Food security, climate change and the Indus Civilisation, 3000-1500 BC

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I. HOW CAN ARCHAEOLOGY BE RELEVANT TO GLOBAL FOOD SECURITY?
Pressures on food security today

- Climate change
- Water scarcity
- Population
- Political pressures
- Land use competition
- Distribution systems
Three big questions

How did societies respond?

How did these pressures affect food security in the past?

Can we learn anything from their successes and failures?
Some possibilities

How did various pressures food security in the past?

How did societies respond?

PAST

PRESENT

RESILIENCE

ADAPTATION

Capacity
Strategies
Success
II. FOOD SECURITY, CLIMATE CHANGE AND WATER SCARCITY IN THE INDUS
Why look at these issues in the Indus?

The urban Indus (Harappan) Civilisation:

Developed: 3300-2600 BC

Peaked: 2600-2000 BC

Declined: 2000-1500 BC
Climatic vulnerability

Prasad and Enzel 2006
Climate change and the Indus decline

Macdonald et al. 2011
Food security as a mechanism

- Urban food supply based on high yielding wheat and barley
- Climate change reduced crop water supply
- Yields could not be maintained even with more resilient crops
- Cities could no longer maintain food security
- Transition to smaller settlements & local-scale food systems

Less resilient, less diverse food systems

More resilient, more diverse food systems
III. HOW DO WE INVESTIGATE THESE ISSUES IN THE PAST?
Crop water stress as the key

Climate change increased crop water stress

Therefore crops did not yield as greatly/reliably

Urban centres could not maintain secure food supplies

Urban centres declined

People adopted new crops +cropping systems
Methods = isotopic analyses of climate and crop water stress

1) Carbon isotope analysis of archaeological crop remains

2) Oxygen isotope analysis of archaeological faunal remains
Overall research design

On a **site-specific** basis I will use isotopic analyses to test:

- **Faunal $\delta^{18}O$** → **(How) did the climate change?**
- **Crop $\delta^{13}C$** → **Did crop water stress increase?**

And therefore **(how) did climate change and water availability affect food security?**
Impacts, adaptation and resilience

Could crop water stress have undermined food security? Did this increase with climate change?

Does the evidence support adaptive water management?

Does the evidence support adaptive crop choice?

Do some sites appear to have been more resilient than others?

If so why? Social/tech capacity? Crop assemblage? Environment and resources?
V. HIGHLIGHTS SO FAR
Villages = variable crop water status

Diagram: Wallace et al. 2013
Harappa = adaptive management?

Decreasing water stress
Decreasing rainfall
V. COLLABORATIVE OPPORTUNITIES
From foundation to interpretation

- Climate science
- Social archaeology
- Biochemistry
- Archaeobotany
- Geography
- Archaeological isotope analysis
- Geoarchaeology
- Plant sciences
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