

Land for Life

MANAGING LAND SUSTAINABLY FOR BETTER LIVELIHOODS



LEADERSHIP IN AGING AND DISABILITY SERVICES

Land for Life



**MANAGING LAND SUSTAINABLY
FOR BETTER LIVELIHOODS**



This is our world,
our land, our life,
we must nurture it.

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Contents

Acknowledgments	vii
Foreword	viii
Introduction	x



POVERTY	1
Poverty Not a Fate!	2
Conservation Efforts Lift People Out of Poverty in Benin with World Bank Support	7
World Bank–Supported Project Increases Productivity and Reduces Conflicts in Sahel	9
Land Management Comes Full Circle in the Pearl of the Antilles	11
Self-Governance Saves Common Lands from Degradation in India	13
Holistic Land Management Improves Livelihoods in Kenya	15
The Magic Wand	17



FORESTS	19
Dry Forests	21
It Takes Chifeng City: Restoring Land on a Grand Scale	25
Out of Environmental Hazards Livelihoods Are Restored, Friendships Created	27
Unearthing the Ethiopian Humbo Forest with World Bank–Supported Project	29
World Bank/GEF Support Integrated Productivity Conservation in Forests’ Protected Areas	31
Fighting Desertification Is Everybody’s Everyday Business in Nigeria	33
The Fight for Dirt: TEMA	34



CLIMATE CHANGE	37
Climate Change: Ground Zero	38
Native Trees to Restore Salinized Soils and Sequester Carbon	41

World Bank/GEF Sahel and West Africa Program Supports the Great Green Wall Initiative	43
Scientist's Persuasiveness Saves Mongolian Grasslands	45
DeCo! Ghana	47
A Balancing Act for Competing Land Uses in India	49
Profitable Land Investments with Wildlife Works	51



BIOLOGICAL DIVERSITY	53
Biodiversity and Preventing Land Degradation	55
The Hummingbird in China's Gobi Desert.....	57
Life Replaces Once Dry Scrub in Jordan.....	59
World Bank Experience in Community Conservancy as a Social Development Movement in Namibia.....	61
Payment for Ecosystem Services Preserves a Valuable Biodiversity Zone in Portugal.....	62
World Bank/GEF Project Protects Mountain Gorillas in Uganda.....	65
Using Nature to Restore the Grasslands	67



WATER	69
Land for Life, Water for Life: Managing the Extremes	71
Restoring Dry and Salinized Seabeds in the Aral Sea	73
A Green Wall to Catch Fresh Water in Indonesia	75
Building Riverbeds from Sand Dams	76
Mexico's Water Solution from Integrated Landscape Management.	78
World Bank Support Unleashes Prosperity from Senegal River Resources	80



FOOD SECURITY	83
Food Security and Land Degradation	85
Environment-Friendly Farming by the Biovision Foundation	88
Underground Forests That Restore Soil Biodiversity.....	90
World Bank Project Brings Food Security from Sustainable Land Management in Senegal.....	92

Children, Agents of Food Security in Uganda 95

EcoAgriculture: An Innovation That
Restores Landscapes 97

Moving Africa’s Drylands toward Modern Technologies..... 98



AWARENESS CREATION 101

**Coalition Building, Communication,
and Social Media for Greater
Awareness**..... 102

Africa’s Faiths Commit to a Living Planet
under a World Bank–Supported Initiative 107

The DESIRE Project for Greener Land 109

ISO-Certified Cities in the Negev Desert..... 111

Endnotes..... 113

Web Sites and Addresses 114



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Foreword

Productive land is one of the world's most valuable natural assets in banishing extreme poverty and creating shared prosperity. Yet land degradation—which leads to desertification and robs soil fertility—is steadily marching across large tracts of the globe, especially in Africa. This is now one of the most important environment and development issues of our time.

Today, drylands cover about 34 percent of the earth's surface, and land degradation is reaching far beyond drylands. Recent estimates show that every year, 24 billion tons of fertile soils are lost through erosion alone. Between 1981 and 2003, 78 percent of all land degradation was occurring outside drylands.

It has taken us a very short time to destroy what took generations to create—productive soils.

We need to look for innovative new approaches and solutions from grassroots communities which are seldom consulted for their advice and experience. The purpose of the UNCCD's Land for Life Award is to unearth these grassroots solutions and bring them into the forefront of our plans for turning degraded and drylands back into productive use.

This magazine presents 40 innovative case studies from all over the world, illustrating how we can restore the health of degraded lands. These cases have been selected from the more than 250 applications received for the UNCCD Land for Life Award during 2011-2013, and from the World Bank's TerrAfrica portfolio. Their

diversity and range show us that barriers to scaling up sustainable land and water management are not for lack of ideas and initiatives.

The uplifting news is that people are taking action themselves to restore and protect newly fertile land all over the world. There are many cases,



such as those presented here and beyond, that we can learn from. In 2011 alone, the Parties to the Desertification Convention documented some 240 successful sustainable land and water management measures in their reports to the last Conference of the Parties.

These stories testify to the fact that desertification and land degradation are not our automatic destiny. We can roll back the encroachment of drylands and reclaim enough fertile land for the world to feed itself, banish malnutrition, and create sustainable land and water management policies. This is what a land-degradation neutral world is about.

We need political leaders, private sector and communities to mobilize behind scaling up good practices; disseminate valuable new information and knowledge; invest in and mainstream sustainable land and water management at the national level; forge effective partnerships; and monitor desertification, land degradation and drought at all levels. In this way,

A handwritten signature in blue ink, reading "L. GNACADJA".

Luc Gnacadja

*Executive Secretary, United Nations Convention
to Combat Desertification*

we can pursue a comprehensive approach whereby forest, pastoral and agriculture lands are managed in an integrated way to create ecosystems that keep the world's land alive and productive.

We lose more and more fertile land each day to the steady advance of degradation. Let us all cooperate to fight land degradation at all levels, demand action, set measurable targets, and forge partnerships for effective results on the ground.

As the global community comes together to develop the Sustainable Development Goals, now is the time to act on reversing and preventing future land degradation. These stories provide the testimony that it is possible to fight land degradation.

Land is a source of life, a source of wealth and we must nurture it. Let us answer the call.

A handwritten signature in blue ink, reading "Makhtar Diop".

Makhtar Diop

Vice President, The World Bank Group, Africa Region

Introduction

Land Is Life

The greatest challenges facing humanity are interconnected. Ending poverty requires economic growth creating more opportunities for better livelihoods, access to education for all, and empowering women. Food security depends on healthy soils and agricultural yields, which in turn depend on water supply and are being increasingly impacted by climate change. It is hard to name any one issue that stands alone.

It is also true that solving the problems of land degradation and desertification offers an entry point for tackling many pressing development issues. Land degradation is often an underlying factor of rural

poverty, which severely impacts the ability of subsistence farmers to grow food, irrigate their crops and get decent yields.

Close to one third of the wealth of low-income countries comes from their “natural capital” which includes forests, protected areas, agricultural lands, energy and minerals, according to a World Bank report¹. Countries that manage these natural assets carefully are able to move up the development ladder—investing more and more in manufactured capital, infrastructure and “intangible capital” like human skills and education, strong institutions, innovation and new technologies.

An estimated 70 percent of the developing world's 1.4 billion extremely poor people live in rural areas, according to a 2011 report by the



International Fund for Agricultural Development. When land and soil are healthy, it leads to improved agricultural productivity, enhanced biodiversity, and reduced carbon emissions. When land and soil are healthy, both the earth and the communities who inhabit it are more resilient to weather variances and disasters.

We need to meet the needs of the 2.6 billion people without access to sanitation, the 1.3 billion without access to electricity, the 1 billion who are hungry, and the 900 million who lack safe drinking water. We must do so in an era of increased uncertainty as we adapt to climate change and unprecedented urbanization. And we must do so without sacrificing the environment. There is no time like the present.

The urgency for action in Africa is undisputable. Two-thirds of the continent is either desert or drylands—arid, semiarid, or dry subhumid. In the dryland

The Land for Life Award consists of an annual prize fund of US\$100,000, which is typically shared among three winners that are chosen by a panel of experts.

The award is a public affirmation of proven initiatives that offer important lessons on land restoration and that must be scaled up to meet a growing food demand.

Applications come from individuals, nongovernmental organizations, governments, businesses, media, and others contributing to sustainable land management.

The call for applications runs from October through early March, and the winners are announced every June 17, which is World Day to Combat Desertification.

subregions of southern Africa, the Sahel region, and the Horn of Africa, the additional burden of climate change is already evident. Recurrent, prolonged, and severe droughts come with a high loss of human life, conflict, migration, and political instability.

The World Bank and its partners recognize that tackling immediate, decisive steps to slow the effects of climate change is essential to eradicate poverty. Looking at all of its operations through a climate lens, the World Bank is helping 130 countries take action on climate change by supporting on-the-ground action to finance projects that help the poor grow their way out of poverty and increase their resilience to climate change.

Recognizing that healthy land is the backbone of healthy communities, the United Nations Convention to Combat Desertification (UNCCD) and partners have created the Land for Life Award. This is the only global award that focuses solely on organizations and individuals working to restore degraded lands and improve the soil's natural health and productive capacity.

The stories presented here speak about the successes and impacts of land restoration through sustainable land management practices taking place worldwide. They are also a call to action, to get meaningful actions on the ground, boost private investment and encourage governments and development agencies to cooperate better to end land degradation.

These global stories of success are expected to increase investment on SLMW, promote south-south cooperation, and accelerate effort to end poverty. They should inspire every one of us to make a commitment and take all measures we can to strive for eliminating land-degradation. We need to take action now. If not, these testimonies will bear silent witness to a generation that knew better, yet failed to act.

Land: Central to the New Development Agenda

The deadline for the Millennium Development Goals in 2015 is upon us. Soon, world leaders will meet to take stock and set a new agenda on issues that are not new, but on which their understanding of how these issues are integrated has changed. Of the proposed sustainable development goals, an overarching goal has been put forward: “sustainable land use for all and by all.”

Building on the Rio +20 agreements to strive for a land-degradation-neutral world, there is a need to set concrete measureable targets for curbing land degradation. This goal is achievable by encouraging sustainable land and forestry management, agroforestry, water management, soil conservation, and sustainable agriculture and livestock practices. Policy makers are debating whether a land-degradation-neutral world is achievable. The stories in this book show that good examples for land restoration exist, and, if scaled up, can indeed be transformational and positively impact lives and the environment.

POVERTY

That poverty is not fate becomes apparent from the stories from Haiti, from the conservation effort of the coastal population of Benin, and from the courage of farmer innovators in Burkina Faso.

FORESTS

From the Korea-China Friendship Great Green Wall in Kubuqi Desert to Africa's Great Green Wall for the Sahara and Sahel and Lake Chad Initiative, we learn that forests abound and massive afforestation progress exists in arid and semi-arid areas. Curiously, world maps rarely show forests. You get to find out why. We also learn from communities in Humbo, Ethiopia, that unearthed an underground forest and are now deriving multiple benefits.

CLIMATE CHANGE

In India, Abellon is the only business in the world that employs landless farmers and women to practice agriculture under the shade of solar panels. The 12 hectares of solar panels provide the community with clean energy, as well as organic fruits and vegetables grown with water run-off from frequent panel cleaning. The World Bank/GEF Sahel and West Programs in support of the Great Green Wall also offer much hope as they promote a landscape approach to increase productivity while nurturing land resources.

BIOLOGICAL DIVERSITY

This may sound counter-intuitive, but grazing animals can help regenerate degraded landscapes and increase biodiversity. Through the introduction of the framework of holistic management, Alan Savory and the Savory Institute have trained more than 10,000 people in the concept of holistic management to restore land and increase productivity. In Namibia, we learn that community conservancies expanded as social development movement to preserve the growing wildlife populations and generate income.

WATER

Water is the source of life. The regional World Bank-funded Senegal River Basin Project goes beyond countries, to bring cross border solutions that make a long-term dent in poverty and transform the lives of the 35 million riparian people. Projects like this offer many more opportunities with multiplier impacts for agriculture, water supply, energy, navigation, and health. In Indonesia, Conservation International targeted the restoration of a key watershed and planted a green wall of 100,000 native trees over a 200-hectare area bordering two national parks. The wall prevents soil erosion and protects water flows for 30 million consumers downstream in Greater Jakarta.

FOOD SECURITY

One of the biggest challenges for sustainable land management is reaching small holder farmers and changing unsustainable practices. By popularizing the concept of Farmer-Managed Natural Regeneration (FMNR), World Vision has changed how thousands of farmers manage their land, helping them cultivate buried root systems or “underground forests,” in degraded landscapes, and help restore productivity over time.

AWARENESS RAISING

One the greatest achievement of the organizations featured here is their success at making beneficiaries as well as policymakers know the urgency of finding solutions against desertification. The World Bank has contributed by using its convening power to scale up investments, facilitate knowledge sharing and bring together the various stakeholders.

You will find inspiring stories on dialogue and knowledge sharing from the Negev desert, one of the most degraded environments in Israel, through the activism of Bilha Givon, DESIRE’s toolbox of sustainable land management techniques and TerrAfrica’s work to shape beliefs, behavior and actions for a greener and better Africa.

CREATING ECO-SYSTEMS OF SUCCESS

The organizations profiled here are successful because they understood that there are many aspects required to create change. They are tackling the problems of land degradation in various ways, by educating students, by mobilizing volunteers, by offering farmers training and assistance, and by using advocacy with governments for policy change. They are experimenting with new techniques, and revisiting old methods that have since been forgotten. Much of their work demonstrates that sustainable land and water management does not have to be complicated. Many of the

initiatives profiled here empower people at the community level, people who are spreading the word one by one, people becoming a movement for change on how we care for our land and soil.

But the voices of the people and organizations profiled here are often not heard across borders, disciplines and political spheres; leaving their efforts under appreciated and underutilized. The goal of this publication and the Land for Life Award is to draw attention to these valuable lessons.

Each story is different, but taken together, they are all about breaking the vicious cycle of land degradation and poverty, and shifting the paradigm towards a virtuous cycle of healthy soils and better conditions of life for greater prosperity. We hope you find these stories valuable and inspiring.



Poverty



Poverty Not a Fate!

BY UNDP AND WORLD BANK

Ann Juepner, UNDP, and Paola Agostini and Richard Damania, World Bank

“Poverty is like heat; you cannot see it; so to know poverty, you have to go through it.”

—A poor man from Adaboya, Ghana²

Persistent poverty is overwhelmingly rural and geographically concentrated. Despite much progress in reducing poverty in recent years, about 1.4 billion people still live on less than US\$1.25 a day—which is a widely used poverty line.³ South Asia is the region with the greatest number of poor people, but sub-Saharan Africa has the highest incidence of rural poverty.

Poverty is described in different ways, and there is growing agreement that it is multidimensional and at low levels of income it goes well beyond the historical notion of lack of sufficient income (or income poverty) reflected in this global poverty line. It is a dynamic and transformative process that is increasingly influenced by numerous short-term shocks and longer-term stresses, such as seasons, climate variability and change and household-level demographic shocks. This is why, when data is available, there is a greater focus on measuring consumption poverty than income poverty. However defined, such vulnerable populations may move in and out of poverty due to these natural and anthropogenic factors.

Multidimensional poverty acknowledges deprivations in key aspects of human well-being such as health, education and living standards,⁴ with more than 1.75 billion people are living under these conditions.

At least 70 percent of the world’s poor are rural and a large proportion of these are children and the young. Low productivity—especially of land—is often the root cause of much of the poverty that is observed in rural areas. Vulnerability is especially high in the drylands where climate related shocks coupled with land that has low productivity and is vulnerable to overgrazing.⁵

The causal links between poverty and land productivity often run both ways. The poor typically inhabit marginal lands with limited potential, but extreme poverty also creates conditions which induce the poor to degrade soils and deplete valuable natural resources in their bid for survival. The short term gains are counterproductive and ultimately unsustainable. This is especially relevant in regions of the world where agriculture and livestock production, are and will remain, the default sources of income, employment and livelihoods.



The most disadvantaged bear the greatest repercussions of environmental degradation since they directly depend on natural resources for their livelihoods. They are especially sensitive to increased drought intensity in a warming world, especially in Sub-Saharan Africa and South Asia.⁶ They include the more than 1 billion people living in the drylands which account

for the poorest, the hungriest, the least healthy and the most marginalized people in the world.⁷

Drylands cover more than 40 percent of the world's land surface and embrace a variety of environments—sandy deserts, temperate grasslands and savannah woodland—that share the common feature of water scarcity.⁸

Despite the challenges, drylands have been home to people for thousands of years. Today, drylands support about half the world's livestock and are major areas of cereal production. Drylands also affect global climate and are some of the most conflict-prone regions in the world—they cannot be ignored.

The vignettes that comprise this volume tell stories of lands degraded to meet urgent survival needs and innovative policies and land management systems that have reversed these trends. This calls for actions on many fronts—engaging communities, improving land tenure and administration systems and creating resource buffers—such as community forests that reduce incentives to exploit and deforest land with unclear ownership and ensure a supply of resources for times of need.

Partnerships are probably the most needed actions to accelerate the scaling up of existing innovative local efforts. The Land for Life demonstrates that innovations are not lacking. The Equator Initiative, a UNDP-led partnership, brings together the United Nations, governments, civil society groups, businesses, and grassroots organizations to recognize and advance local and indigenous



efforts to reduce poverty through the conservation and sustainable use of biodiversity. TerrAfrica, led by the Africa Union, offers much hope as it brings together partners such as African countries, World Bank bilaterals and civil societies that use their convening power to scale up investments, knowledge dissemination and use of a landscape approach.

One of the critical gaps that need to be filled is the involvement of the private sector. Sustainable development is indeed a viable investment for the private sector.

The stories in this publication contain innovations that demonstrate how land restoration turns the tide on poverty. Integrated sustainable land management approaches that are applied in a participatory manner, built on indigenous knowledge and experience, and particularly target women and young people as illustrated in the stories from Haiti, the Philippines, India and Kenya, are key in achieving more sustainable and shock-resilient livelihoods.

In the last decade, a lot of progress has been made globally in fighting poverty, resulting in the 'rise of the South' with more than 40 developing countries showing markedly accelerated progress in achieving the Millennium Development Goals by 2015.⁹ Clearly, the eradication of extreme poverty and hunger, as Millennium Development Goal number one, is possible.¹⁰

It is an ambitious, though achievable target that will depend on the growth of economies and the distribution of benefits from that growth. The challenge for policy makers and the world at large is to ensure that

the gains are sustainable and do not diminish opportunities for future generations. On its part, the World Bank has embraced a target date for reaching an extreme poverty rate of no more than 3 percent in 2030.

A sustainable human development path calls for strategies that maintain and nurture the productive capacity of nations and communities, so that future generations neither pity the current cohort for consuming too little, nor resent them for diminishing future opportunities. What is needed is a balance that expands the economic opportunities and substantive freedoms of people today while making reasonable efforts to avoid seriously compromising those of future generations.¹¹

Fundamental to poverty alleviation and sustainability in the rural landscape of the drylands is the need for stewardship of land and natural assets to enhance productive capacity and build resilience to the inevitable climate related shocks.

Building on existing opportunities in the drylands, international actors need to rally support for the implementation, through truly participatory processes, of an integrated strategy that enhances the economic and social well-being of dryland communities, while enabling them to sustain their ecosystem services and to strengthen their adaptive capacity to manage all forms of environmental change.

After 2015, efforts to achieve a world of prosperity, equity, freedom, dignity and peace will continue. An ambitious post-2015 development agenda is currently being developed in close consultations among a broad array of partners which include the voices of the poor themselves.¹²





Conservation Efforts Lift People Out of Poverty in Benin with World Bank Support

In Bamezoun, Benin, a sacred forest located in the commune of Aguégoués, in a region irrigated by the Ouémé River in the southeast of the country, the villagers did not realize that wood cutting, poaching, and overfishing—activities they had hitherto depended on to meet their needs—had been exerting considerable pressure on natural resources.

Through the World Bank-funded Community-Based Coastal and Marine Biodiversity Management Project, communities have now been persuaded to abandon these practices. A participative process allowed the creation of community conservation areas to preserve the biological diversity of coastal wetlands. Deeply involved in the process, about 150 communities can now enjoy the sustainable use of the biological diversity of marine resources and benefit from environmentally friendly business activities.

The project has helped bring the riparian populations out of poverty, which had forced them to destroy the natural resources. Now they know that protecting mangroves, coastal zones, and forests is essential for the survival of future generations.

Fish farming is now possible and allows them to meet their families' needs and educate their children. Communities and palm oil producer associations have realized the importance of preserving their forest, as they have reaped the benefits of income-generating activities derived from their conservation efforts.

To enable residents to better manage these newly protected zones, training sessions were organized that covered marine and coastal resource conservation and management, tools and techniques for community-based natural resource management, community-based procurement, financial management of associations, planning, and monitoring of activities.

Infrastructure for market gardening (water pumps, sprayers, development of irrigated areas, seeds, organic fertilizers), fish farming (fish ponds, fish cages, fish pens, aboveground fish tanks), and transport (motorized boats, tricycles, motorcycles) were also provided to enable beneficiaries to engage in income-generating activities such as the production and sale of market products, salt trade, fish farming, fish processing and marketing, and palm oil production. Communities have increased their production, expanded their businesses, and now have profits deposited in savings account at the local agricultural credit union.

Awareness-raising campaigns organized under the Community-Based Coastal and Marine Biodiversity Management Project have helped residents to realize the importance of conserving their natural resources. The project is expected to finance a total of 149 community groups, involving 1,669 direct beneficiaries. The project has not only reduced pressures on natural resources, but has also increased the revenues of beneficiaries. It is important to make the necessary investments so that other Beninese communities can benefit from the project.

Web site: www.worldbank.org





World Bank–Supported Project Increases Productivity and Reduces Conflicts in Sahel

Located in the heart of West Africa, Burkina Faso is endowed with natural habitats such as gallery forests, sacred forests, nature reserves, and wetlands. Particularly notable sites include the Pics de Sindou, the Karfiguela Waterfall, the Sacred Dafra Pond, and the Tengréla Lake. Many of these sites are threatened, in addition to species such as panthers, elephants, crocodiles, and pythons. Over the years, high pressure on the natural resource base and the environment caused rapid degradation. Deforestation alone claims an estimated 10,000 hectares per year.

A World Bank–funded project focusing on lowland areas in selected subwatersheds in Burkina Faso has demonstrated how communities can improve the productive capacity of rural resources. Through sustainable conservation of biological and agricultural diversity and rehabilitation of soil and water resources, the Burkinabe were able to simultaneously generate income and environmental benefits.

The Sahel Integrated Lowland Ecosystem Management (SILEM) Project pioneered the concept of biodiversity in production landscape. It created and catalyzed community dynamics for the sustainable management of natural resources at the microwatershed level by implementing incentives, creating an investment framework consistent with the country's priorities,



and by rewarding, while continuing to strengthen, individual and collective know-how.

Around 160 villages benefited from investment funds to support various natural resource management activities that included soil and agriculture techniques, water conservation technologies, livestock and fishery management, reforestation and forest management techniques, and natural resource protection.

The SILEM Project developed a number of activities related to land planning, including 100 local conventions on natural resources; 3,837 hectares of improved land through stone bunds; 8,307 *fosses fumières*; the recuperation of 3,138 hectares of degraded land using the *scarifiage*, the *zai* technique, and *demi-lunes*; the treatment of 250 gullies for agropastoral production; and 26,500 meters of revitalized small dykes. Through the SILEM Project, 7,500 hectares of native forest were designated for conservation. Other key activities related to the restoration of forest cover and biodiversity included the production of 195,720 seedling plants, the use of 941,934 plants for reforestation, and the establishment of an 11 hectares of botanical conservatory.

Because the main constraint for livestock production is the poor organization of space, SILEM's investment focused on the creation of 3,514 hectares

of pasture zones, 417 kilometers of pasture ways, and 10 pastoral water points.

The key outputs in the promotion of plant production were the conversion and rehabilitation of 166 hectares of lowland areas (mainly for rice production) and the supply of 8,800 kilograms of improved cereal seeds to the beneficiaries of the converted or rehabilitated parcels of land.

Overall, 2,971 microprojects were implemented and 13,218 producers, local institutions, and extension agents were trained on sustainable land management practices. Through participative planning and open dialogue between villages, farmers and herders, the SILEM project fostered peace building and eliminated most conflicts.

Web site: www.worldbank.org





Land Management Comes Full Circle in the Pearl of the Antilles

In a country that was once referred to as “The Pearl of the Antilles” due to its vast land productivity, poverty in Haiti is now widespread and agricultural productivity low due to declining soil fertility and extensive soil erosion. Meeting people’s daily food needs is one of Haiti’s greatest and long-standing challenges. The massive earthquake that hit the island in January 2010 worsened this situation dramatically, and recovery has been painfully slow.

Soil fertility urgently needs to be improved to meet the dietary needs of the rural population. But it’s not just food insecurity that is putting people’s health at risk. Haiti also faces a sanitation crisis. People are forced to find other ways to dispose of their wastes, often in the ocean, rivers, ravines, plastic bags, or abandoned houses. This was one of the causes of the cholera outbreak in late 2010, which quickly turned into an epidemic that has since claimed another 8,000 lives.

In 2006, Sustainable Organic Integrated Livelihoods (SOIL) started addressing these challenges using an integrated approach called ecological sanitation (EcoSan). EcoSan uses specially designed toilet facilities to collect human waste, which is turned into safe, nutrient-rich compost that can be used to regenerate depleted soils and improve agricultural production. This technology is not only environmentally sustainable, it is also affordable—a great asset in a country like Haiti.

More than 30,000 people in Haiti have used SOIL’s EcoSan toilets or similar sanitation facilities set up by other organizations with SOIL’s expertise.





Waste treatment centers collect all the waste products and process them into compost, in accordance with the highest public health standards. The soil quality and yields have improved on many farms, nurseries, and gardens that use the compost. SOIL has set up experimental gardens to show that the quality of the compost improves output. The gardens are also used to test and demonstrate other sustainable land management practices and cultivate seedlings for reforestation.

In 2012, SOIL won the Land for Life Award with a cash prize of US\$40,000. They are using the award to develop an integrated agricultural livelihood learning center. The center will include a full-scale composting operation, fruit tree nursery, and a solar-powered drip irrigation demonstration farm near Cap-Haïtien on the northern coast.

"We live by the Haitian sayings painted on the back of the SOIL Poopmobile: 'Pwoteje anviwonman an se pwoteje tet ou'—'Protect the environment and you are protecting yourself' and 'Chanjman tout bon an komanse nan mwen avan'—Change begins with me," says Sasha Kramer, Executive Director of SOIL.

Web site: <http://www.oursoil.org>

Self-Governance Saves Common Lands from Degradation in India

The fate of common land is predictable—misuse and abuse. Rangelands are overgrazed. Forests are stripped bare. Water is polluted. Scientists call it the “tragedy of the commons.” But with support from the Foundation for Ecological Security (FES), villagers from various states in India have found solutions, and even restored and improved 200,000 hectares of common property rangelands.

For villagers in Barundni in Rajasthan, for instance, the improvements made on their leased land inspired eight other villages to protect 780 hectares of common land, which has improved their livestock systems and fodder supply. Similarly, interventions on the Ladwan watershed by villagers in Madhya Pradesh led to an increase in water levels in 63 of the 83 wells, in addition to increases in food, timber, and fodder production!



In India, common property lands, which are usually located on uplands, are vital for ecological functions. They play key roles in the water cycle, biodiversity conservation and pollination, among other functions. But these lands are also a vital source of livelihoods, especially for the poor, who get their energy and food and fodder for livestock from the forests and water from wells.

A study conducted in 2010 showed that more than one-third of India's land was degraded, and the commons were among the most affected. FES, established in 2001 in New Delhi, began working with the affected communities to set up systems that meet their needs and rehabilitate land using various restoration techniques.

When beginning a new project, FES follows some key steps. It uses local self-governance institutions to promote the conservation and sustainable management of natural resources. FES locates forests and other natural resources to fulfill the economic, social, and ecological demands of the villages and village conglomerates. And FES focuses on improving the living conditions of the poor by stimulating more activities and projects in their areas.

Today, FES is active in over 4,000 villages, and more than 1.7 million people benefit from its activities. The success of FES interventions has led to revisions of national laws for common land management. These achievements earned FES the 2013 Land for Life Award, taking home a first prize of US\$40,000.

Web site: <http://fes.org.in>





Holistic Land Management Improves Livelihoods in Kenya

The most recent study of the economic costs of desertification issued in April 2013 by the UNCCD 2nd Scientific Conference concluded that the most effective solutions must be based on a systems approach.

A prime example is the work of the Rehabilitation of Arid Environments (RAE), a charitable trust involved in rural development in Kenya. RAE is based in Baringo County, in the arid and semiarid lowlands of Kenya's Rift Valley, where it has operated for over 30 years.

When RAE began operations, about 70 percent of Baringo County's land was unproductive, subject to increasing soil erosion and vegetation and biodiversity losses. The land was severely degraded, and insecurity and ethnic conflicts were rife due to resource scarcity. Poverty was high, up to 90 percent in some areas, and food insecurity was common. Lake Baringo, the main source of fresh water in the area, had become silted.

Taking a participatory approach, building on traditional knowledge, RAE introduced a multi-faceted strategy to rehabilitate the degraded areas. Specifically, RAE began to restore the natural savannah grass ecology by seeding the land with indigenous grass species that had disappeared due to overgrazing. RAE agreed on a method to manage the reseeded areas. Fencing was used by the sedentary groups and community-based grazing by the pastoralists. These approaches are complemented by

income-generating activities such as baling hay, harvesting and selling the grass seed, beekeeping, leasing fields, selling milk, thatching grass, and collecting fuelwood.

Today, over 20,000 people benefit directly from the project, with 380,000 of the county's population of 550,000 benefitting indirectly. All of the issues have not been resolved, but native grass and tree species that had disappeared from the area are flourishing. The soil's physical qualities—nutrition and infiltration rates—have improved. Poverty levels have fallen and food security has improved for community groups. Men and women are profiting from the utilization and sustainable management of their improved natural resources and diverse income-generating activities.

Web site: www.reatrust.org







The Magic Wand

When farmers are poor, the land also suffers. Land requires constant investment, and can quickly become degraded due to lack of inputs like fertilizer. For poor farmers in the Philippines, the challenges of poverty are far-reaching. They often lack access to sanitation, and as a result are prone to diseases. The combination of low incomes, degraded land, and poor health creates a downward spiral that leaves farmers vulnerable. Many poor farmers fall prey to usurious lenders and lose their only asset—their land.

The Wand Foundation breaks this cycle of powerlessness by helping farmers reclaim their land through microloans. The organization also helps farmers improve yields and increase their incomes by introducing agricultural technology and eliminating middlemen. The Wand Foundation has trained more than 300 barefoot farm technicians, half of them women, to educate small farmers on how to increase their outputs, diversify crops, and improve their family's nutrition through growing vegetables and other type of livelihoods using their own resources.

The Wand Foundation promotes ecological sanitation by providing toilets to those previously without, and then processing the waste into high-grade organic fertilizer. The fertilizer improves the quality of the soil and yields, and reduces greenhouse gas emissions by acting as a carbon sink and replacing the use of synthetic fertilizers.

The Wand Foundation also organizes the community to maintain the watershed and plant trees to prevent soil erosion. Over 1,700 farmers are Wand members and, so far, more than 1,400 hectares of degraded land have been restored through tree planting and soil and water conservation techniques.

Web site: <http://mindaterrapretabiochar.blogspot.de>





An aerial photograph showing a winding road through a desert landscape. The terrain is characterized by large, undulating sand dunes in shades of tan and gold, interspersed with patches of green vegetation. The road, a dark ribbon, curves from the bottom left towards the top center of the frame. In the far distance, a hazy horizon line separates the desert from what appears to be a distant city or urban area under a pale sky.

Forests



Dry Forests

BY IUCN

Masumi Gudka and Jonathan Davies, International Union for the Conservation of Nature

A single tree in a dryland landscape can hold as much importance to the survival of an entire dryland ecosystem as a patch of forest can in a humid landscape. A few individual trees are often the pillars to the survival of many of the inhabitants and ecosystems in the drylands. In some indigenous communities in dry regions of the world, one tree is owned by several families, signifying the high value placed on this resource. Usually, a tree is the link to a plethora of biodiversity, becoming an ecosystem in itself.

Dryland trees are the key ingredient in supporting the environmental processes and social functions found in the mosaic of habitats and ecosystems that collectively make up the dryland areas. But the trees in drylands often do not reach above 5 meters, one of the criteria defining forests. As a result, extensive tree clusters in the drylands are invisible on forest maps because they fall outside the typical forest definition. Consequently, dryland forests have been largely disregarded as important ecosystems—even if they account for 42 percent of all tropical forests.

Dryland trees can be sparse, but tree density and height can also be comparatively high. Irrespective of their densities and heights, dryland trees and dry forests play important, but often underestimated, roles in dryland livelihoods and ecosystems. How drylands are defined also varies among organizations and governing bodies, which affects how and where their development is addressed. For our purposes, “drylands” encompass

not only dry subhumid, semiarid and arid areas, but the hyperarid areas. In short, it includes all dry areas and deserts.

Deserts are ecosystems in their own right, with highly specialized cultures and biodiversity that are unique to them. The misconception that deserts are wastelands and should be “restored” to a state similar to humid forests inadvertently leads to their degradation, for instance, by planting of alien invasive species to “green” the drylands. However, man-made deserts, like those of Inner Mongolia, which were once productive areas in the days of the great Genghis Khan, can and need to be restored. The term desertification is also misleading because it conjures up images of increasing or advancing deserts. In reality, desertification is the process of land degradation in the drylands, which leads to the loss of productivity.

The cases highlighted in this magazine highlight many ways to control desertification using soft technologies, like the tree planting in China’s Future Forests Programme or FADE’s sand fixing of desert dunes in Nigeria.

Desertification can also be tackled through effective land use planning and sustainable natural resource management by local communities. It is crucial to encourage governments to support bottom-up mechanisms to reverse or mitigate land degradation and incorporate these mechanisms into policy and governance systems.

Sustainable management and restoration of dry forests contributes greatly to overcoming the challenges of desertification, land degradation, and drought. In many drylands, forests protect the water towers and riparian zones that are pivotal for ecosystem function. Dry forests also provide essential seasonal safety nets—sources of secondary income and grazing reserves—for dryland residents. Restoring and sustainably managing these zones reduces the risk of drought, increases ecosystem resilience, and strengthens adaptive capacities.

Forest management in the drylands depends heavily on local land management practices, which have been shown to play a role in conservation, but which in many cases are growing weaker or being abandoned. Dryland trees are conserved through agroforestry, farm fallow practices, pastoralism, and through community protection of sacred sites and forest patches of economic significance. The preservation of abundant biodiversity and traditional cultures in dryland areas is inextricably linked to the availability and use of indigenous trees.

Indigenous and community-conserved areas (ICCAs) widely conserve dryland ecosystems and habitats. There is no clear idea of the number or size of ICCAs across the world, although an estimated 420 million hectares of forests, or 11 percent of the world's total, are under community ownership or administration (Molnar et al. 2004).¹³ Increasing trends of policy decentralization could double forest conservation through ICCAs in the near future (White et al. 2004).¹⁴ Mobile pastoralism in the drylands is highly influenced by the presence of trees, which provide feed, shade, fuel, and a variety of products that can support livelihoods. In many pastoral communities, trees owned by families are governed by a set of rules

and regulations developed and implemented by local institutions. Many dryland farmers also conserve forest cover through agroforestry practices, which, among other benefits, is known to boost fertility and moisture and to provide secondary incomes. Agroforestry is a common land use strategy in the drylands of Africa and Asia, increasingly being recognized as a contributor to biodiversity conservation.

The current global emphasis on maintaining, reviving, and creating forests has major implications for the drylands. There are increasing incentive opportunities for dry forests through carbon credits, although there are barriers to participation in this market and certain associated risks. Weak tenure and poor penetration of government institutions can constrain the use of carbon finance for sustainable land management practices. There is also a risk that incentives to increase forest cover may lead to degradation of important dryland ecosystems—such as savannahs—in pursuit of carbon credits. Carbon stores in dryland ecosystems are predominantly belowground in the root systems, rather than aboveground in standing biomass. Recognition of this and orientation of markets toward compensating for these significant carbon stores will provide important incentives for sustainable land management in the drylands. The spatial scale of the drylands makes them a high priority for climate change mitigation—about 2×10^9 hectares of global shrubland and C_4 grassland (Grunzweig et al. 2003).¹⁵ Investment in anti-desertification measures in the world's drylands appears to be an economical method to mitigate carbon dioxide build-up in the atmosphere while accomplishing other international objectives such as combating desertification and conserving dryland biodiversity (Glenn et al. 1993).¹⁶

- The definition of drylands and deserts varies between different organizations and government bodies.
- Dryland forests don't fit the typical definition of forests.
- The preservation of abundant biodiversity and traditional cultures in dryland areas are inextricably linked to the availability and use of indigenous dryland trees.
- Drylands and desert ecosystems can become degraded by planting trees without carefully considering the prevailing ecosystem.







It Takes Chifeng City: Restoring Land on a Grand Scale

Chifeng City, in Inner Mongolia, China, may not ring a bell. But it bears the title of “the first Chinese village” and is home to the excavation site of the first jade dragon and is the land of the famous Genghis Khan. Back then, it was lush and green. But how times change!

Until 60 years ago, a third of the arid lands of Inner Mongolia was desertified, forest cover was only 5 percent, and drought was frequent. Animal husbandry was difficult, crop returns low, and people lived in poverty. But the tide is turning. Today, forests cover nearly 35 percent of land and the sand is retreating. Through scientific policy planning and mass mobilization, Chifeng’s government has rehabilitated 750,000 hectares of degraded land. Each hectare of shelterbelt forest prevents 10 tons of soil loss each year on average. The area of desertified land is now declining at a rate of 150,000 hectares per year. The government and the people have worked together to turn Chifeng into a model for desertification control in China.

County governments sign a “responsibility contract” with local municipalities, which produce two positive outcomes: first the job of combating desertification becomes a priority across all levels of government, and second, it is integrated into local development planning.

The aim of the municipal government is to improve policies and encourage innovation for sustainable land management. The bottom-up approach

emphasizes afforestation efforts led by companies, households and professional teams. Every year, the peoples’ congress holds a debriefing on desertification. The government reports on the progress and the people give feedback.

The Chifeng government has invested in strengthening a scientific approach to land restoration by training 65,000 technicians and 50,000 local farmers and paying special attention to the ecologically sensitive areas. To learn from and track these efforts, Chifeng has documented over 100 afforestation technologies. As a result, the forestry industry, animal husbandry, and agriculture have all experienced economic growth, and the surrounding environment has improved.

Chifeng City government is a model in China on combating desertification, and has received the top 10 national awards for teams combating desertification.

Web site: www.cfly.gov.cn







Out of Environmental Hazards Livelihoods Are Restored, Friendships Created

It is almost a ritual. Around March of every year, dust storms envelop the city of Beijing. Cities located in the dust path, from China to the Republic of Korea and Japan and as far away as the United States are not spared. A big part of the problem is the expanding Kubuqi Desert in Inner Mongolia, China, which has caused residents to leave their homes. But the construction of the Great Green Wall in the region is halting desertification and preventing sand dune encroachment.

The Great Green Wall is being built through collaboration between the Korean NGO Future Forest and the All China Youth Federation. It is 16 kilometers long and about 1 kilometer wide. As of August 2013, more than 6.62 million trees covering an area of 2,400 hectares have been planted. The “wall” serves as a windbreak, slowing the advance of the yellow sand dunes toward the farms and ranches of the Yellow River Basin. The results are even visible by satellite.

The most important lesson from the project is that a combination of tree-planting and sand fixation methods can slow sand migration and greatly enhance soils natural health and yield capacity. The wall has many benefits for residents and the ecosystem. Local living conditions have improved, plants and animals have returned, and the amount of soil sediment washed into the Yellow River is decreasing.

Much of the work has been achieved by Korean and Chinese students, who have gained valuable experience along the way and remain ambitious. Recently, the team launched a campaign to plant a billion trees in the region.

Squabbles and disagreements are common in international efforts to solve transboundary environmental problems. But cooperation around the Great Green Wall has come to symbolize friendship between the people of Korea and China, which has earned the wall the nickname, “Korea—China Friendship Great Green Wall.”

<http://www.futureforest.org>







Unearthing the Ethiopian Humbo Forest with World Bank–Supported Project

Three decades ago, Humbo was covered with a dense jungle and was home to a variety of animal species. In the 1980s, variable rainfall, expansion of farm and grazing land, environmental degradation, and a severe food shortage turned the lush green forests into a barren stretch with a few clumps of bushes. Trees had been cut down for buildings, firewood, charcoal and furniture, with little or no regulation. Groundwater reserves that provided 65,000 people with potable water were threatened. Agriculture productivity fell by 70 percent. As a result, more than 85 percent of Humbo's 48,893 residents live in poverty. This mirrors the trend in Ethiopia, where overexploitation of forest resources has left less than 3 percent of the country's native forests untouched.

The Humbo Reforestation Project established seven forest cooperatives with local communities and raised and distributed 1 million seedlings to communities. Together, local and international communities managed and reforested over 2,700 hectares of degraded land. Community empowerment through mobilization, awareness creation, land tenure certification, forest cooperative formation, and capacity building provided the communities with security, incentives to protect the forest, and a sense of ownership.

Using farmer-managed natural regeneration (FMNR) with prudent stewardship, communities unearthed an underground forest. Surprised and excited to see the quantity and speed with which vegetation now grows on the once rocky and barren slope, they can now own their forest and reap

its multiple benefits. The increased production of wood and tree products, such as honey and fruit, has contributed substantively to household economies. Improved land management stimulated grass growth, providing fodder for livestock that can be cut and sold as an additional source of income. Lastly, the regeneration of the native forest is expected to provide an important habitat for many local species and reduce soil erosion and flooding.

The Humbo Project is the first large-scale forest-focused Clean Development Mechanism project in Africa to be registered with the United Nations Framework Convention on Climate Change. The World Bank's BioCarbon Fund will purchase 165,000 tons worth of these credits and provide an income stream of more than US\$700,000 to the local communities over a minimum of 10 years. So far the communities have received US\$322,000 from carbon revenue. Further revenue will be available to the community from the sale of the remaining carbon credits not purchased by the World Bank, as well as from the sale of timber products from designated woodlots in the project.

The protected areas of forest now also act as a "carbon sink," absorbing and storing greenhouse gases from the atmosphere to help mitigate climate change. Over the 30-year crediting period, the project will cut an estimated 880,000 metric tons of carbon dioxide from the atmosphere.

Web site: www.worldbank.org





World Bank/GEF Support Integrated Productivity Conservation in Forests' Protected Areas

Liberia is endowed with the major share of the remaining Upper Guinean Tropical Rainforest, a recognized hotspot for biodiversity that is considered a global priority for conservation. Liberia's forests house a range of important biodiversity, including some 240 tree species, 2,000 flowering plants, 125 mammal and 590 bird species, 74 reptiles and amphibians, and over 1,000 insect species.

In May 2003, based on evidence that suggested that the country's forestry stocks were being vastly overexploited and used primarily to finance the civil conflict, sanctions imposed on Liberia by the UN Security Council in 2001 were extended to include a ban on timber production and export. To speed up the lifting of the sanctions, an ambitious forest sector reform process was launched in 2004, led by the establishment of the Liberia Forests Initiative (LFI). The process of defining the LFI resulted in a more balanced and integrated development of Liberia's forests for commercial, community, and conservation uses—the 3 Cs approach, which became the key driving principles for the new forest policy.

The World Bank, through a GEF grant, has recently financed the establishment of an effective park management process in Sapo National Park (SNP), which is recognized as the most pristine tract of forest in West Africa and home to the endangered pygmy hippopotamus. The project was designed to bring SNP's 180,400 hectares of highly threatened lowland rainforest under effective conservation management, as well as bring up to

70,000 hectares of surrounding forest under sustainable use conservation management in a manner compatible with local development.

SNP was chosen for its distinctive biological attributes within the Upper Guinea rainforest ecosystem, the escalating threats it faced, and because of its potential to spearhead the development of the Liberian Protected Areas System under an integrated biodiversity conservation and community-based natural resources management mechanism.

The GEF grant also financed the expansion of a protected areas network that will encompass five protected areas in the country's western region, including a transfrontier Peace Park with Sierra Leone, and sustainable community livelihood activities around Liberia's protected areas.

The foremost accomplishment of the project was that it conclusively established the basis for integrated biodiversity conservation and community development at SNP and in its fringe communities. Furthermore, the project set standards for protected area management in Liberia through its modern form of participatory and adaptive management practices, with the possibility of influencing that sector in the West African region and beyond.

Web site: www.worldbank.org





Fighting Desertification Is Everybody's Everyday Business in Nigeria

As the sand dunes advanced in Kano, Nigeria, farmers abandoned their land and students dropped out of school. The community had to do something to stop the advancing desert. In 2000, the Fight against Desert Encroachment (FADE) partnered with the Ministry of Environment to plant a wall of trees, consisting of three rows. The row of trees facing outward serves as a windbreak. It protects the inner trees and the village from the encroaching sand. The second row is used as woodlots, which can be chopped down for fuel, so that the community does not chop down the windbreak. The final row has fruit trees for food and income-generating products.

After the trees took root, school enrollment tripled, cloud cover improved, and rain increased. The sand retreated and farmers returned home. After two years, FADE replicated the project in other areas using a tree-planting competition for secondary schools as a mechanism to involve young people. FADE organized seminars among farmers, teachers and administrators, and provided advisory services to farmers on what types of trees to plant to prevent desert encroachment.

In 2010, FADE produced a reality show, designed to bring young professionals to the cause of combating desertification. Fifteen "desert warriors" made the journey from Lagos to London, learning about and advocating for environmental protection.

FADE has also been part of exchanges with scholars in China, the United States and Niger, and has succeeded in advocating for greener policies with both the government and companies like MTN, one of Nigeria's largest cellular phone service providers, to support these initiatives.

Web site: <http://www.fadeafrica.org>





The Fight for Dirt: TEMA

It's the same vicious cycle that takes place in many drylands of the world. In rural Turkey, agriculture is the ticket out of poverty for many people. But farmers often end up overexploiting marginal soils. Erosion and land degradation are the inevitable consequences. But in the fight against land degradation, Turkey has an ace up its sleeve through the work of the Turkish Foundation for Combating Soil Erosion, for Reforestation and the Protection of Natural Habitats (TEMA).

TEMA, the largest environmental NGO in Turkey, tackles the problem of land degradation in various ways, including policy advocacy, legal and educational campaigns, and practical work on the ground.

TEMA has filed or has been involved in over 150 legal cases with a 75 percent success rate of the cases that went to a verdict. It has applied the power of civil mobilization to protect the land. In a historic case, it gathered a million signatures in support of a law that TEMA had drafted to protect the soil. This is significant given that at least 24 billion tons of fertile soil are lost through soil erosion every

year according to scientists. That is a loss of 3 tons of soil per person per year, estimated in monetary terms to be US\$70 per person per year or US\$490 billion per year for the global population. This achievement earned TEMA the second runner-up position for the 2012 Land for Life Award of US\$30,000.

Through its legal cases, TEMA prevented a total of more than 70,000 hectares of fertile agricultural land from being sealed for tourist sites or power plants. Influencing national legislation and court rulings on environmental issues is at the core of TEMA's advocacy campaigns. Success is rooted in its varied approaches that combine people power with practical work. People power is built through educating those who have a multiplier effect in the society, such as the teachers, clergy, police and others, and students from preschool to university, as well as through publishing books and teaching materials.

TEMA has over 475,000 volunteers and over 100 volunteer scientists and legal advisors. About 2.5 million people have attended TEMA's education programs. TEMA General Manager, Serdar Sarigul, says:

Our volunteers are our most important asset. They help us to communicate our message to the public. TEMA talks about the issues of soil erosion and land degradation in a language that the public can understand. The volunteers can also launch their own initiatives in their respective regions. This means that TEMA is always relevant to local people's current concerns.



TEMA's strength also comes from its practical experience. It has implemented more than 100 demonstration projects on sustainable rural development, reforestation, biodiversity conservation, and on combating desertification countrywide. Many of them show that sustainable land management does not have to be overly complicated. An example is the saffron project in Çütlük, a semiarid upland region close to Turkey's borders with Syria and Iraq. Here, soils suffer from cotton monocropping, which demands frequent irrigation and leads to increased salinity and loss of nutrients in an already water-scarce area. With experts from Harran University, TEMA explored the viability of commercial saffron cultivation and then reintroduced it into the area. Saffron requires only 10 percent of the irrigation water needed to grow cotton.

Last year, TEMA celebrated its 20th anniversary under the theme, "Soil Means Life." It is using the prize money from the Land for Life Award to raise awareness and promote special publications and seminars conducted by leading environmental experts.

Web site: <http://www.tema.org.tr>



Climate Change





Climate Change: Ground Zero

BY UNEP

Robert Ondhowe, United Nations Environmental Programme

Climate change is transforming how society lives and interacts with nature. Its effects are most readily evident and felt in food security, with land resources playing a major role because of the sizeable global population that still relies on rain-fed and subsistence agriculture. Most African economies, unlike much of the rest of the world, largely depend on land-based economic activities, especially agriculture. Thus, land management strategies that can assist farmers in dealing with changing climatic patterns are critical for food security.

Since 1880, the Earth's average surface temperature has increased by 1.5°F (0.83°C). However, the effect of climate on agriculture is associated more with the variability of local climate than to the global climate patterns. The United Nations Environmental Programme (UNEP), in *Livelihood Security: Climate Change, Conflict and Migration* (2011), observes that, from 1970 to 2006, changes in the seasonal temperatures in the Sahel region of Africa have risen by a range of between 0.5 to 2.0°C. The impact is such that United Nations Secretary-General's Special Advisor on Conflict, Jan Egeland, referred to the Sahel region of Africa as the "ground zero" of climate change. Despite technological advances such as improved crop varieties, genetically modified seed and irrigation systems, the weather is still a key factor in Africa's agricultural productivity, as are its very fragile soil properties and communities.

A study published in *Science* magazine suggests that, due to climate change, "southern Africa could lose more than 30 percent of its main crop,

maize, by 2030. In South Asia, losses of many regional staples, such as rice, millet and maize could top 10 percent.¹⁷" Globally, in many rain-fed, nonirrigated areas, crops are already near their maximum temperature tolerance due to rising temperatures. Yields are also likely to fall sharply from even small climate changes. The poorest countries will be hardest hit, with reductions in crop yields in most tropical and subtropical regions caused by decreased water availability and new or changed insect/pest incidences. Experts project a fall in agricultural productivity of up to 30 percent during the 21st century, but the effects of climate change on crops are expected to vary from region to region.

Tanzania's official report on climate change suggests that the areas that usually get two rainfalls in a year will probably get more, and those that get only one rainy season will get far less. The net result expected is that 33 percent less maize—the country's staple crop—will be grown. Overall, the average crop yield is expected to drop in areas where there is decreased rainfall, whereas cereal production could actually increase in places of increased rainfall, if managed properly.

For the favorable effects on yield to happen, much will depend on the realization of the potentially beneficial effects of carbon dioxide on crop growth and an increase in efficient water use. Stated differently, while adaptation is linked to efficient water use, the health of the land will matter for resilience, with regard to producing more organic carbon and increasing groundwater recharge.



In the long run, climatic change could affect agriculture in several ways, including:

- *productivity*, in terms of the quantity and quality of crops;
- *agricultural practices*, through changes in water use, particularly irrigation, and agricultural inputs, such as herbicides, insecticides, and fertilizers;
- *environmental effects*, particularly those relating to the frequency and intensity of soil drainage through nitrogen leaching, soil erosion, and reduced crop diversity;
- *rural space*, through the loss and gain of cultivated lands, land speculation, land renunciation, and hydraulic amenities; and
- *adaptation*, organisms may become more or less competitive, and humans may develop an urgency to create more competitive organisms, such as flood-resistant or salt-resistant varieties of rice.

Most agronomists, the experts in soil management and crop production, believe agricultural production will be affected most by the severity and pace of climate change, not so much the gradual trends in climate.

The projected climate variability and change are expected to severely compromise agricultural production and access to food. With 70 percent of the population still relying on rain-fed agriculture for their livelihoods, Africa's population dynamic and geography make it particularly vulnerable to climate change. If change is gradual, there may be enough time for the ecosystem, as well as agricultural techniques, to adjust. Rapid climate change, however, could harm agriculture in many countries, especially those that are already suffering from rather poor soil and climate conditions, because there is less time for optimum natural selection and adaption.

Decreases in potential yields are likely to arise from a shortening of the growing period, a decrease in water availability, and poor seed quality.

For scientists and policy making, there are many uncertainties to handle for effective policy design. The uncertainties include the magnitude of climate change, the effects of technological changes on productivity, global food demand, and adaptation possibilities. Worse, related information at the regional level is often lacking.

The imperative to accelerate the scaling up and scaling out of efforts to restore degrading land in the drylands and elsewhere to mediate the effects of climate change is therefore urgent. The innovations highlighted in this magazine are part of the solution and offer hope if supported adequately. In the end, it is the agricultural policies in place that will determine how countries are affected. The urgent need for policies to mainstream sustainable land management to minimize climate change effects cannot be overemphasized.





Native Trees to Restore Salinized Soils and Sequester Carbon

In 2006, in Colonia El Simbolar, a town located 1,150 kilometers northwest of Buenos Aires, farmers struggled to make ends meet and large amounts of land were abandoned. Former farmers of cotton, soybean, fruit, and vegetable survived on social assistance. Part of the problem was land degradation due to high soil salinity. But the producers also lacked education and the capital to invest in agriculture.

To address these challenges, *Grupo Ambiental par el Desarrollo* (GADE) trained the community to plant a resilient native tree called *algarrobo*

blanco, or the white carob tree, which produces wood, flour, and honey. It is a leguminous tree that improves the soil's structure, texture and organic matter content, and reduces surface salt. Nearly 7,000 hectares have been reforested in six years, and the nurseries have generated 1,750,000 white carob seedlings.

For GADE, community leadership gets priority at every stage. Local people, particularly women, who previously had no knowledge about tree nurseries, now construct, prepare and plant seeds, and prune, irrigate, and maintain the nurseries. The community, especially youth, have been mobilized to protect the environment.

The project has set a precedent for large-scale native forestation and carbon sequestration and is a prototype in efforts to fight severe desertification in Latin America and the rest of the world. Project organizers estimate that 324,000 tons of carbon dioxide may be sequestered over 20 years.







World Bank/GEF Sahel and West Africa Program Supports the Great Green Wall Initiative

Ayeleh Fikre, a 73-year-old farmer from Ethiopia's Amhara region, devoted her life to perfecting reforestation techniques. Yacouba Sawadogo, the 70-year-old farmer from Burkina Faso, known as The Man Who Stopped the Desert, spent over 30 years reversing desertification. Thanks to these farmers, and to many other unknown innovators, unproductive lands have become a source of life again. However, the challenge facing African countries is to work together to harness these modest successes and expand their opportunities.

Success means scaling up these actions through investment, knowledge, and partnership. The World Bank is doing just that through the Sahel and West Africa Program (SAWAP), which is its main contribution to the continent's Great Green Wall Initiative. Funded in collaboration with the Global Environment Facility (GEF), the SAWAP supports the efforts of farmers by scaling up investments on sustainable land and water management, facilitating knowledge sharing, and using the World Bank's convening power to bring partners together.

The multisectoral program uses a landscape approach working with agriculture, environment, water, and energy to expand sustainable land and water management. It strengthens a country-driven vision in 12 Sahelian and West African countries: Benin, Burkina Faso, Chad, Ethiopia,

Ghana, Mali, Mauritania, Niger, Nigeria, Senegal, and Sudan, and Togo. This program includes an innovative framework to address the region's environmental and social issues—Africa is leading the way on tackling sustainable land and water management in a changing climate. Based on the smart management of a landscape as a portfolio of renewable assets, the program hopes to secure more food, fiber, freshwater, and firewood while protecting natural assets in the face of climate variability and change.

The program builds on the many years of experience developed under the TerrAfrica Partnership Program on Sustainable Land and Water Management led by the New Partnership for Africa's Development (NEPAD). It leverages TerrAfrica partnerships and benefits from the knowledge of its partners, their investments, and the harmonization of efforts promoted by the coalition.

The SAWAP is composed of 12 discrete country projects that have various entry points, such as land management, biodiversity, water resources, sustainable forest management, disaster risk management, agribusiness, and food security. The portfolio is glued together by a regional project, the Building Resilience through Innovation, Communication, and Knowledge Services (BRICKS) Project. The BRICKS Project provides technical assistance to the regional centers of excellence of Interstate Committee for Drought

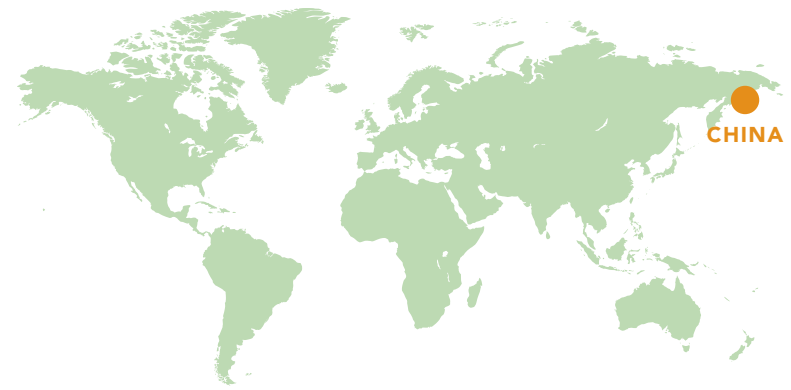
Control in the Sahel (CILSS), the Sahara and Sahel Observatory (OSS), and the International Union for the Conservation of Nature (IUCN) to facilitate technical knowledge exchanges and monitor services among the 12 country investment operations in the broader portfolio.

The resulting global environmental benefits could include sustainable management of natural resources (land, water, and vegetation) on up to 2 million hectares of croplands, rangelands, and dryland forest ecosystems per country; protection of threatened drylands' biodiversity; protection against erosion and desertification; and the potential for sequestering 0.5 to 3.1 million tons of carbon per year.

The most important achievement is the Great Green Wall Initiative's potential to transform the lives of millions of people from Dakar to Addis Ababa and lift them out of poverty.

Web site: www.terrafrica.org





Scientist's Persuasiveness Saves Mongolian Grasslands

The grasslands of Inner Mongolia in northern China are seriously degraded due to overgrazing and the pressures of a growing population. In Hunshandake, herdsman and their families struggle to make a living on land that has nothing left to give. Native species have disappeared, and the loose topsoil triggers sand storms that blow to Beijing and beyond.



Reversing desertification seemed impossible, but Goaming Jiang, a scientist from China, has found a way—his research shows that removing human disturbance on degraded land restores it in a matter of years. So he persuaded herdsman to stop grazing large animals like goats. Instead, they adopted chicken farming, tofu production and ecotourism, and took the pressure off the land. Chicken droppings are used to fertilize the soil.

Not only has the land improved, but the incomes of the Bayinhushu villagers have nearly doubled. Jiang has also encouraged the community to help youth find educational opportunities in the cities in a bid to allow the land time to rehabilitate and support more farmers in the future. The project spurred changes in China's policy for grassland restoration and management. In fact, farmers who lose grasslands for ecosystem restoration are compensated. Clearly, among the poorest populations, creating alternatives to livelihoods is crucial to restoring degradation.





DeCo! Ghana

The soils in the savannah region of northern Ghana are poor and crop yields are low. Chemical fertilizers offer only a temporary solution, and, if not used properly, they can be dangerous to farmers' health. In addition, a large share of the nutrients is eventually washed away due to the low levels of organic matter in the soil. Moreover, chemical fertilizer is subsidized by the government and there is no official supplier of organic fertilizer. Initiatives to encourage farmers to compost also have failed.

This failure was the genesis of DeCo!, a social enterprise that makes an organic fertilizer by working with the local waste management company that collects the waste, fruit, vegetables, and other biomass. DeCo! composts the waste to create a ready-to-use organic fertilizer that is rich in humus and can potentially double crop yields by improving the water- and nutrient-holding capacity of the soil. The waste treatment plants are located close to the villages to minimize the transport costs.

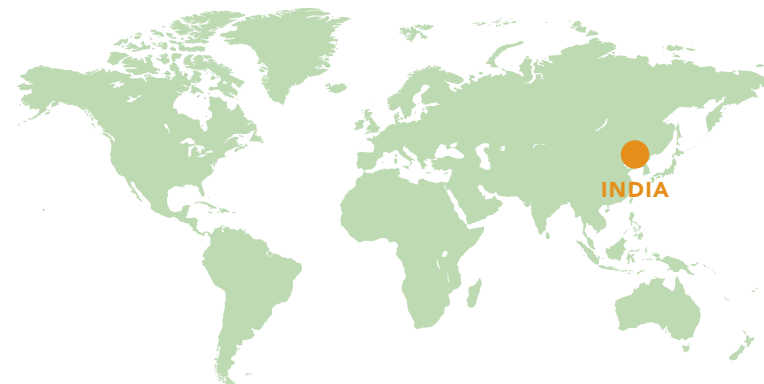
The treatment plants are run by highly educated graduates from around the world, but the enterprise also offers many positions for unskilled labor, providing crucial employment opportunities during the farming off-season. The goal of DeCo! is to become a financially sustainable social business.

Through a partnership with myclimate, a Swiss company offering carbon offsets, DeCo! could potentially become the first organization in Africa to use carbon credits for composting. The credits could lower the price of organic fertilizer by 30 percent, which would make it more competitive with chemical fertilizers. Chemical fertilizers are currently subsidized by

the government. Compared to chemical fertilizer use and the dumping of organic waste into landfills, DeCo! organic fertilizer is an environmentally friendly alternative that reduces the annual emissions by approximately 1,500 kilograms of carbon dioxide equivalent. DeCo!'s long-term goal is to create a franchise that will enable it to scale-up its operations and encourage local entrepreneurship.







A Balancing Act for Competing Land Uses in India

The food shortages that first emerged in 2007 revealed an emerging policy crisis in the land sector due to the competing demands of food production, carbon sequestration, biofuel production and urban development, to name a few. Nearly 60 percent of India's population relies on agriculture. But the sunny state of Gujarat, which was once a leading food-producing area, has heavily degraded soils.

To boost the local economy, the state has put in place incentives to promote solar power production. Abellon, a solar panel business in India's western state of Gujarat, has developed a land use approach that may help balance some of the policy challenges facing governments—it set up a "Solar-Agro-Electric-Model" on 30 acres to generate 5 mega watts (MW) of electricity. Abellon also deliberately decided not to interfere with the existing predominant land use.

Bhatkota Village, near Modasa, was chosen because it is situated in the foothills of the Aravalli mountain range in Sabarkantha district, a rocky and stony area with poor soil water retention and poor cereal production. On the first 17.5 acres set up to produce 3 MW, Abellon discovered that under the region's hot sun, the solar panels provide shade that keeps the soil sufficiently cool for shade-loving vegetables to grow. Water melons and the bottle, little, and finger gourds as well as ginger and turmeric spices can grow underneath the panels. The solar panels have to be washed every two days to avoid dust build up. These precious drops are used to water the vegetables and spices.

Involving rural communities, including through targeting women at the workplace, is having a socio-economic impact because landless farmers and rural women are among Abellon's employees who weed and harvest the crops. Local laborers are also hired to till, clear and fence the land, and for construction.

Abellon estimates that all the solar plants in place to date, with a total capacity 1,059.64 MW, cover 6,181 acres and can sequester about 1,600,000 tons of carbon every year. If a similar approach was applied in this area, they would generate 10,000 tons of agricultural produce and employ 2,000 farmers and villagers.

In 2010, India also launched the Jawaharlal Nehru National Solar Mission to generate 20,000 MW of solar power by 2022.

Web site:
<http://www.abelloncleanenergy.com>







Profitable Land Investments with Wildlife Works

Is land restoration a viable business investment? The experience of Wildlife Works, a private, for-profit company registered in the United States, speaks for itself. For over a decade, the company has worked with local communities around Rukinga Ranch, in Taita Taveta County, southeast Kenya. The area is located between the Tsavo East and Tsavo West national parks, which are Kenya's large natural wildlife sanctuaries. A majority of the local people directly depend on natural resources for livelihoods, including those located within the project area. As a consequence, the local communities extensive harvesting of these natural resources had significant negative impacts on the environment.

Deforestation and slash-and-burn agriculture were rampant. Illegal activities such as bush charcoal production and bushmeat hunting were widespread and uncontrolled. The results were land degradation due to severe soil erosion, infrequent rainfall, and longer droughts. Initial analyses showed that the land would be completely deforested within 30 years.

In 2010, Wildlife Works successfully implemented a project under the REDD+ Project, which is a mechanism for financing large-scale forest conservation in the tropics. The consequent Kasigau Corridor REDD+ Project abides by two of the most stringent and highly regarded environmental standards, and was the first project in the world to be validated and verified under both the Verified Carbon Standard (VCS) and the Climate, Community, and Biodiversity Alliance (CCBA). Through these, the project is now able to raise funds through the sale of Verified Emissions Reductions (VERs).

The VERs are calculated by determining how much of the carbon stored in a native forest would have been converted to greenhouse gases if the forest was destroyed. If Wildlife Works and the community can prove every year that they are protecting the forest, the project earns VERs, also known as carbon credits, for preventing the release of the forest carbon into the atmosphere. With the funds, the organization created the Wildlife Works Carbon Trust (WWCT), which finances projects that deliver tangible cobenefits to the surrounding communities. In addition, Wildlife Works has implemented a number of initiatives that directly address the main drivers of deforestation. Community projects include the provision of bursaries for education and local development, including constructing classrooms, providing school furniture, building water tanks, and renovating chiefs' offices. In 2012, the WWCT's bursary program sponsored 1,607 students for secondary school, university, and college education.

Today, more than 300 people are employed in various ventures of Wildlife Works, with the direct benefits flowing to about 1,800 people. In total, about 120,000 people benefit from the project's activities and the WWCT. Sustainability is a core of its business model, and a large number of members are involved in facilitating knowledge transfer and empowering local actors. On the whole, Wildlife Works has alleviated pressure on 500,000 acres of land and helped secured a contiguous wildlife migration corridor between the Tsavo East and West national parks.

Web site: <http://www.wildlifeworks.com>



Biological Diversity





Biodiversity and Preventing Land Degradation

BY CBD

Braulio Ferreira de Souza Dias, Convention on Biological Diversity

While all life requires water, almost half of the world's terrain, which is home to almost one-third of the world's people, comprises areas where water scarcity is the norm. The arid, semiarid and subhumid lands, including deserts, grasslands, savannahs and Mediterranean ecosystems, cover about 41 percent of the world's land and are home to around 2 billion people, or 30 percent of the global population, and provide approximately 44 percent of the world's cultivated systems.

These carefully balanced ecosystems are at the heart of the challenges we all face in the 21st century. Conserving them, protecting their biodiversity, preventing land degradation, and mitigating effects of drought will all be important if we are to feed a growing population, adapt to climate change, guarantee water security, and ensure secure livelihoods for billions of the world's poorest people. The solutions to conserving these lands and preventing their degradation lie in biodiversity—the variety of life and the patterns and relationships it forms.

Because of the harsh conditions in dry and subhumid lands, many species have developed unique adaptations. The gemsbok (large antelope) of the Kalahari Desert, for example, can survive for weeks without drinking water, while the sociable weaver of southern Africa builds communal nests that can weigh up to 1,000 kg to ensure insulation from extreme temperatures.

However, through a combination of human and climatic factors, pressure is increasing on dry and subhumid ecosystems and the benefits they provide, such as food, forage, fuel, building materials, and water for humans and livestock. Droughts, especially when associated with desertification, can have serious impacts on biodiversity, putting further stress on ecosystem resilience.

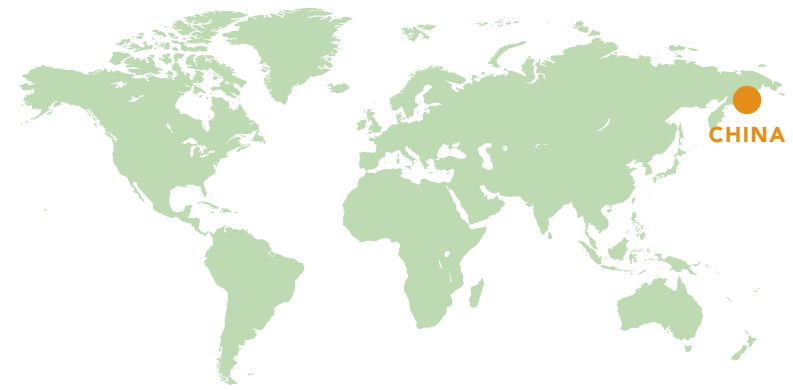
But there is inspiring work being carried out to conserve the biodiversity that underpins these provisioning services. This work includes past winners and semifinalists of the United Nations Convention to Combat Desertification Land for Life Award.

For instance, sixty years ago, in the arid lands of Inner Mongolia in China, one-third of the land was desert, forest cover was only 5 percent, and droughts were frequent. Through scientific policy planning and mass mobilization, the government of Chifeng rehabilitated 750,000 hectares of degraded land. Each hectare of shelterbelt forest prevents, on average, 10 tons of soil loss each year. In 2012, the forest cover of Inner Mongolia had risen to 20 percent. Government and residents worked together, signing “responsibility contracts,” making the job of combating desertification a priority across all levels of government and ensured its integration into local development planning.

Examples such as this one are greatly encouraging and show how joint efforts can make a difference. The Conference of the Parties to the Convention on Biological Diversity adopted the Strategic Plan for Biodiversity 2011–20. The Plan's Aichi Biodiversity Target 15 aims that by 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks have been enhanced through conservation and restoration,

including restoration of at least 15 percent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and the fight against desertification. The actions undertaken to achieve this target will help ensure that dry and subhumid ecosystems continue to provide their crucial services to people, and the examples here can help inspire such action.





The Hummingbird in China's Gobi Desert

When asked how she ended up winning the Nobel Peace Prize, the late Professor Wangari Maathai would recount the story of the little hummingbird she was emulating. When its forest caught fire, that small bird decided not to watch its forest burn with the rest of the animals, but to stay and do what it could do to put out the forest fire with water collected in its beak. "I am doing the best I can," she would declare.

The role of Tie Shunliang, Director of the Forestry and Environmental Protection Bureau of the Qinghai Province, doesn't seem much different. He is in charge of a large region that stretches from the highlands of the Tibetan Plateau to the Gobi Desert, where combating desertification through afforestation is a gigantic task. But through his dedication and leadership, 25,000 hectares of degraded land have been restored, reducing the area affected by desertification at a rate of 2.7 percent per year.

Limited funding and technical staff as well as lack of resources to conduct surveys and outreach in the Gobi desert are daily challenges. But Shunliang's methods of increasing vegetation on degraded land have been widely adopted in dryland areas. He uses poplar planting, farming caragana shrubs, and a special trimming technique for wolfberry. By combining these techniques with water-saving irrigation technologies, the survival rate of plants increases and planting costs fall.

Shunliang is especially well known for the Grain for Green Program, under which 2,000 hectares of land were afforested. He led residents in building

several green walls to shield the land from sand and wind. Part of the success is his starting point, which is always to increase benefits for people at the grassroots level, and his advanced thinking and research on people-centered sustainable land management.

Shunliang also pioneered wolfberry cultivation for medicinal use as a sustainable business to provide environmental benefits. The venture has increased the income of 30,000 people, particularly poor herdsmen and women.







Life Replaces Once Dry Scrub in Jordan

After overgrazing had reduced rangelands near Tell Ar-Rumman, Jordan, to bare land, in 2007, the new Royal Botanic Garden (RBG) fenced off an area to allow its recovery. The action incensed the local herders, who believed they had a right to graze their sheep and goats in the area. Resisting all efforts to fence off the area, they often cut open the fence and sneaked their herds in very early in the morning or late at night. In response, the RBG set up a dedicated Community-Based Rangeland Rehabilitation (CBRR) Program to find solutions of mutual benefit. The CBRR team held meetings with members of the herding community to foster cooperation and find agreement on a sustainable land management approach.

Local herders were offered forage in exchange for not grazing on the site, making it possible for RBG to conduct vegetation surveys and biomass estimates and determine sustainable stocking rates and grazing scenarios. In addition, the CBRR Program provided the herding community with training on better health management, hygiene and herd management techniques, and facilitated access to veterinary care.

After training, the CBRR team allowed the herders to resume grazing on the site at certain times and under specific conditions. This managed-grazing arrangement has yielded positive results for both the land and the livestock owners, and can be replicated in small degraded rangeland areas in other parts of the country.

Although only five local herding families cooperated fully with the CBRR Program in the first year, by 2012, some 38 families were participating. The

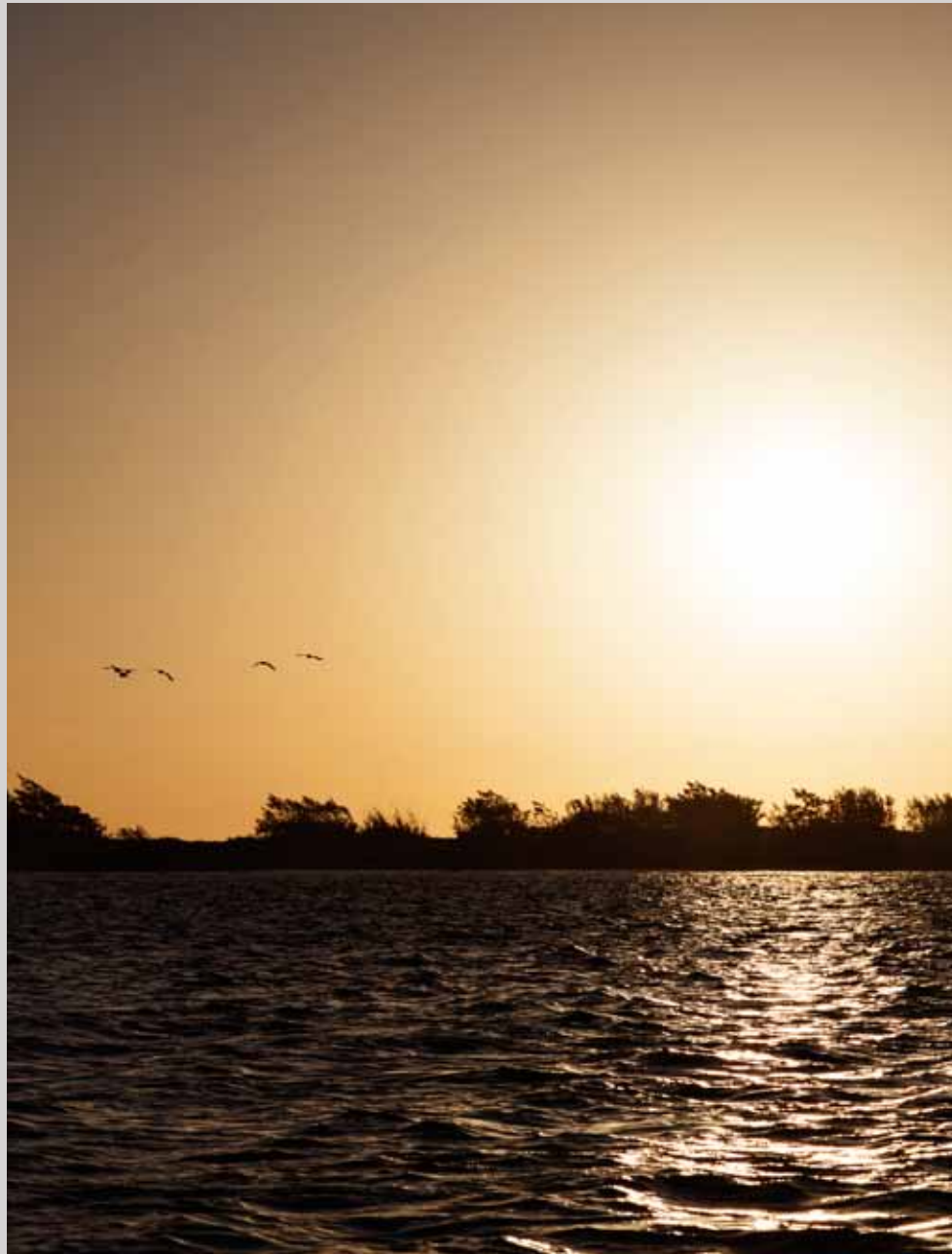
benefits quickly became evident to the early joiners and, by 2009, livestock owners who once grazed the site to bare soil were policing themselves and teaching others.

Focusing on animal health also resulted in increased incomes. For instance, one herder's income rose from US\$8,200 in 2007 to over US\$20,000 annually. Another herder with a smaller flock began with a net loss of US\$496 a year, but now earns over US\$6,300 per year. Today, over 400 people benefit directly from the CBRR Program, and a total of around 1,500 individuals have benefitted indirectly. Approximately 200 hectares of land have been rehabilitated.

Biomass increased by 30 percent from 2008 to 2009, by another 30 percent from 2009 to 2010, and 10 percent per year in subsequent years. Some plant species that disappeared from the region years ago have now spontaneously reappeared. The plant species recorded during RBG plant surveys increased from 436 in 2006 to 580 in 2011.

Given the interest shown by associations, NGOs and government agencies, the CBRR Program is planning to share and transfer its expertise to other herding communities, such as the Bedouin communities in the 500 hectare Badia area. With a little financial help, the local communities' vision can be realized.

Web site: <http://www.royalbotanicgarden.org>





World Bank Experience in Community Conservancy as a Social Development Movement in Namibia

Over 40 percent of Namibia's land area is under a conservation regime, the most interesting of which is the communal conservancy, an institutional arrangement that gives local communities property rights over commercial utilization of wildlife and other resources. The 71 community conservancies now support 25 percent of the rural population and greatly contribute to the growing wildlife populations in Namibia, which include the largest population of free-roaming black rhinos, the only growing population of free-roaming lions, and others.

These conservancies have also enabled communities to more easily form joint ventures with commercial enterprises (primarily for tourism, but also enterprises that make commercial use of indigenous plants), which have generated income and other economic benefits for remote rural communities. Their formation has become a social development movement as well as an accepted and holistic approach to conservation.

With the U.S. Agency for International Development's LIFE Program, the World Bank and the GEF have provided support to conservancies for participatory land use planning, development, and extension of community wildlife management and monitoring. Through the program, communities are provided incentives to manage and use resources in sustainable and productive ways to reduce deforestation, land degradation, and biodiversity loss. This support has facilitated the strategic introduction of wildlife in conservancies with low game densities and diversified income-generation opportunities to increase nonfinancial benefits and new income to households.

The project supported community-based integrated ecosystem management practices in 16 conservancies, covering a total area of 38,595

km.² The project's overall impacts are numerous, particularly in terms of the participatory management of the conservancies, the conservation and sustainable utilization of biodiversity, and the improved livelihood of local communities.

In addition, the project put a legal framework in place and built human capacity by incorporating integrated ecosystem management into the national program. It also created enabling conditions to link economic incentives with environmental management and wildlife conservation through strengthened ownership at the local level.

Between 2005 and 2009, the total revenues for all the conservancies—including cash (salaries, jobs from the tourism sector, and various payments) and proceeds from other sources (such as meat sold and consumed and plants utilized and sold)—increased substantially from US\$1.4 million to US\$3.5 million (NACSO 2010). Also, the increase in the number of registered conservancies established since the start (from a baseline of 42 in 2005 to 59 in 2010) indicates that the community-based natural resource management initiative has grown in popularity over the years at both the national and international levels.

The program in Namibia has already demonstrated the effectiveness of devolving management authority over wildlife to landholders as a conservation mechanism. Still, to enhance conservation efforts, more effort is needed to improve community coordination and management of conflicts between people and wildlife.

Web site: www.worldbank.org



Payment for Ecosystem Services Preserves a Valuable Biodiversity Zone in Portugal

Nature acts as one. And a design for holistic approaches to manage the environment sustainably, while widely recognized, has been difficult to create due to the varied and complex nature of managing the interests in land use. The Baixo Alentejo region in southern Portugal is a showcase that confirms this delicate balance is possible and profitable for all.

According to Portugal, 60 percent of its territory is susceptible to desertification and drought. The Baixo Alentejo region to the south is one of the most vulnerable areas in the country. Soil erosion and low fertility are common, and extreme climatic events are becoming more frequent in the form of floods, droughts, and heat waves.



Castro Verde, a rural semiarid and subhumid zone in Baixo Alentejo, has shallow and stony soils. Up to 80 percent of Castro Verde's soils are less than 20 centimeters deep, of which more than 40 percent are stones and gravel. There is a high risk of soil erosion and the soil's water-retention capacity is less than 40 millimeters. But these constraints mask the area's high biodiversity value. In 1995, Birdlife International listed it as an Important Bird Area (IBA). In 1999, the European Commission recognized it as a Special Protection Area for Birds (SPA) in the Natura 2000 Network. The Castro Verde SPA is about 85,000 hectares. It is the most important and representative area for the conservation of steppe birds in Portugal, and one of the most important in Europe, because of its diversity and abundance of endangered species. These endangered species include the great bustard, the little bustard, the lesser kestrel, the black-bellied sangrouse, the Montagu's harrier, and the Calandra lark.

Although the local economy depends heavily on farming, mining and services, it does not threaten the survival of these unique birds, because farmers have found a way to integrate the traditional farming practices in their lifestyle. Fallowing is combined with the rotation of cereal farming and livestock rearing. The result is an extensive traditional farming system with a landscape that resembles the steppe habitat, but in reality, it is a cereal steppe—a pseudosteppe. This ecosystem is a habitat for this unique bird community.

In 1990, it became obvious to the League for the Protection of Nature (LPN) that this land use was threatened because of the growing interest in intensive forestry of the water-draining non-native Eucalyptus tree. The likelihood of wiping out the already threatened bird species became high.

In 1992, LPN, in partnership with the Castro Verde Municipality and the Campo Branco Farmers Association, began looking for a solution that would also maintain the Mediterranean agroecosystem as part of the local heritage. With the farmers and local authorities, they agreed on a farming regulation to protect steppe birds. Known as the Castro Verde Zone Plan, the agri-environmental scheme, which is part of Europe's Common Agricultural Policy, aims to preserve the ecosystem, protect the exceptional birdlife associated with it, and maintain the traditional farming system.

Through the Castro Verde Zone Plan, farmers are compensated for the loss of income and added costs of applying measures to protect the birds' habitat. Farmers apply voluntarily for a minimum period of five

years. The measure is strongly supported by local farmers and over the last 15 years has been key to the preservation of agriculture, birds, landscape, and traditional livelihoods.

LPN is guided by the principle that man is an integral part of nature and the two work best when in partnership.

Web site: www.lpn.pt







World Bank/GEF Project Protects Mountain Gorillas in Uganda

Africa's tourism potential will continue to grow by attracting new markets and developing new products. Safari tourism, nature tourism, and cultural tourism are all booming and generating employment and significant revenues. The World Bank has many successful stories engaging with the tourism sector in Uganda, South Africa, Mozambique, Zambia, Namibia, and Botswana. In most of these projects, evidence shows that by improving protected area management, economic benefits can result from nature-based tourism activities that take place in the better-managed parks.

Since the mid-1990s, wildlife conservation projects in the mountainous regions of Uganda have played a pivotal role in protecting the mountain (eastern) gorilla and its habitat, and in the process have created thousands of new conservation and tourism jobs. Prior to that time, poaching was rampant and institutional capacity was weak. Beginning in 1995, with the Bwindi Impenetrable National Park and Mgahinga National Park Conservation Project, and continuing in 1999 with the US\$35 million Protected Areas Management and Sustainable Use (PAMSU) Project, the World Bank and the GEF provided the financial foundation for a long-term program of sustainable biodiversity conservation.

The Bwindi Trust is now considered a model of innovative conservation finance and management. Its original endowment of US\$4 million has generated income that assisted communities with alternative livelihoods and has underwritten core operating expenses of the mountain gorilla's

protected areas. Thanks in large part to the Bwindi and PAMSU projects, poaching has been all but eliminated in Bwindi. Gorilla populations, tourist visits, and revenues have all climbed steadily.

Across Uganda, the 1,300-member staff of the Uganda Wildlife Authority (UWA) is well trained and equipped for the first time in living memory. PAMSU has delineated park boundaries in all 23 of Uganda's protected areas. It has also provided critical infrastructure, such as roads and staff housing, to the priority areas. PAMSU has been instrumental in helping communities form comanagement partnerships with UWA that promote conservation and provide alternative livelihoods and social services such as education and health clinics.

The PAMSU Project left a legacy of successful partnerships among World Bank, GEF, and Ugandan stakeholders. A new project in the Democratic Republic of Congo (DRC) has just begun to support management in the neighboring Mikeno sector of the Virunga National Park, an important habitat for mountain gorillas. Since some of the gorilla groups cross back and forth from the DRC to Uganda and Rwanda, protecting this charismatic species in each of the three countries has positive externalities for the other countries, driving economic growth in otherwise remote areas. The effective enforcement has led to the resurgence of the mountain gorilla in Uganda, Rwanda, and the DRC.

Web site: www.worldbank.org





Using Nature to Restore the Grasslands

From the savannahs of Africa and the pampas of Latin America to the steppes in North America and North Africa, drylands are famous for their vast grasslands. Alan Savory, a Zimbabwean biologist, rancher and farmer, has dedicated his life and more than half a century of his research to healing grasslands around the world. Over many years of trial and error to find the root causes of desertification, he developed and refined the method now known as “holistic management.”

Holistic management is based on a decision-making framework that results in ecologically regenerative, economically viable, and socially sound management of the world’s grasslands. From this knowledge, land managers and users can use large herds of domestic livestock to mimic wildlife and to restore balance to the land.

Holistic management has enhanced biological diversity and wildlife habitat and increased land productivity, livestock stocking rates, and the prosperity of pastoralists worldwide. More than 10,000 people have been trained in holistic land management and its associated land and grazing procedures, and an estimated 40 million acres are managed holistically worldwide.

Savory donated his ranch in Zimbabwe to create the Africa Center for Holistic Management as a learning site for community and emerging commercial farmers. He is cofounder of the Savory Institute in the United States, which is dedicated to promoting large-scale restoration of the

world’s grasslands through its global Impact Hub Strategy, with learning centers being established on all continents to disseminate this knowledge and speed up the natural regeneration of grassland landscapes.

Web site: www.savoryinstitute.com





Water





Land for Life, Water for Life: Managing the Extremes

BY WORLD METEOROLOGICAL ORGANIZATION

Water and land are closely intertwined. When a rain drop falls, the land surface determines which way it will initially flow and, to some extent, the variety of uses it will be put to. Water can evaporate directly from the surface, infiltrate the ground, or flow into rivers, dams, or other areas. It can be used by plants and animals to give life, consumed by humans, or used for a variety of purposes before being channeled back into the system. Water can be stored naturally, but it can take many years to reenter the surface land system.

But this story about water begins with the eastern tropical Pacific Ocean, where intense solar heating produces high evaporation, which turns into moisture. This moisture then moves into the lower levels of the atmosphere and plays a key role in defining the weather and distribution of water over land surfaces. This low-level atmospheric moisture is carried westward by the trade winds across the Earth and thus shapes the spread and location of the drylands around the globe. The results from this global picture are further influenced by how the moisture flow interacts with, among other factors, the different oceans.

Now let's go to South America, where this story continues to unfold. The coastal region is virtually a dryland for a reason. Along the coast, a breeze also forms and flows from the ocean over the land, but barely brings enough moisture with it to form a cloud canopy that can supply rain water

to the nearby areas. The outcome is land with an arid or semiarid climate, where plants can cope with a short rainy season and dry conditions that last two-thirds of the year.

Then around Christmas, the trade winds vanish and the previously cold waters in the ocean warm up. An ocean breeze full of moisture flows and rises over the land, but the hills block its flow, and the moisture turns into clouds and falls as rain. A rainy season with dark clouds arrives to deliver hour after hour of rain on the land. Plants, animals, and humans are prepared for their most productive period of the year and a burst of activities takes place in the rural areas. Vegetation grows, insect populations explode, and landscape changes in a matter of days. The land changes color as the soil moisture is replenished by constant rainfall, and the water reservoirs, which were dry, dusty surfaces, are refilled.

But the climate, like humans, is not a static artifact; it is dynamic. The next year, a phenomenon termed *la Niña* may appear. It happens when the ocean waters are cooler than at the start of the rainy season and the trade wind system fails to weaken enough. The moisture that should form over the South American coast travels and falls way out, causing flooding in the western Pacific islands. There is still rain for the plants, animals and farmers, but only toward the end of the season. The land may be green, but there

is a noticeable difference in plant development—they do not develop as usual because of drought.

The other extreme occurs when most of the year those warm conditions prevail and the supply of moisture in the atmosphere is greatly increased. This is the *el Niño*—not the global *el Niño*—that brings rainfall amounts three or four times more than in a normal year, with massive negative effects including landslides, known locally as *deslaves*, erosion, and destruction of infrastructure.

This rainfall cycle in South America has been in place for centuries and occurs in different forms in other regions. It dates further back than the

famous Inca period, and while the farmers are familiar with it, passing on knowledge from one generation to the next, inhabitants of the region now also have mobile phones and the Internet to turn to. Climate experts and government authorities are using these technologies to announce rainy seasons, so that the arrival of *el Niño* finds people who are prepared for a longer than normal rainy season.

People sometimes relate drought to dry or desert lands, but climate data show that from year to year, there are big changes in the total amount of rainfall and its distribution. Even lands rich in water can suffer drought when water is not available in the required quantity and at the right time to maintain the systems that depend on it.

Water quality is influenced by all of these uses, including the interactions with the land and vegetation, and so forth. It can be abundant and revitalize the floodplains, but it can cause damage to the land and crops. Clearly, to manage water efficiently, the health of the land must remain on our radar screens as part of a sound drought and flood management plan.

The stories featured here underline the importance of healthy land to meet present and future water demand in a climate where extremes are present. These stories also show that simple technologies can make the difference between drought and water scarcity and access to and the availability of freshwater resources for present and future generations.





Restoring Dry and Salinized Seabeds in the Aral Sea

The shrinking Aral Sea has exposed 60,000 km² of seabed, which is now a giant salt desert. The dust and salt that blow from it across the countryside are causing health problems for people living nearby. Dr. Liliya Dimeyeva has dedicated her career to creating green seabeds in the desiccated land, and has discovered an effective afforestation procedure of planting saplings in the severely degraded land.

The road was bumpy; the saplings Dimeyeva planted the first year were destroyed by frost. The following spring the saplings took root, and survival rates varied from 33 to 72 percent. This is no small feat on heavy and highly saline ground. The results of her methods are promising, but it is impossible to cover the entire dried up seabed with green plantations. Other strategies must be used, like planting protective forests to form windbreaks or creating “green spots,” which are a small ecological oasis of up to 5 hectares that would speed up the natural plant colonization of the dry seabed.

But Dimeyeva now has new challenges to resolve: how to preserve the saplings that survived, identifying the factors that have the greatest impact on their survival in the tough seabed conditions, and the further development of the ecosystem. Her studies are the first of their kind. She has long collaborated with Japanese scientists; they have conducted joint expeditions and created documentary films, and she has presented her work at scientific conferences and universities in Japan.



Land degradation through salinization, following prolonged irrigation of land for food production, is a widespread and well-known problem. But land salinization due to the shrinking of a sea is not common, and her work has brought public attention to new challenges in combating desertification.





A Green Wall to Catch Fresh Water in Indonesia

The Gedepahala landscape in the West Java Province of Indonesia includes a network of mountainous water catchments that provide water to more than 30 million people in the Greater Jakarta metropolitan area. But water springs in the region have disappeared, as forest cover in the upper streams was lost to the conversion of land to smallholder agriculture and an increase in human activity.

Since 2008, Conservation International (CI) has led a collaborative, community-based sustainable land management initiative to create a “green wall” of native trees to restore the landscape. More than 100,000 trees have been planted on more than 200 hectares, with the active collaboration of 644 local community members and 20 park rangers. There are new efforts to restore another 100 hectares as a corridor between the natural forest site and the initial restoration block. This would restore a 300 hectare buffer zone in the degraded area and connect the natural forest to the existing forest block.

In addition to using participatory approaches to involve the communities, there are incentives to strengthen the project’s long-term survival, particularly because the land users are often tenants, not the owners. Participants who practice agroforestry—planting and tending the trees on their farms—get assistance in growing food crops. They are also given training on sustainable land cultivation, soil retention and regeneration, and are encouraged to add other income-generating activities like fisheries and livestock rearing.

The CI initiative also emphasizes the value of the forests. There are new schemes to provide clean water to the villages. And for the first time last year, one village started using electricity generated from a local stream using a pico-hydropower system.

The Green Wall Project to Improve Ecosystem Services and Protect Future Generations on the Gedepahala Landscape still has two unmet goals: first, to create a conservation education program that will allow it to reach the villagers through the school system, and second, to purchase a four-wheel vehicle to reach areas with some of the most difficult terrain.

Web site: www.conservation.org/global/indonesia





Building Riverbeds from Sand Dams

Globally, 500 million smallholder farmers provide up to 80 percent of food consumed in most of the developing world. Most of these farmers rely on rain-fed agriculture. In the drylands, climate change is causing more droughts and floods as well as shorter, more unpredictable rainfall. It is reducing the ability of these farmers to grow food. Eighty-four



percent of Kenya is drylands, and the rainfall is increasingly unpredictable, variable, and infrequent. And when it rains, up to 85 percent of the water may be lost as runoff, washing away fertile topsoil and seeds and undercutting food production.

Makueni County in Kenya is typical. An estimated 57 percent of the households lack access to an improved water source. On average, women and children spend four and a half hours a day collecting water. In times of drought, it takes up to 12 hours, which leaves little time to invest in sustainable land management and food production. It is not surprising that Makueni County has a Human Development Index of 0.558 and that 31.1 percent of its children are underweight. But a study conducted in Kenya in 1999 showed that where sand dams were built, households suffering from malnutrition declined from 32 to 0 percent, and incomes significantly increased.

Guided by the principle that poverty alleviation in drylands can only be achieved through sustained investment in soil and water conservation, Excellent Development began working with self-help groups in Makueni in 2002, with the sand dam as the technology of choice. A sand dam is a reinforced concrete wall that is built across a seasonal sandy river. During the rainy season, the river carries silt and sand downstream. The heavy sand accumulates behind the dam, while the light silt washes over the dam. Within one to four rainy seasons, the dam fills with sand. But, up to 40 percent of the volume behind the dam is water, trapped between sand

particles and protected from evaporation. A mature sand dam stores up to 20 million liters of water. The dam is replenished with each rainfall, but even without regular rain, it can supply over 1,000 people with a year-round local water source.

Sand dams differ from other dams. Their spillway is in the middle, not on the side of the dam. This allows the river to continue flowing normally, which reduces soil erosion. In fact, a sand dam is not really a dam—rather, it is the creation of a new and higher riverbed that acts like a sponge to soak and store the water and protects it from evaporation and contamination. The aquifer is replenished from the water stored behind the dam, and the river flow is slowed down, which reduces flooding in the lower catchment. Sand dams are invaluable in areas with seasonal rivers and sandy sediments.

Altogether, 111 self-help groups have constructed 366 dams with help from Excellent Development and its strategic partner, Africa Sand Dam

Foundation (ASDF). Sand dams supply water for domestic and agricultural use. Livestock can drink from beneath the dam—often from a specially built trough. The banks of the sand dams also sustain the vegetation, tree planting, and other greening activities around the dams. Best of all, water collection now only takes 30 minutes, saving people between 4 and 11.5 hours a day. Time saved from collecting water creates the opportunity for people to invest in sustainable land use techniques like terracing, tree planting, and reclaiming gullies. This improves soil and water conservation, restoring degraded land and enabling improved food production.

Excellent Development and ASDF provide support for people to achieve food security through climate-smart agriculture. This support involves establishing seed banks with improved drought-resistant seeds, diversifying crops, zero grazing of livestock, composting, using manure and planting cover crops, inter-cropping, setting up vegetable nurseries, and planting trees on farms. Between them, the self-help groups, Excellent Development, and ASDF have built over 1,400 kilometers of terraces and planted 860,487 trees on farms. The impact on the community is visible. A 2013 Normalized Difference Vegetation Index study of Makueni County shows that there is significantly greater vegetation during drought, drought resilience, and recovery from droughts where sand dams have been built.

Excellent Development and Africa Sand Dam Foundation (ASDF) have supported pilot programs of the technology in another six countries. But with only limited funds, scaling up the activities remains a challenge.





Mexico's Water Solution from Integrated Landscape Management

The Amanalco-Valle Bravo Basin located near Mexico City is one of Mexico's highly valued natural resources. Some describe it as a promising area for creating markets for environmental services, and

for good reason. The valley's rich natural resource base includes over 35,000 hectares of temperate forest, nearly 18,000 hectares of agricultural land, 5,300 hectares of pastureland, and 1,770 hectares of surface bodies of water.



Today, the Amanalco-Valle Bravo Basin feeds the Valle de Bravo dam that supplies water to 8 million people, including 40 percent of the drinking water of the Cutzamala System, which accounts for 20 percent of the water that is consumed in Mexico City and other cities and towns in the State of Mexico. The basin's natural resources support the livelihoods of 53 highly marginalized rural communities. But it was not always this way. Population pressure and unplanned development led to the basin's environmental degradation over at least 15 years.

Then, in 2007, the Mexican Civil Council for Sustainable Forestry (CCMSS)—a nongovernmental not-for-profit organization that was created in 1996 to address community forest use, forest conservation, forest industrialization, and forest commercialization—started working in the basin under the Integrated Landscape Management Project. Guided by a few core principles, CCMSS's strategy became strengthening governance capacities and sustainable land use management to improve the living conditions of the local population.

CCMSS focuses on three major activities: strengthening local governance and building social capital; applying sustainable land management

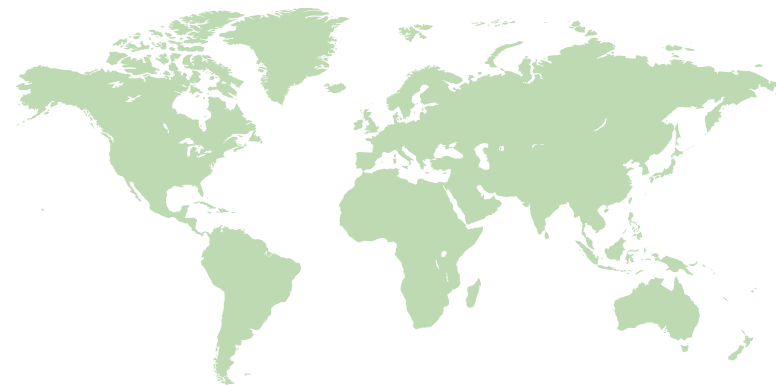
through the hands of rural communities; and setting up mechanisms of payment for environmental services (PES) and Reduced Carbon Emissions from Deforestation and Forest Degradation (REDD+). Governance and social capital are built through a communal approach. In Mexico, *ejidos* and communities collectively own 60 percent of the land, so CCMSS is working with a dozen communities and *ejidos* to implement land use plans and improve their natural resource management strategies. Some 1,500 smallholder farmer families practice sustainable agriculture and forestry management on over 15,200 hectares of communal areas and *ejidos*. The benefits are apparent down to the household level. The communities have worked on restoration of over 2,800 hectares of forest and have planted 22 new hectares of native tree forests.

CCMSS also works closely with 122 peasant families that have converted their 200 hectares of agricultural land to sustainable agriculture, while eliminating agrochemicals and developing activities to regenerate and protect soils and improve hydrological services.

At least 10 percent of the families now produce 3–5 tons of compost per hectare per year to improve soil fertility. There is evidence of increased food security among the farming families and crop diversity has increased from just one—corn—to seven crops, including fruit trees. Further, women make up 40 percent of the participants and agricultural productivity for the participating families increased by 20 to 50 percent.

CCMSS promotes community forest management as a means to achieve forest conservation and stimulate development for people living in the forests. It is also expected to help rural communities apply forest management schemes on par with international standards of best forest management practices. CCMSS participates in research and public policy analyses that promote favorable governmental actions for community management and forest use and that aim to improve the living conditions of hundreds of rural communities. CCMSS also focuses on encouraging forest research and knowledge sharing about the principle problems and important trends in forest management. The Integrated Landscape Management Project could achieve more, much more, if scaled up.





World Bank Support Unleashes Prosperity from Senegal River Resources

In Senegal, near the village of Sadel and five hours of rough road northeast of Dakar, the markets are anything but deserted. Thanks to improved irrigation, communities along the river are now able to sell watermelons, squash, tomatoes, and even rice. Now, the riparian population can enjoy the waters flush with fish and earn their livelihoods almost entirely from river resources.



The Senegal River Basin has huge potential and can transform the lives of 35 million people. Currently, less than 30 percent of the basin's hydropower potential of 1,200 MW is utilized. Less than 40 percent of the 375,000 hectares of irrigable lands are developed. Of the nearly 140,000 hectares that are serviced, only 90,000 are really usable.

The World Bank-funded Senegal River Basin Multi-Purpose Water Resources Development (MWRD) Project brought some solutions as it addresses fisheries, irrigation, health, and water resources management in Guinea, Mali, Mauritania, and Senegal. As part of the World Bank's Regional Integration Program, the project goes beyond countries to bring cross-border solutions that make a long-term dent in poverty.

The approach used offers more opportunities to develop infrastructure with multiplier impacts for agriculture, water supply, energy, navigation, and health than a single operation. As proven by the results and the recent inclusion of Guinea to the Senegal River Basin Organization, when countries jointly manage shared water resources, there are significant benefits—benefits that emerge beyond the water sector in terms of poverty reduction, low carbon growth, regional trade, and stability.

For the 12 million residents of the Senegal River Basin, water is a vital part of their livelihoods. Not only are fish from the river a source of food, but the annual floods during the rainy season are crucial for replenishing the nutrients that sustain pasture land and irrigated crops. Without access to

water, grass for grazing becomes scarce, and only a few crops grow in the harsh climate.

With the MWRD project, more than 5,200 hectares of land have been rehabilitated for agricultural use through irrigation and water management, meaning that some residents can plant at least two seasons during the year. The increased cultivation opportunities have particularly impacted women, many of whom are household heads and rely on subsistence agriculture to support their families.

By some estimates, fish sales in the Senegal River are up nearly 13 percent since the start of the project and there are clear indications from residents in riverside villages that both the size and quantity of the catch have significantly improved. Thanks to the uptick in fishing, former migrants are back among the fish, fields, and family that—after making a difficult choice—they had previously left behind.

Perhaps the most compelling result has been in the improvement of local health, and subsequently improvements in child mortality and education. Prevention and control activities such as distributions of mosquito nets, which have

more than doubled the number of households using bed nets, regular medication, and antiparasitic treatments have reduced the prevalence of malaria and bilharzias, or snail fever.

Web site: www.worldbank.org







Food Security



Food Security and Land Degradation

BY UNCCD

Komila Nabiyeva, United Nations Convention to Combat Desertification

Food production has a profound impact on our environment. Globally, agriculture consumes 70 percent of all freshwater for irrigation. It drives 80 percent of deforestation and is the source of 30 percent of all greenhouse gas emissions. Yet, food production is unavoidable because food is a basic need for all of us. To make things worse, unsustainable land and water management exacerbate land degradation and biodiversity loss.

The Food and Agriculture Organization (FAO) of the United Nations projects that by 2030, the growing global population will increase the demand for food by 50 percent. To meet this demand, an additional 120 million hectares of new, productive land will be needed. This is a new farm the size of South Africa. At the same time, the amount of productive land available for food production globally is falling, largely due to urban development and other human activities that degrade an already limited natural resource. Humanity will never meet the global food demand unless the current trend of land degradation is curbed.

Globally, 43 percent of rangelands and 20 percent of croplands are already degraded, according to FAO. And the annual loss of 12 million hectares of productive land to desertification and drought is an opportunity lost to produce 20 million tons of grain. Human action and chemical processes are the main causes of land degradation in all ecosystems, with overgrazing,

inappropriate farming practices, and agropastoral land uses as the lead drivers. Missing or misguided policies often make the situation worse. Scientists estimate that soil erosion alone is costing the international community up to US\$490 billion per year.



For a long time, it was assumed that because food production was a necessary evil, the associated environmental degradation should be tolerated. But researchers are now finding that food production need not be synonymous with environmental degradation. The case studies presented here back that evidence and expose other myths associated with food production and the drylands. Innovations from the Biovision Foundation show that fertilizer-free and herbicide-free food production systems are possible without compromising production levels. Mechanical technologies, like those invented by the late Italian scientist Venanzio Vallerani, that are built on traditional knowledge and systems can transform the land situations in most drylands. And with the use of “underground forests” and EcoAgriculture, Niger and Kenya can give new life to tired land and soil.

The moral obligation to feed the growing population and to eliminate chronic hunger and poverty is not in question. But the research advances to date mean that meeting this demand at the expense of the environment is irresponsible. What is lacking is the shift of policy makers from food production to sustainable food production, where new land degradation is

- Chronic hunger affects over 900 million people worldwide
- By 2030, the demand for food is expected to increase by 50 percent
- By 2030, we may need 120 million hectares of new land to meet food demand
- 12 million hectares of land are lost due to land degradation every year
- Land degradation costs the global community at least US\$490 billion per year

avoided, sustainable land use is rewarded, and the restoration of degraded land becomes an investment.

The Green Revolution was the legacy of the 20th century. The aspiration of a land-degradation neutral world, which was articulated by all world leaders at the United Nations Conference on Sustainable Development (Rio+20), must be the legacy of the 21st century agriculture.





Environment-Friendly Farming by the Biovision Foundation

The Green Revolution came with the increased use of fertilizers and insecticides and doubled global wheat production. But it had a huge environmental price tag. The 700 percent increase in fertilizer use resulted in soil acidification, depletion of essential humus content, and eventual loss of its economic viability. The intensification produced further damage through the loss of soil fertility, unsustainable water usage, greenhouse gas emissions, and chemical runoff poisoning rivers.

The *International Assessment of Agricultural Knowledge, Science, and Technology for Development* (IAASTD), published in 2008, came to the conclusion that industrial style agriculture was not sustainable and would never be able to feed the over 9 billion people expected to inhabit our planet by 2050. The report, written over six years by over 400 scientists from all over the world, recommended localized smallholder structures for our agriculture and food systems.

The Cochair of the IAASTD was Hans R. Herren, World Food Prize Laureate 1995, and founder of Biovision Foundation. Guided by the principle that nature can be a powerful ally to science and technology in poverty alleviation, this Swiss-based NGO has been supporting ecological sustainable development in East Africa for 15 years to combat hunger, poverty, and disease. Its special focus is on information dissemination for smallholders. Through the magazine *The Organic Farmer*, radio shows, a special Internet platform called Infonet-Biovision.org, an SMS advisory service and practical courses on the ground, millions of smallholders have

improved their productivity with sustainable and affordable methods and are braced for the challenges of climate change.

A classic example of Biovision's approach is a method known as Push-Pull. It is an integrated, sustainable farming method that improves maize yields and soil fertility: the stemborer pest is repelled by the smell of desmodium planted as an intercrop between the maize (push). Napier grass is planted as a border crop and it attracts the stemborers away from the maize field (pull) and kills the stemborer's larvae with its sticky plant material. Desmodium can also fix nitrogen and so improves maize yields without the use of synthetic fertilizers and pesticides and protects the soil from drying out too fast. The napier grass is also a welcome source of healthy animal fodder. This method has increased yields among smallholders by 200 to 300 percent. It also protects the environment in a truly sustainable manner and is affordable for those who lack the capital to invest in fertilizers and pesticides.

While industrial agriculture is still viewed by many as the answer to improving yields, drought and pest infestations still cause crop failures. With climate change, the rainfall has become more irregular, so more resilient methods are required. The ability to control pests ecologically can transform the food sector significantly, given that plant pests alone are responsible for up to 80 percent of crop losses. In addition, the negative effect of pesticides on bees, and therefore the pollination process, is now globally recognized.

Biovision Foundation seeks to establish sustainable ecological food systems across the globe, starting with work on the ground with those directly involved in the production process, but also by advocating its

approach at the national and global levels to ensure that the political framework supports the changes.

Web site: www.biovision.ch





Underground Forests That Restore Soil Biodiversity

Visualize severely degraded land and images of bare denuded lands—no trees and no plants, conjure it up in your mind. But according to Tony Rinaudo, who pioneered farmer-managed natural regeneration (FMNR), these degraded woodlands and farmlands are often hiding vast “underground forests” just waiting to spring into life to restore the land. Look closely at these bare landscapes and you are likely to find small shrubs sprouting from tree stumps, or roots buried under the ground. But



these are usually missed or mistaken for weeds and are burned or cleared before planting crops.

In Rinaudo’s FMNR method, however, through culling and nurturing, these tiny shrubs grow into resilient multipurpose trees that eventually restore the land to full productivity. According to Rinaudo, the first step is to assess each of the germinating stumps, taking note of the types and numbers of each species. Next, the stumps to be used for regeneration are identified and tagged so that the community spares them. About five or so of the tallest and straightest stems of the selected stumps are identified and pruned, while the rest are culled. Crops are then cultivated around the stumps. The stems grow over time and provide a protective barrier to the environment and for crops. Pruning provides the community with sources of fodder, fuel, or building materials. However, whenever a stem is cut, the rule is to nurture a new young stem to replace it.

FMNR repairs the land by increasing woody vegetation and biodiversity as well as improving the soil structure and fertility through leaf litter and nutrient recycling. As trees grow, they curb erosion and serve as windbreaks that decrease soil moisture evaporation and protect crops and livestock from harsh climatic elements. Eventually, springs reappear and water tables are restored.

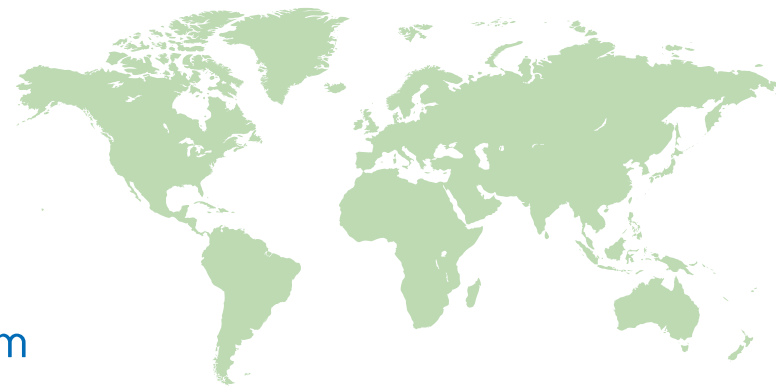
Rinaudo stumbled upon the idea in the early 1980s in Niger. He observed that these indigenous shrubs and stumps were “just waiting for some care

to grow.” With the cooperation of a few willing farmers back then, his theory proved right, and within 20 years, this form of land regeneration had spread to over 5 million hectares of land in Niger. The successful trial run on nearly 3,000 hectares in Ethiopia led the government to make a commitment to restore over 15 million hectares of degraded land using Rinaudo’s approach. The results are quick and dramatic, especially where they are combined with other sustainable land management techniques. In Ethiopia, for instance, the communities were picking fruits, animals were returning, and erosion and flooding were in decline within two years.

Moreover, the technique is effective not only for drylands, but in nondryland ecosystems as well. World Vision, where Rinaudo has been working for the past 14 years, has trained thousands of farmers in FMNR in 14 countries and diffused the technology successfully to countries like Indonesia, East Timor, and Myanmar. FMNR is a revolutionary land restoration technique with vast untapped potential for investment.

Web site: www.worldvision.com.au





World Bank Project Brings Food Security from Sustainable Land Management in Senegal

Land degradation is increasingly affecting land resources in Senegal: almost two-thirds of the arable land, about 2.5 million hectares, is degraded. Soil fertility depletion is one of the main causes of stagnating agricultural productivity and, consequently, one of the major constraints to agricultural and economic growth.

Senegal's territorial ecosystems and their products are an important part of its natural wealth and essential to the country's food security. But because

most of the rural population heavily depends on land resources for its livelihood, increasing land degradation reduces their livelihood options and income-generating opportunities, thus exacerbating their poverty and vulnerability.

In the small village of Wellou Bell, a World Bank-funded sustainable land management (SLM) project was critical in addressing land degradation and subsequently contributed to food security. By making water available in Wellou Bell through water retention, the project allowed pastoralists to stay longer in their villages, therefore increasing the amount of milk provided to the communities. This sedentary period also increased the manure and improved soil fertility. In addition, because Wellou Bell is a crossroad village, the pond is used by about 2,000 cattle and 15,000 sheep and goats in transhumance from all regions. As a result of these efforts, Wellou Bell has become a vibrant community, animated by the social and economic activities.

Many other villages and communities benefitted from this SLM project. The 20,066 hectares of land recovered using SLM practices contributed to food security, income generation and improved living conditions, including better health and education.

The improved soil fertility translated into an increase of production of the main staples: millet production rose from 550 to 850 kilograms per hectare by fighting the millet wild weed *Striga helmonthic*; rice production rose from 1,200 to 2,300 kilograms per hectare with the use of peanut shell; and



peanut production from 600 to 1,400 kilograms with the use of organic fertilizer. Furthermore, nurseries built for fruit and plant production and their associated gardening activities had significant positive impacts on resident's nutrition in the short run.

The SLM project brought a dynamic change at the grassroots level by empowering women to purchase or request land ownership as individuals or as a group. The introduction of certain technologies like fruit and tree planting, usually dedicated to women, made them even more involved in the production and reinforced the need to change the rules of land tenure.

The diffusion of technologies responding to women-specific needs, like improved charcoal-saving stoves and biogas from manure, reduced the time women spend collecting wood and gave them more time to devote to productive activities. The 6,600 improved charcoal-saving stoves distributed to women added to the success in the fight against deforestation by reducing the pressure on natural resources.

Web site: www.worldbank.org

Before the project, my agricultural production covered just about 3 months of my household consumption needs. With the organic amendment with the project, my yield increased by 50%. This allowed me to feed my family for 7 to 8 months.

—*Producer from Meouane*

I have abandoned my land for years because it was invaded by salt. With the anti-salt dam built by the project, I can now access my village even in rainy season and grow rice on my farm. From November to May 2012, I managed to produce enough rice to feed my family.

—*Fatou Faye, female head of household
and rice producer from Simal*

With the 30,000 plants produced by the project, we hope to turn our local landscape green in the near future. Before, I spent FCFA 300 (US\$0.6) per day to buy wood for cooking, with the improved charcoal-saving stoves, I only spent FCFA 100 (US\$0.2). Now my house is cleaner and the fire risks are reduced.

—*Ndeye Fatou Ndiaye, female leader,
president of CLCOP in Notto Diobass*

I migrated to the city of Thies as a cab driver but I came back to the village because of the project. With my agroforestry activities and the use of compost, I am earning more than in town.

—*Young man, Notto Diobass*







Children, Agents of Food Security in Uganda

The reality of the primary school system in Uganda is often disheartening. Drop-out rates, especially in rural areas, are up to 75 percent, and the curriculum tends to focus on theory, not practice. Children who drop out of school early often depend on subsistence agriculture, but don't understand the many negative environmental impacts that may result from their agricultural practices.

The Conservation Efforts for Community Development (CECOD) has a program that gets to the heart of these challenges. It takes children out of the classroom and into the real world, where they learn many different ways of managing land sustainably. CECOD has trained 7,500 teachers from 681 primary schools under Primary Teacher Colleges Catchment Area. The organization has 364 ongoing school-based microprojects that promote sustainable land management practices.

In St. Aloysius Primary School in Mbarara, for instance, 14-year-old Brendah Nyakato shows her school friends how to sort waste and produce organic manure for the school garden, where the children grow bananas. In another primary school in Mbarara, children are learning to build energy-saving stoves to avoid deforestation and protect soil from erosion. They are also encouraged to take practical action, like leading campaigns to stop littering and to improve the local environmental quality. The outcomes are impressive: the program has reached 103,600 primary school pupils, the

ecoschool children have planted almost 52,000 trees in their communities, and the training has benefited about 18,750 households. The organization has launched over 250 ecostudent parliaments and ecoparent associations that spearhead pupils' involvement in school planning and influence decision making in environment-related activities.

CECOD's achievements made them one of the two runners-up for the 2012 Land for Life Award, and it received US\$30,000 to support its activities. In granting this award, the panel concluded that this approach may have several other positive externalities in addition to promoting sustainable land management education like improved school attendance by children, if they perceive that there are tangible additional benefits of going to school because of sustainable land management learning.

With the cash award, CECOD immediately launched its own Green Flag Award. This is a competition that recognizes schools and communities that are leaders in collaborative, sustainable natural resource management. In 2013, the Green Flag Award was shared by 88 primary schools, and the scheme is targeting 200 schools in 2014. With appropriate support and guidance, children need not wait to be leaders of tomorrow. They can start investing in their future today.

Web site: <http://cecodug.org>





EcoAgriculture: An Innovation That Restores Landscapes

The new land rush, popularly known as the “land grab,” the recent food crises, and the recurrent resource-based conflicts simmering in many regions all signal that productive land is in short supply. Not surprisingly, the advocates for food security and biodiversity conservation are vying to advance their agendas in the same critical regions of the world.

EcoAgriculture Partners is built on the idea that meeting societal needs will require pursuing strategies that address these competing demands simultaneously. Its strategies are designed to manage landscapes so that they can produce food, conserve ecosystem services and biodiversity, and improve the well-being of residents. The desire of EcoAgriculture Partners is to create a world where agricultural communities manage their landscapes so that they can simultaneously enhance rural livelihoods, conserve biodiversity and ecosystem services, and produce crops, livestock, fish, and fiber sustainably.

EcoAgriculture launched the Landscapes for People, Food, and Nature Initiative to break down the silo or tunnel vision that was blocking collaboration among the many different organizations and stakeholders working on these issues. The approach begins with seeking to understand the system itself—the first step is to map the movement of water, nutrients and wild species through landscapes, observing how they interact with crops and livestock production. In the process, EcoAgriculture identifies opportunities to modify farming practices or other land uses to minimize the trade-offs and take full advantage of the synergies between agriculture and biodiversity conservation. Scaling this work is critical; over 2 billion

hectares of land could potentially be restored and there are growing calls, on the global level, to adopt a landscape approach to their restoration.

EcoAgriculture has developed the tools to assess, plan, negotiate and design the interventions, and to track the changes that result. Experience has also taught EcoAgriculture that having strong leadership is the single greatest factor for success in scaling up integrated landscape management. They build this human capacity by training, supporting, and networking leaders at the grassroots level.

EcoAgriculture has given advisory and technical support to dozens of landscape initiatives in countries such as Costa Rica, Ethiopia, India, Kenya, Nepal, Rwanda, Tanzania, Uganda, and the United States. EcoAgriculture Partners and the Landscapes for People, Food, and Nature Initiative have tremendous potential for replication on a wide scale across Sub-Saharan Africa, Asia, and Latin America.

Web site: www.ecoagriculture.org





Moving Africa's Drylands toward Modern Technologies

is this correct map?

Agriculture has come a long way since the hoe gave way to the plow and then to the tractor, and in the process these inventions have improved global food security. But agriculture is also responsible for land degradation—crops consume essential soil nutrients, land clearing and tilling pave the way to soil erosion, irrigation causes saline build up in the soils, and on and on. Food production is a necessary evil, but land degradation is outpacing its restoration at an increasing and unsustainable rate for ecosystem functioning.

But Dr. Venanzio Vallerani, who passed away in November 2012, again turned to the tractor and the plow to fix the problem. Working with the Nardi agricultural machinery firm, they designed three special types of plows, the *Treno*, *Delfino* and the new *Delfino3*, suitable for rehabilitating different soil types and for different uses.

Delfino automatically penetrates into the soil and reemerges on the soil surface, excavating semicircular microbasins that are about 3.5 to 5 meters long, and 40 to 70 centimeters deep, at intervals of 1 to 3 meters. It creates up to 7,500 microbasins with underground bags per day, and can also create them as contours. Up to 15 hectares of land can be treated and seeded per day, but to minimize the above mentioned problems and maximize results, only 10–20 percent of the soil is plowed.

Rainwater, its runoff and other valuable resources, such as fine soil, organic matter and seeds, are trapped in the semicircular bunds. This prevents

run-off and enables the drought-resistant plants already sown or planted in the semicircular bunds to germinate. This soil-processing system raises the water table and makes two to four times more water available for crops, pastures, and plants. When compared with the manual approach to land rehabilitation, food production increases two to four times, animal and vegetable biodiversity rise considerably, while pastureland increases both in terms of quality and quantity up to 30 times.

The Vallerani System, as the innovation is now known, is a mechanization of a traditional water-saving practice that is widely used in the Sahel region—digging half-moons to trap water for cultivation. Vallerani believed in water harvesting and retention for the reforestation of arid zones. But his field experience convinced him that the labor-intensive initiatives in the Sahel, while effective, would have limited reach.

Mechanization was the solution to rapid and vast landscape-level restoration, and with the poor in mind, Vallerani designed and patented this system. Up to now, it has been used in 13 countries on over 115,000 hectares. Studies show that wherever it has been used correctly, the results are excellent. It restores hundreds of acres in a relatively short time and is highly efficient and fast, especially in soils that are not too stony or sandy.

In the Gansu and Inner Mongolia regions of China, Vallerani and Chinese scientists used it in a pilot reforestation program including over 3,000 hectares of degraded land. A study conducted afterward shows that it is

twice as efficient in catching water. Soil moisture increased by 60 percent and the soil's compactness was reduced by 82 percent. The survival rate of planted trees increased by 50 percent.

Delfino, *Treno*, and *Delfino3* are not yet used widely, but they have great potential for reforestation, pasture development or re-greening, and for the international community to achieve the global aspiration of a land-degradation neutral world in a relatively short period.





A photograph of a desert landscape. In the foreground, a large sand dune with distinct wind-swept ripples slopes upwards from the bottom left towards the right. On the left side of the dune, a cluster of dead, bleached, and tangled trees stands against the sand. The background shows a flat horizon under a vast, overcast sky with soft, grey clouds. The overall tone is somber and desolate.

Awareness Creation

Coalition Building, Communication, and Social Media for Greater Awareness

BY TERRAFRICA

Gayatri Kanungo and Madjiguene Seck, World Bank TerrAfrica Team

Sustainable land and water management (SLWM) has proven to be central to combating desertification and increasing agricultural productivity. SLWM provides multiple dividends to livelihoods, growth, social protection, and climate change mitigation and adaptation. In essence, SLWM sustains the people, preserves the land, and impacts vegetation cover and composition—all contributing to a green economy. Creating awareness on these issues has helped us—the beneficiaries—better understand that desertification and land degradation threaten the processes that sustain the global ecosphere and life on earth.

Clearly, combating desertification, land rehabilitation, SLWM, livelihood generation, and awareness raising are all now part of the same equation—given that raising awareness is inherently linked to these key issues, and even more closely to the ones on meeting basic needs, capacity building, and data and information. Creating equitable access and ownership through awareness creation and communication are critical for success.

Cognizant of the fact that civil society organizations play a key role in influencing national, regional, and global policy making, their efforts in promoting and enhancing awareness around critical land issues need to be brought into the discussion. It is encouraging to see that there is a spread in both the numbers and types of actors involved in communication and

dissemination of information in stronger partnerships with governments and international institutions.

This featured section focuses upon approaches used by selected civil society, groups, and organizations—the DESIRE project, Sustainable Development for the Negev, and TerrAfrica—in building awareness. It captures the successful link created up the chain between beneficiaries as well as policy makers in the context of land degradation and desertification.

Twenty-eight partner institutions from across the world, consisting of research institutes, universities, NGOs and SMEs, have started a large integrated research project—the DESIRE—to establish promising alternative land use and management conservation strategies in 16 degradation and desertification hotspots around the world.

Similarly, the Sustainable Development for the Negev was set up to increase public awareness and involvement; data collection and analyses; education discussions; and local, regional, and international cooperation on environmental issues and use of natural resources.

TerrAfrica, an African-driven global partnership program,¹⁸ is working to improve natural resource-based livelihoods and ecosystem functions through scaling up SLWM across sectors. Significantly, it is a vehicle for implementing the land-related strategies of the Rio conventions, especially the UNCCD. The partners work together across sectors to mobilize, align and plan investments, and to convene knowledge, tools, and stakeholders.

TerrAfrica created an enabling environment for effective mainstreaming, upscaling, and financing of SLWM strategies and is recognized as the precursor of climate-smart agriculture. Interestingly, the TerrAfrica “Knowledge Base” is providing a shared space for people committed to advancing SLWM in Africa to share resources, ideas, and experiences—an effort toward creating an open knowledge platform that engages the global community in conversations that drive local action. More recently, TerrAfrica established a partnership with Connect 4Climate (C4C) to develop a more visible and radical new approach for communication. Together they have energized participating countries’ constituencies by increasing their audiences through social media and by stimulating their interest in seeking solutions to adapt to climate change.

TerrAfrica designed an innovative and strategic communication approach that:

- promotes SLWM practices in Sub-Saharan Africa;
- motivates key stakeholders to collaborate as a coalition of institutions mainstreaming SLWM;
- improves the mechanism through which partner organizations and national governments collect and exchange SLWM knowledge;
- shapes public opinion with the ultimate goal to create pressure on policy makers and governments to increase funding for projects across



TERRAFRICA MANDATE AND MISSION

“Our Land, Our Wealth, Our future in Our hands”

- Coalition building: 24 Sub-Saharan countries members under the leadership of the African Union; 20 partners including Regional Economic Communities, UN bodies, international organizations such as the World Bank, EU, bilaterals and civil society.
- Knowledge creation and dissemination: the TerrAfrica Knowledge Base provides a shared space for people committed to advancing SLWM in Africa to share resources, ideas, and experiences.
- Investment: TerrAfrica scaled up US\$3 billion for SWLM; put an additional 174,000 hectares under SLWM; sequestered 520,000 tons of carbon dioxide equivalent; positively impacted 420,000 farmers; engaged 95,000 extension workers; prepared or delivered 18 country investment frameworks; 37 operations are in preparation or implementation in 27 countries; implemented 10 country-level and 3 multicountry/regional TerrAfrica-supported projects; and monitoring and evaluation framework has been approved and key indicators have been adopted in investment operations and country programs.



sectors and countries to tackle land degradation, climate change, and natural resource overreach; and

- provides communication support to combine the traditional and new media/processes/tools, according to each project's needs.

Youth outreach has also been a key element of this communication strategy, as African youth have asked to be part of the debate and the solutions. To kick start an interactive dialogue among African youth and give them a voice, TerrAfrica, in collaboration with C4C, organized competitions to challenge young people aged 13–35 from all over the world to submit photos, videos, music videos, and podcasts that communicate compelling climate change and land degradation stories. TerrAfrica and C4C's innovative communication approach has enabled the

program to both focus on its core and streamline methods to reach its widening group of stakeholders.

Overall, the TerrAfrica program is now proving to be a robust model for donor harmonization, Africa-driven development, multi-disciplinary work, and mutual accountability. The World Bank—along with numerous national and international partners—has been deeply involved in cofounding and implementing the TerrAfrica partnership with the African Union's (AU) New Partnership for Africa's Development (NEPAD) Planning and Coordinating Agency (NPCA).

Web site: www.terrafrica.org







Africa's Faiths Commit to a Living Planet under a World Bank–Supported Initiative

Described as the biggest civil society movement on climate change in history, and the biggest mobilization of people and communities that we have ever seen on this issue, faith groups have a crucial role to play in protecting our planet. Nowhere is this more true than in Africa, where 90 percent of the population describe themselves as either Christian or Muslim—with 470 million Christians and 234 million Muslims. Moreover, faith leaders are figures of huge influence and trust. They cannot be ignored in the search for a coordinated response to protecting our planet.

The Alliance of Religions and Conservation, a secular body that helps the world's major faiths develop environmental programs based on their own core teachings, beliefs and practices, is doing just that, with support from the World Bank's African-led TerrAfrica partnership. The innovative project is a new awakening to help shape beliefs, behavior, and actions for a greener and better Africa. The unprecedented outreach to 184 million people provides an extraordinary opportunity for long-term engagement to achieve long-lasting impact and create a more sustainable Africa.

In fact, 27 faith groups in Sub-Saharan Africa have received support under the project to consult with their own local communities—in their mosques, temples and churches, with their young people's associations and women's groups, and in their schools—on actions needed to protect their environment. The resulting long-term plans of action on the environment were endorsed by the highest authority of the faith groups, ranging from the National Muslim Council of Tanzania to the Hindu Council of Africa,

the Qadiriyyah Sufi Movement in Nigeria, and the Protestant Council of Rwanda. This is the first time that African faith communities have come together to develop long-term plans on the environment, and this offers a unique opportunity for the World Bank, through TerrAfrica, to further build on its initial pioneering engagement to secure practical results.

The 27 faith groups in 11 different countries proposed a range of practical actions for their 184 million followers. Plans focus on community awareness raising, conservation and climate smart agricultural practices, including the sustainable use of land and water and environment education in faith-run schools. Many of the plans focus on using faith institutions as model demonstration centers to teach followers simple techniques of sustainable conservation agriculture. The faiths are also planning massive reforestation and tree-planting programs, with over 43 million trees to be planted in the next seven years.

In Ethiopia, where 85 percent of people make their living from the land, and with a church membership of 43.5 million people, this engagement could have a huge impact. The Orthodox Church, with 500,000 clergy, proposes that its 3,000 monasteries be not only spiritual centers, but become monastic communities that act as pioneers for the introduction of environmental conservation and carbon trading, as well as centers of demonstration and learning for improved agricultural practices, sustainable land management techniques, and innovations such as the introduction of biogas digesters and solar energy.

In Kenya, the 9 million Catholics, 3 million Methodists, 3 million Presbyterians, 5 million Anglicans, 1.2 million members of the Full Gospel Churches of Kenya, and the 6.5 million of the Supreme Council of Kenya Muslims agreed together to introduce “Farming God’s Way,” rooted in biblical teachings.

Women are central to the life of faith groups and have been key participants in this effort. In Tanzania, women not only gain new skills in nursery management and agroforestry, but are able to earn money to put food on the table and send their children to school. In Uganda, Muslim women in Gomba have been planting fruit and ficus trees around their homes, gardens and mosques, practicing agroforestry, and installing energy saving tools.

Children are also a key feature of the environmental plans—educating them continues to be the backbone of the faiths’ activities in Africa. In Kenya, the project has reached out to faith schools and introduced a toolkit on “education for sustainable development,” integrating religious wisdom and environmental education.

In Nigeria, the Qadiriyyah Movement, which has an estimated 15 million followers, proposes setting up Green Grocery kiosks on the streets of Kano as official retail outlets, where the organic fruit and vegetables grown by its children in school orchards can be sold. A street-cleaning program also gives children school marks and trains them to recycle discarded plastic water bags for use in the school’s tree nursery.

This work has been hailed as transformative and “a new awakening that will help shape beliefs, behavior, and actions for a greener and better Africa.” There is hope that with faith, vision and partnership, that “new awakening” will be only the beginning—on the journey together to protect our living planet.¹⁹

Web site: www.arcworld.org





The DESIRE Project for Greener Land

Productive land is scarce and, partly because everyone likes to use the best land available, is often threatened by degradation and desertification processes that reduce its productivity. This is especially the case in dryland areas. More than 1 billion people, many of whom are farmers who depend on the land for their livelihoods or even their survival, live in affected areas. Preventing desertification is critically important, as is restoration where it has occurred.

DESIRE—Desertification Mitigation and Remediation of Land, a “global approach to local solutions”—is a research network focused on building a learning community among scientists and practitioners. DESIRE offers fresh thinking and practical solutions to the problems of land degradation and soil and water conservation, especially in dryland areas. It is a knowledge management hub for sustainable dryland management. Since its launch in 2007, using a unique approach developed by the project, DESIRE has gathered about 40 case studies in the WOCAT—World Overview of Conservation Approaches and Technologies—format (www.wocat.net). Problems addressed range from wind and water erosion to salinization, vegetation degradation, competition for access to water, forest fires, and

droughts. Findings from the project have been published in the *Desire for Greener Land*.²⁰

In short, the DESIRE project is a like toolbox that contains a variety of solutions and advice on how to “treat sick” land. The DESIRE approach is to identify, scientifically assess, and develop sustainable local land management strategies in partnership with stakeholder groups. It also places priority on integrating social and economic aspects, including gender issues and economic analysis, into land management strategies. DESIRE offers guidance and accessible tools to support decision making, evaluate sustainable land management activities, and disseminate the results.

DESIRE is a partnership between Alterra Wageningen University in the Netherlands and 25 other partners worldwide. Funded by the European Union, DESIRE works in close collaboration with the WOCAT network.

Web site: <http://www.desire-project.eu>,
<http://www.desire-his.eu>







ISO-Certified Cities in the Negev Desert

The Negev Desert, Israel's largest land reserve, boasts some of the country's largest nature reserves and national parks, but this desert is also used by its chemical industry for quarrying, mining, and agriculture. In the mid-1990s, Israel set up two industrial municipalities, one of which is the Romat Hovav Industrial Park, situated 12 kilometers south of Beer-Sheva. It has 21 chemical factories spread over 6,000 acres. All of the factories deal with the treatment of hazardous waste, air pollution, chemical waste, and chemical sewage. Over 400 acres at Romat Hovav Industrial Park serve as evaporation pools. The resultant air pollution and chemical leaching into the soil and water have earned the region recognition as one of the country's most polluted and polluting sites.

Thus, the region is vulnerable to land degradation and environmental hazards with impacts on groundwater, air quality, and public health. The chemical waste has a direct impact on the health and well-being of some 400,000 residents in North and Central Negev, of which over 230,000 live within a 20 kilometer radius of the area. This is one of Israel's peripheral zones, not just due to the significant environmental problems caused by unsustainable planning, but also because it is populated by economically marginalized groups like the Bedouin.

To promote sustainability in the area, Bilha Givon, without government help or affiliation to a national body, set up Sustainable Development for the Negev in 1998. She has dedicated her career to engaging communities in environmental awareness, protection, and restoration. In 2003, she created environmental responsibility forums that, for the first time, brought

together industry polluters and community for constructive dialogue. The outcome was an upgrade in environmental standards and industry taking responsibility for the surrounding communities. Today, Israel has nine such active forums, with 12 factories in the Negev region.

In 2005, the Sustainable Development for the Negev initiated a comprehensive environmental empowerment program in Dimona, a development town with 40,000 people. Its pursuit of the sustainable settlement concept earned it International Organization for Standardization (ISO) 14001 certification, which is audited every year. It is the first settlement in Israel to earn this title.

These and other initiatives have been replicated in other settlements such as Beer-Sheva, with 200,000 people, Ofakim, and Kiryat Gat and Kiryat Malachi, and also with six Bedouin cities: Raat, Kseifa, Arara, Hora, Segev Shalom, and Tel Sheva.

Web site: <http://www.negev.org.il>





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Web Sites and Addresses

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<l.dimeyeva@mail.ru> ,	"Institute of Botany and Phytointroduction 36-D Timiryazev Str. Almaty 050040 Kazakhstan"
cciccd@forestry.gov.cn, quhaihua9@sina.com	Forestry and Environmental Protection Bureau of Qinghai Province Shunliang, No.18 Hepingli DongJie, Dongcheng District, Beijing, 100714, CHINA
http://english.tema.org.tr/	"TEMA, Çayır Çimen Sokak Emlak Kredi Blokları A-2 Blok Kat:2 Daire:8 34330, Levent-İstanbul, TURKEY"
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http://www.desire-project.eu	"DESIRE Alterra, P.O. Box 47 Droevendaalsesteeg 3 6700 AA Wageningen Netherlands"

http://www.excellentdevelopment.com/home	"Excellent Development, Studio 59, The Market Building, 195 High Street, Brentford, TW8 8LB, United Kingdom"
http://www.futureforest.org/	Future Forest, Kwon Byong Hyon, Hyundai Plaza #201 Muak-dong 82, Jongro-gu, Seoul, South Korea, 110-080
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www.lpn.pt	"Liga para a Protecção da Natureza (LPN) Portugal Estrada do Calhariz de Benfica, 187, 1500-124 Lisboa, Portugal"

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www.worldvision.com.au	World Vision Australia, GPO Box 399, Melbourne, Victoria, 3001 Australia