

PA-ABZ-006



**DESFIL**

**Development Strategies for Fragile Lands**

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**DEVELOPMENT OF NRM DATABASE  
FOLLOWING ARTS/FARA NRM ANALYTICAL FRAMEWORK:  
A CONCEPT PAPER  
A Discussion Paper**

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## ACRONYMS

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AF	Agroforestry
ANRO	Agriculture and Natural Resources Office
API	Assessment of Program Impact
CBA	Cost-Benefit Analysis
CFA	Communaute Financiere Africaine
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo
CR	Communaute Rurale
DEFIL	Development Strategies for Fragile Lands Project
FAO	Food and Agriculture Organization
GIS	Geographic Information System
IARC	International Agricultural Research Center
ICRAF	International Center for Research in Agroforestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFAD	International Fund for Agricultural Development
IITA	International Institute for Tropical Agriculture
IMF	International Monetary Fund
KAP	Knowledge, Attitudes and Practices Survey
LOP	Life of Project
LUMP	Land-Use Management Practice
M&E	Monitoring and Evaluation
NGO	Nongovernmental Organization
NPA	Non-Project Assistance
NRM	Natural Resources Management
ORSTOM	Office de la Recherche Scientifique et Technique d'Outre-Mer
OTA	Office of Technology Assessment
PAM	Policy Analysis Matrix
POL/CDIE	Political/Center for Development Information and Evaluation
PRA	Participatory Rural Appraisal
PVO	Private Voluntary Organization
SFE	Soil Fertility Enhancement
SSA	Sub-Saharan Africa
SWC	Soil and Water Conservation
USAID	U.S. Agency for International Development

## I. INTRODUCTION

For each agroecological zone, there is a substantial body of knowledge about how rural producers manage the natural resource base in pursuit of a better livelihood. There is a wealth of wisdom from research and development reports. The collective body is rich with information about the economical and ecological impacts of various natural resources management (NRM) practices, the enabling conditions for the diffusion of these practices, and the programmatic options for establishing the enabling conditions and diffusing the practices.

The purpose of this activity is to collate the existing data into an electronic database in such a way that U.S. Agency for International Development (USAID) Missions can more effectively use the data to achieve their goals. The database will be organized according to the NRM Framework to more easily discern cause-and-effect relationships among critical variables associated with adoption. Field-level data will be collected on rural producers' traditional NRM practices using participatory rural appraisal (PRA) teams. To obtain other research and development data, collaborators will contact a number of national and international research institutions such as ICRAF, ICRISAT, IITA, CIMMYT, and ORSTOM, as well as nongovernmental organizations (NGOs) and private voluntary organizations (PVOs).

As the Africa Bureau's focus moved toward impacts, the Agricultural offices in USAID/W and the Missions have worked to identify the linkages between program investments and people-level impacts (PLIs). A critical step in achieving PLIs is the broad-based adoption of NRM practices that increase productivity and safeguard the natural resource base. One role of Missions is to assist host governments to establish the policy, institutional, and socio-economic conditions—the enabling conditions—that increase the incentives for broad-based adoption of sustainable agricultural management practices. The Missions and USAID/W have conducted a large number of case studies in order to identify: (1) the necessary and sufficient set of enabling conditions, and (2) the potential short- and long-term consequences of the diffusion and adoption of various practices. The NRM Framework was developed to better understand the cause and effect relationship among the variables in the process. Preliminary analysis of the case studies led to the development of the NRM Indicator Catalogue that identified illustrative indicators at each level. POL/CDIE has adopted the framework in its Agency-wide program to monitor environmental impacts of USAID programs.

This activity is the next step in identifying intermediate indicators that can be plausibly associated with broad-based adoption of appropriate practices. There is confidence that the indicators in the catalogue are associated with adopters, but it is not clear which are the most critical for USAID and host governments to assess progress toward national or regional-level impacts. This database will be developed to organize data to allow analysis of data generated from sites across regions within an agroecological zone. By comparing cases across regions, we aim to identify variables that most commonly distinguish adopters from the nonadopters, regardless of site. *This analysis will allow Missions and host governments to identify the programmatic options that are most effective in establishing the enabling*

conditions, and to identify the expected outcomes of the widespread adoption of sustainable NRM practices by rural communities.

This activity will increase the Africa Bureau's and USAID Missions' understanding about both the: (1) political, economic, and ecological impacts on and from various agricultural management practices; and (2) the process of diffusing appropriate sustainable agricultural practices for widespread adoption by natural resource users through community resource management. The research will focus on: (1) identifying, for each major agroecological zone, the biophysical and socioeconomic elements that need to be addressed; (2) analyzing the array of existing and/or newly developed agricultural management practices and their individual and aggregate impact on the natural resource base; and (3) assessing the conditions under which sustainable practices can increase productivity and maintain the resource base in each agroecological zone. A major output of the activity will be the identification of intermediate indicators for monitoring and evaluating program and project impacts during and after implementation. A specific target of the database is to assist Missions in monitoring and reporting on program and project impacts for their API reports.

## II. DESFIL RESEARCH AGENDA

DESFIL is a centrally funded project of USAID (R&D/EID/RAD) which conducts applied research and provides technical assistance to USAID Bureaus and USAID Missions, host countries, and international and national private voluntary organizations. Its geographic scope is global and its ecological scope includes arid and semi-arid lands, humid tropical lowlands, and steep slopes. DESFIL focuses its analytical efforts on three priority research themes: sustainable agriculture, community forest management, and indigenous peoples. A major component of the DESFIL applied research agenda focuses on determining how the interactions between policy, technology, incentives, community resource management, and gender issues influence the choices that resource users—women and men—make with respect to the management of fragile lands (figure 1). Its goal is to promote the effective participation of local resource users—men and women—in the sustainable management of fragile lands.

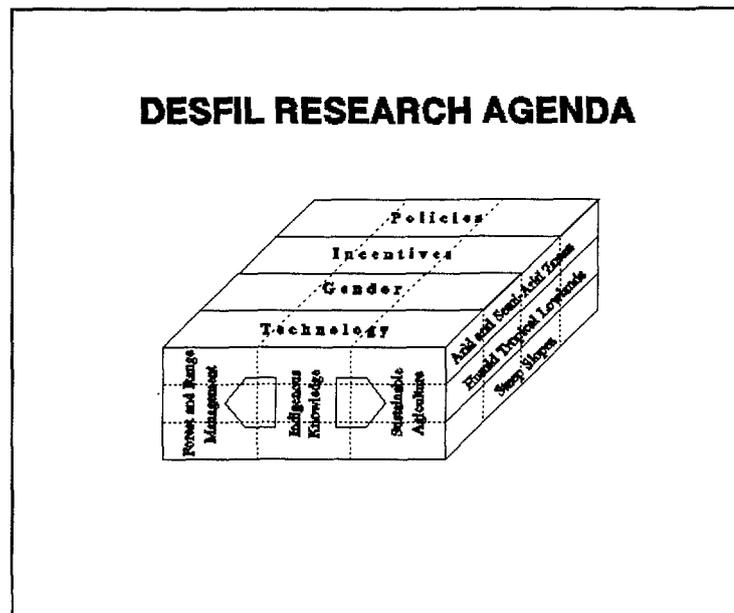


FIGURE 1

DESFIL will develop a taxonomy that will include the inventory of NRM practices and their biophysical and socioeconomic aspects—positive and negative—that relate to adoption and their cost/benefits over the short, medium, and long terms. Conditions

conducive to community-based NRM will be a key topic of the inventory. As data are collected, analyzed and entered into the database, it is anticipated that the hardcopy version will resemble an encyclopedia of land management practices adapted to the agroecological conditions in which they were developed and used. A manual will be developed concurrently to describe the methodology used in conducting the inventory. A workbook will describe how to use the taxonomy to develop strategies for the sustainable management of fragile lands.

### III. DESFIL'S APPROACH TO THE USE OF THE NRM ANALYTICAL FRAMEWORK

DESFIL applies the NRM Analytical Framework in its research agenda to provide USAID Missions with clear indicators to monitor and evaluate their NRM programs and projects. DESFIL uses the interactive and iterative nature of this framework in a logical and effective way to fulfill its mandate: to promote the effective participation of local resource users—men and women—in the sustainable management of fragile lands. Figure 2 is a schematic representation of the relationships among enabling conditions, incentives, indigenous knowledge, the adoption of practices, and the impact of these practices on the environment and users' welfare.

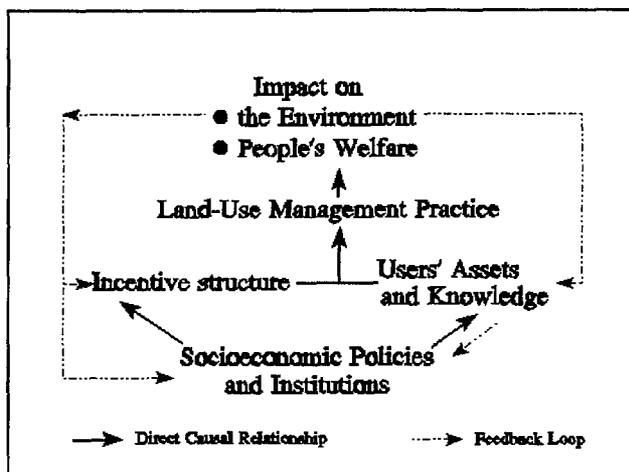


FIGURE 2

#### A. Identification and Characterization of Practices

DESFIL's analytical point of entry into the NRM Analytical Framework is Level III, the identification of practices currently adopted by natural resource users.<sup>1</sup> The NRM practices are identified and characterized within agroecological zones or *terroirs* that are perceived to face problems associated with fragile lands, because DESFIL's mandate concerns fragile lands. This characterization accounts for two important considerations: (1) who uses NRM practices, and (2) in which activities are NRM practices being used?

Within a *terroir*, there may be a large variety of resource users whose purposes of using practices are different and who respond differently to incentives. To capture this heterogeneity, DESFIL categorizes practices according to users' profiles, such as:

- Gender
- Asset endowments (land, labor, and capital)
- Knowledge basis (managerial capability and level of information)
- Sociopolitical status

<sup>1</sup> "An inventory of practices" has been drafted by W. Fiebig, DESFIL's Technology Program Coordinator.

An NRM practice, which may be a technical component or a technological package, can be used in different activities that produce different goods and services. For example, a practice may be used to produce traditional food crops, such as cereals or legumes, or nontraditional exports, fruits, and vegetables. A practice such as brushfire may be used in range management and possibly in ecotourism to clear tourists' view of wildlife. Therefore, in categorizing NRM practices, it is important first of all to identify the major activities in which practices are used to produce goods and services. Identifying these activities is critical for the later steps of our analysis at levels IV, V, and II of the NRM Analytical Framework.

#### **B. Analysis of Impact of Practices on Natural Resource Base**

The second step is to analyze the impact of practices on the natural resource base (Level IV). Do these practices "maintain or improve the productive capacity of soil, forest, range, water resources, and habitat?" Or do these practices contribute to the degradation of natural resources? An NRM practice can be hypothesized to have a direct, if accumulative, impact on the natural resource base. What are the causal relationships? An attempt is made at this stage to prognosticate the short-, medium-, and long-term impacts of the continued use of these practices on the natural resource base. Whether this impact of practices on the natural resource base is intended or unintended by users is further examined, at a later stage, in the analysis of the incentive structure.

#### **C. Analysis of Impact of Practices on Users' Welfare and the Environment**

The third step is to determine the impact of NRM practices on the socioeconomic activities in which users are engaged. Do these practices contribute to "sustainable increases in yields, [and users' welfare] and the maintenance of biological diversity" (Level V). The practices affect users' welfare through the market and social costs and benefits of the goods and services these practices contribute to produce. At this stage, therefore, it is critical to have clearly identified the (major) activities that require the use of practices and the goods and services produced in this process. Clearly, the impact on farm income from the use of compost is different depending on whether compost is used to grow low-priced cereals or nontraditional export-oriented fruits and vegetables. Focusing on the specific major outputs from the use of practices contributes to the development of unambiguous indicators for monitoring and evaluation of NRM programs and projects.

#### **D. Analysis of Users' Incentive Structures Reinforcing Adoption of Practices**

The fourth step is to analyze the incentives that, together with the characteristics of users, determine the choice of practices by natural resource users. The incentive structure is hypothesized to shape and reinforce the behavior of natural resources users, particularly through its effect on both the cost of the practice and the price of the output this practice produces. Here again, therefore, it is crucial that one clearly identifies the (major) activities that requires the use of practices and the goods and services produced in this process. The incentive structure can be viewed as a subset of the "enabling conditions for diffusion of

appropriate practices” (Level II).<sup>2</sup> This incentive structure is a complex set of economic, institutional, and other sociological elements:

- The economic incentives include expected costs and benefits and perceived risks of using NRM practices to generate goods and services;
- The institutional incentives include property rights (land tenure, tree tenure), and local governance; and
- Other sociological incentives include the indigenous community’s norms and beliefs that punish and reward members for engaging in certain NRM practices (for example, protection of *bois sacré*).

The profiles of users (gender, asset endowments, managerial capability, level of information, and social/political status) and the incentive structures determine the extent to which the unintended effects of practices are:

- Externalities, for which users feel no accountability;
- “Social traps” or vicious circles, of which users are aware but against which they lack viable alternatives; or
- Cases of users’ ignorance of the cause-and-effect relationships.

#### **E. Analysis of Policies Affecting Users’ Incentive Structure**

The fifth step is to analyze what and how policy measures support the structure of incentives and reinforce the access of users to assets and knowledge identified previously. This step is also part of Level II of the NRM Analytical Framework. The analysis establishes how policies affect incentives, and in particular, what would be the likely incentive structures if constraining policies (distortions) are removed or enabling conditions introduced. These policies must also reconcile private (individual users or community) incentive with overall societal economic benefit and conservation of the environment. The categorization of enabling and constraining policy conditions will contribute to DESFIL’ s taxonomy. Two broad categories of public policies can be distinguished: (1) economic, and (2) institutional policies. Together, these policies affect, positively or negatively, the community’s norms and beliefs, and thus the incentives they embody.

##### **E1. Economic Policies**

Three levels of economic policies affecting NRM practices may be further distinguished:

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<sup>2</sup> Erdmann (1992) also categorizes “price/market structures” at level II. Land users’ incentives include many factors other than economic, such as socio-political factors, including the community’s norms and beliefs.

- Macro, or economy-wide level, such as exchange rate, fiscal, and trade policies. Such policies, for example, the World Bank/International Monetary Fund structural adjustment programs, which are often instituted without regard to the environment, may actually affect land users' incentives. For example, foreign exchange policies strongly affect the protection or taxation facing products, encouraging or discouraging the use of NRM practices to produce the products affected.
- Sectoral level, such as in pricing of inputs and outputs in crop and livestock production. These policies are often viewed as the most critical to explaining land users' behavior. However, this should be verified through empirical investigations.
- Natural resource-specific policies, such as in pricing of forest products, pricing of ecotourism, and sharing of costs and revenues of reserve management. Although these policies may be considered as part of broad agricultural sector policies, they deserve a particular emphasis. They reflect a conscious effort on the part of government to promote better NRM practices, or to come to grips with the balancing of competing objectives, often involving economic growth and environment conservation.

## **E2. Institutional Policies**

An analysis of the institutional framework is also crucial because institutions establish the "rules of the game" under which markets operate. Changing these rules will alter the incentive structure. For example, changing land tenure regimes may affect land value and output prices; changing the institutional boundaries of rule-enforcing agencies will change transaction costs faced by natural resource users. Enforced new rules of local governance and community participation are important variables affecting land users' behavior.

## **E3. Analysis of Programmatic Actions Establishing Enabling Conditions**

The sixth step is to identify the "programmatic actions that establish the enabling conditions," which are the economic and institutional policies analyzed in step five. This is Level I of the NRM Analytical Framework.

## **IV. ANALYTICAL TOOLS AND DATA COLLECTION**

Land users' behavior—that is, the adoption/adaption of NRM practices—follows a complex, iterative and interactive process. Behavior, which is spurred by factors exogenous and indigenous to the users, is reinforced (in the use or nonuse of practices) by the perceived impact of practices on users' multi-faceted welfare. Undoubtedly, the linkages among programmatic actions, NRM practices, people-level impacts, and the impact on the environment are extremely complex. Good decision-making about NRM depends on a clear understanding of these linkages. Evidence of these linkages must be grounded on sound analytical tools and good information. DESFIL will collect and collate information resulting

from the use of sound analytical tools, and will also, when resources permit, apply some of these tools on good information to further contribute to this understanding.

Establishing the cause and effect relationships of these complex linkages is a difficult prospect. To facilitate the analysis, these linkages may be broken down into three basic questions.

- What are the determinants of land users' behavior, and how is the dependent variable-independent variables relationship established?
- What is the impact of users' practices on fragile lands, and how is this relationship established? and
- What is the impact of users' practices on their welfare and the economy, and how are these relationships established?

#### **A. Analytical Tools**

A wide variety of tools are used by analysts to attempt to answer these questions. They span the realms of biophysical and social sciences, both of which are reflected in the multidisciplinary nature of DESFIL's research agenda. Most of these tools are proven, standard tools, which categorize practices, investigate key determinants of their use, or assess their impact on the environment, but a few are only being recently applied to natural resources. The set of tools includes, but is not limited to, the following: anecdotal description; statistical analysis of biophysical and socioeconomic data; geographical information system (GIS); partial and whole farm budgeting; cost-benefit analysis; price analysis and other policy analysis tools; system analysis; and, if appropriate and when available, simulation models. A major constraint to the choice of analytical tools is data availability.

A few of these tools are briefly examined below, including anecdotal evidence; statistical analysis of biophysical and socioeconomic data; GIS; farm budgeting and cost-benefit analysis (CBA), and two relatively new analytical tools in policy analysis that deserve particular attention, the Green Book and the Policy Analysis Matrix (PAM).

##### **A1. Anecdotal Evidence**

Because of their keen knowledge of NRM in specific areas, land users, researchers, and other field observers can provide insightful information, even if not explicitly supported by rigorous empirical analysis. Lacking better information, this anecdotal or observational evidence may be used to suggest cause-and-effect relationships. Ideally, however, anecdotal evidence is best used to suggest hypotheses to be tested through more rigorous analysis based on empirical data. Nonetheless, there is a strong need to understand land users' perception of the cause and effect relationships of their practices, because this information is critical to understanding why practices are actually adopted, adapted, retained, or abandoned. To a large extent, the success of programs to help users adopt better practices may depend on

their capacity first to identify any gap between users' perception and empirical tested cause-and-effect relationships, and then to find ways of closing this gap. Anecdotal evidence based on the perception of users remains an extremely useful analytical tool.

## **A2. Statistical Analysis of Agronomic and Socioeconomic Data**

Results from on-station and on-farm testing provide an empirical base to assess the potential and actual impact of NRM practices on the resource base (Level IV) and crop yields (Level V). When data is available, statistical analysis of agronomic and other biophysical data can help establish the impact of practices on natural resource base (Level IV) and the environment, either across areas and/or over time.

Combining agronomic and socioeconomic data, statistical analysis can help explain the impacts of NRM practices on users' welfare at Level V, for example, food production and farm income. Also when information is available, statistical analysis of socioeconomic data can help identify across areas and over time the major determinants (independent variables) of users' behavior (dependent variable). It is not anticipated at this time that there will be enough quantitative data collected that will lend itself to a rigorous statistical analysis through the early phases of this research activity.

## **A3. Geographic Information System Analysis**

The NRM database will be structured such that it will be a relational database which will be geo-referenced to determine where exactly the information on land use management practices is coming from. By using geographic analysis tools such as GIS, one can see immediate results in a visual or graphic format. One can also visualize the spatial relationships that are so critical to understanding the cause-and-effect links between enabling or constraining conditions, and the adaptation/adoption of natural resource management practices. This will facilitate our understanding of the linkages among programmatic actions, practices, people-level impacts, and the impact on the environment. Geographic analysis is another tool to help provide a clear understanding of these linkages.

## **A4. Farm Budgeting and Cost-Benefit Analysis**

"Farm" is used here for convenience. It refers to any natural resource activity, including agricultural farm, natural forest, game or range management, ecotourism, or a combination of them. Partial or whole farm budgeting is used to investigate the technical efficiency (incremental yield) and the financial profitability (incremental benefit) of a set of practices compared to an alternative one. For example, farm budgeting can be used to investigate the incentives for using windbreaks to grow crops and harvest wood products, as opposed to not using them. Farm budgeting can also be used to investigate the often limiting constraint of farm-family or whole village labor bottlenecks.

Farm budgeting is the core of cost-benefit analysis. "The design of soil and water conservation programs rarely matches the sophistication of land users' benefit/cost analysis [because] land users' assessments of the costs and benefits are typically more comprehensive

and less fragmented than that of [programs designers],” notes IFAD (1992). CBA can shed considerable light on the expansion or replicability of practices. For example, the cost of rock bunds may increase as more farmers use them because rocks become scarcer and therefore more costly to supply.

Results of farm budgeting and CBA address Level V of the NRM Analytical Framework. However, some of these results can also be viewed as the incentives that reinforce users in the use or nonuse of NRM practices. The dual nature of these results is explained by the feedback loop, the iterative process in the adoption/adaption of natural resources management practices.

#### **A5. The Green Book**

The policy-oriented Green Book is a repository of synthesized information about the impact of policies on natural resources, their users, and the whole economy. The Green Book is based on anecdotal evidence as well as results from more objective analytical tools. The information it contains is a valuable, ready source of working hypotheses to be tested in specific NRM conditions. The utility of the Green Book increases the analysis of policy impacts, and covers similar ecozones and NRM practices as the case being studied.

#### **A6. Policy Analysis Matrix**

PAM is a budgeting tool developed for agricultural policy analysis. With the PAM, one can investigate the impact of policies on the financial profitability (to users) as well as the social profitability (to a country's economy) of NRM practices or a combination of practices used in one or several activities. PAM has been adapted for the analysis of issues of sustainable agriculture, by including change over time from the impact of NRM practices on yields and soil degradation. Important data requirements, however, often limit the use of PAM. If available, results from PAM establish a strong cause-and-effect relationship among policies, the use of NRM practices, and their impact on users' welfare and the economy.

### **B. Literature Review and Data Collection**

Reliable data on land resources—including soils, climate, vegetation, topography—and an inventory of land use practices—both traditional and improved, and their biophysical and socioeconomic aspects—are needed if ecologically sound and socially acceptable land use practices, incentives, and policies are to be developed. Some of these data are more widely available than is generally realized. However, the data is usually fragmented; of different scale and reliability; and stored in different ministries, libraries, and universities. Even where information is already readily available, particularly about soils and climate, other aspects may call for surveys and inventories to be made to gain a holistic appreciation of the problems facing resource users of fragile lands in Sub-Saharan Africa.

The first major task is to find out what data are available and where they are located. The second is to gather existing data together, arrange them in a usable form, assess their utility, and decide what additional data still needs to be gathered. Even countries that have

already carried out a land resources data survey are likely to find out that more data of one kind or another are needed.

The DESFIL taxonomy will consist of an encyclopedia of data collected relative to technologies, incentives and policies that have led to land degradation and those which could establish conditions necessary for sustainable NRM of fragile lands. The data will be organized according to agroecological zones, including arid and semi-arid lands, tropical humid lowlands, and steep slopes.

As data is collected and organized, information gaps will be identified. Case studies will be designed to collect the necessary field-level data using a participatory rural appraisal (PRA) approach to actively involve the resource users in identifying their problems, the underlying causes, and solutions that are appropriate according to their biophysical and socioeconomic environment.

During the course of developing the encyclopedia of worldwide experiences in natural resource management, a manual that will provide a framework for conducting a similar country-specific inventory will be developed. These tools will assist policy makers, development agencies, and field-level NRM practitioners to develop recommendations for NRM strategies for fragile lands that address particular problems in any country with similar agroecological and socioeconomic conditions.

### **C. Development of an NRM Database**

In implementing this approach and using the NRM Analytical Framework, DESFIL will develop a relational, dynamic, and multi-dimensional database. This database is viewed as a repository of key information and lessons learned about NRM practices in fragile lands. The purpose of this database is threefold, which is to help:

- USAID Missions to establish concise and effective intermediate indicators for monitoring, evaluating, and reporting on performance/impacts of their NRM programs and projects, such as API;
- Host-country governments, regional organizations, NGOs, and PVOs similarly to establish indicators for monitoring and evaluation of their NRM programs and projects; and
- Researchers and field practitioners, including USAID Mission staff and host-country government personnel, to further their analysis and design of programs related to NRM, and fragile lands in particular.

The illustrative database includes files, which are organized according to the levels of the NRM Analytical Framework:

**File 1. Village Profile (geo-referenced for GIS)**

Locator ID #:            Census Bureau to the CR level  
                              Latitude/Longitude (degree/minute/second)  
                              Village Name

Descriptions of biophysical conditions, infrastructure, ethnic groups, migration, and so forth.

**File 2. Inventory of Practices (traditional and introduced)**

Practice ID #:            Practices coded and defined for standardization

**File 3. Characteristics of Users and Nonusers of Practices**

Household ID #:        To track lessons learned as practices are adopted/adapted, abandoned, and so forth. Also to gather gender-disaggregated data relative to practices.

**File 4. Impact on Biophysical Change**

**File 5. Impact on Revenue and Productivity**

**File 6. Perceptions of Enabling Conditions**

**File 7. Observed and Measured Socioeconomic Incentives**

**File 8/9. Cost/Benefit Analyses**

**File 10. Policy Implications**

For analytical and practical purposes, these main files are broken down into smaller, more manageable ones. This database is multi-dimensional, as it incorporates biophysical, technical, and socioeconomic variables. To establish a relational database, each file contains two common variables: village locator code and practice code. Establishing a database on a yearly basis reflects the dynamics of users' adoption of NRM practices, and will facilitate monitoring and evaluation over time. Linking files by practice is necessary to avoid ambiguity in the cause-and-effect relationships.

The structure of the database allows one to synthesize the available information in a format that links particular policy measures and incentives to the use of a NRM practice. The database also allows one to identify a policy and establish its eventual broad range impact on land use management.

## **D. Progress and Impact Indicators**

Indicators can be identified at each step of the analysis.

### **D1. Characterization of Practices**

Several indicators can be identified at this stage to inform USAID Missions of the progress by which their NRM programs and projects are reaching the goal of sustainable, broad-based development. The number of men and women users of practices is a good indicator of the widespread use of the technique. However, for a comprehensive picture of the widespread use of practices, other indicators are necessary, such as the area under which practices are used and the period over which they have been in use. The categorization of practices according to users' profiles also suggest working hypotheses of why the use of practices is widespread or not.

### **D2. Impact of Practices on the Natural Resources Base**

Intermediate impact indicators can be identified at this stage. However, most of these indicators incorporate a time dimension, because the impact of practices on the natural resource base is usually cumulative, gradual rather than immediate. Because of this time dimension, the progress or impact nature of indicators for practices of recent introduction are likely to be fuzzy.

### **D3. Impact of Practices on Users' Welfare**

Several impact indicators can be identified at this stage. Impact in the short-term, if they can be identified, may not fully reflect the impact of practices. Here, as in the case of the impact of practices on the natural resources base, there is an important time dimension to account for. At the same time, there may a time lag between the impact of practices on users' welfare and on natural resources. Users may derive short-term benefits in the short-run at the expenses of long-run negative impacts on natural resources.

### **D4. Incentive Structures**

DESFIL puts considerable emphasis on the incentive structure, which shapes and reinforces the behavior of natural resources users. Indicators at this level of analysis are powerful, but they may be impact indicators only by proxy. To the extent that the analysis of the impact of incentives on users' behavior is correct, the design of enabling conditions is critical and dependent on how these indicators change with policy change. Therefore, indicators at this level are key to policy analysis. However, indicators at this level remain, at best, proxies for impact. For example, although a program may strive to contribute to a positive nominal or effective protection for an input, this rate of protection must still be viewed as contributing to a goal and not a goal by itself. Also, the total effect of market incentives may be ambiguous. For example, higher cereal prices that provide incentives to use an improved practice may negatively affect the welfare of the poorer farmers who are net buyers.

## **D5. Enabling Conditions: Policies and Institutions**

Enabling conditions can be seen as the conditions precedents of USAID nonproject assistance programs or conditionalities of World Bank/IMF structural adjustment programs. These enabling conditions may include specific policy measures (for example, taxes on forest products), regulatory instruments (such as a forest code), and organizations (such as local governance bodies). The enactment of these measures is an important indicator, but the real impact of these enabling conditions can only be assessed by looking at whether and how they are implemented. First, users of natural resources must be aware of these conditions to take them into consideration. Second, these conditions must be enforced to have any impact on users' behavior. Therefore, just reporting on the enactment of enabling conditions is not enough. Indicators must also indicate whether these conditions are implemented. Ultimately, the perceptions of users and the analysis of cause-and-effect relationships will determine the impact of the enabling conditions on the adoption of practices.