People Managing Forests

The Links between Human Well-Being and Sustainability

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INTRODUCTION

History and Conceptual Framework

Carol J. Pierce Colfer and Yvonne Byron,
with Ravi Prabhu and Eva Wollenberg

Confusion and dismay are rampant among those concerned about human and environmental issues in the tropics, and with good reason. Forests are being degraded at apparently ever-increasing rates, and human welfare in forested areas is remaining at a constant level at best, more often deteriorating. Many people—researchers, environmentalists, and policymakers of various hues—are trying to address these problems. This book represents the evolution of one cooperative effort to understand and develop mechanisms for dealing with these interrelated problems, and the authors propose some suggestions for improving our future efforts.

In our research, we have asked ourselves one fundamental question: how can we create conditions that allow local people who live in and around forests to maintain the valued aspects of their own way of life and to prosper while still protecting those forests on which they, and perhaps the rest of us, depend? To answer that question, we needed first to identify the conditions that contribute to sustainable forest management (SFM) in general and to the well-being of forest-dwelling people in particular. Satisfied that we had a good grasp of the most important conditions (see later), we set out to examine their relationship to sustainability. This examination is the central theme of this book. Central issues of concern include the identification and roles of relevant stakeholders (including gender and diversity, discussed in Section 1, and the relevance of a "conservation ethic," discussed in Section 2), security of intergenerational access to forest resources (Section 3), and rights and responsibilities to manage forests cooperatively and equitably (Section 4).

We began this exploration looking at criteria and indicators (C&I) for SFM. The primary purpose of C&I is as a tool to assess the sustainability of particular systems quickly, easily, and reliably. Initially conceived as tools for use by external evaluators, the C&I concept has evolved. Some individuals and projects are now using modified C&I in cooperation with local communities as monitoring instruments to make management more adaptive (see Concluding Remarks).

The C&I approach is built on a hierarchical framework in which principles, criteria, indicators, and verifiers are identified, each level more concrete than the previous (see Prabhu and others 1996; Lammerts van Bueren and Blom 1997).

From the beginning, we were convinced that human well-being (HWB) played a part in SFM and were anxious to clarify the links between these concepts. Through a complex global process (described later), we identified relevant C&I and then set out to test the causal links between HWB and SFM, using those C&I.

We started with a series of assumptions, one of which we have since concluded was not an assumption at all but a testable hypothesis:[1] "that human systems are complex adaptive systems, intimately connected with each other and with biological systems, in a self-organizing process of coadaptation" (Colfer and others 1995). In retrospect and technically, we should have identified the null hypothesis, that human systems are *not* said "complex adaptive systems...." Such a null hypothesis suggests that simple cause-and-effect relationships can in fact be found, that clear and consistent links exist between, for instance, HWB and SFM.

Links were indeed what we were initially seeking. Building on the best science we could bring to bear, within the state-of-the-art C&I framework, we sought evidence of such links. We applied the C&I framework to define and refine concepts and to test specific links in several locations, drawing on the long-term experience of various researchers. However, the results, though rich in insights, provided little conclusive evidence of such links. Concepts such as gender and other kinds of diversity, views about nature, secure access to resources, equitable sharing of benefits, and participation were found to be important everywhere, but in different ways in different places. Marshalling clear evidence to link these issues to SFM in the direct way demanded by reductionist science proved impossible.

Ultimately, after giving it our best effort, we concluded that we must reject the null hypothesis. We cannot thereby prove our hypothesis that human systems are in fact the complex and adaptive systems we think they are. But our findings certainly tend to support that view. Our findings have serious implications for our usual research methods. If we are indeed dealing with complex, interrelated, and adaptive systems, new research paradigms, approaches, and methods are vitally needed. We suggest a few ways of approaching this issue in our concluding chapters.

This introduction is composed of three major parts. The first part is a chronological treatment of the six years of research on which this book is based, divided in a way that reflects the evolving, iterative nature of our research approach. We describe the series of field tests used to evaluate C&I for SFM; lay out the conceptual framework with which we began this research by providing definitions of terms, assumptions, and three conceptual issues relating to our scientific "worldview"; discuss the social principles that were identified in the multinational field tests of C&I (the results of previous tests); and introduce the themes and hypotheses (that resulted from the C&I research) that are the focus of this book. These ideas discussed in this chapter were our foundation when we began the C&I tests in 1995.

In the second part, we describe the relevant tools and approaches used in the analyses. The methods, tested in the social science methods tests undertaken between 1996 and 1998, inform much of the research reported here. In most cases, these methods are supplemented by longer-term, more qualitative methods.

In the final part of this chapter, we examine our findings, our methodological shortcomings, and draw some conclusions about the nature of scientific inquiry that focuses on dynamic and interdependent systems.

History and Context for This Research

The Past

In 1994, the Center for International Forestry Research (CIFOR) in Bogor, Indonesia, initiated a project to assess existing sets of C&I for SFM for timber in several locations—initially, in Germany, Indonesia, Côte d'Ivoire, and Brazil.[2] For this work, we considered principles as abstract, "motherhood" statements; criteria as desirable conditions, somewhat more specific; indicators as ideally measurable, observable, and directly linked to the criteria under which they fall; and verifiers—the subject of some controversy in the literature—to be similar but even more specific than indicators (they can be threshold levels or means of verification). The term C&I refers to this conceptual framework that helped to guide much of the research reported here.

On the basis of the CIFOR team's experience in Germany, where no social scientists were included in the interdisciplinary test team, project leader Ravi Prabhu concluded that a conceptual framework was needed to deal with social issues. Colfer joined the group to develop a conceptual framework for dealing with social issues (Colfer and others 1995), to help future team members address social issues more systematically. We gave the conceptual framework to all CIFOR test teams, stressing their freedom to accept, adapt, or reject it in their evaluation of the sets of social C&I. In the

initial testing process, which eventually expanded to include Austria, Cameroon, the United States, and Gabon, the social scientist team members typically found the conceptual framework useful but still were dissatisfied with the assessment tools available to them. Although lingering doubts remained, a "generic template" of C&I gradually evolved (Prabhu and others 1996, 1998; see Annex 1 for the most recent version), primarily based on materials from humid tropical forests managed for timber. At the same time, parallel activities were under way that looked at C&I in forests managed by communities (coordinated by Nicolette Burford de Oliveira with Cynthia McDougall) (Burford de Oliveira 1997, 1999; Burford de Oliveira and others 1998, 2000; Ritchie and others 2000) and in plantations (coordinated by Christian Cossalter at CIFOR) (Muhtaman and others 2000; Sankar and others 2000).

By clearly demonstrating the importance of social issues in SFM, the first five field tests (in forests managed for timber) convinced us to mount a subsidiary effort focused specifically on the social C&I. In 1996, Wadley and Colfer tested eight social science methods in West Kalimantan as possible mechanisms to make quick and reliable assessments of HWB issues (see Chapters 5, 8, and 12; Colfer and others 1997c). After that experience, a selection of 12 methods was systematically tested by teams in Cameroon, Indonesia, and Brazil in 1997 and 1998; in most cases, teams were led by social scientists.[3] Based on the results of these tests, the methods were revised again and then published (Colfer and others 1999a, 1999b, 1999c; Salim and others 1999). The major themes stressed in the first four sections of this book were selected based on the results of these various C&I tests.

The testing of these methods, however, was only half of the task we had set ourselves. We also wanted to gain a better understanding of the causal relationships between HWB and sustainability. In the unanimous judgement of our interdisciplinary and multicultural test teams, HWB was an important concern in SFM. Yet the links remained clouded; some evidence seemed contradictory.

At that stage, we hoped that by more carefully examining the research results from our methods tests across sites—particularly in comparison with long-term, qualitative studies in the area and with forest quality—we might be able to shed some light on the relationships between HWB and SFM. Authors compared methodological test results with their long-term knowledge of study sites to draw conclusions about these issues. As part of our initial approach (which reflected some reductionist influences that have in fact strengthened the clarity with which we can reject the null hypothesis, discussed earlier), we also placed study sites on a loose continuum from "forest rich" to "forest poor"; we indicate the forest quality, using this rough guideline, for each research site (see Annex 2).

The chapters in this book reflect a range of studies that have come out of this research effort, plus a few others that offer related insights. Figure 1 is a

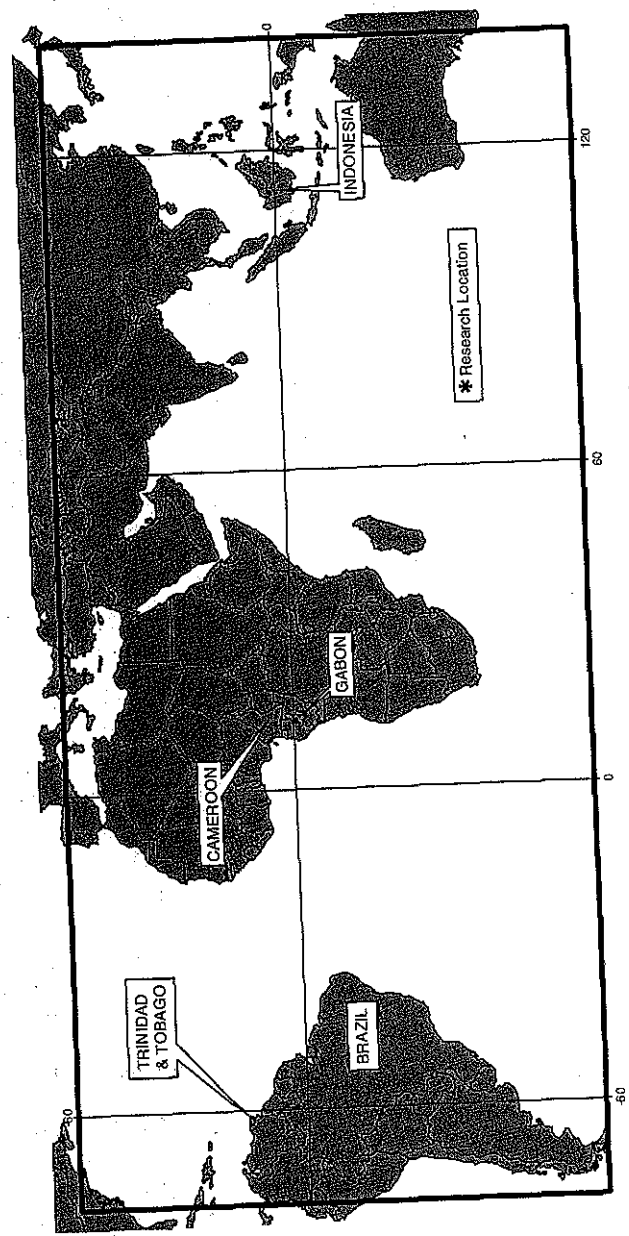

Figure 1. *Map of the World Showing the Research Locations Covered in This Book*

world map on which we have indicated all the research locations covered in this book.

Conceptual Framework

In this section, we define our key concepts and assumptions and discuss some of the issues that have recurred in our work. The discussion draws heavily on the conceptual framework with which we began much of the research reported in this book.[4]

One of the problems in coping adequately with human issues in sustainability has been the lack of a shared vocabulary and a common conceptual framework. Gale and Cordray (1994), for instance, identify nine different views on what should be sustained. The concept of sustainability itself is inherently value-laden (see Chapter 15). The following sustainability criteria reflect our values as professionals concerned with sound resource management practices and our assessment of values that are widely held among other stakeholders. We describe our shared vocabulary and put forth our perceptions of what needs to be addressed most fundamentally—always striving for a minimalist approach.

Definitions. *Sustainability.* With only slight alteration, we can use the definition of sustainable development accepted at the 1992 Earth Summit in Rio de Janeiro, Brazil, for SFM: "Sustainable forest management aims to meet the needs of the present without compromising the ability of future generations to meet their own needs." We followed Prabhu (1995) in considering that the satisfaction of two conditions would be sufficient to indicate sustainability in the context of forest ecosystem management: Ecosystem integrity is ensured or maintained, and people's well-being is maintained or enhanced. In these definitions, we need to specify what is meant by *well-being* and *needs* as well as who the relevant *people* are.

Well-Being or Needs. The fundamental needs that we considered contribute to people's well-being, now and in the foreseeable future, are the following:[5]

- *Security and sufficiency of access to resources now and in the future.* Ultimately, all human life depends on this element; therefore, it plays a crucial role in human–forest interactions.
- *Economic opportunity.* Forest activities should maintain or enhance people's livelihood opportunities.
- *Decisionmaking opportunity.* People have a right to participate meaningfully in decisions affecting their lives.
- *Heritage and identity.* People's rights to their values, behavior, networks, land use, and material goods should be respected, both for the present and as a necessary context for the enculturation of the young.

- *Justice.* Conflict and distribution of benefits, rights, responsibilities, and incentives should be resolved fairly (recognizing varying interpretations of "fair").[6]
- *Health and safety.* Employment in, residence in, or use of a forest should not endanger people's safety or health (physical or mental).

Although this list was compiled with forest-dwelling people in mind, we believe that they do not have very different needs from those of other human beings.

People. We recognize the ultimate interdependence of all people in our assumptions (see the next section): A forest dweller may be dependent on the forest for his daily fare; a settler in a nearby village may need forest-dependent environmental services; a consumer in the nation's capital may suffer if wood prices rise due to deforestation; a farmer in a distant country may depend on the forest for the rains that water her crops or for a stable climate.

For the purposes of effective forest management, the population of people who must be directly considered in daily management needs to be limited in some way. Formal forest managers, for instance, are not omnipotent and cannot be given the responsibility for ensuring the well-being of all humanity, nor can local community managers typically enforce their version of management on outsiders. Even within the forests they manage, these stakeholders are unlikely to be able to affect all the important variables that determine the sustainability of forest management.

It is therefore important first to define who has some interest or rights in forest management, that is, who has a "stake" in the forest (see Chapters 1–6). The most common word used in the SFM literature to designate these people (though inconsistent with the dictionary definition) is "stakeholder." Behan's (1988) discussion of a forest's "constituency" is also quite similar, defined as "the people who know about and care about" that forest.

Once the stakeholders have been defined, it is necessary to ascertain the varying rights and responsibilities among them. Recognition that forest dwellers have been disadvantaged in interactions with outsiders who come ostensibly to manage local forests has been widespread and increasing.[7] Reasons for resolving this human problem, in pursuit of SFM, are both ethical and pragmatic. Ethically, the "well-being" of these people, according to the earlier definition, has in many cases been adversely affected. Pragmatically, when people's well-being is thus affected, potential for conflict, forest and landscape degradation, marginalization, and cultural disintegration is increased. Ultimately, in the worst-case scenario, if *forest actors*—people who have resided in and managed an area for long periods of time and have pre-existing claims and responsibilities in that area, both for themselves and for their descendants—feel their situations are unacceptable, no forest may be left for any would-be claimants.

To identify these forest actors, we developed a simple technique for differentiating among stakeholders (Colfer and others 1999c). First, stakeholders are identified; then, the central forest actors are differentiated by their "scores" on seven dimensions: proximity, preexisting rights, dependency, poverty, indigenous knowledge, the integration of their culture with the forest, and power deficit vis-à-vis other stakeholders.

This method is a convenient mechanism for defining which stakeholders have the most pressing rights (with corresponding responsibilities) and thus constitute a sort of bottom line for stakeholder satisfaction; however, it is not a carte blanche for ignoring the rest. Sustainable forestry will ultimately, and probably inevitably, involve continuing negotiation and conflict management among stakeholders. Some progress is being made toward accomplishing this task in a constructive manner (see Resolve 1994, for examples from Ecuador, Bolivia, and Brazil; Ramirez 1999; Engel and others in press) (see also Concluding Remarks); however, much remains to be done. Some of the most difficult issues revolve around the extreme differences in power among stakeholders (for one perspective on this, with a summary of other views, see Edmunds and Wollenberg 1999; Wollenberg and others in press). One issue not adequately foreseen at this early stage of our research was the importance of intragroup differences, which are highlighted in Sections 1 and 2.

Fundamental Assumptions. Given the complexity of interactions between people and the forest, we acknowledge the probability that numerous unrecognized assumptions will need clarification as research continues. However, outlining two basic assumptions seems useful at this stage:

- *The landscape, where we are evaluating sustainability, is intended to remain largely natural forest in the foreseeable future.* The *natural forest* as discussed here can include logged forest as well as areas in various stages of regrowth (from spontaneous, natural, or planned human causes), or small areas that have been cleared. This assumption derives from a global perception that protecting some forested areas is in the best interests of humans. If, in particular areas, people do not want to protect the forest—as long as the global perception is that forests need protection—we must devise mechanisms whereby sufficient forest benefits accrue to those who live there. Trying to force forest protection has generally been shown to be ineffective (and/or prohibitively expensive). The principles and criteria presented later (see *The Generic C&I Template*) reflect our view that forest protection must also be perceived by local people to be in their best interests.
- *Sustainable natural forest management locally will contribute to sustainable natural forest management nationally and regionally.* Nations and regions are made up of smaller parts that, by definition, include local forests. Although sustainable, local natural forest management is possible without national and regional SFM, the reverse is generally impossible (Lele 1993).

As noted in the opening paragraphs, we initially considered human systems to be complex adaptive systems, intimately connected with each other and with biological systems, in a self-organizing process of coadaptation. We drew this conclusion from the huge body of anthropological literature that showed the changing and interdependent nature of human systems. A cornerstone of cultural anthropology is the holistic nature of culture, and adaptation has been key to human ecological theories.

We decided to re-examine the idea that human systems are complex and adaptive as a hypothesis to be tested, in light of such features as networks of interconnected nodes, self-organization and emergence, self-organized criticality, dynamism between order and chaos, increasing returns, prediction, and feedback (see Waldrop 1992 for a readable exposition of complexity theory). We have explicitly rejected, from the beginning, the ideas that culture change is problematic and that cultural stability is not. Stability and change are aspects of cultural systems that vary in space and time. We have sought to better understand how such changes occur and how they are linked.

Conceptual Issues. Two conceptual issues colored our initial thoughts on principles and criteria for SFM: the nature of the interactions between people and forests, and the role of diversity of human systems in the sustainability of human life on the planet. Although these issues do not form the organizational framework for this book, we continue to consider them important issues related to people and forest management.

Role of People in Relation to the Forest. Most fundamentally, we viewed local people as part of the forest, in recognition of humanity's biological basis and their place in forest ecosystems. People—particularly those we have defined as forest actors—have a relationship of mutual dependence with the forest; they both contribute to and benefit from the forest. In this sense, forest actors constitute a resource, such as biophysical forest resources, available for the benefit of people (themselves and others) and of forests. This interaction between people and their environment means that people living in the forest both depend on it and act on it (Vayda and others 1980; Vayda 1983). Over the past decade, the documentation of long-standing, two-way interaction between human systems and forest ecosystems has been increasing.[8]

Debates about the nature of the human–forest relationship are ongoing. The role of poverty and wealth in affecting people's relationships to the forest is one example. That poor people sometimes constitute a threat to SFM is widely believed, and may be true [though Banuri and Marglin (1993) and Dove (1993) skillfully argue to the contrary]. The degree to which the poor can contribute to SFM has only recently begun to be widely acknowledged (Clay 1988; Posey 1992; Savyasaachi 1993; Colfer and others 1997a), though evidence for this has been around for much longer (for example, Conklin 1957).

One such potential contribution is knowledge. Banuri and Marglin (1993) argue that many indigenous systems of knowledge are available to us

based on indigenous people's experience living with and learning from the environment. Those systems, if recognized and allowed to flourish, would have potentially more benign, nurturing implications for the ecosystem than the dominant system of scientific knowledge does. We suspect that a synthesis of kinds of knowledge—indigenous and otherwise—is more likely needed. But whichever view is true, a growing body of evidence suggests that attention to the voices and perceptions of forest actors may be in both humanity's and the forests' best interests.

Maintenance of Cultural Diversity. Cultures and ecosystems represent storehouses of both complex systems not yet fully understood and creative potential that we have argued should be maintained and nurtured. The destruction, or homogenization, of these diverse systems may seriously reduce the human capacity for sustaining itself.

Diversity in itself is of value for reducing risk, expanding the breadth of human potential, and increasing human knowledge and understanding. But human cultural diversity also represents differing solutions to survival in differing contexts (WRI/IUCN/UNEP 1992; Colfer 2000b); it serves as a dynamic global heritage from which future as well as current generations can benefit. Just as we do not now know which plant species may contain the properties needed to overcome an existing or future disease, neither do we know what human cultural characteristics (knowledge, values, social organization) may be needed in the future to sustain the human species. Enhancing the capability of various cultures to flourish, changing in directions selected and monitored by their adherents, constitutes a kind of "insurance policy" for the human species (as Barbier and others 1994 suggest with regard to biodiversity; see also Smith 1994). The availability of multiple cultures on Earth means that the failure or loss of any one is less likely to threaten the viability of the species.

The Generic C&I Template

This section is an outline of the kinds of social issues considered important for SFM by the CIFOR test teams that have visited forests in numerous countries over the past six years. The C&I that came out of the tests discussed in the previous section (*The Past*) formed an initial element of the research reported here. Because of their central role, we comment at some length on the meanings of the social principles and criteria listed in the *CIFOR Generic C&I Template* (Annex 1).

These hierarchically organized concepts are widely used in the literature on SFM, certification, and ecolabeling of timber (ITTO 1992b; Rainforest Alliance 1993; FSC 1994a; Heuveldop 1994; Soil Association 1994). We have followed the *Oxford Dictionary of Current English* (1987) and defined a *principle* as "a fundamental truth or law as the basis of reasoning or action." Principles, then, are stated as imperatives. We also use the dictionary definition of *criterion:* "a principle or standard that a thing is judged by." The FAO (1995a) defines *criterion* with a focus on forest management, consistent with our usage: "identified elements of sustainability against which forest management can be assessed." *Criteria* are phrased as conditions that must be met for a forest to be judged as "sustainably managed."

Three Principles and Nine Criteria. We identified three social principles as fundamental to SFM:[9]

- *Principle 3:* Forest management maintains or enhances fair intergenerational access to resources and economic benefits.
- *Principle 4:* Concerned stakeholders have acknowledged rights and means to manage forests cooperatively and equitably.
- *Principle 5:* The health of forest actors, cultures, and the forest is acceptable to all stakeholders.

These principles recognize in *forest resources* the importance of the physical and economic basis of human life as well as the cognitive, normative, and symbolic elements. Social scientists have debated for decades the priority of one or the other of these two aspects of the human condition (Harris 1968 is a somewhat dated but comprehensive review of this literature from a "techno-environmental" perspective). The view here is that both "hard" and "soft" elements are important for HWB and thus for the sustainability of forests.

Additionally, the proposed principles, criteria, and indicators are built on the assumptions listed earlier and must be taken as a whole. The criteria are interdependent such that, for instance, forest actors' access to resources must be balanced by appropriate mechanisms for monitoring and control. Participation in forest management is likely to be a parody if forest actors do not have secure access to the resources in question.

Principle 3. This principle addresses the issue of maintenance and fair apportionment of goods and services among stakeholders. If adhered to, it guarantees forest actors' security and sufficiency of access to resources over time; enhances their access to health, safety, cultural integrity, and other elements of HWB; and provides a power base for dealing with other stakeholders. Our site visits (and the literature) provide ample evidence that many forest actors—people with the greatest opportunity and potential to degrade and/or sustainably manage the forest—have not been fairly treated with regard to access to forest resources.

Other stakeholders also have legitimate claims that must be negotiated. This principle recognizes the claims of other stakeholders—such as government, private industry, and environmentalists—to resource access that they consider fair as well. The existence of multiple stakeholders with legitimate and varying claims obviously implies a process of communication, negotiation, and conflict resolution for forests to be sustainably managed (our Principle 4 addresses this issue).

Principle 3 (and its related C&I) is based on two pragmatic suppositions: that people are more likely to manifest stewardship toward forests from which they derive benefit, and that people tend to be more willing to sacrifice immediate gain from activities that may result in forest degradation when they are certain their children will benefit (see Palmer 1993 on Maine fisherfolk). The research reported in Section 3 was intended to test aspects of the causal links implied here.

An ethical consideration, based on justice, reinforces the importance of this principle. Although the claims of forest actors are not absolute,[10] justice demands that they should have some priority over the claims of other stakeholders.

In this discussion, we avoid specifying any particular kind of tenure system[11] because various systems could fulfil the central requirement of this principle (that people feel secure and comfortable that they and their children can continue to use the resources that have been available to them and in which they have a personal investment). We explicitly make no assumption that the claims of the state necessarily supersede those of local communities. Instead, we argue that conflicting claims will have to be clarified by a process of negotiation and conflict resolution.

The concern with economic benefits deriving from forest use evolves from our perception that inadequacy of resources can force people to degrade forest resources. Perceptions of unfair distribution of benefits can stimulate purposeful, retaliatory degradation of forest resources as well as other undesirable conflict. From a more positive perspective, people who have adequate access to resources are likely to be able to fulfil their other needs in accordance with their wishes, thus enhancing their well-being in terms of health, education, and other desired goods and services. Again, an ethical element pertains to justice among stakeholders.

Principle 4. This principle supports the rights of those concerned about and making use of the forest to be actively involved in forest management (see Behan 1988). It is important for several reasons. In many areas, forest actors particularly have had few opportunities to be heard or to integrate their views into formal forest management. Having a legitimized voice provides them with a mechanism for

- enunciating traditional rights and responsibilities and existing systems of forest management;
- protecting the rights identified;
- gaining access to a share in the benefits of forest exploitation;
- integrating their own knowledge, experience, and preferences into overall forest management, thus reducing marginalization (van Haaften 1995); and
- protecting their children's futures by all these means.

Such acknowledged rights also are important for other stakeholders. In the United States, for instance, environmentalists from New York City on

the East Coast may have strong opinions and attachment to the Olympic National Forest in the northwestern state of Washington, thousands of kilometers away; similarly, Jakarta-based environmentalists have strong views on forest management in distant Borneo. The respective forestry agencies obviously have pertinent input regarding forest management. National citizens may have legitimate concerns about how their taxes are being spent and how forest revenues are being collected. Without the acknowledgement of such varying rights, no widely applicable mechanism exists by which the legitimate forest uses of various stakeholders can be integrated into SFM.

The importance of cultural systems for people's well-being, combined with the nearly infinite diversity of such systems in time and space, makes cooperation a crucial part of SFM. To be able to address stakeholders' concerns, many kinds of forest managers must know each other's concerns. The absence of such feedback to formal forest managers has been most obvious in the case of forest actors. Without the active participation[12] of forest actors in forest management, no viable mechanism has been identified for communicating the relevant aspects of their cultures to other stakeholders (and, to a lesser extent, vice versa).

One of the most important functions of participation is in providing a means for forest-based people to control the speed and direction of changes in their lifestyles. Supporting their rights in forest management can help people protect their existing ways of life (by enhancing cultural diversity and protecting cultural and natural resource integrity), insofar as they want to, and alter these lifestyles in ways they consider desirable (see Oksa 1993). Real participation also can reduce such adverse psychological consequences as stress, marginalization, and related physical health problems (van Haaften 1995). Active stakeholder participation in forest management provides a mechanism for dealing with cultural diversity and with the continually changing interface between people and forests.

The call for active efforts to understand and assimilate differing models in the management of a particular forest is built on the increasing recognition that forest actors often have natural resource management systems that are—or have been—viable. The sense that conventional science can learn from indigenous systems is growing. Proactive attempts to integrate indigenous systems with more conventional management models also may be helpful in minimizing conflicts and lead to better overall management.

The other side of this coin pertains to the well-being of forest actors. Insofar as forests are managed cooperatively with other stakeholders, meshing management systems in mutually beneficial ways, the activities of stakeholders who are not forest dwellers will be less disruptive to forest actors and their existing systems.

Without the support of stakeholders, efforts to control access to resources are unlikely to succeed. Forestry officials in charge of forest protection may not support existing mechanisms for controlling access (for example, by allo-

cating forest concessions based on cronyism or failing to enforce forestry regulations). Forest actors may continue to harvest forbidden species or harvest in protected areas, feeling that their own rights have been usurped. SFM requires that these kinds of problems be resolved in such a way that stakeholders support existing mechanisms for control or help develop new, more viable ones.

Principle 5. We have not examined this principle in a systematic way (beyond its initial selection as a principle) simply because of lack of personnel and funding. But we do argue that maintaining the flow of benefits from resources requires that forest health be maintained. We see a strong interdependence among the well-being of forest actors, their cultures, and the forest. Because people depend on the forest, the forest's health is important to them at some level. The health of the forest, in turn, depends on HWB, because poor and unhealthy human beings (or too many human beings) may need to ravage the forest to survive.

Similarly, human culture affects human action, which can enhance or degrade forest health via such mechanisms as sustainable management systems or useful indigenous knowledge on one hand, or exploitative attitudes and practices on the other. Forest actors, who by definition have a strong forest–culture link, long-term rights in the area, and considerable knowledge of and dependence on the forest, are likely to have important elements in their forest management systems that sustain those systems.[13] But changing circumstances (such as access to markets, opportunities for medical care and education, desire for consumer goods, in-migration, gender roles, and technology) can have dramatic effects on cultures. For this reason, the degree to which and the conditions under which forest actors practice SFM merit additional investigation.

Cultures also affect HWB in other ways;[14] thus, "cultural health" needs monitoring in its own right. Culture, as a dynamic mode of adaptation, provides human beings with (malleable) patterns for communication, subsistence, division of labor, inheritance patterns, enculturation of the young, old age security, and values—all critical to HWB. Indeed, even the meaning of *health of people and forests* is defined culturally. In contributing to HWB, these functions contribute to SFM.[15]

Hypotheses or Themes

In this section, we document the evolution of our research process, which did not follow the same order as the chapters of this book. As noted earlier, we began the research reported here with the idea of tracing the causal links between the relevant C&I and SFM in a somewhat reductionist fashion. Indeed, our initial idea was to test how Principle 3 (Section 3 of this book) and Principle 4 (Section 4 of this book) related to SFM. We used techniques determined during our methods tests to reflect aspects of these principles and

then compared the results of those studies across sites. Using long-term, in-depth knowledge of their areas, researchers evaluated the appropriateness of the results obtained from CIFOR's quick assessment methods, which were used in the comparisons. The analyses that most faithfully adhere to this plan are reported in Chapters 11 and 14; we compared results across several sites and tested for differences related to the two principles according to forest quality (the proxy for SFM). The nature of our results supports our view that new and different research strategies are required to reflect the reality of complex, adaptive systems.

We also were interested in testing the importance of two other issues: gender and diversity, and a conservation ethic. Gender and diversity issues (Section 1 of this book) emerged both in the identification of relevant forest actors (or stakeholders) and within the context of all three social principles (Principles 3–5; see Annex 1). In the course of our methods tests, we determined that access to women was both important and difficult in the attempt to assess HWB (see Colfer and others 1997c). Their significance for HWB—by numbers alone, if nothing else!—is obvious. Similar problems were identified with other marginalized groups. We also were convinced of the importance of such people as actors, with existing roles, and their potential contributions in improving both forest management and HWB. Even though Chapter 1 expands on the difficulties of gaining access to marginalized groups, including gender-based groups, Chapters 2 and 3 were initially focused on access to resources. The shift in emphasis reflects the dynamic and systemic nature of the issues we examined as well as the improbability of establishing simple, direct, cross-cultural causal links.

The question of a conservation ethic (Section 2 of this book) has been widely discussed in the West, and environmentalists in particular are interested in its role in SFM. Parties to the debate from various disciplines disagree not only about the degree to which forest dwellers may or may not have a conservation ethic but also about the role of a conservation ethic in enhancing SFM. Our research was designed primarily to test whether a conservation ethic could be identified and to what degree it was correlated with SFM, again using current forest quality as the proxy. As with our other efforts to make systematic comparisons across sites differentiated by forest quality, the results were interesting but not conclusive.

Section 5 of this book covers two more general issues. First, in Chapter 15, we compare SFM in the developed world with the developing-world contexts that dominate this book. Besides providing another view of sustainability, we list the potential differences between developed and developing countries and highlight the ways that context can alter the potential measures of HWB.

The second issue, discussed in Chapter 16, more carefully pertains to our proxy for sustainability. Recognizing that using *forest rich* as a proxy for sustainably managed forests was "iffy," we studied differing management systems

in one comparatively forest-rich environment over time, using geographical information systems (GIS) and remote-sensing tools. This approach, although labor intensive, provides a good sense of biophysical sustainability within different human systems in the same area.

Tools and Approaches

Some of our methodological tools were used in several sites (and thus in several chapters). Here we provide an overview of the seven most common methods.

Galileo and CATPAC[16]

The Galileo program (Terra Research and Computing), used in Chapters 5 and 6, is a multidimensional scaling method. (See the introduction to Section 2 for a discussion of our rationale for using this method.) We conducted conventional Galileo studies[17] (Woelfel and Fink 1980) as a possible means to assess three conditions identified in previous research as relevant in establishing people's roles in SFM: the presence or absence of a conservation ethic, a feeling of closeness to the forest, and an intimate link between local culture and the forest.

The Galileo study begins with the identification of locally appropriate concepts pertaining to the domain of study (in this case, forest–people interactions). This method makes no assumptions about congruence between the researchers' and local people's definitions of these concepts. Such locally relevant concepts can be determined through experience or obtained in an unfamiliar area by content analysis of open-ended interviews on the topic of interest.[18] These concepts are then paired in a questionnaire format in the local language.

A *criterion pair* (often the distance between "black" and "white," as seen in the respondents' own minds) is selected as a measuring stick for comparing each of the pairs of study concepts. Literate villagers can fill in the forms themselves; others are interviewed and asked each measurement. The process typically takes about 20–30 minutes for 20 concepts. Data were entered into the Galileo program and analyzed in Bogor, Indonesia, with assistance from Joseph Woelfel (the principal developer of the software) (Woelfel and Fink 1980; Foldy and Woelfel 1990) and Agus Salim.

The most fundamental output of a Galileo is a *means matrix,* in which the mean response (from all the respondents) is computed for every pair of concepts. Put another way, the means matrix reflects the mean distances perceived by the community in question between every concept and every other concept. The program provides extensive descriptive and inferential statistics, including standard deviations; standard errors; indices of skewness

and kurtosis; sample size; maximum and minimum values; and other, more global statistics. We have been satisfied with fairly simple analyses.

The results of this procedure made it possible to represent the respondents' attitudes and beliefs in a three-dimensional graph or space. This space provides a precise and holistic picture of the respondents' beliefs and attitudes about forests. Locally defined concepts that are closely related are close together in this space, whereas those that are unrelated are far apart. If people think the forest is good, for example, the concept **forest** will lie close to **good** in the Galileo space.[19] One advantage of this model is that dozens or even hundreds of attitudes and beliefs can be displayed simultaneously in a single picture, which makes it possible to see the interrelationships among the beliefs and attitudes. Seeing the "big picture" is important because changing one attitude or belief often changes others. If forest managers are aware of such indirect consequences of change, then their methods of forest management (as it relates to human involvement in the forest) may become more sensitive.

In recent years, Terra Research and Computing has been developing several relevant new programs built on the idea of neural networks (for example, CATPAC and Oresme; see Chapter 2). They represent a kind of artificial intelligence that may allow us to obtain some of the same information we can generate with the Galileo program more simply. CATPAC can analyze text—in much the same way that open-ended interviews could be analyzed—to identify frequencies and clustering of concepts that recur within that text. The important difference is that CATPAC can do it much more quickly. These programs all can be run on an ordinary PC or laptop computer.

In our use of CATPAC, we asked representative individuals about their views on human–forest interactions, trying not to say anything after the initial, very broad question was asked. We taped their responses and then typed them into the computer. The CATPAC program analyzed the content of the responses in seconds. The results are clusters of concepts that tend to occur together in the respondents' speech, reflecting the cognitive patterns of the interviewees. We tried to interview about ten individuals from any given group to be able to make an accurate statement about their views.

The final component of this group of software—the Automatic Strategy Generator (ASG) and its predecessor, the Automatic Message Generator (AMG)—is of a more general interest to researchers, beyond assessment per se. They identify which concepts should be emphasized in an effort such as planned change (for example, encouraging a conservation ethic, or encouraging people to consider forests in a more positive light). These concepts can then be used in extension or "advertising" to affect people's views of the forest. Insofar as the interviewees' views reflect their behavior (Woelfel and Danes 1980; Cary and Holmes 1982; Woelfel and others 1988a, 1988b; Barnett and Woelfel 1998), such changes could have important impacts on forests.

Biplot Analysis

Biplot analysis (Gabriel 1971; Jolliffe 1986) has been used to compare quantitative results across sites (see Chapters 11 and 14). In this kind of analysis, each variable (such as "benefits being shared" or "rights to manage") is represented by an arrow, whereas each point represents a stakeholder. The length of an arrow indicates the amount of variation within that variable. If, in an example pertaining to "rights and means to manage forests," the arrow for "defining borders" is very long compared with the others, then imbalance among the stakeholders is greater for this right. A short arrow implies that the right is fairly equally shared. Inequalities in sharing of rights can thus be determined quickly from this type of graph.

The position of a point shows the level of rights or benefits (depending on the study) for a particular stakeholder, compared with others. If the point lies in the same direction as the arrow, then the stakeholder has more rights or benefits than the average; if the point is in the direction opposite the arrow, then the stakeholder has fewer rights or benefits than average.

The relationship between two variables (say, "defining boundaries" and "assessing fines") can be determined from the angle formed by the two arrows. If the angle is less than 90° (an acute angle), then the two variables are positively correlated. In this hypothetical example, a greater right to define boundaries would also imply a greater right to assess fines. If the angle is greater than 90°, then the two variables are negatively correlated, that is, a group with greater rights to define boundaries would have fewer rights to assess fines.

Gender and Diversity Analysis

Although our emphasis in this book has been on gender (Section 1), many of the same methods that are used to understand gender apply to diversity (ethnicity, class, caste, economic level, and so forth). Chapter 1 provides the most comprehensive discussion of these methods, but we have made extensive use of several tools, which include

- *participant observation,* a long-term, qualitative, anthropological method that involves setting aside personal assumptions, insofar as possible, and using one's self as a methodological tool to understand the workings of local human systems;
- *rapid rural appraisal techniques,* which are quick methods that typically involve female (in the gender case) team members, attention to both genders in data collection, and assessments of contexts in which both genders function (some of these techniques are described in more detail later); and
- *process methods,* the use of focus groups and other interactive methods designed to draw out community members that would not otherwise be

heard (for example, structuring separate meetings so that marginalized groups have a chance to express their views, helping the illiterate or those with poor national language skills to contribute in creative ways, and holding separate meetings for men and women).

Pebble-Sorting Methods

Sharing of Benefits. The pebble-sorting methods proved to be among the simplest to compare across sites (see Chapter 11). For the studies focused on sharing of benefits, stakeholders and benefits were initially identified by Colfer for Bornean sites (based on long-term ethnographic research experience there) and then adapted by the other researchers for their own sites. An attempt was made to keep the categories as comparable as possible, without misrepresenting local stakeholders or benefits. We selected a sample of 12–15 participants from each of the most important stakeholder groups in each area, trying to represent men and women relatively equally, and to attend to other locally important social differences (for example, age and ethnicity). We conducted the method with individuals and with fairly homogeneous groups, collecting relevant demographic data (age, gender distribution, ethnicity, and occupation) for subsequent analysis.

Necessary materials were revised for local conditions (that is, with locally relevant stakeholders and forest resources, in local languages). We limited the number of stakeholder groups to as few as possible (three to ten), with each researcher determining the minimum number that would allow us to maintain the accuracy and integrity of our analyses. Some researchers used a large matrix, for group use; others used plates representing stakeholders or resources in which participants distributed pebbles or seeds. In the Brazilian tests, we used plates with drawings picturing situations related to each stakeholder. Although we had a preestablished set of benefits and stakeholders for each test, we did include additional plates for other stakeholders eventually suggested by individual interviewees. The researchers transferred the quantity of pebbles in the respective plates to the appropriate matrix cells.

Wherever possible, we used the local language in our interviews. The main benefits from the forest, including subsistence products, were listed. The relevant stakeholders or user groups among whom respondents perceived forest benefits to be divided were also identified. Each participant or group of participants allocated 100 pebbles among the stakeholders. We asked the participants to consider the forests in their area and indicate their perceptions of the division of the listed forest benefits.

Intergenerational Access to Resources. This method is very similar to the previous one in terms of sample selection and process (Chapters 7, 11, and 13). In most cases, we asked each participant or group of participants to

allocate 100 pebbles among the generations, with each row equaling 100, explaining to participants that we wanted to understand how local access to resources is changing over time and what they think about the future. We then asked respondents to imagine all the forest resources over time (from the time of one's grandparents through the present to the time of one's grandchildren) and to allocate those resources proportionally among the generations. (Specific adaptations needed for different countries are described in the chapter discussions.)

For a given group of 12–15 group or individual interviews, we computed a mean for each generation. We have been satisfied, based on longer-term familiarity with the areas, that these results provide a succinct and relatively accurate representation of that group's perceptions of changes in access to resources over time.

Rights to Manage Forests. This pebble-sorting method was designed to gain access to local stakeholders' perceptions about the division of management rights and responsibilities among significant stakeholders (Chapters 2, 13, and 14). We initially selected six management functions to reflect overall management:

- defining and protecting boundaries,
- developing and applying rules and regulations,
- monitoring compliance,
- resolving conflict,
- providing leadership or organization, and
- assessing fines and sanctions.

Again, we selected samples of 12–15 respondents from each important stakeholder, user group, or social category in each research locale. They included at least men and women; different ethnic groups; and different occupations. In Cameroon, it was important to differentiate by age as well. All groups selected had a clear relationship with forest management. We conducted interviews in fairly homogenous groups (5–15 people) and individually, collecting relevant demographic data about each respondent (age, sex, ethnic group, and so forth) for use in subsequent analysis.

We used 100 pebbles (or beans, buttons, corn kernels, or nuts, depending on local availability and preference) and a matrix with large enough cells so that people could allocate the pebbles along the rows of the matrix. The rows listed the functions of forest management (earlier), and the columns listed the most important stakeholders.[20] Smaller, paper copies of the matrices were used for recording the data.

We explained to each respondent or group that we were interested in understanding who they considered responsible for managing the forest in the area. We explained that the rows represent different rights and responsibilities in forest management and asked them to allocate the 100 pebbles

among the stakeholders listed across the top (once for each row). The results were then analyzed using cluster analysis.

The initial selection of forest management functions may have had a gender bias in some areas, relating predominantly to the male domain, which may in turn have affected the identification of relevant stakeholders. The Brazil team felt that, despite our efforts at gender equity, greater emphasis on management functions that include the participation of women would have added to the explanatory power of the method.

In areas characterized by commercial extraction of nontimber forest products (such as Brazil nut, *babassu*, and *açaí*), for instance, women participate in these activities, which could be explicitly incorporated into the method. Additionally, management functions linked to the domestic domain (or to the reproduction of the household) might usefully be included. In Pará, a specific example is related to protection of water sources (for drinking and for washing clothes and kitchen utensils). In the Transamazon forest-poor site (Transiriri), the conversion to pasture resulted in the local stream drying up, a matter of continuing complaint by local women. The same was not observed in the forest-rich area. The role of women in protecting these water sources would be a valuable issue to incorporate for future research. Management functions for the reproduction of the household varied considerably across sites. Female-dominated management functions include firewood collection or making charcoal, obtaining manure (from dead palm trees), fertilizing vegetable gardens, and collecting medicinal plants.

The Iterative Continuum Method (ICM)

This experimental, qualitative method (results reported in Chapters 8 and 12) was designed to provide a framework within which to organize thoughts about and emerging understanding of site conditions, over the course of necessarily brief fieldwork. We devised forms with a continuum—a horizontal line that represented different values on our topic of interest—at the top, and space below for writing. Researchers filled in one form on each day of the fieldwork, assessing where the community (or subgroups within the community) should be placed, based on the researcher's understanding, as of that day.[21] Placement was accompanied by an arrow to show the researcher's perception of the direction of change. The pages were then filled with evidence to support the conclusions marked on the continuum. The process of filling in these forms was iterative, whereby a researcher's growing understanding is reflected in changes in daily assessments.

To gain the kind of understanding needed to estimate the placement of a community or subgroup along the continuum, we spent days with representatives of the various stakeholders and subgroups—discussing, observing, inquiring—using elements from Vayda's contextual analysis approach (Vayda and others 1980; Vayda 1983). This approach strives to trace the links among

significant human actions (such as felling timber, monitoring concessionaires, or contributing ideas about forest management to conservation project personnel) in the research setting. The emphasis in this research was on tracing causal links[22] to demonstrate the relevance (or irrelevance) of particular kinds of human actions to SFM.

Researchers supported their initial assessments with cases and evidence. New cases and evidence that accounted for the changes in the researchers' perceptions were documented. By the end of the fieldwork, the state and direction of change along the continua for the locations studied were thereby fine-tuned, and the factors affecting forest management better understood.

All researchers felt the need for some defined points along the continuum (from secure to insecure access to resources [Chapter 8] or from significant to insignificant levels of participation [Chapter 12]) to help "anchor" observations from day to day. Colfer constructed a series of steps (for example, from "very insecure" to "very secure" tenure) that have been systematized by Salim and others (1999).

This method helped qualitative researchers focus on the issue, record what was learned, and think about the implications thereof. It also resulted in a wealth of case material relating to the topic of interest.

Participatory Card-Sorting Method

One prerequisite for effective participation is regular communication. This reasoning led us to develop the participatory card-sorting method (see Chapters 12 and 13). We used a form with a specified number of locally relevant stakeholders. In Danau Sentarum Wildlife Reserve, for instance, stakeholders included the local community, other communities, the government, the timber companies, the Conservation Project, and traders. Each stakeholder was listed on a different colored card, ideally with locally meaningful colors representing each stakeholder. The form also posed four questions, each a concrete example of a component of forest management. The questions in Danau Sentarum Wildlife Reserve pertained to seeking information about fish, looking for rattan, looking for valuable wood, and problems between timber concessionaires and other stakeholders. These questions were designed to reflect local forest management by identifying who had knowledge, who controlled and made use of resources, and who was involved in conflict resolution. We sampled 12–15 respondents in each community, evenly divided (wherever possible) by gender and representing whatever diversity we found. Respondents could be individuals or groups.

People were asked first to rank the stakeholders by importance (when necessary, this term was further explained as involving "rights" or "status" in forest management) for each of these four topics. It was necessary to rank all stakeholders (for analysis purposes), even if their role was quite unimportant. The people were then asked to allocate 100 points among these stakeholders,

depending on frequency of interaction, for each topic. Zero was an acceptable value for frequency of interaction.

The results are a simple average of ranking by importance and by frequency of interaction—both important issues in assessing people's involvement in managing forests. Disaggregating the responses by gender, occupation, location, or some other dimension is straightforward.

Assessment of Findings

As described at the outset of this introduction, our broad purpose has been to contribute to creating conditions that would allow people who live in and around forests to prosper while protecting their environment. As part of that process, this book was initially intended to clarify the causal links between HWB and SFM in a fairly reductionist mode. We hoped that by examining some widely accepted aspects of HWB in forests that varied in their apparent sustainability, we would be able to say with some certainty, "Yes, security of intergenerational access to resources is a critical factor in maintaining forest quality" or "No, security of intergenerational access to resources is unrelated to forest quality." We hoped to establish cause. That goal has been elusive—and for very good reasons, as we argue later. Instead, we found that human cultural patterns (behavioral and cognitive) relating to natural resources tend to vary by area and cultural region rather than by forest quality.

It might be tempting to focus on specific shortcomings of the research. From this perspective our first and simplest mistake was using good forest quality as our best available proxy for sustainable management. Our initial fears about this proxy (along with the continued absence of any other straightforward, inexpensive proxy) proved correct. Excellent quality forest can exist, in the short run, in a context of completely unsustainable management (as in many areas of southern and eastern Cameroon and in central Borneo). In fact, currently sustainable practices also can characterize degraded forest areas, not to mention the multitudinous concepts and differences of opinion about the meaning of "degraded." Current forest quality does not suffice as a proxy for good forest management.

Another straightforward problem involved finding sites that differed along the HWB continua. None of our sites in the developing world (Indonesia, Cameroon, Trinidad, Gabon, or Brazil) was characterized, for instance, by secure intergenerational access to resources. In forest-rich West Kalimantan, local people felt reasonably secure,[23] but we had significant reasons to suspect that their rights were in danger. Indeed, in all our sites, the security of intergenerational access to resources was clearly in jeopardy. Even at the U.S. site in Boise, Idaho, where land tenure is comparatively clearly defined, people's timber-related jobs were on the line—forests were being closed to logging,

and the mills were downsizing. We could not get the spread of HWB values (principles and criteria) that we had hoped for in our test sites.

One can argue, as we have from time to time (Prabhu 1995; Colfer and others 1999c; see also Chapter 15), that the concept of SFM is inherently value-laden and subject to continual redefinition. We defined SFM as including the maintenance or improvement of both ecological integrity and HWB. We also defined critical aspects of HWB in the *CIFOR Generic C&I Template* (CIFOR 1999; Annex 1). However, the concepts of HWB and of SFM are broad, and specifications are necessarily subject to local interpretation and variation if they are to be useful and widely applicable concepts.

But we would argue that any attempt to make global cross-cultural and interregional comparisons of this sort will be plagued by just such problems. One problem that we managed to avoid but is common in comparative cross-cultural research is the temptation to warp the data to fit a predefined conceptual or analytic framework. We went great distances to ensure that questions and definitions made sense in the local context, to ensure that translations were as comparable as possible, to throw out inappropriate methods, and to add new issues as identified in new contexts. We are pleased that some common issues remained that we could compare across sites (Chapters 6, 11, and 14) but are not surprised that some sites and some issues had to be discarded due to incomparability.

Through a process based on the professional judgements of many researchers, we sifted through the incredible variety presented by the real-world circumstances we were able to examine and extracted a few nuggets (the C&I) that have been widely accepted as important for HWB everywhere. But in trying to make the causal links between SFM and the respective manifestations of HWB in different locales, we found that particular historical sequences of events were more informative about these causal relationships than one-to-one correlations between aspects of HWB and SFM (see also Vayda 1996).

We are convinced that the problem lies not with the research process, which was unusually well funded, systematic, global, interdisciplinary, multicultural, and based on state-of-the-art conceptual frameworks and methods; the problem lies in the approach. We are looking at complex, adaptive systems that are dynamic and fluid. The search for straight-line, cause-and-effect links is simply a chimera, a holy grail that we must stop seeking.

HWB and SFM are, in our view, both bundles of complex and interrelated ideas and practices. They are not clear, monolithic concepts subject to tidy dissection as implied by the hierarchy of principles, criteria, indicators, and verifiers. C&I are very useful for ease of communication and as a conceptual and organizational device. Criteria are goal statements, linked to higher-order goal statements. Although a fair amount of commonality in top-order goal statements is to be expected, culture and context will necessarily dictate that all these goals will not be identical or, if identical, will reflect different values in different places.

CIFOR developed CIMAT (Criteria and Indicators Modification and Adaptation Tool), a software package designed to aid users in adapting C&I to particular contexts. The first version precluded the user from modifying the principles on the assumption that all would agree about their importance; however, feedback from users suggests that even the principles should be subject to modification and adaptation (Ravi Prabhu, unpublished data, February 2000).

Prabhu and Colfer (Prabhu and others in press) have believed for some time that a network was a more appropriate metaphor for the linkages between the various components of HWB and SFM. Testing sets of C&I in the field, we were struck by the varying prominence of one criterion or another in different contexts. Although eventually included in the U.S. C&I set (Woodley and others 2000), the generic template Indicator 3.1.1, "Ownership and use rights to resources (inter- and intragenerational) are clear and respect preexisting claims," was initially rejected—not because it wasn't deemed important but because the issue was felt to have been resolved. In Côte d'Ivoire, health took a much more prominent role in the C&I set selected than in other locales, partly because of the devastating impact of diseases such as malaria and AIDS and partly because of people's emotional stress levels related to dramatic competition for land; environmental degradation; spiraling population growth; and influxes of economic, climatic, and political refugees from neighboring countries (van Haaften 1995).

Instead of a hierarchy, Colfer began to imagine the C&I as hills in a landscape, which she likened to the lumps formed by a child's appendages under a blanket. In one locale, lump A, "a knee," would practically disappear (a criterion demoted to a verifier), and lump B, "an arm," would grow dramatically (an indicator rises to a principle). Lump C, "the head," (a principle) might remain the same. The "topography" of the "blanket" thus takes on a whole new configuration of shapes with every movement of the "child" or in each new locale while maintaining some inherent unity.[24]

So, although we continue to use the hierarchical metaphor of principles, criteria, and indicators because of its utility as a communication and organizational device and as an aid in the practical problem of assessment, we are skeptical of the degree to which this structure represents reality.[25] Because of changing field realities and changing human perceptions and values, we suspect that the kinds of globally mandated values represented in the C&I (and discussed in this book) will remain in continuous oscillation with a self-conscious learning process of location-specific testing and adaptation (see Concluding Remarks and Next Steps).

Throughout our research, we have been increasingly convinced that good forest management—that is attentive to human and ecological needs—will require iterative attention to the systems in which people and forests interact. It implies much more creative approaches to these issues, building on methods that can deal with evolving and interconnected systems, whether partici-

pant observation, system dynamics, network analysis, or participatory action research. A wide range of methods are available, waiting to be picked up and applied to the problems of forests and the people who inhabit them by those of us who are concerned about such issues. Our concept of "good forest management" is a far cry from conventional forest management, but we are convinced that without such an iterative process, both our forests and the cultural diversity that so many of us (including forest-dwelling people) value will perish.

Annex 1. Social Criteria and Indicators (C&I) from CIFOR's Generic Template

Principle 3: Forest management maintains or enhances fair intergenerational access to resources and economic benefits.

Criterion 3.1: Local management is effective in controlling maintenance of, and access to, the resource.

Indicator 3.1.1: Ownership and use rights to resources (inter- and intragenerational) are clear and respect preexisting claims.

Indicator 3.1.2: Rules and norms of resource use are monitored and successfully enforced.

Indicator 3.1.3: Means of conflict resolution function without violence.

Indicator 3.1.4: Access to forest resources is perceived locally to be fair.

Verifier 3.1.4.1: Access of small timber operators to timber concessions

Verifier 3.1.4.2: Access of nontimber users to nontimber forest products (NTFPs)

Indicator 3.1.5: Local people feel secure about access to resources.

Criterion 3.2: Forest actors have a reasonable share in the economic benefits derived from forest use.

Indicator 3.2.1: Mechanisms for sharing benefits are seen as fair by local communities.

Indicator 3.2.2: Opportunities exist for local and forest-dependent people to receive employment and training from forest companies.

Verifier 3.2.2.1: The number of local people employed in forest management (disaggregated, for example, by gender and ethnicity)

Indicator 3.2.3: Wages and other benefits conform to national and/or International Labor Organization (ILO) standards.

Indicator 3.2.4: Damages are compensated in a fair manner.

Verifier 3.2.4.1: Number of people affected by off-site impacts, without compensation

Indicator 3.2.5: The various forest products are used in an optimal and equitable way.

Criterion 3.3: People link their and their children's future with management of forest resources.

Indicator 3.3.1: People invest in their surroundings (that is, time, effort, and money).

Indicator 3.3.2: Out-migration levels are low.

Indicator 3.3.3: People recognize the need to balance number of people with natural resource use.

Indicator 3.3.4: Children are educated (formally and informally) about natural resource management.

Indicator 3.3.5: Destruction of natural resources by local communities is rare.

Indicator 3.3.6: People maintain spiritual or emotional links to the land.

Principle 4: Concerned stakeholders have acknowledged rights and means to manage forests cooperatively and equitably.

Criterion 4.1: Effective mechanisms exist for two-way communication related to forest management among stakeholders.

Indicator 4.1.1: More than 50% of timber company personnel and forestry officials speak one or more local languages, or more than 50% of local women speak the national language used by the timber company in local interactions.

Indicator 4.1.2: Local stakeholders meet with satisfactory frequency, representation of local diversity, and quality of interaction.

Indicator 4.1.3: Contributions made by all stakeholders are mutually respected and valued at a generally satisfactory level.

Criterion 4.2: Local stakeholders have detailed, reciprocal knowledge pertaining to forest resource use (including user groups and gender roles) as well as forest management plans prior to implementation.

Indicator 4.2.1: Plans/maps showing integration of uses by different stakeholders exist.

Indicator 4.2.2: Updated plans, baseline studies, and maps are widely available, outlining logging details such as cutting areas and road construction, and include temporal aspects.

Indicator 4.2.3: Baseline studies of local human systems are available and consulted.

Indicator 4.2.4: Management staff recognizes the legitimate interests and rights of other stakeholders.

Indicator 4.2.5: Management of NTFPs reflects the interests and rights of local stakeholders.

Criterion 4.3: Agreement exists on rights and responsibilities of relevant stakeholders.

Indicator 4.3.1: Level of conflict is acceptable to stakeholders.

Principle 5: The health of the forest actors, cultures, and the forest is acceptable to all stakeholders.

Criterion 5.1: There is a recognizable balance between human activities and environmental conditions.

Indicator 5.1.1: Environmental conditions affected by human uses are stable or improving.

Indicator 5.1.2: In-migration and/or natural population increases are in harmony with maintaining the forest.

Criterion 5.2: The relationship between forest management and human health is recognized.

Indicator 5.2.1: Forest managers cooperate with public health authorities regarding illnesses related to forest management.

Indicator 5.2.2: Nutritional status is adequate among local populations.

Indicator 5.2.3: Forest employers follow ILO work and safety regulations and take responsibility for the forest-related health risks of workers.

Criterion 5.3: The relationship between forest maintenance and human culture is acknowledged as important.

Indicator 5.3.1: Forest managers can explain links between relevant human cultures and the local forest.

Indicator 5.3.2: Forest management plans reflect care in handling human cultural issues.

Indicator 5.3.3: There is no significant increase in signs of cultural disintegration.

Annex 2. Descriptions of Comparative Research Sites (Chapters 6, 11, and 14)

One aspect of trying to understand the relationship between forest health and human well-being has been to identify and examine patterned differences in forest sites on the basis of their quality. Our first step was to divide research sites into categories characterized as "forest rich" or "forest poor." This qualitative differentiation was suggested by Center for International Forestry Research (CIFOR) silviculturist (and project leader) Ravi Prabhu. For our purposes, *forest rich* refers to a landscape resembling a "sea of forest with islands of people" and *forest poor* refers to "a sea of people with islands of

forest." We used input from various biophysical scientists and complementary studies in helping us to place our sites on this continuum.

Here, we simply divide the locations where this methods test was conducted[26] into two groups. The forest-rich sites are

- Long Paking, Bulungan, East Kalimantan, Indonesia;
- the Dja Reserve and Mbongo, Cameroon; and
- Trairão and São João, Pará, Brazil.

The forest-poor sites are

- Long Segar, Kutai, East Kalimantan, Indonesia;
- Mbalmayo, Cameroon; and
- Transiriri and Bom Jesus, Pará, Brazil.

Descriptions of the sites follow.

Forest Rich

Long Paking, Bulungan, East Kalimantan, Indonesia.[27] CIFOR's Bulungan Research Forest area, directly adjacent to this community, is considered by the World Resources Institute to be the most intact remaining forest in Southeast Asia (Figure A1). Varying from lowland dipterocarp to montane forest, the area is a biodiversity treasure. The area immediately surrounding Long Paking has been commercially logged and subject to swidden (more pejoratively called "slash-and-burn") cultivation for several years, but its remoteness and low population density have prevented serious environmental degradation.

Long Paking is a riverine community of Lundaye and Abay Dayak swidden cultivators, recently joined by the inhabitants of five Punan hamlets. The Punan are the hunter-gatherers of Kalimantan. The Indonesian government has unsuccessfully tried to "settle" such people in villages for decades. The Punan rarely remain in the village, spending much of their time upriver in their traditional areas. The Dayak are swidden cultivators who supplement their incomes by seeking forest products, both for subsistence (ferns, medicinal plants, fibers, and timber) and for sale (for example, *gaharu,* a rare and fragrant heartwood used for incense); by fishing and hunting; and by periodic wage labor, particularly with the nearby timber company. The village itself is surrounded by the varying stages of forest regrowth that characterize Kalimantan's swidden cultivation systems, supplying the community with the variety of domestic, semidomestic, and wild products that flourish in the different stages. As with almost all Kalimantan communities, land ownership follows traditional rules and is not officially recognized by the government. Limited logging activity has occurred in the area since the 1970s, but significant and accessible forest areas that are almost undisturbed remain. Transport

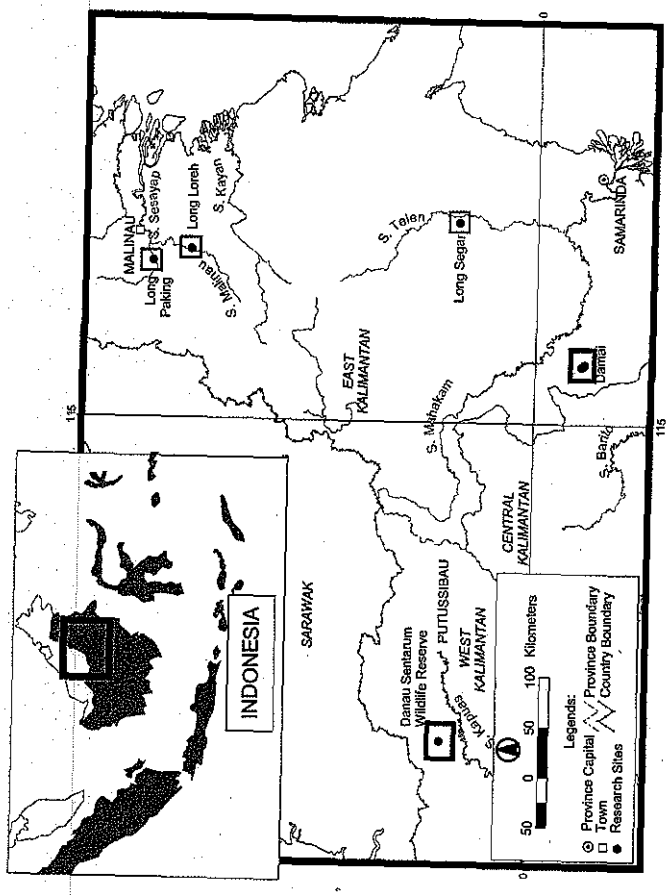

Figure A1. *Map of Indonesia, Focused on Our Research Locations*

is still primarily by river. In the mid-1990s, CIFOR was given access to the adjacent Bulungan Research Forest, where the Indonesian government encourages research, although existing stakeholders (local people, timber companies, mining companies, and plantation companies—most operating to the east of Long Paking) retain rights to continue their activities there.

Dja Reserve, Cameroon.[28] The Dja Reserve (Figure A2) is located in the northeastern corner of the Congo Basin and covers 526,000 hectares. The northern and western boundaries of the reserve can be reached by road from Yaoundé, but access remains difficult in much of the area. Several conservation organizations are active in the area, including Conservation et Utilisation Rationnelle des Ecosystèmes Forestiers d'Afrique Centrale (ECOFAC) in the west, north, and south of the reserve and the International Union for the Conservation of Nature (IUCN) and Soutient au Developpement Durable de la Region de Lomié (SDDL) in the east. ECOFAC and IUCN hope to develop participatory management plans for the reserve. Commercial hunting and logging are seen as the primary threats to the ecosystem, and the projects hope to develop economic alternatives for local people. SDDL operates in a region about 20 kilometers from the reserve boundaries; one of its important goals is the implementation of community forestry, particularly in the *communes* (administrative structures similar to counties) of Lomié and Messok. Another important actor in the region, Société du Littoral pour l'Exploitation et le Transport (SOLET), was the only logging company working in the area (88° N to 89° N) at the time of the test. The main species logged include *Entandrophragma cylindricum* (*sapelli*), *Triplochiton scleroxylon* (*ayous*), *Lovoa trichilioides* (*bibolo*), and *Pericopsis elata* (*asamela*). These species were primarily exported to France, but some of the *sapelli* was sold to PALISCO, another logging company, which had a sawmill at Mindourou to the north of the study zone.

The method reported here was tested in four communities: Messok/Mbaya, Baréko, Pohempoum, and Sembé.

- Messok/Mbaya includes camps of Baka pygmies, selected to reflect the insecurity of tenure that characterizes this group. The Baka inhabitants of Messok, for instance, have been required to move twice since Messok was formed by administrative decrees in 1994.
- Baréko's inhabitants consist of four lineages, which fall into two unequal categories (Grand Baréko and Petit Baréko), both of which were involved in the study reported here. Their relevance in this case derives from their involvement with SOLET, the logging company. One of SOLET's logging areas is completely within the community's forest territory, and another one is shared between Baréko and its neighbor, Messok. About 120 people are employed by the company, the majority from the local area, and the company provides significant contributions to the community.

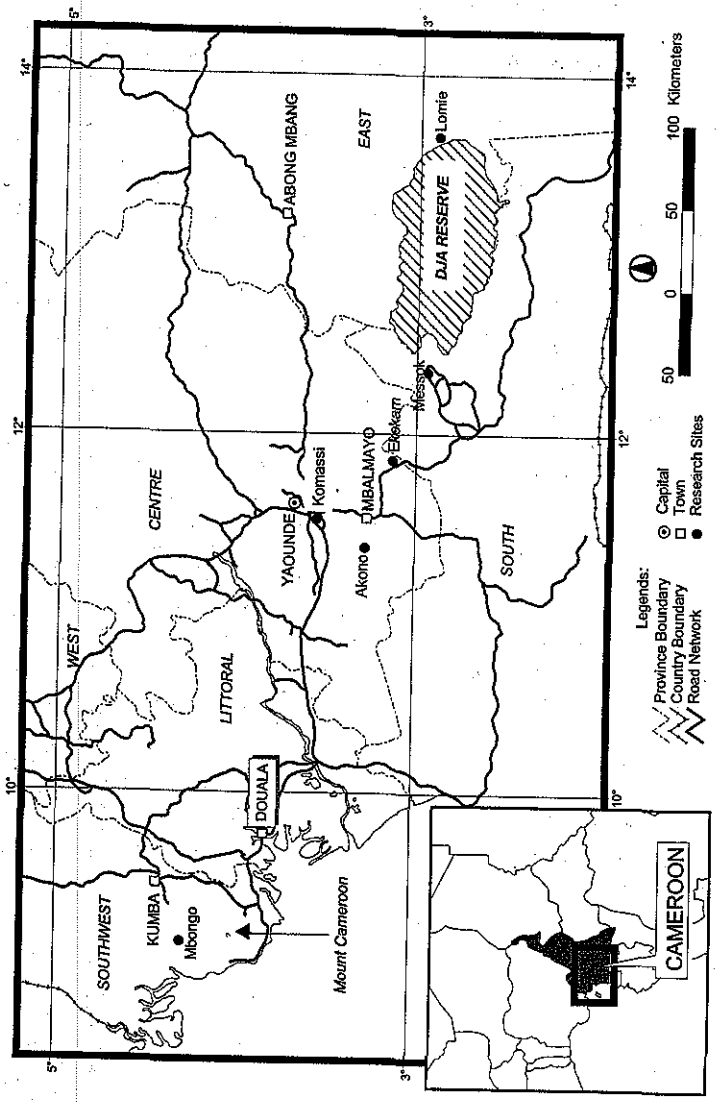

Figure A2. *Map of Cameroon, Focused on Our Research Locations*

- Pohempoum, one of the oldest population resettlement areas in the region, has an ethnically diverse population. Under the Germans, this village was the principal commercial center in the area; Europeans bought rubber and then cocoa and sold manufactured products. This area also is on the periphery of the reserve, which generates considerable concern from conservationists about the hunting proclivities (within the reserve) of the population. Situated close to Sembé, this population has not been concerned with logging and therefore provides an interesting comparison.
- Sembé has a population of newcomers. The first occupants were the Nzime from the clan *babil*, but none remain. The current population is divided among several different ethnic groups. The Kako, who come from the dividing line between the forest and the savanna to the north, are the majority. They were given rights to the forest by the Nzime around 1930. The other groups are the Njem, the Nzime from the clan *balamine*, and the Badjoué, who come from neighboring areas to the north, west, and south, respectively.

Mbongo, Mount Cameroon, Cameroon.[29] Mount Cameroon (Figure A2), located within comparatively easy driving distance from principal population centers, is the site of a major U.K. Department for International Development (DfID)–Cameroonian conservation effort. It is the highest mountain in West Africa (4,095 meters) and the only active volcano. This equatorial forest is Atlantic Biafran evergreen, rich in Caesalpiniaceae. Rainfall ranges from 2,000 to 10,000 millimeters/year (average 3,000 millimeters/year). The area is considered a conservation "hot spot" because of its many rare and endemic species.

Mbongo village, which has the most diverse forest in the Mount Cameroon Project/Limbe area, was the primary location for the study reported here. It is a Balondo village in the Bamusso Subdivision of the Ndian Division in the Southwest Province. It is bordered to the south by the Mokoko River Forest Reserve, to the north by the Atlantic Ocean, to the west by Bonjare village (with which it has close ties), and to the east by Dikome village. This site was selected because of its heterogeneous and comparatively large population and because of its experience with logging companies (over the past ten years). The forest remains in reasonably good condition.

Of Mbongo's people, 55% are native Balondo, about 30% are Ibibios and Ibos from neighboring Nigeria, and about 15% are other Cameroonians (from the Southwest and Northwest Provinces, primarily). Shifting cultivation is the economic base, supplemented by hunting, fishing, and the collection of nontimber forest products. The matrilineal inheritance system was changed to a patrilineal system by a decision of the Balondo Cultural and Development Association (BACUDA) at a meeting in 1980. Interestingly, women were not allowed to own land under the matrilineal system but are now allowed under the patrilineal system. In one sense, the community owns

all primary forest land, and individuals own parcels that are being cultivated or have been recently cultivated by themselves or family members. In another sense, all forest land belongs to the state. Land rental has been common since 1990, particularly for the in-migrant Nigerians.

Trairão, Pará, Brazil.[30] Uruará (3°43′S, 53°44′W; Figure A3) is characterized by upland primary forest on terra firma along with secondary forests in areas of older colonist occupation (beginning in the early 1970s) closer to roads. *Attalea* sp. (*babassu*) and *inajá* palms are increasingly dominant in mature secondary succession, with *Cecropia* sp. (*imbauba*) occurring in recent openings. Selective timber extraction began in Trairão around 1993. The access to the site where the tests were conducted is 25 kilometers west and 50 kilometers north of the town of Uruará, on one of the secondary roads of the Transamazon highway, between the Xingu and Tapajos Rivers. Fertile soils made Uruará one of Transamazon's agricultural poles, attracting colonists from the south and northeast of Brazil to invest in subsistence and commercial agriculture (cocoa, pepper, and coffee) and livestock. Beyond the northern edge of lands occupied since the 1970s, Trairão is a small river that gives its name to a settlement project recently established by the Instituto Nacional de Colonização e Reforma Agrária (INCRA), the Brazilian agrarian agency. The river runs through an area divided into 100-hectare plots for 130 families. These settlers, who arrived in the late 1980s, are mostly children or relatives of Transamazon's early colonists, who arrived in nearby areas closer to the road in the early 1970s. Those colonists—predominantly from the Brazilian northeast, with a mixed indigenous, African, and European ancestry—were attracted to the frontier in hopes of obtaining secure land tenure. They encountered forested land with very little human disturbance, a condition that is gradually changing with opening and burning for swidden agriculture and pasture formation. In general, however, disturbance in the area is still limited.

Commercial logging started in Trairão when a timber company called Marajoara began to operate through the demarcation and selective exploration of tracts of land beyond the colonization schemes. Local industry currently operates with only six commercial species [*jatobá, Cedrella odorata* L. (*cedro*), *Tabebuia* sp. (*ipê*), *cumarú, freijó,* and *pau-amarelo*], allegedly because of isolation and transportation costs. Because of the lack of presence of the local and state governments, the operation of the timber company in the area is viewed by the local residents as a substitute for the state, even though operation is only seasonal. As in most areas of recent occupation, small landholders participate in timber extraction mainly by selling standing trees to the timber company. Even the reduced payment received (equivalent to $10–50 per tree, depending on the species) is considered advantageous to a settler in need of cash for initial establishment. In 1998, the prospect of receiving rural credit and land titling (associated with the arrival of hydro-

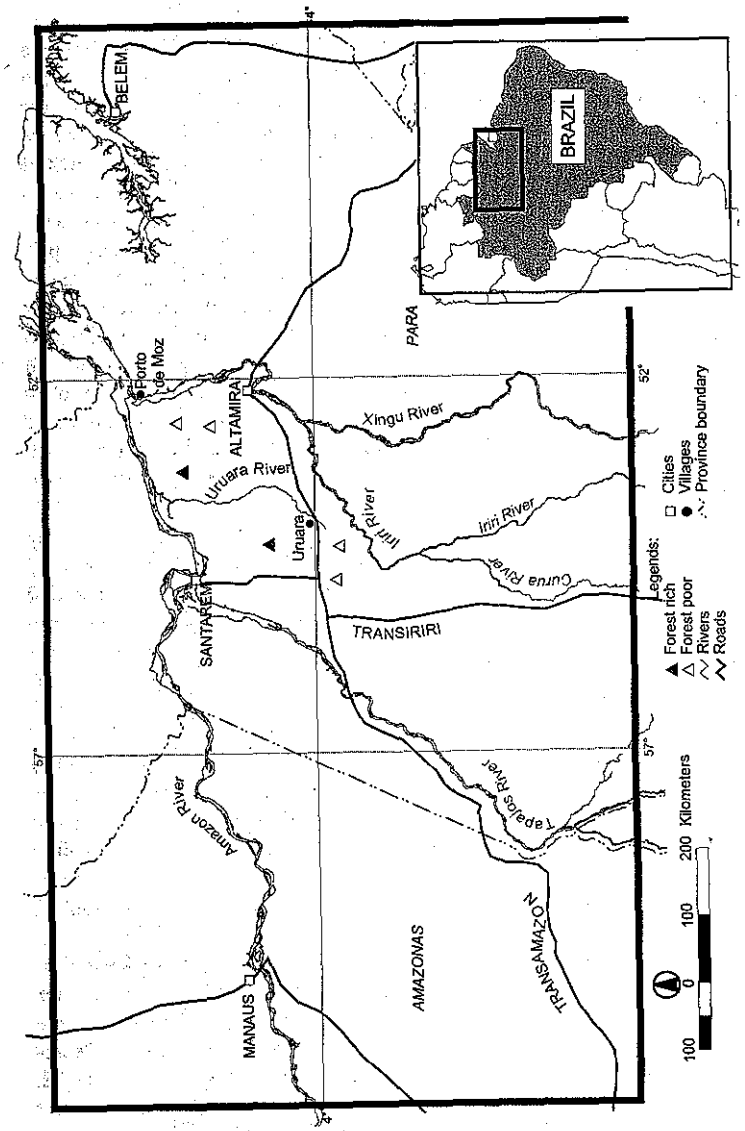

Figure A3. *Map of Brazil, Focused on Our Research Locations*

electric power to Uruará) significantly changed the livelihoods of peasant farmers and the future of the local logging industry.

São João, Pará, Brazil. Porto de Moz (1°45′S, 52°15′W; Figure A3), the area in which São João is found, is located near the mouth of the Xingu River in the Amazonian floodplain. The area is characterized by a very flat landscape with a predominance of alluvial soils and oxisols. Although annual average precipitation is 2,000 millimeters, it is concentrated in the months of December to June. Rainfall from July to November may be less than 60 millimeters/month. The floodplain (the *várzeas*) consists of both seasonally flooded forests and grassy vegetation, whereas upland forests as well as primary and mature secondary growth occur at higher elevations on terra firma.

Technically, all floodplain land belongs to the federal government, under the navy's administration, despite longstanding and culturally accepted resource use patterns by local people. The predominant activities are, in order of importance, timber extraction, fishing, buffalo husbandry, and manioc production. Timber extraction and subsistence agriculture are more important on the terra firma, whereas buffalo raising and fishing take place on the *várzeas*. Human settlements in Porto de Moz are located near the rivers and tiny streams (*igarapés*).

São João is a community 70 kilometers west of the town, or 12 hours by boat. Dwellings are scattered along the margins of the Cupari, an extremely rich fishery and tributary of the Xingu River. A Portuguese merchant first occupied the area early this century, and most of today's 40 families are *ribeirinhos*, or *caboclos*, descending from his family. In contrast to most sites in the vicinity, no timber was commercially extracted in São João. Local forests thus remain almost undisturbed. Lowland resources were traditionally used communally, especially the floodplain. Nearby areas in the terra firma began to be used only a few years ago for agriculture, because the first dwellers focused more on fishing. The Cupari is ideal for catching the more marketable fish species, freshwater turtles, and caimans. Although difficult, it is still possible for the fisherfolk to find *pirarucu* and manatees. Better-off families own small buffalo herds.

New economic opportunities and the prospect of fisheries' depletion are generating friction within the group. Most of the friction has to do with the attempts of some residents to benefit from timber extraction by making individual contracts with Porto de Moz "loggers" who operate in the vicinity. Commercial timber extractors have entered lands in São João twice but were promptly expelled by the majority of the community. Rapid resource depletion without economic compensation, as occurred in neighboring villages, contributed to their opinion: that timber extraction should be carried out only under community managed projects for which they seek government funding. In this regard, a legal entity was recently created and is currently submitting proposals for sustainable forest management activities.

Forest Poor

Long Segar, Kutai, East Kalimantan, Indonesia.[31] Long Segar is situated within a timber concession, where roads have been developed in the last few years, but much travel remains on the river (Figure A1). The area was previously lowland tropical rainforest, and the primary commercial tree species were dipterocarps (most of which have been removed by logging, then plantation development, and most recently, devastating fires related to El Niño in 1997–1998). This equatorial region has two main seasons, rainy (October–May) and dry (June–September), with an additional brief dry spell in January or February.

Long Segar is populated by a community of Uma' Jalan Kenyah Dayak who moved from their remote homeland in the Apo Kayan in the early 1960s. They were attracted by plenty of old-growth forest; abundant pigs; an excellent view of the Telen River and surrounding forest; and more accessible education, medical care, markets, and consumer goods. The people are riverine, swidden cultivators whose animist beliefs were augmented by conversion to Christianity in the Apo Kayan. As with almost all Kalimantan communities, land ownership follows traditional rules and is not officially recognized by the government. Long Segar was part of the U.S.-based Georgia-Pacific timber company's concession in the 1970s and early 1980s. It was technically labeled a "resettlement village" in 1972, giving the inhabitants five years of government assistance of various kinds. In the 1980s, the Muara Wahau transmigration site, covering hundreds of thousands of hectares, was settled by thousands of Indonesian families from other islands a short distance to the north. After the 1983 fires induced by El Niño, Georgia-Pacific relinquished its share of the timber concession to P.T. Kiani Lestari (owned by ex-timber tycoon Mohammad "Bob" Hasan). It later became the site of considerable industrial timber plantation activity, including several other transmigrant settlements designed to supply labor for the timber plantations, in the 1990s. Whereas logging and transmigration represent some competition for forest resources, the industrial timber plantations appear to spell disaster for the local way of life, removing the people's access to most local land. Fires related to El Niño of 1997–1998 seriously degraded the forest in the area.

Mbalmayo, Cameroon.[32] Research took place in an area surrounding the town of Mbalmayo (Figure A2), from Akono (30 kilometers west of Mbalmayo) to Ekekam (60 kilometers southeast of Mbalmayo) along the Sangmelima road. Mbalmayo is an industrial center 45 kilometers south of Yaoundé, the capital of Cameroon. With half a dozen logging industries and many family-run logging units, this town can be considered one of the country's most industrialized areas. Its proximity to the metropolis of Yaoundé on one hand, and industrial growth on the other, have caused a significant population influx to the town. High urban and rural population density directly

influences the vegetation; a degraded forest has replaced the original semi-deciduous tropical dense forest based on an equatorial climate with four seasons. Nevertheless, a few areas of virgin forest still remain in remote villages and in areas without ready access.

The Mbalmayo Subdivision has two forest reserves: the Zamakoe Forest Reserve (4,200 hectares) and the Mbalmayo Forest Reserve (9,700 hectares). The Mbalmayo Forest Reserve, very close to town, is subject to a lot of pressure from the surrounding population. Declassification of part of this forest for the purpose of urban expansion is under way. The Mbalmayo Forest Reserve sustains

- the Forestry School (unique in the whole of Central Africa), for field experimentation; and
- the laboratories and experimental farms of the International Institute of Tropical Agriculture (IITA).

The people of Mbalmayo town are made up of many ethnic groups; the following are the most dominant:

- the Beti, most of whom are civil servants or work for logging companies;
- the Bamileke, immigrants from the west of the country who do manual jobs (such as carpentry, bricklaying, or mechanics) and trade activities; and
- Muslims of diverse origins who make up religious-based communities.

The rural populations all belong to the greater Beti tribe, but clans differ from one village to the next. Thus, we have the Bënë at Metet and Nkout, the Mvog Manze at Yop, the Yanda at Akono, and the Etenga at Mendong. The common language spoken in the area is Ewondo. As a general rule, marriage is forbidden within the same clan; consequently, most adult women found in the villages have come there as a result of marriage.

In the villages, the main activity is agriculture: men involve themselves in growing cocoa and, at times, in tapping palm wine; women grow food crops and harvest nontimber forest products. Illegal sawmill operators are particularly active in this area, despite repressive measures taken by the forest administration. This activity is partly due to the area's proximity to Yaoundé and partly to the high cost of sawn lumber since the last currency devaluation. Land ownership follows traditional rules that are officially recognized by—but sometimes in contradiction to—national law. The local land ownership system is complex; acquiring land may be by inheritance, by cutting down community virgin forest, or by gifts under certain conditions.

Transiriri, Pará, Brazil.[33] Transiriri (Figure A3) is the name of one of the most important secondary roads of the Transamazon highway, starting 10 kilometers west of Uruará and continuing south for about 100 kilometers, where it reaches the Iriri River. Until 1982, the road was only 20 kilometers long and forests were relatively undisturbed. By 1995, most land near the

Transiriri was depleted of commercially valuable timber species. The mahogany in the forests south of Uruará and Altamira were the major resources targeted by timber companies, who extended the road. A few other species were considered commercial (the same ones as in Trairão) and also were extracted.

The area selected for the social science methods tests is between kilometers 50 and 60 of the Transiriri road, on lands beyond the official colonization scheme. Its occupation began with the arrival of families of northeastern Brazilians, mostly from the state of Maranhão, who were guided and transported by timber companies after the road was constructed. Half of the plots were deforested by 1998, mostly for cocoa and pepper plantings and for pasture development. In the two years after the road was constructed, two companies—Peracchi and Bannach—removed most of the mahogany. Bannach built a large processing unit near the margins of the river. The peak of "prosperity" and goods circulation in the Transiriri was in the mid- to late 1980s. The main reason for this prosperity was the operation of the timber processing unit at the Iriri and the related truck traffic. Additional features of this period included the frequent crossings of gold miners coming from upriver and the periodic movement of cattle brought from ranches in Mato Grosso and left on local properties for fattening. Today, the situation is quite different. Gold and beef prices are much lower. The tenure security of 450 households beyond kilometer 40 of the Transiriri road was compromised when a 1993 disposition of the Justice Ministry designated a 760,000-hectare area centered on the Transiriri as indigenous (*arara*) land. The timber company was considered illegal and shut down after the territory was demarcated, and timber extraction in the area has since been prohibited. Local residents say that they have lost economic opportunities such as wage labor, a secure market for their annual crops, and free transportation to the city.

Bom Jesus, Pará, Brazil. In contrast to São João, the community leaders of Bom Jesus—the forest-poor floodplain site in Porto de Moz—have a completely different approach to commercial logging. Bom Jesus (Figure A3), at the margins of the Quati River (a tributary of the Xingu that receives waters from the Cupari, where São João is located), was occupied by *caboclos* in the early nineteenth century, but houses were relocated to their current site in 1991, when a record flood destroyed most of the homes. A larger Catholic and a smaller Evangelical settlement constitute the relocated site of Bom Jesus, where *ribeirinhos* allowed and stimulated timber extraction. Whereas the floodplain extends to the northern margin of the Quati River, the two villages are strategically positioned because areas of upland forest start on their boundaries. As a result, Bom Jesus is one of the most suitable locations for timber extraction in Porto de Moz. Commercial logging has been in place since the 1970s, but on a smaller scale during the first decade. Some 20 species are extracted, including *cedro, Virola* sp. (*virola*), *sucurba,*

jabutirana, cambará, freijó, Hymenolobium sp. (*angelim*), *Vochysia maxima* Duck (*quaruba*), and *ipê*. After the village was relocated, ferries brought trucks and tractors to Bom Jesus and left with loads of timber. Small sawmills were installed in the hinterlands. Economic opportunities brought by logging operations enacted a process of demarcation and appropriation of individual tracts of land in the terra firma, mainly for claiming property rights over trees that were sold directly to timber companies operating in the area, or more often to truck drivers (*caminhoneiros*). Today, only a few trees of commercial size are left in Bom Jesus' terra firma. The exhaustion of forest resources along with the depletion of local fisheries raises serious questions about future survival strategies in Bom Jesus.

We have not included descriptions of the sites in Trinidad, Gabon, and West Kalimantan because we felt the case study approaches of the chapters provided enough detail and because the sites were not included in any of our cross-site analyses. The Trinidad sites are shown in Figure A4, the Gabon sites in Figure A5; and the West Kalimantan sites (DSWR) in Figure A1.

Endnotes

1. We are grateful to Jack Ruitenbeek for helping us state this conclusion in this way.

2. Each team produced a report: Burgess and others (1995) for Indonesia; Mengin-Lecreulx and others (1995) for Côte d'Ivoire; Zweede and others (1997) for Brazil; and later, the Federal Ministry of Environment, Youth, and Family (1996) for Austria; Prabhu and others (1998) for Cameroon; Woodley and others (2000) for the United States; and Nasi and others (1998) for Gabon.

3. These results are reported in Brocklesby and others 1997, Sardjono and others 1997, Tiani and others 1997, Diaw and others 1998, McDougall 1998, Oyono and others 1998, Porro and Miyasaka Porro 1998, and Tchikangwa and others 1998.

4. Besides authors in this book, the following individuals had a significant impact on the evolution of these ideas: Neil Byron, previous program leader for CIFOR's policy work; Heleen van Haaften, an agricultural sociologist with expertise in cross-cultural psychology, working with the Tropenbos Foundation in Wageningen, the Netherlands; Ahui Anvo, a sociologist working with SODEFOR in Abidjan (Côte d'Ivoire team); Laksono, a professor of Anthropology at Gadjah Mada University in Yogyakarta, Indonesia (Kalimantan team); and Jan Kressen, an independent consultant from Germany who specializes in sociology (Brazil team).

5. This set has been modified slightly from the original (see Wollenberg and Colfer 1996).

6. Prakash and Thompson (1994) identified four quite different ways to interpret "fairness," for instance: proportionality (to each according to contribution), parity (equal distribution of outputs), priority (inherent rights, like rank/station), and pot-luck (equal chance, like a lottery).

7. For theoretical discussions of the ubiquity (and perhaps inevitability) of this kind of problem, see Smith and Steel 1995 and Dove 1996.

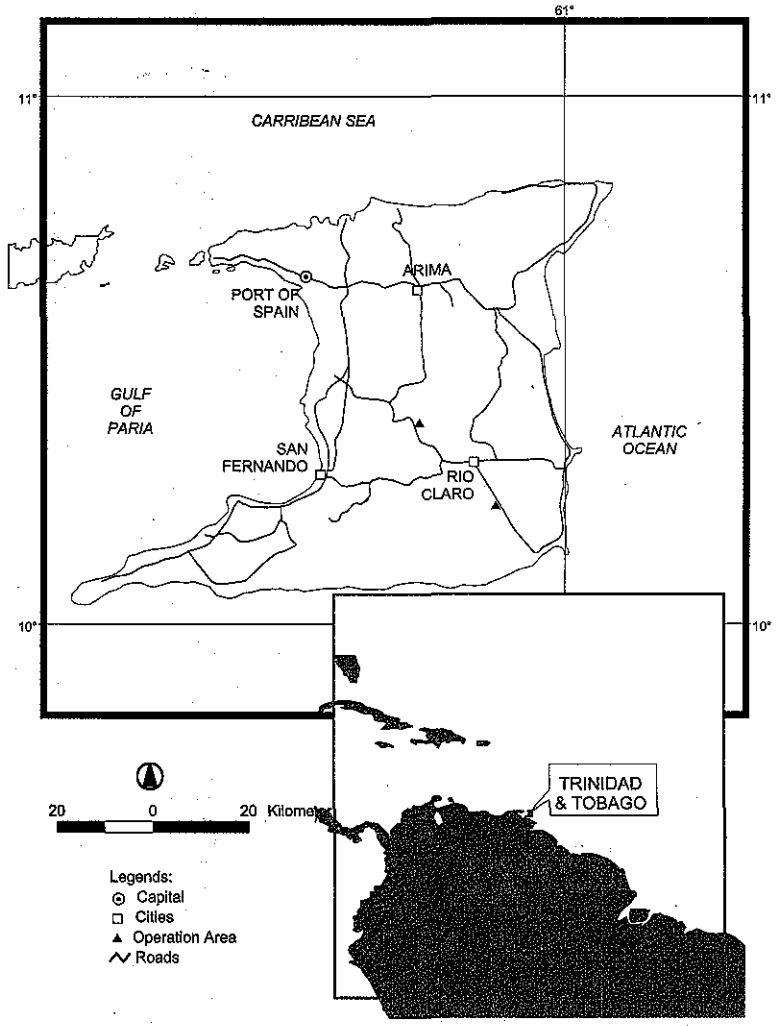

Figure A4. *Map of Trinidad, Focused on Our Research Locations*

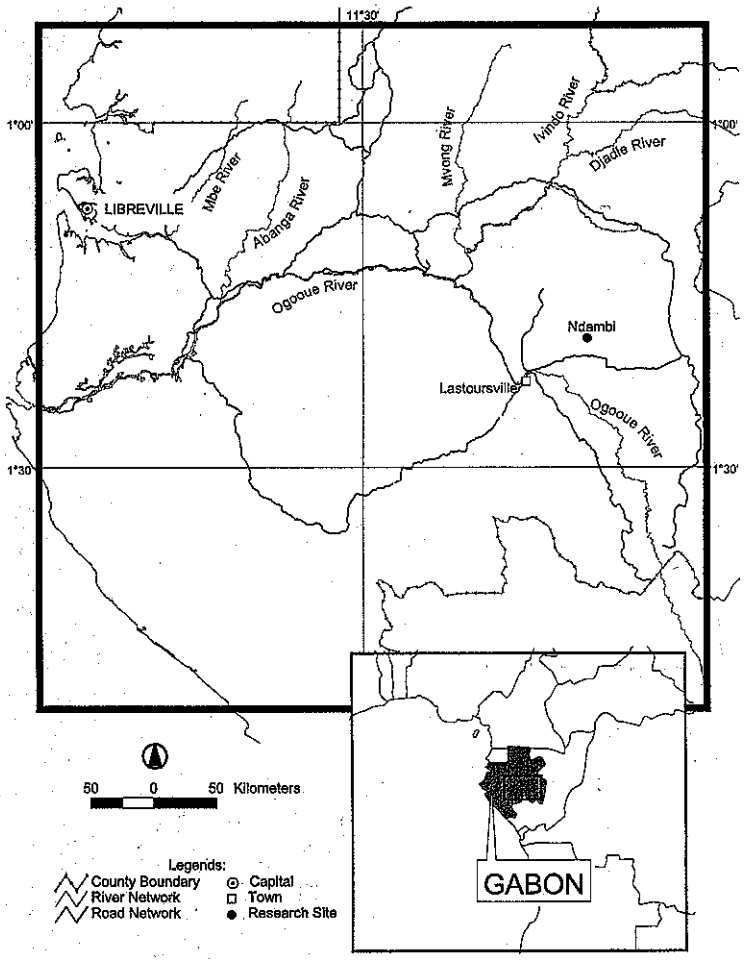

Figure A5. *Map of Gabon, Focused on Our Research Locations*

8. See Fairhead and Leach 1994/95 for examples in Africa; see Roosevelt 1989, Balee 1992, or Salick 1992 for examples in South America.

9. We use the numbering system used in the *CIFOR Generic C&I Template,* for ease of reference. Principles 1 and 2 refer to policy and ecological issues, respectively.

10. This concept is not uncommon. Conditional rights to land are familiar to forest actors in Borneo, for instance, where many communities retain some residual rights, even in otherwise privately held resources (Appell 1986; Colfer with Dudley 1993; Peluso 1994; Ngo 1996). In Côte d'Ivoire, we found a willingness to accept needy outsiders and give them access to land (in return for labor), even when such pressure resulted in environmental degradation (Riezebos and others 1994; SODEFOR 1994; van Haaften 1995).

11. *Tenure* is defined as "the act, right, manner, or term of holding something (as a landed property, a position, or an office)" (*Webster's* 1993). It therefore incorporates, in the context of forest management, various combinations of use rights, stewardship, communal and individual ownership, state management, and so forth. This generality seems appropriate, given global variation.

12. According to Green (1986), *active participation* (in a health context) is "the conscious and intentional involvement of the individual or population in question, as distinct from the passive engagement of the individual or population in each of the activities or processes that follow": identifying their own goals or needs, setting their own priorities among goals or needs, controlling the implementation of programs or solutions, and evaluating or otherwise obtaining feedback on their own progress. The involvement of distinct stakeholder groups in forest management requires varying degrees of negotiation, perhaps at each of these steps.

13. See Palmer 1993 for a counter example from Newfoundland's fisheries.

14. Winthrop's (1991) first definition of *culture* (of many) is "that set of capacities which distinguishes *Homo sapiens* as a species and which is fundamental to its mode of adaptation."

15. Oppressive and unjust elements exist in all cultures; but conversely, human beings universally have difficulty thriving when their cultural systems have been disrupted.

16. Fuller discussion of this method was published by Colfer and others (1999a, 1999b). More detailed descriptions of the individual studies are available in the original reports (Tiani and others 1997 [Mbalmayo]; Tchikangwa and others 1998 [Dja Reserve]; Brocklesby and others 1997 [Mount Cameroon]; Sardjono and others 1997 [East Kalimantan]; Porro and Miyasaka Porro 1998 [Brazil]).

17. Traditionally, a Galileo study requires respondents to report their perceptions of the differences (often called "distances") among a set of concepts considered central to the definition of some topic, for example, "forests." The estimated dissimilarities are averaged across all respondents in any segment and projected onto orthogonal coordinate axes to produce a perceptual map, or space. Within this space, distances are predictive of attitudes, beliefs, and behaviors. Technically, 277 respondents in West Kalimantan estimated the pairwise dissimilarities among a set of terms including "forest" and 19 other concepts identified in previous analyses as pertinent to the perception of forests in Kalimantan villages. The resulting square-mean dissimilarities matrix then was analyzed in several ways, for example, in perceptual maps (multidimensional scaling [MDS]), charts, graphs, tables, and advanced artificial neural networks (ANNs). Perceptual maps were made using Galileo software, which produces

very precise representations of the dissimilarities in graphic form, and which allows transformations (rotations and translations) to common orientations for easy comparisons of data over time and across subsamples. Previous research has shown Galileo to be an appropriate model when holistic models of cognitive structure and processes are required, when precise results are desirable, or when a standard metric needs to be maintained across time or subsamples—for example, when time-ordered maps are needed, when maps are to be compared from sample to sample, and when the concepts to be mapped are known. Galileo modeling may be less appropriate when investigators are uncertain as to which concepts occur in the cognitive model or when reducing the time burden on respondents is crucial, an invariant metric over time and across samples is not needed, and precise results are not important (Woelfel and Barnett 1982, 1992; Woelfel and others 1986; Cary and others 1989; Woelfel and others 1989). When less is known about the concepts that need to be included, as is the case in preliminary studies, similar results can be obtained from CATPAC, a self-organizing neural network that reads text and uncovers the main underlying concepts. CATPAC makes it possible to work from in-depth interviews rather than quantitative scales, yet derive similar results (Cary 1995).

18. CATPAC (described in note 17) is a computer program that can perform this function quickly and easily from text (also tested in CIFOR's methods tests and included in Colfer and others 1999b).

19. We consistently use boldface to differentiate the locally defined concepts used in the Galileo studies from our own, presumably more general, meanings of the same terms.

20. We have tried this with and without columns differentiated by gender. Some researchers felt this differentiation on one form was unwieldy; others liked it. We do have gender-disaggregated data to be reported in the future.

21. This combines some of the approaches suggested by Pretty (1994), for example, persistent and critical observation, negative case analysis, and reflexive journals.

22. See Vayda 1996 for an interesting, philosophical discussion of methods of study and relationships among human actions and their environmental effects.

23. In the short run for environmental sustainability, this perceived level of security may suffice, because people will be motivated to take care of the resource if they think they will continue to have access to it. However, in the long run, human well-being will suffer when they do in fact lose such access.

24. Other images that come to mind include Herbert's (1984) descriptions of the spice worms moving beneath the sand across the landscape in *Dune;* moles appearing randomly in the "Whack-a-Mole" game popular in U.S. amusement parks; and Woelfel's image of lights switching on and off in a network of interconnected bulbs (paralleling the operation of the human brain) also captures some of this idea (presentation on neural networks by Joseph Woelfel to CIFOR, Bogor, Indonesia, in October 1996).

25. Prabhu has argued convincingly for recognizing a useful congruence between principles, criteria, indicators, and verifiers on one hand and wisdom, knowledge, information, and data on the other (Prabhu and others 1996, 1999).

26. This methods test was actually also carried out in several other Cameroonian sites by Chimere Diaw and associates, but the results were not available at the time of this analysis.

27. This research was led by Dr. Mustofa Agung Sardjono (an agroforester). Fieldwork was conducted by Edi Mangoppo Angie, Akhmad Wijaya, and Erna Rositah. The field test occurred in June and July 1997.

28. This research was led by Bertin Nkanje Tchikangwa (anthropologist), who was assisted by Sidonie Sikoua, Moise Metomo, and Marc Felix Adjudo. The research took place throughout most of 1997.

29. This research was led by Mary Ann Brocklesby (a social scientist), who was assisted by Priscilia Etuge, Grace Ntube, Joseph Alabi, Michael Anje, Victor Bau Bau, and John Molua. The field test occurred between July and September 1997.

30. The Brazil-based research was led by Roberto Porro, in partnership with Noemi Miyasaka Porro (both anthropologists), and took place in July and August 1998.

31. This research was led by Dr. Mustofa Agung Sardjono (an agroforester). Fieldwork was conducted by Edi Mangoppo Angie, Akhmad Wijaya, and Erna Rositah. The field test occurred in July and August 1997.

32. This research was led by Anne Marie Tiani (an ecologist). Field assistance was provided by Edouard Mvogo Balla, Annie Oyono, and Diesse Norbert Kenmegne. The test took place over a five-month period in mid-1997.

33. This research was led by Roberto Porro (an anthropologist), who was assisted by Noemi Miyasaka Porro. The test took place in July and August 1998.