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Volume 5, **Social and economic dimensions of global environmental change**, pp 314–324

Edited by

Mr Peter Timmerman

in

Encyclopedia of Global Environmental Change

(ISBN 0-471-97796-9)

Editor-in-Chief

Ted Munn

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Indigenous Knowledge, Peoples and Sustainable Practice

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Indigenous knowledge is entering into the mainstream of sustainable development and biodiversity conservation discourse. Article 8(j) of the Convention of Biological Diversity (Rio, 1992) has contributed to this process by requiring signatories to: “respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional life-styles relevant for the conservation and sustainable use of biological diversity”. As the potential contribution of indigenous knowledge to key items on the global agenda gains widening recognition, an increasing number of scientists and policy-makers are calling for the integration of indigenous and science-based knowledge.

While indigenous peoples who have been lobbying for such recognition have reason to be satisfied, there are also reasons for concern. Are scientists serious enough about this emerging issue to go so far as to question the construction of their own knowledge? Or at the end of the day, will they do little more than add a veneer of traditional ecological knowledge (TEK) and then carry on business as usual? For the time being, the scientific and the development communities views indigenous knowledge first and foremost as a resource to be appropriated and exploited. Integration with (or more accurately into) science implies the application of a validation process based on scientific criteria that purportedly separates the useful from the useless, objective from subjective, indigenous ‘science’ from indigenous ‘beliefs’. Through this process, knowledge corresponding with the paradigm of Western science is extracted, and the rest is rejected. While this cognitive mining may be profitable to science, it threatens indigenous knowledge systems with dismemberment and dispossession.

INDIGENOUS, LOCAL OR TRADITIONAL ECOLOGICAL KNOWLEDGE (TEK)?

The challenge of understanding *indigenous knowledge* begins with the perplexing task of deciding how it should be named. On this matter, few persons agree. Or to be more precise, everyone recognizes that existing terms are for one reason or another unsatisfactory. Should one speak of TEK, the term coined when the field emerged in the public

arena in the 1980s? Or abandon this designation in favor of the term indigenous knowledge? TEK has the advantage of immediately evoking the temporal depth of these sets of knowledge and of clearly flagging their domain, that of nature, while at the same time raising the question of their relationship to the ecological sciences. Associating the term traditional, however, with societies that, in the not so distant past, were dismissed as primitive or savage raises the phantom of social Darwinism. The term is all the more inappropriate, if our penchant for constructing binary oppositions leads us to conceive traditional as a counterpoint to modern, and to think of traditional knowledge as fixed in the past and not susceptible to change. Finally, it may be misleading to apply the term ecological to sets of knowledge whose content and nature extend well beyond the confines of one scientific discipline to include such knowledge as the movements of constellations, the strength of ocean currents or the elasticity of sea ice, and to encompass not only empirical knowledge, but also practices and know-how, value systems, ways of life and worldviews. The fact is that indigenous peoples do not share the dichotomous occidental worldview that separates the material from the spiritual, nature from culture, and humankind from all other life forms, and as a result they do not do science in isolation from other pursuits.

While the label *indigenous knowledge* has the advantage of explicitly designating one of the groups of peoples most concerned – those who designate themselves as indigenous peoples, it raises other concerns. Who is indigenous and who is not? What peoples wish to be designated by this term and which do not? Indeed, this label is poorly adapted to the realities of Asia and Africa, where all peoples are native and any attempt to designate one group as indigenous but not another, provokes confusion. In these regions, unlike in the Americas or Australia, histories of human occupation have not followed a pattern whereby a wave of colonizers coming from abroad has supplanted or dominated a population that, due to its earlier and lengthy presence, is clearly identifiable as aboriginal or indigenous. Furthermore, in several African countries, particularly former colonies of francophone nations, the label indigenous has retained a strongly negative connotation due to its past history of use by colonial oppressors. For this reason, the expression *farmers knowledge* and *local knowledge* are sometimes preferred. The term local knowledge has the additional advantage of not excluding non-indigenous farmers, fishers, health practitioners and others whose extensive knowledge of the natural milieu is also a product of resource-based livelihoods extending across many generations. Its major weakness is a lack of specificity, as most knowledge can be labeled local.

Faced with the complexities of defining indigenous, special rapporteur J R Martinez Cobo provided a report in 1983 to the United Nations (UN) Sub-Commission on Prevention of Discrimination and Protection of Minorities, in which he stressed the right of indigenous peoples themselves to define what and who is indigenous. Further to this principle of self-identification, criteria retained to define the quality of being indigenous include common ancestry with original occupants, a distinct ethnic identity and shared patterns of vulnerability. These definitions are clearly of a political nature. They offer peoples encapsulated within states that may be reluctant to recognize territorial rights or the right to pursue a distinctive way of life, an opportunity to assert their difference and their collective identity. The debate on who and what to define as indigenous is far from closed, and it is unlikely that any single definition will satisfy all parties. Today, the UN Working Group of Indigenous Peoples estimates the world population of indigenous peoples as some 300 million, belonging to some 5000 groups in more than 70 countries, the largest population residing in Asia.

WHAT IS INDIGENOUS KNOWLEDGE?

Indigenous knowledge systems are the complex arrays of knowledge, know-how, practices and representations that guide human societies in their innumerable interactions with the natural milieu: agriculture and animal husbandry; hunting, fishing and gathering; struggles against disease and injury; naming and explaining natural phenomena; and strategies for coping with changing environments. It is through this fine-grained interplay between society and environment that indigenous knowledge systems

have developed diverse structures and content; complexity, versatility and pragmatism; and distinctive patterns of interpretation anchored in specific worldviews. Whereas knowledge is conceived in Western culture as an abstract entity independent from practice (e.g., science as opposed to technology), such a compartmentalized view is alien to indigenous societies. It would be self-defeating to consider farmers' knowledge of rain patterns, soil types and crop varieties apart from the ways in which this information is put into practice in their fields. In other words, indigenous knowledge includes not only knowledge but also know-how. Transmission is not only oral, but also in the context of doing (Figure 1). Finally, unlike science, indigenous knowledge does not oppose the secular to the spiritual, and therefore does not separate the empirical and objective from the sacred and intuitive. In indigenous societies, such boundaries are permeable. On the one hand, much knowledge of nature falls within the empirical realm. Hunters have detailed knowledge of the habitat, behavior, diet and migration patterns of their prey. Farmers know how crops should be rotated to maintain soil fertility and which plant products have insecticidal or medicinal properties. This 'science of the concrete', however, blends imperceptibly into the metaphysical realm. For the hunter, the success of the hunt is as much due to assistance from spirit helpers, as it is to skillful tracking and steady shooting. The continued flow of water for the farmers' field is attributed as much to their respect for the deity of the sacred headwater forests, as to the water-drawing properties of the trees themselves. The concrete and the spiritual co-exist side by side, complementing and enriching rather than competing and contradicting.



Figure 1 Knowledge transmission through observation and practice: young Inuk boy helping his father skin and butcher a caribou (*Rangifer tarandus*) on the banks of the Kuujuaq River (Arctic Quebec, Canada). (Photo by D Nakashima)

ON THE NATURE OF THE "SCIENCE OF THE CONCRETE"

While the current wave of interest in indigenous knowledge dates back no more than a few decades, the knowledge systems themselves have accompanied humankind through countless millennia of environmental change and cultural adaptation. The societies that developed them did not wait for official recognition before forging cultural landscapes and domesticating plants and animals that continue to play a major role in today's global economy. In 1962, Claude Lévi-Strauss, a philosopher and renowned anthropologist, published his seminal work on *The Savage Mind*. In his opening chapter entitled *The Science of the Concrete*, he reflects on the nature and character of indigenous knowledge, which he also qualifies as mythical thought (Lévi-Strauss, 1962). More recently, Berkes (1999), a human ecologist, has dedicated a book to indigenous knowledge entitled *Sacred Ecology*. Between the early work of Lévi-Strauss and Berkes' recent overview, numerous observers have pondered over these knowledge systems. While some accord them great value and others dismiss them as nonsense, their dual nature, combining the material and the spiritual, has been evident to all.

The first scientist to dedicate himself to the contemporary study of indigenous knowledge was Harold Conklin, who completed his thesis at Yale University in 1954 on *The Relations of Hanunoo Culture to the Plant World* (Conklin, 1954) (the Hanunoo are indigenous peoples of the Philippines). Pioneering a new discipline, ethnoscience, which would later come to be called the new ethnography, he dedicated himself to the study of a society's knowledge of its natural environment, through the examination of indigenous semantic categories. It is true that studies of human relations with plants and animals existed well before the 1950s, and that this intellectual tradition continues to this day under various labels composed of the prefix ethno-, followed by a qualifying term: ethnobotany, ethnozoology, ethnominerology. Ethnoscience, however, introduced a radically different approach that focused upon the knowledge of nature possessed by local peoples themselves. Unlike ethnobotany or colonial economic botany, which are basically applied Occidental sciences carried out in exotic locations and among 'exotic' peoples, ethnoscience strives to understand the view from within (an indigenous worldview). As a branch of cognitive anthropology, it focuses upon elucidating a cultural grammar, structures of thought built into the local language. For the first time, the recording of indigenous taxonomies was to reveal not only the breadth of a people's knowledge, but also insights into its very nature (cf. Friedeburg, 1979; Bulmer, 1979; Berlin, 1992; Ellen, 1993).

The classificatory prowess of indigenous peoples is on a par with that of scientists. As Lévi-Strauss has amply

demonstrated, the breadth of indigenous taxonomic knowledge is impressive: a single Seminole informant can identify 250 plant varieties and species, Hopi Indians recognize 350 plants, the Navajo more than 500. The Subanun of the Philippines use more than 1000 botanical terms and the Hanunoo, close to 2000. The diversity and sophistication of plant and animal use also attests to the subtlety of indigenous observations and the capacity to systematize knowledge and know-how. The Buriyat of Siberia, for example, derive from a single species, the bear, no less than 52 therapeutic applications: seven distinct uses for the meat, five for the blood, nine for the fat, 12 for the brain, 17 for the bile, and two for the fur, etc.

As impressive as these figures may be, for the Hanunoo, plants are not the stuff of lists, but rather objects of passionate and prolonged debate. Having rigorously recorded Hanunoo discussions during and after the evening meal, Conklin concluded that plants, especially cultivated varieties, were the focus of a majority of exchanges. Combining the expertise and interests of systematic and economic botanists, Hanunoo conversations centered upon the "hundreds of characteristics which differentiate plant types and often indicate significant features of medicinal or nutritional value" (Conklin, 1954, 97). This knowledge is acquired very young and expanded throughout an entire lifetime. One morning, a seven-year-old Hanunoo girl surprised Conklin by suggesting that he show her the pictures of Brown's three-volume guide to useful plants of the Philippines. On her own initiative, she began to comment on the text, assigning each plant a hanunoo name, or solemnly declaring that she had 'not seen that plant before.' At the end of her remarkable performance, she had identified 51 out of 75 plants with only two errors!

While a 'science of the concrete' might be expected to have practical applications as its sole preoccupation, Lévi-Strauss argues that indigenous knowledge is motivated by considerations other than utility. He cites Speck, for example, who has documented for the Indians of northeastern US and eastern Canada, an extensive herpetological taxonomy that is comprised of distinct terms not only for each genus, but also for species and certain varieties. Yet this knowledge is not practical, as reptiles and amphibians have no economic utility for these groups. Similarly, not only do the Pygmies distinguish between a phenomenal number of plants and animals, but they have also developed detailed knowledge of the habits and behavior of several species, including bats, that cannot be considered to be useful to them. These and other examples, drawn from numerous observers in diverse societies, have led Lévi-Strauss to conclude that it is not, as one might expect, use that leads to knowledge. Of the endless trials conducted for the sake of knowing, only a few end up providing useful results:

“... animals and plants are not known because they are useful, they are found to be useful or interesting because they are first known”.

(Lévi-Strauss, 1966, 9)

THE EPISTEMOLOGY OF SCIENCE AND OF INDIGENOUS KNOWLEDGE

The image of the Other held by the West shifts from one extreme to another. Since the time of the first encounter, indigenous peoples have always been a source of fascination. For many Occidentals they embody the ultimate otherness and, as such, they have been the object of both admiration and scorn. Are the ‘savages’ the embodiment of our unattainable dreams of freedom, courage, purity, simplicity and social equality? Or are they, as we imagine we were before becoming ‘civilized’ – cunning, cruel, ignorant, without faith or order, heeding only the law of the jungle? Until the development of cultural ecology in the 1960s (Lee and Devore, 1968), hunters and gatherers were portrayed as our poor backward cousins, struggling through great efforts and pains to maintain themselves just at the brink of survival. Subsequently, they became the distinguished representatives of what Sahlins (1972) has termed the original affluent society, rich not in material wealth, but luxuriating in time freed by the efficacy of their adaptation to the natural milieu and the adoption of a non-consumptive (Zen) lifestyle. Given these enduring disparities between our views of indigenous peoples, the deep ambivalence of our contemporary discourse on indigenous knowledge should come as no surprise. It is through pronouncements about the Other that Western society plays out its own doubts and fears. In this period of global change, have advances in science and technology brought well-being or alienation to our societies?

Whenever the issue of indigenous knowledge is discussed, sooner or later the recurrent question of validity is raised. Is it scientific? Or, being composed of odds and ends, does it combine the best with the worst, juxtaposing without distinction empirical observations and obscure superstitions?

As a first response, we must understand the persons behind the question. Science is a social construction of our own society, which being modern and Occidental is determined both historically and geographically. It presupposes a separation of the spiritual from the material, of religion from knowledge, and of culture from nature. Such a dissected worldview is not shared by indigenous cultures whose philosophy is better characterized as a cosmivision or as holistic. For this reason, qualifying the knowledge of indigenous people as science is both misrepresentation and reductionism. Nevertheless, this fallacious and futile approach of seeking ourselves in the Other has provided the basis for an

entire critique of indigenous knowledge. It is formulated in most cases as negative definitions, i.e., what indigenous knowledge is not. For example, science defines itself as experimental (deductions from hypotheses are tested), systematic (results can be replicated) and universal (results are independent from context, as variables are isolated and controlled). In contrast, indigenous knowledge is often said to be practical (determined by immediate need and utility), local (only applicable in the setting in which it was developed) and contingent (context dependent).

Some even speculate whether this knowledge might lie somewhere between perception and conception, and better be considered “as much skill, as concept” (Sillitoe, 1998, 229). How do New Guinea highlanders assess the quality of their soil? Even if the results of their analysis do not differ from that of the agronomist, they are reprimanded for not being able to offer up on a platter the analytical discourse that the scientist requires. When asked to explain why or how, they reply: “If one is a farmer, one just knows”. But in this dialogue between the deaf, where are the barriers and to whose limits are they due? Scientists conclude that indigenous people lack the analytical capacity to raise their skills from the plane of the local and pragmatic to that of the systematized and universal (Sillitoe, 1998). But as Sillitoe’s comments suggest, highlander farmers are undoubtedly equally frustrated by the difficulty of communicating their knowledge to scientists, and bewildered by the constraints that the latter impose on how knowledge must be packaged. Instead of opening all intellectual and sensorial pathways (touch, smell, taste, sight, sound) and accepting the farmer’s invitation to feel the texture of the soil, smell its composition or taste its acidity, scientists narrow-mindedly insist that explanations pass by the single limited channel of an intellectual discourse compatible with the Occidental literate tradition. For the scientist, if a farmer’s knowledge cannot be reduced to the written word, then it is not knowledge, but remains merely skills.

All of these criticisms (or more politely, definitions of what indigenous knowledge is not) arise from our own ethnocentrism and an inability to extricate ourselves from our own culturally-embedded point of view.

KNOWLEDGE AS A BASIS FOR SUSTAINABLE PRACTICE

Overshadowed by the pomp and promise of modern science and technology, indigenous knowledge systems have been disregarded until recently. While scientists and development agencies are only beginning to acknowledge their significance, their enduring role as the mainstay of local food production and health care in the developing world cannot be questioned. In sub-Saharan Africa, for example,

local knowledge guides the decisions and practices of small-scale farmers who represent 70–90% of agricultural producers and more than 60% of the population. Artisanal fishers, who represent more than 90% of the fisheries work force world-wide, rely on their own knowledge and skills to locate fish, navigate safely at sea and bring home the catch. Similarly, it is estimated that some 80% of the world's population fulfills their primary health needs through the use of traditional medicines. Even in industrialized countries, local knowledge accumulated across generations continues to play a fundamental role in sustaining localized resource use practices whether they be small-scale farming, fishing, trapping or the gathering of wild produce.

Since the 1992 UN Conference on Environment and Development, and in particular the coming into force of the Convention on Biological Diversity, increasing attention has been drawn to the contributions that indigenous knowledge can make to global biodiversity conservation objectives. This emerging role for indigenous knowledge holders has flowed quite naturally from the recognition that most remaining regions of the world that are biodiversity rich are also homelands for traditional and indigenous peoples. This is no simple coincidence, as in sharp contrast with the biodiversity impoverishment that accompanies the processes of modernization and industrialization, the persistence of traditional ways of life has gone hand in hand with the maintenance of local ecological systems and the conservation, and even enhancement, of biodiversity. In these areas represented as wilderness or virgin in the Western mind, indigenous knowledge participates in the transformation of nature to create cultural landscapes, the products of social system–ecosystem interaction. One dramatic, but by no means unique, example of this process is the use of fire by Aboriginal peoples in Australia to create landscapes that are ecological mosaics (cf. Case Study 1 below). This sustainable practice, which is vital for maintaining biological diversity, has now been integrated into National Park policy in certain parts of Australia through directives that explicitly call for the reinstatement of traditional Aboriginal burning regimes.

Inventories of local biodiversity can also benefit from knowledge encoded in local languages in the form of indigenous categories of natural objects. Finally, as indigenous peoples retain within their knowledge systems an inter-generational memory of fluctuations, trends and exceptional events in relation to the local environment, they can contribute importantly to understanding processes of change, whether these might be long-term, global transformation processes or circumscribed local events. The invaluable contribution of indigenous knowledge to environmental and social impact assessment processes, for example, has been convincingly demonstrated.

Modernization and uniformization of agricultural practices has also triggered a severe loss of biological diversity

of domestic plant and animal stocks. Here again, pastoral and peasant communities that have maintained traditional modes of production have today become the major custodians of the world's crop and domestic animal diversity. In tropical agroecosystems in Thailand and Indonesia, for example, peasants commonly maintain more than 100 domestic plant species, as well as harboring in their paddies, rice varieties adapted to a range of environmental conditions (Altieri, 1999). Slash and burn agriculture as practiced by the Karen of northern Thailand offers one example of a sustainable farming system based upon indigenous knowledge and practice, that enhances biological diversity (cf. Case Study 2 herein).

CASE STUDY 1: ABORIGINAL FIRE REGIMES AND THE CREATION OF CULTURAL LANDSCAPES

Gagadju, indigenous hunter – gathers of Australia's Northern Territory, focus their subsistence activities on a coastal fringe penetrating no more than a few kilometers inland (Lewis, 1989; Nakashima, 1998). Two habitat types dominate this area of flatlands: tall-open eucalyptus forest and eucalypt woodlands. Interspersed between these habitats are freshwater floodplains, paperbark swamps and rain forest stands. A steep sandstone escarpment dominated by Spinifex and other grasses as well as by shrubs, marks the inland boundary of the coastal flatlands. This tropical savannah ecosystem has been and continues to be shaped by the Gagadju through the judicious application of fire.

Burning practices are carefully orchestrated, paying close attention to season, habitat, wind direction, state of vegetative growth, moisture levels, previous burn locations and accumulation of debris. The Aboriginal calendar is divided into six seasons. Three of these constitute the wet period of the year: first, a season of pre-monsoon storms; followed by the monsoon season; and finally the period of 'knock em down' storms. The dry period follows, also divided into three seasons, beginning with a cool, humid season, then a cold weather season and finally a period of hot, dry weather. The Gagadju begin their annual cycle of burning towards the end of the wet period and conduct most burning activities during the ensuing cool and cold weather seasons of the dry period. During the hot, dry season when vegetation is extremely flammable and fires are difficult to control, burns are only conducted under very limited circumstances.

Burning Patterns on the Floodplains

With the end of the monsoon season, water levels on the floodplain begin to recede. Sedges and grasses, which spring up on the exposed flats, quickly mature and are dry

before the coming of the ‘knock em down’ storms. The Gagadju set their first fires in these dry grasses, knowing that the burn will die out along the edges of the rain forests and paperbark swamps (much too moist at this season to burn) and will continue outwards into the floodplains no more than some 2–10 m. These habitat types differ markedly in their sensitivity to fire. When dry, the grasses of the floodplains, as those on the escarpment, burn easily and recover quickly. In contrast, the vegetation of rain forests and paperbark swamps is fire-sensitive, recovering from a burn only with considerable difficulty. At intervals of a few weeks, the Gagadju ignite and burn successive strips of grasses as they mature and dry, proceeding in this fashion farther and farther out onto the floodplain. On each occasion, previous burn areas and fresh vegetative growths on moister soils serve to contain the fire.

This burning of the floodplains serves several purposes. First, the early fires around the perimeters of rain forests and paperbark swamps create fire barriers that shelter these fragile habitats from fires occurring later in the season. Second, the razing of mature, dry stands of grasses triggers a regrowth, whose tender leaves lure kangaroos and wallabies out from adjacent rain forest stands in the early morning and late evening, thus offering the Gagadju hunting opportunities. Finally, the Gagadju note that fires also favorably alter the floodplain habitat for the nesting of waterfowl, particularly magpie geese.

Creating Fire Mosaics

Beginning during the cool season and at the start of the cold season, the Gagadju set fires in the tall-open forest

and eucalypt woodland habitats that dominate the coastal flatlands. These habitats are highly susceptible to burning and at the same time, well adapted to fire. In the understory, leaf litter accumulates quickly and has high oil content, while sorghum grasses provide a dense cover. While these burn easily when dry, the vegetation is nevertheless quick to recover. Thick bark shelters eucalyptus trees from understory fires, and high canopies reduce the likelihood of fires spreading into the forest crown. Wind intensity and direction are important allies. The Gagadju use strong midday winds to aim the fire towards areas of moister vegetation or previous burn sites to limit the extent of the burn. Furthermore, strong winds prevent heat and flames from licking up into the forest canopy, thus protecting trees in flower that will subsequently provide humans and animals with edible fruit. Early in the cold season the fires go out after a few hours and burn relatively small areas. As the season progresses, the vegetation becomes successively drier, and fires burn longer and cover larger areas.

Fires in these wooded habitats serve a number of functions. Circles of fire are used as a hunting technique, driving animal prey to waiting hunters. By removing surface vegetation and debris, burning facilitates the gathering of yams and roots and the hunting of goannas (Figure 2). Burn sites attract kangaroos and wallabies that come to graze the fresh re-growth of grasses. Furthermore, these serial burnings create an ecological mosaic composed of sites at different stages of recovery from burning. This heightens biological diversity and provides the Gagadju with a choice of subsistence opportunities. Finally, regular bouts of controlled burning impede the growth of thick tangles of underbrush



Figure 2 Shaping landscapes with fire: Aboriginal peoples use controlled burning to maintain a habitat mosaic that offers a variety of foraging opportunities. Here a woman sets off to hunt goannas on a newly burned site (Northern Territory, Australia). (Photo by B Glowczewski)

and prevent the dangerous build-up of leaf litter and debris that can result in uncontrollable wildfires.

The central role of traditional Aboriginal burning practices in maintaining biological diversity, and in creating and maintaining the cultural landscapes of Australia, has gained official recognition by National Park authorities in certain parts of the country. In Kakadu and Uluru National Parks the re-establishment of traditional Aboriginal burning regimes has become an explicit Park management goal.

CASE STUDY 2: SWIDDEN CULTIVATION AS SUSTAINABLE PRACTICE – THE KAREN OF NORTHERN THAILAND

Slash-and-burn (*swidden*) agriculture continues to be an important mode of agricultural production in many parts of Africa, Asia, South and Central America and the Pacific (see **Shifting Cultivation and Land Degradation**, Volume 3; **Swidden**, Volume 3). It has also been at the heart of one of the most prolonged and vociferous debates over the sustainability of this traditional practice. While the debate is far from closed, there is growing awareness today that swidden agriculture as practiced by many indigenous peoples is not only sustainable, but also contributes to other

pressing global concerns including conservation of domestic and wild biodiversity, as well as carbon storage.

Land Use Strategies of the Karen

The Karen land use strategy is based upon the maintenance of several major categories of land that can be distinguished by their use, location and the pattern of ownership: rice paddy fields, areas of swidden cultivation, community forest and watershed forest (Figure 3) (Rerkasem and Rerkasem, 1994; Nakashima, 1998). Rice paddies are owned by individual families and tend to be established close to the village, often at the base of slopes where sediment fans have been created by the erosion of soils from swidden fields above. Lands used for rotational swidden agriculture are much more extensive, lying in a broad band surrounding the village. Families divide their holdings into plots among which cultivation is rotated on a 7–10 year basis. Fields are cultivated for only one or two seasons before being returned to fallow. The different types of forested areas, unlike rice paddies and swidden fields, are held as common property. The extensive community forests provide the Karen with wood and other forest products, as well as serving to graze livestock. Watershed forests harbor the headwaters of major water sources and are denoted as sacred.

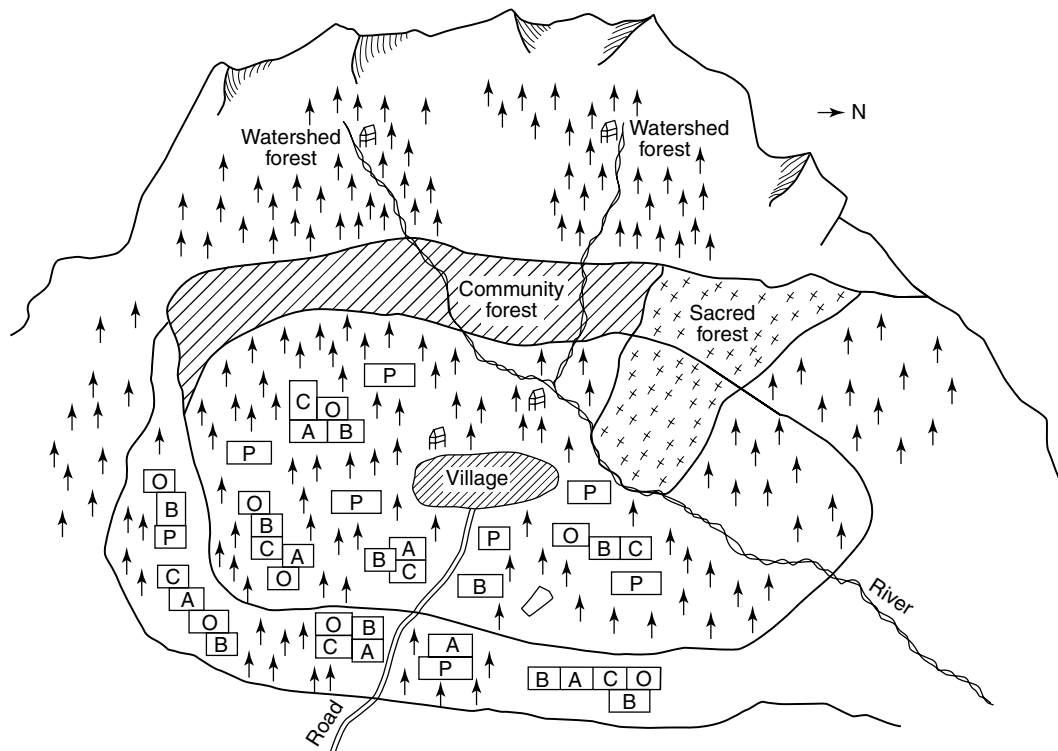


Figure 3 Organization of land use by the Karen of Nong Tau (Chiang Mai Province, Thailand) showing paddy fields (P), swidden fields (O – under cultivation; A – first year fallow; B – 3–4 year fallow; C – 5–7 year fallow), community forest, watershed forest and sacred forest for rituals associated with birth. (Map by J Odochao and C Vaddhanaphuti. Reproduced by permission of Chayan Vaddhanaphuti)

Creating and Maintaining a Biologically Diverse Landscape

Through a judicious mixture of tradition, adaptation and innovation, the Karen people shape the landscape to create and maintain a high level of heterogeneity. From the resultant rich biological diversity, they extract a multitude of materials and products that fulfill nutritional, socio-economic, aesthetic and spiritual needs. Within swidden fields under cultivation, major crops of upland rice, maize and, increasingly today, cash crops such as cabbage, are intercropped with an astounding variety of traditional products such as beans, eggplants, cucurbits, sesame, chilies, yams, gourds, pumpkins, various greens, and spices. Fruit trees, cotton and medicinal herbs are also planted in these fields (Rerkasem and Rerkasem, 1994).

Further to this diversity of cultivated species, Karen farmers also foster the rapid recovery of secondary growth in the fallows, not only to maintain soil fertility and limit erosion, but also to re-establish a botanical community of which they make full use. When clearing a field for cultivation, branches and brush are left on the ground and burned, providing the soil with nitrogen and carbon-rich ash. Trees are cut well above ground level, leaving roots intact and stumps rising some tens of centimeters above the ground (Figure 4). These stumps sprout quickly, speeding recovery of the forest after cultivation and thus maintaining soil fertility.

Furthermore, plots are distributed so as to ensure that recently used fields juxtapose old fallow plots whose advanced secondary growth speeds the recovery of cultivated lands by providing an abundant supply of seeds. From the first year onwards, the fallow fields provide important supplies of medicinal plants, food in the form of mushrooms, tubers and shoots, as well as areas for the grazing of livestock. After several years, the number of plant species re-established on these sites numbers in the 100s, approaching the biological diversity found in adjacent uncut forest areas, such as the community and watershed forests. The Karen agro-ecosystem also encompasses the use and management of permanently forested lands. Community forests provide wild food products such as mangoes, jackfruit, bamboo shoots, mushrooms, greens and edible herbs, as well as medicinal herbs, firewood, and timber and bamboo for construction. Watershed forests, as vital sources of water for swidden and rice paddy fields, are maintained in a state close to forest climax and strictly protected.

Today the loss of traditional lands to logging interests or commercial plantations and state policies encouraging permanent and intensive agriculture are posing major threats to many swidden cultivators. Less land means shortened fallows and depleted soils, jeopardizing the sustainability of traditional practices. Moving from shifting cultivation to permanent agriculture entails major losses in both biological



Figure 4 Karen swidden fields showing various stages of regeneration. When clearing fields for cultivation, swidden farmers encourage re-growth by cutting certain trees well above ground level and leaving others intact (Chiang Mai Province, Thailand). (Photo by D Nakashima)

and cultural diversity, and raises the specter of the millions of hectares of Southeast Asia covered by species-poor *Imperata cylindrica* grasslands, a direct result of the failure of permanent agriculture on phosphorus-poor tropical soils. Rather than import traditional Occidental models of resource exploitation, such as permanent cash monocropping or large-scale non-selective logging, the sustainable practices of small-scale swidden farmers like the Karen should be recognized and supported. They offer numerous benefits including long-term sustainability of local environments and lifestyles, as well as the conservation of domestic crop varieties for many species, and wild plant and animal communities whose biodiversity approaches that of unexploited forest areas and remains far superior to that of permanently cultivated fields. Finally, recent research suggests that agroforests in general, and shifting cultivation in particular, can contribute significantly to carbon sequestration, by replacing conventional monocropping

or *Imperata* grasslands with cyclical systems that include forest production.

INTELLECTUAL PROPERTY RIGHTS AND INDIGENOUS KNOWLEDGE: THE THREAT OF COMMODIFICATION

While biodiversity managers or development practitioners are only beginning to define a role for indigenous knowledge, its utility in another domain has been fully recognized and is being vigorously acted upon. Bio-prospecting, the quest for natural products to be exploited for commercial gain, is explicitly targeting traditional knowledge holders. In this arena, the pharmaceutical, agricultural and biotechnological industries have been particularly active. They recognize that the accumulated knowledge and traditional practices of indigenous communities are a powerful resource that can greatly facilitate the task of identifying useful new varieties of domestic plants or animals, isolating novel biological components, or developing innovative technologies and techniques. Recognition, however, has not automatically led to acknowledgement and the need to share benefits with the community is regularly overlooked.

The patenting of domestic plant varieties, traditional medical products and other biological resources whose identification and use are embedded in traditional knowledge has been a source of grave concern for developing countries and indigenous communities. By conferring upon foreign companies or individuals the exclusive right to exploit for commercial benefit certain 'inventions' that are in fact based upon indigenous knowledge, the patenting process transforms persons who do what they have always done into patent infringers. In one infamous case, the wound-healing capacity of turmeric, known and used in India for centuries, became a patented invention in the US. As a result, it became illegal for Indians residing in the US to use turmeric for this purpose. Similarly, a European patent on the fungicidal properties of the neem plant privatizes the botanical knowledge of Indian farmers who, for generations, have used this natural pesticide in their fields. In the end, both of these patents were revoked, but only after long and costly challenges mounted by the government of India (Dutfield, 1999). Similarly, the Bolivian National Association of Quinoa Producers has mounted a challenge against a US patent relating to a unique male sterile variety of the quinoa plant, a characteristic long known to Andean peasants and used by them to control the development of new hybrids. As Gari (1999, 6) astutely points out this patent does much more than just hijack indigenous knowledge for the eventual material benefit of a developed country. It also "strengthens and spreads the Western paradigm of nature and science", by presenting knowledge pillaged from Bolivian peasants as the cutting edge of biotechnology.

Patents are only one of several legal instruments that constitute the current regime of intellectual property rights (IPRs). Others include trademark, copyright, geographical indication and plant variety rights. For indigenous knowledge holders, IPRs have been more often a source of problems, rather than solutions. Certainly they serve to protect the interests of companies that engage in bio-piracy, the unauthorized exploitation of biological resources and indigenous knowledge. A key debate today is whether contemporary IPR regimes can be adapted to also defend the interests of those who are custodians of indigenous knowledge.

To counter the granting of patents prejudicial to indigenous peoples, actions have been taken before the World Trade Organization under the agreement on trade-related aspects of intellectual property rights (TRIPS). While providing a forum for overturning inappropriate patents, nothing in the TRIPS Agreement has been expressly designed for the protection of indigenous knowledge. Nevertheless, existing IPR arrangements may offer some viable options, and efforts are being made to explore these possibilities, including the development of *sui generis* (of its own kind) systems. The World Intellectual Property Rights Organization, for example, has recently created a commission on genetic resources, traditional knowledge and folklore, whose mandate includes the investigation of innovative measures to accommodate the exceptional characteristics of indigenous knowledge systems.

The challenge is a sizable one. IPRs have evolved within narrow socio-economic and political contexts. Designed to protect individuals whose 'inventions' require safeguarding in view of their potential commercial value, they remain largely incompatible with indigenous knowledge, which is collectively owned; whose invention extends across generations; and whose *raison d'être* is not profit, but ecological understanding and social meaning. Due to this incompatible nature, legal rights may have impacts quite other than those intended. By protecting select elements in isolation from the larger cultural context, they encourage the fragmentation of cultural systems. By designating knowledge owners, they may trigger social dissension between those recognized as proprietors and others who are excluded. Finally, as IPRs protect knowledge by setting rules for their commercial exploitation, ironically they may in the end merely facilitate the appropriation of traditional knowledge by the global marketplace.

RELATIONS OF POWER: KNOWLEDGE APPROPRIATION OR INDIGENOUS EMPOWERMENT?

The scientific and development community views indigenous knowledge first and foremost as a resource to be appropriated and exploited. Even scientists with the best

of intentions may accelerate the demise of other knowledge systems by valorizing components resembling science and implicitly (or explicitly) casting dispersions on other elements that in science's view are mere superstition and belief. Such a process captures and instrumentalizes indigenous knowledge, strengthening the hand of those in positions of power at the expense of indigenous peoples.

This is not to argue against the exchange and sharing of knowledge between scientific and indigenous systems. However, as Agrawal (1999) underlines, it would be irresponsible and a disservice to indigenous peoples to ignore the power relations that define such processes, and in particular, to fail to appreciate the implications of the severe power asymmetry between indigenous peoples and proponents of science.

To seek a way forward, it is important to come back to the questions of culture and worldview. For scientists, culture is a foreign element whose consideration falls outside the bounds of their profession (though they would probably agree to associate the cultural factor with the indigenous component of the equation). They are quite reluctant to admit that the culture of science is, in itself, a valid object of study. Cultural constructions such as the opposition of Nature (environment) and Culture (society), and the differentiation of rationality from spirituality, the empirical (science) versus the symbolic (religion), have provided science with its very foundations, and remain today an everyday reality of scientific thought and practice. These tenets are such an integral part of the scientific worldview that natural scientists are not aware of them as specific cultural interpretations of the world. For them, they simply represent reality. Scientific reality, however, differs from that lived by indigenous knowledge holders, whose conceptions of the world include pathways between natural and societal realms and whose spirituality infuses everyday objects and everyday acts.

In other words, there is no sound basis for deciding that one worldview offers a superior reference point for 'reality' than another. We can of course arbitrarily choose – and given science's institutional power, it is not surprising that the 'objective and rational' scientific method is repeatedly called upon to judge other knowledge systems. But it is important to recognize that this is a societal choice, not one defensible from any neutral or extra-cultural perspective. Consequently, the encounter between scientific and indigenous knowledge must be understood as a meeting of cultures, with the cultural component as prominent in one camp as the other.

Full appreciation of this perspective alters our approach to articulating (a better term than integrating) scientific and indigenous knowledge. Emphasis must be placed on leveling the playing field and appreciating indigenous knowledge not as static sets of information to be conserved *ex situ* and integrated into science, but as dynamic components of

contemporary indigenous societies and cultures. Accordingly, the protection of indigenous knowledge may better pass through pathways such as conserving indigenous language (as knowledge is encoded in language), ensuring knowledge transmission within the societies themselves, empowering indigenous societies so as to increase their control over processes of change, and ensuring continued access to the environments upon which their ways of life depend (*see Development and Global Environmental Change*, Volume 5).

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