Building resilience at community level: Framing adaptation options in vulnerable ecosystems

NASA IDS: Seasonal Prediction of Hydro-Climatic Extremes in the Greater Horn of Africa (GHA)
The First Participatory Research Workshop and Project Meeting
August 11 - 12, 2014
Sheraton Hotel, Addis Ababa, Ethiopia

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“Warming of the climate system is unequivocal.”

“Human influence on the climate system is clear.”

“Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system.

Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.”

IPCC AR5 WG1 2013
## Ethiopia’s changing climate, Conway and Schipper 2010

<table>
<thead>
<tr>
<th></th>
<th>Temperature</th>
<th>Rainfall</th>
<th>Extreme events</th>
<th>Historical trend†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean temperature increased by 1.3°C from 1960 - 2006</td>
<td>Highly variable from year to year, season to season, decade to decade</td>
<td>Regular severe flood and drought events</td>
<td>No significant trend</td>
</tr>
<tr>
<td>Historical trend†</td>
<td>More hot days and nights, fewer cold days and nights</td>
<td>No evidence of changes in frequency or intensity of extremes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020’s</td>
<td>+ 1.2 °C (0.7 - 2.3°C)</td>
<td>+0.4%</td>
<td>Greater increases in rainfall in Oct-Dec, especially in the south and east.</td>
<td></td>
</tr>
<tr>
<td>2050’s</td>
<td>+ 2.2 °C (1.4 - 2.9°C)</td>
<td>+1.1%</td>
<td>Uncertain future El Nino behaviour brings large uncertainties.</td>
<td>Flood and drought events likely to increase</td>
</tr>
<tr>
<td>2090’s†</td>
<td>+ 3.3 °C (1.5 – 5.1°C)</td>
<td>Wetter conditions</td>
<td>Heat waves and higher evaporation</td>
<td></td>
</tr>
</tbody>
</table>
Top 10 CO2 Emitters (Total Tones emitted in millions)

Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.

Should Ethiopia be worried about mitigation?
150 Mt CO2e
The Government of Ethiopia has launched its Climate-Resilient Green Economy initiative (CRGE) with 2 main objectives:

1. **Green growth path**: Reach middle income threshold by 2025 and keep growth carbon neutral.
2. **Resilient economy**: Build the capacity of the economy to cope with the adverse consequences of climate change.

**Development initiatives**
- CRGE
- Green economy
- Resilient economy

**Abatement/avoidance initiatives**

**Resilience initiatives**
Building Resilience

– increasing productivity and incomes,
– enhancing resilience of livelihoods and ecosystems and reducing and
– removing greenhouse gas emissions from the atmosphere.

• Working at the **landscape** level with an **ecosystems** approach,
Framing adaptation

• Adaptation responses can be clustered into the following broad categories:

  – **grey measures**: technological solutions;

  – **green measures**: ecosystem-based adaptation options; and

  – **soft measures**: behavioural, managerial and policy approaches.

• A suite of adaptation technologies or options — grey, green or soft — that are cost effective have to be identified, tested and scaled-up to respond to climate change and building resilience.
Assessing different risks over space

Existing AEZ classification
32 AEZ - 6 temperature regimes
7 moisture regimes

<table>
<thead>
<tr>
<th>Moisture regimes</th>
<th>Temperature regimes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Hot</td>
</tr>
<tr>
<td>Arid</td>
<td>A1</td>
</tr>
<tr>
<td>Semi-arid</td>
<td>SA1</td>
</tr>
<tr>
<td>Sub-moist</td>
<td>SM1</td>
</tr>
<tr>
<td>Moist</td>
<td>M1</td>
</tr>
<tr>
<td>Sub-humid</td>
<td>SH1</td>
</tr>
<tr>
<td>Humid</td>
<td>-</td>
</tr>
<tr>
<td>Per-humid</td>
<td>PH1</td>
</tr>
</tbody>
</table>

Cannot treat Ethiopia as a single area - different responses needed in different zones –

Expert assessment in collaboration with MoA

14 Adaptation Planning Zones

Adaptation Planning Zones
How can we Build resilience at community level in vulnerable ecosystems?

Ecosystem-based & Livelihood Approach
A conceptual framework for building resilience: **Ecosystem-based & Livelihood Approach**

### Step I

- **Exposure**
  - Frequency, magnitude, and duration
- **Sensitivity**
- **Livelihood assets (socio-economics)**
- **Capacity & Willingness**

### Step II

- **Potential impacts**
- **Adaptive capacity**

### Step III

- **Adaptation**
  - **Visioining**
  - **Setting Env. issues**
  - **Planninng design**
  - **Implemeentation**
  - **Result based M&E**

- **Livelihood approach**
  - Development objectives
  - Institutional and Policy environment

### Mitigation

### Outcome

**Climate Resilient Green Economy**
Agroecosystem analysis

- Agroecological settings
- Soil Characteristics
- Farming systems

Agroecosystem Classification
- Pattern
- Sustainability

Climate Resilient and Sustainable Agricultural Development
- Innovation
- Productivity
- Employment
Community-based Innovation platforms

1. Lowland and valley fragmented agroecosystems (AES 1; 7,200 km²)
2. Midland plains with black soil (AES 2; 3,200 km²)
3. Midland plains with brown soils (AES 3; 1,600 km²)
4. Midland Sloping Lands (AES4; 1,300 km²)
5. Hilly and Mountainous highlands (AES5; 2,400 km²)
6. Afro Alpine (AES6; 250 km²)

Constraints
1. Land degradation
2. Deforestation
3. Water logging
4. Soil Acidity
5. Limited local-level capacity
6. Limited access to life-improving technologies
7. Climate Change
Exposure to climate variability and change
Sensitivity to climate stressors
Impacts
Livelihood assets
Adaptive capacity
Vulnerability
Resilience building activities
Improved Sustainable Livelihood
Fig 1. A framework of assessing Vulnerability at community level
## Vulnerability Assessment

<table>
<thead>
<tr>
<th>Vulnerability Factors</th>
<th>Livelihood Capitals</th>
<th>Profiles</th>
<th>Indicators</th>
<th>Units</th>
<th>Hypothesized functional relationship</th>
</tr>
</thead>
</table>
| **Exposure**          |                     | 1. Climate | • Change in temperature  
                        • Change in precipitation  
                        • Occurrence of extreme events | Changes over time, °C  
                        Changes over time, mm  
                        No of events over the last 20 years | Larger change or frequency = higher exposure |
|                       |                     | 2. Ecosystem | • Land suitability for agriculture  
                        • Sustainability of land use system  
                        • Land cover change (primarily deforestation/reforestation)  
                        • Use of soil water conservation techniques  
                        • Irrigation potential | Avg. scale values of soil depth, terrain, drainage, and fertility (1-5)  
                        Assumed intensity of management (High, Medium and Low)  
                        % change over the base line  
                        % of land with SWC structures  
                        Ha of land suitable for irrigation | More forest cover, suitable land, and access to irrigation = lower sensitivity |
|                       |                     | 3. Agriculture | • Annual total production (inverse)  
                        • Changes in productivity  
                        • Diversity of crop species | Tones of total product harvested  
                        Yield in tones/ha  
                        Number of crops in the system | Greater productivity and diversity = lower sensitivity |
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<tbody>
<tr>
<td>Financial Capital</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Physical capital</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Farm size</td>
<td>• Insecticide and pesticide supply</td>
<td>• Access to all-weather roads</td>
<td>• Sex of household head</td>
<td>• Governance</td>
</tr>
<tr>
<td></td>
<td>• Number of livestock</td>
<td>• Fertilizer supply</td>
<td>• Access to schools</td>
<td>• Education level</td>
<td>• Membership in CBOs</td>
</tr>
<tr>
<td></td>
<td>• Savings at household level</td>
<td>• Improved seed supply</td>
<td>• Access to veterinary services</td>
<td>• Availability of extension</td>
<td>• Participation in projects</td>
</tr>
<tr>
<td></td>
<td>• Existing loans</td>
<td>• Irrigation potential</td>
<td>• Access to markets</td>
<td>• Skills/training</td>
<td>• Availability of bylaws</td>
</tr>
<tr>
<td></td>
<td>• Non-agricultural income</td>
<td></td>
<td>• Access to savings and credit</td>
<td>• Health services</td>
<td>• Number of non-working days/month</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Access to electricity</td>
<td>• Radio ownership</td>
<td>• Tradition of working together</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Access to telephone</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ha/HH</td>
<td>% of HHs using insecticide</td>
<td>Walking distance in hours</td>
<td>Male/Female</td>
<td>1-5 scale (election of leadership)</td>
</tr>
<tr>
<td></td>
<td>TLU/HH</td>
<td>% of HHs applying fertilizer</td>
<td>Walking distance in hours</td>
<td>% of HH heads</td>
<td>Yes/No</td>
</tr>
<tr>
<td></td>
<td>Amount of Birr (local currency)/HH</td>
<td>% of HHs using improved seed</td>
<td>Walking distance in hours</td>
<td>No of Das/village</td>
<td>Participation index</td>
</tr>
<tr>
<td></td>
<td>Amount of Birr/HH</td>
<td>% of HHs practicing irrigation</td>
<td>Walking distance in hours</td>
<td>No of training HH head attended</td>
<td>Yes/No</td>
</tr>
<tr>
<td></td>
<td>Amount of Cash obtained per year</td>
<td></td>
<td></td>
<td>Walking distance in hours</td>
<td>No of days</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>% of HH who have tradition of working together</td>
</tr>
<tr>
<td></td>
<td>Greater wealth = greater adaptive capacity</td>
<td>Better access to technology = greater adaptive capacity</td>
<td>Better access to infrastructure = greater adaptive capacity</td>
<td>More human capital, information and services = greater adaptive capacity</td>
<td>Fewer non-working days and more tradition of working together = greater adaptive capacity</td>
</tr>
</tbody>
</table>
Livelihood Vulnerability Index

Red = highly vulnerable (62%);
Yellow = moderately vulnerable (8%);
Blue = less vulnerable (30%).
Problem Tree Analysis

IMPACT

Direct Effect

Poverty

Collapse of Ecosystem

Direct Causes

Land Degradation

Indirect Causes

Reduced production & food insecurity

Migration and social conflicts

Reduced water supply and quality

Reduced soil fertility & high erosion rate

Loss of biodiversity

Low investment

Climate Change

Limited capacity to access technology

Lack of skill and knowledge

Absence of renewable energy source

Insecurity

Livestock pressure

Poor grazing landings

Land Shortage

Absence of alternative livelihood

Inadequate policy enforcement

Improper cultivation

Deforestation

Overgrazing

Cultivation of steep slopes

LIMITED CAPACITY TO ACCESS TECHNOLOGY

LACK OF SKILL AND KNOWLEDGE

ABSENCE OF RENEWABLE ENERGY SOURCE

INSECURITY

LIVESTOCK PRESSURE

POOR GRAZING LANDINGS

LAND SHORTAGE

ABSENCE OF ALTERNATIVE LIVELIHOOD

INADEQUATE POLICY ENFORCEMENT
Methodology

• Organized 21 CBOs following the CBWSM framework;
• CBA planning meetings were held independently at each of the CBOs;
• The CBA options were derived from prior experience;
• Foundational principle was stakeholders capacity to plan and implement projects relevant to their needs.
• Existing field-based extension and watershed planning were leveraged for this initiative,
The sustainability Analysis

• Used the Analytic Hierarchy Process (AHP) for multi-criteria decision making.
  – the overall goal of CBA (implementing integrated land management to address food security and maintaining the ecosystems goods and services) lies at the top;
  – dimensions of sustainability—social, institutional, technical, financial and environmental—are the second level;
  – specific CBA activities (e.g., composting, training in project administration, etc.) form the foundation of analysis
The hierarchal structure used to evaluate the sustainability of Community-Based Adaptation (CBA) activities.

<table>
<thead>
<tr>
<th>Dimensions [weighting]</th>
<th>Indicators/factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social sustainability [0.1]</td>
<td>Training of local communities and administrator Information and knowledge management Establishing school environmental club Developing local level environmental action plans</td>
</tr>
<tr>
<td>Institutional sustainability [0.2]</td>
<td>Training for the planning team and agriculture experts Supervision Annual Workshop</td>
</tr>
<tr>
<td>Technical sustainability [0.5]</td>
<td>Improved SWC practices Conservation of locally important farmers’ varieties Composting Conservation tillage Production of improved stoves Communal pasture management Bee keeping Establishment and preservation of forest</td>
</tr>
<tr>
<td>Financial sustainability [0.1]</td>
<td>Auditing mechanism Improved household income Diversified Income sources Contributions from members</td>
</tr>
</tbody>
</table>
Weighted scores for all five sustainability dimensions of the CBOs

<table>
<thead>
<tr>
<th>CBOs</th>
<th>Dimensions of Sustainability</th>
<th>Sustainability of CBOs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Social</td>
<td>Institutional</td>
</tr>
<tr>
<td>Weight</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.04</td>
<td>0.03</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.07</td>
<td>0.06</td>
</tr>
<tr>
<td>Mean</td>
<td>0.051</td>
<td>0.046</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.0095</td>
<td>0.0082</td>
</tr>
<tr>
<td>Dimension of sustainability</td>
<td>CBOs (n = 21)</td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------</td>
<td>----------</td>
</tr>
<tr>
<td></td>
<td>% Sustained</td>
<td>% Sustained-risk</td>
</tr>
<tr>
<td>Social</td>
<td>9.5</td>
<td>66.7</td>
</tr>
<tr>
<td>Institutional</td>
<td>0.0</td>
<td>47.6</td>
</tr>
<tr>
<td>Technical</td>
<td>9.5</td>
<td>76.2</td>
</tr>
<tr>
<td>Financial</td>
<td>61.9</td>
<td>4.8</td>
</tr>
<tr>
<td>Environmental</td>
<td>14.3</td>
<td>28.6</td>
</tr>
<tr>
<td>Aggregate value</td>
<td>0.0</td>
<td>33.3</td>
</tr>
</tbody>
</table>
Key Adaptation Practices

- Diversified livelihood
- Changes in processes and systems
- Changes in the timing of activities
- Change of technologies
- Changes in resources utilization
- Changes in lifestyle
Establishing Community Innovation Platforms

- Enabling Env't
  - Motivation
  - Support
  - Reward/Result
- Technology
  - Appropriate Participatory
- NRM
  - Land
  - Water
  - Biodiversity
- Market
  - Industry

CRGE
Enabling Environment

• **Active, free, and meaningful participation:** Maintaining an active dialogue across all stakeholder groups;

• **Empowerment:** Planning and facilitation process that prioritizes the farmers and local community needs and customs

• **Accountability:** Establishing local bylaws

• **Training:** Helping communities understand innovative mechanisms

• **Support:** Providing an incentive for communities to take on new adaptation options.
Market

• Assessment of the market structure and consumer preferences;
• Developing market information systems for products;
• Assessment of economic potentials of new crops and products based on the agro-ecology;
• Assessment of the market value of quality traits of the produces; and.
• Linking smallholder farmers to high-value urban and export markets that can raise rural incomes and enhance export competitiveness.
NRM

• It must bring visible and immediate benefits;
• The benefits must be substantial enough to convince the farmers to change their ongoing practices;
• For the technology to be disseminated widely, the farmers must be able to cover the costs incurred on their own; and
• The introduction of new technologies should be followed up by an extension service for a long period.
Technology

- It must bring a visible and immediate benefit, economic or otherwise.
- The benefit must be substantial enough to convince the farmers to change their ongoing practices.
- The costs incurred must be able to be covered by the farmer.
- The introduction of new technologies should be followed up by an extension service for a long period of time.
ESTABLISHING CIPS

- Developing methods and tools
- Assessing impacts and vulnerability

ASSESSMENT

- Understanding the context
- Assessing community resilience

PLANNING

- Participatory identification and adoption of sustainable adaptation strategies

IMPLEMENTATION

- Implementing targeted Adaptation Actions

MONITORING AND EVALUATION

- Monitoring and evaluation adaptation intervention
Adaptation strategies

- AES 1: Biofarm system: establishing permanent agriculture (Permaculture)
- AES 2: Sustainable intensification by adopting vertisol management technologies
- AES 3: Sustainable intensification using conservation agriculture technologies
- AES 4: Sustainable intensification by applying sloping land management technologies
- AES 5: Biofarm system: establishing permanent agriculture (Permaculture)
- AES 6: Bioreserve (protected area):
Continuous Result-based Monitoring and Evaluation

Vision

Planning Implementation

M&E Support

Implementation

Inputs

Time (year)

0 1 2 3 4

Scaling up

Implementation

Output

Short term output

Medium term output