Prehistoric streamflow and demography in the lower Salt River Basin of central Arizona
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Research question
What is the relationship between Lower Salt River discharge variation and population growth and decline among the Hohokam in Canal System 2 from A.D. 750 to 1450?

Problem
Floods and droughts and their effects on Hohokam irrigation systems have played a prominent role in many cultural-historical interpretations of the Hohokam trajectory in the Lower Salt River Basin (cf. Graybill et al. 1989; 2001; Gregory 2001; Nials et al. 1989).

However, not all researchers agree on the effects or importance of streamflow variation on conditions for irrigation agriculture and the Hohokam trajectory (cf. Dean 1980; Fish 1989; Waters and Ravesool 2001)

This study systematically examines the relationship between streamflow and demography over 675 years of Hohokam prehistory.

Data and Methods

Streamflow
1. Annual streamflow discharge variation has been reconstructed from tree-rings from A.D. 572 to 1988 (in million acre feet/year) by Graybill et al. (1989, 2005).
2. I grouped annual discharges by Hohokam temporal/cultural phases (100 to 150 years) and statistically characterized streamflow within each phase by an index of flood and drought frequency and clustering, variability, and streamflow patterns likely to have affected stream channel morphology. Note: floods and droughts are inferred from high (upper quartile) and low (lower quartile) annual discharges.

Demography
Population growth rates are inferred from 851 Hohokam houses excavated during 12 archaeological projects conducted along Canal System 2.

Linkage between streamflow and demography
Patterns of frequent discharge
Changes in stream channel morphology: erosion, deposition, mixing, and higher stream flow velocities
Negative effects on canals and fields
Settlement changes of Lower Salt River basin
Food stress
Out-migration up, fertility down
Inflow to population growth rate

Results
Population growth rates fluctuated widely indicating the effects of in and out migration into the canal system.

Lower population growth rates and population growth rates strongly increased as the frequency and clustering of geomorphically significant streamflow events increased.

Conclusions
The results of this analysis contradict commonly held assumptions regarding the negative effects of floods, droughts, and high variability on prehistoric irrigation agriculture and settlement in the lower Salt River Basin.

Long-term agricultural and ecological benefits of flooding, drought, and high variability could have been essential to maintain agricultural productivity. Flooding likely recharged soil nutrients and flushed salts from fields. Droughts could have forced fallow field time.

Population growth rates in Canal System 2 are strongly affected by in and out migration of both non-canal and canal irrigators.

The strong relationships between streamflow patterns and population growth rates suggest streamflow patterns were influencing demography.

Literature cited


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