

ENVIRONMENTAL REPORT

The Impact of Market Liberalization on the Malawian Environment

Prepared for the U. S. Agency for International Development by

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Executive Summary

Introduction

This report is the result of a negative determination from the *Initial Environmental Examination* of USAID's Agriculture Sector Assistance Project (ASAP) which among other policy reforms, provided the opportunity for smallholder farmers to enter directly into Malawi's lucrative cash crop export sector. The report is specifically written to meet USAID's environmental reporting requirements developed as part of USAID's Environmental Monitoring, Evaluation and Mitigation Plans (EMEMP). The report and methodologies used to complete it reflect several efforts to assess the impact of policy reform that began in 1993 with an intensive study of water quality in small watersheds.¹ The results of the earlier in-depth intensive data collection are reported on in a separate document recently completed by the Environmental Affairs Department (Kamperewera 1999).

Background

Investigations for this report were carried out at a time when a number of changes, triggered by a set of macroeconomic policies, including the agricultural reform policy and other national events were starting to take effect. Key among them were the shift to multi-party democracy, the implementation of fiscal reform measures, and the removal of pricing subsidies. Each had different impacts but the central ones ranged from the collapse of the mechanisms for the enforcement of natural resource laws and regulations, the devaluation of the local currency, and the significant increases in the pricing of fertilizer. Many of these changes occurred in 1994 and resulted in a number of cross cutting environmental and social impacts which make the assessment of a single policy reform measure difficult to isolate and assess. In addition, environmental change, like else where in the world, is an ongoing process often accelerated by policy changes.

A number of the findings from this assessment *are not only* related to agriculture policy reform, but to the pursuit of improved environmental management through Malawi's current cross-sectoral natural resource policy and legislative reforms under the NATURE program. These include the apparent lasting effects of Malawi's political history resulting in low levels of community organization and a distinct lack of initiative on the part of some communities members and their leaders to seek local solutions to declining local and hinterland environmental conditions.

Sources of Information

This report draws information principally from three sources. First, analysis of national level trends in water quality changes including sediment loads and pesticide prevalence are summarized from the recently completed *Water Quality Report of the Lake Malawi/Nyasa Biodiversity Conservation Project* (Hecky 1998). Secondly, a specific assessment of the impact of agriculture practices under different cropping systems, analysis of water quality from farmers fields, and control plots was drawn

¹ For an overview of the different methodologies tried during the five years of the MEMP, refer to the MEMP section of the final report for MEMP II prepared by the University of Arizona and Clark University.

from the *Final Technical Environmental Monitoring Report* using data collected during the 1998/99 growing season in the Kamundi catchment.

Finally, quantitative assessment and qualitative characterization of environmental change was conducted in the Nsipe Extension Planning Area (EPA) during the 1998/99 growing season by Clark University, the University of Arizona, the Department of Forestry, and Bunda College. While the four catchments selected in 1993 for purposes of monitoring policy change, ultimately showed increases in two catchments, the Nsipe EPA has a history of cash cropping predating policy of market liberalization and continuing to the present. It was selected as a representative site where the impact of market liberalisation on the environment could be carried out. This followed a four year period of inconclusive results from earlier monitoring efforts carried out by the Environmental Affairs Department (USAID/Malawi 1995).

The two reports, *Water Quality Report of the Lake Malawi/Nyasa Biodiversity Conservation Project* and *Final Technical Environmental Monitoring Report* though separate in terms of time and scope provide complimentary evidence used to answer the question regarding environmental change. When considered together with the results of the Nsipe EPA study the contributory effect of market liberalization to environmental change is established.

Assessment of impacts

Methodology for Assessment of Impacts

Studies on water in large and small watersheds were based on monitoring and measurements of actual the Nsipe study used a methodology that coupled macro and micro levels of environmental analyses. Developed by Clark University in the early days of MEMP, the methodology entails the use of satellite image analysis in the initial instance to establish and locate environmental “hot spots” such as severely deforested landscapes. Once the “hot spots” are established explanations for the changes are sought at micro level involving the local farmers. At this level participatory research methods are used to explore explanations of some of the “hot thematic changes” noted by micro level analysis.

The major findings relating to the specific questions raised in the *Initial Environmental Examination* and the processes referred to are grouped under aquatic and land use impacts.

Aquatic impacts

- *Is there contamination of groundwater and surface water including Lake Malawi due to increased use of fertilizers and agro-chemicals?*

Records in the *Water Quality Report* show an increase in the import of agro-chemicals from 1990 to 1992 (Kidd 1998) but the same report does not distinguish between imports for use by Malawi’s agricultural sectors. Regardless, there has been subsequent to 1992, a decline in fertilizer use by small holder farmers due to an increase in price resulting from the removal of subsidies (Walker 1994). Initially, fertilizer application has been exclusively on cash crops and high yielding maize varieties. A change was noted in the late 1970s and early 1980s when the use of fertilizer on maize by smallholder farmers became a widespread phenomenon. This was due to the availability of subsidized fertilizer accessed through Maize Clubs.

Smallholder farmers in Nsipe refer to this period as the “golden age of rural farming” (**Focus Group Discussion, Khuzi Village, January 1999**).

Recent declines in the fertility of the soil accompanied by declining yields have convinced farmers of the centrality of fertilizers to their farming enterprises. There has been a further shift though by farmers with sufficient income to increase fertilizer applications to non-cash crops (i.e. maize) while those without are clamoring for government assistance in the purchase of fertilizer (Personal communication).

The *Water Quality Report* summarizes a project study showing low levels of persistent pesticides, organophosphates and organochlorines in Lake Malawi. In addition, the levels of persistent pesticides in the tissues of fish species consumed by humans are also within acceptable limits. “Concentrations of persistent pesticides, PCBs and mercury in most fish from Lake Malawi are low. DDT is the most predominant organochlorine found in these fish, and was found at the highest concentrations in fish high in lipid and in the top predators of the lake.”

Analysis of water and soil samples taken from the Kamundi Catchment reveal the presence of organophosphates and organochlorines which are most likely persistent residuals of aldrin and/or dieldrin.

Water quality can be separated between that for Lake Malawi and the Shire River as there is relatively little outflow from the Lake to the River compared to surface and deep water mixing within the lake itself. Therefore while there is considerable concern over siltation and the impact on hydroelectric facilities along the Shire River, the concern for Lake Malawi is the impact of sediment on the nutrient balance and budget for the fisheries of the lake and how it may affect biodiversity. The *Water Quality Report* indicates that sediment delivery by the rivers flowing into Lake Malawi has been increasing since 1983. The report identifies what are termed ‘disturbed’ and ‘undisturbed’ rivers and for the former the Dwangwa and Linthipe have experienced considerable agriculture expansion which, in conjunction with increasing population pressure and land clearing explain the increasing sediment delivery into the lake. Both the Linthipe and Dwangwa have areas of cash cropping much of which is associated with large estates and the expansion of small estates during the 1970s.

“The southern Linthipe and Dwangwa are the largest riverine contributors of N and P to Lake Malawi/Nyasa. These rivers also have the most variable flows and significant outputs of nitrate and sulfate. Nitrate release is characteristic of catchments losing vegetative cover while sulfate is yielded from wetlands when they are drained and disturbed. The most disturbed southern catchments are exhibiting higher suspended sediment, total phosphorus, and total nitrogen maximum concentrations which are 10, 5 and 9 times higher respectively than concentrations in rivers with less extensive agriculture and land use clearance.”

“The estimated inputs of critical nutrients, nitrogen (N) and phosphorus (P), from rivers are much higher than previously estimated. Phosphorus inputs from all rivers are three times higher than previously thought, while nitrogen is six times higher.”

Contrary to what had been expected, but of concern in relation to the above findings, the small catchment studies at Kamundi from 1998/99 indicate higher nitrate and phosphorus losses in maize crops than the burley.

The field work at Kamundi indicate that contour ridges and vetiver grass in both maize and burley tobacco plots significantly reduced runoff and losses of soil and nutrients which resulted in less pollutant loading in receiving streams. As would be expected, the bare soil runoff plots with no ridges produced the most runoff, followed by the maize plots and then burley.

The small catchment studies collaborate the large catchment findings from the Lake Malawi/Nyasa Biodiversity Conservation Project, that accelerating change accompanying agriculture expansion and population pressure are of as much concern as environmental change that could be attributed to market liberalization.

Landuse Impacts

The Nsipe EPA study, though concentrating on purely qualitative data, was able to establish that there are some changes in both water quality and quantity. While issues surrounding water quantity are explained through annual deficits, those relating to quality were only noted through changes in the taste and odors in the water. Such changes were claimed in one major tobacco-growing village – Semu Chimwala.

- *Is there agriculture expansion onto marginal and unsuitable areas?*

This question was addressed in Nsipe EPA study through a combination of biophysical and social analyses. The study established that the cultivation of marginal and unsuitable areas was a function of how mechanisms for the enforcement of natural resource laws and regulations were managed by the various governments from colonial to the post-Banda government of today. In the post-Banda period, which coincided with market liberalization, environmental legislation was quietly ignored. Regardless, the study showed that there was limited agricultural expansion into these areas. Where expansion did take place (as in Khuzi village), the farmers claimed they were driven by poor quality soils, increasing household members, inequalities in the distribution of land, and landlessness and not necessarily by the desire to grow cash crops.

Market liberalization did not singly contribute to agricultural expansion.

- *Is there a reduction in fallow periods or increases in continuous cultivation?*

The Nsipe EPA study shows that this area was settled at the turn of the century and most of the land suitable for agriculture was allocated circa 1920, as part of the centralization policies of the settler colonial government. In addition, these lands have been sub-divided for family members, ruling out fallowing as a soil fertility management strategy. Further, the same lands, under the same crops (maize, groundnuts, millet, beans, and cassava) have been more or less under continuous cultivation for close to eight decades. The impact in the reduction in the lengths of the fallow periods vis-à-vis agricultural production was ameliorated in part by the introduction of high yielding maize varieties and fertilizers in the 1950s and sustained by the fertilizer subsidies of the 1970s and 80s. The negative impact could also have been further reduced by the adoption of ridging as both the primary land preparation process and a soil and water conservation measure.

For Nsipe EPA, market liberalization did not, in any way alter the trend of continuous cultivation, but affected fertility management by pushing fertilizers beyond the reach of small holder farmers.

- *Does deforestation and continuous cultivation lead to increased soil erosion and loss of soil fertility?*

Continuous cultivation and deforestation combine very well to create conditions for severe erosion. First, deforestation is as much a problem of the past, as it is of the present. Deforestation was noted as taking place in the riverine areas, open grazing areas, as well as arable lands. The reasons for tree loss are many and varied. Notable among them, is the ever-increasing demand for fuel wood for use in the household, village industries, and for sale outside the village. Secondly, continuous cultivation as already noted, is a feature of the farmers' agricultural practices. While continuous cultivation has rendered the soils friable, ridging has compacted the soils in between the ridges, creating perfect conditions for excessive run off.

The combined effects of tree loss and continuous cultivation are leading to widespread erosion across the EPA.

Farmers claim that market liberalization has contributed to deforestation through the opening up of markets for wood and wood by-products. Farmers are particularly concerned about the continued removal of trees along riverine areas.

The claim that the construction of tobacco sheds has contributed to deforestation is not a robust argument as most tobacco farmers build semi-permanent structures that last up to three years. As for mitigation measures against soil erosion the study noted that there is knowledge among farmers that box ridges reduce soil loss. More significantly, they are seeking alternatives to fertilizer, hence the resurgence of soil fertility approaches such as the incorporation of crop residues, application of animal manure, and composting.

- *Does increased rural income from market liberalization lead to adoption of soil and water conservation practices?*

There is nothing to suggest that increased rural incomes are leading to the adoption of soil and water conservation practices. There seems instead to be a conflict of interest between investing in soil and water conservation works and the acquisition of symbols of accumulation. Incomes earned from the sale of tobacco by farmers in Semu Chimwala, Khuzi, and Pheza are used to buy bicycles (considered as multipurpose machines), radios, and other household goods. Food also features as a major expense item.

The failure to invest in soil and water conservation works is partly due to the fact that most of the tobacco farmers belong to tobacco clubs and obtain fertilizer through credit. Thus entrenching the view that soil fertility problems can be solved through the use of fertilizers.

Where an investment is made, it is in the form of hiring labor to make and/or repair ridges – an activity that is tantamount to land preparation under any other land use system. Thus investments in soil and water conservation works are hardly noticeable.

- *Is there an increased use of non-biodegradable plastic material associated with market liberalization?*

Although this question was part of the *Initial Environmental Examination*, it was discussed with USAID and in the light of the apparent lack of evidence of non-biodegradable plastic material in rural areas as not critical to the assessment.

Conclusions

- *What is the effect of market liberalization on the environment?*

Market liberalization had both negative and positive impacts on the environment. The conclusions drawn here are based on the Nsipe Study as well as other documents that were available.

1. The study showed that there was limited agricultural expansion into marginal and unsuitable areas but there was intra-category land cover change (mainly in the form of tree loss). Where agricultural expansion and/or localized intra-category deforestation took place the reasons for the such changes lay in increasing family demands for land, fuelwood, and the allocation of fallow lands and not due to market liberalization.
2. While market liberalization was not directly responsible for any cover changes it was directly responsible for changes in land use, cropping practices, and crop switches. Significant in this regard was that market liberalization did induce change in the cultivation of dambos and riverbeds for horticultural crops.
3. The prohibitive costs of fertilizer have eroded the entrenched belief that fertilizers are the answer to soil fertility problems in Nsipe. More and more farmers are turning to organic soil fertility measures such as burying crop residues, composting, and animal manure that are essential for the regeneration of soil structures. **This is a positive outcome of market liberalization.**
4. A related but somewhat contradictory outcome of market liberalization policy is that farmers are being forced to form maize clubs for purposes of buying fertilizer. Although this may lead to the return of fertilizer as the major soil fertility management approach, the groups may also provide a nucleus for group based activities that may be a springboard for community action.
5. Market liberalization and *mwachifuniro chake ethic* (do as you please) have contributed to the current increased use of wood for wood-based industries, such as brick-making, beer brewing, and sale of firewood.

The fact that the enactment of market liberalization coincided with democratic changes, the rise of the *mwachifuniro chake ethic* among smallholder farmers, and the lack of enforcement of conservation law, the overall environmental impact of market liberalization is rather unclear.

Recommendations

1. The combined effect of market liberalization and the new democratic processes led to the marginalization of environmental considerations by farmers. It is recommended that an extensive environmental awareness program be carried out. In making this recommendation an opportunity is noted through the proposed CBNRM Compass project to be executed in Malawi.
2. That an attempt must be made through facilitated participatory community self-diagnosis to resuscitate and prop up the shaky institutions for local governance. They are essential in the management of common property resources.
3. The level of environmental awareness among the various extension personnel is of great concern and it is therefore recommended that an environmental awareness program be run for extension personnel. Such a program should recognize the fact

that these are technical people and what is at stake is not how they carry out their work, but rather how much their work is environmentally sensitive.

4. Market liberalization as a both a process and policy must have sufficient supporting mechanisms such as an environmentally extension staff, sufficient environmental safeguards, and market integration mechanisms.
5. National institutions and structures for environmental management must continue to perform their vital functions during the implementation of market liberalization. This necessitates a closer synchronization of macro economic changes, such as reductions in the size of the civil service that may remove vital services to farmers that the market may not be ready to shoulder immediately.
6. Agencies working in an African setting should consider adopting the methodology used in this study. The data are available and most countries have various forms of participatory rural appraisal capacities at their disposal. *Care should be taken of the fact that the social analysis can easily become a community needs assessment.*
7. With the apparent recent increases in river sediment loads, water quality assessment measures need to be reestablished. Measuring suspended solids loads can be done at low cost. Good predictive relationships exist between total suspended solids and concentrations of total phosphorus, total nitrogen and total organic carbon, which will provide information on nutrient status through monitoring of suspended solids.

ENVIRONMENTAL REPORT

“Are the makers of such policies (market liberalisation) aware that we are suffering now?” Blazio Jairoso, Village Headman Kasale Village Group Meeting, January 1999

Introduction

This report integrates information generated by two separate but complimentary processes. On one the hand are the findings on the trends in water quality contained in the *Water Quality Report for Lake Malawi/Nyasa Biodiversity Conservation Project* (Hecky 1998) and *Assessment of Agrochemical Impacts on Surface Water in Kamundi Catchment* (Kamperewera 1999) detailing point and non-point sources of pollution respectively. Albeit, this was done in the absence of any integrated report from four years of intensive monitoring in four small catchments, and the absence of useful data from efforts to build a national monitoring program through the development of area based sampling frame. On the other hand the Nsipe Extension Planning Area (EPA) Study carried out by Clark University, the Department of Forestry, and Bunda College sought to assess both qualitative and quantitative environmental change in six villages drawn from the whole of Nsipe.

In the main the findings show that market liberalization did not have a significant impact on land cover change but altered approaches to land use and cropping patterns as farmers switched from food to cash crops (i.e. tobacco, paprika, and pepper). While increases in fertilizer prices had an immediate impact on how farmers practice agriculture the lack of fertilizer is having a positive effect on soil fertility management as farmers are actively adopting organic approaches to soil fertility.

This report is made up of six sections starting with a general background through a set of emerging themes to conclusions and recommendations.

Background to Study

This report is part of an overall framework designed to gain an understanding of the impact of USAID's financial assistance to Malawi. The program in question, the liberalization of the agricultural sector, was meant to improve the overall production and marketing environment for both cash and food crops for smallholder farmers. Central to this program was the support provided to the Malawi government to enable small holder farmers primarily those with holdings of 1.5 ha or less to access the lucrative tobacco and other cash crop markets. Malawi's agricultural system is trimodal (Mhone 1987) with a smallholder sector, located wholly within customary lands (MoG 1993), that is plagued by problems of serious soil erosion, deforestation, and general land and water resource degradation (USAID/MALAWI 1991). This sector was for a time neglected as no extension was provided (Mhone 1987). This envisaged program was to usher a new era in smallholder farming and with it a whole new suite of environmental problems. The general supposition then was that most of the degradation was agriculturally induced and the situation was likely to deteriorate due to market liberalization and appropriately a monitoring program was designed and put into place.

The concern centered on the supposition that the cultivation of tobacco by smallholder farmers would induce crop-switching, demand for more land for cultivation or

increased fertilizer. The new land to be opened for cultivation was likely to be marginal or unsuitable thus inducing soil erosion while increased fertilizer and agrochemical use would lead to water pollution. In the same vein it was thought that any expansions in agricultural land and the construction of tobacco sheds would increase deforestation. It was also noted that the tobacco plant is heavy on plant nutrients and provides poor soil surface cover during the early days of the crop thus requiring adequate physical conservation measures (Goodland, Watson and Ladec 1984). The poor state of soil and water conservation in the farmers' fields was noted but it was thought that the farmers would use the higher incomes from tobacco to establish soil and water conservation works on their lands.

Soil erosion, deforestation, and related environmental change processes are located at the confluence of ecological and social systems (Holling *et al.* 1995). The interactions and linkages that exist between social and ecological systems mean that as one of the systems changes so does the other. Thus environmental changes that may occur in a given place and time may be due to the processes outlined above but may be accelerated by external and/or internal shocks. For example macroeconomic policies have been known to trigger widespread environmental degradation (Young and Solbrig 1993). Following this line of thinking one could argue that the overall performance of both ecological and social systems at the micro level is determined by the macroeconomic policies in place. In addition, interactions between ecological and social systems also occur in a historical time frame and thus it is imperative that the environmental history of a given place be understood (Worster 1990). In studying the process of environmental change, one must fully understand the evolution of the policy environment, the environmental history, the impacts (intended and unintended), and the related political issues and events. This thinking provided an important underpinning to this study.

Purpose of Study

“Serious soil erosion, deforestation, and general land and water resources degradation taking place in Malawi without being properly monitored.”
(USAID/MALAWI 1991)

The Nsipe EPA study sought to provide an in-depth analysis of the environmental impacts of cash cropping by smallholder farmers. One of the guiding assumptions of the introduction of cash crops among smallholder farmers, especially tobacco, was that there would be widespread environmental degradation. In order to counter this obvious impact an environmental monitoring program, known as the Malawi Environment Monitoring Program (MEMP) was put into place. The monitoring program described below sought to understand the environmental impacts of cash crop growing and in particular burley tobacco.

The Government of Malawi developed the MEMP program in conjunction with USAID advisors as part of the Evaluation, Monitoring, Evaluation and Mitigation Plans (EMEMP) process. Details of the evolution of the MEMP program are summarized in the *Final Report for MEMP II*. Briefly, prior to the post Banda era, Malawi was seen as a country rich in data and poor in information or reporting products. Technical assistance was to provide assistance in analyzing, interpretation, and reporting of cross sectoral data collected by technical agencies from four small catchments averaging about 1,000 hectares in size.

Due to the need to collect new data to monitor change associated with policy revision, the MEMP quickly became an intensive data collection program rather than a technical support activity to improve environmental analysis and reporting. Efforts to streamline data collection, or make it more representative of Malawi as a whole, through the development of an area sample frame, were impeded by technical and institutional limitations. As a result, only one report for one small catchment was produced in four years. A final report that summarizes the available data from the MEMP activity was produced recently as part of the closure of the project.

As the first report was only seen as establishing a baseline, and in the absence of any conclusive findings subsequent to the initial report, a more focused study in an area with a known history of cash crop cultivation was deemed essential. Such an area, once chosen would help to explain, through the examination of cropping and production figures, the impact of market liberalization on both the environment as well as the smallholder farmers themselves. Such a study was planned for the Nsipe Extension Planning Area during the 1998/99 growing season.

The Nsipe EPA sought to establish, through a two pronged methodology linking macro and micro levels of environmental analysis, farmer based explanations of environmental change. In addition, the study sought to understand the political and economic actions carried out by the farmers in response to market liberalisation, the perceived impacts of the actions, and the farmers' collective futuristic vision of their environment.

This report presents some of the study results as well as a social and environmental analysis of change across the Nsipe EPA.

Description of the Study Area

The Malawi National Environmental Action Plan ranks soil erosion as the country's number one environmental problem (DREA 1994). According to DREA the areas that are most affected are the customary lands where 85% of Malawi's population resides. In these areas agriculture provides both income and employment (Kapila and Mwafongo 1995). The average land holding is less than 1 ha/household and the farmers have over the years experienced reductions in yields, increasing soil loss, and low returns from agriculture. In a bid to stimulate this sector smallholder farmers were, in 1994 as part of a market liberalization process allowed to engage in cash cropping, especially burley tobacco. The vision was that the farmers would not only realise higher returns for their efforts but also use the returns to construct and maintain robust soil and water conservation measures.

Nsipe Extension Planning Area (EPA) is located in the Ntcheu District, 190km from Lilongwe, the Capital of Malawi and was chosen for this study because of the mixed cropping that is practised there. The EPA is made up of a total of 162 villages, with a population of 23 675 people is physically a complex mosaic of arable fields, hilly areas, dambos, and patches of woodlands. It has an area of 80 000 ha of which 23.75% (or 19 000 ha) is arable. The EPA is wholly under Miombo woodlands dominated by species of *Brachystegia*, *Julbernardia*, *Isoberlinia* and their associates. Soils are variable, mainly sands derived from granites with sandy loams and clays in the valley bottoms. Soil loss of has been noted as a major problem. At national level the deforestation rate is given as 3.5% per annum (Soulsby 1996, SADC/SACCAR 1997). This figure shows that the woodlands are under pressure and most of it is from the ever increasing population with a growth rate of 3.7% per annum and will

continue to decrease due to the increasing demand for wood and non-wood forest products.

Agriculturally Nsipe offers a mixed cropping pattern over an intricate network of ridges. The dominant crops are maize, groundnuts, tobacco, cassava, millet, and other low order crops such as beans, pepper, pumpkins, and sweet potatoes. Of note is the fact that the EPA was reported as having close to 800 peer-formed tobacco clubs (Mr. S. K. Neba, Development Officer, Nsipe EPA, personal communication). The differentiated cropping and agricultural system of Nsipe offered a good setting for the study in that the team was able to look at the overall environmental impact of market liberalisation on a diverse agricultural production system rather than a single on cash crop. More so, a better understanding of the contribution of tobacco to land use and land cover change and any other environment problems can be better understood within a differentiated and variegated agricultural landscape.

Other criteria for selecting the Nsipe EPA included a desire to demonstrate a linkage between current mitigation and implementation programs supported by USAID, the Malawi Agroforestry Extension Project (MAFE) and Small Holder Agribusiness Development Project (SADP) respectively, and the monitoring program. The monitoring program originally was developed to support the provision of data to incorporate into an Environmental Information System (EIS). Initial efforts in the development of the EIS centered on a prototype to address problems of siltation in the middle Shire River. The headwaters for the Rivi Rivi river catchment, an area previously identified as a key contributor of sediment to the Shire, were also found in the Nsipe EPA.

The monitoring of water quality changes in major watersheds such as the Rivi Rivi compliment the micro level examinations of environmental change in places like Nsipe EPA. In addition, macro level assessments of water quality such as those completed over the past two years as part of the Lake Malawi/Nyasa Biodiversity Conservation Project also help to provide a better understanding of the local. That project, while focusing on the watersheds which directly provide runoff to Lake Malawi/Nyasa, also sought to understand how changes on land use influence changes which may impact upon aquatic ecosystems and the conservation of the endemic fish species on a lake-wide basis.

Methodology

Two methodologies were used. The first relates to the monitoring of water quality and the second to the Nsipe study. Although MEMP was a capacity building activity it did not achieve its goal of developing environmental data sets for small catchments. The Lake Malawi/Nyasa Biodiversity Conservation Project was able to capture data on concentrations of nutrients and suspended sediments that were combined with flow data for the major contributing rivers to Lake Malawi. These data are of importance to the original goals of the MEMP and if coupled with the small plot data collected during 1998/99 from Kamundi a relationship between off site and on site pollution sources can be developed.

The Nsipe EPA study employed a methodology that coupled macro and micro levels of environmental analysis. Developed by Clark University in the early days of MEMP entails the use of satellite image analysis to establish and locate environmental “hot spots” such as severely deforested landscapes. Once the “hot spots” are established explanations for the changes are sought at micro level through the involvement of

local farmers. At this level participatory research methods are used to explore explanations of some of the “hot thematic changes” noted by micro level analysis. Such explanations vary but in the main are based on historical antecedents, land use policies, and the roles of the decision-making processes of the farmers themselves (Croll and Parkin 1992). This methodology compels that a cross-section of complimentary methods of inquiry and analyses, encompassing and directly addressing both the biophysical and social contexts of the smallholder farmer are used (Batterbury *et al.* 1997).

This approach was used for the Nsipe to answer a set of specific questions. The study commenced with the classification of the remotely sensed data (1994 and 1998) thus enabling the team to establish land cover changes across the whole of Nsipe EPA.² In addition to change detection the study also utilized a set of criteria to select villages. This was followed by a half-morning meeting of key district officials wherein villages in Nsipe EPA were classified as per criteria according to the knowledge of the field officers. Discussions in this meeting also considered EPA and FEWS cropping data. A total of four villages were selected per set of criteria. The next step was to travel to each of the villages (24 in all) and through rapid rural appraisal techniques as well as the land cover map derived from remotely sensed data one village was selected per set of criteria. Once the villages were selected the next stage entailed the selection of Village Based Enumerators (VBES) who formed a core of the farmer-based research and monitoring technique used in this study. A training program was mounted where participatory rural appraisal techniques and other community based research approaches were imparted to the six VBES.

Out of the 6 villages a proportional sample of households was selected taking into account the fact that some of the villages were matri-local. A total of 231 households were studied through the use of a bifurcated survey instrument where both close and open-ended questions were asked (see Annex I). The information from the household interviews was complemented by focus group interviews, transects, historical profiles and trend analysis. In designing this study sight was not lost of the fact that the outputs would be both a method of work and the actual analysis that was to be used to inform policy. In this manner the environmental impacts of tobacco growing were examined in the context of the land users’ experiences, land management approaches, opportunities and constraints.

Emerging Themes

Household, focus group, and key informant interviews in conjunction with social transects, trend analysis, seasonal calendars, and historical profiles produced a set of overarching outputs that helped explain the impact of market liberalization on smallholder farming sector in Malawi. The broad and commonly recurring themes are as follows:

1. The study established that although individual farmers are conscious of the environmental problems facing the village as well as the possible solutions this consciousness does not readily translate into community action. This pointed towards the lack of a **community spirit** that is essential in the management of common property resources and conservation layouts of close, often interlocking,

² At a later point air photo analysis was used to further characterize land use and cover change around each of the six villages. This was meant to complement interviews as well as satellite imagery. This enabled the research team to establish land cover changes across the Nsipe EPA.

but small pieces of contiguous arable lands. The rise of ‘individualism’ fostered and nurtured during the Banda years (Pryor 1990), the lack of a community spirit, and the weakened local structures of resource allocation and control are leading to the open extraction and sale of woodland resources by farmers. Some farmers blame this development on the rise of “a market that buys anything” an output of the market liberalization process.

2. The villages studied exhibited severe land shortages, inequitable land distribution, and landlessness as seen through the changing roles of the Village Headman in the land allocation process. Landed Family Heads (*Wankulu walima*) are subdividing and allocating family lands to family members or leasing out to the landless now dominate the land allocation process.

“I can always remind the village headman that this is my land.” (Comment from a farmer during the Kasale Village Group Meeting, January 1999)

Not only does this kind of mentality erode the Village Headman’s power but it also effectively negates the effectiveness of local environmental rules and regulations. The lack of commons land to allocate has caused a power shift in the villages where the village headman’s role is now seen as in conflict resolution only.

3. There is unanimity in terms of the fact that soil fertility has been declining over the years (Coote 199). In the past, especially in the late 1970s and early 1980s, the solution was to apply cheap fertilizer purchased through loans accessible through Maize Clubs. Referred to as the “golden age of rural farming in Malawi” the heavy use of fertilizer led to high yields but in so doing masked soil infertility up to a point that farmers ended up considering *the lack of fertilizer as a more serious farming problem than soil infertility*. Current low levels of production and the worsening state of the soil are blamed on the lack of fertilizer that in turn is thought to be due to market liberalization. Market liberalization is considered to have led to unprecedented increases in the prices of fertilizer pushing fertilizers way beyond the income of the majority of smallholder farmers.
4. A full understanding of deforestation and what needs to be done exists. Farmers envision a treeless and unproductive landscape but believe solutions lie with central government and are hence calling for more stringent conservation laws, more forest guards, and free seedlings. The call for stringent laws does not mean the current laws do not have weight. The Environment Act, Land Act, and the Forest Act provide a firm legal basis (Seymour 1998) for a comprehensive environment protection plan. For example the Forest Act provides for Village Forestry Areas – forests managed by local communities but in the absence of an empowered local leadership it is not surprising that only Semu Chimwala village out of the six has earmarked some areas for this purpose. There appears to be no role even for the local leadership in terms of by-laws, let alone concerted community effort. Individuals are known to have “privatized commons” on steep hill slopes and put them under exotic trees.
5. Grazing lands (woodlands) were found to have scant cover and exhibited severe sheet and gully erosion. In some cases encroachment on the upper slopes (foothills) in the form agricultural expansion was noted while almost semi-permanent cultivation of riverine areas was prevalent. Encroachment onto the upper slopes, where noted, was considered to be a recent phenomenon caused by

landlessness and population pressure while for the lower slopes cultivation started as way back as the farmers could remember.

6. The most widely used soil and water conservation measure was found to be the ‘ridge’ with variations of ‘tied and/or box ridges, and ridges on the contour. Ridging as a soil conservation measure was adopted during the colonial era (c. 1940) through the twin roles of Estates and the colonial government’s agricultural services. Gully erosion, a major feature of grazing areas and woodlands, is a threat to a number of arable lands and farmers halt the movement of the gullies by planting **sisal** and/or **bananas** in the direction of the gully spread. Such activities are often confined to the edge of the farmer’s field. The planting of Blue Gum in “**individual woodlots**” on common land was noted while the mango and guava on arable lands are outstanding. As for the indigenous trees, *F. albida* and *Bauhinia thonningi* appear to be preferred species on arable land.
7. Farmers believe that agricultural extension officers are no longer providing their essential advisory service especially in terms of land husbandry.

“The village is concerned that extension workers no longer enforce the law, or even teach us like they used to do in the olden days.” (Farmer, Khuzi Village Group Meeting, January 1999)

The problem is deeper than the farmers can fathom. The ratio of Field Assistant to farmer is 1:1983 (Mrs Mwandire, personal communication, October 1998) and some villages do not even have Field Assistants. Of even greater concern is the level of environmental awareness among the officers themselves that was found to be questionable especially that they were allowing farmers to site tobacco nurseries on steep slopes with little or no conservation measures in place. The apparent lack of environmental awareness may be attributed to the fact that extension as a whole is commodity driven.

8. The farmers gave the impression that environmental change had preceded the **advent of market liberalisation in Malawi**. In most of the villages, changes in agriculture and environment are thought to due to population increase and the demand for new land. Significant changes were noted as being the adoption of new high yielding maize seed varieties, fertilisers (1960s), and ridging (1940s). While they are conversant and aware of when and how tobacco came to their villages and notably 1991, most farmers grew the crop then but do not now are of the opinion that they were ‘ripped-off’ by the early ‘middle-men’ and therefore stopped growing tobacco altogether. Conspicuous in their discussion on issues related to change in agriculture is the role of the colonial state in their adoption of land management practices such the clear felling of arable lands and the coerced adoption of ridging.
9. The current state of the woodland is explained through a number of contemporary and historical causes such as the colonial government’s centralisation policy and processes (land use), timber trading (forestry), and agricultural marketing which through rezoning necessitated the translocation and reconstruction of new homesteads, and clear felling of land. Villages like Khuzi and Pheza actually incorporated into their boundaries some clear felled estate lands.
10. The **defiance of ‘colonial conservation laws’** initiated as a passive resistance program against the colonial authorities by the Nyasaland Congress Party in the 1950s but was never reversed. The rise of the *mwachifuniro chake* (do as you please) ethic a post democracy development that is leading to the widespread destruction of natural resources and is, by the cruel fate of history an extension of the defiance that dates back to the 1950s. It is indeed ironic that the farmers are

asking for stringent conservation laws from central government that would rekindle the Banda years.

11. Central government is expected have solutions to all the problems that plague the smallholder sector. Responding to the explanation that the government has a no money a farmer in Semu Chimwala village responded thus:

“How can you say the government cannot do it. Look at the Starter program.³ Where did the money come from?” (Semu Chimwala village group meeting, January 1999)

With this kind of mentality a lot of work is needed to ensure that the farmers can take responsibility for their lives.

Key Questions and Findings

The Study’s ‘Big Question’ – *What is the effect of market liberalization on the environment?* The broad assumption of this study is that environmental change and degradation were already taking place in most parts of Malawi, Nsipe included, but were accelerated by a combination of market liberalization and other driving forces. The study carried out in Nsipe EPA focused on smallholder agricultural production. Environmental change in an agricultural setting was viewed as exhibiting itself through land use and cover change as well as increased levels of chemical pollution in surface water bodies. The following key findings were established.

1. An analysis of the 1994 and 1998 satellite imagery indicated the dominance of mixed agriculture and woodlands. Ground truthing and field observations through ‘social transects’ showed that the selected villages have mosaics of arable and fallow lands, and woodlands. This was established as the most prevalent form of land cover change.
 2. Air photo-interpretation of 1990 and 1995 photographs covering each of the selected villages shows intra-category changes (arable with tree cover changing from the 4-6% to arable less than 2%). Such changes though significant do not address the issue of agricultural encroachment into marginal and unsuitable lands that can only be addressed by looking at inter-category changes in land use. Intra-category land cover change pointed towards deforestation and the reduction in fallow. In addition, household, focus groups, and key informant interviews confirmed expansions into marginal lands had a taken place but were largely insignificant, as they are no lands to expand into.
 3. Current explanations of environment change, especially related to deforestation may not hold and other alternative explanations to deforestation from activities such as brick-making and beer brewing. Household interviews show that brick making and other wood based income generating activities are major causes of deforestation. For example a 15 000 brick kiln (farm-yard size) will require 10 metric tons of ‘wet’ wood (0.67kg/brick).
- *Is there contamination of ground and surface water, including Lake Malawi, due to increased use of fertilisers and agro-chemicals?*

Although the methods employed in this study do not readily answer this question, the survey instrument sought to establish some noted changes in both the quality and quantity of water. Some of the observed changes are as follows:

³ Starter pack program was a Donor financed seed and fertilizer pack given to smallholder farmers by the Government for the 1998/99 cropping season.

1. There is wide recognition that there has been a decline in the annual quantities of water available to the village due to the loss of surface water storage capacity caused siltation and sedimentation. Farmers claimed that most of the sedimentation was due to the removal of vegetation on stream banks while farmers in tobacco growing villages (Semu Chimwala, Khuzi, and Pheza) specifically blamed tobacco farmers who they thought remove trees for the construction of tobacco sheds.
2. In villages that obtain potable water from streams and rivers (Semu Chimwala and Kanjati) the former claims that river water is now losing taste, especially over the dry season. In addition, the water develops a distinct odor as the rivers dry up. The explanation given by the farmers in this village was that the village had witnessed an upsurge in tobacco cultivation and with it increased fertilizer use. Transects revealed that this is one village where conservation works on arable lands were minimal which may explain why the village is facing water problems. The villagers also think that the use of “soap” and other washing substances in these rivers may also be contributing to water quality issues.
3. The villagers think that to control this problem central government should in the short run support a tree planting program accompanied by the imposition of stringent conservation laws that would curb the removal of riverine vegetation thus protecting the riverbanks and reducing siltation. No direct link was made between soil and water conservation measures and agrochemical seepage from dambos and riverbed based horticultural activities.

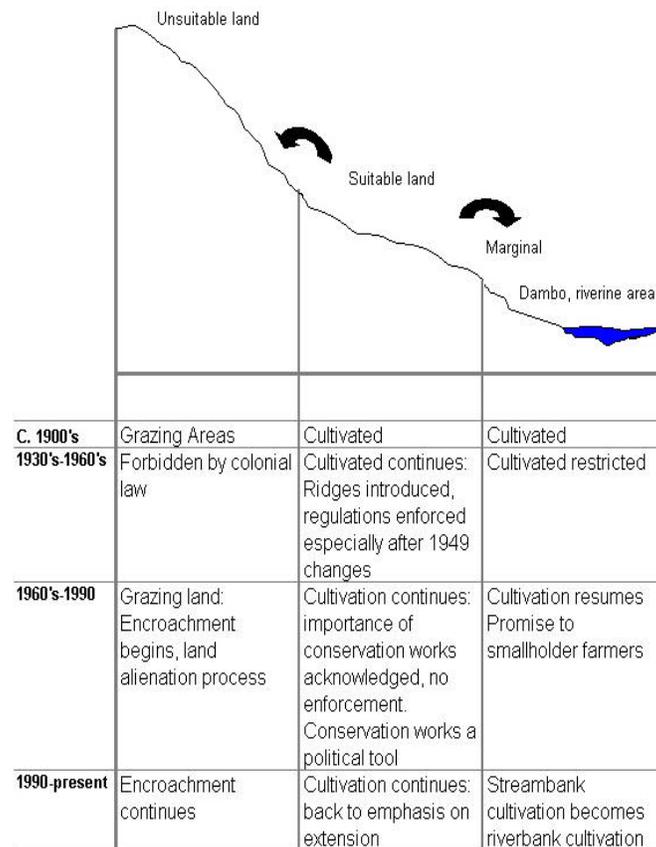


Figure 1: Environmental History for Six Villages in Nsipe

- *Is there agricultural expansion onto marginal and unsuitable areas?*

Household and focus group interviews addressed this question and the outcomes indicate that expansion of agricultural lands into marginal areas has been minimal. More importantly farmers point out that they have been cultivating the same pieces of land since the centralization policies of the 1930s (see diagram above). Expansion into marginal and unsuitable lands has tended to be event or government transition specific (refer to diagram above). Notable are the cycles of the suspension of the enforcement of conservation laws or the adoption of extension programs that often coincided with changes in governments. The following observations help to explain some of the central issues to this question.

1. The cultivation of dambos and riverine areas was a feature of the pre-colonial period but was outlawed in the colonial era when these areas were classified areas unsuitable agriculture. Agricultural expansion into these areas took place in 1960s (advent of independence) in the form of claims and the reassertion of pre-colonial family rights to cultivate these areas. Dramatic shifts in this position occurred, including the cultivation of riverbeds in the mid-1990s through the democracy generated *mwachifuniro chake* ethic. In addition, unconfirmed reports indicate that the cultivation of dambos was actively encouraged following the 1991/92 drought.
2. Farmers do not blame the shift into dambos on population increase but do so in terms of expansions into marginal lands (slopes of over 12.5%). The main message that emerges from this analysis is that agricultural expansion into unsuitable areas took place long before the advent market liberalization.

Expansion into marginal areas is related to landlessness and population pressure. In addition, any impact market liberalization might have had is masked by the democracy and *mwachifuniro chake* (refer to the diagram above).

3. It was noted that in almost all the villages land shortages were artificial in that there is an inequitable distribution of land with the bulk of the land being in the hands of a few Kulak-style *achikumbes* (Mhone 1992). The landless families e.g. in Kanjati village have started to grab 'for the children' regardless of its quality which may explain some of the patchy expansions into the hill slopes encountered in this village. Only one village headman agreed that he was allocating land in marginal areas.
4. Market liberalization has does not feature as an explanation of land cover change but as that of land use change where more arable land is put under tobacco (villages as Semu Chimwala, Pheza, and Khuzi). For farmers who have switched to tobacco but have poor soil and water conservation works on their lands may be contributing to the sedimentation of river systems. It is a fact that tobacco in its early days of growth provides poor soil cover leading to soil erosion and possible loss of nutrients. This is may be compounded by the poor soil structures and the compaction in between ridges.

- *Is there a reduction in fallow periods or increases in continuous cultivation?*

Farmers in all the six villages indicate that they have been cultivating the same pieces of land for the last eight decades. The same pieces of land have been sub-divided to family members. Thus the land holdings per individual household are getting smaller and smaller so much so that fallowing is no longer a soil fertility management option. The issues that emerge from this analysis are:

1. There has been an elimination of forced fallow due to the decreasing land sizes per household. Shortages of land are being caused by the increasing demand for land by family members.
2. All the villages claim that they now cultivate their arable lands continuously, thus eliminating the opportunity for soils to regenerate naturally.

- *Does deforestation and continuing cultivation lead to increased soil erosion and loss of soil fertility?*

The major land use of this area is arable farming and most changes noted center on the adoption of new crops and the subsequent crop mixes overtime. All the farmers claim that continuous cultivation has led to losses of soil fertility and structure, rendering them unproductive and susceptible to erosion. The envisaged solution to soil infertility is fertilizer while erosion is addressed through ridging. A few observations from the study are laid out below:

1. Ridging was adopted during the colonial era as the prime measure of soil and water conservation and was adopted through an incentive system centered on estates and coercion by colonial agricultural offices. Adoption rates increased after the 1949 famine when farmers claim to have seen the benefits of the ridges.
2. 'Ridging' should no longer be considered as a soil and water conservation measure but a way of cultivation, but that box and tied ridges as well as ridges on the contour provide a new generation of effective soil and water conservation measures that the farmers should now be using.

3. That the lack of fertilizer is considered to be a problem and failure to secure fertilizer is blamed on market liberalization. On the one hand fertilizers do not build the structure of the soil and tend to, on poorly conserved lands to be lost into surface water systems. Instead organic methods such as manure application, incorporation of crop residues should be used to rebuild the structure of the soil. Unfortunately the use of manure though highly valued is hampered by the lack of livestock – in fact the national herd has been declining (Seymour, personal communication, November 1998). Similar trends were noted in Nsipe where an average of 0.75 livestock units per household was recorded.

Deforestation is widespread in all the six villages but its effects are more pronounced in Pheza, Khuzi and Kanjati. The villages of Semu Chimwala, Pheza and to a lesser extent Khuzi blame tobacco farmers for this development. The element of individualism and the management of community property do not go hand in hand.

“We own the trees and we can use them the way we want.” (Pheza Village Group Meeting, January 1999).

Statements like these do not suggest good stewardship and to some extent explain why the farmers explain deforestation as having been externally induced. Some of the explanations advanced are as follows:

4. The lasting effects of pre-colonial policies of centralization and clear felling on arable lands are still being felt today. Some villages, notably Kasale, Kachimanaga, Pheza, and Khuzi were affected directly by centralization policies while Khuzi and Pheza inherited clear felled former estate lands which were allocated as arable lands and maintained in that form as encouraged by extension. This explains in part why these villages are so deforested.
 5. The break down in conservation laws that was started by the Nyasaland Congress Party, rejuvenated by the multi-party democracy in the early 1990s as the *mwachifuniro chake ethic* has made a significant contribution to this problem. In addition, poverty and low returns in agriculture are forcing the farmers to sell anything that is permissible in terms of their understanding of the meaning of market liberalization and individualism thus accelerating deforestation.
 6. Local level alternative explanations of deforestation exist in the amounts of wood used in brick molding (0.67kg/farm yard brick) and beer brewing which require fairly large quantities of “wet” wood.
 7. There is also a notable absence of agroforestry interventions except for the protection of *Faidharbia albida* and *Bauhinia thonningi*.
- *Do increased rural incomes resulting from market liberalization lead to increased adoption of soil and water conservation practices?*

The adoption of soil and water conservation measure was noted as being highest in Pheza but not necessarily in Semu Chimwala that has made the most money from tobacco. Adoption of conservation measures in Pheza dates back to the 1940s, and though not related to tobacco growing and the conditions under which the adoption of these measures took place had nothing to do with investments in conservation works. The following key issues were noted.

1. The average tobacco farmer will use fertilizer in his/her crop while the burying of crop residues remains an option for the maize and groundnut crops. The study noted that farmers do not use the fertilizers acquired for tobacco for any other

crop. The rationale being that they can always buy food with the income from tobacco.

2. There is a conflict of between the use of money to acquire bicycles, radios and other household goods and investing in soil and water conservation works. Most tobacco farmers will hire labor at various stages in the growth of tobacco but the nearest in terms of investment n soil and water conservation is labor hired for ridging.
3. In areas where extensive cultivation of horticultural crops is carried out in riverbeds as noted in Pheza, Kasale, and Khuzi farmers actually invest in land degradation by hiring labor to divert streams, drain wetlands and any other activity related to wetland farming.
4. There is nothing to suggest that increased incomes are leading to higher rates of adoption of soil and water conservation partly because the solution to soil fertility problems is viewed as the application of fertilizer. Presently, most tobacco growers obtain fertilizer through their respective clubs.

Conclusions

Village selection for the study was carried out through a three-step process where land cover change and a set of criteria were used to group villages. District and Extension Planing Area level extension personnel were consulted and village crop production data analyzed. Four villages per set of criteria were selected and then through rapid rural appraisal a choice of the most representative village was made. The selection of households was less problematic. Three village lists (FEWS, EPA, and Seed Starter Pack project) were compared and their consistency established. A stratified random sample was selected per village with the assumption that a proportional representation of all sections of the community, and in particular female headed households.

The actual study used a set of methods that included transect walks, in-depth household, focus group and key informant interview, timelines, village mapping, and literature search. By working in this way the information so generated by each tool was corroborated with that from other tools. Triangulation is an essential part of participatory approaches.

The construction of conclusions to the study on the environmental impact of market liberalization of smallholder agriculture in Malawi is confounded by the advent of democracy in that country. The new wind of change triggered a set of political and structural changes and in the environment sector unmasked environmental degradation, invented the *mwachifuniro chake ethic* among smallholder farmers, and froze mechanisms for the enforcement of conservation laws and regulations. Besides market liberalization was part of a national structural adjustment program some of whose requirements were cut backs in the civil service that in turn affected the delivery of extension advice or even law enforcement. It is against this background that the following conclusions and recommendations are made.

1. While Market liberalization was expected to explain agriculture into marginal and unsuitable lands, there is no strong evidence to suggest tat this was the case as there was no significant expansion into these areas after 1994. Expansion into unsuitable areas (wetlands and riverbanks) occurred way back in the 1960s and was encouraged after the 1991/92 drought. Where expansion did take place market liberalization cannot be said to be singly responsible for such change as

landlessness and population increase made major contributions. Besides cash cropping did not lead to land expansion, as the most tobacco growers are the large smallholder farmers with enough land.

2. Market liberalization was not directly responsible for any land cover change it was indeed responsible for land use change and cropping patterns. Barring problems farmers had with the marketing of tobacco market liberalization should have had a larger number of tobacco farmers to date. In a related issue, market liberalization has encouraged the production of horticultural crops most, of which are grown wetlands. There is evidence to suggest that “the cultivation of the riverbed” was encouraged by market liberalization but underwritten by the *mwachifuniro chake*. In terms of land use the major impact has been the reduced food production that farmers experience, as they can no longer afford fertilizer.
3. Although increases in fertilizer prices meant that most smallholder farmers could not buy fertilizer this situation has forced farmers to reconsider organic soil fertility management methods such as incorporating crop residues, animal manure, and composting that will help to regenerate the soil structure.
4. Market liberalization did not only encourage the marketing of cash crops but also the production of horticultural crops – all grown along stream banks and wetlands and indirectly contributed to riverbed cultivation. Riverbed cultivation by virtue of where it is carried out contributes to siltation and chemical pollution of water bodies.
5. Market liberalization and *mwachifuniro chake ethic* have contributed to the current increased use of wood for wood-based industries, such as brick-making, beer brewing, and sale of firewood most of which have become major sources of income for rural households.
6. The study established that institutions and structures for local governance are currently in paralysis and have lost the confidence of the people. Such a situation is not good for the management of common property resources.
7. Reduction in the purchasing power of individual smallholder farmers is forcing farmers to re-establish Maize Clubs in addition to the current Tobacco clubs. This is a pleasant development as these may form a major springboard for new group initiatives that may provide a basis for community action.
8. There is an admirable cadre of extension personnel whose work is hampered by the lack of adequate support infrastructure to carry out their work. Although they carry out their work under difficult conditions their level environmental awareness is questionable.
9. No new laws are needed to curb environmental degradation but what is required is to ensure that the present suite of laws are enforced.

Recommendations

1. Evidence gathered for this study suggests that there is a wealth of knowledge about the environment among the farmers that they must put to use. The combined effect of new democratic processes led to the marginalization of environmental considerations. It is recommended that an environmental awareness be carried out for the farmers. This recommendation is made with the full recognition that this could form part of the CBNRM project proposed for Malawi.
2. The task of local level management of natural resources rests in sufficiently empowered local institutions for local governance. To resuscitate these governance systems it is recommended that a facilitated participatory community

self-diagnosis process be carried out that will help such communities address governance issues.

3. The level of environmental awareness among extension personnel was found to be limited. An environmental awareness program should be run for extension personnel so that they learn to appreciate the environmental impacts of their extension messages can solve this problem. Such a program should recognize that these are technical people in their own right.
4. This study seems to indicate that there was insufficient support for the small holder farmers when the market liberalization process was put into motion. It is therefore recommended that as market liberalization is both a process and policy it must have sufficient environmentally sensitive extension staff, adequate environmental safeguards, and market integration mechanisms. In this respect a closer synchronization of macro economic changes such as reduction in the size of the civil service and the removal of government supported marketing services are not effected before the market can provide such vital services.
5. Agencies working in an African setting should seriously adopting the methodology used in this study. The data are available and most countries have various forms of PRA capacities at their disposal. Care should be taken of the fact that the social analysis can easily become a community needs assessment.
6. The present provisions of the Land, Forest, Water, and Environment Acts should be made visible and become part of Malawi's natural resources management strategies as they contain sufficient safeguards for sound environmental management.
7. With the apparent recent increases in river sediment loads, water quality assessment measures need to be reestablished. Measuring suspended solids loads can be done at low cost. Good predictive relationships exist between total suspended solids and concentrations of total phosphorus, total nitrogen and total organic carbon that will provide information on nutrient status through monitoring of suspended solids.

Annexes

STATUS OF REMOTE SENSING ANALYSIS FOR NSIPE STUDY

The Nsipe case study on market liberalization effects on the environment and rural livelihoods includes both social and land use/cover analyses. This section describes the methodologies and preliminary findings of the remote sensing analysis of land use/cover change for the Nsipe EPA.

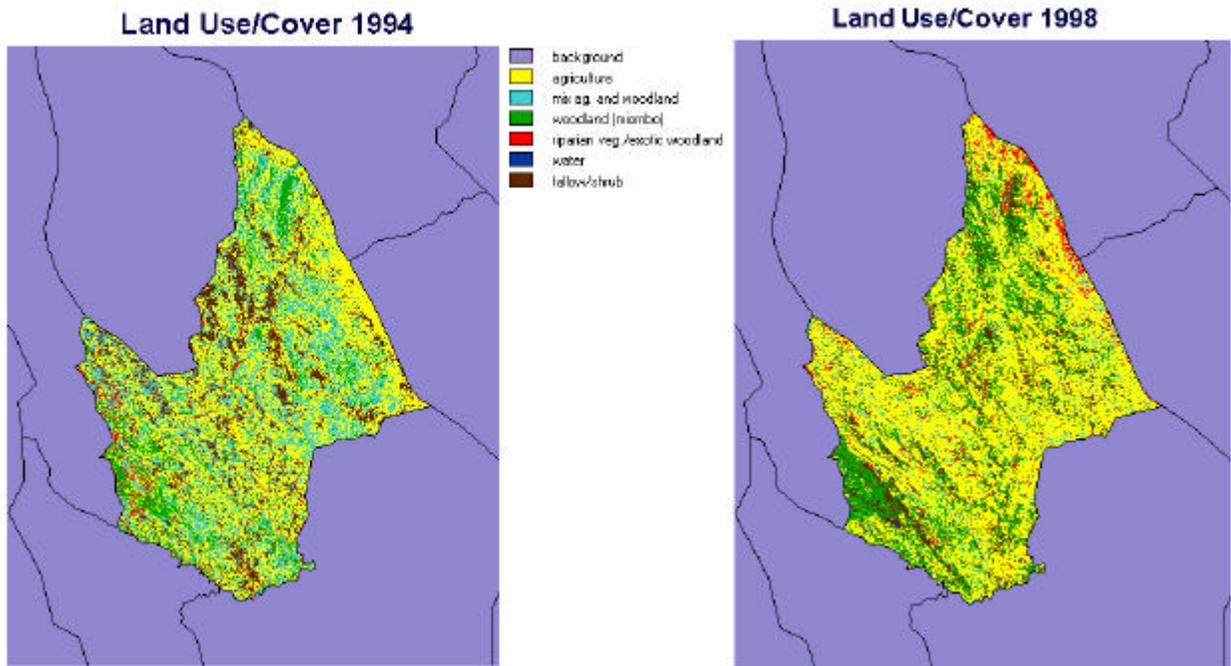
Three time periods are utilized for this study: 1984, 1994, and 1998. With the market liberalization policies taking effect in roughly 1994, it is assumed that these dates can capture significant changes before and after the policy events. While the land use/cover analysis can show changes, however, it is premature to attribute the causes of these changes to market liberalization policies, especially in the Malawi context of a very dynamic political economy in the past 5 years. The social analysis over the next 5 months will assist in understanding the relationship between political economic events and land cover change.

To produce land use/cover change maps from 1984 to 1998, Landsat thematic mapper 30 meter resolution satellite imagery will be classified for the three time periods. To date, much progress has been made with the 1994 and 1998 imagery, and the 1984 image will be classified with the help of aerial photograph interpretation. For purposes of this study, five land use/cover categories are interpreted from the imagery:

- agriculture (maize, tobacco, cassava, etc.)
- mixed agriculture and woodland (agriculture areas with mix of trees including both mangos and miombo woodlands)
- woodland (mostly open canopy miombo)
- riparian vegetation/exotic forest (both dambo cultivation and exotic tree species such as eucalyptus and pine)
- water (the Mpira Dam)
- fallow/shrub (including agriculture land in fallow for more than a year and marginal miombo woodlands)

The landscape in Nsipe is dominated by highly fragmented land management systems. That is, in a small area there is typically a mix of land covers; and thus classifying such an environment is a challenge. Because of this uncertainty, the social analysis includes village mapping and environmental histories so as to verify the generalized remote sensing results.

The preliminary results for 1994 and 1998 are displayed below. One difficulty in comparing these images is that the 1994 image is from the dry season and the 1998 image is from the wet season. It would be highly preferable to conduct this comparison with images representing similar seasons. Even so, these images begin to tell a story about how, when, and where the landscape is changing.



Briefly, these preliminary results show an overall decrease in the combined categories of “mixed agriculture with woodlands” and “woodlands” from 35% to 28% between the time periods. Of note, the “mixed agriculture with woodlands” from 1994 have dominantly become agriculture by 1998. Additionally, the area to the northwest of Mpira dam has experienced significant reforestation following the imposed watershed management of the area, which included the eviction of farming activities from this area. These initial maps will be ground truthed and further improved in the coming months. Additionally, the 1984 image will be classified with the assistance of aerial photography.

Annexes

Nsipe EPA 4 Study: Survey Instrument

Name of Enumerator _____ Village _____

Headman _____ Traditional Authority _____

Section A: Household Profile

A1 Name of respondent _____

A2 Sex of Respondent (circle one) M/F

A3 Head of Household (circle one) M/F

A4 Ethnic group (circle one)

Ngoni

Yao

Lomwe

Chewa

Other, specify

A5 Religious affiliation (circle one of the following)

Christian

Moslem

None

Other, please specify

A6 If the answer to A5 is *Christian* to which of the following denominations does the head of household belong?

Abraham Church

Assemblies of God

CCAP

Independent Assemblies of God

Jehova's Witness

Roman Catholic

Seventh Day Adventist

Zion

Other, specify

A7 Was Head of household born in this village? Yes/No (circle one)

A8 If the answer to A7 is **No** why did he/she come to this village?

A9 Where did they come from?

A10 Who of the following allocated the residential plot?

Parents

Family head

Village headman

Group village headman

Traditional Authority

If inherited, from who

Other, specify

A11 Which of the following village organizations does the head of household belong to?

- Agora
- Community Development committee
- Farm Club, specify
- Nutrition club
- Tobacco club
- Water committee
- Other, please specify

A12 Which of these influences your decisions on agricultural practices most and why?

A13 How many household members normally reside in this household?

Column 1	2	3	4	5
Name of H/H Member	Relation to H/H Head	Sex	Age	Occupation

Section B: Natural Resources Base: Land

B1 Who usually allocates land in this village? _____

B2 Types of lands allocated to the household.

Land allocated to household	Main reason for acquisition	Village land set aside for	When allocated	Period of use	Allocated by	Rights

B3 Has the head of household ever extended arable land since 1994? Yes/No

B4 If Yes, why and how much?

B5 If the response to B4 is No, how has the household sustained crop production?

B6 Can you meet your household's basic food security from the arable land(s) currently available to you? Yes/No

B7 If the answer to B6 is No, how are you going to meet the food requirements of your household?

Section C: Buildings

C1 Has the household built a tobacco shed for its own use? Yes/No

C2 Does the household share the use of a tobacco shed? Yes/No

C3 Has the household been involved in the construction of any of the following in buildings in the last 4 years?

- Bathroom
- Cattle kraal
- Chicken coop
- Goat pen
- Granary
- Kitchen
- Pig sty
- Tobacco shed
- Toilet
- Other, specify

C4 If labor and other materials were paid for where did the money come from?

C5 What tangible possessions (eg equipment and/or livestock) did the household purchase in the last 4 years and which one(s) do you still in your possession?

Equipment/livestock	Source of money	Available/sold

Section D: Household Economy

D1 What are the household's main sources of income?

Major income source	Gender of person involved
Beer brewing	
Brick making	
Craft sales	
Crop sales	
Firewood sales	
Fruit sales	
Hiring out Labor (Ganyu)	
Home baking	
Livestock sales	
Off farm employment	
Remittances	
Sungwi	
Tobacco sales	
Trading	
Other, specify below	

D2 Of these which contributes the greatest percentage of the income?

D3 What are the household's other sources of income?

Secondary income source	Gender of person involved
Craft sales	
Firewood sales	
Fruit sales	
Livestock sales	

Meat sales	
Tobacco sales	
Vegetable sales	
Other, specify below	

D4 What does the household spend its money on?

D5 Do you use hired labor and for which periods in the agricultural calendar?

Section E: Crops

E1 Crops grown in 1997/98 season (add unlisted crops in the extra spaces provided)

Crop	Purpose	Yield	Percent Sold	Income Earned	Seed Source	Fertility Mangmnt	Controlled by (M/F)
Beans							
Cassava							
Ground nuts							
Irish potato							
Maize							
Millet							
Pepper							
Sorghum							
Sweet potato							
Tobacco							

E2 Indicate by ranking which of the following problems affect crop production?

- Expensive inputs
- Infertile soils
- Lack of credit
- Lack of fertilizer
- Low crop prices
- Low yields
- Soil erosion
- Pests
- Unreliable rainfall
- Other, specify

E3 What are you actually doing about the first problem you have identified above?

E4 Do you have access to credit through any of the following? (Enumerator, indicate of the response is *No*)

APIP

Club Agora
 MRFC
 SACCO
 Other, specify

E5 Have you applied any the following soil conservation or improvement measures to your arable lands? (Rank by effectiveness) (**Enumerators please indicate those whose response is none**)

Conservation measure	Rank
Animal manure	
Box ridging	
Burying plant residues	
Ridge on the contour	
Crop rotation	
Early planting	
Fertilizer application.	
Ridging	
Tree planting	

E7 Why do you consider your first choice as the most effective?

Section F: Livestock Ownership

F1 Animals in household.

Animal Type	Number	Owner (M/F)	How Obtained	Cash, Draft, or Subsistence

Section G: Natural resources Base: Woodlands and Grazing

G1 What woodland products does the household use? (List)

G2 Are your needs related to woodlands products satisfied
 Yes/No

G3 If no, why is this the case?

G4 Are your sacred woodlands changing. **Yes/No**

G5 If *Yes* on what changes are taking place in and around these woodlands?

G6 What are the main sources of firewood used by your household?

G7 Is the grazing available to you adequate?
 Yes/no

Section H: Natural resources Base: Water

H1 From the table below indicate your source(s) of water for household use and indicate the major source.

Borehole	
Dam	
Stream	
Spring	
Tap	

H2 Does the main source of water for household use last throughout the year?

H3 Have you noticed any changes in the quality of the water?

H4 What do you consider to be the main threats to your water source?

Section I: Sources of Information

I1 Which organizations extend resource management information to the household?

Message about	Organization
Animal and crop diseases	
Credit	
Crop prices	
Fertilizer	
New agricultural policies	
New seed	
Woodlands	
Water	
Other, specify	

I2 Are you aware of the national policy on market liberalization? Yes/No

I3 If the response to I2 is *Yes*, how did you learn about it?

Section J: Change

J1 Have you noticed any changes in the woodlands (in last 5 years)?

J2 In what ways have these changes in woodlands affected the household?

J3 What did you think are the reasons for these changes?

J4 How have you addressed these changes as an individual?

J5 How have you addressed these changes as a community?

J6 Have you noticed any changes in the soils (in last 5 years)?

- J7 In what ways have these changes in soil affected the household?
- J8 What did you think are the reasons for these changes?
- J9 How have you addressed these changes as an individual?
- J10 How have you addressed these changes as a community?
- J11 Have you noticed any changes in the potable water (in last 5 years)?
- J12 In what ways have these changes in water affected the household?
- J13 What did you think are the reasons for these changes?
- J14 How have you addressed these changes as an individual?
- J15 How have you addressed these changes as a community?
- J16 Five years ago did the food you produced last throughout the year?
- J17 Has there been any change in the amount of food you produce since 5 years ago?
- J18 Which crops are important to the household and have these changed since 5 years ago?
- J19 These days are you relying more or less on tubers and roots to feed your family (as compared to 5 years ago)?
- J20 If Yes, why is this case?
- J21 These days are you purchasing more food than 5 years ago? Why?
- J22 If yes, do you prefer this strategy over producing your own food?
- J23 If No, then why do you continue to grow cash crops?
- J24 What overall affects have market liberalization had on your household?
- J25 Have these affects been beneficial to your household or not? In what ways?
- J27 Do you think that market liberalization has enhance your household food security?
- J28 Has market liberalization increased the available cash in your household?
- J29 If yes, how is this money spent? (list/describe)
- J30 Has market liberalization affected the way decisions are made in the community?
- J31 How has market liberalization affected natural resources?
- J32 Has market liberalization caused any conflicts concerning the use of natural resources? List types of conflicts between households/communities, villages.
- J33 What is being done to resolve these conflicts?
- J34 What changes have you noticed in conservation laws and their enforcement?
- J35 What measures should be take to correct this situation?

Section K: Future

K1 5 years from now, what do you expect the natural resources to be like?

K2 5 years from now, do you think your food security will be increased or decreased?

K3 If you expect a decrease, what are you going to do about it?

K4 What role do you think the government has to ensure food security?

K5 In the future, what role do you think the government should have in managing local woodlands?

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