

Vulnerability of Ancient Northern Mexican Populations to Crop Failure: a Socionatural Approach

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The ability of societies to persist in changing environments is a matter of great significance to interpreting the past and predicting the future. Resilience theorists have argued that understanding relationships between populations and their environments requires those relationships to be conceived as an intersection among human cognition, organization, technology, behavior, and the changing ecology of landscapes. For ancient populations, a key is understanding the conditions to which they were vulnerable. Archaeologists have long suspected that an occupation by prehispanic farmers of the now-desertified plateau of Zacatecas, Mexico, ca. 500 CE was an opportunistic response to the onset of favorable environmental conditions. Similarly, they thought that the population's failure to persist was due to unfavorable climatic change ca. 900 CE, possibly coupled with anthropogenic degradation. To evaluate these possibilities, our research tested for landscape change in one of the main pockets of arable land in the region and related those changes to the record of human occupation up until the present. The hypothesis of settlement opportunism led us to expect indications of decreased temperature and aridity, floodplain stabilization, pedogenesis, and differing vegetative cover corresponding to the time when dense, sedentary human settlement began, 500 CE. The converse hypothesis of failure to cope implied that those conditions reversed ca. 900 CE, producing increased temperature and aridity, erosion, downcutting, and vegetative change. We tested the floodplain and tributary arroyos that must have provided the main agricultural support for several thousand people. These occupants constructed a cluster of over 200 villages surrounding a massive regional ceremonial center, a road system, and agricultural terraces, all which they abandoned after several centuries. Was their settlement system made possible, and then made to fail, by climatic change? Indices of aridity and vegetative changes were constructed from phytoliths, indices of stream behavior and soil formation from loss on ignition, magnetic susceptibility, anhysteretic and saturation remanence, and sediment characterization. The changes were dated by radiocarbon analysis and compared to human settlement history. The results indicate no correlation between environmental change and settlement history. The onset of the current level of aridity occurred long before the main prehispanic occupation, ca. 525-230 BCE, yet this climate permitted pedogenesis, streambed aggradation, and regular overbank flooding, implying favorable conditions for floodplain agriculture. These conditions persisted for centuries before, during, and after the episode of dense prehispanic occupation and were interrupted only by the deforestation and overgrazing of the Spanish colonization, beginning ca. 1550 CE. We conclude that the prehispanic abandonment was not associated with strong environmental perturbation and that the environment experienced by the prehispanic population was markedly more productive than that of today. Either the perturbations were too short-lived to be detected by the measures used or the causes were in

the social realm as opposed to the natural. Both possibilities are being pursued by formal modeling (see Freeman et al. this session).