003; Mann 2005).

Cultural landscapes range over a wide variety of ecoregions and historical times. In South America, a great diversity of cultural landscapes is found from the lowlands of Amazonas to the highlands of the Andes, where Inca trails still represent major trade routes that have been used over the past 10,000 years, and today feature visible traces of prehistoric hunter-gatherer communities, the Inca Empire (15^{th} to 16^{th} centuries), the fights with the Spaniard conquerors (17^{th} and 18^{th} centuries), and current use by Aymara, Quechua, and mestizo peasant communities (cf. Moore 2005).

Figure 1: Two Examples of Cultural Landscapes

(a) In South America, Kayapo Indians create *apêtê* "forest islands" in Amazonian savanna landscapes. Such "ecological engineering" requires detailed knowledge of soil fertility, microclimate, and plant varieties. *Apêtê* are managed as both agroforestry units and game reserves, and successful *apêtê* management depends not just on the cultivators' knowledge of their immediate properties but also about long-term successional processes linked to plants specifically planted to attract useful animals, grow and fruit in the forest islands. Today, Kayapo's knowledge of *apêtê* formation and succession offers valuable insights for designing processes of forestation in savanna and reforestation in denuded areas.

Source: Jose Fragoso, in: Rozzi 2001



(b) In Europe, the Drachenfels hills on the banks of the river Rhine, south of Bonn, represent the first protected area created in Germany. The remains of the quarry that endangered the hill and the castle in the early 19th century can still be seen.

Source: Kurt Jax (early 2001), in: Jax/Rozzi 2004

Cultural landscapes have attracted increasing attention, and the World Heritage Committee of UNESCO has adopted and adapted the concept of cultural landscape as part of an international effort to overcome "one of the most pervasive dualisms in Western thought – that of nature and culture" (UNESCO 2005, p. 84). It is interesting to note, however, that nature and culture have been integrated since the origins of conservation movements in Europe. For instance, the first protected area in Germany, established during the 1830s, was the Drachenfels, a hill with an old castle ruin towering above the banks of the Rhine south of Bonn (Figure 1a). The reason to protect it as a natural monument ("Naturdenkmal") was the danger of a complete destruction of the castle and the mountain side pointing towards the Rhine by a quarry, which had already caused part of the old ruin to collapse. Later the area was greatly extended to include the surrounding hills in the nature protection area ("Naturschutzgebiet") in Siebengebirge. Both the hills of the Siebengebirge and the Drachenfels ruin, however, had a high symbolic value in the context of romanticism and the search for national identity in Germany, which at that time was divided into many small, more or less independent states (cf. Jax/Rozzi 2004). The Drachenfels Naturdenkmal shows how in Germany the conservation movement began not as a movement to protect "wild" landscapes, but as "Heimatschutz" (cf. Dominick 1992; Knaut 1993), which meant the protection of the home country or home landscape (the "Heimat"). This was essentially the protection of cultural landscapes moulded by centuries of extensive use practices (cf. Jax/Rozzi 2004).

The examples of cultural landscapes from South America and Europe illustrate that the biocultural concept of humans as components of ecosystems (modifying and being modified by the habitats they inhabit) can be applied to a wide range of ecosystems subject to different degrees of anthropic influence, from remote areas to the fastest growing metroplexes in the world. This is particularly relevant, given the fact that as of 2007, the world's biocultural diversity encountered a global shift with over 50% of the world's population residing in predominantly urban environments. In response to this shift, the 2008 Erfurt Declaration made a call to apply the Convention on Biological Diversity specifically to urban environments, considering urbanization one of the major drivers for biological and cultural diversity loss (cf. Müller/Werner 2010). Although cities cover only 2% of the world's surface area, they consume 75% of the world's resources. Therefore, it is critical to further incorporate a biocultural approach to examine socio-ecological relations in this major cultural landscape at the beginning of the 21st century, investigating and promoting the cultivation of sustainable biocultural relationships of citizens with both their urban habitats and the neighbouring mosaic of ecosystems.

2.2 Humans' Biocultural Lenses

Humans participate not only in the biophysical, but also in the symbolic, cultural, and linguistic structures and processes of biocultural landscapes. Human perceptions and understanding of biological diversity are embedded in language, culture, and technology. The compound term *biocultural* makes explicit the role that the "cultural lenses" of any human "observer" (including scientists with their research methods, and conceptual taxonomies) have in shaping the construction and interpretation of biodiversity concepts. In turn, the ways humans perceive and understand biodiversity and their environment influence the ways humans inhabit ecosystems, and modify the structure, processes, and composition of living beings, from molecular to global scales. To illustrate this point, it is helpful to look at two contrasting languages, Waorani and English, regarding the way they refer to forest ecosystems.

The indigenous Amazonian Waorani word *ömö* defines forests as worlds inhabited by countless sentient beings, who share with humans the same home, dispositions, values, and culture. This human-forest kinship implicated in the word *ömö* stimulates the performance of rituals, and today it encourages Waorani people to oppose oil extraction in the Amazonian forests (cf. Sawyer 2004). In contrast, the English coinage *woodland* implies that forest ecosystems are a "land of the resource wood". Wood, in turn, refers to an interpretation of trees as a resource, for either fuel or building materials. These contrasting definitions of forest ecosystems illustrate how concepts embedded in language influence both ecological practices, the ways in which humans transform other species and the environment, and ecological knowledge, the ways in which humans perceive other species and their environment (cf. Rozzi 2001). By fostering an understanding of the multiple representations and classifications of biological diversity in various languages, this biocultural method can help to deconstruct the economic-mathematical approach that predominates in European and North American globalized culture, thereby bringing attention to alternative modes of ecological knowledge and practice.

3 Amerindian and Scientific Perspectives of the Inextricable Links of *Habitats, Habits, and Inhabitants*

Both traditional ecological knowledge and contemporary ecological scientific knowledge allows us to understand the vital links between the regional habitats, the inhabitants, and their habits. These habits are essential for the identity and the well-being of both the human and the other-than-human co-inhabitants, thereby generating the sustainability of Amerindian communities. We will succinctly examine the vital links between habitats, habits, and the identity of inhabitants by examining how these bonds

are deeply rooted in the life of the largest indigenous group of southern South America, the *Mapuche* people. The Mapuche define themselves as the people (= *che*) of the land (= *mapu*). Their close links to the land are compellingly expressed in their language (= *dungu*), *Mapu-dungun,* that onomatopoeically dialogues with the land (= *mapu*), and the names of the three main Mapuche groups which refer to the habitats they inhabit:

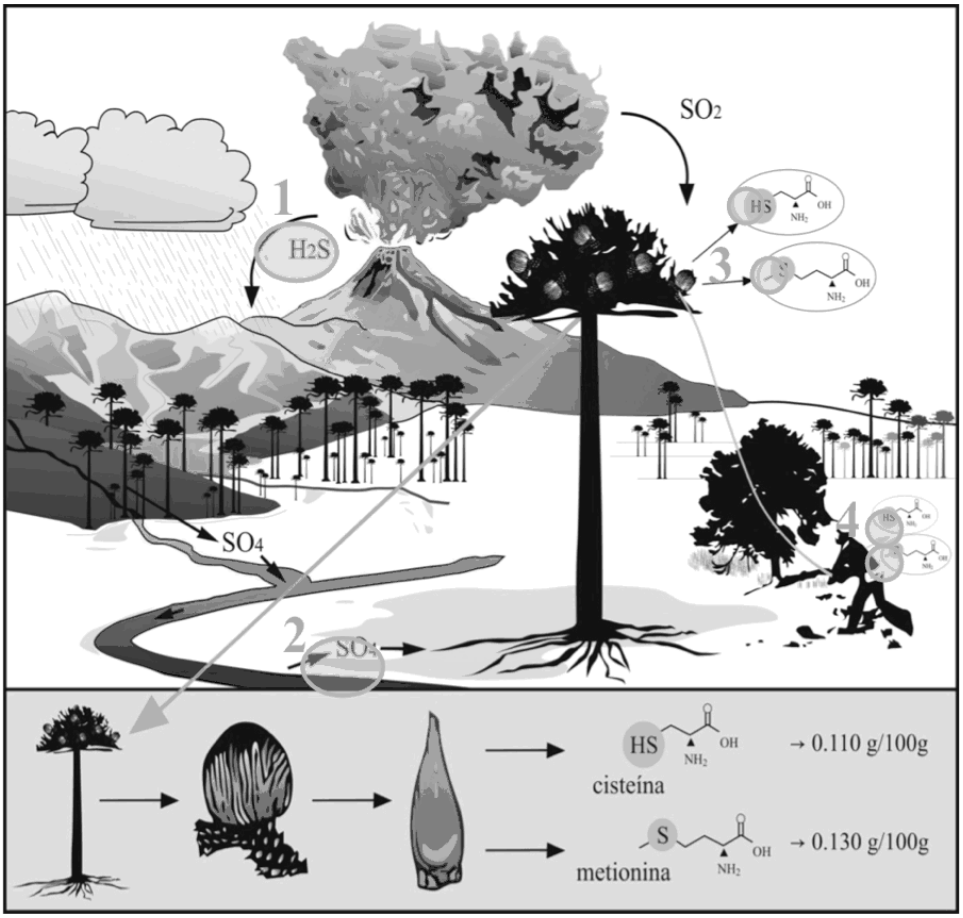
- the *Lafkenche*, people of the *Lafken* or coastal ecosystems (36-40^{o}S),
- the *Williche*, people of the *Willi* or south, inhabiting the evergreen rain forests from the Tolten River (38^{o}S) south to Chiloe Island (42^{o}S), and
- the *Pewenche,* people of the *Pewen* or Monkey-Puzzle tree *(Araucaria araucana)* forests of the volcanic Andean mountain range in southern Chile and Argentina (37-40^{o}S).

The habitat of the *Pewenche* people is the *pewenlemu,* a type of forest *(lemu)* dominated by the *pewen* trees (cf. Rozzi et al. 2010). The social organization and unique ancestral distribution of the *Pewenche* clans is associated with the particular distribution of the *pewenes* (cf. Aagesen 1998). An essential habit of the *Pewenche* is the *pica*, or the gathering of the monkey-puzzle tree cones, whose seeds provide the nutritive foundation of their diet. As illustrated in Figure 2, nowadays the *Pewenche* collect these large cones using ropes, which they throw like lassos in order to bring the cones down from the top of the trees. The seeds contained in these cones posses 0.110 g/100 g and 0.130 g/100 g of cysteine and methionine, respectively (see Figure 2). These are the only two amino acids that contain sulphur in their molecular structure. Additionally, among the fruits and seeds available in the Pewenche territory, the pewen's seeds have the highest levels of methionine (cf. Rozzi/Massardo 2006). This is an *essential amino acid*; i.e., the human body is unable to synthesize methionine, and a lack of it can cause a protein deficiency. Therefore, this amino acid must be obtained through an external nutritive source. An analysis from the medical science perspective provides a functional explanation of this habit, since the tree is fundamental to the diet and health of the *Pewenche*, given that its seeds provide the primary source of methionine available in the volcanic ecosystems in mountain altitudes. This analysis by medical science also allows for a better scientific understanding of the profound meaning of what it is to "be" the people of the *pewen*. By eating its seeds, the *Pewenche* incorporate cysteine and methionine, which become proteins in their bodies. Thus, the *Pewenche* biophysical bodies as well as their cultural identities and welfare arise from this trophic socio-ecological relationships, which can be understood from both the Pewenchen worldview, and through scientific analysis.

The name *Pewenche*, and its people's ancestral worldview, also find a point of convergence with a scientific ecosystemic perspective. An analysis of nutrient flows in high-Andean ecosystems where the *Pewenche* live shows that the entrance of sulphur into the bio-geochemical cycle comes from the volcanoes and their ash, which is

transported by wind and water. As illustrated in Figure 2, rivers bring volcanic sulphur to the soil, where molecules of hydrogen sulfide (H_2S) and sulphur dioxide (SO_2) emitted by volcanoes are transformed by bacteria and fungi (through processes of oxidation and reduction) into molecules of sulfate (SO_4), which in turn can be absorbed by the roots of the *pewen*. Once inside the tree, a chain of metabolic reactions begins in the vegetable cells, where enzymes assimilate sulphur from the inorganic molecules of sulfate, incorporating them in a process of synthesis of organic molecules that generate the two amino acids that contain sulphur: methionine and cysteine (cf. Rozzi/ Massardo 2006). Therefore, when the *Pewenche* eat the fruit of the *pewen*, they are also eating sulphur from the volcanic rocks and ashes. Hence, the *Pewenche* are "people of the *pewen*"; and at the same time *Mapuche*, "people of the land". Physical, biotic, and symbolic bodies are interlaced in this profound integration of habitats, habits, and co-inhabitants, and embedded in the *Pewenche* ecosystemic-cultural unity.

Figure 2: A Scientific Biogeochemical Perspective Concurs with the Integration of *Habitats, Habits, and Inhabitants* Expressed in the *Pewenche* and *Mapuche* Worldviews

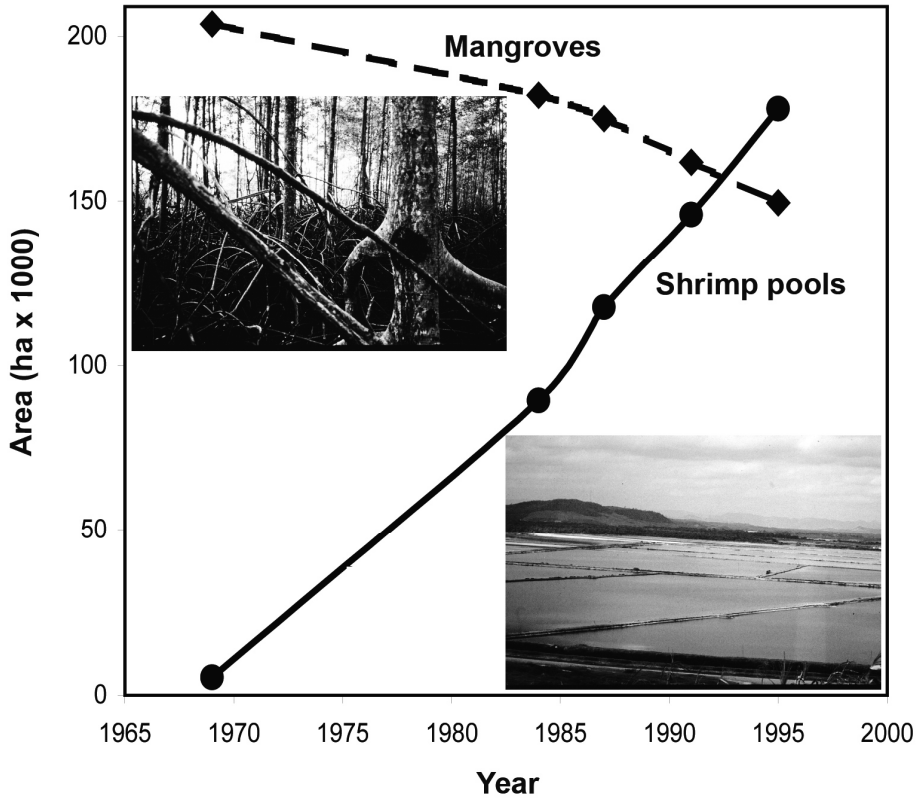


Source: modified from Rozzi/Massardo 2006

4 Loss of the Sustainability of Regional Communities by Disrupting Their Habitats and Habits

A variety of global development projects overlook social and ecological problems derived from the disruption of local habitats and habits that communities have developed within them. A notorious example from Ecuador serves to illustrate this point: the Ecuadorian shrimps, famous in today's international cuisine. Commercial cultivation of two species of shrimps *(Penaeus stylirostris* and *P. vannamei)* began in Ecuador in 1968. Fifteen years later, in 1983, this South American country became the world's principal producer of shrimps (cf. Suarez/Ortiz 2006). This boom involved such a large environmental impact that today the extension of shrimp pools surpasses that of mangroves along the Ecuadorian coast (see Figure 3).

Figure 3: Shrimp Pools



Source: from Suárez/Ortiz 2006, pp. 195-197

In tropical regions of the world, mangroves act as "ecosystem membranes" between terrestrial and marine ecosystems, recycling nutrients and regulating hydrological flows. Their massive conversion to shrimp pools dramatically increases the levels of

sedimentation in coastal waters, and the loss of nutrients that are limiting in tropical soils. Shrimp industries also discharge contaminated waters and divert the course of streams and rivers. These processes drastically affect population levels of species of algae, fish, crustaceans, and molluscs that depend on mangroves at some phase of their life cycles (cf. Mera 1999), and the health of humans who consume shrimps and other coastal organisms (cf. Hagler 1997).

In addition, the shrimp industry causes serious social problems by limiting the access of local communities to coastal natural resources and increasing income differences between a few rich people and a growing number of poor people. Coastal areas are public lands and mangroves are protected by several Ecuadorian laws, as well as by international treaties. However, these regulations and the rights of local communities are ignored or easily violated to favour shrimp industries, which limit or forbid access to the traditional users of mangroves by means of government concessions. Furthermore, the conversion of mangroves and the pollution of estuarine ecosystems diminish the quality of life for fisher communities by diminishing the populations and diversity of species of shellfishes, fish, algae, crabs, and oysters that are traditionally gathered in these ecosystems. This illustrates that the export boom of Ecuadorian shrimps has a less known "side effect": it not only has provoked drastic habitat degradation, but it also has brought a reduction in the quality of life of local people inhabiting the coastal region of this country.

Local communities have resisted the invasion of the shrimp industry, and have opposed this type of development since the 1970s. *Concheras*, or women who collect "conchas" or shellfish for selling and for subsistence in the mangroves of the Ecuadorian and Central American coastal communities, have attempted to stop deforestation of Mangroves, risking their lives by lying down in front of bulldozers and excavating equipment that creates the shrimp pools (cf. Hagler 1997). The majority of these women and their communities are African descendents and conscious about how the explosive growth of shrimp exportation entails a contrasting misery for the coastal inhabitants of Ecuador. On March 11, 1999, FUNDECOL (Fundación de Defensa Ecológica) internationally communicated a strong environmental justice demand written by a *conchera*:

> "We have always been ready to cope with everything, and now more than ever, but they want to humiliate us because we are black, because we are poor, but one does not choose the race into which one is born, nor does one choose not to have anything to eat, nor to be ill. But I am proud of my race and of being *conchera* because it is my race which gives me strength to do battle in defence of what my parents were, and my children will inherit; proud of being *conchera* because I have never stolen anything from anyone, I have never taken anybody's bread from his mouth to fill mine, because I have never crawled on my knees asking anybody for money, and I have always lived standing up. Now we are struggling for something which is ours, our ecosystem, but not because we are professional ecologists but because we must remain alive, because if the mangroves disappear, a whole people disappears, we all disappear, we shall no longer be part of the history of Muisne, we shall ourselves exist no longer […] I do not know what will happen to us if the mangroves disappear, we shall eat garbage in the outskirts of the city of Esmeraldas or in

> Guayaquil, we shall become prostitutes, I do not know what will happen to us if the mangroves disappear […] what I know is that I shall die for my mangroves, even if everything falls down my mangroves will remain, and my children will also stay with me" (in Martinez-Alier 2001, pp. 715f.).

As a result of that local opposition, the government established a biological reserve of mangrove ecosystems in Provincia Esmeraldas in 1995 and, in 1999, created a presidential decree that forbids the cutting of mangroves in Ecuador. These changes to the legislation point to some causes of the rapid environmental degradation occurring in the subcontinent with the highest biodiversity of the planet. At the same time, it provides some hope for a better integration between environmental and social policies by showing that numerous regional populations are aware of the intimate connections between quality of life and the preservation of biodiversity. This awareness is based on the concept of "the good life", "buen vivir" in terms of the Bolivian President Evo Morales, which challenges the concept of the "quality of life" promoted by the market economy that is based almost exclusively on economic indicators (cf. Rozzi/Feinsinger 2006).

The case of Ecuadorian shrimps could apply to innumerable analogous cases throughout South America that affect local cultures that are already living sustainably with their local ecosystem, and whose habits and ways of living are disrupted by development practices that do not take this local connection into account. Based on this, and other cases, which include the expansion of monocultures of exotic tree plantations and salmon farming in southern Chile (cf. Claude et al. 2000; Rozzi et al. 2000), the anchovy fishery in Peru, oil companies in Colombian tropical forests (cf. Sawyer 2004), and dams in Brazil (cf. Fearnside 1999), we identify the following six statements that require urgent critical assessments to transform current prevailing policies in South America:

(1) *Economic growth is presented as helping poor people*. However, mega-projects are frequently opposed by local people whose quality of life is negatively affected. Today, for example, there is a strong opposition against the Pantanal Hidrovia project in which the Paraguay-Parana River would be dredged to let large ships carry cargo from Buenos Aires on the Argentinean coast 3,000 km north to Bolivia, Paraguay, and Brazil. This project could cause the drainage of the world's largest wetland, which is the habitat of endangered jaguars, giant otters, thousands of invertebrates, and tens of Indian tribes, the latter of whom join many non-governmental organizations (NGOs) and individuals in their protest (cf. Gottgens et al. 2001).
(2) *Macroeconomic indicators* – such as gross domestic product (GDP) or per capita income – can be misleading because of the concentration of income in minorities. For example, in Peru the wealthiest 20% of the population receive more than 60% of the national income, while the poorest 20% of the population receive less than

3% of it (cf. Rozzi/Feinsinger 2006). With black humour, the Argentinean writer Jorge Luis Borges said that: "I do not believe in economic statistics because that figure indicated that in Argentina every person ate a chicken per week, but he knew that some people ate a chicken per day while most Argentineans ate less than half a chicken per month" (in Primack et al. 2006, p. 667).

(3) Large-scale natural resource exploitation models generally satisfy the needs of consumerist societies in distant places, and not of local people. More than 90% of the shrimp produced and exported by companies based in Ecuador are consumed only by people of three regions: USA (51%), Japan (27%), European Union (17%) (cf. Suárez/Ortiz 2006). Similarly, 98% of the king crab cans produced in Cape Horn in southern Chile are exported to USA, Asia, and Europe (cf. Rozzi et al. 2006). In 1978 the Chilean government promulgated the Austral Law that eliminates taxes for large companies to carryout economic activities in the far south in order to promote "development" in the region. Under this economic model, almost all of the money resulting from king crab industry and other fishery exports is deposited in the bank accounts of only a few people, while local people see their daily food taken away, their marine resources becoming extinct, and their marine ecosystems degraded.

(4) *In South American countries there is a marked difference between what is written in the law and what happens in reality*. Today, South American countries and citizens have very little capacity to enforce legal environmental regulations when confronted with corporate economic power. The violation of regulation is facilitated by the fact that economic groups increasingly control the national press and other communication media. Therefore, an informed public discussion of these interwoven environmental and social problems is obstructed by the bias and censorship of the communication media. For example, in 1995 the director of national accounts of the Central Bank in Chile was fired on the spot when he published a report in the official national newspaper about the environmental and social costs of the conversion of native forests into woodchips or substitution by exotic plantations (cf. Claude 1997).

(5) *Agents of losses of biodiversity*. Environmental degradation and losses of biodiversity are frequently caused by a few land owners or companies – national oligarchies or multinational companies (for example, oil, mining, or logging companies) – and not by "the poor" as it is generally presented. For example, the Magellan region of the southern extremity of South America presents one of the lowest population densities in the world (< 1 person/km^2). Nevertheless, more than 33% of the forests of the region (> 2 millions of hectares) have been cleared or burned for large-scale sheep husbandry by the owners of a few haciendas or ranches (cf. CONAF-CONMA-BIRF 1997).

(6) *Short-term economic projects recurrently generate rapid socio-ecological degradation*. Throughout the post-Columbian history of the Americas we find booms of

ephemeral large-scale exploitation as well as monocultures that replace native biota. For example, tropical forests have been replaced by large-scale plantations of sugar cane, banana, and cotton in South, Central, and North America, respectively; large-scale ranching of cattle and sheep also crossed the American continent from Tierra del Fuego to North America; silver and gold fever existed as much in Patagonia, Potosí, Ouro Prêto, Zacatecas, and Chihuahua as in California (cf. Bakewell 1998). These are not mere cases from the past. Today in South America extensive mono-specific plantations of *Eucalyptus* in Colombia, southern Brazil, and Chile are replacing native forests; vast areas of native tropical and temperate forests are cleared and burned for ranching activities; mercury pollution caused by the amalgamation of gold in tropical regions such as the Amazon is affecting the health of aquatic invertebrates, fish, and humans downstream from gold-mining activities (cf. Guimaraes et al. 1999). Historical analyses of these and similar cases throughout South America show repeatedly that they have been associated with ephemeral economic booms that left behind degraded social and ecological environments.

5 Losses of Biocultural Diversity

Biodiversity loss is a well-known phenomenon. During the 21st century, 20% of the world's existing biological species may cease to exist. Less widely known, though attracting increasing attention, is the diversity loss that is affecting the world's languages and cultures. There are an estimated 6,912 languages spoken in the world today (cf. Ethnologue 2005). However, more than half of these languages are spoken by very small communities of less than 1,000 or 10,000 fluent speakers. On the other hand, the top ten languages (Chinese, English, Spanish, Hindi, Arabic, Russian, Bengali, Portuguese, German, and French) comprise more than half of the world's population. This rapidly growing concentration of the world population in a few languages is taking place at expenses of the diversity of human languages that have co-evolved in specific ecological and cultural environments.

This global "language shift" (cf. Harmon 2002) is promoted by growing assimilation pressures that entail collective abandonment of native languages. Today, many threatened languages belong to small language families, and are spoken by less than 100 people. For instance, the Fuegian language family in southern South America includes four languages, two already extinct (Selknam and Haush), and two nearly extinct spoken by less than ten persons (Yahgan and Kaweshkar) (cf. Rozzi et al. 2010). Worldwide more than 10% of the living languages are "nearly extinct", almost 30% are highly threatened (less than 10,000 speakers), and as many as 90% of the languages may vanish during the course of this century (cf. Krauss 1991; Maffi 2005). At

the beginning of the 21st century we face three challenging facts regarding biocultural diversity and indigenous people:

(1) More than 70% of the 6,912 languages in the world are indigenous; hence, indigenous peoples constitute most of contemporary cultural diversity (cf. WGPI 2001).
(2) Indigenous people represent a minority; considering its 5,000 ethnic groups, they comprise an estimated population of 300 to 350 millions, i.e. less than 6% of the total world population.
(3) Areas of highest biological diversity on the planet (over a wide biogeographical range from the Polar regions to the deserts, from coastal areas to high altitude zones, from savannas to tropical and temperate rainforests) are inhabited by indigenous people. More than two-thirds of the world's languages are found in the set of 238 ecoregions that were identified by the World Wildlife Fund as having the highest priority for current biological conservation efforts (cf. Oviedo et al. 2000).

These three interrelated facts make evident the current fragility of biocultural diversity. Foreseeing this scenario, in 1988, under the lead of Darrell Posey, the International Society of Ethnobiology was created, and during its First International Congress of Ethnobiology in Belém (Brazil) prepared the Declaration of Belém, which called public attention towards the need to better understand and conserve the "inextricable links" between biological and cultural diversity. Four years later, during another landmark international conference held in Brazil, the Earth Summit, these inextricable biocultural links were widely recognized by the Convention of Biological Diversity (CBD).

The terms traditional ecological knowledge (TEK) and indigenous knowledge (IK) were first used in 1979 and 1980 (cf. Maffi 2001). However, it was only under the influence of the Earth Summit that these terms began to be widely used. Rio 1992 generated global awareness about the complementary nature of biodiversity and the indigenous knowledge of it. The CBD, the Agenda 21 and the Global Biodiversity Strategy included as a principle that "cultural diversity is closely linked to biodiversity. Humanity's collective knowledge of biodiversity and its use and management rests in cultural diversity; conversely conserving biodiversity often helps strengthen cultural integrity and values" (WRI et al. 1992). In turn, the U.S. National Research Council stated in 1992 that development agencies should place greater emphasis on, and assume a stronger role in, systematizing the local knowledge held by indigenous knowledge, gray literature, and anecdotal information. It also emphasized that "a vast heritage about species, ecosystems, and their use exists, but it does not appear in the world literature". Consequently, the declaration mandated that: "If indigenous knowledge has not been documented and compiled, doing so should be a research priority of the highest order. Indigenous knowledge is being lost at an unprecedented rate, and its

preservation, preferably in data base form, must take place as quickly as possible" (NRC 1992). In terms of sustainability, the effort to maintain not only the knowledge of these cultures, but also the lifestyle practices or habits inherently tied to this knowledge, must be considered a priority. In order to achieve this, an evaluation of the influence of global development culture and policies upon these diverse cultures and their habitats must be considered.

6 Formal Education: A Major Driver of Biocultural Homogenization

In spite of the former efforts, patterns of cultural assimilation and homogenization continue dominate the global scenario. One of the main drivers of linguistic and cultural diversity losses is formal education. Worldwide fewer than 500 languages are used and taught in formal education, leaving out more than 90% of world's languages. In addition, more than half of the 193 world's states are officially monolingual. These educational policies are due not only to the dominance of colonial languages such as English and Spanish, but also to internal political conflicts, for example, in Africa many states see minority languages as a threat to national unity. Home to 2,092 languages, Africa harbours more than 30% of the world's linguistic diversity. According to Herman Batibo, unless "unmarked bilingualism" (in which two or more languages of unequal social prestige are treated equally) is achieved in Africa's formal education systems, minority language speakers will continue to face the dilemma of either (cf. Batibo 2005):

a) abandoning their native languages (and the eco-cultural knowledge that go with them) in order to gain access to wider society or
b) conserving their languages but remaining marginalized from national affairs.

The temporal rate and biogeographical scale of current global cultural homogenization is unprecedented. The spread of the dominant culture is proceeding by way of linguistic assimilation as languages of the stronger groups monopolize education, the media, government, and other avenues of public discourse. Still today, in Africa and South America it is possible to detect how the use of local languages and forms of knowledge is restricted, and is often denigrated by labelling these vernacular languages as primitive, even as superstitious, and unfit for the present-day world (cf. Mignolo 2000; Rodney 1982). Analyses about the ongoing linguistic elimination uncover postcolonial patterns of biocultural homogenization. With the aim of overcoming these patterns of linguistic discrimination, UNESCO and numerous non-governmental organizations signed "The Universal Declaration of Linguistic Rights" in 1996 in Barcelona, which affirms that "all language communities have equal rights". Linguistic

Human Rights should help halting the overriding effects of the global-uniform educational system, and fostering the continuity of local languages and educational practices.

7 The Inextricable Links of *Habitats, Habits, and Inhabitants* for Sustainable Cultures

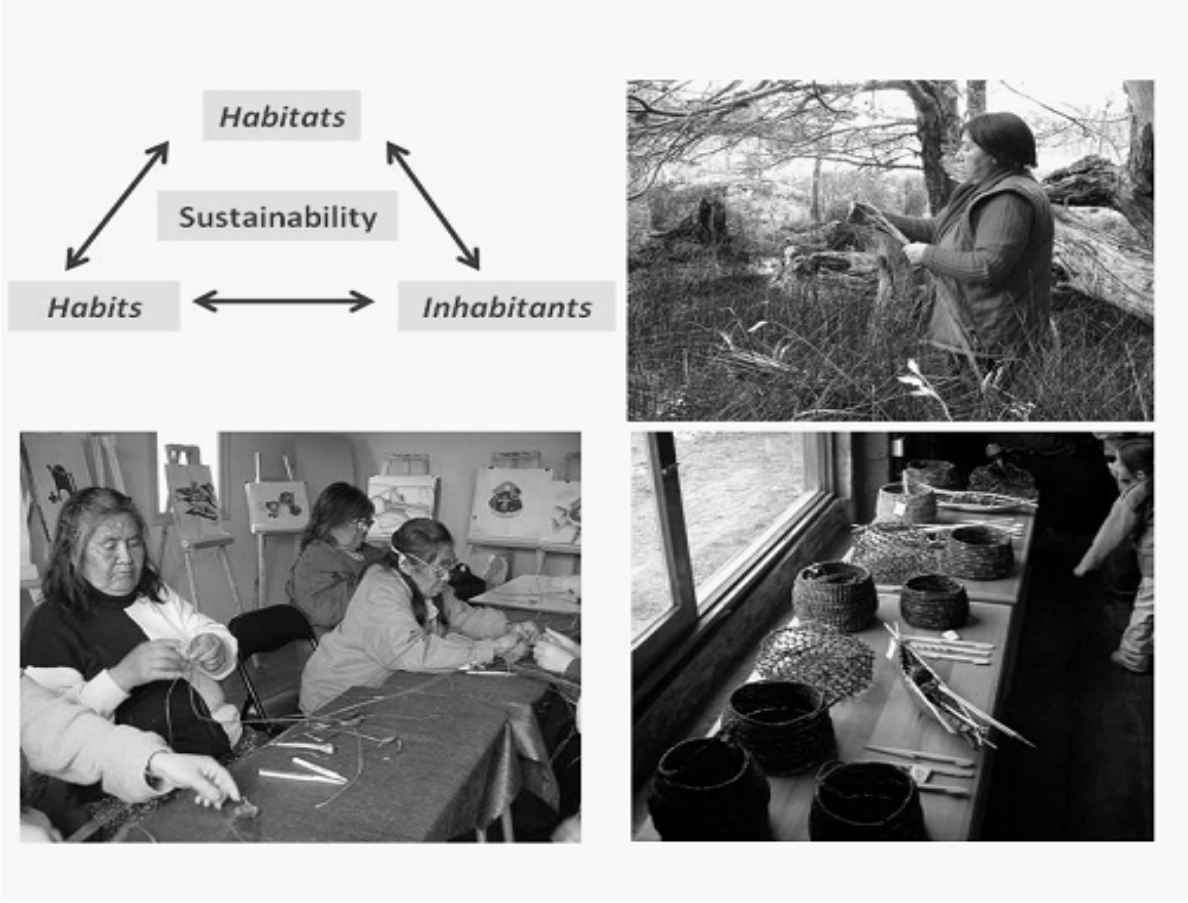
The sustainability of the bioculturally diverse communities around the globe requires recovery of the understanding about the inextricable links between the habitats, the habits, and the inhabitants of a region. With this systemic approach, our proposed biocultural units formed by the triad of habitats-habits-inhabitants acquire essential economic, ecological, and ethical dimensions to better support the sustainability of the highly diverse human and non-human communities of life.

Economically, the biocultural triad highlights the importance of sustainability of territorial rights of indigenous and local communities in South America, and elsewhere. As Walter Pengue emphasizes, autonomy and ownership of the territories are the condition of possibility for the subsistence of rural and other local communities in Latin America (cf. Pengue 2008). The victims of the destruction of habitats and their unique biodiversity in the Neotropics are not only biological species other than humans and future generations. Today, in Latin America numerous indigenous, African-American, fishing, and other rural communities resist, protest against their displacements, and the destruction of their regional habitats (cf. Rozzi 2001). As Colombian philosopher Arturo Escobar criticizes in his landmark book "The Invention of the Third World": It "suffices to take a quick look to the biophysical, economic, and cultural landscapes of the Third World to realize that the Development Project is in crisis" (Escobar 1996, p. 9). Against this background Escobar calls for a post-development era, and for its instantiation, the biocultural approach can contribute to assessing and adapting the interrelations of the biophysical, economic, and cultural components of the landscapes by taking into consideration the high diversity of habitats, habits, and inhabitants who inhabit the regions of the Southern and Northern Hemispheres.

The ecological dimension can be illustrated with reference to a key practice of the southernmost ethnic group of the world: the Yahgan people. At the southern end of the Americas, the women of the Yahgan community weave baskets made of rushes. Different types of baskets are used to gather berries and shellfish in the archipelagos of Cape Horn south of Tierra del Fuego (cf. Gusinde 1961; McEwan et al. 1996). These baskets are central for traditional subsistence activities, whose continuity depends on the conservation of the wetlands habitats where the austral rushes *(Marsippospermu grandiflorum)* grow, and provide the necessary vegetal fibres that are gathered by the Yahgan women (cf. Massardo/Rozzi 2006). Today, the preservation of

these habits and habitats contribute to the well-being of the Yahgan community, to the preservation of their biocultural identity, and also to the richness of the experience of ecotourists who visit Cape Horn. Visitors appreciate the unique sub-Antarctic plants, the Yahagan weaving culture, and their biocultural interrelationships (see Figure 4).

Figure 4: Ecotourism



To implement sustainable ecotourism, we propose that we need to conserve and respect the habitats, habits, and inhabitants. For example, in the South American sub-Antarctic region wetland habitats provide the vegetable fibres needed to carry out the habit of weaving baskets by the inhabitants of Cape Horn, the Yahgan people. Today, the basketry by Yahgan women is linked to a programme of sustainable ecotourism, based on biocultural conservation.

Source: Photographs by Sandra Vallejo, Lorena Penaranda, and Ricardo Rozzi; Omora Ethnobotanical Park Photographic Archive

The ethical dimension of the biocultural triad of habitats-habits-inhabitants is essential because during the last four decades the omnipresence of neo-liberal economy in South America has favoured a marked bias towards economic values, which give little attention to regional biocultural contexts (cf. Pengue 2008). This economic bias has added to the Eurocentric bias carried by dominant, colonial ethics that developed with

little or no consideration for habitats, non-human as well as non-European human co-inhabitants (cf. Rozzi 2001). It is interesting to note that this omission has moved modern ethics away from the original meaning contained in the Greek term *ethos*. The word *ethics* originated from the Greek term *ethos*, which in its more archaic form meant a *den*: the dwelling of an animal (cf. Liddell/Scott 1996). By an extension of the use of this word, its meaning came to include the dwellings of human beings, and later this noun also became the verb *to dwell* (cf. González 1996, pp. 9-12). This dual interpretation of the Greek term *ethos* – as a noun and a verb – was later expressed by two Latin words, which today gain ecological significance: *habitat* and *to inhabit*. In turn, inhabiting a particular habitat generates in the long-term recurrent forms of inhabiting, i.e., habits that configure the *ethos* or identity of the human and non-human inhabitants. In this way, within the history of Western thought, our biocultural approach allows the recovery of an understanding of ethics as a concept that integrates not only the habits, but also the habitats in which these habits co-evolve as ways of co-habitation with diverse human and non-human co-inhabitants in regional ecosystems and the biosphere as a whole (cf. Rozzi et al. 2008).

At the beginning of the 21st century, a biocultural approach to ethics acquires special relevance to counterbalance prevailing anthropocentric ethical approaches, which frequently overlook regional biocultural singularities, "as if" humans and their identities could exist in isolation from their habitats and non-human co-inhabitants. Today, Amerindian and scientific ecological knowledge as well as Western philosophical traditions provide complementary foundations to better understand the interrelated dynamics of the inhabitants, their habits and habitats. This understanding redirects our attention towards the heterogeneous mosaic of biocultural landscapes, spanning over a gradient of human influences from remote to rural and urban socio-ecological systems making evident that a singular culture of sustainability fails to fully address, and consequently threatens, the great diversity and complexity of these biocultural interrelationships. A greater appreciation of this biocultural mosaic within global educational, administrative, and economic systems that prevail today can foster policies that favour the continuity of regional sustainable cultures, with their dynamic, idiosyncratic ways of inhabiting their regional habitats, which could also provide a foundation for a global, heterogeneous meta-culture of sustainability.

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