Explaining Agricultural Technology Adoption Using Choice Experiments and System Dynamics

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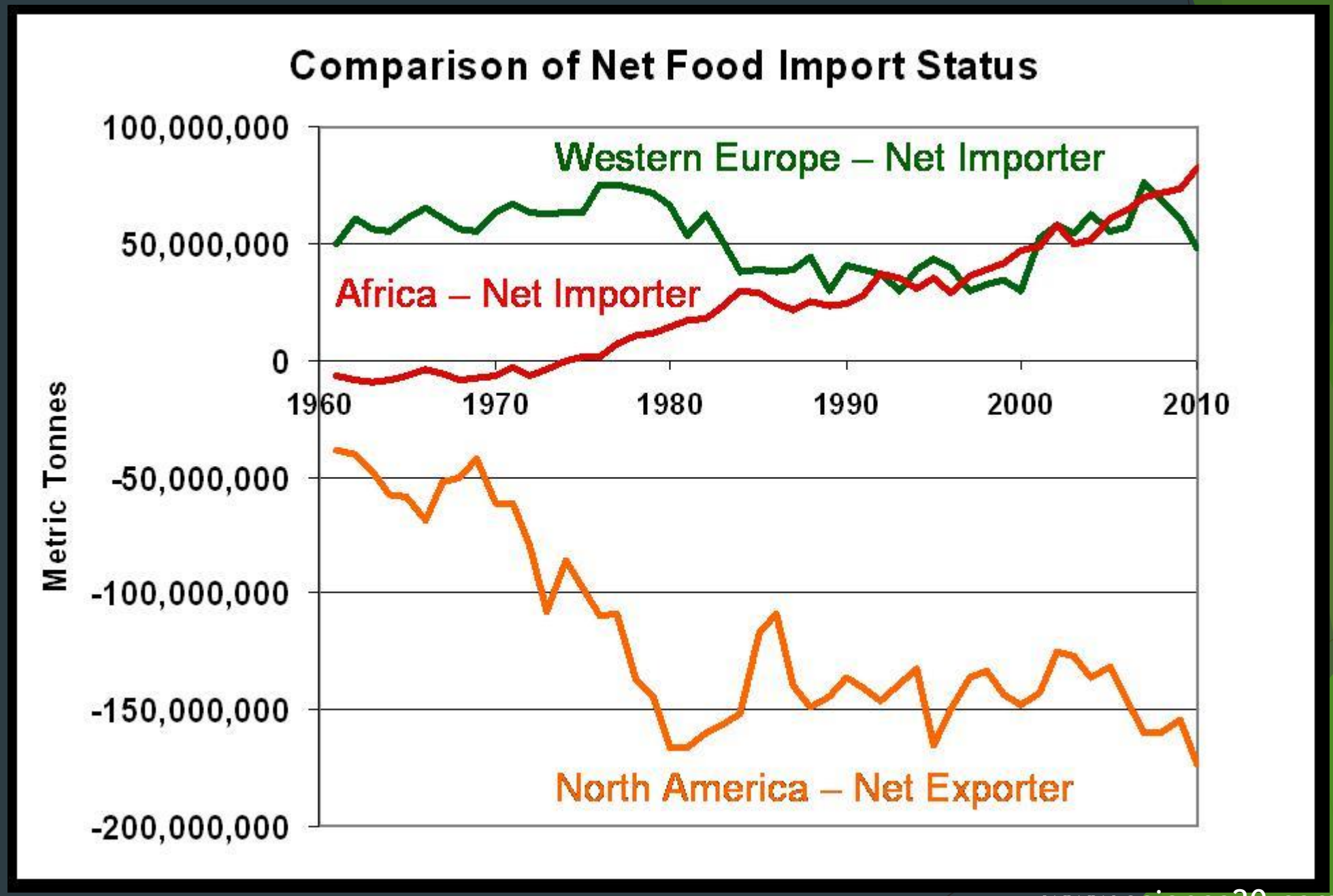

Comparison of Net Food Import Status
100,000,000
50,000,000
0
-50,000,000
-100,000,000
-150,000,000
-200,000,000
Metric Tonnes
1960
1970
1980
1990
2000
2010
Western Europe – Net Importer
Africa – Net Importer
North America – Net Exporter

Hello,
10.8 BILLION

NEW DATA RELEASED in June 2013 by the United Nations predicts a global population of more than 10.8 billion by 2100 — 800 million higher than the U.N.'s 2010 estimate. Population growth is expected to be unevenly distributed across the planet, and the rural to urban migration will continue to explode.

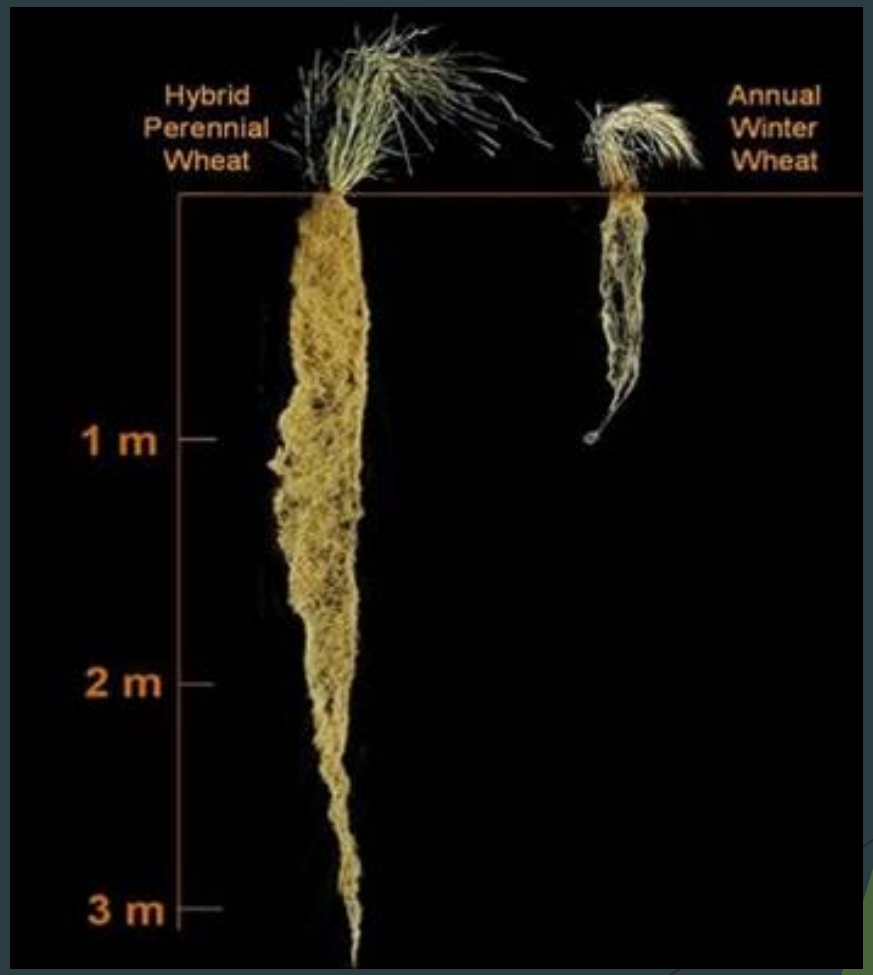
PROJECTED POPULATION CHANGE FOR SELECT COUNTRIES (2010 TO 2100)

Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2012 Revision

Graphic: ensia.com

What is a perennial and why do we care?

1. Reduced costs in preparing fields
2. Reduced erosion
3. Faster establishment in subsequent years
4. Improved soil fertility – larger root mass contributes to soil carbon



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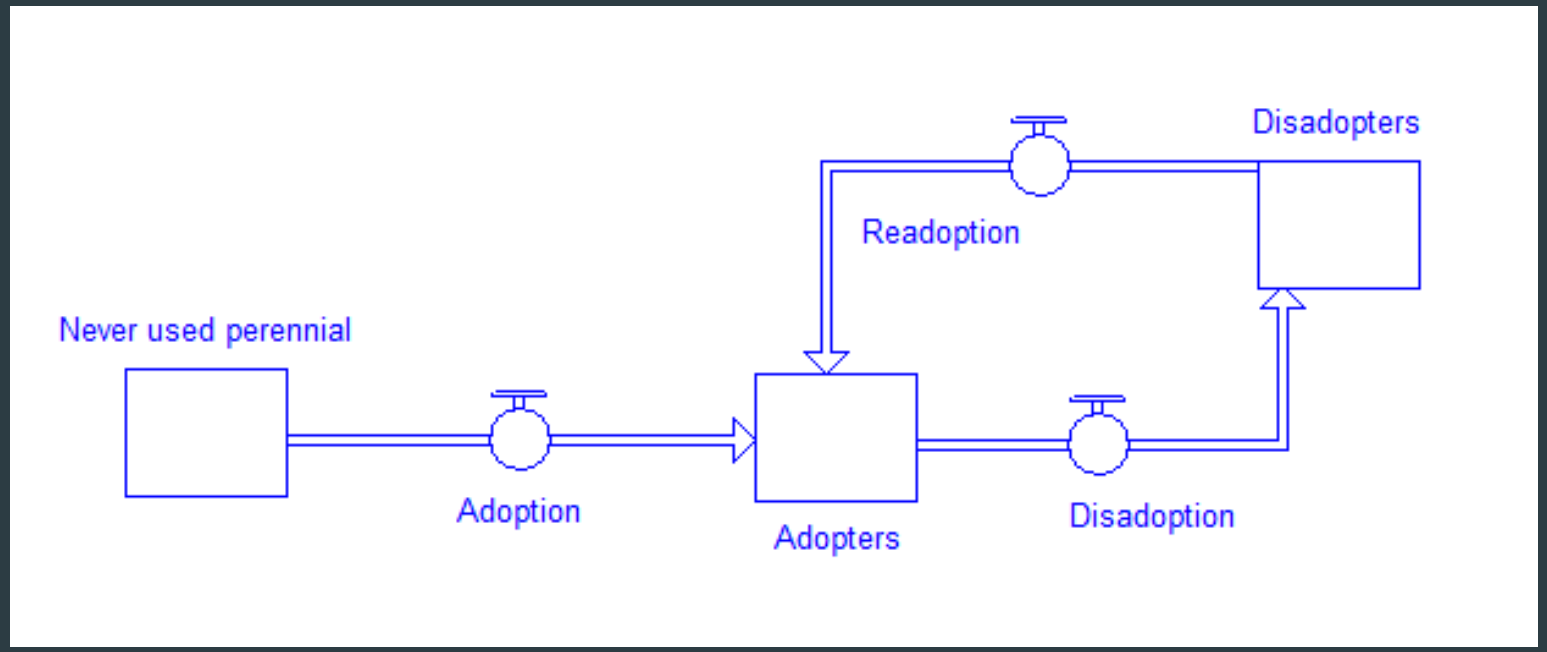
Perennial Pigeonpea in Malawi

Image: Dr. Sieg Snapp, MSU

What's unique about this study?

- Combining system dynamics and choice experiments (consumer theory and diffusion of innovation)
- Incorporating environmental factors, stochasticity into adoption trajectory

System Dynamics – Stocks and Flows



Choice Experiments

CARD 1 VERSION 1			
	MAIZE SEED A	MAIZE SEED B	
Seed Price			
Yield loss due to Pest			Neither Maize Seed A nor Maize Seed B: Given these options, I would prefer to cultivate the seed I now grow.
Seed Type			
Seed Payment	Cash only 	Cash or credit  	
Information	Farmer 	Input Supplier 	

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Perennial Pigeon Pea Adoption

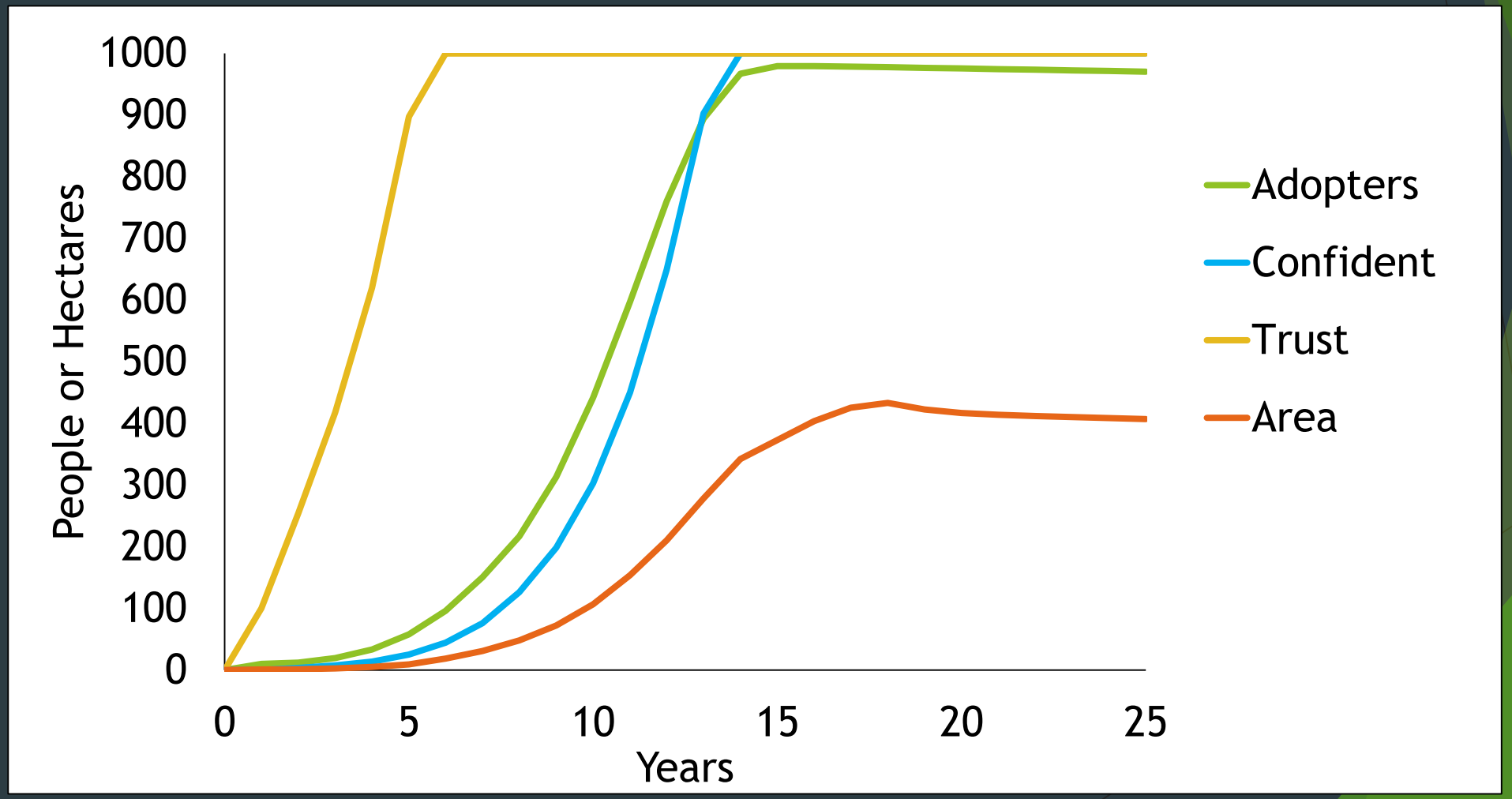
- Focus on southern Malawi and farmers who already grow annual pigeon pea
- Simulate adoption decision of 1000 farmers over 25 years

	Annual	Perennial
Year 1 – growing season	Maize – pigeon pea intercrop	Maize – pigeon pea intercrop
Year 1 – dry season	Destructive harvest	Harvest and ratoon
Year 2 – growing season	Maize – pigeon pea intercrop	Maize – pigeon pea intercrop (higher competition)
Year 2 – dry season	Destructive harvest	Destructive harvest
Year 3 – growing season	Sole Maize	Sole Maize

Base scenario – average yields held constant

- Perennial system has advantage over annual system
- Probability of adoption is 92%
- Gradual gain in trust and skills

Base scenario – average yields held constant



Coarse analysis of cumulative environmental benefits

- Reduced erosion – 61.3% of agricultural land has greater than 2% slope in Southern Malawi (Landsat 30m x 30m)
- Reduced N leaching – from 1.66 kg N/ha with sole maize to 0.72 kg N/ha (30 year average from SALUS)

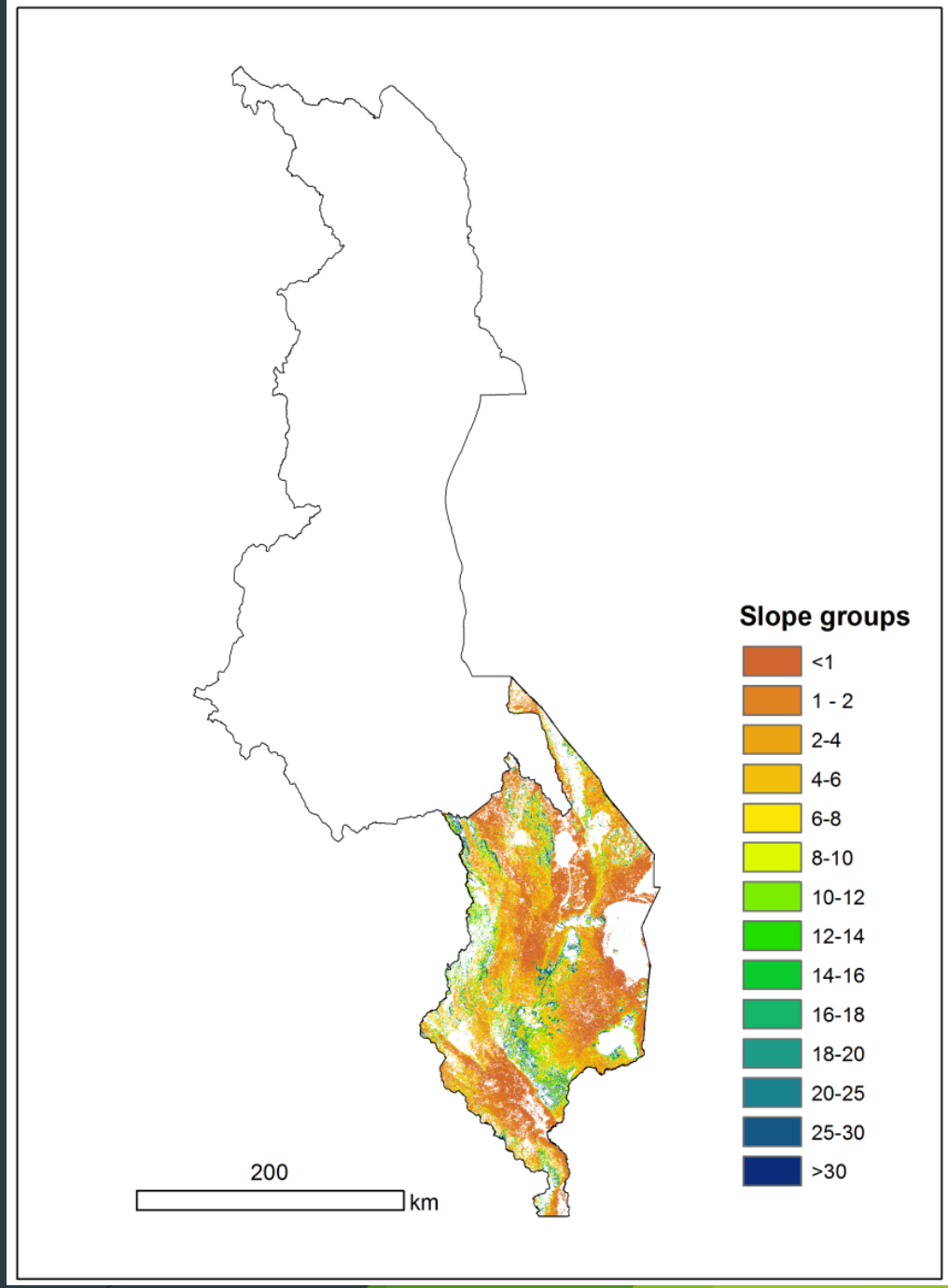
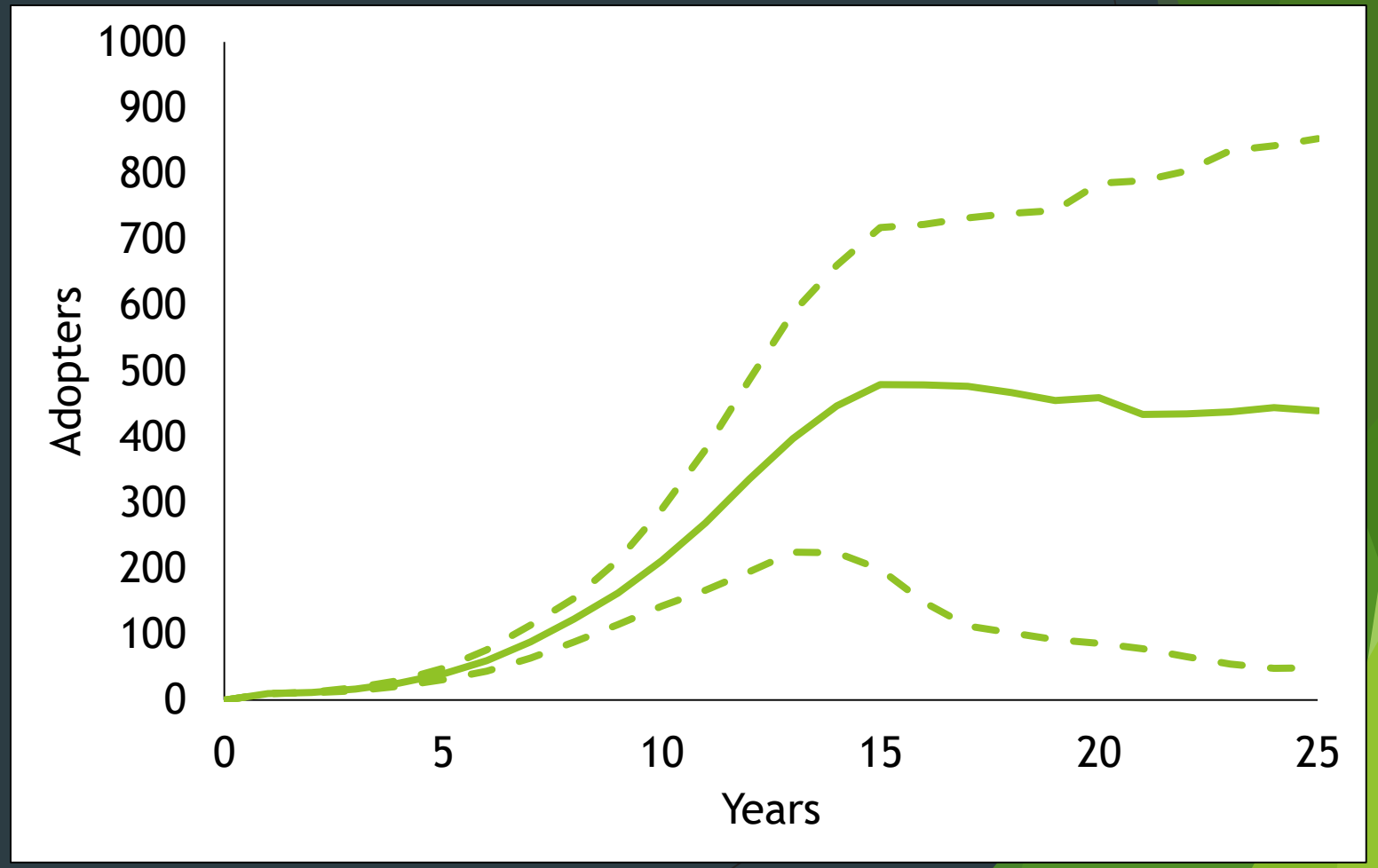


Image source: Guiying Li

Stochastic climate effect on production
(95% confidence intervals – 1000 runs)

- Year 1 intercropped maize 800-2500 kg/ha
- Year 1 pigeon pea 100-600 kg/ha
- Year 2 perennial pigeon pea 400-2000 kg/ha



Conclusions

- Even for technologies that are clearly beneficial for farmers and the environment, stochasticity limits adoption rates
  - Why? Feedback effects
  - Who cares?

Thank you – Any questions?

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