Current Anthropology Volume 43, Number 3, June 2002

Maya Medicine in the Biological Gaze

Bioprospecting Research as Herbal Fetishism

by Ronald Nigh

The relationship of human societies to territory and natural resources is being drastically altered by a series of global agreements concerning trade, intellectual property, and the conservation and use of genetic resources. Through a characteristic style of collective appropriation of their tropical ecosystems, Maya societies have created local institutions for governing access to their common resources. However, new mechanisms of global governance require access to Maya biodiversity for world commercial interests. The Chiapas Highland Maya already face this prospect in the International Cooperative Biodiversity Group drug discovery project, which proposes to use Maya medical knowledge to screen plants for potential pharmaceuticals. The ethnobiological focus of the project emphasizes the naturalistic aspects of Maya medicine, primarily the use of herbal remedies. This biological gaze decontextualizes the situated knowledge of Maya healers, ignoring the cultural context in which they create and apply that knowledge. The search for raw materials for the production of universal medical technology results in symbolic violence to the cultural logic of Maya peoples. Only the full recognition of Maya peoples' collective rights to territory and respect for their local common-resource institutions will provide ultimate protection for their cultural and natural patrimony.

RONALD NIGH is Research Professor at the Centro de Investigaciones y Estudios Superiores en Anthropología Social del Sureste (Carretera a S. Juan chamula Km 3.5, San Cristóbal Las Crusas, 29247 Chiapas, Mexico). He was born in 1947 and received his Ph.D. from Stanford University in 1977 with a dissertation on traditional Maya architecture in highland Chiapas, Mexico. Since then he has pursued applied and basic research on Maya agroecology, food systems, and natural resource management. In 1990 he founded the Global Ecology Laboratory at Mexico's Autonomous National University and began a new phase of research applying geographical information systems and landscape ecology to community-based natural resource and agricultural planning and biodiversity issues. His work at CIESAS includes training activities in organic agriculture for small farmers and rural teachers. The present paper was submitted 31 V 00 and accepted 22 V 01.

The politics of nature is thus based on contested assumptions. These assumptions imply value judgements which are derived from conflicting cultural definitions of the right and the good.

—KLAUS EDER, *The Social Construction of Nature*

The considerations presented in this paper arose unexpectedly from research through which I found myself a modest witness to a major controversy. For several years I have conducted fieldwork on how indigenous farmers in Chiapas, Mexico, articulate the biophysical, economic, and political elements of their life-worlds to construct their livelihoods and reproduce their society. Working primarily with speakers of Tzotzil, Tzeltal, Ch'ol, Mam, and Lakantun (all Mayan languages), I have focused on collective and cooperative organizations dedicated principally to organic agriculture, traditional medicine, ecotourism, and handicrafts that seek to increase the general welfare of their communities and to achieve more effective control over their territories and natural resources (Nigh 1997, 1999, 2000). As a result of this work, I have become aware of an emerging context in which Indian organizations increasingly are engaged in complex international networks with enormous potential effect on their lives.

Throughout the world, the relationship of human societies to territory and natural resources is being drastically altered by a series of global agreements concerning trade, intellectual property, and the conservation and appropriation of biological resources. The importance of these novel issues was impressed upon me by the presence, since 1998, of a major international research effort—the Maya International Cooperative Biodiversity Group (Maya ICBG) bioprospecting project for highland Chiapas, directed by Brent Berlin of the University of Georgia. Having relied on Berlin's recognized ethnobotanical contributions (Berlin and Berlin 1996, Berlin 1992, Berlin, Breedlove, and Raven 1974) in my own research for many years, I watched with some surprise as what appeared to be yet another phase of a long academic career became a hotly contested issue locally and internationally. I found myself socially situated in the controversy because many local scientists participating in the project have been friends and colleagues for many years and many of the Maya involved have collaborated in my own research and applied work.[1]

Criticism of the Maya ICBG, particularly by nongovernmental organizations, has been couched in terms of competing transnational and local interests and how they shape and are shaped by policies and resource con-

1. I especially thank some of the actors in the events referred here—Rafael Alarcón, Sebastian Luna, and Antonio Pérez from OMIECH, Luis García and José Carlos Fernandez of ECOSUR, and Brent Berlin of the University of Georgia—for sharing their views. I am grateful to my colleagues at CIESAS, Graciela Freyermuth, Carolina Rivera, Witold Jacorzynski, Dolores Paloma, and Miguel Lisbona, as well as Brent Berlin and the anonymous referees, for their insightful and constructive comments on the drafts.

flicts (see, e.g., RAFI 2000). While I have favored this approach to political ecology in the past, I share a concern expressed recently by other anthropologists to enrich our understanding through the study of the meanings through which people structure and comprehend their ecosystems (Escobar 1999, Atran 1999). I felt that my relationship to the Maya ICBG controversy presented an opportunity to explore, through my own data and those of other researchers of the Maya area, how different meanings assigned to nature and ecosystems, plants and animals, contribute to contested views of research, the environment, and the human use of nature (Nazarea 1999, Haenn 1999).

Here I analyze a number of meanings generated by the controversy surrounding the Maya ICBG, beginning with the very notion of the Maya. Although the project's focus was restricted to highland Chiapas, working with three distinct Mayan language groups, the adoption of the name "Maya ICBG" for the project participates in symbolic meanings that go beyond mere ethnographic description. Deconstructing "the Maya" prepares the argument about contested visions of nature and human relationships to natural resources. Independently of the many legal and policy issues brought up by the project, I argue that bioprospecting proposals such as the ICBG do violence to indigenous meanings of nature, medicine, and property. These contested meanings—these differing cultural definitions of the right and the good in the context of enormous power inequality—generate conflict. By contrasting the medical knowledge and practices of the highland Maya with the knowledge and practices of scientists turned bioprospectors, I attempt to show how the clash of hidden assumptions produces intercultural misunderstanding.

The Construction of the Maya World

A vast ethnographic literature documents the resilient and fascinating Maya culture area, in which some 29 distinct but related languages and cultures form one of the major indigenous regions of the world. Resistance and continuity of Maya cultures have been identified as defining characteristics of this area (e.g., Ruz 1992) since before the Spanish invasion. Indeed, anthropology's recent attempts to purge itself of ethnographic romanticism and "essentializing" concepts of cultural identity have found the Maya case problematic (Fischer 1999).

On the basis of the archaeological definition of the Maya culture area and ethnographic observation of surviving Mayan-speaking groups in that area, anthropology has identified the Maya as a particularly attractive object of study. The archaeological background, with its focus on material culture, its time lines, and its quantitative methods, gives the notion of "the Maya" a certain concreteness and legitimizes the category in scientific discourse. Thus, one can slip unnoticed from the irrefutable reality of stone monuments, ancient waterworks, and calendrical texts to the ethnographic present of any of some 6 million Maya people, carrying that scientific legitimacy into the realm of social and cultural analysis where it is infrequently granted. Curiously, until the final decades of the 20th century, none of the people we call the living Maya thought of their own identity in terms of this anthropological category. This fact, while recognized by scholars, has done little to dampen the enthusiasm for Maya studies or to lessen the reality of the mysterious Maya for the general public.

To say that "the Maya" is a category "constructed" by anthropologists is not to invoke epistemological relativism or assert that there is no empirical basis for imputing such a category. I rely on insights from cultural studies of science that "nature is always constructed by our meaning-giving and discursive processes" (Escobar 1999: 2) but is contingent on the systematized experience of scientific practice. "To be 'made' is not to be 'made-up'" (Haraway 1997:99). What we must abandon, however, is the idea that the practice of science—be it archaeological, ethnographic, or biological—is the mere uncovering of a pre-given reality. In our practice—in the contingency and specificity of experience—we find an order that we interpret in terms of categories that are simultaneously semiotic, institutional, organic, and material. But these categories are valid, validated, scientific constructions.

The error occurs in the next step, in the naturalization of the idea of the Maya; forgetting its constructed nature, we take "the Maya" literally, as a pre-given part of the natural, real world and therefore a legitimate object of scientific study. Notions of Maya authenticity and purity may impose our own construction on the self-representation of the Maya as they live today. The question of Maya identity and self-representation is a crucial issue in the struggle for recognition of Maya peoples and the defense of their intellectual and cultural patrimony. The anthropological image of the Maya can be seen as an obstacle in this struggle, a romanticized, homogenizing, tourist gaze (Castañeda 1996) that confines Maya culture to the past and ignores the problems and realities of the people who live in the Maya area today.

At the same time, among the different Maya groups, many people who previously represented themselves in exclusively local terms are constructing a pan-Maya identity. There can be no doubt that the Maya are involved in a struggle for recognition and equitable participation in global society and are facing threats to crucial elements of their livelihood and patrimony. Part of that struggle, at least in some areas, involves a fundamentalist reaffirmation of the "old ways" and the essentializing of pan-Maya identity by the Maya themselves. As Herzfeld (1997) has noted, people often essentialize as a political strategy. This Maya self-representation is itself influenced by the archaeo-anthropological concept of the Maya. Thus, the category has now left its birthplace in academia to become a resource in identity politics.

Local identities of Maya groups were the basis of a further important constructed category, "the Maya community." The current concept of the Maya community is an artifact of the ethnographic literature of the middle decades of the last century. A strong nostalgic current in industrial society that idealizes "the village" as the

cradle of our most cherished values (see Critchfield 1994) also nourishes this view. But besides these imaginary dimensions, "the community" is a resource in the political field in contemporary Mexico and Central America. The ethnographic view of community has influenced Indian legislation as well as government and international development policies for many decades and dominates influential expressions of alternative political futures in the region (Toledo 2000). Most important for the case at hand, it is the "community" that is supposed to have legal and moral authority to grant "prior informed consent," a legal prerequisite for biological sampling, including bioprospecting. Therefore, what we mean by "the community" is more than an issue of social theory.

Once again, the empirical referents of the "Maya community"—especially its importance and development during the colonial period (Farriss 1984)—are easy to point to, but I object to its use as an unanalyzed "natural" category. References to community often do not specify whether an actual legal entity or a face-to-face social or cultural unit or a residential unit is meant. Maya society today, in Chiapas and Guatemala especially, is characterized by the "explosion of communities" (Nash 1995), the fragmentation of formerly homogeneous loyalties by the emergence of new social and demographic movements organized around supracommunity interests of religion, politics, gender, productive activity, and migration. Indeed, relationships beyond the community have become a significant source of identity, perhaps as important as "belonging" to a specific community (Hernández and Nigh 1998). The "Maya community" cannot be taken as a given; we must specify how that community is constructed—or how it will be reconstructed—and the current empirical basis of its social solidarity.

The Maya Commons as Spirited Landscape

Some scholars have seen deep historical patterns of human settlement and land use in the Maya culture area (Vogt 1964). Varied forms of collective resource management have characterized communities throughout the Maya area, and these community institutions are often points of conflict and resistance to government and development agencies. The historic form of property among Maya and other Indian communities in Mexico since colonial times has been that of communal lands. This form of land tenure is recognized in the Mexican Constitution, in which the community assembly is designated as the ultimate authority in granting use rights to land parcels and the natural resources they contain. Even after the constitutional reforms of the Salinas administration (1988–94), communal tenure provides full constitutional protection to Indian communities' lands as long as a majority of *comuneros* wishes to maintain that tenure status.[2] In this restricted context of agrarian law, "community" has a precise and unambiguous meaning that is usually, though not necessarily, broadly cultural and social.

Communal lands create an ideal legal context for local management of common-pool resources. Thus, the community has often become an institution for the creation and implementation of rules governing the use of such resources. The Mexican Revolution was fought largely for the restoration to Indian communities of communal lands that had been expropriated during the liberal period of Benito Juárez and Porfirio Díaz in the late 19th century. But the land reform of the revolution created a new category of social property, the *ejido*—a quasi-communal property in which the federal government rather than the community assembly retained ultimate authority. Once again, under the neoliberal policies of the past two decades, the political class of Mexico attempted to eliminate such forms of social property through privatization of ejidos and communal lands. And, once again, the response by Indians has included armed insurrection, drawing world attention to a conflict that has really been continuous throughout the last century (Harvey 1998, Montemayor 1997).

The institutional arrangements that communities adopt to administer their common resources and assign property rights are not static but can change dramatically over time. Within a given community, there may exist a variety of property regimes in which some areas or resources (e.g., house sites) are assigned indefinitely to individual heads of households whereas other areas (forests or rough areas) may be collectively managed. The great advantage of these arrangements is that the design and implementation of the rules governing resource use are entirely in the hands of the local community and can be readily modified to adapt to new circumstances (Ostrom 1990).

One of the great challenges for indigenous communities today is the adaptation of their traditional institutions of common-property resource management to the demands of a growing population and globalizing society: demands for the conservation of their biological diversity and ecosystems, on the one hand, and for aggressive commercialization of their resources, on the other. Far from being archaic arrangements left over from the past, common-property resource management institutions have shown an extraordinary capacity to change over the centuries and are continually being revised to meet new challenges (Bray 1995, Gray, Colchester, and Parellada 1998).

2. Though the Constitution stops short of recognizing rights to "territory," it does grant the community full control over natural resources within the boundaries of its communal lands, except for resources of the subsoil, which are reserved to the state. The concept of "territory," as defined in international indigenous rights documents such as International Labor Organization Convention 169 and the Draft UN Declaration on the Rights of Indigenous Peoples, goes beyond the mere recognition of rights to land property and asserts the notion of the "habitat" necessary for the social and cultural reproduction of the group.

There has been considerable debate in anthropology recently over the ecological sustainability of indigenous common-property resource management systems and whether indigenous people achieved a harmonious relationship with their environment (Krech 1999, Ruttan and Borgerhoff Mulder 1999). These issues are beyond the scope of this paper, but the discussion is relevant in that it has revealed some of the complexities of human societies' engagement with their natural resources and changing environments. Ostrom (1990:91) identifies as one condition necessary for an enduring system of common-property management of a resource the existence of clearly defined boundaries for the system. These boundaries must designate unambiguously the extent of the common resource and the individuals or households that are considered to have rights and obligations with respect to it.

A Maya agrarian community under Mexican law, with clearly defined territorial boundaries and a list of household heads who form part of the community assembly, creates a situation of clearly defined rights with respect to a common land resource. Under these conditions the assembly can issue a set of enforceable rules with respect to the natural resources on its land. The capacity to generate and enforce such clearly specified management systems gives the notion of "community" an empirical content. Wild-crafted, widely distributed medicinal plants and the local knowledges of their uses, shared across different Maya cultures, do not, however, provide such a clearly bounded resource system.

The refusal of most governments to recognize the legitimacy of indigenous systems of property and resource management is one of the most egregious violations of the collective rights of Indian peoples. Ostrom (1990) has identified the wider institutional context of common-property resource systems as another crucial factor determining their success or failure. Indeed, it is clear that the generally poor showing of the ejido system in Mexico as a common-pool resource manager is primarily due to the hostile institutional environment created by the authoritarian, paternalistic, and corporatist rural and Indian policies of the Mexican state in the late 20th century. Recent neoliberal and free-trade policies tend to be even more hostile to forms of local resource management (Key et al. 1990).

Both sociological experiments and studies of empirical cases have begun to provide a robust basis for the theory of common-property resource management (Ostrom et al. 1999). North American social science is focused on the individual actor and theories of rational choice (Ostrom 1998, Ruttan and Borgerhoff Mulder 1999), whereas in the South there is considerably more focus on collective action and cultural analysis (e.g., Bonfil 1996, Toledo 2000). A central question for the North Americans involves determining when people will stop acting as rational maximizers of short-term self-interest, a choice that leads to the tragedy of the commons on a collective level, and cooperate for a better long-term outcome for all. Studies show that people do, in fact, cooperate, presenting the North Americans with something of a paradox needing explanation, while in Mexico such an outcome hardly causes comment.

Everyone agrees, however, that one crucial element necessary for cooperative behavior to occur is communication. In an experimental setting, just being able to communicate in "prisoner's dilemma" and other such games greatly increases the tendency toward cooperation. But communication alone is insufficient. Communication must be effective in establishing the rules of cooperation and mutual commitment to those rules for an enduring system to emerge. Berkes (1999) has argued forcefully that indigenous resource management systems cannot be explained in terms of cost/benefit calculations and individual self-interest alone. Carefully designed experiments indicate that (even with American college students as subjects) the mere transfer of information about optimal individual strategies is not sufficient to influence people's behavior. Rather, "enhancing mutual commitment, increasing trust, creating and reinforcing norms and developing a group identity appear to be the most important processes that make communication efficacious (for resolving social dilemmas)" (Ostrom 1998:7).

The conditions indicated by Ostrom are familiar ones for the anthropologist. Group identity, mutual trust, reciprocity norms, and the importance of individuals with a reputation for keeping community commitments (prestige) are all described in the ethnographies of many Maya and other Mesoamerican communities. Ecological anthropologists since Reichel-Dolmatoff (1976) have observed that indigenous cosmology and culture can reinforce social norms of reciprocity and respect for ecosystem integrity that promote ecologically sustainable behavior. In the recent "science wars" over indigenous knowledge (e.g., Whelan 1999), such studies are dismissed as ethnographic romanticism. However, in common-property resource theory and case studies as developed by Ostrom and others (e.g., Berkes and Folke 1998) we can find solid empirical and theoretical grounding for the notion that indigenous cosmology and worldview can reinforce sustainable patterns of resource use. The critical point is that, even within a theory of rational behavior, the existence of potential benefits from a collectively managed resource can provide a strong incentive for the invention (or reinvention) of cultural institutions and the reaffirmation of cultural identity and continuity.

Atran (1999) has pointed to the interesting situation in the Petén, Guatemala, of two Maya groups—the Q'eqchi' and the Itzaj—that contrast greatly in their treatment of the lowland rain forest. The Q'eqchi', more recent colonists to the Petén from the highland Coban region, plant large (5+ ha) milpas to three crops—maize, squash, and beans—and use a field only once before moving to a new site each year. They do not protect trees or hilltops or keep forest reserves. The Itzaj, by contrast, plant complex polycultures, conserve forest resources in and around their fields, leave large reserves in their plots, and worry about sustaining biodiversity. We found a very similar contrast between the Lakantun (cultural and lin-

guistic kin of the Itzaj) and highland Tzeltal colonists in the Lacandón rain forest of Chiapas (Nations and Nigh 1980). Yet ceremonial life and communal organization are manifestly richer among the Q'eqchi' and the Tzeltal than among the Itzaj and the Lakantun. Atran observes that the Q'eqchi speak of their homeland as the "sacred mountain valley" but do not consider any element of the Petén environment sacred or in need of protection. Thus, despite the lack of well-developed communal organization, the more self-sufficient, autonomous family units of the Itzaj and Lakantun show far greater environmental awareness and stewardship of the forest than their more communally organized neighbors. Indeed, in Atran's study area, the mestizo colonists with a longer history in the jungle are more similar to the Itzaj in their environmental awareness than the highly monolingual Q'eqchi'.

The obvious question is how Itzaj and Lakantun societies achieve cooperative, conservationist behavior toward their forest without a communal institutional framework that regulates and monitors the commons. To account for such behavior, Atran refers to a kind of belief system he calls latent knowledge structures, "cognitive procedures that make possible an evaluation of the future consequences of purposive behavior for one's life and the environment in which life is embedded" (1999:207). In the absence of explicit rules for reciprocity and appropriate conduct, there is a rich set of references in stories, shared personal experiences, and episodes of encounters with spirits interwoven into an imaginary of the forest landscape that motivates characteristic behavior. Atran (1999:206–7) describes the construction of this "spirited" landscape:

> Places in the landscape that the Itzaj call "Mayaland" (*u-lu-um-il maayaj*) tag episodes in a person's life that Itzaj are most readily willing to communicate to others. Reference to such places "automatically" makes recounting of a personal experience culturally relevant for any other Itzaj who is listening. . . . They do not locate the places only, or even primarily, by spatial positioning. . . . They refer episodes to these cultural loci that connect the different paths of individual life stories. . . . They recount that the *arux* (forest spirits) play tricks on people . . . in order to assess valor in doing what is appropriate in the forest. The unworthy will show themselves. . . . Then the arux will abandon them to their fate. . . . There is no principle of reciprocity applied to forest entities, no rules for appropriate behavior and no controlled experimental determinations of the fitness of ecological relationships. Yet reciprocity is all-pervasive and fitness enduring.

We shall return to the notion of latent knowledge structures below. Here it is important to note that the Itzaj and the Lakantun have left their generations-long isolation in the forest and now are surrounded by a sea of colonists and a transformed landscape, as well as government and nongovernmental officials bringing programs of conservation and sustainable development. They have been forced to formalize their knowledge in structured institutions. Thus, with the help of outside advisers the Itzaj participate in the Bio-Itzaj committee to protect mature forest from outside loggers (Atran 1993) and the Lakantun in La Comunidad Lacandona and the Council of the Montes Azules Biosphere Reserve. These and other examples show how Maya latent knowledge structures can evolve into explicit rules for resource management in response to a changing institutional context (e.g., Flores 2000).

Maya Models of Nautre

The cosmology of Mesoamerican peoples has been described as integrating the natural and social worlds into a whole (Bonfil 1996). Men and women not only live in the world but are embedded in it in such a way that every act affects the universe and everything in the universe resonates in the individual. Responsible human action is carried out with consciousness, even manipulation, of this interdependence. Successful farming, for example, depends on maintaining a harmonious relationship with cosmic forces through a series of rituals associated with preparing the soil and planting maize and its companion crops. Not only poor harvests but also illness and natural disasters can be caused by a lack of respect or falling out of harmony with these natural and cosmic forces.

In the communities with which I am familiar in the Maya culture area, all land and natural resources (e.g., springs, caves, rivers, forests, animals) have owners or guardians (Burguete 2000, Pitarch 1996, Vogt 1969). These owners are variously identified as "God," Jesus, the Angel, some Catholic saint (e.g., Saint John), the Earth Lord, or any of several other such spiritual beings. Almost universally among Maya peoples and many other indigenous groups in the Americas, an essential aspect of caring for natural resources is collective or individual ritual obligations to these owners. The users of a resource such as a water hole celebrate periodic festivals to keep the owner happy, providing food and drink, candles, skyrockets, music, and dance. Although the form of the ritual changes, such festivals are sometimes held even among converts to Protestantism (Burguete 2000). Resource users establish a reciprocal arrangement with the owner of the resource, requesting permission and giving compensation in return for use. These rituals are amply described in the ethnographic literature (e.g., Vogt 1969). Through these symbolic relationships of reciprocity, the different Maya peoples establish what is essentially a social relation with the elements of their territory. Participation in the ceremony determines one's status as a resource user and establishes reciprocal obligations with other users.

As is the case in many premodern societies (e.g., Strathern 1980), there is nothing in any Mayan language that corresponds directly to our notion of "nature" or

the environment. This fact suggests an interesting comparative approach examining the way in which different Maya groups refer to the things we mean by our words "nature," "biodiversity," or "genetic resources." One opportunity to engage in this comparative language analysis is provided by a text published by the state government of Chiapas (1991) in which people from several Maya groups (as well as Zoques) write, in their own languages, on "The Conservation of Nature."

If you ask a bilingual native Maya-speaker to translate the concept of "nature," he will usually respond with a word such as *banamil* (Tzotzil). The term has many meanings but is usually translated as "world," "land," or "earth" but also "vegetation" (Laughlin 1975:78). It does not include the sky, the planets, and other heavenly bodies.[3] The term "nature" is sometimes translated by the compound term *banamil vinajel*, roughly "earth and sky" (in Tzeltal the equivalent term is *lum k'inal*). Another term used for "nature" or "countryside" is *k'uxlejal* (Tzotzil "life"). In the text, "conservation" is glossed in Tzotzil as *k'uxubinel*, "to care for to do a favor for to reciprocate" (Laughlin 1975:201). The terms *k'uxubinel ta banamil vinajel* do not correspond very well in meaning with "conservation of nature," in the Western sense of "nature" as opposed to "society" or "the artificial" or as something that has to receive special treatment in order to be "protected" or "conserved." A Maya is in "the world" and must treat each being, including the "owners" of natural resources, with "respect."

There is a current of contemporary thought among the Chiapas Maya that attributes the difficulties facing Indian society today to changes in moral behavior and attitudes of Maya people themselves, encouraged by the expansion of capitalist development ideology or "modernization." For example, Maya people often contrast the attitudes of their ancestors (those within living memory and beyond) with the attitudes of young Indians today. One young Tzotzil-speaker from Chenalho writers (Ximenes Kuteres 1991:30):

> This was the custom of our ancestors, they showed respect for nature (*lek yich'ojik ta muk' li banamil vinajele*). Wherever they went, if the sun came out in their path, they would stop there a while, cross themselves, and beg God that nothing would happen to them on the road. But now we young people don't know how to do this; we say that what the old ones did is useless. But we are mistaken; it was more correct, the way they used to live. Look now at our suffering: what we plant does not grow well, even if the land is fertile, the pests come . . . and we don't know why this is so. But I think it is from not knowing how to respect nature. This is the reason our crops no longer grow.

3. It does include clouds, rain, lightning, and thunder, as these are said to arise from the earth—especially from the mouths of caves, from which the mountain spirits expel them.

Another Tzotzil-speaker, from Chamula, observes (Xilon Komes 1991:25):

> The elders say that in old times the land was very good, it gave very well then, the dry season didn't last long, the milpas grew well. The mountains were full of great trees, of plants; the land was very green. Everywhere there were animals and the chattering of birds. . . . Also there were lakes and rivers that never ran dry, with fish and ducks, and springs flowed everywhere. But now it is not like that, now there is scarcity and suffering, because they say we are finishing the greenness of the land [*syaxal li banamile*, i.e., fertility] that gives the rain. . . .

Besides the degradation of their environment and the changes in their relationship to nature, "progress," that is, the penetration of capitalist market relations into Indian communities, has brought fundamental cultural and socioeconomic changes as well. These changes are complex but are symbolized by the progressive commodification of a central element of Maya culture. Maize is the staple food of all Maya households, and its production, along with the foods that accompany it, such as beans, chiles, and vegetables, is the primary work of a man, just as processing maize into tortillas, tamales, and pozol is the primary work of a woman. Though Maya peoples have been part of a money economy, as wage laborers, for centuries—at least since the Spaniards monetized the payment of tribute in the 18th century—maize is an item whose commodification was always resisted. A writer from Chamula recalled the customs of his elders (Munyos Komes 1991:28):

> When they planted a lot [of maize] they would look for workers to help them, but they would not pay them with money. They would only help each other, or they would pay with maize and beans, because there was the belief that if they paid with money the maize wouldn't grow well. It would be burned by the sun because they thought money was very hot.

Resistance to the commodification of maize was necessary to preserve it as a central axis of community cultures—to keep from destroying the multiple functions (Pimbert 1998) of maize and milpa in the life of the family and the community by reducing it to the one-dimensional yardstick of price. Apart from the plethora of religious and cultural associations of maize in Maya culture, it was the fundamental link of social life and cultural and gender identity. As Collier writes of Zinacantan: "Corn as a basic food is for Zinacanteco men and women what it means to live together in a home . . . to share the production and consumption of corn" (1992: 204–5). When maize was used for payment of labor it retained a locally created value with a dual function as a medium of exchange and the basis of community food security. When money displaces maize as the medium

of exchange, that is, as social relations themselves become commodified, maize "is no longer produced for community food self-sufficiency and comes to be produced for family food self-sufficiency" (García and García 1992:223). Thus, the function and value of maize in society are fundamentally transformed, a change that underlies the changing values concerning respect for nature and community reciprocity that Indians perceive as having occurred since olden times.

In particular, many of the beliefs and customs that can be seen as functioning to reinforce a community's set of rules for managing common resources are questioned by the younger generation. For example, a farmer from Tojolabal country states (Hernández Jiménez 19821982:38):

> It's like they say, that the old customs are disappearing and there is now a custom of not believing things that used to be believed out of fear. Now all those things are being forgotten because they have seen that it's just imagination, that what they believed isn't reality. . . . They had said that it's not good to do certain things at certain times, because everything has a secret. That's what the elders would say, but the youth of today are testing to see if it's true, and they realize that if you do something that you're not supposed to, it comes out all right. That is where now they don't respect those beliefs anymore.

The Maya's forced entry into the capitalist global economy has provoked changes in their relationship to their environment, and the social arrangements and cosmologies that have been effective in resource management are also changing. Writing in Spanish, an Indian schoolteacher from the Tzeltal community of Oxchuc refers to change in his community (Gómez Sánchez 1982:16–17):

> The mountain that is known as the dwelling of the gods is a sacred mountain and is the object of all possible reverence, because it is in this mountain that we find all good and evil. If the gods accept the offerings, they show it through the beauty and development of the crops. . . . The gods notice the attitude of the owners of the milpas. . . . Now in my town we suffer from hunger because the land does not produce. The gods have become permanently angry. They do not send occasional punishments any more, nor do they ask for offerings in order to keep providing food to the people. The elders (*principales*) understand that [the gods] have abandoned their dwellings forever—abandoning the farmer to his luck, because they have abandoned the path of respect and of the good, they no longer believe in the mountains, the roads, caves, and the springs. Meanwhile we have to eat rotten corn from the CONASUPO [government warehouses], because now there is no maize, no beans, no vegetables. There is hunger and disease. In my village we no longer produce food.

The Cultural Logic of Maya Medicine

On the night of the first air strike on Iraq in the Desert Storm campaign commanded by U.S. President George H. Bush, the people of the highland Maya community of Zinacantan, Chiapas, were concerned and frightened. They had been closely following the events leading up to war on the radio news. Despite official rhetoric justifying the military action, the Zinacantecos knew what the war was really about: petroleum. And since there was petroleum in Chiapas—indeed, a newly established exploratory well in Zinacantan itself—they were deeply concerned that the war might reach them. In order to prevent this catastrophe, the shamans of Zinacantan (*j'iloletik*, or seers) performed the ceremony of the Butterfly, which had not been conducted for at least a generation. The purpose was to seal off the paved highway leading into Zinacantan so that war would not enter the highlands. Butterfly is the animal soul of one of Zinacantan's mythological ancestor shamans, whose exploits are recounted in folktales (Robert Laughlin, personal communication; Laughlin and Karasik 1988).

For the Ch'ol community of Nueva Esperanza, the years following the 1994 Zapatista uprising were difficult ones. Although the community had attempted to steer a neutral course through the conflictive political situation of northern Chiapas and create a climate of tolerance for difference, it was continually threatened by a paramilitary organization from a neighboring village that was pressuring it to take sides. One night a messenger arrived warning that the paramilitaries were planning an armed invasion. The community elders called on the four guardians, men who live on the edges of the town and protect it from outside dangers, and with the support of other elders and shamans held a special ceremony in which protector deities were invoked to deflect the malice and aggression of the paramilitaries (by sending them down the road to another community!).

In Chiapas Highland Maya communities, the *j'ilol* (Tzeltal *ch'abajom*) or shaman "sees" into the mountains where ancestral gods and other mountain spirits (the owners) dwell. The shaman's work is to negotiate with this kind of spirit or holy (*ch'ul*) being on the behalf of individuals or the community as a whole (Vogt 1969, Fabrega and Silver 1973). This function of the shaman is another cultural element in which some scholars see an expression of Maya cultural continuity (Vogt 1964, Freidel, Schele, and Parker 1992). Besides important public ceremonies such as the ones referred to above, shamans, both men and women, are often called upon to conduct curing ceremonies for the sick. These ceremonies of sacrifice and prayer involve "seeing" the Earth Lord or other mountain spirits and negotiating the return of part of the patient's collection of "souls," loss of which is always associated with disease. For many Maya of highland Chiapas, both traditional and not so traditional, the *j'iloletik* are virtually the only option and final recourse for the seriously ill (Freyermuth 1999).

The social institutions and cultural logic with regard

to the nature of such fundamental resources as maize are also revealed in Maya notions of health, disease, and curing. The ethnographic record from a wide variety of communities in the Maya culture area and Mesoamerica in general suggests a native cosmology in which the notion of metaphysical balance is a key concept. It is the belief that "continued human existence is predicated on the maintenance of cyclic cosmic balance that both affects and reflects earthly conditions" in terms of "harmony between the physical and metaphysical worlds" (Fischer 1999:480). The notion of reciprocal balance underlies social relationships but also applies to relationships with "supernatural" spirit-owners of "the world," expressed, as in the texts presented in the previous section, in terms of the Maya idea of "respect."

The Maya shaman treats disease essentially by religious means, through sacrifice and prayer. Human intention and behavior, either of the patient or of others in the patient's life-world, cause sickness. It is often the result of deviant behavior, especially disrespect toward elders or higher-ranking individuals or the "owners" of natural resources, refusal to meet obligations of reciprocity with neighbors and relatives, rejection of Maya culture and the adoption of characteristics considered *ladino* or foreign, refusal to speak the Maya language of the community, or the establishment of overly close relationships with people outside the community. The curing ceremony is "socially reconstituting and reoriginating" (Kapferer 1996); the shaman seeks to restore the patient's relationships to the physical, metaphysical, and social worlds—to correct the imbalance that is the root cause of the illness.

The Maya shaman's ritual, both in the highlands of Chiapas and in a wide range of Maya societies reported in the ethnographic literature, has to do with the recovery of the soul or parts of it. The Chiapas Highland Maya have a variety of souls and parts of souls (Hermitte 1970[1950], Holland 1963, Vogt 1969, Guiteras 1961, Pitarch 1996). The two principal concepts are the *ch'ulel* (Tzotzil and Tzeltal) and the *chanul* (Tzotzil *xch'ulel* or Tzeltal *lab*) The *ch'ulel* resides at the heart and is necessary for life.[4] It determines character and is sometimes described as a shadow being with the same general shape as the person. It is the seat of memory, feelings, and emotions and is responsible for dream experiences and the ability to speak (Pitarch 1996). The *ch'ulel* frequently leaves the body, for example, during sleep, but prolonged absence provokes illness. A duplicate *ch'ulel* for each living individual inhabits the interior of certain mountains under the care of the ancestor spirits.

The *chanul* or *lab*, sometimes referred to in the literature by the Nahuatl term *nagual*, is an animal spirit companion. It can be almost any kind of wild animal, insect, or, in some cases, a natural phenomenon such as a thunderbolt. Each person has such a companion animal, which is kept in a corral in the sacred mountain under the care of the highest-ranking "official" of the ancestor spirits and allowed out to graze during the day. Vogt (1969:372) reports that in Zinacantan each person shares a *ch'ulel* with his animal companion. The Tzeltal of Cancuc apparently do not share this particular belief (Pitarch 1996). In Zinacantan and many other Tzotzil-speaking communities, the *ch'ulel* is believed to be divided into 13 parts, whereas in others (e.g., Cancuc) shamans are believed to have 13 animal spirit companions.

Despite these differences, almost everyone in these highland Chiapas communities agrees that misbehavior will result in some kind of soul loss and illness. Also, economic or other success or refusal to share good fortune will provoke envy and sorcery among neighbors. In either case, the recovery of good health and good relationships with fellow community members is achieved by one or more curing ceremonies. (Even Protestants will pray for this purpose, though they may decline to consult a *j'ilol*.) The shaman will usually diagnose the patient by "pulsing," in which the blood speaks to the shaman and identifies the problem. The shaman will pray in front of the patient's house altar and may visit sacred mountains or caves to "see" mountain spirits directly in order to find and recover the lost soul. A ceremony may last one day or several and involves long hours of praying by the shaman. The patient usually remains passive, lying on a bed in front of the altar.

What Freyermuth (1999) calls the "Indian health system" has a variety of specialists—herbalists, midwives, masseurs, paramedics,[5] and diviners. Today spiritualist healers are consulted, especially in urban areas, but the *j'iloletik* are definitely the top rank of the system. Their ability to listen to the speech of the blood in pulsing and to see and deal with the mountain spirits is considered to be a gift from God and the saints and is usually conferred in dreams. Being called in a dream is considered evidence that a shaman has the gift of healing. Some shamans even say that they have learned about medicinal plants in dreams, though most herbalists learn from others, usually their parents. The shamans are powerful stewards of a symbolic and metaphysical field that has been central to the values and norms of Maya communities. Although religious and political change has reduced their monopoly over this field, they continue to be a significant and influential force in the affairs of most Maya communities.

In 1978, in the Declaration of Alma-Ata, the World Health Organization recommended that certain resources of local traditional medical systems be incorporated into governments' strategies for primary health care. As a result, the Mexican government began a series of programs for integrating indigenous healers into official health care services (Freyermuth 1993). These attempts, characterized by Freyermuth as "a difficult encounter,"

4. Many groups also speak of a third soul, the heart-bird (conceived of as a chicken or a dove dwelling in the center of the heart). The presence of the heart-bird is absolutely essential for life. There is little curing activity, apart from some preventive ritual, for the loss of this kind of soul, since it is almost immediately fatal (Pitarch 1996).

5. Spanish *promotores*. They have received government training in primary health care to channel patients to the official health care system. Some of them later start private practices.

were not particularly successful. For example, Ayora (1998, 2000) provides an analysis of the interaction of medical professionals practicing what he calls "cosmopolitan medicine" and local healers. As both these writers note, cosmopolitan medicine characterizes itself as a superior rationality, and therefore the relationship with Maya healers can only be one of subordination. However, if we consider the "path" of sick persons (Freyermuch 1993) in highland Chiapas today, we see that they have a number of choices for health care. Cosmopolitan medicine must compete with other options. At first, patients will attempt to cure their condition with homemade remedies, which may be herbs or, increasingly, store-bought medicines. They may consult a person with a reputation for "knowing plants" (Tzotzil *much'u xojtikin li vomole*) or knowing the remedy for a particular illness (*much'u sna spoxil li chamele*). If these "empirically based" remedies fail, they must choose between cosmopolitan doctors and shamans.

The Maya do not sharply dichotomize between "organic" and "supernatural" causes of disease—all sickness has both aspects, though in varying degrees, and both aspects must be treated if the patient is to be cured. Anyone can apply herbs or drugs, but if the nonorganic aspect is too strong only a *j'ilol* can heal. The secondary importance of herbs for the *j'ilol* was explained to me in an interview by a Tojolobal shaman who used many herbs not only from traditional Maya medicine but also of Chinese and European origin and was well aware of their pharmaceutical properties. The herbs were useful, he said, but what really cured patients was their "promise"—their confession of misbehavior and repentance. The example he gave was of a man suffering from alcoholism: there were herbs to help the patient recover, but if he would not keep his promise not to drink again, then the herbs alone would not cure him.

Thus the Indian health system is a hybrid one in which Maya patients appropriate health care options from a variety of sources according to their own cultural norms and values (Ayora 1998:187):

> For some . . . people, cosmopolitan medicine fails precisely because it separates the biological from the social and spiritual worlds. A cosmopolitan healer focuses his efforts on the biological and bodily dysfunction and pays no attention to the care of the individual's soul or disrupted social relations. On the other hand, for the ill person and her relatives, it is evident that in some instances health problems are the outcome of a disorder in the social world or on the boundaries between the social and spiritual worlds. When seeking treatment for their health problems, patients take into account which practicing healers can provide the level of attention they need.

The Biological Gaze

In an essay concerned with the technologies developed in biology to "gaze at the secrets of life," the science historian Evelyn Fox Keller (1996) notes that the microscope did not become a truly useful tool for science until biologists learned to intervene physically in the structures they wished to observe. The microtome was used to cut exceedingly fine slices of tissue and micromanipulators to modify the structures of the cell itself. These manipulations of the sample to be observed are essential for effective imaging of the cell and its subunits. With the advent of the electron microscope the biological gaze became even more intrusive. To be imaged, microstructures must be extracted entirely from their cellular environments and prepared in ways that completely inactivate their life functions. The images of the most basic structures of life itself are "no pristine point of origin, but already a construct at least partially of our own making" (Keller 1996:121).

The criticism is not that biologists intervene in their material better to reveal the underlying structures of cells. It is, rather, that such revealed relationships are reified and their contingent, contextually dependent nature is forgotten. Instead of merely revealing relationships, they come to stand for "life itself," as in Haraway's "gene fetishism . . . forgetting the tropic quality of all knowledge claims" (1997:142):

> This kind of gene fetishism rests on the denial and disavowal of all the natural-social articulations and agentic relationships among researchers, farmers, factory workers, patients, policy makers, molecules, model organisms, machines, forests, seeds, financial instruments, computers and much else that bring "genes" into material-semiotic being. . . . the gene is fetishized when it seems to be itself the source value. . . .

Writing on "Maya ethnomedicine as a science," Berlin and Berlin state: "Work over the past several decades in the emerging field of ethnobiology, and research in medical ethnobotany in particular, has demonstrated that the ethnobiological knowledge of traditional peoples conforms in many respects to basic scientific principles" (1996:3). Such statements express a truth often taken as self-evident in ethnoecology. They reference an important contribution of the field that led to "a radical shift in mindset from viewing native systems of thought as naïve and rudimentary, even savage, to a recognition that local cultures know their plant, animal, and physical resources intimately" (Nazarea 1999:4). Yet, if we reflect on the idea that traditional ethnomedicine is science, we must ask how this can be so: scientific principles are constructed through scientific theory and practice, whereas Maya healing is rooted in the latent knowledge structures and livelihood practices of local people. Both kinds of knowledge are grounded in social practice but very different kinds of practice, based on different categories and assumptions, involving particular experiences, values, and cultural definitions.

In reality, rather than an empirical "folk" science conforming to universal principles of "real" science, what we have is multiple contrasting orderings of reality (Tam-

biah 1990) among which there is only limited commensurability. It is something to be explained rather than merely taken as "natural" that such different knowledge-making practices converge to the degree that they do. Atran says that latent knowledge structures are like scientific theories in that they generalize from concrete experience but unlike theories are not systematic formulations of laws or methods. Rather, they involve the adjustment of forms of human livelihood to the environment in which they are embedded (1999:207). When these contrasting sets of principles meet in a situation of highly asymmetrical power relations—as when indigenous people encounter scientists in bioprospecting projects—attempting to force indigenous knowledge into the mold of "scientific principles" can only do violence to the former (Scoones and Thompson 1994).

The idea that local knowledge must be science because it leads to empirical results consistent with Western science conceals a circular reasoning based on a concept of nature as pre-given and "science" as the only means of discovering its universal laws. Berlin is perfectly clear on this point, asserting that cultural categories must reflect a "biological reality . . . discontinuities whose structure and content are seen by all human beings in essentially the same ways, perceptual givens" (1992:99). Here I argue, rather, that nature is not perceptually given but constructed, in the microscope or in the forest, by "perceptually guided action" (Varela, Thompson, and Rosch 1991:173), the practices that make up our experience. Latent knowledge structures arise from livelihood practice in the spirited landscape of myth and tales. Scientific knowledge arises from the practices and metaphors of the distinct disciplines. The "biological realities" constructed by these two types of practice clearly have a common basis in intersubjective human experience but cannot be entirely reduced to an "objective" reality independent of that experience.

The biological packaging of Maya medicine—the view of Maya healers primarily as herbalists and empirical pharmacologists—does emphasize the common basis of ethnomedical and scientific knowledge. In this sense, Berlin's research provides an essential dimension of Maya medicine that was previously understudied. The Berlins (1996:53) assert that Maya phytopharmacological knowledge "is an ethnoscientific system . . . based on astute and accurate observation that could only have been elaborated on the basis of many years of explicit empirical experimentation with the effects of herbal remedies on bodily function." However, such explicit experimentation must have occurred at some unspecified time in the past, because no such activity is attested to by any ethnographer. The actual "empirical" practice of Maya healers and their patients that generates such knowledge is, in contrast, set aside in the study of Maya medical botany. A kind of herbal fetishism conceals the social relations and cultural context of Maya healing practices. "Maya medicine as ethnoscience" is a construct that may be useful for scientific or commercial purposes but empties Maya medical practices of their contingency and cultural and social specificity.

An example of the remaking of Maya medical practice for viewing by researchers, tourists, and nongovernmental organization (NGO) personnel can be found at the Museum of the Center for Maya Medicine, constructed by the Organization of Indigenous Healers in the Highlands (OMIECH, the most important organization of Indian healers in Chiapas; see Freyermuth 1993 and below). The museum is located in San Cristóbal de Las Casas and was built with donations from European foundations under the direction of the organization's cosmopolitan medical advisers. It has a dramatic display showing the different aspects of the work of the *j'ilol* and emphasizing the religious basis of his practice. Ayora (2000:184) asserts, however, that setting this content in a "museum" results in the symbolic displacement of religiously based healing practices into the past, "confining them to a dark and closed space where they do not threaten the rational world." The exhibit contrasts with other, brighter rooms of the Center where "modern traditional medicine," the naturalistic practices based on herbal medicine preferred by the cosmopolitan medical advisers, are emphasized. The naturalistic gaze transforms and inverts the hierarchy of Maya medicine.

The leaders of the OMIECH are aware of this tension and continue their traditional practice with their Maya patients and for some tourists while promoting primarily herbal medicine to the outside world. The organization's proposals for outside funding have concentrated on the cultivation of their medicinal plants and the marketing of herbal preparations based on those plants. Both leaders and advisers of the organization express awareness of the contrast between the insider's view, that of the communities the organization serves, and the biological gaze of cosmopolitan doctors and foundation officers. The adaptation to the naturalistic view of their medicine is seen as a necessary survival strategy for the organization, while the community programs attempt to adapt to their patients' desires and needs. Nonetheless, the dilemma is real; as Ayora (1998:13) concludes, "Local people find themselves compelled to objectify segments of their culture for the consumption of travelers in order to maintain their own mechanisms of hybridization."

The Maya International Cooperative Biodiversity Group

The latest encounter of the Maya of highland Chiapas with the biological gaze concerns a significant research project involving bioprospecting and drug discovery using local ethnobotanical and ethnopharmacological knowledge: "Drug Discovery and Biodiversity among the Maya of Mexico." A $2.5 million grant, one of six in the U.S. National Institute of Health's International Cooperative Biodiversity Group (ICBG) program, was awarded for five years (1998–2004). The recipients of the grant formed a consortium that included the University of Georgia, El Colegio de la Frontera Sur (ECOSUR, a local Chiapas research institute), and MolecularNature Lim-

ited, a private British pharmaceutical company (Berlin 1999). According to ICBG director Jonathan Rosenthal (1996), the drug discovery program is

> designed to stimulate the field of bioprospecting, to provide models for the development of sustainable use of biodiversity, and to gather evidence on the feasibility of bioprospecting as a means to: (1) improve human health through discovery of natural products with medicinal properties; (2) conserve biodiversity through valuation of natural resources, training, and infrastructure building to aid in management; (3) promote sustainable economic activity of communities, primarily in less developed countries in which much of the world's biodiversity is found.

The principal investigator's own previous ethnobiological research suggests the likelihood that pharmacologically important natural products will be discovered, given that the search is to be guided by the medical knowledge of the Maya inhabitants of the research area and that the Maya demonstrate an exact and complex understanding of the physiological effects of the medicinal plants of their environment on bodily function and pathogens (Berlin and Berlin 1996:53). Thus the first objective of the Maya ICBG, the discovery of natural products with medicinal properties, will further test this notion and seems feasible.[6]

There can be no doubt concerning the intention of ICBG personnel and Maya ICBG researchers to ensure that the Maya are compensated for use of their knowledge and territories for bioprospecting research for the purpose of commercial development (Grifo and Downes 1996). Maya ICBG policy is that all monetary benefits resulting from the project will be shared equally among the three members of the consortium and the "Highland Maya peoples of Chiapas."

For this purpose, however, no mechanism has been established by the Maya ICBG, though Berlin himself has set up an irrevocable trust fund for Maya peoples to use for community development and the preservation of ethnobiological knowledge. More immediate benefits of the research include training for Maya technical assistants and support for ECOSUR, the local research institute. The Maya ICBG has facilitated the development of eight medicinal-plant gardens, providing technical assistance and garden tools.

In the spirit of Article 8j of the 1992 Convention on Biological Diversity, ICBG policy specifies obtaining *prior informed consent* from the communities in which bioprospecting research is to be conducted. Beginning in early 1998, as the Maya ICBG project initiated its activities, contact was made with Indian organizations and community leaders at several levels. The lack of an institutional and legal framework within Mexico not only for regulating biotechnological research but also for representing basic indigenous rights in general presented a serious obstacle to finding an arrangement agreeable to all the parties involved.

One of the principal problems the Maya ICBG faced in seeking the prior informed consent of the Maya in highland Chiapas was the problem of representation.[7] Under Mexico's current environmental law, researchers are required only to obtain the consent of the owner of a parcel of land on which biological collections will be taken. However, in the case of biotechnological research, a broader principle needs to be invoked, since the samples collected are not simply being used for academic purposes but consciously sought for development into commercial products with intellectual-property protection. Indigenous knowledge is embodied in such potential products either directly, by guiding bioprospecting research, or indirectly, because of the latent knowledge structures and livelihood practices through which indigenous people have managed and preserved the biodiversity in their territories. Thus, the individual owner of a given field in which a collection is made is not the sole owner of the knowledge embodied in medicinal and other species. Nor can he be conceived of, in giving his informed consent, as having the sole right to represent the wider community from which the knowledge embodied in those species arose. Therefore, current Mexican environmental law is inadequate to the task of regulating biotechnological research—something it was never designed to do in the first place.

Early in 1998, researchers associated with the Maya ICBG approached the Chiapas Council of Traditional Indigenous Doctors and Midwives (COMPITCH), consisting of OMIECH and ten other organizations whose members are some 1,100 men and women healers from all Indian areas of the state. COMPITCH was formed in 1994 in the context of the government and NGO encouragement of traditional medicine earlier mentioned. It is a member, in turn, of a national-level organization of Indian traditional healers consisting of 43 organizations from 17 states. Being the organization most broadly representative of traditional Maya medical knowledge in the region, COMPITCH was the logical one to approach. According to its leaders, the Maya ICBG researchers presented them a preliminary document describing the project and invited them to collaborate. When they pointed to the lack of a regulatory framework for bio-

6. Rausser and Small (2000), criticizing previous studies for relying on a "brute force" model of bioprospecting research, present a numerical simulation of the economics involved in such research. They are able to show that if bioprospecting is carried out as a random search it is probably not economical, but when it is guided by previous knowledge such as that of traditional healers the revenues it generates are potentially sufficient to provide incentives for biodiversity conservation. This study supports the Maya ICBG's own assessment of its probability of success in achieving its goals, but it also highlights the crucial role of indigenous knowledge in the bioprospecting process.

7. The issue of representation reflects the ambiguity of the notion of community. At times in the consent process individuals, informal leaders, or formal authorities were treated as representatives of "the community," but later Maya ICBG investigators argued that COMPITCH was not "representative of Maya Indians as a whole." The deficient regulatory framework did not help to resolve these ambiguities.

prospecting in Mexico, they say, the researchers assured them that no activity would be initiated until such a framework was in place. Further attempts to agree on collaborative activities between COMPITCH members and the Maya ICBG were unproductive and were gradually abandoned. Meanwhile, by mid-1998 the Maya ICBG's funding had received final approval from the U.S. National Institutes of Health, and project researchers asked for legal authorization from the Mexican federal environmental ministry to proceed with the project. Faced with lack of agreement with COMPITCH and the absence of any progress by the federal government in creating a clear regulatory procedure, Maya ICBG researchers felt that the only course open to them was to operate within the existing law, obtaining direct consent from communities on whose lands collections would be made. Accordingly, they began to design contracts among the various parties in the spirit of the Convention on Biological Diversity and other relevant international accords.

Following the standard procedure for decades of anthropologists and other fieldworkers in Chiapas, Maya ICBG scientists used their personal and political networks to approach individuals and communities who were sympathetic to the project and obtained written agreements to conduct bioprospecting research on their lands. An agreement was also drawn up among the consortium members involving the protection of intellectual property generated by the research activities that included provisions for benefit sharing with Indian communities, although the specific mechanism of Maya representation remained undefined. To further the process of informed consent, a didactic skit in Maya languages representing the process of bioprospecting and drug discovery was used to communicate the goals of the project to prospective communities.

COMPITCH members became increasingly concerned that the project was advancing in a regulatory vacuum and that the information being provided was insufficient. Seeking advice from the international community, COMPITCH requested a Canadian NGO concerned with issues of commercial use of biodiversity, Rural Advancement Foundation International (RAFI), to come to Chiapas and review the situation. After consulting with RAFI and other local advisers, COMPITCH members concluded that the project was potentially damaging to Maya peoples' interests. In September 1999 they directed letters to local and federal authorities calling for a suspension of the Maya ICBG and exhorting Maya community authorities not to sign agreements until everyone was adequately informed of their implications and proper legal and regulatory frameworks were in place. RAFI reported these events, characterizing the Maya ICBG as "biopiracy," in December 1999, thus directing world attention to the issue (RAFI 1999*a*, *b*).

COMPITCH's open declaration of opposition to the Maya ICBG created a storm of controversy. The federal environmental ministry attempted to mediate what it viewed as a conflict between COMPITCH and the scientists, but little progress was made in a series of talks. The Indian organizations continued to insist that the government establish clear regulations, and the environmental ministry continued to delay issuing such regulations.

The principal point of disagreement, however, concerned the issue of intellectual property. The Maya healers objected to the contract that required exclusivity for the products of the research, and this was one point on which the ICBG and the Mexican government refused to compromise. One COMPITCH *j'ilol*, while giving a classic expression of the principle of common heritage and public domain, also clearly felt that he had the right to a say about the use of his intellectual property:[8]

> Our medicinal plants are not ours. They belong to everyone. We are sharing all the knowledge from the time of our first fathers and mothers, how they cured themselves with medicinal plants, minerals, and animals. In this way we want all communities to have the knowledge to cure themselves. We do not wish someone to appropriate our knowledge only for his or her personal benefit.

Finally, after nearly a year of increasingly heated, even acrimonious debate within Mexico and beyond, in October 2000 ECOSUR retired its application for authorization for biotechnology collection from the environmental ministry and announced a suspension of its activities with the Maya ICBG project. In a public statement directed to COMPITCH the local researchers said that no bioprospecting would be conducted until two conditions were fully met: (1) that the environmental ministry establish the administrative and legal mechanisms for bioprospecting in Indian territories and the procedures for obtaining prior informed consent and final authorization and (2) that Indian communities and organizations establish a formal representative body with the authority to propose modifications to projects that represent Indian interests, to certify prior informed consent, and to enter into agreements with research institutes and/or private companies that guarantee the protection of their rights to knowledge and natural resources. At this writing (September 2001) the project remains suspended indefinitely, though the controversy shows little sign of subsiding.

8. Brush (1996:148) notes that until this century the common-heritage principle governed the use and distribution of plant genetic resources all over the world. Common heritage, a notion derived from Western jurisprudence, "delineates public and private domains and defines products of nature, scientific theory, and folk knowledge to be public goods belonging to the public domain" (Brush 1999:540). As is the case with many societies, however, Maya groups have a range of notions concerning ownership of plant resources, from the purely collective to the individual or the individual "embedded in the context of community use rights" (Cleveland and Murray 1997:485). The medical knowledge of the *j'ilol* or the midwife is a highly individual talent, and people pay significant amounts for their services. Knowledge of plants is often held by family groups, whereas the plants themselves may belong to individuals or come from collectively managed areas.

Situated Knowledges and Universal Technologies

The debate surrounding the Maya ICBG has had a dramatic impact on anthropological research in Chiapas. Nearly all Indian communities are aware of the controversy, though the accuracy of the information they have is highly variable. There is no general agreement among the Maya concerning the project—many see it as highly threatening while others are still willing to collaborate—but it has become a topic of discussion far beyond the membership of COMPITCH and has highlighted the issue of the motivations for and effects of research on the Maya population. Researchers cannot approach a community today without answering a series of questions about the uses to which their results will be put and the benefits or risks of the project for the community. The question of public goods' being appropriated by private interests with little or no benefit for the Maya communities is a central topic of discussion on these occasions.

This discussion of the ICBG controversy could give the impression that many Maya reject Western science or oppose research in their communities. But my experience and that of many others who work with Maya communities suggests that Maya people, even as they value their own cultural heritage, are very much interested in what science can teach them about their own traditions and about the outside world. Organic agriculture, practiced today by thousands of Maya farmers, is an example of a fruitful collaboration between Western agroecological research and traditional Maya farming systems (Nigh 1997, Toledo 2000). There is, in fact, great openness to scientific interpretation and to the potential benefits of new technology. It is not antiscience or closure to new ideas that prompts the negative response to the Maya ICBG.

Long and Villareal (1994) have noted that the generalization and utilization of ecological knowledge is not merely a matter of instrumentalities (e.g., the identification of pharmacologically active plants) or a question of hermeneutics (the contested meanings given by different actors to elements of the natural environment). Rather, it is primarily an issue of control, authority, and power in the interface between the producers and the appropriators of such knowledge. Here, where multiple realities and potentially conflicting interests meet, we must carefully assess whose interpretations or models prevail in the identification of the goals and methods of research.

What has become clear to those of us who continue to do research in Chiapas in the post–Maya ICBG era is that we are facing a fundamental rethinking of the manner in which research in the Maya area is designed and conducted. In this respect, I find the distinction of Waters-Bayer (1994) between *extractive research* and *enriching research* to be suggestive of the kind of change of approach that I believe anthropology will have to undertake in Chiapas and elsewhere. Extractive research is designed to provide information to outsiders: development agents, scientists, or private corporations. Enriching research is that conducted with and by local people to increase their knowledge and empower them to deal more effectively with the contemporary world.

Members of COMPITCH such as the OMIECH have been developing their own proposals for research on Maya medicine, including proposals for possible commercial development, for many years. These would involve considerable collaboration of Maya healers with scientists, providing ample opportunities for productive research as well as training and experience for Maya young people. Yet these proposals did not count as priorities in the elaboration of the bioprospecting research plan of the Maya ICBG, even after the fact, when researchers approached COMPITCH to invite their collaboration. An enriching research design would perhaps have begun with a dialogue with these local projects to construct a mutually acceptable approach to documenting traditional medical knowledge. In the process of this dialogue many issues could have been resolved and a truly informed group of Maya would have been created through which interaction with the wider community could have taken place. In such a project Maya knowledge would have been seen as living and dynamic rather than merely an achievement of the past, an archived "text" to be read for the purpose of guiding bioprospecting research. An enriching research design would have facilitated the contemporary "reinvention" of this "living local knowledge" (Rolling and Brouwers 1999).

The Maya have expressed their belief that their medical knowledge and the plants they use for healing are a common heritage and should remain in the public domain. If their plants hold the key to a cure for AIDS or cancer, they believe that scientists should be free to develop that cure and that it should be shared openly with the world. Yet, before any Maya had been involved in the discussion, the ICBG was already firmly committed to intellectual-property regimes that have largely abandoned the common-heritage principle for the distribution and use of plant resources. The Convention on Biological Diversity removes genetic resources, including crop genetic resources, from the public domain by granting control over access to these resources to the national state.[9]

9. In what many feel is contradictory to the Convention's provisions, the 1994 Trade Related Aspects Intellectual Property Rights agreement (TRIPS) of the World Trade Organization requires countries to create mechanisms such as patents for life forms. In this context, concern has been widely expressed about developing some form of protection for indigenous knowledge and cultural and natural patrimony. These international agreements, including the Convention, reveal the failure of the international community to recognize the need for effective legal mechanisms for the protection of indigenous cultural and natural patrimony (Simpson and Jackson 1998). Despite its well-intentioned language, the Convention is a significant step toward the production of nature as a postindustrial commodity (Smith 1996). Projects such as the Maya ICBG instigate a radical transformation of local appropriation of natural resources through the commodification of ethnobotanical knowledge. Once again, the Maya are forced to objectify part of their culture to conform to the consumption desires of outsiders who come with the

Only under the values of contemporary Western capitalist culture is it considered acceptable to isolate elements of the situated (and therefore privileged) knowledge of a Maya shaman from their social and metaphysical context and use them in the production of universal medical technologies for private commercial benefit.[10] A new legal framework is necessary in which Indian peoples are recognized as possessing individual and collective rights, especially rights "to maintain and strengthen their distinctive spiritual and material relationship with the lands, territories, waters and coastal seas and other resources" and "to the full recognition of their laws, traditions and customs, land-tenure systems and institutions for the development and management of resources, and the right to effective measures by States to prevent any interference with, alienation of or encroachment upon these rights."[11] Only when nation-states are ready to recognize these rights of Maya peoples will their cultural creativity and natural patrimony be guaranteed and the world be assured of the continued contributions of a brilliant civilization.

Comments

STEFFAN IGOR AYORA DIAZ
Facultad de Ciencias Antropológicas, Universidad Autónoma de Yucatán, Mérida 97000, Mexico (*siayora@prodigy.net.mx*). 20 XII 01

This paper can be read as a courageous effort to bring into the academic sphere a bitter discussion that is taking place in Chiapas and elsewhere. However, and in general, it contributes to a *misrecognition* of local medicines in the Chiapas highlands predicated upon the romantic gaze that seems to accompany most discussions of the relationship between local people and nature (Eder 1996). Among its several essentializing attributes are the ideas that indigenous people have a privileged relation to nature, that they live in harmonious convergence with the cosmos, and that, consequently, they are organized into "communities." Nigh concludes from this that indigenous people have a quasi-natural right to control and manage (with centuries-old wisdom) the natural resources, including herbal medicines, they have at hand.

The concept of latent knowledge, as discussed in this paper, seems to drive anthropological thinking back to some sort of cognitive reductionism resembling Jung's collective unconscious. I have discussed in a number of places (Ayora Diaz 1998, 1999, n.d.) how indigenous people, in their medical practice, subordinate herbal therapies to interventions in the spiritual and social domains. It is local healers who have been directly subjected to "training" (a form of neocolonialist intervention called *capacitación* in Spanish) who give public performances structuring their rhetoric around their knowledge of herbal remedies. The organization of healers—imagined, constructed, and consulted by cosmopolitan doctors—gives priority to herbal knowledge, a form of intervention easily translated into scientific thought (Webster 1991). It has therefore been granted recognition and endowed with the power to represent *all* local healers in the region. I wish to underscore two consequences: First, the organization de-authorizes other local medical forms of knowledge, and, second, as it echoes the medical doctrine into which NGO personnel and activists have been socialized it masks its role as a vehicle for new forms of cultural colonization. Herbal knowledge, according to local healers outside the organization, is acquired both through revelation and by oral means. Herbs have healing power because of the prayers recited and the rituals performed by the local healer. Rather than assuming a form of knowledge (naturally) ingrained in the mind structures of indigenous people, it would probably be more profitable to explore how knowledge is locally embodied both in individual practices and in the unequal structure of social relations and power.

This brings me to the second issue: According to my findings, and as Nigh points out, in their therapeutic interventions local healers seek to manipulate the bodily, spiritual, and social domains at once. But this does not imply a state of harmony between indigenous people and the cosmos. I believe that this form of action reflects the local conviction that worldly phenomena parallel those that occur in and between other domains. Far from harmonious, the godly world of the highland Maya is peopled with spirits at war among themselves and with flesh-and-blood individuals (remember the Popol Vuh). Within and between "communities," individuals and healers perform witchcraft to affect their opponents in quarrels, and very often, because of these quarrels, people fall ill. Most of the healers I spoke to recognize that there are God's diseases and diseases provoked by other humans (roughly corresponding to natural diseases and diseases produced by witchcraft). A very fine line separates them: diarrhea may be a disease sent by God (an unlucky occurrence), but if the patient fails to recover or suffers frequent relapses in spite of all quotidian efforts, the afflicted and the family may suspect witchcraft. Thus, a healer recognizes a bodily disorder, its possible link to a social conflict, and the manipulation of spiritual beings by the parties to that conflict. His interventions can hardly be taken as a demonstration of any harmonious convergence between individual and cosmos in indigenous thought.

It is only on the premise of a harmonious indigenous

good intention to "improve human health . . . and promote the sustainable economic development of communities."

10. "Partial perspective can be held accountable. . . . All Western cultural narratives about objectivity are allegories of the ideologies of . . . mind and body, of distance and responsibility. . . . Feminist objectivity is about limited location and situated knowledge, not about transcendence and splitting of subject and object. In this way we might become answerable for what we learn how to see" (Haraway 1991:190). On decontextualized knowledge and universal medical technologies, see Oudshoorn (1994).

11. Draft United Nations Declaration on the Rights of Indigenous Peoples, adopted by the Working Group on Indigenous Populations, UN Economic and Social Council, Geneva, August 1993.

society that one can presume the existence of *Maya* "communities." It has been already argued that, for purposes of control, the Spanish *conquistadores* forced scattered highland hamlets into *reducciones* resembling European villages (Wasserstrom 1983) and that postrevolutionary Mexican parties contributed to the creation of corporate communities (Rus 1994). Efforts to re-create indigenous communities proliferate today (Ayora-Diaz 2000, Vargas Cetina 2001). In fact, one condition imposed by COMPITCH for being recognized as a healer is demonstrating the backing of a "community," and this, I have argued (2000, n.d.), is forcing some indigenous healers to create simulacra of communities. The kind of misrecognition that this paper reinforces contributes, in the long run, to disempowering the very people it seeks to empower and strengthening new forms of cultural colonialism.

MAURICIO BELLON
Centro Internacional de Mejoramiento de Maíz y Trigo, A.P. 6-641, 06600 México, D.F., Mexico (*m.bellon@cgiar.org*). 21 XII 01

This paper deals with an important issue—the interaction between different knowledge systems and the peoples and institutions that generate, support, and use them, particularly when those peoples and institutions represent asymmetrical power relationships—on the one hand the Maya peoples of the highlands of Chiapas and on the other Western scientists from the United States, Mexico, and the United Kingdom. The focus is a critique of a major international research effort—the Maya International Cooperative Biodiversity Group (Maya ICBG), a bioprospecting project for highland Chiapas. The paper argues that the bioprospecting proposal does violence to the indigenous meanings of nature, medicine, and property. It is clear that the scientists in the ICBG project have acted in good faith and tried hard to develop a fair interaction with the Maya people to the extent of their knowledge and the institutional setting available. This paper shows the challenges of this type of interaction: How can benefits be shared fairly? What is fair? Who represents the Maya and their knowledge and can therefore provide prior informed consent?

I think, however, that the critique presented is biased. It reports only on the views of one, albeit probably large and important group of the Maya people—the Chiapas Council of Traditional Indigenous Doctors and Midwives (COMPITCH). There is very scant information on the groups that were willing to work with the ICBG. The paper gives the impression that these groups and individuals were basically the friends of Brent Berlin, which may or may not be the case. We do not learn anything about these other Maya actors and their views, for or against the project. The key disagreement of COMPITCH with the ICBG concerned the issue of intellectual property rights. COMPITCH objected to the contract's requiring exclusivity for the products of the research. The specifics of the intellectual property rights associated with the project are left very vague. It is not clear what these rights entailed. Probably it was not clear even in the project, but this is not explored. If the issue is that the Maya people reject intellectual property rights and favor only collective property, then it is clear that any interaction between them and groups that want to develop medicines is extremely unlikely. While it is easy to talk of the public good appropriated by private interests and the profit motives behind initiatives such as the ICBG, this view fails to recognize that to transform the knowledge of the Maya people or of particular individuals among them into medicines with global reach could require investments of hundreds of millions of dollars. Furthermore, there is no guarantee that the effort will lead to medicines that work, make it to the market, and actually generate a profit.

One of the main reasons for the protection of intellectual property rights is to insure that free riders—people or organizations that did not invest or take risks to generate or maintain a good—do not benefit from it without bearing a share of the costs. The Maya should easily recognize this problem to the extent that they participate in collective-action institutions of their own. While Nigh invokes collective property and action as central to Maya stewardship of resources and knowledge, he fails to point out that a fundamental element in the success of collective action is the way in which an organization controls the problem of free riders (Ostrom 1990). Failure to manage free riders effectively leads to the destruction of collective action and the tragedy of the commons. While intellectual property rights may seem foreign to the Maya, the problem they attempt to address should be very familiar. This is not to say that intellectual property rights regimes do not have problems or generate inequities or that those who have them may not try to abuse them. But it is important to put them in context, as Nigh does with other aspects of collective action.

The paper illustrates how difficult it is to negotiate in good faith in order to generate outcomes that have potential benefits for the parties involved but also entail costs and compromises. Obviously good faith is a necessary but not sufficient condition for such negotiation. It also shows the high transaction costs of such negotiations. The danger is that in the future the knowledge of the Maya, developed and conserved through generations and capable of making important contributions to the welfare of humankind, will be irrelevant in a global world. Even under intellectual property rights regimes there is room for negotiation so that people in the developing world will have advantageous access to the products of such contributions. I hope that a great opportunity that could benefit the Maya and the rest of the world has not already been missed.

BRENT BERLIN AND ELOIS ANN BERLIN
Laboratories of Ethnobiology, Department of Anthropology, University of Georgia, Athens, Ga. 30602, U.S.A. (*eaberlin@uga.edu, obberlin@uga.edu*).
18 XII 01

Nigh's critique of the Maya International Cooperative Biodiversity Group (Maya ICBG) paints a grim picture of biodiversity prospecting and of those who engage in it. From the vantage of his recently acquired postmodernist stance, his accusations are especially damning of our roles in the project. We are accused of "decontextualizing the situated knowledge of Maya healers" and doing "symbolic violence to the cultural logic of Maya peoples." We are bent on the "production of universal medical technologies for private commercial benefit." We "do violence to indigenous meanings of nature, medicine, and property" and force the Maya to "objectify part of their culture to conform to the consumption desires of outsiders." Having spent the better part of our fieldwork lives among the Highland Maya, working in ways that have contributed to the recognition of the remarkable richness of their ethnobiological knowledge and practices, we find these difficult accusations to read, especially when they come from a respected ethnographic fieldworker who has lived and worked in Chiapas for many years.

Unfortunately, the analysis Nigh presents is gravely flawed. A major error in his critique of the Maya ICBG project flows directly from his understanding of the Highland Maya medical system. On one hand he criticizes us for our attention to the empirical (i.e., nonreligious) bases of Maya medicine, arguing that our focus on Maya knowledge of medicinal plants constitutes a kind of "herbal fetishism [that] conceals the social relations and cultural context of Maya healing practices." On the other hand he states, in regard to common illness events, that "patients will first attempt to cure their condition with homemade remedies [herbs]" or "may consult a person with a reputation for 'knowing plants' (*much'u xojtikin li vomole*) [in Tzotzil]."

The Tzeltal equivalent to the descriptive phrase cited by Nigh is *ja'te mach'a sna bey sba swamale* 'he/she who has knowledge of herbs'. Descriptive phrases such as these must be employed to designate persons with more than average knowledge of medicinal plants. The lack of a specific term for "herbalist" in Tzeltal and Tzotzil largely reflects the fact that the knowledge and use of common medicinal plants are widely shared by most adult Maya. It is precisely the knowledge associated with these general Maya healing practices to which our work has been directed (Berlin and Jara 1993; B. Berlin et al. 1990; E. Berlin et al. 1995; Tortoriello et al. 1995; Meckes et al. 1995). Spirituality plays no greater role in naturalistic healing than in other aspects of everyday life such as agriculture and ecotourism—and perhaps less, since ecotourism has recently expanded to include paid guided tours to sacred Maya caves that had heretofore been off-limits to outsiders (Schwartz 2001).

Nigh's emphasis on the magical/religious aspects of Maya healing trivializes the epidemiological significance of the major health conditions that are regularly treated with common and widely known medicinal plants (e.g., the several types of diarrhea, respiratory illnesses, skin, mouth, and tooth infections, sprains, and wounds). Yet these conditions are the everyday illnesses that the Highland Maya deal with constantly and the ones that are the most life-threatening. Consequently, it is an error to state that we "deliberately foreground the 'naturalistic' aspect of Highland Maya medical practice" (i.e., healing with medicinal plants). The "naturalistic" aspect of Highland Maya medical practice is the very foundation of the folk system. We document this claim with extensive ethnographic data based on more than ten years of research (E. Berlin 1998, 1999; B. Berlin and E. Berlin 1994, 1996, 1998; B. Berlin et al. 1999; 1999; E. Berlin et al. 2000). That Nigh wishes to treat spiritual shamanism as central to Highland Maya treatment of disease reflects a romantic and exotic vision of the Highland Maya that has little to do with the empirical procedures that they employ in dealing with sickness and healing in daily life.

Although Nigh argues that it is unjustified to "use ['Maya community'] as an unanalyzed 'natural' category," he uses "Maya" and "community" in exactly the same sense that we used them in our project. In the context of gaining permission and prior informed consent for research, "community" clearly refers to a specific, geographically bounded sociopolitical unit that forms a recognized subdivision of the municipality. Communities, as designated in census records and governmental documents, are the legal decision-making bodies with regard to the governance of natural resource use.

By law and custom, permission from the local community is a prerequisite for any legitimate claim of prior informed consent for any project. Mexican law is quite specific in this regard with reference to research involving biological resources. Articles 87 and 87b is of the Environmental Secretariat's General Law of Ecological Equilibrium and Environmental Protection state that biological collecting permits can only be granted "when [the request] is supported by the previous, expressed, and informed consent of the legal owner[s] of the land[s] on which the biological resource is found" (SEMARNAP 1997). In the context of the Maya ICBG, the "legal owner of the lands on which the biological resource is found" is the local Maya community.

Moreover, in the case of Chiapas, the San Andrés Accords (agreements growing out of the Zapatista rebellion that demand autonomy for indigenous communities) call for the "recognition of indigenous communities as entities of public rights" and "mandate an order of preference that privileges the indigenous communities in the award of concessions for obtaining the benefits from exploitation and use of natural resources" (*Acuerdos de San Andrés* 1996). There is no legal requirement or social precedent for obtaining permission to conduct research from nongovernmental organizations.

The Maya ICBG contacted 47 and obtained prior in-

formed consent to work in 46 communities in 15 municipalities of the highlands of Chiapas representing approximately 30,000 Tzeltal, Tzotzil, and Tojolabal-speaking individuals—an inconvenient fact that Nigh significantly chooses to ignore. We feel comfortable in claiming that we developed an information dissemination program about the activities of our research that, while clearly deficient in some ways, is unprecedented for multidisciplinary research projects on bioprospecting and in anthropology generally. We voluntarily ceased seeking permission in Indian communities and suspended all other potentially controversial research activities while the Mexican government and we tried to negotiate with our detractors, all to no avail.

Nigh's emphasis on the enormous economic rewards that would have resulted from the activities of the Maya ICBG is naïve and presents a grossly distorted picture of our efforts. The drug-discovery component of the project never involved patenting of *plants*. Furthermore, the likelihood that the project's work would lead to the discovery, development, production, and marketing of a new pharmaceutical product based on a *novel compound* was approximately that of winning the Mexican lottery, a fact that we went to great lengths to point out in all of our presentations about the project to community members. Ironically, the Maya communities understood this much more clearly than our detractors, who cast the project as one that would result in great financial rewards for multinational drug firms (our private-industry partner consisted of 12 employees).

Nigh chooses to ignore the project's many applied aims, such as scientifically testing the efficacy and safety of existing Maya herbal remedies so that they might be more effectively promoted in local communities. He does not discuss the project's experiments to develop medicinal plant extracts to be used as natural biological pesticides in local agriculture (Trujillo and García Barrios n.d., Ramírez and García Barrios 2001). Our efforts to codify and make widely available Maya ethnomedical knowledge in bilingual educational publications (see E. Berlin et al. 2000) are likewise ignored. He also minimizes the establishment of cooperative ethnobotanical community gardens as part of the Maya ICBG's effort to promote and maintain traditional knowledge of medicinal plants, all at the explicit request of Highland Maya communities themselves. Finally, Nigh never mentions the biodiversity survey activities carried out exclusively by ICBG-trained Maya researchers. The survey would have put in the hands of the Highland Maya the first complete inventory of the region's rich diversity of plant resources. The importance of such data, to have been published in Spanish, Tzeltal, Tzotzil, and Tojolabal, cannot be overemphasized as the Maya struggle to develop sustainable natural resource conservation and management plans for Chiapas. Tragically, this work, too, was never completed.

Many of Nigh's errors stem from his failure to conduct a careful ethnographic study of the Maya ICBG and of the controversy that ultimately led to its end. To do so would have required that he objectively gather primary data from project members and participants. He spoke only briefly with Brent Berlin about an earlier version of the current paper. He did not follow up on Berlin's suggestion that he check the truth of the accusations that had been brought against the project and widely circulated by the local healers' group and the international NGOs that opposed us. He never interviewed Elois Ann Berlin, the Maya ICBG co-leader most directly involved in research on Highland Maya ethnomedical knowledge, nor did he gather information from project co-leaders at our Mexican host institution, El Colegio de la Frontera Sur. He failed to interview a single Maya of the hundreds that participated in the project, either our collaborators working as research assistants or members of the communities that had provided their prior informed consent for the project to go forward. Given Nigh's careful ethnographic work in the past, the remarkable superficiality of his efforts to learn about the Maya ICBG project is disconcerting indeed.

In his concluding remarks, Nigh characterizes the Maya ICBG as a form of "extractive research . . . designed to provide information to outsiders [such as] development agents, scientists, or private corporations." Our project contrasts starkly with (presumably) his "enriching research . . . conducted with and by local people to increase their knowledge and empower them to deal more effectively with the contemporary world." If Nigh really believes this, he is mistaken. Had he seriously aimed to provide an accurate picture of the project's goals, its accomplishments over the two years in which it struggled to carry them out, and the testimony of Maya communities that had worked closely with it to implement these goals, he could only conclude that our work was enriching in precisely the ways that he finds so laudable. Meanwhile, as the local, national, and international NGOs celebrate their victory of closing down the project, the real losers are the Highland Maya communities themselves, who once again have been denied the opportunity to participate as legitimate players in a changing world over which they now have little control.

STEPHEN B. BRUSH
Human and Community Development, University of California, Davis, Calif. 95616, U.S.A. (*sbbrush@ucdavis.edu*). 11 I 02

The frustration experienced by the Maya ICBG project is increasingly common to all ethnobiological researchers. Anthropologists are particularly susceptible to similar obstacles because of the nature of their fieldwork, but botanists, geneticists, and crop scientists are also affected by the demonization of research involving biological resources. The ETC group (née RAFI) (http://www.etcgroup.org) lists companies and research institutions that are judged to be "bio-pirates," and a significant number of the ICBG projects are tarred with this label. Anthropologists and many other researchers are now impeded or precluded from collecting samples because of the fear that these will lead to illicit gain or

inappropriate products such as genetically modified organisms. Obstacles to research exist at many levels, from the village to the international agency.

Nigh's article is valuable in explicating the ethnographic context of one international project that attempted to combine scientific, commercial, and humanitarian goals. The wider political context of obstructing biological research suggests that we need to go beyond the specific attributes of this project (e.g., a politicized indigenous group, possible commercial exploitation) to understand the general plight of this type of research. Widening the scope of inquiry is suggested by the role of institutions beyond the community at regional, national, and international levels.

Conflicts over collective ownership and individual interests are not confined to the community level. We are possibly witnessing the emergence of an "anticommons" of biological resources (Brush 2002, Heller and Eisenberg 1998). This occurs when the bundle of rights that comprises "property" is divided among different persons and groups and requires negotiation and unanimous consent in the use of a particular asset. Property in intangible, protean assets such as genetic codes or herbal knowledge is especially prone to conflicting claims. In the case of the Maya, the different groups with partial rights include individuals, communities, ethnic group coalitions, scientists, and agencies of the national government. Any one holder of a partial right can block others from using the asset, resulting in the underuse of the asset—a misfortune to all parties. Even though Mexico is a signatory to the World Trade Organization and has a legal regime for intellectual property that is applicable to plant resources, communities can effectively block access to resources. The Maya ICBG project's difficulties are one expression of a biological anticommons, and on a much larger scale this can be seen in the dramatic reduction of international germ-plasm exchange (Charles 2001).

The particular nature of public goods (as opposed to common property) and intellectual property has proven to be difficult to comprehend for many people, including anthropologists. Indigenous people themselves have voiced conflicting positions regarding intellectual property. Nigh effectively relates the plant and knowledge resources of the Maya to the stream of analysis of common property. However, we must also go beyond the bounds of property in material assets to understand the particular difficulties of dealing with knowledge as a public good and in the public domain (Brush 1999). Given the importance of information as a resource in the modern world economy, property conflicts in the future will increasingly involve intellectual property, for the Maya and everyone else. The ICBG project had the misfortune of being one of the first to step into this new arena.

Because the anticommons in biological resources results in part from an inadequate understanding of the nature of public goods and intellectual property, it behooves anthropologists to understand the nature of this property and the political context in which it is contested. Nigh's article is an important contribution in this regard. The future of ethnobiological research will depend on successfully negotiating the political minefield found wherever biological diversity, indigenous people, and researchers are combined. Arguably, intellectual property is going to be more common and restrictive in the future. As the Maya ICBG case shows, indigenous people don't necessarily believe that they have interests in common with anthropologists. We have a daunting challenge either to divert the juggernaut of intellectual property or to learn how to work with indigenous people so that they don't feel compromised by our research. The Maya ICBG project had this intention, and Nigh's article should help others avoid the problems that frustrated this intention. It should become required reading for researchers in ethnobiology and other areas that might involve intellectual property.

FRANCISCO CHAPELA
Estudio Rurales y Asesoría Campesina, Priv. Elvira 120, Fracc. Villa San Luis, 68020 Oaxaca, Oax., Mexico (*era@mesoamerica.org.mx*). 21 XII 01

As a dedicated anthropologist and a Chiapas resident, Nigh is certainly in a privileged position to witness the discussion regarding bioprospecting. His paper sheds light on the issues that need to be addressed and suggests some approaches for dealing with them—for developing a national policy for bioprospecting.

The first issue is the *public* nature of health care systems. Nigh makes it clear that the traditional Maya healing system is a whole that includes commonsense practices, specialized midwives and masseurs, and holistic, spiritual *j'iloletik* healing treatments. Botanical knowledge is just a part of this whole system and makes little sense (if any) in isolation from its context. There is an analogous situation in urban areas, where health care services form a comprehensive system of which pharmacology is just a part. Using pharmacology out of its context (i.e., self-medication) makes little sense and can even be dangerous. Comprehensive health care systems are needed, and the best way to provide them is to make them public, especially in remote, poor areas, where private health services are expensive and inefficient. Traditional health care systems are the main way of accessing public health in rural areas in Mexico. Therefore, a primary goal of a policy for bioprospecting should be to ensure that traditional health care systems are kept in the public domain. To do so, the country needs to make an effort to record the knowledge associated with traditional health care. By setting up a national register with a "mirror" in some internationally recognized institution, effective protection against "biopiracy"—abusive claims to patents on indigenous knowledge, which is in fact "previous art"—can be built. Species, races, ethnobotany, and other relevant knowledge can be safeguarded in this way. This could address the main COMPITCH concern, and certainly COMPITCH itself can be a valuable promoter and provider of such a system of safeguards and must be supported in doing so.

The second issue is the *collective* nature of land stew-

ardship. Nigh makes it clear that the notion of "community" becomes very concrete when we apply it to specific human groups, engaging individuals in relationships of group identity, mutual trust, reciprocity, and authority and leading them to build effective systems of access to and management of natural resources. Fortunately, in Mexico there is legislation that recognizes communal property, and this has contributed to the development of sustainable management systems that have permitted both subsistence and some production to generate cash income in various parts of Mexico, basically keeping traditional social structures functioning. This is the case with the shade-coffee and rain-forest honey production aimed mainly at international markets and the *xate* palm production for the flower business in the United States and Europe. Bioprospecting activities might well be developed through such communal organizations. "Prior informed consent" protocols can be developed using the Mexican property regime's recognition of common property. As Nigh points out, in the specific case of Chiapas, it is unfortunate that the ICBG attempted to negotiate with "the Maya community," because there are in fact thousands of Maya communities and because both collective and individual property rights are heavily contested in Chiapas, which has been in a virtual state of war since 1994. But this does not mean that no functional Mayan communities can be found to negotiate about bioprospecting. For example, ECOSUR has regular activities in the Calakmul area in neighboring Campeche, and there community property rights are widely recognized and respected.

Finally, although Nigh does not explicitly address the strategic goals of the ICBG, it is worth mentioning that bioprospecting activities are trying to eradicate bio-piracy and make biological prospecting activities as transparent, accountable, and beneficial to the parties as possible. In doing so, the U.S. National Institutes of Health and other promoters of bioprospecting in the world are investing in reliable mechanisms for accessing biological diversity. If they were not, it would make no sense for them to expend hundreds of millions instead of directly paying pirate ethnobotanical expeditions, which are almost impossible to prevent and much less expensive. One main component of any reliable access arrangement must be the long-term conservation of landscapes and species diversity. During its short life, the Maya ICBG did not achieve these goals, but it did help to clarify for scientists, indigenous communities and organizations, and policy makers the goals that a progressive bioprospecting policy must target and to identify the policy tools necessary to achieve them. The experience is there. It is up to the national and international communities to develop the policy.

LES FIELD
Department of Anthropology, University of New Mexico, Albuquerque, N.M. 87131, U.S.A. 15 XI 01

In this excellent article, Nigh argues that vastly divergent views about nature, health, and humanity lie at the heart of ongoing conflicts between Maya communities and leaders, on the one hand, and Western biomedical researchers and corporations, on the other. These conflicts are centered upon the control over and commodification of those aspects of the Maya medical system that Western allopathic medicine can intellectually comprehend and commercialize. In the main, Western researchers and corporations want herbs or other plants that Maya use in treating disease. Herbal treatments represent, however, only one facet of the entire medical system and are meaningful only within those broader contexts. Corporate commodification of Maya herbal treatments means ripping the Maya system apart in search of what becomes, in the Western system, the goods.

Obviously the whole infrastructure of property rights, copyright law, and corporate production and distribution has favored and will continue to favor the Western bioprospectors, the university researchers and research facilities, and the biomedical corporations. Nigh argues that this inequality goes much deeper and cannot be addressed only legalistically through modifications of law, fair-trade agreements, or other such ameliorative measures. His analysis underscores the failures of the "indigenous science" approach, which, while an improvement over deep-seated, historical denigration of indigenous peoples and their achievements on the part of various Euro-colonialisms, seems only to have facilitated late 20th-century forms of expropriation and exploitation of indigenous knowledge systems.

A "solution" does not seem to be in the offing. Instead, the question becomes one of outcomes which are less negative and disempowering for "the Maya," whatever that term comes to mean. Nigh pays a great deal of attention to the development of local and pan-Mayan identities in Chiapas. He skillfully navigates his critique of naturalized, essentializing conceptualizations of "the Maya" without pursuing an equally tiresome and (for indigenous peoples) ultimately threatening ultra-constructionist analysis. The task of anthropologists, he argues, is to take as complex, multifaceted, and polyvocal a stance as possible with respect to Maya identity formation at every level, observing, it would seem, both the distance and the supportive role that might be requested of us by Maya peoples. This article that implies that our approach should not be to seek agreement between the bio-corporate world and the emerging pan-Mayan world. Instead, it represents the relationship between emergent Maya identities and corporate globalization as intrinsically conflictual, the ongoing legacy of colonialism in this region.

The most exciting part of the article for me is the description of the philosophical discussions about nature, wilderness, health, and development taking place among Maya intellectuals and scholars. These debates and discussions are being textualized (Chiapas 1991), as is a broad range of indigenous intellectual production in greater Mesoamerica (cf. the work of the Casa de Escritores en Lenguas Indígenas). I would like to take this opportunity to reflect in an optimistic, if not utopian,

way upon both the conflict Nigh has described and the moves Maya intellectuals are making. The work of Maya intellectuals could conceivably lay the groundwork for broadly drawn indigenous epistemologies that might serve as the basis for autonomously conceptualized and administered research and development projects. With adequate financial support (from states? from NGOs?), Maya medicine could emerge as a more powerful, coherent, and cohesive discursive field/practice akin to Chinese or Ayurvedic medicine. Granted, the "playing field," so to speak, could never be level, given the financial and political leverage commanded by corporate biomedicine and its institutions. Perhaps, however, such a development could better protect the resources—natural, manufactured, and conceptual—that Maya peoples rely upon for their health and well-being.

EDWARD F. FISCHER
Department of Anthropology, Vanderbilt University, Nashville, Tenn. 37235, U.S.A. (*edward.f.fischer@vanderbilt.edu*). 9 I 02

Nigh presents a cautionary tale of bioprospecting in the global oecumene. The setting is suitably exotic and native: Maya towns of highland Chiapas. And for anthropologists the plot is a familiar and comforting one (in a *schadenfreudlich* sort of way): a classic clash of civilizations, replete with cultural misunderstandings and crossed intentions. On one side, we have the Maya, with their homegrown views of the world in which they live and egalitarian notions of property rights. On the other, we have a consortium of U.S. and Mexican researchers, funded by the National Institutes of Health and working with a private Welsh pharmaceutical company, that seeks to use indigenous ethnobotany as a shortcut to the discovery of new drugs. Add to this volatile mix the Mexican state and its formal structures for interacting with indigenous communities and we have a perfect recipe for intercultural misunderstanding and the sorts of structures of conjuncture about which Marshall Sahlins writes.

But here we have more structural disjuncture than conjuncture, itself a revealing commentary on changing balances of power in the world system. And it would seem that the good guys won (or at least did not lose) this time. In November 2001 the ICBG project was closed largely as a result of resistance from the Council of Traditional Indigenous Healers and Midwives of Chiapas (COMPITCH) and pressure from groups such as the U.S.-based Global Exchange and the Canadian Action Group on Erosion, Technology, and Concentration. This is an inspiring example of the sorts of new alliances some indigenous peoples are able to forge in this connected world. Yet, at the end of the day, I cannot help but feel that this was an opportunity lost and that its breakdown was due not so much to star-crossed cultural logics as to political maneuvering.

Nigh offers this possibility in his comment that the Maya are generally "very interested in what science can teach them about their own traditions and about the outside world," while the scientists are trying to be culturally sensitive. So what is the problem? As Nigh explains it, it is the clash of worldviews that informed the respective sides' positions in their politicized negotiations. Certainly there are different cultural predispositions, different cultural logics informing the sides of the debate. But cultural logics are ever mutable, and it is my assessment that the two sides could have just as easily chosen to stress their commonalties over their differences. Indeed, the new legal framework to protect indigenous rights that Nigh calls for is not incompatible with the Maya ICBG project as it was conceived. To address the underlying problems Nigh raises would involve establishing a right to cultural knowledge.

Nigh states that "only within the values of contemporary Western capitalist culture is it considered acceptable to isolate elements of the situated (and therefore privileged) knowledge of a Maya shaman from its social and metaphysical context and use those decontextualized elements in the production of universal technologies for private commercial benefit." Perhaps the Maya in highland Guatemala I work with are more entrepreneurial, but I daresay most would not have a problem with this as long as there were an equitable distribution of the profits (see Fischer 2001). Granted, such a sense of equanimity is culturally informed, revealing a clash of cultural logics. But this brings us back to the ever-looming political issue of what interpretations prevail when conflicting interests meet in structurally biased circumstances. More than just opposing the ICBG project, COMPITCH and the other Maya opposition were making a statement—and one that needs to be heard—about the new power relations that hold in this globalized world, decrying epistemological violence to their culture in the name of scientific progress.

Nigh's most important contribution is in pointing to fundamental ethical problems for which there are no neat solutions. These involve, first, gaining permission and informed consent to work with common "cultural property." There is no person, no group that can fully speak for a culture on these matters—even if we could agree on what constitutes a culture and where to draw its boundaries. Then, from whom does one get permission to do research on "the Maya" or even just older Maya men in Chiapas with extensive knowledge of plants? More fundamentally, how can we translate our newly minted Western notions of intellectual property into a Maya cultural vocabulary? Intellectual property is not recognized as such by most Maya people: an individual cannot own knowledge that has been passed down for generations. Indeed, the rise of intellectual and cultural property rights raises troubling possibilities for us in the West as well. Ideas are to be shared, borrowed, built upon, and transformed. If we start patenting cultural ideas or enforcing intellectual property rights, where will it end? At the same time, one must admire the savvy manner in which indigenous activists are able to co-opt elements from a hegemonic system to use as weapons against that system. The Maya leaders of COM-

PITCH are fighting a grand battle of ideas with noble goals and results.

An equally important and related issue concerns returning profits to a studied group. Whether at the level of individuals, communities, or ethnic groups, who should profit from any successes? Certainly we should strive for what Nigh terms enriching rather than extractive research, but the devil is in the details. What if a miracle drug for cancer or AIDS is discovered? To whom should payment be made? Perhaps to the specific individuals who passed the knowledge along to researchers. But, of course, they received that knowledge from family, friends, and neighbors, so perhaps the community as a whole should be compensated. But why that community and not the one 10 kilometers away that has the same knowledge, perhaps ultimately derived from the same source? It would seem, and I daresay the Maya representatives would agree, that this should be global knowledge and its benefits reaped widely.

VIRGINIA NAZAREA
Department of Anthropology, University of Georgia, Athens, Ga. 30602-1619, U.S.A. (*vnazarea@arches.uga.edu*). 8 I 02

Nigh discusses the historical, political, and cultural context of the uneasy encounter between Maya conceptions of disease and healing, as well as community and property, and the Maya ICBG. His main argument is that "bioprospecting proposals such as the ICBG do violence to indigenous meanings of nature, medicine, and property." Although the article was submitted before ECOSUR formally withdrew from the project and the NIH refused to continue funding, Nigh anticipates the dénouement when he writes, "Before any Maya had been involved in the discussion, the ICBG was already firmly committed to intellectual-property regimes that have largely abandoned the common-heritage principle for the distribution of plant resources."

Nigh's article is a timely input to crucial discussions in anthropology: positivism and deconstructionism, engagement with policy and advocacy, communities and environmentalism, and extractive versus enriching research. These controversies are not limited to the Maya ICBG. Broad in scope, they fuel and infect controversies about development, equity, sustainability, and conservation in various arenas. At the heart of the matter are situated knowledges that clash and universal technologies that seek, at all costs, to impose the hegemony of progress and the tyranny of good intentions against what Mohanty (1991) has called "cartographies of struggle."

How is the anthropologist supposed to negotiate this precarious terrain? What lies ahead for the presumably well-intentioned ethnoscientist? In *Ethnoecology: Situated Knowledge/Located Lives* (1999), I suggested that it is time to move away from the long-standing debate on the universality of human cognition so that we can tackle more pressing problems in both theory and practice. Yet, phoenix-like, this dilemma refuses to go away. In this case, Nigh has pointed to the incongruence between the "herbal fetishism" of conventional "natural medicine" that seeks to establish a linear cure-for-disease equation and the local medicine practiced by the shamans, who use these herbs in a more complex "socially reconstituting and reoriginating" context. This fetishism, to follow Nigh's lead, reflects a dedication to reducing categories of indigenous knowledge to fit categories of science point by point, level by level, ignoring all pragmatic contingencies and cultural configurations.

While Nigh cites a statement I made pertaining to "a radical shift in mindset from viewing native systems of classification as naïve and rudimentary . . . to a recognition that local cultures know their plant, animal, and physical resources intimately" in implicit support of Berlin and Berlin's assertion that "work over the past several decades . . . has demonstrated that the ethnobiological knowledge of traditional peoples conforms in many respects to scientific principles," he fails to note that I distinguished between an ethnoecology/ethnobiology, epitomized by Berlin's work, that seeks to legitimize indigenous knowledge through a scientific vindication or benediction and one, exemplified by Conklin's work, that seeks to understand it for its internal coherence and adaptive significance. I emphasized that the difference between the two perspectives is not petty and can lead to quite significant differences in repercussions and outcomes.

Nigh points out that, while local healers base their practices on holistic epistemologies of illness and curing handed down through generations, in their museums and their proposals for funding experts almost exclusively highlight the "naturalistic herbal medicine favored by their cosmopolitan medical advisers." Taussig's (1993) insights on mimesis and representation—how the subordinated and the disenfranchised copy and mock attributes of the dominant group in order to survive—are relevant here. This case demonstrates that the local healers have seen through the paradigm and politics of science and are selectively appropriating its elements to their advantage. It points to the expediency of indigenous knowledge and tells us that the dominated and marginalized have their "public transcripts" and "hidden transcripts" (Scott 1990), too—perhaps even more than the more politically powerful and astute. To rephrase Nigh's analysis, the disctinction between the public and the hidden transcripts—between representation and "soul"—blurred as objections by the highland healers to the Maya ICBG gained momentum. Unfortunately, it appears that their "no," instead of being respected, was taken as a further challenge to the power of persuasion of Western science, law, and economics.

I predict that Nigh's article will be followed by many others on the issues of bioprospecting, intellectual property pertaining to local knowledge and plant genetic resources, and biodiversity conservation. It comes as anthropologists respond to a call for relevance and compete for public and private funding, at a time when we need to glamourize our work by liberally sprinkling it with buzzwords and quantify and "bulletize" our findings to

demonstrate impact. Nigh has done an excellent job of creating the space in which productive discussions can take place. If we have been paying attention and have learned our lessons well, the local people themselves will be participating as equal partners in the ensuing conversation.

CLAUDIA WEIMANN
Institut für Pharmazeutische Biologie, D-79104 Freiburg, Germany (*c.wei@web.de*). 20 XII 01

Nigh describes the current condition of Highland Maya in Chiapas, Mexico, but the problems he presents apply to indigenous people of many cultures. I will offer some examples drawn from my own ethnobotanical field research among the Nahua of the Sierra de Zongolica, Veracruz, Mexico (Weimann 2000).

I shall begin by asking what happens to cultural groups over time. Nigh explains that the Mayan-speaking groups are defined as representing the pre-Columbian past. But cultures and societies should be seen not just as systems but as processes. Human beings respond to their environment, both adapting to natural circumstances and acculturating to adjacent cultural groups (Hirschberg 1999). For example, colonizers accommodate to their surroundings over the years, as Nigh observes for different local groups. The Mayan-speaking people of today are acculturated to the so-called mestizo culture in Mexico, and the same can be said of the Nahua of the Sierra de Zongolica. Because of their special geography, various influences can be observed in the same region. Villages which have been connected by paved roads change their habits (e.g., with regard to the use of Nahuatl) more quickly than those which can only be reached on foot (Weimann 2000).

In 1978 the World Health Organization declared "health for all people in 2000" as the main goal. The Mexican government's strategy was to introduce health promotion programs in several regions. Indigenous healers received instruction because people of the same cultural background trusted them. They could communicate with people in their native language and understand culture-bound syndromes such as *susto* and *mal aire*. Primary health care should include local herbal medicines, which are readily available and cheap, but their safety should be validated. At the same time, ethnobiological studies may be the basis for the development of new drugs (Weimann 2000).

Apart from the possible exploitation of indigenous knowledge, bioprospecting research can lead to misunderstanding of a particular culture, for example, the Maya's medicinal use of plants and other healing rituals. The researcher tends to interpret the use of herbal medicine in terms of his own cultural background. Understanding the use of medicinal plants requires scrutinizing the particular culture's concepts of health and illness. Even if the disease terms recognized are similar to those of biomedicine, the perceived causes of illness are sometimes very different. The form of treatment and its perceived effectiveness are based on cultural interpretations of these illnesses and their perceived causes. For example, the Nahua's concept of "fever" is different from the biomedical one. Fever was believed by the Aztecs and is still believed by the Nahua of Zongolica to be a "hot phlegm" in the body that is expelled by sweating, sneezing, or the action of laxatives or diuretics. Consequently, the plants used for treating it may not have febrifuge effects but may induce sneezing or act as sudorifics, laxatives, or diuretics. The study of the pharmacological effects of indigenous medicinal plants should take into consideration these conceptual differences (see Ortiz de Montellano 1976 and, for further references, Weimann 2000). It should be clear, however, that the "traditional" medicine of today in the Sierra de Zongolica and, I think, other regions of Mexico is a syncretic mix of Spanish and indigenous traditions (Aguirre Beltrán 1980). Since Western medicine influences local traditional medicine, some elements of traditional healing may have been lost, but at the same time there are more possibilities for curing systems.

Ultimately, research should be understood as a dialogue between different cultures. A mutual exchange of cultural knowledge may result, but at the same time there is a process of acculturation. The basis for communication should be respect for nature but also for people and their knowledge. I agree with Nigh that the distinctive characteristics of particular cultural groups should be strengthened to conserve biodiversity in plants, animals, and cultures. We should keep in mind that "cada anciano que se muere es una bibliotéca que se quema" (Every ancient who dies is a library that burns) (Alvarez Santiago 1991).

Reply

RONALD NIGH
Williamstown, Mass., U.S.A. 28 I 02

I thank all of the commentators for their remarks. The range of opinions and insights is rich and reflects the extraordinary diversity of reactions elicited by the Maya ICBG and the larger issues it raises. I have restricted my reply to the two areas discussed that are most central to the paper: the fundamental concepts of nature, community, property, and Maya medical and ecological practice and related topics of intellectual property rights, local knowledge, and control of access to biodiversity. The paper argues that differences concerning fundamental concepts led to conflict and failure to achieve agreement on property rights and access.

Ayora's comments are the most perplexing because, as far as I can see, we agree. Indigenous peoples' privileged relationship to their environment is not a romantic notion but recognition of centuries of cultural and ecological adaptation. Their "quasi-natural right to control and manage their own resources" is acknowledged explicitly

in international law, most recently in the Convention on Biological Diversity, and is not due to any essentialism on my part. Atran's concept of latent knowledge structures seeks to understand how "locally embodied individual practices" induce a culture of stewardship even in the absence of formal common-property resource management institutions. No reference is made to "ingrained mind structures." Ayora's views on medical practices are explicitly and amply endorsed in the paper. Finally, to say that harmony with the cosmos is a widely held value among Maya peoples is not necessarily to say the Maya actually live in harmony with each other or their environment.

The contingent and shifting nature of the "community" in the Maya area, referred to by Ayora, was discussed. This topic is addressed in the Berlins' comments as well and was a central issue in the Maya ICBG controversy. The Berlins' remarks on community are revealing of the underlying problem. They insist that "community" refers to a "specific, geographically bounded sociopolitical unit." Yet, as Ayora notes, such units are often fictions imposed from outside or contingent on immediate interests of particular Maya families or even individuals. Anyone who has worked with Chiapas census data on the locality level knows that the designated points are administrative conveniences that may or may not bear any relationship to local residential patterns or social organization. The representative status, as "legal decision-making bodies," of the 46 "communities" that signed agreements with the Maya ICBG is highly variable. These are simple realities of highland Chiapas.

The Berlins also insist on Articles 87 and 87bis of the federal environmental law, which specify that prior informed consent be given by the "legal owners of the lands on which the biological resources are found." This law was written to deal with traditional biological collections for scientific purposes and did not contemplate bioprospecting projects in which intellectual property rights and commercial interests are involved. Such agreements affect the rights of Indian peoples of whom the owners of a given parcel of land may not be fully representative, a point addressed in the comments of Fischer and Chapela. I am not implying any bad intentions on the part of the researchers, but failure to recognize the gravity of these issues contributed to the eventual cancellation of the project.

The Berlins translate key phrases from the San Andrés Accords between the Zapatista army and the Mexican government as referring to indigenous "communities." In fact, the term used in those phrases and throughout the entire text of the agreement and its extensive annexes is *pueblos indígenas* (indigenous peoples). The struggle to transcend the restricted "geographically bounded" and imposed "community" and to empower regional social and political formations of indigenous peoples is a fundamental dimension of the Maya quest for autonomy (Nash 2001). If I have painted a "grim picture," it is not of biodiversity prospecting and of those who engage in it but of the plight of Maya peoples who have yet to secure a fair hearing for the redress of their ancient grievances and the recognition of their fundamental rights.

Bellon's interpretation of intellectual property rights as an attempt to address the free-rider problem is a curious one. Others would view intellectual property rights as an attempt to legalize free-rider piracy by outsiders who seek individual benefit from the accumulated collective knowledge of Indian peoples. Bellon seems to accept the view that intellectual property rights are a necessary incentive for the development of Maya medicines with "global reach." He apparently discounts the possibility that Mexican society might invest in such development as a public good or that the Maya themselves could find their own means of promoting their medical practice globally, as suggested by Field. It is true that such options are not ideologically favored in the current climate of free-trade capitalism, but that situation may change. In Fischer's words, cultural logics are ever mutable.

Brush also seems to assume the necessity of intellectual property rights schemes and paradoxically identifies opposition to them as part of the "emerging anticommons" of biological resources. He correctly notes that indigenous people do not necessarily believe that they have interests in common with anthropologists. It is clear to me that indigenous people also do not necessarily believe that the privatization of cultural property is compatible with the protection of public goods. As Field remarks, such schemes consistently favor the bioprospectors, researchers, and corporations, not indigenous peoples. It is an error for anthropologists to pretend that they can now broker such outside interests and continue to have the same kind of privileged relationships with the people they study that they enjoyed in the past.

Weimann and Chapela are both sensitive to indigenous people's perceptions and points of view while remaining sympathetic to bioprospecting research. Chapela is correct in pointing out that the Maya ICBG is an attempt to create a scheme for responsible bioprospecting that avoids biopiracy, though I believe his suggestion for a "national registry" of ethnobiological resources is more likely to achieve that goal. If the Maya ICBG experience has taught us anything, however, it is that good intentions are not enough. I do not have the answers to these complex issues, but it is increasingly clear that in a context in which indigenous peoples lack full recognition and autonomy to control their territories and resources, even relatively enlightened projects such as ICBG will not be successful. I can only hope that Nazarea's call to bring indigenous people into the discussion will be heeded.

References Cited

Acuerdos de San Andrés: Acuerdos sobre derechos y culturas indígenas. 1996. (http://www.enlacecivil.org.mx/sanandres/sanandrs.html) [BB, EAB]

AGUIRRE BELTRÁN, GONZALO. 1980 (1963). *Medicina y magia*. Colección SEP [Secretaría de Educación Pública] Instituto Nacional Indigenista 1. [CW]

ALVAREZ SANTIAGO, H. 1991. *El Xochitlali en San Andrés Mixtla: Ritual e intercambio ecológico entre los Nahuas de Zongolica*. Colección V Centenario 7. Xalapa, Veracruz. [CW]

ATRAN, SCOTT. 1993. The Bio-Itza. *Anthropology Newsletter* 34 (7):37.

———. 1999. "Managing the Maya commons: The value of local knowledge," in *Ethnoecology: Situated knowledge/located lives*. Edited by V. D. Nazarea, pp. 190–214. Tucson: University of Arizona Press.

AYORA DÍAZ, STEFFAN IGOR. 1998. Globalization, rationality, and medicine: Local medicine's struggle for recognition in highland Chiapas, Mexico. *Urban Anthropology* 27:165–96.

———. 1999. Medicinas locales en Chiapas: Globalización y luchas por el reconocimiento. *Temas Antropológicos* 20: 196–226. [SIA]

———. 2000. Imagining authenticity in the local medicines of Chiapas, Mexico. *Critique of Anthropology* 20:173–90.

———. n.d. *Globalización, conocimiento y poder: Médicos locales y sus luchas por el reconocimiento en Chiapas*. Mexico City and Mérida: Plazay Valdés/UADY. In press. [SIA]

BERKES, FIKRET. 1999. *Sacred ecology: Traditional ecological knowledge and resource management*. Philadelphia: Taylor and Francis.

BERKES, FIKRET, AND CARL FOLKE. Editors. 1998. *Linking social and ecological systems: Management practices and social mechanisms for building resilience*. Cambridge: Cambridge University Press.

BERLIN, BRENT O. 1992. *Ethnobiological classification: Principles of categorization of plants and animals in traditional societies*. Princeton: Princeton University Press.

———. 1999. *Annual report of the Laboratory of Ethnobiology (1998–99)*. Athens: Department of Anthropology, University of Georgia.

BERLIN, BRENT, AND ELOIS ANN BERLIN. 1994. "Anthropological issues in medical anthropology," in *Ethnobotany and the search for new drugs*. Edited by G. Prance. Ciba Foundation Symposium Publication 185. [BB, EAB]

BERLIN, BRENT, ELOIS ANN BERLIN, DENNIS E. BREEDLOVE, THOMAS DUNCAN, VICTOR JARA, ROBERT L. LAUGHLIN, AND TERESA VELASCO. 1990. *La herbolaria médica Tzeltal-Tzotzil de los Altos de Chiapas: Un ensayo sobre las cincuenta especies de uso más frecuente*. Tuxtla Gutiérrez, Chiapas, Mexico: Instituto Chiapaneco de Cultura. [BB, EAB]

BERLIN, BRENT, ELOIS ANN BERLIN, JOSÉ C. FERNANDEZ UGALDE, LUIS GARCÍA BARRIOS, DAVID PUETT, ROBERT NASH, AND MARIO GONZÁLEZ-ESPINOZA. 1999. The Maya ICBG: Drug discovery, medical ethnobiology, and alternative forms of economic development in the Highland Maya region of Chiapas, Mexico. *Pharmaceutical Biology* 37:127–44. [BB, EAB]

BERLIN, BRENT, ELOIS ANN BERLIN, LUIS GARCÍA, MARIO GONZÁLEZ, DAVID PUETT, ROBERT NASH, CARLOS MONTES, RAMON TRUJILLO, LUIS-ANGEL RAMÍREZ, JUANA HERNÁNDEZ, MARIA-GUADALUPE RAMÍREZ, HAZEL WETZSTEIN, THOMAS MURRAY, RAGHUBIR SHARMA, JAMES AFFOLTER, AND MICHAEL HEINRICH. 2000. "Etnobotánica médica y desarrollo rural: El caso del ICBG-Maya en los Altos de Chiapas," in *Estudios sobre la relación entre seres humanos y plantas en los albores del siglo XXI*. Mexico City: Universidad Autónoma Metropolitana-Iztapalapa. [BB, EAB]

BERLIN, BRENT, DENNIS E. BREEDLOVE, AND PETER H. RAVEN. 1974. *Principles of Tzeltal plant classification: An introduction to the botanical ethnography of a Mayan-speaking people of highland Chiapas*. New York and London: Academic Press.

BERLIN, ELOIS ANN. 1998. "General overview of Maya ethnomedicine," in *Cultural and spiritual values of biodiversity*. Edited by Darrel A. Posey and Graham Dutfield. Nairobi: UNEP. [BB, EAB]

———. 1999. "Ecological, sociocultural, and biological determinants of ethnoepidemiological patterns among the Highland Maya," in *Ethnoecology: Knowledge resources and rights*. Edited by Theodore Grayson and Benjamin Blount. Athens: University of Georgia Press. [BB, EAB]

BERLIN, ELOIS ANN, IN COLLABORATION WITH BRENT BERLIN, JUANA GNECO, FELICIANO GÓMEZ SÁNTIZ, AND SERGIO GÓMEZ LÓPEZ. 2000. *Stalel sk'op ya'yejal bit'il ta pasel wamal poxil ta Oxchuc/Manual etnomédico de Oxchuc: Guia básica y herbolaria*. San Cristóbal de Las Casas, Chiapas, Mexico: El Colegio de la Frontera Sur. [BB, EAB]

BERLIN, ELOIS ANN, AND BRENT BERLIN. 1996. *Medical ethnobiology of the highland Maya of Chiapas, Mexico*. Princeton: Princeton University Press.

———. 1998. *Enciclopedia médica maya*. (Cuatro-lingual [Spanish, Tzeltal, Tzotzil, and English] CD ROM.) San Cristóbal de Las Casas, Chiapas, Mexico: El Colegio de la Frontera Sur. [BB, EAB]

BERLIN, ELOIS ANN, AND BRENT BERLIN, IN COLLABORATION WITH XAVIER LOZOYA, JOSÉ R. RICÁRDEZ, DENNIS E. BREEDLOVE, MARIANA MECKES, JORGE TORTORIELLO, MARIA-LUISA VILLARREAL, GUADALUPE RODRÍGUEZ, ROBERT M. LAUGHLIN, AND LUISA MAFFI. 1996. *Medical ethnobiology of the Highland Maya: The gastrointestinal diseases*. Princeton: Princeton University Press. [BB, EAB]

BERLIN, ELOIS ANN, BRENT BERLIN, XAVIER LOZOYA, MARIANA MECKES, JORGE TORTORIELLO, AND MARIA-LUISA VILLARREAL. 1995. "The scientific basis of diagnosis and treatment of gastrointestinal diseases by the Tzeltal and Tzotzil Maya of Southern Mexico," in *Naked science*. Edited by Laura Nader. London: Routledge. [BB, EAB]

BERLIN, ELOIS ANN, AND VICTOR JARA. 1993. *Me' winik:* A case study at the interface between biomedicine and ethnomedicine. *Social Science and Medicine* 16:1–13. [BB, EAB]

BONFIL B., GUILLERMO. 1996. México profundo: *Reclaiming a civilization*. Austin: University of Texas Press.

BRAY, DAVID. 1995. Peasant organizations and the "permanent reconstruction of nature": Grassroots sustainable development in rural Mexico. *Journal of Environment and Development* 4: 185–204.

BRUSH, STEPHEN B. 1996. "Is common heritage outmoded?" in *Valuing local knowledge: Indigenous people and intellectual property rights*. Edited by S. Brush and D. Stabinsky, pp. 143–65. Washington, D.C. and Covelo, Calif.: Island Press.

———. 1999. Bioprospecting the public domain. *Cultural Anthropology* 14:535–55.

———. 2002. *Farmers' bounty: The future of crop diversity in the modern world*. New Haven: Yale University Press. [SBB]

BURGUETE CAL Y MAYOR, RUBY ARACELI. 2000. *Agua que nace y muere: Sistemas normativos indígenas y disputas por el agua en Chamula y Zinacantan*. San Cristóbal de Las Casas: Programa de Investigaciones Multidisciplinarias sobre Mesoamérica y el Sureste (UNAM).

CASTAÑEDA, QUETZIL E. 1996. *In the museum of Maya culture: Touring Chichen Itzá*. Minneapolis and London: University of Minnesota Press.

CHARLES, DANIEL. 2001. Seeds of discontent. *Science* 294: 772–75. [SBB]

CHIAPAS. 1991. *Conservación de la naturaleza/Xk'uxubinel banamil vinajel/ . . . Primer Concurso Literario Indígena*. Tuxtla Gutiérrez: Gobierno del Estado, Instituto Chiapaneco de Cultura.

CLEVELAND, DAVID A., AND STEPHEN C. MURRAY. 1997. The world's crop genetic resources and the rights of indigenous farmers. CURRENT ANTHROPOLOGY 18:477–515.

COLLIER, GEORGE A. 1992. "Búsqueda de alimentos y búsqueda de dinero: Cambios en las relaciones de producción en Zinacantan, Chiapas," in *Restructuración económica y subsistencia rural: El maíz y la crisis de los ochenta*. Edited by C. Hewitt, pp. 183–221. Mexico City: El Colegio de México.

CRITCHFIELD, RICHARD. 1994. *The villagers: Changed values, altered lives: The closing of the urban-rural gap*. New York: Anchor Books.

EDER, KLAUS. 1996. *The social construction of nature*. London: Sage. [SIA]

ESCOBAR, ARTURO. 1999. After nature: Steps to an antiessentialist political ecology. CURRENT ANTHROPOLOGY 40:1–30.

FABREGA, H., AND D. B. SILVER. 1973. *Illness and shamanistic curing in Zinacantan*. Stanford: Stanford University Press.

FARRISS, NANCY M. 1984. *Maya society under colonial rule: The collective enterprise of survival*. Princeton: Princeton University Press.

FISCHER, EDWARD F. 1999. Cultural logic and Maya identity: Rethinking constructivism and essentialism. CURRENT ANTHROPOLOGY 40:473–99.

———. 2001. *Cultural logics and global economies: Maya identity in thought and practice*. Austin: University of Texas Press. [EFF]

FLORES, ABELINO. 2000. Conocimiento local y manejo de recursos naturales: Ejido 20 de noviembre en la dinámica de la reserva de la biósfera Calakmul. Ph.D. diss., Centro de Investigaciones y Estudios Superiores en Antropología Social, San Cristóbal de Las Casas, Chiapas.

FREIDEL, DAVID, LINDA SCHELE, AND JOY PARKER. 1992. *Maya cosmos: Three thousand years on the shaman's path*. New York: William Morrow.

FREYERMUTH ENCISO, GRACIELA. 1993. *Médicos tradicionales y médicos alópatas: Un encuentro dificil en los Altos de Chiapas*. Tuxtla Gutiérrez: CIESAS-Sureste–Gobierno del Estado de Chiapas.

———. 1999. Morir en Chenalhó: Género, generación y etnia, factores constitutivos del riesgo materno. Ph.D. diss., Universidad Nacional Autónoma de México, Mexico City, Mexico.

GARCÍA BARRIOS, RAÚL, AND LUIS GARCÍA BARRIOS. 1992. "Subsistencia maicera y dependencia monetaria en el agro semiproletarizado: Una comunidad rural mixteca," in *Restructuración económica y subsistencia rural: El maíz y la crisis de los ochenta*. Edited by C. Hewitt, pp. 223–69. Mexico City: El Colegio de México.

GÓMEZ SANCHEZ, MARTÍN. 1982. "El aborigen y el maíz: Oxchuc, Chiapas," in *Nuestro maíz: Treinta monografias populares*, pp. 11–18. Mexico City: Museo Nacional de Culturas Populares/Secretaría de Educación Pública.

GRAY, ANDREW, MARCUS COLCHESTER, AND ALEJANDRO PARELLADA. Editors. 1998. *Derechos indígenas y conservación de la naturaleza: Asuntos relativos a la gestión*. International Work Group for Indigenous Affairs Document 23.

GRIFO, FRANCESCA T., AND DAVID R. DOWNES. 1996. "Agreements to collect biodiversity for pharmaceutical research: Issues and proposed principles," in *Valuing local knowledge: Indigenous people and intellectual property rights*. Edited by S. Brush and D. Stabinsky, pp. 281–304. Washington, D.C., and Covelo, Calif.: Island Press.

GUITERAS HOLMES, CALIXTA. 1961. *The perils of the soul: The world view of a Tzotzil Indian*. Glencoe: Free Press.

HAENN, NORA, 1999. The power of environmental knowledge: Ethnoecology and environmental conflicts in Mexican conservation. *Human Ecology* 27:477–91.

HARAWAY, DONNA. 1991. *Simians, cyborgs, and women: The reinvention of nature*. New York and London: Routledge.

———. 1997. *Modest_Witness@Second_Millennium.FemaleMan©_Meets_OncoMouse™: Feminism and Technoscience*. New York and London: Routledge.

HARVEY, NEIL. 1998. *The Chiapas rebellion: The struggle for land and democracy*. Durham and London: Duke University Press.

HELLER, MICHAEL A., AND REBECCA S. EISENBERG. 1998. Can patents deter innovations? The anticommons in biomedical research. *Science* 280:698–701. [SBB]

HERMITTE, ESTHER. 1970 (1950). *Poder sobrenatural y control social*. Tuxtla Gutiérrez: Gobierno del Estado de Chiapas.

HERNÁNDEZ CASTILLO, ROSALVA AÍDA, AND RONALD NIGH. 1998. Global processes and local identity among Mayan coffee growers in Chiapas, Mexico. *American Anthropologist* 100:136–47.

HERNÁNDEZ JIMÉNEZ, ANTONIO. 1982. "El cultivo del maíz en el ejido Sonora: Las Margaritas, Chiapas," in *Nuestro maíz: Treinta monografias populares*, pp. 19–48. Mexico City: Museo Nacional de Culturas Populares/Secretarías de Educación Pública.

HERZFELD, MICHAEL. 1997. *Cultural intimacy: Social poetics and the nation-state*. London and New York: Routledge.

HIRSCHBERG, WALTER. 1999. *Wörterbuch der Völkerkunde*. Berlin: Dietrich Reimer Verlag. [CW]

HOLLAND, WILLIAM R. 1963. *Medicina maya en los altos de Chiapas*. Mexico City: Instituto Nacional Indigenista.

KAPFERER, BRUCE. 1996. *The feast of the sorcerer: Practices of consciousness and power*. Chicago: University of Chicago Press.

KELLER, EVELYN FOX. 1996. "The biological gaze," in *Future-natural: Nature, science, culture*. Edited by G. Robertson, M. Mas, L. Tickner, J. Bird, B. Surtis, and T. Putnam, pp. 107–21. London and New York: Routledge.

KEY, NIGEL, CARLOS MUÑOZ-PIÑA, ALAIN DE JANVRY, AND ELIZABETH SADOULET. 1998. Social and environmental consequences of the Mexican reforms: Common pool resources in the *ejido* sector. MS, University of California, Berkeley.

KRECH, SHEPARD, III. 1999. *The ecological Indian: Myth and history*. New York and London: W. W. Norton.

LAUGHLIN, ROBERT M. 1975. *The great Tzotzil dictionary of San Lorenzo Zinacantán*. Smithsonian Contributions to Anthropology 19.

LAUGHLIN, ROBERT M., AND CAROL KARASIK. 1988. *The people of the bat: Mayan tales and dreams from Zinacantan*. Washington, D.C.: Smithsonian Institution Press.

LONG, NORMAN, AND MAGDALENA VILLAREAL. 1994. "The interweaving of knowledge and power in development interfaces," in *Beyond Farmer first: Rural people's knowledge, agricultural research, and extension practice*. Edited by I. Scoones and J. Thompson, pp. 41–52. London: Intermediate Technology Publications.

MECKES, M., J. TORTORIELLO, M. L. VILLARREAL, E. A. BERLIN, AND B. BERLIN. 1995. Microbiological evaluation of medicinal plants used by the Maya people of southern Mexico. *Archives of Medical Research* 9:244–50. [BB, EAB]

MOHANTY, CHANDRA. 1991. "Cartographies of struggle: Third World women and the politics of feminism," in *Third World women and the politics of feminism.* Edited by C. Mohanty, A. Russo, and L. Torres. Bloomington: Indiana University Press. [VN]

MONTEMAYOR, CARLOS. 1997. *Chiapas: La rebellión indígena de México*. Mexico City: Joaquin Moritz.

MUNYOS KOMES, XUN. 1991. "K'u to'ox xi x-abtejik ti moletik vo'one (How the elders used to work)," in *Conservación de la naturaleza/Xk'uxubinel banamil vinajel: Primer Concurso Literario Indígena*, pp. 27–29. Tuxtla Gutiérrez: Gobierno del Estado–Instituto Chiapaneco de Cultura.

———. 1995. *The explosion of communities in Chiapas*. Copenhagen: International Work Group on Indigenous Affairs.

NASH, JUNE. 2001. *Mayan visions: The quest for autonomy in an age of globalization*. New York and London: Routledge.

NATIONS, JAMES D., AND RONALD NIGH. 1980. The evolutionary potential of Lacandon Maya sustained-yield tropical forest agriculture. *Journal of Anthropological Research* 36: 1–30.

NAZAREA, VIRGINIA D. 1999. "A view from a point: Ethnoecology as situated knowledge," in *Ethnoecology: Situated knowledge/located lives*. Edited by V. D. Nazarea, pp. 3–20. Tucson: University of Arizona Press.

NIGH, RONALD. 1997. Organic agriculture and globalization: A Maya associative corporation in Chiapas, Mexico. *Human Organization* 56:427–36.

———. 1999. Agriculture in the information age: The transnational ecology of corporate versus smallholder farming. *Urban Anthropology* 28:1–46.

———. 2000. "Contested identities in the global market place: Post-peasant economic organization in Chiapas," in *Strategies for resource management, production, and marketing in rural Mexico*. Edited by G. Rodríguez and G. Y. R. Snyder, pp. 105–30. La Jolla: Center for U.S.-Mexican Studies, University of California, San Diego.

ORTIZ DE MONTELLANO, BERNARDO. 1976. "The rational causes of illnesses among the Aztecs." *Actes du XLIIe Congrès Intemacional des Americanistes*, vol. 6, pp. 287–99. [CW]

OSTROM, ELINOR. 1990. *Governing the commons: The evolution of institutions for collective action*. New York: Cambridge University Press.

———. 1998. A behavioral approach to the rational choice theory of collective action (Presidential Address, American Political Science Association, 1997). *American Political Science Review* 92:1–22.

OSTROM, ELINOR, JOANNA BURGER, CHRISTOPHER B. FIELD, RICHARD B. NORGAARD, AND DAVID POLICANSKY. 1999. Revisiting the commons: Local lessons, global challenges. *Science* 284:278.

OUDSHOORN, NELLY. 1994. *Beyond the natural body: An archaeology of sex hormones*. London and New York: Routledge.

PIMBERT, MICHEL. 1998. *Sustaining the multiple functions of agricultural biodiversity*. United Nations FAO/Netherlands Conference on the Multifunctional Character of Agriculture Background Paper 1.

PITARCH RAMON, PEDRO. 1996. *Ch'ulel: Una etnografía de las almas tzeltales*. Mexico City: Fondo de Cultura Económica.

RAFI (Rural Advancement Foundation International). 1999*a*. Maya Indian organizations denounce biopiracy project in Chiapas. Press release, December 1. www.rafi.org.

———. 1999*b*. Messages from the Chiapas "bioprospecting" dispute: An analysis of recent issues raised in the Chiapas "bioprospecting" controversy with reflections on the message for biopiracy. *Geno-type*, December 22. www.rafi.org.

———. 2000. Stop biopiracy in Mexico! Indigenous people's organizations from Chiapas demand immediate moratorium. *Geno-type*, October 23. www.rafi.org.

RAMÍREZ, LUÍS A., AND LUÍS GARCÍA BARRIOS. 2001. Evaluación del efecto insecticida de extractos de plantas sobre *Leptophobia aripa elodia. Manejo Integrado de Plagas* (*Costa Rica*) 60:50–56. [BB, EAB]

RAUSSER, GORDON C., AND ARTHUR A. SMALL. 2000. Valuing research leads: Bioprospecting and the conservation of genetic resources. *Journal of Political Economy* 108:173–206.

REICHEL-DOLMATOFF, GERARDO. 1976. Cosmology as ecological analysis: A view from the rainforest. *Man*, n.s., 2: 307–18.

ROLLING, NIELS, AND JAN BROUWERS. 1999. "Living local knowledge for sustainable development," in *Biological and cultural diversity: The role of indigenous agricultural experimentation in development*. Edited by G. Prain, S. Fujisaka, and M. D. Warren, pp. 147–57. London: Intermediate Technology Publications.

ROSENTHAL, JONATHAN. 1996. Equitable sharing of biodiversity benefits: Agreements on genetic resources. Paper presented at the International Conference on Incentive Measures for the Conservation and the Sustainable Use of Biological Diversity, Cairns, Australia, March 25–28.

RUS, JAN. 1994. "The 'Comunidad Revolucionaria Institucional': The subversion of native government in Highland Chiapas, 1936–1968," in *Everyday forms of state formation: Revolution and the negotiation of rule in modern Mexico*. Edited by Gilbert M. Joseph and Daniel Nugent, pp. 265–300. Durham: Duke University Press. [SIA]

RUTTAN, LORE M, AND MONIQUE BORGERHOFF MULDER. 1999. Are East African pastoralists truly conservationists? CURRENT ANTHROPOLOGY 40:621–52.

RUZ, MARIO HUMBERTO. 1992. "Los rostros de la resistencia: Los mayas ante el dominio español," in *Del katún al siglo: Tiempos de colonialismo y resistencia entre los Mayas*. Edited by M. del C. León, M. H. Ruz, and J. Alejos, pp. 89–162. Mexico City: Consejo Nacional de Cultura y las Artes.

SCHWARTZ, JANET LESLIE. 2001. Chamula Indians reveal hidden treasures. *TheNewsMexico.com*, August 3. [BB, EAB]

SCOONES, IAN, AND JOHN THOMPSON. 1994. "Knowledge, power, and agriculture: Towards a theoretical understanding," in *Beyond Farmer first: Rural people's knowledge, agricultural research, and extension practice*. Edited by I. Scoones and J. Thompson, pp. 16–32. London: Intermediate Technology Publications.

SCOTT, JAMES. 1990. *Domination and the arts of resistance: Hidden transcripts*. New Haven: Yale University Press. [VN]

SEMARNAP (SECRETARÍA DE MEDIO AMBIENTE, RECURSOS NATURALES Y PESCA). 1997. *Ley general del equilibrio ecológico y la protección al ambiente*. Mexico City. [BB, EAB]

SIMPSON, TONY, AND VANESSA JACKSON. 1998. Protección efectiva para el conocimiento cultural indígena: Un desafío para el próximo milenio. *Asuntos Indígenas* 3:44–56.

SMITH, NEIL. 1996. "The production of nature," in *Future-natural: Nature, science, culture*. Edited by G. Robertson, M. Mas, L. Tickner, J. Bird, B. Surtis, and T. Putnam, pp. 35–54. London and New York: Routledge.

STRATHERN, MARILYN. 1980. "No nature, no culture: The Hagen case," in *Nature, culture, and gender*. Edited by C. MacCormack and M. Strathern, pp. 174–222. Cambridge: Cambridge University Press.

TAMBIAH, STANLEY J. 1990. *Magic, science, and the scope of rationality*. Cambridge: Cambridge University Press.

TAUSSIG, MICHAEL T. 1993. *Mimesis and alterity: A particular history of the senses*. New York: Routledge. [VN]

TOLEDO, VICTOR MANUEL. 2000. *La paz en Chiapas: Ecología, luchas indígenas y modernidad alternativa*. Mexico City: Ediciones Quinto Sol.

TORTORIELLO, J., M. MECKES-FISCHER, M. L. VILLARREAL, E. A. BERLIN, AND B. BERLIN. 1995. Spasmolytic activity of medicinal plants used to treat gastrointestinal and respiratory diseases in the Highland of Chiapas. *Phytomedicine* 2 (1):57–66. [BB, EAB]

TRUJILLO, ROMEO JOSUÉ, AND LUÍS GARCÍA BARRIOS. n.d. Conocimiento indígena del efecto de plantas medicinales locales sobre las plagas de los Altos de Chiapas, México. MS. [BB, EAB]

VARELA, FRANCISCO J., EVAN THOMPSON, AND ELEANOR ROSCH. 1991. *The embodied mind: Cognitive science and human experience*. Cambridge, Mass., and London: MIT Press.

VARGAS CETINA, GABRIELA. 2001. Postcolonial sites and markets: Indigenous organizations in Chiapas, Mexico. *Tamara: The Journal of Critical Postmodern Organization Science*. In press. [SIA]

VOGT, EVON, Z. 1964. "The genetic model and Maya cultural development," in *Desarrollo cultural de los Mayas*. Edited by E. Z. Vogt and A. Ruz L., pp. 9–48. Mexico City: Universidad Nacional Autónoma de México.

———. 1969. *Zinacantan: A Maya community in the highlands of Chiapas*. Cambridge: Belknap Press of the Harvard University Press.

WASSERSTROM, ROBERT. 1983. *Class and society in Central Chiapas*. Berkeley: University of California Press. [SIA]

WATERS-BAYER, ANN. 1994. "The ethics of documenting rural people's knowledge: Investigating milk marketing among Fulani women in Nigeria," in *Beyond Farmer first: Rural people's knowledge, agricultural research, and extension practice*. Edited by I. Scoones and J. Thompson, pp 144–50. London: Intermediate Technology Publications.

WEBSTER, ANDREW. 1991. *Science, technology, and society: New directions*. New Brunswick: Rutgers University Press. [SIA]

WEIMANN, CLAUDIA. 2000. Ethnobotanik der Nahua der Sierra de Zongolica, Veracruz, Mexiko und phytochemisch-biologische Untersuchungen von *Baccharis conferta* Kunth (Asteraceae). Ph.D. diss., University of Freiburg, Freiburg, Germany. [CW]

WHELAN, ROBERT J. 1999. *Wild in the woods: The myth of the noble eco-savage*. Institute of Economic Affairs Studies on the Environment 14.

XILON KOMES, FRANCISCO. 1991. "K'usi li jkuxlejaltike? [What is our life?]," in *Conservación de la naturaleza/ Xk'uxubinel banamil vinajel: Primer Concurso Literario Indígena*, pp. 23–26. Tuxtla Gutiérrez: Gobierno del Estado/Instituto Chiapaneco de Cultura.

XIMENES KUTERES, PEKRO. 1991. "K'ux elan tztuk'ulan li sbanamilik ta vo'oneje (How they used to conserve the land)," in *Conservación de la naturaleza:/Xk'uxubinel banamil vinajel: Primer Concurso Literario Indígena*, pp. 30–33. Tuxtla Gutiérrez: Gobierno del Estado/Instituto Chiapaneco de Cultura.