



International Forestry Resources and Institutions Research Program (IFRI)



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RESEARCH STRATEGY

by

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The International Forestry Resources and Institutions (IFRI) Research Program is a long-term effort to establish an international network of Collaborating Research Centers (CRCs) who will:

- continuously monitor and report on forest conditions, plant biodiversity, and rates of deforestation in a sample of forests in their country or region;
- continuously monitor and report on the activities and outcomes achieved by community organizations; local, regional, and national governments; businesses; NGOs; and donor-managed projects in their country or region;

- analyze how socioeconomic, demographic, political, and legal factors affect the sustainability of ecological systems;
- prepare policy reports of immediate relevance for forest users, government officials, NGOs, donors, and policy analysts;
- build substantial in-country capacity to conduct rigorous and policy-relevant research relying on interdisciplinary teams already trained in advanced social and biological scientific methods; and
- prepare training materials that synthesize findings for use by officials, NGOs, forest users, and students.

This Research Strategy provides a broad overview of the goals of the IFRI research program and its methods of operation. More detailed information about the structure and content of the IFRI database, theoretical foundations, and findings from initial studies is available from the Workshop in Political Theory and Policy Analysis, Indiana University.

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I. THE PROBLEM

Drastic measures to halt the alarming rates of deforestation, especially in the tropical forests of Central and South America, Asia, and Africa, are regularly proposed by officials, scholars, and those concerned with environmental issues. The term "crisis" often appears in the titles of scientific reports.⁽¹⁾ Noted scholars speak about "catastrophes about to happen,"⁽²⁾ or "mass extinction episodes"⁽³⁾. Indeed, projected rates of population growth, deforestation, and species loss are startling:

The world's human population is predicted to be 10 billion by the year 2025 and 14 billion by the year 2100.⁽⁴⁾

Most tropical forests "will be entirely lost or reduced to small fragments by early in the next century."⁽⁵⁾ "[P]rimary ancient forest areas are being destroyed at accelerating rates. At best, they are replaced by secondary forests which offer impoverished biodiversity, and, at worst, they are taken over by desertification."⁽⁶⁾

One quarter to one half of the earth's species will become extinct by 2020.⁽⁷⁾

These losses are often attributed to a set of causes that appear to vary depending on institutional affiliation, academic persuasion, or business/economic concern. Many individuals and environmental groups view commercial logging as the cause of deforestation.⁽⁸⁾ Shifting or new cultivation is viewed as the primary cause by scholars in other narratives.⁽⁹⁾ Excessive energy consumption is cited by others. Population increase is considered by many to be a prime candidate causing deforestation and other environmental harms.⁽¹⁰⁾

A singular view of the cause is frequently paired with a singular view of the solution. Preservationists have often addressed the problem through "save and preserve" solutions. Maintaining the position that strict actions must be taken to preserve the old-growth forests and the diversity of plant and animal life, proponents of this argument push for protected areas where certain activities, such as logging, are prohibited and species such as the spotted owl are protected.

Policy analysts often recommend changes in international agreements or shifts in national policy as a solution. At the United National Conference on Environment and Development (UNCED) held in Rio de Janeiro in June of 1992, three major policy documents were produced at the conference (the Rio Declaration, Agenda 21, and the Forest Principles) and two conventions released for signature (the Convention on Biological Diversity and the Convention on Climate Change). All of these documents proposed the adoption of international standards to regulate the use and management of natural resources --particularly forest resources, so as to enhance their diversity and sustainability over time.⁽¹¹⁾

National governments have adopted government and industry reforestation schemes, forest-based industrial developments, and forestry action plans. National policies range from changing forest commons into private land, assigning governments the responsibility of managing reserves and severely limiting access to these reserves, or prescribing community nurseries of pre-determined tree species in rapidly changing environments--without regard for indigenous people, their changing environments, and methods of management of forest resources.

Agreement seems to exist about the need for immediate action. Less agreement exists about which policies will lead to actual improvements. A common theme in the evaluations of national and inter-national efforts to stem the rates of deforestation is that many of these programs actually "accelerate the very damage their proponents intend to reverse" (F. Korten, 1993: 8).⁽¹²⁾

If the programs that are supposed to stem deforestation tend to accelerate it, something is wrong! The IFRI research program will attempt to ascertain what is wrong and provide better answers to the question of how to reduce deforestation and loss of biodiversity in many different parts of the world. In our efforts to understand what is wrong, we have identified three problems: (1) knowledge gaps, (2) information gaps, and (3) the need for greater assessment capabilities located in countries with substantial forestry resources.

1. Knowledge gaps refer to the lack of an accepted scientific understanding about which variables are the primary causes of deforestation and biodiversity losses, and how these variables are linked to one another. Policies that suggest ways to improve the effects of deforestation are often based on a model or theory about why deforestation is accelerating. However, the current status of theoretical explanations of the causes of deforestation and biodiversity losses is in flux. No agreement exists within the scientific community concerning which of multiple contending models of deforestation and biodiversity loss are empirically valid.

2. Information gaps refer to a lack of reliable data about specific policy-relevant variables in a particular time and location. In other words, the data needed to test competing theories of

deforestation and biodiversity losses are not generally available. Detailed data about forest conditions within a country that are important for policy making are also not available.

3. *Assessment capability* is the presence of permanent in-country centers with interdisciplinary staffs trained in rigorous forest mensuration techniques, participatory appraisal methods, institutional analysis, statistics, qualitative analysis, geographic information systems (GIS), and database management.

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II. ALTERNATIVE APPROACHES TO SOLVING THE PROBLEM

Within the U.S., the Committee on Environment and Natural Resources (CENR) of the National Science and Technology Council focused on the need for a better scientific foundation for future policy initiatives. CENR held a National Forum on Environment and Natural Resource R&D at the National Academy of Sciences in late March of 1994 in Washington, D.C. The Forum brought together representatives from industry, academia, nongovernmental organizations, Congress, and state and local governments to articulate their views on the strategy and priorities for issues related to environmental change. The Forum reached several conclusions about critical research needs that are relevant to the design of the IFRI research program. These include:

An improved understanding of the environmental issues requires a long-term commitment to a balanced research program of systematic observations (monitoring), data and information systems, process studies, and predictions (CENR, 1994: 5).

The areas most in need of augmentation are:

- (i) the scientific basis for integrated ecosystem management;
- (ii) the socioeconomic dimensions of environmental change;
- (iii) science policy tools;
- (iv) observations, and information and data management; and
- (v) environmental technologies (ibid.).

When focusing on the socioeconomic dimensions of environmental change, the Forum identified specific research that needed substantial augmentation and emphasis. These included efforts to:

understand the societal drivers of environmental changes, including the analyses of the environmental impacts of various patterns and growth of population, economic growth, and international trade;

promote policy analysis, including the design, comparison, and *ex post* evaluation of the effectiveness of policy alternatives to prevent, ameliorate, or manage environmental problems;

promote the analysis of environmental goals, encompassing the concepts of distributive justice, procedural fairness, community participation, and economic well-being; and

promote the analysis of the barriers to the diffusion of environmentally beneficial technologies (CENR, 1994: 6).

These critical research needs are challenging and require diverse approaches. One approach is that of global monitoring relying primarily on national inventories and satellite imagery. Major progress to implement this approach has been taken by FAO (1993). A second approach is to link permanent forestry and agro-forestry Research Stations to foster more rapid exchange of scientific findings about how ecological systems are affected by (and affect) climate changes, increased pollution levels, and other environmental threats. Efforts of the U.S. National Science Foundation (NSF) to create such linkages have been successfully initiated.

A third approach--the one taken by the IFRI research program--complements the first two approaches and generates policy-relevant information not available from other strategies. The IFRI program provides an interdisciplinary set of variables about forest management and use that are assessed near the forest in relationship to the local communities utilizing and governing the forest. The effects of district, national, and international policies as they impact on a local setting can be assessed through this effort. The results of IFRI studies provide in-country information for policy makers at the local, district, regional, and national levels. This information will be collected by researchers who are deeply familiar with the local settings rather than collected from secondary sources that are compiled by international organizations or by national agencies drawing on various sources of externally compiled information. The IFRI research program relies on the building of a permanent international network of CRCs. Each CRC will:

design a long-term monitoring plan to include a sample of forests located in different ecological zones, managed by diverse institutional arrangements, and located near centers of intense population growth as well as in more remote regions;

conduct rigorous evaluations of projects undertaken to reduce deforestation, increase local participation, encourage eco-tourism, change forest tenure policies, implement new taxes or incentives, or in some way attempt to improve the incentives of officials and citizens to enhance and sustain forest resources and biodiversity;

provide useful and rapid feedback to officials and citizens about conditions and processes in particular forests of relevance to them;

archive data about environmental and institutional variables in a carefully designed database to be used within each country and to be shared among the participating research centers;

conduct analyses of those policies and institutional arrangements that perform best in particular political-economic and ecological settings; and

prepare materials of relevance for in-service training as well as for educational curricula.

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III. GOALS/OUTCOMES: ADDRESSING KNOWLEDGE AND INFORMATION GAPS AND BUILDING ASSESSMENT CAPACITIES

The goals of the IFRI program are to (1) address the issue of knowledge gaps by seeking ways to enhance interdisciplinary knowledge, (2) to address information gaps by providing a means to ground-truth aerial data and spatially link forest use to deforestation and reforestation, and (3) to address the need for greater assessment capabilities by building capacity to rigorously collect, store, analyze, and disseminate data in participating countries.

A. Goal: Addressing Knowledge Gaps

Any system of interaction involving a relatively large number of variables that relate to one another over time with complex feedback loops is immensely more difficult to understand and control than simple systems tackled in more mechanistic areas, such as in classical physics. Human uses of forest resources involve a large number of potentially relevant variables that operate over time with complex feedback loops. Effective policy interventions are elusive until an empirically warrantable consensus is attained about the set of important variables that impinge on deforestation and biodiversity losses.

Recent attempts to understand processes leading to general environmental harms involve multi-variable models. Paul and Anne Ehrlich (1991: 7), for example, propose a three-variable causal model:

$I = P \times A \times T$, where,

I = impact on the environment,

P = population size,

A = affluence (as measured by levels of consumption), and

T = technologies employed.

An alternative model developed by Grant (1994) for UNICEF to capture processes occurring primarily in developing countries is the PPE spiral where poverty and population pressures are viewed as reinforcing one another and jointly impinging on environmental conditions while all three factors--population, poverty, and environment--affect and are affected by political instability.

The extent of the knowledge gap becomes apparent upon careful examination of these two recent and respected models. They disagree on the sign of the relationship between poverty on environmental variables.⁽¹³⁾ The Ehrlichs include population *size* in their model, which is a state

variable operationalized by either population density or the total number of people. The UNICEF model identifies population *growth* rather than current size. Technology appears in the Ehrlich model but not in the UNICEF model. Political instability appears in the UNICEF model but not in the Ehrlich model. The logical places to intervene are different depending on which model best describes the world. If one accepts the Ehrlichs' view, one should focus attention on the most affluent countries ignoring political instability. Accepting the UNICEF view, one would focus on the poorest countries and stress the impact of political instability.

The effect of opening a region to increased market pressures is also a matter of debate in the literature. Many scholars presume that integrating local resource systems into larger markets by building roads and market centers increases the temptation that local users face to overharvest (see, for example, Agrawal, 1994b). On the other hand, William Ascher (1995) argues that providing the poor in remote regions with better access to income-earning activities reduces their need to overuse forest resources and encourages a longer time horizon in making decisions about the use of local resources (see also Fox, 1993).

The knowledge gap is illuminated further by an important study by Robert T. Deacon (1994) on "Deforestation and the Rule of Law in a Cross-Section of Countries."⁽¹⁴⁾ Using FAO estimates of forest cover in 1980 and 1985 to measure the proportionate rate of deforestation between 1980 and 1985, Deacon first examines the impact of population growth. He finds, in support of the UNICEF model, that a "one percent increase in population during 1975-1980 is associated with a proportionate forest cover reduction of 0.24 - 0.28 percent during 1980-85" (Deacon, 1994: 8). Supportive of the Ehrlich model, Deacon also finds that a "given rate of population growth is associated with a higher deforestation rate if it occurs in a high income country than in a low income country" (ibid.). While Deacon finds significant relationships, population change accounts for only a small proportion of the variance of deforestation (R^2 between .08 and .14).

The primary reason that Deacon undertakes this analysis, however, is to examine the impact of unstable or weakly enforced legal systems on deforestation. The decision to consume forest resources rapidly or to conserve them so as to yield a perpetual stream of future returns is an investment decision. Deacon argues that investments will only be made when those who make a sacrifice not to harvest immediately are assured they will receive the future benefits of their actions. "When legal and political institutions are volatile or predatory, the assurance is lowered and the incentive to invest is diminished" (ibid.: 3). Consequently, Deacon analyzes variables that reflect political instability and the presence of centralized national governments. These variables are positively associated with deforestation, and the proportion of the variance explained rises (R^2 between .19 and .21). Political and institutional variables account for as much or more variance in deforestation as population density. In the 120 countries included in his analysis, the size of the association between population growth and deforestation is reduced when political and institutional variables are included. The association falls substantially in low- and middle-income countries.⁽¹⁵⁾ Deacon's analysis is pathbreaking because it is a rare effort to undertake a systematic analysis of the relative role of population density and institutional variables. He demonstrates that both have an impact on rates of deforestation. What his analysis also shows, however, is that factors affecting 80 percent of the variance in deforestation at a national level are not accounted for. This is a substantial knowledge gap.

While knowledge gaps about relationships at a national level remain immense, greater progress has been achieved in gaining a shared and empirically validated understanding of relationships at a more micro or sub-national level. In the mid-1980s, the National Academy of Sciences (NAS) established a Panel on Common Property Resources. Since then, many theoretical and empirical studies of diverse institutional arrangements for governing and managing small- to medium-sized natural resources have enabled scientists to achieve a growing consensus.⁽¹⁶⁾ Scholars from diverse disciplines now tend to agree that the users of small- to medium-sized natural resources are potentially capable of self-organizing to manage these resources effectively, whether jointly with national governments or with considerable autonomy. Researchers have even identified localities within countries where local users have organized themselves effectively enough that they have improved forest conditions when faced with increasing population density.⁽¹⁷⁾

There are several reasons why local users may more effectively manage resources than national agencies. One reason is the immense diversity of local environmental conditions that exist within most countries. The variation in rainfall, soil types, elevation, scale of resource systems, and plant and animal ecologies is large, even in small countries. Some resources are located near to urban populations or a major highway system and others are remote. Given environmental variety, rule systems that effectively regulate access, use, and the allocation of benefits and costs in one setting, are not likely to work well in radically different environmental conditions. Efforts to pass national legislation establishing a uniform set of rules for an entire country are likely to fail in many of the locations most at risk. Users managing their resources locally may be a more effective way of dealing with immense diversity from site to site.

A second reason for the potential advantage of local organization in coping with problems of deforestation and biodiversity losses is that the benefits local users may obtain from careful husbanding of their resources are potentially greater, when future flows of benefits are appropriately taken into account. At the same time, the costs of monitoring and sanctioning rule infractions at a local level are relatively low. These advantages occur, however, only when local users have sufficient assurance that they will actually receive the long-term benefits of their own investments.

While there is agreement that the potential for effective organization at a local level to manage some of the smaller- to medium-sized forests exists in all countries, local participants do not uniformly expend the effort needed to organize and manage local forests, however, even when given formal authority. Some potential organizations never form at all. Some do not survive more than a few months. Others organize but are not successful. Others are dominated by local elite who divert communal resources to achieve their own goals at the expense of others (Arora, 1994). In some cases, the natural forest must be almost completely gone before local remedial actions are taken. These actions may be too late. Still others do not possess adequate scientific knowledge to complement their own indigenous knowledge. Making investment decisions related to assets that mature over a long time horizon (25 to 75 years for many tree species) is a sophisticated task whether it is undertaken by barely literate farmers or Wall Street investors. In highly volatile worlds, some organize themselves more effectively and make better decisions than others.

Thus, the romantic view that anything local is better than anything organized at a national or global scale is not a useful foundation for a long-term effort to improve understanding of what factors enhance or detract from the capabilities of any institutional arrangement to govern and manage forest resources wisely. Any organization or group faces a puzzling set of problems when it tries to govern and manage complex multi-species (including *Homo sapiens*), multi-product resource systems whose benefit streams mature at varying rates. Any organization or group will face a variety of environmental challenges stemming from too much or too little rainfall to drastic changes in factor prices, population density, or pollution levels. Consequently, essential knowledge can be gained from a carefully designed, systematic study of how many different types of institutional arrangements, including nascent groups, indigenous communal organizations, formal local governments, NGOs, specialized forest and park agencies, and national ministries, cope with diverse types of forest resources. Much is to be learned from both successes and failures. And, since we intend to use multiple performance measures, we expect to find some forest governance and management systems that are evaluated positively in regard to some evaluative criteria (such as the maintenance of forest density and species richness), but not necessarily in regard to others (such as gender representation, financial accountability, adaptability over time, or transparency of decision-making processes).

1. Outcome: Enhancing Interdisciplinary Knowledge

Prior theoretical and empirical studies provide an initial set of hypotheses about general factors that we expect to find associated with the more successful forest governance and management systems (see E. Ostrom, 1990; McKean, 1992; Moorehead, 1994). Thus, the IFRI research program begins with an initial set of working hypotheses that will be revised, added to, and refined over time.

Our initial working hypotheses are that more effective organization to cope with the long-term sustainable management of forest resources will occur where:

local forest users participate in and have continuing authority to design the institutions that govern the use of a forest system;

the individuals **most** affected by the rules that govern the day-to-day use of a forest system are included in the group that can modify these rules;

the institutions that govern a forest system minimize opportunities for free riding, rent seeking, asymmetric information, and corruption through effective procedures for monitoring the behavior of forest users and officials⁽¹⁸⁾;

forest users who violate rules governing the day-to-day uses of a forest system are likely to receive graduated sanctions from other users, from officials accountable to these users, or both;

rapid access is available to low-cost arenas to resolve conflict between users or between users and their officials;

monitoring, sanctioning, conflict resolution, and governance activities are organized in multiple layers of nested enterprises; and

the institutions that govern a forest system have been stable for a long period and are known by and understood by forest users.⁽¹⁹⁾

The variables in these hypotheses are all operationalized using multiple indicators in the IFRI research instruments. Further, we have included other variables noted in the literature as being of importance in explaining processes of deforestation and biodiversity loss. Further variables are included in the design of this study based on the Institutional Analysis and Development framework,⁽²⁰⁾ which has served as the theoretical foundation for many of the successful prior studies of the governance and management of natural resource systems undertaken by colleagues at the Workshop in Political Theory and Policy Analysis.

In the design of this study, we have also been concerned with how national and regional governments can enhance or detract from the capabilities of local entities by the kind of information they provide, by the assurance that they extend to ensure autonomy over the long run, by the provision of low-cost conflict resolution mechanisms, and by policies that allow localities to develop and keep financial resources that can be used to make local improvements. Detailed information about why some national policies tend to encourage successful self-organization and others discourage will be provided. These results will help to reduce knowledge gaps about policy impacts and thus facilitate the development of more effective policies.

The IFRI research program is designed to examine relationships among the physical, biological, and cultural worlds in a particular location and the *de facto* rules that are used locally to determine access to and use of a forest. During data collection, researchers will use ten research instruments called coding forms. Examination of the physical world includes examination of the structure of forests and the species within. There are two coding forms that include rigorous forest mensuration methods in order to generate reliable and unbiased estimates of forest density, species diversity, and consumptive disturbances. Examination of cultural worlds includes gaining knowledge about patterns of socioeconomic and cultural homogeneity, number of individuals and groups involved, and diverse world views. Research conducted using a uniform set of variables using the best methods available for gaining reliable estimates of qualitative and quantitative data will enable scholars to analyze how different institutions work in the context of a large number of ecological, cultural, and political-economic settings. Diverse models of which variables and how they interact to affect behavior and outcomes will be posed, tested, and modified so that policies based on revised and tested models will have a higher probability of being successful than past efforts to reduce deforestation and stop biodiversity losses.

B. Goal: Addressing Information Gaps

Important steps have been taken in the last decade to increase the rigor and quantity of information known about forest cover and rates of deforestation and biodiversity losses in different parts of the world. In 1993, for example, the most "authoritative global tropical deforestation survey to be produced in more than a decade"⁽²¹⁾ was released by the United Nations Food and Agricultural Organization (FAO, 1993). This FAO report attempts to

document the extent of deforestation in tropical countries in an accurate fashion but repeatedly stresses the problems that the project staff faced in obtaining reliable information for the task. After examining the current state of information about forest conditions in tropical countries, the project found that:

There is considerable variation among regions with respect to completeness and quality of the information.

There is considerable variation in the timeliness of the information. The data is about ten years old, on average, which could be a potential source of bias in the assessment of change.

Only a few countries have reliable estimates of actual plantations, harvests, and utilization although such estimates are essential for national forestry planning and policy making.

No country has carried out a national forest inventory containing information that can be used to generate reliable estimates of the total woody biomass volume and change.

It is unlikely that the state and change information on forest cover and biomass could be made available on a statistically reliable basis at the regional or global level within the next ten or twenty years unless a concerted effort is made to enhance the country capacity in forest inventory and monitoring (FAO, 1993: 5-6).

The report concludes its findings concerning information gaps by noting that "forest resource assessments are among the most neglected aspects of forest resource management, conservation and development in the tropics" (ibid.: 6).

1. Outcome: Providing Key Ground-Truthed Information

The IFRI research program will immediately provide key information about variations in forest conditions and the incentives and behavior of forest users within countries participating in the IFRI network. This information is essential for policy analysis and to test theories addressing knowledge gaps. Focusing on a sample of forests located in diverse ecological regions and governed by different institutional arrangements greatly reduces the cost of monitoring as contrasted to national forest inventories. Further, it provides information about the variation of results achieved by different kinds of institutional arrangements.

Both quantitative and qualitative data will be collected about institutional arrangements, the incentives of different participants, their activities, and careful forest mensuration techniques will be used to assess consequences in terms of density, species diversity, and species distribution. The general type of information to be collected at each site is listed in Table 1. This information will immediately be made available to forest users and government officials, and used in regularized policy reports written by analysts who have a long-term stake in the success of the policies adopted. The results of projects adopted in one location can be compared with the results of other types of institutional arrangements in similar ecological zones within the same macro-political regime. The data will also be archived in an IFRI designed, relational database so that changes in institutions, policies, activities, and outcomes can be monitored over time and across

regions within one or more than one country. Data will be collected, owned, assessed, stored, and analyzed by each countries' researchers. The IFRI research program fosters in-country development of information rather than sole reliance on the purchase of secondary data from international organizations. The program also encourages the development of "state-of-the-art" research conducted by researchers who have permanent roots in a country rather than coming in from the outside.

C. Goal: Building Capacity for Assessment

The third major goal of the IFRI research program is to build in-country capacities to conduct forest and institutional assessments on a continuing basis. As the FAO (1993) *Forest Resources Assessment* report cited above indicates, developing sustained efforts to gain an accurate picture of forest conditions or to build a valid understanding of what factors affect forest conditions is impossible *without building in-country assessment capabilities*. There are extraordinary researchers in each country with substantial capabilities that could be utilized in a sustained assessment program. These scholars may be located in different research institutions and separated by disciplinary barriers. Recent developments in the use of computers may not have been made available. For whatever reason, few countries have brought together interdisciplinary teams with extensive training in biology, environmental science, social sciences, and the use of computers to conduct regular assessments that can be used to fill information gaps and gain more valid understanding of the variables that affect rates of deforestation and loss of biodiversity.

The IFRI research program will work with a growing group of in-country research centers who obtain funding from donors and their own institutions to build their capabilities to become a permanent assessment center. The first three IFRI CRCs are located in Bolivia, Nepal, and Uganda. We discuss the methods of our working with these and other centers and how this will build capacity in the next section.

1. Outcome: Legacy of Long-Term Assessment Capabilities

In addition to addressing the problems of reducing knowledge and information gaps to enhance future forestry policy making, the IFRI research program will leave a legacy in each participating country of a core research team that is well-trained in social and biological research methods and the computers to do analysis and manage complex forestry data sets.

Table 1
Data Collection Forms and Information Collected

IFRI FORM	INFORMATION COLLECTED
Site Overview Form	site overview map, local wage rated, local units of measurement, exchange rates, recent policy changes, interview information
Forest Form	size, ownership, internal differentiation, products harvested, uses of products, master species list, changes in forest area, appraisal of forest condition

Forest Plot Form	tree, shrub, and sapling size, density, and species type within 1, 3, and 10 meter circles for a random sample of plots in each forest, and general indications regarding forest condition
Settlement Form	socio-demographic information, relation to markets and administrative centers, geographic information about the settlement
User Group Form	size, socioeconomic status, attributes of specific forest user groups
Forest User Group Relationship Form	products harvested by user groups from specific forests and their uses
Forest Products Form	details on three most important forest products (as defined by the user group), temporal harvesting patterns, alternative sources and substitutes, harvesting tools and techniques, and harvesting rules
Forest Association Form	institutional information about forest association (if one exists at the site), including association's activities, rules structure, membership, record keeping
Governance Form	information about organizations that make rules regarding a forest(s) but do not use the forest itself, including structure, personnel, resource mobilization, and record keeping
Organizational Inventory and Interorganizational Arrangements Form	information about all organizations (harvesting or not) that relate to a forest, including harvest and governance activities

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IV. OPERATIONAL METHODS OF IFRI RESEARCH PROGRAM

As a research program, we envision a process of policy-relevant theoretical development, data collection, analysis, policy reporting, and training that is on-going for the next decade or more. The overarching plan for the IFRI program is that future research goals and objectives will be addressed by a network of CRCs and individual scholars who design and conduct studies within different countries in collaboration with colleagues at the Workshop in Political Theory and Policy Analysis (the Workshop). An IFRI CRC could be a research group associated with a university, a private association, a government research laboratory, or a consortium of individuals and agencies that have agreed to work together to collect, analyze, and archive IFRI data in a particular country or specific region of the world. Individual researchers who are working at a university or research institution completing their doctoral research or working independently may also be associated with IFRI.

The IFRI program includes a training model for each CRC that is intensive in the first two years. Each CRC will send key research personnel for a one-semester training program conducted by staff of the Workshop at Indiana University. This will be followed up with an in-country training program of one-month's duration where the initial core set of researchers from a particular country or region are provided classroom and experiential training opportunities by Workshop

staff and by the local researchers who have just completed the semester in Bloomington. Pilot studies will be conducted soon after this initial training program has been completed. During the pilot studies, the Bloomington staff will be prepared to respond to many methodological queries as in-country researchers find the many complex and unexpected relationships that they are discovering using the methods they have just learned. As local staff become experts in the field administration, analysis, and archiving of the data, further training will be taken over by those heading each of the CRCs. We also see a role from staff from one CRC visiting and working with staff from a second CRC so that the reliability of field methods and interpretations is enhanced.

Criteria for selecting CRCs will be based primarily on level of interest in solving forest resource problems from the bottom up, previous work on forest issues, and capacity to use the database system in an environment that enables communication between nongovernmental policy makers, forest users, governmental policy makers, scholars, and grant-writing capabilities. Demonstrated commitment to continuing, long-term research efforts will also be a criteria for CRC selection.

In January 1993, William Gombya-Ssembajjwe, a Forester from the Department of Forestry at Makerere University in Uganda, and Rosario Leon, the Facilitator for the Forest, Trees and People Program (FTPP) of FAO in Bolivia, participated in a week-long conference in Bloomington to discuss the possibility of opening CRCs at their respective institutions. In February 1993, Makerere University Forestry Department became the first official CRC (the Uganda Forestry Resources and Institutions Center - UFRIC). In September 1993, Elinor Ostrom, C. Dustin Becker, and David Green travelled to Uganda to lead a training program on IFRI research and database methodologies at Makerere University. Gombya-Ssembajjwe and Abwoli Banana, Department of Forestry, were trained as co-leaders of the Center with seven other colleagues at Makerere. Pilot studies in Mbazzi and Mbale were carried out as part of the training for the participants. Two additional studies were conducted by Banana and his field teams in Echuya and Buckaleba sites in November and December 1993. Gombya-Ssembajjwe and Banana spent the spring of 1994 in Bloomington participating in the first semester-long IFRI training program.

Rajendra Shrestha and Elinor Ostrom invited researchers from all over Nepal interested in forestry institutions to a series of meetings held at the International Center for Integrated Mountain Development in Kathmandu. Given the large number of centers interested in these questions, a Nepal Forestry Resources and Institutions Consortium was created in the Spring of 1993 with Rajendra Shrestha as the Coordinator for this group. A faculty member from the Institute of Agriculture and Animal Sciences in Chitwan, Nepal, participated in the first semester-long training program this past Spring. Pilot studies have been conducted in Gorkha and Tanahun Districts funded by the Hills Leasehold Forestry and Forage Development Project. A large number of local forest institutions have been studied in the past and a future activity will be to return to some of these sites where data had been collected so as to enter earlier and current information in the IFRI database.

Rosario Leon, FFTP in Cochabama, Bolivia, has organized several studies in Bolivia as part of the process of creating a CRC, and one member of her team attended the first semester-long training program held in Bloomington during the Spring of 1994. In August 1994, Elinor

Ostrom, Carlos Vacaflores, Mary Beth Wertime, and Paul Turner trained 25 Bolivian scholars and practitioners in a formal training program at Caritas in southern Bolivia. A pilot study of around ten settlements located along the Rio Chapare in the Yuracaré region of Bolivia will be initiated in the Fall of 1994.

Arun Agrawal, an independent IFRI scholar teaching at the University of Florida in Gainesville, conducted one of the first studies using the IFRI coding forms in the Uttarakhand in the Indian Himalayas and in Bhutan in 1993. The coding forms were translated into Hindi for this purpose. Initial analysis of the findings has been submitted to the World Wildlife Fund. Agrawal is now translating the qualitative information written by fieldworkers in Hindi on the forms into English for archiving in the IFRI database.

Several graduate students have also initiated research on IFRI-related studies. Cheryl Danley, a graduate student from Michigan State University, joined the training sessions held at Makerere University in the Fall of 1993 and is carrying out IFRI research in Zimbabwe on communal forests. Two graduate students from Indiana University--George Varughese and Paul Turner--will begin doctoral research during 1994 in Nepal and Bolivia, using the IFRI research instruments. Ajay Pradhan and Tom Koontz have started plans to conduct IFRI research in Nepal and in the Pacific Northwest of the U.S. A doctoral student in the Department of Anthropology at the University of Michigan working with Professor Scott Atran, Norbert Ross, joined the IFRI training program in Bolivia in August of 1994. He is interested in working with Guatemalan colleagues associated with IFRI.

Discussions have been initiated with colleagues interested in the possibilities of establishing IFRI CRCs or pilot studies in Cameroon, Madagascar, and Zimbabwe in Africa; in India and the Philippines in Asia; in Costa Rica, Ecuador, and Brazil in Latin America; in Norway and Sweden among the Nordic countries; and with the U.S. Forestry Service in the Pacific Northwest of the U.S. We would prefer to add around three CRCs per year for the next four to five years so that sufficient time can be spent with each CRC in the early days of its participation in the IFRI network.

We envision that each CRC will go through several phases of relating to the Workshop and to other CRCs in the IFRI network. During the first phase--normally about a year in duration--one or two researchers, who will take a major role in the development of the CRC, would spend at least one semester at the Workshop. They will participate in a general course of study that includes both the underlying theoretical foundations for the IFRI research program and a specific training program on forest mensuration, PRA methods, detailed review of all IFRI data collection forms, and joint fieldwork in a site near to Indiana University.

Ideally during the summer following the above training program, researchers from the CRC and Workshop staff will jointly train a larger group of researchers in data collection and entry methods and jointly conduct one to four pilot studies together. By working side-by-side in the conduct of the initial pilot studies, many of the problems that have faced earlier efforts to undertake multi-national research efforts should be reduced. A key problem facing all such studies is how to establish and keep consistent data collection methods so that the data placed in the same fields in the database are actually comparable. No amount of classroom instruction can

cope effectively with this problem. Working side-by-side in the initial studies in each country is one method of substantially increasing the reliability and validity of the data collection efforts. Further, working out data entry procedures and queries is equally important in developing a database that is robust and can be used over many years and by many participants.

Soon after completing its first round of pilot studies, a new CRC will participate in an annual meeting of all CRCs. The first such meeting will take place at Oxford University in mid-December of 1994. At these meetings, CRCs will share analysis of results from the previous year; discuss how their findings are being reported to public officials, local users, and the broader scholarly community; make proposals to change or add to data collection instruments; and plan for the next year.

During initial training and pilot studies, the person taking primary responsibility for the development of a CRC in a particular country or region will begin work, in consultation with his or her own colleagues and with colleagues at the Workshop, on a research design for a continuing assessment program using the IFRI research instruments. Each monitoring plan will identify major knowledge and information gaps that will be addressed if the program outlined in it were undertaken. Where there are specific questions of importance in a particular country or region not covered by the IFRI data collection instruments, these will be supplemented with new instruments designed by the CRC and shared with other members of the Network. The monitoring plan will be circulated among members of the IFRI network, to public officials and NGOs in the host country, and eventually to potential donors for funding. Once funding is received and the appropriate staff has been hired, the CRC will begin its own research program depending less and less on advice and input from colleagues at the Workshop and other CRCs and more on its own growing expertise. Researchers from each CRC will visit other CRCs and undertake joint fieldwork with the researchers from other CRCs. This is another way that consistent data collection and interpretation can be undertaken in a multi-national study.

We plan that most of the initiative for the IFRI research program will eventually be taken over by one or more of the CRCs or an international center belonging to the Consultative Group for International Agricultural Research center. Once this occurs, the Workshop will become a working partner in an international network rather than the home base of the network.

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V. DISSEMINATION OF RESULTS

The results of the IFRI research program will be disseminated in multiple ways that include:

immediate feedback of a site report to forest users and government officials interested in each site. The site report will contain a list of all plant species located in the forest(s) in the site, their relative importance and density, a history of each settlement, and an overview of the activities of user groups.

policy analysis reports issued by each CRC annually, summarizing the findings from the sample of forests and forest institutions included in that year's study. In the early years, these will be

based on cross-sectional information. In the later years, these will contain analyses of developments over time. These reports will be widely circulated to policy makers, forest users, and scholars within each country and to all of the other IFRI CRCs.

special project reports comparing the activities and results obtained by a particular government, donor, or NGO-sponsored project with other institutional arrangements existing in similar ecological zones. These reports will also be widely circulated to policy makers, forest users, and scholars within each country and to all of the other IFRI CRCs.

M.A. and Ph.D. theses completed by students work at those CRCs that are located within universities or other in-country (or U.S.) universities. These studies will address some of the more difficult knowledge gaps that cannot be addressed in the initial policy reports.

methodological reports written by CRC and Workshop scholars addressing some of the difficult measurement problems involved in the conduct of a multi-country, over-time study of institutional, behavioral, as well as forest condition variables. These will be circulated to interested researchers throughout the world.

scholarly publications submitted by CRC and Workshop scholars to academic journals and university presses so that the findings become part of the generally available knowledge base for social scientists, foresters, biologists, and public policy scholars.

synopses of policy reports and more analytical reports will be made available through the Internet to a wide diversity of interested colleagues who are connected electronically.

training programs for public officials held at CRCs once the in-country database is sufficient to provide better evidence for in-country forest planning.

curricular materials prepared for introduction into undergraduate and graduate instruction in relevant disciplinary courses.

Initial reaction of forest users and government officials in Uganda to the site reports given to them at the time of leaving each site was enthusiastic. The initial reports written by scholars associated with the FTTP program in Bolivia were very positively received, leading to a decision to proceed with the development of a CRC in Bolivia and a long-term study. A report of the pilot studies conducted in Nepal is being drafted during the summer of 1994 and the Leasehold Forestry Project in the Forest Department of Nepal has found the baseline studies conducted for it of considerable value.

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VI. FUNDING

The developmental phase of the IFRI research program has been financed by FAO, USAID, NSF, and the Workshop as co-funders. We are now seeking financial support from multiple national and international donors to support the first operational phases of the long-term research

program. Funding will be needed by individual CRCs to conduct their own long-term assessment efforts, to prepare analyses, to disseminate results, to train staff, to purchase computer equipment, and to train government officials and students based on the findings of their work. Funding will be needed by the Workshop for the next three to five years to continue its role in coordinating the overall research program; for continued work on the theoretical foundations for the overall program; to modify and update research instruments in light of suggestions from CRCs; to develop computer programs that facilitate data entry, analysis, and archiving; to manage and archive data sent by CRCs and distribute that data back to the full network; to train research staff at new CRCs; to organize a visiting scholar program to conduct multi-country, over-time data analysis; to develop library resources for use by visiting scholars and local staff; to respond to initial analyses prepared by CRCs; to set up a reporting system on the Internet; and to develop GIS applications.

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VII. WORKSHOP CAPABILITIES

The Workshop in Political Theory and Policy Analysis at Indiana University is now starting its 21st year of conducting policy-relevant studies with a firm theoretical foundation. Scholars who have regular academic appointments in the Departments of Political Science and Economics, and the School of Public and Environmental Affairs, are associated with the Workshop. Normally, between six and ten scholars from Africa, Asia, Eastern and Western Europe, Latin America, and the U.S. spend a semester or a year at the Workshop conducting their own research projects and participating in the seminars and colloquia that are a regular part of Workshop activities.

Workshop activities are funded by a regular Indiana University budget and by grants or contracts issued by the Ford Foundation, the Bradley Foundation, the National Science Foundation, the United States Agency for International Development, the United National Food and Agricultural Organization. The Tocqueville Endowment for the Study of Human Institutions is now approaching \$1 million.

Past studies of urban service delivery in the U.S. conducted by Workshop scholars have changed the nature of policy dialog regarding how services are best provided. Recent studies of the governance of common-pool resources have received international prizes and been widely and positively reviewed. Workshop studies have now been translated into Arabic, Chinese, German, Korean, Polish, Russian, Serbo-Croatian, and Spanish. A video made from Elinor Ostrom's *Crafting Institutions for Self-Governing Irrigation Systems* is available both in Spanish and English and is being used to train irrigation officials in the Dominican Republic and at several universities within the U.S. Results of prior research on irrigation governance in Nepal is being translated into Nepali for use by the Nepal National Planning Commission, by the UNDP program in Nepal, and to train students at the Institute of Agriculture and Animal Sciences in Nepal. A Nepali-language Newsletter has been developed to disseminate findings from prior studies to a new association of irrigation associations formed in Nepal in light of the findings of prior studies concerning the high performance of many Nepali farmer-managed irrigation systems.

Further and more detailed information about the IFRI Research Program can be obtained by writing to either Elinor Ostrom or Mary Beth Wertime, IFRI Research Program, Workshop in Political Theory and Policy Analysis, Indiana University, 513 North Park, Bloomington, Indiana 47408 USA.

Notes

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Bibliography

Abernathy, V. 1993. *Population Politics: The Choices that Shape our Future*. New York: Plenum Press.

Agrawal, Arun. 1992. "Risks, Resources, and Politics: Studies in Institutions and Resource Use from India." Ph.D. diss., Duke University.

_____. 1994a. "Rules, Rule Making, and Rule Breaking: Examining the Fit between Rule Systems and Resource Use." In *Rules, Games, and Common-Pool Resources*, ed. Elinor Ostrom, Roy Gardner, and James Walker, 267-82. Ann Arbor: University of Michigan Press.

_____. 1994b. "The Illogic of Arithmetic in Resource Management: Overpopulation, Markets and Institutions as Explanations of Forest Use in the Indian Himalayas." Paper presented at the conference "Workshop on the Workshop," Workshop in Political Theory and Policy Analysis, Indiana University, Bloomington, June 16.

Aldhous, Peter. 1993. "Tropical Deforestation: Not Just a Problem in Amazonia." *Science* 259 (March 5): 1,390.

Alper, Joe. 1993. "How to Make the Forests of the World Pay Their Way." *Science* 260 (June 25): 1,895-896.

Apichatvullop, Yaowalak. 1993. "Local Participation in Social Forestry." *Regional Development Dialogue* 14(1) (Spring): 32-45.

Arnold, J.E.M., and J. Gabriel Campbell. 1986. "Collective Management of Hill Forests in Nepal: The Community Forestry Development Project." In *Proceedings of the Conference on Common Property Resource Management*, 425-54. Washington, D.C.: National Academy Press.

Arnold, J.E.M., and W. C. Stewart 1989. *Common Property Resources Management in India*. Oxford: Oxford University, Oxford Forestry Institute.

Arora, Dolly (1994) "From State Regulation to People's Participation: Case of Forest Management in India." *Economic and Political Weekly* (March): 691-98.

Ascher, William. 1993. "Political Economy and Problematic Forestry Policies in Indonesia: Obstacles for Incorporating Sound Economics and Science." Durham, NC: The Center for Tropical Conservation, Report.

_____. 1995. *Communities and Sustainable Forestry in Developing Countries*. San Francisco, Calif.: Institute for Contemporary Studies Press.

Atran, Scott. 1986. "Hamula Organization and Masha'a Tenure in Palestine." *Man* 21:271-95.

_____. 1993. "Itza Maya Tropical Agro-Forestry." *Current Anthropology* 34(5) (Dec.): 633-700.

Berkes, Fikret, ed. 1989. *Common Property Resources: Ecology and Community-Based Sustainable Development*. London: Belhaven Press.

Blomquist, William. 1992. *Dividing the Waters: Governing Groundwater in Southern California*. San Francisco, Calif.: Institute for Contemporary Studies Press.

_____. 1994. "Changing Rules, Changing Games: Evidence from Groundwater Systems in Southern California." In *Rules, Games, and Common-Pool Resources*, ed. Elinor Ostrom, Roy Gardner, and James Walker, 283-300. Ann Arbor: University of Michigan Press.

Breckenridge, Lee P. 1992. "Protection of Biological and Cultural Diversity: Emerging Recognition of Local Community Rights in Ecosystems under International Environmental Law." *Tennessee Law Review* 59(4) (Summer): 735-85.

Bromley, Daniel W., et al., eds. 1992. *Making the Commons Work: Theory, Practice, and Policy*. San Francisco, Calif.: Institute for Contemporary Studies Press.

Campbell, J. Gabriel, and Tara N. Bhattarai. 1983. "People and Forests in Hill Nepal: Preliminary Presentation of Findings of Community Forestry Household and Ward Leader Survey." Project Paper no. 10. Kathmandu, Nepal: HMB/UNDP/FAO Community Forestry Development Project.

Campbell, J. Gabriel, Rajendra P. Shrestha, and F. Euphart. 1987. "Socio-economic Factors in Traditional Forest Use and Management: Preliminary Results from a Study of Community Forest Management in Nepal." *Banko Janakari* 1(4): 45-54.

CENR (Committee on Environment and Natural Resources). 1994. "Draft R&D Strategy." Washington, D.C.: National Oceanic and Atmospheric Administration.

Cernea, Michael. 1993. "Strategy Options for Participatory Reforestation." *Regional Development Dialogue* 14(1) (Spring): 3-31.

Chambers, Robert. 1993. "Participatory Rural Appraisal (PRA): Challenges, Potentials, and Paradigm." East Sussex, England: University of Sussex, Institute of Development Studies.

_____. 1994. "The Poor and the Environment: Whose Reality Counts." Paper prepared for the conference on Poverty Reduction and Development Cooperation held at the Centre for Development Research, Copenhagen, February 23-24.

Chambers, Robert, and Gordon Conway. 1993. "Sustainable Rural Livelihoods: Practical Concepts for the 21st Century." Discussion paper no. 296. Brighton, England: University of Sussex, Institute of Development Studies.

Chambers, Robert, Melissa Leach, and Czeck Conroy. 1993. *Trees as Savings and Security of the Rural Poor*. London: Institute for Environment and Development, Gatekeeper Series no. SA3.

Chambers, Robert, N. C. Saxena, and Tushaar Shah. 1989. *To the Hands of the Poor: Water and Trees*. London: Intermediate Technology Publications.

Chhetri, Ram B., and Tulsi R. Pandey. 1992. *User Group Forestry in the Far-Western Region of Nepal*. Kathmandu, Nepal: International Centre for Integrated Mountain Development.

Chichilnisky, Graciela. 1994. "Biodiversity and Economic Values." Summary of a paper presented at the conference "Biological Diversity: Exploring the Complexities," University of Arizona, Tucson, March 25-27.

Cortez, Francisco. 1986. "Community Forestry in Customary Lands: Lessons from Papua New Guinea." In *Community Forestry: Lessons from Case Studies in the Asia and the Pacific Region*, ed. Y. S. Rao, Marilyn W. Hoskins, Napoleon T. Vergara, and Charles T. Castro, 45-68. Bangkok, Thailand: Regional Office for Asia and the Pacific (RAPA) of the Food and Agricultural Organization of the United Nations.

Cruz, Ma. Concepcion. 1991a. *Population Pressure, Economic Stagnation and Deforestation in the Philippines*. Washington, D.C.: World Resources Institute.

_____. 1991b. *Population Pressure in Tropical Developing Countries*. Washington, D.C.: Population Reference Bureau.

_____. 1991c. "Population Pressure, Deforestation, and Common Property Institutions: An Overview." Paper prepared for the Second Annual Meeting of the International Association for the Study of Common Property, Winnipeg, Manitoba, September 26-29.

Cruz, Wilfrido D., and Ma. Concepcion Cruz 1991. "Population Pressure and Deforestation in the Philippines." *Asean Economic Bulletin* 9(2): 200-12.

Dasmann, Raymond F. 1984. "The Relationship between Protected Areas and Indigenous Peoples." In *National Parks, Conservation, and Development: The Role of Protected Areas in Sustain Society*, ed. Jeffrey A. McNeely and Kenton R. Miller, 667-77. Washington, D.C.: Smithsonian Institution Press.

Davis, Kingsley. 1991. "Population and Resources: Fact and Interpretation." In *Resources, Environment, and Population: Present Knowledge, Future Options*, ed. Kingsley David and M. Bernstam, 1-21. New York: Oxford University Press.

Deacon, Robert T. 1994. "Deforestation and the Rule of Law in a Cross-Section of Countries." Discussion Paper no. 94-23. Washington, D.C.: Resources for the Future.

Ehrlich, Paul R., and Anne H. Ehrlich. 1981. *Extinction: The Causes of the Disappearance of Species*. New York: Random House.

Ehrlich, Paul R., and Anne H. Ehrlich. 1991. *Healing the Planet: Strategies for Resolving the Environmental Crisis*. Reading, Mass.: Addison Wesley.

Ehrlich, Paul R., and Edward O. Wilson. 1991. "Biodiversity Studies: Science and Policy." *Science* 253 (Aug. 16): 758-62.

Fairhead, James, and Melissa Leach, with Dominique Millimouno and Marie Kamano. 1992. "Forests of the Past? Archival, Oral and Demographic Evidence in Kissidougou Prefecture's Vegetation History." COLA Working paper no. 1. Conakry, Guinea: Connaissance et Organisation Locales Agro-ecologiques.

Fischer, G. 1993. "The Population Explosion: Where Is It Leading"? *Population and Environment* 15(2):139-53.

Fisher, R. J. 1989. "Indigenous Institutions and Organizations in the Management of Common Property Forest Resources in Nepal." EAPI Working paper no. 18. Honolulu, Hawaii: East West Center.

_____. 1990. "Institutional Incompatibility in Community Forestry: The Case of Nepal." In *Community Organizations and Government Bureaucracies in Social Forestry*, ed. Jefferson Fox and R. J. Fisher. Honolulu, Hawaii: East-West Center, Environment and Policy Institute.

_____. 1991. "Studying Indigenous Forest Management Systems in Nepal: Towards a More Systematic Approach." EAPI Working paper no. 30. Honolulu, Hawaii: East-West Center.

Food and Agriculture Organization of the United Nations. 1993. *Forest Resources Assessment 1990*. Rome: FAO.

Fortmann, Louise. 1985. "The Tree Tenure Factor in Agro-Forestry with Particular Reference to Africa." *Agro-forestry Systems* 2:229-51.

Fortmann, Louise, and John W. Bruce. 1988. *Whose Trees? Proprietary Dimensions of Forestry*. Boulder, Colo.: Westview Press.

Fortmann, Louise, and J. Riddell. 1985. *Trees and Tenure: An Annotated Bibliography for Agroforesters and Others*. Nairobi, Kenya: ICRAF.

Fox, Jefferson. 1983. "Managing Public Lands in a Subsistence Economy: The Perspective from a Nepali Village." Ph.D. Diss., University of Wisconsin, Madison.

_____. 1993. "Forest Resources in a Nepali Village in 1980 and 1990: The Positive Influence of Population Growth." *Mountain Research and Development* 13(1):89-98.

Gill, Gerald J. 1993. "Indigenous Systems in Agriculture and Natural Resource Management: The Policy Dimension." In *Indigenous Management of Natural Resources in Nepal*, ed. Devika Tamang, Gerard J. Gill, and Ganesh B. Thapa, 3-12. Kathmandu, Nepal: HMG Ministry of Agriculture/Winrock International.

Gilmour, D. A. 1988. "Not Seeing the Trees for the Forest: A Re-appraisal of the Deforestation Crisis in Two Hill Districts of Nepal." *Mountain Research and Development* 8(4):343-50.

Gilmour, D. A., and R. J. Fisher. 1991. *Villagers, Forests, and Foresters: The Philosophy, Process, and Practice of Community Forestry in Nepal*. Kathmandu, Nepal: Sahayogi Press.

Gilmour, D. A., and M. C. Nurse. 1991. "Farmer Initiatives in Increasing Tree Cover in Central Nepal." *Mountain Research and Development* 11(4):329-37.

Grant, James P. 1994. *The State of the World's Children 1994*. Oxford, N.Y.: Oxford University Press for UNICEF.

Guha, Ramachandra. 1983. "Forestry in Britain and Post-British India." *Economic and Political Weekly* (India) 18(43 and 44): 1,882-96; 1,940-46.

Hilton, Rita. 1990. *Cost Recovery and Local Resource Mobilization: An Examination of Incentives in Irrigation Systems in Nepal*. Burlington, Vt.: Associates in Rural Development.

_____. 1992. "Institutional Incentives for Resource Mobilization: An Analysis of Irrigation Schemes in Nepal." *Journal of Theoretical Politics* 4(3):283-308.

Holdren, C. 1992. "Population Alarm." *Science* 255:1,358.

Jodha, N. S. 1993. "Common Property Resources and Dynamics of Rural Poverty." Working paper. Kathmandu, Nepal: International Center for Integrated Mountain Development.

Johansson, S. Ryan. 1988. "The Computer Paradigm and the Role of Cultural Information Systems in Social Systems." *Historical Methods* 21 (Fall) 172-88.

Kiser, Larry L., and Elinor Ostrom. 1982. "The Three Worlds of Action: A Metatheoretical Synthesis of Institutional Approaches." In *Strategies of Political Inquiry*, ed. Elinor Ostrom, 179-222. Beverly Hills, Calif.: Sage.

Kjekshus, Helge. 1977. *Ecology Control and Economic Development in East African History: The Case of Tanganyika, 1850-1950*. Berkeley: University of California Press.

Korten, Frances F. 1993. "The High Costs of Environmental Loans." *Asia Pacific Issues No. 7*. Hawaii: East-West Center.

Lam, Wai Fung. 1994. "Institutions, Engineering Infrastructure, and Performance in the Governance and Management of Irrigation Systems: The Case of Nepal." Ph.D. diss., Indiana University.

Lam, Wai Fung, Myungsuk Lee, and Elinor Ostrom. Forthcoming. "The Institutional Analysis and Development Framework: Application to Irrigation Policy in Nepal." In *Policy Analysis Concepts and Methods: An Institutional and Implementation Focus*, ed. Derick W. Brinkerhoff. Greenwich, Conn.: JAI Press.

Lee, Myungsuk. 1994. "Institutional Analysis, Public Policy, and the Possibility of Collective Action in Common Pool Resources: A Dynamic Game-Theoretic Approach." Ph.D. diss., Indiana University.

Lovejoy, Thomas E. 1980. "A Projection of Species Extinctions." In *The Global 2000 Report to the President: Entering the 21st Century*, G. O. Barney (Study Director), 328-31. Washington, D.C.: Council on Environmental Quality, U.S. Government Printing Office.

Lubchenco, Jane, et al. 1991. "The Sustainable Biosphere Initiative: An Ecological Research Agenda." *Ecology* 72(2):371-412.

Martin, Fenton. 1989/1992. *Common-Pool Resources and Collective Action: A Bibliography*, vols. 1 and 2. Bloomington: Indiana University, Workshop in Political Theory and Policy Analysis.

Mausel, Paul, You Wu, Yinghong Li, Emilio F. Moran, and Eduardo S. Brondizio. 1993. "Spectral Identification of Successional Stages Following Deforestation in the Amazon." *Geocarto International* 4.

McCay, Bonnie J., and James M. Acheson. 1987. *The Question of the Commons: The Culture and Ecology of Communal Resources*. Tucson: University of Arizona Press.

McKean, Margaret A. 1992. "Success on the Commons: A Comparative Examination of Institutions for Common Property Resource Management." *Journal of Theoretical Politics* 4(3) (July): 247-82.

McNeely, Jeffrey A. 1988. *Economics and Biological Diversity: Developing and Using Economic Incentives to Conserve Biological Resources*. Gland, Switzerland: IUCN.

_____. 1994. "Reversing the Loss of Biodiversity: Implementing Political, Economic, and Social Measures." Paper presented at the conference on "Biological Diversity: Exploring the Complexities," Tucson, Arizona, March 25-27.

_____, et al. 1990. *Conserving the World's Biological Diversity*. Gland, Switzerland: International Union for Conservation of Nature and Natural Resources.

Meihe, S. (1990) "Inventaire et Suivi de la Végétation dans les parcelles pastorales à 1990 et évaluation globale provisoire d'essai de pâturage contrôlé après une période de 10 ans." Eshborn, Germany: GTZ, Research Report.

Messerschmidt, Donald A. 1986. "People and Resources in Nepal: Customary Resource Management Systems of the Upper Kali Gandaki." In *Proceedings of the Conference on Common Property Resource Management*, 455-80. Washington, D.C.: National Academy Press.

_____. 1987. "Conservation and Society in Nepal: Traditional Forest Management and Innovative Development." In *Lands at Risk in the Third World: Local Level Perspectives*, ed. P. Little and M. Horowitz, 373-97. Boulder, Colo.: Westview Press.

Moorehead, Richard. 1994. "Policy and Research into Natural Resource Management in Dryland Africa: Some Concepts and Approaches." London: International Institute for Environment and Development.

Moran, Emilio F. 1993. *Through Amazonia Eyes: The Human Ecology of Amazonian Populations*. Iowa City: University of Iowa Press.

Moran, Emilio F., Eduardo Brondizio, Paul Mausel, and You Wu. 1994. "Integrating Amazonian Vegetation, Land-Use, and Satellite Data." *BioScience* 44(5):329-38.

Mortimore, Michael, ed. 1991. *Environmental Change and Dryland Management in Machakos District, Kenya. 1930-90*. London: Overseas Development Institute and the University of Nairobi, Working Paper no. 53.

Murphree, Marshall W. 1993. *Communities as Resource Management Institutions*. London: Sustainable Agriculture Program of the International Institute for Environment and Development, Gatekeeper Series no. 36.

Myers, Norman. 1984. *The Primary Source: Tropical Forests and Our Future*. New York: W. W. Norton.

_____. 1988. "Tropical Forests and Their Species: Going, Going . . ." In *Biodiversity*, ed. E. O. Wilson and Frances M. Peter, 28-35. Washington, D.C.: National Academy Press.

National Research Council. 1986. *Proceedings of the Conference on Common Property Resource Management*. Washington, D.C.: National Academy Press.

Ness, G., W. Drake, and S. Brechin. 1993. *Population-Environment Dynamics: Ideas and Observations*. Ann Arbor: University of Michigan Press.

Netting, Robert McC. 1993. *Smallholders, Householders: Farm Families and the Ecology of Intensive, Sustainable Agriculture*. Stanford: Stanford University Press.

Norton, B. J., ed. 1986. *The Preservation of Species*. Princeton, N.J.: Princeton University Press.

Oakerson, Ronald J. 1992. "Analyzing the Commons: A Framework." In *Making the Commons Work: Theory, Practice, and Policy*, ed. Daniel W. Bromley et al., 41-59. San Francisco, Calif.: Institute for Contemporary Studies Press.

Ostrom, Elinor. 1986. "An Agenda for the Study of Institutions." *Public Choice* 48:3-25.

_____. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. New York: Cambridge University Press.

_____. 1992. *Crafting Institutions for Self-Governing Irrigation Systems*. San Francisco, Calif.: Institute for Contemporary Studies Press.

Ostrom, Elinor, Paul Benjamin, and Ganesh Shivakoti. 1992. *Institutions, Incentives, and Irrigation in Nepal*. Volume 1. Bloomington: Indiana University, Workshop in Political Theory and Policy Analysis.

Ostrom, Elinor, Roy Gardner, and James Walker. 1994. *Rules, Games, and Common-Pool Resources*. Ann Arbor: University of Michigan Press.

Ostrom, Elinor, Larry Schroeder, and Susan Wynne. 1993. *Institutional Incentives and Sustainable Development: Infrastructure Policies in Perspective*. Boulder, Colo.: Westview Press.

Ostrom, Vincent, David Feeny, and Hartmut Picht, eds. 1993. *Rethinking Institutional Analysis and Development: Issues, Alternatives, and Choices*. 2d ed. San Francisco, Calif.: Institute for Contemporary Studies Press.

Pellek, Richard. 1990. "Combating Tropical Deforestation in Haiti: Implementing an Action Plan Requires a More Stable Political Environment." *Journal of Forestry*: 15-19.

Pimental, D., R. Harman, M. Pacenza, J. Pecarsky, and M. Pimental. 1994. "Natural Resources and an Optimal Human Population." *Population and Environment* 15(5):347-69.

Pimm, Stuart L., and Andrew M. Sugden. 1994. "Tropical Diversity and Global Change." *Science* 263 (Feb. 18): 933-44.

Pinkerton, Evelyn, ed. 1989. *Co-operative Management of Local Fisheries: New Directions for Improved Management and Community Development*. Vancouver: University of British Columbia Press.

Place, Frank, and Peter Hazell. 1993. "Productivity Effects of Indigenous Land Tenure Systems in Sub-Saharan Africa." *American Journal of Agricultural Economics* 75 (Feb.): 10-19.

Reid, Walter V., and Kenton R. Miller. 1989. *Keeping Options Alive: The Scientific Basis for Conserving Biodiversity*. Washington, D.C.: World Resources Institute.

Repetto, Robert. 1987. "Creating Incentives for Sustainable Forest Development." *Ambio* 16(2-3):94-99.

_____. 1988. *The Forest for the Trees? Government Policies and the Misuse of Forest Resources*. Washington, D.C.: World Resources Institute.

_____. 1990. "Deforestation in the Tropics." *Scientific American* 262(4):36-42.

Repetto, Robert, and Malcolm Gillis. 1988. *Public Policies and the Misuse of Forest Resources*. Washington, D.C.: World Resources Institute.

Richard, Paul. 1985. *Indigenous Agricultural Revolution*. London: Hutchinson.

Rowe, R., N. Sharma, and J. Browder. 1992. "Deforestation: Problems, Causes, and Concerns." In *Managing the World's Forests*, ed. N. Sharma, 33-46. Dubuque, Iowa: Kendall/Hunt.

Schlager, Edella. 1990. "Model Specification and Policy Analysis: The Governance of Coastal Fisheries." Ph.D. diss., Indiana University.

Schlager, Edella, and Elinor Ostrom. 1992. "Property-Rights Regimes and Natural Resources: A Conceptual Analysis." *Land Economics* 68(3) (Aug.): 249-62.

Schlager, Edella, and Elinor Ostrom. 1993. "Property-Rights Regimes and Coastal Fisheries: An Empirical Analysis." In *The Political Economy of Customs and Culture: Informal Solutions to the Commons Problem*, ed. Terry L. Anderson and Randy T. Simmons, 13-41. Lanham, Md.: Rowman & Littlefield.

Sedjo, Roger A. 1992. "A Global Forestry Initiative." *Resources* no. 109 (Fall): 16-19.

Sen, D., and P. K. Das. 1987. "The Management of Peoples Participation in Community Forestry: Some Issues." London: ODI, Social Forestry Network paper no. 4D.

Sengupta, Nirmal. 1991. *Managing Common Property: Irrigation in India and the Philippines*. London and New Delhi: Sage.

Shanks, E. 1990. "Communal Woodlots in Tanzania: Farmers' Response and an Evolving Extension Strategy." London: ODI Social Forestry Network paper no. 11C.

Shivakoti, Ganesh P., Khadka Giri, and Elinor Ostrom. 1991. "Effects of Different Types and Levels of Intervention in Farmer Managed Irrigation Systems in Nepal." Winrock International Working Paper.

Skole, David, and Compton Tucker. 1993. "Tropical Deforestation and Habitat Fragmentation in the Amazon: Satellite Data from 1978 to 1988." *Science* 260 (June 25): 1,905-910.

Talbott, Kirk. 1993. "Central Africa's Forests." In *Issues in Development*. Washington, D.C.: Center for International Development & Environment, World Resources Institute.

Tamang, Devika, Gerard J. Gill, and Ganesh B. Thapa, eds. 1993. *Indigenous Management of Natural Resources in Nepal*. Kathmandu, Nepal: HMG Ministry of Agriculture/Winrock International.

Tang, Shui Yan. 1991. "Institutional Arrangements and the Management of Common-Pool Resources." *Public Administration Review* 51(1) (Jan./Feb.): 42-51.

_____. 1992. *Institutions and Collective Action: Self-Governance in Irrigation*. San Francisco, Calif.: Institute for Contemporary Studies Press.

_____. 1994. "Institutions and Performance in Irrigation Systems." In *Rules, Games, and Common-Pool Resources*, ed. Elinor Ostrom, Roy Gardner, and James Walker, 225-45. Ann Arbor: University of Michigan Press.

Task Force on Global Biodiversity, Committee on International Science. 1989. *Loss of Biological Diversity: A Global Crisis Requiring International Solutions*. Washington, D.C.: National Science Board.

Thomas, D. B. 1991. "Soil Erosion." In *Environmental Change and Dryland Management in Machakos District, Kenya. 1930-90*, ed. Michael Mortimore, 24-43. London: Overseas Development Institute and the University of Nairobi, Working Paper no. 53.

Thomson, James T. 1992. *A Framework for Analyzing Institutional Incentives in Community Forestry*. Rome, Italy: Food and Agriculture Organization of the United Nations, Forestry Department, Via delle Terme di Caracalla.

Tiffen, Mary, Michael Mortimore, and F. N. Gichuki. 1994. *More People, Less Erosion: Environmental Recovery in Kenya*. New York: John Wiley.

United Nations Population Fund (UNFPA). 1989. *State of the World Population 1989*. New York: UNFPA.

Wade, Robert. 1988. *Village Republics: Economic Conditions for Collective Action in South India*. New York: Cambridge University Press.

Weiss, Edith Brown. 1989. *In Fairness to Future Generations: International Law, Common Patrimony and Intergenerational Equity*. New York: Transnational Publishers and United Nations University.

Wilson, E. O. 1985. "The Biodiversity Crisis: A Challenge to Science." *Issues in Science and Technology* 2:20-29.

Wilson, E. O., and Frances M. Peter. 1988. *Biodiversity*. Washington, D.C.: National Academy Press.

World Bank. 1978. *Nepal Staff Project Report and Appraisal of the Community Forestry Development and Training Project*. Washington, D.C.: World Bank Internal Report.

1. For example, see Wilson (1985), Task Force on Global Biodiversity, Committee on International Science (1989).
2. Bruce Cabarle, Manager of the Latin America Forestry Program at the World Resources Institute, recently commented: "There really is a catastrophe waiting to happen, both for the forests and the people who live off them" (in Alper, 1993).
3. Myers (1988: 28).
4. United Nations Population Fund (1989) projections based on current levels of birth control use. The estimated population in the World Bank's *World Development Report* (1993: 268-69) for 2025 is, however, a more modest 8.3 billion. It is not unusual to find discrepancies this large in projected population figures given different assumptions about initial starting conditions and rates of change.
5. Task Force on Global Biodiversity (1989: 3).
6. Chichilnisky (1994: 4).
7. See Lovejoy (1980), Ehrlich and Ehrlich (1981), and Norton (1986). Reid and Miller (1989: 37-38) estimate that between 1990 and 2020, between 5 to 15 percent of all species would be lost.
8. 8. Task Force on Global Biodiversity (1989: 3); see also discussion in Ascher (1993).
9. 9. "It is this broad-scale clearing and degradation of forest habitats [by communities of small-scale cultivators] that is far and away the main cause of species extinctions" (Myers, 1988: 29).
10. 10. For very recent views stressing the primary and simple role of population increases see Rowe, Sharma, and Browder (1992: 39-40), Abernathy (1993), Fischer (1993), Holdren (1992), Ness, Drake and Brechin (1993), and Pimental et al. (1994).
11. The "Houston Communique" issued in 1990 is also relevant. See description in Sedjo (1992: 16).
12. Korten is summarizing her evaluation of the impact of a "showcase loan" by the Asian Development Bank to support the reforestation of 358,000 hectares of land in the Philippines. Similar evaluations have been made of many national and international efforts (see, for example, Arnold and Stewart, 1989; Sen and Das, 1987; Apichatvullop, 1993; Shanks, 1990; Chambers, 1994; McNeely, 1988; Repetto, 1988; Repetto and Gillis, 1988).

13. This may be due to the fact that UNICEF focuses primarily on the developing world, but then is the Ehrlich model limited primarily to the industrialized world?

14. Deacon did not set out to test either of the models proposed by the Ehrlichs or by UNICEF and made no reference to either of them. Deacon (1994: 2) stresses that the "causes of deforestation are not well understood" and that the causes posited by some analysts are absent in the discussions of others. Deacon's own view is that the insecurity of property rights is a major contributing factor to deforestation.

15. In low- and middle-income countries, a 1 percent increase in population during 1975-1980 is associated with a proportionate forest cover reduction of 0.07 - 0.13 percent during 1980-85.

16. Among the books that have been written since the NAS report that provide a foundation for this growing consensus are: McCay and Acheson, 1987; Fortmann and Bruce, 1988; Wade, 1988; Berkes, 1989; Pinkerton, 1989; Sengupta, 1991; V. Ostrom, Feeny, and Picht, 1993; Netting, 1993; E. Ostrom, 1990; 1992; E. Ostrom, Gardner, and Walker, 1994, Blomquist, 1992; Tang, 1991; and Thomson, 1992.

17. These include the work of Fairhead and Leach (1992) in Guinée; Agrawal (1994b) in India; Tiffen, Mortimore, and Gichuki (1994) in Kenya; Fox (1993) in Nepal; and Meihe (1990) in Senegal.

18. *Free-riding* behavior occurs when individuals do not contribute to the provision and/or production of a joint benefit in the hopes that others will bear the cost of participating and that the free-riders will receive the benefits without paying the costs. *Rent-seeking* occurs when individuals obtain entitlements that enable them to receive returns that exceed the returns they would receive in an open, competitive environment. *Asymmetric information* occurs when some individuals obtain information of strategic value that is not available to others. *Corruption* occurs when individuals in official positions receive personal side-payments in return for the exercise of their discretion.

19. 19. These hypotheses are obviously stated in a very general manner. We are presently developing a working paper that specifies how more specific versions of these hypotheses could eventually be analyzed using the IFRI database.

20. See Kiser and Ostrom, 1982; Oakerson, 1992; E. Ostrom, 1986; E. Ostrom, Gardner, and Walker, 1994.

21. Aldhous (1993: 1,390).

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