Chapter Twelve
Cross-Continental Comparisons: Africa and Asia

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The research in the Western Hemisphere reported in this book has allowed for a cohesive program with a focus on forest ecosystems and has produced a sizable body of findings on human-environment interactions in forests in the Americas. Africa and Asia present different sets of challenges to understanding how human societies intersect with forest resources. Significantly greater population densities exist in parts of Asia, and significantly different institutional environments can be found locally in both continents. CIPEC initiated an expansion to Asia and Africa in 2000, building on a rich array of pre-existing institutional and biophysical information available from the IFRI research teams working in these regions. This chapter will examine the opportunities and challenges of research in Africa and Asia as compared to research in the Americas with respect to land tenure, land-cover change history, population characteristics, and other factors that impact human-environment interactions.

We selected sites in countries in eastern and southern Africa and South Asia where considerable work already had been accomplished by the IFRI research program (see chapter 4): Uganda, Madagascar, Nepal, and India. Research in these IFRI sites previously had focused on field data collection, and we expanded the scope of inquiry to include a spatially explicit dimension using GIS and remote sensing. Use of these tools followed the techniques developed for our other locations (see chapters 1, 3, 6, and 7).

A time-series analysis, combining the detailed information a community-level study provides with the synoptic spatial and temporal perspectives of remotely sensed data, offers a more comprehensive evaluation of

forest change. With this in mind, we used GPS units to locate the specific forests in which the earlier field research had taken place and integrated forest plot information with a Landsat image analysis to evaluate changes in forest cover under different governance regimes (Nagendra 2002; Sussman et al. 2003; McConnell et al. 2004; Nagendra et al. in press). Integrated research of this kind provides a more robust approach for answering the often complex and multidisciplinary questions associated with forest change.

While researchers who work with a mix of remote sensing, GIS, and field data to study land-cover change would like to initiate all aspects of a study at the same time and in optimal locations, often either the fieldwork or the remote-sensing and GIS work is already underway, and the other aspect must be added. Such is the situation in our Africa and Asia research, and while incorporating pre-existing work offers obvious advantages, it also entails certain challenges. Initiating research in field sites in most developing countries comes with significant costs associated with establishing local contacts and creating mutually beneficial institutional relationships. Other political, institutional, infrastructural, social, and cultural challenges range from local to national and require significant time, effort, and finances to learn and manage. The ability to leverage pre-existing research arrangements, relationships, and knowledge, however, can offer worthwhile advantages in time savings and reduced financial outlay.

We have learned valuable lessons in linking pre-existing work to new research (chapter 6). Much of IFRI's pre-CIPEC field program for collection of information on local institutional arrangements and forest conditions was initiated prior to the widespread availability and affordability of handheld GPS receivers. The lack of spatial georeferencing can make direct integration of these field data particularly challenging. Sites selected for

studying the impact of institutions on resource conditions are frequently constructed around specific resources and how communities access and use them. The IFRI fieldwork, which forms the foundation of our research in Asia and Africa, is locally descriptive and hence represents relatively small areas, frequently ranging from tens to hundreds of hectares. As explained in chapter 6, CIPEC primarily has relied on Landsat images, whose footprint is much larger (see figure 3.7) and covers an area of more than 3,000 hectares. These contrasting spatial extents pose a challenge with regard to how the two different kinds of data can inform each other. Overcoming this challenge constitutes an important aspect of studies that incorporate both social and biogeophysical datasets collected across multiple extents and durations (see chapter 9 for a discussion of intraregional comparison methods). An "ethnography of landscape" approach (Nyerges and Green 2000), which is based on the combination of detailed field studies with the spatial and temporal synoptic view offered by remote sensing, offers great potential for the study of forest distribution over large areas (Nagendra and Gadgil 1999; Nagendra 2001; Green et al. under review).

The specific challenges we have faced in building on prior research analyses include determining whether forests and communities included in the earlier work are representative of a larger spatial area and assessing how processes acting in the broader area covered by satellite images can influence the character of institutions and forests studied in the earlier work. We addressed these challenges in our study countries using different approaches. For our African studies, the matching of prior field sites and satellite images took advantage of the clustering of IFRI sites in Uganda and Madagascar (figures 12.1 and 12.2) such that a single Landsat location (see chapter 6) encompassed multiple sites. In Asia, given the wide variation in topography within our study areas in the sub-Himalayan regions of Nepal and India, the sites were

deliberately not clustered and chosen to include a wide range of topography, forest-cover types, and biophysical and social conditions (figures 12.3 and 12.4).

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The combination of GPS location information and the volume of detailed vegetative description contained in the site-specific data added significant value to the training samples used for analysis of the satellite images. While the earlier sites do not cover the full extent of the satellite images, they nonetheless provide an important entry into understanding the processes underway in the broader area, facilitating research into how local social and environmental characteristics affect the larger area and vice versa.

Research Themes and Initial Findings in Africa and Asia Challenging the Conventional Wisdom on Land-Cover Change:

The Population-Degradation Narrative

At the continental scale, Africa and Asia are characterized by very long human occupatios—much longer than the Americas—and by very rapid population growth. Human-environment dynamics in Africa and Asia may thus appear to support a Malthusian connection between rapidly growing population and declining resources (see chapter 2), because forest cover is declining on both continents, while population growth rates are among the highest ever recorded. While policies rooted in assumptions of pervasively degrading landscapes due to population growth and unsustainable land use persist, recent studies have challenged a strictly linear causal relationship between them (Turner et al. 1993; Batterbury and Taylor 1998; Angelsen and Kaimowitz 1999; Place and Otsuka 2000; Lambin et al. 2001; Lee and Barrett 2001; Reenberg 2001; McConnell 2002a; Nagendra and Agrawal 2004). A growing body of empirical evidence has

challenged the conventional wisdom relating population increases to resource degradation, and specific case studies in Africa point to a landscape that has apparently been historically misread (Tiffen et al. 1994; Leach and Mearns 1996; McCann 1997; Gray 1999).

While the countries in which our research has been undertaken—Uganda, Madagascar, Nepal and India—saw rapid population growth in the late twentieth century, the histories of our specific research sites reveal the significance of major migration events before, and subsequent to, European colonization. Madagascar was only settled from Indonesia around 1,500–2,000 years ago—a much shorter time than North America, first colonized by humans at least 10,000 years ago. "Stone age" peoples in Uganda were displaced as the area was settled by "iron age" agriculturalist Bantu peoples from an area near present-day Nigeria only 2,500 years ago.

While urban grain-growing civilizations have been documented in the Indian subcontinent since 5300 B.P., there have been successive waves of migration from different countries into India and Nepal, which continues today. There was considerable movement of ethnicities, religions, and cultures in these areas, with possibly multiple waves of deforestation and reforestation, occurring over millennia. As discussed later in the chapter, the eradication or control of diseases, including malaria and tsetse, have enabled migration into areas previously sparsely inhabited, with significant implications for forest cover.

Africa

Perhaps the most well-known case of misread landscapes was documented by Fairhead and Leach (1996) in an analysis of historic aerial photographs and contemporary satellite images. Their study documented expanding forests near Kissidougou, Guinea, along a portion of the Guinea savanna-forest boundary in West Africa. Detailed land-cover

histories were linked to specific land-use practices in and around village centers. Forest patches in this landscape were shown to represent anthropogenic afforestation, *not* the remnants from pervasive degradation of prior continuous forest cover as had been previously assumed. Such findings are important because they challenge the dominant paradigm established in colonial-era narratives of nearly ubiquitous African environmental degradation at the hands of local populations. Their findings also support models developed by Posey (1985), who documented similar anthropogenic forest production among the Kayapó of central Brazil. In a recent study, Nyerges and Green (2000) have contributed to this discussion by examining forest-cover change in the Kilimi area of northwestern Sierra Leone, in another part of the Guinea savanna-forest boundary. They found that while areas of forest-cover expansion do exist, the dominant land-cover change process documented by Fairhead and Leach (1996)—forest island growth from changing soil structure and fertility, seed import, and fire protection—is not universal. In South Asia, there is similar debate over evidence pointing to widespread deforestation in the sub-Himalayas, where tragic consequences (landslides and floods) often are predicted (Ives and Messerli 1989).

The debate in the literature reflects CIPEC's findings in parts of the Western Hemisphere, including Mesoamerica (chapter 10) and Indiana (chapters 6, 7, and 8). Similar to our Mesoamerican sites (Tucker et al. 2004), the long periods of human occupation and coexistence with forests in Africa, together with the variety of production systems, do not appear to fit easily into notions of either a pervasively degrading or a pervasively reforesting landscape. Instead, the landscapes are patchworks of loss *and* gain of woody biomass. As such, what are the aggregate influences, what is the aggregate direction, and, given African histories of landscape occupation, what is the appropriate time from which to begin measuring these losses and gains? CIPEC's research into these questions as they

apply to Africa (and to Asia), linked with work on land-cover change in the Western Hemisphere, can contribute to a more robust understanding of the spatial and temporal forest changes.

In Uganda, we observed the long-term stability of gazetted forest reserves (forests owned by the government that are not designated as national parks) located in the West Mengo (Mpigi) region (see the online supplement of Dietz et al. 2003). Their boundaries have long been recognized and enforced and have been remarkably stable since the first aerial photographs were taken in 1955. The long-term stability of forest boundaries and cover in the forest reserves is explained primarily by the persistence of well-demarcated and enforced boundaries, continued government intolerance of conversion to agriculture, assignment of local forest rangers to implement and enforce Forest Department management goals (practices maintained by the postcolonial government), and the rapid canopy closure after stem removal. The poor drainage of the soils in the forest reserves also helps discourage conversion to agriculture without major technological investments. Recent increases in illegal harvesting, however, may undercut this long-term stability (Vogt 2003; Banana et al. under review).

We also observe in portions of Uganda human-forest interactions that have led to an advance of trees onto an edaphic grassland savanna, but under a mechanism different from that observed in West Africa (Vogt et al. under review). Our study covers part of Bugala Island, located within Lake Victoria. Until a few decades ago, the island was largely uninhabited due to the presence of tsetse flies. Since 1980, the island has experienced a sustained increase in the number of farmers, new construction of villages and schools, and a variety of new agricultural endeavors.

We documented the advance of woody plants into grasslands (due to changing grassland utilization) and a

subsequent increase in woody biomass on the agricultural landscape by combining Landsat-derived color composites with field observations. A 1995 Landsat Thematic Mapper multispectral color composite was draped over a thirty-meter digital elevation model (shown in a of figure 12.5). The forest/nonforest boundaries as of 1955 also are shown. In this figure, the presence of grassland is indicated by bright tones, and forest is darker (with the darkest areas indicating recent grass burns). The figure shows that forest has expanded into grassland between 1955 and 1995. An oblique aerial photograph (b), taken in 2001 at approximately 500 feet above ground, reveals that woody plants have continued to expand into the savanna since 1995. If past trends continue, one would expect areas with many individual small trees (b in figure 12.5) to be colonized by continuous forest at some date in the future.

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Forest loss in Madagascar (see figure 6.4) has been well documented in both the eastern moist tropical forests (Green and Sussman 1990) and in the dry tropical forests of the south (Sussman et al. 2003), but the proposition that Malagasy forests are universally in decline has been challenged in recent years, as research reveals recent examples of increases in tree cover on the island's central plateau. For example, Kull (1998) and McConnell (2001) have found evidence, using aerial photographs, of the proliferation of fruit orchards and other woody species in the highlands since the 1960s, while Bertrand (1999) has documented the expansion of fuel wood plantations around the capital, Anatanarivo. Our analysis of time-series Landsat images at several IFRI sites in eastern Madagascar, shows that pine, eucalypt, quinine, and acacia forests were found to have exhibited great dynamism (expansion and loss) over the past several decades..

Similarly, analyses of remotely sensed images and field observations in southern Madagascar show that the dry forests (figure 12.2) have not undergone uniform change

throughout the area (Clark et al. 1998; Sussman et al. 2003). While many forest stands have remained virtually unchanged, others have undergone massive clearing. A large number of small, circular, forested stands surrounded by cleared agricultural land on the southeastern coast of Madagascar were observed in Landsat images from 1973, 1985, and 1999. They range in size from 300 m to 400 m in diameter, each covering from seven to thirteen hectares (Clark et al. 1998). Multitemporal color composites show that many of these stands have not experienced significant change since 1973, and comparison with maps based on aerial photographs taken around 1950 shows that the boundaries have remained virtually unchanged during the past fifty years (Sussman et al. 2003). Further, the patches probably have existed without change for the past 300 years, because Robert Drury, who was shipwrecked there in 1701, mentions them in his journal (Drury 1970 [1729]).

Dry forest clearings appear to be associated with a range of land-cover change processes, such as subsistence agriculture, commercial charcoal harvesting for a domestic urban market, and commercial agriculture for an export market (Green et al. under review). Field observations and interviews show that the spatial and temporal patterns of these three processes are significantly different. Qualitative analysis based on interpretation of multitemporal color composites (for example, figures 6.5 and 12.3) indicates that clearing for subsistence agriculture in southern Madagascar has increased in the last 50 years and is not associated directly with proximity to major roads. In contrast, clearing for charcoal for cooking fuel began in the early 1970s and is associated with major roads and a nearby town. Forest clearing for corn production destined for export as cattle feed is a more recent phenomenon (since 1980), has progressed rapidly, and has occurred closer to the nearby coastal port than other types of clearing. Another short-lived deforestation episode (see figure 6.5) was associated with

the arrival of subsistence farmers fleeing an area affected by drought (figure 6.8). Our work also reveals the fragile nature of these dry forests (Sussman et al. 2003; Green et al. under review)—once cut, many convert to secondary grassland.

While the various interpretations of African landscapes contribute to the development of a general understanding about how landscapes function over long periods of time and across large spatial extents, our work points out that multiple mechanisms of land-cover change acting concurrently and coevolving are more likely than a few pervasively operating mechanisms such as those described by Malthus (1989 [1803]) and Fairhead and Leach (1996). The incredible range of conditions, both social and biogeophysical, on the African continent has led to numerous, different mechanisms operating simultaneously. Policy approaches intended to address human-environment relationships will need to engage this diversity.

Asia

In the sub-Himalayan region of Nepal, an intense, thirty-year debate has focused on "the theory of Himalayan degradation." Central to this debate is Yukon's (1979) dramatic assertion that caught the attention of the world: Nepal had lost half its forest cover between 1950 and 1980, and unless steps were taken, there would be no accessible forests by the year 2000. Despite this alarming prediction, large parts of Nepal are still forested, several years after 2000, and there is much evidence of recent reforestation (Ives and Messerli 1989). Even so, deforestation continues in accessible areas, indicating that critical gaps in knowledge exist and more studies are needed to examine land-cover change over larger areas, across a range of biophysical and ecological environments, and covering temporal durations of several decades.

Our initial analysis, in the plains and middle hills of Nepal (figure 12.4), indicates that much deforestation

has occurred since the late 1950s. In the plains, scholars have pointed to the successful efforts of the World Health Organization, the U.S. Agency for International Development, and the Nepali government to combat malaria during the late 1950s as a cause of major migration into the area from India and from the middle hills of Nepal (Bista 1991). The efforts did reduce the number of malaria infection reports from two million cases a year in the 1950s to under 2,500 in 1968 (Jha 1993:37). Government agencies widely publicized the successful malaria eradication program in the middle hills regions and many land-hungry families migrated south as well as some families' migrating north from India Resettlement programs were sponsored by international donors (Moran 1991) . The population of the Terai was estimated to grow by tenfold within a decade of malaria eradication (HMG/N 1984). Even with substantial migration to the south, however, population in the middle hills also has increased substantially since the 1950s.

While substantial deforestation has been observed in many locations, we also have detected significant reforestation as well. Thus, it appears that the sub-Himalayan region is a shifting mosaic of forest loss and gain. Careful interpretation of this diversity is needed. Drawing on methods developed and used in our Mesoamerica research (Southworth et al. 2002; Nagendra et al. 2003; see also chapter 10), we find that differences in land-use/ land-cover change in our Asian study sites are related to the social, institutional, and biogeophysical differences between these areas (Schweik et al. 2003; Nagendra and Schweik 2004). Our research in Indiana (see chapter 6) and Honduras (Southworth and Tucker 2001; Munroe et al. 2002; Southworth et al. 2002; see also chapter 10) has shown that surviving forests tend to be located on steeper slopes, at higher elevations, and in less accessible areas than those forests that have suffered loss. Specifically, the topography in the middle hills is much more rugged and

presents far greater challenges to human movement, forest protection, and agriculture compared to the topography of the plains (figure 12.4). In the Nepal Terai, landholdings and communities tend to be larger than those in the middle hills. Communities constitute a mix of indigenous lowland inhabitants and immigrants from the middle hills, in contrast to the relatively homogeneous inhabitants of the hill forest communities.

Our examinations of the conventional wisdom concerning the fate of forests in Africa and Asia reveal pictures of considerable complexity and contribute to debunking the simplistic, Malthusian view often persisting from the colonial era. The next section describes our efforts to explain the differential role of institutions in shaping patterns of forest-cover change in these regions.

Forest Governance: Ethnic Identity, Land Tenure, Conservation and Decentralization

Having determined that forest-cover change is not unidirectional and that observed dynamics cannot be explained simply by population pressure, our research has sought to explain the role of institutional factors in our study sites in Africa and Asia. Two fundamental, and related, differences in the experiences of European colonization and in the contemporary role of ethnic identity lead us to expect different contexts of forest governance in our Africa and Asia research sites than we have found in the Americas.

While Asia, Africa, and the Western Hemisphere all experienced colonialism, the timing, character, and outcomes of colonial occupation were quite different. At the time of independence from European rule in the Western Hemisphere, the European influence was dominant, and those countries continued to be governed by European descendants. In contrast, indigenous populations were, and continue to be, much higher in both Asia and Africa, and the postcolonial era saw a stronger mix of native and European

cultures. In Africa, European constructs have been taken and used in African ways, and countries are governed by Africans. In parts of South Asia, including India, the culture and governance also remain Asian, but with a significant European bureaucratic logic. Nepal, with the exception of parts of the Terai, was never occupied or colonized by Europeans; however, the Nepali forest bureaucracy interacts extensively with the Indian Forest Service, and many Nepali foresters were trained in India.

Identity plays a large and pervasive role in land use in Africa and Asia, and operates in significantly different form from in the Americas. Ethnic identities in particular, but religious, geographic, and economic identities as well often are much stronger in Africa and Asia than national identities. Smith (1988) notes, "the ethnic 'self' remains the fundamental territorial 'self' in Africa" (p. 78). And in many cases, the existence of ethnic, religious, geographic, or other identities to which primary attachments persist, can be based on connections to land, home area, or territory (Unruh 1998). Dislocation from home areas via conflict or food shortage can result in a relative rise in the influence of identity-based attachments to land, especially if there is an identity component to the dislocation event, and destination locations for migrants become problematic for reasons involving identity (Ibrahim 1998). Notions of identity also can involve land claim justification based on earlier historical occupation. Migrants can then seek out such areas as destination locations, supported by oral histories that can be traced back through time into mythologies about how various peoples came to exist in an area and in the world (Comaroff and Roberts 1977). Such justification can gain renewed strength during dislocation and migration, and the pursuit of a return to historical lands or territory—from which groups were expelled or departed, recently or long ago—can become a priority in a migration event (Unruh in press). In some cases, such a situation can be seen as a

singular opportunity to regain historical lands. In such a context the viability of institutions for rational management of forest resources can be extremely problematic, as various groups, including the state, vie for control of areas and resources.

In many parts of Africa and Asia, customary tenure continues to shape land-use practices, sometimes in tenuous balance with formal, state-sanctioned land rights. At the same time, the effectiveness of major investments in the creation and maintenance of conservation areas in both continents has been questioned. Both of these issues are intertwined with efforts to decentralize control of forests resources. Our research examined (1) different institutional arrangements as mediated by the relationships between customary and formal tenure regimes; (2) the relationship between local community use of forest products and conservation objectives; (3) local attempts to devolve rights from the formal domain to the customary; and (4) the conditions, constraints, and opportunities that ecotourism can provide in the management of forests.

Africa

In the Mpigi District in Uganda, boundaries of gazetted forests have long been recognized and enforced, and have been remarkably stable. Agreements between the British colonial government and the Regents of the Buganda Kingdom in 1900 and 1907 established a process to register private land parcels, referred to as *mailo* land, as well as the gazetted forests. In the 1930s and 1940s, the gazetted forest reserve boundaries were demarcated with earth cairns and the traditional boundary tree or shrub planted at each cairn. Relevant *mailo* owners and traditional administrators were present during the process of demarcation to ensure agreement on the locations of the gazetted reserve boundaries. Since the 1930s, the Ugandan Forest Department has periodically remarked these boundaries. Conversion of gazetted forest reserves to other purposes is consistently

prosecuted even though some charcoal harvesting in small areas may be tolerated by government officials (Vogt 2003). A study comparing IFRI field measures obtained from nine forests in the Mpigi district in 1995 with similar measures obtained in 2000 after a major reduction in the local staff of the Forest Department, however, did reveal deterioration in biomass, basal area, and stem density due to increased levels of tree harvesting (Banana et al. under review).

Expanding forest cover on Bugala Island is also closely linked to institutional factors. The explanation for the advance of agriculture into grasslands, while nearby forests exhibit less clearing, is found in the differences in land tenure between the two categories of land. While both categories are *mailo* land (customarily based), significant enforcement exists in the form of rules against the clearing of forest for agriculture, while similar rules protecting grasslands are not enforced nearly as strictly. The observed agricultural encroachment has resulted, and with it trees have spread into the grassland (figure 12.5).

In Madagascar, preservation of parks is a national priority due to global interest in certain fauna species, particularly lemurs (Sussman et al. 2003), and a number of changes in national policy seem to have played a significant role through time. In the eastern moist tropical forest of Madagascar, our analyses have demonstrated the effectiveness of the Mantadia National Park at halting deforestation, while nearby forests continued to be cleared for agriculture (McConnell 2002a, 2002b; McConnell et al. 2004). Subsequent examination of other forms of forest governance revealed mixed success at preventing forest conversion. A Landsat image time-series analysis suggests that variable rates of change are related to the history of national forest policy and the resulting enforcement activities. The studied forests that are favorably located for generating tourist revenue or have enjoyed substantial external investment appear to have

stable or growing forested areas, compared to private forests and to more distant government forests in which fewer resources are available.

The many isolated stands of tropical dry forest, mentioned earlier, in the southern part of Madagascar appear to be protected by local institutions (see the online supplement of Dietz et al. 2003). Landsat multitemporal color composites and aerial photographs reveal that many of these forests have enjoyed this protection for at least 50 years (Green et al. under review). Referred to as *fady* or taboo forests, local Antandroy peoples have maintained several hundred forest remnants as sacred areas (Elmqvist 2004) that often protect grave sites. Engström (2001) found more than 1,400 of these forest patches evenly distributed throughout the area, but they covered only 4 percent of the total area in the author's analysis. Drury (1970 [1729]) mentioned the sacred grave sites of this region in his journal. Thus, these sacred forests may have been respected by the local people and protected by communal institutions for more than 300 years.

Asia

In large parts of Nepal and India, the protected areas have remained relatively well forested in the face of increasing population pressure. Data from three IFRI sites in the Chitwan district provided us with information on seven forest patches in three different institutional categories: (1) a protected area (the Royal Chitwan National Park), (2) national forests, and (3) areas recently handed over to local users as community forests. All seven forest patches are dominated by *Shorea robusta*, an important tropical moist deciduous hardwood tree. A total of 69 forest sample plots had been laid out in the community forests, 102 plots in national forests, and 45 plots in the national park (see chapters 4 and 5 for a description of plots in IFRI research). Analysis of the forest plot data revealed that,

on average, vegetation density and species diversity in the community forests in the heavily populated Terai region were lower than in the national forests, which in turn were in poorer condition than the forests within co-managed buffer zones at the edges of the national park (Nagendra 2002). Research conducted in the middle hills, however, has documented community forests in much better condition (Varughese and Ostrom 2001). The high levels of biodiversity and biomass found in the protected national park were not surprising, given the manpower and external resources available for preserving the area from human use. Without the same levels of manpower and resources, it is doubtful other areas of the Terai could expect similar results. The fact that areas in poorer condition are handed over to local communities to be managed as community forests (while the forests with greater vegetation density and biodiversity are retained by the Forest Department as national forests under their control) signify the largely top-down nature of these reforms and may indicate a lack of devolution of power to local communities.

In recent years, buffer-zone development projects near protected areas in Nepal and India have sought to provide economic benefits to the local communities through ecotourism, but there is a lack of empirical examination of the effect of these innovative approaches on forest regeneration. However, our image analysis (see figure 12.3) in the Nepal Terai demonstrates that these policies have led to a dramatic increase in forest cover in the buffer zone of the Royal Chitwan National Park during the past decade (Schweik et al. 2003; Nagendra and Schweik 2004).

For the Chitwan district, an initial proof-of-concept methodology was developed and evaluated to locate reforestation anomalies where effective institutions of forest management have impacted forest regrowth significantly. Our methodology combines deforestation theory with satellite image change analysis to identify forest patches that are inconsistent with forest patterns

observed across a larger spatial extent (see also an example from Indiana in chapter 6). Based on CIPEC research on processes leading to deforestation in Honduras (Nagendra et al. 2003), an analysis of deforestation literature, and our knowledge of the landscape, we identified elevation and distance from roads as two variables that are significantly associated with forest cover in the study area. A multitemporal color composite derived from three nearly cloud-free Landsat images from 1976 (MSS), 1989 (TM), and 2000 (ETM+) were examined together with a GIS database on roads and a visual estimation of topography to identify ten forest anomalies (blue and green areas in figure 12.3). Many of these areas had maintained or regenerated tree cover between 1989 and 2000 despite their locations in areas at low elevation and their proximity to roads (Schweik et al. 2003).

A rapid field reconnaissance was undertaken to determine which of these forest anomalies exhibit interesting management innovations. The anomalies we identified fall into three institutional categories: (1) state government command and control, (2) profitable private plantations, and (3) common-property community management. While both state protection and private plantations have the potential to promote regrowth and generate resources, they are, by their very nature, not necessarily equitable forms of resource sharing. Thus, the most interesting of these, from the perspective of identifying common-pool resource institutions that have potential for sustainable and equitable management, are several forest patches adjoining the Royal Chitwan National Park (figure 12.3). These patches fall within the buffer-zone community forestry program and are managed by the forest user communities that derive income from ecotourism (Schweik et al. 2003). We selected one of these forest patches for detailed field study, and it turned out to be a major case of community forestry and a premier ecotourism initiative that we were not aware of until we undertook

this analysis. However, further field research and interviews with user groups indicated that this particular forest management approach is being implemented in a fairly top-down manner.

This methodology allows us to sample a diverse array of land-use/land-cover change patterns and institutional regimes. Thus, we are able to quickly identify areas that have potentially important institutional configurations and to more thoroughly document those institutional arrangements using field studies. Since we know the anomalies do not follow broader deforestation patterns, such as those associated with proximity to roads and population growth dynamics, this finding lends strong support to the hypothesis that institutional arrangements can have significant influence in shaping land-cover change. This methodology also can help to quickly generate or refine hypotheses on what types of institutional arrangements lead to which patterns of land-cover change and, in turn, could facilitate studies using random sampling approaches that provide more variation in dependent and independent variables.

Among developing countries, Nepal has become an enthusiastic leader in setting conservation goals and priorities and experimenting with participatory systems of forest governance (Agrawal et al. 1999). CIPEC research examining the effect of these policies on forest-cover change has enabled us to compare our findings with ongoing analyses of decentralization in a very different context in Bolivia and Guatemala.

Prior to the mid-1950s, traditional practices of forest management were prevalent in the middle hills of Nepal. The Nationalization Act of 1957 brought all forested land under government ownership. As in many other developing countries, the process of nationalization in Nepal converted many limited-access, community-controlled forests to open-access resources (NRC 1986). This loss of ownership by local communities resulted in increased levels

of deforestation in several national forests. Subsequent forest acts have attempted to return some degree of ownership and control of forest resources to the people. By 1999, over 620,000 hectares of forest area had been handed over to 8,500 forest user groups. The most vigorous implementation of these policies has been in the middle hills, where 83 percent of community forests are located (Chakraborty 2001). In contrast, only 17 percent of all community forests are located in the Nepal Terai, and doubts have been expressed about the feasibility of expanding community forestry in this region (Schweik 2000). Problems of implementing community forestry are mostly related to differences in topography and history of settlement between the Terai and the middle hills. While the middle hills have supported local populations for centuries, the Terai has experienced extensive in-migration since the eradication of malaria in the 1960s, and recent deforestation has resulted (Schweik et al. 1997; Matthews et al. 2000). Relatively low forest resource usage prior to the 1960s minimized the need for traditional systems of forest protection, and the challenge for community forestry in the Terai now is to support the creation of new institutions of community forest management that can manage effectively with the increased demand.

The contrast between the relationship of recent migrants to the forest and indigenous user's perceptions of the forest (also seen in other CIPEC sites in Africa and the Americas with long histories of indigenous use)—as a living resource with spirits, gods, and a variety of resources to be used but also protected for future generations—has led to significant conflicts. The conflict over land between the various ethnic groups that have moved to the Terai from the middle hills and the indigenous, long-term residence of the region, such as the Tharus, was substantial. Families who had lived in the region for centuries, but had not registered their land under new

legislation, were evicted from the traditional homesteads and villages (Jha 1993).

Our research in Nepal has thus enabled us to gauge the extent to which these approaches toward decentralization actually have been implemented on the ground and to evaluate their effectiveness. While the Nepal government has developed innovative programs of community-based forest management, concerns have been raised about actual levels of devolution. Although several studies argue that community forestry has been successful in improving the conditions of the people and forests in the Nepal middle hills (Gautam et al. 2002; also summarized in Chakraborty 2001), the effectiveness of community forestry in the Nepal Terai is being questioned (Schweik 2000). With forest users and the Nepali government taking opposite sides, the debate would benefit from careful empirical evaluation.

In contrast to Nepal, decentralization of forest management via the Joint Forest Management program in India has involved far less devolution of power (Agrawal and Ostrom 2001; Sundar et al. 2001). The existence of IFRI sites in similar biophysical and ecological regimes in the sub-Himalayan regions of India and Nepal sets the initial agenda for comparative analysis of decentralization policies in these two countries. With over fifty IFRI sites in the sub-Himalayan region of South Asia, the incorporation of remotely sensed time-series analyses will allow us to carry out a careful empirical examination of the outcome of policies of decentralization on local institutions and forest-cover change.

Lessons from the Africa and Asia Work

CIPEC's research in Africa and Asia demonstrates that forest loss is NOT an inevitable result of population growth. At our sites in Uganda, Madagascar, India, and Nepal, we find institutional regimes assuring the stability, and even expansion, of forest cover despite rapid population growth at the national level. We find

significant deforestation events often associated with specific biophysical and social factors. While the number and distribution of our studies do not enable us to offer general propositions about forest dynamics, they do contribute to a growing understanding on the topic that appears headed toward a coherent framework of understanding.

Several different institutional regimes provide evidence of successful governance of forest resources in our study sites, including management regimes rooted in ethnic traditions, as well as state-sponsored (and internationally assisted) conservation regimes, especially when local communities are given the opportunity to benefit from tourism-based revenues. A number of cases have been identified as successfully managed private forest plantations, at least as judged by the stability or expansion of tree canopy over time. By contrast, large forest resources held under the centralized control of national agencies with insufficient resources and thus inadequate monitoring of forest boundaries appear in many cases to have been the subject of considerable loss of forest cover. These findings underline the importance of careful examination of co-management arrangements that take advantage of not only professional expertise and external resources, but also of the ability of local communities to assure the monitoring and maintenance of forest resources.

Future Directions of CIPEC Research in Africa and Asia: Social Phenomena Different from Those in the Western Hemisphere and their Intersection with Forest Use

An issue of particular importance in future research in Africa and Asia is the conflict and resulting displacement of people. It is our intention to pursue this issue in our ongoing research in these regions.

Conflict and Refugees

In recent decades, refugees have become a significant aspect of African land-cover and institutional change, and complicate research on the intersection of institutions and forest-cover and environmental change. Post-independence conflict, drought, floods, and famines have produced ongoing forced dislocations in Africa (Unruh 1993) not comparable in magnitude or character with the Western Hemisphere. While dislocatees that cross international borders are labeled as refugees and qualify for international assistance, and often settle in organized camps or settlements, the number of internally dislocated persons is often much higher and they are rarely resettled in any organized fashion. The differences in terms of land-cover change and change in institutions are large (Unruh 1993; Unruh and Lefebvre 1995). First, migrations due to forced dislocation disrupt resource use at both source and destination locations—with influences on institutions and land-cover change. Ostrom et al. (1999) make the point that if resource users are added rapidly, such as through migration, local communities and migrants will not share similar understandings of resources and resource use and access.

Second, how refugees settle in destination areas can have a significant influence on land-cover change. Different patterns can emerge from modes of settlement, including (1) in refugee camps or other concentrated areas, (2) in scattered locations within the host community, or (3) scattered in a wide rural area in and around the host area. Concentrated settlement of migrants due to security, humanitarian, or resource availability reasons can encourage forms of resource use that are more competitive and contentious (Unruh 1993, 1995b; Ghimire 1994), and lead to spatially acute forms of resource degradation (land, fuel wood, timber, water, et cetera) (Unruh 1993; McGregor 1994). Decisions about where government and donors locate concentrations of refugees are rarely made with local

community consultation, compensation, or coordination, especially with regard to how land is accessed and used.

Settlement of refugees in more dispersed fashion within a local community results in differentiated approaches to land-cover change. While a good relationship (ethnic, religious, economic, et cetera) between host and refugee populations may result in secure access to land-based resources (Wilson 1992) and more rational and conservative land resource use, this is frequently difficult to achieve. Refugees can derive their own forms of land access and claim in reaction to rules of exclusion by local communities, or exclusion from the institutions which facilitate an equitable place in the local (host) land tenure system (Unruh 1993, 1995a). Such alternative forms of claim and access can frequently result in land being cleared purely for the sake of claim. Often local rules of exclusion are constructed and enforced with regard to refugees in an attempt by the local community to avoid resource degradation and a "tragedy of the commons" scenario. Such exclusion often can be facilitated by the weak position of refugees vis-à-vis local communities (socially, economically, and politically) (Ghimire 1994). However, with resource needs and desperation frequently high among refugees, alternative ways, reasons, and legitimacy can quickly be configured in reaction to exclusion, competition, and confrontation with local communities (Unruh in press). Where refugees are able to engage local (host) resource access and use arrangements, subsets of local rules—special rules that provide limited rights for refugees—can be set up.

In Asia, the influx of refugees from political conflicts, famines, and floods, although far less in the India-Nepal context when compared to Africa, nonetheless pose significant challenges to the study of land-cover change. For instance, a significant influx of political refugees from Bhutan, have placed additional pressure on already scarce forest resources in the east-west Nepal-

India border areas. The tragic violence that has erupted in Nepal during the last decade is creating a new generation of homeless people—many of whom have migrated out of the rural areas to Kathmandu.

The influence of conflict and security issues on environmental change constitutes a significant domain of study. Conflict and insecurity, especially in Africa, operates in such a pervasive and ongoing fashion as to profoundly disrupt human ecologies for millions of people over very large areas (Bennett 1993; Unruh 1995a, 1995b, 2002). The forces of conflict, insecurity, and resource degradation in such disruptions operate in mutually reinforcing ways (Homer-Dixon 1990; Unruh 1993, 1995b, in press). Because few civil institutions can endure the stresses of armed conflict (Ostrom et al. 1999), much of the environmental repercussions from conflict and insecurity can be linked to institutional breakdown, malfunction, and absence, as well as attempts to impose alternative ways of ordering access and use of land resources. For example, the recent violent conflicts in Nepal have had an adverse impact on forest and animal conservation, with increased illegal timber extraction and smuggling, and wildlife poaching. Apart from the institutions of resource use that are directly affected, repercussions on economies, migrations, food security, law, and activities of the international community also affect local to national institutions and systems of resource use and claim. The role of conflict and insecurity on environmental change is likely to become more prominent in the future, given the general recognition that future instability will often comprise low-intensity conflict within nations rather than between them, with their origins buried deep within aggravating problems of inequitable access to resources—including, and often especially, land resources (Creveld 1991; Homer-Dixon 1991; Crocker and Hampson 1996; Sahnoun 1996; Unruh 2001, in press).

Conclusion

As work in Asia and Africa proceeds, we envision the challenges of the expansion to provide for valuable lessons for the conduct of significant aspects of human-environment interactions research. The need to tie remote sensing to pre-existing, local-level field research in a way that the two are able to bring more meaning to each other reflects in significant ways the realities of pursuing such research. Opportunities to bring either remote sensing to pre-existing field research, or the reverse, will in all likelihood be more frequent in human-environment interactions research, as this is more cost and time effective than initiating new research that combines these two aspects from the beginning. We see this as a significant contribution of the Africa and Asia work. In this regard borrowing from other approaches, such as that described for meta-analysis in chapter 13, may provide significant utility.

The different local contexts, histories, and social issues in Africa and Asia, compared to the Western Hemisphere, provide an important opportunity to extend our research on human-environment linkages to these different continents. How the processes of settlement and movement, as well as the constraints and opportunities of different economic, political, and cultural conditions are manifest on land-cover change, will present important insights into the fundamentals of processes, as well as highlight differences or similarities in potential policy approaches. The initial work in Africa and Asia demonstrates that there is substantive variation between countries and regions based on differences in history and in local socioeconomic, political, and biophysical contexts. This hints at the different approaches that are needed in the policy domain regarding workable arrangements for resource management, development, and participation in global efforts at mitigating the effects of global environmental change.

Figure 12.1

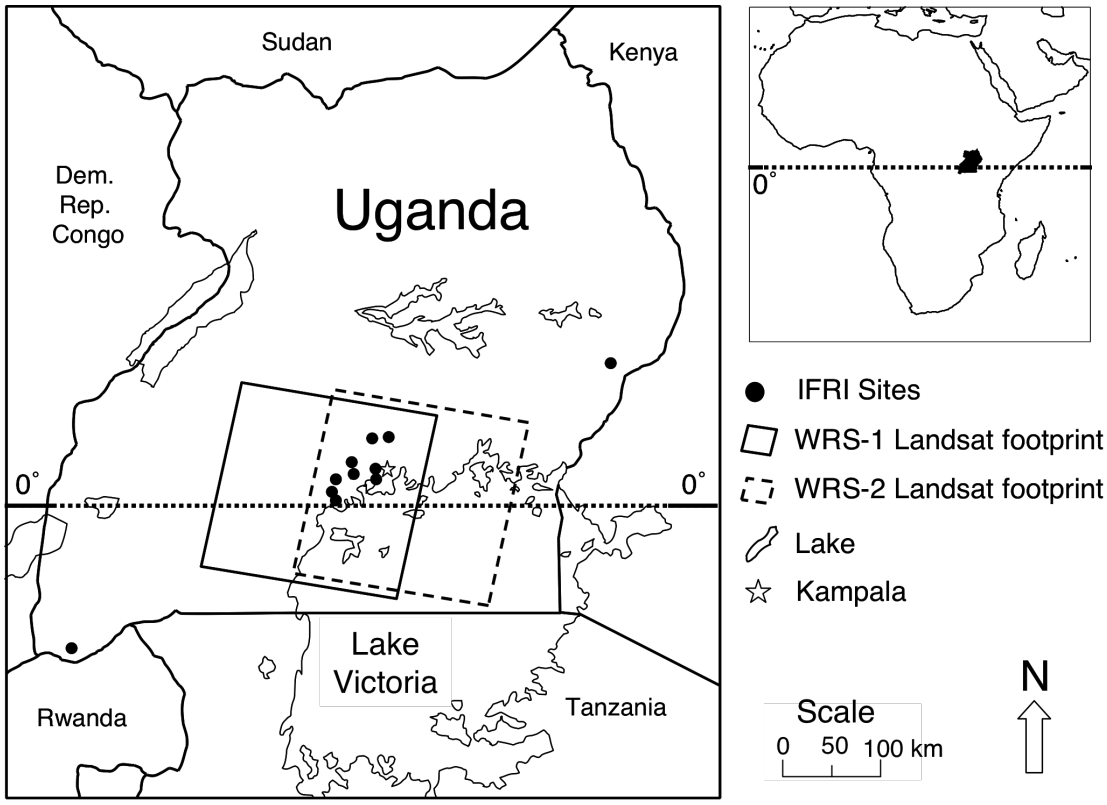

Sudan
Kenya
Dem.
Rep.
Congo
Uganda
0°
0°
Lake
Victoria
Rwanda
Tanzania
0°
IFRI Sites
WRS-1 Landsat footprint
WRS-2 Landsat footprint
Lake
Kampala
Scale
0 50 100 km
N

Figure 12.2

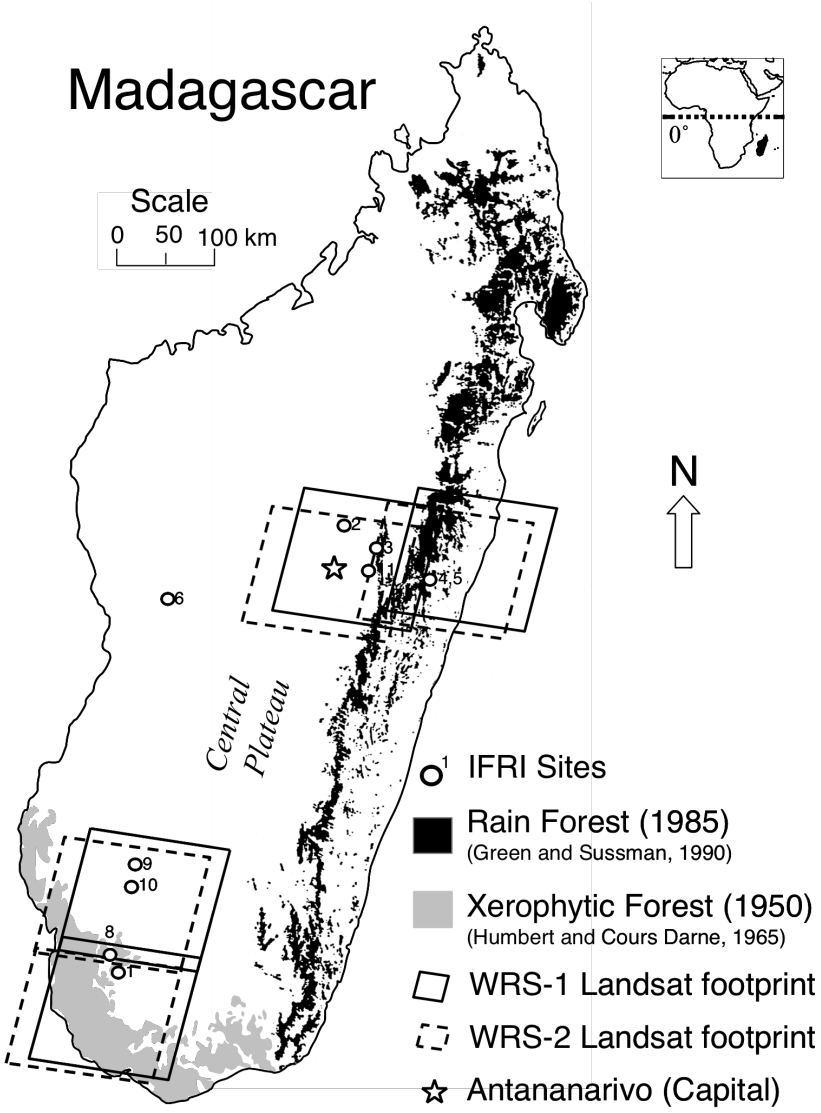

Madagascar
Scale
0 50 100 km
0°
N
Central Plateau
1 IFRI Sites
Rain Forest (1985)
(Green and Sussman, 1990)
Xerophytic Forest (1950)
(Humbert and Cours Darne, 1965)
WRS-1 Landsat footprint
WRS-2 Landsat footprint
Antananarivo (Capital)

Figure 12.3

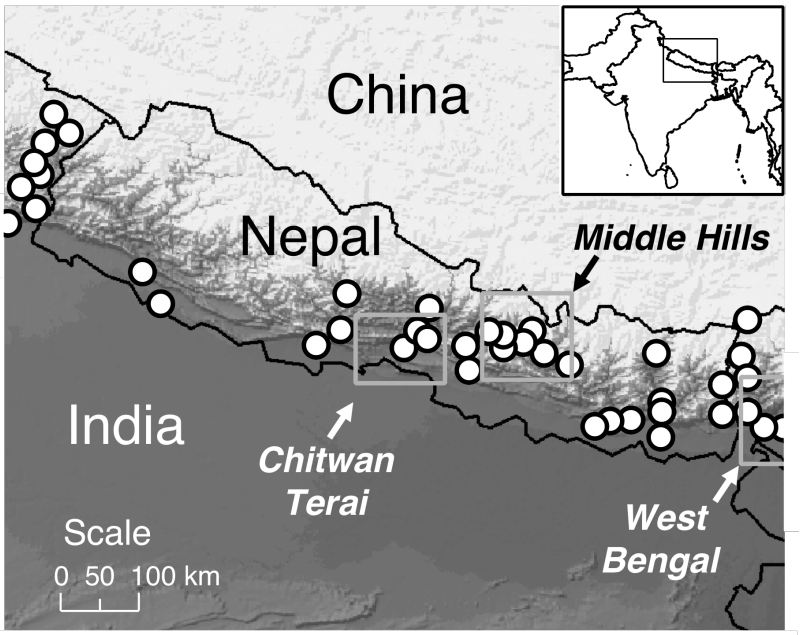
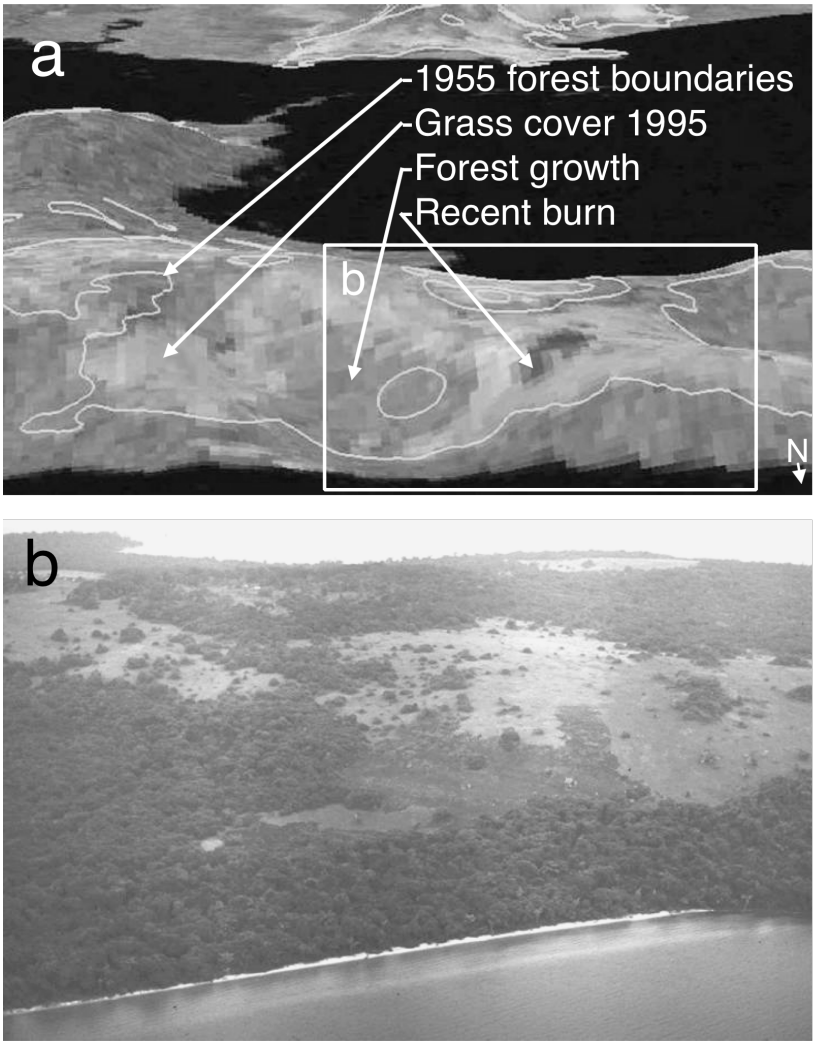

China
Nepal
Middle Hills
India
Chitwan
Terai
West
Bengal
Scale
0 50 100 km

Figure 12.4


a
1955 forest boundaries
Grass cover 1995
Forest growth
Recent burn
b
N
b