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Maize Prices, Trade, and Climate Shocks: Do Trade Policies Mitigate the Effects of Climate Shocks on Maize Prices?

Kathy Baylis and Tess Lallemant

Selected Paper prepared for presentation at the International Agricultural Trade Research Consortium's (IATRC's) 2019 Annual Meeting: Recent Advances in Applied General Equilibrium Modeling: Relevance and Application to Agricultural Trade Analysis, December 8-10, 2019, Washington, DC.

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Maize Prices, Trade and Climate Shocks

Do trade policies mitigate the effects of climate shocks on maize prices?

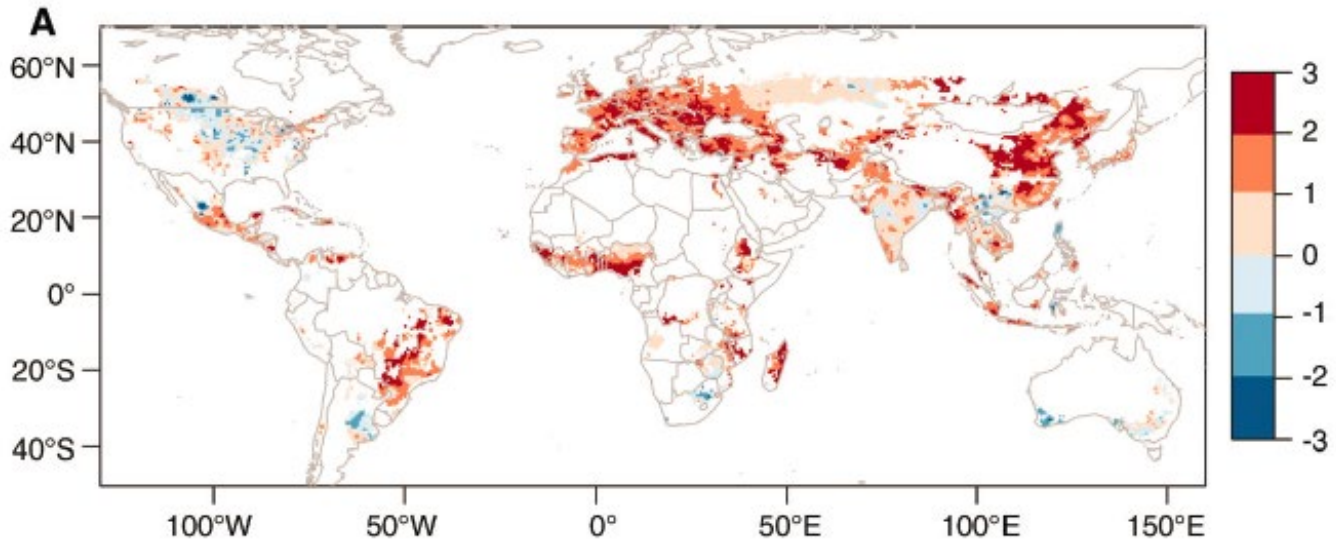
Kathy Baylis

Tess Lallemant

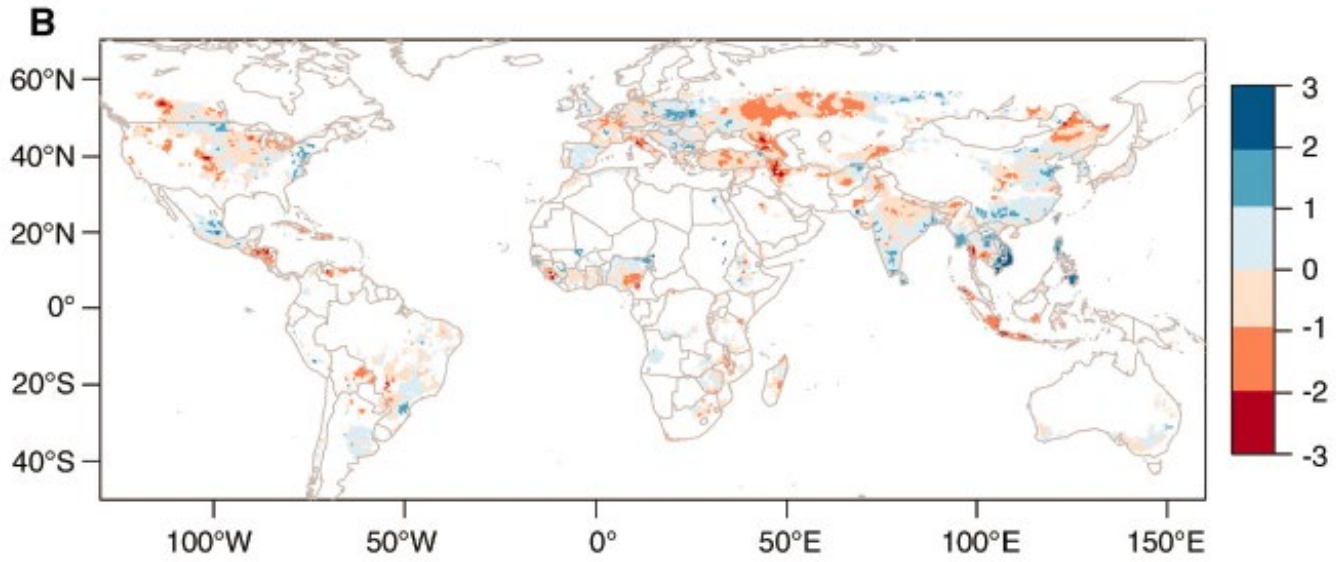
University of Illinois

Agricultural areas on average are warmer and drier

Temperature

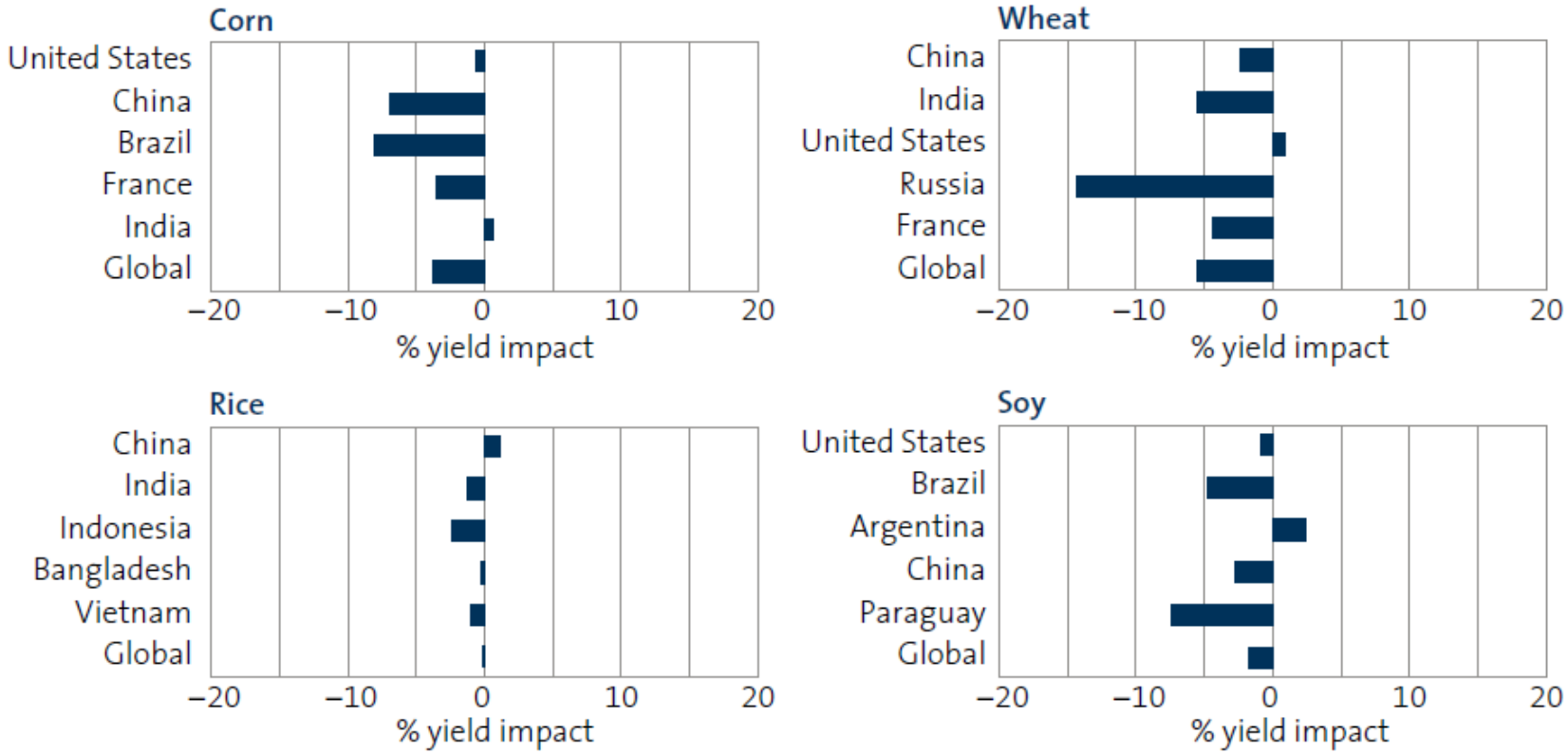


Precipitation



Source: Lobell, Schlenker, Costa-Roberts, 2011

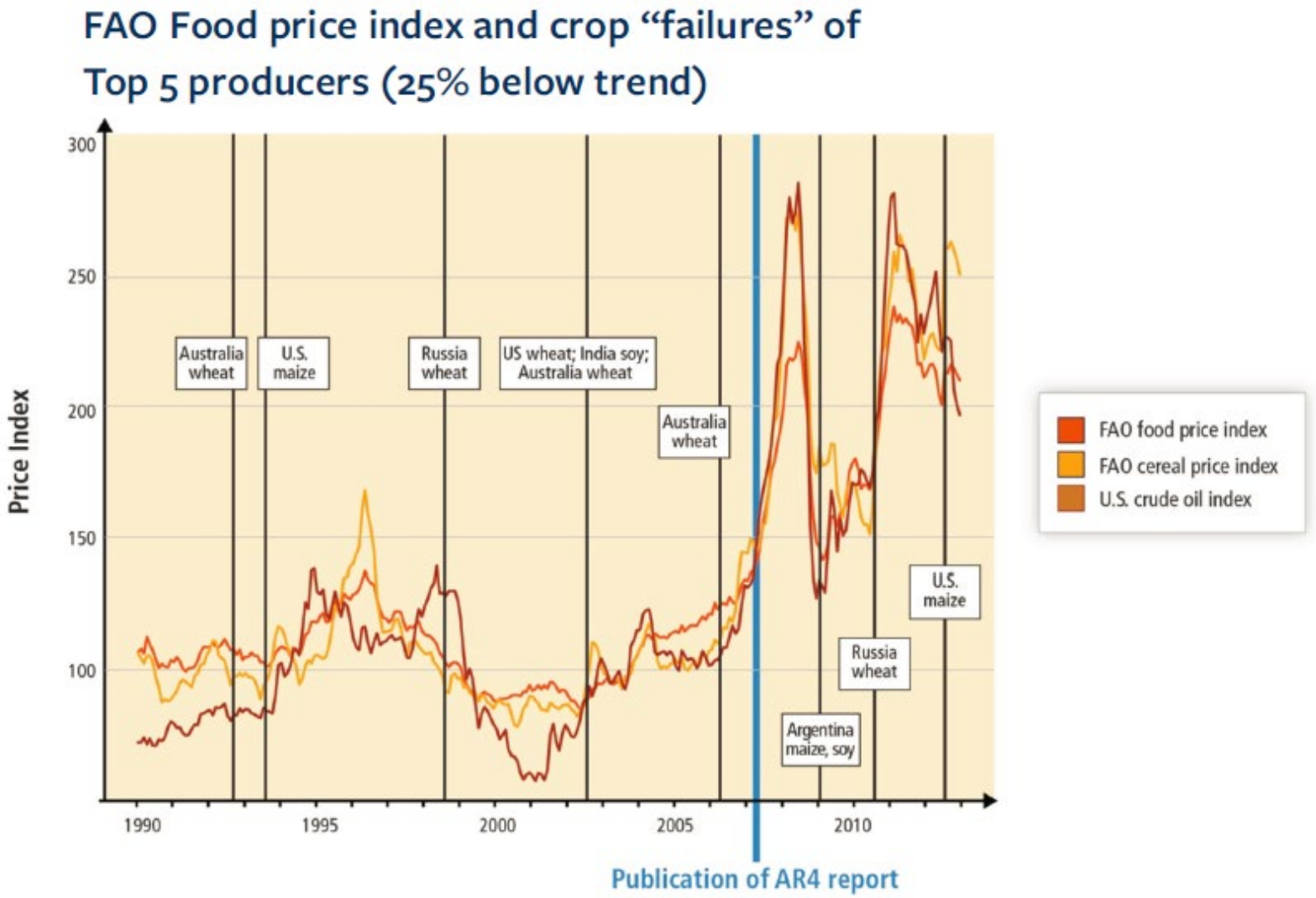
… and that's already affecting yields (1980-2008)



Estimated net impact of climate trends for 1980-2008 on crop yields, divided by the overall yield trend.

Source: Adapted from Figure 3 in Lobell, Schlenker, and Costa-Roberts 2011.

Weather events often precede price spikes



Source: IPCC WG2, Chapter 7.

Literature

Ag-Trade policy frequently used to stabilize price. (Govereh, Jayne, and Chapoto, 2008)

Trade barriers could be ineffective or even harmful for poverty and food security. (Martin and Anderson, 2012; Martin and Ivanic, 2013; Garca-Germn et al. 2013; Giordani, Rocha and Ruta 2016)

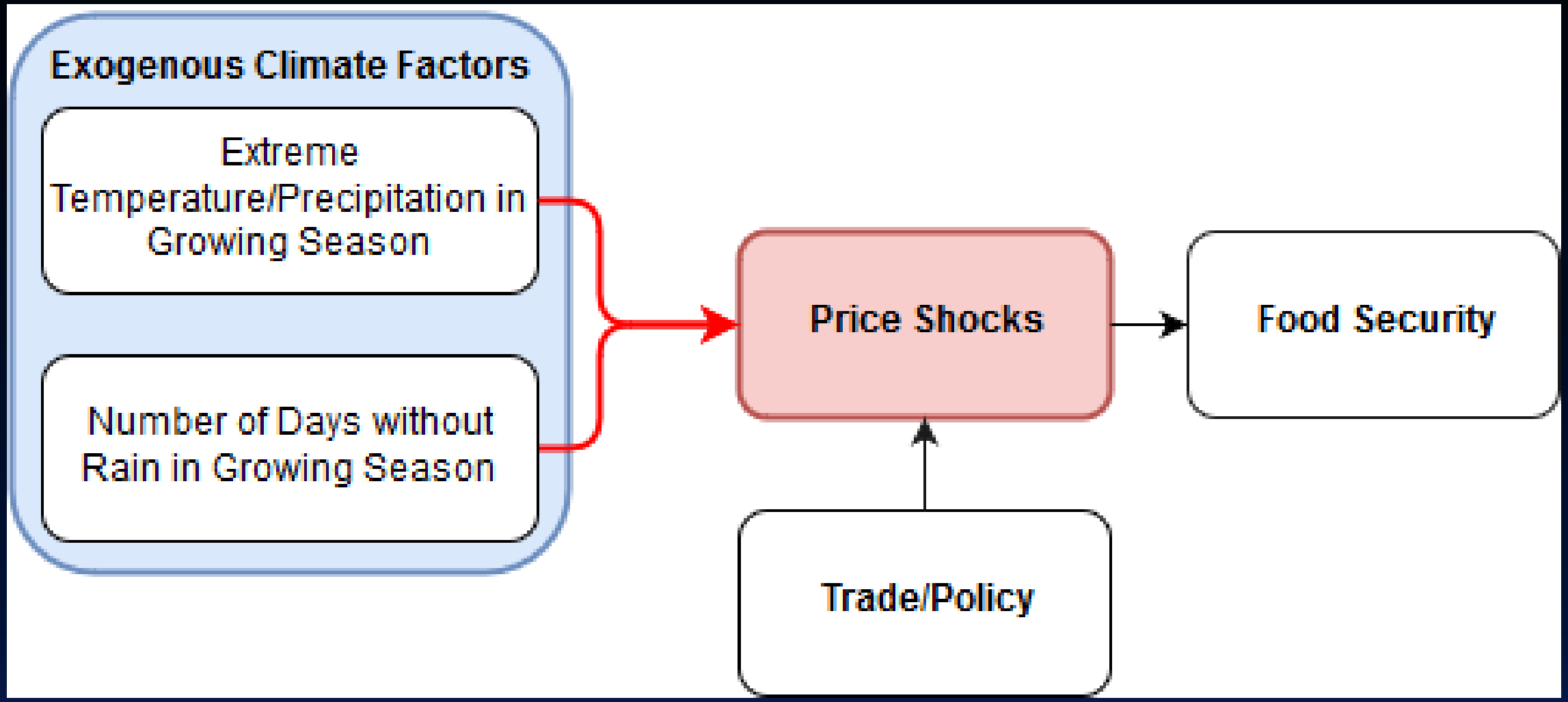
Weather shocks that affect staple crop production are linked to fluctuations in prices. (Brown and Kshiragar, 2015; De Hoyos and Medvedev, 2011; Bowen and Villoria 2018; Hertel, Burke and Lobell, 2010)

Theoretically trade can mitigate effects of local weather shocks on prices.

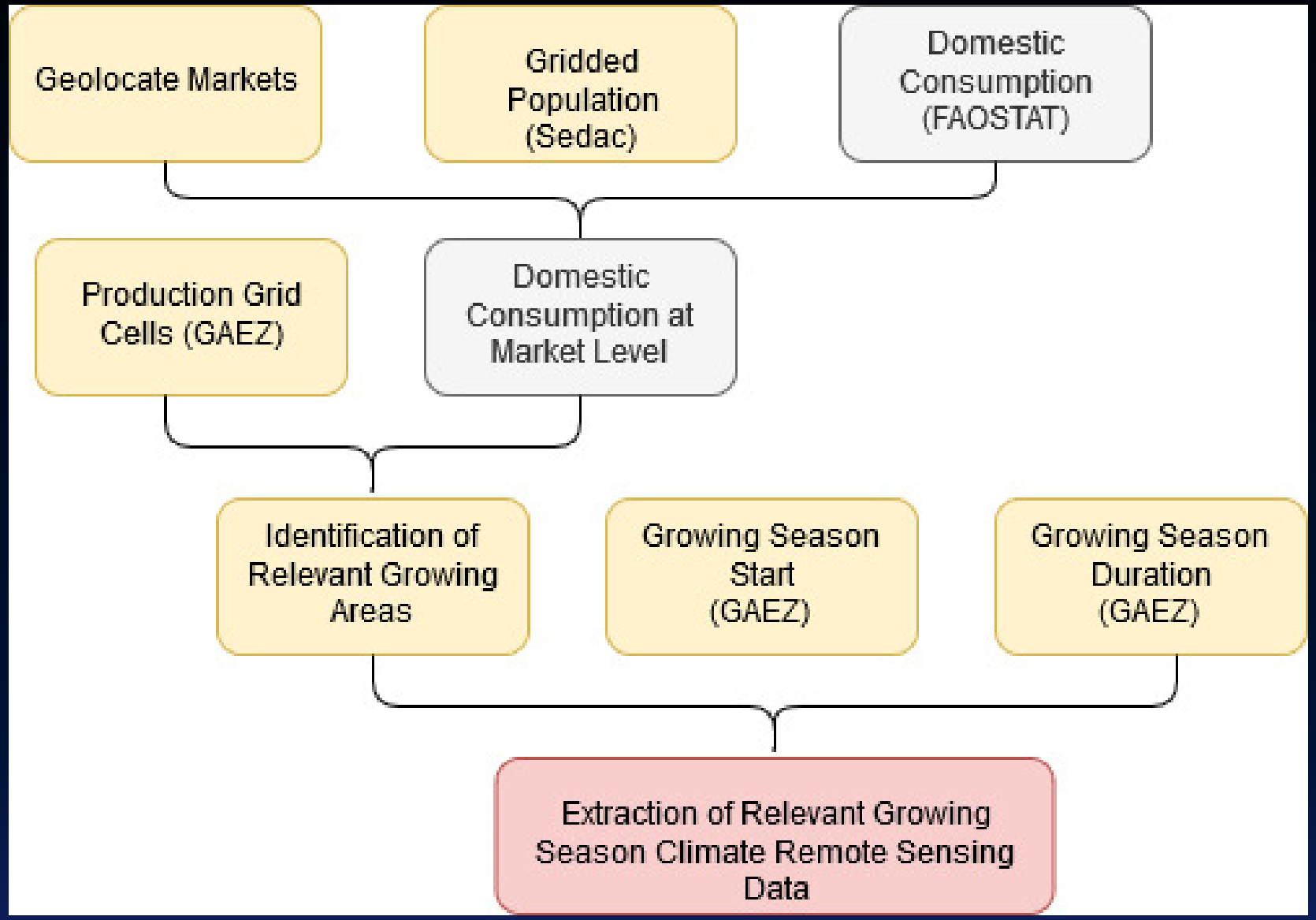
What We Do

- Generate global dataset of market specific agriculturally relevant weather shocks.
- Use monthly prices to assess impact of:
    - a) Weather Shocks
    - b) Trade Openness
    - c) Weather Shocks x Trade Openness

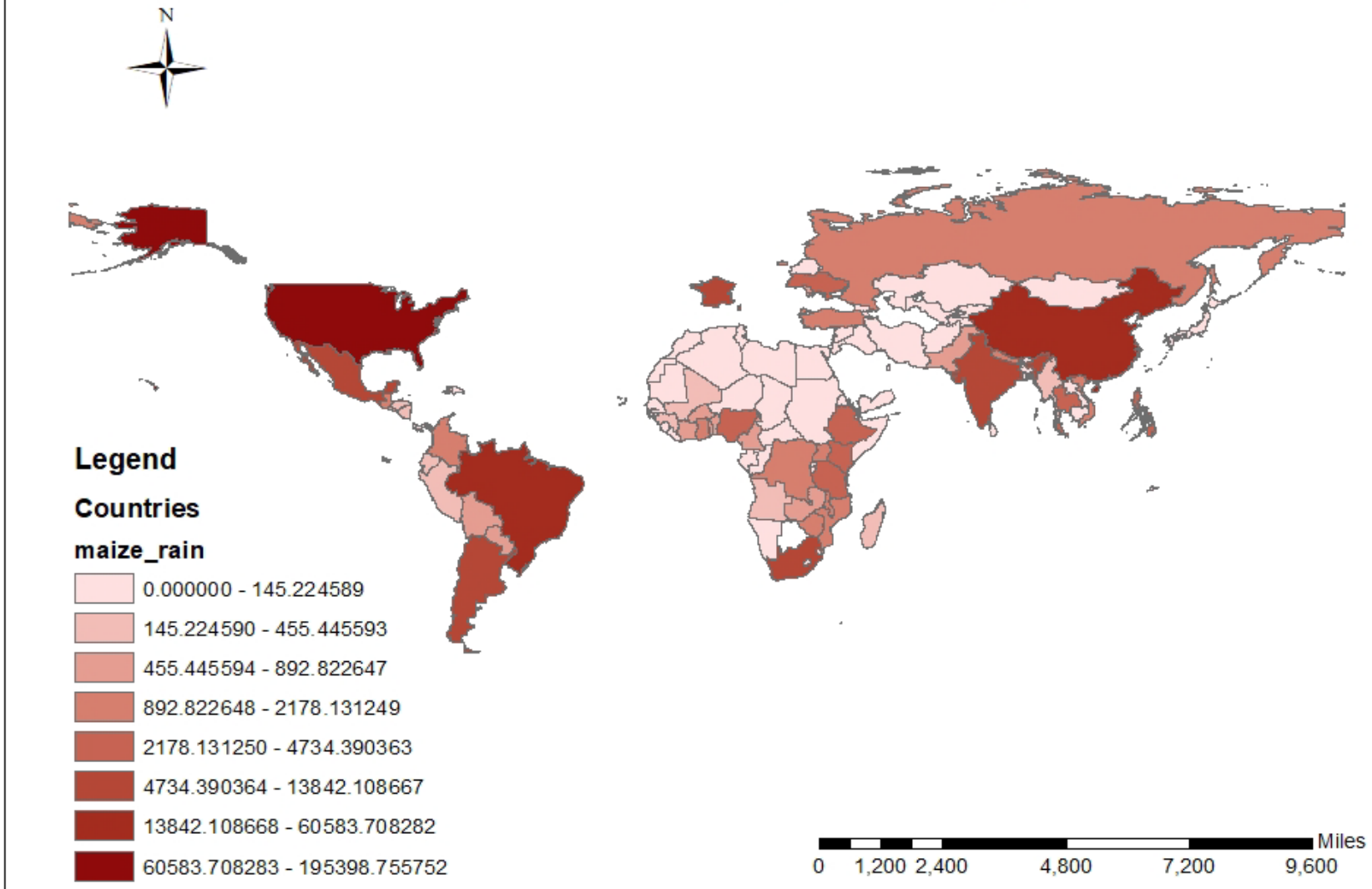
General Framework



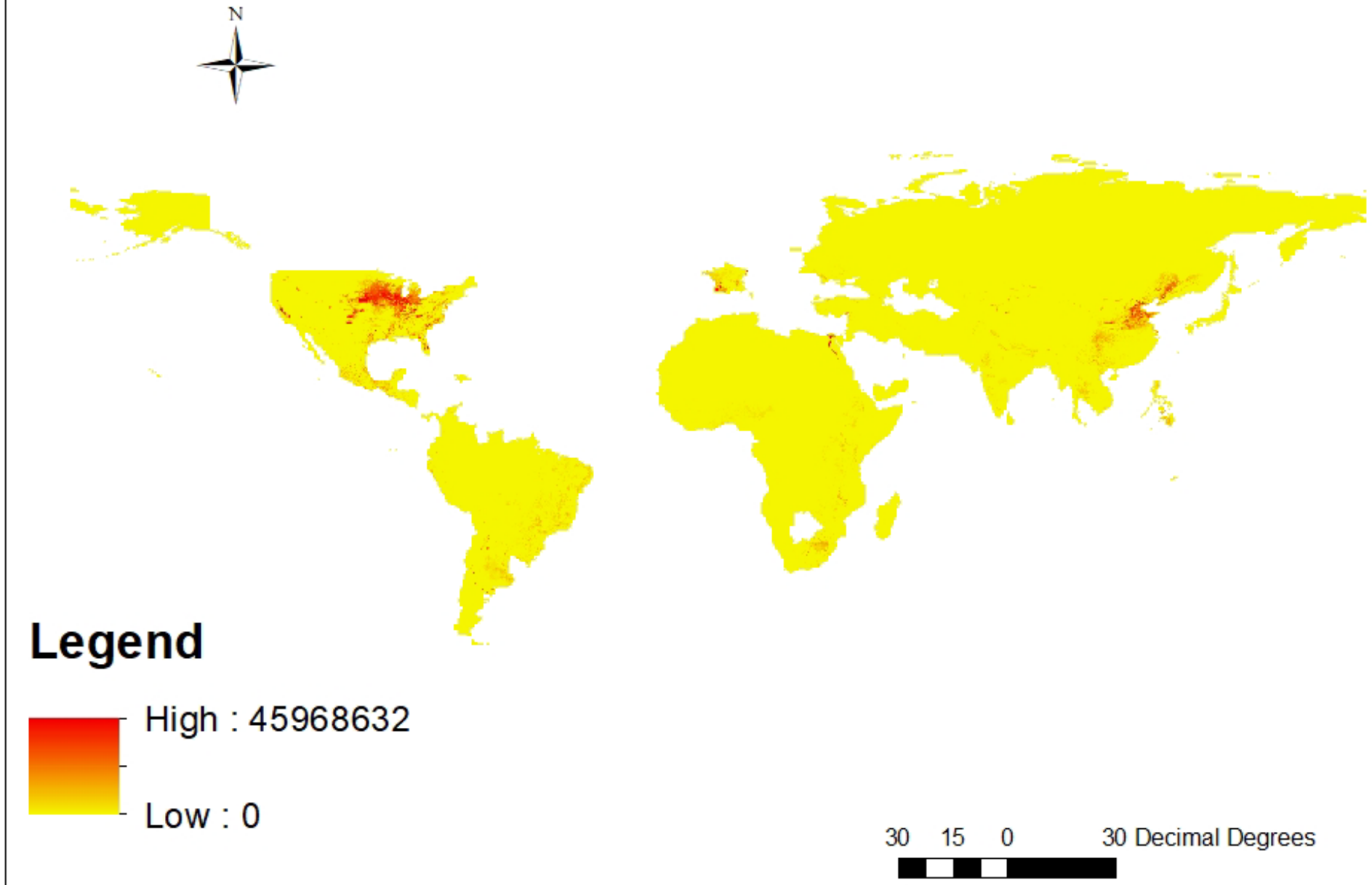
Data Process – Measuring the Market Shed



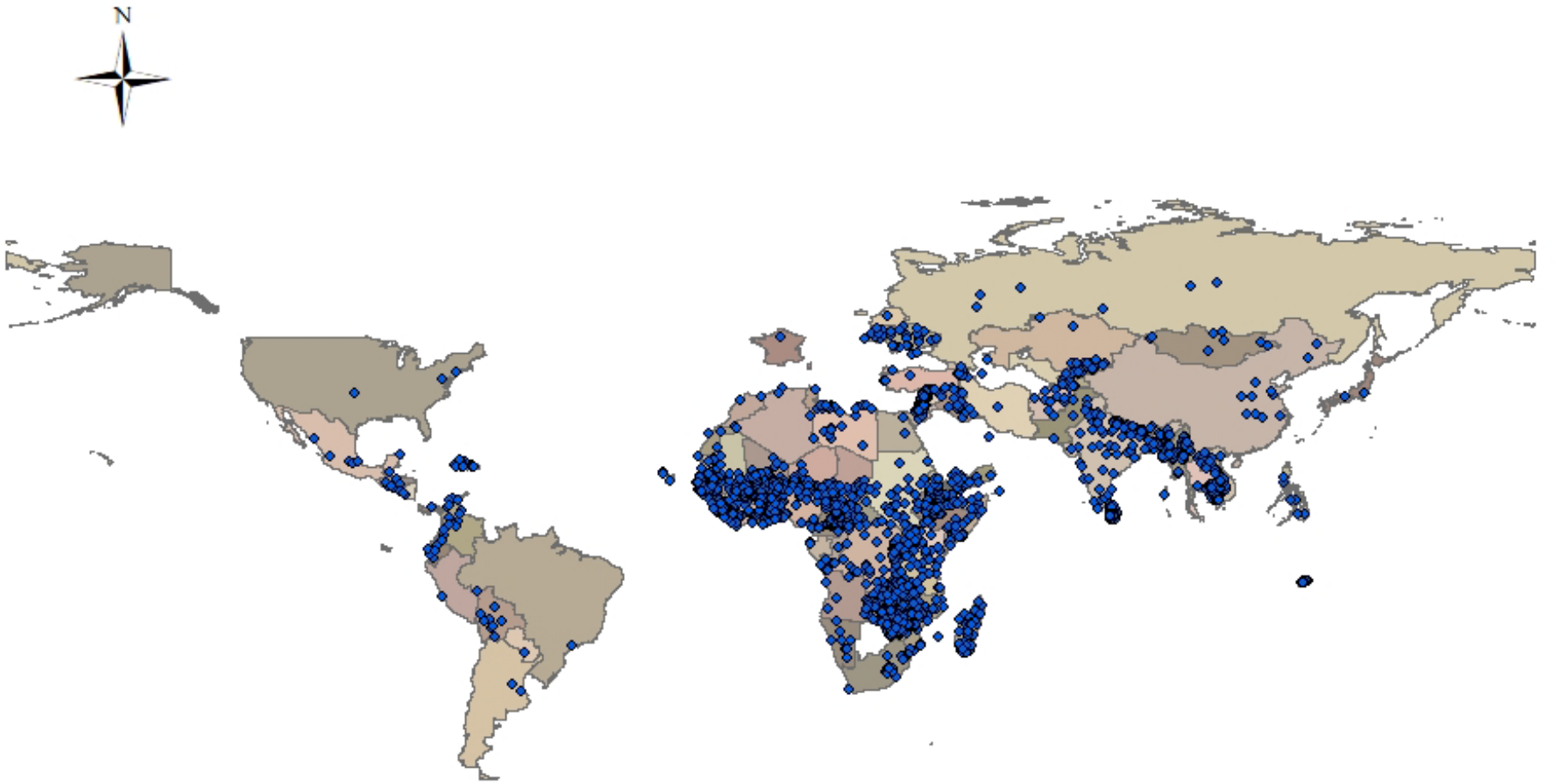
Rainfed Maize by Country



Maize Main Growing Area



Markets Distribution by Countries



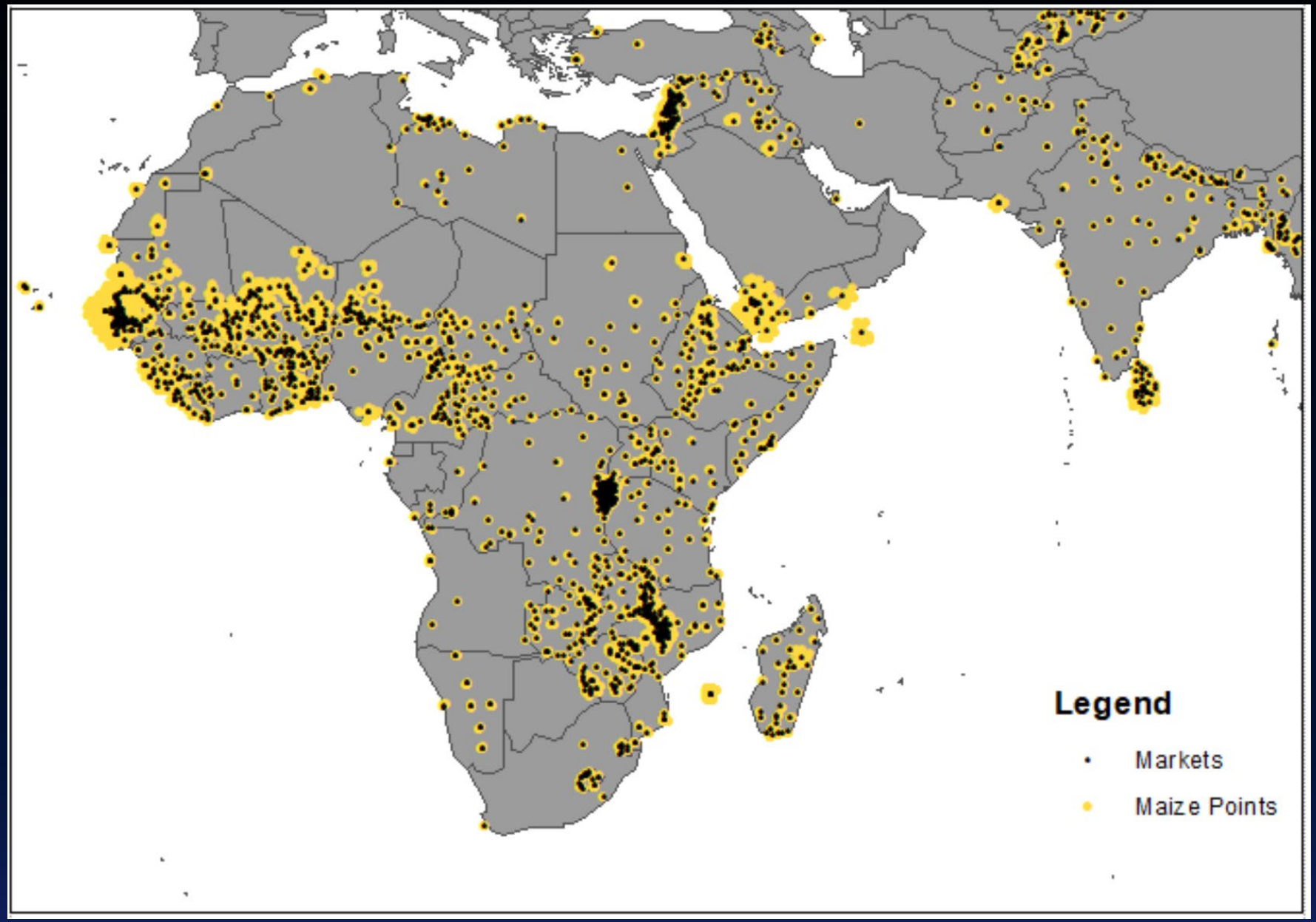
Legend

- Markets

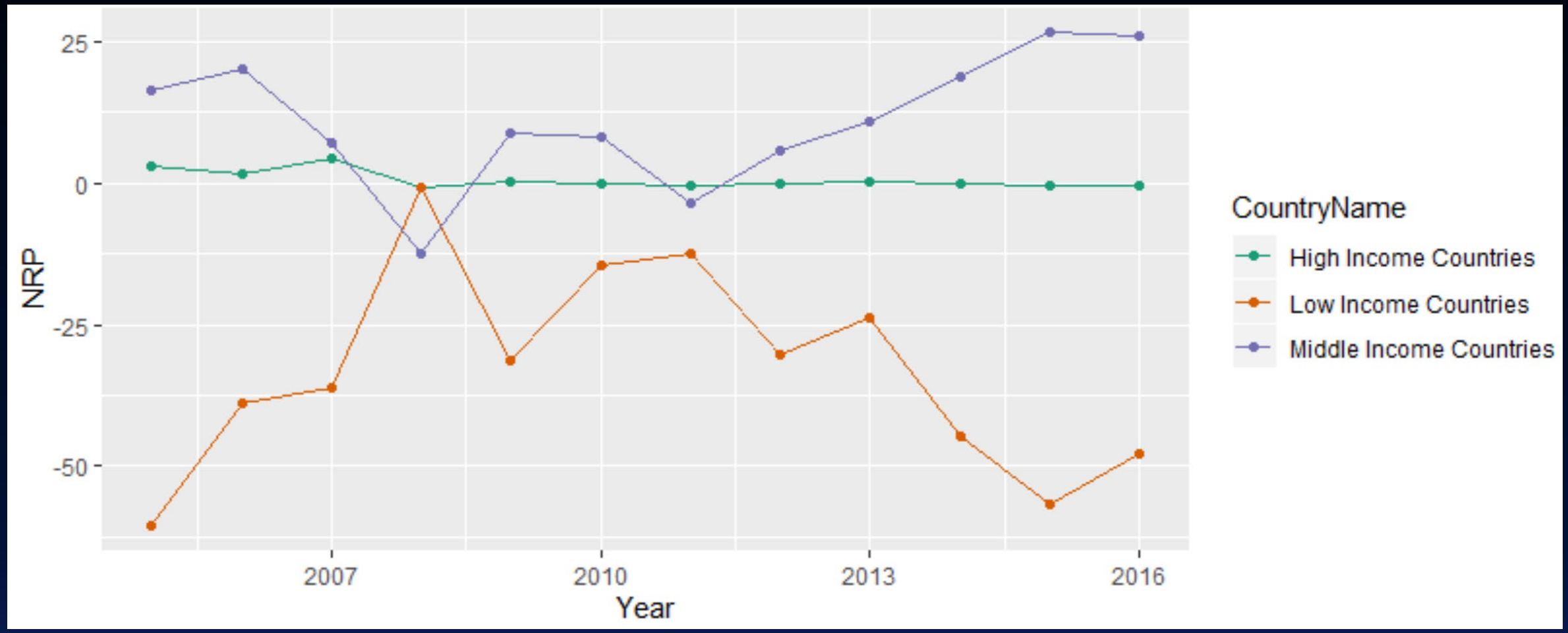
Miles

0 1,200 2,400 4,800 7,200 9,600

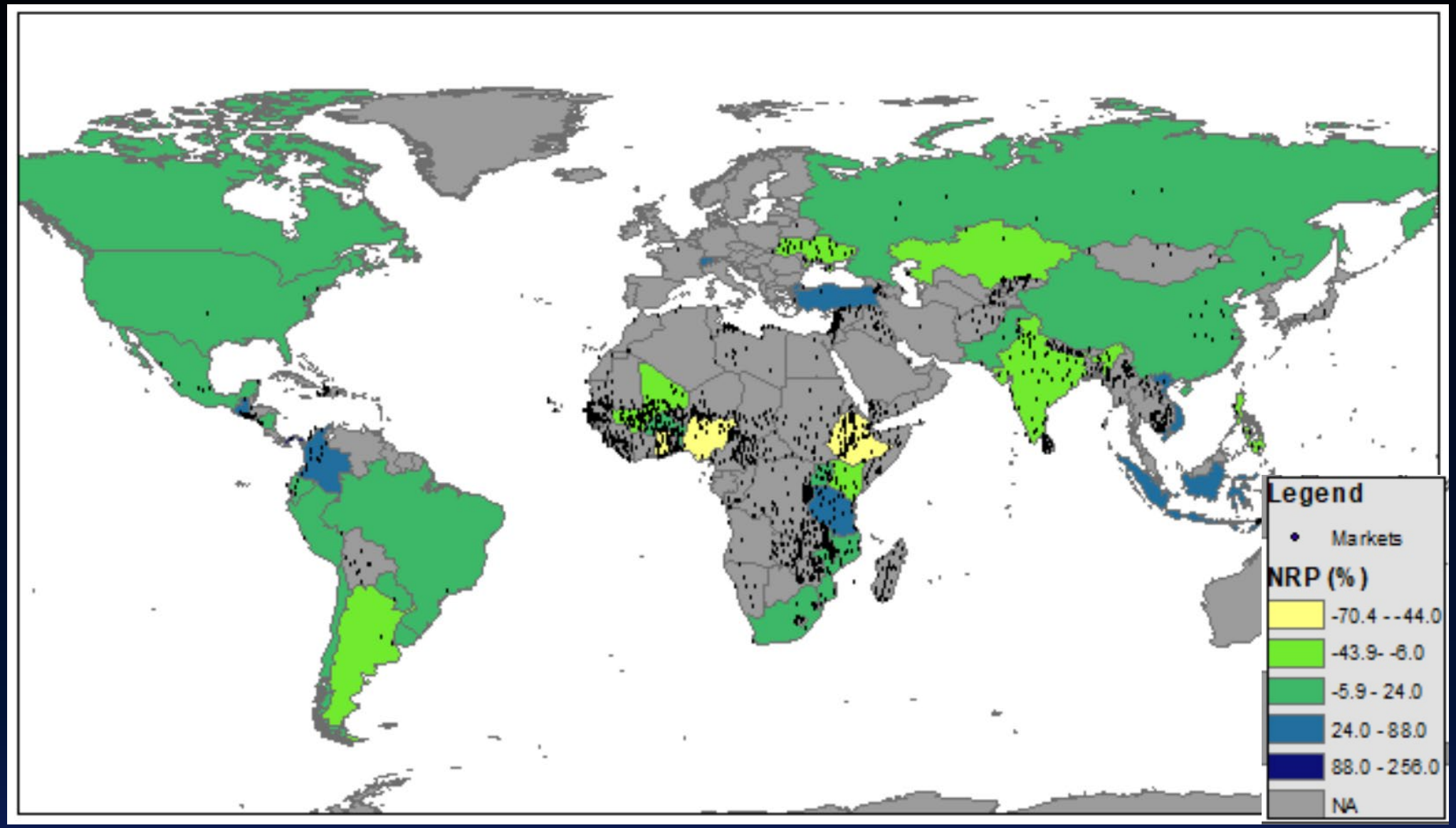
Local Maize Market Shed



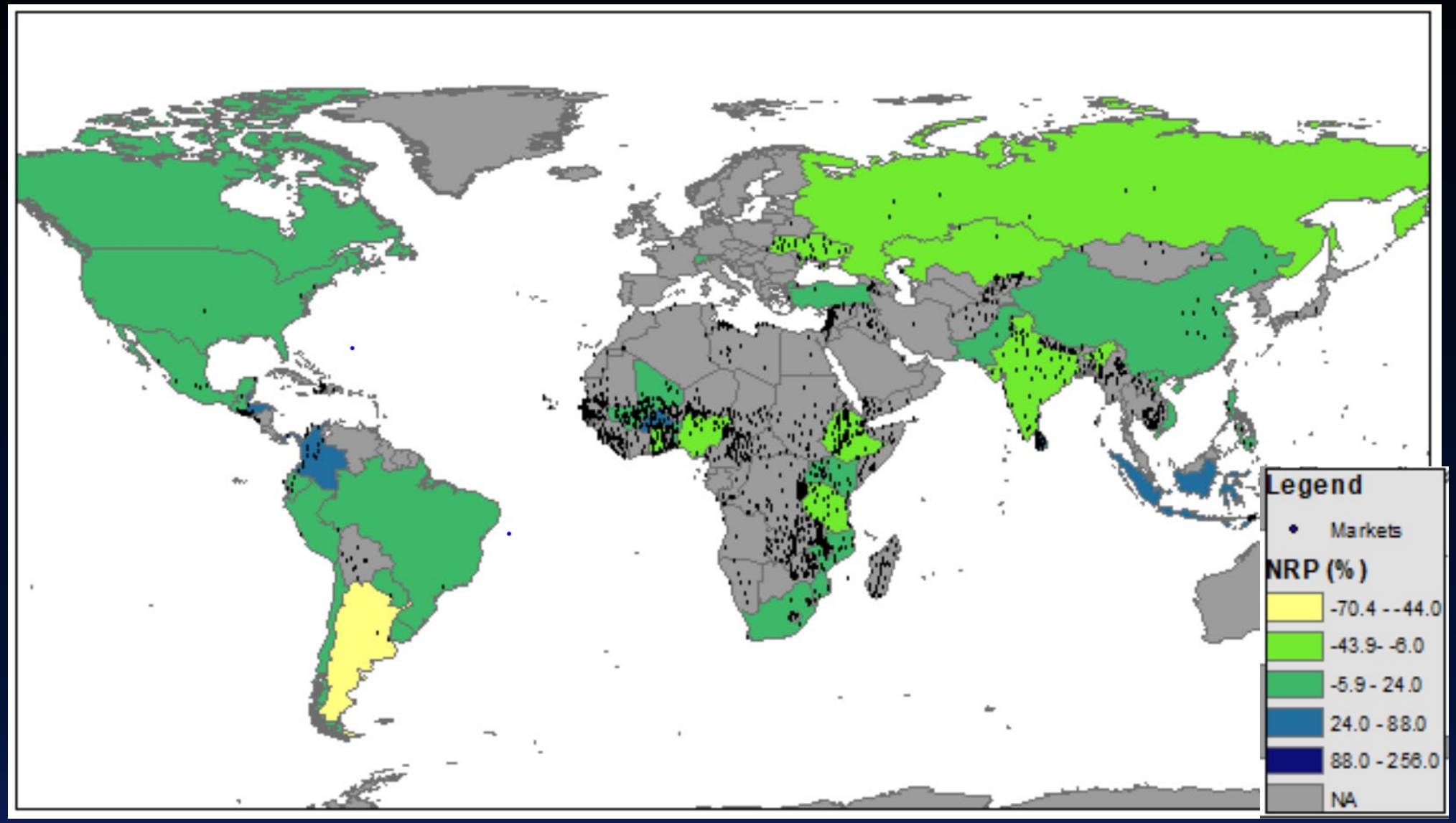
NRP (%) for Maize by Income Group



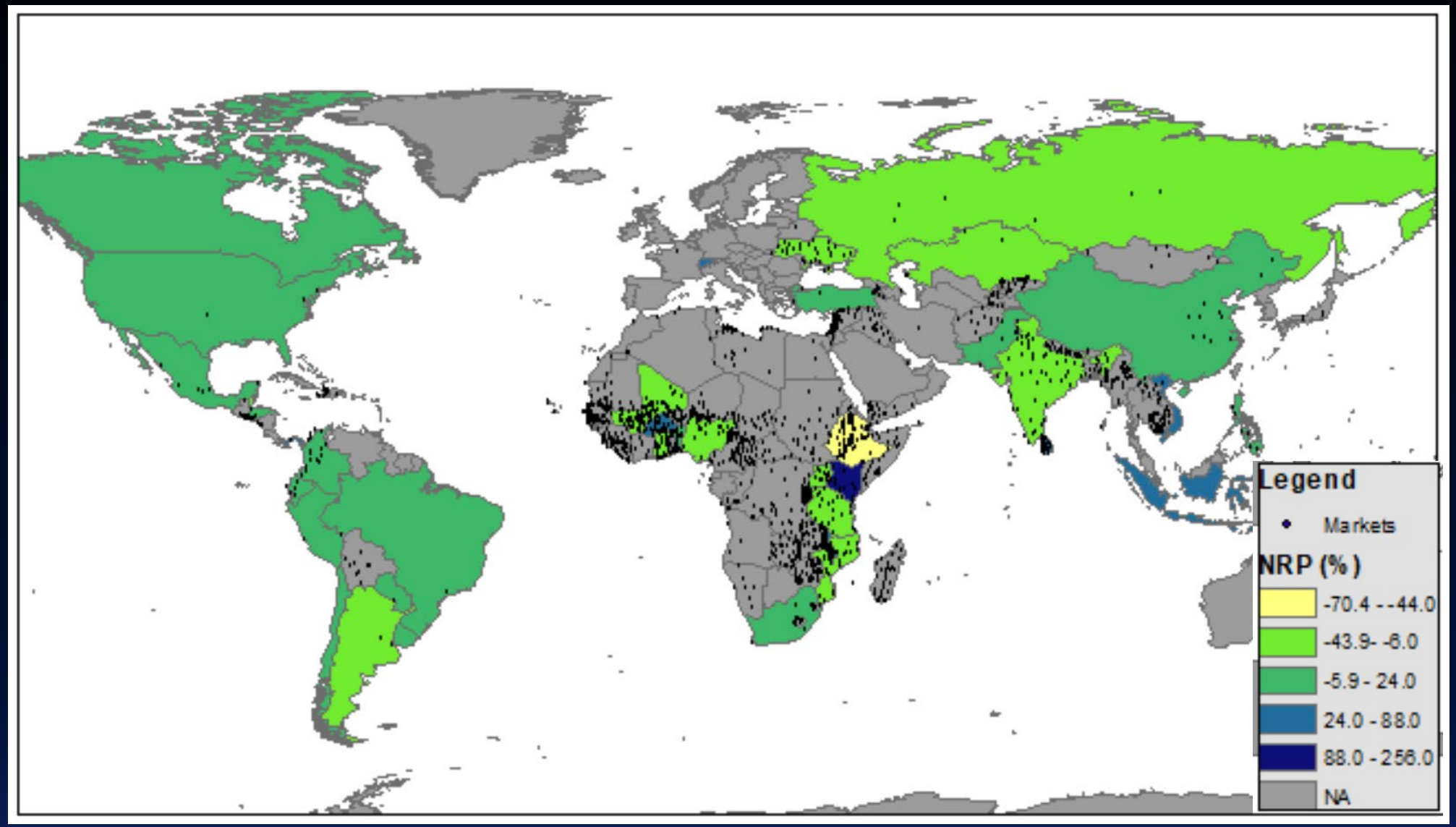
NRP (%) - 2010



NRP (%) - 2011



NRP (%) - 2012



Growing season weather matters for maize price

	ln(price per kg)	ln(price per kg) x % rainfed
Negative z-score rain	-0.021	-0.021
	(0.006)	(0.006)
Positive z-score rain	0.017	0.017
	(0.005)	(0.005)
Z-score % of crop season with no rain	0.003	0.003
	(0.003)	(0.003)
Mean, Max, Min Temp Bins	yes	yes
Year FE	yes	yes
Commodity FE	yes	yes
Market FE	yes	yes
Observations	9,841	9,841
R-squared	0.759	0.759

(Standard errors in parentheses)

High minimum temperatures particularly damaging…

	Ave Temp	Max Temp	Min Temp
5 to 10C			-0.397
			(0.102)
10 to 15C	-0.072		-0.258
	(0.065)		(0.087)
15 to 20C	0.004	-0.041	-0.003
	(0.021)	(0.023)	(0.017)
25 to 30C	-0.020	0.050	-0.033
	(0.020)	(0.023)	(0.022)
> 30C	-0.041	0.030	0.124
	(0.032)	(0.030)	(0.035)

Trade openness is highly correlated with price variation

	CV (price per kg)
$NRAP^2$	0.731
	(0.017)
Commodity code FE	yes
Observations	52,737
R-squared	0.205

(Standard errors in parentheses)

Trade restrictions increase effect of local weather shocks

	ln(price per kg)	x NRAP^2
Positive z-score rain	0.016	0.022
	(0.008)	(0.050)
Negative z-score rain	-0.004	-0.145
	(0.010)	(0.066)
Z-score % of crop season with no rain	-0.004	0.070
	(0.005)	(0.035)
mean, max, min temp bins	Yes	
year FE	Yes	
commodity FE	Yes	
market FE	Yes	
Observations	9,841	
R-squared	0.760	

(Standard errors in parentheses)

Conclusion

We have evidence that trade is mitigating the effects of rainfall shocks on prices.

Next Steps:

a) Tons of Robustness tests
b) Daily temperature data
c) Including LSMS data to look at Food Security Outcomes.

Thank you!

Let us know if you have any questions or suggestions!

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Tess Lallemant – tessl2@Illinois.edu

Data Sources

Maize prices for 874 markets in 52 countries

Monthly Maize Retail Prices

- IFPRI – Food Security Portal
- Famine Early Warning Systems Network (FEWSnet)
- Global Information and Early Warning System (GIEWS)
- World Food Program (WFP)

Weather Indicators

- Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS)
- National Centers fo Environmental Information (NCEI)

Geographic/Agricultural Indicators

- Global Agro-Ecological Zones (FAO)

Trade

- Ag-Incentives – IFPRI
- Kym Anderson - Estimates of Distortions to Agricultural Incentives 1955-2011

Other

- FAOSTAT
- Socioeconomic Data and Applications Center (SEDAC)