

JOURNAL Ecoforum

S u s t a i n a b i l i t y i n A c t i o n



January - March 2015

Ecosystems



SPONSORS



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Contributors



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Conserving and Managing Lake Victoria's Diverse Ecosystems

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Cover Photo by DJ Bwakali
Back photo by Michael Kuttner

Welcome to the Ecosystems Issue



Kennedy Orwa

Nature is a complex system of all of the living things (plants, animals and micro-organisms), interacting with each other, and also with their non-living environments temperature, earth, sun, soil, climate, atmosphere).

Environmental sustainability is assured if the correct balance of the ecosystem elements is maintained. The opposite is therefore true: the absence of any one of the elements, the distortion of quantity or qualities of any one of them causes an imbalance that can lead to a chain of reactions to achieve a “new balance” which may, or may never be attained.

Records abound of extinct animal and plant species and the circumstances that led to such extinctions. It is however apparent that those lessons are not enough: environmentalists are going through gruelling, expensive and desperate attempts to preserve precious species of the plant and animal kingdoms.

In the absence of success in the efforts, it is possible to imagine a world without the king of the African jungle – the lion, or the spectacular wild beast migration of Kenya’s Mara river; it is possible to imagine a world without the Wallabies and Tasmanian devil of Australia; it is possible to imagine a world without the Monarch Butterflies of USA. This can happen to rivers as to any known plants and animals.

Broadening from the species to their habitats – questioning their survival skills, needs and lifestyles inevitably ushers you into the complex realm of ecosystems. It is inevitable that a person desiring the continued assurance of the existence of any species must mind the habitat, food, health and reproduction of the species. That is ecosystem thinking.

Humans are perhaps the most adventurous elements of any ecosystem. Humans are also the best at leaving behind trails of destruction. Building cities, complex homes, roads and entertainment parks are among human activities that have robbed other ecosystem members of their most basic needs. Associated with these is the increase in global temperatures, further threatening species and ecosystems. Being the wisest, it is rational to expect that the humans can comfortably pursue their food and comfort while keeping a balance in the ecosystem.

Any time a ‘stranger’ (living thing(s) or external factor such as rise in temperature) is introduced to an ecosystem, it can be disastrous to that ecosystem. Similarly, if one member of the ecosystem is removed for any reason and by any means, the balance is lost and the effects can be grave. I welcome you to read this Ecosystems issue of Ecoforum and walk with us along the paths of ecosystem talk. Let’s think together and act in unison.

Enjoy your reading!

ECOFORUM

Sustainability in action

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Centre International (ELCI)

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GRAPHICS & DESIGN:
Transcop Imaging

DISTRIBUTION:
Herine Ochola

MARKETING
Environment Liaison
Centre International (ELCI)

Ecoforum Journal is published quarterly by the Environment Liaison Centre International (ELCI), a network of organisations working for a healthier environment and more sustainable world. The magazine focuses on practical, innovative solutions to the region’s environment and social challenges.

The views expressed in Ecoforum do not necessarily reflect those of ELCI or its members and partners. Ecoforum accepts the information contributed by authors, networking organisations and advertisers as factual and correct. Reproduction of material published in Ecoforum is encouraged, but those wishing to do so must acknowledge the source.

Subscriptions to **Ecoforum** (4 issues) is Ksh 6,375/- in Kenya and \$75 outside Kenya payable to ELCI. Digital version is \$3

See subscription form for details.

Cover Art: Kiio Mwanza

Registered with the GPO as a newspaper

Printed on environmentally friendly paper.

Ecoforum Journal
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TURNING UP THE VOLUME OF THE ECOSYSTEM VOICE

Ecosystems are foundations of human wellbeing. They provide services that are invaluable and irreplaceable. Tragically, the holistic soul of ecosystems sometimes works against them.



As a case in point, it's easier for people to relate to forests because they can see and touch them. But forest ecosystems are not as tangible and can hence suffer indifference, ignorance and exploitation. This issue of Ecoforum seeks to address these triple challenges through incisive and informed writing from our experienced writers and environmental experts.

An article on the forest ecosystem services of Kenya's Arabuko Sokoke forest explores local ways of both protecting and tapping into the ancient forest's ecosystems services. In the same vein, another article delves into some of the economic benefits of marine ecosystems from the same coastal area.

Although they are priceless, ecosystems are becoming increasingly vulnerable. An article from IUCN captures the bleak plight of ecosystems and goes a step further to state how they can be conserved for posterity through the innovative red list of ecosystems.

Mahatma Gandhi reminded individuals to be the change they wish to see in the world. Taking cue from this, another article discusses how we can conserve ecosystems through vision, value and ethics. Indeed, ecosystems are not academic theories to be studied and debated. Rather, they are the heartbeats of our lives and our interaction with them must stem from this very fact.

In November 2014, UNEP released a report on mangroves. In it, we were reminded about the importance of mangrove ecosystems, 'about 75 per cent of all tropical commercial fish species and associated ecosystems, such as seagrass meadows and coral reefs, depend on mangrove forests as nurseries, and for shelter and food.' Two articles in this issue reveal how mangroves on Africa's East Coast play fundamental roles in fostering the wellbeing of coastal communities.

As a global publication, we have featured insightful articles from Asia, USA, Central Africa, Southern Africa and Western Africa. Ecosystems know no boundaries. We have followed their footsteps. This Issue of Ecoforum Journal continues our tradition of narrating and analysing environmental issues from across the globe.

Happy reading!

David John Bwakali,
Chief Editor,
Ecoforum Journal

NAIROBI RIVER

ECOSYSTEM

BENEFITS

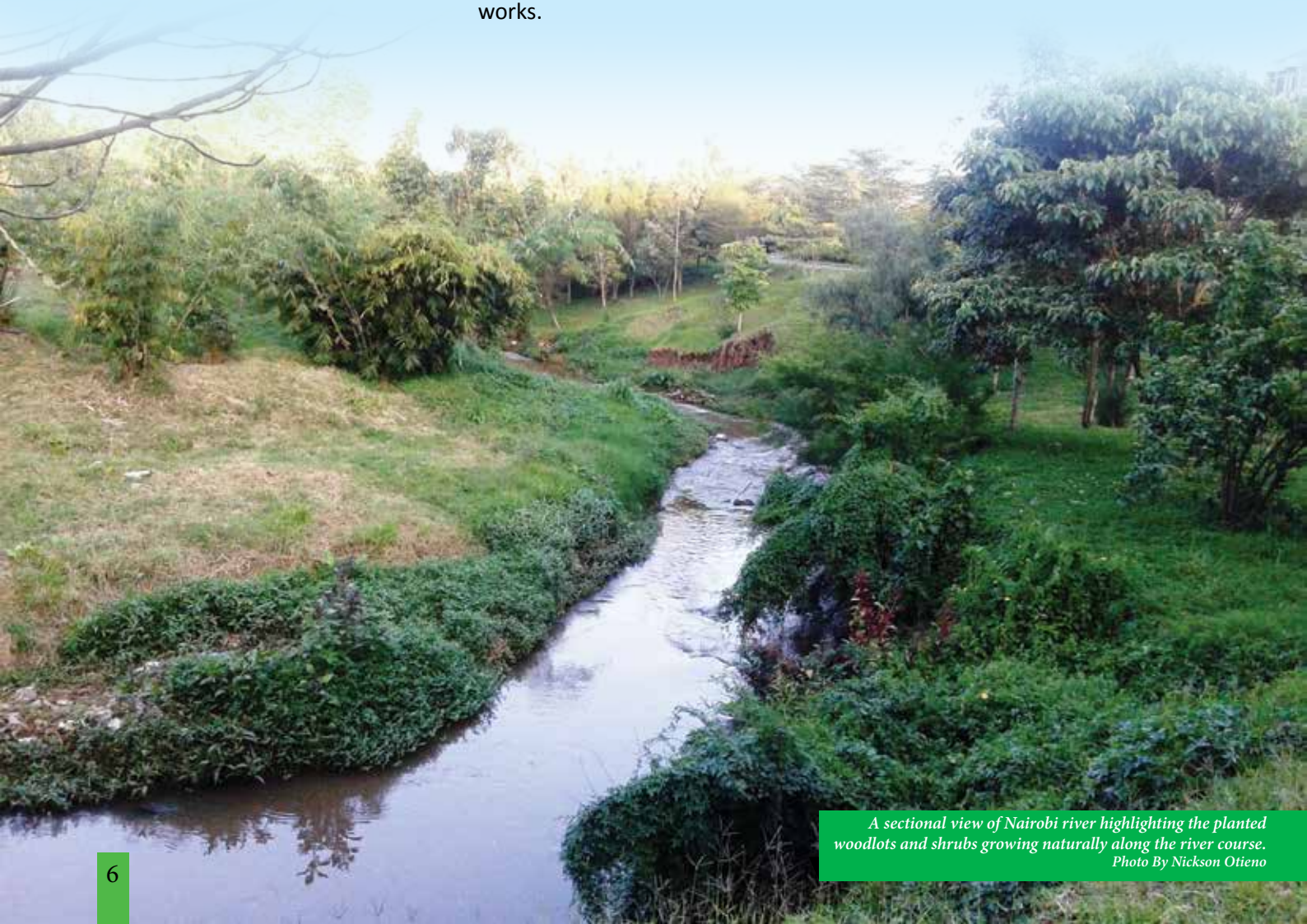
Payment for Ecosystem Services Opportunities

By Nickson Otieno, Kenya

The establishment of Nairobi as Kenyan capital city has a rich history closely linked to Nairobi River. This river, once a pristine ecosystem, has degenerated into a filth and "museum" or physical exhibit of negative urban development. Why did we neglect this jewel? And why should we bother about its conservation?

Nairobi is served by three major rivers: Nairobi, Ngong/Montoina and Mathare. The source of the Nairobi River is the Kikuyu springs at an altitude of 2000m above sea level. From Kikuyu the river flows eastwards through Dagoretti, Kawangware, Chiromo, the central business district, Eastleigh and Kariobangi sewage treatment works.

After Kariobangi the Nairobi River runs through barren Njiru quarry sites where the Gitathuru and Ruaraka Rivers join it. The Nairobi River then flows past the Nairobi Falls and Fourteen Falls. The river joins the Athi River and eventually the Sabaki River which discharges its water into the Indian Ocean at Malindi on the East African coast.



*A sectional view of Nairobi river highlighting the planted woodlots and shrubs growing naturally along the river course.
Photo By Nickson Otieno*

Rapid population growth, urbanisation and industrialisation have put enormous pressure on Nairobi's Rivers. According to the Kenya National Cleaner Production Centre, the Nairobi River Basin is home to 80 percent of Kenya's manufacturing and service enterprises with most of these enterprises discharging untreated or partially treated liquid wastes into the river. There is also a significant discharge of petro-chemicals into the river from petrol stations, motor vehicle garages, and car wash bays along the river.

Studies have shown that solid wastes carried by surface run off from factories, business premises, streets and other human settlements along the river; raw sewage from broken or overloaded sewers as well as raw sewage from informal settlements further contribute to the river's pollution. Another study in 2001 revealed a significant concentration of heavy metals in Chiromo River and Nairobi River.

Such widespread pollution is posing a great danger to the aquatic biodiversity and household consumers of the river water. For example some of the heavy metals could find their way into the fodder crops (Napier grass) and crops grown along the river, then into livestock and eventually into the blood stream of the consumers.

Water related diseases such as typhoid, amoebiasis and diarrhoea could become a threat to the users of the recreational park along the river in case they consume the contaminated water. Many street



*Some of the solid waste that washes into Nairobi River.
Photo by Nickson Otieno*

families and urban poor are still dependent on the river basin for their habitat and livelihoods.

Nairobi River Basin Rehabilitation and Restoration:

UNEP promoted the Nairobi Initiative, which started in April 1999 with the aim of addressing problems such as pollution, waste management, urban greening, community participation, public awareness and legislation.

This initiative evolved into the multi-stakeholder Nairobi River Basin Programme aimed at rehabilitating, restoring and managing the Nairobi

River ecosystem in order to provide improved livelihoods, especially for the poor, enhanced biodiversity, and sustainable supply of water for domestic and industrial, recreational and emergency uses.

The Sewage Improvement Project funded by the African Development Bank targeted improving the sewerage infrastructure in Nairobi so that the wastewater being generated in the city is collected and directed to treatment facilities without being an environmental hazard.

The government decided to establish the John Michuki Memorial Park along the Nairobi River through private-public partnerships to



A sectional view of Chiromo river. The river is characterized by diverse flora and fauna like trees (indigenous and planted, shrubs, grasses, terrestrial wildlife e.g. birds and slugs as well as aquatic species). Photo by Nickson Otieno



A residential development along Chiromo river: the building (left) is oriented to maximize the views towards the river. The development also has a private recreational garden with a swimming pool and children's play area. Photo by Nickson Otieno

celebrate the former Environment minister's contribution towards restoration of Nairobi River and the environment.

Some of the works already undertaken towards the riparian restoration and beautification include removal

of tonnes of garbage, tree planting and landscaping, construction of boundary-delineating footpaths, footbridges, public toilets, floodlights, fences and police post to boost the park's security. The river will be transformed into a major attraction in the city, with activities such as water sports.

THE BENEFITS OF NAIROBI RIVER

Like other ecosystems, rivers accrue immense benefits to humans; usually categorized as Direct Use Benefits (both Consumptive and Non-consumptive benefits) as well as Indirect Use Benefits.

Some of the consumptive benefits include: water source for industrial and commercial use (e.g. in cleaning, cooling and car wash); sustenance of planted vegetation and natural ecosystems; food source; water

for domestic use; irrigation water and provision of livestock feed like napier grass.

Nairobi River ecosystem's non-consumptive benefits are similarly varied touching on its aesthetic values and livelihoods potential. Many city dwellers find beauty or aesthetic value in various aspects of the rivers' ecosystems, such as the orientation of buildings with main views to the river, enjoying scenic drives through Museum hill and Globe Cinema overpasses. In addition, the river environs

provide a tranquil environment to spend leisure time and engage in recreational activities like retreats, team building.

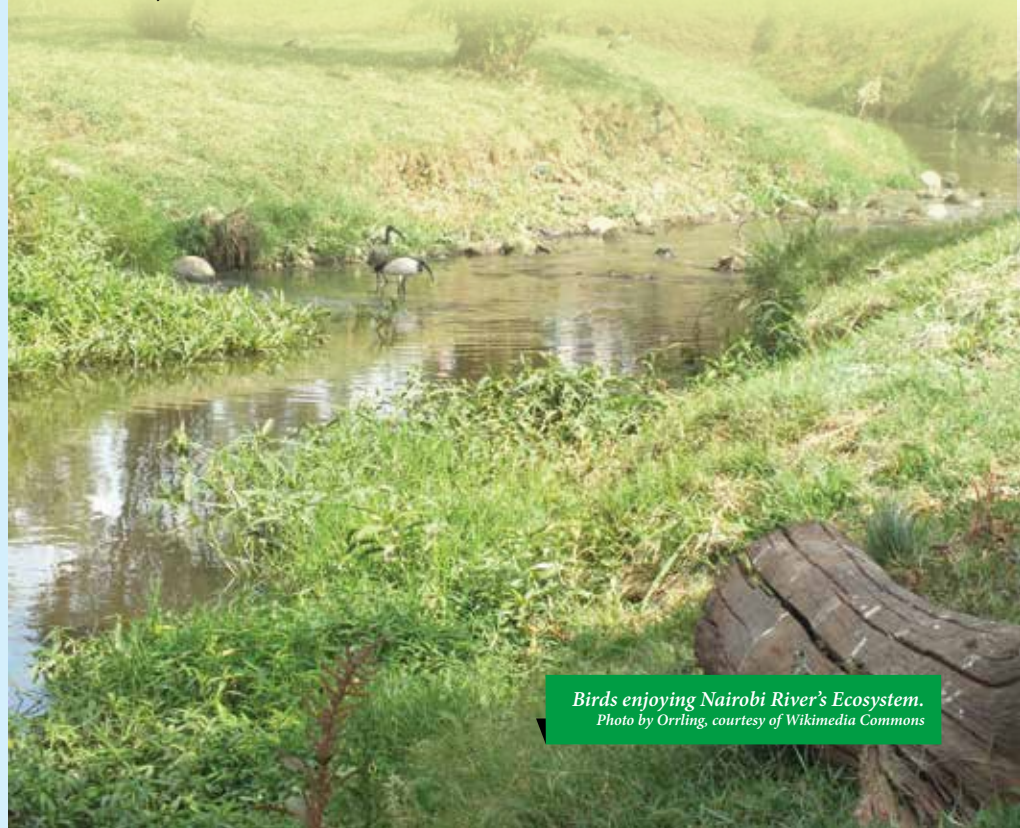
Between 2008 and 2012, over 2,000 women and youth were employed in the restoration of Nairobi River Basin. Many more livelihoods continue to depend on the economic activities supported by the river.

Opportunities for Payment of Ecosystem Services in Nairobi River

There are many reasons for conserving natural resources like river ecosystems. Recognizing that the natural world has monetary value is one of them.

Fiscal resources generated from trade in ecosystem goods and services provided by Nairobi River can be channelled to the 'Nairobi River Trust Fund' to be established on the basis of EMCA 1999 provisions. This fund can be used to facilitate research intended to further the requirements of environmental management, capacity building, environmental awards, environmental publications, and provision of scholarships and grants.

While investing in water catchment protection the "polluter pays



Birds enjoying Nairobi River's Ecosystem. Photo by Orrling, courtesy of Wikimedia Commons

principle" should be implemented to change behaviour of upstream consumers and industries towards less polluting and resource efficient practices.

The opportunities for Payment for Nairobi Rivers' Ecosystem Services are described in four market exchange mechanisms.

Firstly, there can be individual buyers and individual sellers. Self-organized private markets (including NGOs and enterprises) and transactions may include traditional trade in ecosystem goods and services such as sale of tree seedlings from the nurseries established along the river; development of recreational opportunities such as scenic gardens along Chiromo River which can be rented for private weddings and photography.

Secondly, private land trusts can be established to purchase conservation easements from private land-owners to protect pristine landscapes from

intense development. For example, a 'Nairobi River Basin Land Trust' can be established by the companies and the organizations already involved in the establishment of the John Michuki Memorial Park to purchase undeveloped plots beyond

the riparian reserve to maintain or develop them as scenic landscapes with rich biodiversity.

While investing in water catchment protection the "polluter pays principle" should be implemented to change behaviour of downstream consumers and industries towards less polluting and resource efficient practices.

Thirdly, conservation grants by private organizations to private individuals or groups to provide and finance ecosystem goods and services. For example the University of Nairobi may apply for a donor fund to establish a botanical garden on its parcels of land along Nairobi and Chiromo rivers which apart from supporting its educational services will also offer essential ecosystem services to the neighbouring urban population including biodiversity conservation.

Price premiums or donations for water paid by consumers who want to encourage or reward environment-friendly production methods. For example, the Nairobi Water and Sewerage Company (and other water service providers) can offer their customers the opportunity to pay a premium in support of the Nairobi River Conservation.

The company can use the donations to cover the cost differential between traditional waste treatment and setting up a sustainable waste water treatment facility that reduces pollution of the river ecosystem. The treated water is then reticulated into a centralized sanitation system so that all customers receive a mixture irrespective of whether they paid the price premium.

The Price premiums are often associated with voluntary sustainability certification programs warranting that the goods or services were indeed produced using eco-friendly methods. The Voluntary Environmental Code of Conduct for businesses developed by the Kenya Cleaner Production Centre can be used in stimulating businesses to voluntarily improve their environmental performance and reduce pollution loads in the river ecosystem.



Botanical garden in Algiers.
Photo by Yelles, courtesy of Wikimedia Commons.

Some of the sustainable practices to be certified include minimizing and treating discharges from industries within their premises, cleaner production systems, implement water recycling projects to reduce the amount of water abstracted from the river.

In the above example, Nairobi Water and Sewerage Company may offer its customers the option for a normal water bill or a 'Green Water Bill.'

There can also be cap and trade programs that entail use of permits to emit a regulated pollutant or credits to offset the emissions. With permit schemes, firms that can lower their emissions at low cost do so and sell their permits to firms for which costs of cutting emissions are higher than the cost of purchasing permits. With credit schemes, firms that desire to exceed the cap must purchase credits that offset the increase in emissions³.

The involvement of the government is critical for the success of cap and trade programs in these: imposing a limit or cap on some emission or activity; establishing permits or credits for the specified amount of emission or activity and allowing individuals or firms to trade permits or credits under certain institutional rules; monitoring the emissions or activity in question and assessing a penalty if the cap is exceeded.

Alongside such government efforts, the 'Nairobi River Biodiversity Bank' can be created to ensure that there is no net loss of biodiversity within the river's ecosystem. For example, if a property development would result in the loss of biodiversity in a particular stretch of the river the developer must mitigate the loss by creating new bio-zones or enhancing existing biodiversity within another section of the river basin. Interactions among ecosystem custodians and users will generate a market price for biodiversity credits.

Adopt a mile of the Nairobi River

Large enterprises in Nairobi can be encouraged to adopt a mile of the Nairobi River for long-term clean up, re-vegetation and general restoration of the river ecosystem structure and function through their corporate social and environmental responsibility (CSER) programs.

The World Student Community for Sustainable Development (WSCSD) is already spearheading youth-led river monitoring and conservation programs in Kenya under its 'Adopt-an-Ecosystem' programme.

Individual buyer, Government seller

EMCA 1999 has fiscal incentives and disincentives for proper management of natural resources public goods and services financed by taxes

User fees payable to government agencies for access to ecosystem goods (e.g. timber harvesting, water extraction, recreation opportunities, vending in the open green space, conservation easements for roads, drainage)

Fees (taxes or charges) for license to discharge (e.g., pollution taxes)

Introduction of customs and excise waivers, tax rebates, tax incentives to encourage sustainable consumption of natural resources.

Government buyer, Individual seller

The government can provide incentives to private parties for provision of ecosystem services:

Riparian Reserve Incentive Program (RRIP): provides funds to assist landowners within the river basin address existing environmental problems and meet existing regulations. Some of the protection practices that can be funded through

this program include: reduction of soil erosion and sedimentation and conservation for endangered biodiversity.

It can also implement a Green Reward Program that provides additional incentive payments to property owners and industries who are proactively engaged in "meeting the highest standards of conservation and environmental management on their operations" beyond the requirements of the current legal requirements.

The government can also allocate funds to community entities to foster resource conservation and environmental protection in the river catchment areas. This can be in the form of a 'Conservation Reserve Land' program through which private land owners are paid to convert agricultural lands into a watershed conservancy.

Government buyer, government seller

The government may also fund or subsidize other governmental and non-governmental agencies to help provide and protect ecosystem goods and services.

The central government's grants for Nairobi River Basin Rehabilitation and Restoration: For example, the National Environment Trust Fund (NETFUND) and the Water Service Trust Fund provide funds to governmental agencies such as Water Resource Management Authority (WRMA) and Water Services Regulatory Board to manage watersheds and support the development of wastewater treatment plants that help to protect surface and ground water quality.

The government's involvement in improvement of infrastructure and livelihoods in the slums through Slum Upgrading Programs is also one of the ecosystem exchange methods since it reduces the pollution from the informal settlements.

³ Thomas C. Brown, et al. Ecosystem Goods and Services: Definition, Valuation and Provision, 2006

IUCN **RED** LIST OF ECOSYSTEMS

Addressing Africa's Plight

By Edmund Barrow, IUCN

A 2014 EU-Africa Summit noted that 'Proactive measures are required to address the problems of land degradation, desertification and drought affecting many regions in Africa. We take note of the signature of a cooperative

arrangement between our two Commissions to use European space science and technology to monitor ecosystems through the 'Global Monitoring for Environment and Security (GMES) and Africa initiative.'

Indeed, it is critical to know the current status of Africa's ecosystems – as they provide us with so many essential ecosystem services, for example water (the water towers of Kenya) and a wide variety of Non



timber Forest Products on which we all depend on in one way or another.

Being able to assess and then monitor ecosystems will enable us to know the status of Africa's ecosystems, and be able to take appropriate action where needed, for example with respect to climate change

IUCN's Red List of Ecosystems is one such pro-active measure. By the end of 2015 IUCN will have completed a risk assessment for the Americas in a manner that is nationally owned and repeatable so as to monitor change. This tool is based on spatial analysis (using satellite imagery over the past 30+ years) and the analysis of drivers of ecosystem change, including degradation, conversion, climate

change, ocean acidification etc. This will provide decision makers, both in the environmental sector, but perhaps more importantly for use by planners and economic decision makers, as well as those working with broader risk assessment, for instance disaster risk reduction.

Already such risk assessments are being carried out in Africa (e.g. South Africa, Senegal), the Americas, and other parts of the world⁴. This IUCN tool could be an important asset to help Africa assess impartially, practically, and repeatedly the risks to Africa's vital life supporting ecosystems, which can form the basis for land use decision making and investment.

Why the IUCN Red List of Ecosystems?

Everyone knows that coral reefs are in danger, and that the rainforests are disappearing – or do we? What do we know in scientific terms? How much of these ecosystems are left, and how likely are they to disappear?

What is the risk of the Kenya's A m b o s e l i e c o s y s t e m collapsing, or the risk that the water towers of Kenya will become so degraded that their capacity to deliver ecosystem

services to society is impaired, or the risks of ecosystems becoming so endangered that they cause conflict and lead to disasters? IUCN is developing a new tool to provide answers to these and other questions – the IUCN Red List of Ecosystems, and we anticipate having a global Red List of Ecosystems by 2025 – but this will be incremental and build on national and regional assessments.

The IUCN Red List of Ecosystems will be a global standard for assessing the status of ecosystems (Box 1). It is able to identify which ecosystems are not currently facing significant risks of collapse, and which ones are Vulnerable, Endangered, or Critically Endangered. This is measured by assessing losses in area, degradation, conversion, and other major changes (e.g. climate disruption)

Box 1:

The IUCN Red List of Ecosystems will be:

1. Easily understood by policy-makers & the public.
2. Consistent with and complementary to The IUCN Red List of Threatened Species™, which measures extinction risks.
3. Transparent, objective, & scientifically rigorous.
4. Applicable to terrestrial, marine, freshwater & subterranean systems.
5. Applicable at national, regional & global scales.
6. Designed to use historic & present-day data.
7. Able to produce risk assessments that can inform conservation, land use & investment priorities.
8. Defined by criteria that reflect varying levels of risk & loss of function, & which are easily quantified and monitored.
9. A standardized procedure to assess & compare the risk of collapse of ecosystems.

⁴ See www.iucnredlistofecosystems.org for a series of case studies from across the world

How is the IUCN Red List of Ecosystems important for you?

The IUCN Red List of Ecosystems will be a valuable planning tool for different sectors, including for:

Global Environmental

Reporting: to inform governments and the global community on progress towards achievement of the Aichi targets under the Convention on Biological Diversity.

Conservation: to help prioritise investments in ecosystem management and restoration, reforms of resource use practices, and as a means of rewarding good ecosystem management.

Natural resource management (land and water) and macro-economic planning: to highlight risks faced by ecosystems under current and potential land use and development scenarios, and potential effects on services such as clean water, soil productivity, pollination, and the availability of natural products. The globally accepted standards will enable macro-economic planners to evaluate risks of ecosystem collapse and the related economic costs of reduced ecosystem services, or, conversely, the potential economic benefits of improved ecosystem management.

Disaster risk reduction: assessing the ecosystems that are at severe risk, will provide guidance as to the potential for a disaster at some point in the future, and so be one means for disaster risk reduction.

Improvement of governance and livelihoods: to inform development of governance systems

in ways that improves ecosystem management, livelihood security and social outcomes.

Private sector: a means for assessing potential environmental and social benefits and costs of alternative designs of future development projects as well as for monitoring and reporting on environmental impacts.

How is the Red List of Ecosystems being developed? – Potential for Africa

Standardized Red List criteria allow risks of ecosystem collapse to be assessed objectively, transparently and repeatedly, and highlight losses

Box 2:

Progress on RLE around the Globe

RLE's around the world: The RLE standard for assessing ecosystem risk of collapse has been tested on 50 ecosystems spanning six continents and three oceans.

Red List of Continental Ecosystems of the Americas is generating assessments at three scales: the level of 2 watershed assessments; national red lists of ecosystems for Bolivia, Chile, Colombia, Costa Rica, Ecuador, Peru and Venezuela; and an overall analysis of the status of terrestrial ecosystems across the Americas from Alaska to Patagonia.

Establishment of a European Red List of Habitats: A new project will define 650 habitat types and their risk assessment status will be assessed at two geographic levels: EU and Pan-Europe. In terrestrial terms, the EU assessments will be made for the geographical areas west of the current EU-border. In the marine environment, assessments will be made of all the habitat types in the Mediterranean Sea, the Black Sea, the Baltic Sea, the North Sea and/or in the European part of the Atlantic Sea.

of ecosystem functionality and services. At the global level, IUCN will assess the conservation status of the world's terrestrial, freshwater, marine and subterranean ecosystems, aiming to achieve complete coverage by 2025. Criteria for determining threat categories are based on ecosystem extent, and declines in ecosystem distribution and function over historical, present-day and future time frames.

As an example IUCN together with the *Centre de Suivi Ecologique* in Senegal have compiled a **draft** Red List of Ecosystems for Senegal. Map 1 provides a summary of the 55 different ecosystems in Senegal, while Map 2 is a draft risk assessment for the ecosystems of Senegal (**note**: this is still in **draft** form). Some similar, but sub-national assessments have been carried out in South Africa. Using a similar approach to that of Senegal, a Red List of Ecosystems will be completed for the Americas by the middle of 2015.

The same approach can be used at an Africa wide level, regional levels, for individual countries, and even at a sub-national level, e.g. a river basin, or an administrative unit such as a district. This will help provide definitive links between ecosystem status, and land (water) use planning and investment.

Shaping the IUCN Red List of Ecosystems – a collaborative and adaptive process

The Red List of Ecosystems is being developed and implemented jointly by the IUCN Commission on Ecosystem Management and the IUCN Global Ecosystem Management Programme, with active involvement of the IUCN Species Survival Commission and the



A Stream in Amboseli, Kenya. Photo by DJ Bwakali.

IUCN Global Species Programme. The collaboration aims to build, strengthen and promote the Red List of Ecosystems at global, regional and national levels by engaging with partners on the ground and raising awareness amongst policy-makers.

The IUCN Red List of Ecosystems will complement the IUCN Red List of Threatened Species⁵ and other IUCN knowledge products. When used together, these will be the most informative indicators of the status of biological and environmental diversity available at national, regional and global levels. At the national level, we build capacity of national level partners to carry out such risk assessments and for repeat assessments.

RLE and global challenges

The IUCN Red List of Ecosystems will inform assessments of ecosystem health and help quantify the value of healthy ecosystems for human well-being and sustainable resource use. In this world of rapid climate change and increasing risks of disasters, and, nowhere more so than in the

African Continent, we urgently need reliable assessments of ecosystem status to not only raise awareness about threats to ecosystems and the resulting impacts on human well-being, but to also demonstrate how improved ecosystem management can reduce risks, enhance resilience, and be a means for adaptation.

The IUCN Red List of Ecosystems will inform development planners, rural communities, and local and national authorities, enabling them to better manage the finite resources of our planet. Sound environmental management is imperative to maintain functional ecosystems, their biological diversity and the ecosystem services upon which our economies and social well-being ultimately depend.

⁵ The IUCN Red List of Threatened Species developed specific criteria to evaluate the risk of extinction of species, and document conservation efforts. It is the world's most comprehensive inventory of the conservation status of thousands of biological species, and it is widely used by government agencies, NGOs and policy makers. (www.iucnredlist.org).

EAST AFRICA'S ECOSYSTEM HEARTBEATS

Dr Isaac Kalua, Kenya

St Augustine once said that, 'the world is a book, and those who do not travel read only a page.' A journey across East Africa would reveal an exciting world of ecosystems that keep this part of Africa fresh and vibrant.

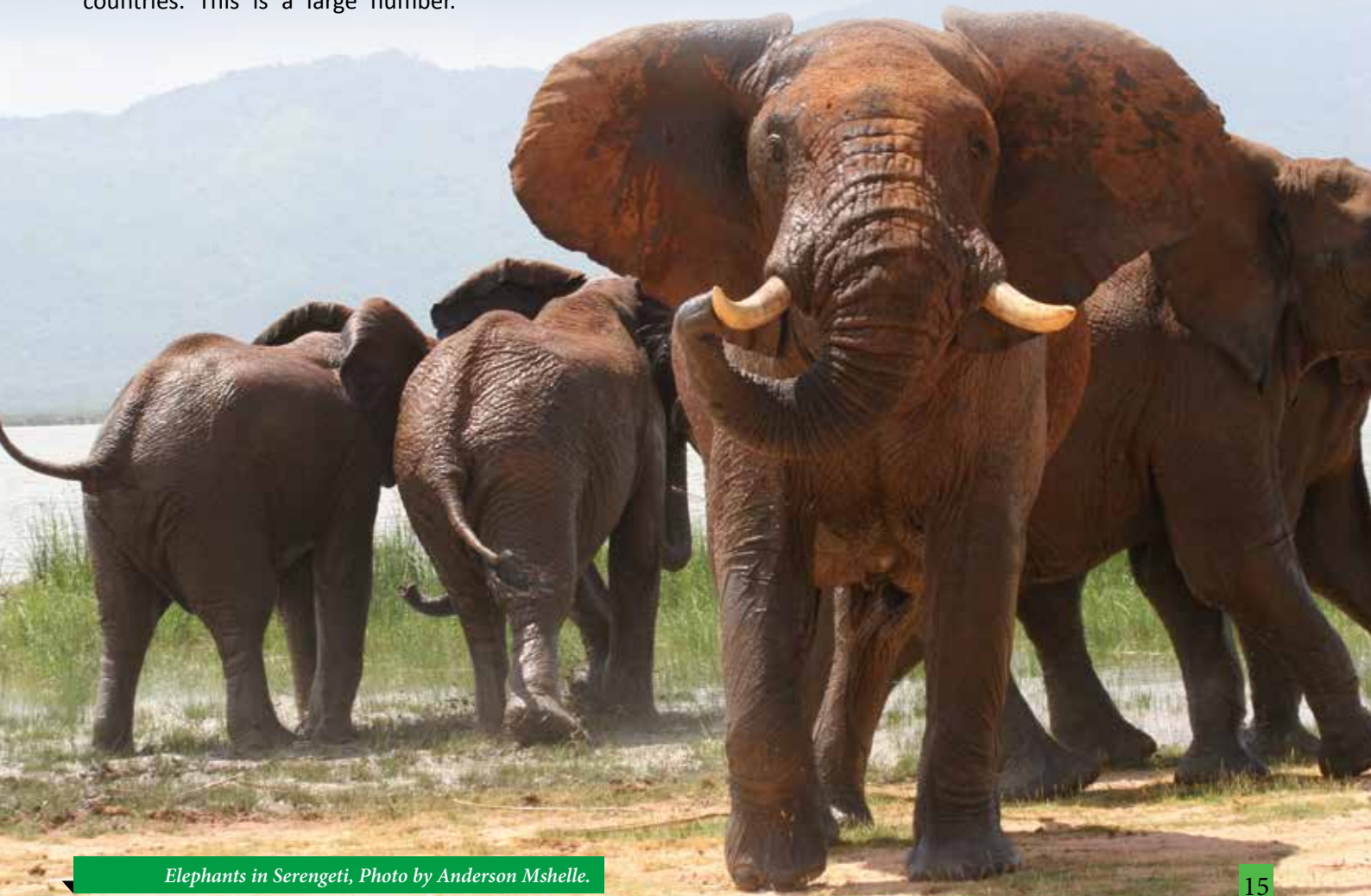
There are nearly 145 million people living in the five East African countries. This is a large number.

But it is more than a number. These are people with dreams and hopes. Fears and tears.

Whatever the fears and tears are about, chances are that in many cases, ecosystems have something to do with it. It may be because dryland ecosystems have been neglected leaving people impoverished,

yet they are extremely rich in ecosystem services that are grossly undervalued; or it may be because of forest ecosystems like the Mau water tower, whose priceless ecosystem services often play second fiddle to the hot Mau politics.

Next door to Kenya, Tanzania is a country that is immensely blessed by Mother Nature. Poets have



Elephants in Serengeti, Photo by Anderson Mshelle.

described it as ‘the country where beauty was created.’ To savour this beauty fully, one should journey to the Serengeti, whose unique ecosystems leave a vast array of wildlife flourishing. As far back as 1913, Stewart Edward White, the American writer and explorer described Serengeti as a paradise.

According to Maasai lore and lingo, Serengeti is derived from a Maasai word that means, ‘land that never ends.’ Indeed, Serengeti seems to go on forever – it covers an area of 14,763 square kilometres. This is more than half the size of Rwanda!

Serengeti and the nature-based tourism that it represents has for long been Tanzania’s largest foreign currency earner. Because of the wildebeest migration that originates in Serengeti, more than 100,000 tourists flock Kenya and Tanzania every year to feast on this amazing spectacle. These tourists leave Tanzania with lifelong memories even as they leave behind much needed dollars. But the big question is this – how many of Tanzania’s forty five million people benefit from these dollars?

The connection between ecosystems and livelihoods must define the way forward for East Africa.

East Africa’s 145 million people *can* be guardian angels of East Africa’s ecosystems. But that cannot happen if their lives are clothed in meagre existence. Neither can it happen if East Africans don’t treat one another as a potential market. In other words, if you are an East African and you sell a given product or service, then know that you have 145 million potential buyers of your product or service.

It is not by mistake that European Union countries trade 63 percent amongst themselves, the wider Europe 40 percent yet Africa is at a lowly 10 percent! The East Africa Community’s Common Market Protocol is a fitting pillar that can anchor multiplied intra-East Africa trade. Products like fruits and vegetables that depend directly on healthy ecosystems should find a wider market within East Africa as this will help their producers to take even better care of the very ecosystems that gift them with these products.

Uganda’s 35 million people are blessed with a country that has immense natural treasures that are not just good to look at but are also good for the economy.

Biodiversity alone contributes well in excess of 60 billion dollars to the Ugandan economy. On its part, agriculture contributes 25 percent of GDP and 50 percent of total exports. Nature’s contribution to Uganda’s economy does not end there. Fisheries employ about 700,000 people. Back on land, forestry in Uganda employs at least 100,000 people directly and another 750,000 indirectly.

It is therefore fair to say that ecosystem footprints in Uganda are truly indelible.

Budongo forest which sits at the top of the Albertine Rift exemplifies the role of ecosystems in Uganda. As was noted in Eilu and Bukenya-Ziraba’s 2004 publication, local communities in the Budongo area use over 63 species of plants for food, fodder or medicine. In this regard, the forest gives them both livelihoods and health. Indeed, the



*The Maasai have for years lived sustainably with ecosystems.
Photo by DJ Bwakali*

forest's providence and rejuvenation are irreplaceable.

Ecotourism can be a great protector of this forest and others in East Africa. Think of what it would do to the local Budongo communities if only five percent of East Africa's 145 million people visited it! More people would appreciate it and the local people would benefit even more from the forest without having to resort to felling down trees.

Ecosystems are similarly on the forefront of enhancing human wellbeing in Burundi. In this country, more than 80 percent of people live in rural areas. Most of them live in a population density of 265.8 per square kilometre. They are resilient people who have experienced war and emerged on the other side of peace with determination and gumption. Indeed, Burundi's famous Karyenda drums are representative of this small country's optimism.

Burundi is home to some crucial and attractive ecosystems. It has a vast stretch of Afro-montane forests that host the Kibira national park. Woodlands and savannah paint the terrain. Burundi also has, right there in the capital city Bujumbura, Lake Tanganyika, one of the largest lakes in the world. Sadly, Burundi's economy remains in the doldrums.

Burundi ranked 185th in the 2011 Human Development Index report. A country of such beauty, resilience and promise shouldn't be occupying the last slots on this UN list because rich natural capital can catapult it to the top, where it belongs.

Also blessed with a plethora of rich ecosystems is Rwanda. One of the many delights of nature in this small east African country is Mt Karisimbi. It is Rwanda's highest mountain. If you stand on this mountain, you will have a perfect view of the hilly, beautiful country of Rwanda. Amidst this beauty is fertile land that enables agriculture to account for more than seventy percent of the country's export revenue.

Rwanda's vision 2020 seeks the, 'transformation of agriculture into a productive, high value, market

middle of the road during a morning traffic jam, lolled on the tarmac and slowly walked away minutes later. Where else in the world does this happen? Kenya must seize on its globally unique natural gifts that stem from inimitable ecosystems.

According to World Tourism Organization statistics, international tourism receipts for 2011 were estimated at US\$ 1,030 billion, worldwide, up from US\$ 928 billion. Out of this, Kenya's share was a paltry US\$ 884 million while France's share was sixty times that of Kenya! In light

of Kenya's unique global attractions, something is wrong with this equation. Massively endowed with bountiful and beautiful ecosystems, Kenya must sustainably scale the tourism heights for the good of her 40 million people.

Even as East Africa trudges towards industrialization, it must take a long, hard look at ecosystem conscious ventures

like ecotourism and sustainable agriculture. How can we transform sustainable agriculture and ecotourism in East Africa so that it is not just for today's survival but also for tomorrow's wellbeing? Similarly, how can this eastern corner of Africa leverage her incredible ecosystems for the sustainable good of 145 million East Africans?

oriented sector, with forward linkages to other sectors.'

Transformation of agriculture.

These three words capture it as they represent the immense potential of ecosystems in empowering communities. As can be attested by Nairobi, even urban communities are beneficiaries of ecosystems. This large city is home to 4 million hard working, fun-loving Kenyans and many thousands of visitors.

Nairobi is the only capital city in the world that is the proud host of a vast 12,000 hectare park inside it! It is no wonder that this unique city once grabbed headlines around the world when two lions strolled right into the



Agriculture in Tanzania - Photo by DJ Bwakali

THE ECONOMIC IMPACT OF **Global Environmental** **Stewardship**

By Rachel Tamigniaux Gupta, USA

September 2014 proved to be the most exciting month for the orange clownfish, or *Amphiprion percula*, since the Disney movie *Finding Nemo*. On the 3rd, September, USA's National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration (NOAA) announced a 90-day finding that a petition by the Center for Biological Diversity provided enough information to potentially add the orange clownfish to the list of threatened and endangered species protected under the Endangered Species Act.

The petition initially requested the listing of eight different species of pomacentrid reef fish (damselfish and clownfish), however the NMFS finding only indicated that the petition presented substantial information for the review of one of the eight species, the orange clownfish. NMFS was later charged with reviewing the status of *A. percula*, soliciting scientific and commercial information from stakeholders, which would further clarify the need for listing of this species.

The orange clownfish is a well-known and easily



recognizable reef fish, particularly among aquarium enthusiasts and recreational snorkelers. The species is sometimes referred to as an anemone fish due to the symbiotic relationship with certain species of sea anemones. The trademark three white stripes on a field of orange gives the clownfish a vibrant and colourful presence admired by recreationists and conservationists alike.

The native habitat of the orange clownfish is generally restricted to the Coral Triangle area of the Indo-Pacific Ocean. Warm waters off the coast of Australia, New Guinea, and the Solomon Islands provide a comfortable living environment for the clownfish and its host anemones. The orange clownfish does not occur anywhere within U.S. jurisdiction and is not known to migrate into U.S. waters, or anywhere for that matter, as the habitat of this species is limited to that of their host anemones.

Despite the foreign status of the orange clownfish, it still qualifies for consideration under the U.S. Endangered Species Act (ESA) due to the law's intrinsic value of global environmental stewardship. Regardless of which country a threatened species inhabits, the ESA provides for the regulation of U.S. activities that could negatively impact the wellbeing of a threatened species.

Particularly in the case of marine species, borders rarely inhibit the movements of species or environmental impacts. Climate change is a very good example of such environmental impacts. The carbon emissions that are released by U.S. consumption have a global effect, including the ocean acidification and coral bleaching that is particularly damaging to reef fish such as the orange clownfish. While the species isn't native to the U.S., the cause of the endangerment certainly can be.

Overall, the ESA is a powerful tool in the protection of endangered species and their habitat on a global level. Signed into law in late 1973, the ESA was designed to provide for the conservation of species endangered or threatened throughout all or a significant portion of their range, and the conservation of the ecosystems on which they depend.

More than 2,000 species are currently listed as endangered or threatened under the ESA including several hundred foreign species like the orange clownfish. To date NMFS has jurisdiction over 122 endangered and threatened marine species including 32 foreign species. NMFS works in collaboration with USFWS to manage ESA species (NMFS manages marine species, USFWS manages land and freshwater species)

Through domestic regulation of activities such as the import, export, take, and commerce of an endangered species, the ESA aims to ensure that people and trade under U.S. jurisdiction do not contribute further to the decline of a listed species.

A species is considered endangered if it is in danger of extinction throughout all or a significant portion of its range. There are a wide variety of circumstances that could result in a species qualifying for listing.

Species must be listed if threatened or endangered due to any of the following 5 factors:

- Present or threatened destruction, modification, or curtailment of a species habitat or range;
- Over-utilization of the species for commercial, recreational, scientific, or educational purposes;
- Disease or predation;
- Inadequacy of existing regulatory mechanisms; and
- Other natural or manmade factors affecting its continued existence.

According to the Center for Biological Diversity, a key stakeholder in the status review and the original source of the petition for listing *A. percula*, the orange clownfish qualifies for protection due to the generally low density of orange clownfish and host anemone populations, the susceptibility of host anemones to warm-water bleaching events, and over-harvest from the global marine aquarium trade.⁹

Listing of the orange clownfish would provide the species certain protections (within the jurisdiction of the U.S.) that would help to prevent further damage to the species' population. The law requires federal agencies, in consultation with the U.S. Fish and Wildlife Service or NMFS, to ensure that actions with a federal nexus (such as authorization or funding) are not likely to further jeopardize the continued existence of a listed species or result in the destruction of designated critical habitat of listed species.

Furthermore, the law prohibits actions that result in the "taking" of any listed species (within the context of the ESA, to "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect). Likewise, import, export, interstate, and foreign commerce of listed species are all generally prohibited.¹⁰

9 November 3, 2014 letter from CBD Re: 90-Day Finding on a Petition to List Seven Indo-Pacific Species of Pomacentrid Reef Fish as Threatened or Endangered Under the Endangered Species Act, RIN 0648-XC775.

10 <http://www2.epa.gov/laws-regulations/summary-endangered-species-act>

Limited take of species by non-federal entities may be allowed through special permits and conservation plans. However, effects to a listed species must be minimized and mitigated to offset the take.¹¹ This is where the economic issues generally come into play with the ESA. Taking of a species can occur inadvertently as a result of construction, development, or in the case of the orange clownfish, recreation and industry.

Furthermore, the law prohibits actions that result in the “taking” of any listed species (within the context of the ESA, to “take” means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect). Likewise, import, export, interstate, and foreign commerce of listed species are all generally prohibited.

In their solicitation for further scientific data warranting the listing of the orange clownfish, NMFS received comments from the public and commercial sectors on the matter. The main stakeholders included the CBD and environmental stewardship advocates concerned with the protection of the clownfish, and the aquarium or recreational interest groups concerned with the impact listing of the clownfish would have on trade.

The ESA requires that listing determinations be based solely on the best scientific and commercial information available such that economic impacts are not considered above the survival of a threatened species.¹² Despite this, a number of commenters on the 90-day finding for the orange clownfish expressed concern that the listing of the orange clownfish would potentially make recreational use and sale of the species more difficult.

Economic factors may not be considered in the decision to list a species, but it plays an interesting part in the discussion when it comes to population levels of the orange clownfish. The species is a very popular one in the aquarium industry across the country, yet in the wild reef ecosystem of the Pacific, the species is reported to be dwindling. Listing could make acquiring

these popular fish legally more difficult. According to a letter received from the Pet Industry Joint Advisory Council, the listing of the orange clownfish would limit international trade of the species such that livelihoods based on aquaculture operations would be negatively impacted. Interestingly enough, the aquarium populations of the species may well benefit the species’ survival, in captivity. A number of like-minded commenters called for the exemption of captive-bred species.

As mentioned above, economic considerations are not meant to be part of the decision-making process resulting in the listing of an endangered species. As humans operating from within the human-economic arena, the discussion of economic impacts of decisions such as these is often unavoidable.

Every time an issue such as this comes to the forefront, it seems like we hear the same old debate. Animals or jobs? Owls or loggers? Clownfish or pet shops? Biodiversity or economy? Those industries that will feel the pinch will inevitably believe the legislation prioritizes foreign species over domestic jobs. The point also stands that a further protected reef system could benefit foreign tourist economies that attract commerce through recreation and access to rare and beautiful species, again at the price of domestic profit. But it is unlikely that either point will influence the decision.

Conservation and protection of biodiversity on a global scale often comes at a domestic price. In the case of the orange clownfish, the price of protecting the species and its habitat has potential impacts to the domestic aquarium industry. It takes great effort to step back from the economic, value-based perspective and evaluate the worth of a species within a scientific context alone.

The issue is in fact one of large-scale biodiversity. We depend on rich biological resources and healthy ecosystems, both domestically and globally, for crucial medical discoveries, economic development, and adaptive responses to a changing climate.

We as humans, have a very difficult time judging the value of a single species from any perspective but our own. However, the protection of the orange clownfish is an issue much larger than one likely to be influenced by short-term economic impacts. The final word will be one based on the scientific need to protect a threatened population, in so far as we can.

¹¹ http://www.nmfs.noaa.gov/pr/pdfs/esa_factsheet

¹² <http://www.nmfs.noaa.gov/pr/listing/>

PROTECTING FOREST ECOSYSTEMS IN MALAWI THROUGH INDIGENOUS KNOWLEDGE

By Chisomo Kamchacha, Malawi

Malawi's forests are on rapid decline!

This alarming deforestation is severely compromising forest ecosystems and leaving the country vulnerable both on the environmental and economic fronts. This begs the question – why did the country start losing its forests? One often ignored answer is this – when the country sidelined local community participation and indigenous knowledge.

Communities play a major role in managing forest reserves. Those that live adjacent to forests have done so for generations and consequently know forests intimately. Traditionally, they never felled trees indiscriminately and usually depended more on non timber products like honey, herbs and mushrooms. In this regard, they had a symbiotic relationship with forests and totally shunned any parasitic aspects.

Beyond the visible forest benefits were the invisible strings of indigenous knowledge: traditions, taboos, stories, shrines and cultural practices. For these communities, such forest intimacy cannot be paid off by one time compensations when development pushes them away from their ancestral lands. This is what happened to Isaac Banda when he was displaced from Kumbali forest together with other hapless community members.

More than thirty years earlier, people who lived in what is today called Kumbali forest were moved as the land was earmarked for construction. These original inhabitants were moved to Mchinji and Salima districts plus other areas in Lilongwe. They were paid compensations according to the government's criteria. But many felt that these compensations fell short in many respects.

Kumbali forest has changed dramatically over the years. Once a habitat for wild animals and a hunting place for surrounding villagers the forest has today been reduced to a farm and a few patches of trees.

Born in 1957, Isaac Banda remembers the long gone elephants, buffalos, hyenas, crocodiles, antelopes and the diverse kinds of birds that once lived in this forest.



Only a few pythons, bush bucks and wild pigs, now exist. Isaac recounts the fruits, wild vegetables, medicines, grasses and wild meat his village used to harvest from the forest whose 650 hectares is now dominated by the brachystegia tree.

But why after more than 30 years, should Isaac Banda cry for the proverbial spilt milk of his beloved Kumbali forest? In the quest to understand what went wrong, and what is affecting forest ecosystems management in the light of indigenous knowledge today, an in-depth study was conducted on the history as well as socio-cultural factors relating to Kumbali forest? It is because for him, the forest was not just a collection of trees and shrubs but in essence a refuge of his culture and ancestry.

In Malawi, the government may acquire private land for a public purpose. When this happens, the owner is entitled to compensation of property and losses incurred or even for lost profits. This system however has several inconveniences that include: loss of private property and homes; damages connected to loss of property and limitation of land usage of land.

The government however contends that fair compensation makes up for any losses incurred. In the case of Kumbali forest, and through the lens of Isaac Banda, the compensation focused solely on the visible and disregarded the invisible factors.

To people like Isaac, invisible factors are just as important, if not more important than the visible factors. Until now, the people from villages surrounding Kumbali forest still consider the forest as the land where their ancestors have slept. They still think of the forest and the graveyards in it as permanent camps for *gule wa mkulu*¹, and they also have historical connections with the big trees that were there when they occupied the land.

There are 12 graveyards in the forest. These are sacred sites in Malawi as they are considered to be the land of the spirits and places where no one should cut trees so that they remain thickets. Being moved from this land, the local community felt that they had been distanced and separated from their forefathers.

The graveyards are also permanent camps for *gule wa mkulu*. Being moved from this place resulted in a disruption of the *gule wa mkulu's* system and traditions. Each camp has its own leadership, values and norms. These camps are rich in history of ancestors and are blessed by the ancestral spirits.

In addition, people connect to the land through the trees present in the forest. Passing through the south east fields of Kumbali forest, there are two fig trees that stand adjacent to each other at a distance of 100 metres. According to Mr Chikale, a 65 years old man who has

lived in the area for over 25 years, the trees grew from poles that were used as goal posts for a football pitch. Such intimate knowledge of the trees is known only by local people like him. For them, the trees are like life-long friends. They are therefore the best custodians of the forest and should be treated as such.

In the early seventies, the original settlers of the land were moved because government had earmarked the land for construction of the state house, which is now called the Kamuzu Palace. Although they were moved for a good cause, their roots in the forest and fundamental role in conserving it was not necessarily taken into account. Consequently, what happened over 30 years ago, is affecting the use of the land today.

Because cultural and spiritual factors were overlooked, conflicts have arisen between the current owners of the land and people from the surrounding villages. People from surrounding villages are now cutting down trees from the forest because the current land owners have opened new fields. These villagers wonder why the owners are cutting indigenous trees which they did not plant. Trees the villagers left when they were moved from the land.

Villagers also wonder why the land owners can cut the natural trees yet they are not allowed to access these trees. Their understanding was that these trees were owned by the government yet they are now witnessing new owners felling the trees. Additionally, villagers wonder why they should protect the forest, the land of their ancestral spirits if someone is going to destroy that history and heritage anyway.

Do the villagers have a case against the government for insufficiently compensating them, or a case against the land owners for disrespecting their forefathers? Some might argue that had they not been moved, they would have cut down the forest anyway, just like they did on the land where they were moved. Possibly, they would have, but maybe with reservations and knowledge about the past, they would not. Today, they are cutting the trees as an act of revenge from being hurt by seeing the land where their forefathers have slept being reduced to a desolate place.

Indeed, tradition and culture can influence protection of ecosystems as well as destruction of ecosystems. Future land use transfers, as well as current forest management plans should be based on holistic approaches that include critical culture and indigenous knowledge analyses. Forests have always been a source of medicines, food, raw materials, construction materials, a place for rituals, and other cultural spiritual practices.

It is imperative to look back and dig deep into the linkages that surrounding communities have with forests so as to preserve both the traditions and forests.

¹ Gule wa Mkulu is a dance among the Chewa people, whom are the dominant tribe in Malawi, and are also present in Mozambique, and Zambia. The dance is recognized as a world heritage by UNESCO.

ECONOMIC EMPOWERMENT THROUGH RWANDA'S GORILLA ECOSYSTEMS

By Caroline Numuhire, Rwanda

Tucked away deep in the eastern-central region of Africa, Rwanda is one of the continent's smallest countries.

It takes two hours from the capital city Kigali to the heart of Musanze, in northern Rwanda. From Musanze to Kinigi, the landscape is the same with strong men pushing bicycles loaded with heavy potato sacks, women wrapped in heavy clothes to protect against the chill and students in school uniform chewing sugar cane.

On the Kinigi narrow road that leads to the Volcanoes National park (VNP), pedestrians saunter by in no hurry to let tourist cars pass as if they want to prove that this

is their street, their region, their gorillas, and their treasury; even if the majority of them have never toured the park. The roadsides are surrounded by fields of corn, beans, potatoes and pyrethrum. At the same time, facing the road, *Sabyinyo* volcano (the volcano with teeth) smiles and receives guests with its marvellous teeth shape.

In October 1902, Friedrich Von Beringe was the first European to discover the Volcanoes National Park. The mountain gorilla subspecies (*Gorilla beringei graueri*) was named in his honour.

The first field study was carried out 57 years later by Dr George Schaller who spent 20 months

observing gorillas on the Ape Primate Expedition in Central Africa. He concluded that these creatures, considered like ferocious in the past, were usually nonviolent and socially intelligent.

On September 24, 1967, the globally renowned Dr Dian Fossey, also known by her Rwandese name Nyiramacibili, began her own research of the mountain gorillas and published several studies on the species. For many years, she lived near gorillas in a cabin on Kalisimbi, the highest volcano in Rwanda (4507m above sea level) and as well as on Bisoke volcano. Sadly, she was murdered on the 26th December 1985 probably by poachers who wanted to freely continue their



Gorilla-Silverback & Group Sitting by Michael Kuttner

savage hunting activities. Her grave is close to Digit's (her beloved gorilla) which was slaughtered in 1977.

Nyiramacibili is the icon of gorilla tourism in Rwanda. Thanks to her zealous work, tremendous discoveries of the Eastern gorilla species have been published in different journals including National Geographic. Since then, gorillas have attracted tourists from all over the world to Rwanda and earned the country much needed revenue.

The VNP receives more visitors than Akagera and Nyungwe national parks. It received 42.3 percent of all visitors who came to Rwanda in 2014. All of the three national parks are managed by Rwanda Development Board (RDB). The 160 km², mountain gorilla park is surrounded by five volcanoes from East to West: *Muhabura, Gahinga, Sabyinyo, Bisoke* and *Kalisimbi*.

As per the last census in 2010, 480 gorillas resided in the Volcanoes Massif of Rwanda, DRC and Uganda. On the Rwandan side, those monitored for tourism and research were 295 living in 18 family groups. Every morning, all gorilla groups are visited by trackers who monitor them and inform guides about their current locations in case tourists want to visit them.

"We visit each family whether there are tourists coming or not" said one of the park guides, Jerome Uwihoreye.

Each gorilla family has its own name with Susa family having the largest members of forty-two. A maximum of eight tourists can visit a group and spend one morning hour with the gorillas. This strict rule is built on ecotourism and was set to minimize the negative impact on the park ecosystems as well as on the gorillas themselves. Tourists have to be at the morning brief at 7 AM at park headquarters in Kinigi. During the briefing, one of the park's 30 guides informs tourists about the park history and current activities.

Many tourists come to Kinigi to see these rare animal species with their own eyes. The mountain gorillas are the largest of the great apes and share 97% of their DNA with human

beings. Their social life structure is close to humanity's. In fact, gorillas live in a family with a male chief that controls the whole group.

The male life expectancy is late twenties or early thirties while female outliving men into their early forties. As soon as the female matures at the age of 8, their mothers push them to join another group to avoid inbreeding.

When they are 12 years old, the backs of males turn from black to silver colour, which is a sign of maturity and they can leave their families to create their own.

The adult male weighs around 165kg and develops secondary sexual characteristics like large canines whereas an adult female can only measure half of the males'. There are jealousies between males and frequent fights as they compete to seduce females. These fights, illness, poaching and trauma are among the major causes of gorillas deaths.

As human beings have fingerprints, gorillas can be as well identified by their *noseprints* allowing the trackers to recognize gorilla families. This technique was discovered by Dian

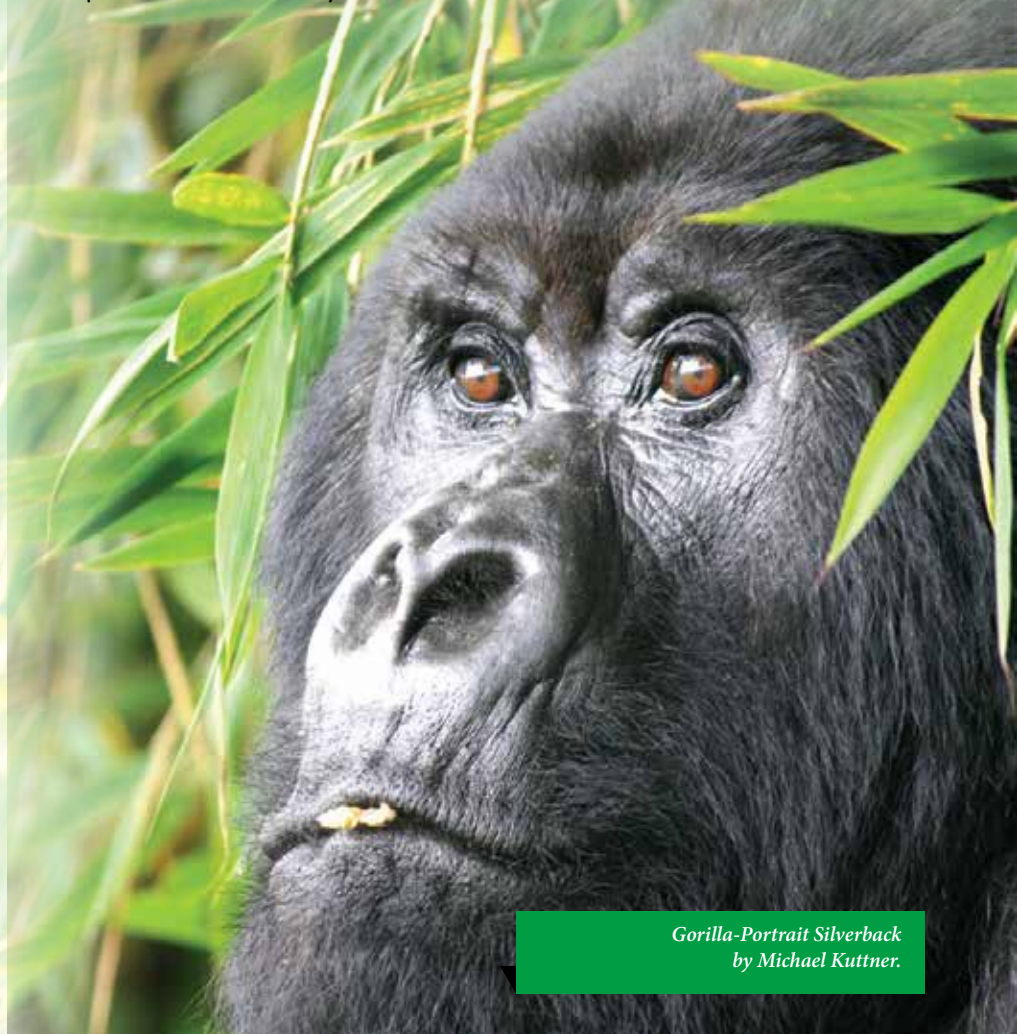
Fossey, who ascertained that a nose of each male gorilla is characterized distinct signs that distinguish it from its peer.

"Our gorillas' noseprints can be in form of points, slashes, Y or W shapes" continued Mr Uwihoreye.

Such unique attributes make gorillas even more fascinating. Even their eating habits are not monotonous. They frequently feast on a wide array of food that includes: gallium vines, thistle, leaves, shoots and the moist stem of bamboos. Besides this, gorillas eat wild celery, blackberries and nettles although some of these species are not available in the VNP.

Gorilla tourists pay \$750, \$500 and \$43 for non- resident foreigners, resident foreigners and Rwandans respectively. Even though Rwandans can pay considerably less amount, they constituted only 10.7% of all recorded visits in 2014.

This might be due to the fact that the \$43 park entry fee is still exorbitant for millions of Rwandans who struggle to satisfy their basic family needs. In addition, tourism



Gorilla-Portrait Silverback
by Michael Kuttner.

excursions are not really ingrained in the local culture. Most Rwandans still regard tourism excursions as *muzungus* (white or wealthy people) activities.

According to Rwanda Development Board, these amounts were determined after a national, regional

annual event is organized at the park headquarters. More than ten thousand guests from all over the world usually attend.

Faustin is also a member of *Iby'Iwacu* Culture Centre, an association that brings together more than a thousand former

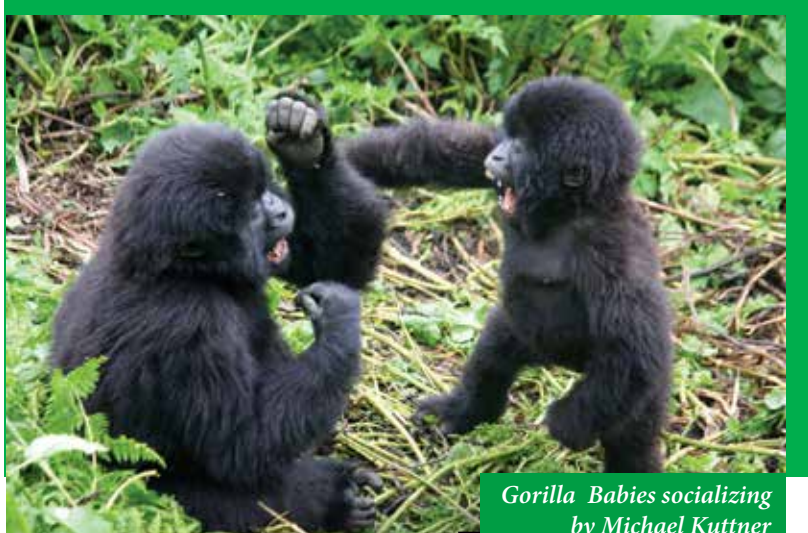
face punishment according to the existing laws are now supported and educated for behaviour change. Now, they have understood a local slogan "*Iyo zibonye amahoro zikamwa amadovize*" (When gorillas are peacefully conserved, they yield wealth").

Tourism is one of the key pillars of Rwanda's economy and has in the last five years contributed 3.3 percent to the GDP. Tourism revenues have increased from \$200 million in 2000 to \$ 281 million in 2013. Consequently, the Rwandan government has invested immensely into tourism, especially as regards security. This is a huge plus for Rwanda because tourism in several other African countries has been adversely affected because of rampant insecurity.

Despite the growth of tourism, most local communities don't earn livelihoods from it but from their farms. The big tourism beneficiaries are the established companies established companies in the hospitality sector.

Hotels like Muhabura (name of the 2nd highest volcano in Rwanda) were among the first to be established in Musanze town. At the opposite side of their reception office, is hung a label inviting clients to stay in room 12. This is the historic room where Diane Fossey spent many nights after coming down from the volcanoes. The Dian Fossey (double) room is the most expensive (\$ 90) almost the double the cost of other "normal" double rooms in the hotel.

Faustin's ancestors lived from hunting and gathering in the mountains. Although they taught him this culture, he will not do the same to younger generations. Rather, he will teach them to dig their lands and protect their park. On their part, the younger generation in the vicinity of Volcanoes National Park will grow up knowing that gorilla conservation is directly linked to economic empowerment. Indeed, man's closest relative in the animal kingdom unwittingly takes care of humans and the favour should always be returned.



*Gorilla Babies socializing
by Michael Kuttner*

and international market research and an assessment of willingness to pay. In 2013, 25,340 people visited the park. Most (38.8%) were Americans followed by English (10.2%) with Rwandans coming in sixth.

Faustin, a middle-aged native resident, joked that even if you paid his park entry fees, he would not easily accept. He would rather use the 30,000 FRw for the permit to buy *igipende* (local sorghum beer) for his wife.

"She would be prouder of me because we only visit humans and not gorillas," he added in toothless smile.

But Faustin can't hide his excitement about *Kwita izina* (name giving) ceremony where he supplies some fresh corn. The initiative was launched in 2008 for monitoring purposes. Since gorillas are considered as "relatives" of human beings they are named just like Rwandan babies who are named after eight days.

For efficient marketing of gorilla tourism, RDB has fused culture and conservation through the gorilla naming ceremony. This

poachers. They used to poach edible animals like antelopes and buffaloes, and would *accidentally* kill gorillas.

Park authorities are now educating the former poachers association about the national and individual economic benefits of the park. Once former poachers form associations, they can benefit from the tourism revenue sharing scheme. This constitutes 5% of the total revenues from the VNP tourism activities.

These funds are given to the administrative sectors surrounding the VNP that in turn use the money to sponsor community development projects including initiatives of former poachers. Projects vary from education and health facilities to agriculture and infrastructure construction.

Faustin now participates in park *patrouilles* and does other cultural tourism activities including showing tourists the king's palace history, traditional healing, iron smoothing, grinding stone, target shooting, drumming and warrior dancers.

All of these were part of Rwandan tradition during the Kingdom period. Poachers who used to

THE BIRDS AND PEOPLE OF KAKAMEGA FOREST

By David John Bwakali, Kenya



*A tree tunnel into Kakamega forest.
Photo by Carol Hunsberger.*

A few meters from a dusty path that leads towards Kakamega Forest in western Kenya lies a medium sized house whose rusty iron sheet roof glints softly in the late afternoon rain.

A stone throw away from the craggy house stands an Elgon Teak tree, regal and replete in its natural splendour. Resting his head on the rugged bark of the tree is Mzee Mumia, a seventy-seven year old man who has lived next to the forest all his life. He is gazing expressionlessly at the African Grey Parrot that can be seen flying gently towards some nearby shrubs.



Yellow-crested Woodpecker
Photo by Shailesh Patel

This famous African Parrot is close to becoming extinct in Kenya. Only about ten of them are thought to be still in the forest. Incidentally, this forest is its last refuge in Kenya, meaning that Kenya is dangerously close to becoming a 'parrot-less' country. This would be a big shame because African Grey Parrots are a rare combination of brains and beauty. The beauty aspect of the parrots is always evident whenever one is spotted perched in the cool branches of the forest or flying in the equally cool atmosphere above those branches.

The 240 square kilometres Kakamega Forest is the eastern most relic of the great Guineo-Congolian forest, which stretches across central Africa. It is the only equatorial rainforest in Kenya and hosts the witty African Grey Parrot plus over three hundred other bird species that nest in the over 380 tree species of the forest. The birds that nest in these trees are a diverse mix of central African lowland species and highland species.

Villagers in Kakamega are immensely proud of the African Grey Parrot. Mzee Mumia says this parrot is like a member of his Luhya community, the second largest ethnic group

nature as it imitates the streams that meander through the trees and monkeys that jump from tree to tree.

'But nowadays, people have become so selfish that they want the parrot to imitate them in their homes instead of imitating nature!' the old man says sadly.

The other bird species in the forest include the Great Blue Turaco, Grey-throated Barbets, Double-toothed Barbet, Yellow-crested woodpecker, White-tailed Ant Thrush, Turner's Eremomela and Chapins' Flycatcher. Also flying and nesting in this wet forest are canaries, sunbirds, weavers, waxbills, sparrows, Bulbuls, Swallows and many more.

Some of the birds in the forest, like the Great Blue Turaco, are quite easy to spot. This bird personifies John Keats words, 'a thing of beauty that is a joy forever.' Its red bill leaves one convinced that it is the main inspiration behind lipstick. Also conspicuous are its blue and yellow feathers that appear beautifully misty whenever the regular raindrops gently interrupt its flight. With a length of 70 – 75 centimetres long, it is the largest Turaco.

Other bird species in the forest like the Turner's Eremomela are quite difficult to spot. This is a very small warbler that is only 8 – 9 centimetres. The general scarcity of this tiny bird has already earned it a place on the International Union for Conservation of Nature (IUCN) Red List of Endangered Species

It was pushed into this list by increasing habitat loss fuelled by increased encroachment into the forest through farming and grazing.

Mzee Mumia's five sons are all farmers who often graze their cows in the forest. Okoti, the oldest of the five, explains this grazing recourse to the forest, 'the birds and monkeys



Great Blue Turaco. Photo by Shailesh Patel

cannot finish all this grass and shrubs in the forest!’

He however condemns the tree felling and charcoal burning that is also contributing greatly to the habitat loss of the birds. However, Kunyobo, his younger brother differs with his brother on this one, ‘we use wood from this forest to build our houses and use the charcoal to cook our food. Aren’t food and shelter basic needs without which we can’t live?’

The Turner’s Eremomela bird would agree with the young man’s observation. It would agree that it too needs the shelter and food that the trees provide. Due to habitat loss, it is becoming more and more difficult to hear the bird’s high-pitched voice chirping away in the forest.

Kakamega forest has 194 forest-dependent bird species. Such birds depend on the forest for their very survival. Luckily, this bird-rich forest still has many birds that are not endangered. The African Barbets can still be found in plenty in the forest,

pecking away at the many fruits in the forest.

One of the larger members of the African Barbets is the Double-toothed barbet. It is a cheeky, cheery and serene bird. With its gleaming red underside, it seems to be forever celebrating Valentine’s day.

Hard to spot but equally beautiful is the Yellow-billed Barbet. It seems to prefer the denser parts of the forest. When it does make an appearance, it doesn’t disappoint. Its yellow bill and partially yellow underside are a sight to behold – they match perfectly. Another yellow-named Barbet is the Yellow-spotted Barbet, a bird whose natural coat of yellow spots is duly complemented by its red forehead.

For generations, Kakamega Forest has provided refuge for birds like the African Barbets and for members of the local Luhya community who depend on the forest for both timber and non-timber products. Conscious of this vital role that the

forest is playing, local conservation activists are now on the forefront of sustainably unveiling the treasures of the forest to both tourists and local people alike.

Many of these local conservationists belong to the Kakamega Environmental Education Programme (KEEP), the official Site Support Group of the forest.

According to a study by the United Nations Environment Programme (UNEP), Kakamega Forest has two major encroached areas with settlements covering a total of approximately 573 hectares. Groups like KEEP are now sensitizing the community on the need to regard the forest as a sanctuary of nature that should be protected at all costs. To their credit, the local conservationists are helping the local people to realize that their own livelihoods are entwined with better protection of the forest birds and animals.

Apart from adults, more than 10,000 children have over the years received

environmental education from KEEP. Ongachi, a twelve year old recipient of this environmental education had some witty thoughts about the birds and people of the forest, ‘every morning I wake up to the sound of birds, which means that without the birds, there would be no morning.’

One morning, Shailesh Patel, a professional bird watching guide from Nairobi woke up to the twin chirps of the White-tailed ant thrush and the Yellow-crested wood pecker. It was already light enough to spot the White-tailed ant thrush balancing on a nearby ant column. But the wood pecker was nowhere to be seen despite its crystal clear sounds.

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But in his mind, Shailesh could already see the sharp bill and calm eyes of the woodpecker, not to mention the yellow crest that gave it its name. He had seen this crest heaving back and forth countless



Double-toothed Barbet. Photo by Shailesh Patel

times, as the bird pecked away at the rough barks of trees. It was always as if the bird was swaying to some unseen natural orchestra.

The birds of Kakamega forest are at the epicentre of the forest’s music. The Barbets twirl to the *tap tap tap* of the woodpeckers. The alert eyes of the Harrier Hawk and Lanner Falcon dance excitedly as they scan the lush canopies for some unguarded nests. The Pink-backed Pelican, White Stork and Black-headed Heron seem to gyrate to the silent melody of the forest streams.

The Common Quail otherwise known as *isindu* in the Luhya language is a local delicacy. Tiny and pretty, it ‘fly-dances’ as it flees gracefully from local hunters. The gleeful cum woeful soprano of the Turner’s Eremomela fits in perfectly, like a dovetail joint, with the cheeky chirp of the lemon dove.

Litungu, a traditional seven-stringed instrument of the Luhya people has a distinct rich sound that seems to draw from the lush musical pitches of the ancients. The harmony inherent in the seven strings of this traditional

lyre seems to be a vindication of the traditional harmony between the people and birds of Kakamega Forest.

Mzee Mumia, the old neighbour of the forest is still leaning on the Elgon Teak tree as he observes in his deep voice, ‘we have eaten the common quail for generations but its beautiful presence remains undiminished. We don’t even eat the Turner’s Eremomela

yet its very existence in our forest is now threatened.’

The old man pauses fleetingly before concluding, ‘it’s all about harmony. Nature’s harmony must not be stilled.’ For this to happen, Kakamega forest ecosystem must be restored fully and left intact.

To paraphrase the words of Ongachi, the twelve year old boy, ‘the songs of the birds must keep preceding the light of dawn, or mornings will start illuminating a troubled forest, a troubled people and diminishing birds.’

TANA DELTA'S MANGROVES

By Julie Mulonga (Wetlands International),

Sarah Ndonge (ELCI)

The beauty and tranquillity of the Tana Delta is enchanting and exceptional. This is where the mighty River Tana empties its waters into the Indian Ocean after meandering for nearly 1000kms from central Kenya's highlands through Garissa, Hola and Garsen before entering the ocean at Ugwana Beach in the Kipini area. The epic river spreads out across a massive floodplain at the coast, creating the Tana Delta.

As the river slows down and spreads out into the flood plain it creates tidal creeks, salt marshes and mangrove swamps. The Tana Delta mangrove forests are unique

because they have all the nine different species of mangroves found along the Kenyan coast. Each species has a unique characteristic that sets it apart from the others.

Of great importance is that the delta is the most recent area in Kenya to be recognised as a Ramsar site. The delta was officially declared a Ramsar site, under the Ramsar Convention, in October 2012. This international recognition calls for the conservation of the delta for sustainable development.





Mangrove trees that have developed special roots for stability,
photo by Benedict Agano WI

Mangroves are salt tolerant evergreen forests found in the area between dry land and the sea in relatively sheltered areas along estuaries and lagoons with low energy waves.¹ They have very unique roots that grow above the ground surface and help the trees to breath. These forests are also a unique habitat for many endangered birds and wildlife and they run along the main river course between Ozi and Kipini.

A group of environmental organisations have been active in conserving the unique ecosystems in this area. This group comprises of Environment Liaison Centre International (ELCI), Wetlands International (WI) together with the Kenya Marine and Fisheries Research Institute (KEMFRI) and community members from Kipini village.

The local people have a wealth of knowledge of the mangrove forests. Like several other community

members, Mr. Awadh Mbarak Hassan, the Beach Management Unit (BMU) chairman knows the local and scientific names of different mangrove species. He confidently points them out, 'Mkomani, Mkanga, *Avicenna marina*, *Rhizophora mucronata*, *Xylocarpus granatum*, *Bruguiera gymnorhiza*, *Ceriops tagal*, *Heritiera littoralis*.'

Indeed, local indigenous knowledge is a critical component of conserving Tana Delta's invaluable ecosystems.

Together with KEMFRI, who have been in the mangrove field for years and local community members, the environmental organisations have undertaken a quick assessment of the mangrove forest. The participatory exercise clearly demonstrated how communities can be actively involved in the collection of scientific data. Along the river bank, the effects of erosion and destruction of the mangroves was quite evident.

However, all is not lost. Little mangrove trees, about half a metre tall grow in the murky waters and confidently sway to the morning breeze, as testament to regeneration of the mangroves destroyed by the el niño floods. In the more mature mangrove forest, trees grow to heights of 20 metres and above.

The muddy path leading to the forest is often laced with fresh footprints of hippos. At night, the water herbivores roam from the river into the forest to feed. In addition, the forest is home to many wildlife and bird species some of which are endangered. They include: the Golden-rumped elephant shrew (*Rhynchocyon chrysopygus*); Wild dog (*Lycaon pictus*); Basra Reed Warbler (*Acrocephalus griseldis*); Lappet faced Vulture (*Torgos tracheliotos*) and Madagascar Pratincole (*Glareola ocularis*). In order to consolidate conservation efforts of such birds, the area has been designated as an Important Bird Area (IBA).

Preliminary findings of the assessment indicated that some of the forests like those in Ozi were generally in a better condition than those in other areas along the Kenyan coast. There is a lot of erosion along the banks of the rivers and this is seriously affecting the mangroves since a number of them have been uprooted.

Deposition of sediments was also observed and poor farming practices upstream also aggravate this problem. There is therefore a need to train farmers upstream on



Community members measuring height of the mangrove trees in Kipini, Tana Delta area,
photo by Benedict Agano WI

1 http://cmsdata.iucn.org/downloads/mangroves_1.pdf

better farming techniques. However, forests in Kipini, especially those near the village were highly degraded as they provide basic products like firewood and building material to the community, necessitating conservation activities.

The Tana Delta's mangroves are very productive ecosystems and thus need to be protected because of their priceless ecosystem services and benefits to the communities that live around them. The mangrove forests are home to different species of fish that are a source of food for the communities. Of great importance is their role as breeding and spawning areas for many crustaceans and fish species. Mangrove wood is resistant to rot and insects, making it extremely valuable. Community members rely on it for construction material as well as fuel.

The mangrove forest protects the coastal area from the effects of strong waves and storms. The dense root system of the mangroves traps sediments flowing off the land consequently preventing soil erosion. In this regard, they act as shock absorbers and bulwarks against sea level rise.

However, there are still no accurate monetary valuations of the mangroves' goods and services. As a result, they are still being destroyed at an alarming rate to make way for urban expansion, ports, and construction of shrimp ponds for short-term benefits to a few at the expense of long term-benefits to society as a whole.



*Fishing is one of the economic activity in the area
Photo by Benedict Agina WL.*

The mangrove forests together with the entire delta have great potential for ecotourism as they provide scenic and unique sights. They also provide a refuge for diverse flora and fauna including invertebrates, fish,



*Mangrove regeneration.
Photo by Sara Ndonye ELCI*

amphibians, reptiles, birds and mammals, which in turn further enhance ecotourism potential.

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Due to climate change, carbon sequestration by forests continues to gain in value. Due to their high biomass density and productivity mangroves play a significant role in carbon sequestration. They can sequester about 22.8 million metric tons of carbon each year.²

It is therefore critical to create benefits from the mangroves forests without depleting them. Apiculture is one such benefit. Bees get the nectar from the mangroves flowers and can thrive in mangrove forests. Crab farming can also flourish within mangrove creeks. Indeed, Tana Delta's mangroves are an invaluable treasure.

² Giri C, Ochieng E, Tieszen L, Zhu Z, Singh A, Loveland T, Masek J and Duke J. 2010, Status and distribution of mangrove forests of the world using observation satellite data, Global Ecology and Biogeography Volume 20, Issue 1, pages 154–159, January 2011

WEST AFRICA'S WONDER RIVER

By David John Bwakali

On 13th October 1974, 286 athletes ran in the first ever Berlin Marathon. Less than three hours later, 32-year old Günter Hallas had won the marathon. Last year in 2014, Kenya's Dennis Kimetto ran forty minutes faster than Günter and set a new world record. When next year's winner crosses the finish line, the 42-kilometre long Berlin Marathon will have covered almost 1,800 kilometres since its inception. This is the length of Senegal River, West Africa's second longest river.

Popularly known as West Africa's water tower, the highlands of Fouta Djallon in central Guinea are the source of Senegal River. Flowing from these highlands

are three rivers that provide eighty percent of Senegal River's waters – the Bafing, Bakoye and Faleme River Rivers.

After leaving Fouta Djallon, the river powers into Mali then flows on to form the boundary between Senegal and Mauritania. It ends its epic journey upon arrival into the Atlantic Ocean.

Mali has the lion's share of the Senegal River basin. 30 million acres – which is 38 times the size of Cape Verde – sits squarely in Mali. Senegal's share of the basin is the least and is one fifth of the size of Mali's share.

Living in the Senegal River basin are millions of people who have swam and fished in the river for centuries. They are a rainbow of ethnicity and include Peuls, Toucouleurs, Soninkes, Malinkes, Bambaras, Wolofs and Moors. They possess an intimate knowledge of the river borne from centuries of living next to it.

Also familiar with the river are the hundreds of bird and fish species that swim, wade and feed in the river.



*Kaedi, Senegal River in Mauritania.
Photo by Bertramz, Courtesy of wikimedia commons.*

Among them is the African spoonbill, so named because of their spoon-like bills.

As the white spoonbill sways its large beak in the cool waters of Senegal River, it appears to be dancing to some riverine music. Left – Right – Swoosh. Left – Right – Swoosh. The swaying is alternately gentle and fast, as if the river's music were a blend of rhythm n blues and hip-hop.

Senegal River doesn't just entail the H₂O liquid known as water. It has also enabled the Senegal River basin. If this basin was a country, it would be bigger than Uganda. Its 74 million acres are teeming with dazzling biodiversity and rich wetlands.

Despite unending hiccups and monumental challenges, agriculture also thrives in the basin, causing the Senegal River valley to be baptized, *Le grenier du Sénégal*. Senegal's bread basket. But it's also a potential bread basket for the three other countries. Indeed, Senegal River basin's irrigation potential in the four countries is one million acres. Only one-fourth of this area is currently under irrigation.¹

For decades, governments of the four countries, local organizations and international donors have invested

1 <http://www.fao.org/docrep/w4347e/w4347e0h.htm>

huge amounts of time and resources towards full utilization of the basin. *Organisation pour la Mise en Valeur du Fleuve Sénégal* (OMVS) has been at the heart of these efforts. It was born through a convention that came into force on 11 March 1972. OMVS therefore shares a birthday with Didier Drogba, born six years later on the same day.

Just like the great Ivorian player, OMVS has scored many goals and also missed many. One of these goals is especially relevant to the riverine communities – secure and increased revenues of people living in the Basin. However, some have ruled the goal as offside arguing that OMVS hasn't really achieved this and instead made things worse by enforcing large scale rice farming as opposed to enhancing the small scale farming that had existed for centuries.

Twenty five years after the birth of OMVS on seventh January 1997, another convention established Diama and Manantali dam agencies. Diama dam is located next to Senegal's Diama town. It prevents salt water intrusion upstream and channels irrigation water into approximately 110,000 acres of land.

Manantali, which is located in Mali, provides hydroelectricity to Mali, Senegal and Mauritania. Despite these massive electricity benefits, Manantali's agricultural benefits haven't met the expectations of



Senegal River Saint Louis, Photo by:
Radoslaw Botew, Courtesy Wikimedia Commons.

local communities and several other stakeholders. Again, the balance between large scale dam ventures and small scale agricultural practices has proven to be quite tricky.

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The African spoonbill is swaying again, oblivious of the politics that has inundated the river basin. All it knows that the river keeps it well-fed and alive. Less than a kilometer away, acres of rice plantations stand still, indifferent to the river's music but swaying to the gentle breeze that is a staple of the river during sunrise and sunset.

The rice farms and African spoonbill are not alone in depending on the river. Thirteen million people live in the Senegal River basin. Out of these, approximately three million live near the river and depend on it for their livelihoods². Whether these livelihoods have been enhanced or undermined with the passage of time is still up for debate. What is clear is that without the river, millions of people would be rendered helpless and hapless.

When the river approaches the end of its 1,800-kilometer journey, it flows into its very own delta and does wonders there. This delta contains rich wetlands that host at least four Ramsar sites. One of these sites is the Djoudj National Bird Sanctuary, a favourite of the spoonbill and at least 1.5 million other birds. Ironically, as Africans migrate to Europe in their hundreds every year, thousands of birds migrate from Europe to Djoudj in Senegal. Without doubt, this place is a 40,000 acre

bird paradise *par excellence*.

Djoudj, which is a UNESCO world heritage site, comprises of a lake, streams and water, water everywhere. The African spoonbill just loves this water, even though it's not a big fan of the crocodiles that like lazing in it. Apart from the crocodiles, sea cows also roam the waters. These sea cows are so unique to West Africa that their other name is West African Manatee. They have short fins that look like legs and small eyes that give them a geeky look.

The *Bassin du Ndiaël* is another Ramsar Site in the Delta. It is now largely dry although half a century earlier, it teemed with hundreds of thousands of garganeys, those small, colourful ducks that glide on water with the grace of a gazelle skipping in the savannah grassland. Thankfully, the *Bassin du Ndiaël* is not just about lost glory as it currently hosts at least 20,000 water birds. On certain days, these armies of birds can be seen, gliding, flying, fluttering, cackling, cooing and chirping.

Guembeul Natural reserve is yet another Ramsar site in the delta. This is where Sahelian mammals and reptiles find much needed refuge. One of these mammals is the spectacular scimitar oryx. Its long horns sit on its head like a crown of elegance.

A patch of brown on its neck matches just as elegantly with its white body, making it to look as if it is wearing a stylish broken suit from Shakara Couture. Once numbering in their hundreds of thousands, the scimitar oryx have dwindled to mere dozens, making the protective refuge of Guembeul Natural Reserve even more critical than ever before.

The fourth Ramsar site in the Senegal River delta is Parc National du Diawling. Its vast 40,000 acres are all in Mauritania and they host over 220 species of birds including pelicans, black storks and flamingos. Just like the three other Ramsar sites in the Senegal River Basin, this is one place that birds, mammals and reptiles can call home.

Above all, millions of West Africans earn livelihoods because of West Africa's wonder river. It is now critical for them to be further empowered so that they can be primary guardians and beneficiaries of the wonder river. In the words of Heraclitus the ancient Greek philosopher, 'you cannot step twice into the same river...'

We only have one chance to interact productively and sustainably with the wondrous waters of River Senegal.

2 http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/wwap_Senegal%20river%20Basin_case%20studies1_EN.pdf

THE SOUP THAT DRIVES THE ECONOMY

How a flourishing marine ecosystem is able to contribute to economic growth

By Mariam Mokhtar, Malaysia

In East and South-East Asia, a wedding banquet, business dinner for a valued client, or memorable family occasion, would be incomplete without shark fin soup. This dish, which was made popular during the reign of various Chinese Emperors over 1,000 years ago, was designed to show-off the Emperor's power and wealth. In recent times, commercial fishing means that the dish is now available to more people. Consumption of shark fin soup is considered a symbol of prestige and opulence in the eastern cultures. Ironically, overfishing of sharks, to satisfy our egos, has caused deleterious effects on the marine eco-system.

The shark is one of the most feared predators of the sea. They roamed the world's oceans over 400 million years ago, and existed 100 million years before dinosaurs inhabited the earth. Ironically, the most intelligent species on earth, *Homo Sapiens* is responsible for making the shark an endangered species, through irresponsible habits such as over-hunting, over fishing, deforestation or via agricultural practices.

The dwindling shark population prompted President Tommy Remengesau, of Palau, a small nation in the western Pacific, which consists of 300 islands and has a population of 18,000 people, to take immediate action. In 2009, Palau established the world's first Shark Sanctuary. The idea was embraced by other countries, such as The Maldives. Countries like Fiji, the Bahamas and those with significant diving attractions, are also taking action to protect sharks.

A study conducted by the Australian Institute of Marine Science has highlighted the expenditure of visitors, who were mostly attracted to the diving, in Palau. The Palau economy was boosted by tourist money being spent on accommodation, food, transport, air fares and diving costs.

Palau, like other nations, is not immune to climate change, but Remengesau, feels that the nation has a special link with the ocean. He said that Palau should be "the conscience of the world".



Fins blocking the pavement

Photo by Gary Stokes Sea Shepherd

The president is worried by the rate at which depletion of stocks of some fish species, such as the bluefin tuna, due to commercial fishing. Overfishing may trigger an ecological chain reaction with devastating and irreversible effects on marine eco-systems, which could take decades to reverse.

Remengesau said, "The ocean is our way of life", and stressed that the ocean has "sustained and nurtured the islanders, and given them their culture and identity".

The Sea Shepherd Conservation Society is an international non-profit, marine wildlife conservation organisation. The Director of Sea Shepherd in Asia, Gary Stokes, described the Palau Shark Sanctuary as a great initiative, "The islanders are now seeing the knock-on effects. Not only are sharks bringing divers, but the entire reef ecosystem is thriving. There are more fish of all sizes. A live shark is worth far more for ecotourism, especially in the diving industry."



Finning in Sri Lanka market
Photo Credit Gary Stokes, Sea Shepherd

Live sharks are beneficial to the islanders of Palau, as they make a sizeable contribution to their country's economic growth. One research suggested that a live shark is worth around \$1.9 million (tourism potential) over its lifetime, whereas 100 dead sharks, sold for meat and medicine, is only worth around \$11,000.

In San Francisco, Dr Alex Hearn, the Director of Conservation Science at the Turtle Island Restoration Network said, "You can kill a shark and get \$130 for its fins; but a healthy shark population, can provide millions of dollars, from tourism, every year, sustainably."

Having spent six years on the Galapagos Islands from 2002 – 2008, Dr Hearn whose work is mainly shark related said, "The Galapagos economy is based on tourism and an important part of that tourism is sharks and marine creatures. It goes beyond jumping into the water and swimming with the sharks. When you walk through the town, you see T-shirts, mugs, hats..."

"You can drive a healthy tourism economy based on this key species. It brings in the tourists, creates jobs, in all sectors of the economy; guides, merchandising shops, travel, administration, restaurant, hotels. There is a lot to be said for responsible tourism in the marine environment, as an economic benefit to conservation."

The shark's fin, when made into a soup, is bland. Chicken stock gives it flavour, and the addition of shark's fin, gives

the soup texture. This process, whereby the shark's fins are cut off and retained, is called finning.

Stokes said, "Finning is the barbaric practice of slicing off the sharks fins at sea. This is happening less and less as countries, globally, have evoked laws on landing sharks either with fins attached, or with a percentage of fins-to-bodies onboard.

"This practice happened a lot on long line tuna vessels which wanted to take the valuable fins, yet not fill up the boat with low value shark carcasses. Now the shark carcasses have a market too, for cartilage, liver oil, leather and meat!"

Concerns have been raised by this cruel practise. Having cut-off the fins, the remainder of the shark's body is dumped into the sea. The shark experiences an agonising death by drowning.

The use of sharks' fins in soup has received wide publicity. Besides this, shark meat is also found in traditional Chinese medicine whilst their leather, teeth and jaws are popular with trophy hunters. Demand for shark fins kills 73 million sharks each year. One third of the shark species that swim in the open ocean have been classified as threatened, with some populations being reduced to 10% of their former size.

Over the last two decades, shark fin soup has seen a

rise in consumption with a Washington Post article claiming that in 2012, over 70 million sharks were killed, (in general, estimates vary from 73 - 263 million sharks killed) to satisfy the growing appetite of China's growing affluent community, in other words, the nouveau riche. The species most affected from the exploitation are the blue shark, shortfin mako, silky, hammerhead, and thresher sharks.

the Chinese Central Government forbade all Government Officers from having shark fin soup at official banquets or functions. The ban was extended beyond official functions. Officials may not attend any event or dinner, at which shark fin soup, or other luxury items, are served. Even friends weddings are off limits, if shark's fin soup will be served.



Whale Shark (copia)
Photo by Alex Hearn

All marine animals absorb pollutants, such as mercury and heavy metals, which are found in the oceans. These toxins are concentrated in higher doses in sharks, as they are the top predators.

Sharks are vital to the ecosystem in which they live, such as in sea grass beds and coral reefs. They help to maintain the balance of marine life. Finning has drastically reduced shark populations and as they are at the top of the food chain, other species with which the sharks interact, also become threatened.

The shark's feeding habits control the number of lower predatory species below them. They help to remove sick and weaker animals from the ecosystem. As they are slow to reach reproductive maturity and produce small numbers of young, over-fishing will make their numbers dwindle even further.

This exploitation increases the threat of extinction, for many shark species. The European Union (EU) supplies 14% of the shark fins to the global market. In 2003, the EU placed a ban on shark finning, but loopholes allow shark fins to comprise a considerable part of any given catch.

This year, a new ban has been proposed to the EU, to remove this loophole and make it illegal to land shark fins without the bodies. The EU and America have banned finning, but the South-East Asian nations, Japan and China still encourage it.

According to Stokes, "The EU and America have banned "finning", but they still land sharks, cut off the fins and send them to Asia. Spain is the number one exporter of shark fins globally to Hong Kong and China. The USA is number 7!"

The biggest disappointment, for the traders, was when

Despite the lack of scientific proof, shark fin soup has long been marketed as a health drink providing longevity, cancer cures or even increased virility. The converse is true and human health may be at risk because of the high doses of pollutants in the shark. Regular and long-term consumption of shark fin soup may lead to heart problems, neurological problems and infertility.

The high rate of sharks being killed by the shark's unnatural predator – humans – has resulted in a disruption to the life cycle of the shark. In 2012, The Global Times, an English-language paper in China claimed that China, Taiwan and Hong Kong are responsible for over 95% of the annual shark harvest.

In an article in the Union-Tribune, Jeff Graham, a shark expert, research physiologist and marine biologist, at the Scripps Institution of Oceanography, issued a warning. He said, "In my opinion, mako sharks will disappear in the next 25 to 30 years, if trends continue as they are."

Although some nations are going to ban commercial fishing, in the Pacific, the problem of enforcement remains an issue. These small island nations may not have much money or resources to police or enforce this ban.

Stokes said, "Many of these island nations are banning shark fishing and some are instituting a total ban on commercial fishing. Like all marine laws, enforcement is the issue.

"This is something that Sea Shepherd is addressing and we have offered to lend our vessels and crews, to

countries for law enforcement purposes. This year we have conducted co-operative enforcement operations with Senegal, Guatemala and continued our long relationship with Ecuador/Galapagos.”

Sharks are the top of the marine food chain, especially for coral reef-systems. Over-fishing affects the lower end of the food chain. In the end, man will suffer, because the seas (or rather sea-life) will die out. Stokes concurs. He said, “On reefs, where sharks have been removed, scientists have seen a collapse in the population of all species.”

A flourishing marine eco-system contributes to economic growth. Stokes has some suggestions for individuals, to help preserve marine eco-systems.

He said, “When you go on holiday, support ecotourism initiatives that are working to promote the health of delicate ecosystems and have a lower impact on the environment.

“Change your own lifestyles, at home. Use fewer single use plastic items (plastic bags, cups, straws, utensils, takeaway boxes). Much of this ends up in the ocean and is choking and killing important species in the ecosystem.

“Get involved within your community. Get educated and help spread the word. Join beach clean-up events and other ocean friendly initiatives. Support ocean conservation organisations with funds or volunteer your time.”

Dr Hearn believes that we should also be more responsible about what we eat from the ocean. He said, “There are several sustainable seafood guides available. Avoid the fish which are caught at the expense of the



Finned Shark
Photo by Gary Stokes, Sea Shepherd



Hammerhead shark
Photo by Alex Hearn

demise of many other species.

“In your daily life, avoid plastic bags which are terrible for all sorts of creatures, like turtles. Turtles think the plastic bags are jelly fish. When ingested, the bags can kill a turtle. Lobby your government to make the right decisions.”

Healthy marine habitats provide food to coastal communities, but they also give us the opportunity to see wild-life, like the large sharks, at close range. A flourishing marine ecosystem is able to contribute to economic growth, but if humans are not careful, there will be knock-on effects and unintended damage to the ecosystem, mainly because we do not have sufficient understanding of the dynamics of the marine ecosystems.

Drought **MITIGATION** IN EASTERN **Kenya**

By Kevin M. Kamuya, Kenya



*Community constructs sand dam
Photo by Utooni Development
Organization*

To many who visit, East Africa appears as a paradise: pleasant weather, abundant wildlife, plentiful trees and blooming flowers throughout the year. Yet this region is also home to vast stretches of arid and semi-arid land, where obtaining sufficient water for crops, livestock and households is difficult at the best of times and impossible at the worst. The threat of hunger is perennial and ever present. Water availability is always at a premium.

Life is *always* precarious, rendered more so by the threat (indeed, the virtual certainty) of major periodic droughts. For the Kamba community in Kenya, sand dams and dry land farming techniques are a response to these threats. In addition to meeting immediate needs of their community, these strategies illustrate the value of a shared commitment by local community groups in addressing their collective crisis through local ingenuity and innovation.



Fruits of Irrigation
Photo by Utooni Development Organization

The devastating droughts in the 1970s created desperate conditions in several different regions of Kenya. As community councils of elders in the region considered disaster mitigation possibilities, the idea emerged from a local engineer to harvest water in structures called sand dams, allowing the use of stored water during the dry seasons. To the surprise of many, these sand dams proved highly effective.

For Utooni Development Organization (UDO), these sand dams were not the only triumph. Rather, the more profound lesson for community resilience and disaster mitigation is the vibrant spirit and flexibility embodied in community self-help groups.

For the Kamba, the present ethos of self-help groups is deeply rooted in their historical-cultural traditions. Despite the disruption of many indigenous practices in Kenya beginning with colonial intervention, Kamba communitarian traditions have persisted. In the

indigenous *mwethya*—work group—individuals are seen as broadly obligated to the larger community from birth and throughout life.

Engaging communities to realize their own urgency in finding solutions has long been a vexing problem in development. To this end, the self-help group model of development mandates the identification of local resources and ability to organize within a community as a prerequisite to any other work.

UDO and other agencies, both locally and internationally, facilitate training and sometimes provide resources, but the heart and soul of these self-help groups are the community members themselves. They identify needs and solutions in their communities, provide labour for work projects, pool funds to sponsor projects or investments, bank seeds for future use and come together to build and then manage water harvesting infrastructure, such as the hundreds of sand dams in Kenya.

Today the pernicious onset of climate change has increased the frequency and intensity of droughts and led to general climatic uncertainty for small-holder farmers. These weather patterns have turned planting and care of crops into guesswork, while never-before-seen early morning frost and new diseases present unknown challenges to food security.

Engaging communities to realize their own urgency in finding solutions has long been a vexing problem in development.

The resulting poor harvests leave farmers unable to feed their families, pay school fees or save seeds and make plans for upcoming seasons. Some are forced to abandon families, farms and their communities, seeking opportunities for casual labour elsewhere. Others, still, engage in cash-generating, and

environmentally harmful livelihood practices, such as brick-making and charcoal-burning.

At present, sand dams and other water harvesting and retention technologies remain a viable solution, but in the wake of such extreme climatic changes, there will be a need for continued adaptation and innovation for new preventive measures that make survival possible. Yet despite the uncertain future for these communities, the one certainty that UDO has learned is that self-help groups will be an essential part of an effective response.



*A sand dam during rainy season
Photo by Utooni Development
Organization*



Conserving Ecosystems Through Our Ethics

By Carole Knight, South Africa

Bare Hills in South Africa. Photo by Carole Knight

For millennia organisms have been the only means of sustaining human beings. They have provided food, medicine, clothing, shelter and energy down through the ages. Many of these needs have been derived from plants grown in different ecosystems. At the planet's present rate of deforestation, habitat incursion and biodiversity loss, however, it is possible that our children's children could have an extinction of experience.

This means that tomorrow's children could be denied the wonder of connecting to, and interacting with, the natural world - disconnection rendering future generations increasingly out of touch with what is wild and free. But, perhaps more importantly, tomorrow's children could be denied the functional and consumptive benefits of the services that ecosystems provide.

Ecological services and weather

Weighing short-term liquidation benefits against long-term worth, it has been calculated that the monetary value of services that forests provide globally to humankind lies in the region of US\$30 trillion. In terms

of a sustainable future, however, this figure becomes meaningless as forests, being integral to the functioning of the Earth as a living system, have an inestimable value.

Forests cover 30% of the land area of the globe, storing an estimated 283 gigatonnes of carbon in their biomass alone; the carbon stored in forest biomass, dead wood, litter and soil being more than the amount of carbon in the atmosphere.

As vast green carbon sinks forests regulate atmospheric chemical compositions, taking carbon dioxide out of the atmosphere and breathing oxygen into the air in an essential life-giving cycle that is crucial for life on the planet. And just as a human body cannot survive without its lungs, the biosphere may not be able to survive without its forests.

Almost all of the water that reaches the atmosphere over land-locked areas comes from trees and plants through transpiration, with just one tree pumping millions of litres of moisture from the soil to the air during its lifetime. At ground level, by absorbing rainwater and releasing it into streams and rivulets by a gradual process, soil erosion and flooding are prevented. Sedimentation is also reduced and the availability of water is extended during hot, dry months when it is most needed by thirsty forest inhabitants.

Forest ecosystems regulate nutrient cycles with elements such as hydrogen, nitrogen and phosphorous coming into forest communities from streams, weathered rock and soil, as well as from human and animal activity. Undisturbed, forests are very efficient at recycling and retaining nutrients. However, once trees are felled, nutrients are lost to the community through water running out of the area in streams and rivulets. Burning of forest biomass also contributes to the loss of nutrients to the ecosystem.

Forests provide additional important ecological services such as pollination, the percolation of water and the protection of fisheries. They regulate temperatures and influence climate by the complex interaction of trees, ground, air and water, for like the icy white expanses of the Arctic and Antarctic, naked ground reflects the sun's incoming rays back into space, absorbing little heat.

Dark green forests on the other hand reflect only 10 to 20% of the sunlight that reaches them, which is very significant in terms of weather patterns because the moisture-holding capacity of air increases when it is warmed. Warmed air is less stable which increases convection currents, the atmospheric circulatory system of the planet, sharing out energy and warmth across the continents.

Without moving air life on the landmasses of the globe would be unendurable with the tropics being searingly hot and the other latitudes being inhospitably cold. Water would be largely confined to the sea with the continents being great desert expanses except for narrow belts of temperate vegetation. There would be little weathering of rock and without erosion, the stripping away of tiny fragments of rock that the wind accomplishes, there would be no soil.

There would be no weather to create cloud cover and water vapour with which to govern the amount of incoming solar radiation reaching the Earth. There would be no cleansing of pollution from the atmosphere and people would eventually suffocate under a blanket of waste and greenhouse gasses.

Climate change and feedback cycles

The Earth's self-regulatory energy systems have maintained equilibrium for over three billion years and for much of that time ancient forests have played a significant part in the links and feedback cycles between the lithosphere, the hydrosphere and the atmosphere. Yet with blatant disregard for the interconnection between the vitality of the Earth as an integrated system, the health and extent of the planet's forests, and ultimately the survival of humankind, the planet has been, and continues to be, deforested at a rate that is alarming to say the least.

The exact number of species that live in rainforest habitats relative to the global number of species is a subject of wide debate. Some biologists put this percentage at 50% of all terrestrial species, which is in accordance with the latitudinal species-diversity gradient that puts highest species diversity in the tropics.

This translates into 42 000 to 60 000 different species of insects alone per hectare of tropical forest. This richness of tropical rainforest biodiversity is of great importance both to the natural world and to humankind, and the depredation that a loss of such biodiversity would bring about should the majority of these species become extinct due to deforestation of their rainforest habitats, is staggering.

Globally deforestation is continuing at a rate of more than 13 million hectares a year. This represents the equivalent of 36 football fields per minute, and it is estimated that after the first decades of the 21st century only 10% of tropical forests globally will still be standing. At risk are the important ecosystem services and biological diversity that rainforests provide.

However, as rainforests absorb 20% of carbon in the atmosphere, a greater threat from deforestation and degradation of the world's rainforests may come from climate change. For with the clearing of land and the burning of biomass there is not only a reduction of carbon sinks, there is the release of stored carbon back into the atmosphere.

Deforestation is the third largest source of greenhouse gas emissions, generating between 15 to 20% of overall carbon emissions. This is changing rainforests from being net absorbers into large-scale emitters or net sources of carbon, which could amplify carbon-induced climate change in a powerful positive feedback loop.

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In terms of biodiversity, rising carbon dioxide levels are changing the proportion of the trees that make up the canopy. Spurred by increased carbon dioxide levels in the atmosphere, fast-growing species power ahead crowding out slower-growing ones.

And as rapidly-growing species shade out their neighbours, rainforest biodiversity declines as birds and animals that depend on slower-growing species as food vanish along with their resources.

A historical context

Deforestation as practiced by humankind is regrettably not a recent phenomenon. It stretches back to the beginning of civilisation with the first evidence of deforestation appearing in the Mesolithic in Europe.

During Neolithic times stone axes from the Langdale axe industry in the English Lake District were used to convert forests to farming land. The Palace of Knossos in Minoan Crete was severely deforested in the Bronze Age and by as early as 1500 AD many of the vast forests of medieval Europe had disappeared to provide wood for housing, heating and cooking. This led to a nutritional decline in people of the time as many forest species such as deer and wild boar, which were staples of a high-protein diet, were eliminated.

Historically, war has also been a significant cause of deforestation with, for example, the failed invasion of England by the Spanish Armada in 1559 causing a huge waste of prime timber, weakening Spain's domestic economy. In the early 19th century whole woody regions of England were overharvested to provide the 6000 mature oak trees required to build each of the war ships in Lord Nelson's Royal naval fleet. While more than a century later almost half of the forest cover in Vietnam was destroyed during the Vietnam War through the use of Agent Orange, bombs and bulldozers.

Species on the move

Most living things on Earth support others in symbiotic relationships with keystone animal and plant species influencing and supporting other species, extinctions leading to co-extinctions. In this way the loss of just one species can irrevocably change the ecosystem in which it exists.

Climate change is seen as the single greatest threat to the Earth's ecosystems. However, with the capacities of different species to adapt to change varying, different species using different cues to initiate events such as breeding and migration, not all species are reacting uniformly to a changing world climate.

Studies show that there is a poleward shift in species' distribution of, on average, around six kilometres per decade, with a retreat up mountainsides of 6.1 metres per decade. Many species are therefore relocating

which is causing a disruption of connectedness between species, as for example, a key prey species arrives too late for a predator or moves too far north or south to be of use to the predator.

Dislocations caused by some species shifting rapidly while others are left behind are causing numerous extirpations and possible extinctions. While in species such as crocodiles, which have sex-ratios determined by the temperature at which their eggs are incubated, global warming represents a direct threat.

Climate change, fynbos and ants

The fynbos biome with its mix of approximately 8700 species of small shrubby plants and sandstone, shale and limestone soils is a fine example of how niche specialists, plants that can thrive only within very narrow limits in an ecosystem where low levels of nutrients and poor soils, can predominate.

Approximately 60% of fynbos plant species require ant-assisted seed dispersal with ants as myrmecochores (seed dispersers), being integral to the functioning of fynbos systems in a synergistic interrelationship that benefits both species.

A study on ant assemblages conducted in the Greater Cederberg Biodiversity Corridor shows that a changing climate in the region will directly affect ant assemblages in substantial and complex ways. It will also indirectly affect them via plant responses to climate change. In turn changes in ant assemblages are likely to affect the ways in which seeds are dispersed owing to different responses in the myrmecochores (seed dispersers), with changing relative abundances of ant populations, differences in behaviour and seed-type preferences, influencing ecosystem functioning.

In this way, changed responses in ant species in relation to factors such as plant seed size and the depth at which seeds are stored in nests, together with changes in temperature and water availability, are likely to precipitate vegetation changes in the Cape Floristic Region. This may result in fynbos being replaced with a different, unknown vegetation type and another ecosystem altogether by the middle of this century.

Ecological Networks and species survival

Species are under increasing pressure from large-scale transformation and fragmentation of natural ecosystems. However, an important programme has been developed, whereby biodiversity loss is stemmed through the implementation of ecological

networks as a way of mitigating the impact of changing ecosystems. This model, developed by the Department of Conservation Ecology and Entomology, Stellenbosch University, South Africa, offers an encouraging perspective on biodiversity conservation, especially as it can be extrapolated to other parts of the world.

Consisting of interconnecting linear corridors with associated nodes and patches of undisturbed land, ecological networks have as their goal the maintenance of portions of transformed landscapes in a close-to-natural state, based on certain key premises that need to be integrated into the ecological network design: the maintenance of natural reserve areas (adjacent to ecological networks or as nodes within); the maintenance of as much undisturbed land as possible; the maintenance of high quality habitat heterogeneity; and the development of high quality, large corridors.

Other key premises are the stimulation of natural disturbance such as fire and grazing; and the maintenance of the “metapopulation trio” of large patch size, good patch quality and reduced patch isolation. This creative management approach

promotes natural functioning of ecosystems in an agroforestry setting as well as ensuring survival of species, some of which are threatened.

The Future is in our hands

Ecological bankruptcy is a powerful potential destabilising factor. Therefore environmental depletion, whether it is legally carried out on a nation’s doorstep or illegally executed far from home, is of equal consequence, making practices such as “discounting over distance” whereby some nations of the world expropriate resources from other geographical areas, patently no longer appropriate.

Natural ecosystems constitute the last biotic frontier and the future of many of the Earth’s species is in our hands. Meeting the challenge will require a changed global mindset. It will require different priorities, values and ethics. It will require a shared vision and an unparalleled degree of cooperation, across national boundaries and between national leaders and among nations’ citizens. For the sake of our children’s children, let’s hope we are up to the challenge!



*Trees are integral part of natural ecosystems.
Photo by Carole Knight*

Butterfly

Benefits

From Arabuko

Sokoke Forest Ecosystem

By Angela Wairimu Ouma, Kenya

Ecosystems provide people with a range of services that would be extremely costly or impossible to replace. These include: detoxification and decomposition of wastes; nutrient cycling; pollination of wild plants and crops; disease and pest control; air and water purification; stabilization and moderation of the earth's climate; moderation of floods; generation and renewal of social fertility and much more.¹

Over the years, ecosystems have been plagued with biodiversity loss especially in agriculture where threats to pollinator diversity and loss of crops have undermined productivity and returns. All this is despite our reliance on ecosystem services and biological goods for raw materials in industries such as agriculture, horticulture, cosmetics, pharmaceuticals, pulp and construction. Agriculture is a prime example of the perils of biodiversity loss. Similarly, the loss of pollinators is a major problem.

One-third of the world's crops require pollination to set seeds and fruits. The annual value of this service in the United States is calculated at \$6-\$8 billion, with worldwide estimates being \$65-70 billion. The ongoing global decline of pollinators such as butterflies, bees and bats has negatively affected agricultural productivity.²

The Economic of Ecosystems and Biodiversity (TEEB) launched in 2008 by the Convention on Biological Diversity provides insights on the economic value

of biological goods and ecosystem services. This is important as it places value on our biological resources. It can be used for planning and undertaking demand cost benefit analysis when these resources are threatened. This further means that conservation efforts can be monetized. Areas where ecosystems and biodiversity have been devastated can be sustainably restored. This presents a significant opportunity for investment and related growth in wealth and jobs.

Ecosystems can also provide sustainable, low tech jobs. This reduces poverty, improves livelihoods, enhances the provision of clean water, presents an opportunity for green energy adoption and develops local tourism; especially in third world countries.

In investment scenarios, forest and desert ecosystems are likely to see job growth in the short, medium and long term. Investing in forest ecosystems by way of

*Monarch Butterfly by Pink Zinnia.
Courtesy of Wikimedia Commons*

¹ Ahmed Djoghlaif. Business, Biodiversity and Climate Change. 2009/2010 for Climate Action.

² Ahmed Djoghlaif. Business, Biodiversity and Climate Change. 2009/2010 for Climate Action.

conservation and reforestation could boost formal employment alone in the sector by 20% by 2050.³ Desert ecosystems provide an opportunity for wind and solar energy harvesting on a large scale.

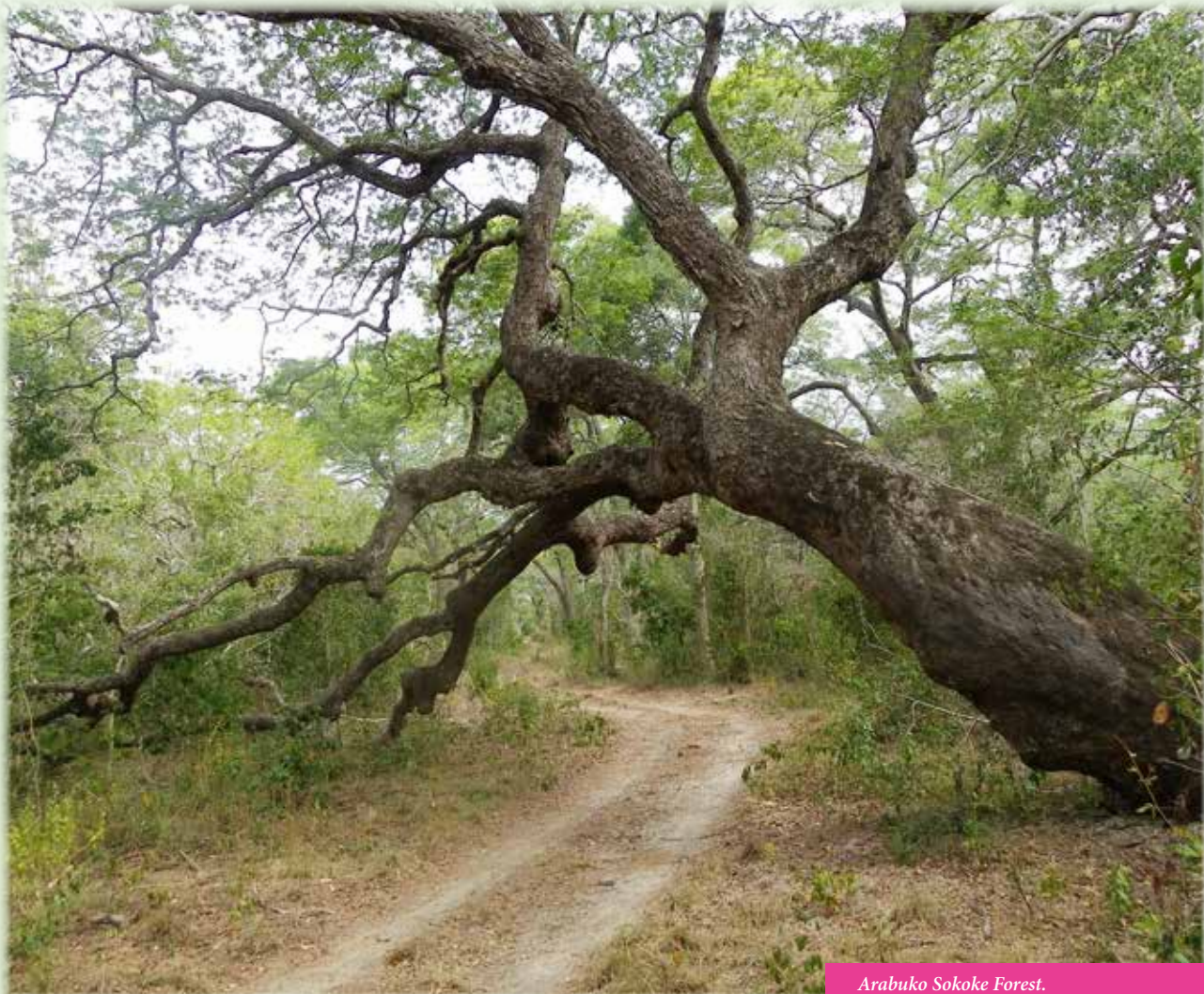
Jobs created through the consideration and conservation of ecosystems have stood the test of time because they become part of the ecosystem; making them sustainable and regenerative. As the world becomes more aware of the importance of biodiversity preservation, efforts for conservation of endangered species are being rewarded by higher prices.

Reclamation of different ecosystems are creating jobs globally. Governments and policy makers are increasingly placing environmental preservation as an important pillar of sustainable development. For example, the first of the seven key aspirations by the African Union (AU) for the Agenda 2063 is that of a prosperous Africa based on inclusive growth and sustainable development; to which ecosystem preservation is a key economic driver.

In coastal Kenya, Kipepeo⁴ Project which started in 1993 is tapping into ecosystems to empower people and conserve the environment. The project started at the mangrove forest of Arabuko-Sosoke and has had a major impact on people's lives.

Arabuko-Sosoke Forest is a 42,000 Ha island of unique bio-diversity in the north coast of Kenya. The forest is globally important for biodiversity conservation. Arabuko Sokoke Forest is home to a number of near-endemic and endemic species. It is the largest surviving protected fragment of the mosaic forest that once stretched from Southern Somalia to Northern Mozambique. It is also home to globally threatened species of birds, amphibians and mammals such as the Clarke's weaver which is endemic to the forest and Dakatcha woodlands.

Some of the rare birds found are Sokoke Scops Owl, Sokoke Pipit, Amani Sunbird and Spotted Ground Thrush. Others include the endemic Golden-rumped elephant shrew (also found in Boni forest), the elephants, baboons, vervet monkeys, Civets and amphibians among others.



*Arabuko Sokoke Forest.
Photo by Kenya Forest Service*

In the 1990s 54 - 59% of forest adjacent communities wanted the entire forest cleared for settlements and

³ Towards A Green Economy. A Synthesis for Policy Makers. 2011

⁴ Kipepeo is Swahili for butterfly

were even lobbying for de-gazettement. The reasons for this discontentment was because of poverty, hunger for land, squatter invasion, wildlife crop raiding and resource denial by the forest guards. It is during this time that the Kipepeo project was set up in 1993 to try and change the attitude of forest adjacent communities by giving them a stake in the in the conservation

Butterflies were chosen as an avenue of changing attitudes and empowering people. Butterfly species were selected on basis of likely demand, seasonal availability and ease of rearing. Exports started soon after and by 2001, earnings had increased tenfold from just about \$5,000 to \$130,000. A legal cash revenue stream from the forest had been created and more people now feel the direct value of the forest. Over the years, the revenues have stabilized to an average of \$80,000 annually.

The project has added real value to the forest. While the exact impact on the forest may be difficult to say, the project has also had tremendous impact on the attitudes of the people. The number of people calling for clearing of the forest has reduced.

The farmers and their families have also learned about the global significance of the forest even as they have experienced benefits from butterflies. The project established Wildlife Clubs in forest adjacent schools and many children learned more about insect life histories.

Subsistence agriculture has for a long time been the main occupation of the surrounding population. Forest usage by the community includes collection of water, fuelwood, poles and herbs, butterfly farming and hunting of wildlife meat. The Kipepeo project provided a gateway for more conservation projects to ensue, most recently being electric fencing that greatly reduced losses (crops and human life and injury) from elephants residing within the forest.

Others include tour guiding, eco-tourism facilities and support for students' school fees. Butterfly farming has also encouraged the local community to form and work in groups. Most of the groups have ventured into other activities such as bee-keeping, tree nurseries and woodlots which have all reduced the reliance on forest resources. In addition, the butterfly farmers groups provided an easy entry into the introduction of participatory forest management and the formation of the forest associations.

The monitoring work that has been undertaken since

the inception of butterfly farming has not shown any negative effects on the wild butterfly populations so far. In this regard, the butterfly project doesn't seem to be disruptive to the natural forest ecosystems.

The farmers raise the pupae in their cages and do not collect pupa from the wild apart from catching the female butterfly that lays eggs on food plants in their cages.

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The farmers and their families have also learned about the global significance of the forest even as they have experienced benefits from butterflies. The project established Wildlife Clubs in forest adjacent schools and many children learned more about insect life histories.

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The Arabuko Sokoke Forest Management Team has an ecological monitoring system geared towards detecting any possible negative effects thus no negative impacts on the forest have been noticed. Climate change is however affecting pupa production due to the prolonged dry seasons. During such times, production goes down considerably since the farmers cannot easily catch females to lay eggs. Some of the species are also not available during dry seasons.

Kipepeo has proved to be a sustainable ecological conservation venture. Butterfly farming has been replicated in Taita Hills, Kwale, Kakamega forest and even in Tanzania's West Usambara Mountain.

However, global competition is reducing the demand for pupa. Some markets have been lost to competitors with butterfly species that have more desirable characters as compared to species available in Arabuko-Sosoke Forest thus only market worthy species are raised.

Since commencement of the Kipepeo project the forest ecosystem has ensured the continuity of butterfly varieties. This stability means that the farmers have been able to gain a steady income from butterfly farming. Over the years, this has translated to forest communities that are more collaborative, better educated and increasingly economically empowered. This shows that ecosystem-based job creation can stand the test of time, cater for a large number of people and provide continuity.



KENYA'S MARINE BIG 5

*Bottlenose dolphin
Photo by Watamu Marine Association*

*By Michael G. Mwang'ombe
Watamu Marine Association, Kenya*

Dolphins are cornerstones of Kenya's marine ecosystem as a whole and the north coast that Watamu is a part of in particular. As long term residents or semi-residents of the Watamu waters, they can serve as important sentinels of the health of coastal marine ecosystems.¹

Ask any tourist to name the Big Five of Kenya, and they will no doubt list familiar animals. Although visitors to Kenya are aware of its beautiful beaches, coral reefs, fishes and sea turtles, not many know that three different species of dolphins and whale have been identified in Watamu which could easily be included in the "Marine Big Five"

Both in Kenya and worldwide, relatively little is known about the wealth of marine mammals inhabiting Kenya's inshore and oceanic waters. Sadly some species face human threats such as fishing by catch, loss of habitat, resulting in their decline in the Western Indian Ocean. Such decline in turn affects the overall balance of the delicate marine ecosystem.

The good news is that Kenya, over recent years, has been recording new species. This has been reported by sports fishermen from the Kenya Association of Sea Anglers. They are part of the Kenya Marine Mammal

Network (KMMN), whose database is run by scientists at Watamu Marine Association (WMA) and Global Vision International (GVI), together with Kenya Wildlife Service. The research unearthed through this collaboration contributes to both conservation and tourism efforts.

Tourists can expect to see Indo-Pacific bottlenose dolphins, Indo-Pacific humpback dolphins, spinner dolphins and humpback whales. In addition, there are occasional sightings of killer whales, sperm whales and dwarf minke whales. More unusual species include pilot whales, Bryde's whales and striped dolphins.



*The dolphin dance.
Photo by Watamu Marine Association*

¹Bottlenose Dolphins as Marine Ecosystem Sentinels: Developing a Health Monitoring System

WMA and GVI have been recording the hotspots for dolphins and whales, aided by sports and local fishermen and other marine users including divers. So far in Watamu Marine Reserve, over 100 bottlenose individual dolphins have been identified, mainly living in family pods of up to 25. It is understood that Watamu is an important natural sanctuary for mothers and calves.

Dolphin watching and whale watching boat excursions have been a popular tourist activity in Watamu for the last twenty years, and in recent years, local fishermen are combining fishing trips with dolphin and whale watching for their guests. This helps WMA market Watamu as a destination of international distinction, combining sustainable tourism, community based ecotourism activities and conservation efforts.

In 2012 a five star hotel in Watamu was the first coastal hotel to offer whale-watching excursions and in 2014 sports fishermen followed suit. WMA has therefore developed good dolphin and whale watching guidelines in an effort to protect marine mammal populations and the marine ecosystem that they depend on.

East African humpback whales are a special sub-population from the South West Indian Ocean. Interestingly, Watamu sports fishermen say that they have only been seen in Kenya in the last 15 to 20 years. This is possibly due to previous threats from hunting and the whaling industry in the southwest Indian Ocean before it was banned by international law in 1986.

Each year they are first sighted along the East African

coast of in early June as they make their annual northwards migration from Antarctica.

It is believed that they travel to warm tropical inner reefs to enable them breed and give birth to their calves, which remain with the mothers for about two years, until they are weaned. They then make the return journey in October, swimming over 4,000km to the cold food-rich seas of Antarctica, their main feeding area.

These magnificent marine mammals can reach a length of 15 metres and weigh around 30 tonnes, about six times the weight of an elephant. Watching them in their natural environment leaping out of the water, sometimes in pairs, or larger family groups, is an unforgettable sight. Also amazing is that these marine giants mainly feed on small fish like sardines and small shrimp-like creatures called krill.

Reports of humpback whales in Kenyan waters rocketed in 2013 and 2014, with up to 25 whales per day spotted between July and September in the Malindi-Watamu Marine Reserve alone. Assisting the research work of WMA, local and sports fishermen were especially helpful in reporting, with over 550 whales seen during the 2013 peak season. Sometimes, the whales can even be seen from hotels in Watamu.

Following on from occasional shore sightings, scientific based Land based surveys (LBS) of Humpbacked Whales were successfully pioneered by WMA in 2014. They were conducted in July and August during the height



WMA and GVI have been recording the hotspots for dolphins and whales, aided by sports and local fishermen and other marine users including divers.

*A powerful ocean spectacle
Photo by Watamu Marine Association.*

of the migration. WMA researchers conducted weekly surveys from a single position to reduce error, four days a week, five hours per day. After 144 hrs hours of observations, 73 adults and 7 calves were spotted, 5km off shore and as close as 750 metres from the shore.

Since 2011 in just over three years, fifty fishermen participants have reported 821 sightings from Shimoni to Lamu. The Indo-Pacific bottlenose dolphin is the most frequently sighted species along the length of the Watamu coast, most of them close to shore.

Humpback whales come second and Spinner dolphins are third, sighted 32 times, most of them by sea anglers from Watamu. Spinner dolphins are mainly found in deep offshore waters in the Watamu Banks. They are known to be the most acrobatic of dolphins with their breath-taking high spinning leaps, hunting in “super pods” of up to 1,000 strong, impressively corralling their prey into fish bait balls. Sports fishermen sometimes describe the ocean as being “black with dolphins” when they are sighted.

Surprisingly, killer whales, also known as orca and actually the largest dolphin specie, were sighted annually on three occasions in Watamu waters during the month of February and around the offshore sport fishing area known as “The Rips”. Fishermen say they are seen every 1 – 3 days, following the boats in family pods of up to six, often unnervingly observed attempting to take the fish bait.

However despite all this positive information, Watamu cetacean populations face serious threats. The ring net fishery continues to be a subject of much controversy and stakeholder conflict. Although it is still considered a legal and permitted fishing method by the Department of Fisheries it is arguably a very destructive method of fishing, causing the depletion of fish stocks and damage to coral reefs and the marine environment in the local protected marine areas. Some local tour boat captains state that the ring net fishery has been the main contributory cause to the decrease in dolphin numbers.

Indeed, WMA and boat operators have observed a marked change for a fourth season running in the bottlenose dolphin population movement as they have now translocated and are feeding in South of Watamu as opposed to North Watamu, which is their normal foraging area and where the ring nets have been operating. Continuation of this commercial scale fishery will result in a reduction in prey and source

of food for resident dolphin populations. WMA, local conservationists and the community boat operators are concerned that dolphin populations may move away from the Watamu Marine Protected Area entirely, should the ring net fishery continue.

Further to this, offshore oil and gas exploration is gathering pace in Kenya across the entire sea board. Of real concern in the Watamu area is the leasing of L Block 16 which includes the Arabuko Sokoke Forest (the last indigenous coastal forest) and the Watamu National Marine Park and Reserve to an oil exploration company.

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WMA continues to work with Kenya Oil and Gas Working Group and CANCO conservation organisation to lobby and establish mitigation measures with the oil companies.

However, increased awareness because of the KMMN’s work will ultimately help protect dolphin and whale populations in Kenya. As cornerstones of coastal Kenya’s marine ecosystems, sea mammals must be conserved at all costs.

WMA wish to thank the African Fund for Endangered Wildlife for supporting Watamu Marine Mammal Conservation and Research

NORTHERN KENYA'S ECOSYSTEM-BASED ADAPTATION AND CLIMATE SMART AGRICULTURE

By Wendo Hausner – Wetlands International Kenya

Africa's climate is changing; this change is evident to most of us, from the city dweller to the village farmer and herdsman. Rainfall patterns have altered and droughts have become more frequent and severe; floods in lower areas are more common place. Nowhere in Kenya is the change in weather more apparent than in Arid and Semi-arid Lands (ASAL) up north. Isiolo County is one of the ASAL areas in Kenya that has been hit hard in recent years by drought and famine.

Communities in Isiolo County are waking up to the fact that there is an urgent need to transform their livelihoods in order to cope with the new developments affecting their way of life. In a desperate attempt to arrest the disaster risks facing the locals as a result of climate change and climate variability, communities have resorted to unfamiliar livelihoods to cope. This change is an acknowledgement that the time to build resilience to climatic changes and variability is now. In their resolve to adapt and overcome biting food insecurity, farming is their new refuge; at least for those who have had to come to terms with loss of livestock, or *mali* as they refer to it.

As farmers across the country and continent continue to embrace "climate-smart" innovations to increase food production and boost food security, pastoralist communities in Isiolo have taken note that "smart farming" may be the way to go.

In Bisan Biliqo, one of the communities in Merti Sub-County of Isiolo County, a growing group of farmers have decided to utilize waters from Ewaso Nyiro in food production to supplement their nutritional needs and

keep famine at bay. Most of those practicing farming near Ewaso Nyiro used to be pastoralists before losing their herd to drought.

The narrative is similar a few kilometers across the Ewaso nyiro, the river that Boranas proudly call 'our mother' and have composed endless songs to describe its value and important. In Gafarsa village, an even larger scale of farming is taking place against all the challenges that irrigating farms with water from the river presents.

Farmers brave crocodiles and falling water levels every year to water their crops and put food on their children's plates. The Ewaso nyiro river ecosystem is at the center of it all. Indeed, community-based adaptation married so well with ecosystem-based adaptation in these regions of Biliqo and Gafarsa. The Borana community here practices these two concepts despite lacking theoretic appreciation of the same.

Climate-smart agriculture is one of the best community-based adaptation alternatives available for communities that are trying to transform from an increasingly untenable pastoralist livelihood to farming or agro-pastoralism. As the past few years have shown, climate-smart agriculture has potential to help farmers mitigate, and adapt to climate change.

Many farmers across Africa have been seeking solutions for poverty and food insecurity. Climate-smart agriculture is providing these solutions. However, ecosystems can be victims of agriculture unless agricultural practices adopted are also ecosystem-smart, meaning they consider ecosystem sustainability as their central tenet.

When Wetlands International started work in Isiolo County through the Partners for Resilience programme, one of the approaches targeted was Ecosystem-based adaptation. This was in response to the realization that

although forced by climate change towards farming and agro-pastoralism, the communities involved lacked requisite farming skills and the Ewaso nyiro ecosystem was getting degraded through riparian cultivation and clearing of vegetation.



Riparian cultivation (On the foreground) before reticulation of water to the new farm: Biliqo village, Isiolo County, Kenya. Photo by Wendo Hausner

These practices were exposing the same vulnerable communities to risks such as erosion and crop loss during floods. Flooding of the river is very important for lower Ewaso nyiro communities because it rejuvenates grasses and vegetation in critical grazing rangelands.

As the organization with more experience in natural resource management and wetland ecosystem conservation, Wetlands International had to take leadership in entrenching the concept of ecosystem-based adaptation among the communities through capacity building and incentive-based adaptation.

Four years down the line, after numerous community meetings and training sessions, ecosystem-based adaptation is no longer a new concept in Isiolo County. In the past one year, a new project by the organization has executed ecosystem-based adaptation by encouraging and supporting climate-smart agriculture in two communities through an approach called Biorights.

With support from the Changieni Rasilimali facility from ACT! Wetlands International Kenya has boosted the farmers' efforts in Biliqo and Gafarsa through the WARACLIREC project. Biorights is a new incentive-



Maize crop growing in one of the plots under irrigation in Biliqo village, Isiolo County, Kenya. Photo by Hausner Wendo

based approach that emphasizes ecosystem management and restoration by giving communities loans or grants for livelihood improvement in return for an agreed commitment to conserve local ecosystems, particularly wetlands. This is in recognition of the central role ecosystems play in supporting the resilience of communities to climate

change through the goods and services they provide.

In Biliqo, by supporting installation of pipes to carry water 500 meters from a solar-powered pump near the river to a farm situated away from the riparian area, the WARACLIREC project wields the double-edged sword of ecosystem conservation and climate-smart farming.

In return, the farmers are re-afforesting the riparian areas with seedlings provided by the organization. Before, all the farmers used to have small plots on the river banks so as to enable them access water for irrigating their crops. This practice had a three-pronged risk; crops used to be washed down by the river during floods, farmers were susceptible to regular attacks by crocodiles from the river and the riparian area continued to be degraded through erosion due to loosening of the soil, further exacerbating risks. Now, it is certain that with improved understanding and with support from development partners, ecosystem degradation will be something of the past.

Riparian cultivation in Biliqo (On the foreground) before piping of water to the new farm

Currently, the farm is flourishing with maize, cereals and vegetables. Abdi Jarso, 70, the chairman of the farmer's group observes that while they previously struggled to farm near the river at the peril of crocodiles and crops being swept away on a yearly basis, they now feel safe and secure at their current site. He adds that the water pipe system reduces loss of water and enables them to get more water to the farm than they previously did.

"Our vision is to supply the whole of Isiolo County and beyond with vegetables and fruits in the coming five years," says Halaqo, another farmer.

In Gafarsa, just like in Biliqo, local farmers received support in irrigating their farms through expansion and de-silting of the local canal. The canal now reaches a new farm over a kilometer away from the inlet. On their part, the farmers are re-afforesting degraded riparian



Pawpaw trees growing in one of the farms in Gafarsa village, Isiolo County, Kenya. Photo by Wendo Hausner

areas. In Gafarsa, the project also utilizes the Biorights approach. In both communities, the farmers have also committed to plant trees in their cultivated fields; these have the double benefit of providing shade for crops to reduce water loss and significant potential for carbon



The solar-powered water pump used for irrigation in Biliqo village, Isiolo County. Photo by Leonard Sweta

dioxide sequestration to mitigate climate change.

The greatest benefit of the crop-tree mix is that the farmers can look forward to a bumper harvest of fruits because a large amount of the trees they have been provided with are fruit trees. They include pawpaw, guavas, and passion fruits.

The farmers will be cultivating these and other fruits among their crops to not only strengthen food security but also supplement their diet with vitamins. Even though all these are positives for communities that boost community-based adaptation, the greatest win is for the ecosystem.

Through strengthening of a local traditional resource management system, the woodlands and bush lands along the Ewaso nyiro have been conserved.

Local indigenous trees can be seen growing among the crop fields in Biliqo and Gafarsa, thanks to knowledge of community ecosystem-based adaptation techniques.

Utilizing the Biorights approach, the farmers in Biliqo and Gafarsa are embracing a transformation in livelihood from pastoralism to agro-pastoralism while actively participating in conservation and restoration of Ewaso Nyiro's riparian ecosystems. Lessons in Ecosystem-based Adaptation have convinced farmers in these villages that Conservation Agriculture is the way to go in the face of climate change, and Wetlands International Kenya is proud to help them chart their path to climate resilience.

CONSERVING AND MANAGING LAKE VICTORIA'S DIVERSE ECOSYSTEMS

By Halinishi Yusuf,
Environment Liaison Centre International, Kenya

Lake Victoria management has been a highly contested subject in local and international scientific forums. Despite the many management strategies put forward and billions of dollars expended, no significant improvement can be confidently reported, at least by considering the current ecological condition of the lake.

Ecological integrity of the lake has perpetually dwindled, manifested by the marked changes in the total biomass and shifts in distribution and composition of plankton, macrophytes and fish species. Some fish species,

including some haplochromines have completely disappeared from the lake, indicating continued threats to species and unabated loss of biodiversity.

The dire situation is further aggravated by the almost absolute human dependence on the lake for their socio-economic wellbeing. This has resulted in subsequent environmental degradation of the lake and its entire basin.

Every day when boats dock at the dozens of landing beaches along Lake Victoria's sea shores, they find people



waiting with a mixture of expectation and desperation. The men have braved the darkness of the night to fish. The women brave the morning chill to receive them and begin different tasks on the fish that has just been landed. Often, buyers too are there at the beach, ready to purchase choice pieces of fish and ferry them onward to distant markets.

The ever increasing fishing effort, and especially unsustainable fishing coupled with pollution

from municipal, industrial and agricultural wastes and excessive siltation has seen the lake's integrity acutely drop. The lake ecosystem has undergone alarming changes which have accelerated and are increasingly dominated by the potentially toxic blue-green alga.

The continued drop in fish landings of the major species from Lake Victoria is alarming. Recent statistics show that Nile perch, *Silver cyprinid* (also known as Omena), Nile tilapia, together with other cichlids and Haplochromids are on a decline hence necessitating calls for a new management and conservation strategy. In the year 1999, the governments (Kenya, Uganda and Tanzania) whose economies were gaining from the exploitation of Lake Victoria, decided to embrace the co-management approach. Co-management was seen as a paradigm shift in fisheries management by giving more power to the resource users to govern and manage their own resource.

Co-management brought in the Beach Management Units (BMU) which, having been initially accepted by the communities, have grown distant from them. This follows a deep rooted belief that BMUs have been imposed on them by their governments, leading to the general lack of support for the initiative and failure to police it. Though the idea would work perfectly if well implemented, most fishers feel 'used' by the government.

A BMU chairperson in the Lake Victoria region laments "although the co management idea would work well in managing our fisheries resource, we face a lot of challenges as the management committees. We have

powers we cannot fully execute. For instance, when we arrest offenders, the actual enforcement capacity lies primarily with the provincial administration and many

a time, the offenders bribe their way out. Fish landing taxes collected are revenue to the government yet there is little done to develop our beaches and the fishery itself.'

Another major hurdle that BMUs have faced so far is lack of resources to enable effective operations and functions. Most of them, for instance, lack patrol boats to

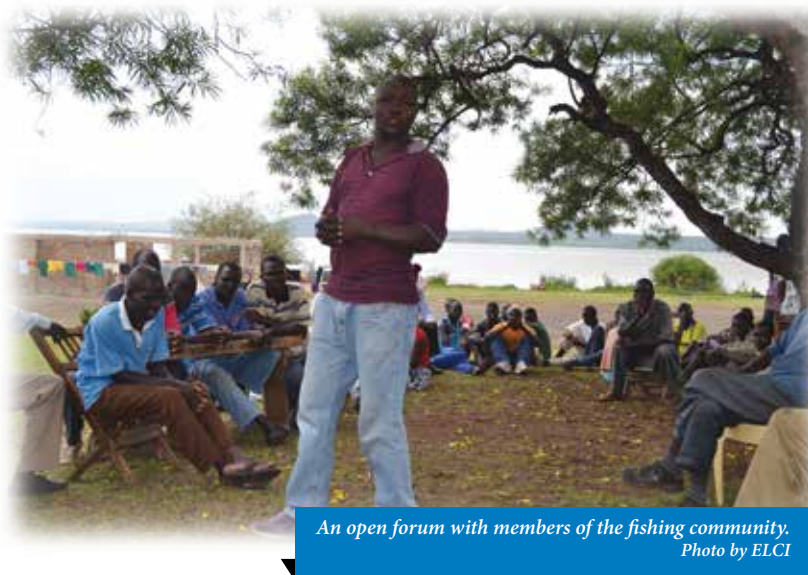
undertake surveillance. Inadequate training and lack of inclusive involvement in management and monitoring has continually undermined the gains that could have been achieved from this sort of co-management practice.

The menace of illegal fishing gear (< 5") is still a challenge for the government and the BMUs. The ever increasing population will forever be in need of not only a steady food supply but also a sustainable income. In realizing these goals the fishing communities have been driven to go for what they can find, even if it means breaking the law. As the sector experiences decrease in annual landings, the number of illegal fishing gears has been on an increase from 33,000 to 54,000 in a 12 year period (2000 to 2012).

One of the key aspects in the BMU Regulations of 2007 is promotion of sustainable development of the fisheries. Management measures such as closing certain areas to fishing, closing areas during breeding seasons, restricting fishing gear, and limiting the number of fishing vessels among others are mandatory. However, most of these, unfortunately, remain beautifully written on paper and little is actually done in their implementation. Unsustainable fisheries exploitation methods remain a key driver to L. Victoria's ecosystem degradation.

Of new beginnings...

Environment Liaison Centre International (ELCI), in partnership with Act! and working together with fisheries experts from the Kenya Marine and Fisheries Research Institute (KMFRI) alongside the fisheries offices, has seen the successful demarcation of critical fish breeding areas



An open forum with members of the fishing community.
Photo by ELCI



Kennedy Orwa, ELCI Executive Director participating in the demarcations exercise. Photo by ELCI

in Homa Bay and Busia counties around Lake Victoria.

Critical fish breeding areas are treated as ‘critical habitats’ because they contain features essential for the conservation of a threatened or endangered species and that may require special management and protection or for its recovery. The demarcation and closing off of critical fish breeding areas is expected to lead to rejuvenating the fishery by allowing fish and other non-fish organisms to breed.

Closing off of critical fish breeding areas, dubbed Community Protected Areas, is no different from that of Marine Protected Areas (MPAs) and is implemented in a more or less same fashion. An MPA is an area of intertidal or sub-tidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or the entire enclosed environment (Kelleher and Kenchington, 1992). Community Protected Areas or Lacustrine Protected Areas (LPAs) can either be permanently closed or occasionally fished. While this may gradually increase the fishery’s biodiversity, it may not do so for all the species, and not equally if at all.

Critical fish breeding areas are treated as ‘critical habitats’ because they contain features essential for the conservation of a threatened or endangered species and that may require special management and protection or for its recovery.

A combination of both the critical habitat and the LPA concept is sure to change the scientific and ‘layman’ view on biodiversity conservation and socioeconomic benefits to the fishing communities. Though most view a larger area of operation is quite beneficial, the real fruits come from accurately determining the location to set up the LPAs. Building on the numerous studies of the fishes of Lake Victoria and their ecology, there is need for more precise demarcation of these LPAs and their management.

Representative beaches identified include Koginga Beach, Kananga Beach, Ndhuru Beach and Ng’ou Beach in Homabay County and Sisenye (Busembe and Omena beaches) in Busia County. The research group sensitized the riparian communities of these beaches on the importance of sustainable resource management and conservation practices of fish species in conservancy reserves and the different critical fish habitats. All the beaches have champions whose role is to work with the surveillance committee to ensure compliance with new management strategy.

A baseline study of some of the conservancy sites (Simunyi, Ng’ou and Sisenye Conservancy Sites) on the fish diversity, planktons and macro invertebrates showed that there is little species diversity. However the species forming the current fishery of the lake and which requires utmost conservation all appear at the sites sampled, i.e. *Lates niloticus* (Nile perch), *Oreochromis niloticus* (Nile tilapia), *Oreochromis leucostictus*, Haplochromine species, *Rastrineobola argentea* (Omena), *Brycinus sadleri*, *Labeo victorianus*, *Clarias gariepinus* and *Tilapia rendalii*.

The fact that a lot of larval fish, especially of tilapia, Nile perch and haplochromines were caught in these areas is a confirmation that these are breeding and nursery grounds. Most large adult fish were absent from these sites, indicative of heavy exploitation pressure.

On tolerance status, the majority of the macro-invertebrates sampled (18 genera, and RA of 57.9%) were tolerant whereas only 2 genera accounting for only 4.5% were sensitive. This is an indication of the high human presence in these breeding areas leading to destruction of microhabitats for the sensitive taxa and negative alteration of suitable water chemistry. Should the area remain completely protected as suggested, the abundance and diversity of the sensitive taxa shall increase consequently increasing food types of fish.

The study recommended that other human activities should be minimized or stopped (if possible) from these closed areas and areas closer to them in order to give the breeding and growing fish good environment. Other activities such as domestic washing, bathing and other such activities that introduce phosphorous directly into the water should be banned from the lake shores. Alternative sites far from the lake should be designated for such and they should have a wetland buffer to ensure that waste water is 'cleansed' before it joins the main water body.

The quest for a balanced ecosystem that can nurture itself and support other functions such as provision of food and other ecosystem services requires precision. Limnology and the study of phytoplankton forms an important area of aquatic ecology studies for Lake Victoria in mapping out key areas of possible algal blooms and cyanotoxic potential to allow for protection and sustainable utilization of the fishery resources. This will be key in supporting socio economic development of the lakes dependants as well as solving environmental problems.

The quest for a balanced ecosystem that can nurture itself and support other functions such as provision of food and other ecosystem services requires precision.

Forecast

Although this is a relatively new concept in inland fisheries and approach to ecosystem management, the expected outcomes are predicted to be greater than originally thought. Looking at MPAs, they have successfully provided a refuge for overfished species and a rejuvenation area for those populations experiencing decline in numbers. The LPAs, having a community based management approach, is bound to bring in more benefits to the fishery and surrounding ecosystems, especially as it applies the principle of self-accountability.

This project is as much conservation oriented as it is a national food security initiative. There are always misconceptions by local fisher communities – and most fail to recognize the differences – of all scientific

research programs. Most think that they are government initiatives to regain or increase the hold of the resource, whereas most scientific projects (if not all) are solution oriented.

As a species our adaptation to the environment and evolutionary development is not solely dependent on ourselves, but also extrinsic factors beyond our control. For instance, overfishing leads to the loss of not only the economically viable species, but also those that are dependent on it for symbiotic or parasitic relationships. Hence, eliminating one species has a ripple effect on the whole ecosystem and eventually us.



Huge fish captured after 3 months closure in Sisenye Omena beach in Busia. Photo by ELCI.

MARINE Ecosystems of MANGROVES

By Helmut Egesa Wagabi

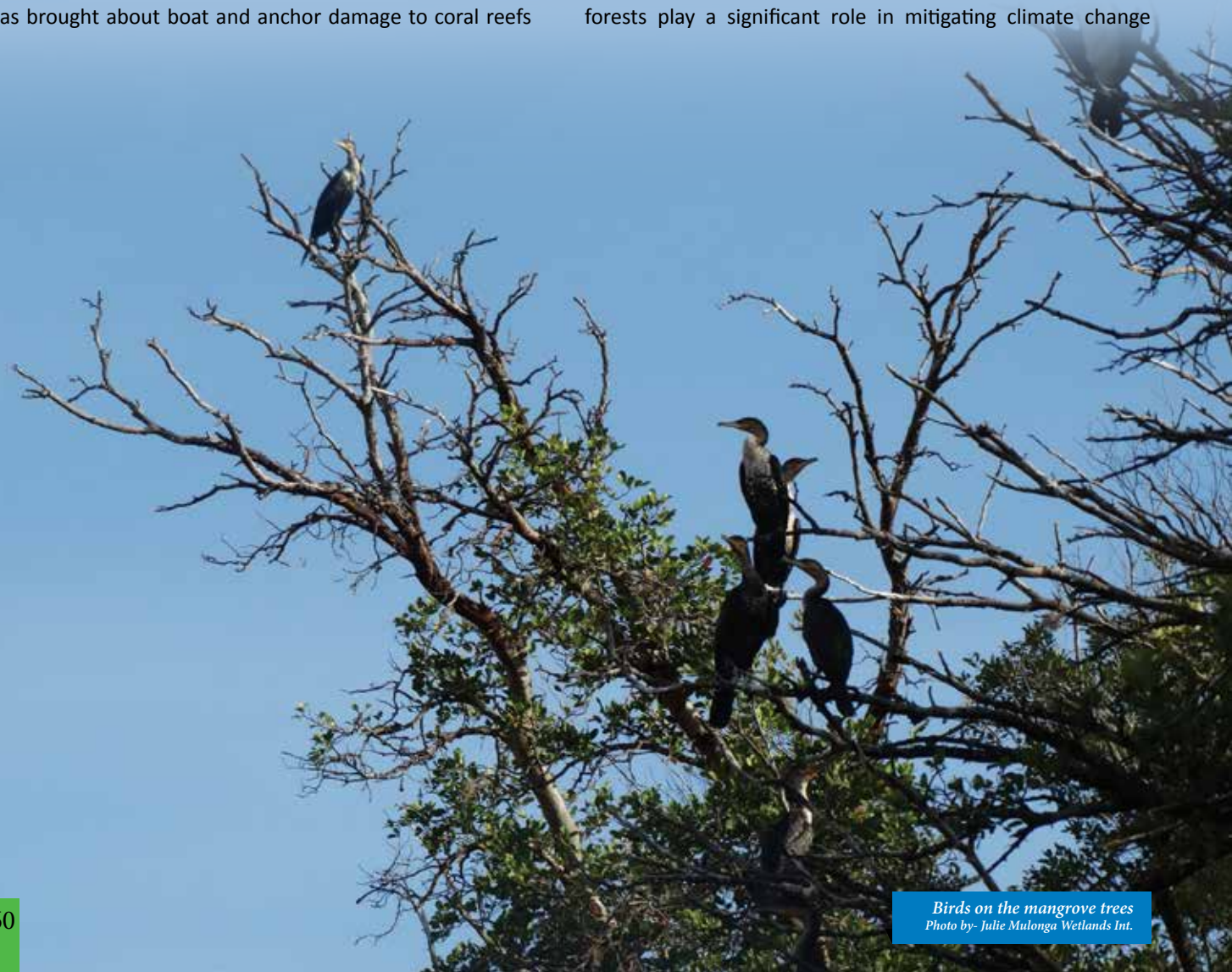
Mangrove forests are among some of the most productive and biologically important ecosystems of the world. They provide exceptional ecosystem goods and services that include tourism sights, wood products and wood-fuel. In addition, mangrove forests create stable shorelines and reduce the destructive effects of natural disasters such as tsunamis and hurricanes. They act as a basin of pollutants, trap sediments and strip nutrients in the land so as not to threaten seagrasses and coral reefs.

The conservation of mangrove forests in Kenya's coast has not been without setbacks. Coastal tourism has been and remains a good source of income for many along the coast. It has, however, had far reaching effects on the ecosystem. It has brought about boat and anchor damage to coral reefs

and greatly increased demand for land that is needed for construction of hotels and lodges. Mangrove poles and coral reefs are used for construction and shells are collected as souvenirs thus creating an imbalance in the ecosystem.

Human activity along the coast has worsened the effects of climate change and now sea level is known to be rising at about 1 mm per year. Significant activities include burning of oil and natural gas and indiscriminate clearing of forests. Burning of fossil fuels – oil and natural gas- to generate energy emits a lot of carbon dioxide into the atmosphere, and the cutting down of trees adds more CO₂, which acts as a blanket and traps heat in the air thus regulating the climate.

To arrest this situation it is important to realise that mangrove forests play a significant role in mitigating climate change





Mangrove trees along River Tana
Photo by Sarah Ndonye ELCI

because of their ability to prevent CO₂ such as that emitted from factories and assembling plants, from destroying the environment. For this to succeed, there is need for effective mangrove management which can be achieved through the Reduction Emission from Deforestation and Degradation (REDD) plan.

Scientists are, therefore, working together with the local community at the coast to protect and extend mangrove areas in order to protect the coastal marine ecosystems that preserve marine life and enhance human wellbeing.

The Northern Rangelands Trust – Coast, is a scientific organization operating in Pate and Kiunga in Lamu, north coast region in Kenya. The organization provides technical and financial support for community conservancies in the areas. Dr. Alison Green, a senior scientist working with the organization reports that the Pate Marine Community is mobilizing many in the fishing villages to manage their fisheries with the technical support provided. In addition, the Kenya Marines and Fisheries Research Institute, under its principal scientist, Dr. Gitundu Kairo, have a project dubbed Mangroves Together (Mikoko Pamoja) in Gazi Bay in Kwale which shows locals how to manage mangroves for the good of all.

Mangroves provide breeding ground for fish which is a source of livelihood for many coastal communities and therefore the conservation of these forests will ensure a reliable source of fish for consumption and also for export.

Humans should follow the footsteps of mangroves and protect, not decimate fish. Technologies that encourage low- impact and fuel-efficient fishing methods, as well as aquaculture production systems that use environmentally-friendly feeds and reduce fossil fuel use, could reduce the sector's carbon

footprint and strengthen its role in reducing poverty and improving economic growth and food nutrition security.

It is therefore important to strengthen regional and national fisheries agencies and community and trade fishing associations to encourage sustainable and equitable use of marine resources, including mangroves, and formulate policies that will ensure the benefits of these industry improvements impact small-scale producers and traders.

Mangroves are beneficial to the entire marine life. When their leaves and branches fall in water, for instance, they decay as a result of bacteria and fungi working on them. The nutrients that were available in the leaves are used by algae and seagrass which are later eaten by the turtles, fish and snails.

Even as mangroves play an indirect role in feeding turtles, efforts to conserve marine turtles by the Local Ocean Trust also known as the Watamu Turtle Watch in Malindi are increasingly frustrated by those interested in catching and eating the turtles. Currently, five marine turtle species – Green, Olive Ridley, Loggerhead, Leatherback and Hawksbill, are endangered species and their eggs are vulnerable to destruction from the construction of hotels and sand mining along the beach.

Apart from contributing to turtles' food chain, mangroves also contribute to meeting diverse human needs. Mangrove wood is hard and insect-resistant and so many have cleared mangrove forests for timber and fuel. Unfortunately, their benefit to humans is a double-edged sword that is working against them. It is estimated that mangroves are being deforested at the rate of 40 percent compared to terrestrial rain forests such as Kakamega forest. This practice leaves the land quite vulnerable to soil erosion which negatively affects

farming activities along the coast. However, organizations like Local Ocean Trust are partnering with marine forests in conserving these vital marine forests.

Mangroves are also critical to human health. Recent studies have shown that different species can treat toothache, sore throat, constipation and fungal infections. Similarly, sponges, soft corals and tunicates can be used successfully in the treatment of debilitating illnesses. Mangroves also provide toxic substances that have been used for their fungal, antibacterial and pesticidal properties.

Even as mangroves boost human health, their own health together with that of the entire marine ecosystem, is often under siege from factors like oil. The coastal waters of the Red sea and the western Indian Ocean are the major sea routes for large petroleum and oil tankers supplying the world with products from the Middle East. Major shipping routes run close to coral reefs near the port of Djibouti and Port Sudan and ships often discharge oily wastes and sewage.

Ships also cause physical damage to the reefs when poor navigation brings them into collision with the reefs. Longshore currents and winds in the western Indian Ocean are instrumental in the horizontal distribution and spread of pollutants, particularly in bringing oil slicks from the open sea into the coastal areas.

Similarly, oil tankers often empty ballast and wash engines on the high seas and residues of degraded oil are consolidated and washed ashore by onshore winds, currents and waves. Tar balls litter beaches with harmful effects on wildlife and humans that use the beaches. Soluble polychlorinated biphenyl (PCBs) from these products poison marine life and accumulate in the food webs, leaving physiological disorders in their wake.

In addition, drilling the seafloor for oil has the potential of removing deep sea ecosystems and bringing up immense sediment plumes which can temporarily choke off the oxygen supply over large areas. It is believed that the deep sea hosts more diverse and unique ecosystem than the terrestrial ecology.

Indeed, deep seas are ten times larger than continental shelves in the world's oceans. Up to half of the CO₂ we have put into the atmosphere has been absorbed by deep sea. Therefore, introducing light into the dark deep sea will deter some fish species and alter their feeding and reproductive behaviours and ultimately lead to their extinction.

When a habitat is converted, an array of ecosystem services is associated with the species present in that location is changed, often with direct and immediate effect on the people. Changes in biodiversity also have numerous indirect impacts on ecosystem services over longer time periods, including influencing the capacity of ecosystems to adjust to

changing environments, causing disproportionately large and irreversible changes in ecosystem processes, influencing the potential for infectious disease transmission.

The sea is also polluted through point sources such as the discharge of contaminated water from coastal industry, sewage discharges and development sites, on one hand, and diffuse sources through agriculture and forestry, on the other hand. The diffuse sources are associated with leakage of nutrients into ground water, which are later transported into the sea. There have also been instances in which Municipal Council waste and sewage have been discharged into the sea without receiving proper treatment. These practises greatly undermine marine ecosystems and should be avoided.

A proper management of mangroves requires an Ecosystem Based management (EBM) approach which links mangroves with seagrass, coral reefs and ecosystems outside the river. At the Kenyan coast, this approach is seen when farmers, builders, fishermen conservationists, politicians and energy practitioners come together to explore how the ecosystem connects to people.

All these stakeholders strategise on better ecosystem management and protection. This plan is based on sound scientific knowledge about connections between people and the environment. The Kenya Marines and Fisheries department is using this ecosystem approach in Gazi area in Kwale County. Mangroves are wonderfully diverse habitats that carry out their processes and functioning modestly behind the scenes without a big fuss or drama. Many people don't fully understand the many natural benefits of mangroves. They have naturally evolved to undertake critical ecosystem services that are irreplaceable.

We must therefore act now to conserve these incredible habitats by voting for more marine reserves and by educating people about the multi-benefits these floating forests provide us with; benefits we often take for granted.

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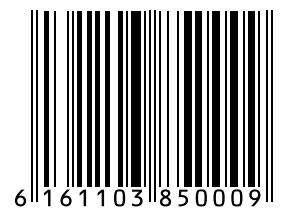
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