The role of perception in subsistence farmer adaptation in Africa – enriching the climate finance debate

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Outline of presentation

- Introduction
  - Subsistence farming
  - Climate finance
  - Knowledge on climate change

- Description case studies

- Method

- Results

- Conclusions and recommendations
Introduction – subsistence farming

- Contribution agriculture to African GDP: 29% (UNECA, 2001)
- Agricultural systems underperforming; environments degraded (Magadza, 2003)
- Mostly subsistence-based and rain-fed, production for local markets (Rockstrom et al., 2010)
- Vulnerable to changing weather patterns.

→ Subsistence farmers crucial for Africa to adapt: ‘being able to maintain (or improve) living standards in the face of the expected changes in climate trends and the intensity and frequency of severe climate related hazards that might affect people's livelihoods’ (van Aalst et al., 2008).
Introduction: climate finance

- Developed country Parties shall ‘assist the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects’ (convention text, 1992, art. 4.4).

- Africa is considered ‘particularly vulnerable’ (e.g. Copenhagen Accord (2009)).

- Climate finance increasing
  - Proliferation of climate funds: LDCF, SCCF, AF, PPCR, (GCF), ...
  - Increased public financing, some private adaptation financing

- However relatively little to adaptation, only a part of that to Africa; and difficult to reach local level. Unclear what constitutes adaptation
Introduction: knowledge on CC

- Changing climatic conditions perceived by farmers (e.g. Bryan et al, 2009, Deressa et al, 2009)
- Yet they do not know what CC is.

→ How can climate finance support millions of subsistence farmers to adapt if these people hardly know or understand what climate change is?

→ Our approach: perception of climate related hazards and adaptation:
  - perception influences decisions
  - present hazards/future changes
Case study: Ghana

- 5 villages in three distinct ecological zones
- Sub-tropical climate
- Annual rainfall decreased: 1700 mm/year (1975) to 1400 mm/year. Rainy season shortened – difficult to make projections for future
- The temperature increased by 1°C (1961-2000), and is projected to keep rising (2°C in 2050; A1B)
Case study: Ghana (II)

- Large agricultural labour force
- Slash-and-burn, very little irrigation
- Correlation agricultural yields and rainfall
- High levels of deforestation
Government addresses problems

- Dayi River Basin Board (2010)
  - Integrated water management

- Draft National Irrigation Policy, Agriculture and Sustainable Land Management Strategy and Action Plan
  - Hard measures (e.g. irrigation, seeds, sustainable land management)
  - Soft measures (e.g. building institutional and technical capacity, awareness raising, knowledge development)
Case study: Botswana

- 2 villages in semi-arid Motloutse River Basin
- One rainy season; 300-400 mm/year; highly erratic. Declined by 5-15% in 20th century. Changes difficult to predict for rainy season.
- Temperature increased by 1.3°C (1958-1998), projected to rise by 3.5°C towards 2100 (A1B)
- The per capita annual food production declined by 60% compared to the production peak in 1971 (FAO, 2011).
Case study: Botswana (II)

- Poverty widespread
- Importance agricultural sector
- Constrained yields
  - poor farming practices
  - poorly organized markets
  - water stress
  - degraded lands
Case study: Botswana (III)

Government

- Integrated Support Programme for Arable Agricultural Development (ISPAAD)
  - Combat poor technology adoption
  - free seeds, fertilizers and draught power

- Labour Intensive Public Work Relief Program / DRP
  - Finances bottom-up initiatives and creates jobs
  - Established 1982
  - Peak: assistance to 45% of family farmer labour force, equalling 11.1% of total rural household income
Method

- Face-to-face, administered interviews in subsistence farmer communities
  - Socio-economic situation, perception of CRH and adaptation
  - Mostly closed questions, Likert scale
  - HH randomly picked
  - Interviews took 45-75 minutes
  - Response rate 100%

- Regression and Chi-square tests
Results

- Respondents perception:
  - highly dependent on the climate for their livelihood
  - highly vulnerable to CRHs
  - Very afraid of CRHs
Results (II)

Perceived successiveness of individual adaptive measures

- % of respondents
- Not at all 0
- 1
- 2
- Medium 3
- 4
- 5
- Extremely good 6

Ghana

Botswana
On-farm adaptation...

**Perceived successfulness of adaptive measures**

<table>
<thead>
<tr>
<th></th>
<th>Ghana</th>
<th>Botswana</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average</strong></td>
<td>2.6</td>
<td>5.1</td>
</tr>
<tr>
<td><strong>Median</strong></td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

- **Change crops**: Average 2.6, Median 3
- **Irrigation**: Average 4.7, Median 5
- **Change planting**: Average 2.4, Median 2
- **Education**: Average 5.1, Median 5
- **Outmigration**: Average 4.2, Median 5

Legend:
- Not at all 0
- 1
- 2
- Medium 3
- 4
- 5
- Extremely good 6
Perceived successfulness of adaptive measures

**Ghana**

- **Average:** 5.0
- **Median:** 5

**Botswana**

- **Average:** 5.5
- **Median:** 6

**Education**

- **Average:** 5.0
- **Median:** 5

- **Average:** 5.5
- **Median:** 6

**Legend:**

- Black: Not at all 0
- Brown: 1
- Red: 2
- Orange: Medium 3
- Green: 4
- Olive: 5
- Green: Extremely good 6

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...Education...
...Off-farm adaptation

Perceived successfulness of adaptive measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Ghana</th>
<th>Botswana</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>1.1</td>
<td>3.2</td>
</tr>
<tr>
<td>Median</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

- Change crops
- Irrigation
- Change planting...
- Education

- Change profession
- Outmigration

- Not at all
- 1
- 2
- 3
- 4
- 5
- Extremely good

% of respondents
Motivation to adapt in Ghana and Botswana (N=227)

- **Dependence on agriculture**
  - Motivation to adapt: \( R^2 = 0.0695 \)
  - Motivation to adapt: \( R^2 = 0.004 \)

- **Perceived vulnerability**
  - Motivation to adapt: \( R^2 = 0.0997 \)

- **Experience**
  - Motivation to adapt: \( R^2 = 0.1235 \)

**Notes:**
- Scale is from not at all (0) to extremely (6)
- Respondents (N=227)
- Linear trend line
- Second order polynomial trend line
Results (IV)

- Motivation and perceived successfullness in adaptation increases with increasing means (workforce, money, assets)
- Farmers that cultivate more land or grow more crops are more succesfull in adaptation

Means to adapt in Ghana and Botswana (N=227)

- **Motivation and perceived successfullness in adaptation increases with increasing means (workforce, money, assets).**
- **Farmers that cultivate more land or grow more crops are more successful in adaptation.**

Scale is from not at all (0) to extremely (6).
Results (V)

$X^2$ test on individual adaptive measures:

- perception of CRHs mostly related to on-farm adaptive measures
- Perception of effectiveness of individual measures is not related to means, recovery, overall successfulness, or motivation to adapt.

**Factors influencing the perceived successfulness of adaptive measures (N=227)**

<table>
<thead>
<tr>
<th>Individual adaptive measures</th>
<th>Change crops</th>
<th>Change planting dates</th>
<th>Irrigation</th>
<th>Change profession</th>
<th>Outmigration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability of a drought</td>
<td>3,00 x10^{-6} *</td>
<td>1,17 x10^{-6} *</td>
<td>0,0013</td>
<td>0,1662</td>
<td>0,8537</td>
</tr>
<tr>
<td>Fear of future droughts</td>
<td>1,03 x10^{-13} *</td>
<td>4,66 x10^{-13} *</td>
<td>0,0132</td>
<td>7,52 x10^{-6} *</td>
<td>0,0343</td>
</tr>
<tr>
<td>dependency on climate</td>
<td>1,69 x10^{-11} *</td>
<td>4,07 x10^{-14} *</td>
<td>0,0035</td>
<td>5,44 x10^{-7} *</td>
<td>0,0255</td>
</tr>
<tr>
<td>Vulnerability to CRHs experience</td>
<td>2,03 x10^{-10} *</td>
<td>4,41 x10^{-9} *</td>
<td>0,0973</td>
<td>0,0071</td>
<td>0,0211</td>
</tr>
<tr>
<td>means to cope</td>
<td>0,0029</td>
<td>9,51 x10^{-5} *</td>
<td>0,000146*</td>
<td>0,0337</td>
<td>0,0092</td>
</tr>
<tr>
<td>recover</td>
<td>0,0121</td>
<td>0,0129</td>
<td>0,0068</td>
<td>0,0433</td>
<td>0,1126</td>
</tr>
<tr>
<td>succesful in adapting</td>
<td>0,0106</td>
<td>0,0034</td>
<td>0,0513</td>
<td>0,0081</td>
<td>0,3595</td>
</tr>
<tr>
<td>Motivation to adapt</td>
<td>0,0078</td>
<td>0,0016</td>
<td>0,0056</td>
<td>0,0062</td>
<td>6,33 x10^{-6} *</td>
</tr>
</tbody>
</table>

* = significant for $\alpha=0.01$ after Bonferroni correction
Conclusion and recommendation (I)

➢ Overlap between:
  – respondents’ perception of CRHs and existing environmental degradation;
  – respondents’ measures to adapt to CRHs and the way environmental and economic problems are addressed in national development plans and policies.

→ International climate finance community should build on existing development plans and policies in developing countries that already address climate-related problems.
Effective adaptive measures ≠ effective adaptation

– Overall successfulness is more related to means, dependency, experience, and recovery; motivation to adapt increases with experience and means

Finance ’soft’ adaptation (e.g. knowledge sharing, capacity building)

In doing so: include development component (e.g. poverty and limited water availability)
Motivation to adapt to CRHs decreased with increasing perceived vulnerability. Adaption measures of African farmers may not be sufficient for future climatic changes (Boko et al., 2007),

the message to international climate finance institutions is that *ex post* adaptation (incl. disaster relief) will remain important.
Thank you for your attention

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Experience and adaptation (Ghana only)

- Motivation (Likert scale):
  - $R^2 = 0.0368$
  - $R^2 = 1E-05$

- Perceived means (Likert scale):
  - $R^2 = 0.0005$
  - $R^2 = 0.1045$

- Perceived successfulness (Likert scale):
  - $R^2 = 0.0986$
  - $R^2 = 0.0011$

Respondents (N=107)
- Second order polynomial trend line
- Linear trend line

Experience in farming (years)
20 out of 36 test scores significant for $\alpha=0.01$ after Bonferroni correction

Within this set of indicators, Means and Climate dependency have central role (in green)

Overall Successfulness and Experience come second

<table>
<thead>
<tr>
<th></th>
<th>Fear</th>
<th>Dependency</th>
<th>Vulnerability</th>
<th>Experience</th>
<th>Means</th>
<th>Recovery</th>
<th>Successful</th>
<th>Motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability of drought</td>
<td>$3.73 \times 10^{-6^*}$</td>
<td>$1.08 \times 10^{-5^*}$</td>
<td>0.0131</td>
<td>0.1922</td>
<td>0.0383</td>
<td>0.8818</td>
<td>0.9147</td>
<td>0.1939</td>
</tr>
<tr>
<td>Fear of future drought</td>
<td>$2.59 \times 10^{-9^*}$</td>
<td>$7.89 \times 10^{-10^*}$</td>
<td>$6.51 \times 10^{-6^*}$</td>
<td>$4.43 \times 10^{-7^*}$</td>
<td>0.2484</td>
<td>0.0109</td>
<td>0.0224</td>
<td></td>
</tr>
<tr>
<td>Climate-dependency</td>
<td>$3.80 \times 10^{-30^*}$</td>
<td>0.0243</td>
<td>$1.87 \times 10^{-6^*}$</td>
<td>0.0014</td>
<td>$2.63 \times 10^{-5^*}$</td>
<td>$1.58 \times 10^{-5^*}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vulnerability to CRHs</td>
<td>0.0146</td>
<td>$2.97 \times 10^{-6^*}$</td>
<td>0.1535</td>
<td>$3.46 \times 10^{-5^*}$</td>
<td>0.0185</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience</td>
<td>$4.87 \times 10^{-17^*}$</td>
<td>$4.47 \times 10^{-9^*}$</td>
<td>$1.79 \times 10^{-8^*}$</td>
<td>$1.05 \times 10^{-12^*}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Means to cope</td>
<td>$6.85 \times 10^{-6^*}$</td>
<td>0.0187</td>
<td>$3.32 \times 10^{-5^*}$</td>
<td>$5.20 \times 10^{-5^*}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recover</td>
<td>0.0187</td>
<td>0.0790</td>
<td>0.0187</td>
<td>0.0790</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Food production and population growth

Botswana only (FAO data)

Source: FAO STAT