Linguistic, Cultural, and Biological Diversity

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Abstract

Over the past decade, the field of biocultural diversity has arisen as an area of transdisciplinary research concerned with investigating the links between the world's linguistic, cultural, and biological diversity as manifestations of the diversity of life. The impetus for the emergence of this field came from the observation that all three diversities are under threat by some of the same forces and from the perception that loss of diversity at all levels spells dramatic consequences for humanity and the earth. Accordingly, the field of biocultural diversity has developed with both a theoretical and a practical side, the latter focusing on on-the-ground work and policy, as well as with an ethics and human rights component. This review provides some background on the historical antecedents and beginnings of this field and on its philosophical and ethical underpinnings, and then surveys the key literature on biocultural diversity, concentrating on three main aspects: global and regional studies on the links between linguistic, cultural, and biological diversity; the measurement and assessment of biocultural diversity; and the protection and maintenance of biocultural diversity. The review concludes with some considerations about future prospects for this emerging field.

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INTRODUCTION

If the 1980s might be remembered as the decade of biodiversity—in which the term biodiversity was coined to call attention to the massive, human-made extinction crisis threatening the diversity of life in nature—then the 1990s might be dubbed the decade of *biocultural* diversity—when the concept of an intimate link between biological, cultural, and linguistic diversity was put forth and its implications for life in both nature and culture began to be explored. By the mid-2000s, a small but significant body of literature on biocultural (or, in a less widespread version, biolinguistic) diversity has accumulated, and a related field of both scholarly research and practical applications is emerging.

The main foci of this emerging field are as follows: (*a*) the parallels and correlations between biodiversity and linguistic diversity, the overlaps in the global distribution of languages and biodiversity, and the relationships between language, traditional knowledge, and the environment; (*b*) studies and assessments of the common threats to biodiversity, cultural diversity, and linguistic diversity and of the sociocultural and environmental consequences of loss of these interlinked diversities; (*c*) approaches to the joint maintenance and revitalization of biocultural diversity; and (*d*) development of the related aspects of human rights.

This review first outlines the history of the field's emergence and then appraises various aspects of the relevant body of literature.

HISTORICAL ANTECEDENTS

Parallels and affinities between evolutionary biology and historical linguistics and between languages and species were already drawn by Charles Darwin (in both his *Origin of Species* and *The Descent of Man*; Darwin 1859, 1871) and commented on by linguist August Schleicher in *Darwinism Tested by the Science of Language* (Schleicher 1863), although such remarks soon led to a reaction in linguistics against what was interpreted as a likening of languages to natural organisms. Analogies between languages and species became discredited and were relegated to the shelves of misconceived ideas until recently.

As for the links between language and the environment, interest in this topic has precedents in the history of anthropology. In the North American anthropological tradition, the study of Native American languages naturally led to such interest, as linguistic anthropologists such as Boas, Sapir, and Whorf were struck by the elaborate ways in which indigenous languages encoded and inventoried, among other things, the characteristics of the local landscape and its flora and fauna. In particular, Sapir noted that language bears "the stamp of the physical environment in which the speakers are placed" while reflecting "the interest of the people in such environmental features" (Sapir 1912, pp. 228, 229). From Boas's famous notes on Eskimo words for snow (Boas 1911; see Martin 1986, Pullum 1989 on the later vast misinterpretations and distortions, both scholarly and popular, of this topic) to Whorf's related remarks in his popular 1940 article "Science and Linguistics" (Whorf 1940), these early studies had

a foundational role in anthropology. However, this was not specifically to the effect of giving rise to a distinct tradition of research on the relations between language (and/or culture) and the environment. By and large, these early observations on the language of the environment rather contributed to the development of concepts of linguistic and cultural relativity.

Another pioneer of North American anthropology, Alfred Kroeber, studied the relationships between Native American culture areas and the natural areas (today, we would say ecosystems or ecological niches) of the North American continent, finding significant geographical correlations between the two (Kroeber 1963). Whereas several of Kroeber's students (including Julian Steward) later developed a focus on cultural ecology, Kroeber's specific approach in this classic work did not directly result in an established research tradition on the links of cultures (and/or languages) and biogeography. Rather, the idea of such correlations tended to be unpopular among scholars, as it was also before Kroeber's work, because it evoked romantic nationalist theories of geographic and biological determinism.

This unpopularity is somewhat of a paradox in light of Kroeber's conviction that this area of inquiry offered a special opportunity for "a modern, nonsimplistic environmental study which would almost certainly stimulate analogous research elsewhere" (Kroeber 1928, quoted in Heizer 1963) and that his work in no way represented "a relapse toward the old environmentalism which believed it could find the causes of culture in environment" (Kroeber 1963, p. 1). Kroeber made it clear that "[w]hile it is true that cultures are rooted in nature, and can therefore never be completely understood except with reference to that piece of nature in which they occur,. . .[t]he immediate causes of cultural phenomena are other cultural phenomena. . . .[T]his does not prevent the recognition of relations between nature and culture, nor the importance of these relations to the full understanding of culture" (Kroeber 1963, p. 1)—a statement that might be taken as programmatic for the current lines of research, if with the addition that recognition of these relationships is, conversely, also central to the full understanding of nature.

DEVELOPMENT OF CURRENT LINES OF RESEARCH

Despite such significant antecedents, the development of an integrated field of research on cultural, linguistic, and biological diversity has long been in the making. Recent interest in the links between language and the environment has arisen in part from the work carried out over the past few decades by ethnobiologists and ethnoecologists studying indigenous knowledge and use of local flora, fauna, and ecosystems, as well as by researchers interested in indigenous place naming. In part, this interest also stems from research in linguistics on the notion of "linguistic ecologies," seen as networks of human relationships that encompass not only the linguistic and social environment, but also the physical environment, as interrelated parts of a whole (Mühlhäusler 1996). Investigation of these topics has led to increasing recognition of the value of the ecological knowledge and practices of indigenous and other local peoples, and of the significant extent to which such knowledge and practices are developed, encoded, and transmitted through language.

More specifically, a focus on the relationships between linguistic, cultural, and biological diversity, their global overlapping distributions, and the common threats they are facing emerged in the mid-1990s in the wake of an alarming and thought-provoking observation: that the ongoing worldwide loss of biodiversity is paralleled by and seems interrelated to the "extinction crisis" affecting linguistic and cultural diversity (Krauss 1992; Harmon 1996, 2002; Nabhan 1997; Posey 1999; Maffi 2001c).

In the early 1990s, linguists started calling attention to a worrisome trend that was

Biocultural diversity: diversity of life in all its manifestations—biological, cultural, and linguistic—which are interrelated within a complex socio-ecological adaptive system

becoming increasingly apparent: Many of the world's languages, especially those spoken by small-scale indigenous and minority societies, were seriously under threat of replacement by "larger," majority languages, whether national or transnational (Robins & Uhlenbeck 1991, Hale et al. 1992). This loss of linguistic diversity was estimated to endanger the survival of 50%–90% of the 6000+ currently spoken languages by 2100 (Krauss 1992). In the effort to rally linguists and others around this issue, parallels were drawn with the better-known phenomenon of biodiversity loss and with the endeavors undertaken by biologists to stem this loss (Krauss 1992).

This clarion call did not go unnoticed by nonlinguists, soon reaching a small but active contingent of social scientists and conservationists who had independently been pointing to the links between and the common threats to cultural and biological diversity (Dasmann 1991, Harmon 1992, Nietschmann 1992, Clay 1993, Durning 1993; see also the Declaration of Belém issued in 1988 by the International Society of Ethnobiology, which affirmed the existence of an "inextricable link" between cultural and biological diversity). It was increasingly apparent that the variety of cultural knowledges, beliefs, and practices developed by human societies, as well as the languages that embody them, are being placed at risk by the socioeconomic and political processes threatening the integrity and the very survival of indigenous and local cultures and of the environments in which they live—and that this massive and rapid change has profound implications for the maintenance of life on earth. It became clear that an interdisciplinary effort was needed to bring together these different threads and begin to portray an integrated picture of the state of the diversity of life in all its forms—biological, cultural, and linguistic—the pressures it is undergoing, and the possible actions to ensure its perpetuation (Harmon 1995, 1996; Krauss 1996).

Among the events that catalyzed such an interdisciplinary effort was the international working conference "Endangered Languages, Endangered Knowledge, Endangered Environments," held in Berkeley, California, in 1996. This conference brought together scholars and practitioners in the linguistic, social, behavioral, and natural sciences, along with members of indigenous peoples, to identify avenues for theoretical investigation of and applied work on what was beginning to be labeled as "biocultural diversity." (For the outcome of the conference, see Maffi 2001c.) The conference was organized by Terralingua (**http://www.terralingua.org**), an international nonprofit organization also created in 1996 with the specific purpose to promote knowledge and protection of biocultural diversity through research, education, policy development, and on-the-ground action.

As a result of the confluence of these and other related endeavors, a multifaceted field of inquiry on linguistic, cultural, and biological diversity, with both a theoretical and an applied side, has begun to develop—an interesting case of a new domain of interlinked investigation and practice arising from a perceived urgent need in the real world, similar to the prior development of conservation biology in response to the biodiversity extinction crisis. At this point, a picture of language-environment interrelations is taking shape at various degrees of resolution, from a global to a local scale. The following sections review some of the key aspects of this emerging picture through the recent literature. First, though, it may be useful to touch on some of the philosophical and ethical underpinnings of this new field, as they have been explored in some of this literature.

PHILOSOPHICAL AND ETHICAL UNDERPINNINGS

Harmon has offered the as yet most thorough and thoughtful approach to the philosophical and ethical foundations for the field of biocultural diversity. In his work, he has provided the first comprehensive review of the state of linguistic diversity and the geographical overlaps between linguistic and biological

diversity pointing to the "converging extinction crises" of these diversities (Harmon 1995, 1996; see next section for details). With appropriate caveats, he takes linguistic diversity to be a major indicator for cultural diversity and the loss of "language richness" as a proxy for the loss of "cultural richness." On this basis, he addresses a fundamental question (Harmon 2002): If the world's diversity in nature and culture is indeed rapidly diminishing, why should we care?

His answer stems from an examination of philosophical, biological, psychological, and linguistic literature from the Enlightenment to the present. Through this excursus, he shows the interwoven (and possibly coevolved) diversity in nature and culture to be the "preeminent fact of existence," the basic condition of life on earth. The continued decrease of biocultural diversity, he concludes, would "staunch the historical flow of being itself, the evolutionary processes through which the vitality of *all* life has come down to us through the ages" (Harmon 2002, p. xiii).

Others have similarly stressed the evolutionary significance of diversity not only in nature but also in culture and language as a way of "keeping options alive" for the future of humanity and the earth (Maffi 1998, 2001a). Bernard (1992, p. 82) has suggested that "[l]inguistic diversity... is at least the correlate of (though not the cause of) diversity of adaptational ideas" and that therefore "any reduction of language diversity diminishes the adaptational strength of our species because it lowers the pool of knowledge from which we can draw." Mühlhäusler (1995, p. 160) has argued that convergence toward majority cultural models increases the likelihood that more and more people will encounter the same "cultural blind spots"—undetected instances in which the prevailing cultural model fails to provide adequate solutions to societal problems. Instead, he proposes,"[i]t is by pooling the resources of many understandings that more reliable knowledge can arise"; and "access to these perspectives is best gained through a diversity of languages." (And see Fishman 1982 for an early, masterful treatment of this topic from a Whorfian perspective.) Along similar lines, Krauss (1996) has proposed that global linguistic diversity as such constitutes an intellectual web of life, or "logosphere," that envelops the planet and is as essential to human survival as the biosphere—a concept of course reminiscent of Teilhard de Chardin's "noosphere" and of the classical notion of the Logos.

Further, from both a psychological and an ethical perspective, Harmon (2001, 2002) pinpoints the enduring fallacy of equating unity with uniformity (which underlies all efforts to promote homogenization, whether by nation-states or by the forces of economic globalization). Rather, he argues that the perception of diversity is the basic condition for the functioning of human consciousness (through the distilling of sameness from difference) so that if consciousness is what defines us as humans, then diversity makes us human. From this, he derives a "moral imperative" to preserve diversity and to strive not for uniformity but for unity in diversity.

Wollock (2001) reaches analogous conclusions through a critique of Western linguistic science. He suggests that, if this scholarly tradition has largely been silent about linguistic diversity and has ignored or even denied any connection between language and the real world, it is because it was born of the nominalist philosophical tradition that has taken hold in the history of Western thought. Nominalism treats all universal concepts (including "nature" and "community") as arbitrary social constructs with no connection to the real world. Within this tradition, language itself is seen as an arbitrary system of signs that bears little or no relation to the extralinguistic world (on this point, see also Pawley 2001). Such a conception of language, Wollock argues, is by definition incapable of addressing the relationship between language and the environment or with the ways in which language may orient the mind in

Language richness: the total number of distinct languages found in a given region or country or worldwide, as a measure of linguistic diversity

Logosphere: the symbolic planetary web of the "logos," or spoken word, represented by the global network of human languages

certain directions—including directions that may be either beneficial to or destructive of the environment. According to the author, nominalist philosophy in fact lies behind most of the discourse of "colonizing cultures" about both language and the environment, and behind the increasing tendency for this discourse to treat diversity as an epiphenomenon at best and a nuisance and a threat at worst.

GIS: geographic information systems, a technology for representing and analyzing georeferenced data

On the other hand, Wollock also contends that the response does not lie in the recent postmodernist trend, which, in reaction to the centralizing and homogenizing tendencies of modernism, denies the existence of any overarching system of meaning and only admits of diversity, decrying unity as an illusion. Wollock observes that all great metaphysical traditions recognize endless diversity as the reality of the planet, and indeed the universe, while perceiving a fundamental unity in it—the unity of the Logos, whose likeness can be approximated only through the maximum diversity. He argues that only a shift from viewing language as grammar to viewing it as action within the social and natural world can make it possible to talk adequately about the relationship of linguistic diversity to biodiversity, of how languages as repositories of cultural memory and guides to action can influence the landscape and its biodiversity. In understanding and celebrating unity in diversity, he concludes, lies our best hope for a sustainable future.

From yet another complementary angle, Suckling (2000) suggests that the deep connections between language and ecology, and thus the mutual consequences of linguistic and biological diversity loss, are apparent especially in the role of metaphor in human communication and the extent to which biologically based metaphors support our understanding of the world. As both biological and linguistic diversity are eroded, he argues, these fundamental metaphors are also being lost as tools for thought and for recognition of identity and otherness.

LINGUISTIC AND BIOLOGICAL DIVERSITY: GLOBAL AND REGIONAL STUDIES

The tasks of systematically testing the claim that biodiversity and linguistic and/or cultural diversity are mutually related and of assessing the state of each of these diversities in relation to the others depend largely on the availability of effective ways to represent, locate, and measure these diversities. The focus of much of the "first generation" of biocultural diversity research, beginning with Harmon's groundbreaking work (Harmon 1995, 1996), has thus been on developing such tools. This effort has been facilitated by the progressive accumulation of data on biodiversity and linguistic diversity (and, to a lesser extent, other aspects of cultural diversity), as well as by the recent development of electronic means for representing geospatial data [that is, geographic information systems (GIS)].

In approaching this challenge, Harmon (1996, 2002) first revisited the once-tabooed issue of the comparison of species and languages, dispelling the misperception that an analogy between the two implies equating languages with natural organisms. He illustrated how, although the concepts of species and languages (and speciation and language genesis) are unquestionably fuzzy categories with porous boundaries and defy ironclad definition, they are not arbitrary and correspond to real entities (and processes) in the world. (For another recent view of languages as species, see Mufwene 2001.) The factual observation that the global distributions of species and languages significantly overlap, Harmon pointed out, then begs for explanation as well as heightened attention to the common threats both species and languages are undergoing.

Drawing on global biodiversity data as well as catalogs of the world's languages (Harmon 1995), Harmon showed notable correlations between linguistic and biological diversity on a global scale (Harmon 1996). He found that 10 out of the top 12 "megadiversity"

countries for biodiversity [as defined by IUCN—The World Conservation Union; McNeely et al. 1990] also figure among the top 25 most linguistically diverse countries. His global cross-mapping of languages and higher vertebrate species (see Maffi 1998 for the earliest printed version of this map) (**Figure 1**) brought out a remarkable overlap between linguistic and biological diversity throughout the world, with the highest concentration of bioculturally megadiverse countries in Central and South America, central Africa, South and Southeast Asia, and the Pacific. Similar results emerged from a global comparison of languages and flowering plant species. These correlations, Harmon argued, suggest that both biological and linguistic diversity in such countries are especially vulnerable to the effects of adverse political, economic, and social processes and policies.

Harmon (1996) also pointed to several large-scale biogeographic factors that could account for these correlations because they might comparably affect the development of both biological and linguistic diversity (such as extensive land masses with a variety of terrains, climates, and ecosystems; island territories, especially with internal geophysical barriers; or tropical climates, fostering higher numbers and densities of species). In addition, he hypothesized a process of coevolution of small human groups with their local ecosystems, through which, over time, humans interacted closely with the environment, modifying it as they adapted to it and developing specialized knowledge of it, as well as specialized ways of talking about it. Thus the local languages, through which this knowledge was encoded and transmitted, would in turn have become molded by and specifically adapted to their socioecological environments. Along the same lines, Mühlhäusler (1995, p. 155) notes, "Life in a particular human environment is dependent on people's ability to talk about it." (On the evolutionary dimensions of human-environment relationships and the issue of the possible coevolution of cultural, linguistic, and biological diversity, see also Hunn 2001, Maffi 2001b, Smith 2001.)

In contrast, Mühlhäusler (1996) called attention to the fact that linguistic and cultural distinctiveness can develop also in the absence of mutual isolation: for example, among human groups belonging to the same broadly defined cultural area, or whose languages are considered to be historically related or to have undergone extensive mutual contact, and who occupy the same or contiguous ecological niches. Such circumstances—high concentrations of linguistically distinct communities coexisting in the same areas and communicating through complex networks of multilingualism—have occurred frequently throughout human history (Hill 1997) and still do today in many parts of the world, the Pacific being a prime example. This phenomenon of "sympatric" linguistic boundary formation points to the role of sociocultural factors, along with biogeographic factors, in the development of linguistic diversity.

Other research conducted by linguists and anthropologists during the 1990s also sought to correlate the global distribution of linguistic diversity with both environmental and social factors. Nichols (1990, 1992) developed a theory of linguistic diversity in space and time in her work on linguistic typology. She identifies biogeographic factors similar to Harmon's, which affect the worldwide distribution of lineage density. She lists features such as low latitude, coastlines, high rainfall, and mountains among the factors positively correlated with high lineage diversity. To these, she adds historical and economic factors such as scale of economy—large-scale economies historically bring about both economic and linguistic spread and thus lower diversity. This, she shows, has been the case especially in the Old World (Africa and Eurasia), whereas early human colonization of the New World and the Pacific brought about very high lineage density. On this basis, she distinguishes spread zones, characterized by rapid spread of languages or language families and with low genetic linguistic diversity, from

IUCN: The World Conservation Union

Sympatric linguistic boundary formation: the development of linguistic distinctiveness between human communities in the absence of geographic discontinuity

Lineage density: the ratio of distinct linguistic lineages to areas within a continent or other well-defined region

Spread zone: geographic area characterized by rapid spread of languages or language families and presenting low genetic linguistic diversity

residual zones with high genetic diversity and no appreciable spread of languages or language families.

In a study on density of human languages in North America, Mace & Pagel (1995) hypothesized that group boundary formation in human societies may be an active process correlated with competition over resources and that this process in turn may lead to language diversification. On a smaller scale, Hill (1996) reported comparable findings in a study of dialectal variation in Tohono O'odham (a Uto-Aztecan language spoken in Arizona, in the United States), where the differential sociolinguistic characteristics of two dialect communities of Tohono O'odham (a localist versus a distributed stance) correlate with the extent to which each community can make secure claims over vital resources such as water.

On similar grounds, Nettle (1998, 1999) aimed to develop a theory of linguistic diversity and its global distribution by correlating this distribution with ecological and socioeconomic factors. He identified seasonal versus nonseasonal climates, with the attendant patterns of rainfall, as the key factors affecting the distribution of linguistic diversity worldwide. He subsumes these factors under the concept of ecological risk. His data show that areas with lower rainfall and shorter growing seasons, where people are at higher subsistence risk, tend to correlate with geographically more extended ethnolinguistic groups and fewer different languages, whereas areas with higher rainfall and longer or constant growing seasons (such as in tropical and equatorial regions) correlate with higher numbers of smaller-scale ethnolinguistic groups and thus higher linguistic diversity. He attributes this difference to the fact that in the former case people need to establish larger networks of exchange to mitigate their ecological risk, whereas in the latter case people can be more self-sufficient in their localized ecological niches. [See Harmon (2002) and Skutnabb-Kangas & Harmon (2002) for some of the theoretical and methodological shortcomings of Nettle's work that limit the generalizability of his otherwise significant findings.]

Early work on the links between biodiversity and linguistic and cultural diversity soon attracted the attention of conservation organizations and other international agencies concerned with implementing the mandate of sustainable development issued by the Rio Summit of 1992, and particularly with the call for protection and promotion of the "innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity" (Convention on Biological Diversity, Article 8j; CBD 1992). The United Nations Educational, Scientific, and Cultural Organization (UNESCO), the United Nations Environment Program (UNEP), the World Wide Fund for Nature (WWF), the Society for Conservation Biology, and IUCN all commissioned and published articles and studies on biocultural diversity (Borrini-Feyerabend et al. 2004, Harmon & Maffi 2002, Maffi 1998, Maffi et al. 1999, Oviedo et al. 2000, Skutnabb-Kangas et al. 2003), propelling this work into the domain of policy.

In particular, Oviedo et al. (2000) undertook the further development of Harmon's initial work on the global overlaps between biological and cultural diversity through the use of GIS. Again with due caveats, the distribution of the world's languages (based on the GIS database elaborated by SIL International, the makers of *Ethnologue*, the as yet most complete catalog of the world's languages; Grimes 2000) was taken as a convenient proxy for cultural diversity at large and plotted against the distribution of the world's ecoregions (as identified by WWF), with special reference to the ~200 ecoregions chosen by WWF as priorities for conservation, to determine the extent to which cultural diversity abounds in those biodiversity-rich and threatened ecoregions. A map of the global overlapping distributions of ecoregions and languages was produced for inclusion in the publication. An initial analysis of the results of this mapping showed that

Residual zone: geographic area characterized by high genetic linguistic diversity and presenting no appreciable spread of languages or language families

Ecological risk: the level of risk that ecological factors such as climate and rainfall pose for a population's subsistence

UNESCO: United Nations Educational, Scientific, and Cultural Organization

UNEP: United Nations Environment Program

WWF: World Wide Fund for Nature

Ecoregion: relatively large land or water unit containing a set of natural communities that share most of their species, dynamics, and environmental conditions

the highest concentration of ethnolinguistic groups occurs in tropical forest ecosystems, whereas lower densities are found in arctic and desert environments (a finding that coincides with Nettle's, reviewed above, and for which Oviedo et al. similarly provide an explanation in terms of subsistence strategies).

The applied goal of this project was to promote an integrated biocultural approach to the conservation of WWF's priority ecoregions and of biodiversity at large, through mutually beneficial partnerships with indigenous and traditional peoples living in those regions and the promotion of their land and traditional resource rights and linguistic and cultural rights. At this level, the project drew some criticism from observers (e.g., McIntosh 2001) concerned that WWF's shift from a local to an ecoregional (thus often transnational) scale in their conservation efforts may actually purport a move away from the greater accountability involved in community-based conservation, particularly in regards to indigenous counterparts. (Concerns of this nature are part of a larger ongoing debate about the goals and modus operandi of conservation organizations and the successes and failures of the sustainable development paradigm; see Chapin 2004, Maffi 2004 for reviews.)

At the same time, these critics saluted the key finding that emerged from this mapping exercise, that is, the strong correlations between biodiversity and cultural diversity, pointing out that this finding stresses the central role of indigenous peoples in the global conservation initiative. The significance of this issue, and more generally of the role of culture in conservation, has in fact continued to work its way into conservation organizations, particularly IUCN, whose Commission on Environmental, Economic, and Social Policy (CEESP) now includes, among the priorities for its 2005–2008 mandate, the "improved understanding of the synergy between cultural diversity and biological diversity and on how this may be harnessed and applied towards shared values, tools, mechanisms and processes that enhance conservation and promote a more sustainable and equitable use of natural resources" (CEESP 2004). UNESCO's recent Universal Declaration on Cultural Diversity (UNESCO 2001), although not recognizing an explicit link between cultural and biological diversity, emphasizes cultural diversity as the "wellspring of creativity" (Article 7) and affirms that "cultural diversity is as necessary for humankind as biodiversity is for nature" (Article 1).

CEESP: IUCN's Commission on Environmental, Economic, and Social Policy

The topic of global biocultural correlations has continued to stimulate both further research and critiques in the academic environment as well, contributing to the development of theory, methodology, and data sets for this field of study and to the refinement of research hypotheses and parameters. Apparently unaware of some of the previous research on the same topic (particularly Harmon's), Sutherland, an ecologist, compares both the global distribution and the extinction risk of languages and species (Sutherland 2003), reaching conclusions that are largely in line with earlier findings and forecastings. In particular, by applying to both species and languages the internationally agreed criteria for classifiying extinction risk in species, he finds that languages (as per the *Ethnologue* catalog) are at far greater risk than are species (specifically birds and mammals, which he chooses for comparison). His quantifications confirm the conjectures found early on in the current literature on language endangerment (e.g., Krauss 1992). With some discrepancies (perhaps due to different methods of analysis), Sutherland also confirms a number of biogeographic correlations in the distribution of languages and species, high diversity in both cases being positively associated in his data with area, low latitude, forest cover, and altitude, but not with rainfall. In his calculations, he also finds period since settlement to have little effect on language diversity.

Because of the high visibility of its publisher (the journal *Nature*), Sutherland (2003) triggered several media stories, including a scathing essay by Berreby in the *New York Times* (Berreby 2003), in which the author

inveighed (mostly on ideological grounds) against the validity of species-languages comparisons and of efforts to maintain or revitalize endangered languages. Several letters from the public later published by the *Times* vigorously countered Berreby's arguments.

Collard & Foley (2002) follow the lines of earlier studies such as Mace & Pagel (1995) and Nettle (1998) in exploring biogeographical correlates and possible determinants of human cultural diversity. In this case, instead of using languages as proxies for the world's cultures, they derive the distribution of cultural diversity from *Atlas of World Cultures* (Price 1990). The article contains a concise but very useful discussion of some of the main caveats in the use of such global comparative databases on cultures, as well as of the notion of culture itself as an analytical unit—caveats that mirror those about languages noted by other researchers (e.g., Harmon 1996, 2002; Oviedo et al. 2000). The authors also point to historical factors (such as state expansion) that may have reduced cultural diversity and masked the impact and visibility of older ecological factors. They stress, though, the importance of separating out the issue of "how easy it is to define any particular cultural unit from the issue of whether such units exist" (Collard & Foley 2002, p. 374) and consider this unit as valid both temporally and spatially for their analytical purposes. On this basis, they map out the distribution of world cultures according to latitude, which shows a pattern fully consistent with that of the distribution of languages in earlier studies: Cultural diversity is higher in tropical areas and lower at higher latitudes, in both the northern and the southern hemisphere, and in both evolutionarily "older" continents such as Africa and "newer" ones such as the Americas, with Europe showing the lowest diversity, a likely reflection of empire formation there. The authors also find positive correlations of cultural diversity with temperature and rainfall. These findings suggest to them that the pattern of human cultural diversity is not simply the random effect of historical factors, but reflects both the length of population history in a given location and the constraints and potential carrying capacity of the environment. In this context, while calling for more studies of the behavioral and cultural factors leading to boundary formation, they argue that "social boundary formation, which in turn reflects social behavior and interaction between residential units, is responsive to environmental and resource factors" (Collard & Foley 2002, p. 379). Another significant point Collard & Foley make is that, although the distribution of cultural diversity shows clear global patterns, analysis at higher resolution and smaller scale also reveals significant differences from region to region. This discrepancy between global and sub-global patterns leads them to call for smaller-scale analyses that will be more sensitive to the role of local, especially historical, factors in altering patterns of global diversity.

This point is widely shared among researchers on biocultural diversity. Stepp et al. (2004) explicitly stress the need for developing studies on a regional scale that will allow investigators to better identify the correlations and mutual influences and perhaps even discern causal factors in the development, maintenance, and loss of biocultural diversity. At the same time, these authors make a major contribution to the refinement of global biocultural analyses by bringing greater sophistication to the use of GIS in such studies. Their work, still at a preliminary stage, marks a shift in the intended use of GIS: from employing this technology mostly as a demonstration tool to illustrate the patterns of biological and linguistic (and cultural) diversity, to using it for the in-depth exploration of factors that may correlate with observed patterns and of explanatory hypotheses about these patterns. This research is also beginning to expand the roster of data used to explore the links between biological and linguistic diversity (the latter again being taken as a proxy for cultural diversity, with data from *Ethnologue*). One significant advance is the adoption of a

GIS database of global biodiversity (specifically, vascular plant diversity) organized not by countries or ecoregions as in previous studies but by diversity zones (standardized units of area), which allows for comparable diversity categories on a global scale (database developed by Wilhelm Barthlott and coworkers at the University of Bonn). A GIS mapping of the two data sets shows a high geographical correlation between linguistic diversity and biodiversity, particularly in Mesoamerica, the Andes, West Africa, the Himalayas, and South Asia/Pacific (**Figure 2**). As in previous research, the observed correlation is strongest in the tropics. Another significant pattern noted by Stepp et al. is a correlation between low population density and high biocultural diversity, perhaps due to an increase in both linguistic homogenization and impact on the environment at higher population densities. In the further development of their work, the authors plan to elaborate regional mappings that will allow for better exploration of such patterns, with the inclusion of possible social and historical factors.

A number of continental and regional studies, some descriptive, some based on mappings and quantitative data, are already available, including a map of indigenous peoples and environments in Central America (Chapin 1992); an overview of biodiversity and cultural diversity in Mexico (Toledo 1994); a study of cultural and biological diversity in Latin American ecoregions (Wilcox & Duin 1995); an ecological approach to language diversity in West Africa (Nettle 1996); cross-mappings between the locations of South American indigenous peoples and habitat types as well as between South American indigenous reserves and biosphere reserves and national parks (Lizarralde 2001); a study of the correlation of linguistic, cultural, and biological diversity in America north of Mexico (Smith 2001); an analysis of the distribution of cultural and biological diversity in Africa (Moore et al. 2002); and overviews of the Colorado Plateau ecoregion in the southwestern United States as a hotspot of biocultural diversity (Nabhan et al. 2002a,b). All these data variously help focus attention on the theoretical and methodological requirements and on the kinds of data and integration thereof needed for in-depth studies at a subglobal level. Especially highlighted is the need for historical perspective both on processes of environmental change and on human population movements and expansions and other social, economic, and political factors that may have affected the location and numbers of human populations and their relationships with and effects on the environment. The importance of a better understanding of how environmental factors may similarly or differentially affect cultural groups and species, as well as issues of scale and degree of resolution of the analyses, is also in the foreground.

Diversity zones: units of area (10,000 sq. km.) that categorize the world's biodiversity on the basis of the number of vascular plant species per unit

In this connection, Manne (2003) provides a critical appraisal of biodiversity—cultural diversity links through a study focused on Central and South America, using the distribution of languages as indicator of cultural diversity and that of Passeriform birds for biodiversity. Her main finding is that the scale of resolution strongly affects the results. At a coarse scale, the respective distributions overlap significantly in the region of study. At a finer scale, however, the correlation is considerably weakened, with no simple monotonic relationship between numbers of species and languages. Manne's research also shows no common environmental variables (of the kinds instead found to be significant in other studies reviewed above) affecting the distribution of languages and species. She also finds differences in geographical range sizes and overlaps between species and languages; the ranges of birds are larger and more overlapping than those of languages and the cultural groups who speak them. [But note that this finding may be skewed by the lack of adequate data on and ways of representing the degree of "porousness" of cultural and linguistic borders. Both linguists and anthropologists, e.g., Mühlhäusler (1996), Turner et al. (2003), have shown such borders to be the locus of significant cross-linguistic and cross-cultural

IBCD: Index of Biocultural Diversity

interaction and of higher levels of diversity of linguistic and cultural traits.]

Manne also compares degrees of threat for species and languages, adapting to languages, as did Sutherland, the internationally recognized threat categories for species. Her finding here is that even at a coarse scale the distributions of threatened languages and species do not tend to coincide in Central and South America. She points to some possible historical as well as data availability factors that might account for this finding, but from both this result and her data on distribution of language and species richness she concludes that "we should not generally expect spatial congruence in distribution of richness or of endangerment between biological and cultural diversity" (Manne 2003, p. 526). Interestingly, a global map of threatened ecosystems and languages (Skutnabb-Kangas et al. 2003), although showing a similarly limited correlation in South America, presents a significant correlation in Mexico and Central America, as well as parts of North America, Equatorial Africa, South Asia, and the Pacific. This finding suggests that establishing the extent to which Manne's statement may indeed be generalizable to analyses at a subglobal level depends on the future availability of a greater number of such studies and on more standardized and therefore comparable methodologies and data sets.

MEASURING AND ASSESSING BIOCULTURAL DIVERSITY

The issue of standardization and comparability is also central to another aspect of the field of biocultural diversity, that is, work concerned with the joint measurement and assessment of the global conditions and trends of biodiversity and cultural diversity. The earliest efforts in this connection go back to Harmon (1992) in the context of affirming the relevance of cultural diversity for protected area conservation. Indicators of biodiversity were by then commonly used to monitor the state of the natural world. Harmon set out to identify indicators that might allow for gauging the state of cultural diversity in relation to the state of biodiversity, and thus for determining whether cultural diversity is indeed diminishing and whether it is diminishing in tandem with biodiversity. He proposed a number of potential indicators: from language, ethnicity, and religion to diet, crops, land management practices, medical practices, social organization, and forms of artistic expression.

In later work, Harmon's choice of cultural indicators has focused on the first three indicators listed above owing to the ready availability of global data sets on languages (Grimes 2000) and ethnicity and religion (Barrett et al. 2001). In a collaborative effort, Harmon and Loh have developed a framework for an Index of Biocultural Diversity (IBCD) (Harmon & Loh 2004, Loh & Harmon 2005), which is meant to measure the condition and trends in biocultural diversity on a country-to-country basis (the level at which the available data sets are organized) by aggregating data on the three cultural indicators with data on diversity of bird/mammal species and plant species as indicators for biodiversity (also selected on the basis of data availability). The IBCD features three components: a biocultural diversity richness component, which is the sheer aggregated measure of a country's richness in cultural and biological diversity; an areal component, which adjusts the indicators for a country's land area and thus measures biocultural diversity relative to the country's physical extent; and a population component, which adjusts the indicators for a country's human population and thus measures biocultural diversity in relation to a country's population size. For each country, the overall IBCD then aggregates the figures for these three components, yielding a global picture of the state of biocultural diversity in which three areas emerge as core regions of exceptionally high biocultural diversity: the Amazon Basin,

Central Africa, and Indomalaysia/Melanesia. This largely confirms the geographical correlations found in other work reviewed above, in which either languages or ethnicities were used as proxies for cultural diversity.

Harmon and Loh point to a number of limitations of the IBCD and caveats concerning its use, making it clear that this index, like any index, should be used only to measure general conditions and trends and should not be expected to provide an in-depth analysis of the phenomenon at hand, particularly as concerns within-country variation in biocultural diversity. They also point out that, in its current version, the IBCD only portrays the state of biocultural diversity at the beginning of the twenty-first century, whereas data on trends are as yet missing and are the object of future research. They conclude that these latter data, used in conjunction with careful qualitative analyses, will ultimately provide a more adequate and accurate picture of the global state of biocultural diversity. They do, however, openly acknowledge that the main value of such an index will be largely practical and political, such as to raise awareness about biocultural diversity among decision makers, opinion makers, and the general public and promote needed action for its protection and restoration.

It is in fact noteworthy that the Convention on Biological Diversity—one of whose goals, as previously mentioned, is the protection and promotion of traditional knowledge, innovations, and practices relevant to the conservation of biodiversity—is currently considering the state and trends of linguistic diversity as a possible indicator of the state and trends of traditional knowledge. The IBCD is a potential candidate to fulfill this role.

Also very relevant in this connection is some of the recent quantitative work carried out by ethnobiologists to measure and assess the persistence and loss of traditional ecological knowledge (TEK). Researchers such as Zent (1999, 2001), Lizarralde (2001), Ross (2002), Zarger & Stepp (2004), Zent & Zent (2004), and others are contributing to the development of quantitative methods for the investigation of the acquisition and transmission of ethnobotanical and ethnoecological knowledge and for the identification of factors (such as age, formal education, bilingual ability, length of residency, change in subsistence practice, etc.) that may affect the maintenance or loss of TEK. As more of these studies become available, they will likely constitute an increasingly significant source of data for the elaboration of more refined indicators of the conditions and trends of cultural diversity in support of a better understanding of the state of biocultural diversity and of the development of appropriate policies.

TEK: traditional ecological knowledge

Likewise, significant contributions to the measurement and assessment of biocultural diversity should come from linguistics, in terms of more elaborate criteria for evaluating the state of the world's languages. Even if time-series data on the number of languages should become available in the near future, sheer trends in language richness are not a fully adequate indicator of the state of languages, as researchers in this field well recognize. Better data on numbers of speakers over time and other sociolinguistic vital statistics, particularly on intergenerational language transmission, contexts of use, availability of mother tongue education, etc., will be needed for this purpose. An expert group on language endangerment and language maintenance recently gathered by UNESCO has put forth a set of recommendations for the assessment of linguistic vitality (UNESCO 2003), which should provide useful guidance also for the development of linguistic diversity indicators. [Specifically on the role of education through a mother-tongue medium and on educational policies in the maintenance of linguistic diversity, see Skutnabb-Kangas (2000). On structural and functional indicators of language obsolescence, see Hill (2001).]

PROTECTING AND MAINTAINING BIOCULTURAL DIVERSITY

Of course, no matter how sophisticated our understanding of biocultural diversity and ability to represent, measure, and assess it may be, without appropriate action we would still, most likely, be presiding over the demise of our bioculturally rich world, given the forces causing its erosion. This is why the relevance of affecting policy and public opinion is high on the minds of researchers in this field, giving it its characteristic mixture of theory and practice, research and advocacy, and knowledge building and knowledge dissemination.

As indicated at various points above, several international organizations, both in the biodiversity conservation area (WWF, UNEP, IUCN) and in that of linguistic and cultural diversity (UNESCO), have noted the significance of the biocultural perspective and incorporated it to a greater or lesser extent in their own approaches and activities.

Developments in the field of human rights, such as the United Nations' Draft Declaration on the Rights of Indigenous Peoples and other advances in the definition of indigenous peoples' and minorities' land rights, traditional resource rights, property rights, and cultural and linguistic rights, are also relevant to the protection and promotion of biocultural diversity. All these are contributing to the establishment of a link between biodiversity and cultural and linguistic diversity in the arena of human rights, as well as to the promotion of a new vision in which the protection of human rights (both individual and collective) is intimately connected to the affirmation of human responsibilities toward and stewardship over humanity's heritage in nature and culture. (For reviews, see Maffi 2001a, Posey 2001, Skutnabb-Kangas 2000.)

The dissemination of research activities, along with advocacy, has thus had some initial success in producing general awareness of these issues. It has even resulted in a certain amount of change in national and international policies, as well as an increase in the availability of financial and other resources in support of efforts to promote the protection and maintenance of biocultural diversity at various levels. Yet, much more is needed, especially in terms of change in general attitudes and behaviors. The recent proliferation of news stories as well as of popular books on the loss of linguistic diversity (e.g., Crystal 2000, Dalby 2003, Nettle & Romaine 2000)—which generally point to a link between language loss and culture and knowledge loss, and in some cases also biodiversity loss—may help increase general awareness of biocultural diversity and its predicament, which should be a key to political action.

Ultimately, the most fundamental impetus for the protection and maintenance of biocultural diversity can come, not from top-down efforts, but only from the ground-up action of indigenous and other societies worldwide whose languages, cultural identities, and lands are being threatened by global forces. A perceived link between language, cultural identity, and land (rather than an abstract notion such as nature) is common among many indigenous societies (see, e.g., Blythe & Brown 2003). It is no surprise, then, that many of the most explicit efforts to maintain and revitalize linguistic, cultural, and biological diversity jointly are grassroots efforts, whether entirely endogenous or promoted and assisted by national and international organizations. Learning about and from these efforts and making the lessons as widely available as possible is the goal of some of the ongoing work in biocultural diversity (L. Maffi & E. Woodley, *Global Source Book on Biocultural Diversity*, in preparation).

FUTURE PROSPECTS

Over the course of about 10 years, the field of biocultural diversity has emerged as an example of an integrated, transdisciplinary field (Somerville & Rapport 2000), spanning the natural and social sciences, as well as linking theory with practice and science with policy,

ethics, and human rights. No doubt, at the present stage this field needs an opportunity to better define its theoretical and philosophical assumptions, its research questions, its methodologies, and its overall goals. The increasing focus on the topic of biocultural diversity in academic settings promises to bring to this field the benefit of scientific rigor and critical analysis. We can also hope that the adoption of biocultural diversity as a domain for academic inquiry will foster a transdisciplinary turn in academe, leading to greater communication and exchanges among disciplines, as well as more work by interdisciplinary teams, and thus to the elaboration of a new synthesis about the connections between linguistic, cultural, and biological diversity. A transdisciplinary approach should also make research more sensitive to real world needs and research findings more relevant for policy and other applications. Above all, a transdisciplinary study of biocultural diversity should contribute to our understanding that, as Harmon (2002) puts it, diversity in nature and culture makes us human. In this resides the hope that greater respect for and stewardship over our shared natural and cultural heritage can be achieved—before it is too late.

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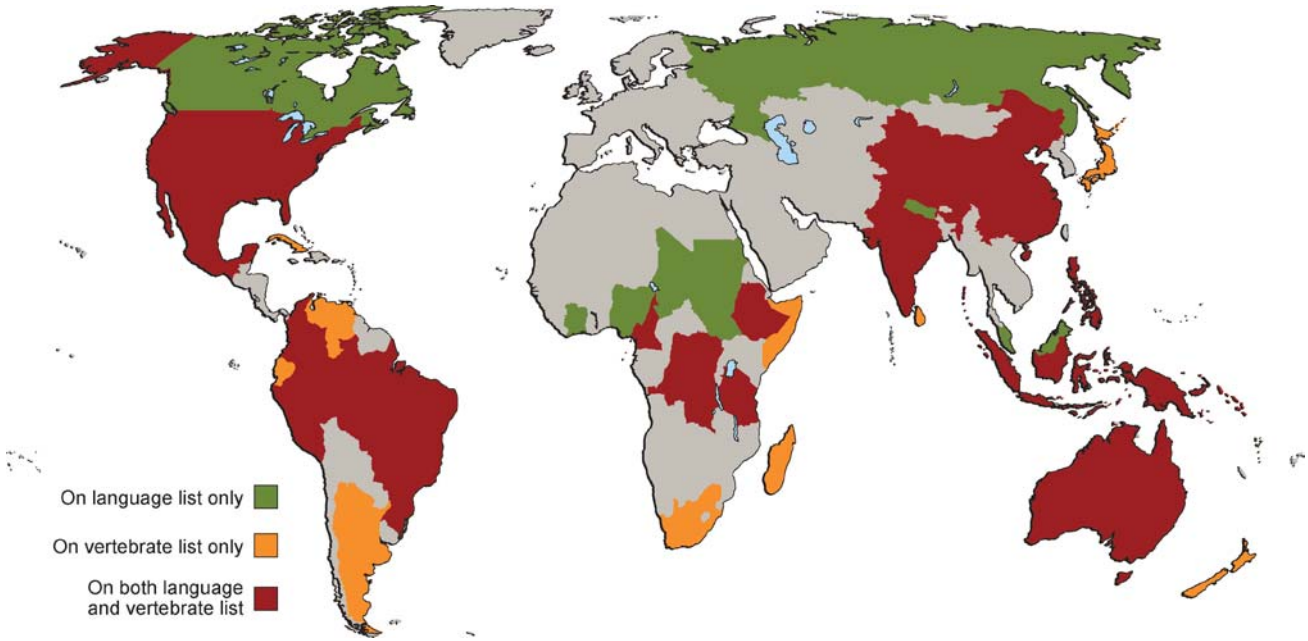

Figure 1

World map showing overlap of endemism in languages and higher vertebrates. Original work by D. Harmon, based on Harmon 1996. First published in Maffi 1998. Reproduced with permission.

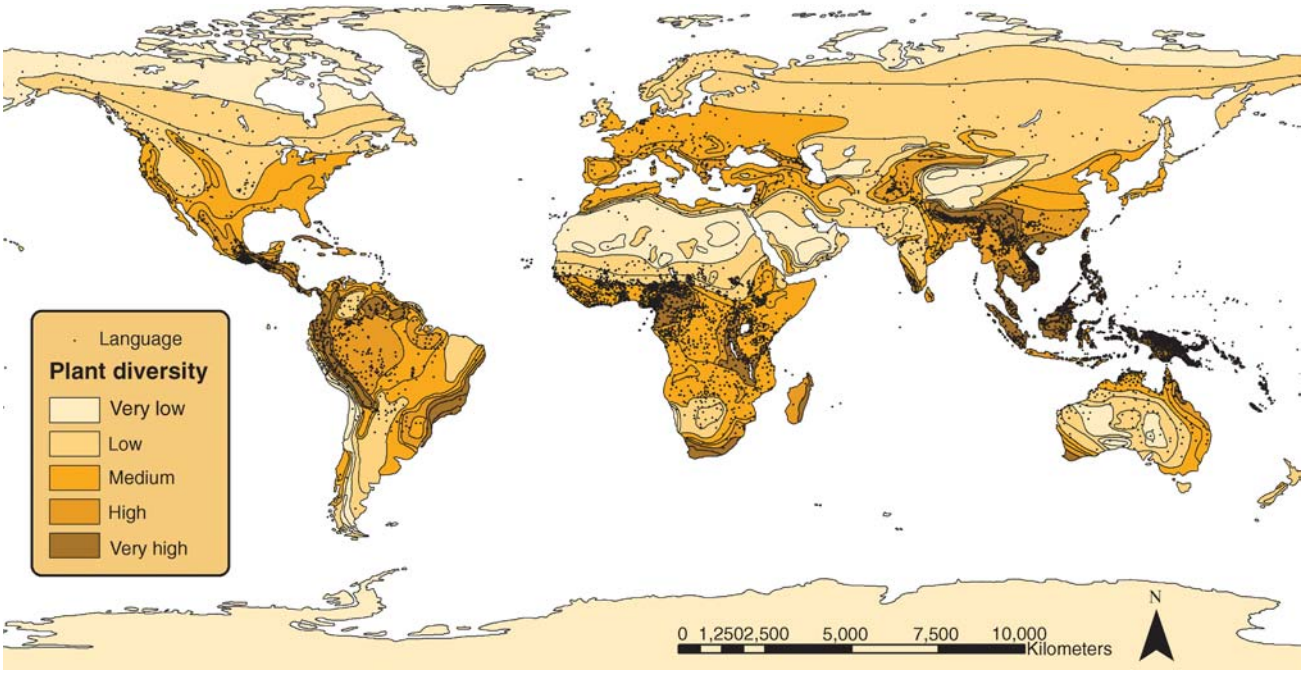

Figure 2

Plant diversity and language distribution. From Stepp et al. 2004. Used with permission.

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