

ECONOMIC INCENTIVES FOR BIODIVERSITY CONSERVATION IN EASTERN AFRICA

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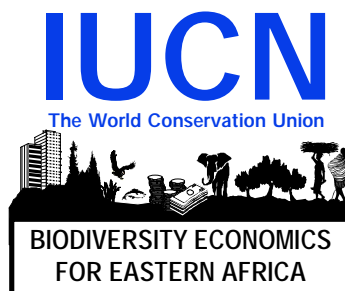


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INTRODUCTION: USING ECONOMIC INCENTIVES FOR BIODIVERSITY IN EASTERN AFRICA

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The importance of economic incentives for biodiversity

Biological resources, ecosystems and their diversity form the basis of human economic activities. In turn, almost all forms of human production and consumption have the potential to deplete, convert, pollute or otherwise degrade biodiversity. Activities such as over-grazing, over-fishing, conversion of forest and wetlands to agriculture and unsustainable plant and animal products utilisation all degrade and deplete biodiversity directly. Other activities such as the use of destructive fishing or timber harvesting techniques, slash and burn agriculture, open pit mining and the disposal of untreated agricultural and domestic wastes into land and water degrade the biodiversity as secondary effects of the technologies and methods they employ.

The economic activities which degrade biodiversity are in turn permitted – or even encouraged – to take place because of broader failures and distortions in the markets, institutions, policies and laws which govern economic activity and biological resource use. Many of the goods and services associated with biological resources, ecosystems and their diversity – and the premium attached to conserving them – are undervalued by the market, or ignored in national and sectoral policies, laws and institutional arrangements. Biodiversity tends to be under-priced, over-consumed and under-conserved because it is treated as a free good which can be mined, converted, depleted or otherwise degraded at no cost and because biological resources are made relatively less valuable than other goods and products. Lack of markets, and unsupportive government policies and institutional mechanisms have in many countries failed to either present adequate sanctions against biodiversity loss or provide sufficient encouragement for people to engage in biodiversity conservation. These market, policy, legal and institutional failures and distortions constitute the underlying economic root causes of biodiversity degradation and loss because they encourage people to take part in production and consumption activities which deplete, replace or degrade biological resources and ecosystems.

There is a clear need both to prevent or mitigate the production and consumption activities that degrade biodiversity directly, and to identify and overcome the underlying root economic causes of biodiversity loss. Of overriding importance is to set in place the conditions under which it will be more economically desirable for people to conserve, rather than to degrade biodiversity in the course of their economic activity. In other words there is a need to provide clear economic incentives for biodiversity conservation. An incentive can be defined as:

“A specific inducement designed and implemented to influence government bodies, business, non-governmental organisations, or local people to conserve biological diversity or to use its components in a sustainable manner. Incentive measures usually take the form of a new policy, law or economic or social programme.”
(UNEP/CBD/COP/3/24)

The provision of economic incentives, and dismantling of economic disincentives, are necessary conditions for biodiversity to be conserved in Eastern Africa. Governments, the private sector and local communities will all be unwilling – and often unable – to conserve biodiversity unless it is economically worthwhile for them to do so. To date, few positive incentives have been set in place in Eastern Africa to induce people to conserve biodiversity in the course of their economic activity. In turn, there exists in the region a set of perverse or negative incentives, all of which can encourage biodiversity degradation and loss – such as a subsidised and protected commercial agricultural sector, lack of markets and prices for many biodiversity products and services, and restrictions on the ownership and use of biological resources and biodiversity areas.

The important role of economic incentives is recognised in the Convention on Biological Diversity, which encourages and obliges their use as tools for biodiversity conservation. Article 11 of the Convention explicitly calls for Contracting Parties to “... as far as possible adopt economically and socially sound measures that act as incentives for the conservation and sustainable use of components of biological diversity ...”. Article 20 (financial resources) again mentions the use of economic incentives to achieve the objectives of the Convention. Incentive measures are also central – although implicit – to the implementation of other parts of the Convention including Articles 6 (general

measures for the conservation and sustainable use of biological diversity), 8 (in situ conservation), 10 (sustainable use of the components of biological diversity), 14 (impact assessment and minimising adverse impacts) and 16 (access to and transfer of technology).

The rationale and aims of the workshop

Despite the importance of economic incentives as tools for biodiversity conservation, there is little experience of their real-world application or practical use in Eastern Africa. This workshop was convened because there is a clear need to document existing cases and lessons learned on the use of economic incentives in the region, and to develop a strategy and way forward for their development, use and co-ordination for biodiversity conservation in Eastern Africa. Its basic rationale was that:

- ❖ People degrade biodiversity because it is easier, cheaper or more profitable to them – because they can gain economically from doing so.
- ❖ If biodiversity is to be conserved in Eastern Africa, it must make economic sense – to governments, to the private sector, to urban dwellers and to local communities.
- ❖ Economic incentives induce or motivate people to conserve biodiversity in the course of their economic activities by making it more profitable to do so.
- ❖ Despite the importance of economic incentives for biodiversity conservation, there is little real-world experience of their use in Eastern Africa.
- ❖ There is a need to develop a strategy and way forward for the use of economic incentives for biodiversity conservation in Eastern Africa.

In line with this need, the workshop aimed:

- ❖ To learn about the use of, and needs for, economic incentives for biodiversity conservation in Eastern Africa
- ❖ To identify ways forward in the use of economic incentives for biodiversity conservation

The focus and content of the workshop

Taking some of the key concerns and experiences in the use of economic incentives for biodiversity conservation in Eastern Africa, the workshop had as its overall focus:

- ❖ Overcoming macroeconomic and sectoral economic policy disincentives to biodiversity conservation
- ❖ Promoting biodiversity conservation through partnerships with the private sector
- ❖ Local-level economic incentives for biodiversity conservation: collaborative management, sustainable use and benefit-sharing

The workshop included a number of case study papers on the use of economic incentives for biodiversity conservation in various Eastern African countries at various levels of scale, and in various sectors. All of these papers, which are presented in this document, highlighted that, unless concrete and targeted economic incentives are provided, biodiversity conservation is unlikely to be either acceptable or sustainable over the long-term in Eastern Africa. They also demonstrated the need to search for lasting solutions to overcoming the economic forces which lead to biodiversity degradation and loss, and set in place innovative arrangements for making biodiversity conservation economically desirable for the different producers and consumers whose actions impact on its integrity.

Following the presentation of these papers and their discussion, workshop participants formed into six break-out groups, in order to further determine the need for – and experiences of – economic incentives for biodiversity in Eastern Africa. These groups focused on:

- ❖ Required actions at the government environment agency level
- ❖ Required actions at the government development agency level
- ❖ Required actions at the national policy and legislative level
- ❖ Required actions at the NGO level
- ❖ Required actions at the industrial and private sector level
- ❖ Required actions at local community level

Discussion in each group centred on the following questions:

- ❖ How do the actions or decisions of this group contribute to biodiversity degradation?
- ❖ What are the major needs for economic incentives for biodiversity conservation for this group or at this level?
- ❖ How can this sector work with others to implement or participate in incentive measures for biodiversity conservation?
- ❖ Examples of key areas in which to pilot the use of economic incentives?

A clear recommendation arising from these more detailed discussions was that there is an urgent need to address economic issues related to biodiversity, and to set in place effective, appropriate and sustainable incentives for conservation. These conclusions and recommendations, and their translation by workshop participants into a concrete plan of action for Eastern Africa, are presented at the end of this document.

THE ROLE OF ECONOMIC INSTRUMENTS IN UGANDA'S ENVIRONMENTAL POLICY

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Introduction

The Government of Uganda initiated a National Environment Action Planning Process (NEAP) in 1991. The process aimed at developing a cross-sectoral, comprehensive and home grown framework for the management of the environment and natural resources in the country. The NEAP process had four major outputs including the National Environment Management Policy (1994), the National Environment Statute (1995), the National Environment Investment Plan and the National Environment Management Authority. The NEAP process also initiated legal and policy reforms in other related sub-sectors including the Water sub-Sector, the Wildlife and Tourism sub-Sectors, to mention but a few.

This analysis looks at the role of economic instruments in this wider environmental policy setting in Uganda, covering the National Environment Management Policy (1994), the Water Action Plan (1995) and the Fisheries and Wildlife Policy (1996).

Let me however, point out two things from the outset. The management of the environment and natural resources in Uganda over-relies on a command and control approach, leading today to a proliferation of statutes, guidelines and regulations often without the corresponding capacity to enforce them. Secondly, there is disproportionately more concern over pollution control in spite of the continued over-reliance on a primary natural resource base for which the risk of resource draw-down and over-exploitation is probably more important than pollution.

Conservation, Resource Scarcity, Opportunity Cost and Compensation

Conservation involves the setting aside of resources and the disuse of environmentally damaging procedures. It involves for example, the setting aside of protected areas including National Parks, Wetland Reserves, the disuse of environmentally damaging processes and procedures, or the use of pollution abating technologies. Environmental conservation and the prevention of environmental degradation thus costs money. Besides, conservation through the setting aside of resources or the disuse of various processes and procedures implies direct opportunity costs. Protected areas for instance, cannot be put to agricultural use. In many areas also, protected areas harbour vermin that raid adjacent farmlands rendering them unsuitable or unprofitable for agricultural use. To off-set the opportunity costs of conservation and generate incentives for a positive conservation attitude therefore, innovative funding mechanisms must be found.

To understand the role of incentives and disincentives in conservation therefore, let me examine the concepts of income, utility derivation and welfare, opportunity cost and compensating and equivalent variation as they apply to welfare economics.

Protected area (PA) adjacent communities obtain various resources from the protected area. These resources may be directly used and therefore have direct use values like fuelwood, medicines, game meat etc., or may indirectly support the well-being of individuals through indirect use value like wind break effect, micro-climate effects, soil erosion control etc.

The amount of resources direct use communities can access from a PA depends on the conservation status of the area. We have Strict Nature Reserves (SNRs) in which no extractive activities are permitted. We also have multiple use areas, where extractive use of resources is permitted under a controlled use regime.

Strict Nature Reserves exclude community access for extractive use of resources. Because people cannot utilise the land or obtain the products of the current land use for their own use, we say an opportunity cost of use is generated. If the area was previously open land with no conservation status (or of lower conservation status), the new status implies that adjacent communities have lost a source of livelihood, a source of income and the associated utility derivations. They can no longer access game meat for food, medicines or fuelwood for cooking or sale. They have no PA derived income to meet their needs to achieve utility or satisfaction.

This situation generates a conflict between individual utility satisfaction objectives and the general social good of maintaining PAs. The management challenge in such a case then, is how to bridge individual utility satisfaction objectives and the wider societal objectives of maintaining PAs.

Intuitively, one management option could be to pay a sum of money to PA adjacent communities that makes them as well off as they were when they accessed PA area resources. The equivalent payment referred to above is called the "equivalent variation". The corresponding payment PA adjacent communities should pay to conservation authorities to access PA resources such that the authorities are indifferent is called the "compensating variation".

Compensating and equivalent variations are theoretically the true measures of benefit that communities enjoy or are denied by protected area management systems. Policy options should therefore, aim to charge protected area resource users or compensate them for denied user rights if conflicts are to be eliminated.

Economic incentives and disincentives aim to address this policy requirement through the following measures;

Economic Incentives for Pollution Management in Uganda

The National Environment Management Policy, in line with the "polluter pays principle", states in part that the pollution management objective for Uganda is to control the pollution of water, land and air from domestic, industrial and other emissions and discharges, and to promote environmentally sound management of wastes and hazardous materials. These objectives, it states, will be achieved by;

- (i) establishing environmental standards for permissible levels of pollution;
- (ii) strengthening institutional and technical capacities for waste management;
- (iii) enhancing institutional co-ordination;
- (iv) establishing a system for monitoring compliance with water, land and air pollution control standards and regulations;
- (v) requiring waste generators to pre-treat their effluent according to established standards before discharge;
- (vi) conducting regular environmental audits to ensure the adoption of environmentally sound practices etc.

In this regard, the National Environment Management Authority (NEMA) developed air and water standards, standards for the discharge of effluent into water, standards for the control of noxious smells, noise and vibrations and soil quality standards to advise potential polluters on acceptable waste, and emission discharge levels in their sectors. NEMA has moved on to draft effluent discharge regulations to enforce some of the standards.

The National Environment Statute (1995) Section 99 on offences relating to environmental standards and guidelines, states that any person who:

- a) contravenes any environmental standard prescribed in Part VI of this Statute;
- b) contravenes a measure prescribed under the Statute or;
- c) uses natural resources in a wasteful manner contrary to measures described under Part VII of the statute; commits an offence and is liable on conviction, to imprisonment for a term not exceeding eighteen months or to a fine not less than one hundred and eighty thousand shillings (US \$ 133) and not more than eighteen million shillings (US\$ 13,333) or both.

However, environmental compliance involves the adoption of costly process and technology modifications. This cost implication determines whether firms voluntarily comply with requirements or risk penalties due to non-compliance. Considering that the cost of compliance would be considerably prohibitive due to the mainly waste intensive nature of most of our processing facilities which are also dominantly marginal, a combination of regulatory measures, induced self-regulation and economic instruments have been designed, developed and implemented to offer a source of incentives for behaviour change. Two proposed approaches in the area of pollution management are described below;

The Malaysian Model for Control of Industrial Effluent

The Uganda Government developed standards for effluent discharges. The standards define the maximum permissible level of pollution a facility may be allowed to emit or discharge into the environment. This standards approach could be combined with an economic incentives mechanism of effluent charges based on the following empirical calculation for the fisheries sub-sector:

Fish processing firms generate an average of 120-150 m³ of waste water of about 300mg/l BOD content per day. The management objective in the sector is to reduce the amount of discharges in volume and pollution loading (BOD) to less than 25 m³ of waste water discharge of BOD₅ = 50mg/l per day.

Firms that cannot achieve this desired environmental performance level, however, may pay an effluent discharge fee. The fee will vary according to:

- (i) the quantity of waste discharged (m³);
- (ii) the pollutant or class of pollutants discharged; and
- (iii) the existing level of pollution.

Effluent charges will be structured such that, on average, each processing firm will pay up to US\$ 9 million (US\$ 6,593) per annum or on average US\$ 24,658 (US\$ 18) per day, this being the average capital cost of constructing an anaerobic lagoon treatment facility for a medium sized fish processing plant in Uganda at 1997 prices.

The Estimated Marginal Environmental Damage Approach

The theoretically correct effluent charge should equal the marginal environmental damage. The marginal environmental damage due to BOD related pollution of Lake Victoria can be estimated by pursuing the reasoning below;

The harvest function $h(t)$ of a fishery is determined by the size of the stock. The size of the stock in turn is closely related to the history of the fishery, and the level of fishing effort.

The harvest (h) can therefore be explained by a number of factors represented by the following regression equation:

$$Y_N = \alpha + \beta_1 C_E + \beta_2 E_P + \beta_3 A_{BOD} + \beta_4 L_{FC} + \beta_5 F_E + \varepsilon.$$

where

- Y_N = Annual Fish Catch
- C_E = Catch per Unit of Effort
- E_P = Export Prices
- A_{BOD} = Annual BOD Loading
- L_{FC} = Lagged Annual Fish Catch
- F_E = Level of Fishing Effort
- ε = Regression Error Term

Interpretation of an empirically generated regression function would advise on the associated environmental damage of a given level of pollution. The value of the marginal damage should be the price of polluting.

Raising Local Benefits through Benefit Sharing

The idea of benefit sharing was first introduced in Uganda in 1991 by the then Uganda National Parks authorities. The main aim of the program was to strengthen the linkages between wildlife conservation agents and the local community through a system that compensated local resource users for their loss of access rights and the opportunity costs they incurred by conserving biodiversity. This, the program believed would foster a common need to conserve biodiversity in protected areas and encourage local communities to participate in park management activities.

The program introduced the following incentive and benefit sharing schemes;

- (i) limited access to the in-park resources,
- (ii) revenue sharing program,
- (iii) support of community development projects,
- (iv) resource substitution,
- (v) agricultural extension services,
- (vi) direct benefits,
- (vii) conservation education.

The Revenue Sharing Program

The revenue sharing program was adopted as a government policy in 1994. The policy was implemented country wide in 1995 and has now been subsequently included in the Uganda Wildlife Statute (1996). The revenue sharing arrangement was initially set at 12% but was later increased to 20% in 1996. Whereas the idea is a good one, the revenue sharing program has been criticised for involving limited public consultation and involvement during its establishment and elaboration. Similar initiatives are applicable, as administrative measures in the management of forests in the forest reserve system.

The Multiple Use Program

Following a number of hostile encounters between local people park and forestry authorities, the government has now agreed to identify a number of activities that could meet community needs without damaging the biological resource.

The main aim of this initiative is to enable communities to access some of the protected resources on a sustainable basis. The initiative also hopes to resolve the conflict between the community and protected area. It also aims to promote mutual trust between community and government institutions especially the Uganda Wildlife Authority and the Forest Department.

Sustainable Use of Open Access Resources Including Fisheries and Forests

The management of forest and fisheries resources in Uganda is provided for under;

- (i) the Forest Act (1962) for forest resources, and
- (ii) the Fish Act (formerly the Fish and Crocodiles Act of 1964);
- (iii) the Trout Protection Act of 1964; and
- (iv) the Fishing (Amendments) Rules (1998) for fisheries resources.

The Forest Act (1962) requires that any person should first obtain a license from the Chief Conservator of Forests before cutting, taking, working or removing any forest produce from the central forest reserves. S.14 of this Act provides that; "1) subject to any exemptions granted under the provisions of this Act, no person shall cut, take, work or remove forest produce in or from a forest reserve, village forest or open land unless he is licensed to do so under the provisions of this Act, no person shall; (a) clear, use or occupy any land in a forest reserve..." or (b) Construct or re-open any road, track or bridge in a forest reserve".

The Act also provides for powers of Local Authorities. Section 5(1), provides that in any order constituting a local forest reserve, the minister shall specify the local authority which shall have the maintenance and control thereof, and thereupon, or with effect from a date specified in such order, the duty of controlling and maintaining such local forest reserve. However, the local authority is to execute its duties upon the advice of the Chief Conservator. This ensures that genetic resources are efficiently managed even at the lowest levels of government.

Rule 3 of the Forest Rules (SI 246-2) Laws of Uganda, 1964, Volume VI makes certain species of trees "reserved forest produce" which cannot be harvested without a permit. This is a device that can be used to conserve other specific forest genetic resources. What in essence is required is breadth of outlook and interpretation of the law.

The Fish Act of 1964 and the Trout Protection Act 3/1967 provide for the control of fishing, the conservation of fish, the purchase, sale, marketing and processing of fish, and incidental matters. It prohibits any person to fish in any waters of Uganda without being in possession of a valid fishing license.

The principal management tool for the sector under the two Acts is the licensing system, and the strategy, the control of fishing gear.

The fisheries resource is also regulated through Administrative Orders. Here the Minister responsible for fisheries is given wide powers to impose extra controls and restrictions, as he deems fit. The Minister may,

- (i) prohibit the use of a particular fishing method if it is likely to be destructive;
- (ii) declare specific periods of the year to be closed to fishing in any area specified in an order. These orders however, do not carry the force of law and are thus not actionable in court.

The problem of resource over-exploitation in both open forests and fisheries theoretically arises due to the variance between the responsibility and rational conservation of the resources under a private property regime and the tragedy of the commons for those under an open access regime.

Critical comparisons of the two variant property rights conditions reveals that two measures could be critical to natural resource conservation;

- (i) a property rights definition over the resource needs to be instituted to confer to a group of people a common property rights ownership over the resource;
- (ii) the cost of harvesting of the resource must be raised through appropriate resource user charges;
- (iii) to benefit from the power of the market, defined resource user rights should be recognisable, but also transferable.

Hence, a system of competitive bidding for forest exploitation in both central and local government reserves; and a transferable quota and licensing system/model has been proposed for the management of fisheries resources. The box below describes the empirical basis for the proposed fishing quotas for Lake Victoria.

It might be challenging to determine a price for each quota. Consultation and a mechanism of competitive bidding, however, may achieve a full-cost price that generates profit and encourages sustainable utilisation of the resource.

Conclusion

Economic instruments have been applied as practical and innovative approaches to environmental management in many countries with varying degrees of success. In Uganda, they have been applied in mainly post processing sub-

sectors like the distribution of beverages where the deposit-refund system applies to ensure better management of used containers.

Whereas the range of economic instruments of relevance to the management of natural resources and the environment are many and varied including indirect fiscal and financial instruments, adaptations of the examples of economic instruments outlined above can be applied as an integrated package to improve both resource and environmental performance in the natural resources sub-sector.

The above measures will however, need to be supplemented with demand side management involving the careful assessment of expected resource harvest levels and their ability to sustain pressures of actual resource draw-down. In this regard, some of the net cash flow from resource exploitation should be charged and invested in improving the productivity of the resources. Besides raising funds for conservation, such taxation could initiate relocation of productive resources to other sectors with relatively higher absorptive capacities.

Finally, supervision, monitoring and regulation of the utilisation of resources and the environment needs to be strengthened. Charge government departments and agencies thus need to be strengthened. Community participation in the management of resources, however, should be emphasised, with a clear plan to re-equip NGOs and other conservation associations to spearhead this effort. The long-term effect of these measures will be the sustainable use of natural resources and the environment that still generates broad economic benefits.

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MACRO-ECONOMIC POLICY INCENTIVES AND DISINCENTIVES FOR BIODIVERSITY CONSERVATION: THE CASE OF STRUCTURAL ADJUSTMENT AND DEFORESTATION IN TANZANIA¹

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Introduction

Tanzania is a very heterogeneous country in terms of soils, vegetation, climate and distribution of animal and human populations. It is this unique combination which determines its biodiversity value, population settlement, land use patterns and pressure on resources. In terms of vegetation, about 42% of mainland Tanzania (this excludes Zanzibar) is under forests and woodlands, 20% is under grassland and scrub, while 10% is cultivated (MNRT, 1997)². Of the forests and woodlands, 6% are natural forests, 0.3% are mangroves and 96.5% are woodlands. As much as 40% of the country is under forests and woodlands, most government efforts are directed at activities taking place in the 10% or less of the land under agriculture and in urban centres. There are no clear land use plans on how to use a large proportion of the land, apart from 26% of the land already set aside as protected areas (URT, 1994). Protected areas located near densely populated areas are under pressure of encroachment from agricultural extensification.

According to Monela (1995), closed forests are mainly rain forests, which are confined to mountain areas, hills and river valleys. They are mainly found on the chain of mountains, which extend from the south of the country to the north-eastern part and collectively known as the "Eastern Arc" mountains of Tanzania.³ The Usambara, Udzungwa, Nguru, Uluguru and Pare Mountains comprise the Eastern Arc Mountains. The other rain forests are found on isolated extinct volcanic mountains of Kilimanjaro and Meru (in the north), Mount Rungwe (in the south) Mahale Mountains on the shores of Lake Tanganyika and Ngorongoro Crater. Others are found on foothills of other isolated mountains in the country and where permanent water exists such as in riparian forests in river valleys.

The distribution of these rain forests, in a way, mirrors the distribution of human population and its density in the country. Most of the population lives on the periphery of the country with the central part being less populated. Consequently high population densities and much human pressure on land and forest resources characterise the rain forest areas. This complicates conservation efforts. The woodlands are mainly those of 'miombo' and constitute more than 93. % of the total forest reserve area of Tanzania (Temu, 1979 p.5)⁴. Considerable tobacco production, which requires large amounts woodfuel for its curing, comes from areas bordering these woodlands. There are also considerable agricultural activities in the vicinity of and within parts of the miombo woodlands.

As noted above, about 20% of Tanzania's land area is under grasslands, and is therefore potential pastureland for domestic and wild animals. Grazing also takes place in parts of the miombo woodlands and this raises the potential grazing area to about 60 million hectares out of 88.6 million hectares of land in Tanzania (Hofstad, 1995). Further, due to the presence of tsetse fly, about 60% of the livestock is concentrated in about 10% of the potential grazing area. Bagachwa *et al* (1995, p.34) report that an estimated livestock population in the country in 1992 at 25.9 million, comprising of 13.2 million cattle, 9.1 million goats and 3.6 million sheep.

The grasslands and some of the woodlands support considerable wildlife as well. In terms of agricultural extensification, the interest in the grasslands could be on how much agricultural expansion is taking place in them. Agricultural expansion into the woodlands is also of interest, in addition to knowing the extent of woodland deforestation (complete and permanent removal of the forest cover) and degradation (negative change in the

¹ The author acknowledges useful interactions with colleagues in the *Miombo Study Group*, including Godwin Kokwero of CIFOR, Gerald Monela and George Kajembe of Sokoine University of Agriculture, Jessie Chipika of the University of Zimbabwe, Issac Minde of ECAPACA, James Luhanga of Malawi, and many others.

² Data comes from a recently completed mapping project under the Forest Resources Management under the Strategic Action Planning Unit (SAPU) of the Forestry Division in the Ministry of Natural Resources and Tourism (MNRT) .

³ These are the biodiversity hot spots

⁴ According to Temu (1979, p.5), Tanzania had 11.2 million hectares of miombo woodlands. besides their soil, water and environment conservation functions, miombo woodlands are a major source of Fuelwood, building poles and fine timbers. Also food (from wild animals, fruits and honey) forage for domestic livestock, weaving materials, wood for hand tools, handicrafts and herbs are obtained from miombo woodlands.

structure and composition of the woodlands) due to grazing by domestic animals on one hand and wildlife on the other. The factors influencing woodland deforestation and degradation through animal grazing may not necessarily be the same as those influencing the same phenomena through agricultural land expansion. And neither will the process and pattern of deforestation and degradation be the same. Mangrove forests are found on the coast and these pose special challenges of conservation.

There is a growing consensus within the international academia and development community, that macro-economic reforms could impact on the natural resources of a country. Evidence for this recognition had led to, among other things, the launching of research programmes dedicated to the theme of structural adjustment and the environment (Reed, 1992; 1996). Furthermore, various reports have been published that attempted to link development and the environment (World Bank, 1992, 1994; Duncan and Howell, 1992; Brown and Pearce, 1994; Tiffen, *et al* 1994; Bradley and McNamara, 1993).

In Tanzania, a number of studies have addressed the issue of macro-economic policy and the environment in recent years (Mascarenhas, 1991; Mbelle and Mashindano, 1994; Sankhayan, 1994 and Bagachwa, *et al* 1995) and the ninth national economic policy workshop held in November 1994 dealt specifically with the theme of 'structural adjustment and the environment' (Bagachwa and Limbu, 1995). The evidence emerging from these studies points to the fact that deforestation, forest and land degradation are not so much issues of forestry alone but are intimately related to questions of public policies, economic and social forces which encourage different agents to intervene in forest areas as part of their livelihood strategies.

This paper discusses some hypotheses on how macro-economic policies and the various instruments put in place to implement them are likely to influence conservation. Particular emphasis is placed on potential impacts on deforestation in Tanzania. The paper is limited to policies, which encourage agricultural production and possibly agricultural expansion, and in the process create demand for additional land.

Conceptual framework

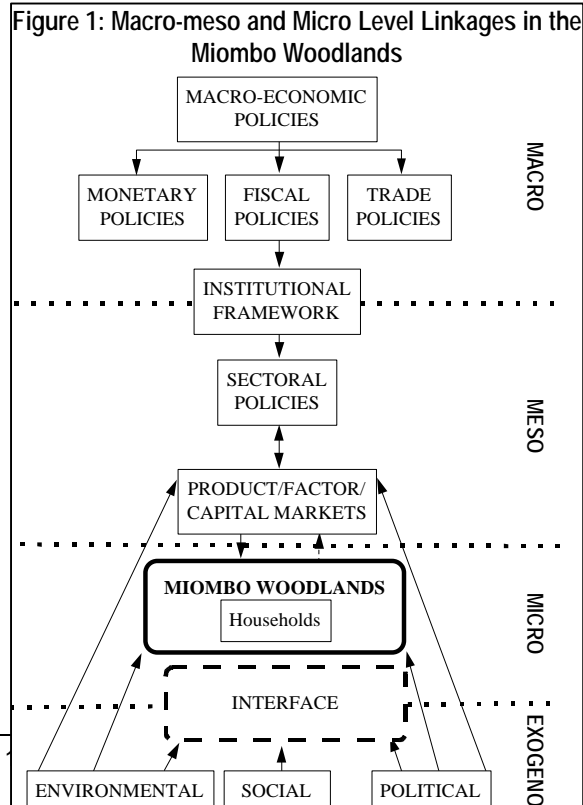
The thrust of this study is to shed some light the complex inter-relationships between macro-economic policies (e.g. monetary, fiscal, exchange rate, trade, employment, etc.), and how these, in turn, influence sectoral policies and activities such as agriculture, forestry, fishing, hunting etc. to shape people's livelihood strategies. An understanding of livelihood strategies of people in their environment is key combating those negative impacts on biodiversity conservation and reinforcing the positive ones. In this section, a framework of analysis is proposed and a set of hypotheses proposed.

The conceptual framework is a top-down model that shows how macro-economic policy changes at the central government level are transmitted down to decision-making matrices of households and firms. Such decisions on resource use are likely to impact the environment both positively and negatively. The framework identifies the most important price and non-price factors that determine the ultimate response/behaviour of households in their production and consumption functions at the ground.

The price and non-price factors operate at three levels of decision making e.g. political economy level, policy delivery level and household/firm response level. At each level of decision-making, there is set of **institutional filters**, as it were, that constrain or modify the intended outcomes of the policy.

Political economy refers to the decision making process that determines the choice of macro-economic measures to be undertaken at the national or economy-wide level. The choice of policy measures depends upon the existing macro-economic situation, extent of external pressure and the available institutional capacity to make decisions at the top policy making level of the country or economy. Any changes at macro-economic policy level influence activities in other sectors through tools and instruments such as: market reforms, subsidies, prices, tariffs, taxes, interest rates, exchange rates, etc.

On the other hand, **policy delivery** is the process that translates policy at macro level into a meso-level involving various sectors, regional or provincial policies and legislation. In each of the sectors and regions there are specific markets for products and factor of production (e.g. product, labour, capital and land) to which



households and firms respond or absorb information from. The institutional filters that distort the operation of the macro-economic policies as they are translated into sectoral, regional and legislative policies also strongly work at this level, so that unintended policy outcomes may actually result.

Lastly, **response determinants** are the many factors that determine how micro-level actors (households and firms) will respond to information coming from the markets behind sectors and legislation. Decisions by households and firms on how much to produce, consume, invest, employ, use inputs, etc. are made on the basis of prevailing demand, supply and prices in the various markets where households and firms participate. Apart from purely price factors, micro-level actor's decisions depend on non-price factors such as social structures, traditions and cultures (such as gender roles) as well as physical environmental conditions e.g. resource fragility, regenerative capacity and local ecological conditions.

Thus, any observable action by an economic agent at the ground (be it a farmer, a timber trader, a charcoal maker, a local official responsible for enforcement, a consumer, etc.), can be attributed to proximate determinants e.g. information coming from the markets. In context of Tanzania, the above framework can be used to explain the mounting evidence that rates of soil erosion and deforestation may have been accelerated under structural adjustment programmes due to policy impact on increased cost of fertilisers and pesticides, reduced availability of credit with which to purchase such inputs; changing the erosive/non-erosive balance in the cropping pattern and increased timber extraction as a result of both internal and external market liberalisation; and reduced government spending on enforcement of laws and regulation, afforestation and extension services (Bagachwa, *et al*, 1995).

Evolution of Tanzania's macro-economic policy

The present day macro-economic policies in Tanzania are rooted in the history of the country, which cannot be dealt with at length in such a paper. However, it may suffice to note that the post-colonial Tanzanian policy regime can be categorised into three major periods. The first is the period between 1961 and 1975, a period we characterise as **growth with state intervention**. This was followed by the by **years of economic crisis** covering the period from 1975 to 1985. The post-1986 period is characterised by macro-economic reforms, the most prominent being the **structural adjustment programme (SAP)**.

An examination of the performance of the economy during the three periods reveals the path that led to present-day macro-economic reforms. Available data indicate that Tanzania experienced a high rate of economic growth, averaging 6% per annum during the first six to seven years of independence e.g. the period 1961-67. Growth slowed down remarkably after the Arusha Declaration in 1967 such that during the years 1967-73, GDP growth dropped to an average of about 4.0% per annum. From 1973 to 1978 GDP growth rate slowed down to 2.3% per annum, just under the population growth rate. Further stagnation was experienced during the late 1970s. For example, between 1979 and 1985, GDP growth averaged around 1.5%, meaning a considerable economic decline in per capita terms. The post-1986 period was followed by economic policy reforms spearheaded by the IMF/IBRD.

Available information shows that economic growth increased again after the introduction of Economic Reform Programme of the IMF e.g. a growth rate of around 4.0% for the period 1986-91 and 3.8% between 1992 and 1995. The GDP growth rate in 1996 is around 4.9%, suggesting that per capita incomes are rising during the period of economic reforms (URT, 1997; BOT, 1997). An over view of the performance of the economy during the three periods is shown in Table 2.

Table 2: Sector Real Growth Rates of the Tanzanian Economy, 1966-1995

	1966-70	1971-75	1976-80	1980-85	1986-92	1993-95
	%	%	%	%	%	%
Agriculture	2.1	2.5	1.8	3.0	4.9	5.9
Manufacturing	8.1	4.8	2.7	4.9	3.8	1.8
Economic service ⁽¹⁾	5.9	3.7	2.6	0.4	4.2	6.8
Public services ⁽²⁾	6.0	12.9	9.1	2.6	0.4	1.1

⁽¹⁾Economic Services include electricity and water, financial services, trade and hotels, transport, and storage.

⁽²⁾Public services include public administration.

Source: National Accounts 1966-1976, 1976-1992; Statistical Abstract, 1995.

The first responses by the government to the economic crisis of the mid-1970's were the "**home grown SAP's**" e.g. the 1981 National Economic Survival Programme (NESP) and the 1982 IMF stand-by agreement (Ndulu, 1987). However, NESP did not have much positive impact on the economic performance in the country because it was based on foreign capital inflows, which did not materialise. The first home-grown programme was followed by a more comprehensive 1982/83 - 1985/86 "home grown" Structural Adjustment Programme (SAP). This plan aimed primarily at improving external and internal balance and reduction of inflation. It also included incentives to improve capacity utilisation and labour productivity, and provided for higher budgetary allocations for the agricultural sector. However, as negotiations with the IMF/IBRD and other foreign donors regarding funding did not result in agreements, the impact of the SAP remained limited.

In 1986, the agreement with foreign financiers and especially with IMF/IBRD on the principles of Tanzania's future economic policies was reached. This provided required external finances for the implementation of the **Economic Recovery Programme (ERP)** of 1986/87 - 1988/89 and the **Economic and Social Action Programme (ESAP)** of 1989/90-1991/92. After 1992, reforms became a regular feature of the budgetary process through the **Five-Year Rolling and Forward Budget Plan**. All these plans were standard structural adjustment programmes aiming at restoration of balances in Tanzania's economy and creation of a basis for sustainable growth through liberalisation of various sub-markets from excessive state control. Since 1986, economic policies in Tanzania have changed substantially, including the following steps towards a more market-oriented policy regime:

- ❖ Devaluation of the shilling from T Sh 16.5 to USD in 1986 to T Sh 500 to USD in 1994. In 1997, the rate reached 600 T Sh to the dollar. Today the exchange rate stands at 690 TSh to the Dollar.
- ❖ Liberalisation of the foreign exchange market first through own-funded imports, then in 1989 with the Open General License-system, and finally, in 1992 through dollar auctions and the Bureau de Change system;
- ❖ Almost total liberalisation of imports, with only seven articles remaining on the 'negative list' in early 1994. Today only petroleum products are price controlled.
- ❖ Considerable reduction of price controls and introduction of positive interest rates in financial sector operations;
- ❖ Civil service reforms to diminish the size of bureaucracy and improve its efficiency;
- ❖ Larger budgetary allocations, more liberal marketing arrangements, and increased producer prices to the agricultural sector ;
- ❖ Introduction of more market-based rules in the industrial sector, including plans to privatise the state-owned manufacturing sector ; and
- ❖ Plans to increase private sector activity in the financial sector previously completely controlled by the state.
- ❖ Tight monetary policy
- ❖ Rationalisation of government budgets and improvement of tax collection

Implications of the Policies

The home-grown reform measures targeted at improving agricultural production as much as the foreign-backed reforms, but the latter placed much stronger emphasis on some measures than earlier reforms. Some of the recommended measures to reform the agricultural sector have been to improve marketing and distribution of farm inputs as well as letting the market determine the level of prices of agricultural inputs. A major feature has been a continuous diminishing role of state institutions in production, marketing of agricultural products and distribution of farm inputs. At the same time we see the market and the private sector assuming increasing roles in the economy.

During the two periods, inflation rates increased considerably and there were massive declines in the value of the local currency through devaluation. Also an increasingly liberalised environment for importation and exportation of goods and services characterises the two periods. Thus during the two periods after 1975, per capita incomes have declined. These and other conditions have raised the cost of living, making it increasingly difficult for both urban and rural dwellers to make ends meet. Rural households barely have any disposable incomes to improve their agriculture. Also they have had to look for other sources of income for survival.

Hypotheses to explain policy impacts

Building upon the discussion evolution of macro-economic policies in Tanzania and the analytical framework suggested above, the following hypotheses on how policy variables might be influencing livelihood strategies on the ground that have the potential for deforestation and forest degradation through agricultural expansion are suggested.

- ❖ Devaluation of the local currency increases prices of imported inputs, agro-chemicals and machinery. As these become more expensive, farmers reduce or abandon their use thus accelerating extensive agriculture which could result into clearing forests and woodlands for more agricultural land.
- ❖ Removal of price controls and parastatal monopolies under the liberalisation policy has created more space for formal and informal trading activities in food and non-food crops. This stimulates production of those products demanded by the market. Since the private sector has not fully assumed some agricultural services provided by government, this may result into an uninformed farming community which may not know fully well the implications of their production, for example on the environment. The increased production may result into reducing fallow periods, opening up of new land and having crop combinations which encourage land degradation, as farmers respond to unrestricted market opportunities. Such responses may result into both deforestation and land degradation.
- ❖ Falling yields encourage farmers to extend the agricultural frontier through extensification, thus possibly encroaching upon buffer zones around conservation areas.

Policy implications on deforestation

The three economic policy periods have some attributes common to all while some are very specific to individual periods as summarised in Table 4.

It is shown that economic and social policies are not consistent in the post-independence period. Further, the quantity and quality of data on candidate variables vary considerably from period to period. Given these and other complexities it is proposed that the deforestation process may be better understood if the three economic periods were firstly to be analysed separately.

Table 4: Developments with Potential for Influencing Encroachment on Forested Land

State Intervention (1961-75)	Economic Crisis Years (1976-85)	Foreign-backed Economic Reforms (1986-95)
Increase in production of food staples	Increase in production and real prices of staples	Increased production of staples at decreasing rate and decrease in their real producer prices
Increase in production of export crops	Decrease in production and in real producer prices of export crops	Increase in production and in real producer prices of export crops
Increasing per capita incomes and improving economy in general	Declining per capita incomes and deteriorating economy in general	Increasing per capita incomes but socio-economic hardships continue.
Centrally controlled marketing of agricultural products	Marketing of agricultural products liberalised in later years	Liberalisation of marketing of agricultural products
Subsidised agricultural inputs and their centralised distribution in later years	Subsidised agricultural inputs and their centralised distribution	Removal of subsidies for agricultural inputs. Gradual liberalisation in distribution of inputs
Rapid increase in social services and infrastructure for their delivery.	Decline in rate of increase of social services and their supporting infrastructure	Declines in provision of social services and in their supporting infrastructure
Low agricultural technology	Low agricultural technology	Low agricultural technology
High population growth (3.3% per year)	High population growth (2.8% per year)	High population growth (2.8% per year)
Villagisation programme	Limited villagisation programme	No villagisation programme

The intention of the paper is not to determine the extent of deforestation, but identify and confirm potential determinants of such a process. Since many policies have influenced events in the two periods, only a few macro-economic policies would be evaluated for their potential for deforestation and forest degradation through agricultural expansion.

Overall, declines in per capita incomes, increasing inflation and less incomes from export crops worsened living conditions for all people. In fact, it is reported (Bagachwa, 1995, p.62) that average rural incomes by households were estimated to have declined by 47.9% between 1977 and 1983, while the real value of average civil service wage was, in 1986, less than 18% of its real value in 1975, and could only buy a quarter of the requirements of a typical household. This situation provided the incentive to increase production of the staples for own consumption and local trade. The overall picture is that the structure of rural incomes saw growths in non-farm incomes and remittances and declines in growth from farm production activities. Farmers had to make up for declining incomes through remittances from their relatives in urban areas and through non-farm activities which could have impacted on exploitation of forest resources. For example, during this period the production of charcoal and firewood for own consumption and trade increased by 75% and 54% respectively.

The changes in income sources reflect changes in priorities and activities in the rural areas, hence changes in the rural structure. They reflect a growing dependency on non-farm activities for livelihood. How this translated into dependence on forest resources and loss of biodiversity as sources of income in this period remains to be studied in more detail.

Empirical testing of the hypothesis

By using secondary data, a number of attempts were carried out to test the above hypotheses using aggregate level data.⁵ The tests included:

⁵ These results are to be checked against micro-level studies carried out in four villages in Morogoro Region of Tanzania. For details see a paper by Kajembe and Monela (forthcoming).

- ❖ Regressing changes in fertiliser prices against quantities of various types of fertilisers used (e.g. calcium ammonium nitrate CAN, triple super phosphate TSP and nitrogen phosphate potassium NPK) to test for price changes caused by devaluation of the Tanzania shilling.
- ❖ Regressing prices (resulting from devaluation and restructuring of marketing institutions) against area cultivated for particular crops to test for impacts of changing prices of agricultural output upon area cultivated.
- ❖ Regressing changes in yields on areas cultivated for various crops to test for the impact of declining yields on area cultivated.

Impact of changes in fertiliser prices on quantities of fertiliser used:

It is hypothesised that increases in fertiliser prices due to devaluation and removal of subsidies will lead to a decrease in the quantities of fertilisers used by farmers. Data were obtained from the Ministry of Agriculture, Livestock and Cooperatives in Dar es Salaam covering the period 1978-1990. Unit prices of each type of fertiliser were converted into real ones by dividing them with the national consumer price index computed by the Bureau of Statistics. Then these real prices were translated into price indices using 1978 as the base year. A simple linear log-log model was specified as follows:

$$(1) \quad \text{Log } Q_i = \alpha_0 + \alpha_1 \text{Log } P_i + \alpha_2 \text{Log } P_j + \mu$$

Where:

Q_i is the quantity of fertiliser of type i

P_i is the real price of fertiliser of type i

P_j is the real price of fertiliser type j considered to be a substitute to fertiliser type i

μ is the error term

$i = \text{CAN, TSP, NPK, etc.}$

The estimated results for CAN, TSP AND NPK are as shown in equations 2:

$$(2) \quad \text{Log } Q_{\text{CAN}} = 9.39 - 2.49 \text{Log } P_{\text{CAN}} + 2.53 \text{Log } P_{\text{SA}}$$

(4.95) (-2.49) (2.11)

Adj. $R^2 = 0.51$ D.W. = 2.44 $F = 7.43$

The coefficients on equation (2) have the expected signs indicating that the quantity of CAN is inversely related to its own price and that sulphate of ammonia is a substitute for CAN. However, both coefficients are not statistically significant at conventional levels. Despite this limitation, they are indicative of the fact that when prices of fertilisers increase due to devaluation and removal of subsidies, farmers use less quantities or even abandon the use of fertilisers. This decision is likely to encourage use extensive cultivation methods by increasing cultivation areas.

Impact of producer prices on area cultivated:

It is hypothesised that under structural adjustment, real producer prices have increased due to devaluation and the freeing of markets from previous state controls. These factors tend to stimulate farmers to increase the output of the crops demanded by the market. However, increased output is achieved under extensification rather than intensification due to high input prices. Data were obtained for the period 1984/85 - 1995/96. Prices used were the announced prices for the given crops for that year. The model for testing this relationship is specified as follows:

- (3) $\text{Log } A_i = \alpha_0 + \alpha_1 \text{Log } P_i + \alpha_2 \text{Log } P_j + \mu$
 Where:
 A_i is the cultivated area for crop i
 P_i is the real price of crop j
 P_j is the real price for crop j , considered to be a substitute to crop i
 μ is the error term
 $i, j = \text{maize (ma), paddy (pa)}$.

The estimated results for maize and paddy are given as follows:

- (4) Maize: $\text{Log } A_{\text{ma}} = 7.61 + 0.69 \text{Log } P_{\text{ma}} - 0.74 \text{Log } P_{\text{mi}}$
 (5.68) (1.62) (-2.55)
 Adj. $R^2 = 0.34$ D.W. = 0.91 $F = 3.33$
- (5) Paddy: $\text{Log } A_{\text{pa}} = 0.98 + 2.44 \text{Log } P_{\text{pa}} - 10.4 \text{Log } P_{\text{ma}}$
 (0.29) (2.98) (-2.33)
 Adj. $R^2 = 0.44$ D.W. = 0.88 $F = 4.92$

The results confirm the positive relationship between the own price increase and cultivated area for the selected crops. The coefficients have the expected signs although statistically significant at conventional levels. The regression results of one year-lagged price did not improve the results.

Impact of changes in yield, cost of living and population on area cultivated:

It is hypothesised that farmers react to falling yields for various crops by increasing the area under cultivation to maintain level of production. Therefore a negative relationship between area cultivated and yields is expected. Also when the cost of living rises, farmers cultivate more land to compensate for the lower incomes. On the other hand, the population factor also has a direct relationship with areas cultivated. Ministry of Agriculture data for the period 1984/85 -1995/96 on area cultivated and yields were applied to the following model:

- (6) $\text{Log } A_j = \alpha_0 + \alpha_1 \text{Log } Y_j + \alpha_2 C + \alpha_3 P$
 Where:
 A_j is the area cultivated of crop j
 Y_j is the yield of crop j
 $j = \text{cassava, coffee, cotton and maize}$
 C is the cost of living index and P is a population factor

The estimated results for cassava, coffee, cotton and maize are shown in the following equations:

MAIZE

- (7) $\text{Log } A = -961.957 + 0.0457 \text{log } Y - 6.938 \text{log } C + 119.401 \text{log } N$
 SE (118.056) (0.329) (4.915) (73.138)
 $R^2 = 0.447$ $N = 12$ $df = 8$

SORGHUM

- (8) $\text{Log } A = 23.183 - 0.046 \text{log } Y - 0.580 \text{log } C + 3.895 \text{log } N$
 (21.183) (0.037) (0.685) (9.579)
 $R^2 = 0.553$ $N = 12$ $df = 8$

PADDY

- (9) $\text{Log } A = 96.225 - 0.011 \text{log } Y + 0.900 \text{log } C + 10.145 \text{log } N$
 (57.447) (0.051) (1.566) (22.961)
 $R^2 = 0.570$ $N = 12$ $df = 8$

PULSES

$$(10) \quad \text{Log A} = 471.640 - 0.130 \log Y - 0.376 \log C + 7.636 \log N$$

$$(88.940) (0.114) (1.719) (25.158)$$

$$R^2 = 0.562 \quad N = 12 \quad \text{df} = 8$$

TEA

$$(11) \quad \text{Log A} = -30.090 - 0.001 \log Y - 0.0197 \log C + 2.001 \log N$$

$$(1.736) (0.008) (0.047) (0.681)$$

$$R^2 = 0.895 \quad N = 12 \quad \text{df} = 8$$

COTTON

$$(12) \quad \text{Log A} = 41.619 - 0.124 \log Y + 0.057 \log C + 20.932 \log N$$

$$(57.451) (0.114) (1.719) (25.158)$$

$$R^2 = 0.562 \quad N = 12 \quad \text{df} = 8$$

SISAL

$$(13) \quad \text{Log A} = 23.183 - 0.046 \log Y - 0.580 \log C + 3.895 \log N$$

$$(25.352) (0.037) (0.685)b (9.578)$$

$$R^2 = 0.289 \quad N = 12 \quad \text{df} = 8$$

TOBACCO

$$(14) \quad \text{Log A} = 26.623 - 0.012 \log Y + 0.113 \log C + 0.063 \log N$$

$$(3.075) (0.005) (0.1209) (1.348)$$

$$R^2 = 0.445 \quad N = 12 \quad \text{df} = 8$$

PYRETHRUM

$$(15) \quad \text{Log A} = 6.240 - 0.002 \log Y - 0.006 \log C + 0.094 \log N$$

$$(0.155) (0.001) (0.0069) (0.076)$$

$$R^2 = 0.250 \quad N = 12 \quad \text{df} = 8$$

The results show that, coefficients for sorghum, pulses, tea, sisal and pyrethrum have the expected signs for all three explanatory variables (yield, cost of living and population size) although statistically not significant at conventional levels. On the other hand, the coefficients for maize, paddy, cotton and tobacco show mixed results. Therefore these results do not give us outright statistical grounds for concluding firmly about the hypothesised relationship. They do however, give an indication of the possible influence of policy variables such as changes in the prices of inputs, general price level and removal of subsidies on the increase in areas cultivated for pulses, tea, sisal and pyrethrum. With more data and rigorous modelling of the expected relationships, better results can be obtained from which firm conclusions can be made.

Conclusion

This paper has tried to trace the evolution of macro-economic and sectoral policies in Tanzania and structural adjustment programme in particular in relation to livelihood strategies of people. A conceptual framework outlining how policy measures at a macro-level may be linked with responses of economic agents on the ground that impact on the environment has been elaborated together with policy impacts during the three major periods in the economic history of the country. Resulting from this background, a set of hypotheses which seek to explain how changes in macro-economic policy variables are transmitted to households and firms through product, factor and capital markets have been put forward. Simple regression analysis has been applied to test the hypotheses using aggregate level data.

The signs of the coefficients for some crops are indicative that hypothesised relationships may indeed hold although the statistical significance is rather low. In a way therefore, this study sets the stage for a larger study in which more ground truthing of relationships between policy and degradation will be examined more closely.

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LOCAL INCENTIVES AND DISINCENTIVES TO WETLANDS CONSERVATION IN UGANDA

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Introduction

Wetlands are what we in Uganda call swamps. According to our local definition, a wetland is a vegetated area of land that is flooded either permanently or seasonally. Its wetness attracts specific plants and animals, and creates a unique ecosystem. Wetlands in Uganda include swamp forests, papyrus and grass swamps, upland bogs, shallow lakes and rivers. Wetlands cover about 13% of the Uganda's land surface area. They have traditionally played an important role in rural communities through the provision of fish, water, and other materials for humans and livestock. Wetlands also play an important role in regulation of the flow and purification of water as well as serving as refuge for many wildlife species. In Uganda, the overall management of wetlands is vested unto the National Wetlands Programme in the Ministry of Water, Lands and Environment.

The overall goal of the Uganda National Wetlands Conservation and Management Programme (NWP) is to sustain the biophysical and socio-economic values of wetlands for present and future generations. One of the approaches to attaining this, is promoting the efficient use of wetlands as a natural resource, with the general aim of enhancing their overall economic production and maintaining their biodiversity and functions. It is therefore essential to understand the processes through which the wetlands perform their functions and consider the sustainability of the use of these resources so as to provide sustainable benefits to local communities while ensuring that the overall function of the wetlands are maintained.

Local incentives for wetland conservation

An incentive is defined as "something that rouses or encourages a person to some action or effort", or a stimulus. The incentives and disincentives to wetland conservation vary depending on the nature of stakeholder at hand. For example an incentive to a resource manager may be perceived as a disincentive to the resource user, investor or donor and vice versa. Below are some of the key local incentives for wetland conservation in Uganda.

Political will:

The impact that the National Wetlands Programme has had on wetlands' legislation in Uganda is considerable. There are four major recent legislation that recognise wetlands as an important natural resource, and have provisions for the regulation of their access and use. These are The Constitution of the Republic of Uganda (1995), The National Environment Statute (1995), The Local Government Act (1997), and The Land Act (1998).

Policy formulation and enactment:

In addition, in 1995 cabinet approved the National Policy on the Conservation and Management of Wetlands. The policy is now in place and is being implemented along with the various stakeholders in wetland conservation. The policy was developed through a process where the views were collected from the local communities and administration. The policy has now been translated into some common local languages.

Local Government support:

Under the Local Government Act, management of wetlands and most other natural resources like forests is decentralised to districts. At the district level, technical officers have been trained in the assessment of wetland resources and in conservation (wise use) planning, based on a National Wetland Inventory. At the community level, methodologies for local management of wetland resources are developed at selected demonstration sites and extended to new communities. Consequently, the programme in terms of training has increasingly targeted local stakeholders, district technical staff and community oriented service organisations, with follow up and general support, to enable them to become the agents of wetland policy implementation.

Ban on wetland drainage:

The potential importance of wetlands to national development and the threats that cause wetland degradation were recognised in 1986, when government banned further large scale drainage until a policy for their conservation and

sustainable use was put in place. This has considerably reduced the destruction in most of the country as the NWP goes ahead with implementation of the enacted policy.

Institutional set up of a government division:

Under the mainstream public service, wetland conservation and management has been given due recognition by the creation of the Wetlands Inspection Division under the Ministry of Water Lands and environment. A number of conservation organisations have wetland management components e.g. LVEMP, GEF/Biodiversity and EANHS.

Awareness to communities and stakeholders:

The NWP with support from both the central and local government has created awareness to local communities and other stakeholders. This has been through radio programmes, and drama in schools. In addition, wetland conservation is being considered by the National Curriculum Development Centre to be incorporated in the schools curricula.

Training of communities in wise use of wetland resources:

Local communities and administrative councils (LCs) have been trained to build capacity for conservation at lower levels.

Guidelines for use of the key resources:

The use and or misuse of resources is being redirected by formulation of resource use guidelines and by-laws. These are drawn through a participatory process where the communities take a big role. Uganda is divided into small administrative groups referred to as Local Councils (LCs), which have secretaries for environment at each level, and these are the entry points for conservation.

Added value to Local Products:

The NWP has developed a strategy to promote traditional crafts production and marketing. An example is the construction of a crafts centre at one of the Project sites in Masaka districts to promote the improvement and marketing of locally made crafts.

Development of alternatives to wetland resources for the communities:

A number of activities have been developed with communities in collaboration with district technical officers. These include among others, bee-keeping, fish farming and tree planting. These are expected to provide some benefits to communities while at the same time promoting the conservation of wetlands.

Local disincentives for wetlands conservation

Development versus Environment aspects:

In the process of encouraging investment, there has been a lot of laxity for government to stick to the strong principles of conservation. This has led to salvaging of some key wetlands around the urban centres to some developments, without due consideration that "development without environment may not last". An example is one of the key wetlands near the Kampala City, which is reputed for its filtration and purification role.

The old notion that Wetlands are wastelands:

Until recently, there was a common belief that "wetlands are just wastelands". The wetlands were considered as unutilised agricultural land and homes for man's enemies e.g. mosquitoes, den of criminals, and home to dangerous animals e.g. pythons.

Previous policies conflicting with new policies:

Due to land shortage in some parts of Uganda, there was a deliberate agricultural policy in the 1970s to encourage drainage of wetlands for agricultural development. This set a bad precedence for the current wetlands policy.

Lack of attachment of economic values (Cost/Benefit Analysis) to useful resources:

One of the setbacks to the justification for the need for allocation of resources to wetland conservation is lack of concrete data on the resources and their values. This also leads to the lack of recognition of wetland conservation compared to other development aspects like the establishment of industries, housing estates, highways, etc.

Trans-boundary nature of wetland benefits:

Though some communities can be convinced to sacrifice their adjacent lands, the benefits accrued from the conservation go beyond the custodians. It may thus serve as a disincentive if the communities, which are not putting in much effort, benefit at the expense of those who directly conserve the resource.

Lack of a Wetlands Act:

Though a policy is in place, some aspects of conservation need a clear specific legislation for wetlands. In Uganda, forest resources enjoy security from the Forest Act and it has been relatively easy to reverse negatives of past regimes in their management.

Challenges in wetland management

The wetlands in Uganda are vast and extremely important ecosystems. The NWP has succeeded in making this clear to the general public in Uganda, and has been able to have wetlands protected in the Constitution, the National Environment Statute, the National Wetlands Policy, and recently in the Land Act (1998). By now, the NWP has moved into the area of wetland management at district and local levels.

However, it is proving difficult to cover different aspects at all levels at the same time, especially when the team is small, the country large, and the issues are complex. With the Programme switching from a main emphasis on wetland policy and legislation to community operations, the NWP has learned that the development of a wetland policy is far simpler than its implementation. Now the NWP is in the process of implementation, and has confronted the following realities on the ground:

- ❖ Although the Land Act has probably clarified it to some extent, the ownership of wetlands remains a complex issue, which is variously interpreted by different stakeholders depending on their interest. However, in very few cases does a central or local management authority exist, with the ultimate power to give or withhold access and user rights to wetland areas. As a result, few of the guidelines on wise use of wetlands currently being developed by the NWP can be enforced. In addition, wise users of wetlands are usually not protected from other unwise users (abusers) who may disturb their management regime.
- ❖ The NWP has to deal with the legacy of previous government policy that encouraged the reclamation and development of wetlands. In Kampala most of the industrial areas were located in low-lying areas which in fact were wetlands. Up-country, until recently the government actually stimulated and facilitated the drainage of wetland and their conversion to agricultural land. The radical change in policy, from conversion to conservation, has not been fully internalised and accepted at all levels of society, including the judiciary and legal practitioners. Specific and focused sensitisation on this subject is needed.
- ❖ Wetlands in Uganda cover up to 13% of the surface area, and have tens of thousands of kilometres of wetlands edge. Almost everybody in Uganda lives near to a wetland edge, and the NWP has not the slightest possibility to reach even a fraction of wetland edge dwellers with practical demonstrations of wise wetland use.
- ❖ Environmental concern in Uganda is restricted to a limited group of well-educated urban elite. In the poor rural areas, survival, or at best, the immediate improvement of the poor living conditions is the issue.

Conclusions

It is our sincere belief that given the importance of the wetlands for Uganda, there is a continued need for a strong wetland institution in the country. The long-term role of this institution should be to ensure the effective implementation of the National Policy for the Conservation and Management of Wetlands in Uganda.

What wetland conservation means and how it relates to the development aspirations of the people of Uganda is summarised in the Policy itself:

“To sustain the (wetland’s) ecological and socio-economic functions for the present and future well-being of the people”

The principle concept underlying this aim is that the wetlands of Uganda constitute an enormous benefit and source of wealth that needs to be judiciously used, and fairly distributed among all people. This wealth must not be hijacked by a few individuals, or squandered by many in a desire for quick monetary gains. Within the framework of this concept, sustainable use is not only allowed, but also seen as positively desirable. This is because it is now believed that the more tangible are the benefits people receive from a (natural) resource, the more they are prepared to care for it wisely and with a view to the long-term sustainability of the resource. This explains the need to maximise economic incentives and minimise the disincentives

The strong Government support for wetland conservation and management during the last ten years is unique in Africa and beyond. If this support can be maintained in future, the National Wetlands Programme in the Ministry of Water, Lands and Environment will continue to yield considerable benefits for the country as a whole, and for numerous rural individuals, who depend, knowingly or unknowingly, for their daily sustenance on the proper management of wetland resources.

COMMUNITY BENEFIT SHARING AND PRIVATE SECTOR PARTNERSHIPS AS ECONOMIC INCENTIVES FOR WILDLIFE CONSERVATION AROUND NORTH-WESTERN PARTS OF THE SERENGETI NATIONAL PARK, TANZANIA⁶

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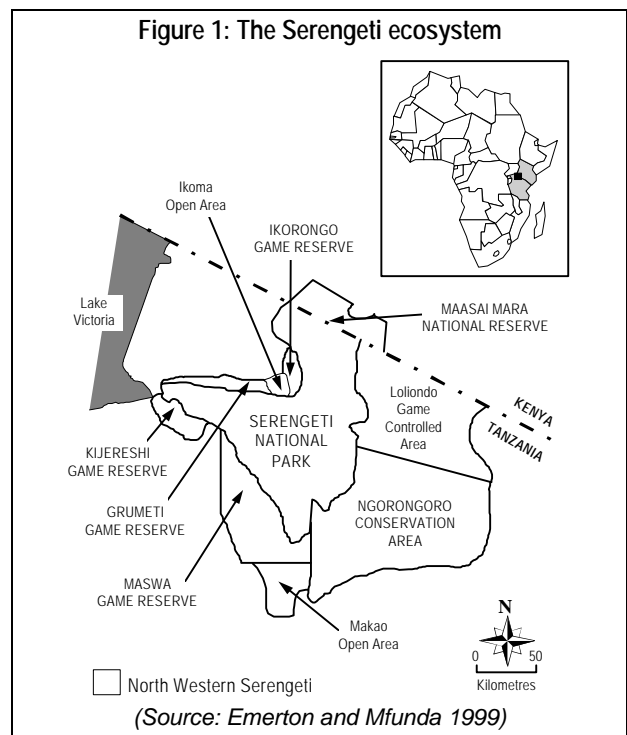
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Introduction

The Serengeti ecosystem

The Serengeti/Maasai-Mara Migratory Ecosystem is one of the most important cross-border conservation areas in East Africa. The Serengeti ecosystem spans some 25,000 km² of north western Tanzania and south western Kenya and, with its natural barriers which effectively prevent the emigration or immigration of large mammals, is primarily defined by the annual movements of the migratory wildebeest (Sinclair 1995). It is bounded by the north by the rangelands of the dry Loita and Mara plains of Kenya, to the east by the Loita Hills of Kenya and Gol Mountains of Tanzania, to the south by the Eyasi Escarpment of Tanzania and to the west by a band of cultivation extending to Lake Victoria. The Serengeti contains a range of vegetation types. Northern sections are characterised by rolling, wooded savannahs, south eastern parts feature virtually treeless plains, while further to the east the terrain rises steeply to massif highlands and forested areas (MNRT 1985).

The Serengeti has major conservation significance because of the large and varied wildlife populations it supports. Thirty species of ungulates and 13 species of large carnivores have been recorded in the region (Sinclair 1979), in addition to over 500 species of birds (TANAPA 1992). Savannah areas of the ecosystem are estimated to contain some 1.3 million wildebeest, 0.2 million zebra, 0.5 million gazelles, 7 500 hyena, 2 800 lion and a vast number of other ungulates and their attendant carnivores (Sinclair 1995). The region also encompasses the famous Ngorongoro Crater and the historic Olduvai Gorge, site of fossil finds of early man. These large populations of plains mammals and sites of cultural and historic heritage have national economic importance as a source of tourism earnings. The three strict protected areas in the Serengeti ecosystem – Maasai Mara National Reserve in Kenya, and Ngorongoro Conservation Area and Serengeti National Park in Tanzania – account for the majority of wildlife tourism bednights and income in each country (Emerton and Mfunda 1999).



⁶ This paper summarises work carried out by the *Serengeti Regional Conservation Strategy* (SRCS), a joint initiative between the Government of Tanzania Ministry of Natural Resources and Environment's Wildlife Department and NORAD. The Serengeti Regional Conservation Strategy has since 1985 been working in the Districts around the Serengeti National Park to integrate and reconcile conservation and development objectives so that each can be promoted without detriment to the other. It also draws heavily on a case study carried out by SRCS in collaboration with IUCN EARO as part of the *Evaluating Eden Project* of the International Institute for Environment and Development. This project aims to evaluate the environmental, social and economic dimensions and impacts of community wildlife management initiatives in East and Southern Africa.

Conservation problems

Like many other protected areas in East Africa, the ecological and biological integrity of the Serengeti is threatened by a number of conservation and human development problems. A major threat facing the ecosystem is the rapidly increasing human population. Rapid population growth puts more pressure on natural resources, and an eroded natural resource base in turn results in declining socio-economic indicators (Borrini-Feyerabend *et al* 1997). Population growth rates in the two Districts to the north-west of the Serengeti range between 2.22% and 3.26% (Evjen Olsen 1998), as compared to a national average for Tanzania of 2.8%. This trend, if unchecked, will almost certainly lead to an increase in the demand for good fertile land, and exacerbate the already-existing conflict between protected area managers and local people (Mfunda 1999).

Other challenges in the Serengeti include encroachment, poaching and inadequate management caused by the weak financial base, poor co-ordination and few trained personnel of the government agencies mandated with natural resource management in the area (SRCS 1998). Diminishing financial and human resources, together with increased pressure on natural resources, have generated conflicts that threaten to undermine conservation efforts around the Serengeti. The major reasons for these conflicts may be attributed to the competition for land, water, good grazing and lack of attention to the process of involving local people in wildlife planning, management and decision making.

The Serengeti Regional Conservation Strategy

In response to these conservation and development problems, a regional project – the Serengeti Regional Conservation Strategy (SRCS) – has been initiated. The SRCS has since 1985 been working in the Districts around the Serengeti National Park to integrate and reconcile conservation and development objectives so that each can be promoted without detriment to the other. Its objective hinges on the need for a change in attitude and approach away from the protectionist approaches that been employed around the Serengeti to date, and have resulted in conflict between park authorities and local communities. The SRCS has defined its main challenges as being to:

- ❖ Give equal weight to fulfilling the basic needs of local communities and to strengthening the protection of the region's conservation areas;
- ❖ Create awareness of present resource problems and their underlying causes
- ❖ Design activities to resolve resource-use conflicts;
- ❖ Engage in a continuous process of communication between, and awareness building in, local communities and central, regional and district levels of government.

This paper describes some of the ways that the SRCS has attempted to set in place local economic incentives for wildlife conservation.

Existing benefit-sharing activities

To date local communities, while bearing many of the opportunity costs associated with wildlife conservation in terms of restrictions on their land and resource utilisation, have reaped few benefits from the protected areas in the Serengeti ecosystem (Emerton and Mfunda 1999). These economic inequities have been a major source of conflict between local communities and park authorities. Several methods have been applied by the SRCS and other government authorities in providing direct and tangible benefits from wildlife-related activities to local people. These are described below, and include a community wildlife utilisation scheme, community development funds and revenue-sharing activities, and are described below.

The community wildlife utilisation scheme

This activity was initiated in 1993, with the objective of providing direct benefits in cash and kind from wildlife to local people. It also aims to reduce and legitimise poaching of wildlife, which was being widely practised in the area.

Under the community wildlife utilisation scheme, a quota for wildlife cropping is set and endorsed by the government Department of Wildlife at the request of local communities. Cropped meat is then sold in local markets, at a price set by villagers themselves, and other trophies such as hides and horns are also marketed. Funds raised are put into Village Natural Resource Funds and used for community development activities, with the assistance of government District Authorities, Tanzania National Parks Authority and the SRCS. As illustrated in the table below, significant revenues have been raised for villages by the sale of game meat.

Table 1: Income from community wildlife utilisation scheme in selected villages around the Serengeti

Village	Sales of skin (TSh '000)	Sales of meat (TSh '000)	Total income (TSh '000)
Robanda	565.8	62.2	628.0
Natta-Mbiso	248.3	62.2	310.5
Iharara	221.5	56.0	277.5
Mugeta	275.1	43.6	318.7

Mariwanda	275.1	52.2	327.3
Hunyari	289.0	26.1	315.1
TOTAL	1874.8	302.3	2177.1

(Source: SRCS 1997)

The introduction of this scheme has improved substantially the benefits directly accruing to villages from wildlife. As well as increasing the amount of protein made readily available on local markets and undermined illegal poaching activities, it has earned income and supported a wide range of basic community infrastructure developments.

Community development funds

Several arrangements exist by which direct income is earned from wildlife by local communities, including – as well as the community wildlife utilisation scheme described above – various payments made by tour operators. With the assistance of the SRCS, a series of Village Natural Resources Funds have been established in order to administer these earnings and ensure that they are spent in a way which translates into benefits for all community members. Village Natural Resources Funds are administered by elected local committees in a transparent manner, and are used to finance development activities for the benefit of the whole village – such as schools, clinics, infrastructure maintenance and small-enterprise developments. Some of these projects are listed in the table below.

Table 2: Use of Village Natural Resource Funds for development activities

Village	Development activities
Robanda	<ul style="list-style-type: none"> • Construction of nurses houses • Construction of natural resource committee offices • Construction of classrooms • Purchase of milling machine • Purchase of essential drugs • Running of water pump
Hunyari	<ul style="list-style-type: none"> • Construction of dispensary • Construction of natural resource committee offices
Mariwanda	<ul style="list-style-type: none"> • Construction of teachers houses • Construction of primary school classrooms • Construction of primary school office
Natta-Mbiso	<ul style="list-style-type: none"> • Construction of teachers houses • Roofing primary school classrooms • Construction of primary school pit latrines

(Source: Mfunda 1999)

Revenue-sharing

The two districts to the north-west of the Serengeti – Bunda and Serengeti – receive a proportion of revenues from hunting activities in the Game Reserves and Open Areas outside the strict Serengeti National Park. These revenues are earmarked for general development activities in the area. As illustrated in the table below, hunting revenues make a substantial contribution to District revenues and development activities – perhaps as much as 80% of their total budgets (SRCS 1992).

Table 3: Serengeti and Bunda District hunting revenues

	Tourist hunting (US\$)	Serengeti District resident hunting (US\$)	Bunda District resident hunting (US\$)
1990	6,064	na	2,780
1991	3,874	749	1,307
1992	11,751	1,122	2,257
1993	8,879	809	1,318
1994	10,308	na	na
1995	9,970	na	na
1996	4,863	na	na
1997	11,397	na	na
1998	7,671	2,521	4,411

(Source: Emerton and Mfunda 1999)

The economic impacts of existing benefit-sharing activities

The initiatives described above that have been undertaken by SRCS and other government authorities have increased significantly the level of local economic benefits accruing to communities living around north-western parts of the Serengeti. However, although benefit-sharing activities have undoubtedly improved local perceptions of wildlife, led to local development gains and enhanced relationships between park authorities and the villages around the Serengeti, it is not clear whether they have provided adequate incentives for community members to conserve wildlife, or to consider its presence to be an economically desirable or viable land use option. They are limited both in their scope and in the quantity of funds they raise.

Landholders around the Serengeti continue to bear substantial costs from wildlife – in terms of direct damage caused to crops and other agricultural enterprises, as well as through the opportunity costs of land and resource utilisation activities foregone. Furthermore, while these costs accrue as cash and livelihood losses, most benefit-sharing activities provide only indirect benefits through improving general infrastructure and thus have little impact on household cash income, subsistence or livelihood security. In common with other protected area buffer zones in Eastern and Southern Africa (Emerton 1998), many of the members of communities around the Serengeti still feel that they lose out in economic terms from wildlife. With high levels of poverty and unemployment, limited and insecure livelihoods, and in the face of rapid population growth and rising pressure over land and other resources, it is doubtful whether benefit-sharing activities are proving sufficient conditions for the majority of community members around the Serengeti to be economically willing, and economically able, to conserve the wildlife on their lands.

Ways forward in community-private sector partnerships

Recognising that indirect benefit-sharing arrangement may not, by themselves, provide sufficient economic incentives for local wildlife conservation, SRCS has begun to take the concept of community wildlife gain a step further. Especially, private-sector tourism activities have been identified as having major potential for increasing the local economic gain from wildlife.

As well as generating direct income flows to the villages around the Serengeti, such arrangements have the potential to increase the degree to which community members participate in making decisions and choices about the wildlife on their lands, and extend the responsibility for local benefit-sharing beyond government alone. Under partnerships between communities and the private sector, the government's role is becoming much more of a regulatory and advisory one – which may ultimately be more sustainable, given severe and increasing public sector constraints in terms of funds and human resources. It is also a role that is supported more broadly by the on-going liberalisation, privatisation and devolution of the role of the public sector in the Tanzanian economy as a whole.

SRCS has recently helped to initiate three new forms of community-private sector partnerships, which have the aim of increasing direct local economic gain from wildlife. These are described below, and include joint ventures, land leases and tourist hunting activities in Wildlife Management Areas.

Joint ventures

The development of wildlife-based local enterprises around protected areas can play a crucial role in supporting community conservation. SRCS has recently started to initiate and co-ordinate joint wildlife business ventures between external investors and landholders. To date one such arrangement has been facilitated – the development of land adjacent to Grumeti Game Reserve for a wildlife viewing camp to be run as a joint venture partnership between a foreign-owned company and a local village. In this enterprise the Village Council will hold equity and be paid land rent and bednight levies, and has additionally negotiated for casual staff and management trainees to be provided from local sources and for the funding of a micro-credit scheme from lodge profits.

Land leases

Land leases are another way in which local communities can gain directly from private sector wildlife-based tourism. In the area bounded by Serengeti National Park, Grumeti and Ikorongo Game Reserves SRCS has assisted in the negotiation of a lease agreement between a safari company and the Village Council. This land lease permits a wildlife viewing camp to use village land as a base for its operations in return for an annual rental fee, the payment of a fixed levy on income from accommodation, and contributions made towards the cost of local infrastructure provision and maintenance.

Tourist hunting in Wildlife Management Areas

Recent changes in Tanzania's national wildlife policy establish a new category of land use in wildlife areas – Wildlife Management Areas (WMAs). WMAs allow villages the power to decide on how best to zone different types of wildlife use such as hunting, game viewing and live capture (MNRT 1995).

SRCS is giving increasing attention to the signing of Memorandums of Understanding between government and communities, and the development of WMAs as areas to be used by villages for local economic gain. Under these arrangements, SRCS is proposing the allocation of key wildlife species – such as lion, buffalo, leopard and zebra –

to local communities, so that they can be auctioned for live capture or hunting, at prices and under terms acceptable both to private investors and villages. This would provide a significant level of income for Village Natural Resource Funds.

Conclusions

While traditional benefit-sharing activities between government and local communities are important and necessary conditions for making wildlife conservation into an economically desirable, and viable, land use option for local communities, by themselves they may not be sufficient. The experiences gained by SRCS demonstrate that there are a range of ways in which the traditional benefit-sharing concept can be extended, and the local economic gains accruing from wildlife can be increased. Of particular importance in the Serengeti has been the development of financial arrangements between private sector tourism operators and local communities. Tourism provides an excellent economic tool for increasing community benefit from wildlife, and thus reducing conflict over resources around protected areas. Innovations in the way that communities and the private sector interact in wildlife use and management have great potential to alter the local economic balance of wildlife.

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MARKET-BASED ECONOMIC INCENTIVES FOR NATURAL WOODLAND CONSERVATION IN THARAKA, KENYA⁷

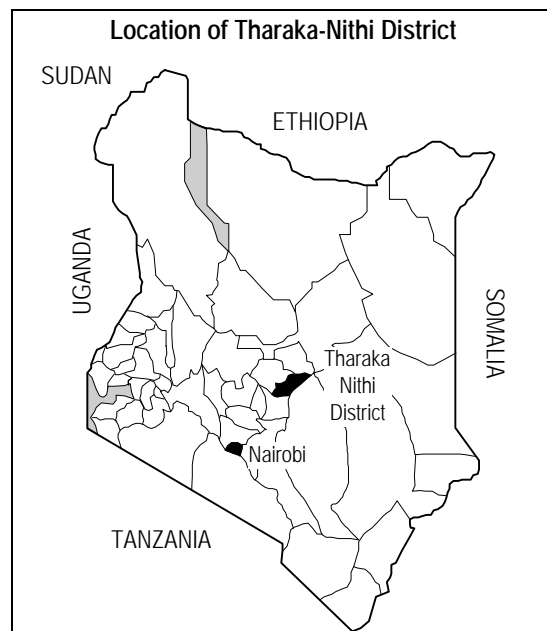
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Introduction

This paper looks at the provision of market incentives for forest conservation and livelihood development in Tharaka through the development of commercial uses of trees, focusing on one species – *Melia volkensii*. Tharaka Nithi District lies in eastern Kenya, stretching from Nithi on the wet and fertile slopes of Mount Kenya down to the drylands of Tharaka. The vast majority of Tharaka is remote and dry – rainfall is uncertain, agriculture unreliable and transport and communications poorly developed. There is frequent drought, and livelihoods are insecure. In recent years, as the population has grown and become more sedentary, available sources of income and subsistence have become more limited and pressure on the natural resource base has grown. Land exhaustion, soil erosion and woodland loss are all occurring. As well as contributing to biodiversity degradation and loss, this deprives households of a vital source of subsistence production and emergency fallback.

Given these severe agroclimatic and infrastructural constraints, finding secure and sustainable sources of livelihood is a major problem in Tharaka. The majority of Tharakan households are poor and lack opportunities to expand or improve their agricultural production base. With only limited cropping and livestock possibilities, households are constantly searching for additional sources of subsistence and income.



Tree products already make a major contribution to Tharakan livelihoods. They provide a wide range of subsistence items and – to a limited extent – cash income, and play an especially important role for poorer farmers and women. The development of a broader commercial base for tree products has great potential for improving rural livelihoods in Tharaka as well as providing incentives for households to conserve indigenous tree resources. A major challenge is to find sustainable ways of generating cash and non-cash income from trees, to ensure that an adequate proportion of this income accrues to households in the arid and semi-arid areas of the District, and to ensure that these trees also provide substantial subsistence benefits within farm households.

Livelihoods in Tharaka

Tharaka Nithi District covers an area of nearly 2 300 km², with a population of approximately 300 000 people. It can be broadly divided into two agroclimatic and socio-economic zones: Nithi and Tharaka. Nithi lies mainly in the high and medium potential lands (HMPL) tea and coffee zones of the slopes of Mount Kenya, where land is fertile, annual rainfall is high at around 700-2 500 mm, and markets and infrastructure well developed. In contrast, Tharaka is comprised of the remote arid and semi-arid lands (ASAL) and semi-desert running towards the Tana River, where agricultural possibilities are limited and rainfall is below 500 mm a year.

⁷ This paper summarises selected findings from a 3 year research project *The Economic Value of Tree Products in Semi-Arid Tharaka, Kenya*, funded under the Forestry Research Programme of DfID and carried out in collaboration between the Kenya Forest Department, Kenya Forestry Research Institute, Policy Research Group Kenya and University of East Anglia. The project will end on August 31 1999.

Although the HMPL of Nithi constitute only one fifth of the total area of the District, they contain nearly two thirds of its population. In contrast the ASAL of Tharaka comprise over three quarters of total land area but contain only a third of the District's population. HMPL and ASAL areas of Tharaka Nithi District are closely linked through a number of resource flows. Natural resources, including tree products and human labour flow upwards from ASAL to HMPL while income, food and processed goods flow downwards.

Traditionally, most land in Tharaka was managed under subsistence-based extensive agro-pastoralist and shifting cultivation systems of production. More recently, farmers have been shifting downwards from Nithi to Tharaka, landholdings have become consolidated and individualised and population pressure has risen sharply. As land has become increasingly scarce, farming systems have become intensified and become more crop-based, and population densities have more than doubled in the last decade, from under 30 persons per km² in 1979 to over 70 persons in 1989 (CBS 1979 and 1989).

Today 90% of land is under permanent arable production (Sutherland and Ouma 1995), including millet, sorghum, cowpeas, green gram, cotton, groundnut and sunflower. There has been little development of infrastructure, services or markets and average per capita incomes lie well below the national for Kenya at US\$ 150 (Emerton 1991). Regular drought and uncertain rainfall mean that livelihoods are extremely insecure, population growth and land pressure have constricted agricultural production bases. Although agriculture forms the basis of production, towards the drier parts of Tharaka, a seasonal rainfall of 130 mm is reached in only 6 out of 10 years (Sutherland and Ouma 1995) and even drought tolerant crops can be expected to fail for two out of three years. Most households experience severe food shortage from late September through to late December. This problem is particularly acute for poor households, who often sell their food crops shortly after harvest to raise cash.

There is a clear need, under continuing and increasing cash scarcity and agricultural uncertainty, for households in Tharaka to find additional sources of income and subsistence which supplement their existing livelihoods and can be maintained over the long-term without degrading the natural resource base. This paper describes how one tree species – *Melia volkensii* – may help to meet some of these needs.

Existing tree values in Tharaka

There is a long history of indigenous tree use in Tharaka, and some species have been domesticated over time through farm forestry (Blomley *et al* 1991a, 1991b). Many of the trees planted on farms – or left on farms after bush clearing – have multiple uses, such as *Tamarindus indica* (*muthithi*), whose fruits are sold locally and supplement farm income, whose branches provide shade for animals, crops and people, leaves provide green manure, which is used to hang beehives and bark and is widely used for human medicine.

Trees have a high livelihood value in Tharaka because they provide support to household subsistence. They yield a wide range of products, including fuel, shelter, fodder, foods and medicines. Understanding the diversity of this tree use, and its value in local livelihood terms, forms a first step in identifying the potential for broadening tree use and income generation.

The value of tree products in Tharaka extends beyond their direct uses. Tree products generate vital support to livelihoods by producing goods for fuel, shelter and food which are unavailable or unaffordable elsewhere for many households. They also support agriculture – the basic means of production for most of the population – through providing goods such as manure and fodder as well as helping to improve on-farm soil conservation and productivity.

Trees also form a source of insurance and fallback. As is the case in many other parts of dryland Africa (see Barrow 1996), they are used as contingency measures, and increase livelihood resilience in the face of risk and uncertainty. In an uncertain environment, Tharakan livelihoods are characterised by their adaptability and change, and by the interdependency and substitutability of different elements of production and consumption. As particular sources of food, fodder and fuel become scarce over the year as a result of drought, lack of cash or crop failure, a variety of fallback sources are used to substitute and supplement for scarce or missing goods. Many of these alternative or substitutes come from trees. For example wild fruits provide drought foods when crops fail, leaves and pods provide livestock fodder when there is no pasture. This influences the choice of trees which are maintained or planted on people's farms, many of which are multiple use trees and can simultaneously generate a range of subsistence products.

In general, commercial tree use is however poorly developed in Tharaka. Where sales of tree products take place, the vast majority of income accrues to middlemen and professional marketing bodies rather than to the farmers who grow them. Farmers realise low rates of income from trees because there is only a small value added at the household level, the prices they receive are low and markets are undeveloped. Lack of technical and market information about trees is a major constraint to farmers wishing to expand their income and production base.

Despite the lack of effective markets, a range of existing indigenous trees uses have market applications, although these are poorly developed. These include fruits (e.g. *Balanites aegyptica*, *Tamarindus indica*, *Adansonia digitata*, *Combretum aculeatum*, etc); gums, oils and resins (e.g. *Acacia senegal*, *Berchemia discolor*, *Hyphaene compressa*);

hats, baskets and mats (e.g. *Hyphaene compressa*, *Adansonia digitata*, *Phoenix reclinata*, etc); honey-supporting species (e.g. *Acacia spp.*, *Albizia spp.*, etc): and numerous medicinal trees. Indigenous trees which are currently used may have a range of additional applications, or existing uses may be further developed – especially in commercial terms. A major challenge is to identify ways in which trees can be used as a source of income by farmers in Tharaka. *Melia volkensii* is one tree species which can help to meet these needs.

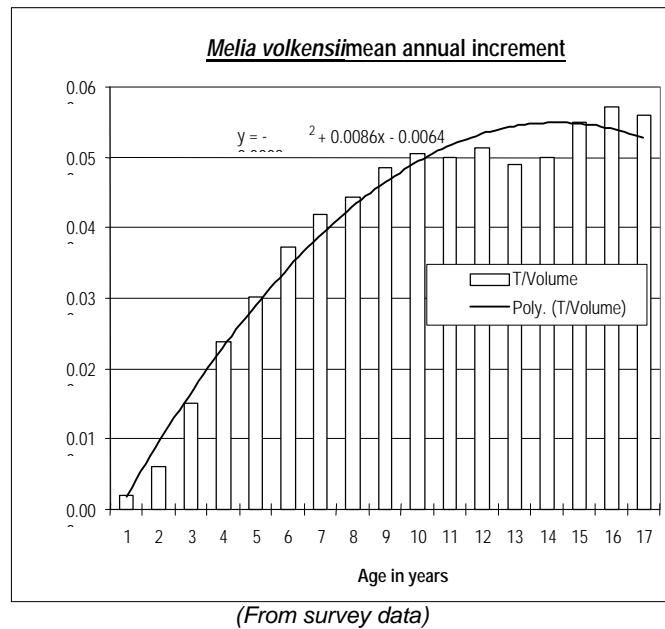
Uses and potential of *Melia volkensii*

One tree species which can make huge contributions both to the livelihood security and the cash income of households in Tharaka is *Melia volkensii*. Already found widely on farms, and already playing a major role in household subsistence, *Melia* also has significant market potential. Through the further development of markets for its products, *Melia* may provide a means to helping to overcome the vicious cycle of poverty in which many farmers are entrapped – that which is precipitated by unreliable weather conditions, low crop yields, low cash income, poor infrastructure and insecure livelihoods.

Melia volkensii is a deciduous tree that can attain 6-20 metres in height, occurring mainly in dry bushland and woodland, and in wooded grasslands (Beentje 1994). It occurs from southern Somalia down into northern Tanzania and is widespread – both on and off farms – in Tharaka. Major uses of *Melia* include timber, fuelwood, medicines, fodder, bee forage, mulch and green manure. Three of these uses – timber, fodder and carving wood, are further analysed in this paper, because they have the greatest potential importance in cash income and livelihood terms to farmers in Tharaka.

Timber potential

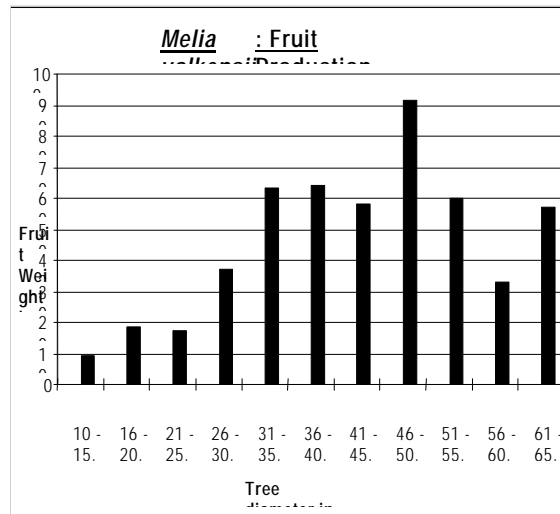
The use of *Melia* for timber production, already taking place to a limited extent, has much potential for further development. *Melia volkensii* is a very fast growing tree – even faster than many of the commercial exotic species (such as *Azadirachta indica* and *Grevillea spp.*) which have been promoted by donors, research institutes and forestry extensionists in arid and semi-arid lands. At an age of 10 years the tree has a diameter at breast height (dbh) mean annual increment (MAI) of 2.8 cm, reaching an average diameter of 28 cm. The total volume yield at this age and diameter is over 0.5 m³ of wood and a merchantable stem volume of 0.22 m³. From analysis, tree growth picks up at 6 years, and the rate of increase in MAI starts to decline after 10 years (shown in the accompanying graph). These data from Tharaka are comparable to data collected in other parts of arid and semi-arid Eastern Kenya. This age of 10 years, which is when farmers in Tharaka tend to fell *Melia*, is comparable to the maximum point of volume increase, that in turn translates into biological rotation.



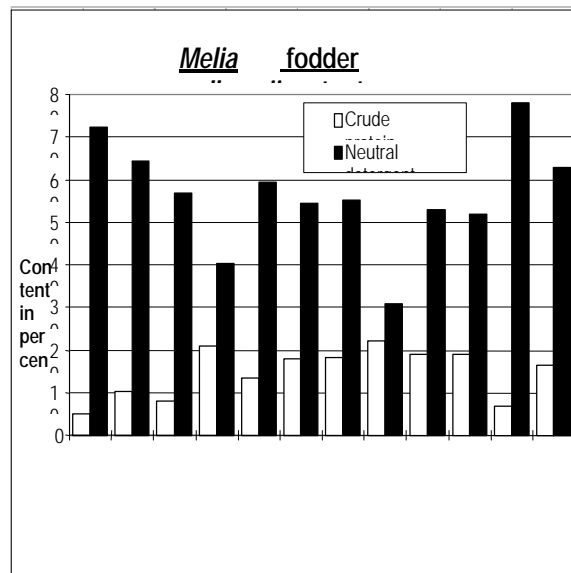
Although *Melia* is not yet well-established in the market, there is a growing demand for its timber. Already dealers from upper parts of Nithi District are coming down to Tharaka, because other sources of timber are becoming progressively more scarce in higher potential areas of the District.

Fodder potential

Many farmers in Tharaka already use *Melia* leaves and fruits as a source of dry-season livestock fodder. *Melia* produces flowers and fruits twice a year, with fruit becoming ripe at the end of the dry seasons as the leaves emerge. Trees can yield up to 100 kg of fruits per year (as shown in accompanying graph). *Melia volkensii* fodder is viewed in Tharaka to be of high quality for both cattle and goats. The tree comes into leaf, and is pruned for fodder, towards the end of the dry season. This is a time when other sources of fodder are extremely scarce in Tharaka, and when livestock become short of food. *Melia* leaves have a very high protein content (21%) as compared to conventional dairy feeds (an average of 16%) (as shown in accompanying graph). Livestock also feed on fallen fruits.



(From survey data)



(From survey data)

Carving wood potential

Although at present there is almost no use of *Melia* for carving wood, there are indications – both from within Tharaka and from other areas where there is a high demand for carving wood – that there may be much potential for its development. Tharaka lies close to some of the major carving areas in Kenya, where traditional carving species are becoming difficult to access, and expensive to buy. Carvers are already starting to come into Tharaka searching for new sources of raw materials, and *Melia* is already starting to be used as an alternative to the most popular species of carving wood. Preference for carving wood is based on many attributes, including durability, resistance to insects, workability, density and aesthetic value. As described in the table below, *Melia* has many of these characteristics, and compares well with many of the traditionally popular carving wood species. The sale of *Melia* for carving wood can provide an important market for farmers, and generate significant income.

Macroscopic features and densities for selected carving wood species in Kenya

	Pores	Colour	Growth rings	Grain	Texture	Rays	Density
Traditionally favoured species:							
<i>Brachylaena huillensis</i>	NVNE	Grey/yellow	Distinct	Straight	Fine	NVNE	Heavy
<i>Dalbergia melanoxylon</i>	NVNE	Purple/black	Distinct	Straight	Fine	VHL	Heavy

<i>Olea europaea</i>	NVNE	Brown/yellow	Distinct	Straight	Fine	VNE	Heavy
<i>Melia volkensii</i>	VHL	Pink/yellow	Distinct	Straight	Medium	VHL	Moderate-heavy
Other alternatives:							
<i>Terminalia Brownii</i>	NVNE	Yellow/brown	Distinct	Interlocked	Medium	VHL	Moderate-heavy
<i>Terminalia pruniodes</i>	VHL	Brown/yellow	Distinct	Interlocked	Medium	VHL	Moderate-heavy

NVNE-Not visible to the naked eye, VNE- Visible to the naked eye, VHL- Visible with hand lens.

Density: Heavy- >0.75g/cm³, Moderate-0.4g/cm³ to 0.74g/cm³, Light-<0.4g/cm³.

(From survey data)

Economic analysis of *Melia volkensii* at the farm level

Already used for subsistence purposes, such as fodder, firewood and manure, and with a demonstrable potential for income-generation through such products as timber and carving wood, an important question is whether the further development of *Melia* uses and markets makes financial and economic sense for farmers in Tharaka.

Analysis has been made of the costs and benefits of growing *Melia* for farmers. These calculations are based on existing land uses and market prices in Tharaka. They assume a 10 year rotation of *Melia volkensii* – that which farmers already carry out, and that which is optimal in productivity terms. They taken into account both the costs and benefits of production of *Melia* and crops.

Two calculations of the financial desirability of *Melia volkensii* can be made – one based on the use of fallow land, and one on integration with crops. For both these analyses it is currently impossible to quantify the economic contribution of subsistence products of *Melia* such as fodder, bee forage and manure, the environmental impacts such as improved soil fertility, windbreak and crop shelter or the social benefits such as reduced fuelwood and livestock grazing-related labour, improved cash availability, increased livelihood diversity and enhanced security in dry seasons and drought⁸. The analyses look at the cash returns to *Melia* fuelwood and timber, and compare this to the value of crops. Subsistence uses and environmental benefits will further add to the overall economic desirability of *Melia*. This study merely assesses whether, in cash terms, it is worthwhile for farmers to grow *Melia* on their farms, and to thereby simultaneously achieve other subsistence, social and environmental goals.

As shown in the table below, which *Melia* competes well as an alternative to crops, in purely financial terms. Average returns to cropping (once the costs of labour and other inputs have been deducted, and using local crop mix, yields and price data) are only just under KSh 3,000 or KSh 27,780 over 10 years (at the time this study was carried out there were approximately 60 KSh to 1 US\$). Over a 10-year rotation, grown on fallow land, *Melia* can generate cash benefits in excess of KSh 255,000 per acre – nearly ten times as much as this. Taking into account the both opportunity cost of crops foregone and the time factor involved in tree production, this gives a net present value over 10 years, discounted at 10%, of KSh 66,609.

Returns for *Melia volkensii* per acre of fallow land (KSh/acre)

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Timber income											245,150
Fuelwood income											10,300
Planting labour	-900										
Seedlings purchase	-2,380										
Pruning labour			-260		-345	-797	-964				
Tools purchase		-660									
Loss of crops	-2,778	-2,778	-2,778	-2,778	-2,778	-2,778	-2,778	-2,778	-2,778	-2,778	-2,778
Net income	-6,058	-3,438	-3,038	-2,778	-3,123	-3,575	-3,742	-2,778	-2,778	-2,778	252,672
Net present value	66,609										

It is however far more likely that farmers will continue to combine crop and tree production – this is already the case among the few farmers who do cultivate *Melia*. Here, crops are continued to be grown alongside *Melia* until the 5th year, after which trees have acquired ecological dominance. In effect this means that each field is given 5 years of fallow – this again fits in well with local farming systems, where land is usually cultivated for 3-4 years and then left to fallow for 5-10 years. In line with average farm sizes in Tharaka (23 acres), cultivated areas (3 acres) and labour availability, and recognising the need to keep at least parts of farms under natural woodland pasture, it is possible for most farmers to put 5 acres under an integrated production system and plant half an acre with *Melia* every year. This means that at any one time, once the system is up and running (after the 10th year in production), 3 acres will always be under crops and there will be a continuous stream of income from *Melia*.

Even over the first nine years, before the system is fully established or a continuous flow of tree income is coming in, farmers will receive income from crops of between KSh 6,000 and KSh 12,000 a year. Once the system is established – after the 10th year – the net returns to a five acre combined tree and crop area is more than KSh 128,000 a year or KSh 25,600 per acre (as illustrated in the table below), comprised of crops for home consumption and for income, and tree income. Over a ten year period the system will yield a positive net present value of some KSh 111,000 or just over KSh 11,000 an acre.

**Returns for *Melia volkensii* per 5 acres of combined trees and crops
(KSh/year once system is up and running)**

	KSh/5
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⁸ These uses are being valued as part of the research project, but these data are not yet available.

	acres
Timber income	122,575
Crop income	8,334
Fuelwood income	5,150
Planting labour	450
Seedlings purchase	1,190
Pruning labour	1,183
Tools purchase	66
NET INCOME overall	128,020
NET INCOME per acre	25,604

Conclusions

Trees already play an important role in rural livelihood systems in Tharaka – mainly as a source of subsistence products such as fuelwood, fodder, wild medicines and emergency foods, and as a contingency in terms of stress and drought. The example of *Melia volkensii* demonstrates that they can also be used as a tool to strengthen livelihoods still further, increase household economic security and diversity, and both financially and economically benefit farmers.

Planting part of farms with *Melia*, which already occurs naturally, can significantly enhance farm income over crop production alone. At the same time it increases the supply of products which are important for household subsistence, such as fodder, bee forage, manure, fruits and firewood. It can do this without interfering with, or diminishing the farm area available for, existing land use systems – most importantly pasture and crop production – and actually strengthens these other systems (through contributing to soil fertility and crop protection, and ensuring that there is adequate fallow, thus guarding against soil exhaustion, and through providing dry-season food sources for livestock herds). It also, by increasing the income generated from a given area of the farm, puts farmers in an economic position where they can afford to keep at least part of their land outside crop production – under natural mixed woodland. This is important in livelihood security terms (these areas of natural woodland provide a vital source of pasture, wild foods and medicines, honey, firewood, and many other products to the household, as well as providing emergency goods and fallback in times of stress), and also makes a significant contribution to natural woodland biodiversity conservation in Tharaka.

Markets for tree products such as those yielded by *Melia* are already starting to develop in Tharaka. There is an extremely high demand for tree products such as timber, carving wood and woodfuel, both within Tharaka, from higher potential Nithi District, and from surrounding areas. This study shows that supporting the development of these markets, and enhancing the ability of Tharakan farmers to supply them, may be a means of both improving local livelihoods and of conserving biodiversity.

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CONCLUSIONS AND RECOMMENDATIONS OF THE WORKSHOP

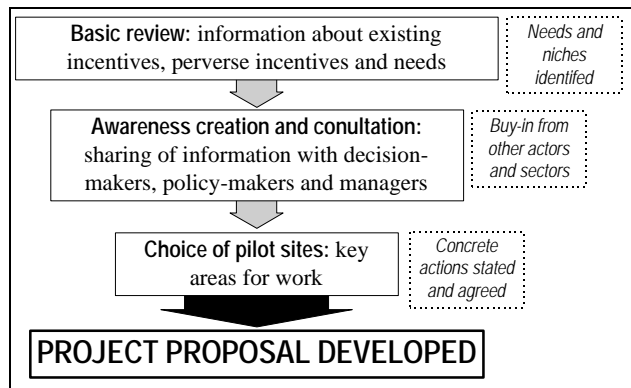
The overall conclusions of the workshop were that:

- ❖ There are few economic incentive measures integrated into biodiversity conservation in Eastern Africa;
- ❖ There are economic disincentives to biodiversity conservation that need to be overcome in Eastern Africa;
- ❖ There is a need to set in place positive economic incentives for biodiversity conservation in Eastern Africa.

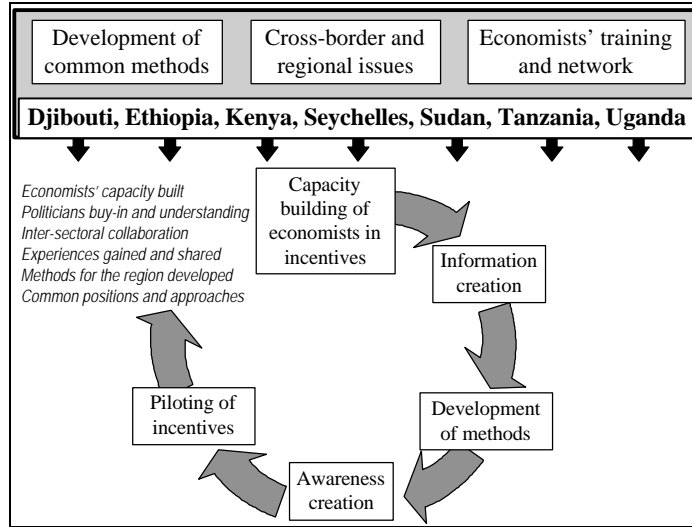
Each break-out group identified key needs, niches and areas for the use of economic incentives for biodiversity conservation in Eastern Africa. These are summarised in the table below.

RURAL COMMUNITIES	PRIVATE SECTOR	GOVT (DEVT)	GOVT (ENVT)	NGOs
<ul style="list-style-type: none"> • Empowerment • Collaborative ventures • Benefit-sharing • Alternative income • Harmonisation of transboundary policies and practices 	<ul style="list-style-type: none"> • Integration of biodiversity into lending • Biodiversity awareness • Work on demand and markets • Encourage rehabilitation of industrial sites 	<ul style="list-style-type: none"> • Biodiversity-replacing production activities • Provision of resource rights • Incentives for clean technologies and energy use 	<ul style="list-style-type: none"> • Biodiversity utilisation • Improved harvesting technologies • Financing of community programmes • Research and information into use of innovative incentive measures • Regional initiatives 	<ul style="list-style-type: none"> • Joint management • Biodiversity enterprises • Improved gear and methods • Community finance and funds • Waste management

An economics core working group developed these recommendations further into a detailed strategy and plan of action. This resulted in clear agreement to fully develop a proposal, at country and regional levels, in the use of economic incentives for biodiversity conservation in Eastern Africa. This process of project development is summarised below:



Taking into account the different views, needs and interests of members of workshop participants, the broad content and form of project actions were agreed. This is summarised below:



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