INDIGENOUS PEOPLES AND BIODIVERSITY*

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ABSTRACT

Indigenous people number over 300 million. They are inhabitants of practically each main biome of the earth and especially of the least disturbed terrestrial and aquatic ecosystems of the world. Based on an exhaustive review of recently published data, this chapter stresses the strategic importance of indigenous peoples in the maintenance and conservation of world's biodiversity. Four main links between biodiversity and indigenous peoples are examined: the correlation between biological richness and cultural diversity on both geopolitical and biogeographic terms, the strategic importance of indigenous peoples in the biomass appropriation; the remarkable overlap between indigenous territories and world's remaining areas of high biodiversity; and the importance of indigenous views, knowledge and practices in biodiversity conservation. The chapter finishes emphasizing the urgent need for recognizing a new bio-cultural axiom: that world's biodiversity only will be effectively preserved by preserving diversity of cultures and viceversa.

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I. INTRODUCTION

Biodiversity as a word and concept originated in the field of conservation biology. However, as Alcorn (1994:11) states "...while proof of conservation success is ultimately biological, conservation itself is a social and political process, not a biological process. An assessment of conservation requires therefore an assessment of social and political institutions that contribute to, or threaten, conservation". One of the main social aspects related to biodiversity is, undoubtedly, the case of the world's indigenous peoples.

Scientific evidence shows that virtually every part of the planet has been inhabited, modified and manipulated throughout human history. Although they appear untouched, many of the last tracts of wilderness are inhabited and have been so for millenia. Indigenous peoples live in and have special claims to territories that, in many cases, harbor exceptionally high levels of biodiversity. On a global basis, human cultural diversity is associated with the remaining concentrations of biodiversity. Both cultural diversity and biological diversity are endangered.

Given the above, this chapter offers a review about the multiple importance of indigenous peoples and makes the point that valuable, local-specific views, knowledge and practices are used by indigenous peoples who have relied for centuries upon the maintenance of biodiversity. Indigenous peoples are often classified as impoverished or treated as invisible. However, in the final analysis, they hold the key to successful biodiversity conservation in most of the biologically richest areas of the world.

II. INDIGENOUS PEOPLES

Indigenous people number over 300 million (Table I). They live in about 75 of the world's 184 countries and are inhabitants of practically each main biome of the earth. Indigenous peoples, also called tribal, aboriginal or autochthonous peoples, national minorities or first peoples, are best defined by using several criteria. Indigenous peoples may have all or part of the following criteria: (a) are the descendants of the original inhabitants of a territory which has been overcome by conquest; (b) are "ecosystem peoples", such as shifting or permanent cultivators, herders, hunters and gatherers, fishers and/or handicraft makers, who adopt a multi-use strategy of appropriation of nature; (c) practice a small-scale, labor-intensive form of rural production which produce little surplus and has low energy needs; (d) do not have centralized political institutions, organize their life at the level of community, and make decisions on a consensus basis; (e) share a common language, religion, moral values, beliefs, clothing and other identifying characteristics as well as a relationship to a particular territory; (f) have a different world-view, consisting of a custodial and non-materialist attitude to land and natural resources based on a symbolic interchange with the natural universe; (g) are subjugated by a dominant culture and society; and (h) consist of individuals who subjectively consider themselves to be indigenous.

It is possible to find indigenous peoples carrying out many different activities of use and management of planet's ecosystems: As forest-dwellers in the tropical lowlands or in the mountains, as pastoralists in savannas and other grasslands, or as nomadic or semi-nomadic hunthers and gatherers in forests, prairies and deserts.

Fishing is, in addition, the principal economic activity and source of food for several million coastal and island dwellers, as well as many indigenous peoples inhabiting margins of rivers.

Large numbers of indigenous peoples are, however, peasant producers and therefore can be indistinguishable from the non-indigenous peoples living nearby. In the Andean and Mesoamerican countries of Latin America, for instance, indigenous peoples farm like mestizo peasants. Similarly, in India distinctions between scheduled tribes and non-tribal peoples cannot be made solely on the basis of productive activities. In these and other many cases non-indigenous peasants and indigenous peoples produce the same crops with the same farming methods. Since in numberless countries many mestizo peasants are direct descendants of the indigenous peoples and retain most of their cultural traits, it has been pointed out that a broader definition of indigenous peoples might increase the real numbers. Thus, by considering other characteristics than language it is possible to enlarge the number of indigenous peoples in the contemporary world. Given the above, some authors like J. Burger think that the number of indigenous people can double the previously estimated. Thus, in the contemporary world there may be as many as 600 million indigenous peoples. However, such figures need qualification.

Based on percentage of total population identified as belonging to indigenous peoples, it is possible to recognize a group of selected nations with a strong presence of these peoples: Papua New Guinea (77%), Bolivia (70), Guatemala (47), Peru (40), Ecuador (38), Mynamar (33), Laos (30), Mexico (12) and New Zealand (12). On the other hand, the absolute number of people recognized as indigenous allow to identify nations with high indigenous population such as India (over 100 million) and China (between 60 and 80 million).

III. BIOLOGICAL DIVERSITY AND DIVERSITY OF CULTURES

On a global basis, human cultural diversity is associated with the remaining concentrations of biodiversity. In fact, evidences exist of remarkable overlaps between global mappings of the world's areas of high biological richness and areas of high diversity of languages, the single best indicator of a distinct culture. The above correlation can be certified both on a country by country basis as well as using biogeographic criteria.

Measured by spoken language, all the world's people belong to between 5,000 to 7,000 cultures. It is estimated that 4,000 to 5,000 of these are indigenous cultures. Thus, indigenous peoples account for as much as 80 to 90 percent of the world's cultural diversity. On the basis of the inventories done by linguists, we can draw up a list of the regions and countries with the greatest degree of cultural diversity in the world. According to Ethnologue. the best existing catalogue of the world's languages, there is a total of 6,703 languages (mostly oral), 32% of which are found in Asia, 30% in Africa, 19% in the Pacific, 15% in the Americas and 3% in Europe (Grimes, 1996). Only twelve countries account for 54 per cent of human languages. These countries are Papua New Guinea, Indonesia, Nigeria, India, Australia, Mexico, Cameroon Brazil, Zaire, Philippines, USA and Vanuatu (Table II).

On the other hand, according to the most recent and detailed analysis about biodiversity on a country by country basis (Mitermeier & Goettsch-Mittenneier, 1997) there are, similarly, 12 countries which house the highest numbers of species and endemic species (Table III). This assessment was based on the comparative analysis of eight main biological groups: mammals, birds, reptiles, amphibians, freshwater fishes, butterflies, tiger-beetles and flowering plants. The nations considered as "megadiversity" countries are: Brazil, Indonesia, Colombia, Australia, Mexico, Madagascar, Peru, China, Philippines, India, Ecuador and Venezuela (Table III).

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the twelve main centers of cultural diversity (in terms of number of languages) are also in the roster of biological megadiversity nations and, reciprocally, nine of the countries with the highest species richness and endemism are also in the list of the 25 nations with the highest number of endemic languages (Tables II and III).

The links between biological and cultural diversity can also be illustrated by using the data of the called Global 200, a program of World Wide Fund for Nature (WWF) developed as a new strategy to identify conservation priorities based on a ecoregional approach. As part of this program, WWF has identified a list of 233 terrestrial, freshwater and marine biological ecoregions representative of the Earth's richest diversity of species and habitats. A preliminary analysis conducted by the People & Conservation Unit of WWF about the presence of indigenous peoples in the 136 terrestrial ecoregions of Global 200, revealed interesting patterns. As shown in Table IV, nearly 80% of the terrestrial ecoregions are inhabited by one or more indigenous peoples and half of the global estimated 3,000 indigenous groups are inhabitants of these ecoregions. On a geographical region, basis all the regions, excepting the Palearctic region, maintain 80% or more of their ecoregions inhabited by indigenous people (Table IV).

IV. BIODIVERSITY AND BIOMASS APPROPRIATION: THE ROLE OF INDIGENOUS PEOPLES

Biodiversity conservation can not be separated from natural resources utilization. Human appropriation of nature inflows minerals, water, solar energy and principally living beings (biomass) from ecosystems. World statistics indicate that almost half the inhabitants of the planet are still people engaged in the appropriation of natural resources. This appropriation is carried out by a myriad of rural or primary producers through the management of terrestrial, marine and freshwater ecosystems.

Forty five per cent of the total human population has been recorded by the Food and Agricultural Organization (FAO) as agricultural population (FAO, 1991). It can be estimated that between 60 and 80 percent of this agricultural population is represented by small-scale, solar-energized productive units based on a multi-use management of nature (Toledo, 1990). In fact, the statistical record shows that by 1990 around 1,200 million rural people were practicing agricultural activities on areas of 5 hectares or less. This figure coincides with the last available world census of agriculture by the FAO in 1970, where more than 80% of all reported holdings were smaller than 5 hectares. A similar pattern is found in world's fisheries where more than 90 percent are small-scale, artesanal operators, acting in a great variety of coastal habitats.

Most of these small-scale farmers and fishers develop its production activities not as socially isolated households but as familial nuclei belonging to specific village communities, many of which, in turn, correspond to cultures that can be considered as indigenous. Morever, within the core of these community-based producers, those identified as indigenous people are who carry out the biomas's extraction affecting at the lowest level their local ecosystems. Called "ecosystem people" by some authors such as R.F. Dassman and M. Gadgil, these producers subsist by appropriating a diversity of biological resources from their immediate vicinity. Their quality of life is therefore intimately linked to the maintenance of certain levels of local biodiversity (Gadgil, 1993 and see below). As a consequence, they are productive actors in little transformed habitats of the world, including the main forest and sea dwellers, slash and bum agriculturalists, some 25-30 million nomadic herders or pastoralists (in East Africa, Sahel and Arabian peninsula), most of the 15-21 million world fishers, and all the half a million hunters and gatherers still recognized as citizens of the contemporary world.

In conclusion, indigenous peoples are the fraction of human appropriators of biomass determining the lowest ecological impacts. They generally live in what may be termed "frontier lands" or "refuge regions"; thus remote areas of great "wilderness" where the structure, not the components, of original ecosystems remains more or

less untouched. In many cases these lands and waters are untamed, unknown, unowened and unclaimed.

V. BIODIVERSITY AND INDIGENOUS PEOPLE' S LANDS AND WATERS

Indigenous peoples occupy a substantial share of the world's little disturbed tropical and boreal forests, mountains, grasslands, tundra and desert, along with large areas of the world's coasts and near-shore waters (including mangroves and coral reefs) (Durning, 1993). The importance of indigenous territories to biodiversity conservation is therefore evident.

In fact, indigenous peoples control, legally or not, immense areas of natural resources. Among the most remarkable examples are the cases of the Inuit people (formerly known as Eskimo) who govern a region covering one fifth of the territory of Canada (222 million hectares), the indigenous communities of Papua New Guinea whose lands represent 97 % of the national territory, and the tribes of Australia with nearly 90 million hectares (Figure 1). Although numbering only above 250,000, the indians of Brazil possess an area of over 100 million hectares, mainly in the Amazon basin, distributed in 565 territories (Figure 2 and Table V). Nearly 60% of the priority areas on central and southern Mexico recommended for protection are also inhabited by indigenous peoples (Figure 3), and half of the 30,000 rural communities are distributed in the ten most biologically rich states of the Mexican territory. In summary, on the global scale it is estimated that the total area under indigenous control probably reach between 12 and 20 percent of the earth's land surface.

The best example of notable overlaps between indigenous peoples and biological rich areas is the case of tropical humid forests, In fact, there is a clear correspondence between areas of remaining tropical forests and the presence of indigenous peoples in Latin America, the Congo Basin in Africa, and several countries of tropical Asia such as Philippines, Indonesia and New Guinea, The strong presence of indigenous peoples in Brazil, Indonesia and Zaire alone, which accounts for the 60 per cent of all the tropical forest of the world, is remarkable.

In Latin America, this geographical relationship has been strikingly verified for the Central American countries by a National Geographic Society map produced by a project headed by Mac Chapin in 1992. The same pattern can be found in the tropical humid areas of Mexico inhabited by 1.6 million of indigenous people, and for many regions of the Amazonia basin (see the case of Brazil in Figure 2). It has been estimated that in Amazonia above 1 million indigenous people of eight countries posses over 135 million hectares of tropical forests (Davis & Wall, 1994).

Many temperate forests of the world also overlap with indigenous territories as for example in India (see Figure 4), Mynamar, Nepal, Guatemala, the Andean countries (Ecuador, Peru and Bolivia) and Canada. On the other hand, over two million of islanders of the South Pacific, most of whom are indigenous peoples, continue fishing and harvesting marine resources in high biodiversity areas (as coral reefs).

VI. BIODIVERSITY AND ETHNOECOLOGY: INDIGENOUS VIEWS, KNOWLEDGE AND PRACTICES

Biodiversity is a very wide concept that refers to the variety of landscapes, ecosystems, species and genes, including their different functional processes. Therefore, maintenance and conservation of biodiversity demand efforts on these four levels. While the first level is oriented to preservation of assemblies of "ecosystems", the second ones focuses on protection of habitats in which the populations of species live. At the species level, most knowledge on biodiversity concerns the large plants and animals such as flowering plants and vertebrates.

The extent of diversity of smaller plants and animals remains to be inventoried and protected. While most biological diversity is constituted by wild plants and animals, an important subset involves the diversity among of domesticated organisms. In this fourth level, the interest focuses on conservation of genetic variation of crops and domesticated animals.

This section is dedicated to examine the potential role of indigenous peoples in biodiversity conservation from an ethnoecological perspective. Ethnoecology can be defined as an interdisciplinary approach exploring how nature is seen by human groups through a screen of beliefs and knowledge, and how humans in terms of their images use and/or manage natural resources. Thus, by focusing in the kosmos (the belief system or cosmovision), the corpus (the whole repertory of knowledge or cognitive systems) and the praxis (the set of practices), ethnoecology offers an integrative approach to the study of the process of human appropriation of nature (Toledo, 1992). This approach allows to recognize the value of the belief-knowledge-practice complex of indigenous peoples in relation to the conservation of biodiversity.

Vl.a The Kosmos

For indigenous peoples land and in general nature, has a sacred quality which is almost absent from Western thinking. Land is revered and respected and its inalienability is reflected in virtually every indigenous cosmovision. Indigenous people do not consider the land as merely an economic resource. Under indigenous cosmovisions, nature is the primary source of life that nourishes, supports and teaches. Nature is, therefore, not only a productive source but the center of the universe, the core of culture and the origin of ethnic identity. At the heart of this deep bond is the perception that all living and non-living things and natural and social worlds are intrinsically linked (reciprocity principle). Of particular interest is the research done by several authors (Reichel-Dolmatoff, E. Boege, Ph. Descola, C. van der Hammen) on the role played by the cosmology of several indigenous groups as a mechanism regulating the use and management of natural resources. In the indigenous cosmovision each act of appropriation of nature must be negotiated with all the existing things (living and non-living) through different mechanisms as agrarian rituals and shamanic acts (symbolic exchange). Humans are thus seen as a particular form of life participating in a wider community of living beings regulated by a single and totalizing set of rules of conduct.

VI. b The Corpus

Indigenous societies house a repertory of ecological knowledge which generally is local, collective, diachronic
and holistic. In fact, since indigenous peoples possess a very long history of resource-use practice, they have
generated cognitive systems on their own circumscribed natural resources which are transmitted from generation
to generation. The transmission of this knowledge is done through language, hence the corpus is generally an
unwritten knowledge. Memory is, therefore, the most important intellectual resource among indigenous
cultures.

This body of knowledge is the expression of a certain personal wisdom and, at the same time, of a collective creation, it is to say, a historical and cultural synthesis turned into reality in the mind of a individual producer. For this reason, the corpus contained in a single producer's mind expresses a repertoire that is a synthesis of information from at least four sources: (a) the experience accumulated over historical time and transmitted from generation to generation by a certain cultural group; (b) the experiences socially shared by the members of a same time's generation or cohort; (c) the experience shared into the household or the domestic group to which the individual belongs; and (d) the personal experience , particular to each individual, achieved through the repetition of the annual cycles (natural and productive), enriched by the perceived variations and unpredictable conditions associated with them.

Thus, indigenous ecological knowledge is normally restricted to the immediate environments and is an intellectual construction resulting from a process of accumulation of experiences over both the historical time and the social space. These three main features of indigenous ecological knowledge (being local, diachronic and collective) are complemented with a fourth characteristic, namely holistic.

Indigenous knowledge is holistic because it is intrincately linked to the practical needs of use and management of local ecosystems. Although indigenous knowledge is based on observations on a rather restricted geographic scale, it must provide detailed information on the whole scenery represented by the concrete landscapes where natural resources are used and managed. As a consequence, indigenous minds not only possess detailed information about species of plants, animals, fungi and some microorganisms; they also recognize types of minerals, soils, waters, snows, landforms, vegetations and landscapes.

Similarly, indigenous knowledge is not restricted to the structural aspects of nature, which are related to the recognition and classification (ethnotaxonomies) of elements or components of nature, it also refers to dynamics (which refers to patterns and processes), relational (linked to relationships between or among natural elements or events) and utilitarian dimensions of natural resources. As a result, it is possible to integrate a cognitive matrix (Figure 5) which certifies the holistic character of indigenous knowledge and serves as a methodological framework to ethnoecological research (Toledo, 1992).

VI.c THE Praxis

Indigenous societies generally subsist by appropriating a diversity of biological resources from their immediate vicinity. Thus, subsistence of indigenous peoples is based more on ecological exchanges (with nature) than on economic exchanges (with markets). They are therefore forced to adopt survival mechanisms that guarantee an uninterrupted flow of goods, materials, and energy from ecosystems. In this context a predominant use-value economic rationality is adopted, which in practical terms is represented by a multi-use strategy that maximizes the variety of goods produced in order to provide basic household requirements throughout the year (for further details on this strategy see Toledo, 1990). This main feature accounts for the relatively high self-sufficiency of indigenous households and communities.

Indigenous households tend to carry out a non-specialized production based on the principle of diversity of resources and practices. This mode of subsistence results in the maximum utilization of all the available landscapes of the surrounding environments, the recycling of materials, energy and wastes, the diversification of the products obtained from ecosystems and, especially, the integration of different practices: agriculture, gathering, forest extraction, agroforestry, fishing, hunting, small-scale cattle-raising, and handicrafts. As a result, indigenous subsistence implies the generation of a myriad of products including food, domestic and work instruments, housing materials, medicines, fuelwoods, fibers, animal forage, and others.

Under the multi-use strategy, indigenous producers manipulate the natural landscape in such a way that two main characteristics are maintained and favored: habitat patchiness and heterogeneity and biological as well as generical variation. In the spatial dimension, indigenous become a complex landscape mosaic in which agricultural fields, fallow areas, primary and secondary vegetation, household gardens, cattle-raising areas, and water bodies are all segments of the entire production system. This mosaic represents the field upon which indigenous producers, as multi-use strategists, play the game of subsistence through the manipulation of ecological components and processes (including forest succession, life cycles, and movement of materials).

It has been demostrated that some natural disturbances can increase biodiversity if they increase habitat heterogeneity, reduce the influence of competitively dominant species, or create opportunities for new species

to invade the area On the other hand, number of species is commonly relatively small in highly disturbed biotic communities, because few populations are able to re-establish themselves before they are reduced by later disturbances. In contrast, a low rate of disturbance provides few opportunities for pioneer species and might allow competitively dominant species to usurp limiting resources. Therefore, biodiversity is often greater at intermediate levels of disturbances than either lower or higher rates.

The creation of landscape mosaics under the indigenous multi-use strategy in areas originally covered by only one natural community represents a human-originated mechanism which theoretically tends to maintain (and even increase) biodiversity. Several authors have already stressed the importance of the models of low intensity mosaic usage of the landscape by indigenous peoples and other small-landowner populations for biodiversity conservation.

The same diversified arrangement found in indigenous landscapes tends to be reproduced at a micro-level, with multi-species, multi-story crops or agroforests favored over monocultures. As a consequence, animal and especially plant genetic resources tend to be maintained in indigenous agricultural fields, aquaculture systems, homegardens and agroforests (Gadgil, et al 1993). Polycultural systems managed by indigenous agriculturalists and agroforesters are relatively well known and the recent specialized literature is plenty of case studies illustrating such designs. Especially notable are the homegardens and agroforestry systems of the tropical and humid regions of the world, which operate as human-made refuge areas for many species of plants and animals, notably in areas strongly affected by deforestation.

At farm level, it is broadly recognized that crop populations are more diverse in indigenous farming systems than in agricultural areas dominated by agroindustriality. Therefore, indigenous peoples are recognized as key agents of on-farm preservation of plant genetic resources threatened by agricultural modernization (genetic erosion). The loss of biodiversity is also experienced in farming systems as indigenous cropping polycultural patterns are replaced by fossil-fueled monocrops. Indigenous agricultural systems and landscapes are then acknowledged as designs that preserve not only landraces of crop species, but semidomesticated and wild crops relatives and even non domesticated species.

VII. CONSERVING BIODIVERSITY BY EMPOWERING INDIGENOUS PEOPLES
During the past three decades, as the loss of landscapes, habitats, species and genes, has become an issue of international concern, the protected areas of the world have increased notably both in size and number. However, as protected areas expanded, it became evident that the North originated model of uninhabited national parks could not be applied worldwide. Today, there are just nearly 10,000 nationally protected areas (parks and other reserves) in more than 160 countries, covering some 650 million of hectares, which represents over 5 percent of earth's land surface. Many of the areas that have been established as protected areas and many of those that are suitable for future addition to the protected area network are the homelands of indigenous peoples. In Latin America alone, over 80 per cent of protected areas are estimated to have indigenous people living within them. On the other hand, large tracts of the territories under indigenous control, estimated in between 12 and 20 per cent of the earth's surface, are in the scope of conservationists as future reserves. Morever, some authors like B. Nietschmann and J. Alcorn (1994) think the bulk of the world's biodiversity is embodied within the limits of the indigenous territories of the tropical countries.

Given the above, as well as the evidences offered and discussed in the previous sections, the idea that biodiversity conservation is impossible without the participation of indigenous communities is increasingly gaining recognition in national and international conservation circles. For example, in its latest guidelines, IUCN's Commission on National Parks and Protected Areas (1994) consider that indigenously established

"protected territories" can now be recognized as national parks, wilderness areas, protected landscapes and managed resource protected areas. On the other hand, the international conservation community is beginning to realize that sacred forests, mountains, lakes, rivers, and deserts can be considered protected areas, as well as managed reefs, lagoons, rivers and grasslands.

Protected areas based on consultation, co-management and even indigenous management, are likely to be increasingly important in coming years as the key role of indigenous cultures is being gradually recognized. It is important, however, not to over-idealize indigenous peoples and their resource management strategies and stewardhip skills. Conservationists have been frequently criticized for over-romanticize indigenous peoples, creating a late-twentieth-century version of "the noble savage". Acknowledgment of the positive links between indigenous peoples and biodiversity has been increasingly tempered by the recognition that under certain circumstances (high population densities, market pressures, unsuitable technologies, local disorganization) indigenous peoples can act as disruptive, not as conservationist, actors.

Biological diversity and sustainable development, are today two of the most powerful and central concepts in environmental protection. In recent years, special attention is being payed to the sustainable development of community-based peoples, as a key mechanism for the reinforcement of correct participation of local communities in biodiversity conservation. It is possible to define sustainable community development as an endogenous mechanism that allows a local society to lake (or retake) control of the processes that affect it. In other words, self-determination and local empowerment, conceived as a "taking of control", have to be the
central objectives in all community development.

Given the demostrated importance of indigenous peoples for biodiversity conservation, it is essential to recognize the necessity of empowering local communities. That is to maintain, reinforce or give control to the indigenous communities on their own territories and natural resources as well as sufficient access to information and technology. Important here are legally recognized and enforceable rights to lands and waters, which give the communities both an economic incentive and a legal basis for stewardship. In many countries, national recognition and policy support for existing, community-based property rights systems are crucial. In many Asian and African countries, returning a measure of control over public lands and resources to local communities is also fundamental to slowing biodiversity loss in threatened regions.

Similarly, it is very important to establish new resource-management partnerships between local communities and the state and other society institutions to maintain biodiversity. Local stewardship in conjunction with external governmental and non-governmental agencies and institutions is perhaps the best way to guarantee effective protection of landscapes, habitats, species and genes worldwide, and specially in tropical countries.

VIII. CONCLUDING REMARKS: A BIO-CULTURAL AXIOM

The research accumulated in the three last decades by investigators belonging to the fields of conservation biology, linguistic and anthropology of contemporary cultures, ethnobiology and ethnoecology, have evolved convergently towards a shared principle: that world's biodiversity only will be effectively preserved by preserving diversity of cultures and viceversa. This common statement, which represents a new bio-cultural axiom, has been nourished by four main sets of evidences: geographical overlap between biological richness and linguistic diversity and between indigenous territories and biologically high-value regions (actual and projected protected areas), recognized importance of indigenous peoples as main managers and dwellers of well-preserved habitats, and certification of a conservationist-oriented behavior among indigenous peoples derived from its pre-modem belief-knowledge-practices complex.

This bio-cultural axiom, called by B. Nietschmann the "concept of symbiotic conservation", in which "biological and cultural diversity are mutually dependent and geographically coterminous", constitutes a key principle for conservation theory and applications, and episthemologically is an expression of the new, integrative, interdisciplinary research gaining recognition in contemporary science.

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FIGURE LEGENDS

1. Terrestrial and marine protected areas with significant involvement or interest of indigenous peoples in Australia. Source: Elaborated upon data from the Australian Federal Government.

2. Geographical location of indigenous territories in Brazil, according to their legal situation and size area. Not e the large tracts of areas under indigenous control in the Amazonian region, the core of Brazilian biological ichness. Source: Adapted from the map of Terras Indigenas do Brasil. Instituto Socioambiental, San Paulo, Brasil..

3. Geographical location of priority areas recommended by the Comision Nacional para el Estudio y Uso de la bodiversidad (CONABIO) of Mexico, overlapping with territories of indigenous communities. Note the highnumber of overlapping areas in the central and southern portion of Mexico, where most of the biologicalrichness of the country is concentrated. Source: Modified from CONABIO's Map on priority areas forconservation, 1996.

4. Geographical location of the main 20 indigenous groups (A) and principal forestry areas (B) of India. Although the long history of migrations of peoples makes difficult to distinguish indigenous peoples in India, there are about 100 million people considered by the government as "scheduled tribes" speaking over 300 languages. These groups are generally residents of remote hilly or forested areas. Source: Modified from The State of India's Environment 1984-85.

5. Matrix of indigenous ecological knowledge. See text.

TABLE 1 Estimated numbers of the world's indigenous peoples.

Region	Number of cultural groups	Population
North America	250	3,500,000
Latin America an the Caribbean	800	43,000,000
Former Soviet Union	135	40,000,000
China and Japan	100	67,000,000
The Pacific	1,273	2,000,000
Southeast Asia	900	30,000,000
South Asia	700	100,000,000
Australia and New Zealand	250	550,000
Africa	2,010	50,000,000
Total	6,418	336,050,000

Sources: Burger, 1987; Hitchcok, 1994; Thakur & Thakur, 1994.

TABLE II

Top 25 countries by number of endemic languages.

1. * Papua New Guinea (847)
2. * Indonesia (655)
3. Nigeria (376)
4. * India (309)
5. * Australia (261)
6. * Mexico (230)
7. Cameroon (201)
8. * Brazil (185)
9. * Zaire (158)
10. * Philippines (153)
11. * USA (143)
12. Vanuatu (105)
13. Tanzania (101)
14. Sudan (97)
15. * Malaysia (92)
16. Ethiopia (90)
17. * China (77)
18. * Peru (75)
19. Chad (74)
20. Russia (71)
21. Solomon Islands (69)
22. Nepal (68)
23. * Colombia (55)
24. C6ted'Ivoire(51)
25. Canada (47)

Considered "megadiversity" countries by Mittermeier & Goettsch-Mittermeier, 1997.

TABLE III

Top 12 countries by number of species (richness) an endemic (endemism)[a].

	Biological diversity		
	Richness	Endemism	Both
* Brazil	1	2	1
* Indonesia	3	1	2
* Colombia	2	5	3
* Australia	7	3	4
* Mexico	5	7	5
Madagascar	12	4	6
*Peru	4	9	7
* China	6	11	8
* Philippines	14	6	9
* India	9	8	10
Ecuador	8	14	11
Venezuela	10	15	12

* Countries included in the list of the 25 nations with the highest number of endemic languages. [a] Calculated for the following biological groups: mammals, birds, reptiles, amphibians, freshwater fishes, butterflies, tiger-beetles and flowering plants (Source: Mittermeier & Goettsch-Mittermeier, 1997).

TABLE IV

Indigenous peoples (IP) in Global 200 terrestrial ecoregions considered a priority areas by World Wildlife Fund for Nature.

Region	Ecoregions	Ecoregion with IP	%	Total IP in ecoregions	Number of IP in ecoregions	%
World	136	108	79	3000	1445	48
Africa	32	25	78	983	414	42
Neotropic	31	25	81	470	230	51
Nearctic	10	9	90	147	127	86
Asia and Pacific (Indo-Malayan)	24	21	88	298	225	76
Oceania	3	3	100	23	3	13
Palearctic	21	13	62	374	111	30
Australasia	15	12	80	515	335	65

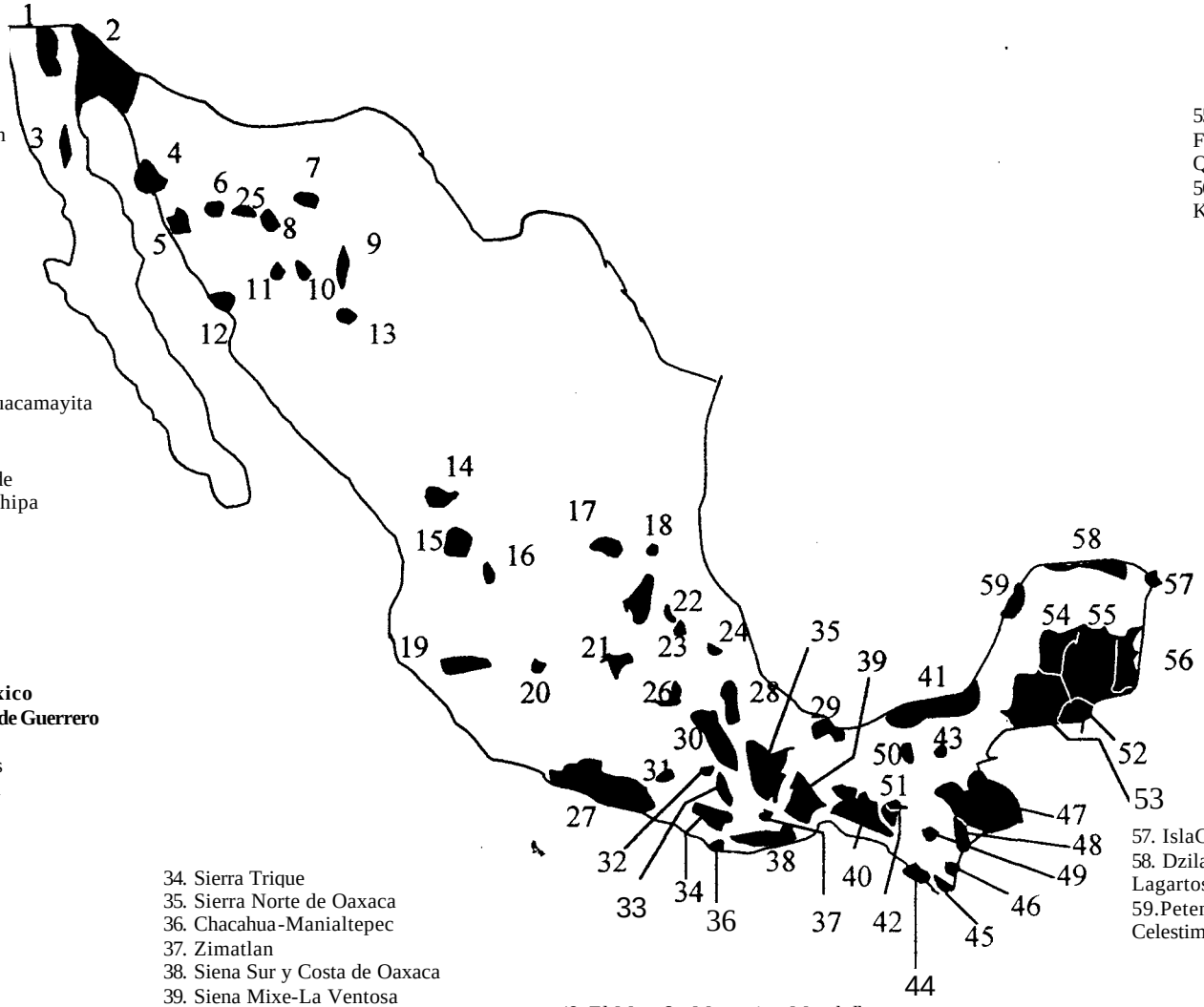
Source: WWF International, People and Conservation Unit, Unpublished Report, August, 1998.

TABLE V Legal

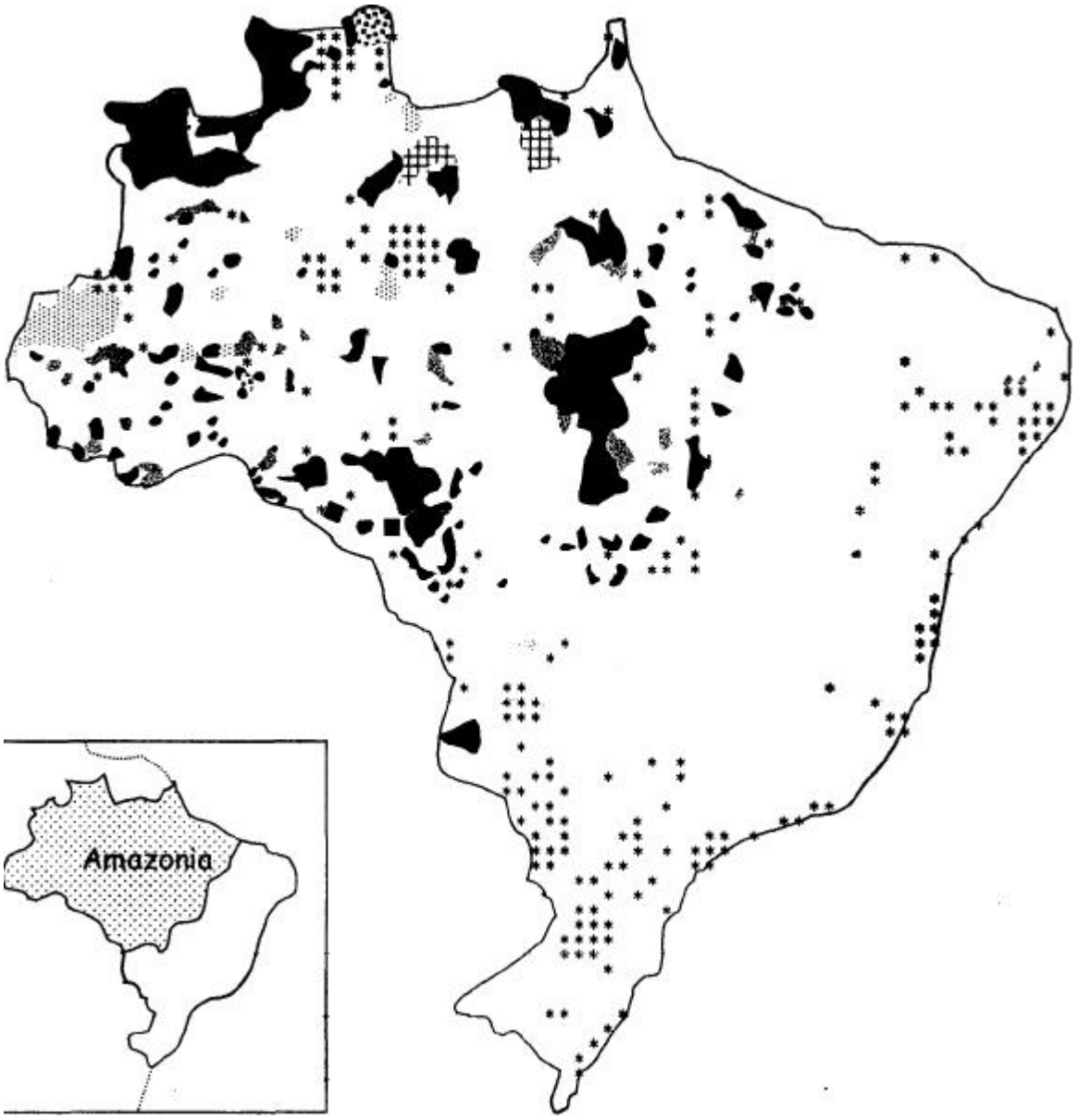
situation of indigenous territory in Brazil (November, 1997).

Legal situation [a]	No. of indigenous areas	Area (ha)	%
Not identified	74	2,749,000	2.60
To be identified	96	4,983,578	4.92
Interdicted	5	8,897,066	8.88
Identified	12	1,998,117	1.97
Delimited	67	19.963,673	19.86
Demarcated and confirmated	73	14,816,728	14.77
Regularizated	238	47,093,429	47.00
Total	565	100,501,591	100.00

[a] According to the National Indian Foundation (FUNAI).



1. Siena de Juarez
2. Delta del Rio Colorado-Alto
3. Santa Maria- El Descanso
4. Isla Tiburón-Sierra Sen
5. Cajón del Diablo
6. Siena Libre
7. Basaseachic
8. Yécora-El Reparto
9. Montes Azules
10. Barrancas del Cobre
11. Cañón de Chinipas
12. Las Bocas
13. Guadalupe, Calvo y **Mohinora**14. Guacamayita
15. Sierra de Jesus
16. Sierra Fría
17. Llanura del Rio Verde
18. Sierra de Abra-Tanchipa
19. Manantlan
20. Tancitaro
21. Sierra de Chincua
22. Tlanchinol
23. Huayacocotla
24. Cuetzalan
25. San Javier Tepoca
26. Sur del Valle de **Mexico**
27. Sierra Madre del Sur **de Guerrero**
28. Perote-Orizaba
29. Sierra de los Tuxtlas
30. Tehuacan-Cuicatlan
31. Cañon del Zopilote
32. Siena Granizo
33. Sierra de Tidaa
34. Sierra Trique
35. Sierra Norte de Oaxaca
36. Chacahua-Manialtepec
37. Zimatlan
38. Siena Sur y Costa de Oaxaca
39. Siena Mixe-La Ventosa
40. Selva de Chimalapas
41. Sepultura-Tres Picos-El Baúl
42. El Suspiro-Buenavista-Berriozabal
43. Lagunas Catazaja-Emiliano Zapata
44. Triunfo-Encrucijada-Palo Blanco
45. Tacaná-Boquerón-Mozotal
46. Selva Chicomuselo-Motozintla
47. Lacandona
48. El Mom6n-Margaritas-Montebello
49. Huitepec-Tzontehuitz
50. El Manzanillal
51. Altos de Chiapas
52. Rio Hondo
53. Silvituc-Calakmul
54. Zona de Punto Puuc
55. Zonas Forestales Quintana **Roo**
56. Sian Ka'an-Uaymil
57. IslaContoy
58. Dzilam-Ria Lagartos-Yum **Balam**
59. Petenes-Ria Celestim



Regularizated

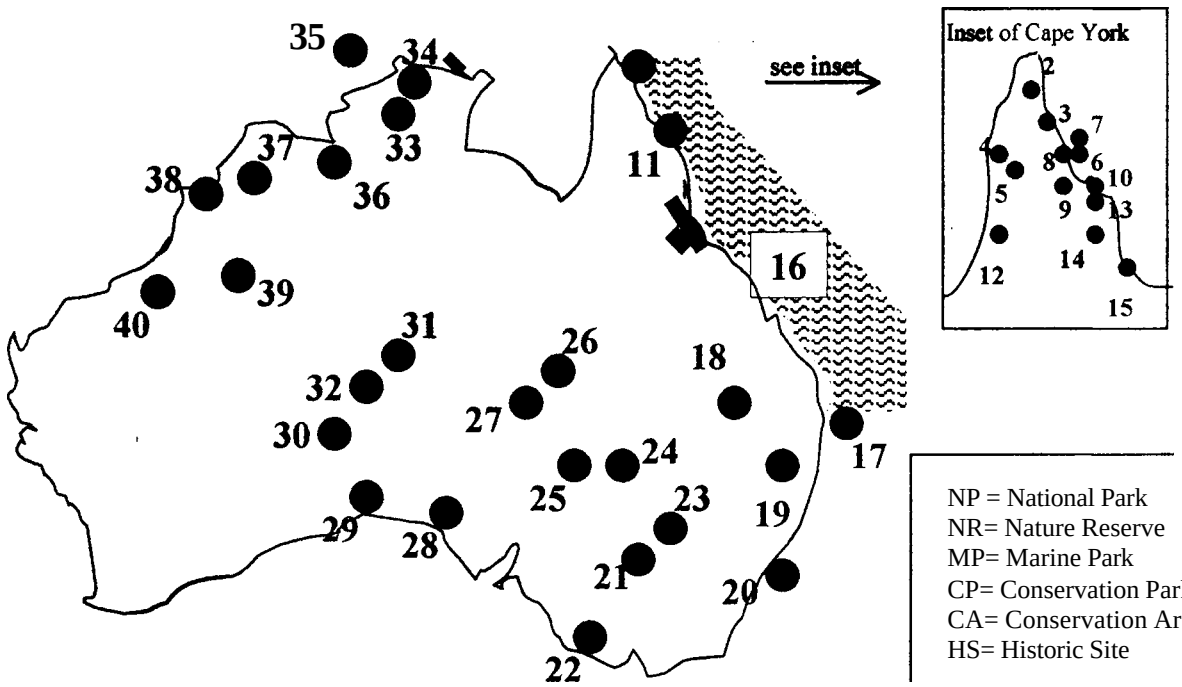
Delimited

In identification process

To be identified

Identified

* Areas of less than 10,000 ha



Jardine River NP
Iron Range NP
Forbes Islands NP
Archer Bend NP
Rokeby-Croll NP
Flinders Island Group NP
Clack Islands
Cliff Islands

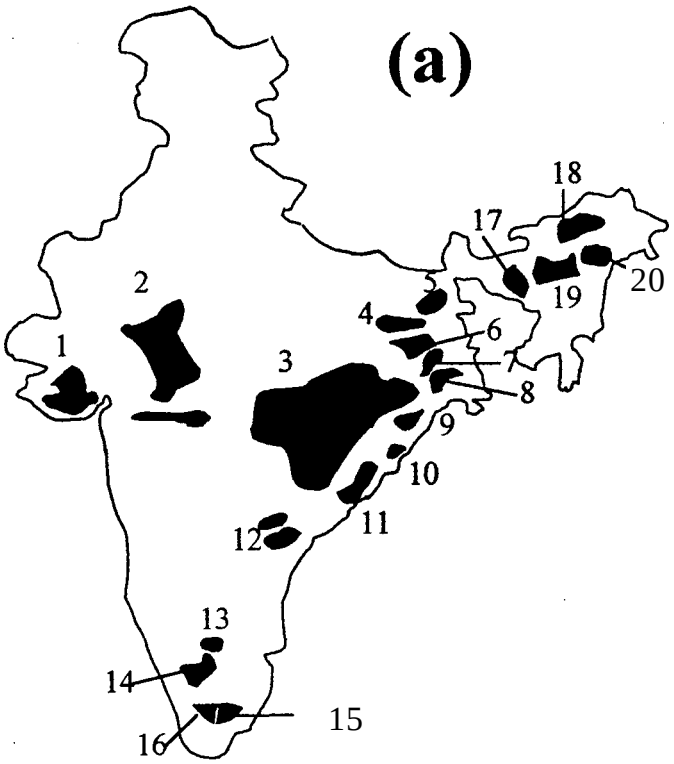
9. Lakefield NP
10. Starcke NP
11. Cape Melville NP
12. Mitchell and Alice Rivers NP
13. Mt. WebbNP
14. Cedar Bay
15. Mossman Gorge NP
16. Great Barrier Reef MP

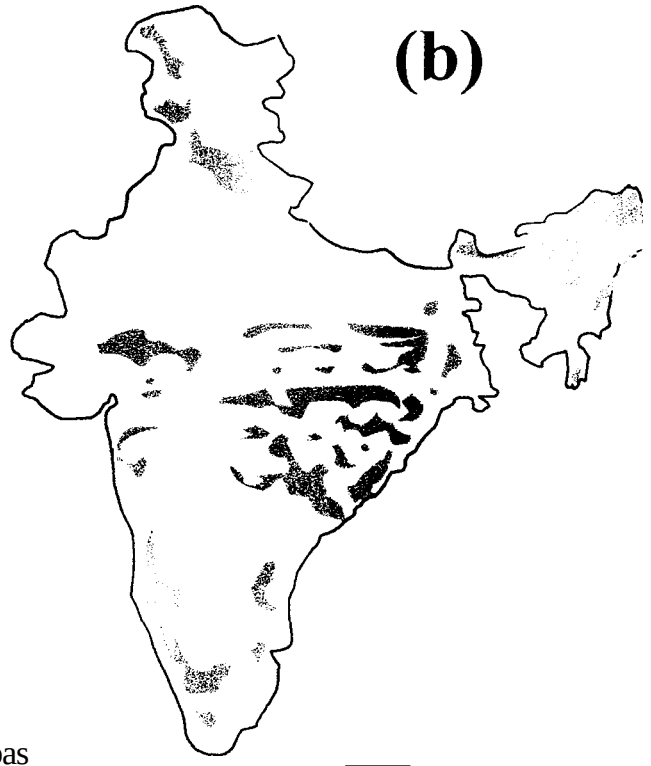
17. Fraser Island NP
18. Carnarvon Gorge NP
19. Mt. YarrowychNP
20. Jervis Bay NR
21. Lake Mungo NP
22. Coorong NP
23. Mt. GrenfellHS
24. Mootwingee NP

25. Gammon Ranges NP
26. Simpson Desert NP
27. Witjara NP
28. Yumbarra CA
29. NullarborNP
30. Unnamed CP
31. Watarraka NP
32. Uluru-Kata Tjuta NP

33. NitmilukNP
34. Kakadu NP
35. Gurig NP
36. Purnululu NP
37. Proposed Buccaneer Archipelago MP
38. Karlamilyi NP
39. Rudall River NP
40. Karijini NP

	Astronomical	*Physical*			*Biological*	*Ecogeographical*
		Athmosphere	Lithosphere	Hydrosphere		
Structural	Types of astros and constellations	Climate Winds Cloud Snows	Rocks Soils Landforms	Types of waters	Plants Animals Fungi Microorganisms	Vegetation and other landscape units
Relational	Several	Several	Several	Several	Several	Several
Dynamic	Solar and lunar cycles, movements of constellations and stars	Climatic events	Soil erosion	Water flows Water tables	Life cycles Nesting seasons etc.	Ecological succession
Utilitarian	Several	Several	Several	Several	Several	Management units





1. Kolis
2. Bhils
3. Gonds
4. Oraons
5. Santhals
6. Mundas
7. Hos
8. Juangs
9. Khonds
10. Savaras
11. Gadabas
12. Chenchus
13. Sholegas
14. Toda Kotas
15. Kadras
16. Irula Kurumbas
17. Garos
18. Daflas
19. Khasis
20. Nagas

Forestry areas