World Development, Vol. 12, No. 8, pp. 837-847, 1984.
Printed in Great Britain.

0305-750X/84 $3.00 + 0.00

Land-use Planning to Help Sustain Tropical Forest Resources

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Summary. – Greater use of land-use planning could help sustain tropical forest resources, particularly in countries where future alternatives have not been closed off by prior land-use allocations. Although suitable planning techniques are available, they have not been used to their full potential in tropical countries because of (1) insufficient appreciation by decision-makers, (2) limited availability of data, (3) scarcity of planning expertise, (4) cost, and (5) domination of decision-making by special interest groups. The usefulness of existing techniques can be improved by (1) increasing the timeliness and focus of analysis, (2) improving the data base, (3) encouraging public participation, (4) improving communication of findings, (5) adopting an interdisciplinary approach, and (6) incorporating better monitoring and evaluation in project implementation.

1. INTRODUCTION

Most conversion of forest land to other uses occurs without adequate consideration of whether the natural and human resources available will sustain the new land use (Hamilton, 1982). Unfortunately, much of the remaining tropical forest land is too infertile or dry to sustain traditional farming or extensive livestock grazing and most people in tropical countries do not have the capital, skills, resources and access to inputs and services necessary to apply intensive agricultural techniques on this land. When such lands are cleared for unsustainable land uses, the soil, water and biological resources on- and off-site may be degraded in the long run (FAO, 1976). Similar problems may occur following uncontrolled commercial logging, mining or road construction on steep slopes.

The problem, then, is to match land development activities to the specific site capabilities. Sites that cannot sustain other uses should be retained in natural conditions or reforested for such uses as watershed protection, nonwood products, preservation of biological diversity outdoor recreation, or closely-regulated wood harvesting. Forested sites that can sustain other uses may be modified for more intensive forestry or agroforestry purposes or converted to agricultural, mining, urban or industrial uses compatible with the natural and human resource capabilities.

Some tropical countries are using land-use planning to help match land capability with land use. Broadly interpreted, land-use planning has four components: (1) biophysical assessment, (2) financial and economic analyses, (3) social assessment, and (4) monitoring and evaluation. Land-use planning is best viewed as a flexible, iterative process that produces information as needed rather than resulting in a blueprint for development. This flexibility is especially important in forest resource development projects where the risks may be large and the approaches are innovative or experimental. For example, social forestry projects may involve people who have not participated in forestry before or may use lands outside of the foresters customary domain.

2. BIOPHYSICAL ASSESSMENT

A biophysical assessment provides one dimension of information for effective land-use management. Existing techniques are straightforward and relatively efficient. They can be carried out at different levels of detail with

*The author would like to acknowledge the helpful comments of Bruce Ross-Sheriff and Walter Parham in preparing this paper. This paper is drawn from Chapter 11 of the report, *Technologies to Sustain Tropical Forest Resources* (Office of Technology Assessment, 1984). Some other articles drawn from the OTA report are Hyman (forthcoming and submitted a and b) varying requirements for monetary resources, staff expertise and available data.

Many factors affect the biophysical suitability of a site, including:

1. Climate – precipitation, temperature, wind, droughts, floods, storms, fire risk and air pollution potential
2. Geomorphology and geology – slopes, stability, location and uses of surface and ground water, mass movements of earth, depth to bedrock and unique features
3. Soils – nutrients, structure, depth and erodability
4. Flora and fauna – biological diversity, ecosystem fragility, valuable species, pests and diseases.

There are two basic approaches to biophysical assessment. The most common approach consists of identifying the constraints that could inhibit a particular land use and looking for sites where the constraints are manageable. A less common approach is land classification – determining the best uses for each site within a given parcel of land. At present, neither approach is used to its full potential in tropical countries (Qadri, 1982). In particular, the latter approach has great potential to help sustain the long-term productivity of forest resources.

(a) *Selecting a location for a given land use*

The first step in choosing a site for a given land use should be to determine what constraints might affect that type of development. By eliminating sites with incompatible characteristics, some of the harmful, unintended consequences of land conversions can be avoided (e.g. soil erosion or build-up of soil salinity).

Usually, site suitability is a matter of degree and varies with the technologies adopted, intensity of management and care in implementation. Certain sites are permanently unsuitable for particular uses. Other sites may be conditionally suitable if good management practices are followed.

(b) *Land classification*

Land classification is a 'site-oriented' approach that categorizes land in terms of its suitabilities for various uses. Table 1 briefly describes some common land classification methods. These methods are mainly suited for identifying the resources of a given area.

Classifications may be made at various levels. Macro-level classifications are a broad-brush scanning of large land areas to establish national or regional priorities. Micro-level classification is a task for local public or private land managers who have specific mandates such as economic production, watershed management, wildlife conservation, and military security. The most immediate need in developing countries is for macro-level classification (Hamilton, 1981). Subsequently, micro-level classifications could be used to support decisions on the use of specific land parcels. Micro-level classifications are important because land characteristics may vary a lot within a broad-brush classification.

Existing land classification systems have some limitations. They are less well-suited for determining appropriate management practices for existing land uses or predicting the consequences of proposed changes in land use and policies (Mueller-Dombois, 1981). Since many systems are oriented toward a particular land use such as agriculture or forestry, they do not consider overall land suitability (Qadri, 1982). None of the systems measures land productivity directly because that would be expensive and time-consuming. Some systems are more appropriate for use in ecological studies than in helping decision-makers answer land management questions (Cameron, 1981). None of the systems identifies what are the direct or indirect biophysical impacts of land use conversions. Moreover, these systems neglect gradual changes in biophysical factors that may result in varying limitations on land uses (Lee, 1981).

(c) *Analytical techniques based on biophysical factors*

Planners have a number of techniques to incorporate biophysical factors in decision-making. Map overlays are commonly used in the United States for selecting sites for particular land uses. One such technique (McHarg, 1969) begins with a set of key biophysical attributes. For each attribute selected, a separate map is produced with white, black or shades of grey to show whether the attribute is suitable, unsuitable or partially unsuitable for a specific type of development. The overall suitability is determined by laying the individual maps over each other and examining the distribution of shading intensities. This procedure implicitly assigns an equal weight to each biophysical attribute although, in fact, their importance may vary.

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Table 1. *Common land classification methods*

1. *Australian Land System*
The Australian Land System (Christian and Stewart, 1968) uses aerial photos to survey large areas for agricultural, forestry and recreational potential. A 'site' is defined as a uniform land form with common soil types and vegetation. A 'land unit' is a collection of related sites with a particular land form. A 'land system' is a group of geomorphologically and geographically associated land units, usually bounded by a geological or geomorphogenetic feature or process.

2. *Ecological Series Classification*
The Ecological Series Classification (Mueller-Dombois and Ellenberg, 1974) describes forest habitat types in bioclimatic terms: a plant community's soil, water and nutrient regimes; soil surface characteristics, and undergrowth plant distribution. The technique produces site indices for each habitat type that vary with the productive capacity of the trees, natural regeneration capability, the appropriate species for tree-planting, fertility requirements and engineering properties.

3. *Holdridge Life Zones System*
Holdridge Life Zones (Holdridge, 1967) are broad bioclimatic units defined by mean annual precipitation, mean annual biotemperature (air temperatures adjusted to eliminate negative values), and potential evapotranspiration. These broad units can be subclassified by soil, seasonal rainfall distribution, drainage and mature vegetation associations.

4. *Canadian Biophysical System*
The Canadian Biophysical System (Lacate, 1981) is a hierarchical classification. The basic unit used is the 'land type', which is characterized by a homogeneous soil series and sequence of vegetation. Land types are subdivided into 'land phases' according to their stage of vegetative succession. 'Land systems' are groups of land types with a recurring pattern of land forms, soils and a sequence of vegetation. The next broader unit, the 'land district' has a distinct pattern of relief, geology, geomorphology and a sequence of vegetation. Finally, there are 'land regions', distinct climatic zones associated with a particular climax vegetation.

5. *Webb's Structural Classification of Humid Forests*
This is a classification system for humid forests based on vegetation structure and physiognomy including such factors as forest structure, composition, canopy closure, type of emergents, species growth forms, and leaf size (Webb *et al.*, 1977). The system correlates vegetation, structure, and physiognomy with rain, altitude, cloudiness, temperatures, soils, drainage and wildlife habitat.

6. *Krajina's Biogeoclimatic Zonation System*
Krajina's Biogeoclimatic Zonation System (1973) is based on forest habitat types. Each zone is characterized by a climatic climax vegetation, climate and soil type. However, a 'climatic climax' might be deflected into an 'edaphic climax' due to poorly or excessively drained soils or a 'topographic climax' on steep slopes or alluvial flats.

7. *USDA Soil Conservation Land Capability System*
The USDA Soil Conservation Land Capability System (Klingebiel and Montgomery, 1961) uses soil survey mapping units grouped into eight classes according to the capability to sustain cultivation, grazing, forestry, wildlife, and recreation without erosion. The classification system indicates the degree of limitation to intensive uses.

8. *California Soil Vegetation Survey*
The California Forest and Range Experiment Station (1958) developed a classification system predicated on the assumption that soil types are correlated with differences in vegetation on undeveloped lands. Aerial photos are used to observe the type, age, density, and structure of the vegetation.

Source: Adapted from Hamilton, 1982.

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The 'METLAND' technique (Fabos *et al.*, 1978) is an extension of the map overlay approach which uses computers to manipulate data and generate alternative plans. Thus, the attributes can be given different weights and more attributes can be included.

Both of the above techniques assume that natural system relationships are determined by land physiography. Neither technique is well-suited for analysing indirect or cumulative impacts of land uses. Unless combined with simulation modelling, these techniques do not reflect dynamic changes over time in the magnitudes or types of impacts associated with various land use activities.

Other techniques reveal site potential for specialized uses; an example is the Habitat Evaluation Procedure (US Fish and Wildlife Service, 1980). This procedure assesses the impacts of land-use changes on the quantity and quality of habitat for selected fish and wildlife species. The procedure relies on aerial photos or field work and modelling. Since a proposed action often results in gains for some species and losses for others, the Habitat Evaluation Procedure has a provision for calculating relative value weights for the indicator species. The above techniques and others are described in detail and evaluated by Nichols and Hyman (1982).

One specialized indicator for forestry is Wadsworth's (1969) watershed value index. This is a numerical scoring system that can be used as a rule-of-thumb in deciding whether a forest cover should be retained on a site for watershed protection. The index accounts for slope and the existence of critical environmental factors.

(d) *Applications of land classification and site-suitability analysis*

Land classification and site-suitability analyses have been applied in a fair number of tropical countries although more often as a research effort than as part of a routine planning process carried out by a government agency or private firm. For example, the techniques have been demonstrated in Mexico (Marten, 1981) and Venezuela (Hawes and Hamilton, 1980). Holdridge Life Zones have been mapped for over 20 countries. The map overlay method has been used in Brazil to identify priorities for establishing parks and protected areas (Burley, 1982). FUDENA, a Venezuelan conservation organization, used map overlays together with the Holdridge Life Zone classification to show that dry forests and grasslands were underrepresented in existing protected areas relative to moist forests.

Malaysia has one of the best land capability planning systems in the tropics. The system includes geological surveys, regional soil surveys and a combination of the Canadian and US Soil Conservation Service land inventories. It has been particularly useful in designating areas for tin mining, large-scale oil palm, rubber and wood plantations and resettlement projects. One reason for the effectiveness of the Malaysian system is that it is carried out by economic planning units which have the authority to ensure that the plan's provisions are implemented (Hepburn, 1974; Moss, 1981).

The US Agency for International Development (AID) has instituted land use planning for many of its projects in developing countries. For example, the AID-funded 'Benchmark Soils Program' in such countries as Brazil, the Philippines, Indonesia and Cameroon identifies soil types and tests similar soils for crop yields under different agricultural practices. The Government of Nepal, with AID assistance, has completed a national land inventory that includes topography, geology, vegetation, climate and soils. AID has assisted Sri Lanka with planning for the resettlement and watershed management associated with the Mahaweli reservoir. An AID project in the Eastern Andes was completely redesigned as a result of land capability analysis. Development planning for the Mekong River basin sponsored by UNDP, AID, and several bilateral aid agencies has emphasized the use of these techniques. Some land classifications have been done in Indonesia (Sandy, 1981), Pakistan (Quereshi, 1981) and the Philippines (Umali, 1981b).

3. FINANCIAL AND ECONOMIC ANALYSES

After the biophysical suitability of a site has been determined, the next step is to analyse financial and economic benefits and costs. The purpose of these analyses is to maximize the values obtained from natural resources while conserving resources for the future and ensuring an equitable distribution of the income.

A financial analysis considers the anticipated cashflows to the owner or users of the land. An economic analysis is made from the perspective of society. The financial and economic

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impacts of land conversion depend on the previous uses of the land; quantity and quality of labour and capital used; energy-intensiveness of the technologies; existence of infrastructure and markets; and site location, accessibility and size. Often, there are conflicts between the financial decisions made by individuals and the decisions that would be preferred from a societal perspective.

Financial and economic analyses can provide an additional quantitative dimension on the desirability of land-use changes and offer a systematic way to organize information for decision-makers. Since it is easiest to place monetary values on marketable goods and services, these analyses are most applicable in decisions involving agricultural or industrial production, human services and residential development. Economic and financial analyses are most appropriate where decision-makers agree on values and goals (including the trade-offs between efficiency and equity) and where there are few unintended effects off-site. Consequently, it has been necessary to adapt the techniques to forestry and environmental quality decisions where the effects are broad, diffuse and harder to quantify in economic terms (Gregersen and Contreras, 1979; Hufschmidt and Hyman, 1982; and Hufschmidt *et al.*, 1983).

The fundamental limitations of financial and economic analyses are

1. Imperfections that distort prices observed in real markets
2. Inability to assess the distribution of costs and benefits among segments of the population and across generations
3. Inadequacy of techniques for measuring benefits or damages associated with environmental effects and insufficient empirical information on cause–effect relationships when acceptable economic techniques exist
4. De-emphasis of long-term effects due to discounting for the time value of money
5. Inadequate treatment of risk and uncertainty.

In many cases shadow prices or estimated values must be imputed where market prices do not exist or are presumed to reflect societal values poorly. However, shadow pricing may increase the potential for political manipulation of an economic analysis (Wisdom, 1982).

Within the past 15 years, a variety of techniques have been developed to assign values to environmental effects (Hyman, 1981b). Four basic types are:

1. *Revealed preference measures* which examine actual consumer behaviour and estimate shadow prices for extramarket goods and services by examining expenditures to avert damages, replacement costs to repair damages, travel costs to recreational facilities, differences in property values around amenities and disamenities, and wage differentials associated with risky occupations
2. *Hypothetical valuation methods* which rely on direct questioning, bidding games, use estimation games, or trade-off analysis to elicit the maximum amount that consumers are willing to pay for a gain or the minimum amount of compensation that they are willing to accept for a loss
3. *Human capital methods* which are used to place values on human mortality and morbidity
4. *Threshold analysis* which asks how large the benefits of preserving land in its current state would have to be in order to outweigh the benefits of conversion to other uses.

Careful attention must be paid to the assumptions underlying the use of these techniques and their susceptibility to problems of validity, reliability, and biases (Hyman, 1981a). Many of the techniques tend to underestimate environmental values, but this is not a problem where decision-makers only need a lower-bound estimate to support conservation decisions. For example, Gregersen (1982) cites an analysis which showed that wildlife values exceeded wood product values in a case in Peru. Since many situations are less clearcut, more sensitive techniques are needed. However, the most important constraint on economic evaluation of environmental benefits is not inadequacy of the techniques but a dearth of scientific data on cause–effect relationships for various land use activities.

Another problem arises because most economic analyses determine the environmental value of forest resources 'at the margin' and this can differ significantly from the average value of forest resources. For example, if the value of genetic resources in any small area of forest is not large, an economic analysis may justify clearing the forest piece-by-piece until it is all converted to non-forest uses, without ever accounting for the overall loss of genetic resources (Gregersen, 1982).

Establishing monetary values for the multiple benefits of forests can be useful in making decisions on the choice of outputs, production

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techniques, regulatory policies, fees for concessions and leases, compensation for land takings or off-site damages, and priorities for industrial or social forestry projects (Gregersen, 1982). The potential users of this information include the private sector, multilateral development banks, UN agencies, bilateral assistance agencies and national or local governments. The influence that an economic analysis has in land-use decisions depends on how well it addresses the issues of concern to decision-makers, Sometimes, however, economic analysis is used to justify decisions that already have been made on other grounds.

4. SOCIAL ASSESSMENT

In the past, multilateral development banks often viewed large-scale forestry operations exclusively from the perspective of their economic impacts. The poor records of many of those projects forced an awareness of the importance of social and institutional dimensions of land-use decisions (Noronha, 1980). The extent to which social assessments are now made varies among organizations and across projects. It often is argued that better social assessments could contribute greatly to the success of development projects.

Some proposed development activities are infeasible because the necessary human resources are unavailable or cultural values inhibit effective implementation. Forest development projects often have undesirable impacts on certain groups of people, particularly on the former users of a site. Hardly any land is totally unoccupied by people. The 'reserve' forest land in most less developed countries contains shifting and settled cultivators, hunters and gatherers, and livestock herders. Other untitled lands may have uncertain land tenure status. In some cases, large landholders or the landless poor have appropriated these lands. Communal lands that appear to be useless scrub forests at first glance actually may support a sizeable number of people. If the interests of past users of a site are not considered, these people may undermine the success of a development project (Hoskins, 1982). Social assessments can help planners avoid or mitigate some of these problems or suggest ways to compensate the people who are adversely affected.

Culture-specific information also is needed on how projects should be designed to (1) announce the availability of government services such as forestry extension; (2) reduce the risks facing adopters of new techniques; (3) encourage activities that provide off-site benefits not captured by individuals undertaking the activities (e.g. reduced soil erosion down steep slopes); and (4) give landless people incentives for resource conservation. For example, one reason why social forestry projects fail is that the local people may not be interested in the species of seedlings distributed or are unfamiliar with the growth requirements or products of these trees. Cultural factors may differ within a country. For example, a credit programme for farm forestry work well in one part of the Philippines and poorly in another because of differences in local attitudes toward debt (Hyman, 1983b).

A development project involving local people is more likely to be successful if the intended beneficiaries are brought into the planning process from the beginning. Otherwise, (1) intended beneficiaries might be unwilling to participate; (2) benefits might be captured by local elites; or (3) project activities may be designed on the basis of unrealistic assumptions about the participants' skills, capital or access to inputs.

Variations in the success rate of projects often can be explained by differences in the capabilities of the local, regional, national, and international organizations involved. Common institutional problems include the (1) lack of strong leadership accepted by the community and willing to take the initiative; (2) domination of decision-making by elites for their own special interests; and (3) factionalism by socioeconomic, ethnic or religious groups that makes it difficult for people to work together (Van Heck, 1979). Government laws and policies such as price controls, trade restrictions, and property rights also can have unintended effects on people's decisions to participate in land use development projects (Hyman, 1983a).

AID conducts some social assessment for projects, including an analysis of absorptive capacity and expected impacts; however, the amount and type of analysis conducted varies. AID has written guidelines for preparing a 'social soundness analysis' as part of each project paper (US AID, 1982), but these guidelines do not provide operational details on how to conduct the analysis.

The World Bank currently is revising its guidelines for project appraisal to incorporate social assessment procedures. The World Bank also recently prepared guidelines for projects affecting tribal groups or involving resettlement of populations.

5. MULTIPLE-OBJECTIVE PLANNING METHODS

Once information is available on the likely biophysical, economic and sociocultural aspects of a land-use development project, decision-makers need some way to judge the relative importance of the various findings. Too often, decision-makers avoid confronting trade-offs among conflicting objectives systematically. Considerable progress has been made in the past two decades in developing multiple-objective planning techniques to address these trade-offs directly (Cohen, 1978; Nichols and Hyman, 1982). These techniques have been used mainly in planning water resource development projects, but with some adaptation, they can be applied to land-use planning for forest resource development as well.

Multiple-objective planning techniques are broader than single-objective approaches such as the maximization of physical production or net economic returns. Multiple-objective techniques attempt to categorize effects so that they can be compared within separate accounts (e.g. income, employment and reductions in runoff), but they are not necessarily forced into a single measuring unit. Some of these techniques also provide a systematic means for decision-makers to assign relative value weights to each account (Hyman *et al*, submitted).

Multiple-objective techniques can improve the planning process in at least three ways. First, they can broaden decision-making to allow consideration of a wider range of value judgments. Second, by systematically investigating alternative projects, the range of choice can be expanded and the relationship between alternatives and the relative weights on the objectives can be explored. Third, the analyst's perceptions of a problem are likely to be more realistic if the full range of objectives is considered.

6. MONITORING AND EVALUATION

Since it is impossible to plan in advance for all contingencies and impacts associated with land use development, project monitoring and evaluation are necessary (Hyman, submitted c). In some cases, increased efforts at monitoring and evaluation may be more productive than devoting more resources to pre-project planning.

Monitoring is a continuous process of collecting, analysing and communicating information on projects regarding the (1) participation rates, (2) timely and appropriate provision and use of inputs, and (3) execution of operation and management activities. Monitoring focuses on achievement of planned targets and the reasons for achievements or shortfalls. Monitoring takes place during implementation and indicates whether managerial improvements are necessary.

Evaluations examine the effectiveness of the project's design, estimate the production and distribution of outputs and assess the human and environmental impacts of the project. There are two types of evaluations: ongoing and ex post. Ongoing evaluations are performed during project implementation. Their purpose is to suggest necessary modifications in project design or the timetable, scale, geographic location, resource allocation or staffing. Ongoing evaluations also can suggest ways to reduce the detrimental effects of unanticipated problems such as the weather or market prices.

Ex post evaluations, conducted after project implementation has been completed, are used to:

1. Identify people adversely affected by social impacts who may deserve compensation
2. Determine whether unintended environmental impacts require mitigation
3. Suggest follow-up or complementary projects that build on the original project
4. Assist in the reformulation of broader laws, policies, and strategies
5. Provide lessons for planning other projects elsewhere.

Monitoring and evaluation have been relatively neglected concepts in development planning, although AID and the World Bank are now emphasizing their importance. Comprehensive monitoring and evaluation systems are being carried out now for social forestry projects in Nepal (Bhattarai and Campbell, 1982), Malawi (French, 1984), and for several projects in India. Spears (1983) lists common positive features and problems identified through evaluations of World Bank-supported industrial and social forestry projects.

7. CONSTRAINTS

Techniques to analyse the biophysical, economic and social impacts of land-use conversions are available, but their use is constrained by (1) an insufficient appreciation of the techniques by decision-makers, (2) limited availability of data, (3) scarcity of expertise, (4) cost and (5) dominance of decision-making by special interest groups.

Many decision-makers do not understand the techniques of land-use planning or their potential utility. As a result, they may base resource development decisions on pre-established priorities, political convenience, or intuition rather than analysis (Lee, 1981). To overcome this constraint, decision-makers need to be shown that planning can help them. Analytical information should be brought into the early stages of the planning process. It also is important to overcome the perception that planning leads to automatic or permanent land use dedications.

The limited availability of data is frequently a problem. Ground surveys are slow, expensive and inadequate for some types of information. Aerial photographs have a small area of coverage and they are relatively expensive. Remote sensing images from multispectral scanners on orbiting satellites are becoming more widely used. However, institutional constraints may limit use of existing data from any of the above sources. Aerial photos, satellite images and even contour maps may be classified for security reasons.

To date, governments in tropical countries have been able to purchase satellite images at relatively low cost (Umali, 1981a) because of the fixed capital costs borne by the US government. This policy may change if the US government sells these satellites to the private sector. Remote sensing is not a complete substitute for field data because it cannot provide all of the biophysical information necessary for forest land management decisions (Cameron, 1981). However, remote sensing can be useful in estimating rates and locations of deforestation and forest resource degradation if time-series data are available. Furthermore, there can be considerable variation in the interpretation of LANDSAT data by different technicians and some areas consistently are obscured by cloud cover. However, optical enhancement techniques can improve the spatial, textural, and tonal qualities of the images and computer analysis can increase the interpretability. Minicomputers may bring down the cost of this analysis.

Effective land-use planning requires expertise in many disciplines: geology, hydrology, climatology, ecology, geography, agronomy, forestry, economics, sociology and planning or public administration, to name a few. Even where sophisticated methods such as remote sensing and computer software are cost-effective, the lack of trained planning staff can preclude their use. The scarcity of expertise is one of the most serious constraints to land-use planning and one that may take considerable time to remedy. Nevertheless, effective results sometimes can be obtained from small, low-input planning teams following well-defined procedures.

Land-use planning activities can require a high initial investment, particularly where large land areas are concerned. At the same time, the benefits often are spread among large groups of people in present and future generations rather than among a few identifiable individuals who would be willing to bear the costs. Thus, it is likely that major land-use planning efforts in many poor countries will require foreign financial assistance.

In some countries, there is little actual governmental control over public lands because of the political influence of large logging, mining or agricultural interests. This problem is aggravated by the inability of many governments to enforce sanctions in remote locations against large numbers of illegal forest occupants, nomadic grazers, or tribal groups with customary rights. Even where the government has effective control over public lands, self-interest still can be a constraint. Prerogatives over government lands often are jealously guarded by key decision-makers. Forest Departments may resist any analyses that could result in the classification of land out of the public forest (Pandey, 1981).

8. OPPORTUNITIES

Considerable opportunity exists to make land-use planning techniques more useful by (1) increasing the timeliness and focus of analysis, (2) improving data, (3) encouraging public participation, (4) adopting an interdisciplinary approach, and (5) improving the communication of findings. Land-use planning has a good potential in countries where large tracts of forest land (with or without an existing forest cover) still remain and where future alternatives have not been closed off by prior land-use allocations (Hamilton, 1982). However, some of these lands may be biophysically capable of sustaining only a limited range of land uses or may be subject to encroachment by the landless poor.

A planning analysis only will be of use to decision-makers if it is geared to their needs and is timely. If the analysis is too narrow or superficial, decision-makers will not obtain the information they need. On the other hand, if it is too broad, costly delays will occur in project implementation or decisions

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will proceed without the plan. The timeliness and focus of the analysis can be improved by clearly defining the objectives of the plan and by setting priorities for what to study. For some uses, planning techniques that are relatively less precise and less expensive will be satisfactory. For example, it might not be necessary to use surveying instruments to measure slopes precisely at each site.

The adequacy of baseline data and information on cause–effect relationships associated with various tropical land uses needs to be improved. Much of the existing information on the connections between biophysical factors and land uses is derived from studies done in the temperate zones in developed countries (Qadri, 1982). The degree of transferability of this information to the tropics is questionable. In some cases, it might not be appropriate to transfer information obtained in one region of the tropics to others (di Castri and Hadley, 1979). Thus, more applied research is necessary.

Greater public participation in the early stages of the planning process could improve social assessments and increase the ability of local people to solve their own problems. However, public participation can be difficult to achieve. For the most part, foresters and land-use specialists have not been trained to facilitate a dialogue with local people to determine local needs, priorities and resources or to convince them of the desirability of tree planting and better land-use management. In some cases, the rural poor are unwilling to speak openly for fear of retaliation or because they speak a different language from the project staff. Sometimes, individuals with vested interests can dominate participation while the general interests of the local population are underrepresented (Huizer, 1982). Where the rural poor are excluded from political participation in government, it is unlikely that they will be allowed to participate effectively in the design or operation of development projects.

Most government agencies conduct activities that affect land use. Yet, there is little co-ordination among agencies with such diverse responsibilities as agriculture, forestry, military operations, water resources, mining, human settlements, transportation and wildlife. Forest Departments in many tropical countries, particularly those that retain the model set up under British or French colonial rule, remain detached from other sectors of public administration. An interdisciplinary approach to land use planning that transcends narrow agency missions is important and may be more likely to occur if carried out by national economic planning agencies with broader responsibilities. However, plans might not be implemented if they were not prepared by the land-administering agency. Thus, another alternative would be for Forest Departments to hire expertise in a broader range of disciplines or provide additional training for existing staff. In particular, social scientists should have a larger role in land use planning. In the short-run, some foreign technical assistance may be necessary.

Finally, scientific information needs to be presented in a simple, yet realistic form that decision-makers can understand. Key assumptions should be stated explicitly and tested. Sufficient budget and staff time should be devoted to communication of the findings or else the plans are likely to draw little attention.

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