Developing a Participatory Socio-Economic Model for Food Security, Improved Rural Livelihoods, Watershed Management and Biodiversity Conservation in Southern Africa

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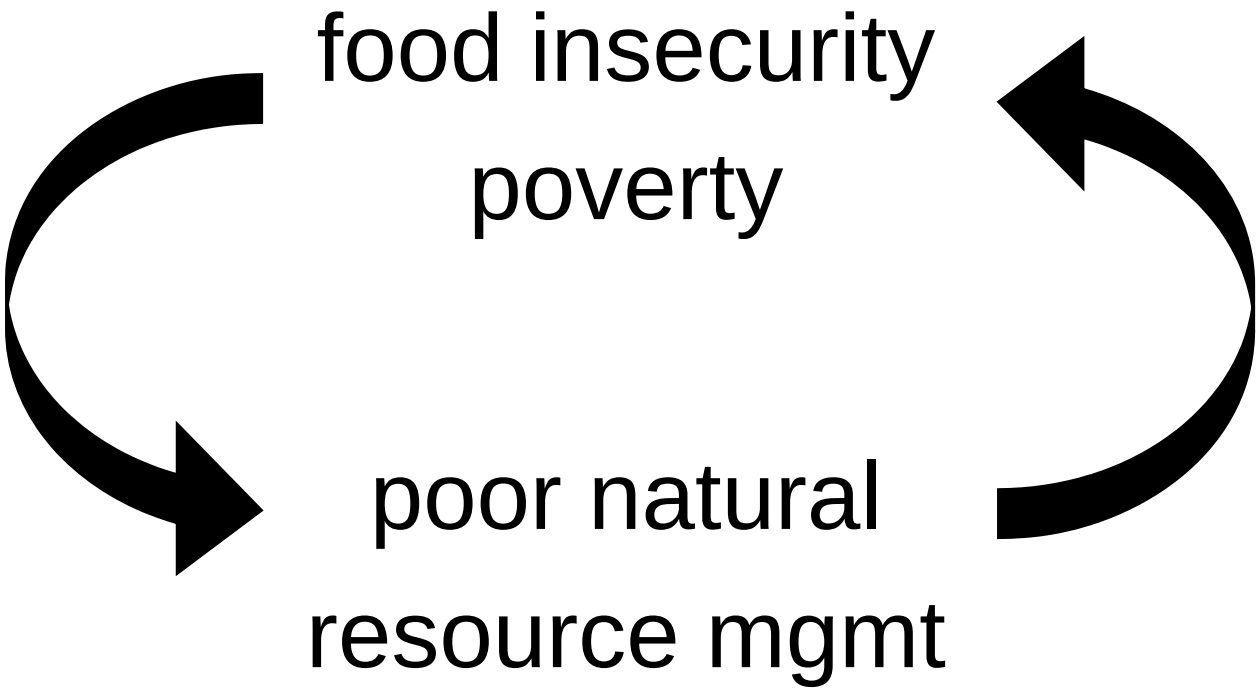
August 31, 2009

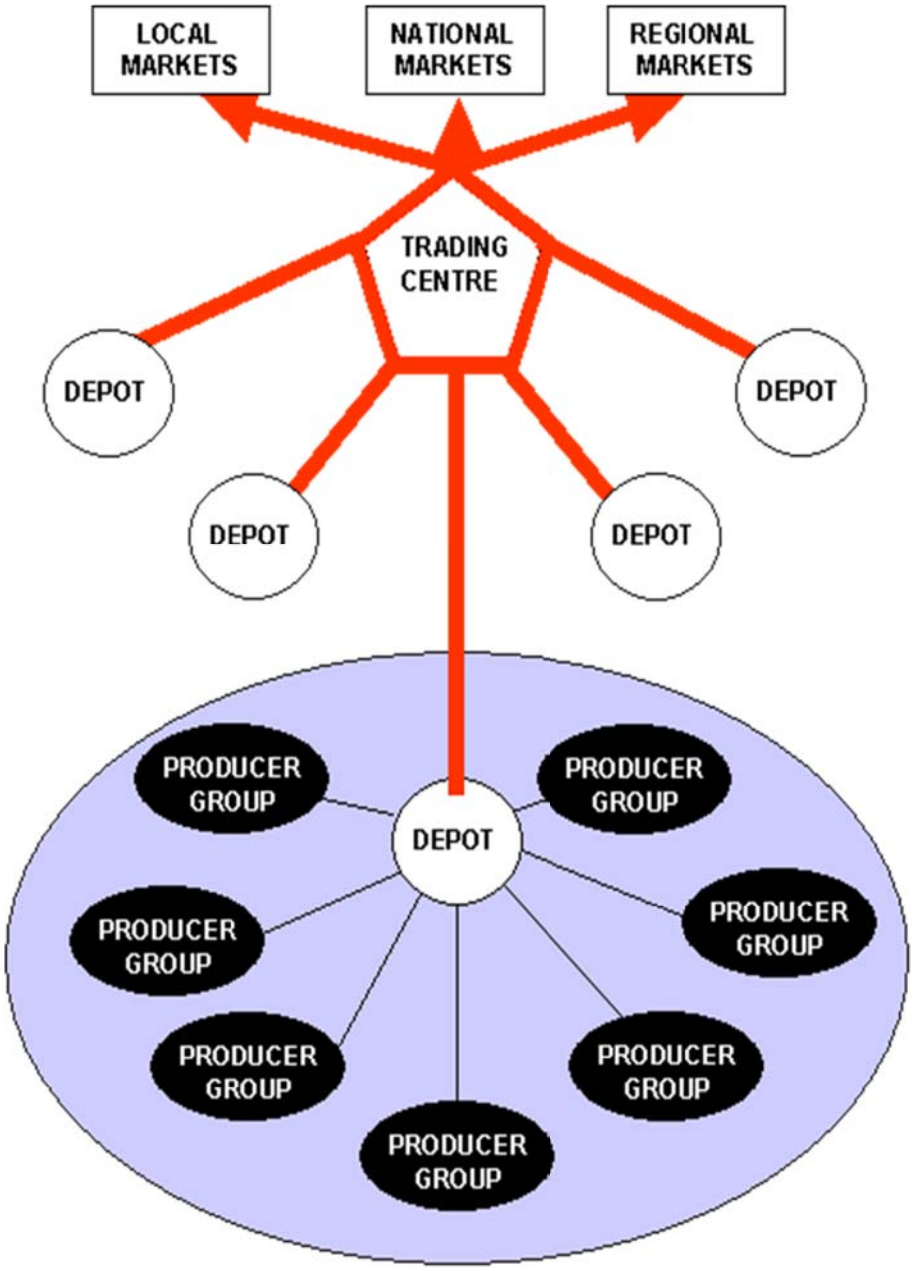
Zambia
Malawi
Mozambique
Zimbabwe
Botswana

Problems Affecting Conservation Are the Same Problems Affecting Rural Development



COMACO

Community Markets for Conservation


LOCAL MARKETS
NATIONAL MARKETS
REGIONAL MARKETS
TRADING CENTRE
DEPOT
DEPOT
DEPOT
DEPOT
PRODUCER GROUP
PRODUCER GROUP
DEPOT
PRODUCER GROUP
PRODUCER GROUP
PRODUCER GROUP
PRODUCER GROUP
PRODUCER GROUP

Over 1700 firearms surrendered

Over 40,000 snares surrendered

661 poachers reformed and trained

Specific Aims

1. To determine the extent to which the COMACO model can be economically self-sustaining and the effectiveness of the different COMACO model components.

   - business economic analysis
     - historical analysis
     - profit and cost centers
   - natural resource economic valuation--What is the “cost” of biodiversity conservation by this model? (more on this near the end of this presentation)

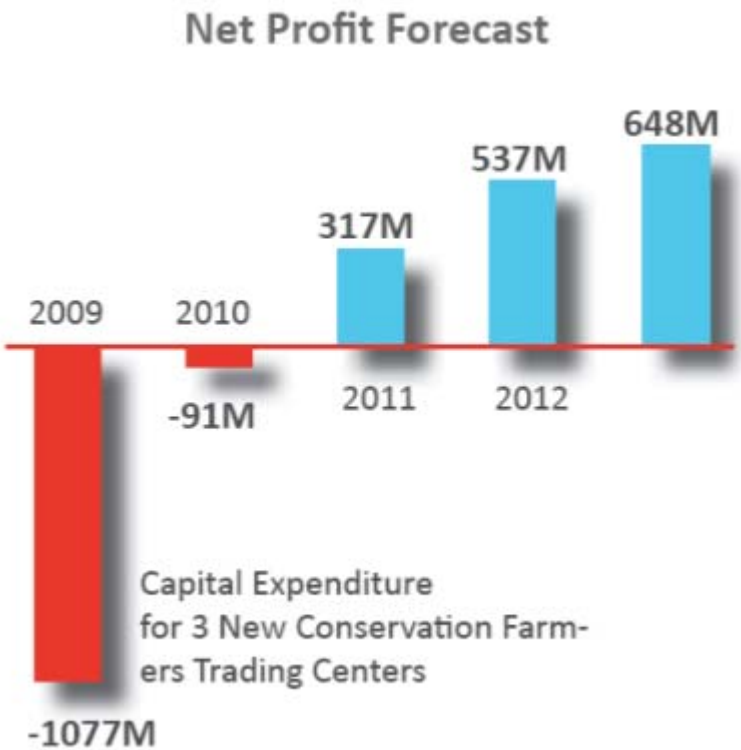
Summary (USD) COMACO East*							
Location	08/09 FY	09/10 est	10/11 est	11/12 est	12/13 est	13/14 est	Total est
Sales	$ 470,192	$ 1,229,970	$ 1,753,297	$ 2,045,928	$ 2,363,134	$ 2,542,041	$ 9,934,370
Expenses	720,786	$ 2,660,597	$ 2,653,997	$ 2,464,382	$ 2,515,512	$ 2,616,112	$ 12,910,600
Net Revenue	(250,593)	(1,430,627)	(900,701)	(418,454)	(152,378)	(74,070)	(2,976,230)
Rev - expansion $	N/A	(978,127)	(571,001)	(327,054)	(96,778)	(33,070)	(2,006,030)
Donor Support	388,841	$ 1,108,214	$ 1,108,659	$ 1,287,247	$ 1,333,335	$ 1,338,357	$ 6,175,811
Closing Balance	138,247	(322,413)	207,958	868,792	1,180,957	1,264,287	3,199,581

* Includes HQ, Lundazi, Mfuwe, Nyimba, Chama (analysis does not include 2009 West Expansion)

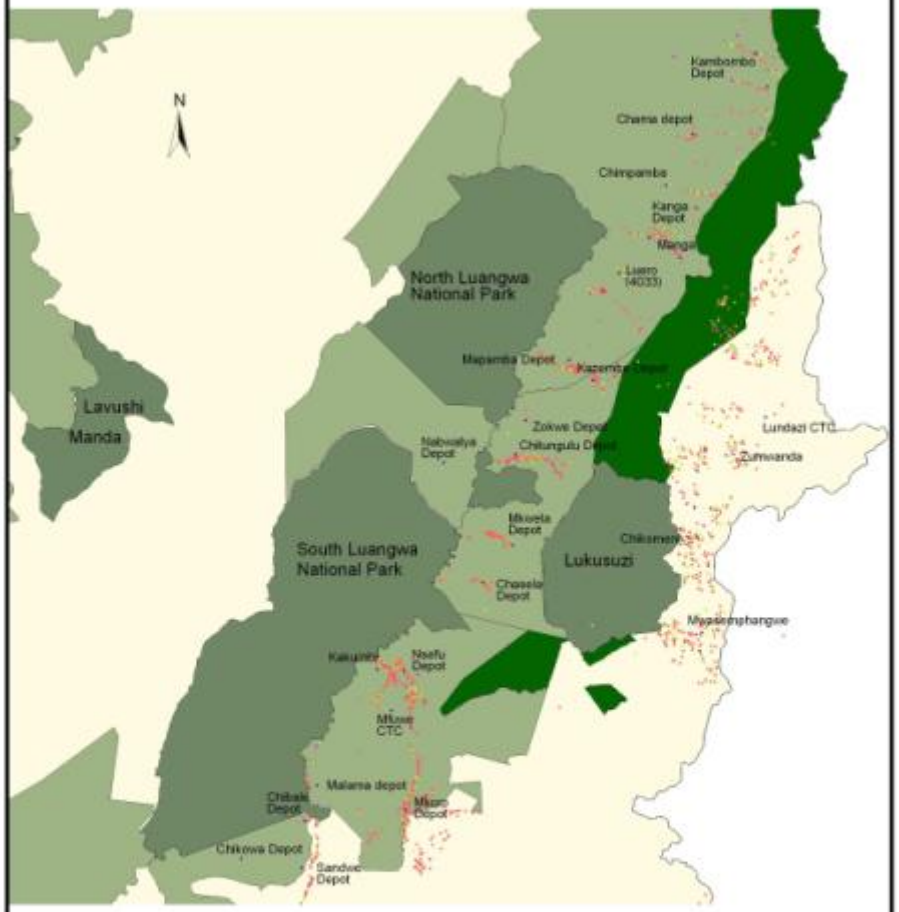
* 80% total HQ & Chipata overhead attributed to COMACO East.

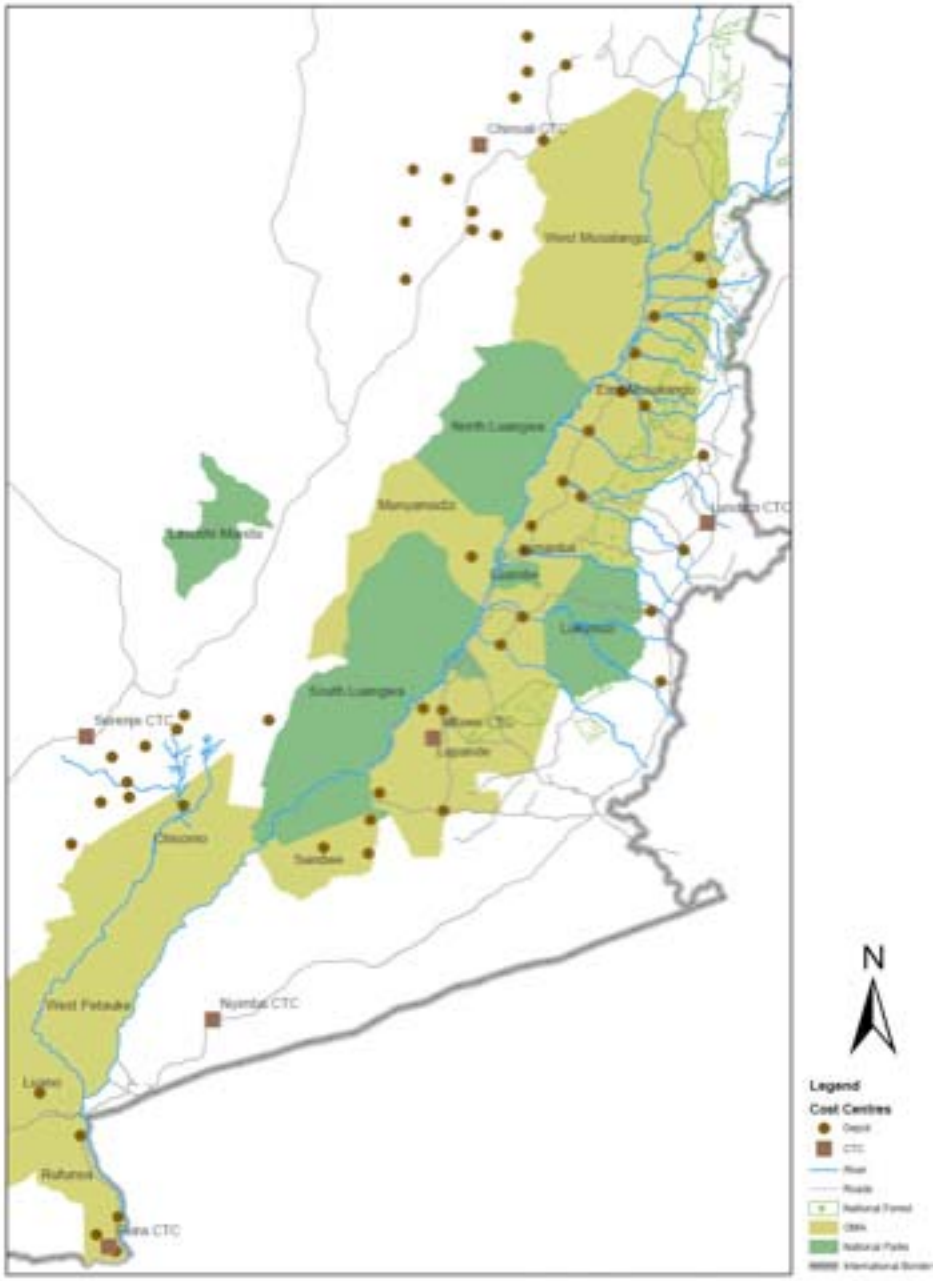
Sustainability Analysis of Established Centers (HQ**, Lundazi, Mfuwe)						
Location	09/10 est	10/11 est	11/12 est	12/13 est	13/14 est	Total est
Sales	$ 838,406	$ 1,108,978	$ 1,206,486	$ 1,400,639	$ 1,478,098	$ 6,032,607
Expenses	$ 1,405,258	$ 1,411,116	$ 1,423,279	$ 1,461,368	$ 1,523,563	$ 7,224,585
Net Revenue	$ (566,852)	$ (302,138)	$ (216,793)	$ (60,730)	$ (45,466)	$ (1,191,978)

**HQ Overhead expense reduced by 50% current OH covers 6 centers



Distribution of Comaco Villages





Impacts of improved business economic sense

- Accelerated adoption of business methods and accounting (now keep day-to-day sales)
- Recognized impacts of transportation costs and value added products (changed location of 3rd CTC from Feira to Nyimba)
- Historical analyses of CTC costs (used to budget new CTCs in Serenge & Chinsali)
  - examples: entered commodity market (2 x 100 ton consignments, K1800/kg price)
  - carbon credits

Specific Aims

2. To identify and integrate new technologies into the COMACO model to improve its profitability, food security, and rural incomes.

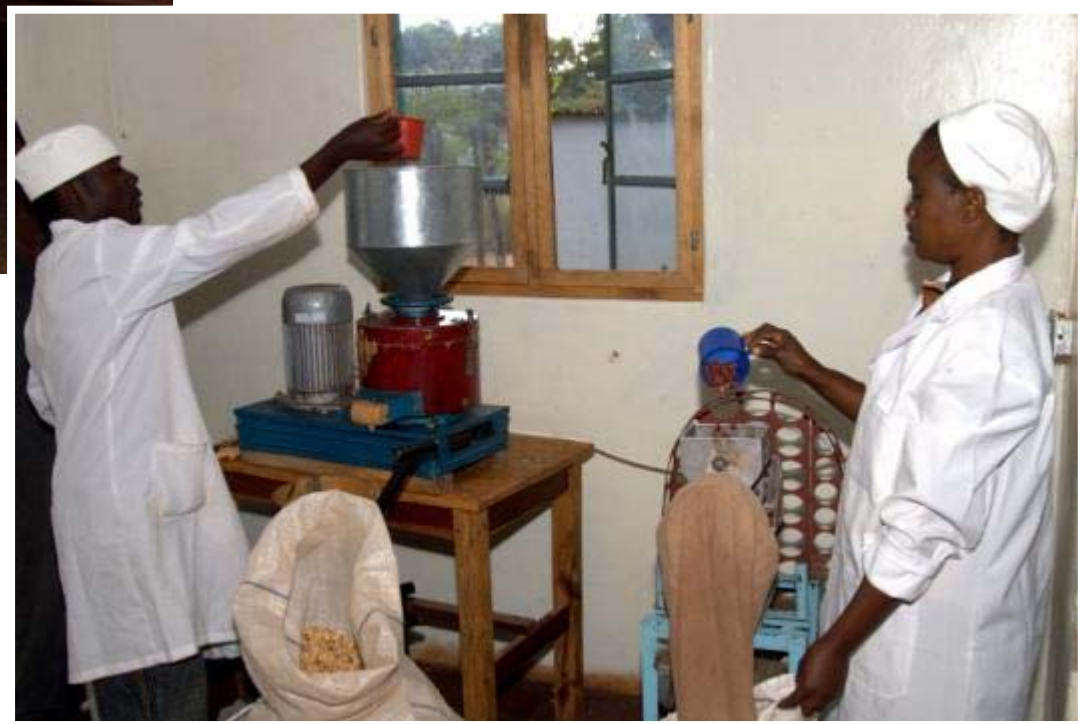
- food sciences
- crop and soil sciences
- veterinary sciences (poultry and goats)

Food processing at COMACO
- Peanut butter processing in 2005 -

Roasting → Sorting → Milling

Peanut butter processing - 2007

- Hygiene practices improved considerably, but still needed improvement
- Quality problems: phase separation, leaky jars



Peanut butter processing in 2009

Cooling

Blanching

Research to improve peanut butter

- minimize oil separation
- improve packaging
- improve price/unit
- improve shelf life

"Crunchy" peanut butter produced in 2007

Photo: June 24, 2009

Basic food hygiene workshop - 2007

- Trainees at the Lundazi COMACO Processing Center

Practicing proper hand washing and surface cleaning

Impact of training

- Enhanced capacity for safe food processing with electronic & printed materials for future in-house training
- Provided WFP with proof of training, which helped COMACO get approved as a HEPS vendor for WFP
- 270 ton contracts at $350/ton (contracts with WFP and Catholic Relief Services)
- Now also selling to 4 regional hospitals and starting with schools
- Approx 60% is used within Eastern Province itself
  - provides unknown cost savings
  - reduces carbon footprint vs importation

How does it look in 2009?

As of June 2009:

– Seeds for new product development lab have been “planted”

New product development

- Extrusion could be key to product line extension
- 2 extruders now available

First extruder

Extruder purchased with funds from General Mills

New product development:

Rice crisps

Health snacks

Energy health bar

Soil and crop sciences

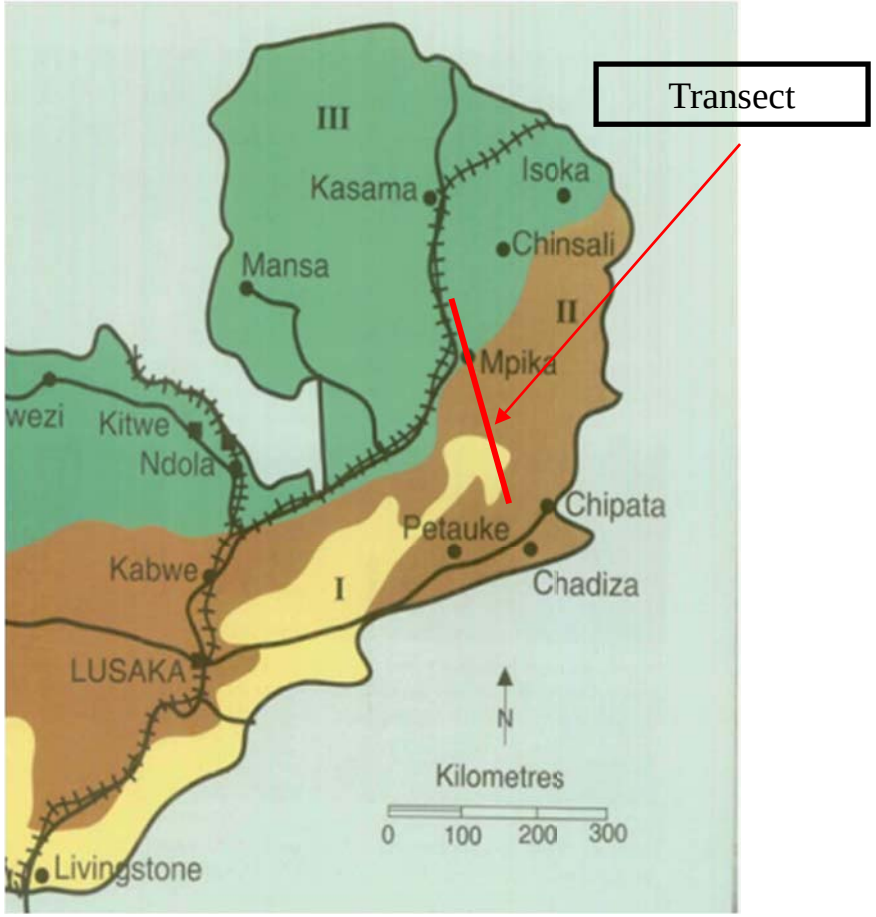
To investigate:

(i) under which environmental conditions conservation farming works best;

(ii) what are the reasons for better yields;

(iii) what types of organic amendments (qualities) are best for improving production potential under conservation farming.

Methodology



Agroecological Zones;

I: <700mm rainfall p.a.
Rift Troughs

Loamy and clayey soils with coarse to fine loam top soils

II: 700- 1000mm rainfall p.a.

Degraded plateau

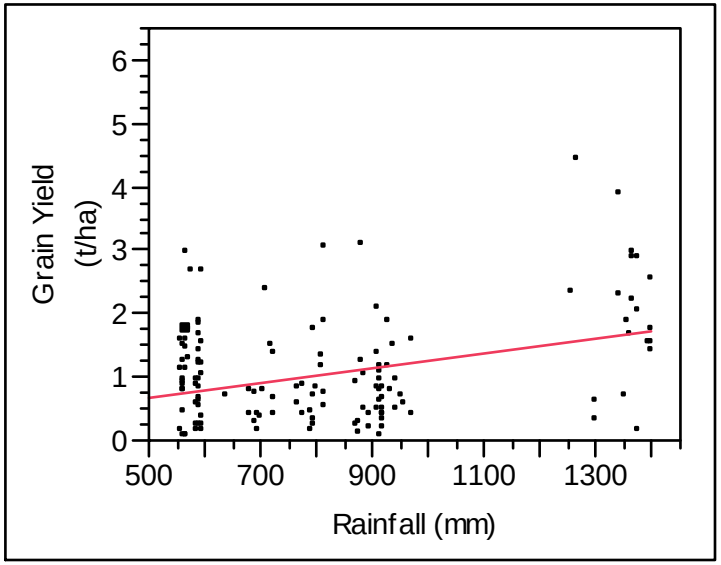
Moderately leached clayey to loamy soils

III: >1000mm rainfall p.a.

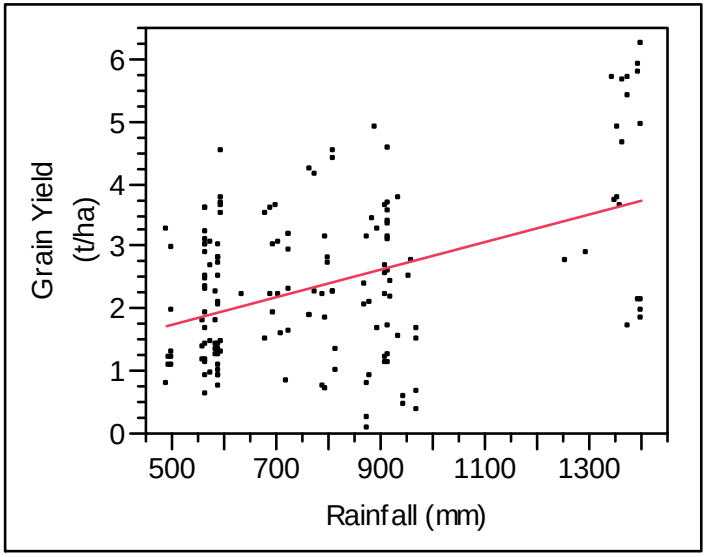
Degraded plateau

Highly weathered and leached clayey to loamy soils;

Grain yield under conservation farming along a climatic gradient



Traditional plot



Biochar + fertilizer yields

- benefits of conservation farming increased with increasing rainfall
- quantified max yields possible for each agroecozone, providing benchmarks for conservation farming results (max yield with inorganic fertilizer + biochar or manure + fertilizer)

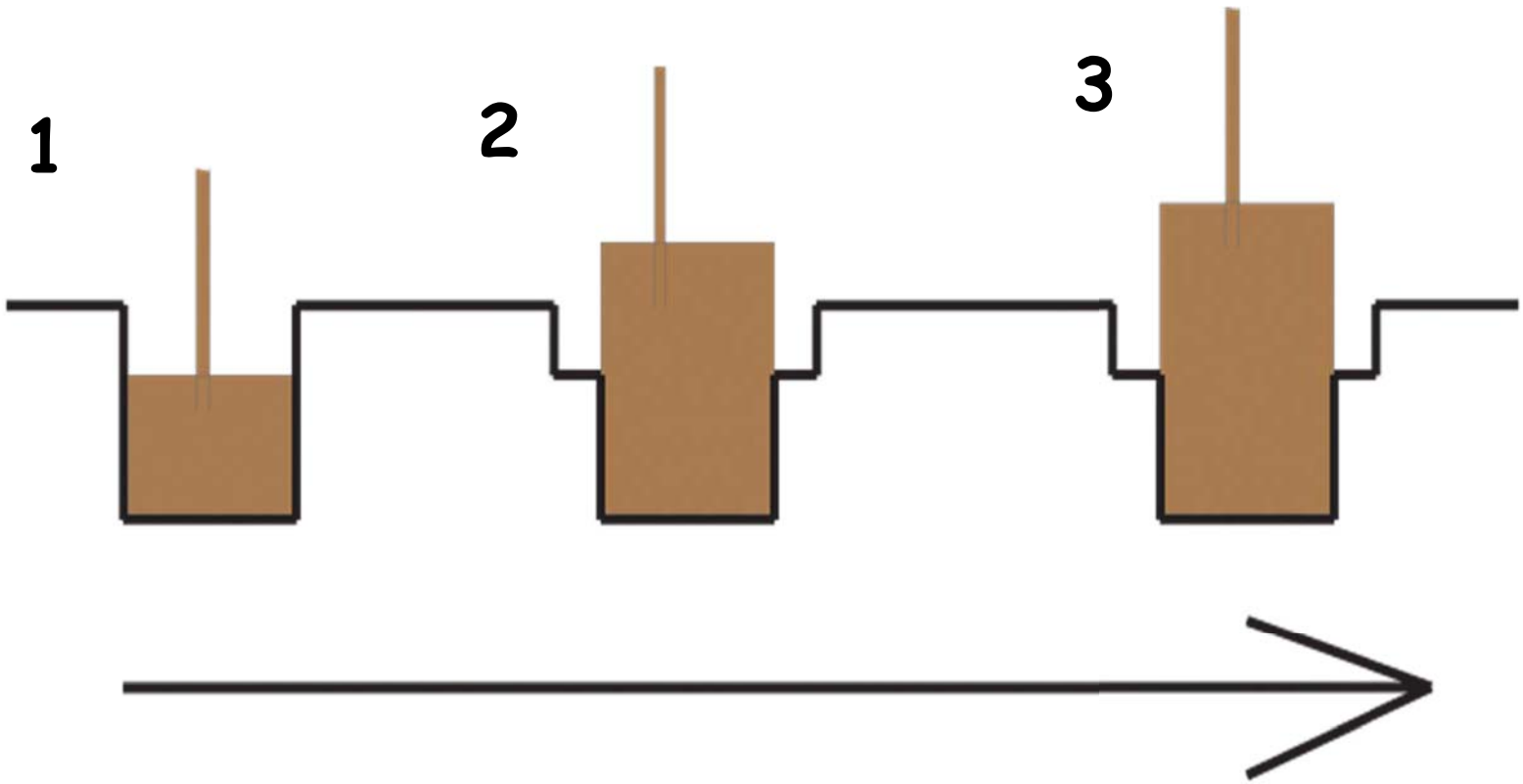
Soil and crop sciences practical recommendations

1. Plant seeds just below OM additions for the following years while re-digging the trench to allow collection of water.

2. Need to increase nutrient return to soil (e.g. growing termites in basins in dry season)

3. For soil organic amendments, use biochar for sequestering carbon in soil and retaining nutrients and moisture. Combine this with high nitrogen manure eg Tithonia

Future considerations



Year 1, dig basin

Plant the seed just below the OM additions, for the following years while re-digging the trench to allow collection of water.

Year 2 dig small trench around the basin, add OM on top instead

Veterinary Sciences:

Poultry and Goats

initial research:

- survey of causes of mortality
- survey of husbandry practices

focused research:

- NewCastle Disease community vaccination efforts (over 10,000 birds per cycle per site)

training:

- improved husbandry
- disease prevention/recognition
- extension staff “training the trainers”

Poultry Health and Management

A guide to raising healthy village poultry

Compiled by: Erin McDonald

Special thanks for illustrations:
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Specific Aims

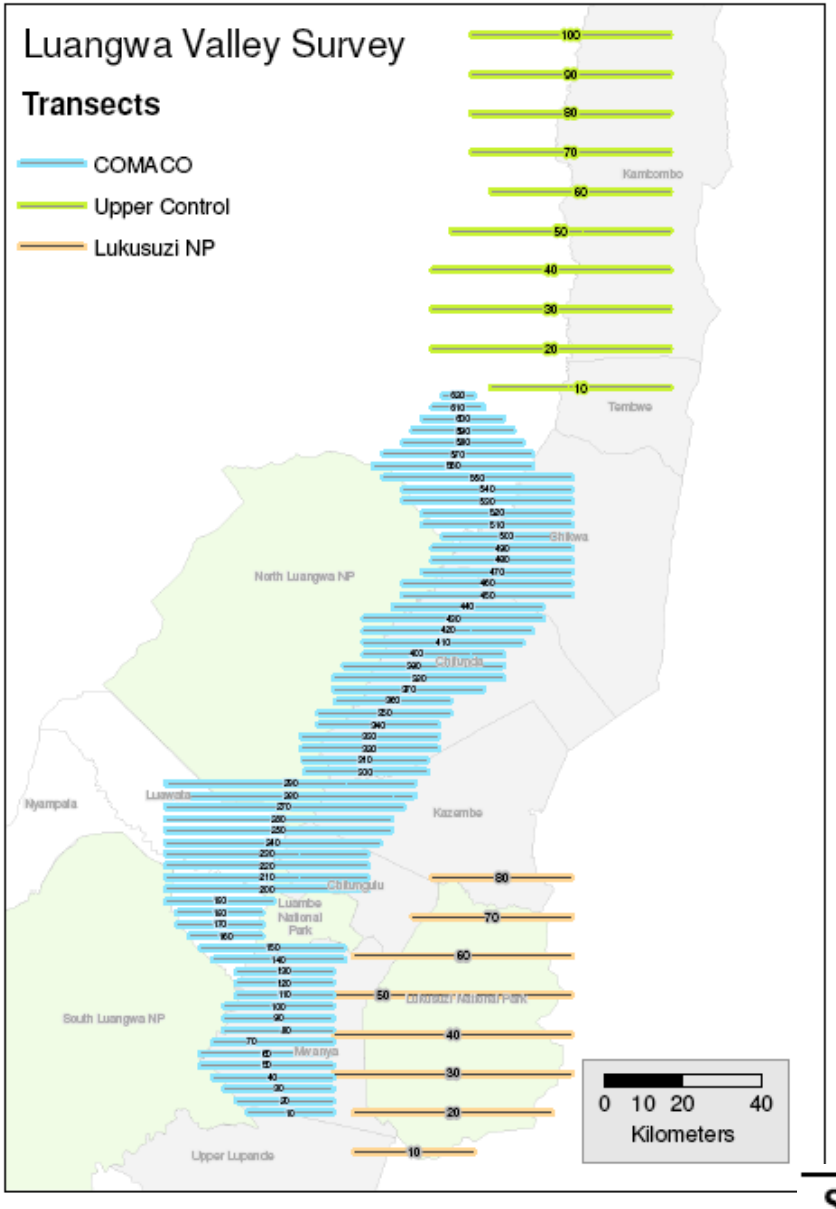
3. To determine the extent to which the COMACO model provides self-sustaining social institutions and meaningful roles for COMACO participants.

- COMACO baseline surveys

Specific Aims

4. To determine the extent to which the COMACO model improves biodiversity and watershed conservation.

- aerial wildlife surveys (COMACO core and control areas, hippos)
- watershed, canopy and bushfire analysis



Aerial Survey 2008
28 Sept - 4 Oct

1999, 2002 - ZAWA
2006, 2007, 2008 - WCS

Survey zone	Area	Transect spacing
COMACO core	6,650 km^2	3 km
Upper Control	5,250km^2	10 km
Lukusuzi National Park	3,900 km^2	10 km

Changes in “Poaching Liable Guild”: waterbuck, eland, roan, hartebeest, kudu

	1999+2002		2006+2008		
Area	**Total**	**Se**	**Total**	**Se**	**d-test**
Chikwa/Fulaza	**109**	43	**464**	126	***2.68***
Chifunda	**17**	6	**123**	50	***2.11***
Chanjuzi	**0**	0	**216**	50	***4.34***
Munyamadzi	**146**	37	**218**	84	0.78
Mwanya	**111**	40	**124**	44	0.22
Total	**325**	56	**694**	125	**2.70**

Reducing Human wildlife conflicts in Game Management Areas.

Elephant Damage to Crops

Better controls on use of electric fencing

Chili blasting, using transformed poachers to reduce crop damage by elephants

Blasting Materials

What are the costs and benefits of providing biodiversity conservation through the COMACO model?

- what is the value of wildlife?

--willingness to pay survey of tourists

--vital information for Zambian government

- what is the value of improvements to human nutrition/health? What is the value of a life?

Use-Value of wildlife to South Luangwa National Park visitors

Attribute	WTP Range (Entrance fee *increase* from the current USD 25 per day per person)
Small to Medium Animals (per 10% increase in population)	**$0.50-0.90**
Large Mammals (per 10% increase in population)	**$1.60 - 2.00**
Prominent Species (per 10% increase in population)	**$2.10 - 2.80**
Rhinoceros Re-population (10 breeding pair program)	**$1.30 - 5.50**

- Willingness to Pay (WTP) values for change in a single attribute
- WTP increase linearly with population increase
- Highly Statistically Significant Results
- An increase of 10% in large mammal populations alone represents a potential $50,000 value to tourists each year
- An increases of 10% in all wildlife groups represent a value of around $142,000/year
- Non-use values are in addition to this, and likely to be much larger

Food Security, Malnutrition, Child Mortality and the Value of Statistical Life

- Over 30,000 member households of COMACO, mostly in the Eastern Province of Zambia. COMACO targets households that are most food insecure
  - **Over 30,000 U5's are part of COMACO member families.**
- Under 5 Mortality is 152 per 1000 in Eastern Province [119 nationally and ranked 13th highest rate of child mortality in the world (UNICEF 2009)]

Food Security, Malnutrition, Child Mortality and the Value of Statistical Life (cont.)

- Malnutrition in children compounds the effects of other diseases, and the ‘probability attributed risk factor’ has been estimated to be 51% for under five in-patients in rural Kenya (Bejon, 2008).
  - Preventing malnutrition in U5’s reduces in-patient deaths by 51%
- Assuming a 15% mortality rate (likely to be higher) of those admitted underweight, 627 children lost their lives in these areas in 2008 alone, from a probabilistic perspective

How does COMACO affect this?
(Malnutrition, Child Mortality, and the Value of Statistical Life)

- Consider a range of impact levels: proportion of members (and their families) who attain a state of food security either partial (50%) or complete (100%) and assume food security results in proper nutrition

  Based on the these assumptions – the number of U5 deaths would have been 134 to 269 *greater* without COMACO (2008)
- The approximate Value of a Statistical Life in rural Africa is $100,000

Child U5 Mortality 2008

Likely deaths

896

without COMACO

COMACO (30%)

x 0.30

269

Food Security Impact

x 50% or 100%

67 or 134

AVOIDED U5 DEATHS

Value to Communities of reduced Mortality (2008)

x $100,000 =

$ 6,700,000

Up to

$13,400,000

- Value from 2004 – 2008 is between $39,000,000-$78,000,000

What are the costs and benefits of providing biodiversity conservation through the COMACO model?

- are there additional economic benefits to conservation farming?

--carbon markets for agroforestry efforts

--goal of 1 million Faidherbia albida plantings per year

(aforestation, reforestation, avoided deforestation, soil sequestration from CF; compliance vs voluntary markets; different methodologies, validation, verification, standards)

Faidherbia albida

Lessons for Global Development

(Luangwa Valley not unique, can be used in buffer zones where people & wildlife share resources)

1. local ownership/pride
2. **help develop analytical business skills**
3. **value-added products, stable contracts**
4. **food safety/hygiene training essential**
5. shelf life and packaging
6. cropping practices/ soil amendments vary tremendously--farmer education
7. sustainable ag methods can improve yields and also lead to new opportunities for profit
8. traditional practices off-farm can impact environmental benefits of on-farm changes

Lessons for Global Development

9. **introduced livestock disease can mimic impacts of climate change**
10. **farmers often adapt poorly when they need to rely on a new livestock species**
11. utilize existing veterinary services (e.g. poultry)
12. food processing waste can be utilized for additional products such as animal feed or biochar
13. farming strategies still are in need of great improvement and site-specific development (e.g. Faidherbia)
14. assessments of impacts on food security can be difficult (move toward biometric markers)

Lessons for Global Development

15. truly holistic approaches to biodiversity conservation can be successful but require time
16. long-term presence of WCS allowed development of COMACO over decades, beyond time-frame for standard grants/programs
17. iterative process requires constant monitoring and evaluation
18. **importance of communications (V-sat connectivity) and transportation**
19. scaling up is required to become economically self-sustaining
20. **traditional business models promote scale and product diversity (in contrast to eco-tourism models or forest crop models that rely on provision of small # of crops, but don't contribute back the value-add)**

Lessons for Global Development

21. risks can arise from influence of neighboring nations/conflicts
22. **climate variability can have tremendous impacts on agricultural businesses, need to have multiple income streams and build toward an operating reserve**
23. **crop diversification can be a critical adaptation to climate change and increased variability (e.g. cassava)**
24. long-term relations with local government essential
25. **benefits of strategic partnerships (e.g General Mills)**

Lessons for Global Development

26. **efforts to improve economy can have wide-ranging, unintended impacts** (e.g. shift toward a cash crop monoculture can leave a community ill-prepared to cope with climate or market variability, leading to unsustainable natural resource utilization, long-term loss of economic opportunities, and food insecurity)
27. **holistic approaches to biodiversity conservation can provide diverse economic and social benefits**
28. **rural development and biodiversity conservation efforts can and should be integrated--each impacts the other**

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