



# Prehistoric Population and Climate Variation, the Agua Fria Watershed, Arizona

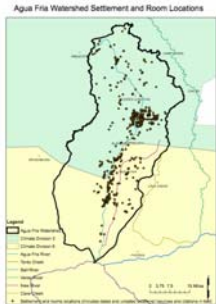


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## Did climate conditions contribute to the settlement pattern shifts within the Agua Fria watershed in the late AD 1200s?

### Population Movement



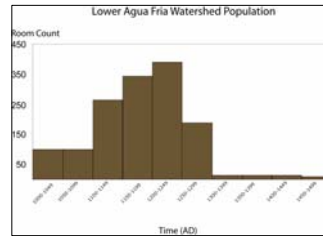
People lived within the Agua Fria river watershed, which runs south from central Arizona to the Salt River in the Phoenix Basin, for hundreds of years, farming on the mesa tops, in the canyons and in the foothills area directly north of Phoenix.

Around AD 1250-1300, people shifted their residences within the watershed, depopulating the lower Agua Fria, while population increased in the upper Agua Fria. Could climatic conditions have contributed to this movement of people within the watershed?

### Settlement Pattern Shift

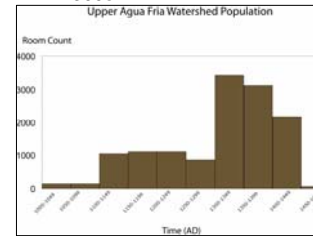
#### Lower Agua Fria

- Depopulation beginning in the late AD 1200s



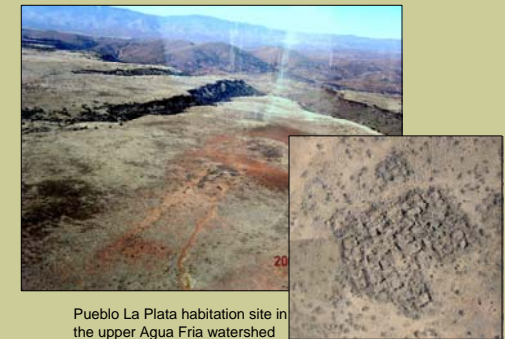
#### Upper Agua Fria

- Population pulse in the early AD 1300s



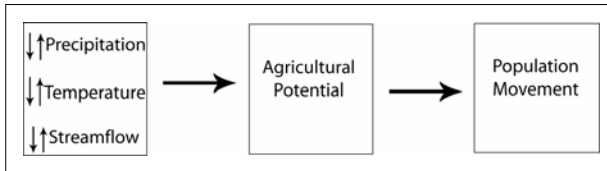
### Climate and Population Change

A period of higher precipitation may have contributed to the population increase in the upper Agua Fria watershed in the A.D. 1300s. It is not clear, however, that extreme climatic conditions contributed to the depopulation of the lower Agua Fria watershed in the late 1200s.



Pueblo La Plata habitation site in the upper Agua Fria watershed

### Climate Variables Affect Population Movement through Agricultural Potential



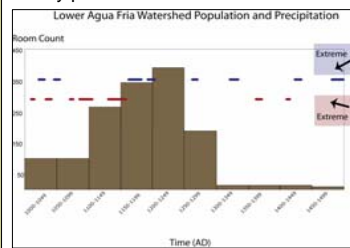
Retrospected temperature<sup>1</sup> data were derived from tree ring sequences constructed for the Colorado Plateau. Retrospected precipitation<sup>2</sup> data were derived from tree ring sequences for Arizona climate divisions 3 and 6 (upper and lower Agua Fria watersheds). Retrospected stream flow<sup>3</sup> data from the nearby Verde River were used as a proxy for Agua Fria River data.

Settlement pattern data were gathered from Wilcox<sup>4</sup>, the AZSITE state level database<sup>5</sup>, and the Coalescent Communities database<sup>6</sup>.

### Precipitation Extremes and Population

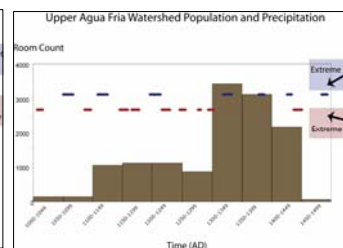
#### Lower Agua Fria

- Depopulation is not preceded by or coincident with extreme dry periods



#### Upper Agua Fria

- Population pulse is coincident with extremely wet periods



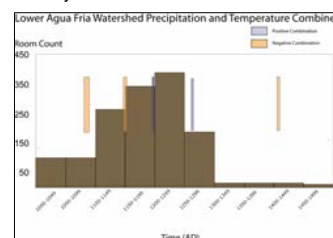
### Precipitation and Temperature Combined in their Effect on Agricultural Potential

		Precipitation	
		wet	dry
Temperature	warm	neutral	negative
	cool	positive	negative

### Precipitation and Temperature Combined

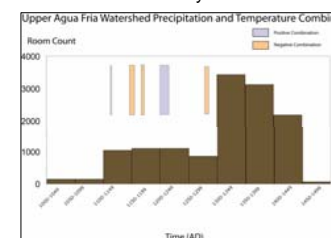
#### Lower Agua Fria

- Negative combinations are 50-100 years before the depopulation and therefore unlikely contributors.



#### Upper Agua Fria

- A positive combination is 100 years before the population increase and therefore is an unlikely contributor.



### Population Movement and Human-Environment Interaction

Understanding the interactions between people and their environment is of increasing importance in the American Southwest today with its growing human population and limited water resources.

Further research into the effects of climate on population movement will be valuable not only for increasing knowledge on population movement in the late 13<sup>th</sup> century, but also for decision makers today as they implement water and land-use strategies affecting agriculture, livestock business, and human population.

### Acknowledgements

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### References

- <sup>1</sup>Graybill, D. A. 1993. The Reconstruction of Prehistoric Salt River Streamflow. In The 1980-1984 Excavations at Las Colinas: Environment and Subsistence, edited by D. A. Graybill, D. A. Gregory, F. L. Nails, S. K. Fish, C. H. Mieszkowski, R. E. Gasser, and C. R. Sauter, pp. 25-38. Archaeological Series 162, Volume 5. Cultural Resource Management Division, Arizona State Museum, University of Arizona, Tucson.
- <sup>2</sup>Ni, F. and T. Cavazos, M.K. Hughes, A.C. Comrie, and G. Funkhouser. 2002. Cool-season precipitation in the southwestern USA since AD 1000: comparison of linear and nonlinear techniques for reconstruction. *International Journal of Climatology* 22(13):1645-1652.
- <sup>3</sup>Sabzevar, M. W., and K.F. Kilgus. 2009. Reconstructed Temperature and Precipitation on a Millennial Timescale from Tree-Rings in the Southern Colorado Plateau, U.S.A. *Climatic Change* 70:465-487.
- <sup>4</sup>Wilcox, D. R., and G. Robertson Jr., J. S. Wood. 2001a. Anecdotes to Perry Mesa: Early Pueblo III Defensive Refuge Systems in West-Central Arizona. In *Deadly Landscapes: Case Studies in Prehistoric Warfare*, edited by G.E. Rose and S.A. LeBlanc, pp. 109-140. University of Utah Press, Salt Lake City.
- <sup>5</sup>Wilcox, D. R., and G. Robertson Jr., J. S. Wood. 2001b. Organized for War: The Pinyon Mesa Settlement System and its Central-Arizona Neighbors. In *Deadly Landscapes: Case Studies in Prehistoric Warfare*, edited by G.E. Rose and S.A. LeBlanc, pp. 141-184. University of Utah Press, Salt Lake City.
- <sup>6</sup>Wilcox, D. R., W. H. Doelle, J. B. Hill, and J. P. Holmstead. 2003. Coalescent Communities GIS Database. Museum of Northern Arizona, Center for Desert Archaeology, Geo-Map, Inc. On file, Center for Desert Archaeology, Tucson.