FARMS TO LANDSCAPES: A SYSTEMS PERSPECTIVE

Climate Smart Agriculture GLEE
Tuesday, 14 March 2016
Lusaka, Zambia
FARMS TO LANDSCAPES: A SYSTEMS PERSPECTIVE

Learning Objectives:

1) Reinforce the message that Climate Smart Agriculture is not simply a set of specific practices used by farmers in their fields, rather it is an overall approach to addressing productivity, mitigation, and adaptation at multiple scales over time.

2) Illustrate the different spatial scales at which climate smart agriculture interventions should be considered, from field to the landscape scales, and how interactions at the various scales can occur.
AGRICULTURAL SYSTEMS

Ecological context
Sociocultural context
Climate Change
Economic context
Agriculture as economic livelihood

Climate-Smart Agriculture Considerations
Agricultural Systems

- Ecological context
- Sociocultural context
- Economic context

Agriculture as economic livelihood

Sieg Snapp, Malawi: Legume diversification at the farm scale
Clarisse Umutoni, Mali: Community-level policy development for NRM regulation

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AGRICULTURAL SYSTEMS

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AGRICULTURAL SYSTEMS

Clarisse Umutoni, Mali: Community-level policy development for NRM regulation

Robert Richardson, Zambia: Examining farm to landscape interactions

Sieg Snapp, Malawi: Legume diversification at the farm scale

David Yanggen, Mali: Response & reflections

Agriculture as economic livelihood

Economic context

Sociocultural context

Ecological context
RESPONSES AND REFLECTIONS

1) How are presentation concepts reflected, or not, in mission portfolios?

2) In hindsight, how would current activities have been changed to be more climate smart?

3) Have there been institutional/bureaucratic obstacles to achieving desired climate smart agriculture objectives?
Three Problems: One Priority

PROBLEM #1: DEGRADED SOILS

Nutrient and soil organic matter depletion and soil erosion worsen the effects of climate change and decrease farmer resilience.
PROBLEM #1: DEGRADED SOILS

Greatest soil organic matter losses occur when forests and grasslands are converted to agriculture; losses continue for decades.
Problem #2 : Bare soils

Several months of crop growth followed by many months of bare soil
Problem #3: Poor plant growth

Downward spiral of soil degradation resulting in low yields, further decreasing SOM & increasing erosion AND... reduced crop response to fertilizer!
Problem #3: Poor plant growth

Zambia-wide survey by Bill Burke and others found maize did not respond to fertilizer at soil organic matter levels below 1.2%.
Priority #1
Priority #1: Above- & below-ground biomass

- Improved crop genetics and fertilizer are not enough
- Soils require more biomass inputs to be climate smart & resilient

BIOMASS!
Priority #1: Above- & below-ground biomass

Resilient legumes = more biomass
Pigeonpea
*Cajan cajan*

Perennial cowpea
*Vigna unguiculata*

Runner bean
*Phaseolus caccineus*

Lablab
*Lablab purpureus*
Even more biomass: Doubled-up Legume Systems
Sole maize + recommended fertilizer

Doubled-up pigeon pea rotation + ½ fertilizer

Maize yield

Profit

Protein yield

Fertilizer efficiency

Ground cover

Sole maize = 100%
Doubled-up pigeon pea rotation

Resilient legumes = more biomass = resilient soils = higher, more reliable yields

Ollenburger and Snapp, 2015
TAKE AWAY MESSAGES

Priority #1: Above- and below-ground BIOMASS

• Crop genetics & fertilizer is not enough
• Resilient, long-lived legumes are a priority, to produce food AND biomass
• Biomass = improved soil = higher, more stable maize yields = Climate Smart Agriculture
NEXT STEPS

• Seed vouchers for resilient legumes, e.g. pigeonpea variety ‘Mthawajuni’

• Extension messages linked to vouchers, and ‘sms’, on how to grow doubled up legumes and ratoon pigeonpea

• Research on ratooning systems, and markets, to develop recommendations that promote pigeonpea, lab lab, and climbing bean
Building farmer’s resilience to climate change through local natural resource policy instruments

Climate Smart Agriculture conference, March 13-16, 2016, LUSAKA, ZAMBIA

Clarisse UMUTONI, Augustine AYANTUNDE, & Siaka COULIBALY

International Livestock Research Institute (ILRI) & Association Malienne d’Eveil pour le Développement Durable (AMEDD), Mali
OUTLINE

- Context
- Local adaptation strategies in building resilience to climate change
- Process of elaboration and formalization of natural resource policy instruments
- Impact of local policy instruments on natural resource management in southern region of Mali
- Take away messages
CONTEXT

Why natural resource policy Instruments?

- Decentralization of natural resource management in Mali

- Natural resources play a big role in the livelihoods of local population
Reduction of grazing area
Degradation of grazing
Overgrazing

Abusive cut of trees
Degradation of forest
Overexploitation

Land degradation
Decrease in soil fertility
Land shortage
Water shortage

Climate change and population growth

Farmers and herdsmen are affected
They adopt new practices to adapt to the changes occurred
LOCAL ADAPTATION STRATEGIES IN BUILDING RESILIENCE TO CLIMATE CHANGE

- Expanding cultivated area, hence reducing the availability of rangeland and livestock corridors
- Diversifying activities (diversify into livestock or new crops/irrigated agriculture, etc.): a mix of productive activities which in turn is influenced by access to productive resources
- Increasing in livestock movement in search of grazing resources (Increasing of transhumant movements)
- Clearing forest for farming

Increasing pressure on natural resources

Increased conflicts among farmers and herders
WHAT IS THE LINKAGE BETWEEN FARMERS’ ADAPTATION STRATEGIES TO CLIMATE CHANGE AND LOCAL POLICY?

- Institutions have the ability to respond effectively to longer-term climate change as well as being able to manage the risk associated with increased climate variability.

- Institutional connections provides HH and communities greater flexibility in their choice of diversification and adaptation strategies.

- Adaptation never occurs in an institutional vacuum.
Under the Feed the Future Africa RISING project ILRI and its local partner (AMEDD) are supporting the process of development and formalization of local natural resource policy instruments and demarcation of livestock corridors in southern part of Mali.
DEVELOPMENT OF LOCAL NATURAL RESOURCE POLICY INSTRUMENTS (NRPI)

Figure 1. Intervention communities
INTERVENTION OF ILRI & AMEDD

2 phases:

1) Assessment of existing NRPI

• Help to identify opportunity to strengthen local policy instruments

2) Support the process of development and formalization of NRPI and demarcation of livestock corridors in Southern Mali
1) ASSESSMENT OF EXISTING LOCAL NATURAL RESOURCE INSTITUTIONS

Results of the preliminary analysis showed that the local natural resource institutions (rules and norms) were oral and informal, which essentially renders them largely ineffective.

The participation of community members in their elaboration was low, exclusive and did not involve all natural resource stakeholders.
2) THE PROCESS OF ELABORATION AND FORMALIZATION OF NRPI AND DEMARCATION OF LIVESTOCK CORRIDORS IN SOUTH REGION OF MALI AIMED AT REDUCING CONFLICT AMONG NR USERS, ESPECIALLY FARMERS AND HERDERS
APPROACH

• Focus group discussions involving key stakeholders who relied on natural resources for their livelihoods including migrant herders. With external support, they get engaged in negotiation, communication, expressing their needs and interests.

• The debates were sometimes long in reaching consensus acceptable to all major natural resource users.
Results from dialogue among NR users

After consultation, agreements on accessing and use of different natural resources were reached about:

**Land use:**
- Rules of access to community land and acquisition by foreigners
- Land transaction and transfer procedures in the community
- Conditions of access by women

**Grazing area:**
- Pasture - access and use of grazing areas particularly by transhumant herders
- Prohibition of cropping on grazing land and extension of crop land into livestock corridor
- Condition of accessing crop residues after harvesting whether for transhumant herders or community members
RESULTS FROM DIALOGUE AMONG NR USERS

- Fixing of the period of opening crop field with residues for grazing
- Rules of access to watering points
- Conflict management

**Livestock corridors**
- Demarcation of livestock routes in the community
- Management of livestock corridors

**Forest**
- Rules for cutting and sale of wood, quotas for harvesting forest resources for use as timber and fire wood
- Modalities for exploitation of forest resources
- Defining trees which are subjected to specific protection
RESULTS FROM DIALOGUE AMONG NR USERS

- Penalties were also defined for offenders!

- All the stakeholders agreed to respect these rules and that offenders will pay fines

- Management committees were set up and trained for the enforcement of the agreed rules in each intervention community.
FORMALIZATION OF LOCAL NATURAL RESOURCE INSTITUTIONS

After the agreements were reached on the rules:

• Validation of local natural resource institutions elaborated by the village committee

• Approval by the local (commune) and district administrative authorities (Mayor, Prefect)
FORMALIZATION OF LOCAL CONVENTIONS

Once the elaborated rules were approved by the local authorities:

- They become a legally binding set of rules for the community to manage their natural resources.
BENEFITS OF NATURAL RESOURCE POLICY INSTRUMENTS

• Conflict reduced in the intervention communities: livestock corridors demarcated and farmers compensated

From farmers’ comments:

<<We are very happy about this work because it means the animals will no longer enter our land and we can grow crops safely without fear of damage by animals>>.
With strong local institutions, natural resources on which rely all farmers, are better managed. Farmers are better equipped to adapt to climate change.
TAKE AWAY MESSAGES

• Adaptation never occurs in an institutional vacuum. Therefore, inclusive local institutional arrangements are essential to building resilience of the rural communities to climate change.

• Effective farmers’ adaptation to climate change requires local natural resource policies that are flexible and responsive to the uncertainties associated with climate change to provide support to household and communities in their choice of adaptation strategies.
TAKE AWAY MESSAGES

• From our experience in Southern Mali, local institutions governing natural resource management can serve as viable policy instruments to promote equitable and sustainable use of natural resources, and reduce conflict if strengthened through appropriate and inclusive processes involving the local communities and the State agencies.

• Elaborated local policy instruments will lead to better natural resource management and improved agricultural productivity.
EXAMINING ASSUMPTIONS ABOUT CSA WITH PARTICIPATORY MODELING:

Field-scale practices ↔ Landscape-scale impacts

Robert B. Richardson, Michigan State University

Climate Smart Agriculture GLEE: Africa
Lusaka, Zambia, March 15, 2016
AGRICULTURAL SYSTEMS: Complex, Social-ecological, Multi-scale

- Linkages between farm-scale practices and landscape-level impacts on ecosystems are not well understood.
- Closely-held (but poorly-examined) assumptions often influence or guide development investments intended to achieve Climate-Smart Agriculture (CSA).
- Participatory system dynamics modeling can be used to test those assumptions and determine priorities for mission investments.
ZAMBIA CASE STUDY: CSA practices and deforestation

Background:

- Relatively low population density
- Population projected to triple to ~ 43 million by 2050
- High rates of urbanization, increasing demand for food and energy
- High rates of deforestation (150,000—300,000 ha/year), a leading cause of greenhouse gas emissions

Hypotheses: CSA practices that increase yields or produce fuelwood will reduce deforestation pressures

- Increased yields will reduce need for land conversion
- On-farm fuelwood production will reduce demand for forest products

Study site: Eastern Province and Lusaka Province
AGRICULTURE IN CONTEXT

- Ecological context
- Sociocultural context
- Economic context
- Climate Change
- Agriculture as economic livelihood

CSA here?
SYSTEM DYNAMICS MODELING

• … is a quantitative modeling tool that uses systems thinking to analyze the impact of feedback loops in complex and dynamic systems.

• Participatory system dynamics modeling was used to elicit stakeholder views of the system and how it operates, and to use that information to inform the construction of the model.
Causal feedback loops form the structure of the model.
PARTICIPATORY SYSTEMS MODELING

- Participatory modeling can be a useful tool for identifying the primary drivers of change in complex agro-ecological systems.
- The approach also allows for examining hypothetical or alternative scenarios.
- Given limited resources, modeling outputs can be useful in prioritizing mission investments across multiple objectives.
NATIONAL MODEL
Deforestation by Driver

Time (Year)

ha/year

Land conversion
Charcoal
Fuelwood

Construction
Comm. Timber

2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060

40,000
30,000
20,000
10,000
0
EASTERN PROVINCE

Miombo Clearing by Driver

Time (Year)

Land conversion
Charcoal
Fuelwood

Construction
Comm. Timber

ha/year
SCENARIOS: EFFECT OF MAIZE YIELD INCREASE ON FOREST COVER

Scenario: maize yields increase at 3x their current rate – no effect on deforestation
Efficient stoves and full electrification have only a marginal effect on slowing deforestation. Rural interventions unlikely to address deforestation from urban energy demand.
CONCLUSIONS

- Charcoal production and clearing for agriculture are both important drivers of deforestation
  - Charcoal dominates in Lusaka
  - Clearing for agriculture dominates currently in Eastern
  - Charcoal expected to dominate both provinces in the future
- Clearing land for agriculture is driven by *rural population growth*, not low yields or land abandonment
- Charcoal production is driven by *urban population growth* and *energy demand*
  - Better to focus efforts on alternative energy sources and education to reduce urban charcoal use
  - Counter to conventional assumptions
TAKE-AWAY MESSAGES

Modeling complex social-ecological systems

• Linkages between farm-scale agricultural practices and landscape-level impacts on ecosystems can be complex.

• Closely-held assumptions about those linkages should be critically examined in order to have the greatest impact on development objectives.

• Participatory system dynamics modeling can be a useful tool for identifying the primary drivers of change in complex agro-ecological systems.

• The approach can also be useful in prioritizing mission investments.