

# Endangered languages, endangered knowledge

Luisa Maffi

---

In the life of languages, change is the rule rather than the exception. Pervasive variation occurs within any given speech community, and speakers in each generation use their language or languages slightly differently from their predecessors, in both unconscious and conscious ways (Stross 1975). Through these processes, languages keep responding and adapting to their users' communication needs (Kay 1977), serving as dynamic bridges between the past and the future and as vehicles for the continued, and continuously innovative, transmission of a community's knowledges, beliefs, values, and practices (Maffi 2001a). Under these normal circumstances, it is accurate to say that languages do not die: they only get transformed.

But then, we also know that in some cases languages do die (Crystal 2000, Dixon 1997). That is when, rather than being transformed through use and inter-generational transmission, a given language becomes increasingly restricted in use, and ultimately ceases to be passed on from one generation to the next. In such cases, the flow of communication and transmission is interrupted because speakers voluntarily or unwillingly shift to another, generally dominant, more prestigious, more powerful language and choose not to teach their native language or languages to their children. In extreme but far from rare instances, the breakdown of communication and

transmission may even be due to decimation of the speakers because of natural disasters, disease, war, or genocide.

Both phenomena are known, or can be inferred, to have occurred throughout the history of humanity. Yet, while language change has long been an object of study for linguists (and in fact can be said to be one of the very roots of the emergence of the modern discipline of linguistics in the nineteenth century), language

death is a more recent focus of attention. Scholarly interest in this issue manifested itself sporadically from the late nineteenth century on. Linguists who had taken up the study of indigenous and minority languages sometimes expressed concern for the future prospects of these languages and their speakers in light of ever-increasing social, political, and economic change. It was only during the decade of the 1990s, though, that

this concern came to a head with a rapid and exponential rise of interest in the issue (Crystal 2000, Dixon 1997, Dorian 1989, Grenoble and Whaley 1998, Hale *et al.* 1992, Robins and Uhlenbeck 1991). To a large extent, this rise of interest was due to the accumulation of a growing mass of data not only on the grammatical and lexical features of the world's languages, but also on the state of vitality of the languages (see e.g., Grimes 2000). From Europe to the Americas, Australia and Oceania, Asia,

Dr Luisa Maffi is a linguist, anthropologist, and ethnobiologist. She is cofounder and President of Terralingua: Partnerships for Linguistic and Biological Diversity. Terralingua is an international NGO based in Washington, DC, devoted to supporting the world's linguistic diversity and to exploring the links between linguistic, cultural, and biological diversity, through research, information, education, and policy. She is editor of *On Biocultural Diversity: Linking Language, Knowledge, and the Environment* (2001). Email: maffi@terralingua.org

Africa, the message was the same: the indigenous and minority languages of the world were disappearing at an alarming and accelerating rate, replaced by a small number of ever-expanding, majority languages (referred to as “killer” languages in Skutnabb-Kangas 2000).

At the outset, clarion calls about this language endangerment crisis were issued by linguists mostly out of a professional preoccupation that this ongoing language loss – projected to threaten the survival of 50–90% of the world’s 6800 languages in the next 100 years (Krauss 1992) – spelled the impending demise of linguists’ very object of study. These scholars would point out that, in order to adequately characterise the notion of “human language”, it is necessary to have access to the fullest possible variety of human languages, their sounds, their ways of expressing grammatical categories and relations, and so forth. In this case, the appeal tended to be to the linguistic profession to refocus its priorities from the elaboration of abstract models of grammar (based on English and a few other major, well-described languages) to the “old-fashioned” task of doing linguistic fieldwork to describe and document as much as possible of the world’s endangered languages, so as to preserve them for posterity.

To outsiders, and particularly to the members of indigenous and minority language communities, this initial call to action may have sounded self-serving for the linguistic profession. Nevertheless, during the 1990s it became increasingly recognised within the profession that the “posterity” in question should first of all include the descendants of the last fluent speakers of these languages, so as to help maintain – or, as the case may be, restore – the life of languages. A small but highly motivated group of linguists have actually chosen to put their skills to the service of linguistic communities seeking to establish language revitalisation and language education programmes (e.g., Hinton 1994). A few non-profit organisations were created to pursue the purposes of this “salvage linguistics” (such as the Foundation for Endangered Languages in the UK, the Endangered Language Fund in the U.S., the Society for Endangered Languages in Germany, and the Clearinghouse on Endangered Languages in Japan). These organisations have contributed to raising general awareness of the

language endangerment crisis and to gathering information and promoting research about indigenous and minority languages, including by offering small grants. Some of the recipients of such grants have been members of language communities researching their own languages, and in general grant policies have stressed the importance to make research data available to language communities in useful form and have also invited work aimed at setting up language maintenance and revitalisation programmes. International organisations such as UNESCO also have variously taken on the issue of language endangerment, such as with the publication of an atlas of endangered languages (Wurm 1996) and the compilation of “Red Books” of endangered languages and of a World Languages Survey.

At the same time, other reasons for concern emerged during the 1990s, centred on what might be lost to the speakers themselves, and to humanity at large, through the erosion of the world’s linguistic diversity. The consequences of linguistic diversity loss began to be discussed also in terms of human rights, ethics, and social justice and of maintaining cultural identity and heritage (Skutnabb-Kangas 2000, Skutnabb-Kangas and Phillipson 1994, Thieberger 1990). Links were suggested between linguistic (and cultural) diversity and biodiversity as distinct but mutually supporting manifestations of the diversity of life on earth (Harmon 1996, Krauss 1996, Maffi 2001a, Maffi *et al.* 1999, Mühlhäusler 1996). Research pointed to the interrelations between language and the environment, particularly through the mediation of traditional ecological knowledge, language being the main repository of and transmission vehicle for knowledge (Maffi 2001a, b). Out of the coalescence of environmental, cultural, linguistic, and human rights issues an interdisciplinary field has arisen that has come to be known as “biocultural diversity”. The emergence of this field has both given rise to and been promoted by another non-profit organisation, the international NGO Terralingua: Partnerships for Linguistic and Biological Diversity. Terralingua was created in the mid-1990s with the specific purpose to support and foster the world’s linguistic diversity and to explore the links between linguistic (and cultural) diversity and biodiversity. Terralingua’s work, carried out

through a programme of research, information, education, and policy advocacy, has begun to call international attention to new approaches to joint conservation of both natural and cultural resources (Maffi 1998, Maffi *et al.* 1999, Oviedo *et al.* 2000, Posey 1999). It has also brought to the fore the issue of linguistic human rights as a key aspect of protection and promotion of linguistic diversity (Skutnabb-Kangas 2000, Terralingua 1998).

The responses to the linguistic diversity crisis developed by scholars during the 1990s and into the twenty-first century have thus tended to fall into two categories: those aiming to document languages and preserve a record of them in grammars, dictionaries, and texts, and those aiming to support and promote linguistic diversity as such, as a key component of the diversity of life. These two classes of responses are by no means mutually exclusive, either in theory or in practice. Both of these approaches are needed, given the multifaceted nature of the problem (and proponents of one approach have generally acknowledged, and sometimes embraced, the rationale and *modus operandi* of the other). What is perhaps even more needed, though, is the eventual integration of this variety of efforts into one well articulated, solidly grounded, and clearly identifiable domain at the intersection of research and practice, in a way somewhat comparable to what relatively new fields such as conservation biology and ecosystem health have accomplished in relation to biodiversity and ecosystems.

Such a specifically defined field of linguistics, in which the currently dispersed efforts to confront the language endangerment crisis could be synergised and concepts, terminologies, and methodologies could be clarified, harmonised, and strengthened, would probably bestow to this kind of endeavour the legitimacy and authority it does not yet possess within linguistics – and it might even significantly contribute to revitalising linguistics as a discipline and conferring it new relevance within and beyond academia. Under such a scheme, students would be able to enter, and train for, an integrated field of research and action that would have defined its own goals, theory, methodology, and whose legitimacy would be recognised both within academia (and thus within the academic merit

system) and outside of it (such as in non-academic education, especially at the grassroots, as well as in non-profit service organisations, and so forth). And the currently bemoaned lack of funding for work in support of endangered languages might be more easily overcome because of both the distinct “real world” nature and higher visibility of this field.

It is interesting to note that one of the first books to provide a popular review of the linguistic diversity crisis, David Crystal’s *Language Death* (Crystal 2000), advocates something similar in contemplating top priorities for action. The name that Crystal suggests for this field-to-be is “preventive linguistics”, based on an analogy with medical matters. This label lends itself to ambiguity of interpretation and may not go down well with many of the potential members of the field or potential users of its results (especially indigenous and minority language speakers). Alternatively, a label of “conservation linguistics” might be suggested, by analogy with “conservation biology”, and following a distinction between “preserving” (*ex situ*, i.e., in books and other material records) and “conserving” (*in situ*, i.e., within the speech community), as suggested in Maffi (2000). Objections might be raised in this case as well (e.g., Skutnabb-Kangas 2000: x, footnote 1), due to earlier negative connotations of the word “conserve” – the sense in which people associate it with “keeping in a museum” or “freezing in time”. The point, however, would be to promote the identification of this word, as referred to language, with “maintain in context” and “maintain through continued use and development”, in a way similar to how the word is increasingly understood in relation to biodiversity. And the analogy might be pushed even further, along the lines of the progression from preservation to conservation to land ethic to ecosystem health advocated by environmental philosopher J. Baird Callicott (David Rapport, pers. comm. 2001). Following this analogy, one might suggest that the ultimate goal in the case of languages should be ensuring the health of linguistic ecologies, or of what has been termed the “logosphere”, the web of the world’s languages (Krauss 1996).

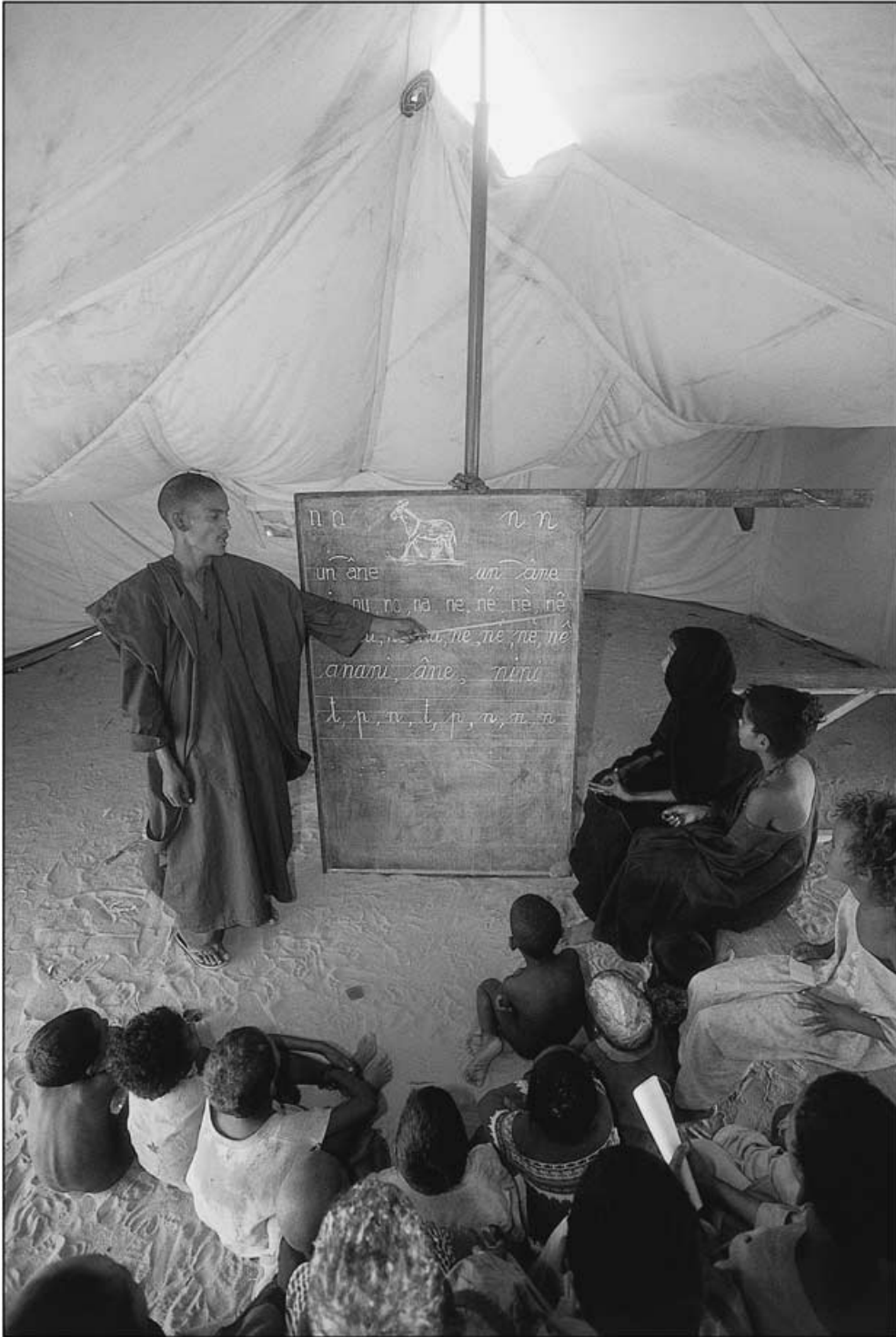
Whatever label might eventually come to be chosen for such a field, it may be useful to review what the field would need to accomplish

in order to advance the integration of scholarship concerned with language endangerment and linguistic diversity and to promote its relevance to policy and applied work. Several similar points are made by Crystal (2000). First of all, an emerging field of “conservation linguistics” (if for convenience we choose to use this term here) should, of course, develop its own theoretical perspective. As Crystal notes, at this time there is not even a coherent terminology to refer to the phenomena involved in the loss of linguistic diversity (“language endangerment”, “language obsolescence”, “language death”, and so forth). It should also be recognised that such terminology is not ideologically neutral, and that some might prefer to make explicit reference to the agency behind, say, “language death”, and speak instead of “language murder” (Skutnabb-Kangas 2000). We also need to define what exactly we mean by “linguistic diversity” to begin with: just “language richness”, or do rarity and endemism play a role too, as they do in the definition of biodiversity along with “species richness”? What else may be involved? At the theoretical level, other issues to be addressed include identifying the specific structural and functional changes in a language that allow us to conclude that the language is becoming obsolescent rather than undergoing “normal” change (Hill 2001); the range of known circumstances that lead to language loss and shift to dominant languages; and the conditions under which one can say that a language has become “endangered”, “obsolescent”, or “dead”. In all instances, the appropriate conceptual vocabulary and methodology need to be elaborated on the basis of a solid typology of the relevant phenomena. Although concerned linguists may feel as if it is a drop in the bucket, much work has already been done on situations of language loss and language shift around the world. This scholarship needs to be brought together in a comparative and synthetic fashion. We may discover that we actually know more than we thought – and we would certainly also discover where the gaps are.

As Crystal (2000) also points out, having a well-developed theoretical framework is essential to guide the task of gathering information about, and assessing and monitoring, the state of the world’s languages. To evaluate the current conditions and future prospects of a lan-

guage, it is not enough to just know the sheer number of speakers of the language at a given time; it is also necessary to have details about trends in the number of speakers over time, and to correlate these with speaker population demographics, sociolinguistic factors, socio-political and economic context, and so forth. This approach is analogous to that taken in assessments of biodiversity or the state of the world’s ecosystems, which commonly seek to determine current conditions, threats and trends, and future prospects (as well as response options, on which more below). In turn, also by analogy with biodiversity, monitoring of global trends in linguistic diversity would benefit from the development of indexes measuring the vitality and continuity of the world’s languages, thus allowing for the identification of long-term trends in lieu of the current sketchy data and “off-the-cuff” projections.

Furthermore, referring to the work of Terlingua, Crystal argues that the links with ecology are not just metaphorical or only pertaining to the ecology of languages per se (Haugen 1972, Mühlhäusler 1996). This and other work, especially by ethnobiologists and ethnoecologists, suggests that linguistic ecologies and biological ecologies are mutually related through human knowledge, use, and management of the environment and through the languages used to convey this knowledge and practices (Maffi 2001a, Oviedo *et al.* 2000). This two-way relationship needs to be brought out and studied in depth. It is generally agreed upon that small-scale societies with a history of continued and unchallenged occupation of given territories will over time tend to develop and maintain detailed and accurate knowledge about their ecological niches, as well as about sustainable ways of extracting and managing natural resources. Their ways of speaking, oral traditions, and verbal art forms will transmit this knowledge. Historically, cases in which a dynamic balance between humans and the environment on which they depend has not been sustained are largely linked to the rise of complex civilisations, living and expanding their dominant reach beyond the confines of local ecosystems. By and large, this has happened to the detriment of indigenous and other local societies, whose control over their lands and resources and freedom to practice their ways of life and use their languages



A bush school in Mali. J.-L. Manaud/Hoa-Qui

have been undermined or taken away. (See references in Oviedo *et al.* 2000, Skutnabb-Kangas 2000, and Maffi 2001a.) Although we need a better understanding of the nature and extent of the links between language and knowledge or language and culture, initial evidence suggests that losing one's heritage language(s) often implies losing the knowledges, beliefs, values, and practices that the language(s) encode(s) and convey(s) (Zent 2001).

On these grounds, it then makes sense to entertain the goal of assessing and monitoring the state of biological and linguistic (and more broadly cultural) diversity in an integrated fashion. A project for a Global Biocultural Diversity Assessment, recently set up by Terralingua, proposes to do just that, in connection with major environmental assessments such as the current international effort known as Millennium Ecosystem Assessment. It can be expected that this kind of interdisciplinary work, predicated on close collaboration between natural and social scientists (and on training of a new generation of scientists with interdisciplinary skills), will yield a much more sophisticated understanding of the complex and interlinked phenomena that affect the various manifestations of the diversity of life, and that it will provide more effective tools for action geared to the elaboration of policy and other response options to the diversity crisis.

This is not to say that a considerable amount of work has not already been done in terms of policy and other responses to the crisis. Such work concerns especially, on the one hand, the formulation of linguistic human rights, including linguistic rights in education, and the protection thereof; and, on the other, the development of a wide variety of language maintenance and revitalisation programmes and projects around the world. (For reviews, see Fishman 1991, 2000, Hinton and Hale 2001, Skutnabb-Kangas 2000, Skutnabb-Kangas and Phillipson 1994). Yet, linguistic human rights continue to be violated or at least not enforced all over the world, and language communities continue to struggle to establish and sustain language programmes, often with little or no outside help – when such programmes do not encounter resistance or outright opposition. Here, too, there is an urgent need to globally assess the state of affairs and identify the gaps.

In relation to linguistic human rights, perhaps the main gap at the international level is the lack of an established framework for the protection of such rights. Although a Draft Universal Declaration of Linguistic Rights was submitted to UNESCO in 1996, it has not fared well in terms of approval by this agency; nor have alternative processes emerged to address this need. In some cases, regional policies (such as the European Charter on Regional and Minority Languages, adopted in 1992 and signed by an increasing number of European countries since) appear to have made greater strides. However, the ultimate litmus test lies in country-level policies, and at this level the available data suggest that the picture worldwide is not good. By and large, individual countries at best pay lip service to linguistic human rights but do not adequately implement them – particularly in terms of providing opportunities for education in indigenous and minority languages – or they apply “benign neglect”; at worst, they actively suppress these rights (Skutnabb-Kangas 2000). As concerns indigenous and minority language support programmes in general, countries rarely take an active and constructive role in accepting and promoting linguistic diversity in their midst. Rather, they tend to push for monolingualism in the national languages, putting forth misguided arguments, such as that multilingualism threatens national unity or that language programmes are too costly (Skutnabb-Kangas 2000).

It is to the country level, therefore, that much of the focus of language-related policy action needs to turn, taking into account the local political, economic, and social realities, while at the same time not losing sight of the global perspective on issues of linguistic diversity and language endangerment. One can only illuminate and strengthen the other. The same can be said in relation to language maintenance and revitalisation programmes and projects. Global (or even regional) reviews of what has been and is being done will be extremely useful in providing a typology of this kind of responses, and in suggesting what works (or does not work) where and under what circumstances. On the other hand, the pressure needs to be on national governments and other domestic institutions to devise or support, and fund, such policies, programmes, and projects.

In connection to response options, it is thus evident that a major task for those concerned with the fate of the world's linguistic diversity continues to be one of raising, and in fact maintaining a high level of, public awareness and attention to this issue. Creating a climate that will induce governments and other relevant administrations to develop adequate language policies, language education programmes, and so forth has as one of its preconditions a well-informed public: a public favourable to linguistic diversity as a benefit for the health and vitality of both human societies and ecosystems rather than suspicious of it as a potential or actual threat to societal cohesiveness and stability. Achieving this aim will require a major creative effort on the part of all concerned. Linguists, in particular, will need to focus on fully developing and communicating innovative concepts such as the "logosphere" (Krauss 1996), "linguistic ecologies" (Mühlhäusler 1996), "languages as resources" (Maffi 1998), and maybe even "linguistic services" (analogous, and perhaps linked, to the ecosystem services provided by Earth's ecosystems).

A climate of public awareness is also one precondition for calling the attention of funding institutions, that so far have hardly taken language issues into account (with the obvious exception of research foundations – in which case, however, the focus has traditionally been on linguistic theory rather than language description or applied linguistics, let alone language policies). Initial signs of change are currently visible in this domain, as a consequence of the growing awareness of the linguistic diversity crisis that developed during the 1990s. Among research foundations, the US National Science Foundation has started a line of funding for description of endangered languages. Major private foundations such as the Ford Foundation, MacArthur Foundation, and Volkswagen Foundation have begun to offer funding for work on endangered languages, language maintenance, and language policy. It is essential to keep this momentum so that such lines of

funding will become well established and increasingly adopted by other funding agencies.

Still, those who care about the loss of linguistic diversity, as a part of the diversity of life, themselves often feel at a loss when it comes to making others care. In the face of the crisis, the message hardly seems to get out fast enough, far enough, wide enough, convincingly enough. For each small victory noted, there always seem to be so many more defeats, whether in terms of deaths of last fluent speakers of given languages, suppression of linguistic human rights, abolition or failed implementation of language education policies, and so forth. Whatever hard-won progress there may be, it never appears to be immune from being drastically reversed. The approach advocated here, as a necessary step, is one in which science (both social and natural), information, education, policy, advocacy, applied work, all join hands and support one another to face the crisis.

But this is not all. This is a necessary, yet not a sufficient step. These fields speak to the rational in us, but we also need to appeal to people's emotions and sense of aesthetics. Language and languages are not only useful tools; they are also a thing of beauty, and the loss of the many voices of human language is also a tremendous loss of beauty. To convey this message, we need art too. That's undoubtedly why so many writers, and so many scientists turned writers, have been pouring a growing flow of ink into crafting impassioned meditations and personal accounts about the loss, about its impact on the human spirit, on the human species, on life as we know it. We need more of this – wordsmiths (and why not, as Crystal suggests, also visual artists and musicians) who will speak not just to our minds but to our hearts and souls. Science and art can also join hands to shake us, move us, inspire us away from short-sighted destructive behaviours, point us toward a more sustainable future in which the diversity of life can again fully thrive and be cherished, for the physical, cultural, and spiritual well-being of present and future generations.

## References

- CRYSTAL, D. 2000. *Language Death*. Cambridge: Cambridge University Press.
- DIXON, R. M. W. 1997. *The Rise and Fall of Languages*. Cambridge: Cambridge University Press.
- DORIAN, N. (ed.) 1989. *Investigating Obsolescence: Studies in Language Contraction and Death*. New York: Cambridge University Press.
- FISHMAN, J. 1991. *Reversing Language Shift: Theoretical and Empirical Foundations of Assistance to Threatened Languages*. Clevedon, Philadelphia and Adelaide: Multilingual Matters Ltd.
- FISHMAN, J. 2000. *Can Threatened Languages be Saved?* Clevedon, Philadelphia and Adelaide: Multilingual Matters Ltd.
- GRENOBLE, L. A. & WHALEY, L. J. (eds) 1998. *Endangered Languages*. Cambridge: Cambridge University Press.
- GRIMES, B. (ed.) 2000. *Ethnologue: Languages of the World*. 14<sup>th</sup> ed. Vols. 1 & 2. Dallas, Texas: SIL International.
- HALE, K. *et al.* 1992. "Endangered languages". *Language* 68(1): 1–42.
- HARMON, D. 1996. "Losing species, losing languages: Connections between biological and linguistic diversity". *Southwest Journal of Linguistics* 15: 89–108.
- HAUGEN, E. 1972. *The Ecology of Language*. Stanford: Stanford University Press.
- HILL, J. 2001. "Dimensions of attrition in language death", in L. Maffi (ed.) *On Biocultural Diversity: Linking Language, Knowledge and the Environment*, pp. 175–189. Washington, DC: Smithsonian Institution Press.
- HINTON, L. 1994. *Flutes of Fire: Essays on California Indian Languages*. Berkeley, CA: Heyday Books.
- HINTON, L. & HALE, K. (eds) 2001. *The Green Book of Language Revitalisation in Practice*. Orlando, FL: Academic Press.
- KAY, P. 1977. "Language evolution and speech style", in B. G. Blount & M. Sanches (eds), *Sociocultural Dimensions of Language Change*, pp. 21–33. New York: Academic Press.
- KRAUSS, M. 1992. "The world's languages in crisis". *Language* 68: 4–10.
- KRAUSS, M. 1996. "Linguistics and biology: Threatened linguistic and biological diversity compared". *CLS* 32, *Papers from the Parasession on Theory and Data in Linguistics*, pp. 69–75. Chicago: Chicago Linguistic Society.
- MAFFI, L. 1998. "Language: A resource for nature". *Nature and Resources: The UNESCO Journal on the Environment and Natural Resources Research* 34(4): 12–21.
- MAFFI, L. 2000. "Language preservation vs. language maintenance and revitalisation: Assessing concepts, approaches, and implications for the language sciences". *International Journal of the Sociology of Language* 142: 175–190.
- MAFFI, L. (ed.) 2001a. *On Biocultural Diversity: Linking Language, Knowledge and the Environment*. Washington, DC: Smithsonian Institution Press.
- MAFFI, L. 2001b. "Linking language and environment: A co-evolutionary perspective", in C. L. Crumley (ed) *New Directions in Anthropology and Environment: Intersections*, pp. 24–48. Walnut Creek, CA: AltaMira Press.
- MAFFI, L., SKUTNABB-KANGAS, T. & ANDRIANARIVO, J. 1999. "Linguistic diversity", in D. Posey (ed.) *Cultural and Spiritual Values of Biodiversity*, pp. 21–57. London and Nairobi: Intermediate Technology Publications and UN Environment Programme.
- MÜHLHÄUSLER, P. 1996. *Linguistic Ecology: Language Change and Linguistic Imperialism in the Pacific Rim*. London: Routledge.
- OVIDIO, G., MAFFI, L. & LARSEN, P. B. 2000. *Indigenous and Traditional Peoples of the World and Ecoregion Conservation: An Integrated Approach to Conserving the World's Biological and Cultural Diversity*. Gland, Switzerland: WWF-International and Terralingua.
- POSEY, D. (ed.) 1999. *Cultural and Spiritual Values of Biodiversity*. London and Nairobi: Intermediate Technology Publications and UN Environment Programme.
- ROBINS, R. H. & UHLENBECK, E. M. (eds) 1991. *Endangered Languages*. Oxford: Berg.
- SKUTNABB-KANGAS, T. 2000. *Linguistic Genocide in Education – or Worldwide Diversity and Human Rights?* Mahwah, NJ: Lawrence Erlbaum Associates.
- SKUTNABB-KANGAS, T. & PHILLIPSON, R. (eds) 1994. *Linguistic Human Rights: Overcoming Linguistic Discrimination*. Berlin and New York: Mouton de Gruyter.
- STROSS, B. 1975. "Variation and natural selection as factors in linguistic and cultural change", in M. D. Kinkade *et al.* (eds) *Linguistics and Anthropology: In Honour of C. F. Voegelin*, pp. 607–632. Lisse: Peter de Ridder.
- TERRALINGUA 1998. *Linguistic Human Rights in Education*.

Submission to the Working Group on Indigenous Populations, United Nations Centre for Human Rights. UN document E/CN.4/Sub.2/AC.4/1998/2.

THIEBERGER, N. 1990. "Language maintenance: Why bother?" *Multilingua* 9(4): 333–358.

WURM, S. A. (ed.) 1996. *Atlas of the World's Languages in Danger of Disappearing*. Paris and Canberra: UNESCO and Pacific Linguistics.

ZENT, S. 2001. "Acculturation and ethnobotanical knowledge loss among the Piaroa of Venezuela:

Demonstration of a quantitative method for the empirical study of TEK change", in L. Maffi (ed.) *On Biocultural Diversity: Linking Language, Knowledge and the Environment*, pp. 190–211. Washington, DC: Smithsonian Institution Press.