

Environmental,
social and
economic
assessment of
the fencing of
the Aberdare
Conservation Area

Executive Summary, September 2011



A report for: The Kenya Wildlife Service, Kenya Forest Service, Kenya Forests Working Group, United Nations Environment Programme and Rhino Ark

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Acronyms and Abbreviations

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ACA	Aberdare Conservation Area
BCR	Benefit Cost Ratio
BCS	Biotope Consultancy Services
CBA	Cost Benefit Analysis
CFA	Community Forest Association
EIA	Environmental Impact Assessment
EMCA	Environment Management and Coordination Act
GIS	Geographical Information System
GPS	Geographical Position System
GWh	Gigawatt Hour
Ha	Hectare
KEFRI	Kenya Forestry Research Institute
KenGen	Kenya Electricity Generating Company
KFS	Kenya Forest Service
KFWG	Kenya Forests Working Group
KG	Kilogramme
KM	Kilometre
KPLC	Kenya Power and Lighting Company
Kshs	Kenya Shillings
Kwh	Kilowatt Hour
KWS	Kenya Wildlife Service
NDVI	Normalized Difference Vegetation Index
NPV	Net Present Value
NTFP	Non Timber Forest Products
PA	Per Annum
PELIS	Plantation Establishment and Livelihood Systems
PES	Payment for Environmental Services
RA	Rhino Ark
UNEP	United Nations Environment Programme
USD	United States Dollar
WRUAs	Water Resource Users Associations
WRMA	Water Resources Management Authority

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Introduction

This study was carried out to assess the environmental, social and economic effects of the electrified fence around the Aberdare Conservation Area – a length of fence of nearly 400 km. The construction of the fence took nearly twenty years of planning, fund raising and mobilization of government, donor, private partners and adjacent communities' resources. A study carried out by Butynski (1999) identified a physical barrier as a necessity for the ACA to:

- a) Prevent wildlife from moving out of the ACA, therefore reducing human-wildlife conflicts
- b) Protect the significantly important habitats, species and overall diversity the ACA offers by reducing encroachment, over exploitation of the ACA's natural resources and
- c) Allow management authorities to control and better manage the ACA resources in a sustainable manner

The electrified fence was expected to allow for the regeneration of species, protection of one of Kenya's main water sources and protection for the fence-adjacent communities from marauding wild animals. The value of the fence can therefore be seen in terms of:

- a) Human life and property
- b) Water – for human and economic uses
- c) Land values
- d) Tourism
- e) Carbon credits
- f) Natural environment

With the completion of the fence in August 2009, Rhino Ark and partner institutions commissioned Biotope Consultancy Services (BCS) in February 2010 to carry out an environmental, social and economic assessment of the fencing of the Aberdare Conservation Area (ACA). The specific objectives of the consultancy were to:

- a) Carry out an assessment of the fencing of the Aberdare Conservation Area in order to guide its future management as well as management of the ecosystem.
- b) Provide an in-depth review of fencing as a tool to help sustainably manage a conservation area adjoining settlements, such as the Aberdare Conservation Area.
- c) Assess the land use and land cover changes within ACA and adjoining areas from 1988 (inception of the ACA project) to the year 2010 (completion of the project).
- d) Assess the effect of the fence on vegetation within ACA and adjoining areas.
- e) Assess the effects of the fence on human encroachment (settlement and cultivation) and fires on the Aberdare ecosystem.
- f) Assess the effect of the fence on land use/cover recovery in the ACA and adjoining areas and the effects on hydrological characteristics of rivers emanating from the ACA.

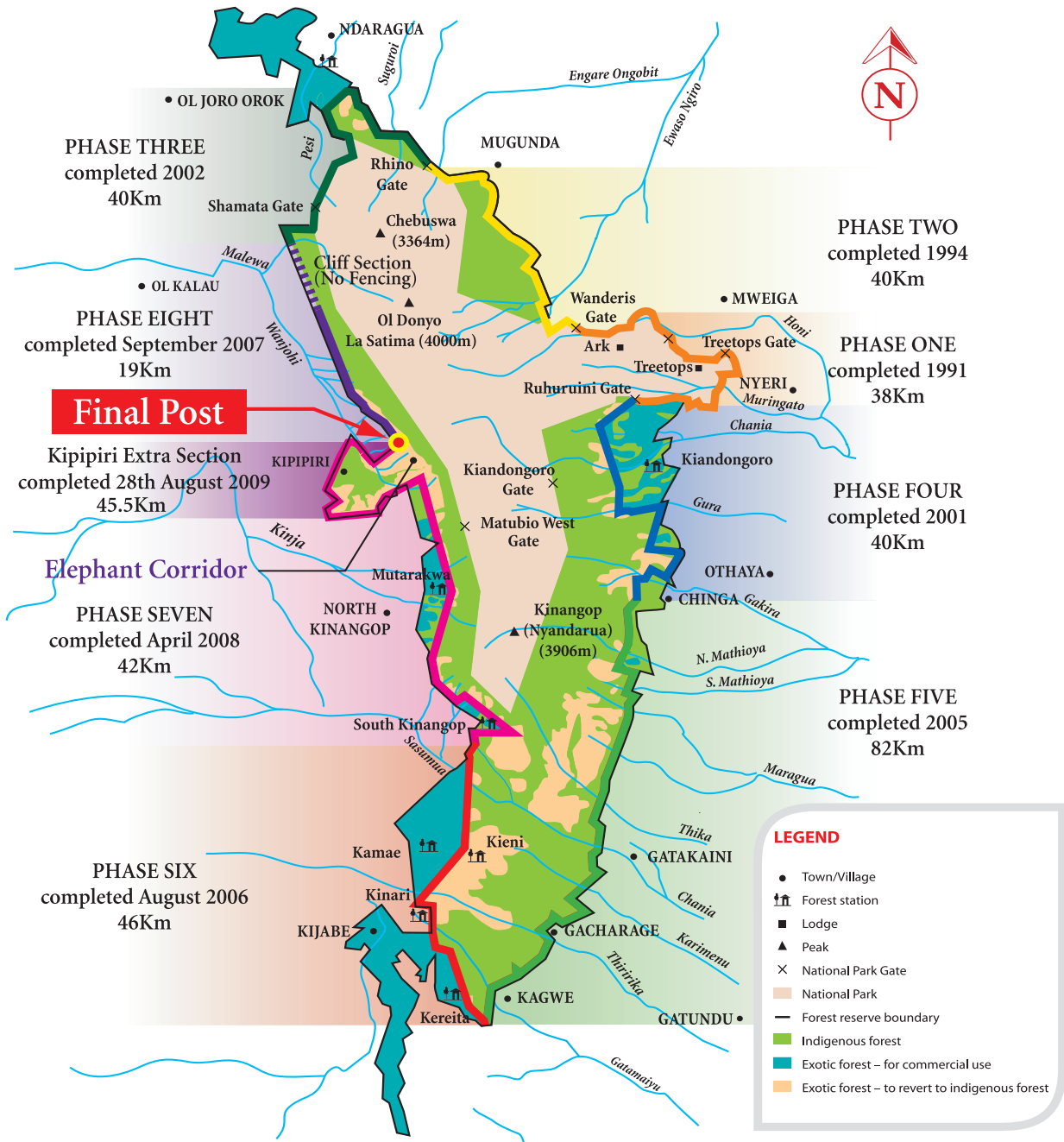
- g) Assess the impact of the fence on trends in human-wildlife conflicts.
- h) Assess the effect of the fence on fauna within ACA and adjoining areas.
- i) Assess the effect of the fence on tourism.
- j) Assess the effects of the fence on socio-economic activities e.g. charcoal production, logging, grazing, fuel wood collection and other livelihood-related activities.
- k) Perform economic analysis and CBA for the ACA fencing project.
- l) Recommend an institutional framework to sustainably manage the ACA.

A number of methodologies and approaches were adopted for the study. Literature review of pertinent policy and previous research was carried out. This was particularly useful in providing some vital baseline data, government policies and issues surrounding different ecosystem management tools and local community involvement and benefit-sharing for their roles in conservation work.

Remote sensing and Geographical Information Systems (GIS) were used to study land use/cover changes for 1987 (before the fence construction), 2000, 2005 and 2010. A total of nine transects were made around the fence and as close as possible to the transect positions made by Butynski (1999). These transects enabled inventory of flora and fauna species sighted in and outside the electrified fence. Hydroclimatological data from the Water Resources Management Authority (WRMA) was obtained but it was inconsistent and inadequate. The aim of this sub-component of the study was to assess whether there was a response, positive (+ve) or negative (-ve), of selected ACA Rivers to ecosystem degradation and subsequent recovery.

Socio-economic data was obtained from structured questionnaires, which were administered to a sample of 250 fence-adjacent

“ Nairobi accounts for about 60% of Kenya's GDP. The energy, water and some raw materials used to drive economic activities in the City and environs are derived from the Aberdare ecosystem. The conservation of the ACA and sustainable utilization of its resources are therefore crucial if Nairobi is to continue with this significant contribution to the National economy ”



communities, in addition to stakeholder meetings, which were held in each of the ACA's five districts (former Thika, Muranga North, Nyeri, Kiambu and Nyandarua), focus group discussions and key informant interviews. Separate questionnaires were also administered to the Foresters in each district, KWS personnel and other key institutional stakeholders. Discussions were held with a number of organizations and institutions who depend for their operations on resources from the ACA, such as KenGen and Nyayo Tea Zone Corporation, among others.

The methodology used to calculate economic returns was cost-benefit analysis, a standard method used for evaluating

interventions and projects. It consists of impact analysis followed by valuation of the identified impacts. All direct, indirect and external effects are incorporated into the impact analysis. The objective is to compare the present value of a stream of benefits to a stream of costs. Discounting is used to calculate the present value of future costs and benefits. Most commonly, the discount rate used is an interest rate taken from financial markets. Evaluation can be based on a number of decision criteria – internal rate of return (IRR), benefit-cost ratio (BCR), external rate of return (ERR) and net present value (NPV). The IRR is used to measure private benefits using market prices while the ERR is used to measure public benefits using economic prices.

CHAPTER 1

Key findings

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School children participate in an annual commemorative Fence Run

The following are the key findings of this study:

1.1 ACA-wide findings

- i) An increase in mountain forest cover from about 62,000ha in 2005 to 74,800ha in 2010, an increase of 20.6%. This increase can be attributed to the effects of the fence and associated fence management guidelines as well as government policy interventions. These findings are supported by the higher normalized difference vegetation index (NDVI) detected in the 2010 image compared to that of 2005.
- ii) A decrease of the open areas (which include grassland and farmland) by about 54%, from 9,259 ha to 4,223 ha. This signifies ecosystem recovery that is attributable to the fence and related government policies.
- iii) An overall increase of the area under plantation forests by 47% between 2000 and 2010.
- iv) Continuing ecological succession in areas that were disturbed by human activities will lead to increasing diversity and productivity as natural climax communities are restored.
- v) The management of the fence as well as the ACA itself is of prime importance if the economic benefits demonstrated in this report are to continue to be enjoyed by the fence-adjacent communities, commercial farming which relies on water from the Aberdares, projected irrigation in the Lower Tana Basin, urban centres and the city of Nairobi. The benefits of protecting the ACA accrue locally, nationally and internationally.
- vi) In spite of the positive changes noted above, the management of the fence so that it meets the original objectives of diminishing or eliminating altogether the problems that led to its construction is hampered by inadequate resources (human and capital) and lack of a management structure that involves the key stakeholders.
- vii) There is weak monitoring of illegal activities in several sections, or phases, of the fence. This is attributed to inadequate personnel (such as rangers) and resources to police the forest reserve. There is need for enhanced engagement of stakeholders and especially members of Community Forest Associations (CFAs) in policing the ecosystem in addition to recruitment of more rangers. Incidences of weak enforcement and lack of compliance with legal requirements were reported by stakeholders in several sections of the fence. A study to establish firmly the causes, magnitude and locational spread of illegal activities is recommended. The study should establish the extent to which lack of a negotiated policy and governance guidelines regarding the management of the ACA fence and its resources contributes to this situation.
- viii) The forest margin communities have continued to exert pressure on the ACA due to population pressure, poverty and inadequate livelihood improving interventions in these areas.
- ix) Wildlife populations appear to have increased due to the fence, affecting some areas of the ACA more than others – due to reduced poaching and the “island effect”.

1.2 Findings in detail

In all fence Phases, or sections, the area covered by Mountain Forest increased substantially, except in Phase 3 (no significant change) and in Phase 7 (decline).

Human-wildlife conflicts

- x) It should be noted that where monkey/baboon deterrent wires are attached to posts in designated areas as specified in the 1999 Butynski Report, this system of deterrence has been largely effective.

Illegal activities

- xi) These have reduced considerably due to access restrictions into the ACA.

Socio-economic effects

- xii) Food security and household incomes have improved since wildlife (large mammals especially) are no longer a problem to crops and livestock.
- xiii) The security of local people, including school-going children, has improved considerably.
- xiv) Land values have improved following the separation of humans and wildlife by the fence.
- xv) In some areas, on-farm tree planting has been enhanced as a response to reduced access to the ACA.
- xvi) Cattle rustling has also been reduced since it is not now possible to drive stolen livestock through a porous forest boundary.
- xvii) There has been a considerable reduction in cold nights-related morbidity and a rise in labour availability as it is no longer necessary to guard crops at night. This was a problem, for example, in Kiambu district.

Water resources

- xviii) Variations of ACA rivers discharge have occurred, but it was not possible to separate climatic from land use/cover effects. However, the ACA rivers were reported to be more stable than the Mt. Kenya rivers – a fact attributed to better land cover in this ecosystem.
- xix) The hydrological and climatic data for the ACA rivers is inadequate due to gaps and inadequate coverage.
- xx) The water supplied from the ACA is of major benefit to local communities, and nationally to agriculture, tourism and urban centres, particularly Nairobi, a centre of economic activity. However, the major users of the water, e.g. the Water Service Boards and Water Service Providers were unable to provide data on water abstractions, population served and revenue collected.

1.3 Economic analysis

1.3.1 Importance of the Aberdare Conservation Area

The identifiable benefits to the nation of the Aberdare range ecosystem include the following:

- i) Domestic water supply to populations in Central Kenya, some parts of Rift Valley and downstream Tana River, which are estimated at an economic value of Kshs.646.6 million.
 - ii) Almost all of Nairobi water supply, with an economic value of Kshs.1,465 million Kenya shillings.
 - iii) Irrigation water in Central Province and downstream Tana River, with an economic value of Kshs.6,300 million.
 - iv) Contribution of water to the Tana River, estimated at 58%. The Tana River produces hydropower generation of 1252 GWh, economically valued at Kshs.3,030.5 million.
 - v) Irrigation water for Lake Naivasha horticulture and floriculture production, with an estimated economic value of Kshs.931.4 million.
 - vi) Irrigation water in the Ewaso Ngiro River basin, valued at Kshs.76.4 million.
 - vii) Contribution to agriculture in the region, with an estimated value of Kshs.21,900 million in traditional farming areas and excised areas.
 - viii) Contribution to carbon sequestration and soil erosion control with an estimated value of Kshs.1,895 million.
 - ix) Benefits totalling to Kshs.2,916 million to forest adjacent communities.
 - x) Contribution to Nyayo Tea Zones, tourism and royalties with an estimated value of Kshs.227 million.
- and
- xi) A biodiversity value estimated at an annual value of Kshs.20 billion.
 - xii) Incremental water benefits to commercial water users valued at Kshs.32 billion at market prices.

Although many other social, environmental and aesthetic benefits are not identifiable, the total annual benefits of products and services is Kshs.39,387.9 million (excluding incremental benefits). When the annual biodiversity value (estimated at Kshs.20,000 million) is included, the total annual benefits are Kshs.59,387.95 million.

1.3.2 Cost-Benefit Analysis Results

Cost-benefit analysis was done using discount rates of 7% and 5% for a period of 25 years. The values were calculated at baseline, actual and future scenarios for the whole ecosystem. Additional community level CBA analysis was done at actual and future scenarios. The economic analysis of the Aberdares ecosystem both at the whole ecosystem and community level shows that the fence has created tremendous benefits as follows:-

- Calculations for Cost-Benefit Analysis (CBA) at 7% and 5% discount rate indicate the project was worthwhile at Benefit-Cost Ratio (BCR) of 4.55 to 5.35 averaging at 5 at ecosystem level and 2.01 at the fence adjacent community level, even without including the biodiversity value.
- The inclusion of an annual value of Kshs.20 billion for biodiversity improved the BCR from 6.98 to 7.75 averaging at 7 for the whole ecosystem and an average of 13 for fence adjacent community.
- The actual Net Present Value (NPV) for the whole ecosystem averaged at Kshs.322 billion without biodiversity at 7%, and Kshs.537 billion with biodiversity. For the forest adjacent community, the actual NPV averaged at Kshs.17 billion at 7% without biodiversity and Kshs.223 billion with biodiversity.
- Using a discount rate of 5% improves the NPV, which averages at Kshs.404 billion for the whole system and Kshs.22 billion for the community without counting biodiversity. With biodiversity, the NPV for the whole ecosystem improves to an average of Kshs.666 billion and Kshs.274 billion for the community.

In cost-benefit analysis, the use of a low social discount rate is used for projects with benefits accruing in the future especially in natural resources projects. The Central Bank average rate is 6.5% and in the analysis, the discount rates used are 5% and 7%. The lower rate gives a high NPV as shown in the figure below:



“Incidences of human-wildlife conflicts involving large mammals have decreased considerably in all areas around the ACA due to the fence as well as strict enforcement of existing rules and regulations by the KWS.”

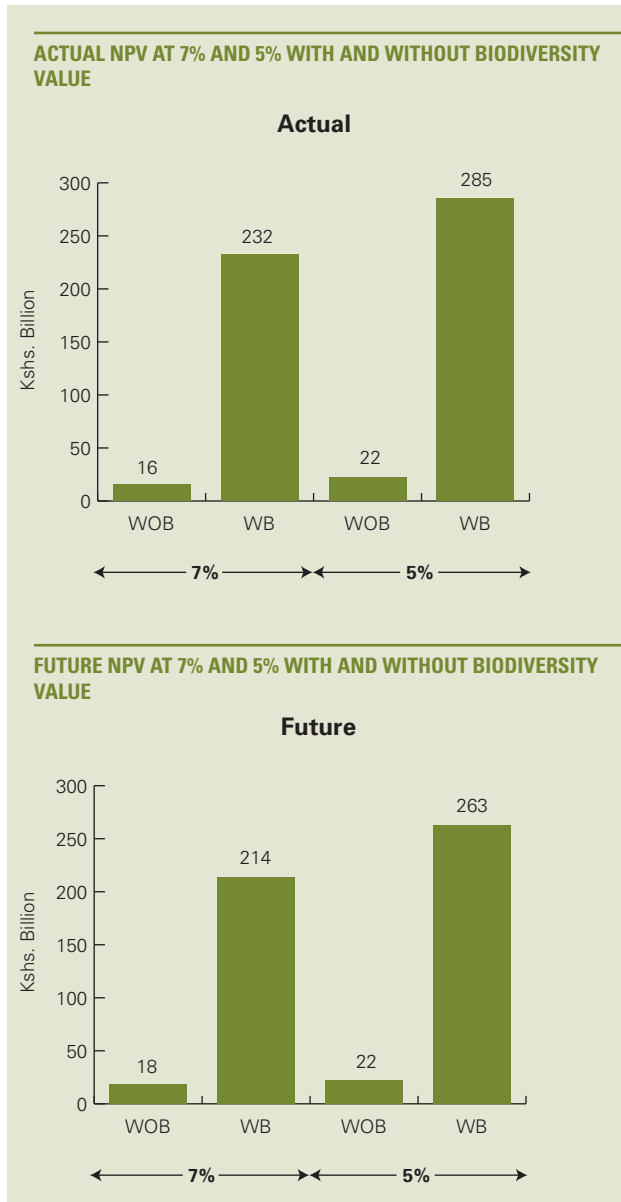
The following can be noted from the analysis:

- The BCR range from 4 to 7 and average at 6. These imply the investment already utilized and future investments are justified in conserving the ACA ecosystem.
- The use of a low social discount rate which mitigates against the individual and commercial short-sightedness in exploiting natural resources vis-à-vis the society’s long-term approach in exploitation of natural resources.
- The NPV of investments are high at 5% (Kshs.444 billion) with biodiversity.
- With the biodiversity value that was estimated by the community, the NPV increases by 59% to Kshs.704 billion.

These points lead to the conclusion that due to its huge future benefits, the conservation of the ACA ecosystem is of national importance and should be prioritized in conservation efforts.

- For the fence adjacent community, the BCR is 2.01 and NPV is Kshs.16.3 billion without including biodiversity value, and calculated at 7%. With biodiversity, they improve to BCR of 13.6 and NPV of Kshs.232 billion, at 7%. At a discount rate of 5%, the NPV without biodiversity increased to Kshs.22.3 billion, while with biodiversity, it increased further to Kshs.285 billion.
- At 5% discount rate, the NPV increases to Kshs.22.3 billion without biodiversity value, but inclusion of biodiversity increases the NPV to Kshs.263 billion. This analysis shows that biodiversity preservation is of great importance due to the current and bequest values attached by the community to the Aberdare Ranges.

The impacts of discount rates and inclusion of biodiversity shows the great future benefits in terms of NPV to the community as illustrated below:



From these diagrams, the impact of using a lower discount rate increases the NPV slightly. However, including biodiversity increases NPV tremendously showing the critical need for biodiversity conservation.

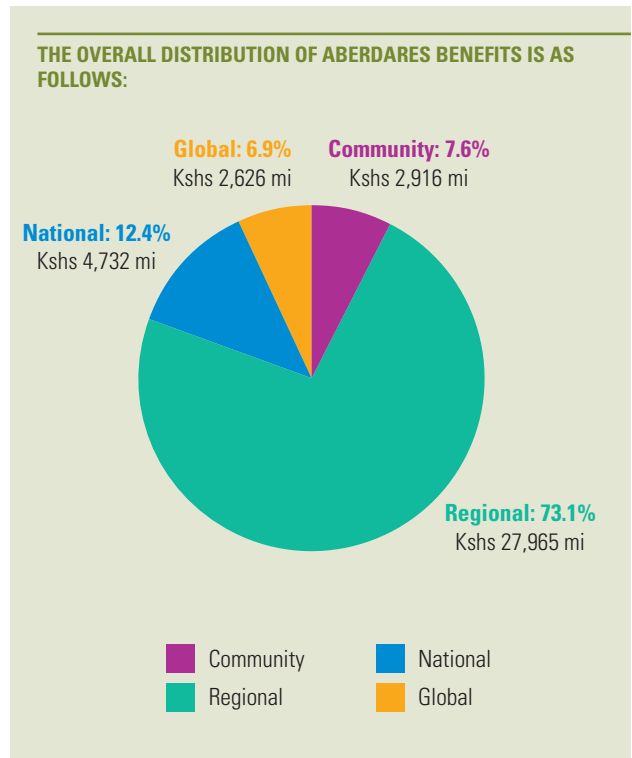
1.3.3 Distributive Analysis Results

Overall distributive results

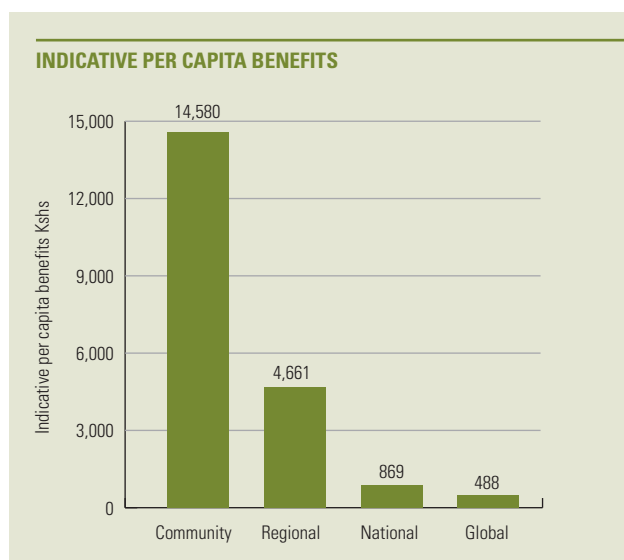
A preliminary distributive analysis was also undertaken to allocate the actual benefits of Kshs.38.515 billion, at community, regional, national and global levels. The preliminary results are shown below:

Level of distribution	Estimated benefits (Kshs.bi)	% allocation
Community level	2.916	7.6
Regional level	27.965	73.1
National level	4.732	12.4
Global level	2.626	6.9
Total	38.239	100.0

The distributive analysis shows that benefits accrue at all levels with fence-adjacent communities getting 7.6% of benefits, regional communities at 73.1%, the national economy at 12.4% and the global economy at 6.9% of total benefits as shown below:



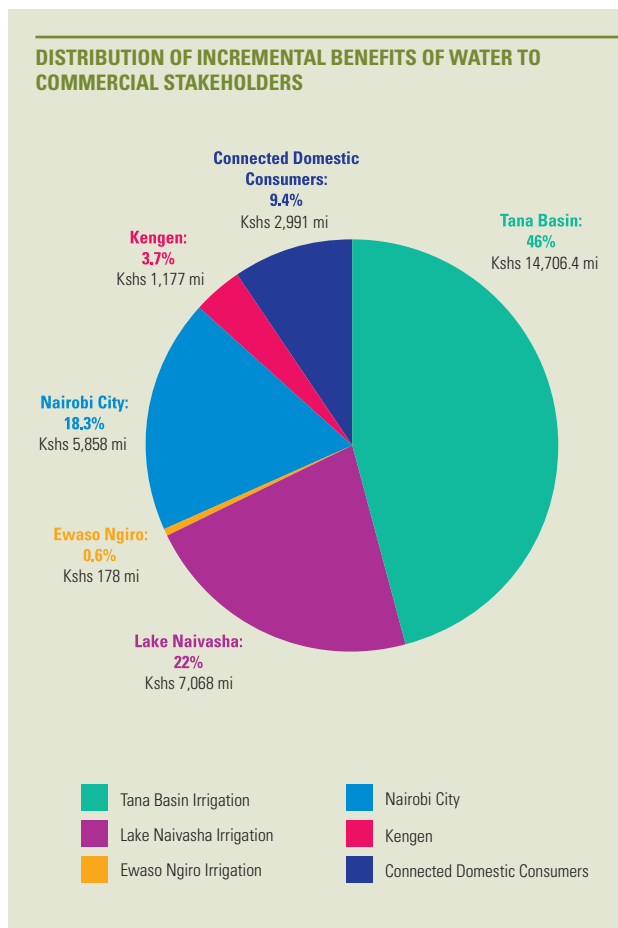
Calculation of per capita benefits is hampered by inadequate data for some districts. The distribution analysis is based on 200,000 local people (40,000 households X 5); regional population of 6 million; national benefits (mostly Nairobi water (3.2mi) and electricity (2mi), etc.) to 32 million (Kenya population less regional population); and global at 1.5 million visitors. Carbon credit is for global population. This would give the following indicative per capita benefits as shown below:



It is noted that the fence adjacent community gets Kshs.14,589/ca compared to regional Kshs.4,661/ca, national Kshs.869/ca and global Kshs.488/ca. Although these figures are indicative, they show that the community is the major beneficiary.

Commercial Stakeholders benefiting from Aberdares Water

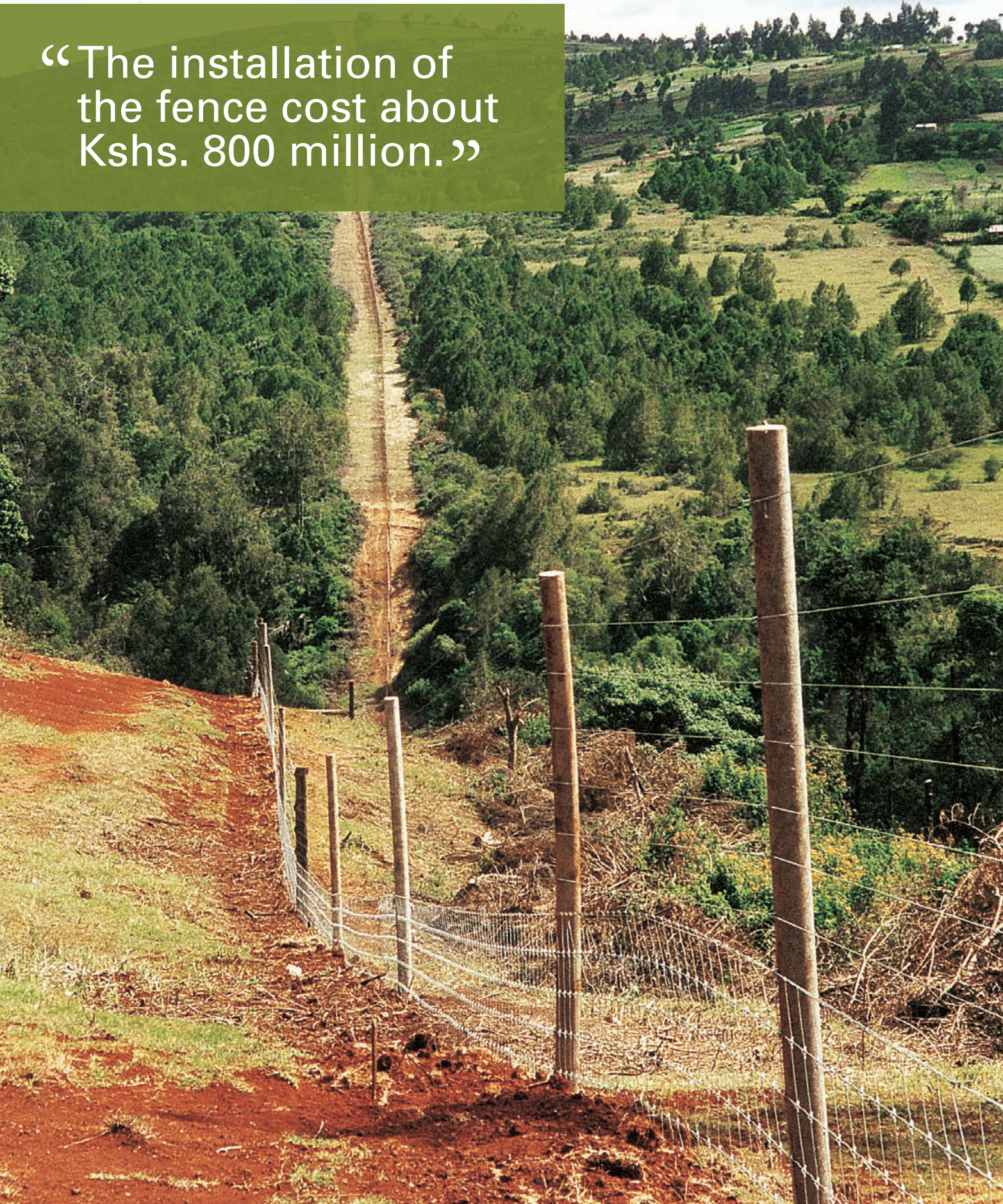
The main stakeholders include irrigators in the Tana basin, KenGen hydropower generation, Nairobi City, L. Naivasha horticulture/floriculture producers, Central and Rift Valley connected consumers and Ewaso Ngiro North irrigation. Agriculture and livestock production are not included although they benefit from the water. These major beneficiaries acquire water at economic prices totaling Kshs.12.45 billion, but sell their services at market prices giving them a gross revenue of Kshs.44.43 billion, getting gross incremental benefits totaling Kshs.31.98 billion. The estimated distribution of gross incremental benefits is as shown on the right:



It is noted that out of the incremental benefits totaling Kshs.31.98 billion, irrigation accounts for 68.6%, Nairobi city for 18.3%, connected domestic producers for 9.4% and KenGen for 3.7% of total incremental benefits.

The KenGen value is based on sales to Kenya Power and Lighting Company, while the market price for electricity is much higher. In the recent drought, water sales to consumers were at Kshs.0.50-1.00/Litre. This would translate to Kshs.500/1,000/m³. The economic price of water is therefore undervalued. Despite the under-valuation of water, it is apparent that the commercial stakeholders are reaping huge benefits and a mechanism for taxation through payment for environmental services (PES) should be introduced and paid to a trust for conservation and maintenance of the Aberdares Ecosystem.

“The installation of the fence cost about Kshs. 800 million.”



CHAPTER 2

Discussion

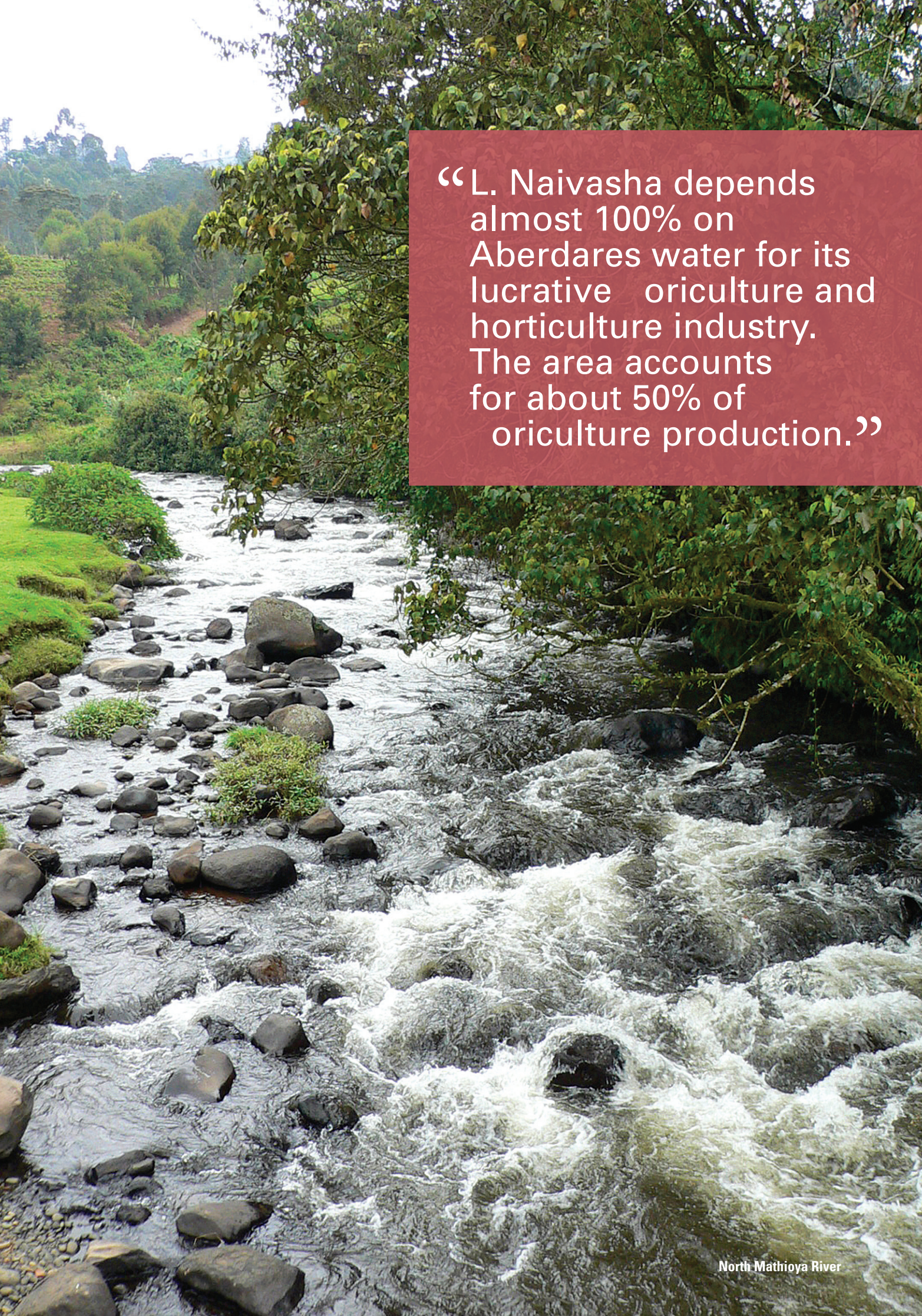
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After the completion of the fence, the main work is the maintenance of the fence and improvement in general management of the conservation area by KFS, KWS, the community and Rhino Ark. This is critical. The implications of a lack of concerted effort in maintenance would include:

- i) Continued degradation of the ecosystem leading to less downstream benefits to all stakeholders.
- ii) Increasingly drastic water shortages in Nairobi, which depends almost entirely on Aberdares water. The city accounts for about 60% of GDP (about 1,049,899 million at current prices).
- iii) Decrease in electricity supply, as Aberdares water accounts for 58% of hydropower in the Tana system, 40% of national hydropower production and 27% of all electricity produced. The impact would affect industries seriously. For example, the industrial loss due to the 2006 drought was estimated at USD1.6 billion (Kshs.128 billion at current exchange rate).
- iv) Vision 2030 has irrigation development in the Tana Basin as one of its pillars. Several projects have been proposed, but shortage of water from the Aberdares would affect the development goal, affecting the progress in self-sufficiency in sugar, rice and other crops.
- v) L. Naivasha depends almost 100% on Aberdares water for its lucrative floriculture and horticulture industry. The area accounts for about 50% of floriculture production and at a 2008 value of Kshs.40 billion, the loss would be over Kshs.20 billion.
- vi) Degradation of the ecosystem would affect the climatic patterns and global warming, affecting almost all of Central province agriculture valued at over Kshs.110 billion as well as other agriculture in other areas due to the loss of the carbon sink.
- vii) There would be a loss of biodiversity in terms of unique flora, fauna and aesthetic value of over Kshs.500 billion over 25 years.

The following conclusions can be made on the basis of the findings.

- i) The Aberdares ecosystem contributes about 2% of Kenya's GDP (2008 GDP at current prices). If the tentative value of biodiversity at Kshs.500 billion is added, the contribution to the national GDP is even greater at about 25% of 2008 GDP. About 25% of the Kenyan population, in Central Province, Nairobi, and parts of Rift Valley, Eastern, North Eastern and Coast Provinces depend on the Aberdares water for domestic use and agriculture.
- ii) The Aberdares ecosystem is key to increasing the irrigation potential in the Tana River basin with an estimated potential of 205,000 hectares.
- iii) Its importance in the energy sector, tourism, horticulture/ floriculture, smallholder and large-scale agriculture and carbon sequestration is of considerable value.



“L. Naivasha depends almost 100% on Aberdares water for its lucrative oriculture and horticulture industry. The area accounts for about 50% of oriculture production.”

CHAPTER 3

General Recommendations

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The way forward hinges on two key areas:

- Fence maintenance and overall ecosystem management; and
- Control of degradation within the protected area, the surrounding farming areas, and the downstream areas.

The following recommendations are made for management of the ecosystem:

- Payment for environmental services.** A system of payment for environmental services (PES) to be institutionalized in the Ministry of Forestry and Wildlife and the EMCA systems. Major beneficiaries such as Nairobi City, KenGen, L. Naivasha growers, large-scale irrigators and WRMA, among others, should pay an annual stipulated cess for fence maintenance and control of degradation in the protected area.
- Fees for water abstraction and timber extraction.** The water abstraction tariffs and the current levels of royalties should be raised and some portion be allocated for conservation.
- Budget allocation for ecosystem management.** Government, especially the Ministry of Finance, to be sensitized on the value of Aberdares ecosystem and the need to empower KFS and KWS to offer more effective management and control of illegal activities. This implies additional budget allocation for ecosystem management.
- Community involvement.** The communities adjacent to the fence need to be sensitized on the importance of the ecosystem to their livelihoods, and the need to be proactive in surveillance and reporting of illegal activities. The CFAs can be sensitized to employ surveillance scouts by encouraging them to contribute some amounts of money monthly. Requests for additional gates and other livelihood issues need to be discussed. Statements by communities about their expectations point to inadequate understanding of the scope of the fence project and the roles of various stakeholders. This has resulted in misunderstandings that undermine the fence management process in some areas.

The following recommendations are made for encouraging soil and water conservation in the 2,000km² of farmland in the Aberdares catchment area:

- Capacity building** for communities in agro-forestry and forage production to minimize their dependency on protected areas and forestry benefits.
- Part of the funds raised under Payment for Ecosystem Services (PES) system described above be used in empowering the communities in **income generating activities**, e.g. tree nurseries, apiculture, bamboo cultivation, etc.
- The **key beneficiaries to build some enabling environment** for the communities, e.g. road and water infrastructure, social infrastructure and enhancing improvement in agriculture through information.
- Major **soil and water conservation and afforestation** programmes to be developed in the area through joint donor, government and beneficiary efforts.

Specific Recommendations



Elephant and farmers are secure thanks to the 400km long Aberdare Fence (background: Mt. Kenya)

- i) **Address** challenges in fence management, e.g. power failures, lack of transport, inadequate personnel and logistical support.
- ii) **Consult** with communities and stakeholders prior to the institutionalization of any proposed management body for the fence and ACA, regarding preferred composition and approach. Such opportunity should also be used for inventory of community projects promised during fence construction, which have remained unfulfilled, thereby raising some negative feelings. There are several windows of opportunity for retrospective consultation on the fence management, especially with facilitation of civil society organisations (CSOs). This will ensure a strong grassroots support, which is currently less than optimal. Communities should be engaged through elected groups rather than individuals to keep off vested interests.
- iii) **Monitor** the resources (status, dynamics and trends) of the ACA on a continuous and sufficiently comprehensive basis to provide data for planning and decision making.
- iv) **Consider** representation from the following organizations in the formation of the Aberdare Trust:
 - Civil society organizations (CSOs). Rationale: representation of non-state actors, who have deep involvement in community activities and engagement with Government, especially in policy change environment.
 - Nyayo Tea Zone Development Corporation (NTZDC). Rationale: Through their mandate of buffer zone development and management, they provide enormous support in management of buffer zone areas. Important in providing support for a policy for Payment for Environmental Services (PES).
- v) **Adjust the price of water abstraction upwards** to promote efficient use of water. Comparisons of the water use charges and the market rates show a wide gap. This makes water abstractors to misuse water and use no conservation methods.
 - KenGen. Rationale: Highly dependent on ACA to provide more than 70% of the country's hydro-power generation. Important in providing support for a policy for Payment for Environmental Services (PES).
 - Private Sector Alliance (KEPSA). Rationale: Represents business and industry interests. They can also contribute to support of activities in the buffer zone and have the potential, like CSOs, of remaining neutral in management of the fence. Important in providing support for a policy for Payment for Environmental Services (PES).
 - Water Service Boards. Rationale: Can act as important source of pressure to make sure the ecosystem is well managed by WRMA in terms of engagement in ecosystem conservation activities. They could also play an important role in providing support for a policy for Payment for Environmental Services (PES).
- vi) **Gate Management.** Around the ACA fence there are 125 gates. Previous studies, e.g. Butynski (1999), FAO (1998) and Rhino Ark (2006) recommended that several issues regarding gate management should be considered. The issues that need to be revisited include:
 - Develop gate management guidelines for each category of gate type.

- Establish gate monitoring data to keep track of type and amount of goods extracted.
- Improve enforcement. Cases of corruption, where some people are allowed to carry out proscribed activities injurious to the long-term sustainability of resource use in the ACA, need to be stopped.
- Develop mechanisms for dealing with offenders, considering the presence of statutory ecosystem management bodies such as KWS and KFS, with different mandates.
- Establish formal relationship with recognized local community groups with clear gate management responsibilities.
- Resolve the issue of inadequate or inconvenient access gates.

vii) **Buffer Zone Management.** While the original aims of fencing around the ACA have been achieved to a very large extent, as highlighted in the impacts section, efforts to address livelihood issues, particularly of the fence-adjacent communities, has been low. Community dependence on ACA has been high, especially in terms of fuel wood and grazing. Although the survey indicates reduction in these activities, population pressure is likely to reduce the positive benefits being enjoyed by all stakeholders. Therefore, appropriate interventions in buffer zones will be required. These may include the following, among others:

- Introduction of high value crops to boost income
- Promoting alternative sources of energy such as biogas, energy saving jikos, solar panels, among other domestic energy technologies
- Planting of trees to meet needs such as building but also improve the local ecological environment
- Intensification of fodder production on farms to reduce pressure on ACA for grazing and interaction of livestock with wild animals
- Support for local communities to engage in profitable eco-tourism activities
- Alternative revenue sources such as bee keeping, butterfly farming, herb plants and tree crops such as *Prunus* and bamboo

viii) **Integrate the ACA and buffer zone activities.** A management plan should be developed to take care of both conservation and buffer zone population well-being. The social pillar of Vision 2030 seeks to build a “just and cohesive society with social equity in a clean and secure environment”. One of the ways to contribute to Vision 2030 through ACA interventions is highlighted above by deliberate investment in support to local livelihoods.

ix) **Institutionalize Payment for Ecosystem Services (PES).** The Aberdares ecosystem, with calculated annual benefits of Kshs.38.239 billion, contributes about 2% of GDP (2008 GDP at current prices). If the tentative value of

biodiversity at Kshs.500 billion is added, the contribution to the national GDP is even greater at about 25% of 2008 GDP. About 25% of the Kenyan population in Central Province, Nairobi and parts of Rift Valley, Eastern, North Eastern and Coast Provinces depend on the Aberdares water for domestic use and agriculture. Also, the Aberdare Conservation Area is key to increasing the irrigation potential in the Tana River basin with an estimated potential of 205,000 hectares. Its importance in the energy sector, tourism, horticulture/floriculture, smallholder and large-scale agriculture and carbon sequestration is of considerable value. Maintaining the fence is therefore of paramount importance. A sustainable way of funding fence and ACA management should involve the major stakeholders benefiting from the ecosystem, who can contribute directly to funding fence related activities including conservation projects within the ACA and its buffer zones. In this regard, the consultants recommend a serious consideration for the introduction of *payment for environmental services* (PES) from all consumers of goods and services from the ACA. This is being practiced in several areas around the globe and is certainly not new in Kenya. However, it will require *policy support and stakeholder consultations* to arrive at a reasonable level and modality of levying PES. Meanwhile, the exchequer can continue to fund the ACA as well as providing funds for the fence through increased allocation from treasury.

- x) **Communication.** A structured communication strategy is needed to avoid distortion of information or misrepresentation of facts among stakeholders.
- xi) **Awareness-creation.** It is important that the institutions with the mandate to manage the ACA step up awareness creation among the fence-adjacent communities regarding fence management, gate access and ecosystem values.

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