Environmental and socioeconomic outcomes of the new African Green Revolution

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MAIN QUESTIONS

- **What LCLUCs can be attributed to subsidized inputs, environmental controls or socioeconomic factors?**
- **How do socioeconomic and environmental factors interact with subsidized inputs to change poverty status?**

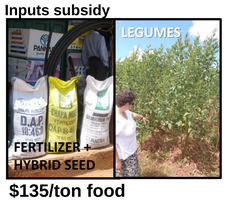
THE 21ST C AFRICAN GREEN REVOLUTION (1.0)

Goal: Support smallholder farmers, protect the environment, and help farmers adapt to climate change

- *Develop/disseminate seed varieties
- *Enhance soil health
- *Accelerate access to seeds & fertilizers
- *Improve access to markets and to finance
- Promote policies supporting farmers
- Build African scientific capacity

* Elements of Malawi's subsidy program Learn more from the Alliance for a Green Revolution in Africa: www.agra-alliance.org

Inputs subsidy



$135/ton food

Food aid delivered

$806/ton food

MALAWI

- 80% of food is produced domestically by smallholder farmers
- Government subsidy reaches ~60% of smallholder farmers
- N application rates increased from ~0 to 35 kg N/ha
- Typical farm practices have a net removal of 48 kg N /ha /year

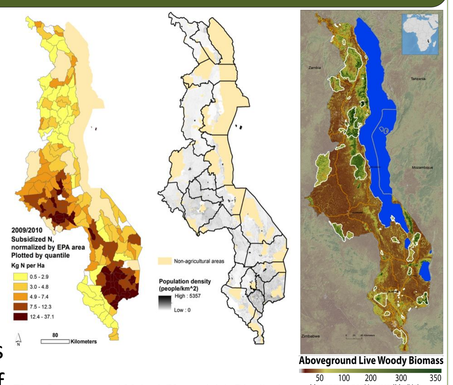


Fig. 1. Locator map of Malawi (Upper right). Distribution of N through the subsidy program (left). EPAs in central and southern Malawi received more inputs because of high population density (Center). Most of Malawi has been cleared for agriculture except for protected areas (white).

SOCIAL & ECONOMIC OUTCOMES

FOOD SECURITY

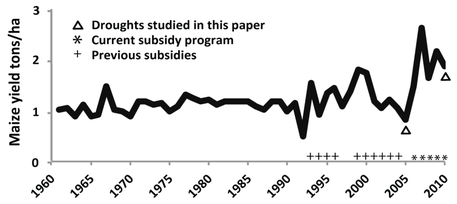


Figure 2. *Annual maize yields in Malawi*

Harvest year	Million tons of maize	Maize yields (tons ha^{-1})	Food requirement	Rainfall
2005	1.2	0.8	-44%	Drought
2006	2.6	1.5	+20%	Good
2007	3.2	2.6	+48%	Good
2008	2.6	1.6	+20%	Good
2009	3.5	2.2	+62%	Good
2010	2.8	1.9	+28%	Drought
2011	3.2	2.1	+48%	Drought

Figure 3. *National maize production, yields, food requirement and rainfall for Malawi*

- Food insecurity reduced by 4.5 million people
  - 2004/5: 5 m people in need of food aid. Yields averaged 0.8 tons/ha. By 2010, only 0.5 million people needed food aid and yields averaged 1.9 tons/ha.
  - 2007: 1st time national average yields >>2MT/ha
- Malawi has become a food exporter
  - Starting in 2007 when the country exported 100,000 tons; providing 10,000 tons of food aid to Lesotho and Swaziland.
- Cost to benefit ratio ~1:9
  - 2007 cost = $72 m
    benefit = $688 m

FOOD PRICES

- Initial reports that prices have dropped require more robust analysis that adjusts for underlying trends
- ***Current work:*** price trends, volatility changes and market integration before and after the subsidy

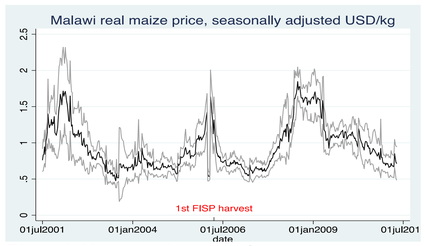
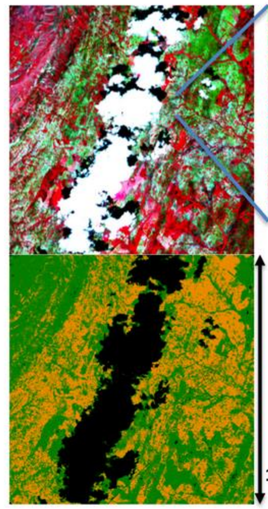


Figure 4. *Mean price in nine markets . The grey lines represent one standard deviation above and below the mean. The data are seasonally adjusted) and deflated by the monthly CPI, available from the Malawi central bank.*

POVERTY

- ***Research question: How do socioeconomic and environmental factors interact with subsidized inputs to change poverty status?***
- Initial reports suggest that poverty rates have fallen since the subsidy program. This requires more analysis.
- ***Current work:*** examine the correlates of LCLUC, and fixed effects of environmental variables to study how district-level poverty rates have changed over time.

LCLUC AND ENVIRONMENTAL OUTCOMES



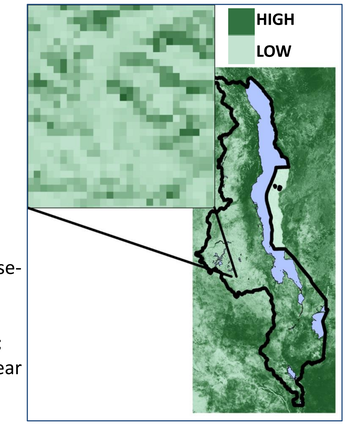


Fig. 5. From top left, proceeding clockwise: False-color infrared Quickbird image with zoom; MODIS EVI of Malawi, with zoom; image of maize fields; Linear mixture analysis of crops (orange) and savanna.

- Heterogeneous landscape can be studied with coarse data sets (Fig. 5)

- Changes in inputs for smallholder agriculture can be seen in MODIS phenology (Fig. 6)

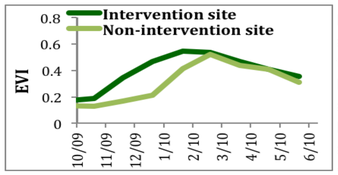
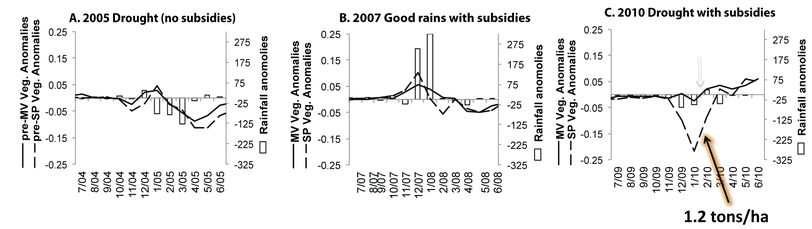


Fig. 6. MODIS EVI showing averaged phenology for two sites (left). Precipitation and EVI anomalies for A) drought, B) good rain w/ subsidy and C) drought w/ subsidy

- Climate vulnerability appears to be reduced as nitrogen assists in drought resistance (Fig. 6)



CONCLUSIONS

- **Preliminary results suggest that LCLUC analysis will be powerful when combined with socioeconomic outcomes**
- **MODIS may be an appropriate study instrument, even when land use happens at a small scale**
- **Future work will focus on correlates in socioeconomic change and LCLUC.**