



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

*No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.*

## **Flood-Induced Migration and Armed Conflict**

Ramesh Ghimire, Susana Ferreira and Jeffrey H. Dorfman  
Department of Agricultural and Applied Economics  
The University of Georgia  
Athens, GA, 30605  
(ghimire@uga.edu)

*Poster prepared for presentation at the Agricultural & Applied Economics  
Association's 2012 AAEA Annual Meeting, Seattle, Washington, August 12-14, 2012*

*Copyright 2012 by [Ramesh Ghimire, Susana Ferreira and Jeffrey H. Dorfman]. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.*

## Abstract

We analyze the **link between large and destructive floods and armed conflict** in 117 countries between 1985 and 2009 employing **flood-induced migration** as a potential transmission channel. We use **rainfall** as an **instrument for flood-induced migration** and employ a **two step procedure** (Rivers and Vuong 1988) to estimate the model. We find that floods are likely to increase the risk of armed conflict through the channel of migration.

## Introduction

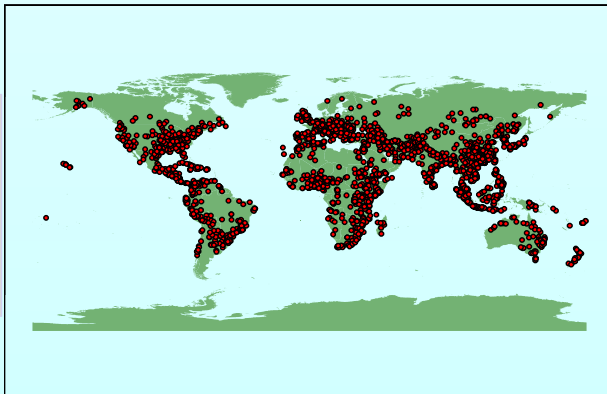
Natural disasters, such as earthquakes, droughts, and floods occur regularly across the world and have profound political, environmental, and social effects. Previous studies find that natural disasters tend to increase the risk of armed conflict (Nel and Righarts 2008; Brancati 2007). However, they offer little insights regarding the potential channels through which this happens. We explicitly model flood-induced migration as a potential mechanism through which large floods might result in armed conflict.

Natural disasters are becoming destructive and severe overtime (CRED/OFDA 2011). This could create environmental scarcity and result into mass migration. This migration combined with socioeconomic and institutional factors increases the risk of armed conflict in receiving areas.

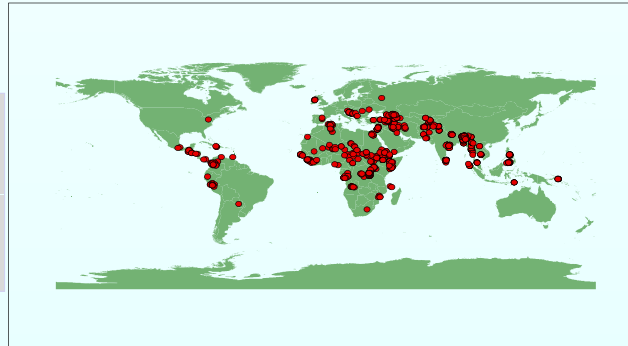
Sudden influx of environmental migrants can burden economic and resource base of the receiving area, promoting native-migrant contest over existing resources. It may generate distrust between the area of the migration's origin and host area. Further, it may ensue ethnic tension in the receiving area if the migrants and residents belong to different ethnic groups (Reuveny 2007).

## Objectives

To estimate the relationship between floods and armed conflict, through a flood-induced migration mechanism.



Geographic location of large flood events (1985-2010)



Geographic location of armed conflict (1989-2008)

## Data and Methods

Flood data [flood-induced migration] from Brakenridge (2011)

Armed conflict data from the Uppsala Conflict Data Program (UCDP) (2011)

Controls include socioeconomic, institutional, political indicators, and geophysical country characteristics.

We use a **random effects logit model with an endogenous explanatory variable** to estimate the relationship between flood-induced migration and armed conflict.

$$(1) y_1 = \delta_1 z_1 + \delta_2 y_2 + u_1 : \text{Structural equation}$$

$$(2) y_2 = \alpha_1 z_1 + \alpha_2 z_2 + v_2 : \text{Reduced form equation}$$

where:

$y_1$  is indicator for armed conflict [incidence or onsets];  $y_2$  is flood-induced migration [number of people displaced internally due to floods];  $z_1$  is a vector of exogenous variables [country area, terrain ruggedness, GDP/capita, youth population, conflict in neighboring country (=1), oil exporter (=1), noncontiguous state (=1), new state (=1), instability (=1), democracy (=1), anocracy (=1), ethnic fractionalization];  $z_2$  is an instrument for flood-induced migration [rainfall];  $\delta$ s and  $\alpha$ s are the parameters to be estimated, and  $u_1$  and  $v_2$  are error terms.

We **lag** all explanatory variables except country physical characteristics to **mitigate potential endogeneity bias**.



Flood-induced migration



Armed conflict

## Results and discussion

Large floods increase the probability of the **incidence** of armed conflict through migration. However, the results are weaker statistically to explain **onset** of armed conflict.

### Flood-induced migration and armed conflict (1985-2009)

VARIABLES	First stage	Second stage	
	Flood-induced migration	Incidence of armed conflict	Onset of armed conflict
Ln(rainfall, mm)	119,250*		
Flood-induced migration		4.83e-06*	4.39e-07
Ln(country area, km <sup>2</sup> )	50,331	0.399	0.274**
Terrain ruggedness	-184,617	2.525***	0.424
Conflict in neighboring country (=1)	52,629	-0.0408	0.744**
Ln(GDP/capita)	-124,173	0.0574	-0.327
Youth population (%)	17,311	-0.159*	0.0119
Noncontiguous state (=1)	444,163	-0.502	0.819
Oil exporter (=1)	-45,856	0.250	0.663
New state (=1)	175,261	0.945	1.432
Instability (=1)	23,868	0.109	-0.517
Democracy (=1)	139,555	-1.268**	-0.167
Anocracy (=1)	-118,999	0.785*	0.322
Ethnic fractionalization	-170,173	3.731**	0.450
Observations	2,418	2,418	2,418
Number of id	117	117	117
Wald chi2 (34)		70.32 (p = 0.0002)	61.05 (p = 0.0030)

Note: Coefficients of the random effects logit model. Dependent variable as indicated by column heading. \*\*\*p<0.01, \*\*p<0.05, \*p<0.1

## Conclusions

Large and destructive floods increase the likelihood of armed conflict through a migration channel (flood-induced migration). The marginal effects suggest that for the average country, a one million increase in flood-induced migrants is associated with a 23% larger probability of incidence of armed conflict.

## References

- Brakenridge, R. (2011), Space-based measurement of surface water, <http://floodobservatory.colorado.edu/>
- Brancati D. (2007), Political aftershocks: The impact of earthquakes on intrastate conflict, *Journal of Conflict Resolution*, 51(5): 715-743
- CRED/OFDA (Center for Research of the Epidemiology of Disasters/Office of Foreign Disaster Assistance) (2011), *International disaster database*, [www.emdat.be](http://www.emdat.be) (Accessed: June 12, 2011).
- Nel, P. and M. Righarts (2008), Natural disasters and the risk of violent civil conflict, *International Studies Quarterly*, 52 (1): 159-185
- Reuveny, R. (2007), Climate change-induced migration and violent conflict, *Political Geography*, 26(6):656-673.
- Rivers, D. and Q. H. Vuong (1988), Limited information estimators and exogeneity tests for simultaneous probit models, *Journal of Econometrics*, 39 (3): 347-366.
- UCDP (Uppsala Conflict Data Program) (2011), UCDP/PRIO armed conflict dataset, [http://www.pcr.uu.se/research/ucdp/datasets/ucdp\\_prio\\_armed\\_conflict\\_dataset/](http://www.pcr.uu.se/research/ucdp/datasets/ucdp_prio_armed_conflict_dataset/).