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MALAWI'S ENVIRONMENTAL MONITORING PROGRAM:

A MODEL THAT MERITS REPLICATION?

Environmental & Natural Resources Policy & Training Project

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Acronyms

ADD	Agricultural Development Division
ADS	Automated Directives System
ASAP	Agricultural Sector Assistance Program (USAID/Malawi)
ASF	Area Sample Frame
CFR	Code of Federal Regulations
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DREA	Department of Research and Environmental Affairs
EMEMP	Environmental Monitoring, Evaluation, and Mitigation Plan
GIS	Geographic information system(s)
GOM	Government of Malawi
ha	hectare(s)
IEE	Initial Environmental Examination
kg	kilogram(s)
MEMP	Malawi Environmental Monitoring Program
MOALD	Ministry of Agriculture and Livestock Development
MOREA	Ministry of Research and Environmental Affairs
NATURE	Natural Resources Management and Environmental Support Program (USAID/Malawi)
NEAP	National Environmental Action Plan
NGOs	Nongovernmental organizations
SO	Strategic Objective
USAID	U.S. Agency for International Development

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Executive Summary

With support from the U.S. Agency for International Development (USAID), the Government of Malawi (GOM) is developing a national environmental monitoring program, commonly referred to as the Malawi Environmental Monitoring Program (MEMP). This ambitious effort, which represents a work in progress, has generated considerable enthusiasm within participating ministries, strengthened institutional capacity, and produced several unanticipated benefits. USAID/Malawi should be commended for its initiative in supporting the program. The MEMP has been promoted as both a potential illustration of the operation of an environmental monitoring, evaluation, and mitigation plan (EMEMP) and a possible model for how USAID might work in other countries in sub-Saharan Africa to monitor and mitigate the environmental impacts of policy reforms associated with nonproject assistance.

The present report is intended to assist USAID/Malawi in documenting progress through its investments in the MEMP and to provide guidance related to the development of capacity in regard to environmental monitoring. The report is based on a visit to Malawi in August 1996, which included a review of program documentation, a visit to one of four pilot monitoring sites, and discussions with the staffs of USAID, the prime contractor for the technical assistance provided to the GOM, and of several Malawian ministries involved with the MEMP.

Through its nonproject assistance, USAID seeks to encourage opportunities for smallholder farmers to gain access to the lucrative markets associated with burley tobacco. Tobacco is one of Malawi's largest sources of foreign exchange. USAID's assistance is intended to address the stark contrast in opportunities available to estates and smallholder farmers by allowing the latter to grow and sell burley tobacco legally. Before the nonproject assistance began, the GOM controlled production of burley tobacco in an attempt to ensure that production did not exceed anticipated demand.

According to the agreement between USAID and the GOM governing the assistance, USAID would release funds once the GOM initiated several actions and "adopted a plan...for monitoring the environmental impacts of reforms implemented" as part of the Agency's assistance. The MEMP's primary objective is to address "the potential environmental impacts of increased smallholder production of burley tobacco" in terms of soil erosion, water quality, and deforestation.

Analysis of the MEMP's progress to date has identified several issues that merit additional attention.

- The GOM's policy reforms first permitted smallholders to produce burley tobacco during the 1990-91 growing season, but initial monitoring did not begin until late 1994, several months after the start of the growing season.

- The processes by which four pilot monitoring sites were selected is not well documented. The sites are supposedly "indicative (but not necessarily representative)" of smallholder burley

production. For this reason "credible linkages between what is observed at the catchment level and national trends cannot be established."

- Through the choice of initial monitoring sites and their lack of representativeness, it is doubtful that the MEMP can provide useful data on the relation between burley tobacco and its environmental impacts.

- The production of burley tobacco potentially affects water quality, soil fertility, and forests. Estimates vary considerably about how much wood is required to cure tobacco. Estimates from industry sources are lower than those of critics of tobacco. Debates about the volume of wood required for tobacco are especially germane to Malawi. The country has one of the world's highest rates of deforestation, and vast areas are denuded in response to high demands for wood that are not otherwise satisfied.

- Lengthy delays characterize efforts to analyze and publish data from the four pilot monitoring sites. Through mid-1996, data had been analyzed and summarized, and published for only one site.

- The MEMP emphasizes collection of data on deforestation, soil erosion, and water quality, but considerably less attention to the impacts of a degraded environment on Malawi's endangered or threatened species and their habitats.

- No Malawian interviewed for the report was able to identify an instance in which results from the MEMP have led to any mitigation, changes in policy, or proposals for changes in such policies. Given the delays in analyzing and publishing the data collected to date, it may be premature to expect any mitigation; problems have not yet been linked conclusively to the policy reforms associated with USAID's assistance.

- There is no link between the data collected and any identifiable demand or need for these data. The GOM's first environmental monitoring report does not provide recommendations relevant to mitigation or suggest any changes in policies. Few policymakers are aware of what the MEMP offers, and none of them have requested analyses of the MEMP's data or proposals for policy changes.

- These conclusions have led to changes in the technical assistance provided to the GOM. These changes include the placement of an environmental policy advisor in the Ministry of Research and Environmental Affairs and that of an environmental scientist at the University of Malawi.

- The use of the pilot catchment sites relies on intensive monitoring of geographically limited areas. In an effort to move toward the development of a national monitoring system, USAID is financing the development of a pilot data collection system using an area sampling frame (ASF). The process will use surveys to gather physical information about representative segments of land that have been chosen randomly. With such representativeness it will be

possible to extrapolate from the sample of segments and respondents to the entire population in the selected Agricultural Development Division.

- USAID's interest is in the identification and mitigation of the environmental impacts of policy reforms associated with its agricultural and environmental initiatives. According to the conditions associated with these initiatives, a nationally representative program will be created to address this need. Presumably, therefore, the GOM will be monitoring the environmental impacts of policy reforms for many years.

- Continued monitoring of policy-related impacts may be desirable from USAID's perspective, but this does not mean that Malawi's policymakers share this preference. An emphasis on the environmental impacts of policy reforms may not be sufficiently broad for the GOM's needs, and the impacts may not be perceived as ones that merit special attention.

- These factors suggest that it may be unrealistic to assume--even if funds, staff, and equipment are available--that the GOM will continue to monitor solely or primarily to identify the environmental impacts of diffuse and multiple policy reforms.

- In view of the current situation with the MEMP, including uncertainty about its purposes and intended duration, the development of a strategic monitoring plan is recommended. This plan would specify the MEMP's purposes and then use these purposes to justify the data to be collected.

- Despite the concerns identified, the MEMP represents USAID's largest and most important investment in the development of an environmental monitoring capacity. The program is notable for its emphasis on the development of indigenous capacity. USAID/Malawi can appropriately share credit with the GOM for considerable progress to date. Monitoring skills have been enhanced considerably, and there exists a cadre of GOM employees who are comfortable in the use of geographic information systems.

In conclusion, Malawi's experience with its environmental monitoring program can be instructive for other countries and USAID missions in those countries. The development of an effective monitoring system requires considerable planning, foresight, and patience. In the absence of such virtues, success will be elusive. This finding suggests, therefore, that efforts to replicate Malawi's effort should proceed with caution. However desirable such a comprehensive monitoring program may be, successful implementation may represent a challenge that many governments may not be able to overcome.

With support from the U.S. Agency for International Development (USAID), the Government of Malawi (GOM) is developing a national environmental monitoring program. This ambitious effort has generated considerable enthusiasm within participating ministries, strengthened institutional capacity, and produced several unanticipated benefits. USAID/Malawi should be commended for its initiative in supporting the program. It has been promoted as both a potential illustration of the operation of an environmental monitoring, evaluation, and mitigation plan (EMEMP) and a possible model for how USAID might work in other countries in sub-Saharan Africa to monitor and mitigate the environmental impacts of policy reforms associated with nonproject assistance.

In Malawi, such assistance has involved two phases of a seven-year Agricultural Sector Assistance Program (ASAP) and a five-year Natural Resources Management and Environmental Support Program (NATURE). The programs have several goals, one of which is common to each program--the development and implementation of the Malawi Environmental Monitoring Program (MEMP) through both nonproject (or program) and project assistance. In exchange for the ASAP's and NATURE's nonproject assistance, the GOM has agreed to a series of policy reforms related to agriculture and environmental management, respectively. The GOM has also agreed to a series of conditions related to the MEMP's implementation (see Table 1). Project funds are used to provide training, technical assistance to the GOM, and equipment to collect and analyze data on the state of Malawi's environment.

The present report assesses efforts to implement the monitoring program. The report is intended: a) to assist USAID/Malawi in documenting progress through its investments in the monitoring; and b) to provide guidance to other USAID missions, the Bureau for Africa, and other donors in developing governmental capacity in regard to environmental monitoring. The report is based on a two-week visit to Malawi in August 1996, which included a review of program documentation, a visit to one of four pilot monitoring sites, and discussions with the staffs of USAID, of the University of Arizona, the prime contractor for the technical assistance provided through the ASAP and NATURE Projects, and of several Malawian ministries involved with the MEMP. Appendix 1 provides a list of people contacted.

Background

USAID/Malawi initiated ASAP in September 1991. An amendment to the program in September 1994 extended the anticipated life of the nonproject assistance by four years (through fiscal year 1998) and added $35 million to it (for a total of $55 million over seven years). As part of this program assistance, the GOM agreed to a policy reform agenda with four themes: production and marketing of crops; efficiency of input delivery; equity in the agricultural sector; and crop diversification. As USAID/Malawi (1991) noted, the agenda's overall intent is to:

> restructure the agricultural sector in such a way that smallholders on customary land and agricultural laborers and tenants have available to them the opportunities, mechanisms, and resources to participate in and help drive sectoral growth and development. Within the smallholder subsector, the program is working...: (1) to liberalize the overall pro-

Table 1: Conditions and Covenants Related to Malawi's Environmental Monitoring Program

	Condition	Anticipated Completion Date
ASAP Special Covenant	The Government of Malawi "will conduct regular monitoring of the environmental impacts of reforms implemented as part of ASAP."	
ASAP Tranche 2	The Government of Malawi's adoption of a plan, acceptable to USAID, "for monitoring the environmental impact of reforms implemented as part of ASAP." The plan is to include "regular annual reporting based on agreed-to indicators."	February 1992
ASAP Tranche 5	The grantee is "making available sufficient financial and staff resources to effectively and efficiently implement agreed upon environmental monitoring and mitigative agroforestry activities."	June 1995
NATURE Tranche 1	The Government of Malawi must "clearly delineate the role for the institution responsible for coordinating and monitoring environmental and natural resource management activities."	December 1995
NATURE Tranche 2	The Government of Malawi must certify that "the coordinating and monitoring framework described in [NATURE] tranche one is fully functioning."	September 1996
ASAP Tranche 6	The grantee is "making available sufficient financial and staff resources to implement agreed upon environmental monitoring, research and mitigative agroforestry activities.	September 1996
ASAP Tranche 7	The grantee: a) "has evaluated its environmental monitoring, research and mitigative agroforestry activities, redesigned them as recommended, and is providing sufficient financial and staff resources to effectively implement agreed upon environmental monitoring, research, and mitigative agroforestry activities"; and b) "is implementing a nationally representative environmental monitoring program to identify the environmental impacts of economic policy reforms undertaken as a result of ASAP."	September 1997

Note: ASAP's tranches 1, 3, and 4 do not have language pertinent to a monitoring program.

Sources: USAID/Malawi, 1991; 1994.

duction and marketing environment for cash and food crops; and,...(2) to liberalize the production of burley tobacco, Malawi's premier cash crop....

Through ASAP, USAID seeks to encourage opportunities for smallholder farmers, primarily those with holdings of 1.5 ha or less, to gain access to the lucrative markets associated with burley tobacco. Tobacco is one of Malawi's largest sources of foreign exchange.[1] Malawi has one of the world's largest auction floors for tobacco and, once sold, Malawi's tobacco is exported to more than 60 countries.

From a farmer's perspective, the production of burley tobacco has considerable appeal. The economic returns per unit of investment associated with tobacco are among the highest available to farmers in Malawi. Despite this appeal, the GOM prohibited smallholders from growing burley tobacco (as well as tea and sugar) before 1990, although a fair number apparently did so illegally. Estates monopolized its production in the 1970s and 1980s and profited greatly as a result. In the earlier decade, for example, the real value of estate production increased by over 9.5 percent per year and by more than 5 percent per year in the 1980s (USAID/Malawi, 1991). In contrast to the estates' growing prosperity, the value of Malawi's smallholder production increased by less than one-half of 1 percent between 1978 and 1988.

ASAP is intended to address the stark contrast in opportunities available to estates and smallholder farmers by allowing the latter to grow and sell burley tobacco legally. Before ASAP, the GOM controlled production of burley tobacco through a system of quotas in an attempt to ensure that production did not exceed anticipated demand, thereby resulting in lower prices. Prior to the 1990-91 growing season, all quota allotments had been given to estates.[2] For that season the GOM made a pilot allocation of 1.5 million kg of production quota to smallholder farmers to comply with the conditionality of the World Bank's Agricultural Sector Assistance Credit. With the advent of ASAP, the GOM agreed to further liberalization and increased quota allotments for smallholders, rising from 3.5 mil kg in 1991-92 to 10.7 mil kg in 1995-96. In addition, the requirement that smallholder tobacco be sold through a parastatal marketing board has been eliminated, and smallholder farmers now have direct access to the auction floors.

The present allotments can accommodate many smallholders. Production levels for burley can reach 1500 kg/ha/year, although production of 800 to 1200 kg/ha/year is more common among smallholders (World Bank 1995). Maximum quotas were initially established at 600 kg/year per smallholder, although many receive allocations of 150 to 300 kg, depending on the

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[1] Malawi produces six types of tobacco (burley, flue-cured, Northern Division dark-fired, Southern Division dark-fired, oriental, and sun-air cured), but the first two types typically account for 85 to 90 percent of total export earnings associated with tobacco (USAID/Malawi, 1991).

[2] The growing season for burley tobacco usually begins in mid to late September with the growth of seedlings, their planting in November and December, and harvesting in February, March, and April.

amount of land they farm. Burley tobacco grows best with a four-year rotation. To encourage observance of this schedule, quotas are normally allocated so that no farmer will use more than 25 percent of his or her land for tobacco in a season.

The government's liberalization efforts have been highly successful, at least in terms of the number of smallholders that legally produce burley tobacco. Approximately 7,500 smallholders produced 2.26 mil kg in 1990-91, and these numbers increased to 2.62 mil kg and 8,700 farmers the following year (Carvalho et al., 1993). By 1992-93, 25,000 to 30,000 smallholders grew burley. The numbers of growers remained relatively unchanged the following season during a drought that substantially decreased Malawi's overall production of tobacco. With the end of the drought, the number of smallholder producers swelled to over 50,000 in 1994-95 and to nearly 110,000 in 1995-96. The demand for quota allocations was so great that the government increased the 1994-95 quota for smallholders to 15 mil kg (from 9.2 mil kg) and to 30 mil kg (from 10.7 mil kg) for the following season. Further increases are anticipated. According to a recent analysis from the World Bank (1995), the Government expects that as many as 300,000 smallholders will be growing burley tobacco by 2005.

Encouraged by such success and in the belief that ASAP's first phase had "provided the foundation and momentum for [a] broader reform package," USAID/Malawi (1994) expanded the number and scope of agriculturally related policy reforms when it amended ASAP in late 1994. The purpose and goals remained unchanged, but the intended policy reforms were extended to include continued liberalization of the tobacco subsector; stabilization of maize prices; elimination of all limitations on the private sector's buying and selling of smallholder-produced commodities; removal of the bans on export for all crops other than maize; and the elimination of subsidies for seeds and fertilizer and increased reliance on the private sector for the sale of these inputs.[3]

Environmental Considerations

At least two laws and one directive mandate USAID's consideration of the environmental impacts of its activities and any mission's efforts to use program assistance and its associated policy reforms as a vehicle for achieving sustainable development. First, the Agency's Environmental Procedures (22 *CFR* 216) indicate how the National Environmental Policy Act should be implemented. The procedures provide a statement of the Agency's policy in regard to the environment and are intended to:

> "(1) Ensure that the environmental consequences of A.I.D.-financed activities are identified and considered by A.I.D. and the host country prior to a final decision to proceed and that appropriate environmental safeguards are adopted;

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[3] The amended ASAP program addressed the removal of subsidies for seeds and fertilizers. USAID/Malawi determined that pesticides were not subject to subsidies or price controls in Malawi. As a result, since the government's policies did not overtly encourage the use of pesticides, USAID decided that the amended ASAP need not target them.

(2) Assist developing countries to strengthen their capabilities to appreciate and effectively evaluate the potential environmental effects of proposed development strategies, and to select, implement and manage effective environmental programs; [and] (3) Identify impacts resulting from A.I.D.'s actions upon the environment.... (USAID, 1980).

Second, the Foreign Assistance Act, as amended in 1991 through Section 496(h)(2)(B), specifies that "policy reforms shall also include provisions to protect...long-term environmental interests from negative consequences of the reforms." Such a mandate is clearly directed at the policy reforms associated with program assistance.

Missions' obligations associated with USAID's Environmental Procedures are straightforward. With few exceptions, a mission must complete an Initial Environmental Examination (IEE) that provides a "first review of the reasonably foreseeable effects of a proposed action on the environment." Completed IEEs include a threshold decision, which is either positive or negative. A positive decision indicates that a proposed action is likely to have a significant effect on the environment and that further review of these effects is required. A negative determination indicates the opposite, namely that a proposed action is not likely to have a significant impact on the environment.

In contrast to the routine and relatively smooth implementation of the Environmental Procedures, implementation of Section 496 is more problematic (Hecht, 1994). USAID has not provided formal guidance on its use, application, or requirements, and this surely frustrates even the most conscientious Agency employees. Unfortunately for missions involved with policy-related program assistance, the lack of guidance does not excuse them from compliance. Missions are legally obligated to protect against the possible negative environmental consequences of policy reforms *even in instances in which an IEE has indicated, through a negative determination, that such reforms are not anticipated to have a significant effect on the environment.*[4] Protection against such consequences arguably requires their identification and mitigation.

Third, with USAID's efforts to re-engineer its operations and focus on results, the Agency's Automated Directives System (ADS) requires that Strategic Objective (SO) teams monitor "all programs, results packages, and activities to ensure that the environmental

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[4] This situation raises several related problems. The Agency's Environmental Procedures do not define what constitutes a significant effect except to note that such an effect represents a "significant harm to the environment." When significant effects are absent, Section 496 seemingly requires USAID to protect against insignificant or nonsignificant harm to the environment. Another perspective on this situation suggests that a project's reasonably foreseeable environmental impacts might be significant but to declare them so would require either an environmental assessment or an environmental impact statement and a likely delay in a project's initiation.

consequences of all actions taken by USAID are considered and that appropriate safeguards are adopted." The ADS also obligates such teams to "collect information on both the results supported by development partners and the status of critical assumptions on a regular basis." This requirement has important implications. IEEs are intended to provide an initial assessment of "reasonably foreseeable" impacts of a proposed action on the environment. Judgments about such impacts require *assumptions* about cause-and-effect relationships that have not yet occurred, yet these are exactly the kinds of assumptions that would benefit from monitoring. Finally, missions and their SO teams must also "monitor ongoing activities for compliance with approved" IEE recommendations.

Despite these new procedures, which are intended to streamline implementation, USAID has not yet specified the practical implications associated with its new procedures. For example, if an IEE discusses the potential environmental impacts associated with a forthcoming activity and the host country is not able to provide information about the occurrence or magnitude of these impacts once the activity begins, is USAID required to establish (and operate) a program to monitor the impacts? Similarly, if a host country has primary responsibility for implementing an activity, how can a country-based mission ensure that the host government adopts appropriate environmental safeguards (and who is to determine what is appropriate)?

Environmental Monitoring, Evaluation, and Mitigation Plans

The Bureau for Africa developed the concept of EMEMPs in the early 1990s. Not only do EMEMPs address the concerns identified in Section 496, but more important, such plans also reflect the Bureau for Africa's recognition of the intrinsic merit of environmentally sound monitoring and mitigation. About 25 such plans were under development in USAID-supported countries in sub-Saharan Africa in early 1994. EMEMPs do not have a formal definition, but they typically represent an effort to anticipate and respond to potential environmental harms, to monitor the harms, and to mitigate them (Hecht, 1994). EMEMPs are often a result of IEEs and are discussed within them, at least for USAID missions in sub-Saharan Africa.

The EMEMP concept was developed after preparation of the IEE for the ASAP's first phase, but the IEE's discussion clearly suggests the need to monitor and mitigate the possible adverse effects of the ASAP-related policy reforms. According to the IEE (USAID/Malawi, 1991), ASAP's successful implementation could increase:

> the probability of Malawi's soil, water, and forest resources becoming negatively impacted. For example, improved prices and increased levels of income could lead to the increased desire...to place more land under cultivation and/or increase the intensity of farming on existing land. Since most of Malawi's best arable lands are already under cultivation, the pressure to increase cultivation on steep, highly erodible, and more marginal lands could increase. This in turn would increase the probability for increased soil erosion, deforestation, and deterioration of water quality. Similarly, intensified farming practices, including increased use of fertilizers, may increase the level of nitrates and phosphates in water supplies and result in eutrophication of surface waters.

To address these possibilities, the IEE noted that, as part of ASAP's funding and implementation, the GOM would monitor the impact of the program's policy reforms on biodiversity, the natural resource base, and on human-made and natural environments. Such monitoring would assess not only ASAP's "specific environmental impacts," but would also "become a part of the Government's routine environmental reporting system" (USAID/Malawi, 1991).

As USAID/Malawi's justification for ASAP observed, "serious soil erosion, deforestation, and general land and water resources degradation are taking place [in Malawi] without being properly monitored." Monitoring could, however, generate information for use in planning for development and "taking corrective actions where appropriate" (USAID/Malawi, 1991, Annex Q) The monitoring program would, therefore, create "increased opportunities...for environmental mitigation and mid-course changes in policies that are found to have adverse impacts on the environment."

USAID indicated that ASAP's project funds would be used to assist the GOM in establishing a unit to "monitor land use and water quality, and measure soil erosion, deforestation, and water resources degradation" on customary lands (i.e., land used by smallholders). In addition, USAID stated that the monitoring program would also assess:

a) the encroachment of cultivation into steep escarpments, marginal areas and hills, and develop appropriate land use policies for such areas....;
b) the environmental impact of reform initiatives as well as that of other GOM and donor activities; and
c) collect and analyze data necessary for policy development and regulatory action.

By mid 1994, during the development of the justification for ASAP's second phase, the need to monitor the environmental impacts of the policy reforms became increasingly important. The initial IEE for ASAP had recommended a negative determination because the reasonably foreseeable effects of the reforms were not deemed to be significant. This situation changed considerably in the IEE for the ASAP's second phase. That IEE expressed "concerns about potentially significant long-term environmental impacts resulting from ASAP-supported policy reforms" including expansion of cultivation into "environmentally significant or sensitive areas...and increased use of unsustainable or environmentally detrimental cultivation practices" (USAID/Malawi, 1994). The IEE also noted that: "An already severe fuelwood shortage in many parts of the country will be exacerbated as market liberalization leads to more people producing dark-fired tobacco, which requires more wood [than does burley tobacco] in the curing process" (USAID/Malawi, 1994).

Given the identification of potentially significant impacts in an IEE's threshold decision, the Agency's Environmental Procedures mandate a positive determination and the preparation of either an environmental assessment or an environmental impact statement, both of which are

substantially longer and more detailed than an IEE, which is often only a few pages in length.[5] Notwithstanding this requirement, the IEE for ASAP II recommended a negative determination subject to the implementation of environmental monitoring and mitigation activities and the inclusion of an EMEMP "as an integral component of greater ASAP monitoring and evaluation requirements and treated as such in all future program monitoring and evaluation activities."

Conceptually defining an environmental monitoring program is not the same as creating one. Designers of such programs face many choices and must make many decisions, each of which leads to different consequences. Failure to address the choices is likely to lead to unintended consequences and the poor use of limited resources. For these reasons, the design and establishment of monitoring programs require considerable attention. The primary question relates to intended goals and outcomes--what purposes is a monitoring program intended to serve and what are the desired outcomes? The ultimate goal of most monitoring programs is the improved management and protection of natural and environmental resources. This goal can be achieved if monitoring of programmatic interventions and environmental impacts leads to: a) improved use of or practices that affect natural resources; b) mitigation or elimination of undesirable environmental impacts; and, c) policies that encourage sustainable development.

The establishment of clear goals (and indicators of or criteria for success) is only a first step, but one that helps in making all subsequent decisions. Other issues or questions that require attention include these:

1. Where should monitoring occur, what data should be collected, how, and for what time period?
2. Should responsibility for managing and implementing a monitoring program be centralized in a single agency or decentralized, with responsibility for data collection, analysis,

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[5] There is disagreement about the interpretation of the Environmental Procedures as they relate to nonproject assistance. In such assistance, USAID does not have direct control over or responsibility for activities or policy reforms, and environmental impacts are likely to be diffuse and long term. When an action is found to have a significant effect on the environment, Section 216.3(a)(3) of the Agency's Environmental Procedures permits USAID to avoid the completion of an environmental assessment or an environmental impact statement when: a) a substantial number of assessments or impact statements have been prepared in the past, if relevant to the proposed action; b) the Agency has previously prepared a programmatic assessment or impact statement covering the activity in question; or, c) when the "Agency has developed design criteria for such an action which, if applied in the design of the action, will avoid a significant effect on the environment." The third option appears relevant to nonproject assistance, particularly if one is willing to include a monitoring program as part of design criteria. Application of this section requires approval of the Agency's administrator or one of its assistant administrators. According to the Bureau for Africa's Environment Officer, USAID has not developed or defined what constitute design criteria.

and interpretation distributed among several agencies? What are the practical consequences and strengths and weaknesses of each alternative?

3. Do those responsible for these tasks have the requisite skills, abilities, and equipment to meet their obligations?

4. When appropriate or desired, how will causality be established between interventions, such as policy reforms, and environmental impacts?

5. What is the intended relation between monitoring, mitigation, and policy change?

6. How will those responsible for analysis and interpretation ensure the monitoring program's relevance and contribution to the program's overall goals and objectives?

7. Under what conditions or circumstances will the monitoring program be sustainable?

8. Can the monitoring program contribute to intermediate or subsidiary goals, such as a donor's need to track and evaluate the environmental impacts of its investment or assistance?

9. How will it be determined whether a monitoring program has been a worthwhile investment? What criteria should be used to judge success?

In the sections that follow, each of these questions is discussed in terms of the choices made as part of the MEMP and, more generally, what lessons might be applicable to the development of monitoring programs in other countries.[6] At least one note of caution is essential. Malawi's experience to date can only be illustrative; not all of its experiences are directly relevant elsewhere. Moreover, the MEMP is a work in progress, which implies the likelihood of changes in direction and emphasis as lessons are learned and applied. Despite these caveats, the MEMP offers a useful example of a developing country's commitment to improved understanding of environmental change. The program can also serve as a prototype in USAID's efforts to encourage the development and implementation of EMEMPs.

Goals and Criteria for Success

According to the agreement between USAID and the GOM governing ASAP, USAID would release funds under the program's second tranche once the GOM initiated several actions and "adopted a plan...for monitoring the environmental impacts of reforms implemented as part of ASAP" (USAID/Malawi, 1991). Responsibility for developing this plan was given to Malawi's Department of Research and Environmental Affairs (DREA), which, under the Banda administration, was part of Office of the President and Cabinet, when it was created in 1991. With the election of President Bakili Muluzi in May 1994, a decision was made to decentralize responsibilities in an effort to improve efficiency and to minimize the number of functions that reported directly to the president's office. DREA was initially placed in the Ministry of Health for several months before being established as the Ministry of Research and Environmental Affairs (MOREA) in September 1994. MOREA has no responsibility for implementation, but the parliament's approval of an Environmental Framework Bill in June 1996 will provide the

[6] The report also addresses several issues in detail (such as the Area Sample Frame, discussed below) that the Bureau for Africa included in the scope of work for this activity.

ministry with increased responsibilities and a statement of obligations. In the words of MOREA's environmental coordinator, the upgrading to ministry status has been a blessing and one that has placed MOREA "at par" with other ministries.

While still a department, DREA (1993) produced a monitoring plan in April 1993, and then revised and reissued a subsequent plan nine months later (DREA, 1994a). These documents provide the basis of much of the discussion that follows.

Although the first phase of ASAP involved several policy reforms, the initial plan indicated that the monitoring program's primary objective would focus on "the potential environmental impacts of increased smallholder production of burley tobacco" in terms of soil erosion, water quality, and deforestation. In addition to attempting to identify these impacts, the plan indicated that the monitoring program would have two other objectives: a) the establishment of a national institutional capability to monitor and manage the country's natural and environmental resources; and b) the distribution to government agencies of equipment that could be used to produce maps and documents quickly.

The first two objectives clearly reflected USAID's intentions. Although the conditions precedent and program covenants in ASAP's first phase (see Table 1) refer specifically to monitoring of the environmental impacts of the program's policy reforms, USAID is also interested in encouraging "the establishment and operation of an environmental monitoring unit within [DREA] for the purposes of establishing environmental policies, conducting environmental research activities, and monitoring environmental impacts on natural resources" (USAID/Malawi, 1991, 34). This broadened perspective for the MEMP is one of the NATURE Project's key activities. The justification for the NATURE Project declares that the MEMP's objectives will be expanded "to include establishing a national capacity to monitor and document trends related to environmental and natural resource use" (USAID/Malawi, 1995, 36).

Whereas USAID's statements provide a reason and rationale for the monitoring, DREA's initial plan was much less precise and reflected somewhat different purposes and objectives. DREA's plan emphasized processes and outputs rather than desired outcomes. "Success," the government declared in this prospectus, would be "judged by the data collected, the analysis of these data, and most important...the production of timely maps, reports, statistical bulletins, etc. that will be needed by the GOM and USAID/Malawi to decide upon possible mitigation measures" that may be required because of smallholders' production of burley tobacco (DREA, 1993, 10). Only in the revised prospectus is it noted that, without indicating how, the program's results "will greatly assist Malawi [to] formulate new policies or modify existing ones for the purpose of minimising resource management problems" (DREA, 1994a, 11).

The two plans also discussed the monitoring program's intended contribution to:

a) a comprehensive environmental information system in support of Malawi's National Environmental Action Plan (NEAP);

b) a tool for use in environmental impact analysis;

c) a tool for assessing *all* on-going or proposed development activities;
d) the assessment of causal effects of any environmental changes;
e) the classification and quantification of natural resources; and
f) strengthened technical and institutional capabilities within the GOM.

These anticipated contributions reflect the high expectations associated with the MEMP.

Selection of Monitoring Sites

Although the GOM's policy reforms first permitted smallholders to produce burley tobacco during the 1990-91 growing season (and during the 1991-92 season as a result of ASAP), initial monitoring did not begin until December 1994, several months after the start of the 1994-95 growing season. As noted above, DREA produced descriptions of the MEMP in early 1993 and again in January 1994. These descriptions outlined DREA's strategy for monitoring and also discussed where the monitoring would occur.

The processes by which the DREA selected monitoring sites is not well documented, and several respondents provided different explanations for the ultimate choices. Initial discussions about monitoring sites involved USAID representatives from the Regional Economic Development Support Office in Nairobi. Their recommendations suggested the monitoring of ten river basins, plus the establishment of permanent sampling stations on the shores of Lakes Chilwa and Malawi (DeGeorges, 1992).

DREA eventually decided in favor of intensive monitoring at small pilot catchments in five areas. As the DREA (1993) explained, the sites were selected because of their accessibility, the "presence of a reasonable number of burley tobacco growers in a defined catchment area, the presence of perennial streams within the catchment and the size of the catchment."[7] DREA (1994a) also indicated that the catchments were selected because each is afflicted with some kind of environmental problem, such as persistent flooding or high rates of deforestation. Some respondents also suggested that the sites were selected on the basis of their proximity to parks and protected areas.

Given the GOM's interest in developing an institutional capacity to monitor environmental change, the sites are appropriate for that purpose. Moreover, several of the sites provide the opportunity for government departments to collect data at new locations (e.g., the Department of Meteorology and data on rainfall at Kamundi).

[7] The monitoring at the Kalambo site in Chapananga was halted in early 1995 due to problems with accessibility. There are no plans to renew the monitoring effort there.

Since the selections were made, the rationale for the choices has engendered considerable discussion.[8] The sites were chosen because they are supposedly "indicative (but not necessarily representative)" of smallholder burley production. "Given the bias inherent in the selection process," as the DREA (1993) observed,

> results from the catchments, however rigorous, cannot be considered *a priori* representative of the country as a whole. Credible linkages between what is observed at the catchment level and national trends cannot be established by the [Environmental Monitoring Program] as now constituted....Cause and effect relationship between policy and changes observed at the catchment level cannot be made explicitly.

The consequences of these decisions are far reaching. Some people believe the catchments are too small to provide meaningful data--at least one catchment is approximately 800 ha. One of the MEMP's primary purposes is to ascertain the environmental impacts of smallholder production of burley tobacco. The need to assess these impacts provided a major rationale for USAID's investment in the MEMP. More important, the claimed ability to monitor (and mitigate) the impacts of ASAP's policy reforms provided a justification for the negative determinations included in ASAP's Initial Environmental Examinations.

Through the choice of initial monitoring sites and their lack of representativeness, as the GOM acknowledges, it is doubtful that the monitoring program can provide useful data on the relation between burley tobacco and its environmental impacts (or, more generally, on the relation between the larger universe of ASAP-related policy reforms and their environmental impacts).[9] Despite the recognition in early 1993 that the monitoring program as then (and currently) designed cannot satisfactorily address the relation between policy reforms and impacts, this has not deterred subsequent claims that the MEMP provides a means to discover, review, and mitigate the negative environmental impacts of the GOM's policy reforms (e.g., USAID/Malawi, 1995).

At least one further problem exists with the choice of monitoring sites. When government budgets are constrained, resources should be devoted to principal problems and geographic areas. For this reason GOM respondents were asked if their ministries or departments would be engaged in monitoring at the four sites absent the MEMP's requirement that they do so. No one answered affirmatively. Respondents agreed that the sites do not reflect their departments' priorities, that the sites are at "relatively unimportant locations," and that alternative monitoring sites would provide data of greater relevance to their needs.

If the monitoring at the catchment sites is intended primarily as an exercise designed to strengthen institutional capacity, then the location and representativeness of monitoring sites is

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[8] As one advisor (Hall, 1995) observed, "the unsystematic and undocumented procedure for selecting the five watersheds represents a serious deficiency in the program...."

[9] Issues associated with research design and data collection are discussed below.

much less important, and different evaluative criteria are relevant. Likewise, if training is the key objective, then different questions about the monitoring sites should be raised. For example, what are the goals of continued monitoring at the four catchment sites? How will one know when and whether these goals have been achieved? How long should monitoring continue at the sites?

The Duration of Monitoring

The last question is particularly important, and answers to it vary considerably. One perspective suggests that the monitoring in the four catchments should continue, perhaps for as many as five to ten additional years. This period is necessary to observe long-term environmental changes, such as those associated with forest cover and soil erosion, at least in the view of some people in the Department of Forestry. MOREA (1996a, 46) favors continued, intensive monitoring at the catchments "in order to continue characterization, understanding and documentation of human-environment interactions, long-term trends and [the] socio-economic factors that influence them."

Others, in contrast, suggest that relevant environmental impacts can be detected in much shorter periods and that monitoring of just two cropping seasons is sufficient (e.g., USAID/Malawi, 1994). Still another perspective argues that monitoring at the catchments should end immediately because all the lessons and experiences that can be gained have already been learned. If this is the case, then further monitoring at the sites may be a poor use of limited resources, which, arguably, could be used more effectively elsewhere. This appears to be the perspective of the technical assistance team provided to the GOM through USAID's NATURE Project and a cooperative agreement with the University of Arizona and Clark University. In a summary of the MEMP's first two years, the team (University of Arizona, 1996b) concluded that "intensive monitoring in the...microcatchments is unsustainable" and cannot be justified in the absence of further agency commitment.

The appropriate period for monitoring at the catchment sites can be put into perspective when longer term goals are considered. The GOM has agreed to develop and implement a nationally representative environmentally monitoring program (see Table 1). The present catchment sites are not representative (and are not, therefore, likely to be part of a national system), so it is unclear how continued monitoring at the sites contributes to the long-term goal. If further training is required, then it can be provided at sites that are or will be a part of national program. Here too there seems to be some uncertainty. The University of Arizona (1996b) believes that "expertise now exists to monitor as necessary anywhere in the country." Several Malawian respondents were less sure of this ability, pointing to their need to gain further experience with new equipment and its maintenance. If, in fact, the present sites (as opposed to the skills learned at them) do contribute to the long-term goal, then advocates of this perspective should make that case persuasively.

The problems and issues associated with the appropriateness of the four monitoring catchments are not being raised for the first time. MOREA recognizes the need to move forward, and the GOM is considering several options. One of these would expand the number of

catchments being monitored. Sites would be selected on the basis of a perceived need to address known or anticipated problems, such as the siltation of the Shire River, which is used to produce hydroelectricity. This approach would link monitoring more closely with mitigation, and follow the preparation of a "design paper with key indicators, data requirements, collection strategy, framework of analysis, reporting format, and implementation plan" (University of Arizona, 1996a). With the MEMP's support, the Department of Forestry will soon start a monitoring effort in the Dzalanyama Forest Reserve, which serves as an important water catchment for Lilongwe, Malawi's capital. Still another site-related initiative involves the development of a pilot area sampling frame. Before discussing that, however, attention is first given to the types and kinds of data that are being collected at the four catchment sites.

Potential Monitoring Needs

Environmental scientists do not suffer from a shortage of items to monitor and measure. Their problem is to choose from among many possibilities and in the context of perceived needs and problems, available resources, skills, and equipment, and in terms of the questions addressed. When scientists are interested in assessing relations between interventions and impacts, they typically develop hypotheses and then determine what data are needed to test the hypotheses. For example, smallholder production of burley tobacco might have direct impacts on:

1. *Water quality and quantity.* Farmers producing burley tobacco desirably use about 1,000 kg of fertilizer per ha of crop, although about 650 kg per ha would be satisfactory for farmers who expect to produce about 1,000 kg of tobacco per ha (International Fund for Agricultural Development, 1993, 66). When available, farmers might also use pesticides to protect against such potential problems as "bushy top" virus, which aphids transmit, and bacterial wild fire disease.[10] Runoff from fertilizers and pesticides can contaminate water used for human and animal consumption. Malawi's tobacco nurseries also require large amounts of water in September and October, a period at the end of the dry season when stream flows are naturally diminished.

2. *Soil.* Tobacco is a highly erosive crop and imposes considerable demands on soil nutrients. Goodland, Watson, and Ledec (1984) suggest, as an illustration, that, for comparable volumes of production in tropical agriculture, tobacco depletes more than 10 times as much

[10] A considerable difference exists between suggested and actual levels of use for fertilizers and pesticides in Malawi. Use of both in sub-Saharan Africa is typically low, and rising prices (and the end of subsidies for the former) make these inputs relatively expensive for most smallholders in Malawi. There is conflicting information about the frequency with which these inputs are used. Citing data from the GOM, the World Bank (1996a) estimates that 3 and 42 percent of smallholder farmers used pesticides and fertilizers, respectively, during the 1992-93 growing season. In contrast, a survey of farmers (USAID and MOALD, 1993) concluded that over 70 percent of smallholders had used pesticides on their tobacco crops in 1991-92. MOREA (1996, 2) reports that smallholder farmers use such inputs "extensively."

nitrogen, 24 times as much potassium, and 36 times as much phosphate as does cassava. The differences between the nutrient demands of tobacco and maize are less striking, but in each instance maize depletes the three nutrients substantially less than does tobacco.[11] Due to tobacco's impacts on soil fertility and potential problems with nematodes, tobacco should not be grown on the same land more than once every four years.

3. *Forests and wood products.* After harvesting, burley tobacco is cured in wooden sheds. Sheds include a roof made of thatched grass supported by forked poles about two meters apart on which farmers hang drying sticks on wooden racks (Lowore et al., 1995). Due to damage from weathering and termites, sheds can be used for only two years, at which time they are dismantled. The remnants are used for fuelwood. Construction requires relatively straight poles, and those resistant to termites are preferred. The consequence is that burley growers are selective in what kinds of wood they seek and can use.

Estimates vary considerably about how much wood is required to cure or dry tobacco. The Panos Institute (1994) estimated that trees from 1 hectare (ha) are needed to cure 1 ha of tobacco.[12] Other estimates are in different units, and different kinds of tobacco require different amounts of wood, so not all estimates are directly comparable. USAID/Malawi (1994) states that the curing of 1 ton of burley tobacco requires 5 m^3 of wood; Lowore and his colleagues (1995) estimated that a shed of 30 m by 2.5 m would require about 30 upright poles and 180 rafters, thus utilizing about 0.7 m^3 of wood. A respondent from the Ministry of Agriculture and Livestock Development (MOALD) indicated that a shed of about 70 m in length is required to cure the production (i.e., 300 kg) associated with a typical smallholder's plot of 0.2 ha of tobacco. This estimate is comparable to USAID's. Other sources (e.g., Panos Institute, 1994; International Tobacco Growers Association, 1995) suggest that from 4.8 to 12.9 kg of wood are required to cure one kg of tobacco. As might be expected, estimates from industry sources are lower than those of critics of tobacco.

The volume of wood required for curing tobacco is a contentious issue. In his study of tobacco in Uganda, Aliro (1993) concluded that "the most striking effect of tobacco growing is the near depletion of both natural and planted forests." The Economist Intelligence Unit (1983) reached a similar conclusion when it observed that tobacco contributes to deforestation in some countries. In contrast to these views, the Tobacco Association of Malawi (1996) contends that tobacco is not responsible for deforestation in that country. According to its analyses, the most severe problems with deforestation in Malawi occur in areas where tobacco is not a major crop. Other research (Jere, 1993) suggests that while the greatest demands for wood are associated with

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[11] For example, the World Bank (1995) estimates that each ha of maize in Malawi requires 40 kg of nitrogen and 10 kg of phosphate. In contrast, the comparable requirements for tobacco are 144 kg and 108 kg, respectively.

[12] Few smallholders would or are able to devote a full hectare to tobacco; planting tobacco on 0.2 ha is far more likely.

the need for fuelwood, Malawi's tobacco growers account for almost a quarter of all household consumption of wood.

Debates about the volume of wood required for tobacco are especially germane to Malawi. The GOM (DREA, 1993) acknowledges that Malawi has one of the world's highest rates of deforestation, and vast areas are denuded in response to high demands for wood that are not otherwise satisfied. Malawi can ill afford any acceleration in the rate of deforestation. As USAID (1994) has observed, however, "As the demand for firewood and poles increases, and as land is cleared for agricultural purposes, the rate of deforestation also increases."

In addition to concerns about the required volume of wood, its source is also of concern. Shortages of wood on customary land lead many smallholders in Malawi to cut illegally on public lands, including forest preserves and other protected areas. In turn, illegal cutting contributes to further erosion and prevents sustainable management of forested areas. Such cutting would not be unexpected in the Kamundi catchment, where the DREA (1993) stated that the area's forest cover "is very sparse and people get their poles from some distance away."

In sum, hypothesized relationships suggest the kinds of data that should be collected in any monitoring activity. In the absence of hypotheses, there may not be a rationale for some data that are collected while other, essential data needs are ignored or neglected.

The MEMP's Approach to Data Collection

The GOM's 1993 and 1994 descriptions of the MEMP do not indicate how choices were made about what kinds of data to collect in an effort to relate smallholder production with potential environmental impacts. The descriptions provide a list of items to be monitored at each catchment site. These include such items as:

a) streams flows (depth, duration, and speed);
b) water quality (total dissolved solids, sulfate, nitrate, phosphate, sodium, potassium, and sediment yield);
c) pesticide residues;
d) rainfall (volume and intensity);
e) soil erosion (measured through the use of soil pits and erosion control plots);
f) forest cover, composition, and estimated harvest intensity; and
g) changes in use of agricultural lands.

To collect the relevant data, the MEMP relies on field assistants, which the MOALD employs. The assistants live at each catchment site. The assistants record the data as appropriate and collect and store temporarily the water and soil samples that must be analyzed elsewhere.

In addition to reliance on paid field assistants, the MEMP staff has also initiated a Farmer-Based Environmental Monitoring and Evaluation System. This system enlists farmers in the collection of data on soil erosion on their holdings. In the Kamundi catchment, for example, six

farmers have soil erosion pits and another six gather data on rainfall. Doubts exist about the quality of data collected, but the use of soil pits allows farmers to observe the processes and consequences of soil erosion. According to the field assistants, this process engenders considerable pride and interest in the monitoring program among participating farmers. When community meetings are held to discuss the MEMP, these farmers are likely to be far more persuasive voices for change than are junior representatives of the MOALD. Continued reliance on farmers should be encouraged, but the process and lessons should also be documented so that others can benefit (Bingham, 1995).

There are several problems with the collection of data at the field sites. First, although the field assistants are conscientious, they have not received sufficient training either in the routine maintenance of equipment or in regard to quality control and assurance. As an illustration, one field assistant indicated that he walks two separate 1.5 km transects each week during the growing season, between October and May. He is supposed to record his observations about crop height, whether and when fields are fertilized, and whether they were weeded in the past week. He is not sure of the purposes of the transects, observed that he had not been trained in how to conduct them properly, and noted the difficulty in completing them during the rainy season. The results of the transects are sent to the MOALD in Lilongwe. When an official from that ministry was asked what is done with the transect reports, he replied that their quality was so poor that nothing is done with them. Such problems suggest the desirability of a manual on quality control and assurance for field assistants' use (Bingham, 1995). The development of such a manual is one of NATURE's intended work products.

Hall (1995) observed a related problem with the MEMP's field assistants. In his opinion, their ability to link monitoring and mitigation is limited because of the assistants' "lack of core training in agriculture and related technical subject matter such as soil and water conservation practices reduces their ability to provide farmers with useful extension suggestions." This is a useful insight, and further training is almost always desirable. Unfortunately, however, it may be difficult to recruit and retain such well-trained people when they may be asked to live in remote areas for extended periods.

Second, during the rainy season there is too much data for one person to collect, and data quality can suffer as a result. After each rainfall each soil pit must be emptied of water and sediment; the latter is saved for further analysis. At the site visited in Kamundi there are six control pits for which the field assistant is responsible. Each pit is about one m^2 and about 1.5 m deep, thus making access to and removal of sediment difficult. There have also been reports (e.g., Bingham, 1995) that the soil pits are not emptied completely after each rain. MOREA (1996a) recognizes that the data already collected may be of "poor quality due to a lack of training in proper data collection and recording procedures."

Once collected, the soil and water samples are stored until they are collected and then transported to either Lilongwe or Blantyre for analysis. The field assistant at Kamundi complained that samples are infrequently collected during the growing season, and this taxes his capacity to store the samples. Samples are supposed to be collected after every rainfall, but those

analyzing the sediment loads noted that, in many instances, the small volume of soil they receive per observation does not merit analysis.

Third, the capacity of government departments to analyze the data collected is in doubt. Several of the line ministries responsible for the analysis have not yet analyzed data from all the catchments from 1994-95, the first monitoring season. Some facilities are overwhelmed, employees are typically inadequate in numbers, and other, more pressing demands are imposed on them. USAID/Malawi counted 64 donor-funded projects in Malawi related to the environment and natural resources in 1995. Such projects can overwhelm the GOM's administrative capacity and redefine the GOM's agenda, regardless of how well intentioned staff may be.[13]

Having opted for a decentralized approach, MOREA serves as a coordinating entity. Other departments and ministries are supposed to analyze data and then submit their findings to MOREA for synthesis, integration, evaluation, and interpretation. MOREA is also tasked with compiling, editing, and publishing the results so that they can be distributed to potential users of the data, including USAID and policymaking institutions within the GOM. Given the shortage of technical expertise within the line ministries and MOREA, the latter has found it difficult to accomplish these tasks.

Limited technical expertise frustrates MOREA's efforts to understand the monitoring data it receives. Officials from the Ministry of Irrigation and Water Development reported their efforts to format data on water quality in the catchments in such a way that their counterparts in MOREA could quickly understand the data's meaning and significance. MOREA, in turn, cited the ministry's report on water quality as particularly difficult to understand. In fact, as MOREA's environmental coordinator lamented, his staff needs additional training in analysis because "they don't know what to do with the MEMP data" received.

Fourth, there are concerns about the kinds of data collected. The data collected through the MEMP are appropriate for an environmental monitoring program, but this does not insure their relevance or interest to the officials responsible for making new policies or decisions about how and when to mitigate existing environmental impacts. Rather than identifying data needs solely from an environmental perspective, monitoring programs intended to produce mitigative measures should also consider the needs and preferences of these officials. As the MEMP moves from intensive monitoring at a few sites to a nationally representative program, MOREA should address this issue to insure that the MEMP's limited resources are used to collect important, policy-relevant information rather than that which is merely desirable or which is of limited value to policymakers.

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[13] As Eastman and Toledano (1996a, 25) point out, "it would be fair to say that Malawi is inundated with donor workshops, particularly in the area of environmental management. Although beneficial to the attendees, they have had a stifling effect on [their] regular duties. It is not uncommon to find civil servants being absent from their regular duties for weeks at a time."

Findings and Implications

Such concerns explain the delay in issuing reports that summarize the monitoring program's findings. MOREA sought data from the line ministries on the first year's (1994-95) monitoring effort, but it received a complete set of data for only one of four catchments. The report on these data was not issued until April 1996 (MOREA, 1996a). As MOREA (1996a) has acknowledged, "the practical requirements to process and report environmental information appear to exceed many agencies' capacity." If these agencies find it difficult to analyze and provide timely reports on data from four catchments, what are the implications for efforts to establish and implement a national monitoring program? The answer to this question should be an integral part of plans to develop that program.

The Difficulty in Reaching Conclusions

The delay in analyzing and interpreting the data and then in publishing the results means that it is not yet possible to reach any firm conclusions about the environmental impacts of ASAP's policy reforms, especially those associated with smallholders' production of burley tobacco. This situation would exist even in the absence of problems in the selection of the original monitoring sites. Smallholders began their legal production of burley tobacco four years before the monitoring program was initiated, so no baseline data from the pilot catchments are available. In the opinions of many Malawian staff associated with MEMP, either the program will need several more years of monitoring at the catchments to determine the environmental impacts of burley tobacco *or* the issue of causality is so complex that no amount of monitoring with the present approach will provide a meaningful answer. Still a third possibility exists--the area devoted to burley in each catchment may be so small relative to the total area devoted to agriculture that causality cannot be captured with the present approach to monitoring.

Uncertainty about the Number of Burley Growers

A further problem in establishing relationships involves uncertainty about the number of farmers growing burley, the volume and types of inputs used, and the volume of burley production in each catchment. Without this information it is not possible to determine either the causes or the magnitude of the environmental consequences associated with burley production. For example, if high levels of soil erosion are noted, are they due to the practices of a few farmers growing tobacco (and many farmers growing other crops), or is the erosion due to the practices of scores of tobacco growers? In an effort to relate degradation of water quality to the use of fertilizers, Imam (1996) emphasizes the need to document the amount and type of fertilizer applied as well as the method of its application.[14] He notes that knowledge of the timing of

[14] Monitoring at the catchments began in December 1994, *after* the 1994-95 growing season had already begun. By December, most fertilizers would already have been applied to burley fields. Monitoring the impacts of fertilizers on water quality is best done soon after application of the fertilizer and then after the first rainfall following application (MOREA, 1996b), so the

nutrient applications does not allow one to draw reasonable conclusions about fertilizers' impact on water quality.

The author's repeated efforts in Lilongwe to determine the annual volume of smallholder burley production in each catchment were unsuccessful, and there is some uncertainty about the number of burley farmers in the catchments. Further lack of agreement also exists in regard to the size of the catchments as well as whether the catchments contain perennial streams. There is further irony in regard to the total number of smallholder farmers throughout Malawi who have decided to grow burley as a result of the GOM's policy initiatives. Although that number exceeded USAID/Malawi's initial expectations, the people responsible for the monitoring program believe that identifying the environmental impacts of burley production "is impossible...using the original approach of off-site stream sampling" because *so few* smallholders now grow burley (MOREA, 1996a). The technical assistance team provided through NATURE (University of Arizona, 1996b, 5) reached the same conclusion: "One difficulty facing the MEMP in its initial phase is that despite policy liberalization, the farmers' hypothesized entry into burley production has not occurred" (at least in several of the catchment sites).

The Limited Area Devoted to Smallholder Production of Burley Tobacco

There is yet another reason why it is difficult to attribute environmental outcomes to policy reforms. The Kamundi catchment is approximately 1300 ha, of which about 515 ha are cultivated. In the most recent growing season, tobacco was planted on only 24 ha, with no single plot more than 0.2 ha. Does such a small portion of land used for tobacco merit an intensive monitoring program when other crops (e.g., cotton) or agricultural practices (e.g., the use of banned pesticides) are of potentially greater concern and interest to the government? Is it even possible to distinguish tobacco-related environmental impacts from all other causes and possible explanations of whatever impacts are observed?

Inability to Establish Causal Relations

However desirable answers to such questions, the results of the initial monitoring do not allow one to answer them conclusively. Establishing a causal relation between an intervention and a subsequent impact requires the elimination or rejection of plausible alternative explanations for the outcomes observed. That is not yet possible with the data collected through the MEMP. Although some people (Eastman and Toledano, 1994) initially believed that the present monitoring strategy would allow the establishment of causality, MOREA and its collaborators are now much less certain. In its summary of the first year's data, for example, MOREA (1996a) reported that the "small number of farmers and their scattered distribution in the catchments [make] it impossible to attribute environmental change to burley production using the original approach."

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initial monitoring results may understate the environmental impacts of fertilizer use.

Indeed, the analyses of the first year's data are inconclusive. Two examples illustrate the point. The World Bank *estimates* that the average rate of soil erosion in Malawi is 20 tons per ha per year on gross arable land, with some areas experiencing as much as 50 tons per ha per year. The highest rates of erosion are believed to be in central and southern Malawi. Possible explanations include a population density exceeding 225 people per km^2 of cropped land. More than a quarter of this cropped land is on steep slopes, and some commentators believe that soil erosion has reached "alarming proportions" in Malawi (USAID/Malawi, 1994; 1995). Not surprisingly, Malawi's NEAP (DREA, 1994b, 61-2) identifies soil erosion as the country's most severe environmental problem when measured in terms of annual social costs.

Notwithstanding these concerns, the MEMP detected relatively low levels of erosion.[15] Such levels are indicative of good soil conservation and management practices, which are not typically associated with traditional farming in Malawi and which contradict other assessments of the situation. Indeed, Imam's (1996, 57) analysis of the same data prompted him to conclude that problems with sampling and data quality "lead to a gross underestimation of the total seasonal sediment yield" from the microcatchments.

As a result of its monitoring of wood consumption, the MEMP staff observed that burley farmers consume more wood than do nonburley farmers. "In this case," MOREA (1996a, 13, 41) observed, "the increased demand on wood resources creates a high potential for deforestation..., [but] the observations suggest that no significant difference can be attributed to burley farming alone considering that woodfuel was the first priority reason cited for tree cutting by the rural households." Unfortunately, the report does not indicate the magnitude of the difference, and the Department of Forestry believes that conclusions based on a single year's data are premature.

Neglect of Biodiversity

The MEMP emphasizes collection of data on deforestation, soil erosion, and water quality, but considerably less attention to the impacts of a degraded environment on Malawi's endangered or threatened species and their habitats. Section 119(g)(8) of the U.S. Foreign Assistance Act stresses the importance of ensuring that "ongoing and proposed actions by the Agency do not inadvertently endanger wildlife species or their critical habitats, harm protected areas, or have other adverse impacts on biological diversity." USAID's Environmental Procedures thus require that the IEE "for each project, program or activity having an effect on the environment shall specifically determine whether the project, program or activity will have an effect on an

[15] MOREA (1996) reported erosion of 1.2 tons per ha per year at the monitored sites. Information received subsequent to the completion of the draft report indicates that this number is a typographical error and should be 12 tons per ha per year and represents data from one site, Chilindamaji, rather than an average of all four sites.

endangered or threatened species, or critical habitat."[16] If such an effect is likely to jeopardize such a species or to modify its critical habitat adversely, then a case can be made that a positive determination is required. If such a decision is reached, the subsequent environmental assessment or environmental impact statement would have to discuss "alternatives or modifications to avoid or mitigate such impacts on the species or its habitat."

Malawi has considerable biological diversity, but much of it remains to be catalogued and described scientifically. Scientists estimate, for example, that Lake Malawi contains hundreds of fish species found nowhere else, and appropriate data on wildlife populations on public and customary lands are inadequate (USAID/Malawi, 1995). Protection of its biological diversity is of importance to the GOM. It ratified the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in May 1982, and the loss of Malawi's biodiversity is listed as one of the country's priority problems in the NEAP.

The U.S. Government lists the African elephant (*Loxodonta africana*), the leopard (*Panthera pardus*), and the African wild dog (*Lycaon pictus*) as endangered, and these species are found in Malawi. Other U.S.-listed southern Africa species that may be found in Malawi include the black rhinoceros (*Diceros bicornis*), the pangolin (*Manis temmincki*), and the red lechwe (*Kobus leche*). The International Union for the Conservation of Nature further identifies the cheetah and several avian species as endangered or threatened in Malawi.

The IEEs for ASAP's two phases recognize the possible intrusion of farmers into environmentally sensitive areas due to its policy reforms. The IEEs also note that the need for wood for drying sheds may exacerbate demands on forests and other public lands. These areas are likely to provide critical habitats for many of Malawi's vulnerable species. Indeed, as the second ASAP IEE observes, destruction of forest lands leads to loss of plant and animal habitat. Beyond this single statement, neither IEE "specifically determines" (or discusses) what impacts the ASAP might have on endangered or threatened species or their critical habitats in Malawi. Perhaps as a result, the monitoring at the four catchments does not assess the environmental impacts of policy reforms on biological diversity.[17] In the words of one person associated with the MEMP, there is no monitoring of animal life, and "we are not interested in animals."

While such a view may not be shared widely, it is indicative of the desirability of greater attention to issues related to biological diversity, not just with the MEMP but with other monitoring programs as well. This attention need not require vast resources, but it may require

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[16] Note that "the effect on the environment" need not be significant in order to require an IEE's attention to the issue.

[17] A reasonable argument can be made that the catchments are too small to monitor in regard to changes in biological diversity or potential impacts on endangered species. Even if this is true, however, the limited size of the catchments does not obviate USAID's need to ensure that its activities do not endanger wildlife species or their critical habitats.

the inclusion of additional departments (e.g., Malawi's Department of National Parks and Wildlife) in monitoring activities, their assistance in identifying vulnerable species and habitats, limitations on agricultural access to certain areas, or geographic restrictions on the use of selected pesticides. Each country that has ratified the CITES has a management and scientific authority responsible for the convention's implementation in that country. These authorities should have the latest information on the status of rare, vulnerable, endangered, and threatened species in their countries.

Mitigation and Policy Change

Environmental monitoring programs should have intended outcomes beyond measurement of impacts, as noted earlier. Such outcomes can include mitigation of observed impacts, changes in farming practices, new policies, or more effective implementation of existing policies. Equally important, USAID (1995) has stated explicitly that the MEMP will ensure "course correction of programs as appropriate during implementation" and will be used to mitigate "any adverse long-term impacts [on the natural resource base] due to policy reforms."

Is there evidence that the MEMP has met these expectations? This question cannot yet be answered in the affirmative. No Malawian interviewed for this report was able to identify an instance in which results from the MEMP have led to any mitigation, changes in policy, or even proposals for changes in such policies. There are several explanations for this situation. First, some respondents are not aware that the MEMP has goals other than monitoring and the development of institutional capacity. As one Malawian respondent explained, in his view the MEMP "is just a monitoring program, not an extension program."

Second, given the delays in analyzing and publishing the data collected to date, it may be premature to expect any mitigation; problems have not yet been linked conclusively to the policy reforms.[18] This explanation has some merit, but it leads to another question. If the data had been analyzed and these data indicated the existence of negative environmental impacts (regardless of their causes), would there be examples of mitigation or midcourse corrections? Here again, the answer is unlikely to be affirmative.[19] At present, there is no linkage between

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[18] In its initial analyses, MOREA (1996a, 46) did conclude, however, that the "environmental impacts highlighted...are substantial and have the potential to devastate the already deteriorating environment and the natural resources." These impacts include high levels of residues from pesticides, such as DDT, dieldrin, aldrin, and heptachlor, that have been banned in many countries, including Malawi. These residues were not linked to farmers' use of pesticides for burley production, but the residues were found in samples collected from farmers' soil pits and in streams in the Chilindamaji catchment.

[19] The NATURE Project contains a mitigative agroforestry component, which Washington State University implements in conjunction with the GOM. This component is designed "to increase options for communities to meet their food, cash and wood needs, with sustained use of

the data collected and any identifiable demand or need for these data. MOREA's (1996a) first environmental monitoring report does not provide recommendations relevant to mitigation or suggest any changes in policies. Moreover, according to several Malawians involved with the MEMP, few key policymakers are aware of what the MEMP offers, and none of them have requested analyses of the MEMP's data or proposals for policy changes. Hall's (1995) observations may provide part of the explanation for this situation. In his opinion, the senior staffs in the participating ministries generally "do not have a complete understanding of the [MEMP's] objectives, methodology, problems, and accomplishments."[20] This situation, he adds, has led to less than full cooperation and a reluctance to release technical staff to assist with the MEMP.

Addressing the MEMP's Problems

The University of Arizona's technical assistance team recognizes many of the MEMP's problems. In its review of the MEMP's first two years, the team (1996b, 26, 31), declared that the intended and implicit linkage between monitoring, mitigation, and decision making has "failed to materialize":

> Underlying the presumption that the information emerging from the monitoring program would be used in the decisionmaking process was the fundamental--and ultimately simplistic--assumption that if information exists, it will be used....[T]he information that trickled up to higher echelons was rarely, if ever, put to use.
>
> there is no method for the MEMP to effect *action*, although certainly a great deal more emphasis must be placed on ways in which recommendations arising from program activities can be reported in ways that enhance and assist the decisionmaking process.

These conclusions have led to some changes in the technical assistance provided to the GOM through the NATURE Project. These changes include the placement of an environmental policy advisor in MOREA and that of an environmental scientist at the University of Malawi. The policy advisor, who began work in mid-1996, will work with MOREA to strengthen its policymaking and analytic skills and, more important, to serve as a direct link between the

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natural resources" (USAID, 1995, 37). Such an effort is appropriate, but it is not a direct result of the MEMP. Neither the agroforestry component nor its successes are discussed in the initial summaries of the MEMP's data-collection activities (MOREA, 1996a; University of Arizona, 1996b).

[20] This problem was addressed partially in June 1995, when the technical assistance team presented a two-day workshop to Malawi's environmental decision makers to introduce them to the concepts and possible applications associated with GIS (Eastman and Toledano, 1995; 1996a). One product of the seminar was a recognition of the "need to begin sensitization and develop support at much higher political levels within the GOM" (University of Arizona, 1996b).

MEMP and senior policymakers in all ministries with responsibility for the management or oversight of Malawi's natural and environmental resources. The advisor will also be responsible for convening representatives of other bilateral donors who have an interest in environmental issues in Malawi. As noted earlier, other donors support the GOM's environmental initiatives, but none of these other donors are involved with the MEMP or have otherwise benefitted from its existence.

One of the scientist's goals will be the development of an environmental sciences capability within the university system. Such a capability would address the current shortage of skills and staffing relevant to the MEMP and increase students' and professors' familiarity with GIS. The environmental scientist, who will assume his or her position in late 1996, will also encourage applied research on environmental issues related to the MEMP.

Such research is notably absent. DREA emphasized the need for research not only to complement the monitoring but also to examine the linkages between policy reforms and environmental impacts. In fact, DREA (1993, 7) declared a research component to be "fundamental" to the MEMP's success. As a result, the initial monitoring strategy described the need for a program of grants to fund research "to identify explicit links between changes in framing practices for environmental impacts." The following year USAID/Malawi (1994) indicated that this research component would be "aimed at developing environmentally sustainable, alternative on-farm and post-harvest practices and technologies to mitigate any adverse impacts" associated with the policy reforms undertaken as part of ASAP.

Despite this emphasis, a MEMP-related research agenda does not exist, and the MEMP has not yet funded any university-based research. The environmental scientist is expected to develop and implement the grant program for research, and such a program would presumably be open to government agencies, university staff, and representatives of nongovernmental organizations (NGOs). To date, however, no NGOs have been involved with the MEMP in any substantive way. The NATURE Project intends to address this situation by "broadening institutional relationships to include Malawian colleges, training and research institutes, NGOs, and other administrative agencies."

In addition to the two new advisors to the MEMP, the University of Arizona's staff has indicated that attention to mitigation in the future will focus on issues that policymakers agree are salient from a political perspective as well as those that are essential from an environmental perspective. In recognition that mitigative efforts reflect political decisions, the Arizona team and it counterparts in MOREA also intend to present analysis and information in ways that address policy concerns and issues directly.

The desirability of linking monitoring and mitigation is indisputable, but the process of establishing the linkage is obviously not straightforward. USAID's (1995) discussion of the MEMP implies that mitigation naturally follows monitoring. In fact, bowever, those responsible for monitoring often have few opportunities to affect mitigation. In the words of one MEMP

advisor (Hall, 1996), policymakers must consciously make the linkage between monitoring and mitigation:

> it is a mistake to confound the production of policy-relevant environmental information with the implementation of actions to reverse or reduce environmental degradation. This is too broad a mandate and institutionally unsound to say the least.

This conclusion may be debatable, but it does emphasize the need to integrate prospective mitigators (i.e., relevant policymakers) in discussions about the design, implementation, and intended uses of monitoring programs.

The Area Sampling Frame

The use of the four catchment sites relies on intensive monitoring of geographically limited areas. As already noted, the catchments are not representative of other areas in Malawi, so generalization from data gathered at the catchments is problematic. In an effort to remedy this situation and to move toward the development of a national monitoring system, USAID/Malawi is financing the development of a pilot data collection system using an area sampling frame (ASF). Such a system will first be developed in the Machinga Agricultural Development Division (ADD), one of eight ADDs in Malawi. ADDS correspond roughly to agroecological zones. The expectation is that a sampling frame will be developed for the other seven ADDS if the pilot process is successful.

Wigton (1996) discusses the details of the sampling, but the process will use surveys or questionnaires to gather physical information about representative parcels or segments of land that have been chosen randomly (after stratification into estates, public lands, and customary land holdings). Randomization will ensure the representativeness of the segments (and, therefore, that of the respondents who will be surveyed in each segment). With such representativeness it will be possible to extrapolate from the sample of segments and respondents to the entire population in the Machinga ADD. Assuming that the ASF is properly established and that funding is available to proceed with its use, the same parcels of land in each sampling segment will be resurveyed periodically (as will the inhabitants of that land at the time of the survey), thus providing an opportunity to assess change over time. The sampling error will depend on the number of segments and people surveyed.

The sampling units were still being defined in August 1996. The administration of the pilot survey is scheduled for early 1997. The sampling instrument and the issues to be addressed have not yet been finalized.

The ASF has several potential advantages. A single survey can be used to gather information not only on environmental and natural resources but also on other topics of interest

to the GOM (and donors), such as health, education, transportation, agriculture, and food security.[21] The administration of the survey can also take advantage of an existing cadre of enumerators within the MOALD, which has taken the lead in defining the segments to be sampled in the Machinga ADD, in southeastern Malawi.

The concept of an ASF has appealing features (including its ready applicability in other countries), but its use should be considered carefully. A distinction must be made between the design and selection of the sampling units on the one hand and the process of data collection on the other hand. The survey's design and administration are vitally important. No one wants to (or can) make inferences from flawed data, so enumerators must be well trained, there must be agreement about what constitutes an example of a situation, and the importance of accuracy and truthfulness must be emphasized. As an illustration, enumerators tasked to assess soil erosion may wish to count the number of erosion-induced gullies in each segment. For such data to be of value, however, there must be agreement about what constitutes a gully. That determination should not require enumerators to make subjective judgments.

It may be similarly desirable to know some of the physical attributes of each gully (e.g., width, depth, and length). Here again, comparability is essential--two or more observers should independently agree on a gully's dimensions, and annual (or other periodic) measurements should occur at exactly the same physical location. Such problems may and, perhaps, should discourage the collection of some data that require enumerators to observe and measure physical attributes of the segments for which they are responsible. A related concern focuses on the kinds of physical data that can be collected. To determine the quality of drinking water, one proposal suggested the collection of a sample of water from the first household in each sampling unit. That idea was rejected due to its impracticality and a concern that the number of samples collected would overwhelm the GOM's capacity to analyze them promptly.

Required Analytic Capabilities

The GOM's analytic capabilities are a concern in regard to the monitoring data from the four catchments, and a similar concern is relevant to data collected through the ASF. As presently envisaged, the pilot ASF will produce several thousand completed surveys, each with responses to scores of items or questions. Each response must be coded and collectively analyzed. The skills associated with the latter task are far different from those associated with the training in geographic information systems (GIS) already provided to many MEMP

[21] The GOM currently surveys about 50,000 people on a recurring basis in an effort to ascertain the country's relative food security. There are concerns about the accuracy of the data collected and the significant cost associated with the effort. Due to these and other problems, the World Bank (1995) believes that the Ministry of Agriculture and Livestock Development needs to improve the way it uses surveys to estimate crop yields each year. An ASF could address the Bank's concerns and provide data of better quality at a sharply lower cost.

participants.[22] In other words, the ASF approach does not capitalize on the training provided or the skills developed in the MEMP's initial years.

The data collected from the ASF's surveys, in contrast, will require skills in statistics and training in new software (such as STATA; the Statistical Analysis System, SAS; or the Statistical Package for the Social Sciences, SPSS). Although spreadsheets can be used for some simple bivariate analysis, their use would do an injustice to the data and to the possibilities associated with their use and interpretation. If the goal is a simple summary or description of results (e.g., 43 percent of surveyed respondents farm on customary lands; 22 percent of smallholders are growing burley for the first time), then spreadsheets are appropriate. If the ASF's goals are more ambitious than mere description, and they should be, then more sophisticated statistical analysis is essential. USAID/Malawi recognizes this need and has begun discussions with the staff of the University of Malawi about how best to address this issue.

In the absence of such analysis, the data will be of only limited relevance to mitigation, policymaking, and the identification of the environmental impacts of policy reforms. As an illustration, appropriate analysis of data collected via the ASF's surveys could improve understanding of how different patterns of land tenure affect farmers' willingness to adopt various long-term soil conservation practices and how variables such as gender, income, size of holdings, crops grown, and geographic location affect rates of adoption. Alternatively, the survey might be used to assess the comparative feasibility of different approaches to mitigation, an issue that the technical assistance team cites as one deserving attention (University of Arizona, 1996b).

Appropriate analysis can also contribute to an improved understanding of likely causes and explanations and facilitate the identification of relationships among physical and environmental attributes, environmental damage, and people's attitudes and behaviors. These issues could benefit from attention through the MEMP's revitalized research program. To

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[22] As part of the technical assistance offered to the GOM through the ASAP and NATURE Projects, the Clark Labs for Cartographic Technology and Geographic Analysis of Clark University have provided considerable training in the use of GIS. As a consequence, GIS (and remote sensing) serve as important analytic tools for those agencies and individuals involved with the MEMP. Nonetheless, as Eastman and Toledano (1996a, 19) explain, "the GIS implementation project was not directly concerned with the nature of the MEMP infrastructure and any specific activities related to burley monitoring." GIS and the ASF are compatible and complementary, and data collected via the ASF may be amenable for use with GIS. For example, using GIS, data collected from the ASF's sampling units can be used to assess changes over time among sampled units and to make comparisons among these units. In contrast, *with GIS* extrapolation to the population of all potential sampling units on the basis of data collected from individual sampling units would be problematic. For example, if 14 percent of smallholder farmers used pesticides in a sampling unit, what value would be assigned to the other units of analysis? Without any variation in values, the use of GIS would be inappropriate (i.e., every unit would have the same value--14 percent).

facilitate this attention, researchers should be included in the design of the survey instrument that will be used in the pilot study in the Machina ADD. Their inclusion in the design process would encourage the involvement of social as well as natural scientists in the research program.

Internal Validity and Nonsampling Error

Surveys are susceptible to problems associated with internal validity and nonsampling error when respondents are asked potentially sensitive questions. Such questions might involve income, farming practices (e.g., which pesticides are used, the frequency with which crops are rotated, or the volume of crops produced relative to allocated levels of production), or the frequency with which farmers gather wood from public lands. Expecting truthful answers to sensitive questions presumes that respondents have a high degree of trust in government and are convinced that the disclosure or acknowledgment of potentially illegal activities will not be penalized. Some respondents may not have the requisite level of trust after Malawians' experience during the Banda years, when dissent and expression of contrary views were rarely tolerated.

As noted earlier, one of the original catchment sites was dropped from the monitoring program because of problems with access. Such problems may arise with the use of an ASF, which relies on random sampling *irrespective* of the ease of access to a sampling unit. To ensure representativeness and, therefore, the ability to generalize, sampling segments cannot be changed after their selection due to a lack of paved roads, proper accommodations for enumerators, or for any other reason. Moreover, one should appreciate that surveys will be conducted during the rainy season (approximately November to May), when crops are grown and when farmers are busiest, but also when access is most likely to be inconvenient.

Commitment to the Long-term Use of the ASF

The ASF will be of significant value only if a long-term commitment is made to its use and an effort is made to ensure the quality of the data collected. Continued use of a national ASF will require a considerable commitment of resources. The cost of defining the sampling units for one ADD is approximately $80,000 (which included a one-time training program). Additional funds would be required to define and select the sampling units if the ASF approach is to be applied to all of Malawi. Other funds would be required for the recurring costs associated with administering the periodic surveys and analyzing the data. Although USAID may be willing to finance some of the costs of developing a national ASF, USAID is not likely to fund the recurring costs. For these costs, the GOM will be expected to provide the necessary resources. Such a commitment will depend on the perceived importance of the sampling scheme and the degree of local ownership of the process. That sense of local ownership is not yet evident. MOREA, which is responsible for coordinating the MEMP and for developing a strategy for a national monitoring program, has not yet played or sought a meaningful role in the development of the data collection system associated with the ASF. Likewise, there is some uncertainty among the MEMP's participating ministries about the relation between the MEMP and the ASF, even among those who attended the June 1996 training session on the latter. For

this reason, agreement should be reached promptly about the relation between the ASF and its contribution to the MEMP.

These concerns should not discourage further attention to the ASF or its development in Malawi. The ASF offers a robust approach to data collection and the ability to generalize from relatively small samples to significantly larger populations with a high degree of accuracy. Having noted the ASF's advantages and encouraged its use, it is also important for its advocates and intended beneficiaries to reach agreement, well before the current ASF pilot process is completed, about what data can and should be collected, on the intended outcomes of the collection process, the criteria for and indicators of success, who will analyze the data for each substantive sector, what skills and software will be required to do so, the specific uses to which the results will be directed and, if so desired, whether and how the approach can be used to identify possible linkages between policy reforms, environmental impacts, and mitigation. Identification of so many issues and the potential long-term costs of a fully functioning ASF underscore the importance of reaching agreement about what the ASF can reasonably accomplish.

As an illustration, disagreement exists in regard to the purposes of the pilot survey. Those responsible for its design view that survey as an means to test their methodologies, to train interviewers and to assess their effectiveness, and to identify potential problems that may affect subsequent surveys. Proponents of this perspective thus point out that the kind and number of questions asked are not of vital importance; their interest is in knowing how well the process works before moving to the ASF's full implementation. Others, in contrast, appear to view the initial survey as a source of comprehensive data relatively free from error. The second group views the number and kinds of questions as important, since such questions and their answers will supposedly satisfy many of their data needs. More modest expectations should characterize the initial effort.

Advocates of the ASF should also appreciate that its use will not necessarily address or overcome the problems associated with Malawi's limited institutional capacity to implement an effective monitoring program. In the absence of such capacity, few innovations are likely to succeed or be sustained (Eastman and Toledano, 1996b).

Issues of Sustainability

What are the prospects that the GOM will fund and support the MEMP after the end of ASAP and NATURE? Answering this question requires some agreement about what the MEMP is and what its purposes are. USAID and the GOM have agreed that the latter will establish and implement a nationally representative environmental monitoring program, and USAID's expectation is that the program will operate "in perpetuity" (Loken, 1994). Whether this objective is achieved will depend on what purposes the MEMP is intended to serve.

On the one hand, USAID's initial (and continuing) interest is in the identification and mitigation of the environmental impacts of the policy reforms associated with ASAP and NATURE. According to the conditions associated with ASAP's last tranche, the nationally

representative program is intended to address this need. Presumably, therefore, the GOM will be monitoring the environmental impacts of policy reforms for many years. This obtains both because these impacts are likely to be long term (and extend well beyond the end of ASAP and NATURE) and because USAID anticipates that the number of smallholder burley growers will increase to the point that they produce almost 40 percent of all burley tobacco in Malawi (USAID, 1995). USAID's obligations to protect against the long-term environmental impacts of policy reforms do not end when its financial assistance ends.

Continued monitoring of policy-related impacts may be desirable from USAID's perspective, but this does not mean that key policymakers in Malawi will necessarily share this preference. An emphasis on the environmental impacts of policy reforms may not be sufficiently broad for the GOM's needs, and the impacts may not be perceived as ones that merit special attention. As one expatriate advisor remarked, collection of data related to burley tobacco has been "command driven," not demand driven. Moreover, the policy reforms are not among the *major* causes of Malawi's environmental problems. The curing of tobacco affects demand for forest products, but other causes (such as population growth, a shortage of alternate fuels, and declining agricultural productivity) arguably provide a better explanation of the current state of the country's problems with deforestation.

Perhaps more important, even if the government is convinced of the merits of long-term monitoring of the environmental impacts of policy reforms, this report has highlighted the difficulties in doing so. Establishing causal linkages between policy interventions and environmental impacts is problematic at best. If USAID's premier effort to support a program of monitoring and mitigation is not able to identify clearly what the impacts are, then is it reasonable to assume that more modest efforts in other countries will encounter success? Achieving success requires attention to all the issues discussed above, including: decisions about the use of centralized versus decentralized approaches to a program's management and implementation; selection of sites; approaches to sampling; decisions about the relative intensity of monitoring (i.e., intensive monitoring at a few sites, less intensive monitoring at many sites, or extensive monitoring combined with intensive monitoring in strategic areas); indicators to be monitored; quality control; data analysis and interpretation; and identification of interested clients from among the ranks of policymakers who are able to affect change.

In addition, although USAID may have an obligation to address and mitigate the environmental impacts of its policy-reform initiatives, USAID cannot compel host governments to do so. Any leverage that USAID possesses will diminishes or disappears when its projects or programs end.

In short, these factors suggest that it may be unrealistic to assume--even if funds, staff, and equipment are available--that the GOM will continue to monitor solely or primarily to identify the environmental impacts of diffuse and multiple policy reforms. This problem is compounded when the reforms are complementary, are not easily identified as discrete actions, and when multiple and intertwined causes provide explanations for the outcomes observed.

On the other hand, the prospects for continued monitoring are substantially better when the purpose is an awareness of key environmental problems that are directly observed to affect livelihoods, well-being, and economic development. Such a program could be tailored to the country's definition of its most critical needs, more readily find an interested and supportive policymaking clientele, and be more attractive to other donors (Hecht, 1994). Such a program also has far greater appeal to those who control domestic purse strings, and it has a far greater cbance of baving programmatic impact. This is not to argue that the environmental impacts of policy reforms are unimportant or should be neglected. A more general program lets the problem define and justify the need for monitoring as opposed to a situation where what is monitored is determined even before there is any indication of a need to monitor. Hecht (1994, 49) provides still another reason why a "general" monitoring program may be desirable:

> An EMEMP designed narrowly to target the detailed impacts of a particular activity, which needs specific data on a clearly defined time schedule, will not be well suited as a vehicle for institution building. In contrast, an EMEMP designed to build more general monitoring databases can more easily afford the costs of serving as a training and institution-building tool because it is less essential that specific data be available at a particular time.

A further consideration involves the components and emphasis of a program designed to monitor the impacts of policy reforms versus one intended to assess environmental resources. As Imam (1996, 61) explains:

> Monitoring activities that are designed to identify causes and effects of specific environmental problems differ from programs designed to inventory environmental resources. Building a successful environmental and water-quality monitoring program requires a clear vision of the environmental problem being addressed, a set of clearly stated and defined goals and objectives for the monitoring activities, and a well-defined criterion that can be used to judge whether these objectives have been achieved.

This recommendation can be instructive. If a nationally representative monitoring system will be implemented, what might such a system include, and how can it best serve and contribute to Malawi's quest to manage its resources sustainably while simultaneously ensuring that attention is not denied to issues or problems of interest to USAID (which, theoretically, should coincide with those of the host country)? As an illustration, since deforestation is a major concern in Malawi, a monitoring program with a forestry component would have as its goal the detection of changes in land cover, land use, and in the vegetation itself. Outputs would include information on the extent of change, the rate at which change is occurring, the location of the change, and identification of the primary or proximate causes of the changes. Agreement would also be necessary on the scale and frequency at which the program should be implemented.

These observations create a potential dilemma for other USAID missions that seek to address faithfully the expectations associated with the Agency's Environmental Procedures and Section 496. If the establishment of monitoring program designed to assess the impacts of policy

reforms is not likely to bear programmatic fruit, is the only alternative a more general monitoring program, such as that being established in Malawi? The answer is clearly no. A system can be designed to monitor these impacts, but such a system would probably place USAID's interests above those of the host country. Few countries have monitoring interests that focus primarily on the impacts of policy reforms, although attention to these reforms may provide a training ground for the development of a more comprehensive approach to environmental monitoring. The "more comprehensive approach" is likely to be more expensive than its policy-related sibling, but the former offers much greater long-term appeal.

Questions are also appropriately raised about the sustainability of the analytic skills developed through Clark University's training in GIS, remote sensing, and global positioning systems. Staff from the Clark Labs provided introductory, intermediate, and advanced workshops on these topics to GOM employees in Malawi in April 1994, August 1994, January 1995, and June 1995. Although the training was deemed to be successful, its presenters are not optimistic about the prospects for institutionalizing the newly acquired skills within the GOM. Absent a restructuring of the civil service, which is highly improbable, Eastman and Toledano (1996a, 36) report that "no government officer or agency [can] successfully use GIS on a continuing basis." This conclusion is based on a judgment that there are no incentives to develop and maintain technical skills with the GOM; all such incentives appear to be directed to those who hold political or administrative positions and who, therefore, have little time to use GIS. Given the resources devoted to training, this is a disconcerting conclusion and suggests that, if expertise with GIS is required for the MEMP's success, MOREA and its sister agencies should look to either the private sector or to the university community for assistance related to the use and application of GIS and remote sensing.

The MEMP, Reengineering, and Performance Monitoring

USAID's goal in Malawi is broad-based and sustainable economic development (USAID/Malawi, 1996). Within this goal, one of USAID/Malawi's five strategic objectives is the "increased sustainable use, conservation, and management of renewable natural resources." NATURE contributes to this objective and, in the mission's view, "explicitly embodies an emphasis on 'managing for results.'" These results are intended to include: field-level adoption of appropriate management practices; a comprehensive policy and legislative framework for the management of Malawi's natural and environmental resources; and the strengthening of institutions responsible for these resources.

USAID/Malawi is currently engaged in the development of indicators for its strategic objectives. In terms of its support for the MEMP, tentative, intermediate indicators of success now include:

a) the development and use of a prototype environmental information system with bibliographic archiving and a data standard for digital mapping; and

b) the testing, implementation, and evaluation of environmental monitoring methodologies.

These indicators represent a commendable effort to ensure that USAID's investment in Malawi leads to the desired results. To assist in the process, USAID/Malawi requires the NATURE Project's technical assistance team to provide annual workplans that identify objectives, intended results, and indicators. The University of Arizona (1996c) recently submitted the first such workplan, and USAID/Malawi was reviewing it at the time of the field work. This approach has considerable merit and should be continued.

As all USAID missions are aware, USAID emphasizes attention to results and measurable *outcomes* (as opposed to outputs) and a means to evaluate and assess the impact of its programs. This approach suggests the need to develop and apply evaluative criteria to the MEMP so that judgments about its success are not dependent on anecdotal evidence alone. Before evaluative criteria are developed, however, it is first necessary for there to be agreement about a monitoring program's goals and objectives. In the context of the MEMP (or any other environmental monitoring program), for example, such agreement would logically be the result of a strategic plan.[23] This plan, which might be only two or three pages in length, would:

a) identify and explain the program's primary purposes and goals (What does the program intend to accomplish? To what identifiable need or problem does the program respond? What will be better or different as a result of the program's successful operation, and when will these results occur?);

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[23] A NEAP can provide a useful organizing framework for such a strategy. NEAPs typically identify a country's major environmental problems, reflect a country's priorities for action, and are often endorsed by a country's political leadership. Environmental monitoring programs can thus be presented or proposed as a vital component of a NEAP's implementation and as a tool that is required for the NEAP's success. Having noted the opportunities associated with NEAPs, one should also be cautious about their utility. As a recent World Bank (1996b) report concluded, the Bank's insistence on the completion of a NEAP as a prerequisite for further lending can undermine local ownership of the plan. The same report also noted that "many NEAPs [appear] to be one-time efforts that ended with a document; few countries have thus far succeeded in establishing an ongoing, self-sustaining strategic environmental planning process at the national level." Malawi's NEAP may be illustrative of such concerns. According to one close observer, the World Bank insisted that Malawi complete its NEAP as a prerequisite for further loans. At the time of this insistence, MOREA did not have the staff capacity to coordinate the development process, so the Bank funded the establishment of a separate NEAP secretariat. Although the secretariat was housed in MOREA's offices, the staff was not functionally a part of MOREA. The result, as one respondent commented, was that the "kind of internal coordination and cross-fertilization that should have taken place to tie the MEMP and the NEAP together never happened."

b) use these purposes to justify the data to be collected (What data will be collected? How? Why? Who will interpret and analyze them? How? What is the minimal number of locations and environmental parameters that can be monitored and still provide meaningful information?);

c) identify the institutions responsible for implementing the program, specify their responsibilities, and explain how the institutions will coordinate their efforts;

d) explain the data's intended uses (What can or should be done with the data? What are the specific problems to which the data will or can be applied?);

e) identify the resources and skills required to implement the program (What equipment and training are necessary, and who will provide them?[24] What are the initial and projected recurring staff and financial commitments associated with the program's operation, and what will be the source(s) of the funds required?); and,

f) identify concrete linkages between the data's collection, interpretation, and intended end users (Which policymakers, not organizations, want the data and the results of their interpretation and analysis? In what format will the data be presented to policymakers, and how will this format meet their needs? How have these needs been identified?)

In the Malawian context some of these questions have already been answered. For others, however, there remains disagreement or a need to answer them for the first time. As part of the requirements associated with the ASAP's last tranche, which involves the implementation of national representative environmental monitoring program (see Table 1), the GOM is required to provide USAID/Malawi with "a comprehensive list of actions that the [GOM] intends to take" in regard to that program (USAID/Malawi, 1994). As the MEMP moves from intensive monitoring at catchments to a national monitoring system, the articulation of a strategic plan could assist MOREA in its efforts to develop the list of intended actions. Regardless of how these suggested components of a strategic plan for a monitoring program are addressed, their resolution should reflect agreement between those funding and those implementing a monitoring program.

Conclusions

The MEMP arguably represents USAID's largest and most important investment in the development of an environmental monitoring capacity. The program is notable for its emphasis on the development of indigenous capacity and its conscientious effort to comply with both the letter and spirit of Section 496 of the U.S. Foreign Assistance Act. In addition, USAID/Malawi

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[24] The individuals or organizations making recommendations for the acquisition of training and equipment probably should not also have responsibility for providing the training or equipment.

can appropriately share credit with the Government of Malawi for considerable progress to date. Monitoring skills have been enhanced considerably, and there exists a cadre of GOM employees who are comfortable in the use of software for GIS. This familiarity has benefits not only for the MEMP but for other agency functions as well. GIS provides a common analytic language, and this language facilitates improved communication and coordination among agencies within the GOM. This coordination increases the opportunities for multisectoral responses to Malawi's severe environmental problems. Furthermore, the wealth and variety of data collected to date offer the prospect that the MEMP will soon contribute to better and better implemented environmental policies and practices in Malawi.

Malawi's experience with its environmental monitoring program can be instructive for other countries and USAID missions in those countries. The development of an effective monitoring system requires considerable planning, foresight, and patience. In the absence of such virtues, success will be elusive. In their presence, however, much can be accomplished when agreement exists about ultimate goals and the actions required to achieve them. These virtues suggest as well that a successful program is more dependent on personal and institutional attributes than it is on the availability of sophisticated equipment. However attractive such equipment may be, its value is diminished when data are of poor quality, when the volume of data overwhelms institutional capacity to analyze and interpret them, and when policymakers do not appreciate that they are the clients and intended beneficiaries.

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Appendix 1

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