

LANGUAGE ECOLOGY

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1. Introduction

Language plus ecology = language ecology, linguistic ecology, ecolinguistics? Simple? No. The first serious sociolinguistic attempts to explore linguistic ecology pleaded for linguistics to be grounded in societal context and change. Trim 1959 and Haugen's seminal 1971 article entail multidisciplinary and build on multilingual scholarship (of the works cited by Trim, eight are in German, six in English, and four in French; academia has become more monolingual in globalization processes). Haugen refers to status, standardization, diglossia, and glottopolitics, but not to language rights (the concept did not exist then – see the entry Language Rights). Today's interpretations of what language ecology is range widely. Many researchers use "ecology" simply as a reference to "context" or "language environment", to describe language-related issues embedded in (micro or macro) sociolinguistic, educational, economic or political settings rather than de-contextualised. Here "ecology" has often become a fashionable term for simply situating language or language study in some way, i.e. it is a metaphor.

Others have more specific definitions and sub-categories (e.g. articles in Fill & Mühlhäusler, 2001; Mufwene, 2001; Mühlhäusler, 1996, 2003; and two pioneers Jørgen Chr. Bang & Jørgen Døør, see <http://www.jcbang.dk/main/ecolinguistics/index.php>). In this article, we use Wendel's 2005: 51) definition: "The ecological approach to language considers the complex web of relationships that exist between the environment, languages, and their speakers". "Environment" here means the physical, biological AND social environments. Many sociolinguists pay only lip-service to the first two.

We start with a discussion of definitions, first language-related, then ecology-related, and finally put the two together. The connecting concept for us is diversity, and the struggle for its maintenance, in nature AND culture.

2. Diversities – definitions, status and threats

2.1. Linguistic diversity

The term **language** is extremely imprecise. For defining what "language" is for our purposes analysis must engage with those power relations which are decisive for whose definitions about the relative languageness or otherwise of various idioms prevail and why (see Skutnabb-Kangas 2000, Chapter 1, for a discussion of what a language is; see also the entry Dialect). Borders of a concept are often in the perceptions of the observer rather than in the characteristics of the observed: languages are, above all, protean. One example of the porous borders is the 15th edition of the **Ethnologue** (<http://www.sil.org/ethnologue/>), the most comprehensive global source list for (mostly oral) languages, edited by Raymond G. Gordon, Jr. of the Summer Institute of Linguistics. It lists 6,912 languages, but some 41,000 names or labels for various languages.

Even if we knew what a language is, we certainly have extremely unreliable figures for the number of **speakers** for most of them, including the largest ones, where the differences of estimates of the speakers of the same language may be tens of millions (see Skutnabb-Kangas, 2000).

Languages are in most cases both known best and transmitted to the next generation by **native speakers/users'** or **mother tongue'' speakers/users** of those languages. But we are likewise using contested concepts here. Distinguishing mother tongue speakers or native speakers from those who have learned some language only later and for whom it is

not their primary means of communication in childhood (or one of them, in case of childhood bilinguals or multilinguals) is extremely tricky.

If we could define language and native speaker, we might then measure reliably the **relative linguistic diversity** of geographical units, for instance countries, through the number of languages spoken natively in the country. The most linguistically diverse countries would then be the ones with most languages. Papua New Guinea, with its over 850 languages would be the uncontested world champion.

But this way of measuring **linguistic megadiversity** has also been contested. Clinton Robinson argues that the most diverse country is not the one with the largest number of languages, but the one where the largest linguistic group represents the lowest percentage of all linguistic groups (Robinson, 1993). There is a very big difference in the list of the world's linguistically most diverse countries, depending on which of these measures we use – except for the first, Papua New Guinea, on both lists.

Measuring **cultural diversity** is even more difficult, regardless of how "culture" or "cultural traits" are defined (see, e.g., articles in Posey, ed., 1999, and Maffi, ed, 2001, for a sampling). **Biolinguistic diversity** is a more narrow concept than **biocultural diversity**; language is included in culture.

Equating language groups with cultural groups is even more risky, since there **are** many examples of non-convergence both ways: several cultural groups using the same language, or one cultural group using two or three different languages. When ethnicity, another contested concept, is added, so that we get **ethnocultural groups defined on the basis of languages**, the measures become even more fluid.

All the concepts used, language and mother tongue, culture, and ethnicity, are relational, not characteristics of people; they are social constructs, not inherited givens; they are hybrid and nomadic, dynamic and changing, not static; people may claim several of them at the same time and be multilingual and multicultural, and multiethnic, or "bicultural". All of them play ever-changing roles for people's multiple identities, and are variously focussed and emphasized in various situations and at various times; their salience is always variable. ALL identities are of course constructed to the extent that we are not born with identity genes. Even in cases where we are talking about phenotypically visible genotypical features like skin colour, very obviously the way these features are interpreted are social constructions, not innate.

But with all these caveats and challenges, it is still the case that many of those groups who demand linguistic human rights (see the entry Language rights) do claim these concepts: they claim to know what their mother tongues are and which ethnic or ethnolinguistic or ethnocultural group(s) they belong to. They see their language as a "cultural core value" (Smolicz, 1979). And there is in reality a very high degree of convergence between ethnicity, culture and mother tongue, regardless of how much liberal political scientists or post-post-modern sociolinguists want to denounce this, and "disinvent" the concepts. It seems that the same few examples of non-convergence and of loss of language, with the culture and identity still living on (the Irish, the Jews, and a few more) are

often repeated and used as proof when claiming that there is little or no relationship between language and culture. Several of the critics seem, erroneously to assume that if a concept (such as "mother tongue", "language", "ethnicity", "culture") is socially "constructed" (rather than "innate" or "inherited" or "primordial" or whatever one sees as the opposite of constructed) it is somehow a less valid concept.

Bearing in mind the intrinsic pitfalls in identifying and quantifying languages, some basics follow about linguistic diversity. There are probably between 6,500 and 10,000 **spoken (oral)** languages in the world, and possibly an equal number of **sign languages**. **Europe and the Middle East** together account for only 4% of the world's oral languages (275 according to Krauss 1992: 5). Of the 225 in Europe, 94 are "endangered" (see below). The **Americas** (North, South and Central) together account for around 1,000 of the world's oral languages, 15%. The rest, 81% of the world's oral languages, are in **Africa, Asia** (around 30% each) and the **Pacific** (just under 20%).

Nine countries in the world have more than 200 languages each, accounting for more than half the world's languages, a total of 3,490 (Krauss 1992: 6). Another 13 countries have more than 100 languages each. These top 22 countries, just over 10 percent of the world's countries, probably account for some 75 percent (over 5,000) of the world's oral languages.

The **top 10 oral languages** in the world, in terms of number of mother tongue speakers (more than 100 million speakers), (Mandarin) Chinese, Hindi, Spanish, English, Bengali, Portuguese, Arabic, Russian, Japanese and German – see Skutnabb-Kangas, Maffi & Harmon, 2003 - represent only 0.10 - 0.15% of the world's oral languages, but account for around half of the world's oral population. There are around 60 languages with **more than 10 million speakers**, together accounting for far over 4 billion people. **Less than 300** languages are spoken by communities of **1 million speakers and above**. Most languages are spoken by fairly few people. Over half of the world's (oral) and most of the Sign languages are spoken by communities of less than 10,000 speakers. And half of these, around a quarter of the world's languages, are spoken by communities of 1,000 speakers or less; around 10% of the world's languages are spoken by less than 100 speakers each. The **median** number of speakers of oral languages is probably some 5-6,000 people.

Languages are today being killedⁱⁱⁱ at a much faster pace than ever before in human history. As a consequence, linguistic diversity is disappearing.

2.2. Biological/ecological diversity

Just as the number of languages has been used as a proxy for linguistic diversity, the number of species has been used as a proxy for biodiversity. But we have very little solid knowledge of these numbers, much less than about the number of languages. Figures of between 5-15 million separate species are "considered reasonable" (Harmon, 2001: 63), with a "working figure" of about 12.5 million. But figures as low as 2 million and as high as 50 million (Maffi, 2001, Note 1) or even 100 million (Solé et al., 2003: 26) have been mentioned. The highest figures are based on the estimate that

most of the world's species (maybe up to 90%, Mishler, 2001: 71) have not yet been "discovered", i.e. named and described by (mostly Western) scientists; only some 1.5 million different species (from plants and animals to fungi, algae, bacteria and viruses) have so far been identified by natural scientists. Many may become extinct before having been studied at all.

A relatively simple global measure of ecological diversity which corresponds to a linguistic megadiversity list is **megadiversity countries**, Russell & Cristina Mittermeier's (see 1997) concept (see www.af-info.or.jp/eng/honor/essays/1997_2.html). These are "countries likely to contain the highest percentage of the global species richness" (Skutnabb-Kangas, Maffi & Harmon, 2003; see also Conservation International at <http://www.conservation.org/xp/CIWEB/publications/videos/index.xml>). Researchers have also developed concepts covering larger units where there is a high concentration of species. Ecoregions and biodiversity hotspots are important examples.

The World Wide Fund for Nature (WWF) defines an **ecoregion** as follows: "A relatively large unit of land or water containing a geographically distinct assemblage of species, natural communities, and environmental conditions" (here from Oviedo & Maffi, 2000: 1). The definition might seem fairly vague, but this is a necessary result of trying to capture the fact that for conservation work (and in general too) species and their living conditions have to be seen not as isolated but as relational, just as mother tongue and ethnicity are not characteristics of individuals or groups, but are indexical of relations, including power relations, between them and other people. WWF has identified nearly 900 ecoregions. 238 of them have been termed "Global 200 Ecoregions" because they are found "to be of the utmost importance for biological diversity" (ibid.). Most of them are in the tropical regions, just as languages are. Eric Smith's (2000: 107) account based on the 12th edition of the **Ethnologue** shows that 55.6% (3,630) of the world's endemic languages are in the tropical forest regions.

Another global measure is **biodiversity hotspots**: "relatively small regions with especially high concentrations of endemic species" (the definition is from Skutnabb-Kangas, Maffi & Harmon, 2003: 55). This concept was created by Norman Myers; see Center for Applied Biodiversity Science, <http://www.biodiversityhotspots.org/xp/Hotspots>).

2.3. Threats to diversities

"In the last five hundred years about half the known languages of the world have disappeared", according to Hans-Jürgen Sasse (1992: 7). The most optimistic prognoses of what is happening to the world's languages suggest that around the year 2100 at least 50% of today's close to 7,000 spoken languages may be extinct or very seriously endangered (with elderly speakers only and no children learning them). This estimate, originating with Michael Krauss (1992) is also used by UNESCO (see, for instance http://portal.unesco.org/culture/en/ev.php-URL_ID=8270&URL_DO=DO_TOPIC&URL_SECTION=201.html, or the position paper **Education in a Multilingual World**, UNESCO 2003c).

Pessimistic but still completely realistic estimates claim that as many as 90-95% of today's spoken languages may be extinct or very seriously endangered in less than a hundred years' time. This is Krauss' estimate today (e.g. 1996, 1997; see also Krauss, Maffi, and Yamamoto 2004). UNESCO's Intangible Cultural Heritage Unit's Ad Hoc Expert Group on Endangered Languages (see UNESCO 2003a; see also UNESCO 2003b, c) uses this more pessimistic figure in their report, **Language Vitality and Endangerment** (UNESCO 2003a). There may be only 300 to 600 oral languages left as unthreatened languages, transmitted by the parent generation to children. These would probably include most of those languages that today have more than one million speakers, and a few others. Almost all languages to disappear would be Indigenous languages, and most of today's Indigenous languages would disappear, with the exception of very few that are strong numerically (e.g., Quechua, Aymara, Bodo) and/or have official status (e.g., Māori, some Saami languages). Still more pessimistic estimates suspect that only those 40-50 languages will remain in which people can, within the next few years, talk to their stove, fridge and coffee pot, i.e. those languages into which Microsoft software, Nokia mobile phone menus, etc., are being translated (Rannut 2003). Our 2005 printer has some instructions in 32 languages, including some fairly small in numbers like Estonian, Latvian and Lithuanian. One could also use the number of languages into which Harry Potter films are being dubbed - Catalan-speaking children in Barcelona, Catalunya, staged a huge demonstration demanding that the films be dubbed into Catalan.

Nobody knows what will happen to the world's Sign languages. There is today no idea of how many Sign languages there are. The 14th version of the *Ethnologue* only listed 114 Sign languages – a veritable underestimation. There are Deaf people everywhere in the world, and where hearing people have developed spoken languages, Deaf people have developed Sign languages. These are in every respect full languages (see, e.g. Lane 1992, Ladd 2003). The World Federation of the Deaf (www.wfdeaf.org) estimates that there are some 70 million Deaf people in the world. Only in Aotearoa/New Zealand does a Sign language have an official status similar to the other official languages (in this case English and Māori). In a dozen countries Sign languages are mentioned in the constitution.

Today, linguistic diversity is disappearing much faster than biodiversity. According to conservative (i.e. optimistic) assessments, more than 5,000 species disappear every year; pessimistic evaluations claim that the figure may be up to 150,000. Using the most “optimistic” estimate of both the number of species (the high figure of 30 million) and the killing of species (the “low” figure of 5,000/year), the extinction rate is 0.017% per year. With the opposite, the most “pessimistic” estimates (5 million species; 150,000/year disappear), the yearly extinction rate is 3%.

On the other hand, researchers who use the high extinction rates often also use higher estimates for numbers of species. If the number of species is estimated at 30 million and 150,000 disappear yearly, the rate would be 0.5% per year. Many researchers seem to use yearly extinction rates which vary between 0.2% (“pessimistic realistic”) and 0.02% (“optimistic realistic” - these are our labels).

If we disregard the cumulative effect and do a simplified calculation, according to the “pessimistic realistic” prognosis, then, 20% of the biological species we have today might be dead in the year 2100, in ninety years' time. According to the “optimistic realistic” prognosis the figure would be 2%. **Optimistic** estimates, then, state that 2% of biological species but 50% of languages may be dead (or moribund) in a 100 years' time. **Pessimistic** estimates are that 20% of biological species but 90% of languages may be dead (or moribund) in ninety years' time.

Obviously the figures for extinction for biological species are much higher if we only take mammals, or birds, or only animals and plants - and these are the species best described by natural scientists - cuddly koalas are more interesting for most funders than slimy algae or invisible bacteria (agro-biotech corporations are an exception). But since we know very little about the relationships enabling healthy ecosystems (see Rapport, 1989) to be maintained, we need to use the total figures.

We could summarise the three main reasons for the disappearance of biodiversity as follows:

- The poor and powerless economic and political situation of people living in the world's most diverse ecoregions;
- Habitat destruction through logging, spread of agriculture, use of pesticides & fertilisers, deforestation, desertification, overfishing, etc. (see Diamond, 2005).
- Knowledge about how to maintain biodiversity and use nature sustainably disappears with disappearing languages.

It is especially the explication of the third reason that we turn to next.

3. Relationships between linguistic diversity and biodiversity

3.1. A correlational relationship

A comparison of the world's linguistic and biological megadiversity countries shows a very high overlap; both languages and biological species become thicker on the ground the closer to the equator one moves, and arctic areas have fewer species and languages. Conservationist David Harmon was probably the first scholar ever to put figures on the high correlations between biodiversity and linguistic and cultural diversity (1995).

When assessing the correlational relationship between biodiversity and linguistic diversity, we can use detailed types of correlation, with certain species or species groups as indicators, as Harmon did. In addition, we can use the more global measures of biodiversity presented above. Harmon compared the top 25 countries in the world with the largest numbers of, on the one hand, endemic languages (languages unique to a particular country; some 83-84% of the world's languages are endemic), and on the other hand a number of indicators of biodiversity, such as endemic higher vertebrates (mammals, birds, reptiles and amphibians) or flowering plants. 16 countries (of the 25) are on both languages and vertebrates lists, a coincidence of 64%. "It is very unlikely that this would only be accidental", Harmon concludes (1995: 6). He got similar results with flowering plants and languages: a region often has many of both, or few of both. The same is true for butterflies and

languages, and birds and languages, etc. The conclusion is that at least when using the species mentioned as indicators, there is a high correlation between countries with biological and linguistic megadiversity (see also Harmon 2002; Skutnabb-Kangas, Maffi & Harmon, 2003: 41 have later added some other biodiversity indicators). A **Framework for an Index of Biocultural Diversity** being prepared by David Harmon and Jonathan Loh shows many detailed correlations still more clearly.

Of the 6,867 ethnolinguistic groups in the world (according to the definition presented above), some 67% (4,635) were found in the **Global 200 Ecoregions** (Oviedo & Maffi 2000: 1-2). With many more detailed measures counted, the conclusion in the Executive Summary of Oviedo & Maffi, 2000 (p. 2) is as follows:

Correlations between Global 200 ecoregions as reservoirs of high biodiversity and areas of concentration of human diversity are clearly very significant, and unequivocally stress the need to involve indigenous and traditional peoples in ecoregional conservation work. Furthermore, there is evidence from many parts of the world that healthy, non-degraded ecosystems - such as dense, little disturbed tropical rainforests in places like the Amazon, Borneo or Papua New Guinea - are often inhabited **only** by indigenous and traditional peoples (emphasis added).

This also means that where we others have settled, meaning often in temperate climates, we have been a disaster to the world's biodiversity. We would obviously also have colonised and inhabited those areas which are still today relatively less degraded, had we been able to. Jarred Diamond shows convincingly that what has kept us out is the fact that we westerners have not been able to manage the climate (Diamond 1991, 1998). Even if this is true of some relatively biodiversity-poor areas too, such as the arctic areas, mostly we are talking about the biodiversity-rich tropics.

3.2. Towards causality in biocultural/biolinguistic relationships

But the relationship between linguistic and cultural diversity on the one hand and biodiversity on the other is possibly not only correlational. There seems to be mounting evidence that it might be causal. Ethnobiologists, human-ecologists and others have proposed “theories of ‘human-environment co-evolution’”, including the assumption that “cultural diversity might enhance biodiversity or vice versa” (Maffi 1996): biodiversity in the various ecosystems and humans through their languages and cultures have mutually influenced each other (e.g. Maffi, 2001; Maffi et al., 1999, Skutnabb-Kangas, Maffi & Harmon, 2003; see also www.terralingua.org). Neither type of diversity can probably be seen **directly** as an **independent** variable in relation to the other. But linguistic and cultural diversity seem to be decisive **mediating** variables in sustaining biodiversity itself, and vice versa, for as long as humans inhabit the earth.

But the evidence for a correlational relationship between biodiversity and linguistic and cultural diversity does not prove anything about a **causal** relationship. For "proving" this causal relationship, several types of knowledge would be needed. Some exists, some we have only partially at the moment; many issues have not been investigated yet. But the criteria and the whole nature of the evidence obviously also depend on

the kind of scientific paradigms used. Likewise, whether already existing evidence is seen as sufficient to lead to rapid action depends on whether short-term corporate profit or the Precautionary Principle prevails, just to take two possibilities.

As soon as humans came into existence, we started to influence the rest of nature (see Diamond, 1998 for a fascinating account on how; see also Cavalli-Sforza, 2001). Today it is safe to say that there is no “pristine nature” left - all landscapes are cultural landscapes; they have been and are influenced by human action, even those where untrained observers might not notice this immediately. The concept of **Terra nullius** (= empty land) has finally been invalidated.

But the various ways that different peoples influence their environments were and are filtered through their cultural patterns - we can, for example, think of simple examples, comparing the attitudes to the meat of cows, pigs, dogs or rats as human food, and the implications of this to the occurrence, spread and life conditions of the animals. Or while more than 40,000 edible plants were known to the Aboriginal inhabitants of South Australia, very few of them have found their way to the plates of the European invaders. The Europeans have neither lexicalised these items of food nor used them (Mühlhäusler, 2003: 59). If one does not “see” them or sees them as “weeds” (see Crosby, 1994), they are more likely to disappear. We have a similar but smaller-scale difference in the use of mushrooms between the Finns and the Germans on the one hand - they name and use mushrooms - and the British on the other hand who don't.

On the other hand, local nature and people's detailed knowledge about it and use of it have influenced the perceptions, cultures, languages and cosmologies of the people who have been dependent on it for their sustenance. To remain with food examples, if the areas where people have lived for a long time have plenty of animal protein but little of plant protein as, for instance, in the Arctic areas, it is unlikely that religions which support vegetarianism could have developed - and they haven't.

UNEP's (United Nations Environmental Program^{iv}, <http://www.unep.org/>) mega-volume, **Cultural and Spiritual Values of Biodiversity. A Complementary Contribution to the Global Biodiversity Assessment** (Posey, ed. 1999) summarises some of this evidence of causality. Likewise, articles in **On Biocultural Diversity. Linking Language, Knowledge and the Environment** (Maffi, ed., 2001) illustrate it.

This relationship and mutual influence between all kinds of diversities is of course what most indigenous peoples have always known. Some describe their knowledge in the UNEP volume. The conservation traditions that promote the sustainable use of land and natural resources, expressed in the native languages, are, “what Hazel Henderson called ‘the cultural DNA’ that can help us create sustainable economies in healthy ecosystems on this, the only planet we have (Gell-Mann, 1994: 292)”, quoted in Nations (2001: 470).

3.3. Traditional ecological knowledge encoded in small (indigenous and local) languages and its disappearance

To discuss this indigenous knowledge and its present uses further and to highlight its disappearance, we need first to remind ourselves of the fact that the least biodiversity-wise degraded areas tend to be areas inhabited

by indigenous peoples only. Since the degradation is mainly created by humans, a conclusion is that those indigenous peoples who have not been colonised by others, have been and are important agents in the maintenance of biodiversity. The knowledge they have when interacting with (the rest of) nature in non-degrading ways is part of what has been called "traditional ecological knowledge" (TEK),

in-depth knowledge of plant and animal species, their mutual relationships, and local ecosystems held by indigenous or traditional communities, developed and handed down through generations (Skutnabb-Kangas, Maffi & Harmon 2003, Glossary, p 56).

The classifications of animals and plants obviously reflect the environment where people live. But they develop over a long time, and this largely explains why indigenous peoples have not necessarily been good guardians of their environments. Even in terms of vocabulary for describing the environment, Mühlhäusler (2003) estimates on the basis of his pilot studies on "desert islands" and Creole situations (Norfolk Island, Mauritius, New Zealand, St Helena, St Kitts and several others, p. 59) that "about 300 years are needed for a match between a language and the biological environment of its speakers to come about" (ibid.: 37). Before that there is "a major discrepancy between what people can name and what they need to name to sustain their island environment" (ibid.: 59).

In situations where people move to a new place with their old language, this is initially "ill-suited to the task of talking about" the new environment (ibid.: 46) because of the "considerable initial mismatch between linguistic categories and natural boundaries" (ibid.: 59). The likelihood is that they may ruin much of that environment before they start to understand, classify and name it, regardless of whether there are already other people living there who had a "perfect" understanding of the biodiversity around them (like in Australia) or not (as in Aotearoa/New Zealand when the first Māoris arrived a millennium ago). In the absence of lexicalisation, people "under-utilize or over-exploit their environment" (ibid.: 59).

Even if the vocabulary is there, people may still be "environmentally illiterate", i.e. unable to name animals, plants and features of the landscape (Mühlhäusler 2003: 41), for instance in urban contexts or if their technologically oriented worldview sees nature as a passive "ecomachine", for humans to use and exploit as they please - this is partly what enables the "growthism ideology" (ibid.: 132) to continue.

But it is not only the vocabulary of languages that is culture-specific - Mühlhäusler also claims, with many others (e.g. Michael Halliday, 2001) that grammars are "fossilized experience". Each grammar "can be seen as a repository of past experience, as the outcome of a very long process of adaptation to specific environmental conditions" (ibid.: 120); this is a result of the fact that "each language is functionally integrated with a vast array of grammar-external parameters" (ibid.). Discussing various aspects of grammar (pronouns, transitivity, passives, ergativity, tense/time, abstract nouns and nominalizations, binominals, counterfactuals), Mühlhäusler shows how various perspectives on the world are privileged

depending on the grammatical structures of various languages. This also implies that "there could be a discrepancy between past functionality and present day requirements" (ibid.: 100)^v. His arguments about the grammatical structures of the "European" languages making it easier, for instance through nominalizations, to construct issues like polluting as commodities to be bought and sold - the Kyoto negotiations come to mind - and to hide agency - things just happen - are amply illustrated in several detailed articles in the **Ecolinguistic Reader** (2001), edited by Fill and Mühlhäusler.

Another type of proof of causality could be to be able to show that it is likely that the knowledge about how to maintain aspects of biodiversity (and thus the practice of doing it) disappears if a language disappears. Luisa Maffi showed in her doctoral dissertation (1994) that nuances in the knowledge about medicinal plants and their use disappear when indigenous youth in Mexico become bilingual without teaching in and through the medium of their own languages - the knowledge is not transferred to Spanish which does not have the vocabulary for these nuances or the discourses needed (see also Nabhan, 2001, Carlson, 2001).

Pekka Aikio, the President of the Saami Parliament in Finland (personal communication, 29 November 2001) reported that Finnish fish biologists had just "discovered" that salmon can use even extremely small rivulets leading to the river Teno, as spawning ground - earlier this was thought impossible. Pekka stated that the Saami have always known this - the traditional Saami names of several of those rivulets often include the Saami word for "salmon spawning-bed". This is ecological knowledge inscribed in indigenous languages. This example shows that it is possible for Western researchers to discover for themselves the knowledge that has already been encoded in the indigenous language - but, as in this case, probably at least a millennium later than the indigenous people had it. But in many cases, the knowledge may disappear in ways where a western scientific retrieval is impossible, for many reasons, including all those material reasons which are causal factors in the disappearance of both biodiversity and linguistic diversity. And in many cases a rediscovery of the knowledge may come too late in any case.

3.4. Processes in the disappearance of traditional knowledge through hierarchisation of languages and knowledges in education

Some critics accuse those worried about endangered languages^{vi} of wanting to preserve/conservate indigenous and minority languages and knowledges in some kind of museal conditions. According to them, we are preventing indigenous peoples from becoming modern, implying that they want to assimilate into larger, mostly western, languages and cultures, at the cost of their own. "Traditional" to these researchers still seems to mean backward, static, non-scientific, foreclosing all economic and social mobility and opportunities^{vii}.

In fact, in many cases, as Oviedo and Maffi state (2000: 6), TEK "is found to be more complete and accurate than Western scientific knowledge of local environments" (ibid., 6-7). Several articles in Maffi (ed., 2001) and Posey (ed., 1999) also testify to this. Few people seem to

know, for instance, that Linnéan categories were based on ancient Saami categorisation of nature (Gutierrez-Vazquez, 1989: 77). This knowledge is in no way static either, as the Four Directions Council in Canada (1996, quoted from Posey, 1999: 4) describes:

What is "traditional" about traditional knowledge is not its antiquity, but *the way it is acquired and used*. In other words, the social process of learning and sharing knowledge, which is unique to each indigenous culture, lies at the very heart of its "traditionality". Much of this knowledge is actually quite new, but it has a social meaning, and legal character, entirely unlike the knowledge indigenous people acquire from settlers and industrialized societies.

And it is exactly this transmission process that is at grave risk as soon as indigenous children attend schools where their languages are not the main teaching languages and where their cultural practices do not permeate the learning processes. This is linguistic and cultural genocide, according to articles IIb and IIe of the UN 1948 Genocide Convention (see Skutnabb-Kangas 2000). The 2002 report **Science, Traditional Knowledge and Sustainable Development** by the International Council for Science (ICSU - see www.icsu.org) shows very clearly that TEK is seen as containing a great deal of knowledge unknown to and of utmost importance to (western) science, and that scientists are worried about the diminishing transmission of it. ICSU's stance agrees fully with the importance of linguistic and cultural human rights in education even if they do not formulate their worries in human rights terms:

Universal education programs provide important tools for human development, but they may also compromise the transmission of indigenous language and knowledge. Inadvertently, they may contribute to the erosion of cultural diversity, a loss of social cohesion and the alienation and disorientation of youth. [...] In short, when indigenous children are taught in science class that the natural world is ordered as scientists believe it functions, then the validity and authority of their parents' and grandparents' knowledge is denied. While their parents may possess an extensive and sophisticated understanding of the local environment, classroom instruction implicitly informs that science is the ultimate authority for interpreting "reality" and by extension local indigenous knowledge is second rate and obsolete. [...] Actions are urgently needed to enhance the intergenerational transmission of local and indigenous knowledge. [...] Traditional knowledge conservation therefore must pass through the pathways of conserving language (as language is an essential tool for culturally-appropriate encoding of knowledge). (from various pages in ICSU 24).

Since TEK is necessarily encoded into the local languages of the peoples whose knowledge it is, this means that if these local languages disappear, without the knowledge being transferred to other, bigger languages, the knowledge is lost. We then have to ask the two questions: Has the knowledge been transferred to other languages? The answer is No. Are the languages disappearing? The answer is Yes. Michael Warren, one of the people first using the concept of indigenous knowledge, echoes ICSU when he concludes (2001: 448):

Of major concern is the rapid loss of the knowledge of many communities as universal formal education is enforced with a curriculum that usually ignores the contributions of local communities to global knowledge. The loss of knowledge is linked indelibly to language extinction since language is the major mechanism for preserving and transmitting a community's knowledge from one generation to another.

In this perspective, the first conference investigating this relationship between humans and their environment "Endangered Languages, Endangered Knowledge, Endangered Environments" (see Maffi (ed.) 2000) stressed "the need to address the foreseeable consequences of massive disruption of such long-standing interactions" [i.e. the human-environment co-evolution]" (Maffi 1996). The processes of language loss also "affect the maintenance of traditional environmental knowledge - from loss of biosystematic lexicon to loss of traditional stories" (ibid.). Thus loss of languages on a massive scale may also entail loss of some of the basic prerequisites for maintaining life on the planet.

Linguistics in its structuralist forms has tended until recently to concentrate on the forms of language rather than its social functions. Sociolinguistics and the sociology of language have brought in contexts of use but seldom addressed issues of language and power. Such key concepts as diglossia have suffered from the absence of any anchoring in social theory, as indeed has much work in language planning (Williams 1992). As a result there tends to be little clarification of the causes of linguistic hierarchies or of the implications for language ecology. Languages do not in fact "spread" without agents, just as language "death" and "attrition" are not "natural" processes, analogous to biological processes: agents have often willed and caused linguistic death and continue to do so.

Dominant languages are legitimated through processes of hegemonic saturation in public discourse, the media and public education to the point where their learning, involving subtractive language shift (i.e. adopting the dominant language involves loss of the first language^{viii}), is accepted as natural, normal and incontestable. Linguistic hierarchies and a stratifying education system reflect monolingual ideologies, a particular model of society and particular interests, namely those of dominant groups.

The maintenance and continuous reconstruction of these hierarchical relationships between users of languages usually involves a pattern of stigmatisation of dominated languages (barbarian, patois, ...), glorification of the dominant language (the language of reason, logic, progress etc) and a rationalisation of the relationship between the languages and their speakers, always to the benefit of the dominant one and making it seem as if they are "helping" the dominated ones. Knowledges encoded in and transmitted through these languages are hierarchised through similar processes. "Aid" organisations and many NGOs often seem to function as yesterday's missionaries, with similar consequences. Linguistic hierarchies reminiscent of the colonial period underpin much World Bank and IMF education policy, which currently sets the tone for "aid" alongside notoriously anti-social, poverty-inducing structural adjustment policies. A study of the World Bank's investment in education reveals that there is a rhetoric of support for local languages, but in fact the policies serve to consolidate the imperial languages in Africa (Mazrui 1997). Linguistic imperialism is underpinned by the belief that only European languages are suited to the task of developing African economies and minds, the falsity of which many African scholars have shown (Ansre, Bamgbose, Kashoki, Mateene, Ngũgĩ, see references in Phillipson 1992).

4. Work to counteract ecolinguistic threats and promote the survival of diversities

Signed by 150 states at the 1992 Rio Earth Summit, the Convention on Biological Diversity, dedicated to promoting sustainable development, is the most important international treaty on ecology. It recognizes that biological diversity is about more than plants, animals and micro organisms and their ecosystems – it is also about people and their environment (see <http://www.biodiv.org/convention/default.shtml>), and here languages are included. In its Article 8j about traditional knowledge, each of the states promises,

(j) Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices.

Further work on the Convention stresses the interlocking of language and ecology in traditional knowledge and its inter-generational transfer:

Traditional knowledge refers to the knowledge, innovations and practices of indigenous and local communities around the world. Developed from experience gained over the centuries and adapted to the local culture and environment, traditional knowledge is transmitted orally from generation to generation. It tends to be collectively owned and takes the form of stories, songs, folklore, proverbs, cultural values, beliefs, rituals, community laws, local language, and agricultural practices, including the development of plant species and animal breeds (see <http://www.biodiv.org/programmes/socio-eco/traditional/>).

Several international organisations work for the promotion of linguistic diversity. Some collect and/or analyse the basic data (e.g. the **Ethnologue**, or UNESCO (Martí et al., 2005), **International Clearing House for Endangered Languages** in Tokyo, all UNESCO's endangered languages-related projects (start from http://portal.unesco.org/culture/en/ev.php-URL_ID=8270&URL_DO=DO_TOPIC&URL_SECTION=201.html). The **European Bureau for Lesser Used Languages**, EBLUL (www.eblul.org), is an example of proactive work to counter the minorisation of languages in European Union countries. **Terralingua** (www.terralingua.org) is devoted to preserving the world's linguistic diversity and to investigating links between biological and cultural diversity and its web-site has lists of and links to organisations working with both endangered languages, including various types of “salvage operations”, and with language rights.

Language scholars who have discussed the ecology of languages, starting with Trim and Haugen (e.g. 1972) have been aware of the threat and many are trying to counteract it, through analysis and action (see, e.g. Brenzinger (ed.) 1992, Fill 1993, 1998, Fishman 1991, Grenoble & Whaley 1996, 1998, Hinton 1994, Huss 1999, Mühlhäusler 1996, Phillipson & Skutnabb-Kangas

1996). In the struggle against linguisticism (Skutnabb-Kangas, 1988), linguistic imperialism (Phillipson, 1992) and domination, speakers of threatened languages are using many strategies (see the entry Language Rights). Revitalisation and even the reclaiming of earlier minorised languages are also taking place. It is a promising development that organisations and projects such as UNEP or **2010 Biodiversity Indicators Partnership** now accept the multidisciplinary ecolinguistic principle that we in Terralingua have advocated, expressed by the latter in a statement that summarises many of the arguments of this entry^{ix}:

There is a fundamental linkage between language and traditional knowledge related to biodiversity. As languages go extinct, there is an irrecoverable loss of unique cultural, historical and ecological knowledge. Local and indigenous communities have elaborated complex classification systems for the natural world, reflecting a deep understanding of local flora, fauna, ecological relations and ecosystem dynamics. This traditional ecological knowledge is both expressed and transmitted through the local or indigenous language. When young people no longer learn the language of their ancestors, or know it only partially and instead learn and use another majority or dominant language, the special knowledge incorporated in their ancestral language is often not transferred to the dominant language that replaces it. Commonly, this is because the dominant language does not have the vocabulary for this special knowledge, or even because the very situations in which this kind of knowledge and its relevance for survival are learned do not occur in the dominant culture. Information on status and trends of numbers of speakers of indigenous languages may therefore be used as a proxy for measuring trends in the status of traditional knowledge, innovations and practices.

4. To conclude

Colin Baker sums up the importance of ecological diversity in his review of Skutnabb-Kangas, 2000 (Baker, 2001: 281).

Ecological diversity is essential for long-term planetary survival. Diversity contains the potential for adaptation. Uniformity can endanger a species by providing inflexibility and unadaptability. As languages and cultures die, the testimony of human intellectual achievement is lessened. In the language of ecology, the strongest ecosystems are those that are the most diverse. Diversity is directly related to stability; variety is important for long-term survival. Our success on this planet has been due to an ability to adapt to different kinds of environment over thousands of years. Such ability is born out of diversity. Thus language and cultural diversity maximises chances of human success and adaptability.

Biocultural diversity is thus essential for long-term planetary survival because it enhances creativity and adaptability and thus stability. We envisage a balanced ecology of languages as a linguascape where interaction between users of languages does not allow one or a few to spread at the cost of others and where diversity is maintained for the long-term survival of humankind (as Baker, 2001 suggests). If the detailed knowledge, encoded in small indigenous languages, about the complexities of biodiversity and how to manage ecosystems sustainably, is to be maintained, the languages and cultures need to have better conditions: they need to be transferred from one generation to the next, in families

and through schools. Researchers need to understand and challenge the unequal power relationships implicated in the destruction of language ecologies.

If global linguistic diversity is not to suffer irreparable attrition, as a result of linguistic genocide, major changes are needed in educational language policy. Strategies to counteract the linguistic dominance and hierarchisation that may ultimately lead to the disappearance of the majority of today's languages are urgently needed. Today's efforts are completely insufficient.

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ⁱ We use the double form to indicate that Signers, representing a large number of the world's languages, do not "speak" Sign languages. In all instances when we use "speaker", this means "speaker/signer", and "language" includes Sign languages.

ⁱⁱ See Skutnabb-Kangas 1984, 2000, for probably the most thorough existing systematisations of these definitions.

ⁱⁱⁱ Using "killed" rather than "dying" or "disappearing" highlights the fact that it is neither "natural" (in the same sense as for biological organisms) nor agentless for languages to disappear. And if there are agents responsible for and/or contributing to the killing, the scope for action may also be broader than if one thinks one is fighting against a "natural development". Processes leading to linguistic assimilation and therefore often languages disappearing include linguistic genocide. Besides, all the verbs, kill, disappear, die, are equally metaphorical.

^{iv} UNEP was one of the organisers of the World Summit on Biodiversity in Rio de Janeiro in 1992; see its summary of the knowledge on biodiversity, Heywood, ed., 1995.

^v For a partial scepticism in relation to this view, see, e.g. Jung 2001.

^{vi} See UNESCO 2003 a, b, c, for some cautious attempts to support endangered languages, also in education.

^{vii} Stephen May's 2003 article presents a summary and reflective theoretical and empirical critique of these misconceptions.

^{viii} **Subtractive spread of languages** - incoming language first *displaces*, then *replaces* original languages. Often a result of linguistic imperialism (see Phillipson 1992).

Subtractive language learning - a new (dominant/majority) language is learned **at the cost** of the mother tongue which is displaced, with a diglossic situation as a consequence, and is sometimes replaced. The person's total linguistic repertoire does not show (much) growth as a result of the learning.

Additive spread of languages - incoming language is initially used for new functions ('neoplacement'), but does not replace original languages which continue to be used and developed, even if some diglossia may occur. Later, terms in the original language may develop for the neoplaced concepts.

Additive language learning - a new language is learned **in addition** to the mother tongue which continues to be used and developed. The person's total linguistic repertoire is extended (Skutnabb-Kangas 2000: 72). Seeing some language rights as human rights, with the protection that these enjoy, can support additive rather than subtractive (or replacive, Haugen, 1972) language learning and facilitate the maintenance of linguistic diversity.

^{ix} It can be found under their Indicator Status of Traditional Knowledge, Innovations, and Practices, [Status and trends of linguistic diversity and numbers of speakers](http://www.twentyten.net/focal_area/focal5.htm#f5.1) (http://www.twentyten.net/focal_area/focal5.htm#f5.1).