



**EfD**  
Environment for Development

## RESEARCH BRIEF

The **Environment for Development** initiative is a capacity building program in environmental economics focused on international research collaboration, policy advice, and academic training. It consists of centers in Central America, Chile, China, Ethiopia, Kenya, South Africa, Sweden, Tanzania, and the US (Resources for the Future in Washington, DC). Financial support is provided by the Swedish International Development Cooperation Agency (Sida). [www.efdinitiative.org](http://www.efdinitiative.org)

# Climate change can have significant negative impacts on Ethiopia's agriculture

BY ZENEBE GEBREEGZIABHER, ALEMU MEKONNEN, RAHEL DERIBE, SAMUEL ABERA,  
AND MESERET MOLLA KASSAHUN  
DRB 13-14, MARCH 26, 2014

Except for the lowlands and pastoralist areas, mixed crop-livestock farming is the dominant farming type in Ethiopia. However, there have been few attempts to look into the economic impacts of climate change in the context of Ethiopia. Particularly, the role of livestock was disregarded in the previous studies. This study explores the crop-livestock inter-linkages and climate change implications for Ethiopian agriculture. Findings suggest that climate change can have significant negative impacts on Ethiopia's agriculture unless appropriate adaptation measures are adopted. Moreover, increasing/decreasing rainfall associated with climate change is damaging to both crop and livestock agricultural activities.

Analyzing the impact of climate change on agricultural production broadens and extends the understanding of the complex interlinks between climate change and agricultural productivity in Ethiopia and enhances informed policy making by the government and crop decisions by farmers.

The objective of this paper is to analyze the impact of climate change and weather variation on agriculture, inclusive of livestock production. We use a Ricardian analysis, named after the economist David Ricardo (1772-1823), who studied factors of production such as land. The model is useful for analyzing different climatic variables as rainfall and temperature, and examines the relationship between the value of land, soils and socio-economic variables. We studied the effects on crops and livestock, both separately and taken together.

The dataset used for this study comes from a survey of 1000 farm households in the Nile Basin of Ethiopia during the 2004/05 production year.

The study shows that temperature and rainfall greatly affect livestock net revenue. Socioeconomic variables, livestock ownership and distance from output markets also have significant and positive relationships to livestock net revenue, whereas distance from input (seeds and fertilizer) markets have a significant negative relationship. On the other hand, crop net revenue is dependent on soil types, access to irrigation, household size and distance from input markets. Surprisingly, livestock ownership, access to extension programs and access to credit have a

### Key Points

- Unless appropriate adaptation options are adopted, climate change will have a negative impact on the Ethiopian economy.
- An increase in temperature will reduce agricultural and crop net revenue on a per hectare basis while it increases livestock net revenue in the Nile basin.
- While warming temperature tends to be beneficial to livestock up to a certain limit, changing rainfall tends to be more harmful.

## Climate change can have significant negative impacts on Ethiopia's agriculture

negative correlation to crop net revenue.

Changing rainfall and temperature patterns due to climate change have different effects on crops and livestock. The effects also depend on the season of the year in which the change in temperature or rainfall takes place and the extent of the change (mild or extreme). Our analysis indicates that an *increase in annual average temperature* leads to a decrease in net revenue from crop agriculture and from total agriculture revenue inclusive of livestock, whereas it leads to an increase in net revenue from livestock production alone. On the other hand, an *increase in annual rainfall* would have significant positive effects on crop net revenues and whole farm net revenue, but a negative impact on livestock net revenue. However, a *decrease in annual rainfall* is more likely under climate change scenarios, and this would reduce net revenue from both crops and livestock.

### Conclusions

From the crop production point of view, the study suggests that it is essential to introduce new crops/varieties that are more appropriate to hot and dry conditions and that will give farmers a hand in adapting to harsh climatic conditions. At the same time, profitable micro-irrigation systems, improved water and soil management, and appropriate meteorological information should be fostered. On the other hand, from the livestock production point of view, the paper recommends production and use of local breeds, as well as disease tolerant breeds that are adapted to local climatic stress and feed sources. Animal health should also be improved.

### ABOUT THIS BRIEF

This brief is based on "Climate change can have significant negative impacts on Ethiopia's agriculture," Zenebe Gebreegziabher, Alemu Mekonnen, Rahel Deribie, Samuel Abera, and Meseret Molla Kassahun, December 2013, EfD Discussion Paper 13-14. (The DRB series of research briefs is associated with the EfD Discussion Paper Series.)

### FURTHER READING

Mendelsohn, R., W. Nordhaus, and D. Shaw. 1994. The Impact of Global Warming on Agriculture: A Ricardian Analysis. *American Economic Review* 84: 753-771.

Deressa, T.T., and R.M. Hassan. 2009. Economic Impact of Climate Change on Crop Production in Ethiopia: Evidence from Cross-Section Measures. *Journal of African Economies* 18(4): 529-54.

Gebreegziabher, Z., J. Stage, A. Mekonnen, and A. Alemu. 2011. Climate Change and the Ethiopian Economy: A Computable General Equilibrium Analysis. <http://www.rff.org/RFF/Documents/EfD-DP-11-09.pdf>.)

### CONTACT

Zenebe Gebreegziabher (email) [zenebeg2002@yahoo.com](mailto:zenebeg2002@yahoo.com), (tel) + 251 914 70 01 95

Alemu Mekonnen (email) [alemu\\_m2004@yahoo.com](mailto:alemu_m2004@yahoo.com), (tel) +251 552 3564



EfD Center in Ethiopia, [www.efdinitiative.org/centers/ethiopia](http://www.efdinitiative.org/centers/ethiopia)  
[eepfe-edir@ethionet.eth](mailto:eepfe-edir@ethionet.eth), Phone 251 11 552 3564 /550-6066. Fax 251 11 550-5588,  
Environmental Economics, Policy Forum for Ethiopia, (EPPFE), Ethiopian, Development  
Research Institute (EDRI). Blue Building, Near National Stadium, Office Numbers 401-409,  
fourth floor, P.O.Box 2479, Addis Ababa, Ethiopia

RESEARCH BRIEF

## Climate change can have significant negative impacts on Ethiopia's agriculture



EfD, Environment for Development initiative, [www.environmentfordevelopment.org](http://www.environmentfordevelopment.org)  
EfD Secretariat: [info@efdinitiative.org](mailto:info@efdinitiative.org), Phone: +46-31-786 2595, Fax +46-31-786 10 43,  
[www.efdinitiative.org/efd-initiative/organisation/secretariat](http://www.efdinitiative.org/efd-initiative/organisation/secretariat), Department of Economics,  
University of Gothenburg , PO Box 640, SE 405 30 Gothenburg, Sweden