Analyzing the Hohokam water system with different scales

Workshop on
Cross-scale Resilience
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Image from Google Maps

The system

- Agrarian society in a desert climate
- Large scale irrigation with water diverted from rivers (Salt, Gila, Verde, Santa Cruz)
- Use of the systems for over 1000 years before depopulation (approximately 100AD 1450AD)
- Irrigation is still important, with canals using routes of ancient ones
- Outlook of a resilient system

Data

- Environmental Proxies (River discharge, Rainfall)
- Population estimates
- Settlement positions in different periods and Irrigation system characteristics
- Crop choices and soil information

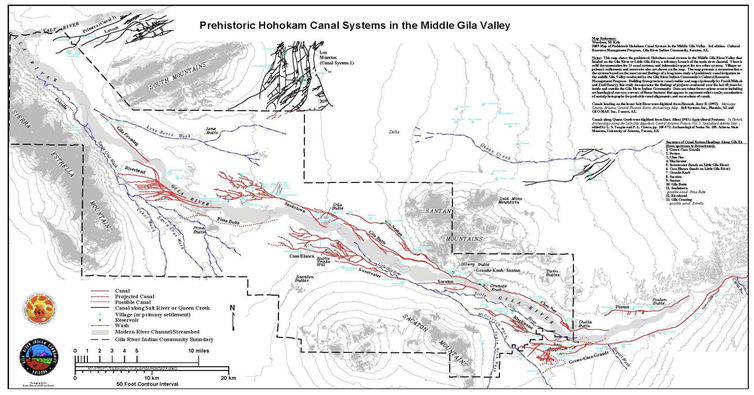


Image from Woodson 2010

Research Question

What were the daily efforts needed to sustain this system?

For the analysis, we utilize different time scales, spatial scales and agency scales.

Past systems
Scenarios about daily actions

Present systems
Known daily actions

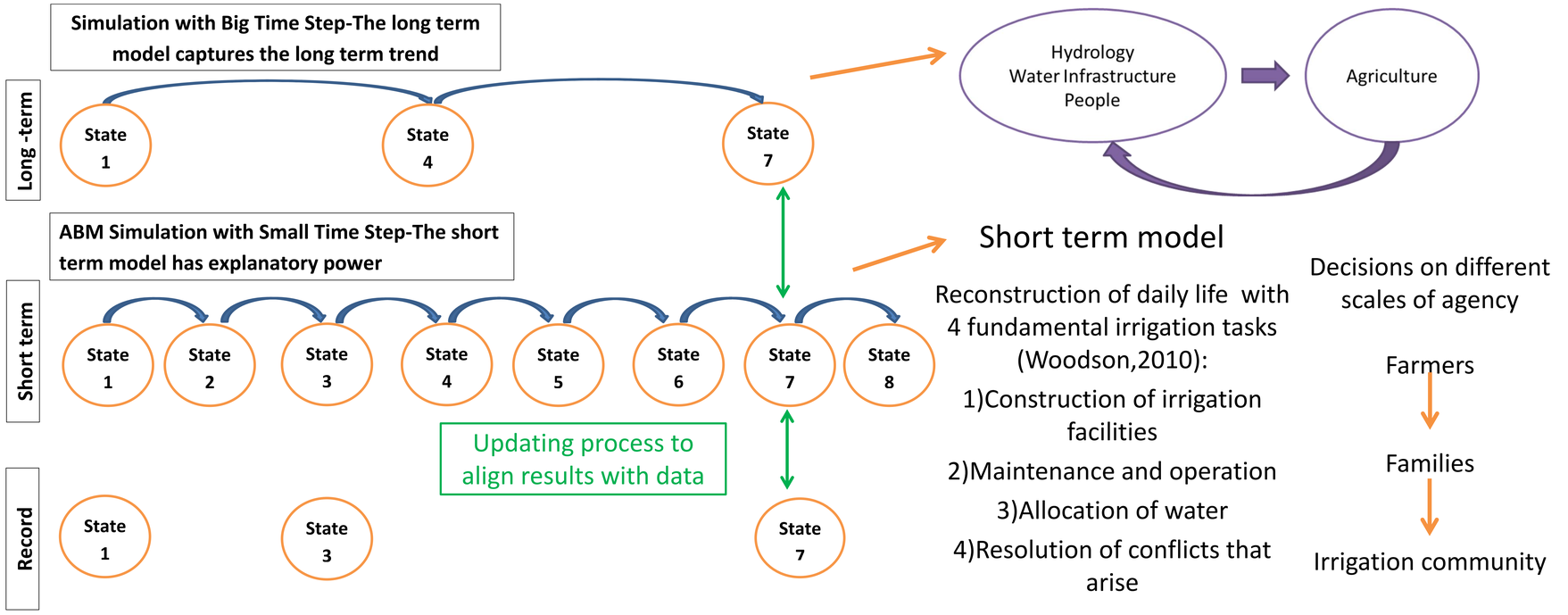
Methodology that links daily actions with long term effects

Observed long term patterns

Scenarios about long term patterns

Core of the methodology: Agent Based Modeling (ABM); a method in which agents interact with each other and with their environment under predefined rules and change their state at each time step.

Methodology



Long-term model (Kuil et al, 2016)

Short term model

Reconstruction of daily life with 4 fundamental irrigation tasks (Woodson,2010):

1)Construction of irrigation facilities

2)Maintenance and operation

3)Allocation of water

4)Resolution of conflicts that arise

Decisions on different scales of agency

Farmers ↓ Families ↓ Irrigation community

Assessing Cross-scale Resilience

Event scenarios pushing the boundaries of the system → The scenarios are implemented on an ABM short term model of the system → Check what happens to the system after different time periods →

Parameters to check (Sundstrom et al,2014)

Variable	Functional Attribute
Population size	Emergency services
	Production
	Transportation options
	Employment diversification and evenness
	Energy grid
	Food network
	Types of open spaces
	Ecosystem services

References

- Kuil, Linda, et al. "Conceptualizing socio-hydrological drought processes: The case of the Maya collapse." *Water Resources Research* 52.8 (2016): 6222-6242.
- Sundstrom, Shana M., et al. "Transdisciplinary application of cross-scale resilience." *Sustainability* 6.10 (2014): 6925-6948.
- Woodson M.K. 2010; The Social Organization of Hohokam Irrigation in the Middle Gila River Valley, Arizona; Arizona State University

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