

Environmental management in South America: An indigenous perspective

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ABSTRACT – The modern world has unleashed an environmental crisis of unprecedented proportions. As the pace of globalisation advances unstoppably, a sustainable relationship with the earth's natural resources is of the utmost importance. The ecological knowledge of partially-integrated indigenous communities may provide new ways of dealing with some of the environmental issues commonly encountered throughout the world, such as biodiversity loss, food depletion, and habitat degradation. In our brief study, we aimed to present the aspects of the sustainable environmental management which is currently practised by two indigenous peoples in South America: the Mapuche Pewenche and the Kichwa. The former successfully maintain their most precious natural resource, the monkey puzzle tree; the latter develop agro-forestry with an effective rotational system and adopt successful measures in the hunting grounds. In both cases, sustainable living and social integrity are inextricably intertwined, and are critically dependent on traditional knowledge.

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1. Introduction

1.1 Research questions

In times of an unprecedented environmental crisis driven by human activities (Wilson, 2001; IPCC, 2013), an appropriate management of the Earth's ecosystems is of the utmost importance. In order to preserve its natural resources and invaluable biodiversity, while improving human well-being, conservation efforts that rely on a multicultural and multidisciplinary approach may provide the most reasonable solution (Wiersum, 1997). Understanding even a fraction of the immense array of human relationships with nature, whose main interactions do not conflict with the fundamental principles of sustainability, would improve the effectiveness of conventional conservation measures (Halme & Bodmer, 2007; Hanazaki, Alves & Begossi, 2009; Wawrzyk, 2013).

Here, we briefly report on some of the long-acquired practices (related to the environment) employed by local indigenous cultures in South America. In this context, we put forward three questions that will serve as a basic framework to develop further ideas:

- (1) How profound is the indigenous ecological knowledge in South America?
- (2) Can we find sustainable management practices in indigenous cultures?
- (3) If so, are these practices developed and implemented out of conservation awareness?

1.2 Traditional culture

Given the above-mentioned questions, our primary objectives are to describe a few ethnoecological scenarios and provide relevant examples of sustainable living as currently practised by native groups in South America. We refer to their lifestyle as of one being deeply rooted in traditional culture. Although widely used in the literature concerning indigenous studies, the term "traditional culture" is broad, and may hence embody various meanings and be subject to personal uses and interpretations.

For the purposes of this project, we apply this term specifically to groups of indigenous people who have managed to largely maintain their ancient ways of living, up to the present day, despite the varying degrees of contact with so-called complex societies¹. It should not, however, be assumed that new knowledge cannot be incorporated into the culture. Our definition also implies that the acquired knowledge is systematically passed on from generation to generation, from individual to individual, without being essentially lost in time. Lastly, only groups whose practices do not include the use of the powerful technology which has shaped the modern world (i.e., a

¹ In anthropology, "complex societies" are referred to modern societies whose social and cultural patterns are greatly stratified. Far from being a term associated with superiority assertions, it simply accounts for the inevitable variety of socio-cultural groups, considerably different from one another (and often unequal), co-existing in a typical modern urban environment.

technology which possesses no self-limiting principle) are considered. To put it differently, their technology may be said to have a “human face”, a term used by E. F. Schumacher (1973) to refer to technological practices which tend to have self-balancing and self-adjusting virtues.

2. Indigenous knowledge

2.1 Essential aspects

As noted by Boillat & Berkes, (2013), traditional ecological knowledge may be understood as a knowledge-practice-belief complex. In other words, it is both empirically based and inextricably associated with a set of beliefs.

To illustrate this concept, consider a given species that is used for its nutritional, social or mythological value – or all these values combined. Wild animals, for example, are a very important element in the diet of indigenous people, being a main source of protein (Sirén, Cardenas & Machoa, 2006). Not only that: they can also have an influence on their social organisation because, in some cases, leadership is decided on the basis of hunting success (Stearman, 1989). In this way, as people show interest towards the usefulness of a particular species, information on its life history, inter and intraspecific interactions, habitat preferences, and population dynamics are naturally gathered (Choo, Egleé & Simpson, 2009).

2.2 Values and importance

It is undisputable that indigenous groups detain an enormous body of knowledge of nature and the physical world (Pitman *et al.*, 2011; Jácome-Negrete, 2013; Sletto & Rodriguez, 2013). Such knowledge, with its specificities, variations, and complexities, has been increasingly acknowledged in the scientific literature over the last decades (Wawrzyk, 2013).

Interestingly, ethnoecological knowledge may coincide with scientific findings and assumptions². Some notable cases can be found in the recent literature, including the following two examples:

1. In Southern Peru, the Quechua people have developed a complex soil classification based on fertility, quality and other aspects. Much of the information on the types of soil and other criteria which they use to determine different soil categories are comparable with Western scientific soil classifications. The resulting classification has been demonstrated to be very useful in implementing crop and field management (Furbee, 1989). In addition, indigenous soil classification provides very detailed information and is one of the best tools

² That is not to say that traditional ecological knowledge cannot provide more in-depth details or even novel aspects when compared with the current scientific knowledge.

for mapping soil diversity, because the costs involved in conventional soil surveys are very high (Niemeijer & Mazzucato, 2003).

2. In Venezuela, the cultivation of palm weevil larvae by the Jotí, a semi-nomadic group in Amazonia, represents an important activity. Entomophagy (i.e., the consumption of insects by humans) is practised by numerous indigenous groups, and can provide, as for the Jotí, an extra source of protein, fat, and vitamins (Gahukar, 2011). Choo *et al.* (2009) showed that the Jotí possess an extensive ecological and behavioural knowledge of two palm weevil species, the ones used as food, and that this knowledge is applied to optimise the harvests. Moreover, they have a deep and valuable understanding of palm and palm weevil interactions on natural forest settings, being able to adapt biological and meteorological requirements to their cultivation needs (Choo *et al.*, 2009). As pointed out by the authors, since scientific research on this field has mainly focused on palm plantations, the indigenous knowledge on natural settings is particularly valuable.

For various reasons, traditional ecological knowledge is largely under-documented. This is still so despite the current efforts of, for example, ethnobotanical studies to preserve its particularities before they disappear amid the rapid pace of globalisation (Cámara-Leret *et al.*, 2014b). It should be mentioned that the ethnoecological interest goes much beyond the struggle for documentation. Combined with western scientific-based models, indigenous ecological knowledge is expected to play a vital role in the management of the most biologically diverse areas of the globe (Wiersum, 1997; Townsend, 2001; Cámara-Leret *et al.*, 2014a).

Such expectation lies in the fact that indigenous traditional practices have shown satisfactory results, in general, when it comes to nature conservation inside their territories. For example, Marinaro *et al.*, (2014) carried out a study in the dry forests of Northern Argentina and concluded that indigenous properties had a higher mammal and tree diversity than that found in protected areas in the same region; they also found that the number of indicator species differed between the compared areas, being higher in indigenous land. In order to develop an efficient conservation strategy, the authors recommended taking into account indigenous practices. In another study, conducted by Nelson & Chomitz (2011), the authors revealed that indigenous areas in Latin America are more effective in reducing fire incidence than strict protected areas (where only conservation-related use is allowed).

3. Indigenous management practices

There is a polemic debate among researchers and conservationists over the relationship between indigenous practices and nature conservation. Many authors emphasise the positive conservation status shown by areas inside indigenous territories and under indigenous management (Davis &

Wali, 1994; Townsend, 2001; Nelson & Chomitz, 2011). They argue that the existence of an indigenous conservation ethics and of taboos related to religion contribute to successful management (McDonald, 1977; Johannes, 2002; Fernández-Palacios *et al.*, 2008). This is especially so in those cultures that, historically, had to deal with resource depletion, because the needed resources became limited relative to demand, and their actual management is the result of that learning (Johannes, 2002). Others authors argue that the positive effects on the environment observed within indigenous areas are a mere result of low population densities and a lack of access to modern technology (Rudel, Bates & Machinguiashi, 2002; Sirén, 2004, 2006).

While there are examples showing that the depletion of natural resources is linked to indigenous misuse, there is also evidence of indigenous people as good managers of ecosystems. In the latter case, they are good managers because they employ effective conservation measures, not only because their population is not large enough (as in many cases) to cause considerable damage to nature.

To complement this section, we present two case studies (with very different surrounding environments) from two countries in South America. The first case is on the Mapuche Pewenche, in Chile, and their interaction with a coniferous tree; the second one regards the agricultural system and hunting practices of the Kichwa people from the Ecuadorian Amazon.

3.1 *The Mapuche Pewenche*

In the Chilean Patagonia, a community called Mapuche Pewenche (Fig. 1) perpetuates a profound connection with a majestic coniferous tree, the monkey puzzle (*Araucaria araucana*). Endemic to a small latitudinal range of the Andes, monkey puzzle stands have suffered from intense deforestation and degradation – especially during the last century (IUCN, 2014). Nowadays, this species, which is classified as endangered in the IUCN Red List, is also among Chile's most endangered tree species. For the Mapuche Pewenche (the "People of the Monkey Puzzle Tree"), whose presence and lifestyle have little to do with acts of deforestation, the preservation of its vulnerable populations means preserving their own tribal identity.

Monkey puzzle seeds constitute an essential element in the diet of the Mapuche Pewenche. They are used in various ways: they may be eaten raw, toasted, or boiled, dried for flour production or fermented to produce a ceremonial beverage, the *muday*. Additionally, they play an important role in their small-scale livestock development, as they are used as food for goats, cattle and wool animals, and are traded with merchants (Herrmann & Torri, 2009).

As described by Herrmann (2005), this indigenous community detains a vast ecological knowledge of the tree on which they are dependent – this is indeed a critical dependence because the harshness of the environment leaves no room for agricultural practices. By monitoring monkey puzzle tree populations, the Mapuche Pewenche know precisely their distribution and abundance,

being able to distinguish productive and high-quality areas from unproductive and low-quality areas. All the knowledge that has been acquired over millennia is applied to obtain satisfactory harvests, while ensuring that future seed production is not negatively affected by management misconduct.

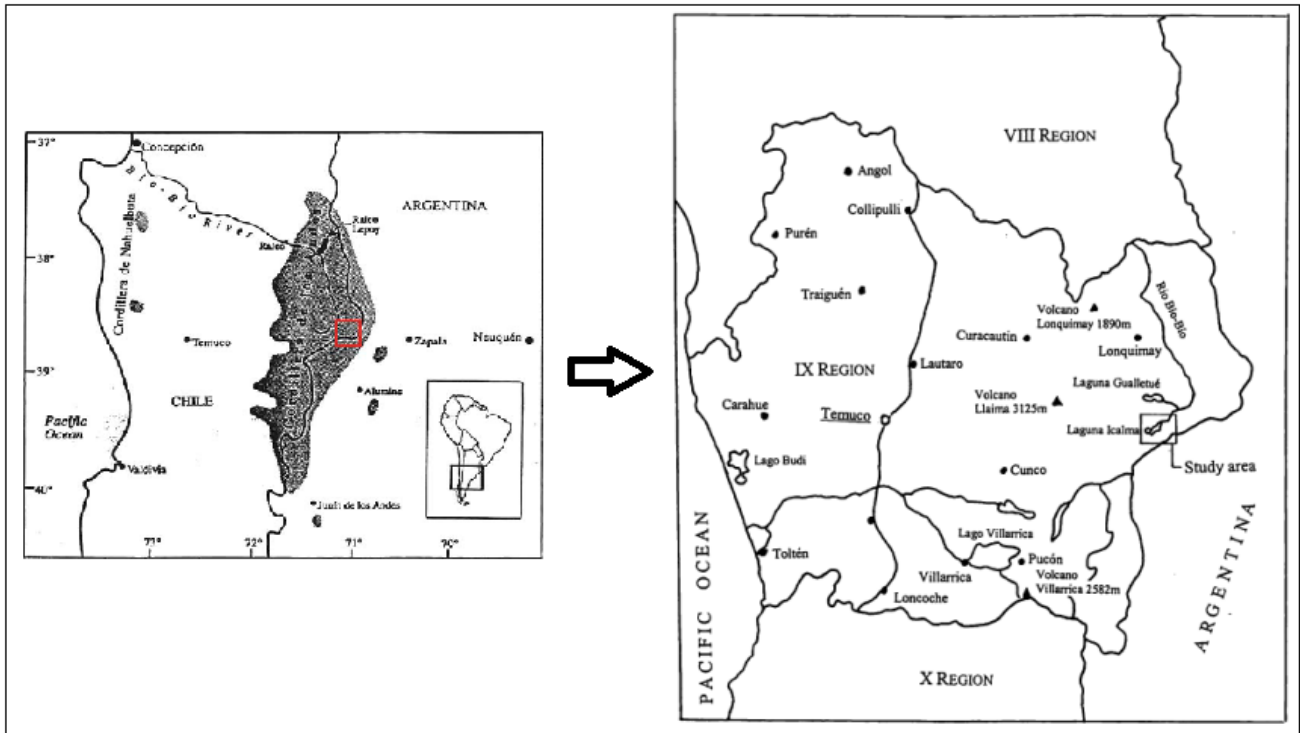


Fig. 1 The maps show the south-central part of Chile with the location of the indigenous community to which this subsection is referred, the Mapuche Pewenche (maps modified from (Herrmann, 2006)).

Although simplistic in nature, the measures employed by the Mapuche Pewenche to preserve the monkey puzzle tree are extremely effective. To begin with, the annual harvest starts mostly after the phase of seed dispersal, which means that not all seeds are available for collection. Also, the harvest takes place in multiple areas, with each of them being managed by an extended family. These separate “family territories” ensure that, consciously or not, harvest pressure is not concentrated on only a few areas. The deliberate avoidance of the least productive areas, which in future occasions may become of interest for harvesting, serves a similar purpose, namely that the forest is allowed to regenerate. Other relevant measures include the avoidance of cones with immature seeds, the collection on the ground of only seeds found within a short distance from the trees (as areas outside the canopy shade offer better light conditions for germination), and facilitating germination by digging certain seeds into the soil (Herrmann & Torri, 2009).

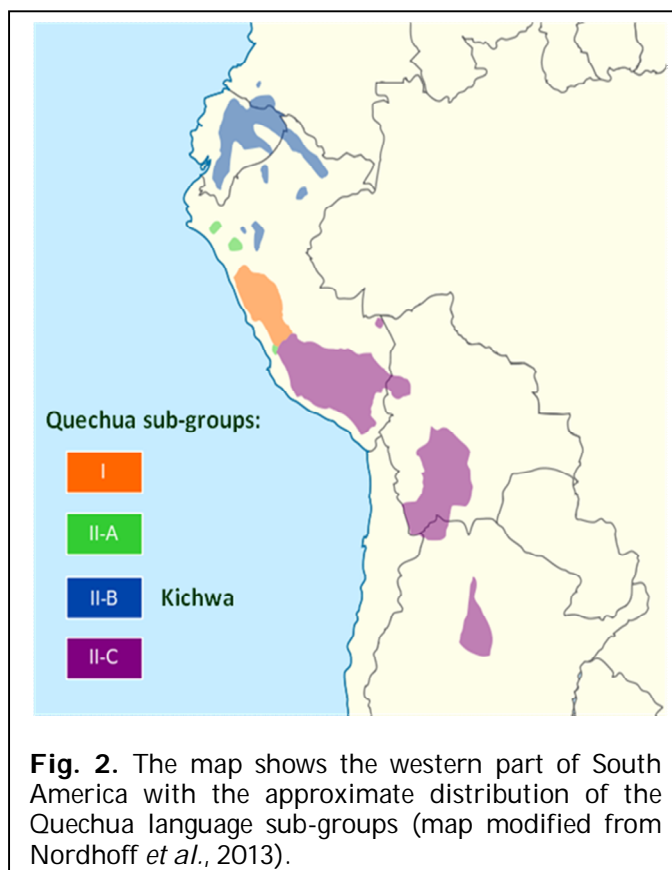
Lastly, it is important to mention the sacred, spiritual side associated with the monkey puzzle tree. For the Mapuche Pewenche, this tree symbolises life itself for it is the single most important external element in their lives. The fact that certain places are respected with devotion, or avoided

due to a particular superstition, further contributes to the preservation of the species given that the seeds remain uncollected (Herrmann, 2005). The same sacred-conservation pattern is also seen elsewhere in indigenous life (Ferronato & Cruzado, 2013). In conclusion, the tribal life of this mountainous community provides a relevant example of how social, cultural, and spiritual values, that is, everything that is regarded as essential, are dependent on a sustainable management of the environment.

3.2 The Kichwa people

The Kichwa people live in Colombia, Peru and (mainly) in Ecuador (Fig. 2). The Kichwa language is a sub-group within the Quechuan family group, which has its distribution within several countries in western South America (Nordhoff *et al.*, 2013). Here, our focus is on the agriculture system and hunting practices of the Kichwa people from the Ecuadorian Amazon.

Traditionally, Kichwa families have their main cultivation fields close to their houses, and most of them have a secondary home, *purina*. The *purina* is located at some distance, several days walking sometimes, from the main settlement, where they go frequently in order to enjoy better hunting and fishing grounds (Sirén, 2004).



Their agriculture system is elaborate and very dynamic. The process starts by clearing the underbrush and felling the trees in the forest; this open space is then used as a field, called *chacra*. After the *chacra*, the field goes through an intermediate stage, called *ushun*, and the process ends in a third stage, *purun*, which contains a higher biodiversity and is the most similar to a natural forest (Vacacela, 2005).

This management implies a temporary rotation of the agro-forestry fields: the *chacra* has chiefly herbs species that grow very fast, and people can use them for different purposes (e.g., as food, medicines, ornaments, and for rites). Typical plants at this stage are different varieties of maize, cassava and plantain (*Zea mays*, *Manihot*

esculenta and *Musa* sp., respectively) (Sirén, 2004). After two years approximately, the field is turned into an *ushun* by including new species in each sowing, such as fast-growing woody plants (Vacacela, 2005).

Therefore, the fields typically show an ecological succession where one stage gradually transforms into the next (Siren, 2004). In this way, after six years approximately since the beginning of the *chacra*, a new stage takes place, the *purun*; at this point, many woody plants are present in the field and the soil recovers part of its fertility (Vacacela, 2005). After this stage, the field becomes a fallow; after a variable time of the fallow period a new cycle can begin with the *chacra* stage (Sirén, 2004; Vacacela, 2005). Some woody plants are favoured, especially when clearing for a field: chonta (*Bactris gasipaes*), cacao (*Theobroma bicolor*) and cedar (*Cedrela odorata*) among others. They are very useful because of their fruits, in the case of chonta and cacao, and timber, in the case of cedar (Sirén, 2004).

In contrast to agriculture, territories for hunting are not delimited. Different hunting territories overlap and they are not regarded as private properties (Sirén, 2006). The Kichwa people follow several rules to reduce the problem of game depletion (Sirén, 2004; Jácome-Negrete *et al.*, 2013). In the case of large mammals, for example, hunters try to avoid pregnant females (Sirén, 2004). Also, on several species with low population densities they apply limited quotas for hunting, for example in the case of some peccaries (*Tayassu pecari* and *Pecari tajacu*), or temporary restriction for hunting, such as in the endangered peccary *Tayassu terrestris* (Jácome-Negrete *et al.*, 2013). In addition, there are several experiences for the establishment of strict protected areas inside indigenous territories, where hunting or fishing are not allowed; they normally use sacred areas, which have high biodiversity, for this goal (Jácome-Negrete *et al.*, 2013).

The success of their agricultural system and hunting practices is linked to a low population density (Sirén, 2004), as in any process in ecology; in any case, sustainability is inherent into the management of ecosystems by indigenous people (Townsend, 2001).

4. Conclusions

We have previously mentioned that some researchers attribute a number of recent cases of resource depletion to environmental misuse by indigenous people when it comes, for example, to the loss of old-growth forest and over-hunting (Sirén, 2004; Sirén *et al.*, 2006). In our opinion, one explanation may lie in the fact that indigenous cultures have been increasingly interacting with capitalist cultures. Traditionally, their management systems were not designed to cope with the factors that characterise modern societies, such as powerful technology, money economies and trade, new needs, and export markets (e.g., meat demand by city dwellers) (Johannes, 2002); also, catastrophic pollution events, like those caused by oil and other large companies in their territories, and the recent invasion of non-indigenous settlers contribute negatively to this scenario. Finally, it

is very important to indicate that most indigenous communities still do not have the right to decide how to manage their own territories. This is because governments, acting under the influence of international companies, are not giving proper attention to the legal recognition and demarcation of indigenous land, as many human rights defenders, researchers and conservation activists have reported (Davis & Wali, 1994; Survival International, 2015). The recognition of indigenous land property is highly desirable (other than morally necessary), so that traditional and successful management can be fulfilled (Davis & Wali, 1994).

Nowadays, an agreement among governments, international institutions, NGOs, other stakeholders and indigenous people is needed to design conservation practices to better balance nature and people who are living inside threatened tropical ecosystems in South America (and elsewhere). To do it, we encourage stakeholders and scientists to take into account the huge traditional ecological knowledge and the indigenous conservation ethics.

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