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Dilemmas of Development:

Burley Tobacco, the Environment, and Economic Growth in Malawi

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ABSTRACT

Dilemmas of Development:

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Efforts to encourage smallholder farmers in Malawi to produce tobacco for export illustrate the dilemmas that developing nations and donor organizations face when their quest for development entails compelling economic incentives but potentially harmful impacts on human health and the environment. In addition to the well-known impacts on health associated with the use of tobacco, its production can have deleterious effects on the environment, especially when production (and curing) entails substantial use of wood in a country facing high levels of deforestation. This article examines the rationale for choosing tobacco as a vehicle for economic development in Malawi and then addresses the difficulties associated with efforts to monitor and mitigate the environmental impacts of sectoral adjustment programs. Although advocates of sustainable development routinely argue that development can occur without damage to the environment, achieving this goal is problematic when poverty and malnutrition are widespread, as is the case in Malawi.

Malawi is a desperately poor country plagued by seemingly intractable social, economic, and environmental problems. In its major urban areas, every third adult is infected with the HIV virus (Bureau of the Census, 1994), and few of them can afford medical care. Malawi has one of the world's highest rates of population growth--almost 4 percent per year between 1990 and 1993--and this growth occurs in a country where GDP per capita is less than \$200 per year (United Nations, 1995a). Malawi also bears the burden of one of the world's highest rates of deforestation. The country may be losing as much as 3 percent of its forest cover each year, and this contributes to loss of habitat and severe soil erosion. A landlocked country with few natural resources other than its 11 million people, the prospects and opportunities for development are limited.²

Agriculture represents one such opportunity. Malawi's population is predominantly rural, with 85 to 90 percent of its population living outside urban areas. Agriculture employs about 90 percent of the workforce and also generates about 90 percent of Malawi's foreign exchange. For these reasons, success in the agricultural realm is important not only because of the need to feed millions of marginally nourished people but also because agriculture represents the single best hope to escape the chains of poverty.

This article examines efforts to loosen these chains and explores the dilemmas that bilateral donors and recipient nations confront when they seek to address the fundamental problems of underdevelopment. These dilemmas force difficult choices about pathways to development, compliance with economic and environmental covenants that donors impose on recipients, and about how best to cope with the potential trade-offs between the quest for economic growth and environmentally sustainable development.

Agriculture in Malawi

As in many societies, Malawi suffers from an inequitable distribution of income.³ Urban dwellers typically have higher incomes than do their rural brethren. Among the latter, owners and operators of Malawi's agricultural estates fare better economically than do smallholders. They are called smallholders because of the amount of the land they farm; more than 75 percent farm less than one hectare (ha). Based on current cropping patterns, they find it difficult to grow enough food to meet minimum dietary requirements. In fact, most smallholder households exhaust the supplies of food they have grown three to four months before the next harvest (World Bank, 1996a). The consequences of this deprivation are readily evident. Over three-quarters of children under age five are underweight or suffer from stunted growth. Of the Malawians who are fortunate to be able to farm as much as 1.5 ha, they are usually able to meet their families' needs for food--but not much else. Most Malawians spend about three-quarters of their income on food.

Extensification of agriculture offers hope for increases in production and incomes in some countries. Such a choice is not a viable or environmentally friendly option in much of Malawi. Nearly all the land suitable for cultivation is already farmed. As Kydd (1985) has noted, smallholder farmers were using virtually all of the land available to them in the 1970s. In addition, Malawi has one of the highest population densities in Africa, with over 175 people per km² of arable land (World Bank, 1995). With a fixed amount of land and a rapidly growing population, the average hectareage per smallholder farmer is declining. In 1982-83, 27 percent of all smallholders cultivated 0.5 ha or less; ten years later 48 percent did so (Government of Malawi, 1994). Such population pressures also force many people to

invade forests or protected areas or to farm on land of marginal agricultural value, including slopes exceeding thirty to thirty-five degrees. Agricultural extensification is the most important cause of deforestation, at least according to the World Bank (1995). Unfortunately, extensification is the most common means of increasing agricultural production in Malawi.

Intensification is another option, but that requires improved farming practices and more and better inputs (such as fertilizers and high-yielding seed varieties). Widespread illiteracy limits the spread of better farming techniques; poverty and lack of credit frustrate efforts to acquire inputs. Where intensification has occurred, it often results in the elimination of fallow periods, which are important for agriculture to be sustainable.

Seeking Solutions

Given the pervasive range and variety of Malawi's problems, no single or simple solution exists. Although an increase in the production of food crops (such as maize and cassava) is essential, their production does not generate much income or foreign exchange. That task is best left to cash crops that can compete in regional or world markets. Whereas other developing countries find profit in their production and export of tea, coffee, cotton, and bananas, Malawi is one of the world's major producers of burley tobacco, which is exported to as many as sixty countries. Tobacco is Malawi's single largest cash crop and produces most of the country's foreign exchange.⁴ No other country devotes as much of its agricultural land to tobacco as does Malawi, and no other country is as dependent on tobacco for its export revenues as is Malawi.

Despite tobacco's powerful financial appeal, opportunities to produce burley tobacco have long been limited. Beginning in the 1920s, for example, estates monopolized its

production as a result of a series of colonial-based policies that favored and protected European planters (McCracken, 1983). Through a National Tobacco Board (NTB), which was established in 1926, these expatriate planters imposed limits on smallholder production of all types of tobacco, required the registration and approval of smallholders who wanted to grow tobacco, reduced and controlled the number of sites where tobacco could be marketed, and limited the prices at which smallholders could sell their tobacco. In some years, when smallholders' tobacco was sold at auction, as much as half of the proceeds were used to subsidize the NTB's operation (McCracken, 1983).

With independence in 1964, the country's new political leaders found further reason to favor large estates at the expense of smallholders. Leases for estates and licenses for burley production provided instruments for political and economic patronage to be distributed to those in the private sector as well as to politicians and senior civil servants (Kydd, 1985). Recipients provided both support for and loyalty to an autocratic government.

To complement the patronage, government policies encouraged and subsidized the cost of growing burley tobacco on estates. In the words of one elegant writer, regulations limited the cost of agricultural inputs, the low cost of estate leases lowered the cost of land, subsidized credit lowered the cost of capital, and restrictions on smallholder production lowered the cost of labor (USAID/Malawi, 1991). As USAID's analysis concluded:

Burley's economic and political importance...led to the creation, in post-colonial Malawi, of an almost classic colonial-style social structure in which barriers to entry to income-earning opportunities...held down wages. Public policy...served the interests

of those who dominate the country's socio-economic structure (USAID/Malawi, 1991: 70).

Such an arrangement perpetuated a tenant system of farming that began in the 1920s. Tenants lived on estates, produced tobacco with inputs that estate owners provided on credit, and then sold their tobacco to the estates at prices the government established. These prices were considerably lower than what estates received when the tobacco was auctioned (USAID, 1991).

In contrast to the government's largesse to estate owners, other policies actively discouraged or prohibited smallholder production of tobacco. Smallholders could not legally grow burley tobacco until 1990. In addition, however, smallholders who produced other types of tobacco were required to sell it (plus all their cotton and groundnuts) through the Agricultural Development and Marketing Corporation (ADMARC), a parastatal. ADMARC successfully sold most tobacco crops, but then returned as little as 20 percent of the proceeds to smallholders (USAID/Malawi, 1991).

Given all these circumstances, it is not surprising that large estates monopolized burley production and profited greatly as a result. In the 1970s, for example, the real value of estate production increased by over 9.5 percent per year and at more than 5 percent per year in the 1980s (USAID/Malawi, 1991). In contrast to the estates' prosperity, the value of smallholders' agricultural production increased by less than one-half of 1 percent between 1978 and 1988. In short, the economic growth that did occur was inequitably distributed, and those most in need of the benefits associated with development were the least likely to receive them.

As the World Bank (1995: 100) has observed, 'permission to grow burley tobacco is perhaps one of the most powerful, and feasible, tools available to [the Government of Malawi] to redistribute wealth and reduce poverty within a reasonable period of time....' However appealing such permission might be, owners and operators of estates, large tobacco interests, and those representing them (such as the Tobacco Association of Malawi) would understandably be opposed to new sources of competition. In their opinion, and that of the government as well, production of burley tobacco should be regulated to ensure that supply did not exceed anticipated demand, thereby lowering prices and revenues in a country overwhelmingly dependent on them. Accordingly, beginning in 1965, the Government of Malawi regulated the volume of burley tobacco that could be produced. Estates were required to apply annually for licenses, which when granted, allowed specific levels of production. Sole reliance on estates was also intended to ensure that the quality of tobacco produced would be acceptable to foreign buyers, who converge in Malawi at one of the world's largest auction floors for tobacco.

If a country's most powerful agricultural interests and its counterparts in government are satisfied with the status quo, how can change be encouraged, especially when the intended beneficiaries are the least politically effective members of society? This question is one that the donor community addressed in the early 1990s through a series of sectoral adjustment programs.

For those not familiar with such programs, a brief digression is desirable. In the 1970s and into the 1980s, bilateral donor agencies relied primarily on project assistance as a vehicle to distribute foreign aid and to encourage economic development. This assistance

usually emphasizes specific and geographically discrete activities, such as the construction of roads or health clinics or efforts to eradicate malaria. However successful project-based assistance is or has been, it does not address the root causes of economic stagnation that retard development. In Malawi, as an illustration, public policies rather than a lack of skills or technology prevented smallholders' access to the potential economic benefits associated with major cash crops.

In an effort to address root causes of economic stagnation and in recognition of the policy-related causes of limited development, some donors increasingly switched to sectoral adjustment loans and nonproject assistance in the early 1980s. Such assistance is not directed at specific development projects but at policy and institutional reforms, both at the macroeconomic level and in certain sectors, including agriculture, in order to promote and encourage development. In exchange for a loan or grant in hard currency, a recipient government agrees to policy reforms that the donor believes are related to structural problems in an economy. Funds are normally provided through a series of installments or 'tranches,' which coincide with the government's initiation and implementation of previously specified covenants affecting policy reforms and institutional changes. Some donor agencies, including USAID, typically also complement adjustment programs with long-term technical assistance teams that provide guidance in the implementation of the policy reforms.

Examples of such reforms include liberalization of markets, reductions in subsidies for food and agricultural inputs, or enhancing the availability and effectiveness of credit. The expectation of nonproject assistance, which is often combined with project-based technical assistance, is that removal of intrusive government involvement in an economy will spur

production and create entrepreneurial activities that either do not exist or that are stifled because of a government's policies. In turn, increased production is expected to promote economic development and improvements in standards of living.

Accepting the Assumptions

In the 1980s and 1990s, both the World Bank and USAID provided tobacco-related loans or grants to the Government of Malawi. On the Bank's part, it funded three loans between 1983 and 1990, the most recent of which was intended to increase production by 9,000 tons per year. USAID began its tobacco-related efforts in Malawi in late 1991, with the initiation of a US\$55-million, seven-year Agricultural Sector Assistance Program (ASAP). As part of ASAP, the Government of Malawi 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: 2) 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 production and marketing environment for cash and food crops; and...(2) to liberalize the production of burley tobacco, Malawi's premier cash crop....

ASAP is intended to provide smallholders with increased opportunities to grow and sell burley tobacco legally. As a result of ASAP, the Government of Malawi liberalized access to the burley market and permitted smallholders to grow and sell the tobacco. For the

1990-91 growing season (with the World Bank's encouragement through an agricultural sectoral loan), the government permitted smallholders to produce and sell their burley tobacco at the auctions. With the advent of ASAP, the government agreed to further liberalization and increased quota allotments for smallholders, rising from 3.5 mil kg in 1991-2 to 10.7 mil kg in 1995-6.⁵

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.

These changes led to impressive gains for smallholders. On the one hand, if the estimates of the Ministry of Agriculture (in USAID/Malawi, 1997) are accurate, then smallholders produced 20 percent of Malawi's burley tobacco in 1995 and over 40 percent the following year. These farmers had produced less than 3 percent in 1992. For the 1996/97 growing season, smallholders produced over 50 million kg of burley tobacco, nearly all of which was intended for export (Schmick, 1997). Furthermore, in contrast to earlier concerns, the quality of smallholders' burley production often exceeds that grown on estates, at least

when measured by the average price obtained on auction floors (Carvalho et al., 1993; World Bank, 1995). The typical smallholder producer is also able to grow his or her tobacco at a lower cost than can estates.

On the other hand, as the number of smallholder farmers growing burley has increased, so also have their incomes. The economic returns from the production of burley tobacco are substantially higher than for food crops like maize, Malawi's primary food staple. According to Malawi's Ministry of Agriculture (in USAID/Malawi, 1997), the real per capita incomes of smallholder burley producers more than doubled between 1991 and 1996, from US\$153 to US\$315.

These increases are impressive, but they should be placed in context. Less than 5 percent of Malawi's smallholders were the direct beneficiaries of such increases, and they were likely to have been among the wealthiest of smallholder farmers even before they embarked on burley production. Most poor smallholders, those most in need, have either been unwilling to risk or unable to afford burley production. Indeed, one survey of such smallholders found that their economic well-being had deteriorated because of failed burley production (University of Arizona and Clark University, 1996). Furthermore, volatility in world demand and prices paid for tobacco could affect further increases and the ability to sustain previous gains.

Issues

What are the costs and consequences of success? This is a relevant question because the production and sale of tobacco (and other crops intended for export) raise important

social, economic, and environmental issues. Although this article focuses on the last issue, brief mention of the former ones highlights some of the dilemmas of development.

First, given what is known about tobacco's impact on human health, one can reasonably question the propriety of a donor's support for its production. Should a government promote a product whose use is a major cause of death and disability? The World Bank recently answered this question in the negative. Arguing that 'the production and subsequent consumption of additional tobacco produces a large net global economic loss,' the Bank (1991, 1994a) concluded that it would no longer provide loans or guarantee investments related to the production, processing, or marketing of tobacco.⁶ Furthermore, the Bank added, 'every effort' should be made to identify and encourage the production of alternative crops that can substitute for tobacco.

Second, should the production of crops for export be encouraged in countries that are unable to meet domestic demands for food and where a large portion of the population is undernourished? The Food and Agriculture Organization (FAO) (1995) considers Malawi to be a country with low food security, which means that there exists continuing uncertainty about both the stability and availability of food supplies. Malawi produced considerably less food per capita in the early 1990s than it did in the early and mid 1980s. Malawi has also been one of the largest recipients of donor-provided food aid in sub-Saharan Africa over the last few years, receiving more such aid than all but a few of its continental counterparts (World Bank, 1996b).⁷ With a higher proportion of its agricultural land devoted to tobacco than any other country, the growth of cash crops for export arguably inhibits or discourages the production of essential food crops (see, for example, United Nations, 1995b). The

counterargument is that increased incomes associated with the production of crops for export contribute to food self-reliance. Such incomes increase purchasing power, increase access to vital agricultural inputs, and allow a household to acquire food.⁸

Third, is tobacco a crop that world markets will continue to demand, and will it have continued access to markets in developing countries? World prices for many agricultural commodities, including tobacco, fluctuate considerably from year to year. Good prices one year are often followed by disastrous prices the next year, and Malawi has often been a victim of these price shifts. Due to its high and increased dependence on tobacco, Malawi is highly susceptible to future shifts in demand, competition from other African countries with more land and lower transportation costs, and events, such as rainfall, over which it has little control (World Bank, 1995; Schmick, 1997). Small-scale farmers in the midst of abysmal poverty may not be candidates for participation in such risky schemes, or so some might argue. Antismoking efforts in many developed countries are gradually having an impact on consumption, and per capita consumption is declining in Japan, Western Europe, and the United States. This is not an auspicious sign for producers of tobacco in the long term.

Tobacco from Malawi must also compete with tobacco produced elsewhere, including the United States. Prospective competition with US farmers is a sensitive issue, and one that the Congress has addressed vigorously. US legislation restricts USAID's ability to support agricultural activities in developing countries. The Foreign Operations, Export Financing, and Related Programs Appropriations Act, 1995 (and similar wording in previous legislative appropriations dating to 1978), prohibits USAID from financing: 'any loan, any assistance or any other financial commitments for establishing or expanding production of any commodity

for export by any country other than the United States, if the commodity is likely to be in surplus on world markets at the time the resulting productive capacity is expected to become operative and if the production will cause substantial injury to United States producers of the same, similar, or competing commodity....⁹ Other legislation has required the US representative to the World Bank's Board of Directors to oppose Bank loans to developing countries to grow crops for export that might compete with US farmers (Lele, 1987; Office of Technology Assessment, 1988).

More recently, domestic content legislation approved in 1993 (and effective on 1 January 1994) required US cigarette manufacturers to use at least 75 percent US-grown tobacco in their products. In 1993, about 45 percent of tobacco in US-manufactured products was produced outside the United States (US Department of Agriculture, 1995), so the legislation had an immediate and dramatic impact. Imports of unmanufactured tobacco into the United States dropped by 27 percent in 1994 and another 22 percent the following year. The decline in Malawi's exports of tobacco to the United States was even more precipitous than the average. After record exports to the United States in 1993, the value of these exports fell by nearly 50 percent the following year.

After complaints that the domestic content requirement was inconsistent with the General Agreement on Tariffs and Trade, the United States revised its procedures for limiting tobacco imports. The content requirement was replaced in September 1995 with annual quotas for tobacco imports.¹⁰ Imports above the allowable amount are subject to a duty of 350 percent.

Given the weakening demand for tobacco in many industrialized nations, restrictions on tobacco imports in consuming nations, and the tendency for production to exceed consumption, the World Bank (1991) predicted that the real price of tobacco will decline in the future, just as it did in the 1960s, 1970s, and 1980s. Although consumption is expected to increase in the developing world, the future for tobacco is not bright. As the World Bank (1995: 116) recently concluded, 'in order to achieve sustainable growth and poverty reduction [in Malawi], there must be decreased dependence on tobacco for export and increases in rural cash incomes....' The Bank added, however, that income from tobacco production might be the vehicle for diversification into other high-value crops.

Environmental Issues

No donor opposes sustainable development. A common goal is to foster economic development while minimizing unacceptable environmental impacts. In the abstract, this is an easy goal to state and support. In contrast, achieving the goal is often difficult. No one actively pursues negative impacts, but they are often difficult to avoid, especially in large-scale projects or in trends unleashed nationwide by policy reforms or institutional changes. As the case in Malawi demonstrates, moreover, what may be an appropriate path to economic development for poor farmers does not necessarily mean that the path is free of environmental concerns. Consider, for example, that smallholder production of burley tobacco in Malawi might affect some or all of the following:

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

24 times as much potassium, and 36 times as much phosphorus 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. Due to tobacco's impacts on soil fertility, farmers are advised not to grow tobacco on the same land more than once every four years. Doing so reduces a soil's fertility and thus productivity.

2. *Water quality and quantity.* Farmers producing burley tobacco desirably use about 1,000 kg of fertilizer per hectare of crop and, when available, pesticides to protect against such potential problems as 'bushy top' virus, which aphids transmit, and bacterial wilt fire disease.¹¹ 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.

The availability of clean water is a critical issue in Malawi. Lake Malawi (and several other large lakes) potentially provide unlimited supplies of water, but few farmers rely on irrigation or have access to the lakes' water. Like its neighbors in southern Africa, Malawi has already suffered through two major droughts in the 1990s, and agricultural production plummeted during both. Furthermore, Malawi's annual renewal freshwater resources have declined so precipitously on a per capita basis over the last 40 years that the limited availability of water is considered to be 'a severe constraint on socio-economic development' (United Nations 1996: 264-6). In short, Malawi can ill afford to misuse or overuse the water it does have.

3. *Forests and wood products.* After harvesting, burley tobacco is cured in wooden sheds. They include a roof made of thatched grass supported by forked poles about 2 m 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.

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 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 crucially germane to Malawi. One FAO report (de Montalembert and Clément, 1983) concluded that Malawi faced a fuelwood deficit and that its six million people in 1980 were able to meet their minimum needs for fuelwood only by overcutting existing resources. By the mid-1980s, other research

concluded that Malawi's deforestation was so severe that it could not be reversed. As French (1986: 534) explained, it is inconceivable that farmers would switch from growing food to trees for fuelwood: 'That way would lie starvation, a choice that nobody is going to make.' A few years later the Government of Malawi (1993) acknowledged that Malawi has one of the world's highest rates of deforestation. Vast areas continue to be denuded in the 1990s in response to high demands for wood that are not otherwise satisfied. Recent estimates (Mponda, 1996) indicate that indigenous forests provide as much as 90 percent of the annual demand for energy in Malawi. Consequently, although most wood is used for heating and cooking, one has to be apprehensive about anything, including the curing of tobacco, that contributes to further deforestation.

In addition to concerns about the required volume of wood, its source is also of concern. The Special Crops Act of 1973 requires tobacco estates to plant at least 10 percent of their land with trees for the estates' eventual use (Mponda, 1996). Despite claims to the contrary (e.g., International Tobacco Growers' Association, 1997), compliance is infrequent and enforcement rare. Less than one in five estates is self-sufficient in wood (World Bank, 1995). For those that are not, customary lands are usually the main source of wood.

The Crops Act does not apply to smallholders and, given the scarcity of land, few would be inclined or able to comply even if the act did apply. Shortages of wood on customary land lead many smallholders to cut illegally on public lands, including forest preserves and other protected areas. Many others, while not cutting illegally, cut far in excess of sustainable yields. Illegal and excess cutting contributes to further erosion and siltation and precludes sustainable management of forested areas.

In apparent recognition of such potential environmental problems, especially tobacco's demands on forest products, Malawi's National Environmental Action Plan (Government of Malawi, 1994) recommended that the country reduce its reliance on tobacco and shift toward more environmentally benign cash crops. The World Health Organization (1995) raised similar concerns about the adverse environmental impacts of growing tobacco. The World Bank (1995) also recommends diversification away from tobacco in order to reverse land degradation and problems with soil fertility.

Addressing Potential Environmental Impacts

If donors support policy reforms that potentially contribute to negative environmental impacts, what obligations, if any, do they have to identify and mitigate the impacts? As recent research (e.g., Tobin, 1996a, 1996b) indicates, how donors answer this question varies considerably. Some donors, such as the Japanese, place major responsibility on the recipients of the assistance. In the opinion of Japan's aid bureaucracy, recipients should be responsible for determining whether anticipated environmental impacts should be identified, whether potential negative impacts will be acceptable, and what will (or will not) be done about them.

In contrast to that approach, the US Government attaches stringent environmental requirements to its foreign assistance. Several laws mandate USAID's consideration of the potential environmental impacts of its activities and any efforts to use nonproject assistance and its associated policy reforms as a vehicle for achieving sustainable development. First, the Agency's Environmental Procedures 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;

(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 US Foreign Assistance Act, which governs the distribution of aid to developing countries, 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 nonproject assistance.

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

In contrast to the routine and relatively smooth implementation of the Environmental Procedures, implementation of the environmental provisions of the Foreign Assistance Act is more problematic (Hecht, 1994; Rock, 1995). USAID has not provided formal guidance about how its staff should address the environmental consequences of policy-based reforms. Unfortunately for missions involved with nonproject 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 known to have a significant effect on the environment.¹² Protection against such consequences arguably requires their identification and mitigation.

Implementation: Burley Tobacco in Malawi

The authors of the IEE for ASAP were not reluctant to identify what they considered to be potentially serious environmental problems. The document (USAID/Malawi, 1991) declared that 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...[T]he 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.

Such impacts could arguably lead to a positive determination and thus require the preparation of a more thorough and detailed environmental assessment, which might have led to the program's delay or demise. Instead of providing a positive determination, however, USAID bestowed a negative determination on ASAP. USAID did so on the basis of its commitment to fund the development of a program to monitor the impacts of ASAP's policy reforms, particularly smallholder production of burley tobacco, on biological diversity, the natural resource base, and on human-made and natural environments. The program is also intended 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) and 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 [Government of Malawi] and donor activities; and
- c) collect and analyze data necessary for policy development and regulatory action (USAID/Malawi, 1991).

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 Malawi Environmental Monitoring Program (MEMP)

The problems of designing and developing an effective environmental monitoring program are compounded considerably when such a program is to be established in a developing country. Almost by definition, such countries are typically short of resources and professional expertise, and many of their residents deem survival and economic growth to be more important than concern for future generations. Despite such problems, the Government of Malawi committed itself to develop what is now known as the MEMP when it agreed, in 1991, to accept the grant funds associated with ASAP. How well has the MEMP fared, and how well has it succeeded in identifying and mitigating the environmental impacts of ASAP's policy reforms? The answer to this question is of relevance not only to Malawi but also to other efforts to assess the environmental impacts of sectoral and structural adjustment programs, which have been popular with bilateral and multilateral development agencies in the 1980s and 1990s.

The discussion that follows selectively highlights some of the key issues that have arisen with the MEMP. Similarly, the discussion addresses generic issues rather than ones that are applicable only to Malawi.

1. Establishing cause-and-effect relationships

As noted earlier, one of the MEMP's primary purposes is to monitor the environmental impacts of smallholder production of burley tobacco. Doing so requires attention to several issues. First, identifying changes in environmental quality depends on knowledge of the situation before an intervention occurs. Without such knowledge, baseline data are absent, and it will be impossible to know whether changes have occurred. Second, the establishment of a monitoring program requires knowledge of where anticipated impacts are likely to occur.

Third, identifying and mitigating the impacts of an intervention requires an ability to separate them from impacts due to other causes. As an illustration, if an increase in soil erosion is detected, is it due to the 'new' production of tobacco (or changes in the relative mix of or dependence on other crops), increased deforestation (either related or unrelated to the curing of tobacco), increased production on steep slopes due to population pressures, changes in intensity and duration of rainfalls, or changes in the accuracy and coverage of monitoring instruments?

How these issues have been addressed illustrates the complexity of linking national policy reforms with environmental impacts. On the one hand, for example, although the beginning of ASAP coincided with the 1991-92 growing season, smallholders produced limited quantities of burley tobacco the previous season under the auspices of a loan from the World Bank.¹³ Far more important, due to limited expertise, problems with the MEMP's design, and delays in the acquisition and placement of monitoring instruments, monitoring did not begin until December 1994, several months after the start of the 1994-95 growing season and five growing seasons after smallholders first produced burley tobacco in meaningful

amounts. As a consequence, no baseline data were collected; some, many, or most of the environmental impacts of burley production had already occurred before the program designed to identify and monitor them had started.

On the other hand, under the reforms associated with ASAP, more than two million smallholders gained eligibility to grow burley tobacco. No one expected or assumed that most smallholders would do so (or that they would grow only tobacco), so this made the placement of monitoring sites both perplexing and problematic. The environmental impacts of national policy reforms are not likely to be concentrated geographically. Whereas the potential direct impacts of building a dam or a road can be ascertained with a fair degree of ease, such is not the case when those responsible for monitoring are not sure where to monitor. The government's response was to initiate intensive monitoring at four pilot catchment sites, with each site approximately 1,000 ha. The sites, in the districts of Nkhata Bay (northern region), Ntcheu and Kasungu (central region), and Mangochi (southern region), 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' (Government of Malawi 1993).

The rationale for the choices has engendered considerable debate about the sites' merits and appropriateness. The sites are supposedly 'indicative (but not necessarily representative)' of smallholder burley production, so any attempts to generalize to other areas is problematic. 'Given the bias inherent in the selection process,' as the Government of Malawi (1993) observed:

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.

Through the choice of initial monitoring sites and their lack of representativeness, it is doubtful that the monitoring program will be able to provide useful information 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 impacts). It is likewise the case that the MEMP will find it difficult to identify and distinguish among the causes of observed impacts.

In addition to their lack of representativeness, the monitoring sites suffer from other problems as well. When government budgets are constrained, resources should be devoted to principal problems and geographic areas. Whatever appeal the MEMP's monitoring sites might have, they do not reflect the priorities of the ministries involved with the monitoring. Representatives of several of these line agencies believe that the sites are at 'relatively unimportant locations' and that alternative monitoring sites would provide data of greater relevance to their needs. The concern about the appropriateness of monitoring sites raises issues of sustainability and continuity once USAID's support for the MEMP ends.

Furthermore, if Malawians perceive the sites to be relatively unimportant and the data collected at them to be of limited value, then the duration of the monitoring effort becomes an issue. Here too there is disagreement and a lack of consensus. One perspective argues that another five to ten years of monitoring at the four sites will be required in order to

observe long-term environmental changes, such as those associated with forest cover and soil erosion. A competing perspective maintains that monitoring at the four sites should end immediately because all the lessons that can be gained have already been learned. If this perspective has merit, then further monitoring at the four sites is a poor use of limited resources.

2. Data collection and analysis

The Government's descriptions of the MEMP do not indicate how choices were made about what kinds of data to collect, but the descriptions do provide a list of items to be monitored. These include:

- 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.

These items represent reasonable choices, but the linkage between intent and outcome is a tenuous one. To collect the required data, the MEMP relies on field assistants, who live at each catchment site. The assistants record the data and collect and store temporarily the water and soil samples that must be analyzed elsewhere.

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 and records 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. When an official from the Ministry of Agriculture was asked what is done with the transect reports, he replied that their quality was so poor that nothing is done with them.

Furthermore, during the rainy season there is too much data for one person to collect, and data quality may suffer as a result. After each rainfall several soil pits must be emptied of water and sediment; the latter is saved for subsequent analysis. Each pit is about one m² and about 1.5 m deep, thus making access to and removal of sediment difficult. Once collected, the soil and water samples are stored until they are collected and then transported elsewhere for analysis. Samples are supposed to be collected for transport 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.

Finally, there are problems in analyzing the data collected. Most of the data from the first monitoring season, in 1994-95, were not analyzed or interpreted. Some facilities are overwhelmed, employees are inadequate in numbers and expertise, and other, more pressing demands are imposed on them. More than 60 donor-funded projects related to the environment and natural resources operated in Malawi in 1995. Such projects overwhelm the

government's analytic and administrative capabilities and frequently redefine its agenda, regardless of how well intentioned staff may be. As the Government of Malawi (1996: x) acknowledged, 'the practical requirements to process and report environmental information appear to exceed many agencies' capacity.'

The delays in analyzing and interpreting the data mean that it is not yet possible to offer any valid conclusions about the environmental impacts of ASAP's policy reforms, especially those associated with smallholders' production of burley tobacco. In the opinions of the 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.

There is a related problem. In the first years after liberalization of the quota system the majority of production licenses were issued to smallholders in the traditional tobacco-growing areas in central and southern Malawi.¹⁴ Although this geographic pattern of distribution can be justified on the basis of population and economic needs, these regions are densely populated, have the least land available for smallholder farming on a per capita basis, and already the victims of Malawi's most severe environmental problems. In other words, these regions can least afford further extensification and more environmental insults.

Unfortunately, extensification is the route that most smallholders have chosen to achieve their impressive increases in burley production. Yields per hectare have been highly

stable, suggesting limited use of fertilizers, but the amount of land devoted to tobacco has increased significantly, albeit only at a rate only slightly lower than the increase in production.¹⁵ It is unclear whether farmers have planted additional lands, which is not an option for most farmers, or switched their fields from food crops to tobacco (or a combination of the two). In either instance, however, the results are potentially undesirable.

Extensification is not a viable long-term option, and reducing the land devoted to food crops risks food shortages in a country with frequent droughts and only one growing season.

Smallholders' neglect of or lack of familiarity with conservation techniques that would promote environmentally friendly production compounds these concerns. Neglect of environmental considerations has long been evident in Malawi. McCracken (1983; 1985) and Vaughan (1987), for example, describe environmentally unsound farming practices related to tobacco production in Malawi in the 1940s.

Given Malawi's huge increase in population over the past 50 years, farmers' attention to environmental concerns seems imperative. Recent studies suggest, however, that such attention is often not evident. In a survey of smallholders living around the four monitoring sites in 1994/95, Moodie (1996) found that few of her respondents understood the causes of environmental effects or were willing to acknowledge the consequences of their own actions on the environment. Often, Moodie reported, farmers ignored environmental problems, blamed 'others' for their occurrence, or simply accepted adverse impacts, such as an increase in pests, as acts of God.

Moodie concluded that few farmers have the motivation or incentive to change their agricultural practices. Either as tenants on estates or as producers on customary lands they do

not own, most of Malawi's small-scale farmers have little reason to invest in the future by limiting production in the present or by devoting scarce resources to long-term soil and water conservation practices that would promote sustainable production. As one respondent told Moodie (1996: 19), 'those in the future will have to take care of the future.'

3. Mitigation and policy change

Environmental monitoring programs should have intended outcomes beyond measurement of impacts. Such outcomes can include mitigation of observed impacts, changes in farming practices, new policies, or more effective implementation of existing policies. Is there evidence that the MEMP has met these expectations? No respondent 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 were not aware that the MEMP has goals other than monitoring and the development of institutional capacity. As one respondent explained, in his view the MEMP 'is just a monitoring program, not an extension program.'

Second, given the delays in analyzing the data and publishing the results, it may be premature to expect any mitigation; problems have not yet been linked conclusively to the policy reforms.¹⁶ 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 mid-course corrections? The answer is unlikely to be affirmative. Unfortunately, there is no linkage between the data collected and any identifiable demand or need for these data. Few key policy makers are aware of what the MEMP offers, and none of them have requested analyses

of the MEMP's data or proposals for policy changes. As one recent review (University of Arizona, 1996: 26, 31) of the MEMP observed, 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.

Despite these problems, the MEMP is a work in progress with considerable opportunities for change and improvement. For example, when it became clear that weak linkages exist between data collection and mitigation, a decision was made to hire an environmental policy specialist within the Ministry of Research and Environmental Affairs, which is the lead agency for the MEMP.

Conclusions

These findings are disconcerting, but they are not surprising. Efforts elsewhere have not encountered intended success in identifying and delineating the long-term environmental impacts of policy reforms (World Bank, 1994b; Rock, 1995; Young and Bishop, 1995). Moreover, the MEMP represents an ambitious effort to develop a comprehensive monitoring program where none existed previously and where relevant skills and expertise are not available in the quantities desired. Where such skills do exist, they are in high demand.

Retrospectively, much could have (and probably should have) been done differently.¹⁷ The MEMP's advocates recognize this, but they also note that a conscious decision has been made to promote local ownership of the program and to ensure that it contributes to the

strengthening of local institutional capacity. The MEMP has clearly done so. The evidence can be found in increased collaboration among ministries with responsibility for natural resources, enhanced analytic capabilities, including expertise with geographic information systems, and in ongoing efforts to use the MEMP as the basis for a national monitoring program directed at key environmental problems.

More generally, the situation in Malawi illustrates some of the dilemmas of development. From an economic perspective, the World Bank, USAID, and the Government of Malawi have arguably selected well in their efforts to promote smallholder production of burley tobacco. Although its economic future is uncertain, burley tobacco represents the single best opportunity for tens of thousands of impoverished smallholders and their families to improve the quality of their lives in the short term. When poverty and malnutrition are rampant, their victims should not be faulted for failing to look far beyond their next meal.

From a health and environmental perspective, in contrast, criticism is arguably appropriate. Malawi cannot safely sustain further damage to its fragile ecosystems; hundreds of thousands of new Malawians find themselves dependent on these ecosystems each year. Efforts to monitor and mitigate the environmental impacts associated with tobacco have faltered, but who would argue that smallholders should be prohibited from growing burley until a satisfactory monitoring program exists? Likewise, once these smallholders began their production, should it cease because of problems in establishing cause-and-effect relationships between production and impacts? Few are reasonably likely to answer in the affirmative, even among those who are firmly committed to sustainable development.

Endnotes

1. This article is based on research conducted for and supported by the Bureau for Africa of the US Agency for International Development (USAID). The authors' views do not necessarily represent USAID's. Much of the research on which this article is based resulted from interviews the senior author conducted in Malawi in 1996. Thanks are due to Dan Dworkin, Kurt Rockeman, and two anonymous reviewers for their comments on an earlier version of this article.
2. Several large lakes, including Lake Malawi, comprise about one-quarter of Malawi's area, thus diminishing the area available for habitation and agriculture.
3. Among the 13 African countries for which the World Bank (1996a) has data, Malawi has the highest level of level of income inequality.
4. Malawi produced just under 10 percent of the world's burley tobacco and almost 19 percent of the world's traded burley tobacco in 1992 (World Bank, 1995). This level of production is probably large enough to influence world prices for the crop.
5. Considerable evidence suggests that the operation of the allocation and licensing system for burley tobacco was not as efficient or effective as it might be. As an illustration, the International Fund for Agricultural Development (1993: 4) reported that 'no clear control over the system exists' and substantial overlicensing is common. Prior to the removal of restrictions on smallholder production in 1996, licenses were allocated annually, several months before the growing season began. Licensees did not necessarily grow as much burley as permitted; in 1992-93, production of burley tobacco on estates was 33 million kg less than had been allotted (USAID/Malawi, 1994). When such shortfalls occurred, estates often

bought burley tobacco from smallholders who had grown it illegally. In contrast to the shortfalls, production in excess of quotas was also common. Penalties for doing so were rare (Carvalho, 1993).

6. The Bank does, however, allow for exceptions 'for countries that are heavily dependent on tobacco as a source of income (especially for poor farmers and farm workers) and foreign exchange earnings (i.e., those where tobacco accounts for more than 10 percent of exports)' (World Bank, 1994a). Only two countries, Malawi and Zimbabwe, meet the latter criteria. Of the five tobacco-related loans the Bank provided between 1980 and 1990, three were to Malawi.

7. Much of this assistance was intended for refugees from Mozambique, which inundated Malawi in the early 1990s. Nonetheless, the volume of food aid to Malawi in the mid-1990s is substantially higher than in years prior to the influx of refugees.

8. Proponents of both sides of the debate about food versus cash crops can marshal evidence to support their position in respect to the situation in Malawi. One analysis of the factors that led to a famine in Malawi (then Nyasaland) in 1949 concluded that: 'Tobacco production by tenants presumably did compete with food production for limited family labour, and thus placed a number of tenants in a potentially vulnerable situation as regarded their food supply' (Vaughan, 1987: 85). As Vaughan (1987: 100) also noted, however, 'it was not the tobacco farmers who suffered food shortages, for in general they were better endowed with land than the average, and they were also more likely than most to have the cash to buy food and make up any household deficit.' A survey of burley-producing and nonburley-producing smallholders in Malawi in 1995 (University of Arizona and Clark University, 1996) found no statistically significant differences in the amount of maize that each grew. The

researchers found that, due to higher incomes, burley growers had greater food security than did nonburley growers. Among those surveyed, nonburley growers typically expected that they would deplete their supplies of maize earlier than did burley growers.

9. USAID's (1986) Policy Determination, 'Assistance to Support Agricultural Export Development' (PD-15) governs the agency's implementation of this requirement, which is commonly called the Bumpers' amendment. The directive instructs agency staff 'to avoid supporting the production of agricultural commodities for export by developing countries when the commodities would directly compete with exports of similar U.S. agricultural commodities to third countries and have a significant impact on U.S. exporters.' Before approval of its ASAP, USAID concluded that support for smallholders' production of tobacco in Malawi would not contravene the directive. ASAP's intent is to increase opportunities for smallholders to produce tobacco rather than to increase the volume of burley tobacco produced.

10. The initial annual quota was for 150,000 metric tons, of which 12,000 tons was allocated to Malawi.

11. 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 evidence about the use of these inputs. Citing data from the Government of Malawi, the World Bank (1996a) estimated 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 Malawian Ministry of Agriculture, 1993) concluded that over 70 percent of smallholders had used pesticides on their

tobacco crops in 1991-92. Malawi's Ministry of Research and Environmental Affairs (1996:

2) reports that smallholder farmers use such inputs 'extensively.'

12. This situation raises several problems. USAID'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.' Even when such significant effects are absent, the Foreign Assistance Act 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. Rock's (1995) review of the environmental impacts of USAID's nonproject assistance underscores the difficulties associated with well-intentioned efforts to identify and monitor these impacts.

13. Equally important, some smallholders had illegally grown burley tobacco for many years before the government's liberalization of the quota system. These smallholders, without quotas for production and prohibited from access to auction floors, sold their production to estates at less-than-market prices.

14. For the 1992-93 growing season, for example, the six Agricultural Development Divisions (ADDs) in the Central and Southern Regions received 37.4 and 48.2 percent (by weight), respectively, of the total allocations for smallholders (Carvalho et al., 1993). The two remaining ADDs in the Northern Region received the remainder.

15. Total farm production of all forms of tobacco was estimated to be about 153,000 metric tons in 1997, compared to slightly over 98,000 metric tons in 1994. (After tobacco is cured, it weighs about one-third less than when harvested). Depending on the year, burley

comprised approximately 70 to 80 percent of Malawi's tobacco production, with the higher percentage occurring in the most recent years. In contrast, burley comprised less than 10 and 20 percent of total tobacco production in 1964 and 1974, respectively (Schmick, 1997).

16. In its initial analysis of data from its monitoring program, the Government of Malawi (1996: 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 soil pits and at one of the monitoring sites.

17. Readers should also appreciate that the MEMP is a work in progress with considerable opportunities for change and improvement. As an illustration, when it became clear that weak linkages exist between data collection and mitigation, a decision was made to hire an environmental policy specialist within the Ministry of Research and Environmental Affairs, which is the lead agency for the MEMP.

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