

# NSF Coupled Natural Human Systems

## LIVING WITH LOCUSTS

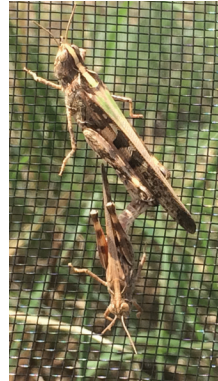
2013 – 2019



Global Locust Initiative



Linking Livestock Markets and Grazing Practices with the Nutritional Ecology of Grasses and Locusts Under Alternative Property Rights Regimes



### OVERVIEW

This project integrated novel fundamental research from multiple disciplines across four different countries—Australia, China, Senegal, and the US—to improve our ability to manage social-ecological systems. We investigated physiological, ecological, and nutritional mechanisms responsible for locust outbreaks and migration. This is one of the first projects to apply both highly-controlled lab and field-based techniques to connect physiological mechanisms to agricultural practices and livelihoods.

### LEAD INSTITUTIONS & PARTNERS



#### AUSTRALIA



Australian Plague Locust Commission  
**Department of Primary Industries**  
Local Land Services  
**University of Sydney**

#### SENEGAL



Peace Corps Senegal  
**Plant protection agency**  
**(La Direction de la**  
**Protection des Végétaux)**  
Université Cheikh Anta  
Diop de Dakar, Senegal

#### CHINA



Chinese Academy of  
Agricultural Science  
**Grassland Research Institute**  
Inner Mongolia Agriculture University  
**Institute of Zoology,**  
**Chinese Academy of Sciences**  
Lanzhou University



UNITED STATES - Partial lab work completed at ASU facilities

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### RESEARCH QUESTIONS

How do insect-nutrient relations and livestock grazing strategies interact to affect food prices, food security, and rangeland degradation?

How do property rights regimes affect the adaptive capacity of societies to respond to the linkages between overgrazing and locust outbreaks?

### KEY FINDINGS

**A new paradigm for plant-insect interaction research:** many locust species are actually harmed by excessive nitrogen. Farmers may be able to keep locust populations in check through soil management practices that increase nitrogen.

**Government policy intervention may provide herders with less assurance of land rights;** unwittingly incentivizing overstocking and reduced nitrogen levels.

Farmer and herders face **many tradeoffs** between stocking rates, weather events, and financial decisions.

### MAJOR OUTCOMES



Increased understanding of how livestock grazing influences locust outbreaks through changes in plant nutrition.



Enhanced knowledge of how locust outbreaks impact livelihoods, livestock markets, and grazing decisions by developing models, theoretical predictions, and enterprise budgets.



Generated livestock enterprise budgets to calculate profit per animal unit sold and determined economic shocks to the meat sector due to locust outbreaks.

### TRAINEE RESEARCH INVOLVEMENT

20 Undergraduate Students

11 Graduate Students

2 Postdoctoral Researchers

3 High School Students

### FUTURE PATHWAYS

Research on this project is developing new insights into the interaction between environmental risks and property rights. We are learning about novel feedbacks between livestock production, policy mechanisms, and land tenure institutions. This fundamental research is also being applied in the USAID OFDA project.

### 16 RESULTING PUBLICATIONS IN:

Advances in Insect Physiology

BioScience

Ecological Economics

Frontiers in Ecology and Evolution

Functional Ecology

Global Environmental Change

Journal of Economic Behavior & Organization

Journal of Environmental Economics and Management

Journal of Experimental Biology

Landscape Ecology

Land Use Policy

Metaleptea

PLOS ONE

Royal Society Open Science

Science of The Total Environment

The Rangeland Journal