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COMMONALITIES BETWEEN CULTURAL AND BIO-DIVERSITY

Term Paper

by

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Executive Summary

Language, religions and knowledge diversities and the environment diversities have been intimately related throughout human history. However, it is only in our era of globalization, on the light of the continuing process of extinction of cultural and biological diversity, that natural and social sciences have increased their attention on the complex and diverse phenomena of the human relationship with the environment.

The growing recognition of the commonalities and the interlinkages of these dual realms of diversity and the fact that the breakdown of these connections underlies many of the environmental and social problems humanity is facing, have let to frame a new field called “biocultural diversity”, which is defined as the total variety exhibited by the world’s natural and cultural systems.

The main objective of this term paper is to introduce the recent and not yet widespread concept of biocultural diversity and to show some exemplary preliminary qualitative and quantitative results of scholars regarding the relations between biological and cultural diversity dimensions which suggest that, success in conserving biological diversity may well be interrelated to the maintenance of cultural diversity, and that, conversely, the loss of cultural diversity is part and parcel of the same socio-economic and political processes leading to biodiversity loss.

Acronyms

BD	Biological Diversity
CBD	Convention on Biological Diversity
CD	Cultural Diversity
ED	Ethnic Group Diversity
IBCD	Index on Biocultural Diversity
IUNC	International Union for the Conservation of the Nature
LD	Language Diversity
RD	Religion Diversity
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environmental Program
WRI	World Resources Institute
WWF	World Wildlife Fund
UNESCO	United Nations Educational, Scientific and Cultural Organization

"Biodiversity is not an object to be conserved. It is an integral part of human existence, in which utilization is part of the celebration of life"
(Posey 1999: 7).

1. Introduction: the diversity of life

The most striking characteristic of life on Earth is its enormous diversity. The diversity of life on Earth is formed not only by the variety of plant and animal species and ecosystems found in nature (biodiversity), but also by the variety of cultures, languages, religions and philosophies in human societies (cultural diversity). The relationships between biological and cultural diversity, and the growing threats they face in common, have drawn increasing attention over the last decade. Concerns about these dual realms of diversity have found their way into the 1992 United Nations Conference on Environment and Development (UNCED) – the Earth Summit in Rio de Janeiro and they are reflected in the ensuing international action plans and instruments (Agenda 21; Rio Declaration; Convention on Biological Diversity [CBD], and subsequent others), as well as in major global biodiversity conservation plans and policies (WRI/IUCN/UNEP 1992; UNEP 1995; IUCN 1997; IUCN/WWF 1998; WWF 1998b).

During the 1990s, it became increasingly apparent that human relationship with the environment is a highly complex and diverse phenomenon and that, the biodiversity crisis should be understood on the basis of a more detailed evaluation of the interactions among a wide range of social, cultural, economic, political and ecological variables.

This perspective has led to rise, in both the environmental and the social sciences, of an integrated *biocultural* approach to the planet's environmental crisis, suggesting that success in conserving biological diversity may well be interrelated to the maintenance of cultural diversity, and that, conversely, the loss of cultural diversity is part and parcel of the same socio-economic and political processes leading to biodiversity loss.

This term paper attempts to: 1) describe both world's biodiversity and its cultural diversity; 2) present the threats that each of them is facing; 3) frame the concept of biocultural diversity in order to show the interlinkages and commonalities between linguistic, religious, cultural and biological diversity; 4) present a quantitative measurement of biocultural diversity.

2. Biodiversity

2.1 What is Biodiversity?

Biological diversity – or biodiversity- is the term given to the variety of life on the earth and the natural patterns it forms (CBD).

The history of the natural world is the history of the increase in the number of species of living organisms over time. So far about 1.75 million different species of plants, animals, fungi, algae, bacteria and viruses have been identified. And that figure is small compared to the total number of species that scientists believe may exist on the planet. Biologists reckon that the number of species currently living on Earth may range between 5 and 15

million, though estimates range from 3 to 100 million. Scientific evidence indicates that most natural diversity is concentrated in the tropical regions of the planet. The highest species diversity is found in the forests of the tropics (such as the rain forests of the Amazon Basin in South America, the Congo Basin in central Africa, and many parts of South Asia and the Pacific), as well as in certain marine and coastal environments (such as coral reefs and mangroves).

However, a remarkable variety of plant and animal species exists in all kinds of environments. This includes tundra (the treeless plains of the Arctic regions) and deserts, whose flora and fauna often include species that are rare or endemic*.

2.2 Why should we conserve biodiversity?

Biodiversity is essential to the healthy functioning of ecosystems (the systems formed by the interactions of living organisms with their environments) and to the ability of ecosystems to provide their vital service. These « ecosystem services » include recycling soil nutrients, pollination, purifying the air, and providing fresh water as well as biological materials for food, fibre, and fuel.

Diversity is the basic condition of the natural world, diversity is what makes environments resilient, that is, able to adapt to change and successfully tolerate climate variation, natural disasters, infestations of pests, and other potentially destructive conditions. It is the combination of life forms and their interactions with each other and with the rest of the environment that has made earth a uniquely habitable place for humans.

Biological resources are the pillars upon which we build civilizations. Nature's products support such diverse industries as agriculture, cosmetics, pharmaceuticals, pulp and paper, horticulture, construction and waste treatment.

This means that we need to conserve biodiversity because all life, including human life, our personal health and the health of our economy and human society depend on the continuous supply of the good and services provided by ecosystems which are extremely costly if not even impossible to replace.

3. Cultural Diversity

3.1 What are culture and cultural diversity?

Cultural diversity along biodiversity has become better known in the last decades. But defining cultural diversity has always been challenging and differs in different spheres such as political, academic and cultural. Culture as the core of the definition is a concept which has many facets. Culture originated from the Latin word "colere" meaning "care for" or "look after" in term of agriculture, then Cicero (106-43 BC) introduced the concept of "cultura" referring material and spiritual products and abilities (Schäfers, 2000). Western belletrists held the "restrict view" that culture refers to literature, painting, architecture and the traditional performing arts like theatre, opera etc. The aim of protecting culture is to show it to a wide range of audiences. Social scientists have created a broader semantic of culture by defining culture as "rules of social behaviour and ways of relating to others and to the world being slowly assimilated by each member of a

* That is, they exist in a particular region only.

given community” (UNESCO, 2002). The 1982 World Conference on Cultural Policies gave culture an anthropological frame which resulted in a wide used definition today: “[...]culture should be regarded as the set of distinctive spiritual, material, intellectual and emotional features of a society or social group, and [...] encompasses, in addition to art and literature, lifestyles, ways of living together, value systems, traditions and beliefs” (UNESCO, 2002).

Similar to the definition of culture, cultural diversity is in a process of being defined in equally ambitious terms. According to UNESCO Universal Declaration on Cultural Diversity it is defined as “a source of exchange, innovation and creativity, cultural diversity is as necessary for humankind as biodiversity is for nature” (UNESCO, 2002). Cultural diversity is also seen as a “mechanism that assures that creativity, dignity and tolerance will be partners rather than victims in the design of models for sustainable development” (UNESCO, 2002). Another definition is offered by the GBS (Global Biodiversity Strategy): “The variety or multiformity of human social structures, belief systems, and strategies for adapting to situations in different parts of the world” (et al. Saunier, Richard E, 2004). One can see not only culture is defined differently by different stakeholders, but there is also a large range of definitions for cultural diversity. Every definition covers a certain facet of the cultural diversity concept, for political stakeholders have specific political goals and their implementation in mind whereas different academic disciplines try to convey their different perspectives. This results in an unclear boundary concept of culture and culture diversity, nevertheless a certain truth exists in every definition. And it is not an urging necessity to enhance the conservation of cultural diversity by creating a universal concept.

3.2 Why should we conserve cultural diversity?

A philosophical thought of diversity can be traced back to James Knew. He believed that diversity are means through which consciousness operates. Human beings are born to diversity, and the capacity for discerning and classifying difference is basic definitive of humanity. Pluralism makes “the very life we lead seem real and earnest” (Harmon, 2001). Diversity surely not only has the function of the “philosophical merit”, but is also essential to the survival of humankind.

“Culture takes diverse forms across time and space. This diversity is embodied in the uniqueness and plurality of the identities of the groups and societies making up humankind” (UNESCO, 2002). Culture is a fundamental element which differentiates animals and homo sapiens. To keep human beings humane means to conserve cultural diversity, for culture can only develop further if a basis of variety is provided to avoid stagnation. Without this variety no new difference can be generated which will inevitably lead to “cultural blind spots”, meaning “undetected instances in which the prevailing cultural model fail to provide adequate solutions to social problems” (Maffi, 1998). That’s why we have to “keep the option alive” to tackle the emerging issues. Only by enhancing more understandings one can gain more reliable knowledge. “Ecology shows that a variety of forms is a prerequisite for biological survival. Monocultures are vulnerable and easily destroyed. Plurality in human ecology functions in the same way” (Maffi, 1998).

Culture is a motor for development and culture diversity is a renewable resource for linking cultural values and material well-being, hence indispensable for the sustainable development in the long term run.

4. Linkages and interaction between biodiversity and cultural diversity

Diversity is not only a characteristic of the natural world. The idea of “diversity of life” goes beyond biodiversity. It includes the cultural and linguistic diversity found among human societies. The history of the human species is part and parcel of the history of life on earth, ever since the first species of our genus homo (which means “human”), *Homo habilis*, appeared in Africa probably about 2,5 million years ago. And the world’s diversity is interlinked. Due to the efforts of scholars from different disciplines the mutuality between biodiversity and cultural diversity is widely recognised. Nevertheless, how biodiversity and cultural diversity are interlinked and how they interact with each other still needs to be studied further. The objective of the paragraph below is not to cover all aspects related to the world’s diversity, but to introduce the concept of biocultural diversity and to show some exemplary preliminary results of scholars regarding the relations between biodiversity and some cultural dimensions such as language, beliefs and indigenous knowledge.

4.1 *The concept of biocultural diversity*

Biocultural diversity is defined as “The diversity of life on earth in both nature and culture” (UNESCO – Terralingua – World Wild Fund for Nature, 2003). It is well known that ecological diversity is a guarantee for the long-term survival for humankind. Ecosystem is dedicatedly interwoven. Damage to elements in ecosystem could have unpredictable impact on the well-being of humankind. Diversity has enabled species to adapt to natural environment for survival. Losing biodiversity means losing the adaptability which leads to extinction of species. The same applies to cultural diversity. The literature about cultural diversity offers two main approaches to explain how cultural diversity comes into being: “The phylogenetic perspective sees it as a branching process of speciation and extinction, akin to biogenetic phylogenies.” (Smith, 2001) This means that cultural diversity is generated through isolation and chanced by historical factors. But this approach does not apply to non-linguistic diversity. The adaptationist perspective explains cultural diversity with the process in which human beings develop their culture catering their natural environment. In this case the occurrence of cultural diversity is closely related to the natural environment people live in. Simultaneously communities developed in-depth knowledge of local systems through using ecosystem services to meet their needs for life including material, cultural and spiritual requirements. The knowledge they gained over time through these activities is an essential support to conserve the biodiversity. That is to say, that culture and ecosystem have coevolved in the history of human civilization (Smith, 2001) Likewise, the extinction crises can have a mutual impact on both of the biocultural systems as well. To conserve these two systems it is vital to focus on identifying, recognising and understanding the “inextricable link” between them and this is what the concept of biocultural diversity is about.

4.2 Biodiversity and world religions/philosophies

As mentioned above culture is defined very diversely by different disciplines over time, but most of the definitions include religions and philosophies as an integral part of culture. World's religions and philosophies all express their own interpretations about the relations between human beings and nature. This part of the term paper purposes to take Christianity as the major western religion and some of the oriental religions as examples to show how they are linked with the conservation of biodiversity and the debate which role religion has in shaping environmental attitudes.

According to Sonia P. Juvik (Juvik, 1993) there are three basic viewpoints of the world's religions and philosophies concerning the relationship between humans and nature which can affect the preservation of biological diversity:

1. Nature and the creator are one. People should have respect and fear for the sacredness of natural objects.
2. human beings and nature are equally important; human beings are stewards of the land and must seek and harmonize with natural processes. This belief system includes eastern religions like Taoism and Buddhism.
3. The Christianity created a hierarchy by putting God above human beings, human beings above nature.

A conclusion is drawn that Christianity representing the western world can easily evolve into an ecological destructive capitalism, because Christianity foster human superiority over and contemptuousness of nature. The bible story that the language diversity is a curse of God to make human beings have difficulties to communicate with each other is seen by some as an example for a religious approach in favour of monoculture. (Maffi 1998)

Comparing to western religion, oriental religions such as Buddhism, Confucianism and Taoism have strong orientation toward nature, conceive of divine power as impersonal and believe world and man eternal and uncreated. Buddhism advocates respect and compassion toward all life. It is argued that tropical forests are favourable places to meditate because of their natural and peaceful environment, many temples are built in forests. Since these forests are considered as sacred space, biodiversity is thus preserved (Sponsel, 1993).

Confucianism and Taoism, two of the major Chinese religions and philosophies introduced the concept of the unity of nature and human beings. This concept traced back to the creation of the Chinese character, “天”, meaning “nature”. The character contains three parts which include the meanings of earth and human. The creation of this character shows the Chinese way of thinking toward the world. Both Taoism and Confucianism believe in the need for harmony between nature and human beings. They appraise “simple way of life” and discourage technological development. They view technology as a danger which may destroy the simplicity of “heart” and lead to uncontrollable state of mind, thus the way to wisdom will be lost (sishuwujing, 1983). Apparently such kind of approach to world is in favour of the conservation of nature and sustainable use of natural resources, however, the environmental problems in China show that the reality is not in accord with the traditional ideology.

It may be true that some of the religious ideas are more in favour of the ecosystem and nature and some are less. But whether there is a cultural mechanism as such which contributes to the biological conservation or whether it is only the modern illusion about

the wisdom of the past, it still needs to be further explored. If such a cultural mechanism exists, research has to be carried out on how this mechanism works and how it maintain its power under the overwhelming force of market economy.

4.3 Biodiversity and languages and indigenous knowledge

The correlation between linguistic and cultural diversity and biodiversity becomes visible if one compares the geographical distribution of these diversities. According to the booklet of UNESCO – Terralingua – World Wild Fund for Nature published 2003 it is found out those 7 out of 9 high ranking countries for linguistic diversity are covered by 17 high ranking countries for biological diversity. The 25 top countries for the number of endemic languages include 13 of 17 biological megadiversity countries. They also found out humid tropical climates appear to be especially favourable to both biological and linguistic diversity.

Unfortunately tropical forests are often threatened areas where the languages are facing extinction as well. Due to socio-economic and political change unsustainable land use and exploitation of natural resources with agribusiness, cattle ranching, logging, mining, oil drilling, construction of big dams and urban development become normal practices endangering the ecosystem. Losing traditional way of life and values in favour of environment accelerate this process. Communities begin to adopt ways of dealing with environment which are not adapted to local conditions and subsequently do damage to local ecosystem. This in turn, causes language and culture shift, which means to replace the endemic language and traditional culture with a majority language and dominant culture. Consequently local ecological knowledge and experience disappear gradually, with it the language through which the knowledge and experience are shared and communicated fades out. On the one hand, the loss of indigenous ecological knowledge and language leads to more vulnerability of ecosystem; on the other hand the degradation of ecosystem may generate further loss of knowledge and language. Linguistic ecologies “encompass not only the linguistic and social environment, but also the physical environment, within a worldview in which physical reality are not seen as separate phenomena, but instead as interrelated parts of a whole” (Maffi, 1998). This fact has been shown in the case of the Yoem pueblo of the Yaqui people of the Sonoran Desert, Arizona. The inability of Yoem elders to perform rituals correctly is due to environmental degradation resulting in language and knowledge loss, which in turn affects the local system by creating a vicious circle (Maffi, 1998).

Language and indigenous knowledge are as important as ecosystem and intimately linked with each other. Fostering the health and vigour of ecosystem is one and the same goal as fostering the health and vigour of human societies, their cultures, and their languages.

5. Common threats to the world’s diversity

5.1 The process of extinction of biodiversity

The rich biological diversity on our planet is the outcome of over 3.5 billion years of evolutionary history. It has been shaped by forces such as changes in the planet’s crust, ice ages, fire, and interaction among species. But, from the dawn of agriculture, some

10,000 years ago, through the industrial revolution of the past three centuries, human beings have been first actors in altering and recompensing landscapes and natural resources.

As is well known, the world's biodiversity is at extreme risk. Biologists speak of a massive « extinction crisis », that is, a world-wide loss of plant and animal species and their habitats (the natural environments of these species).

Scientists agree that the extinction crisis is due almost exclusively to human action. Two of the main causes are 1) habitat destruction[†] and 2) invasions of exotic species, alien to the region where they spread[‡].

According to the Secretariat of the Convention on Biological Diversity, we are creating the greatest extinction crisis since the natural disaster that wiped out the dinosaurs 65 million years ago. Species have been disappearing at 50-100 times the natural rate, and this is predicted to rise dramatically. Based on current trends, an estimated 34,000 plant and 5,200 animal species face extinction.

While the loss of individual species catches our attention, the gravest threat to biological diversity it is posed by the fragmentation, degradation, and direct loss of forests, wetlands, coral reefs, and other ecosystems. About 45 per cent of the Earth's original forests (which are home to much of the known terrestrial biodiversity) are gone, cleared mostly during the past century. Despite some reforestation initiatives, the world's total forests are still shrinking rapidly, particularly in the tropics. Up to 10 per cent of coral reefs – among the richest ecosystems – have been destroyed, and one third of the remainder face collapse over the next 10 to 20 years. Coastal mangroves, a vital nursery habitat for countless species, are also vulnerable, with half already gone. Global atmospheric changes, such as ozone depletion and climate change, only add to the stress. A thinner ozone layer lets more ultraviolet-B radiation reach the Earth's surface where it damages living tissue. Global warming is already changing habitats and the distribution of species. Scientists warn that even a one-degree increase in the average global temperature, if it comes rapidly, will push many species over the brink. Our food production systems could also be seriously disrupted[§].

5.1.1 Promoting nature and Human well-being through a global Convention

The continuing and accelerating loss of habitat and species worldwide, led to discussion of the need for a comprehensive global treaty to conserve biological diversity.

In 1992, the largest-ever meeting of world leaders took place at the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil. An historic set of agreements was signed at the "Earth Summit", including two binding agreements, the Convention on Climate Change, which targets industrial and other emissions of

[†] When we clear forests to create more farmland, we not only change the way the land is used, we destroy the habitat of plants and animals that require a forest environment to survive. And, as more and more of the planet is converted to a narrow range of human uses (including transport and infrastructure for that transport), specialized species are driven to extinction. Destruction of tropical moist forests in the Amazon, central Africa, and southeast Asia are prime examples

[‡] Some species are capable of aggressively invading new habitats, taking over or driving out populations of localized native species in the process. Exotic species are especially devastating to remote islands (e.g. Hawaii and Guam) but they can also have major impacts in large continental masses, as has happened in Australia.

[§] From the booklet published by the Secretariat of the Convention on Biological Diversity. *Sustaining Life on Earth. How the Convention on Biological Diversity promotes nature and human well-being*, April 2000.

greenhouse gases such as carbon dioxide, and the Convention on Biological Diversity, the first global agreement on the conservation and sustainable use of biological diversity. The biodiversity treaty gained rapid and widespread acceptance. Over 150 governments signed the document at the Rio conference, and since then more than 175 countries have ratified the agreement.

The Convention has three main goals: 1) the conservation of biodiversity, 2) sustainable use of the components of biodiversity, and 3) sharing the benefits arising from the commercial and other utilization of genetic resources in a fair and equitable way.

The Convention recognizes – for the first time – that the conservation of biological diversity is "a common concern of humankind" and is an integral part of the development process.

The Convention reminds decision-makers that natural resources are not infinite and sets out a new philosophy for the 21st century, that of sustainable use. While past conservation efforts were aimed at protecting particular species and habitats, the Convention recognizes that ecosystems, species and genes must be used for the benefit of humans. As an international treaty, identifies a common problem, sets overall goals and policies and general obligations, and organizes technical and financial cooperation required to conserve biological diversity. However, the responsibility for achieving its goals rests largely with the countries themselves.

Governments are required to develop national biodiversity strategies and action plans (on sectors as forestry, agriculture, fisheries, energy, transportation and urban planning), and to integrate these into broader national plans for environment and development.

The Convention represents certainly an important part of the world community effort to address biodiversity conservation, but the convention's success will depend on the combined efforts of the world's nations. The responsibility to implement the Convention lies with the individual countries and, to a large extent, compliance will directly depend on informed self-interest and peer pressure from other countries and from public opinion**.

5.2 The process of extinction of cultural diversity

Biodiversity loss has been relatively well known to a broad public since the late 1980s due to the efforts made by biosystematists and conservation biologists. But the world's language and culture loss including traditional knowledge of indigenous social groups remained less known until recent years.

Estimation suggests that the world's language diversity, an integral part of culture, reached its peak 10,000 years ago. At that time as twice as the current number of languages may have been spoken. Immigration and political and economic development have always had impact on linguistic diversity. Colonization and empire building accelerated the speed of the reduction of linguistic diversity. Comparing with 500 years ago, there are 15% fewer languages nowadays estimated (Maffi, 1998).

** From the booklet published by the Secretariat of the Convention on Biological Diversity. *Sustaining Life on Earth. How the Convention on Biological Diversity promotes nature and human well-being*, April 2000.

Today the languages orally spoken are estimated to more than 6000. However, most of these languages are spoken by indigenous people or minority groups. About half of the world's languages are spoken by communities of 10,000 speakers or less. Communities of 1000 or fewer speakers cover one-fourth of the world's languages. Overall, linguistic communities of less than 10,000 speakers make up only 0.2 % of the world population. 95% of the world population speak altogether less than 300 languages. This means that the diversity of the world's linguistics lies in the hands of minority groups of people. The languages of these small groups of people are largely under threat of extinction due to the force that urges people to cater to the main stream society and adopt the majority language. Maffi noted that "these figures portray a threat to linguistic diversity that may be far greater in magnitude than the threat facing biodiversity" (Maffi, 2001) . Some well informed predict that 90% of the world's languages is facing the fate of extinction or becoming moribund in the 21st century (Maffi, 2001).

Along with the loss of the language diversity are traditional and indigenous knowledge endangered by dominant cultural framework at the same time, and local knowledge has to face extinction as well, for this kind of knowledge and experience are usually kept and forwarded orally from generation to generation. If the younger generations lose the language of their ancestors, it is very probably that they also lose the knowledge passed through generations. This is unfortunately not a rare case shown in many case studies.

5.3 Globalization and the world's diversity – threat or not?

Since the emergence of the word "globalisation" this concept has always been debated in a broad range of discourse. In general there are two controversial views about globalisation: on the one hand, communication has been largely enhanced between nation states which provide people with a freedom of information. Global problems such as environmental issues can be solved globally; on the other hand, wide spread dominant culture, in this case the western culture, is considered by many as a "cultural invasion" or "MacDonaldisation" (Hafez, 2000) . The force of free market economy has been showing its power in the process of globalisation.

Irrespective whether one holds the optimistic or the pessimistic view, globalisation is doubtless a challenge that the world's diversity is facing: "Globalisation, in its powerful expansion of market principles, has created new forms of inequality which seem to foster cultural conflict rather than cultural pluralism" (UNESCO, 2002). The waves of immigration crossing local and national borders make it more difficult to keep people's cultural identities. This results inevitably in losing part of local knowledge in favour of the "mainstream culture".

Both cultural and biodiversity and their interlink are facing a common challenge in the age of globalisation. The ever growing autonomy market makes it difficult for many societies to resist the global consumerism by losing their traditional values. And this, in return, results in unsustainable use of natural resources and endangers the ecosystem putting the world's diversity at an unpredictable risk. In order to ensure the long-term values in biocultural diversity, globalisation must shape in the interest of conserving the world's diversity by means of global corporation and dialogue. Globalisation may become a chance for cultural intermingle and hence contribute to the conservation of biodiversity instead of being a threat to the world's diversity.

6. Biocultural diversity: a new approach towards a more effective conservation of the world's diversity

6.1 An holistic approach to natural and cultural systems

The links and the correlations that we have described in the previous paragraphs endorse the idea that biological and cultural diversity are not separate aspects of the diversity of life, but they are rather intimately related and mutually supporting ones. The growing recognition of these commonalities has led to frame a new field called “biocultural diversity”.

As we mentioned in paragraph 4.1, biocultural diversity (BCD) is the total variety exhibited by the world's natural and cultural systems. It may be thought of as the sum total of the world's differences, no matter what their origin. It includes biological diversity at all its levels, from genes to populations to species to ecosystems; cultural diversity in all its manifestations (including linguistic diversity), ranging from individual ideas to entire cultures; the abiotic or geophysical diversity of the earth, including that of its landforms and geological processes, meteorology, and all other inorganic components and processes (e.g., chemical regimes) that provide the setting for life; and, importantly, the interactions among all of these (Harmon and Loh, 2002).

6.2 Quantitative Method used in the new approach: A Global Index of Biocultural Diversity

A first-wave scholarship on BCD has aimed to establish correlations between biological and cultural/linguistic diversity in terms of (1) geography (e.g., areas of overlap), (2) theory (e.g., how language may be related to long-term environmental management in indigenous communities), and (3) common threats to their continuation.

In order to deepen the theoretical foundations of BCD research and to explain the complexities of how humans and non-humans species interact not only with one another but also with abiotic diversity^{††}, a second wave of BCD scholars is now attempting to develop useful baseline data for measuring quantitatively the value of biocultural diversity and to provide scientists and policy makers with useful information for enforcing a more effective conservation of world's diversity. The so called Index of Biocultural Diversity (IBCD) can be considered a first step toward developing such data. The IBCD is being developed in 2002 by Harmon and Loh under the auspices of Terralingua, an international nongovernmental organization that works on several fronts to assess the world's BCD^{‡‡}.

In brief, the IBCD uses a combination of indicators of BCD to establish rankings for 238 countries and territories. There are five indicators:

- the number of (1) languages, (2) religions, and (3) ethnic groups present within each country as a proxy for its cultural diversity; and the number of (4) bird and mammal species (combined) and the number of (5) plant species as a proxy of its biological diversity.

^{††} E.g. through formation of cultural landscapes

^{‡‡} The project has been funded by the Ford Foundation and The Christensen Fund.

6.2.1 Purpose of the IBCD

The Index on Biocultural Diversity (IBCD) is modeled after indexes used in the conservation field to esteem current conditions and trends in the state of the environment. Its purpose is to measure conditions in global biocultural diversity and to serve as a benchmark for assessing trends in biocultural diversity. Using a small number of indicators, the IBCD aims to point toward a general understanding of what is happening to biocultural diversity, as well as toward the gaps in knowledge.

The IBCD has three parts, each of which analyzes these indicators in a complementary way:

- A *biocultural diversity richness component* (BCD-RICH), which is a relative measure of a country's "raw" BCD using unadjusted counts of the five indicators.
- An *areal component* (BCD-AREA), which adjusts the indicators for land area and therefore measures a country's BCD relative to its physical extent. This is important to measure because large countries are more likely to have higher biological diversity than small countries.
- A *population component* (BCD-POP), which adjusts the indicators for human population and therefore measures a country's biocultural diversity relative to its population size. This is important to measure because countries with high human populations are more likely to have higher cultural diversity than countries with small populations. Nevertheless, some countries with small populations have cultural diversity that is high relative to their population size; and, conversely, some countries with high populations have cultural diversity that is low relative to their population size. BCD-POP adjusts the rankings to account for these situations.

6.2.2 Data sources for the indicators

The data sources for the cultural and biological diversity indicators are the following:

- **Number of languages.** Language data are derived from the 2000 edition of *Ethnologue*, the standard reference list of the world's languages (Grimes 2000). *Ethnologue* is a country-by-country listing of languages. There are well over 7,000 entries in the 2000 edition, representing 6,809 unique languages, both living and extinct.
- **Number of religions.** Data on religions are from the *World Christian Encyclopedia*, second edition (Barrett et al. 2001). The compilers of *World Christian Encyclopedia* have tracked information on 19 major religions and related religious categories (such as "nonreligious" and "atheist") for more than 20 years and have time-series data going back to 1900 (on a global level).
- **Number of ethnic groups.** Data on ethnic groups are also taken from the *World Christian Encyclopedia*, second edition (Barrett et al. 2001).
- **Number of bird/mammal species; number of plant species.** Data on bird/mammal species richness, on and plant species richness—the two indicators of biological diversity used for the IBCD—are taken from *Global Biodiversity: Earth's Living Resources in the 21st Century* (Groombridge and Jenkins 2002).

6.2.3 Limitations of the IBCD

IBCD is a global index and as all the global environmental and cultural indices is based on datasets that are incomplete or of uneven quality, and possibly out of date as well.

- The IBCD measures the status of and trends in BCD on a country-by-country basis. Organizing the IBCD this way is not ideal from an ecological and ecolinguistic point of view, since species, cultures, and languages usually do not respect national borders. In addition, changes in national boundaries can wreak havoc on trying to establish meaningful time-series data sets. However, most of the global data relevant to the IBCD is organized on a country-level basis, and all global indices are organized this way.
 - The basic building blocks of data needed to fully determine the global status of BCD are not presently available.
 - The index presented here is based on richness data only. A more sophisticated analysis would take abundance distributions into consideration, but the lack of data on relative abundance of species, language speakers, etc., precludes this possibility at present.
 - If data are missing for a particular indicator (LD, RD, ED, MD, or PD) within a component's cultural diversity (CD) or biodiversity (BD) parts, the remaining indicators are used to calculate that country's IBCD.
- Despite these problems and limitations, IBCD it can be recognize as a valuable source of information because it offers first-cut guidance about large-scale trends, using the current best available data.

6.2.4 Method for calculating the IBCD components

The three components of the IBCD (BCD-RICH, BCD-AREA, and BCD-POP) are derived from five indicators of BCD: number of languages, number of ethnic groups, number of religions, number of bird and mammal species (combined) and number of plant species. Each of the three parts of the IBCD gives equal weight to cultural and biological diversity.

A country's IBCD value in fact is calculated as the average of its cultural diversity (CD) and its biodiversity (BD), or:

$$IBCD = (CD + BD)/2$$

In measuring a country's cultural diversity (CD), equal weight is given to linguistic, religious, and ethnic diversity. Therefore CD is calculated as the average of a country's language diversity (LD), religion diversity (RD), and ethnic group diversity (ED):

$$CD = (LD + RD + ED)/3$$

In measuring biodiversity (BD), equal weight is given to animal species diversity (using birds and mammals as a proxy for all animal species) and plant species diversity.

Therefore BD is calculated as the average of a country's bird and mammal species diversity (MD), and plant species diversity (PD):

$$BD = (MD + PD)/2$$

To calculate CD and BD, the authors first took the logarithms of the richness values for each indicator in each country. They used logarithms because BCD - whether measured using species, languages, ethnic groups, or religions - is not distributed evenly around the world. For example, 833 of the world's 6,800 languages (12%) are spoken in just one

country, Papua New Guinea. The average number of languages spoken in the 229 countries and territories for which we have data available is 45, Mali being an average country in this respect. But only in a minority of the world's countries (50) are there 45 or more languages spoken, whereas in the majority of countries (179) there are fewer than 45 languages spoken. In almost half of those countries (85) there are fewer than 10 languages spoken.

Applying a common log scale essentially compresses a large range of values down to a manageable range. For example, as noted above, the maximum number of languages spoken in one country is 833, the average number of languages spoken is 45, while several countries share the minimum value of 1 language only. Taking the common logs of these three numbers ($\log 833 = 2.92$; $\log 45 = 1.65$; $\log 1 = 0$) gives us a scale of 2.92 to 0 instead of 833 to 1. The common log scale smoothes out the skewed distribution into a linear distribution, and the values, when compared with one another, fall into a much more even (linear) pattern.

Detailed information on the methods used for calculating IBCD components are contained in the annex of this paper.

6.2.5 Results form the three components

IBCD-RICH offers the most basic analysis of the available data. This method has both advantages and disadvantages. Simplicity is its most obvious virtue. However, it does not distinguish between countries or territories which have a high BCD only because they have a large land area or population and those which possess high diversity regardless of their land area or population. This is a disadvantage because countries are not being compared on a like-for-like basis. A least-squares statistical analysis shows that there is a strong correlation ($R^2 > 0.6$) between country's-RICH and BD-RICH values.

IBCD-AREA and IBCD-POP offer two alternative perspectives. IBCD-AREA is a robust method for analyzing biodiversity because the relationship between species richness and area (which was used to derive the index values of each country) is based on established ecological theory and observations, namely, that the number of species increases as a function of land area. It is reasonable to assume that the same relationship would be true for cultural diversity indicators. Interestingly, no single country or territory is more diverse than the world as a whole, after taking land area into consideration, for any of the five indicators used in IBCD-AREA. The global diversity value is therefore equivalent to the maximum index value. There is a good correlation ($R^2 > 0.57$) between number of languages and area, ethnic groups and area, bird/mammal species and area, and plant species and area. By contrast, there is only a moderate correlation between religions and area, and a poor correlation between CD-AREA and BD-AREA.

IBCD-POP is also based on the species-area relationship. While the analogous richness population relationship might be intuitively apparent between a country or territory's cultural diversity and its population size, it is not obvious between biological diversity and human population. However, in IBCD-POP, there is a good correlation not only between language and population and ethnic groups and population, but also between birds/mammals and population, and plants and population. By contrast, there is only a moderate correlation between religion and population and a poor correlation between CD-POP and BD-POP.

The fact that the correlation between CD-AREA and BD-AREA and between CD-POP and BD-POP is relatively weak ($R^2 = 0.20$) means that countries with high cultural diversity do not necessarily have high biological diversity, and vice versa, after adjusting for either their land area or population size. Where there is no adjustment made, as in the IBCD-RICH index, there is a high correlation. Tables 1 and 2 show the actual values (see Annex).

Comparison of the three components: rankings. Table 3 (see Annex), which summarizes the rankings for all three components, provides another basis for comparing the results among them. Perhaps the most striking aspect of the comparison is how consistently high Papua New Guinea and Indonesia rank under all three variants. Papua New Guinea ranks 2nd in IBCD-RICH, 2nd in IBCD-AREA, and 1st in IBCD-POP, with Indonesia ranking 1st, 1st, and 4th, respectively. By any measure, these two countries are the world leaders in BCD. Cameroon and Colombia are not far behind, being the only other two countries to rank in the top 10 under all three variants. When IBCD-RICH, -AREA, and -POP are themselves averaged (column 8 of Table 3), Papua New Guinea emerges slightly ahead of Indonesia, and so can lay claim to the title of the world's most bioculturally diverse country—at least by these measures.

The world's core regions of BCD. The world's four most bioculturally diverse countries—Papua New Guinea, Indonesia, Cameroon, and Colombia—rank in the top ten for all three components of the index.

By combining the results of BCD-RICH, BCD-AREA, and BCD-POP, three “core regions” of global biocultural diversity have been identified, they include countries of various sizes and populations:

- The Amazon Basin, consisting of Brazil, Columbia, and Peru, which ranked highly in BCD-RICH; Ecuador, which ranked highly in BCD-AREA; and French Guiana, Suriname, and Guyana, which ranked highly in BCD-POP.
- Central Africa, consisting of Nigeria, Cameroon, and the Democratic Republic of Congo (BCD-RICH), Tanzania (BCD-AREA), and Gabon and Congo (BCD-POP).
- Indomalaysia/Melanesia, consisting of Papua New Guinea and Indonesia (BCDRICH), Malaysia and Brunei (BCD-AREA), and Solomon Islands (BCD-POP).

Note that these regions are derived cumulatively; that is, they are geographic clusters centered on countries that are high in “raw” BCD richness (as measured by IBCD-RICH) to which adjacent countries highly ranked in IBCD-AREA and IBCD-POP are added.

The resulting core regions are intuitively plausible in that they identify biogeographic realms that most experts would also identify as being among the most important for BCD: Indomalaya, the Amazon Basin, and Central Africa. Harmon and Loh believe this is strong evidence that the three components of the IBCD give a more usable and realistic picture of where the world's BCD is located than would an index based on raw BCD richness alone.

7. Conclusion

In this paper we covered many aspects related to the commonalities of the world's diversity, we introduced some theoretical and empirical work that have been done on this fascinating topic. Some of these works provide us with new perspectives to view the relationship between biodiversity and cultural diversity and raised interesting questions

about how the two complex systems are dependent on each other; some case studies offer proofs of overlapping in term of geographical distribution between biodiversity and cultural diversity. However, there are a few controversial results of these case studies as well, such as in the North America case mentioned above. Hence we are well-aware of the fact that a broader discussion on how biological and cultural diversity might influence each other and how they are interlinked still has to be done. Especially more empirical data and research are indispensable to strengthen the validity of the outcoming theories. The IBCD can be considered as the first step attempted to develop a quantitative analysis about biocultural diversity. In fact, the value of an IBCD is largely practical and political. Pinpointing the world's areas richest in biocultural diversity helps raise the awareness of the general public about what is at stake and can be used to help prioritize strategic investments in biocultural diversity conservation. But as mentioned before, this indicator has many limitations, e.g. datasets are not complete and sometimes out of date. On the whole, commonalities between biological diversity and cultural diversity are intrinsic aspects of the biocultural concept; moreover, the links and interactions between the two systems are dimensions which are the core of the world's diversity. Future empirical research should focus on these dimensions raising questions like: does traditional knowledge or beliefs enhance the conservation of the biocultural diversity or are they only some anthropologists' romantic interpretations? By answering this we should not be pessimistic, but looking critically at possible controversial findings, thus wrong tracks may be avoided.

8. Appendix

Calculating the IBCD components

IBCD-RICH. To generate the raw richness component of the index (IBCDRICH), each country's value with the global richness value has been compared. For example, staying with language diversity, the index is calculated as the log of the number of languages spoken in a country divided by the log of the number of languages spoken worldwide. The total number of languages currently spoken is 6,800 ($\log 6,800 = 3.83$).

Hence the formula we used is:

$$XX\text{-RICH} = \log N_i / \log N_{\text{world}}$$

where $XX = LD, RD, ED, MD, \text{ or } PD$; N_i = number of languages, religions, ethnic groups, or species in country i ; N_{world} = the actual observed number of languages, religions, ethnic groups, or species in the world);

IBCD-AREA. To compensate for the fact that large countries tend to have a greater cultural and biological diversity than small ones simply because of their greater area, a second component of the IBCD adjusts the BCD value for each country by accounting for its land area. This was done by calculating how much more or less diverse a country is in comparison with an expected value based on its area alone.

The expected diversity of a country is derived from the species-area relationship, which comes from ecological theory:

$$\log S = c + z \log A$$

where S = number of species; A = area; and c and z are constants.

The formula simply states that the log of the number of species presents in a country or territory increases in proportion with the log of the area of the country or territory. The constants c and z can be derived by observation. Harmon and Loh applied the same formula to indicators of cultural diversity, hence:

$$\text{expected } \log N_i = c + z \log A_i$$

where N_i = number of languages, religions, ethnic groups, or species in country i ; A_i = area of country i ; and c and z are constants.

To find the values of c and z for each of the indicators used in the IBCD-AREA analysis, Harmon and Loh scatter-plotted $\log N_i$ against $\log A_i$ for all countries, and drew the best-fit straight line through the scatter; z is the slope of the line and c is the point where it intersects the y-axis.

To calculate the deviation of each country from its expected value they simply subtracted the expected $\log N_i$ value from the observed $\log N_i$ value.

$$\begin{aligned} \text{Deviation from expected value} &= \log N_i - \text{expected } \log N_i \\ &\text{or } \log N_i - (c + z \log A_i) \end{aligned}$$

This gives a series of values for each country where a score of 0 means that the country is exactly as diverse as one would expect based on its area, a score of 1 means it is ten times more diverse, a score of 2 means it is a hundred times more diverse, a score of -1 means it is ten times less diverse, a score of -2 a hundred times less, and so on.

The index is calculated such that the global value is equal to 1.0 and the minimum value is zero. The global value for each of the five measures is also the maximum value, or, put another way,

the world as a whole is more diverse than any country, even after adjusting for land area. The minimum value was selected by choosing a value below that of the any country. Hence the formula used to calculate a country's area-adjusted diversity value for each of the five indicators was:

$$XX - AREA = \frac{D_i - D_{min}}{D_{max} - D_{min}}$$

where

D_i = observed log N_i – expected log N_i ; D_{min} = a value below that of the least diverse country; and D_{max} = D_{world} , the actual observed value for the entire world.

IBCD-POP. Finally, a third component of the index, IBCD-POP, compensates for the fact that more populous countries tend to have greater cultural diversity than small ones because of greater population size. This was done in the same way as compensating for area, by calculating deviation from an expected value based on population size alone, using the formula:

$$\text{expected log } N_i = c + z \log P_i$$

where N_i = number of languages, religions, ethnic groups or species in country i ; P_i = population of country i ; and c and z are constants.

To calculate c and z , log N_i against log P_i for all countries was scatter-plotted, and the best-fit straight line was added; z is the slope of the line and c is the point where it intersects the y-axis. To calculate the deviation from the expected value they simply subtracted the expected log N_i value from the observed log N_i value.

The formula used to calculate a country's population-adjusted value for each of the five indicators was the same as that used to calculate the area-adjusted value:

$$XX - POP = \frac{D_i - D_{min}}{D_{max} - D_{min}}$$

where D_i = observed log N_i – expected log N_i ;

D_{min} = a value below that of the least diverse country; and

D_{max} = D_{world} , the actual observed value for the entire world.

However, unlike IBCD-AREA, for some component indicators the value of D_{max} in IBCD-POP was not equal to D_{world} , and so an arbitrary maximum value was chosen at a level greater than that of the most diverse country.

Tables^{§§}

Table 1. Correlations between the five indicators and area and population

Correlation (R2)	Area	Population
Languages	0.58	0.57
Religions	0.38	0.42
Ethnic groups	0.61	0.65
Birds and mammals	0.71	0.63
Plants	0.59	0.65
CD vs BD	0.20	0.20

(Correlations R2 > 0.6)

Table 2. Correlations between cultural diversity and biodiversity

Correlation (R2)	CD-RICH	CD-AREA	CD-POP
BD-RICH	0.63	0.07	0.06
BD-AREA	0.08	0.20	0.05
BD-POP	0.08	0.04	0.20

(Correlations R2 > 0.6)

^{§§} Source: Harmon, D., and J. Loh, 2004.

Table 3: Summary rankings: IBCD-RICH, IBCD-AREA, and IBCD-POP

Country or Territory	(1) Index of Biocultural Diversity, IBCD-RICH	(2) Rank, RICH	(3) Index of Biocultural Diversity, IBCD-AREA	(4) Rank, IBCD- AREA	(5) Index of Biocultural Diversity, IBCD-POP	(6) Rank, POP	(7) Spread Between Highest and Lowest Rank	(8) Average, IBCD-RICH, IBCD-AREA, IBCD-POP	(9) Rank, Average IBCD
Papua New Guinea	0.728	2	0.802	2	0.865	1	1	0.798	1
Indonesia	0.760	1	0.813	1	0.718	4	3	0.764	2
Cameroon	0.671	8	0.725	4	0.720	3	5	0.705	3
Colombia	0.664	10	0.729	3	0.697	7	7	0.697	4
Brazil	0.710	3	0.681	10	0.677	12	9	0.689	5
Malaysia	0.640	14	0.712	5	0.664	16	11	0.672	6
Nigeria	0.688	6	0.693	8	0.607	31	25	0.663	7
Peru	0.642	13	0.666	12	0.674	13	1	0.660	8
Congo, Dem Rep (Zaire)	0.669	9	0.649	19	0.654	20	11	0.657	9
Mexico	0.663	11	0.667	11	0.623	27	16	0.651	10
India	0.709	4	0.697	7	0.541	59	55	0.649	11
Tanzania	0.638	15	0.651	16	0.631	25	10	0.640	12
Laos	0.594	27	0.649	18	0.671	14	13	0.638	13
Brunei	0.497	80	0.708	6	0.695	8	74	0.633	14
Nepal	0.606	23	0.690	9	0.598	35	26	0.631	15
Australia	0.646	12	0.552	61	0.681	11	50	0.627	16
Solomon Islands	0.538	48	0.638	22	0.703	6	42	0.626	17
Venezuela	0.607	22	0.639	21	0.633	24	3	0.626	18
Ecuador	0.576	31	0.662	13	0.628	26	18	0.622	19
United States of America	0.678	7	0.593	37	0.572	45	38	0.614	20
Congo	0.574	34	0.595	35	0.671	15	20	0.613	21
Myanmar	0.619	17	0.635	23	0.579	40	23	0.611	22
China	0.689	5	0.628	27	0.514	79	74	0.610	23
Panama	0.537	49	0.650	17	0.642	23	32	0.610	24
Kenya	0.608	21	0.628	26	0.590	38	17	0.609	25
Bolivia	0.581	30	0.585	39	0.656	19	20	0.608	26
Gabon	0.549	43	0.579	41	0.693	9	34	0.607	27
Philippines	0.617	19	0.652	15	0.535	63	48	0.601	28
Suriname	0.518	61	0.562	48	0.712	5	56	0.597	29
Viet Nam	0.605	24	0.654	14	0.532	66	52	0.597	30
Central African Republic	0.575	32	0.555	58	0.651	21	35	0.594	31
French Guiana	0.488	83	0.555	58	0.730	2	81	0.591	32
Ghana	0.585	28	0.621	28	0.567	50	22	0.591	33
Thailand	0.599	25	0.630	25	0.543	56	31	0.591	34
Cote d'Ivoire (Ivory Coast)	0.584	29	0.603	34	0.577	41	12	0.588	35
South Africa	0.594	26	0.593	36	0.573	44	18	0.587	36
Guyana	0.518	63	0.555	55	0.683	10	53	0.585	37
Ethiopia	0.613	20	0.593	38	0.550	54	34	0.585	38
Guatemala	0.549	42	0.635	24	0.568	49	25	0.584	39
Vanuatu	0.502	75	0.582	40	0.663	17	58	0.582	40
Costa Rica	0.513	69	0.641	20	0.591	37	49	0.581	41
Uganda	0.571	36	0.619	29	0.550	53	24	0.580	42
Sudan	0.618	18	0.538	69	0.583	39	51	0.580	43

cont.

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