

# Water, Vegetation, and Society

## How it started...

**Three major research questions:**

- How much water do ecosystems use?
- How do they respond to rainfall variability?
- How do these responses impact food security and ecosystem resilience?

Answers require new theory, new observations, and new methods

**Improving seasonal forecasts for drought and crop production with real-time sensor networks**

PULSE lab: Princeton University Low-cost Sensors for the Environment

Cost: <\$70

V1:  $T_{air}$ ,  $T_{leaf}$ , RH, NDVI,  $SW_{in}$ ,  $SW_{out}$ , Rainfall, Soil moisture

V2: Rainfall, Soil moisture

Real-time environmental data via cellular SMS. Designed to address lack of climate & crop data availability in remote areas

**Integrating social and environmental aspects of hydrological change**

Rainfall distribution, 1979-2008

Seasonal rainfall total (mm)	Southern Province (Relative Frequency)	Eastern Province (Relative Frequency)
100-200	~0.02	~0.01
200-300	~0.28	~0.02
300-400	~0.02	~0.32
400-500	~0.45	~0.02
500-600	~0.02	~0.02
600-700	~0.28	~0.02
700-800	~0.45	~0.32
800-900	~0.28	~0.45
900-1000	~0.02	~0.15
1000-1100	~0.12	~0.02
1100-1200	~0.02	~0.12
1200-1300	~0.02	~0.02
1300-1400	~0.02	~0.02
1400-1500	~0.02	~0.02

Distribution of reported drought coping strategies, 2008

Strategy	Southern Province (%)	Eastern Province (%)
Reduce # of Meals	~15	~10
Relief Food	~10	~5
"Food for work" program	~5	~2
Piecemeal	~5	~2
Work on farms of other smallholders	~35	~10

Hydrological dynamics and coping strategies are coupled for smallholder farmers in Zambia

1  
Patterns & Processes  
in Water-Limited  
Ecosystems

2  
Development of  
Environmental  
Sensor Systems

3  
Coupled Natural-  
Human Dynamics in  
Dryland Agriculture

# How it's going...



Coupled Natural-  
Human Dynamics in  
Dryland Agriculture



Development of  
Environmental  
Sensor Systems



Patterns and  
Processes in  
Water-limited  
Ecosystems

A horizontal diagram consisting of three colored circles (blue, purple, magenta) numbered 1, 2, and 3 from left to right. Below each circle is a brief description of its research focus. Horizontal double-headed arrows connect the circles, indicating interactions or dependencies between the three areas. The first arrow connects circle 1 to circle 2, the second arrow connects circle 2 to circle 3, and the third arrow connects circle 3 back to circle 1.

Applied  
Ecohydrological Modeling

“Conservation Ecohydrology”