1ST AFRICA
Food Security & Adaptation Conference 2013

Nairobi | August 20 - 21 2013

Harnessing Ecosystem based Approaches for Food Security and Adaptation to Climate Change In Africa

ORGANISED BY

UNEP

FAO FIAT PANIS

SUPPORTED BY

World Agroforestry Centre · Nestlé Good Food, Good Life · FAIRTRADE · CIAT · PACJA Pan African Climate Justice Alliance · Bioversity International

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UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP)

FOOD AND AGRICULTURE ORGANIZATION (FAO)

SUPPORTED BY

WORLD AGROFORESTRY CENTRE

NESTLE FOODS

IUGG UNION-COMMISSION ON CLIMATE AND ENVIRONMENTAL CHANGE (IUGG-CCEC)

FAIR TRADE INTERNATIONAL

INTERNATIONAL CENTRE FOR TROPICAL AGRICULTURE (CIAT)

PAN AFRICAN CLIMATE JUSTICE ALLIANCE (PACJA)

AFRICA ADAPTATION KNOWLEDGE NETWORK (AAKNET)

BIOVERSITY INTERNATIONAL

ECOAGRICULTURE PARTNERS

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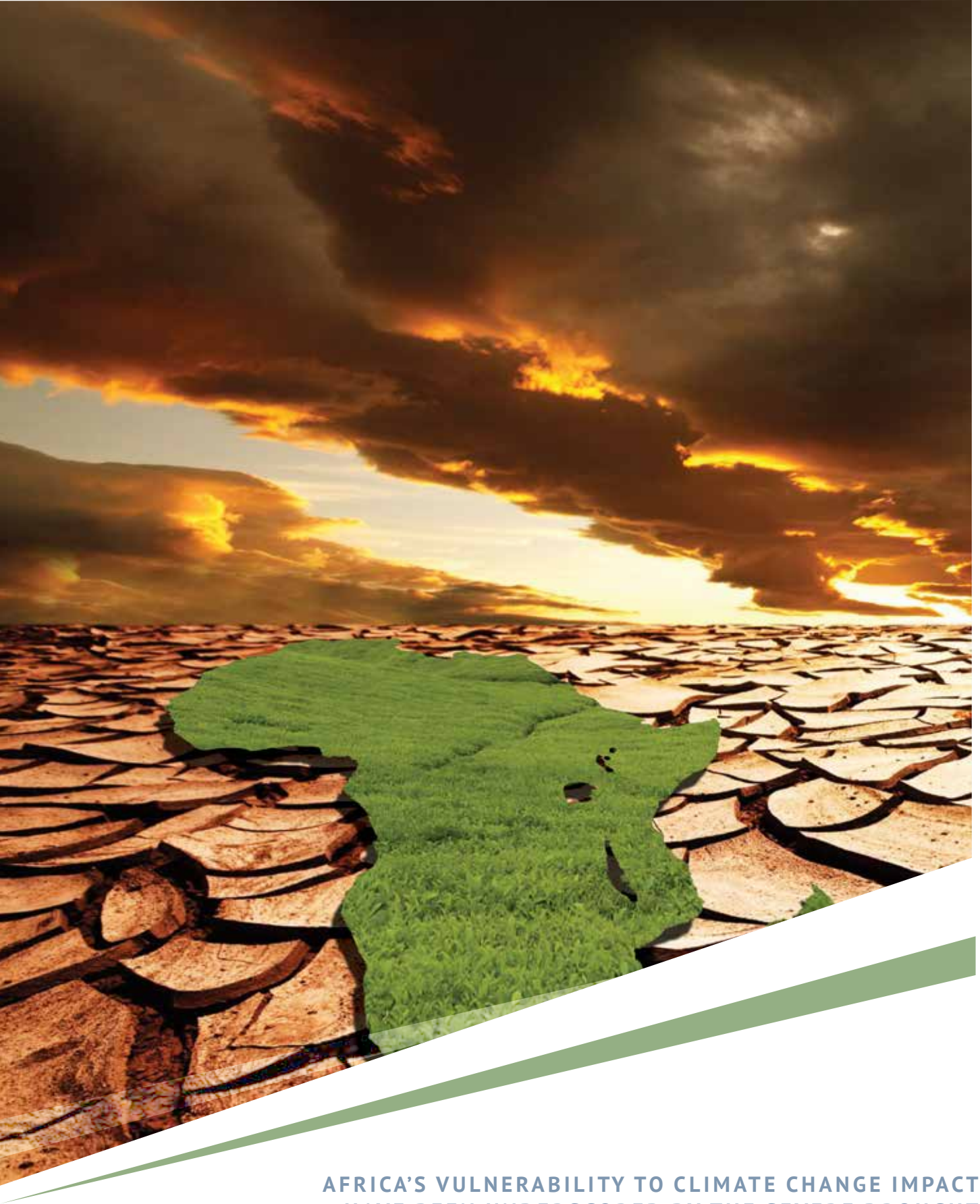


AFRICA'S VULNERABILITY TO CLIMATE CHANGE IMPACTS HAVE BEEN UNDERSCORED BY THE SEVERE DROUGHTS EXPERIENCED RECENTLY IN THE SAHEL IN 2012 AND THE HORN OF AFRICA IN 2011.

Context

HARNESSING ECOSYSTEM-BASED APPROACHES FOR FOOD SECURITY AND ADAPTATION TO CLIMATE CHANGE IN AFRICA

Africa's vulnerability to climate change impacts have been underscored by the severe droughts experienced recently in the Sahel in 2012 and the Horn of Africa in 2011. These bring into focus the serious impacts of climate change on the continent and highlight the urgent need for adaptation as a priority in providing sustainable solutions to reduce the vulnerability of a great majority of Africa's one billion citizens. Africa's population is expected to constitute about 23% of the global population by 2050. This places a huge demand on governments and states to provide opportunities for enough food and the new dietary demands. Both an increasing population and changes in dietary preferences will put further strain on productivity in matching quantity and quality in food outputs over the next coming years. The questions however, are the types of measures/approaches required for the changing needs for food security. The challenge therefore is in charting new pathways to eliminate food insecurity, adapt to the changing climate and build sustainable systems. This will require innovative solutions that build on an internally driven process of change by individuals, communities and institutions coupled with adaptation to climate change.

With the shift towards Sustainable Development Goals (SDGs) to replace the Millennium Development Goals (MDGs) after 2015, approaches that serve multiple purposes and provide cross-cutting benefits are highly needed in Africa and elsewhere. For example, achieving food security is unmanageable without climate change adaptation measures and practices that not only support farmers in producing enough food to meet people's nutritional needs, but that also preserve ecosystems, from degradation, for example, preventing soil erosion, water, nutrients and pollinators that underpin agricultural productivity, particularly in smallholder dominated landscapes. Approaches with the potential for informing and guiding policy and practices are imperative. One of these approaches is ecosystem-based adaptation (EbA), which provides flexible, cost effective, and broadly applicable alternatives for building robust food systems on less inputs and reducing the impacts of climate change. Practices such as agro-forestry, buffer strips, on-site water conservation, use of native species, etc. have demonstrated that ecological based approaches can provide just the right framework for catalyzing transformative change on a larger scale. Adopting ecological based approaches could help build efficient food systems and resilient livelihoods, and ultimately achieve global food security in a changing climate. This raises the question of what ecological based approaches can do differently to get Africa and other regions out of food insecurity. How can the emerging ecosystem-based approaches in addressing food shortages be consolidated and up-scaled? What scale of production is appropriate to achieve this?

With the shift towards Sustainable Development Goals (SDGs) to replace the Millennium Development Goals (MDGs) after 2015, approaches that serve multiple purposes and provide cross-cutting benefits are highly needed in Africa and elsewhere. security.

Workshop Scope and Objectives

In Africa, where food waste is negligible, and population growth remains high, increased and sustainable production is a key requirement for food security.

In Africa, where food waste is negligible, and population growth remains high, increased and sustainable production is a key requirement for food security. In this context, harnessing ecosystem-based adaptation in response to climatic change impacts in agriculturally dominated areas is timely and opens a window of opportunity for taking stock of the state of ecosystem-based knowledge for food security in the continent. Building on the commonalities shared by countries in Africa, sharing lessons of ecological approaches for food security and climate change adaptation can be formulaic as well as easily disseminated. Fostering regional co-operation through knowledge sharing could boost and enable institutional processes for integrating ecosystem-based adaptation approaches into food security policies hence helping countries in addressing both climate risks and food insecurity using consolidated solutions that serve communities now and in the future. The workshop and follow-up activities will provide a platform for facilitating learning from each other's experiences. Consolidating knowledge on ecological approaches from countries and participants working in the region is an important way of optimizing the use of resources for addressing food insecurity and climate change adaptation under the current financial resource constraints.

The key objectives of the workshop are:

- Aggregate the lessons shared into common solutions for food security and climate change adaptation across country application, in building the capacity of the practitioners, supporting policy processes at all levels as well as empowering countries in undertaking bigger actions.
- Share information on targeted ecological actions that provide opportunities for addressing perennial food insecurity in Sub Saharan Africa.
- Identify key challenges and bottlenecks hindering the scaling-up of ecosystem-based adaptation practices, and how can they be overcome.

Expected Outcomes

- Improved understanding of harnessing ecosystem services for food security and adaptation to climate change in agriculturally dominated landscapes in Africa and elsewhere.
- Policy options and innovative approaches explored for increasing the role of ecosystem-based approaches in food security and climate change adaptation.
- Engagement of key regional partners and policy makers within the continent on food security and climate change adaptation.

Programme Agenda

DRAFT PROGRAMME AND AGENDA OF THE 1ST AFRICA FOOD SECURITY & ADAPTATION CONFERENCE

Harnessing Ecosystem-based Approaches for Food Security and Adaptation to Climate Change in Africa

TUESDAY, 20 AUGUST

8.00-9.00 Registration

9.00-10.00 HIGH LEVEL OPENING SESSIONS (CONFERENCE ROOM 1)

Moderated by **Dr. Richard Munang,** *Africa Regional Climate Change Coordinator, UNEP*

- Welcome Remarks: **Mr. Mounkaila Goumandakoye**, Regional Director & Representative, UNEP Regional office for Africa
- Remarks from: **Mr. Modibo Traore**, FAO Representative to the AU and UNECA
- Opening Address: "Food Security, and Climate Change in Africa: Issues, Opportunities, and Challenges" **Dr. Tony Simons,** Director General, World Agro Forestry Centre (ICRAF)
- Keynote Policy Address: "Uplifting the Use of Ecosystems in Addressing Food Security in Africa" **Cabinet Secretary, Ministry of Agriculture, Livestock and Fisheries, TBC**

10.00-10.20 Group photo, Networking Tea & Coffee break

10.20-13.00 PLENARY SESSION: SHARING LESSONS ON ECOSYSTEM BASED APPROACHES FOR FOOD SECURITY AND CLIMATE ADAPTATION (PRESENTATIONS OF PRACTICAL CASE STUDIES FROM COUNTRY PROJECTS) (CONFERENCE ROOM 1)

Moderated by **Dr. Dennis Garrity,** *Senior Fellow, World Agroforestry Centre, Kenya*

This session will showcase practical examples of work from countries which have harnessed ecosystems services to enhance food security and climate change adaptation and at the same time enhanced the productivity of the ecosystems. This will address successes, experiences, challenges, sustainability, cross-cutting issues and lessons learnt.

13.00-14.00 Lunch

1400-16.00 **DISCUSSION AND WORKING SESSIONS: MAINSTREAMING ECOSYSTEM BASED APPROACHES FOR FOOD SECURITY AND CLIMATE CHANGE ADAPTATION IN AFRICA**

Adopting ecological based approaches will help build efficient food systems and resilient livelihoods, and ultimately achieve global food security in a changing climate. This raises the question of what ecological based approaches can do differently to get Africa and other regions out of the pack of food insecurity. The following discussion sessions will explore in more depth the questions below: How can the emerging ecological innovative solutions in addressing food shortages be consolidated and up-scaled? What existing policy frameworks can be harnessed to integrate ecological based approaches into food security initiatives? What funding mechanisms can be harnessed to promote integrated ecosystem based adaptation approaches? What is the scientific perspective on ecosystem based approaches in addressing food security and climate change adaptation?

DISCUSSION SESSION 1.1: UP-SCALING ECOLOGICAL BASED APPROACHES FOR FOOD SECURITY AND CLIMATE CHANGE ADAPTATION (CONFERENCE ROOM 10)

- What are some examples of guidelines for up-scaling ecosystem based approaches?
- What should be considered in up-scaling ecosystem based approaches?
- What are the barriers to up-scaling ecosystem based adaptation practices, and how can they be overcome?
- How can emerging ecosystem-based innovative solutions be consolidated and up-scaled?
- What scale of production is appropriate to achieve integration? Small versus large?
- How can we expand food productivity beyond agricultural lands and consolidate gains made through ecological approaches?

Moderated by **Dr. Alex Awiti,** *Director, East African Institute of Aga Khan University, Kenya*

DISCUSSANTS

- **Mr. Nicholas SSenyonjo,** Executive Director, Environmental Education Foundation), Uganda
- **Dr. Benjamin** Delali Dovie, University of Ghana, Ghana
- **Dr. Carlo Fadda,** Bioversity, Kenya
- **Mr. Welton L. Phalira,** LEAD Southern and Eastern Africa, Malawi

DISCUSSION SESSION 1.2: MAXIMIZING POLICY FRAMEWORKS TO INTEGRATE ECOLOGICAL BASED APPROACHES FOR FOOD SECURITY AND ADAPTATION (CONFERENCE ROOM 11)

- How can existing policy frameworks on food security both at the regional and national levels be maximized to integrate ecosystems based adaptation approaches for food security initiatives?
- What are some shortcomings of current food security policies and frameworks?
- What are examples of current linkages between food security frameworks and Climate Change Adaptation strategies?

Moderated by **Dr. Tewolde Egziabher,** *Director General, EPA, Ethiopia*

DISCUSSANTS

- **Dr. Evelyn L Namubiru-Mwaura,** Policy Officer, Land and Environment, AGRA, Kenya
- **Ms. Annet Kandole,** CARE Uganda

- **Ms. Jacqueline Nyirakamana,** NBI Focal Point Officer, Rwanda
- **Dr. Grace Abolaji,** Agricultural Education and Extension, Nigeria

DISCUSSION SESSION 1.3: FUNDING MECHANISMS FOR ECOSYSTEM BASED APPROACHES FOR FOOD SECURITY AND ADAPTATION (CONFERENCE ROOM 12)

- What funding mechanisms for food security should be harnessed to promote integrated ecosystems based adaptation approach?
- How can investment and institutions be mobilized?
- What are the potential impacts on future economic development?

Moderated by **Mr. Emmanuel Dlamini,** *Chair, Africa Group of Negotiators, Swaziland*

DISCUSSANTS

- **Mr. Muzinduki Patrick,** Head of Research and Advocacy Unit, KRRC, Uganda
- **Dr. Ebenezer Tabot-Tabot,** Africa Regional Director, Centre for Env and Human Dev't, Cameroon
- **Mr. Michael Makonombera,** Ministry of Environment, Malawi
- **Mr. Antwi-Boasiako Amoah,** EPA, Ghana

DISCUSSION SESSION 1.4: THE SCIENTIFIC PERSPECTIVE ON ECOSYSTEM BASED APPROACHES USED ACROSS THE CONTINENT (CONFERENCE ROOM 13)

- What does the science tell us about those approaches? This will allow matching local knowledge of use of these practices, with their scientific basis where applicable.
- What are other examples of the ecosystem approaches in use?
- What are the current limitations in their use in their respective places?
- What do we know of the scientific basis of some of the ecosystem-based approaches?
- What are some scientific limitations of the ecosystem-based approaches?
- What should be the current scientific research priorities?

Moderated by **Prof. A.B. Salifu**, *Director-General, Council for Scientific and Industrial Research, Ghana*

DISCUSSANTS

- **Dr. Fred Kizito,** CIAT Senior Scientist: Soils, Water and Landscapes, Kenya
- **Dr. Fred Kihara,** Water Fund Manager, The Nature Conservancy , Kenya
- **Dr. Frederick Atieno,** Bioversity, Kenya
- **Dr. Emilie Smith Dumont,** ICRAF Scientist, Kenya

1600-18.00 **PLENARY SESSION: PRESENTATIONS FROM DISCUSSION SESSIONS 1.1-1.4 (CONFERENCE ROOM 1)**

Moderated by **Sara J. Scherr,** *President EcoAgriculture Partners, USA*

THIS SESSION WILL INCLUDE A PRESENTATION AND DEBATE OF DISCUSSION SESSION FINDINGS.

18.00 **END OF DAY 1**

WEDNESDAY, 21 AUGUST

9.00-9.15 Reflections on Main Messages and Highlights of Day 1

9.15-10.30 PLENARY SESSION: BEYOND 2°C - IMPLICATIONS FOR FUTURE AFRICA FOOD SECURITY & ADAPTATION UNDER INCREASING TEMPERATURES (2°C, 3°C, 4°C) (CONFERENCE ROOM 1)

A key threshold measuring the march of global warming was crossed recently when the concentration of carbon dioxide in the atmosphere topped 400 parts per million. How much worse will the situation be when more climate change is induced when the CO2 concentration increases from 400 ppm to 450 ppm and beyond? At this rate, we are on track not for a 2 degree but for a 3 to 5 degree increase in temperature by the end of the century – a catastrophe. What does the 400ppm increase in CO2 emissions means for future African food security efforts? It is a critical turn that has great burden for Africa. Understanding what this means for the region could chart the way towards new financial needs for Africa in dealing with the challenge.

Moderated by **Dr. Richard Munang**, *Africa Climate Change Head & Coordinator, ROA/UNEP*

OPENING PRESENTATION

by Ms Sandra Freitas, *Climate Analytics, Togo*

DISCUSSANTS

- **Prof. Shem Oyoo Wandiga ,** University of Nairobi, Kenya
- **Prof. Linus Opara, Stellenbosch** University, South Africa
- **Prof. A.B. Salifu,** Director-General, Council for Scientific and Industrial Research, Ghana
- **Prof. Idowu O. Oladele,** University of the North West, South Africa

10.30-11.00 Networking Tea & Coffee break

11.00-13.00 PLENARY SESSION: THE ROLE OF THE PRIVATE SECTOR: CHALLENGES AND OPPORTUNITIES (CONFERENCE ROOM 1)

Aligning ecological approaches that enhance food security with economic opportunities is crucial in undertaking the changing climate adaptation. Looking at how the different business models can be used to allow companies to target growth while contributing to better management of ecosystems is necessary for societal wellbeing. This session will focus on opportunities for the private sector in underpinning their supply chain with ecological approaches.

- How can an enabling environment be created for private sector engagement?
- What challenges are faced by the private sector that prevents its participation?
- What are the investment opportunities in harnessing ecological approaches for businesses?
- What models have worked and how can they be capitalized on?

Moderated by **Tom James,** *Programme Editor, African High-Growth Markets, The Economist, UK*

DISCUSSANTS

- **Mr. Hans Joehr,** Head of Corporate Agriculture, Nestle, S.A.
- **Ms Anesu Makina ,** Business & Biodiversity Programme, University of Pretoria, South Africa
- **Dr. Bill Carter, Ashoka** Diamond Leader for Africa, and Leader, Nutrients for All Initiative, Ashoka
- **Dr. Alex Awiti, Director,** East African Institute of Aga Khan University, Kenya

13.00-14.00 Lunch

14.00-17.00 PRESENTATION OF CONCLUSIONS AND RECOMMENDATIONS REACHED AND ADOPTION OF CONFERENCE DECLARATION (CONFERENCE ROOM 1)

Moderated by **Dr. Desta Mebratu,** *Deputy Regional Director, Regional Office for Africa, UNEP*

17.00-18.00 END OF DAY 2: CLOSE OF CONFERENCE

Examples from Countries

The Practical examples of ecosystem-based approaches from countries showcases successes, experiences, challenges, sustainability, cross-cutting issues and lessons learnt in enhancing food security, climate change adaptation and productivity of other ecosystems.

- AQUATIC PROJECTS
- AGRICULTURAL PROJECTS
- FORESTS PROJECTS
- WETLANDS PROJECTS
- CAPACITY BUILDING
- DESERT PROJECTS

Rehabilitation of small water reservoirs in the Savannah Region for the benefit of women and youth groups in Togo

BY
M. BAMALI DIDIER
MS. SANVEE AYABA
M. TCHABORE HATIMI

REHABILITATION OF SMALL WATER RESERVOIRS IN THE SAVANNAH REGION FOR THE BENEFIT OF WOMEN AND YOUTH GROUPS IN TOGO

THE PROBLEM: WHAT RISKS HAVE BEEN ADDRESSED?

- The project was implemented in the northern region of Togo named "Région des Savanes" (savannah region). This region is the southern periphery of the Sahel. Therefore, the savannah region is the driest region of Togo.
- Rain falls are between 900 and 1200 mm per year, but the rains are concentrated in only four months (June to September). Therefore, the dry season becomes very long; lasing for eight months.
- Temperatures are constantly high in the dry season; sometimes the temperature exceeds 40°C (March). During the long dry season is plagued by high insolation and poor vegetation due to degraded soil. The rest of the year experiences high evaporation exceeding 1500 mm.

- The natural vegetation is comprised mostly of dry savannah with some relics of dry forests. The savannah region has a typical arid soil. Soils are battleships; degraded and dissected.
- This area is 80% rural and agriculture is the main activity of about 90% of the population. The agricultural activities depend on climate variability and anomalies. Because of climate change, the region is experiencing frequent climatic anomalies, affecting agricultural activities, increasing poverty, and undermining food security.
- The region must reduce its vegetable and crop production susceptibility to climate change in order to reduce its vulnerability and support food security.

OBJECTIVES

- Reduce the vulnerability to climate change impacts of women and youth groups through the rehabilitation of two water reservoirs.
  - » Reduce the dependence of farmers to climate.
  - » Create awareness within local communities of the negative impacts of climate change.
  - » Promote water harvesting as an efficient adaptation action to support food security in the country.
  - » Help achieve food security in a changing climate.
  - » Improve water management.
  - » Promote fish farming.
  - » Promote tree planting.
  - » Diversify food production and alleviate poverty.

REHABILITATION OF SMALL WATER RESERVOIRS IN THE SAVANNAH REGION FOR THE BENEFIT OF WOMEN AND YOUTH GROUPS IN TOGO

METHODOLOGY & IMPLEMENTATION

1. *What ecosystem approaches were adopted to implement project activities?*

The ecosystem approach adopted to implement project activities was based on adaptation through water harvesting and conservation to support food production in a changing climate.

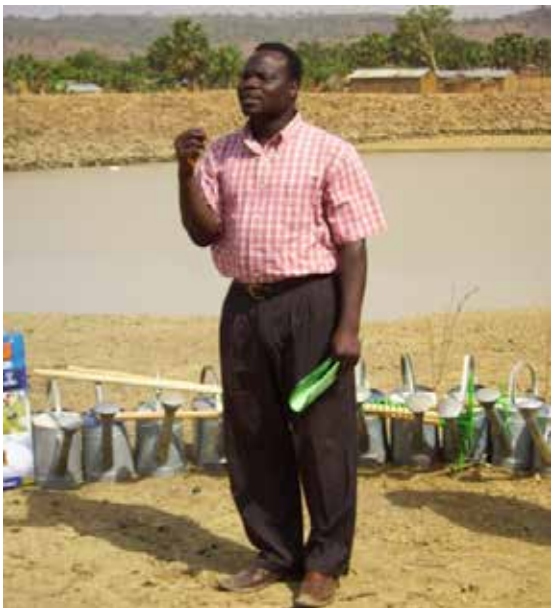
The implementation of the project was focused on the rehabilitation of water reservoirs. But, because of the link between biodiversity, land degradation (the project area is a driest region of the country), pesticides usage (very dangerous for human and environment), food security, human health the project coordination team integrated all these components. The main goal was to help beneficiaries raise their resilience to climate change.

How did the coordinating team achieve this goal?

Awareness-raising activities focused on planting trees, using and utilizing organic pesticides in the place of chemicals.

In the restoration of dams, the dredging of the reservoirs, and the rehabilitation of fish pounds, the coordination team sent an environmentalist to advise the entrepreneur on good practices to avoid destroying the aquatic biodiversity (fish species such as captain, carp, catfish and crocodiles) of the reservoir in TIMBOU. Dredging took place during the driest period and the abyssal part of the water reservoir which is just at the foot of the dam was not affected. In addition to the dredging, the basin has been widened and deepened for greater water retention.

The beneficiaries were also educated on the itinerary of production and biological control against pests. To this end, suitable equipment was granted to them during the reception ceremony of the dams. In addition, other production equipment (backpack for biopesticid (produced with the grains of the Neem tree), rakes, watering cans) have been given to all groups.



REHABILITATION OF SMALL WATER RESERVOIRS IN THE SAVANNAH REGION FOR THE BENEFIT OF WOMEN AND YOUTH GROUPS IN TOGO

2. ***What risk was this approach addressing?***

Climate risk (UNFCCC); land/soil degradation and desertification (UNCD); biodiversity destruction (UNCBD); chemical contamination risk (PoPs); and food security.

3. ***Which time of the year was this approached applied?***

Project implementation was not seasonally-depended.

4. ***Who were the target groups of the project?***

Women and youth groups.

5. ***Who were the key stakeholders of the project and what methods were used to involve them?***

Key stakeholders: Traditional and religious leaders, Women and youth groups, Agricultures, livestock owners, NGOs, Ministers, Regional water office, Regional environment office, Regional agriculture offices, Local and administrative authorities, UNFCCC focal point, CCDARE team from Nairobi.

METHODS USED TO INVOLVE STAKEHOLDERS

Stakeholders	Methods used to involve them
Local and administrative authorities	✓ Meeting to introduce the project for administrative and political support ✓ Involvement in the main phases of the project implementation: Launching ceremony and Reception ceremony ✓ Information sharing (reporting) and permanent communication
Traditional and religious leaders	✓ Meetings to present the project for their adherence to the project ✓ Mobilization of local populations to collect stones and plan trees ✓ Resolution of potential conflicts after project implementation
Women and youth groups, Agricultures, Livestock owners	✓ Meeting to introduce the project for their adherence to it, ✓ Participating in the construction of the dam (collecting stones), planting trees and stabilizing the dam ✓ Water committees to manage dams ✓ Attending to the awareness and sensitizing workshops
NGOs	✓ Raising awareness and sensitizing local population ✓ Stabilization of the dam by growing a solid grass ground cover ✓ Participating in planting trees and evaluation of the project
Stakeholders	✓ Methods used to involve them
Ministers, UNFCCC focal point and Regional offices	✓ Meeting to introduce the project for administrative and political support ✓ Interdepartmental consultations from the project design to the project implementation ✓ Monitoring (central, regional and local levels), evaluation of the project (reports) and permanent communication
Nairobi CCDARE Team	✓ Project monitoring: Report (Activity and financial reports at all phases of the project implementation were sent) ✓ On-site visits/field mission

REHABILITATION OF SMALL WATER RESERVOIRS IN THE SAVANNAH REGION FOR THE BENEFIT OF WOMEN AND YOUTH GROUPS IN TOGO

Official Project Launching Ceremony

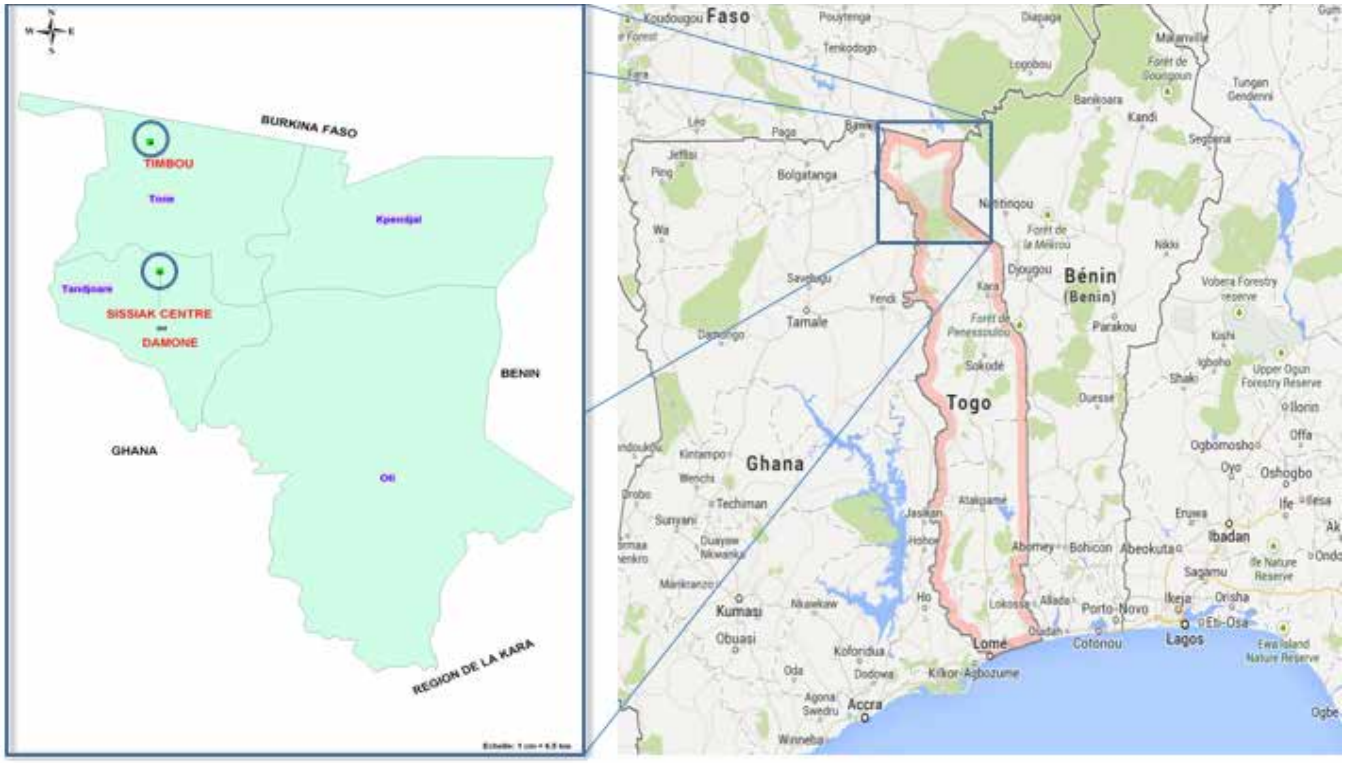
On-Site Visit of the Minister

REHABILITATION OF SMALL WATER RESERVOIRS IN THE SAVANNAH REGION FOR THE BENEFIT OF WOMEN AND YOUTH GROUPS IN TOGO

6. *What is the replication potential of the project?*

- The "Rehabilitation of water reservoirs in the Savannah Region for the benefit of women and youth groups" project was one of the best project of the CCDARE programme (August 2009 – March 2010).
- This project was the only project to use ecosystem approach based on adaptation to support food security.
- Very appreciated during the rainwater harvesting-adaptation workshop held in Seychelles.
- The project met a real and urgent local need and was implemented successfully.

THE SOLUTION: WHERE DID THE ACTION TAKE PLACE AND WHAT WAS DONE?



HOW DOES THIS ECOSYSTEM APPROACH ADDRESS & ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?

REHABILITATION OF SMALL WATER RESERVOIRS IN THE SAVANNAH REGION FOR THE BENEFIT OF WOMEN AND YOUTH GROUPS IN TOGO

THE BIG PICTURE

Number of people who benefited		Emerging opportunities
TIMBOU	DAMONE	✓ Brick-making
Before	Before	✓ Market gardening
1460	1838	✓ Off-cycle cash crop
After	After	✓ Petty trading
8000	2500	✓ Fish farming
		✓ Organic farming

TIMBOU

- The dam has been rehabilitated;
- The reservoir has been excavated;
- Three sediment traps have been constructed;
- The overflow has been restored to prevent reservoir siltation;
- A new water supply point was set;
- Three fish ponds have been rehabilitated;
- End result: The storage capacity of the reservoir has been increased from 50,000 to more than 70,000 cubic meters

REHABILITATION OF SMALL WATER RESERVOIRS IN THE SAVANNAH REGION FOR THE BENEFIT OF WOMEN AND YOUTH GROUPS IN TOGO

Water reservoir before the project

Water reservoir after the project

The Spillway before the project

The Spillway after the project

The dam before the project

The dam before the project

REHABILITATION OF SMALL WATER RESERVOIRS IN THE SAVANNAH REGION FOR THE BENEFIT OF WOMEN AND YOUTH GROUPS IN TOGO

The dam after the project

The dam after the project

Fish pound before the project

Fish pond after the project

Water supply point

Sediment traps

REHABILITATION OF SMALL WATER RESERVOIRS IN THE SAVANNAH REGION FOR THE BENEFIT OF WOMEN AND YOUTH GROUPS IN TOGO

OUTPUTS OF THE PROJECT

DAMONE

- A new dam has been built;
- The inner wall of the dam has been paved;
- The outer wall of the dam has been grassed;
- The reservoir has been excavated and enlarged;
- A new spillway has been built;
- A new water supply point was set;
- In final, the water reservoir in Damone was not rehabilitated but entirely reconstructed.;
- **End result:** In spite of the precocious water dumping, the storage capacity of the reservoir increased from 9000 to more than 24000 cubic meters.

Reservoir before rehabilitation

Reservoir after rehabilitation

REHABILITATION OF SMALL WATER RESERVOIRS IN THE SAVANNAH REGION FOR THE BENEFIT OF WOMEN AND YOUTH GROUPS IN TOGO

The dam before rehabilitation

The dam after rehabilitation

Although the reservoir is not as full as expected, water remains abundant until the next rain season (January 2011, MEHV)

REHABILITATION OF SMALL WATER RESERVOIRS IN THE SAVANNAH REGION FOR THE BENEFIT OF WOMEN AND YOUTH GROUPS IN TOGO

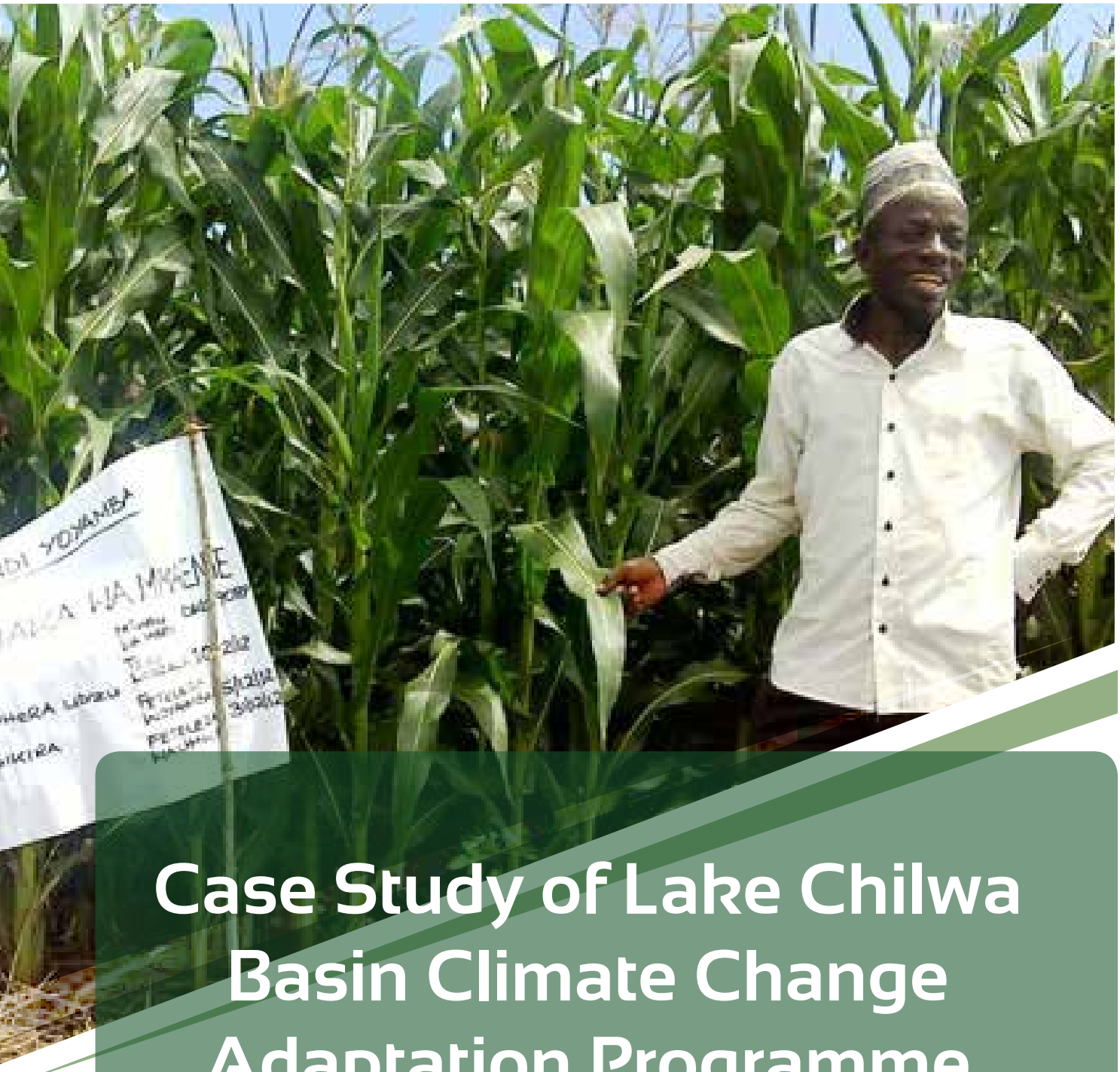
DISAPPOINTMENTS

PROJECT COORDINATION TEAM

M. BAMALI Didier
Ministry of Environment

Ms. SANVEE Ayaba
Ministry of Agriculture

M. TCHABORE Hatimi
Ministry of Water



Case Study of Lake Chilwa Basin Climate Change Adaptation Programme

BY
WELTON PHALIRA AND SOSTEN CHIOTHA

CASE STUDY OF LAKE CHILWA BASIN CLIMATE CHANGE ADAPTATION PROGRAMME

THE PROBLEM: WHAT RISKS HAVE BEEN ADDRESSED?

- Soil erosion
- Fish population depletion,
- Low agricultural production
- Low adaptive capacity to the impacts of climate change (e.g. floods and drought)

THE OBJECTIVE

- To strengthen the social and ecological resilience of the Lake Chilwa Basin to the impacts of climate change and variability

CASE STUDY OF LAKE CHILWA BASIN CLIMATE CHANGE ADAPTATION PROGRAMME

METHODOLOGY & IMPLEMENTATION

1. ***What approaches were involved in the EbA project?***
   - » Hotspots approach
   - » Participatory adaptive research
   - » Capacity development
   - » Collaboration and networking
   - » Communication and outreach
   - » Stakeholder engagement

2. ***What risk did this approach address?***
   - » Collaboration and networking: inadequate collaboration, learning and sharing amongst stakeholders
   - » Stakeholder engagement: ownership, sustainability and immediate social and economic needs.

3. ***In which time of the year was this approached applied?***
   - » Hotspots approach: at start of project (reviewed annually).
   - » The others: throughout the year since Programme inception in 2010. Adaptive measures also reviewed annually.

4. ***Who were the target groups of the project?***
   - » Local communities (mainly smallholder farmers) in the selected hotspots
   - » Local and district institutions dealing in environment and natural resources management
   - » Partner institutions that were tasked to deliver essential services to the communities

5. ***Who were the key stakeholders of the project and what methods were used to involve them?***
   - » Community groups (agricultural production and marketing, environment and natural resources management)
   - » District councils
   - » Government ministries and Departments
   - » Nongovernmental organizations
   - » National and international researchers

6. ***What methods were used to involve them?***
   - » Consultative meetings and workshops
   - » Joint planning and implementation
   - » Knowledge and information sharing forums (discussion forums, conferences)
   - » Exchange visits
   - » Press releases
   - » Publications
   - » Community radio programmes

7. ***What is the replication potential of the project?***
   - » Huge potential for replication and up-scaling
   - » Piloted initiatives are currently being scaled up and out systematically
   - » Most fishers and smallholder farmers now realised the vulnerability of the Lake Chilwa ecosystem to climate change and variability

CASE STUDY OF LAKE CHILWA BASIN CLIMATE CHANGE ADAPTATION PROGRAMME

THE SOLUTION: WHERE DID THE ACTION TAKE PLACE AND WHAT WAS DONE?

Where did the action take place?

10 selected hotspots in the Lake Chilwa Basin covering the three districts of Machinga, Phalombe and Zomba, Southern Malawi.

CASE STUDY OF LAKE CHILWA BASIN CLIMATE CHANGE ADAPTATION PROGRAMME

THE SOLUTION: WHERE DID THE ACTION TAKE PLACE AND WHAT WAS DONE?

WHAT ACTIONS WERE TAKEN?

- Organisation and training of individuals, groups and institutions;
- Promoting the adoption of drought tolerant crops, conservation agriculture, livestock production and forestry conservation and rehabilitation;
- Promoting the use alternative energy and fuel efficient technologies;
- Supporting smallholder farmers and fish trading groups with business knowledge, skills and resources;
- Rehabilitating infrastructure for weather and water monitoring and training personnel and local communities in data capture and management; and
- Establishing a community radio station for engaging stakeholders in the discourse of climate change mitigation and adaptation.

FOOD SECURITY

- Conservation Agriculture improved the yields of smallholder farmers from 0.5 MT to 1.25 MT per Ha, on average.
- At least 21,000 people (4,536 HHs) made food secure from baseline: 184,000 (40,000 HHs)
- Early maturing and drought resistant crop varieties helped farmers to escape hunger during lean, dry months.
- Capacity building initiatives provided farmers with the knowledge and skills to adopt food security enhancing adaptive practices.
- The small-livestock promotion component is a relatively new strategy that is envisaged to provide smallholder farmers with alternative sources of food (protein) and income in times of crop failure (which are typical in several parts of the basin).

CLIMATE ADAPTATION

- **Conservation** Agriculture improved soil structure, reduced soil erosion and improved soil fertility hence increasing the resilience and productivity of the soil system to drought, splash action and erosion.
- **Excess yields** from field crops, and improved gains from fish businesses provided farmers with back up resources for use in times of need, making them more resilient to the impacts of unpredictable rains and floods.
- **Weather** and water monitoring assisted stakeholders to take timely action towards supporting affected communities.

ECOSYSTEMS PRODUCTIVITY

- Ecosystem biodiversity has been restored (including the return of birds, insects, mushrooms and wild fruits) in some areas
- Water catchment and other fragile areas are now protected from human induced degradation while river banks have been rehabilitated.

CASE STUDY OF LAKE CHILWA BASIN CLIMATE CHANGE ADAPTATION PROGRAMME

THE BIG PICTURE

NUMBER OF PEOPLE WHO BENEFITED

- Over 1,000 people are now equipped with knowledge and skills in climate change adaptation.
- 834 smallholder farmers undertaking conservation agriculture on an estimated 145 hectares.
- 3,702 smallholder farmers supported with cassava and orange fleshed sweet potato vines that were planted on 73 hectares (production is est. 1,200 MT).

- 210 farm families supported with start-up livestock inputs in form of pigs (70 families) and poultry (140 families).
- Over 1.6 million trees planted in degraded and fragile areas including water catchments and river banks.
- 1,000 farm families supported with 12,000 fruit trees including grafted mangoes, avocado pears and citrus fruits.
- Over 100 programmes played on the national radio station

CASE STUDY OF LAKE CHILWA BASIN CLIMATE CHANGE ADAPTATION PROGRAMME

THE BIG PICTURE

NUMBER OF PEOPLE WHO BENEFITED

- 85 women benefitting from solar fish dryers and improved fish smoking.
- 698 households were supplied with cook stoves.
- 170 enterprising were provided start-up resources for value-addition of fish, rice, pigeon peas and chillies.
- 85 women fish traders produced at least 8 metric tons of fish registering a price increase of 170% from approximately US$2.86 to US$7.71 per kg of fish.
- Many crop and fish enterprise groups were linked to markets and banks.

EMERGING OPPORTUNITIES

- Bitumen road and a telecommunication centre project will boost marketing of produce and access to resources (including food)
- Community radio will improve communication and the discourse of climate change among a wide range of stakeholders
- Pilot initiatives being scaled up and out of the basin
- Farmers and fishers appreciate the extent of vulnerability of the fishery
- Fish is the most productive resource in the basin, and is also highly vulnerable
- Robust awareness and capacity building is likely to enhance uptake of tested adaptive options

CASE STUDY OF LAKE CHILWA BASIN CLIMATE CHANGE ADAPTATION PROGRAMME

THE BIG PICTURE

HOW DID THE PROJECT ADDRESSED SUSTAINABILITY AND CROSS-CUTTING ISSUES/

- Stakeholder engagement in interventions
- Women empowerment through agribusiness and training
- Integrated and multiple approaches/activities (long term + short term benefits)

WHAT SHOULD BE CONSIDERED IN UP-SCALING ECOSYSTEM BASED APPROACHES?

- Strategic importance
- Relevance of the approaches chosen in relation to the issues being addressed
- Urgency of the problem to addressed versus the actions to be undertaken
- Side effects of the approaches (if any) on the social and ecological systems and how to address them
- Economic aspects and social and political acceptance of the approaches and initiatives

WHAT ARE THE CURRENT LIMITATIONS IN THE USE OF ECOSYSTEM APPROACHES

WHAT DO WE KNOW OF THE SCIENTIFIC BASIS OF THIS ECOSYSTEM-BASED APPROACH?

- Integrated management of natural ecosystems together with social systems presents the opportunity for mutual benefits between the two systems, which enhances sustainability and resilience to the impacts of climate change and variability.

WHAT ARE THE SCIENTIFIC LIMITATIONS?

- Understanding and demonstrating how adaptation functions and its wider implications for resilience.
- The need for continuous testing and learning (experiential) versus time and resource rigidity.

Soil Water Conservation Programs with Emphasis on Water Harvesting Technologies in Uganda

BY
DAMASCUS ONYANGO

SOIL WATER CONSERVATION PROGRAMS WITH EMPHASIS ON WATER HARVESTING TECHNOLOGIES IN UGANDA

THE PROBLEM: WHAT RISKS HAVE BEEN ADDRESSED?

- Climate risk is defined as the possibility of injury, damage to property, or financial loss owing to severe or extreme whether events, unusual seasonal variations such as floods, heat waves or drought or long term changes in climate or climate variability.
- Major climate risks in Eastern Uganda that exacerbate community and household vulnerability are heavy and erratic rainfall leading to landslides in hilly areas and floods in low-lying areas and droughts within the year and mid-season, affecting crop and livestock yields.

THE OBJECTIVE

- The overall objective of the Harnessing Ecosystem-based Approach for Food Security and Adaptation to climate change in Africa is to contribute to poverty alleviation in East Uganda by promoting enhanced efficiency of natural resource use, improved land and ecosystem productivity, and reduced vulnerability to extreme weather events.

METHODOLOGY & IMPLEMENTATION

- **What ecosystem approaches were adopted to implement project activities?**
  The approach utilized was soil water conservation programs with an emphasis on water harvesting technologies.
- **What risks did this approach address?**
  Risks included: damage to crops and property, financial loss due to unusual seasonal variations, floods, heat waves or drought erratic rains and landslides in hilly areas.
- **In which time of the year was this approached applied?**
  The Eastern Region has two major seasons; early March to May which is characterized by torrential rains, floods storms and August to November which is normally a short-long dry spell.
- **Who were the target groups of the project?**
  Community, farmer groups, youth groups, agro processors, fish farmers schools and institutions.
- **Who were the key stakeholders of the project and what methods were used to involve them?**
  District leaders, special interest groups, e.g. religious organizations local or National NGOs Through: Dialogues on policy, Information sharing, Consensus building, Decision-making, and Implementation of practical solutions
- **What is the replication potential of the project?**
  The replication and potential of this project will depend on the nature and similarity of the problems involved and the demand and involvement of local people and stakeholder and farming methods acquired.

THE SOLUTION: WHERE DID THE ACTION TAKE PLACE AND WHAT WAS DONE?

The following activities have been implemented in Tororo and neighboring districts:

- **Fish farming in ponds**
  Two ponds of 900 square meters were completed to provide for income-generating projects and enhance food production in Eastern Uganda is greatly strengthened nutrition. They were completed with support from the American embassy in the form of a small grant.
- **Rain water harvesting projects**
  This is intended to make available hybrid technologies adequate for catchment, harvesting and storage of water for small-scale producers through module systematization. These will allow for efficient management of the resource by storing water in the periods when there is surplus for subsequent use in times of water deficit.

SOIL WATER CONSERVATION PROGRAMS WITH EMPHASIS ON WATER HARVESTING TECHNOLOGIES IN UGANDA

HOW DID THIS ECOSYSTEM APPROACH ADDRESS & ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?

- **Crop selection:** Early planting, Crop rotation and Intercropping
- **Soil management:** Appropriate tillage, and Application of organic manure and fertilizers
- **Contour farming:** Contour ridging, Thresh lines, and Grass barrier strips
- **Agro forestry**
- **Ecosystem productivity** is greatly increased by making water accessible to crops, animals, and human beings for physical social and economic benefits which include:
  Increased production, Agro-processing industries, Trade, Fish farming, Improved social services, and Transport.

THE BIG PICTURE

- **Number of people who benefited**
  Baseline analysis extract: district population 468,106, number of household 85,477, land size 1,211 square kilometers. The number of people who benefited were 2,040 after intervention.
- **Emerging opportunities**
  Economic access to sufficient food, Increased irrigated areas and cropping, Agro-processing industries, aquaculture and improved social services.
- **Replication and up-scaling potential**
  This will depend on the success of the original project, the nature and similarity of the problem, the demand and involvement of stakeholders to build resilience and improve livelihoods overall, and the scalability of lessons learnt.
- **How did the project address sustainability and cross-cutting issues?**
  Capacity building: institutional strengthening, enacting legislation, regulations, awareness and development of mitigation actions and adaptation to climate change.
- **What should be considered in upscaling ecosystem based approaches?**
  Traditional knowledge regarding social and cultural benefits and conservation of biodiversity

WHAT ARE THE CURRENT LIMITATIONS IN THE USE OF ECOSYSTEM APPROACHES?

1. *What do we know of the scientific bases of this ecosystem-based approach?*

- Scientific technological advances are providing tools and opportunities to enable more effective adaption to climate variability and change.
- There is also scientific evidence that suggests that climate is changing and the human activities are exercabeting natural changes which will have a significance impact on ecosystems and physical systems linked to human actions.

2. *What are the scientific limitations?*

- A major difficulty for ecosystem adaptation is the need to analyze simultaneously the multidimensional issues of time and space.
- Normally, a few components are considered whereas ecosystem structure, function, and change with time result from the interactions of many interconnected factors.
- A major challenge for ecosystem science therefore is to evaluate and understand the integrated effect.
- Other factors: Lack of scientific information, Inadequate capacity by community to adapt to technological advances, Limited capacity building, Science and technological development, and Lack of good governance

SOIL WATER CONSERVATION PROGRAMS WITH EMPHASIS ON WATER HARVESTING TECHNOLOGIES IN UGANDA

A forestation by the local community Paya sub county

Yams growing in swampy area in Hisega in Butaleja Sub county

SOIL WATER CONSERVATION PROGRAMS WITH EMPHASIS ON WATER HARVESTING TECHNOLOGIES IN UGANDA

Organic farming using good agricultural cultural practice

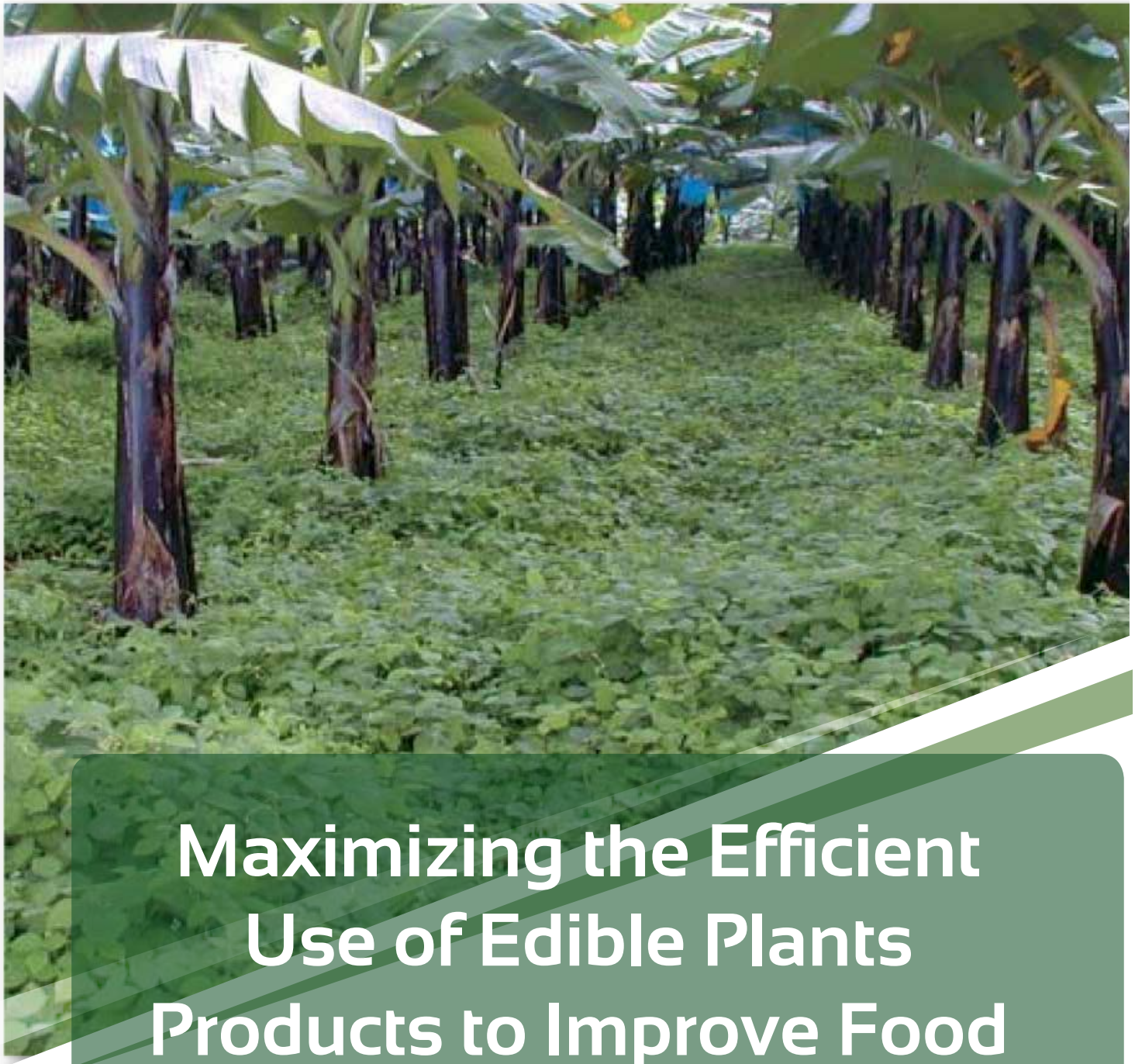
Organic farming using good agricultural cultural practice

SOIL WATER CONSERVATION PROGRAMS WITH EMPHASIS ON WATER HARVESTING TECHNOLOGIES IN UGANDA

Outlet for animals to drink water

Water reservoir under construction

Drainage channel in a banana plantation



Maximizing the Efficient Use of Edible Plants Products to Improve Food Security in Ivory Coast

BY
KOYA NATOUEU

MAXIMIZING THE EFFICIENT USE OF EDIBLE PLANTS PRODUCTS TO IMPROVE FOOD SECURITY IN IVORY COAST

THE PROBLEM: WHAT RISKS HAVE BEEN ADDRESSED?

- Dredging of sand in an area of mangroves lagoon
- Ineffective use of edible products

THE OBJECTIVE

- To maximize the efficient use of edible plants, products, and sub-products of an ecosystem to improve food security, enhance adaptation to climate changes, and encourage the development of ecosystems.
- Special case of banana

  We illustrate our practical case with banana production while noting that many edible plants sub-products should not be wasted, exploited or inappropriately valued as in the case of the banana.
- This will effectively solve the problem of global agricultural waste (50% of biodegradable waste, 45% loss of food products from wholesalers to retailer - a major cause of poverty) by optimizing the use of agricultural resources worldwide.

MAXIMIZING THE EFFICIENT USE OF EDIBLE PLANTS PRODUCTS TO IMPROVE FOOD SECURITY IN IVORY COAST

METHODOLOGY & IMPLEMENTATION

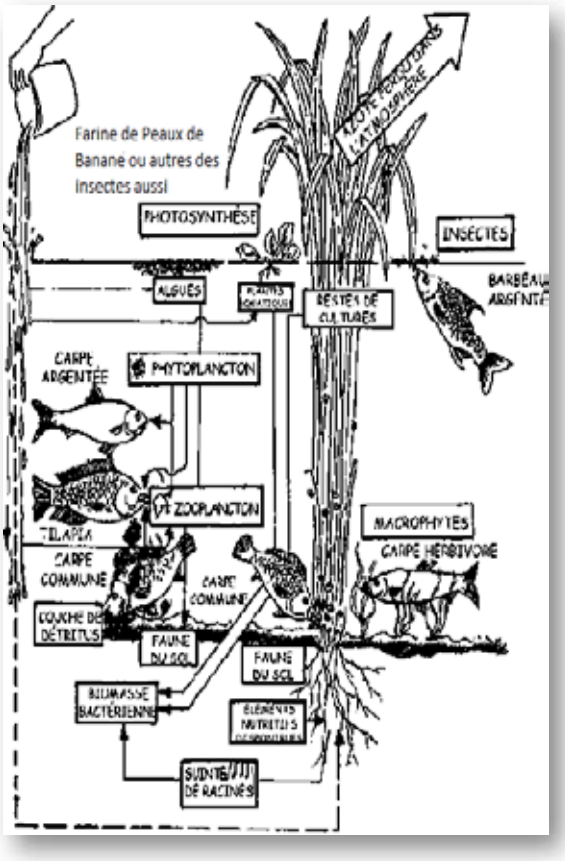
- **Use of the ecosystem to plant bananas.**
- **Using banana to fight against the erosion of the riverbanks.**

- Selling bananas in only a few areas of the country (Ivory Coast) coupled with rubber and cocoa exploitation, push people to abandon food crops.
- Collecting the bananas peels to make banana flour to reduce garbage in the landfills and biogas (greenhouse gas emissions). Use this flour as food supplements for humans, livestock, wildlife and the flora of the drained mangrove (for example).
- This will preserve the ecosystem of the mangroves and save the endangered edible flora and fauna (fish, etc.) of this ecosystem, nutrient intake may also come from other types of flours and even termites .
- This nutrient intake must be controlled to prevent the eutrophication of the lagoon.
- Feeding insects especially termites with flour of banana peels around termites territory. This process during rainfall may produce edible termites to feed people.
- What ecosystem approaches were adopted to implement project activities?

  The approach aims to:

  * Provide food to the wildlife and the flora of mangrove lagoon; and
  * Provide food to termites and insects living around the bananas, taro, yam, sweet potato, cassava and mango sites.

MAXIMIZING THE EFFICIENT USE OF EDIBLE PLANTS PRODUCTS TO IMPROVE FOOD SECURITY IN IVORY COAST



METHODOLOGY & IMPLEMENTATION

» The mangrove ecosystem is characterized by very specific ecological conditions:- Highly variable depending on the salinity freshwater inputs (precipitation, rivers ...)- Water low in oxygen (anoxia due to a very high bacterial activity)- A soft substrate, unstable (composed of sediments from rivers, streams ...)- Alternating shoreline exposure/ flooding due to the ebb and flow of tides, resulting in extended periods of desiccation and immersion.

WHAT ARE THE DANGERS AVOIDED BY THIS APPROACH?

» The risk that the fauna and flora of the mangrove lagoon is destroyed;

» The risks associated with the destruction of beneficial fertilization of land essential for growth of edible plants and insect colonies;

» Risks related to the release of biogas (containing greenhouse gas emissions) from the decomposition in landfills, of edible plants peels;

» The risks associated with the erosion of the riverbanks that could cause the loss of their ecosystems.

PERIOD OF THE YEAR CHOSEN:

» In the period from April 2012 to January 2013

WHO WERE THE TARGET GROUPS OF THE PROJECT?

» The banana growers (yams, taro, potato, mango, cassava);• Populations in areas where rubber and palm oil are produced at the expense of food crops;• Unskilled and unemployed young men and women from rural areas; and• The populations living near banana plantations sites and mangrove sites, feeding on the flora and fauna of the sites.

WHO WERE THE KEY ACTORS OF THE PROJECT AND WHAT METHODS WERE USED TO INVOLVE THEM?

» The Non-Governmental Organization for Ivorian Engineering Sciences Practices Japanese Adapted Development of Africa (GISP'JADA), which is an NGO for environment, sustainable development and the fight against poverty. I am the Executive President. These projects involved both following structures as well:

» Engineers and environmentalists qualiticians students of the Institute of Technologies Abidjan (ITA) and;

» The Non Governmental Organization "Better Living", whose objective is the fight against poverty by encouraging the emergence and development of the cooperatives in foodstuffs and assist them in the sell of the foodstuffs at the national level and internationally.

WHAT IS THE REPLICATION POTENTIAL OF THE PROJECT?

» The project can be replicate easily especially because the raw material needed for the project is readily available, for the majority of plants, almost all the year.

MAXIMIZING THE EFFICIENT USE OF EDIBLE PLANTS PRODUCTS TO IMPROVE FOOD SECURITY IN IVORY COAST

THE SOLUTION: LOCALIZATION & ACTIONS

- Because of the drainage (uncontrolled and harmful) of the mangrove bed, it supplies food in a natural way, to the aquatic fauna and flora;
- To boost the cultivation of edible plants, it was necessary to allow to feed insects with flour of edible plants peels, especially those of bananas by mixing many flours from the peels of plant products, and thus fertilize their land by providing food to insects;
- For landfills, to reduce the production of greenhouse gas emissions. The skin were valued after their collections in markets, links small businesses and households with small pickers of garbage; and
- To stop riverbank erosion, it was necessary to use banana plants along the riverbanks to mitigate or prevent the erosion process.

HOW DOES THIS ECOSYSTEM APPROACH ADDRESS AND ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?

FOOD SECURITY

- In areas where the supply of food crops are neglected for rubberwood cultures;
- The increase of edible aquatic mangrove resources exploited by fishermen and traders in the villages of Dabou, Jacqueville ... Whose livelihoods are dependent on fishing and
- The supply of useful soil-fertilizing insects such as termites. Spread on the ground, around the mounds and all arable land flours of edible plants peels during the rainy season to produce edible termites that are sold in the markets.

ADAPTATION TO CLIMATE CHANGES

- We have reduced greenhouse gas emissions. These gases come from the decomposition of the edible plants peels if these banana skins were dumped in garbage dumps and
- We have contributed to the fight against the erosion of riverbanks by planting of banana plants along the riverbanks.

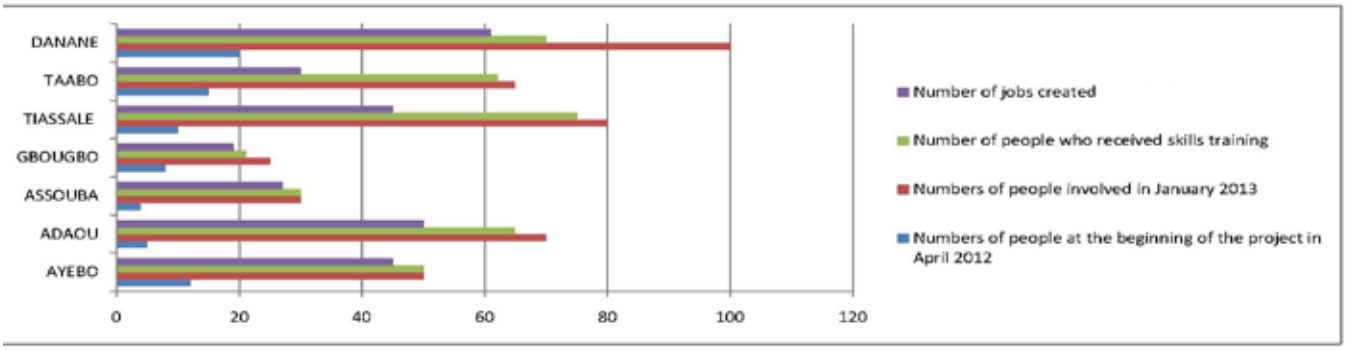
CONTRIBUTION TO FOOD PRODUCTIVITY

- Preservation and Development of the fauna and flora of the mangrove by providing nutrients to plants, in a controlled manner, to prevent the eutrophication;
- Farming of useful soil fertilizing termites, fed with flour banana peels soil. Plus, the availability of edible termites during the rainy season; and
- Resistance of the riverbanks of due to the banana plants to preserve their ecosystems.

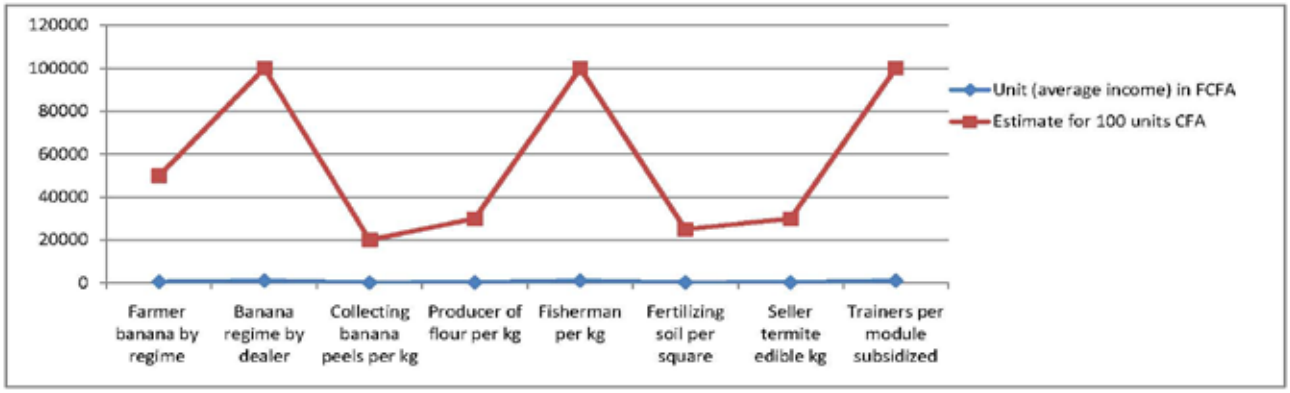
MAXIMIZING THE EFFICIENT USE OF EDIBLE PLANTS PRODUCTS TO IMPROVE FOOD SECURITY IN IVORY COAST

NUMBER OF PEOPLE WHO BENEFITED

Villages	Numbers of people at the beginning of the project in April 2012	Numbers of people involved in January 2013	Number of people who received skills training	Number of jobs created
AYEBO	12	50	50	45
ADAOU	5	70	65	50
ASSOUBA	4	30	30	27
GBOUGBO	8	25	21	19
TIASSALE	10	80	75	45
TAABO	15	65	62	30
DANANE	20	100	70	61
Total	**74**	**420**	**373**	**277**



Types of jobs per unit	Unit (average income) in FCFA	Estimate for 100 units CFA
Farmer banana by regime	500	50000
Banana regime by dealer	1000	100000
Collecting banana peels per kg	200	20000
Producer of flour per kg	300	30000
Fisherman per kg	1000	100000
Fertilizing soil per square	250	25000
Seller termite edible kg	300	30000
Trainers per module subsidized	1000	100000



MAXIMIZING THE EFFICIENT USE OF EDIBLE PLANTS PRODUCTS TO IMPROVE FOOD SECURITY IN IVORY COAST

RECOMMENDATIONS

EMERGING OPPORTUNITIES

- Exploit the great opportunities offered by the peels of taro, yam, sweet potato, cassava and mango ...
-

REPLICATION AND UP-SCALING POTENTIAL

- This project has a strong potential for replication with the possibility of a very good scalability. If the project works as a well-organized company, based on standards of good governance, the company will employ young men and women throughout the country.

MAIN RESULTS

HOW DID THE PROJECT ADDRESSED SUSTAINABILITY AND CROSS-CUTTING ISSUES?

- • By providing nutrients to the fauna and flora of the lagoon;
- • By providing nutrients to termites and insects;
- • By providing food crops to people in rural areas who have neglected foodstuff to cultivate rubberwood and palm trees;
- • Ensuring decent and sustainable jobs for young women and men;
- • This Project includes the valuation of garbage, fishing, food, employment, agriculture, safeguarding the environment, education, scientific researches

WHAT SHOULD BE CONSIDERED IN UP-SCALING ECOSYSTEM BASED APPROACHES?

- The study of development and soil fertilization by insects and microflora farmland through agricultural sub-products that are destined to go to waste;
- Further analysis in the laboratory to identify all the components of flours form sub products of edible plants to cleanse them of all possible harmful substances;
- Physical and financial resources to effectively operationalize all areas of the project;
- Strengthening the capacity of project sponsors;
- Creating real green jobs, meaning they are decent because of the industrialization and standardization of chain-manufactured products
- Developing new markets;
- Contributing to an interest in studies and development of other parts of edible plants, growing the concept of 'build with nature';
- Conduct studies to packaging techniques and nutrient enrichment of its flours.

WHAT ARE THE CONCLUSIONS IN THE USE OF ECOSYSTEM APPROACHES?

WHAT DO WE KNOW OF THE SCIENTIFIC BASES OF THIS ECOSYSTEM BASED APPROACH?

- Non-edible parts of the banana can be used to make animal food and, compost, or, crafts from banana fiber, such as hats, bags and purses. Banana plays an important role in the field of health, food security and is a source of income;
- Duration of degradation of a banana peel is 8 to 10 months. Reduced into flour, this degradation time is reduced to almost less than two days to become simple elements;
- In fact, you should know that 15-20% of the production of the agricultural sector are not used;
- Do not peel the tubers as their skins are rich in nutrients for many of them;
- "Macrotermes falciger" (edible termites) are rich in protein.

MAXIMIZING THE EFFICIENT USE OF EDIBLE PLANTS PRODUCTS TO IMPROVE FOOD SECURITY IN IVORY COAST

WHAT ARE THE CURRENT LIMITATIONS IN THE USE OF ECOSYSTEM APPROACHES?

WHAT ARE THE SCIENTIFIC LIMITATIONS?

- The lack of recent data on the annual amount of national banana peels and the other edible agricultural products and products listed above;
- The changes in climatic periods that disrupt the cycles of production of food crops;
- Detail on the opportunities offered by its various sub-products for future scientific studies ecological systems;
- The lack of analysis equipments to follow the insects species in their natural environments and
- The lack of materials to see the extent of damages on different areas of drainage sand of lagoon bottom in Abidjan.

Fish and Crab Farming in Mozambique

BY
BY MANUEL MENOMUSSANGA

FISH AND CRAB FARMING IN MOZAMBIQUE

THE PROBLEM: WHAT RISKS HAVE BEEN ADDRESSED?

- **Influence of floods and droughts** affecting key livelihood activities for the community including rain-fed agriculture, fishing and traditional livestock rearing.
- **Destruction of extensive patches of mangrove** during the 2000 floods, over exploration, and very pour regeneration.
- **Decline in local fishery** and low yelds in agricultural production.

THE OBJECTIVE

Overall goal

- To contribute to the reduction of vulnerability by enhancing the adaptive capacity to local communities.

Three specific objectives:

- **Objective 1:** To raise awareness on climate change and its impacts in the community and on all stakeholders;
- **Objective 2:** To introduce ecosystem-based sustainable natural resource use practices; implemented as adaptation measures to climate change (demonstration activities); and
- **Objective 3:** To incorporate lessons learnt from the project implementation in District planning processes.

METHODOLOGY & IMPLEMENTATION

- Ecosystem-based adaptation approaches such as fish farming, crab farming, and mangrove reforestation were used to address floods, droughts and mangrove degradation;
- Literature review, workshops, capacity building, trainings and field work were adopted to implement project activities and these activities were carried out throughout the year, some of them were more concentrated in summer and others in winter months;
- The main targets of the project were small, local communities who are the most vulnerable to climate change (Local and traditional leaders, fishers and farmers);
- The major stakeholders were local leaders, chiefs, extension agents working in the area and local Government (Departments of Agriculture, Forestry and Fishery);
- Their involvement was concentrated in the early stages through consultations regarding the project and through participation in all proposed demonstration activities, including meetings and workshops and
- The replicability potential of the project is very high as it addresses food security issues, on which livelihoods depend, and as such local actors carry the potential of replicating similar projects on their own.

Community members (fishers and farmers)

METHODOLOGY & IMPLEMENTATION

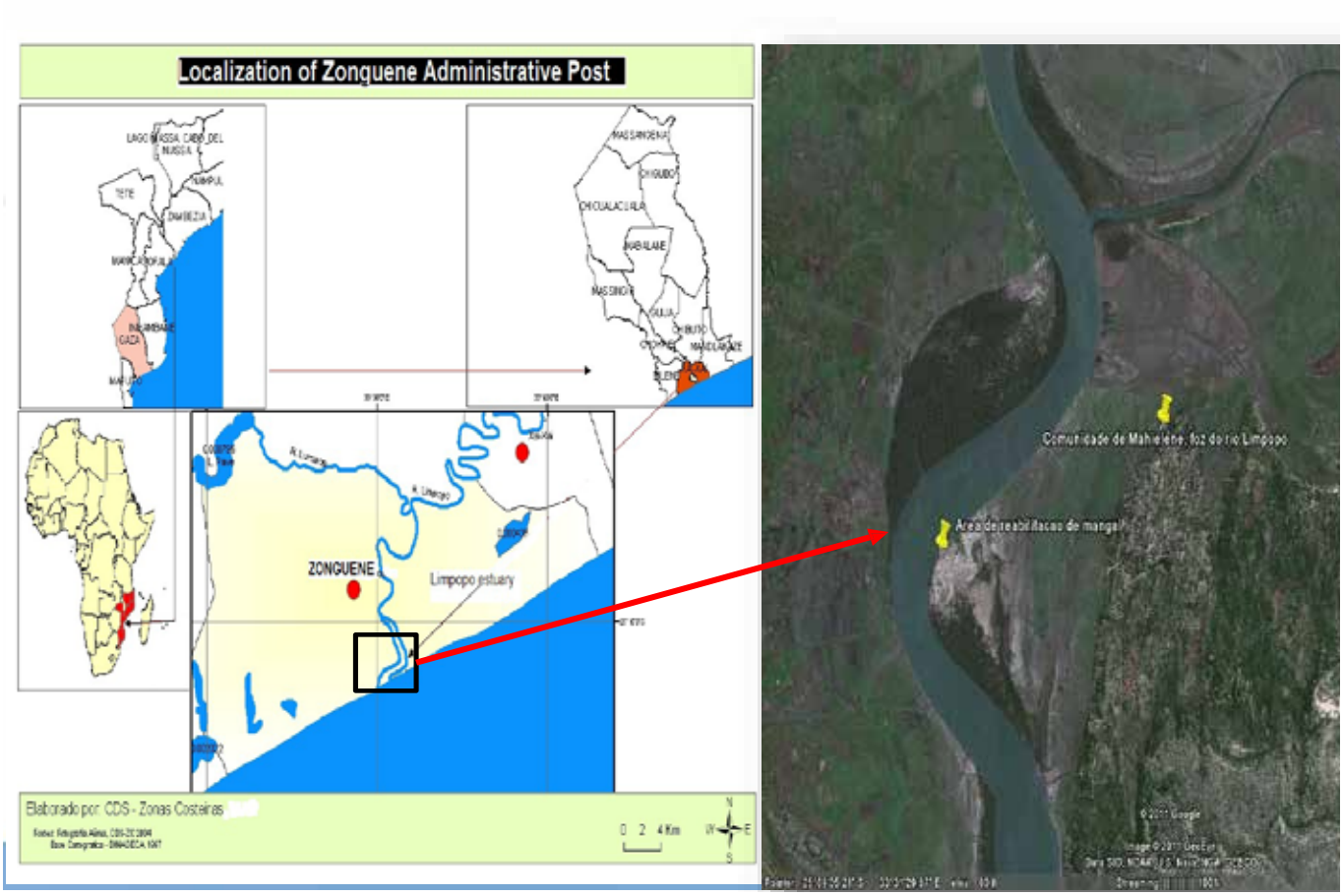
Local/traditional community leaders

Target group: Local communities (Local traditional/ community leaders, fishers and farmers).

Methods of involvement: Meetings, Workshops, capacity building, participation in project activities

WHERE DID THE ACTION TAKE PLACE?

The project is being implemented in Zongoene, south of Xai-Xai District, Gaza province, along the lower Limpopo, where the river empties into the Indian Ocean via an extended estuary.



FISH AND CRAB FARMING IN MOZAMBIQUE

THE SOLUTION: WHAT WAS DONE ?

HOW DID THIS ECOSYSTEM APPROACH ADDRESS & ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?

- Ecosystem-based adaptation approaches such as fish farming, crab farming, and mangrove reforestation were used to address food insecurity, climate adaptation and ecosystem productivity;
- Community-based and community-led interventions helped enhance adaptive capacity, resulting in the establishment of fish ponds, crab growth cages and mangrove nurseries;
- Mangroves now provide a nursery area for many important edible marine species like fish, crabs and shrimp, reforestation of mangroves ensures the continued productivity of this ecosystem;
- The introduction of crab farming is also having the effect of reducing the deforestation pressure on mangroves at the local level and creating demand for mangrove nurseries and restoration activities that provide yet another alternative economic activity and
- Fishery productivity and yield have increased, contributing to enhanced food security.

FISH AND CRAB FARMING IN MOZAMBIQUE

ENHANCING CLIMATE ADAPTATION

These community-based and community-led interventions helped enhance adaptive capacity, resulting in the establishment of fish ponds, crab growth cages and mangrove nursery


Mangrove nursery


Fish ponds


Crab growth cages

Families that once could only rely on sea fishing for a significant part of their diet are now involved in sustainable fish and crab farming and are raising enough food to sell a surplus in the market. The income is used to purchase food that fills other dietary requirements and other goods for the households, ensuring food security and increasing the resilience of local communities to climate change.


Establishment of fish Ponds: About 60 community members participated in the process, providing seasonal labor for the household members involved

FISH AND CRAB FARMING IN MOZAMBIQUE

ENHANCING FOOD SECURITY

Families that once were solely dependent on fishing activity at the sea are now involved in fish farming and they are getting enough for consumption and also selling the harvest.

Reception of fingerlings for restocking the ponds/December 2012

Local fishermen feeding the fish in the pond

FISH AND CRAB FARMING IN MOZAMBIQUE

ENHANCING FOOD SECURITY

Fish from the ponds, ready to be sold in local markets

Fish farmer selling the fish at the local market

ENHANCING FOOD SECURITY:

QUANTITY OF FISH PRODUCED AND IMPACT ON LOCAL INCOME

Quantity of fish produced in fish ponds from March to September 2012

Table 1 – Quantity of fish produced in fish ponds from March to September 2012

Fish farming	
Number of pond	Yield per pond (Kg/pond/6 months) – From March to September 2012
1	266 Kg
2	250 Kg
3	279 Kg
4	271 Kg
Total (4 ponds)	**1.066 Kg**

Table 2 - Impact of fish farming on local income

Fish farming			
Destination of the product (Fish)	Number of Kg	Price/Kg of fish	Total income (Metical)
Consumption	300 Kg	-	-
Sale	766 Kg	100.00 Mt	**76,600.00** Mt (equivalent to **2.641** USD)

The income is used to purchase food that fills other dietary requirements and other goods for the households, ensuring food security and increasing the resilience of local communities to climate change.

ENHANCING FOOD SECURITY

Crab farming			
Number of cage	Yield per cage (Kg/cage/month) – From March 2012	Price/Kg of cab	Total income (Metical)
1	1Kg	75.00 Mt	75.00 Mt
Total (84 cages)	84 Kg	75.00 Mt	**6,300.00** Mt (equivalent to **217** USD)

- Income is used to purchase food that fills other dietary requirements and other goods for the households, ensuring food security and increasing the resilience of local communities to climate change.
- The introduction of crab farming is also having the effect of reducing the deforestation pressure on mangroves at the local level and creating demand for mangrove nurseries and restoration activities that provide yet another alternative economic activity.

ENHANCING ECOSYSTEM PRODUCTIVITY

- Mangroves provide a nursery area for many important edible marine species like fish, crabs and shrimp, reforestation of mangroves ensures the continued productivity of this ecosystem.

FISH AND CRAB FARMING IN MOZAMBIQUE

ENHANCING ECOSYSTEM PRODUCTIVITY

REHABILITATION OF IRRIGATION CHANNELS SILTED DURING THE FLOODS OF 2000

USING MACHINES FOR OPENING THE CHANNELS FOR MANGROVE AREA IRRIGATION

FISH AND CRAB FARMING IN MOZAMBIQUE

CONSTRUCTION OF A SMALL DAM TO REGULATE WATER FLOW TO MANGROVE AREA

COMMUNITY MEMBERS PARTICIPATING IN THE CONSTRUCTION OF SMALL DAM TO REGULATE WATER FLOW TO MANGROVE REFORESTATION AREA

FISH AND CRAB FARMING IN MOZAMBIQUE

ENHANCING ECOSYSTEM PRODUCTIVITY

COMMUNITY MEMBERS PARTICIPATING IN THE CONSTRUCTION OF SMALL DAM TO REGULATE WATER FLOW TO MANGROVE REFORESTATION AREA

THE SITUATION AFTER THE INTERVENTION (WATER COMING IN THE REFORESTATION AREA) DEGRADED AREA READY FOR REFORESTATION

FISH AND CRAB FARMING IN MOZAMBIQUE

ENHANCING ECOSYSTEM PRODUCTIVITY

ESTABLISHMENT OF MANGROVE NURSERY: PEELING THE SEEDS

ESTABLISHMENT OF MANGROVE NURSERY: WATERING THE SEEDLINGS IN THE NURSERY

FISH AND CRAB FARMING IN MOZAMBIQUE

ENHANCING ECOSYSTEM PRODUCTIVITY

PLANTATION PROCESS: COMMUNITY PARTICIPATION IN MANGROVE PLANTATION

PLANTATION PROCESS: COMMUNITY PARTICIPATION IN MANGROVE PLANTATION

FISH AND CRAB FARMING IN MOZAMBIQUE

ENHANCING ECOSYSTEM PRODUCTIVITY (10 MONTHS LATER)

MANGROVE REFORESTATION IS ENABLING THE RECOVERY OF AREAS PREVIOUSLY OCUPIED BY THIS ECOSYSTEM.

REFORESTATED AREA (2 YEARS LATER)

REFORESTATION OF MANGROVES HAS ENSURED THE NORMAL FUNCTIONING OF THIS ECOSYSTEM, WHICH HAS IN TURN INCREASED FISHERY PRODUCTIVITY AND YIELD, ENSURING ENHANCED FOOD SECURITY

FISH AND CRAB FARMING IN MOZAMBIQUE

THE BIG PICTURE

- Zongoene has a total population of about 28.000 inhabitants of which 10.000 live in the project area where 3000 are fishers. Many households were experiencing an average of four to five months of food shortage every year, mainly affecting fishers.

- These community-based and community-led interventions helped enhance the adaptive capacity, resulting in the establishment of fish ponds and crab growth cages, directly benefiting 98 households (490 people) involved in the implementation of the activities:
    - 10 households in crab farming,
    - 20 households in fish farming and
    - 68 households in mangrove reforestation including 4 that are permanently involved in the mangrove nurseries.

- According to estimates, another 2000 people benefited from fish and crab for consumption and besides this, about 1500 community members, students and community leaders directly benefited from the project in terms of capacity building, skill development and a more profound awareness, which contributed to broaden local knowledge on climate change and adaptation and widen the livelihood strategies.

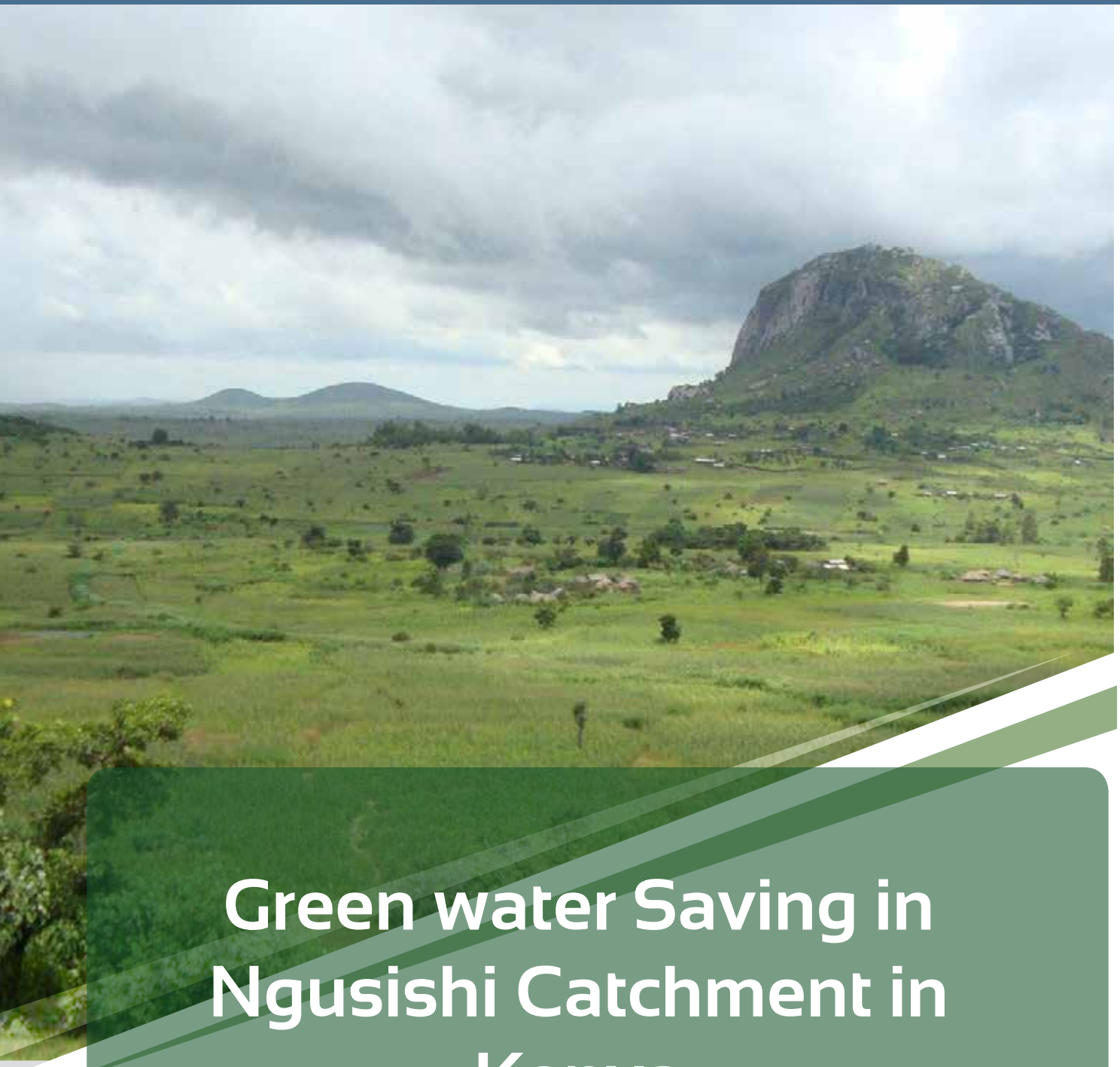
- About 6 trainings were provided including
    (i) Establishment of fish ponds and crab cages;
    (ii) Monitoring of fish ponds and crab cages;
    (iii) Establishment of mangrove nursery;
    (iv) Hydrological rehabilitation;
    (v) Mangrove seed harvesting and
    (vi) Mangrove plantation and monitoring of growth.

- About 10 ha of degraded mangrove were reforested.

- The project has facilitated opportunities for future intervention in several ways:
    - Bringing a new mindset in the local community and other partners. Many community members are showing great willingness to learn and adopt new strategies and develop fish and crab farming for their livelihood. Based on the experience of this project, the School of Marine and Coastal Sciences, from Eduardo Mondlane University, is implementing fish farming in the same area, for commercial purposes;
    - The involvement in different project activities such as trainings, capacity building, workshops and awareness, has forced various stakeholders to recognize the problems and the need for action and helped making climate change a priority area in local interventions;
    - Sharing data and information from survey findings among stakeholders on issues of climate change and variability, adapted technologies and best practices to adapt to the changing climate, has contributed to broaden local knowledge on climate change and adaptation and widen the livelihood strategies.

- The replication and up-scaling potential of the project is promising. Since fish and crab farming, including mangrove reforestation, addresses food security issues, it has a high potential for sustainability as local communities view it as a means to food insecurity in the face of climate change.

- The project also addressed sustainability by introducing new innovative methods and technologies for livelihood diversification. The activities introduced do not distinguish between men and women and are meant to benefit both gender groups on an equal basis. The involvement of women and youth organizations at different stages of the project made sure that women and youths were not neglected.

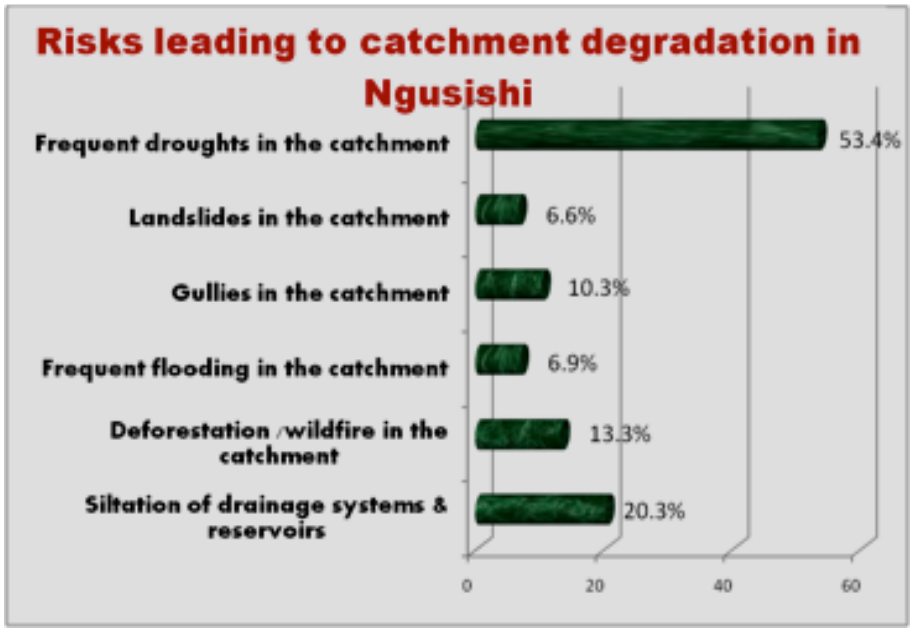


Green water Saving in Ngusishi Catchment in Kenya

BY
CHRIS SHISANYA

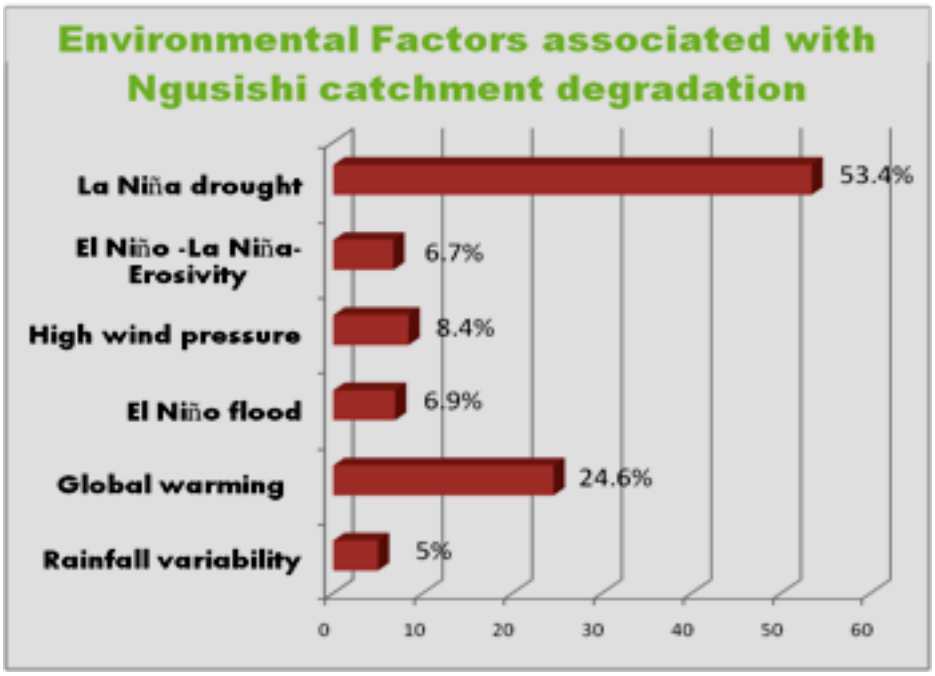
GREEN WATER SAVING IN NGUSISHI CATCHMENT IN KENYA

THE PROBLEM: WHAT RISKS HAVE BEEN ADDRESSED?



» Surface water depletion downstream due to global and micro climate change (Van Aalst, 2006)

» Deforestation which threatens surface water infiltration and groundwater storage



» Declining water quality which impacts ecological and biological systems living within the catchment area

MAIN CAUSE:

» Poor management of watershed resources leading to water stress for irrigation (Clarke & King, 2004)

GREEN WATER SAVING IN NGUSISHI CATCHMENT IN KENYA

THE OBJECTIVE

- To increase farmers' adaptation to climatic risks and impacts;
- To mitigate agricultural water vulnerability to climate change;
- To enhance farmers' cooperation in the management of their catchment; and
- To implement farmer-friendly Green Water Saving (GWS) schemes to ensure food security and farming livelihood in Ngusishi Catchment.

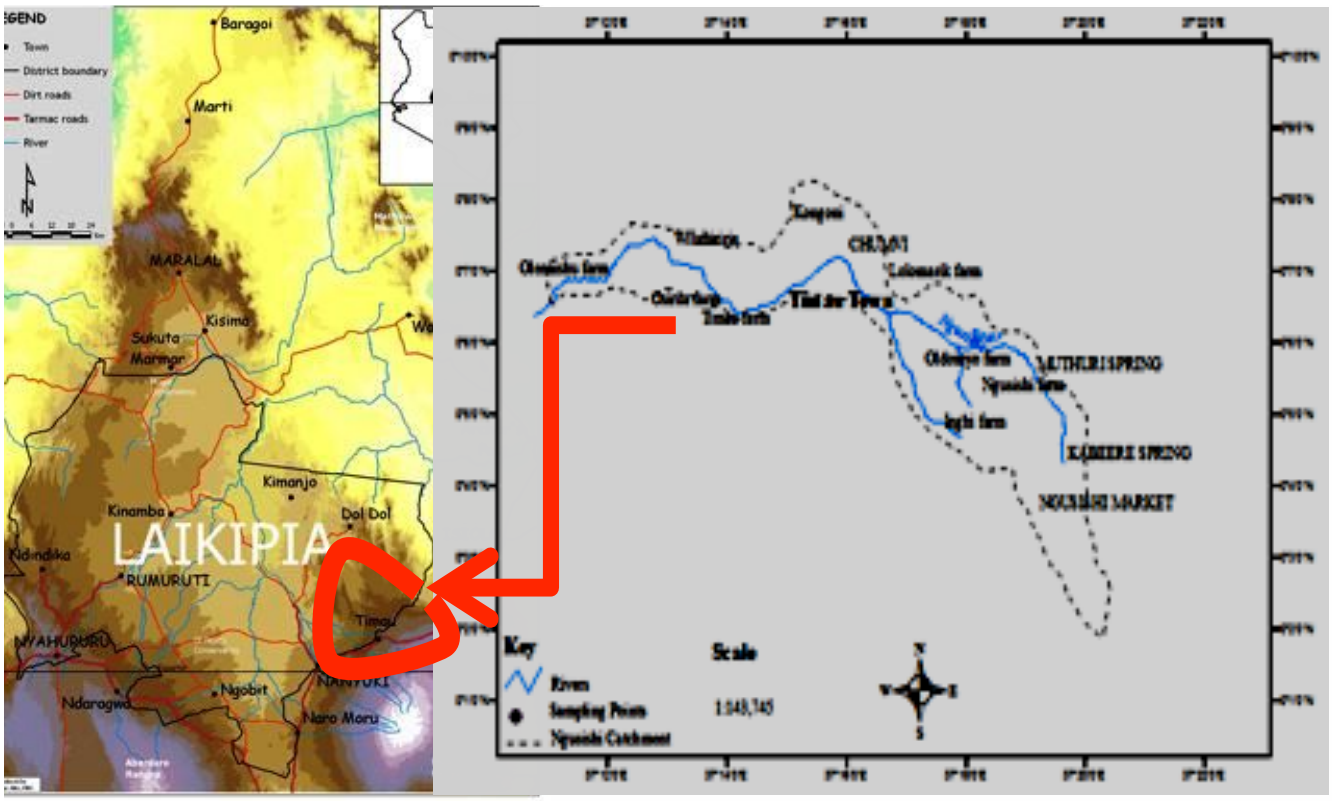
METHODOLOGY & IMPLEMENTATION

ECOSYSTEM APPROACH ADOPTED: PAYMENTS FOR ECOSYSTEM SERVICES (PES)

- The approach was to address issues of deforestation, water availability and quality
- It started in 1999 and is being applied throughout the year and currently within the mandate of Ngusishi WRUA
- Target groups include both upstream and downstream farmers
- Key stakeholders included horticultural farmers, livestock keepers, WRMA, and WRUA involved through public consultations (Chief's Barazas)
- The project is being replicated in the whole catchment, from Batian to Kongoni villages

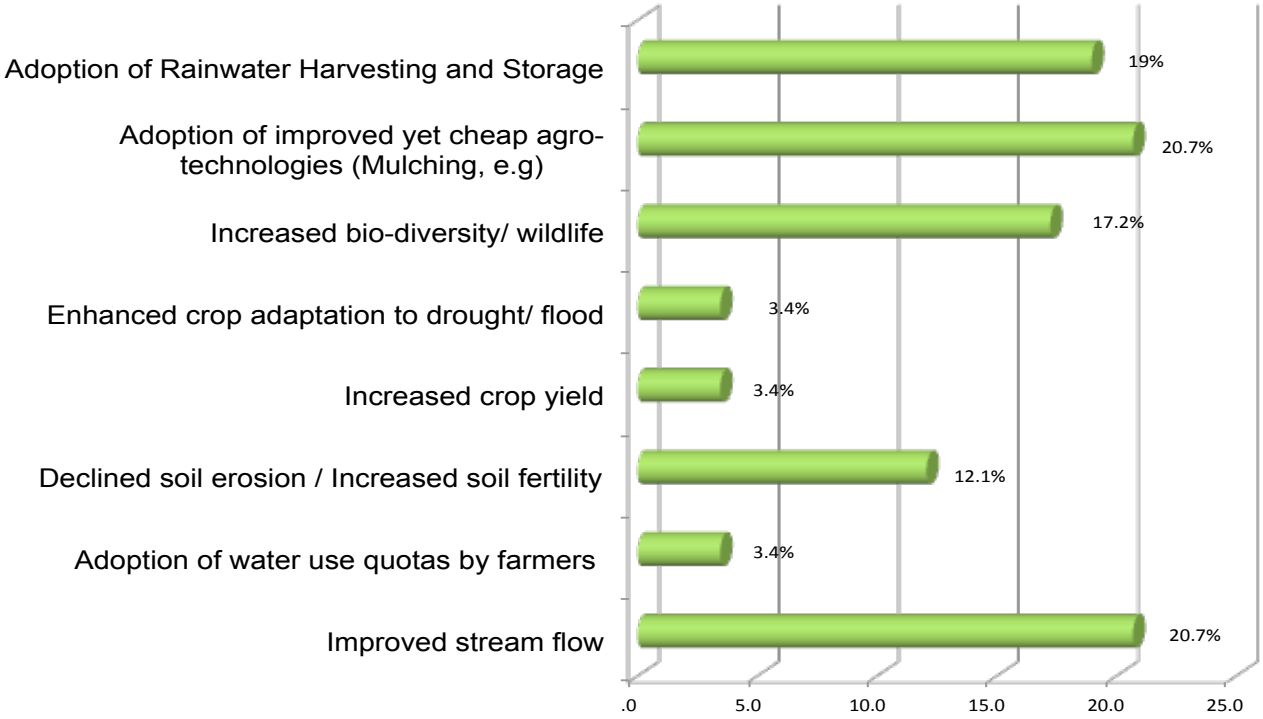
THE SOLUTION: WHERE DID THE ACTION TAKE PLACE AND WHAT WAS DONE?

The project covers the following areas: Batian, Chumvi, Kabubungi, Kabeere, Kongoni, Lobelia, Lucern, Muthuuri, Ole-Naishu, Siraji and Wiumiririe belonging to the Upper Highland Agro-Ecological Zone 3 (UH3-AEZ), mainly suitable for wheat-barley cropping (Jaetzold et al., 2007). Average altitude: 2280-2370 m; Average Annual Temperature: 13.5- 14.90C; and , Average Annual Rainfall of 850-950



GREEN WATER SAVING IN NGUSISHI CATCHMENT IN KENYA

HOW DID THIS ECOSYSTEM APPROACH ADDRESS & ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?



THE BIG PICTURE

- To increase farmers' adaptation to climatic risks and impacts;
- To mitigate agricultural water vulnerability to climate change;
- To enhance farmers' cooperation in the management of their catchment; and
- To implement farmer-friendly Green Water Saving (GWS) schemes to ensure food security and farming livelihood in Ngusishi Catchment.
- The following are to be considered in upscaling Green Water Saving Schemes:
  - Assessing bio-physical, social, political and economic impacts of the project on the catchment water, the people and their livelihood prior to implementation;
  - Putting in place an institution capable of managing the resources in a cost-efficient and effective manner; and
  - Ensuring the schemes' financial self-sufficiency in the long run by assessing local stakeholders' willingness to implement and fund schemes rather than relying on the government and other external budgets.

WHAT ARE THE CURRENT LIMITATIONS IN THE USE OF ECOSYSTEM APPROACHES?

- Green Water Saving evolves around Soil and Water Conservation (SWC), agro-technologies and hydro-policies that are strategically blended within "Payment for Ecosystem Services" (PES);
- They need the existence of a catchment management plan (for activities) and a compensation mechanism (for funding) by local stakeholders;
- Luwesi, Shisanya and Obando (2012) have established that the schemes are environmental and social friendly but economically inefficient and not feasible.

Introduction of Rainwater Harvesting and Utilization of Techniques Project in Bugesera District, Rwanda

BY
DISMAS KARURANGA

INTRODUCTION OF RAINWATER HARVESTING AND UTILIZATION OF TECHNIQUES PROJECT IN BUGESERA DISTRICT, RWANDA.

THE PROBLEM: WHAT RISKS HAVE BEEN ADDRESSED?

- Due to high population density in Rwanda (384 people/sqKm), high population growth (at 2.9%) and agriculture dependence for population in rural areas (90%), there is extreme pressure on limited land and ecosystems and the demand for arable land due to a lack of alternatives to agriculture for income generation;
- Thus, the project aimed at improving living conditions and food security of the targeted groups through the protection and sustainable management of natural resources (soil and water). In addition, the project contributed to reduction of pressure on limited land and ecosystems by promoting new techniques for rainwater harvesting for domestic and supplemental irrigation and also by promoting techniques for soil conservation and improvement of soil fertility.

THE OBJECTIVE

- Overall objective: To improve living conditions of the targeted groups through the protection and sustainable management of natural resources (e.g. soil and water for food security in the country).
- Specific Objectives:
  - To improve the agricultural production through the appropriate and low costs system of rainwater harvesting;
  - To increase soil productivity through efficient and sustainable management of natural resources;
  - To improve livelihoods of the population through the improvement of water availability for domestic use; and
  - To strengthen the capacities of the beneficiaries.

METHODOLOGY & IMPLEMENTATION

- The implementation of the project used a participatory approach by involving all stakeholders to serve their needs, access their inputs and secure their cooperation;
- Thus, a National Steering committee which included Government Institutions, Research Institutes and Universities, Private sector and NGO's was set up for the guidance and monitoring of all project activities;
- In addition, a Project Coordination Unit was established with the mandate to manage day to day project activities;
- The project started by June, 2007 and officially closed in 2011;
- The project targeted three districts in Rwanda (Bugesera, Rwamagana and Nyaruguru) threatened by drought and land degradation problems;
- Key stakeholders of the projects were Districts, Ministries and Agencies((agriculture, local government, natural resources), NGO's, Development Partners, and Privates Organizations; all of whom were represented in the Project Steering Committee;
- Now, the project is being upscaled throughout the country through the Ministry of Natural resources under Government Supervision.

THE SOLUTION: WHERE DID THE ACTION TAKE PLACE AND WHAT WAS DONE?

- The Action took place in Bugesera, Rwamagana and Nyaruguru districts in Rwanda.
- The project consisted of Promoting the techniques of rainwater harvesting by:
  - Constructing water tanks for 4 schools and public buildings;
  - Constructing roof water collection tanks for 20 families;
  - Constructing 10 farm ponds using a pre-sedimentation process;
  - Drilling of 10 wells for small irrigation;
  - Development of 100Ha for a small irrigation perimeter; and
  - Providing 100 pedal pumps.

INTRODUCTION OF RAINWATER HARVESTING AND UTILIZATION OF TECHNIQUES PROJECT IN BUGESERA DISTRICT, RWANDA.

THE SOLUTION: WHERE DID THE ACTION TAKE PLACE AND WHAT WAS DONE?

- Promoting the techniques of soil conservation and fertility improvement through:
  - Prioritizing fruits, oleaginous and food crops and 100Ha;
  - Providing agricultural inputs for the first agriculture season (which were paid back by agriculturalist after harvest); and
  - Grouping farmers in cooperative and sensitizing them to savings initatives (the funds founds collected from farmers were used to buy agriculture inputs for the following season)
- Strengthening capacity and technical support through:
  - Training 600 farms in RWH techniques and environment protection topics; and
  - Training and sensitizing technical staff through workshop, conferences and exchange field visits.

HOW DID THIS ECOSYSTEM APPROACH ADDRESS & ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?

- The approach addressed and enhanced food security,climate adaptation and ecosystem productivity through:
  - Awareness created in this project enabled the policy framework to support an effective system for environmental management and ecosystem conservation;
  - The availability of water in both the rainy and dry season and soil conservation methods enabled local populations to enhance their economic productivity by using natural resources in an environmentally friendly manner; and
  - Due to efficient water use and RWH, vulnerability to floods and droughts was reduced in the project area;
  - Encroachment to fragile soils and wetlands was reduced.

THE BIG PICTURE

- 4 schools, 20 families and about other 600 individuals benefited from this projects;
- During implementation of this project, demand was identified for irrigation, livestock watering, institutional facilities, and urban high density areas;
- This project involved researchers who are developing more programs in favor of RWH and many other government and non-government stakeholders and are engaged in RWH; and
- Committees were created, either as Farmer Field Schools Associations/Cooperatives or self-help-groups, for sustainability of the project.

Village of Rutete with plastic tanks for Rain Water Harvesting (left) and horticulture seedlings in nursery in Bugesera District (right)

INTRODUCTION OF RAINWATER HARVESTING AND UTILIZATION OF TECHNIQUES PROJECT IN BUGESERA DISTRICT, RWANDA.

ENHANCING FOOD SECURITY:

Transplanting of seedlings in a Nursery (left) and Garden and vegetables growing (cabbage) and small plastic tank (black) installed at a primary school (right)

Runoff harvesting pond (left), masonry tanks (middle) and vegetables of kitchen garden irrigated by water collected from the ferrocement tanks (left)

A plot of tomatoes growing, banana plot and a ferro-cement tank installed on a primary school.

INTRODUCTION OF RAINWATER HARVESTING AND UTILIZATION OF TECHNIQUES PROJECT IN BUGESERA DISTRICT, RWANDA.

WHAT ARE THE CURRENT LIMITATIONS IN THE USE OF ECOSYSTEM APPROACHES?

WHAT DO WE KNOW OF THE SCIENTIFIC BASIS OF THIS ECOSYSTEM-BASED APPROACH?

» Literature explains that Ecosystem management that uses an ecosystem-based approach to resource management can address the myriad challenges that arise from fragmented landscapes and diverse management strategies. In our view, an ecosystem management approach has five key elements. Ecosystem management:

1. Requires consideration of geographic areas defined by ecological boundaries and the perspectives provided by different spatial scales and longer time frames.
2. Requires managers to take into account the complexity of natural processes and social systems then use that understanding to craft management approaches that take advantage of these processes rather than work against them.
3. Incorporates an explicit definition of biological and social goals at both the national and local scales and elevates maintenance and restoration of ecological sustainability and ecosystem integrity as important goals.
4. Emphasizes collaborative decision making to deal with a landscape owned by many individuals and organizations with different values, interests, and capabilities.
5. Uses a process of adaptive management to account for the uncertainty inherent in our understanding of the future, and employs a wide range of strategies and policy tools.

» An ecosystem management approach can help to solve these issues which include:

- ◊ Ecological concerns including loss of biological diversity, invasion by exotic species, fragmentation of habitat and landscapes, and decline of key ecosystem processes. These changes have resulted in declines of species, such as the Coho salmon (Oncorhynchus kisutch) and the Scarlet macaw (Ara macao), as well as ecosystems, such as coastal mangroves throughout the tropics and the longleaf pine forest communities in the Southeastern United States.
- ◊ Economic difficulties due to declines in the effectiveness of ecosystem services including loss of economic capacity in forestry, agriculture and fisheries; lowered resilience to catastrophic change caused by fire or other disturbances; and loss of aesthetic value due to land-use patterns such as urban sprawl.
- ◊ Ineffective decision-making processes including top-down approaches that restrict creative strategies and undermine support by affected parties; adversarial processes that have led to excessive conflict and impasses; and narrow regulatory strategies that have failed to induce needed changes in behavior.
- ◊ Social concerns including the disassociation of people from the land and from each other, which has frayed the basic fabric of civility that holds communities together.

» Scientific limitations in the use of ecosystem approaches:

- ◊ The Ecosystem Approach places emphasis on the total natural resource base in an integrated, holistic manner that is neither spatially constrained nor easily linked to formal, traditional conservation organisations or agency structures.
- ◊ The integration of social and economic dimensions with ecology and natural resource management is still more conceptual than practically orientated.
- ◊ The doubtful idea of whether the existing sectoral structures should be dismantled in order to practice ecosystem approach is discouraging.
- ◊ In main part biodiversity conservation is viewed as an ill-affordable luxury.
- ◊ Successful implementation of Ecosystem approach requires the ability of societies to take a more flexible position on policies as wide ranging as trade and subsidy, taxation and consumption, agriculture, and environmental protection.

Ensuring Food Security through Backyard Gardening in Uganda

BY
HAMBA RICHARD

THE PROBLEM: WHAT RISKS HAVE BEEN ADDRESSED?

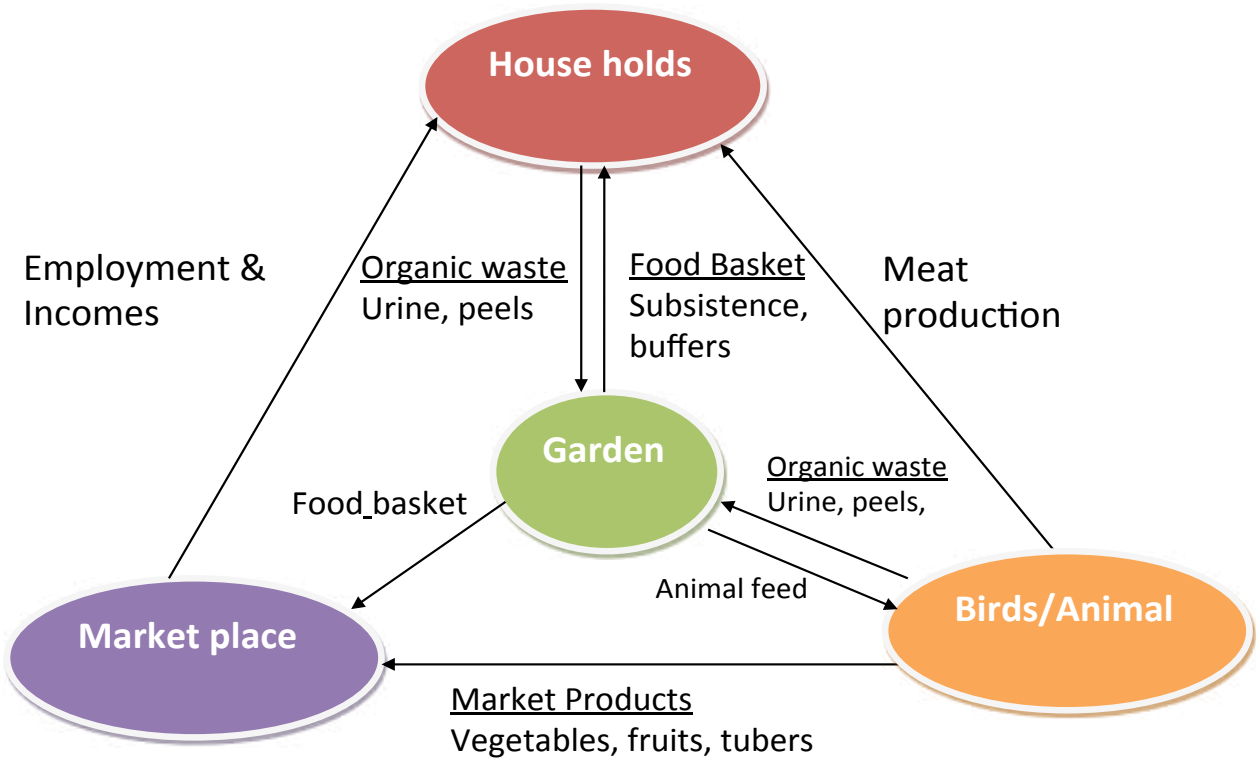
CLIMATE CHANGE:

- Food shortages among households
- Non-availability of land for garbage disposal
- Absence of water conservation schemes
- Depletion of tree cover due to mushrooming commercial and housing complexes

THE OBJECTIVE

1. Define a baseline study of the most highly utilized means of economic activity at the household level in rural and urban settlements
2. Indentify and introduce predominantly-existing household farmers to commercial agricultural production
3. Determine the replicable abilities of successful initiatives amongst farmers towards ensuring continuously stable food baskets
4. Advise on value addition at all levels of production along the value chain/process

METHODOLOGY & IMPLEMENTATION



ENSURING FOOD SECURITY THROUGH BACKYARD GARDENING IN UGANDA

WHAT RISKS DID THIS APPROACH ADDRESS?

- Inadequate food supplies among households
- Un-employment
- Poor disposal of waste material (un-sorted garbage)
- Land shortage in urban centers

WHO WERE THE TARGET GROUPS OF THE PROJECT?

- Low income earners
- Women groups (widows, single mothers, the sick)
- Un-employed youth
- HIV affected families (for food supplements i.e. vegetables, fruits)

WHO WERE THE KEY STAKEHOLDERS OF THE PROJECT AND WHAT METHODS WERE USED TO INVOLVE THEM?

- Community leaders
- Women groups
- Youth groups
- Urban practitioners
- Environmental activists

WHAT IS THE REPLICATION POTENTIAL OF THE PROJECT?

- Small land farm holders Reasons:
  - (1) Easily adapted to the farming idea
  - (2) Use of simple tools and techniques affordable to many farmers
  - (3) Land requirement of this technique is ¼ of 1 acre or less.
- The potential use of harvest water for land irrigation
- Farmer can select seeds from the harvest for the coming season (i.e. pawpaw, tomatoes, sugar canes, matooke, vegetables, etc)

Backyard Gardening

Domestic Farming

HOW DID THIS ECOSYSTEM APPROACH ADDRESS & ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?

FOOD SECURITY:

- Practicing farmers grow a variety of food supplies/produce (including supplements)
- Locally available farm inputs have increased (i.e. seeds, animals breeds)
- Households engage in crop & animal farming (Both require enough water supplies motivating farmers to adapt water harvest techniques)

INCREASING FARMER PRODUCTIVITY

CLIMATE CHANGE ADAPTATION:

- Use of organic manure from crop or animal waste maintains the natural fertility of the soil (Industrial made fertilizers wear out the soils)
- Use of organic waste such as manure reduces chance of households burning (less smoke to the atmosphere)
- Continuous plant cover reduces the level of carbonic present in the atmosphere (lessening contributions to global warming)

URBAN FARMERS

Location	Target Farm Group	Before intervention	After intervention
Kasubi	Women groups	3	6
	Youth Groups	0	2
	Local leaders	2	2
	Urban practitioners	1	1
	Environmental activist	1	1
Total		**6**	**12**
Kawaala	Women groups	2	6
	Youth Groups	1	3
	Local leaders	0	2
	Urban practitioners	1	2
	Environmental activist	1	2
Total		**5**	**15**
Nakulabye	Women groups	3	4
	Youth Groups	1	1
	Local leaders	0	1
	Urban practitioners	0	0
	Environmental activist	0	1
Total		4	8
Namungoona	Women groups	3	7
	Youth Groups	1	2
	Local leaders	0	1
	Urban practitioners	1	1
	Environmental activist	1	1
Total		6	12

ENSURING FOOD SECURITY THROUGH BACKYARD GARDENING IN UGANDA

EMERGING OPPORTUNITIES

- Increasing domestic food production levels from organic farming techniques
- Maintaining of the soil nutrients by fixing nitrates and maintaining soils oxidation
- Water harvesting at households
- Increasing income and saving of the households involved

Buffer to markets

Potted Garden for subsistence

REPLICATION AND UP-SCALING POTENTIAL

Backyard Gardening is highly replicable:

- Among urban farmers because of the small land holds that they possess.
- For modern farmers who can offer surplus produce to the commercial markets for small earnings.
- Utilizing labour intensive techniques is easily applicable to interest farmers even among youth.

HOW DID THE PROJECT ADDRESSED SUSTAINABILITY AND CROSS-CUTTING ISSUES?

- Backyard gardening increases food sustainability among households because of the consistent renewal of plant cover that is harvested by plucking off top covers (leaves & fruits) which allows farmers not to uproot the original plant.
- Plucking is a good harvest technique especially for crops and plants that contain leaves or fruits which are common among many small scale farmers.
- Compact areas with lots of plants tend to keep moisture in the soil better so water is used more efficiently.

WHAT ARE THE CURRENT LIMITATIONS IN THE USE OF ECOSYSTEM APPROACHES?

WHAT DO WE KNOW OF THE SCIENTIFIC BASIS OF THIS ECOSYSTEM BASED APPROACH?

- This approach utilizes local knowledge and farm techniques including elementary tools of farm production.
- Square foot gardening will normally give you a better yield for the area you are using. This makes it better for those with limited space.
- Weeds are easier to control since plants are compact and close together. Weeds get crowded out.

WHAT ARE THE SCIENTIFIC LIMITATIONS?

- The use of organic manure is limiting to production as yields cannot be compared to factory made fertilizers that are highly applicable to capital intensive techniques on large scale.
- Because crops are crowded, there can be less air circulation which can cause issues with mildew or disease that you might not have from other planting methods.
- Organic manure takes a longer period than chemical fertilizers to become ready for because of the long fermentation process of organic materials from fruit peals, crops waste, leaves, animal waste etc.
- Gardening requires physical exertion, including lots of bending, stooping, digging and carrying. The repeated gardening actions put strain on your back and joints like your knees.

Promotion of sustainable organic agriculture as an ecosystem-based Approach in Zambia

BY
DANIEL KALALAA

PROMOTION OF SUSTAINABLE ORGANIC AGRICULTURE AS AN ECOSYSTEM-BASED APPROACH IN ZAMBIA

THE PROBLEM: WHAT RISKS HAVE BEEN ADDRESSED?

- Agriculture is the mainstay for the majority of households in Zambia, with over 80% of Zambia's labor force dependent on agricultural production. Of these: 79% are SSFs; 20% are emergent farmers and 1% are commercial farmers.
- Most SSFs are found in rural areas where there is widespread dependence on rain-fed subsistence agriculture, severe poverty and chronic food insecurity.
- In addition to the many challenges facing SSF agricultural productivity, there is overwhelming evidence that climate change effects are now very prominent in Zambia.
    - *The mean annual temperature in Zambia has increased by 1.3° since 1960, a rate of change which is confidently projected to continue.*
    - *An average country wide decline in rainfall of about 58 mm has occurred in the period 1971- 2005 compared to the period 1940 to 1970 (Shitumbanuma, 2009)*
    - *There has been a general tendency for a late onset of the rainy season and early withdrawal of the rains since the 1980s (MTNR, 2002)*
    - *There has been a northward shift in the agro-ecological zone boundaries leaving most of Southern Province and a large part of Western Province in region I with a mean seasonal rainfall < 800 mm (Shitumbanuma, 2009)*
    - *The country has experienced increased frequency, magnitude and intensity of floods and droughts over the last two decades (NAPA, 2007)*
- Interventions to address food and income security therefore, have to ensure that land productivity is enhanced and maintained while ensuring that the adaptive capacity of rural farmers and resilience of agricultural ecosystems to climate change effects are enhanced as well.

THE OBJECTIVE

To address the above challenges, the Promotion of Rural Food Security Programme (PRFSP) was implemented by five local Zambian partner organizations with funding from the Scottish Government.

The overall programme objective - to improve food security, household incomes, and resilience to climate change of rural communities through more widespread adoption of Sustainable Organic Agriculture (SOA) practices.

Specific strategic objectives

- To enable small-scale farmers to achieve sustainable increased production of food and commercial crops, by using SOA methodologies.
- To improve nutrition status and household food security.
- To increase community resilience and capacity to cope with the challenges of climate change.
- To multiply the programme's impact by securing governmental support for more widespread adoption of organic/ conservation farming practices.

PROMOTION OF SUSTAINABLE ORGANIC AGRICULTURE AS AN ECOSYSTEM-BASED APPROACH IN ZAMBIA

METHODOLOGY & IMPLEMENTATION

- The PRFSP promoted SOA with the aim of vesting SSFs with skills and knowledge on how to increase and maintain their farm productivity and to easily adapt and become resilient to effects of climate.
- The PRFSP was implemented for 32 months, starting in November 2008.
- The target group consisted of rural resource poor farmers from five drought-prone districts of Zambia.
- Implementation was by a consortium consisting of Kasisi Agricultural Training Centre (KATC), Catholic Relief Services (CRS), Caritas Livingstone, The Jesuit Centre for Theological Reflection (JCTR), and the Scottish Catholic International Aid Funds (SCIAF).
- The Ministry of Agriculture and Livestock (MAL) was also actively involved in the PRFSP activities.

THE SOLUTION: WHERE DID THE ACTION TAKE PLACE AND WHAT WAS DONE?

- The PRFSP was implemented in five drought-prone districts of Zambia namely, Chongwe, Kazungula, Shangombo, Sesheke and Mongu.
- These districts are in the agro-ecological regions I and II of Zambia.
- The following key operational areas were used in the promotion of SOA:
  - Training
  - Research
  - Extension
  - Lobbying and Advocacy

TRAINING AND EXTENSION

On-farm training of small scale farmers in Chongwe district by KATC staff

On-station training of Government extension staff at KATC training facilities

- A total of 1500 farmers representing 16% of the total number of direct beneficiaries, were trained in SOA principles and practices at Kasisi Agricultural Training Centre (KATC) at the beginning of the programme.
- A number of extension staff from MAL and consortium member organizations also received the training.
- Follow-ups were made to trained farmers to ensure that what they had learned was being practiced.

PROMOTION OF SUSTAINABLE ORGANIC AGRICULTURE AS AN ECOSYSTEM-BASED APPROACH IN ZAMBIA

RESEARCH

Evaluation of small scale planter

Evaluation of the "albida effect" on Tithonia diversifolia a KATC.

- A number of on-station and on-farm trials in SOA practices were conducted.
- Trials included: the use of green manures and cover crops, integration of agroforestry species in upland field crop production, feeding trial of traditional poultry, minimum and/or zero tillage practices.

LOBBYING AND ADVOCACY

- In an effort to ensure widespread adoption, various stakeholders (Policy makers and traditional leaders) were sensitized on the benefits of SOA.
- Field days and/or meetings were organized for members of parliament, traditional chiefs and other relevant stakeholders.

PROMOTION OF SUSTAINABLE ORGANIC AGRICULTURE AS AN ECOSYSTEM-BASED APPROACH IN ZAMBIA

HOW DID THIS ECOSYSTEM APPROACH ADDRESS & ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?

- By definition SOA is a farming system that is economically viable, environmentally friendly and socially just.
- Through the promotion of SOA practices and principles, the PRFSP aimed at increasing the SSFs agricultural productivity.
- The principles and practices promoted were grouped in three broad categories:
  - Soil and water conservation
  - Soil fertility improvement and management
  - Natural pest and disease management

1. WATER AND SOIL CONSERVATION

Practices used in the protection of soils are, in most cases, good water conservation techniques too.

Other measures include:
- Wind rows,
- Contour ditches,
- Contour terraces and other similar techniques

2. SOIL FERTILITY IMPROVEMENT AND MANAGEMENT

Soil fertility in SA is improved through a number of cheap and environmentally friendly methods. These include:

Animal manure

Compost

Green manures and cover crops

Fertilizer trees and shrubs

Other techniques include:

- Extracts of compost, manure, and plant leaves
- Worm cast
- Aerated teas

Organic agriculture largely relies on the recycling of nutrients and farm wastes for the improvement and maintenance of soil fertility

3. NATURAL PEST AND DISEASE MANAGEMENT

The management and control of pests and diseases in SOA include two major categories of practices these are: preventive and curative.

1. Preventive measures
    - » Enhancement and maintenance of soil health
    - » Companion planting
    - » Crop rotation and biodiversity
    - » Intercropping
    - » Use of resistant varieties
    - » Barriers

2. Curative measures - Mostly achieved through the use of botanical pesticides and biological control.

THE BIG PICTURE

- » The programme had a total number of 9,498 beneficiaries spread across the five districts.
- » The most commonly adopted techniques/practices included:
    - ◊ minimum tillage (mostly basins),
    - ◊ composting and application of manure
    - ◊ no burning
    - ◊ non-usage of inorganic fertilizer
    - ◊ crop rotation and diversification
- » It was noted that among those deemed as not having adopted SOA, most were in fact practicing one or two techniques associated with SOA.

1. INCOME, FOOD AND NUTRITION SECURITY

The following findings were made during the end of project survey:

- » Food and nutrition security were assessed in terms of the number of months in a year that households had staple food from their own production, and in terms of how diverse the household diets had become.
- » General increase in household food security, with staple crops lasting up to 9.5 months of the year compared to 6.5 months indicated in the baseline. There were, however, some significant regional differences.
- » The average household dietary diversity score (determined by summing either the number of individual foods or food groups consumed over a reference period) rose from the baseline value of 1.9 to 5.3.
- » Income security was determined in terms of increased quantities of marketable surplus of agricultural produce and increased sales and income from household produce.
- » Increase in the number of participating households with one or more surplus farm produce for sale from 25.9% to 69%.
- » Sixty-one percent (61%) of the households reported that sales of surplus farm produce was contributing to 50 % or more of their income. This is an increase from the baseline figure of 18.9%.

2. RESILIENCE AND CAPACITY TO COPE WITH EXTREME WEATHER

- In the context of upland agricultural ecosystems, SOA practices and climate change adaptation strategies are mutually supportive in that many climate adaptation strategies fit squarely into SOA practices and vice-versa.
- One of the indicators of the resilience and capacity to cope with climate change effects was the adoption of SOA principles and practices.
- There was an increase in the proportion of land under cultivation using SOA techniques from the baseline value of 8.4% to 13.1%.
- The average area of land cultivated using SOA practices increased from 0.5 ha to 1.3 ha.
- The majority of farmers had allocated only a portion of their land to SOA, and so were practicing SOA techniques alongside conventional farming. Only less than 5% were found to cultivate their land on a purely organic basis.
- Other indicators of resilience and adaptability to climate change effects were crop diversification and the growing of drought resistance crops/varieties.
- Fifty-one percent (51%) of the respondents were found to be growing drought-tolerant varieties of one or more of the following crops: sorghum, millet, local maize, cassava and cowpeas.
- This reflects an overall increase from the baseline value of 40.5%.
- There was an increase in the number of households that reported increased yield for 3 consecutive seasons through drought-resistant crops from 0% to 60%.
- The number of respondents practicing maize mono-cropping was seen to reduce from 78% to 6%.
- These figures suggest that the PRFSP had been highly successful in promoting crop diversification.

Crop diversification at on-farm demo plot in Chongwe (maize, groundnut and cowpeas)

PROMOTION OF SUSTAINABLE ORGANIC AGRICULTURE AS AN ECOSYSTEM-BASED APPROACH IN ZAMBIA

3. AGRICULTURAL PRODUCTIVITY

- Farmers reported significantly higher yields for maize from SOA (with an average output of 2,408 kg/ha); the average maize output from conventional agriculture was 1,175 kg/ha.
- There was evidence of increased yields even among those who were practicing just one or two SOA techniques.
- The number of farmers who reported an increase in production as a result of using SOA practices increased from 2.3% to 75%.

EMERGING OPPORTUNITIES, REPLICATION AND UP-SCALING POTENTIAL, SUSTAINABILITY AND CROSS-CUTTING ISSUES

- As a result of the positive impacts, a follow up programme (Kulima) is currently underway, and is being implemented in Zambia, Burundi and Malawi.
- There is very high potential for the replication and up-scaling of the PRFSP:
  - The fact that SOA builds on indigenous knowledge, rather than introducing practices that are totally new to an area.
  - The emphasis on reliance on locally available resources as opposed to external inputs.
  - The engagement of government extension staff, combined with the sensitization of traditional leaders and policy makers, made it possible that the programme had a wide country-wide spill-over effect.
- Sustainability is one of the factors at the heart of SOA.
- Right from the start, farmers were trained on self-reliance and low or zero dependency on external inputs.
- Cross-cutting issues such as gender issues, HIV/AIDS, and climate change were taken into account through the training that the programme offered to the beneficiaries.
- Gender was also observed in the selection and recruitment of beneficiaries.

WHAT SHOULD BE CONSIDERED IN UP-SCALING ECOSYSTEM-BASED APPROACHES?

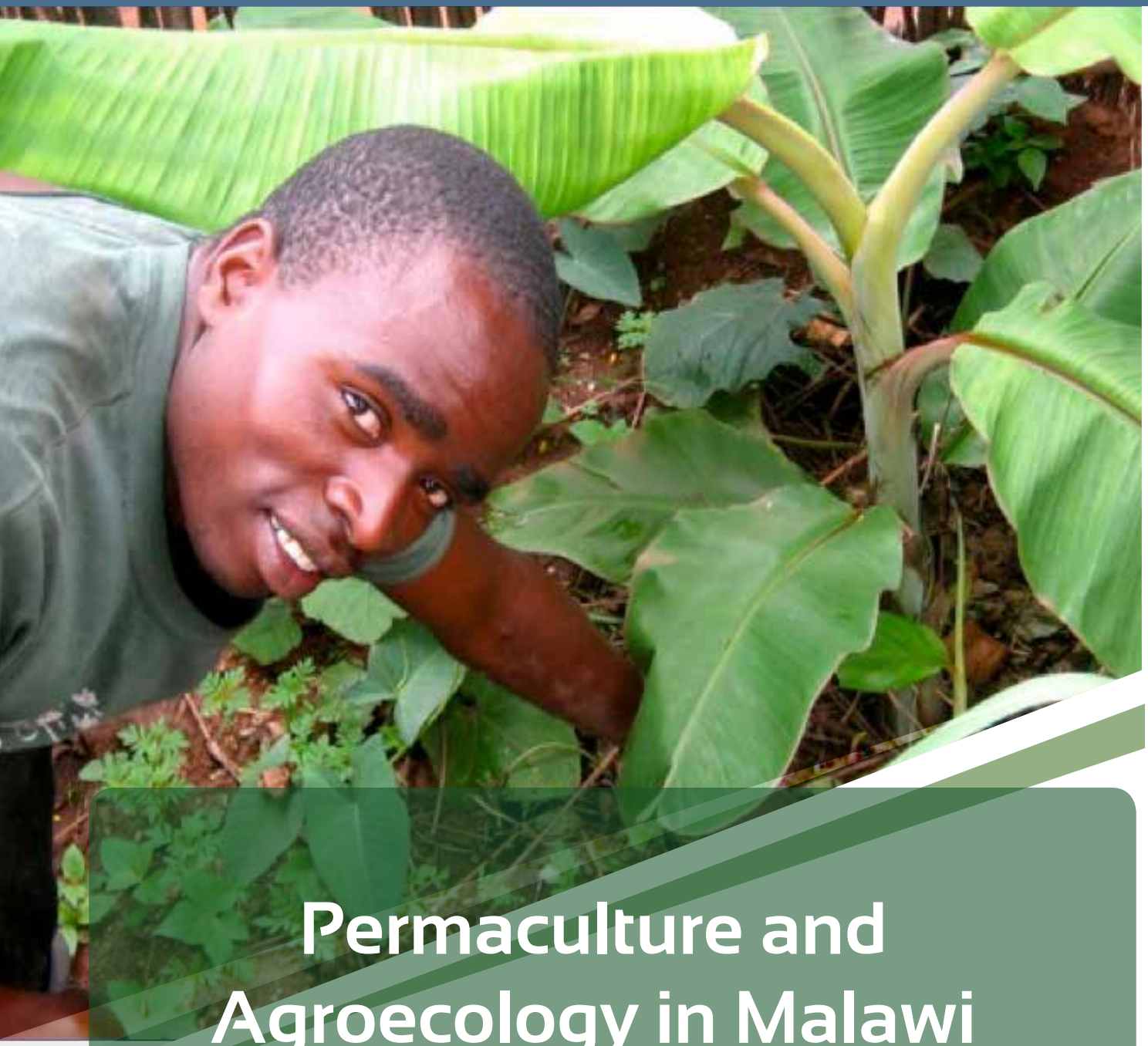
- From the PRFSP, a number of factors need to be addressed in the Zambian context, to facilitate the up-scaling of SOA as an ecosystem based approach:
  - The formulation and implementation of deliberate policies that recognize and support sustainable organic farming in the country.
  - Secondly, there is need for Government support of SOA. This support could be in form of:
  - Training of extension staff and other key players so that these in turn can train farmers.
  - SOA could be introduced in agricultural training colleges.
  - Provision of subsidy packages that encourage farmers to be self-reliant and depend more on the efficient recycling of resources to increase productivity.
  - Land tenure – farmers can only sustainably improve the land only if it belongs to them.

WHAT ARE THE CURRENT LIMITATIONS IN THE USE OF ECOSYSTEM APPROACHES?

- Generally there is a tendency of promoting adaptation approaches that advance the political ambition of policy-makers.
- These in most cases fail to address the problems felt by the rural communities.
- From the lessons learnt through the PRFSP, the following were observed as limitations:

    - Poverty – this forces people to cultivate on land that is very prone to degradation.
    - Political will – the subsidies placed on chemical fertilizers and maize production have resulted in farmers abandoning sustainable practices.
    - The integration of agroforestry species on farms was difficult to achieve as rural population do not have alternative energy sources.

Intercropping of sorghum with pumpkin in Sesheke



Permaculture and Agroecology in Malawi

BY
MOLLY CHEATUM

PERMACULTURE AND AGROECOLOGY IN MALAWI

THE PROBLEM: WHAT RISK HAVE BEEN ADDRESSED?

- 85% of the population in Malawi consists of rural, predominantly subsistence farmers
- Nearly 60% experience year round food insecurity
- 13% of children under 5 are underweight while 47% are stunted, with known malnutrition in rural areas
- Rural and urban farmers depend heavily, if not solely, on maize for income making them vulnerable to fluctuating markets
- Economically dependent on expensive inputs for farming perpetually keeping them in a cycle of debt
- A Malawian's average daily caloric intake is 54% maize contributing to nutrient deficiencies
- Sweeping and burning around homes is leading to high rates of erosion and soil nutrient loss
- Lack of crop diversification make Malawians more susceptible to droughts, floods, and other natural phenomena outside their control

THE OBJECTIVE

- To improve food and nutrition security
- To improve and enhance agrobiodiversity
- To improve environmental and economic viability of land

METHODOLOGY & IMPLEMENTATION

- Approach: Permaculture and Agroecology
- Risks: Climate change; Income instability; Food and nutrition insecurity; Environmental degradation.
- Time Period and Ecosystem: July, 2012 – June, 2013 (one rainy season and dry season) semi-arid to sub-humid deciduous woodlands.
- Target Groups: 8 women and 13 men from Nkhundi, Kandiweni, Chikhawo and Landscape Villages.
- Key Stakeholders: Members of staff at Kusamala and their family members; Red Soil Project.
- Replicability: Using farmer-to-farmer networks expect each staff member to influence 5 people, resulting in 105 people indirectly benefiting.

THE SOLUTION: WHERE DID THE ACTION TAKE PLACE AND WHAT WAS DONE?

Lilongwe District, in the areas of traditional authorities (TA) Chimutu and Tsabango

- Sensitization
  - Informal and formal interviews
- Capacity building/training
  - Wet season household gardens, providing a diverse, nutritious food source during the "hungry season" and increasing agrobiodiversity

- ◊ Improved soil fertility through mulching, composting, and ground cover
- ◊ Water management utilizing swales and grey water harvesting
- ◊ Reforestation with agroforestry and multi-use tree species

» Monitoring and Evaluation

- ◊ Baseline Surveys; Follow-up Surveys

HOW DID THIS ECOSYSTEM APPROACH ADDRESS & ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?

Malawi's national climate change adaptation strategy highlights five priority project areas, which include:

- » Develop sustainable rural livelihoods
- » Improve agricultural production in the face of climate change
- » Improve ability and preparedness to cope with droughts and floods

The results of this project that address those priorities include:

- » Planting a diverse range of crops and trees increases resilience to extreme weather events by reducing the likelihood of complete crop failure
- » Extended harvest season due to planting drought tolerant species and crops with different rates of maturation
- » Increased resistance to drought through improved soil structure and water content
- » Sustainable diversification of rural livelihoods

HOW DID THIS ECOSYSTEM APPROACH ADDRESS & ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?

Staff member's house six months after project implementation.

Neighbor's house, a typical example of swept yards in Malawi.

THE BIG PICTURE

- Number of people benefited: 48 dependents directly benefitted from increased access to nutritious foods, income generating opportunities, and improved environmental health
- Emerging opportunities: Reduced dependence on markets for vegetables, increased consumption of different foods, saved money for other household needs, increased income by selling excess produce, extended harvest season by planting drought tolerant crops with different rates of maturation
- Replication and up-scaling: Growing interest from neighbors and other community members, plan to replicate model in other communities
- Sustainability and Cross-cutting issues: Resilience to climate change, Gender and livelihoods, Health and natural medicines (i.e. prophylaxis)
- Up-scaling ecosystem based approaches: this project is readily replicated

BUILDING RESILIENCE

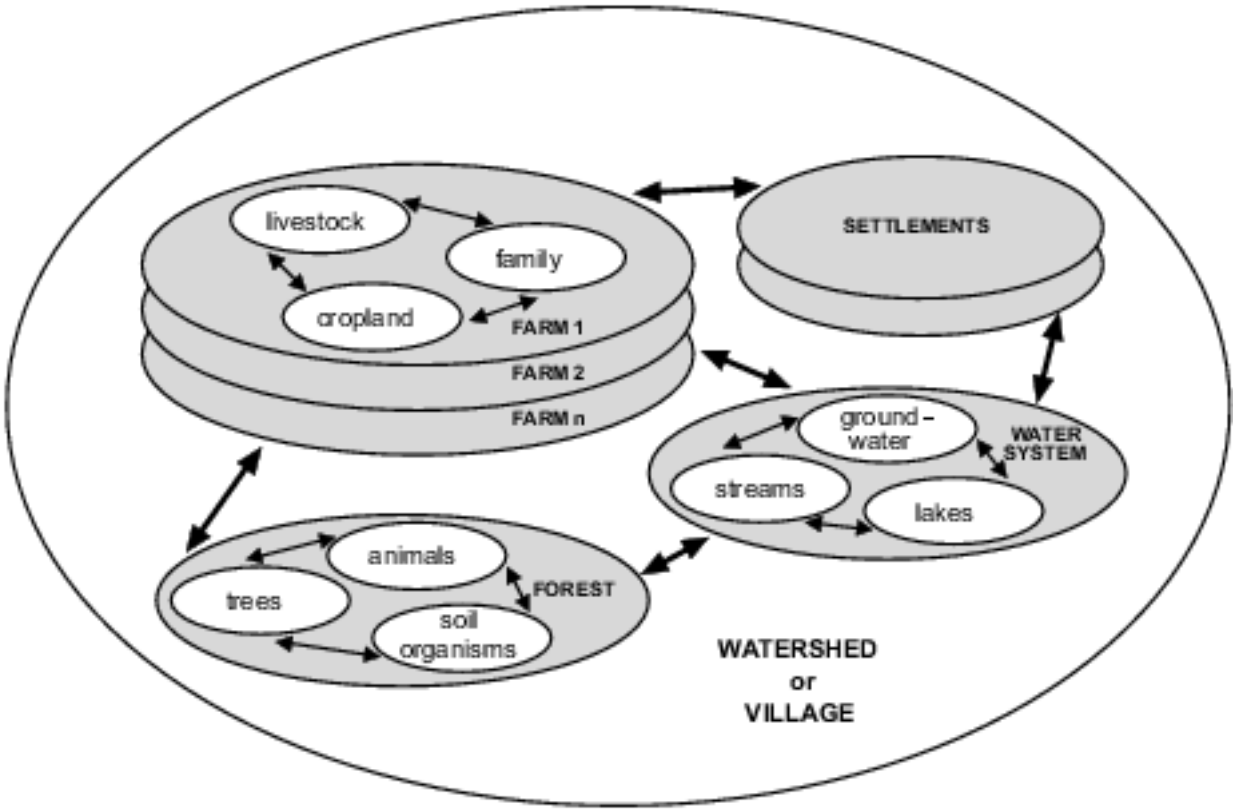
Dan Chikhawo showing how he uses the greywater from his shower to produce food.

GENDER AND LIVELIHOODS

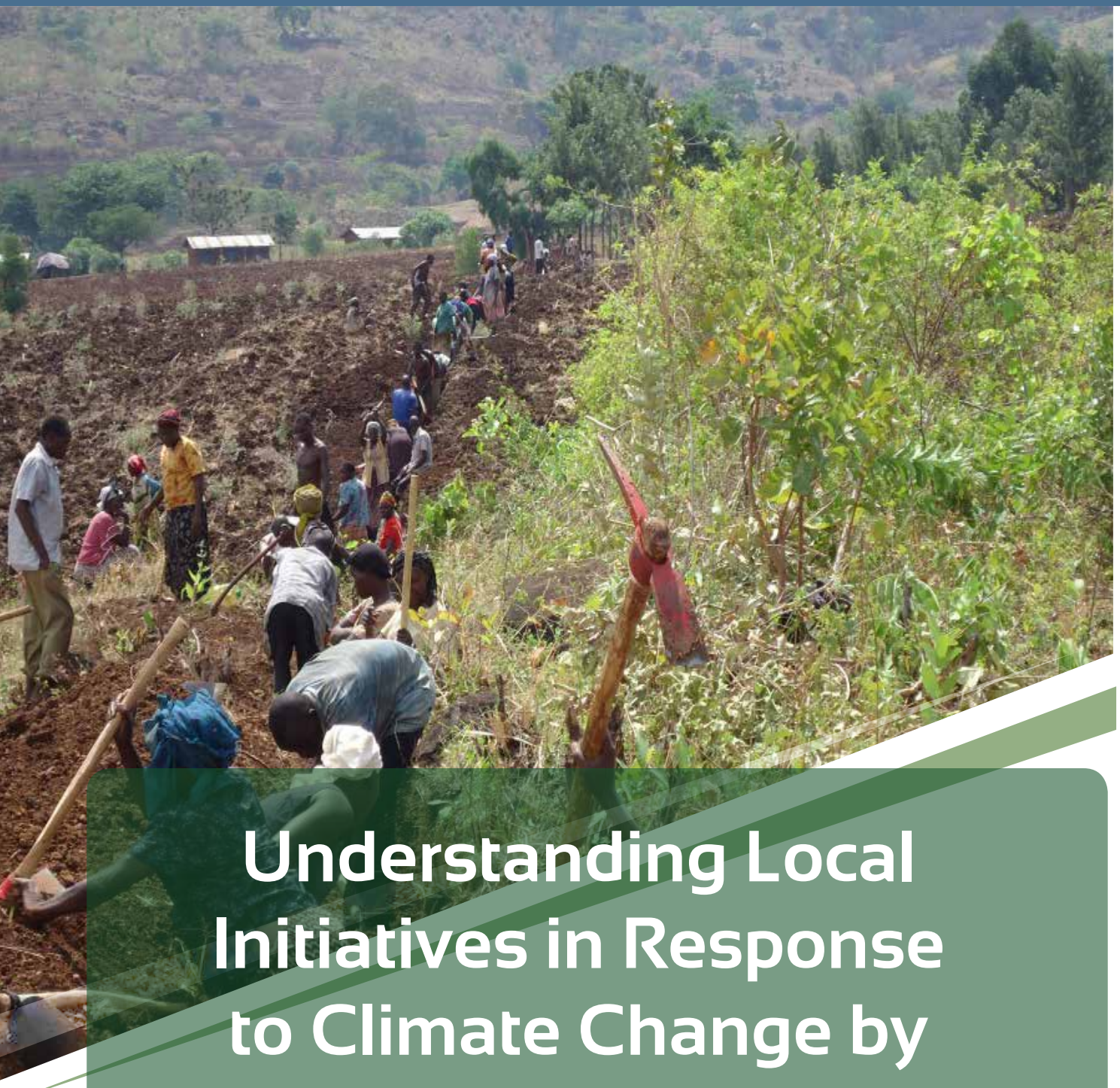
Rhoda Godfrey, her mother and sister plant maize, pumpkin, beans, mulberry, cassava, and moringa for household consumption. They also grow tomatoes and onions to generate additional income.

Issac Banda demonstrates growing artemisia, neem, and lemongrass. All are used as natural medicines including the prevention of malaria.

WHAT ARE THE CURRENT LIMITATIONS IN THE USE OF ECOSYSTEM APPROACHES?



Integrated (holistic) management typically has to deal with complex systems, which are difficult to measure.



Understanding Local Initiatives in Response to Climate Change by Smallholder Farmers in Uganda

BY
NICHOLAS SSENYONJO

UNDERSTANDING LOCAL INITIATIVES IN RESPONSE TO CLIMATE CHANGE BY SMALLHOLDER FARMERS IN UGANDA

THE PROBLEM: WHAT RISK HAVE BEEN ADDRESSED?

- Increased focus by government on the agricultural development throughout Uganda notably in Mukono district.
- Mukono district has a population of 1,128,500 females and 571,700 males. 80% of the population depends on small scale agriculture (NDAP, 1998).
- Dependence on scientific agricultural methods has done little to improve the agricultural sector in the district. Instead it has derailed attention from growth and the spread of easily replicable indigenous innovations of the land
- Poor agricultural practices have intensified the levels of environmental degradation reducing the quality and quantity of output thereby threatening food security.
- A few farmers have come up with innovative practices to enhance or maintain their crop production and environmental conservation.
- Rural farmers have new knowledge and innovations, often little is known of an innovation and the innovators themselves do not perceive their innovation / good practice to be ground breaking or different.

METHODOLOGY & IMPLEMENTATION

What ecosystem approaches were adopted to implement project activities?

- **Chicken droppings:** Focuses on a green vegetable locally known as 'nakati.' The farmers improved production by using composted chicken droppings.
- They carried out field trials on farms since they were getting poor yields every season due to declining soil fertility.
- The chicken compost was used as it is readily available in the community
- From 35 farmers, so far 245 more have managed to adapt this technology as it leads to high yield and is less costly compared to use of organic chemicals.
- **Rainwater trapping:** A farmer employs techniques of capturing rain water and soil nutrients around his piece of land since he lives uphill. The infiltration capacity of the soils had been decimated as a result of the patches of the hard pans created by run offs.
- His technique therefore, aims at trapping run offs, modifying the micro-climate around his land through trees as well as replenishing nutrients into the soils for the benefit of his crops.
- This is used mostly during dry spells.
- From a single farmer applying this method, 215 farmers have adapted the use of this technology and more are expected to picked it up.
- However, much of the technology of water collection is still rudimental. This is mainly because of limited funds to purchase the rain water tapping equipment.
- Use of animal manure in tissue culture banana growing: When one woman realized that she could no longer harvest good banana bunches, she came up with two workable solutions; 1) to improve the soils by applying animal manure available at her household and neighbors and 2) to plant other banana varieties.
- So far, over 342 famers have adopted the use of this from the 4 farmers who were originally using the technology.
- However, issues remain as they still need too much of it, especially on banana plantations.

THE SOLUTION: WHERE DID THE ACTION TAKE PLACE AND WHAT WAS DONE?

- The project targeted small holder farmers in Kyampisi sub county, Mukono District, Central Uganda.

UNDERSTANDING LOCAL INITIATIVES IN RESPONSE TO CLIMATE CHANGE BY SMALLHOLDER FARMERS IN UGANDA

HOW DID THIS ECOSYSTEM APPROACH ADDRESS & ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?

- Farmers who apply unique practices to avert or mitigate the adverse effects of climate change and poverty.
- Farmers are more knowledgeable about the current trends in climate patterns and what they need to do.
- Have started to bite in most places in terms of addressing food shortage, emergency of crop pests and diseases, erratic rains and extinction of both flora and fauna.
- Majority of the farmers still depend on subsistence farming due to issues like land shortages, inadequate labor, lack of credit and other agricultural inputs.

THE BIG PICTURE

- The farmers have the potential and will to improve on agricultural productivity but are not always brought on board to realize their full potential by the concerned stakeholders
- This study, therefore, sought to investigate and document innovations being applied by smallholder farmers in Kyampisi sub-county to sustain and / or improve land productivity, alleviate poverty and conserve the environment amidst a horde of challenges.

WHAT ARE THE CURRENT LIMITATIONS IN THE USE OF ECOSYSTEM APPROACHES?

- A comprehensive policy geared at promoting sustainable organic agriculture in the country is not in place.
- Limited funds allocated to agriculture in the country need to increase if we are to improve food security at household level
- Limited information centers should be established at parish level to enable rural people to have a chance to access relevant information.
- Limited government integration of income and non-income factors in development planning in areas like food security, nutrition and employment.

CONTRIBUTION TO FOOD SECURITY AND ECOSYSTEM PRODUCTIVITY

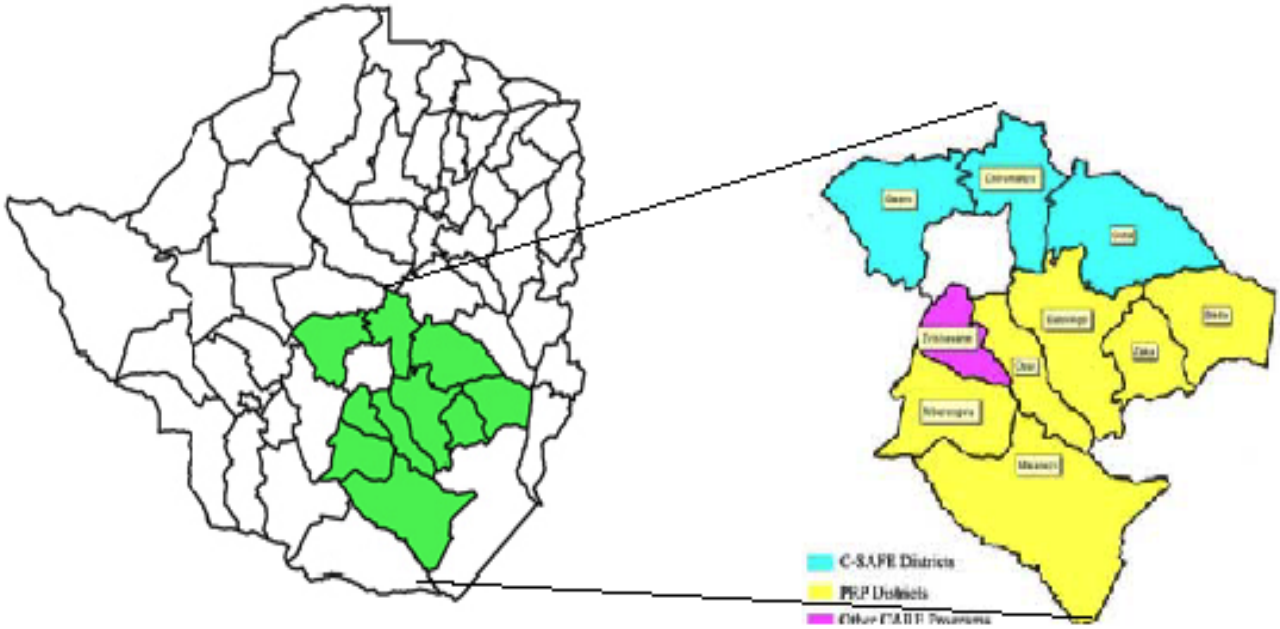
- The use of animal manure has increased matooke yield. The area supplies Matooke to the surrounding trading centers on a regular basis.
- Food production now takes place even during dry spells. This is attributed to run-off tapping water collection.
- Climate change information centers provide regular information regarding changes in weather.

UNDERSTANDING LOCAL INITIATIVES IN RESPONSE TO CLIMATE CHANGE BY SMALLHOLDER FARMERS IN UGANDA

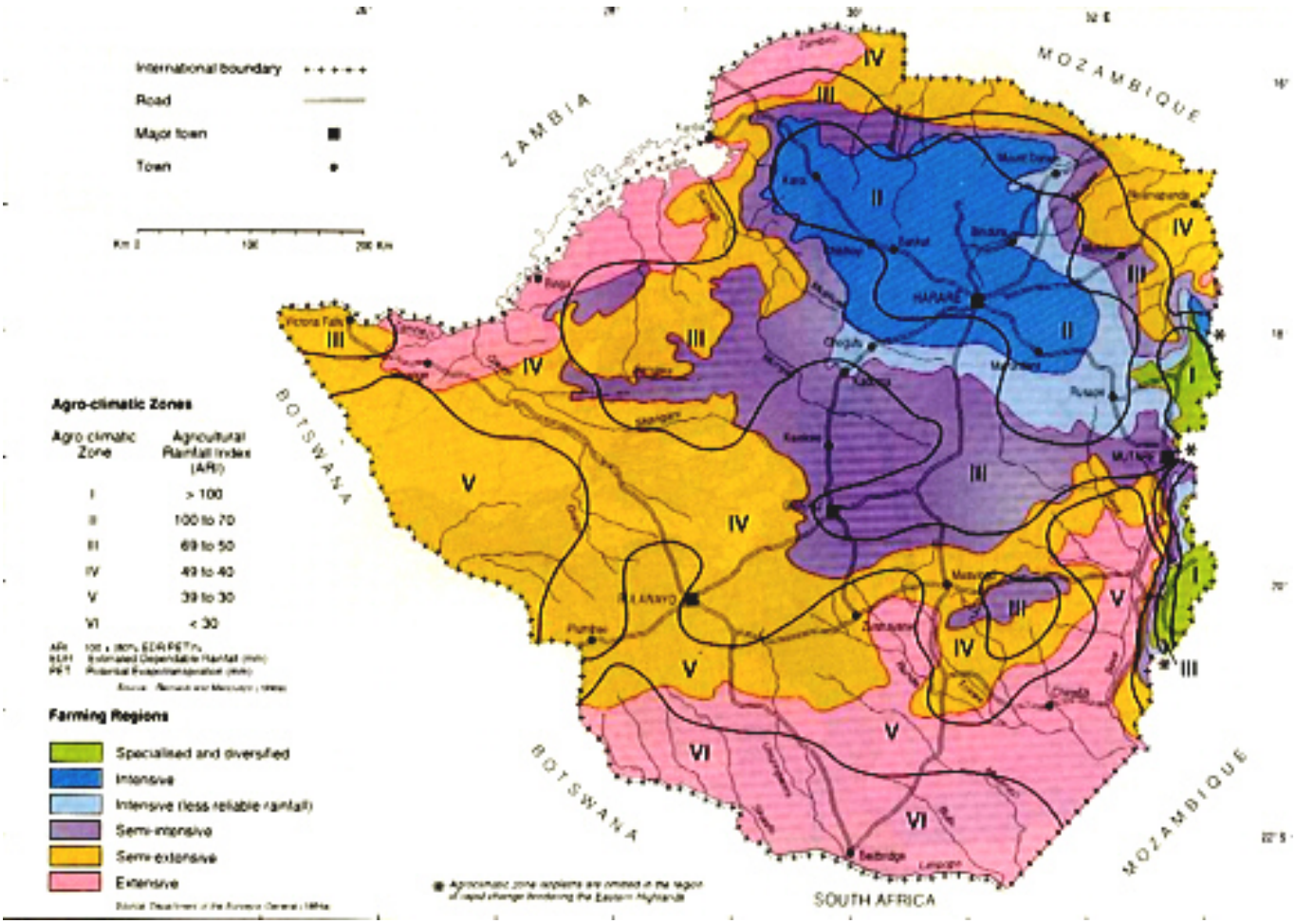
Agroforestry, Conservation Farming & NTFPs in Zimbabwe

BY
BY LESLIE MHARA

BACKGROUND – AREAS OF OPERATION



BACKGROUND- ZIM AGRO ECO ZONES



THE PROBLEM: WHAT RISKS HAVE BEEN ADDRESSED?

- Food insecurity due to insufficient agricultural production (mainly due to prolonged drought periods among other factors)
- Nutritional insecurity
- Limited livelihood opportunities
- Depletion of the natural resource base
- Families affected by HIV, with limited labour capacity and with high dependency ratios

THE OBJECTIVE

- To reduce food insecurity for vulnerable individuals while conserving and making more efficient use of natural resources.

METHODOLOGY & IMPLEMENTATION

What ecosystem approaches were adopted to implement project activities?

- Agroforestry (for fodder, soil nutrient building, biological remedies, live fencing)
- Conservation Agriculture (CA) (including the promotion of locally-available and drought- tolerant cultivars like small grains)
- Sustainable harvesting of non-timber forestry products (NTFPs) like Mopani worms, amarula fruits, honey, mazhanje and indigenous vegetables and planting of woodlots.

What risks did this approach address?

- Lack of fodder, building of the soil structure, texture and organic matter which has been degraded over the past decades (through agroforestry)
- Food security issues (through live fencing)

Maize crop planted soon after cutting down of the agroforestry trees

METHODOLOGY & IMPLEMENTATION

What risks did this approach address?

- C.A. is useful in promoting sustainable use of the natural resources, and improves food security by improving the yield from 0.8t/ha to 2 to 4t/ha.

What risk did this approach address?

- NTFPs reduces the risk of depleting resources and communities can use NTFPs over and over, thus reducing the food insecurity.

In which time of the year was this approach applied?

- The approaches are being used year-round since for example the C.A. calendar runs from June to May of the next year.
- The NTFP approach, however, intensifies during the time when the products are in season (e.g. December and April for the Mopani worms).

Honey after processing

Who were the target groups of the project?

- Most vulnerable households, i.e. those with;
  - Low ownership of productive assets,
  - Low labour capacity (those with chronically ill members),
  - High dependency ratio (elderly women, with young orphans, orphans); and
  - Limited livelihood options.

PARTICIPATORY SOCIAL MAPPING AND RANKING WAS USED

Who were the key stakeholders of the project and what methods were used to involve them?

- Grassroots to the national level stakeholders
  - Village heads, chiefs, councillors, District administrators, rural district councils' chief executive officers, line ministries and departments, research institutions like ICRISAT, River of life, CYMMIT, other NGOs and private sector
- Engaged in planning and coordination meetings, training and lessons learnt workshops, and field days which were also done at different stages of the project.

What is the replication potential of the project?

- The potential for replication is enormous .
  - The above named approaches are being used by CARE in a number of projects currently being implemented .
- Frequency and magnitude of the droughts is also increasing and affected other parts of Zimbabwe hence the same approaches may be used as a means of addressing food security and building the communities' capacity to adapt to climate change induced shocks.

THE SOLUTION: WHERE DID THE ACTION TAKE PLACE AND WHAT WAS DONE?

- Southern districts of Zimbabwe
  - Masvingo, Zaka, Bikita, Chivi, Mwenezi districts
- Midlands
  - Mberengwa district
- Matabeleland South
  - Beitbridge and Gwanda provinces where food and livelihood insecurity remain persistent problems due to droughts and low production levels.

- The solutions implemented include:
  - Identification of the communities and beneficiaries (com rank, CBDRR)
  - Trainings for the stakeholders and officers
  - Cascading trainings for communities on:
    - Agronomic practises for different Agroforestry species and their uses,
    - Conservation farming principles and techniques,
    - Seed multiplication,
    - Post harvest handling and processing,
    - Agronomy of the indignoeus drought tolerant crops and cultivars,
    - Sustainable harvesting of the NTFPs,
    - Marketing, leadership and conflict resolution, constitution development, record keeping, operation and maintenance of the equipment given, bylaw formulation, and
    - DRR and CVCA concepts and mainstreaming of the crosscutting issues.
- The solutions implemented include provision of
  - Planting materials (Agroforestry),
  - Seeds (conservation farming), and
  - Non food items like solar driers, Kenyan bee hives, oil pressers etc. for the NTFPs.
- Monitoring visits are also done so as to make sure that all the project activities continue as expected.

HOW DID THIS ECOSYSTEM APPROACH ADDRESS & ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?

FOOD SECURITY

- Agroforestry:
  - Feed for livestock is now available year round and farmers can produce high quality livestock for sale;
  - Soils are now more fertile and as a result, communities can now produce more for consumption and for sale; and
  - Communities now have organic remedies which do not disturb the ecosystems as compared to inorganic remedies (chemicals).
- Conservation Agriculture
  - Communities can produce more efficiently and effectively on a smaller piece of land though the use of minimum inputs and by organic means; and
  - CA also emphasises the use of drought tolerant cultivars which thrive better in difficult conditions ensuring higher production levels and achieving food security.
- NTFPs
  - Communities have a source of readily available NTFPs for consumption and for sale. This means that they will continue having a reliable source of protein (i.e. Mopani worms) and available cash for buying other food.

Some of the farmers show their harvest at a field day in Chivi district

HOW DID THIS ECOSYSTEM APPROACH ADDRESS & ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?

CLIMATE ADAPTATION

- CA enhanced the communities' capacity to adapt to climate change as it conserves limited resources like rain and at the same time makes more efficient use of such resources.
- It also emphasises the use of drought tolerant indigenous crops/cultivars like the small grains which thrive better in harsh conditions where temperatures are increasing and the rainfall amount and patterns are changing causing adverse effects.
- NTFPs also assist in ensuring that the little natural resources which are available are conserved, preserved, improved and communities get the most benefit out of them.
- Woodlots are also being established which assist in making sure that the plants where non-timber products are found are always there and available.
- Agroforestry ensures that there is a better alternative for fodder for fast growing species.

ECOSYSTEM PRODUCTIVITY

- CA emphasises the use of an organic means of production which make use of the different components of the ecosystem.
- An active use of the microorganisms in the soil increases the productivity of the ecosystem. It ensures that the different processes that occur will occur in their natural states.
- NTFPs ensures that the different component of the ecosystem are available and are never depleted but are in actuality improved though sustainable harvesting and preservation. This ensures that there is no break in the lifecycle of the different organisms and the organisms/microorganisms required for the ecosystem to thrive.

THE BIG PICTURE

NUMBER OF BENEFICIARIES

ECOSYSTEM APPROACH	BENEFICIARY FIGURE (HHs)
Agroforestry	2264
Conservation Agriculture/farming	37391
NTFPs	6000
TOTAL	45655

THE BIG PICTURE

EMERGING OPPORTUNITIES

- Consumer preferences for organically produced foods are increasing.
- Although, this trend is less prominent in developing markets, public awareness is increasing.
- Holistic solutions to the challenges of climate change favour an Ecosystem-based Aapproach.
- Increasing awareness and adoption of rangeland management models that integrate sustainable cropping practices are being promoted as addressing the multiple issues facing the environment.

REPLICATION AND UP-SCALING POTENTIAL

- Has great potential since the effects of the droughts are continually becoming more intense
- The severity of food and livelihood security situation reflects the fragility of livelihoods throughout Zimbabwe
- A great need exists to assist these communities so that they are better positioned to adapt to and respond to shocks which are being brought about by climate change.

HOW DID THE PROJECT ADDRESS SUSTAINABILITY?

- Trainings were done to ready communities
- Linkages with ministries and government were established
- Local management groups/committees were formed
- Bylaws for implementation were drafted
- Farmer groups were also linked to markets to establish long-term relationship
- The above interventions were also linked to other interventions like the internal savings and lending

HOW DID THE PROJECT ADDRESS CROSS-CUTTING ISSUES?

- Crossing cutting issues like gender, HIV and AIDS, child protection, and disability issues among others were mainstreamed
- The project baseline included a gender analysis to supplement the information which was already present
- The project ensured that women had an influence in community decision-making
- All the management committees were formed with 60% women representation

A woman lead farmer demonstrating at a field day in Chivi District

Trainees at a CVCA training

THE BIG PICTURE

What should be considered in upscaling ecosystem based approaches?

- Integrating applied research during piloting interventions or further research on proven models in local context
- Enhancing information sharing across ecosystems and communities
- The cataloguing of knowledge and an assessment of knowledge efficacy in addressing climate change impacts

What should be considered in upscaling ecosystem based approaches?

- Methods need to be researched, piloted, and published before implementing them in full-scale practice
- Provide sufficient resources to get complimentary activities (and the multiple benefits they can provide) to a broader scale
- It is prudent to empower communities to act
- The planning, development and implementation of a "training-of-trainers" programme promoting "community-to-community" learning and exchange for Ecosystem-based Approaches is needed

WHAT ARE THE CURRENT LIMITATIONS IN THE USE OF ECOSYSTEM-BASED APPROACHES?

What do we know of the scientific basis of this ecosystem-based approach?

- CA: The history of tillage dates back many millennia
- Tillage was done for a number of reasons which were however, at the expense of men, environ and natural resources
- Questioned by Edward H. Faulkner in the 1930s
- The tragic dust storm in the mid-western United States in the 1930s was a wake-up call
- Hence the coming of CA; which aims to conserve, improve and make more efficient use of natural resources through integrated management of available soil, water and biological resources combined with external inputs

What do we know of the scientific basis of this ecosystem based approach?

- Agroforestry is a farming system that integrates crops and/or livestock with trees and shrubs.
- Scientific foundation of agroforestry is based on the multipurpose tree (MPT).
- By using these trees and shrubs, agroforestry systems restore the benefits of forest plants to agricultural lands, increasing productivity and improving environmental services, such as erosion control, pest control, water management, and climate regulation.

What are the scientific limitations?

- The main limitation to the use of the above named approaches has been knowledge.
- Most communities seem to have no knowledge of these approaches and hence cannot employ them in cushioning themselves from the adverse effects of climate change.
- The other limitation is that some practitioners try to employ a one-size-fits-all approach, without contextualising the solutions so that they address problems specific to that ecosystem.
- Thus there is a need to tailor-make these approaches so that they address the real issues of concern to specific sites

Experience of Supporting Forest Adjacent Communities to Promote Food Security in Uganda

BY
ANNET, KANDOLE

EXPERIENCE OF SUPPORTING FOREST ADJACENT COMMUNITIES TO PROMOTE FOOD SECURITY IN UGANDA

CONTEXT

- Uganda developed a national climate change adaptation plan in 2007 with several key areas, among them are; Community tree growing and managing land degradation.
- The National Forest and Tree Planting Act 2003 recognizes community participation in forest resource management.
- Uganda has lost up to 24% of the forest cover since the 1990s.
- Agriculture, where most women are engaged, is affected by poor management of natural resources which affects fisheries, water resources, forests, soils and wetlands.

We shall not talk about addressing CC and food security without talking about good governance.

THE OBJECTIVE

- The **programme's overall goal is** "Poor natural resource-dependent households have achieved improved livelihoods and natural resources are conserved as a consequence of civil society participation and equitable community-based management systems".
- **Target beneficiaries:** 75,000 people
- Period: 2009-2013
- Project target : Poor households dependent upon natural resources.

RISK ADDRESSED: FOOD INSECURITY FOR FOREST-ADJACENT COMMUNITIES - CASE STUDY OF ITWARA CENTRAL FOREST

- Vermin and problem animals pose a very big challenge to small holder farmers adjacent to protected areas. Crop raiding directly affects food security, restricts land use options, but also escalates poverty and vulnerability.
- Lack of access rights to forest resources can result in conflict between people and the protected area that leads to encroachment leading to deforestation.
- About 5m people live around protected areas wildlife national parks and reserves, central forest reserves, or other gazzeted areas.

EXPERIENCE OF SUPPORTING FOREST ADJACENT COMMUNITIES TO PROMOTE FOOD SECURITY IN UGANDA

ECOSYSTEM APPROACHES

- Facilitating emergence of ecosystem structures at the local levels as engines for natural resources governance
- Developing resource management plans and linking the policy and practice.
- Building strategic partnerships (between communities, CSOs and Government).
- Promoting a balance between forest resource utilization, conservation, and promotion of initiatives that contribute to food security.
- Building the capacity of the community's structures so that they are conduits for championing forest governance, and addressing climate challenges through engagement with leaders.

LOCAL GROUPS ENGAGING WITH FOREST AUTHORITY ON KEY FOREST GOVERNANCE ISSUES

EXPERIENCE OF SUPPORTING FOREST ADJACENT COMMUNITIES TO PROMOTE FOOD SECURITY IN UGANDA

STAKEHOLDERS OF THE PROJECT

- The key stakeholders to this project are: forest adjacent communities comprised of small scale farmers, District local government, the ministry of water, civil society organizations.
- Key involvement: mobilization of communities to negotiate with forest estate managers.
- Strengthening capacity of community structures to engage with duty bearers to negotiate for access rights to natural resources, livelihood improvement based upon the CVCA and poverty levels.
- The project also facilitated a forest governance forum.

THE SOLUTION: WHERE DID THE ACTION TAKE PLACE AND WHAT WAS DONE?

- The ecosystem targeted was Itwara central Forest Reserve in the Albertine rift in Uganda.
- Key actions: Support communities adjacent the CFR and building strong partnerships with government through an MOU.
- Undertaking Climate Vulnerability Capacity Assessment for communities to understand the coping/adaptation strategies. Includes a situational analysis and development of an action plan.
- Conducting a participatory forest resource assessment to agree upon allowable and disallowable resources based upon quantities or availability. (Penny Scot)
- Promoting buffer crops particularly chili to protect households against crop raiding.
- Promoting community-based Law enforcement initiatives that prevents illegalities in forest.
- Promoting tree planting/reforestation to facilitate community investment in forestry for household income and provision of forestry services.
- Facilitating strategic linkages and networks of the groups with service providers in agriculture etc...

HOW DOES THIS ECOSYSTEM APPROACH ADDRESS & ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?

FOOD SECURITY:

- Significant reduction of crop damage, households have been able to cultivate and harvest food crops.
- CARE in partnership with TBG is promoting chili (capsium annum) production; about 0.5tonnes marketed during the off peak dry season earns households about $60 per week.
- 3 tons of chili marketed in peak season earns poor households about $240 per week.
- Returns can be used to buy food items for households.
- Increases were realized in crop production (for instance, maize) as a result of reduced crop raiding.
- Farmers are now focusing on implementing management plans through lobbying other actors including government to secure additional services for instance from NAADs, since they now have a strong voice.

ECOSYSTEM PRODUCTIVITY

- About 31,272 tree seedlings have been planted to harness the ecosystem and boost household investment in the short and medium term.
- A reduction in the disturbance of the ecosystem has now occurred since access is regulated and monitored.

CLIMATE CHANGE ADAPTATION:

- Planting of indigenous tree species particularly prunus africana in addition to eucalyptus.
- Some households clinging to traditional food crops and resisting new varieties with allegation that new varieties are more vulnerable to diseases.

POTENTIAL FOR REPLICATION

- The game changer is the formation of management structures that are now the foundation for developing and implementing management plans:
    - The forest governance forum is an avenue of political leaders and technical staff to share information and build synergies.
    - There must be willingness of the forest estate managers to support communities where communities have no land for investment in tree planting.
    - The policy should provide for such arrangements. For instance, the governance policies are provided for under the local government Act 1997 (inter district cooperation).

THE BIG PICTURE

- The Rights, Equity and Protected Areas project has, to-date, reached about 64,500 persons.
- In order to address equity and fairness issues, the project employed the governance framework. (e.g. Governance analysis, gender transformative approaches – engaging men).
- The structures are legitimate entities bound by a constitution and registered.
- Because investment in tree planting is by a group, people may not trade off returns.

EXPERIENCE OF SUPPORTING FOREST ADJACENT COMMUNITIES TO PROMOTE FOOD SECURITY IN UGANDA

BUILDING PARTNERSHIPS FOR IMPROVED FOREST GOVERNANCE

WHAT SHOULD BE CONSIDERED FOR UP-SCALING?

- The link between the policy and practice. A policy can be very good on paper but the implementation can be another story.
- Building Partnerships between communities and government.
- Focusing on governance of the resource and inclusion of all actors.
- Recognition that communities who interact with the resource play a significant role/ determines its fate.
- Recognition of the effects of bad governance on Climate Change and food security/ corruption in the natural resource sector.

LIMITATIONS OF THE SCIENTIFIC FRAMEWORK

Advantages

- Restoration of the rainforests
- Role of forests in the hydrological cycle
- Shifting to other livelihoods with lesser risk to climate change

Limitations

- Limited recognition of the institutional framework
- Research in developing Africa is not a big priority for investment yet it plays a big role
- Linking research to needs of poor communities

EMERGING OPPORTUNITIES

- Emergence of ENR CSO networks at national level and regional level.
- EAC: is there opportunity for a platform.
- Realization of impacts of food insecurity on the economy. Study for Uganda: Malnutrition costs Uganda an estimated US$899 million annually - as much as 5.6 percent of its GDP - according to findings of a new report: http://www.irinnews.org/report.aspx?reportID=98255

The Case of Community Markets for Conservation in Zambia

BY
MULEBA NSHIMBI_

RISKS AND PROBLEMS ADDRESSED BY COMACO

- Wildlife depletion and their habitats
- Unsustainable woodfuel extraction
- Ecosystem degradation
- Food insecurity, Poverty & Low rural household income.

THE OBJECTIVE

To help households living around wildlife and forest protected areas (PAs) to achieve food security and increase income.

METHODOLOGY & IMPLEMENTATION

- Agro-forestry & conservation farming
- Poacher transformation programme
- Diversified & environmentally sustainable livelihood activities
- Annual programme
- Poor/vulnerable individual rural households
- Traditional leaders
- Community Resources Boards (CRBs)
- Zambia Wildlife Authority (ZAWA)
- Local Authority
- Same agro-ecological zone
- Similar local area governance institutions

THE BIG PICTURE

- Over 40,000 farmers trained
- 19,000 adopted sustainable practices (Lewis et al., 2011)
- Presence of accessible locations and good infrastructure
- Behavioral change through market incentives

APPROACHES USED TO ADDRESS & ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY

- Unique approach-targeting individual households
- Capacity building and local empowerment
- Investing in land-based livelihood activities
- Linking livelihoods to profitable urban markets
- Soil fertility enhancement

REPLICATION AND UP-SCALING POTENTIAL

- Start small-scale
- Partner with committed organisations
- Utilize local knowledge and skills to sustain extension work
- Rely on local leaders to identify vulnerable individuals/households
- Formulate business plans that target these households
- Maximize adaptive efforts to reduce transaction costs
- Allocate sufficient time and expertise to raise needed financing

ADDRESSING SUSTAINABILITY & CROSS-CUTTING ISSUES

- Willingness of local stakeholders
- Avoiding over-reliance on wildlife to support development objectives
- Providing a business mechanism linking producers with more profitable markets
- Prioritizing production of food crops
- Avoiding punitive anti-poaching efforts
- Working on a large scale (over 35,000 sq km)
- Flexibility
- Having specified goals i.e. using markets to encourage sustainable practices

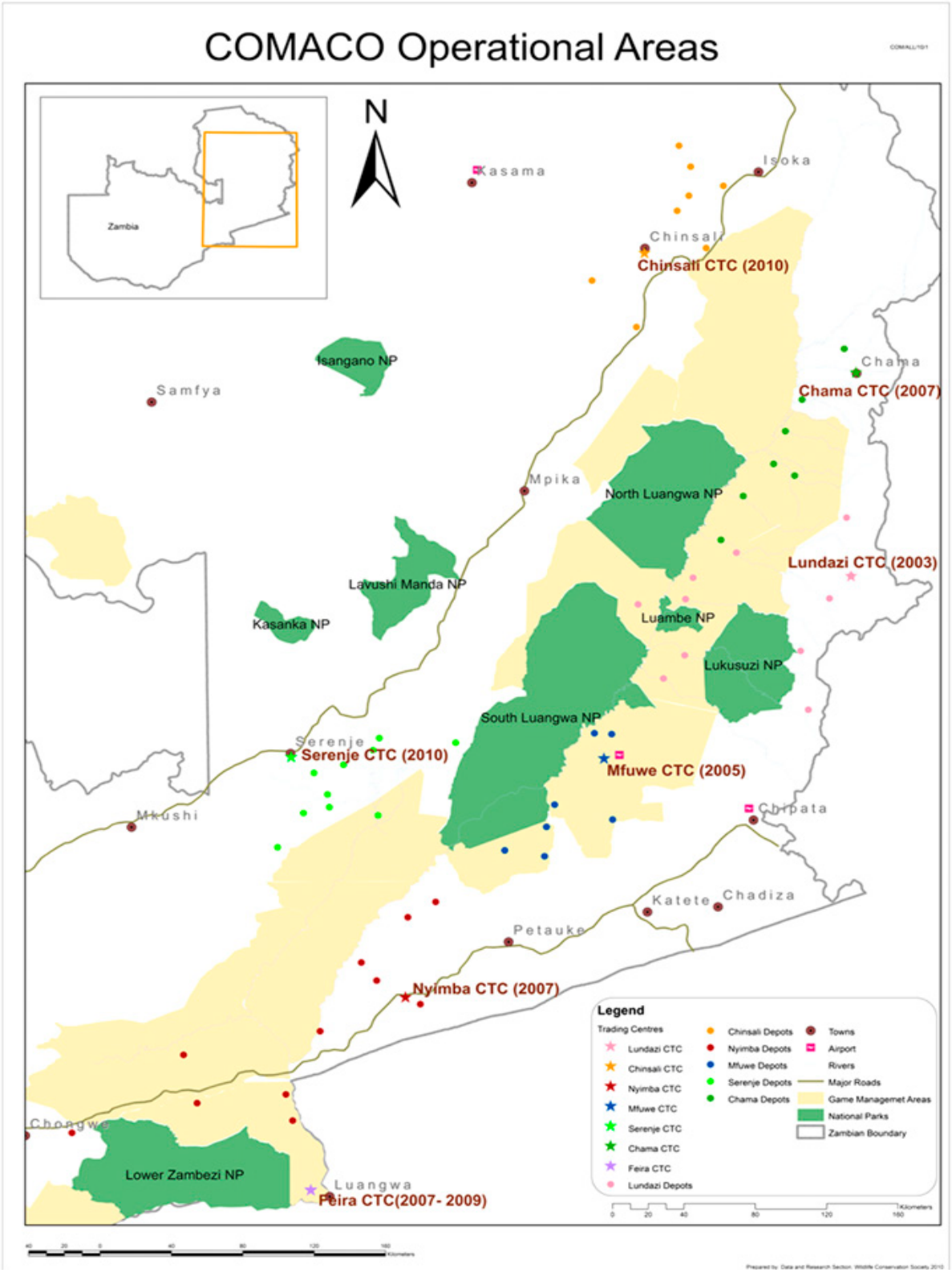
CONSIDERATIONS FOR UP-SCALING ECOSYSTEM BASED APPROACHES

- Learning from long-term, community-based experiences
- Creating close working relationships with local communities
- Deepening understandings of local social, cultural, economic and ecological conditions
- Adopting an adaptive management framework
- Political stability and institutions embracing good governance
- Support from local government and main-line ministries

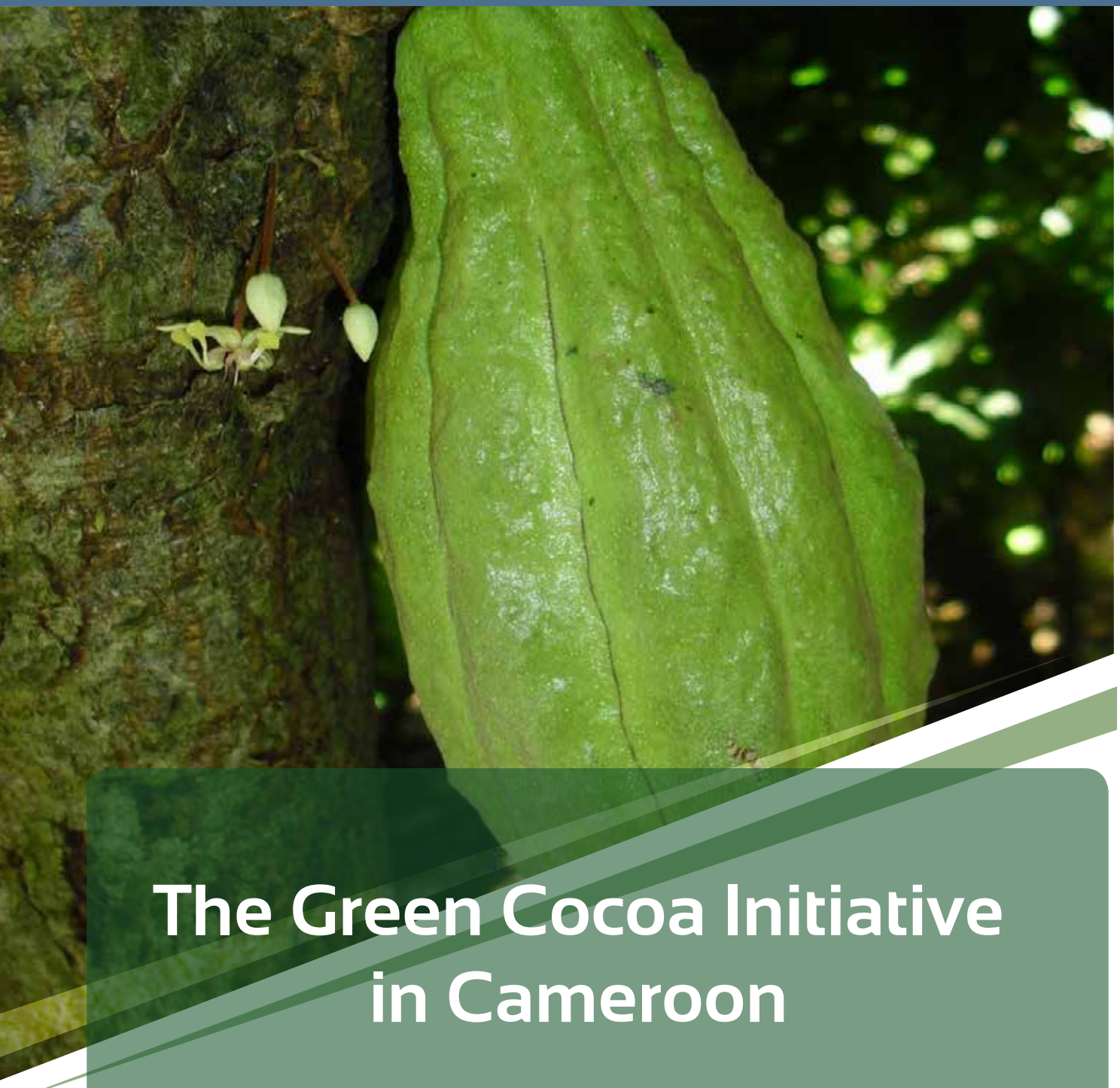
SCIENTIFIC BASES OF ECOSYSTEM-BASED APPROACHES

- EbA involving agro-forestry & conservation farming practices lead to high farm productivity
- Guarantee farmers of meeting food, water, and soil needs at minimum costs (Jenkins et al., 2004; McNeely & Schroth, 2006; Ajayi, 2007; Giller et al., 2009; Rockstrom et al., 2009; USAID, 2011)
- Scientific Limitations of EbA
- May lack universal application e.g. due to differences in climatic patterns and agro-ecological zones

PROJECT LOCATION



Luangwa Valley, Eastern Zambia



The Green Cocoa Initiative in Cameroon

BY
EBENEZER TABOT

THE PROBLEM: WHAT RISKS HAVE BEEN ADDRESSED?

- We established in a survey that cocoa processing is a source of excessive CO2 emission and hitherto unknown driver of deforestation and forest degradation, resulting in:
  - Health risks due to exposure to heat and wood smoke in cocoa drying ovens;
  - Forest degradation;
  - Habitat fragmentation and destruction;
  - Erosion of dependable resource base;
  - Food insecurity; and
  - Low birth rates due to inadequate environmental inputs resulting from scorched lands and dried up streams.

THE OBJECTIVE

Increase the communities' resilience and adaptive capacity to the negative fallouts of climate change:

- We designed the 'Green Cocoa Initiative,' an on-going two-year pilot project to run from January 2013 to December 2014.
- It is participatory and multi-pronged terrestrial ecosystem-based initiative meant to generate significant ecological and livelihoods outputs and outcomes.

General Objective

- To substitute wood with locally-generated biogas as heat source in cocoa ovens, restore ecological sanity, and improve livelihoods options and quality of life.

Specific Objectives

- To reduce CO2 emissions from wood ovens by about 80%;
- To improve the quality of microclimate through tree planting on degraded lands;
- To improve quality of life by eliminating the intake of high doses of wood smoke and prolonged exposure to heat;
- To add value to waste lands by planting about 15,000 trees;
- To improve food production by about 65% through the use of slurry from anaerobic digesters; and
- To improve nutrition and protein intake through non-conventional livestock production (Snail, achatina marginata and Cane rat, Thryonomys Swinderanus).

METHODOLOGY & IMPLEMENTATION

1. METHODOLOGY

We adopted a multi-stakeholder, terrestrial, ecosystem approach that links ecosystem functions to socio-economics and captures the three objectives of the Convention on Biological Diversity (CBD). These are:

- Conservation
- Rational use of biodiversity, and
- Equitable sharing of the benefits.

In adopting the above methodology, the project addresses risks associated with deforestation, forest degradation, habitat fragmentation and destruction, associated food insecurity and erosion of livelihoods implications and CO2 emissions.

2. IMPLEMENTATION

The project targets 15 cocoa producing villages in Fako Division in the South West Region of Cameroon. 10 of the villages lie within the boundaries of the Southern Bakundu Forest Reserve. 5 others are located inside the Mount Cameroon National Park. Implementation consists of:

- Community mobilization and sensitization to present the findings of the baseline survey.
- Brainstorming on the proposed action to resolve the problem.
- Designation of 'community insiders' to act as interface between the project and participating communities.

The following activities were planned:

- Creation of 60 user groups comprising 900 women, men and youth (4 groups per village);

Each user group specialized in one of the following:

  - Sustainable agriculture
  - Non-conventional livestock production
  - Nursery creation and management
  - Anaerobic digester construction
- Training of 90 youth (6 per village) in all stages of anaerobic digester construction
- Training of 150 women (10 per village) in tree nursery creation and management
- Training of 300 women, men and youth (20 per village) in non-conventional livestock production
- Training of 150 women and youth (10 per village) in Tree-on-Farm agriculture (inter-planting NTFPs with other crops in farms)

STATUS OF IMPLEMENTATION

Activity	Status
Construction of 3 cross-community anaerobic digesters	Completed
Construction of 3 biogas-enabled cocoa ovens	On-going
Creation of 1 central tree nursery with al least 1000 trees per village, holding at least 5 NTFP species each	On-going
Domestication of 2 wild animal species: establishment of Snail (achatina marginata) and Cane rat (Thryonomys Swinderanus) multiplication facilities the also serve as training grounds	On-going
Practicing tree-on-farm agriculture on existing farming systems	Pending maturity of tree nurseries
Tree planting on degraded lands	Pending maturity of tree nurseries

HOW DOES THIS ECOSYSTEM APPROACH ADDRESS AND ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?

We are addressing this and subsequent issues in perspective (in terms of expected results) given the project is on-going. In this light, it is expected that:

- Deforestation will fall by about 80%, CO2 emissions will reduce and global warming will be mitigated;
- Drudgery and health risks resulting from inhaling wood smoke and exposure to excessive heat will be eliminated;
- Micro climate and general wellbeing will improve;
- Ecosystem balance will be maintained through tree planting;
- Slurry from anaerobic digesters will contribute to sustain the amount of organic matter, improve infiltration rates and water holding capacity, as well as reduce run-off and limit soil erosion on scorched lands;
- Protein intake will be enhanced through wild animal domestication;
- Food production will increase and be sustained; and
- Shelf life of perishables will increase as women dry, preserve and pack seasonal fruits, spices and vegetables in biogas ovens.

THE BIG PICTURE

BENEFICIARIES

- The primary beneficiaries of the project are the 400 women, 200 men and 300 youth who are members of 60 user groups.
- Secondary beneficiary group covers the 18,000 inhabitants of the 15 participating village communities.

EMERGING OPPORTUNITIES

- The participatory approach used to enlist the collaboration of community members is a positive sign that augurs well for selfless community participation and eventual ownership of project outputs and processes.
- The institutional support of the government of Cameroon to the project, through two supervisory ministries and municipalities is a good indicator of post project continuity.

REPLICATION AND UP-SCALING POTENTIAL

- Given the likely ecological and socio-economic similarities of all cocoa producing areas around the world, the potential for up-scaling and replicating this project is high.
- It must, however, be bore in mind that in order to increase its acceptance and adoption, communities will need to be given the opportunity to internalize the multiple processes that make up the ecosystem approach.

LIMITS TO REPLICATION AND UP-SCALING

- The ecosystem-based approach is inter-disciplinary in nature, combining expertise from the environmental, economic and social sciences, each of which have different methods of evaluation and analysis.
- It has been suggested that if we want Ecosystem-based interventions to bring about lasting changes and be meaningful in the long term, we need to build in appropriately supported interventions.

Empowering Local Communities to Harness Ecosystem-based Approach in Uganda

BY
RUYONGA GODFREY

EMPOWERING LOCAL COMMUNITIES TO HARNESS ECOSYSTEM BASED APPROACH IN UGANDA

THE PROBLEM: WHAT RISKS HAVE BEEN ADDRESSED?

- For decades the upper River Mpanga catchment on the slopes of Ruwenzori mountains has been the bread basket for kabarole district.
- The area was heavily degradation through poor farming methods, indiscriminate reclamation of surrounding wetlands, deforestation without replenishment leading to soil erosion, loss of soil fertility, silting of the rivers, frequent flooding, poor yields, food insecurity, and disruption of livelihoods.
- As a result of degraded soils on the hill slopes, farmers turned to adjacent wetlands in the immediate catchment without knowing of their invaluable ecological functions.

THE PROBLEM STATEMENT

- A baseline study showed that the community had relevant knowledge about climate change, but could not relate it to food security and livelihoods.
- Most organizations had done a lot of theoretical work without engaging the community practically which left the community more confused and without tangible results on ground.

OBJECTIVES

- Develop a one stop practical training and information center for biodiversity conservation, CC adaptation and mitigation, and food security.
- To replant 100ha of degraded local and central forest reserves in the district with appropriate indigenous tree species and re-introduce agroforestry species in the neighboring communities.
- Develop a platform to share information and raise awareness on affordable mechanisms to harnessing ecosystem-based approaches for food security and adaptation to Climate Change.
- To create awareness and pilot 3 ecosystem based strategies for harnessing food security and adaptation to Climate Change.

METHODOLOGY & IMPLEMENTATION

Ecosystem approaches adopted to implement project activities are:

- Conservation and restoration of forests to stabilize land slopes and regulate water flows.
- Establishment of diverse agroforestry systems to cope with increased risk from changes in climatic conditions.
- Sustainable management of wetlands and forests for the maintenance of water flow and water quality.
- Management of invasive alien species that are linked to land degradation and which threaten food security and water supplies.

RISKS ADDRESSED

- Uncontrolled biodiversity loss and overexploitation of their habitats
- Water shortage
- Reduced productivity and loss of livelihoods.
- Increasing unplanned urbanization and pollution.
- Invasive plant species which colonize armlands, threatening productivity, food security, and livelihoods.
- Reducing carbon sinks.

EMPOWERING LOCAL COMMUNITIES TO HARNESS ECOSYSTEM BASED APPROACH IN UGANDA

RISKS ADDRESSED

- Abandonment of traditional farming practices e.g. agroforestry and soil and water conservation measures.
- Degraded river banks, leading to mudslides and crop loss.
- An increase in conversion of protected areas into farm land threatens the integrity and survival of the remaining forest, native species and reducing carbon sinks.

METHODOLOGY

- The project started in 2010 with soil and water conservation and reforestation components.
- It targeted natural resource dependent communities living in Ruwenzori highlands, within the immediate upper catchment of river Mpanga, in Burahya county, Kabarole District.
- The target community was purposely selected based on the above inclusion criteria.
- The above approaches have been tailored to follow the local community farming calendar which was drawn by them.

IMPLEMENTATION

- 100 acres of degraded forest reserve was secured from the National Forest Authority, 40 cares of which have already been restored.
- Indigenous tree nurseries were set up and so far 180,000 tree seedlings have been raised planted in the community and forest reserves.
- Over 40,000 agroforestry trees have been planted in the community and their benefits are already evident.
- To ensure sustainability and reliability of the project, a practical training center was set up at Tooro Botanical gardens with model home on 2.5 acres piece of land.

- The local leaders and target communities were mobilized and introduced to the project.
- Field practical trainings were held on:
  - Water shed protection value
  - Soil and water conservation
  - Biodiversity
  - Food security
  - Climate change adaptation and mitigation measures

EMPOWERING LOCAL COMMUNITIES TO HARNESS ECOSYSTEM BASED APPROACH IN UGANDA

- Three pilot degraded hills were and selected for practical soil and water conservation demonstrations
  - Trenches were dug and stabilized with grasses and the soils mulched.
  - Selected fruit and other agroforestry species were planted.
  - *Lantana camara* (invasive species) was uprooted and burnt.
  - Degraded wetlands in the adjacent valleys were left to regenerate.
  - Degraded parts of the river bank were replanted with indigenous tree species.



RESULTS SO FAR

- 9 degraded sites have been fully restored,
- Some of the formerly degraded areas are already agriculturally productive, and
- The tree cover in the district has improved.

HOW DOES THE APPROACH ADDRESS & ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?

- The capacity of communities and stakeholders has been built through dialogues, sensitization meetings and trainings on climate change adaptation and security strategy.
- The provided inputs in form of planting materials, tree seedling, and bee hives acted as capital for the target communities who are now producing enough food for consumption and sale.
- Some of once abandoned lands have yielded productive gains which has led to increased food productivity in specifically in karangura sub-county.
- Invasive species (lantana camara) has been greatly reduced through uprooting and burning and the once unproductive farm lands are productive again.
- River banks which were at risk of mudslides have become stable again.
- Soils on mountain slopes have been stabilized, erosion and river siltation reduced and productivity increased.

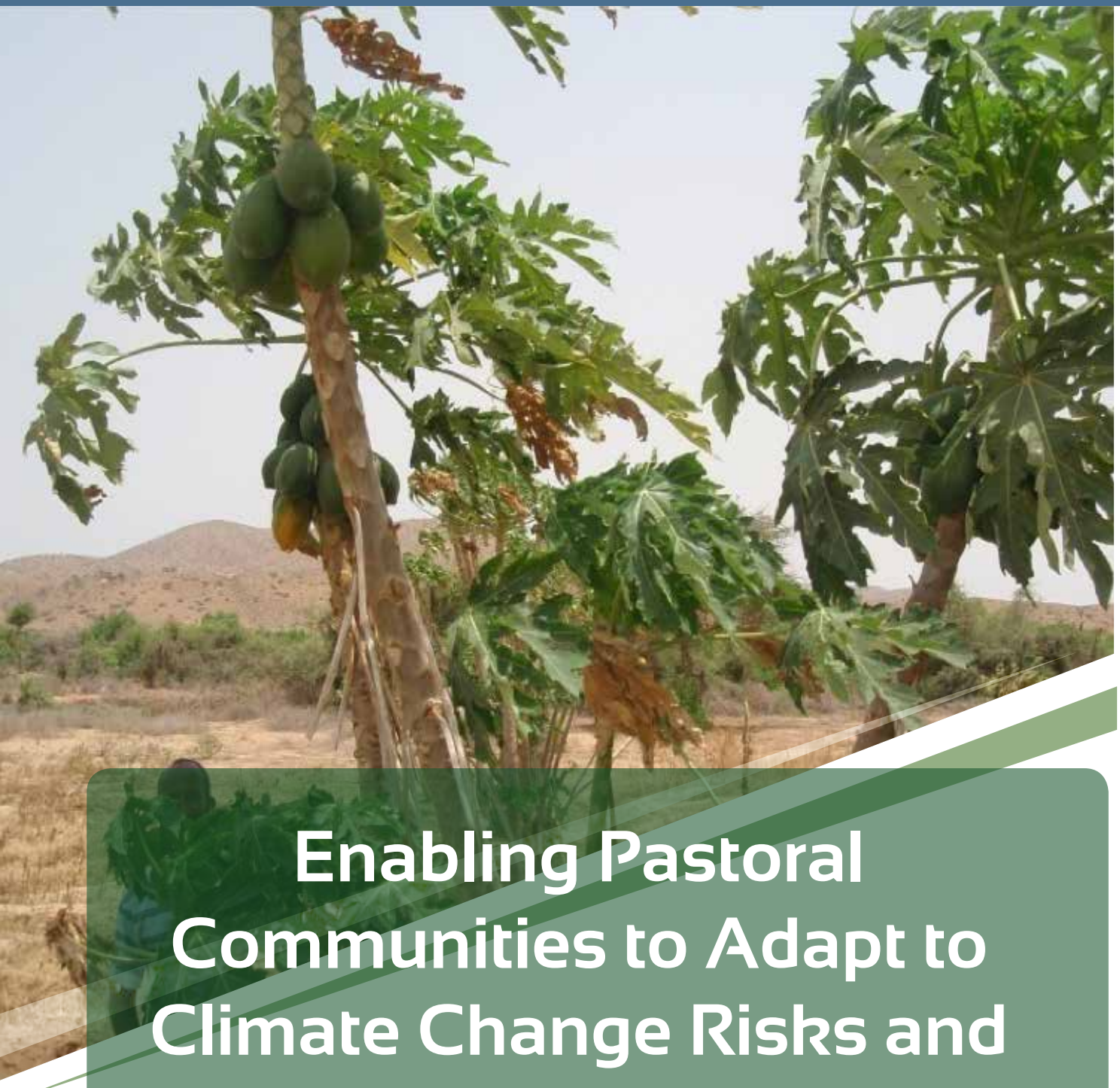
EMPOWERING LOCAL COMMUNITIES TO HARNESS ECOSYSTEM BASED APPROACH IN UGANDA

THE BIG PICTURE

- More than three hundred (300) households so far have directly benefited from the project and a lot more have benefitted indirectly.
- The practical training center is now fully functional, more and more community members are benefiting from the project.
- Partners such as care international in Uganda and PROTOS have come up to support and strengthen the project.
- The project trained community process facilitators who have continued to upscale it in the community.
- The project emphasises gender equity, and the involvement of those affected by HIV/AIDS.
- While up-scaling the project the community should be at the forefront and practical demonstration must be emphasized.

CURRENT LIMITATIONS OF THE USE OF ECOSYSTEM APPROACHES

- Inadequate manpower to sensitize the community on the use of ecosystem approaches.
- Population explosion where people are forced to encroach and degrade fragile ecosystems even after knowing their importance.
- Some approaches may not be replicable in different areas.



Enabling Pastoral Communities to Adapt to Climate Change Risks and Restoring their Rangeland Environments

BY
NETSANET DENEKE

ENABLING PASTORAL COMMUNITIES TO ADAPT TO CLIMATE CHANGE RISKS AND RESTORING THEIR RANGELAND ENVIRONMENTS

THE PROBLEM: WHAT RISKS HAVE BEEN ADDRESSED?

» Climate variability is posing a significant challenge to Ethiopia by affecting food security, water and energy supply, poverty reduction and sustainable development efforts, as well as by causing natural resource degradation and natural disasters. Thus climate change risk in pastoral communities of Ethiopia required a response by this joint programme.

THE OBJECTIVE

» The core objective of environment Joint Program (JP) is to enhance the enabling policy environment to effectively plan and execute pastoralist-related climate change adaptation and mitigation measures at federal, regional and district levels and pilot measures to enable the pastoral communities develop capacity for managing climate change risks and shocks in four pastoral regions in six districts of Ethiopia.

METHODOLOGY & IMPLEMENTATION

» Range land rehabilitation and natural resource management capacity enhancement were the adopted ecosystem-based approaches chosen for implementation by the joint program.

» Climate Change was the risk this approach addressed.

» This approach applied during 2010 -2013 years.

» The target groups of the joint programme were the vulnerable pastoral communities which live in four pastoral regions in six districts of Ethiopia.

» Pastoral communities, the government of Ethiopia (MoA & EPA) and three UN agencies (UNEP, UNDP & FAO) were the key stakeholders of the joint environment program and joint programming and participatory planning, implementing. Their involvement included monitoring and evaluation.

» The replication potential of the Joint Program is very high.

THE SOLUTION: WHERE DID THE ACTION TAKE PLACE AND WHAT WAS DONE?

Where did the program take place?

» The JP has been implemented in four regions (Afar, Somali, Oromiya and SNNPR) and within six pilot districts of Ethiopia.

What was done?

1. Climate change mitigation and adaptation options for pastoralists mainstreamed into national/sub-national and district development frameworks (development plans, strategy, policies);
2. Government and pastoral institutional capacities strengthened to effectively respond to the climate change risks and challenges (training on natural resource management, resource-related conflict prevention and management, climate change adaptation/mitigation program planning, monitoring and evaluation, early warning and response systems; and provision of materials for local government and communities); and
3. Pastoral community coping mechanism/sustainable livelihood enhanced (IGA, range land rehabilitation, water development, animal health post renovation and nursery establishment to restore the degraded ecosystem) .

ENABLING PASTORAL COMMUNITIES TO ADAPT TO CLIMATE CHANGE RISKS AND RESTORING THEIR RANGELAND ENVIRONMENTS

HOW DOES THIS ECOSYSTEM APPROACH ADDRESS & ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?

- **Mainstreaming Climate Change adaptation/mitigation into national and local development plans** (create enabling environments to harness various options of Climate Change adaptation/mitigations on national as well as local development plans)
- **Capacity building** (through providing training & equipments for pastoral communities and local government institutions)
- **Range land rehabilitation** (improve the survival of livestock which will directly contribute to food security)
- **Animal health post-renovation** (reduced death of livestock will improve the livelihood and food security of pastoralists)
- **Developed water schemes** eliminated more than six hours from single trip to fetch water and gave pastoralists an opportunity to spend more time on other income generating activities. These also improved the ecosystem productivity (improving biodiversity) by serving as habitat for several birds species
- **Provided income generation activities** have diversified income sources of pastoralists and improved their livelihoods which also enhanced their resilience for Climate Change
- **Established nurseries** (with multipurpose trees) restored the degraded land, improved the productivity of ecosystem and contributed to food security.

THE BIG PICTURE

- The joint programme targeted a total of 32,160 pastoral community members (14,658 women and 17,502 men) as direct beneficiaries
- After the JP started, the national CRGE strategy was developed and launched this is seen as an emerging opportunity to harness ecosystem based approach
- The replication and up-scaling potential of the JP is very high and Ministry of Agriculture committed to up-scaling
- The JP addressed sustainability and cross-cutting issues through creating strong ownership among the direct beneficiaries and local government institutions
- Participating the local communities and integrating all development actors to have a common understanding should be considered in the future up-scaling of ecosystem based approaches

WHAT ARE THE CURRENT LIMITATIONS IN THE USE OF ECOSYSTEM APPROACHES?

- What we know regarding the scientific basis of ecosystem based approach is:
  - ◊ There is no single or unique ecosystem approach
  - ◊ The final goals of the approaches acknowledge human participation and interests
  - ◊ Emphasis is on maintaining the interactions within and functioning of natural systems
  - ◊ The approach may be applied over a wide rang of scales

WHAT ARE THE SCIENTIFIC LIMITATIONS?

- Scientific findings of ecosystem-based approach lack simplicity and clarity necessary for decision-makers
- Lack of an interface/dialog among science, decision-makers, and development actors/practitioners
- Underestimating traditional ecosystem-based adaptation and inducing technical approaches without harmonizing it within the existing system

Use of Agroforestry Technology to Stabilize Sand dunes in the Desert Ecosystem in Nigeria

BY
AJIGO JOHN

USE OF AGROFORESTRY TECHNOLOGY TO STABILIZE SAND DUNES IN THE DESERT ECOSYSTEM IN NIGERIA

THE PROBLEM: WHAT RISKS HAVE BEEN ADDRESSED?

» The Encroachment of Mobile Sand Dunes on Farmland and Settlements in the Sahel Community Nigeria

COMMUNITY ALMOST SUBMERGED BY MOBILE DUNES

FARMLAND TAKEN OVER BY DUNES

USE OF AGROFORESTRY TECHNOLOGY TO STABILIZE SAND DUNES IN THE DESERT ECOSYSTEM IN NIGERIA

OASIS ALMOST COVERED BY DUNES

A COMPLETELY DRIED OASIS

USE OF AGROFORESTRY TECHNOLOGY TO STABILIZE SAND DUNES IN THE DESERT ECOSYSTEM IN NIGERIA

A TYPICAL ACTIVE OASIS

USE OF AGROFORESTRY TECHNOLOGY TO STABILIZE SAND DUNES IN THE DESERT ECOSYSTEM IN NIGERIA

THE OBJECTIVE

- To provide the necessary interventions that are required to stabilize the dunes and enhance food security and adaptation to climate change.
- To improve habitat conditions for enhanced economic/ farming activities among the rural communities.

METHODOLOGY & IMPLEMENTATION

What ecosystem approaches were adopted to implement project activities?

- The use of Agroforestry technology to stabilize sand dunes and restoration of dead Oases to enhance water availability.

What risks did this approach address?

- The semi-arid areas of Nigeria are characterised by low rainfall, low primary productivity, and sparse vegetation. Since the severe drought of early 1970's, desertification remained one of the pressing environmental problems being faced in the Sahel region. Ecosystem degradation resulting from environmental changes and human activities has culminated in formation of highly unproductive mobile sand dunes.
- The approach is addressing the risk of total displacement of over 5000 men, women and children from Tohsua community by the moving sand dunes, water scarcity and the risk of food insecurity in the area as farm lands are being taken over by unproductive sand.

In which time of the year was this approached applied?

- Between April and June

Who were the target groups of the project?

- The impoverished male and female farmers, in Tohsua community

Who were the key stakeholders of the project and what methods were used to involve them?

- Key stakeholders include the community, the Local and State government, the Department of Forestry; University of Maiduguri and Nigerian Environmental Study/Action team. All the stakeholders were involved through participatory consultations.

What is the replication potential of the project?

- The project from its design has the potential for scalability. The State and Local Government councils who are the custodians of the people's money are involved right from onset with the hope that they will be responsible for scaling up to other communities. Also communities are required to form a local implementation committee (PIC) who are specifically trained in the technical areas of the project to enable them replicate the projects.

USE OF AGROFORESTRY TECHNOLOGY TO STABILIZE SAND DUNES IN THE DESERT ECOSYSTEM IN NIGERIA

THE SOLUTION: WHERE DID THE ACTION TAKE PLACE AND WHAT WAS DONE?

- The project was implemented in Tohsua community of Yobe State, Nigeria.
- It started with the community-led entry using social analysis systems tools to get the attention of the community, know the relevant stakeholders, what effort the communities have made before and introduce the new work to be done to reduce dunes encroachment and restore water to Oases.
- Project Implementation Committee members were chosen by the communities and they are to participate actively from the beginning of the project to end and are responsible for maintenance and sustainability of the project
- State and Local Government council of the area were involved as stakeholders from the onset of the project as a strategy to encourage replication.
- The project involved the planting of 15,000 seedlings of the early colonizing and fast growing Prosopis juliflora on the lee side of the dunes (which are threatening the farm lands and the community) to serve as barrier to movement of dunes and later restore the fertility of the soil. The plant used was an satisfactory species which will in addition provide food for livestock and fuel wood for the people.
- Digging of shallow wells in the oases and planting of trees around to conserve water for household uses, watering of livestock and irrigation purpose.

HOW DID THIS ECOSYSTEM APPROACH ADDRESS & ENHANCE FOOD SECURITY, CLIMATE ADAPTATION AND ECOSYSTEM PRODUCTIVITY?

FOOD SECURITY

- The planting of this leguminous specie, helps to protect farm lands, restore and improve the soil fertility, support the growth of cereal crops which are the major crops grown by the people. The trees also through the root system prevent movements of dune, stabilize and improve the soil structure. The leaves are good sources of feeds to support the livestock productivity. The availability of water in the oasis encouraged dry season farming to enhance food security. Trees around the oases act as a buffer and help minimise the rate of evaporation.

CLIMATE CHANGE ADAPTATION

- Climate change is likely to exacerbate the already fragile ecosystem of the area. The frequency of the movement of the dunes will increase and may displace the people completely. The planting of the trees will serve as a buffer and restricting and reducing the movement of the dunes and prevent them from covering farmlands. The community which is at the verge of being displaced will be protected. The means of livelihoods which is mainly livestock and cereal production will be enhanced.

CONTRIBUTED TO THE ECOSYSTEMS PRODUCTIVITY:

- The approach consciously employs the planting of leguminous trees with the aim of protecting restoring the land and the lost nutrients back to the soil. The roots of the trees will stabilize the movement of soil and thereby prevent the removal of soil nutrients. The soil structure will also be improved as the leaves and other materials fall back to the soil encouraging the trees planted to contribute to the process of restoration and productivity of the ecosystem.

USE OF AGROFORESTRY TECHNOLOGY TO STABILIZE SAND DUNES IN THE DESERT ECOSYSTEM IN NIGERIA

COMMUNITY SENSITIZATION

USE OF AGROFORESTRY TECHNOLOGY TO STABILIZE SAND DUNES IN THE DESERT ECOSYSTEM IN NIGERIA

NEWLY PLANTED PROSOPIS JULIFLORA

USE OF AGROFORESTRY TECHNOLOGY TO STABILIZE SAND DUNES IN THE DESERT ECOSYSTEM IN NIGERIA

ONE OF THE SHALLOW WELLS

USE OF AGROFORESTRY TECHNOLOGY TO STABILIZE SAND DUNES IN THE DESERT ECOSYSTEM IN NIGERIA

WATERING OF LIVESTOCK

WATERING POINTS PROVIDED

USE OF AGROFORESTRY TECHNOLOGY TO STABILIZE SAND DUNES IN THE DESERT ECOSYSTEM IN NIGERIA

FARMING RESUMES AT THE REHABILITATED OASIS

USE OF AGROFORESTRY TECHNOLOGY TO STABILIZE SAND DUNES IN THE DESERT ECOSYSTEM IN NIGERIA

THE BIG PICTURE

NUMBER OF PEOPLE WHO BENEFITED

» The number of people that benefited is over ten thousand. This is far above the five thousand anticipated from the start of the project. The neigbouring communities are trooping to Tohsua and are copying the processes and acquiring the early maturing varieties of crop seeds from them.

EMERGING OPPORTUNITIES

» The success recorded in this project has stimulated the interest of other communities who are demanding similar projects. Again, other areas such as oasis rehabilitation and provision of seeds are big issues. Most of the oases they depend on are drying and unless water provision is given better attention, the community will have no other alternative than to relocate.

REPLICATION AND UP-SCALING POTENTIAL

» The Local and state Government is expected to take up the issue of replication. The communities also have been equipped with knowledge to be able to carry out the projects on their own.

HOW DID THE PROJECT ADDRESSED SUSTAINABILITY AND CROSS-CUTTING ISSUES?

» The project has in place the project implementation committees at the community level made up of men and women, who are charged with the responsibility of the sustainability of the projects. The committee members have also been linked properly to the Local Government Councils for any support they may need. Gender consideration was incorporated from the beginning of the project.

WHAT SHOULD BE CONSIDERED IN UP SCALING ECOSYSTEM-BASED APPROACH?

» Proper community entry to identify stakeholders and involve them from onset will make the project more acceptable to the community.
» Local committees must be put in place to prepare for maintenance and sustainability of the projects
» Materials for scaling up should be easily available.
» Capacity of the local committees should be built.
» Involvement of the state and local Government will facilitate the up-scaling.

WHAT ARE THE CURRENT LIMITATIONS IN THE USE OF ECOSYSTEM APPROACHES?

WHAT ARE THE CURRENT LIMITATIONS IN THE USE OF ECOSYSTEM APPROACHES?

» The seedling uptake depends on the level of moisture that is available and tolerance level of the plants. Where moisture is limited and the choice of tree species are not heat tolerant, the survival rate will be less.
» The risks of livestock destroying the seedlings before they are established.
» Success requires the commitment and participation of the community members to plant such huge numbers of seedlings.

WHAT DO WE KNOW OF THE SCIENTIFIC BASIS OF THIS ECOSYSTEM-BASED APPROACH?

» The scientific basis of this ecosystem includes:
  ◊ Creating a barrier to slow down the movement of wind which in turn will reduce the movement of sands.
  ◊ The type of tree species used are soil-friendly as they deposit nitrogen in soil to improve soil nutrients and the dry leaves improve the water holding capacity of soils as such improve the soil structure to support growing of plants.

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