

## **Case: The Agave Cultivation in the Arid Pre-Hispanic Northern Mexico**

### **Summary**

Agave is a perennial plant that can be used for multiple purposes: as edible materials for yielding caloric values and as fiber materials for producing items like clothing, ropes, and baskets. Historical records indicate that the cultivation of agave was a common practice in pre-Hispanic Northern Mexico and the American Southwest (e.g., the region of La Quemada). It is generally accepted among archeologists that the agave cultivation was linked to the strategy of ensuring food supply when maize cropping failed from droughts. That is, the cultivation of agave was an 'insurance' measure, the strategy that complemented for maize in times of maize production failures. Scholars hypothesize that this complementary effect was what enabled the pre-Hispanic settlers to withstand frequent droughts and maintain their inhabitance in the arid region for long periods.

### **Institutional Analysis**

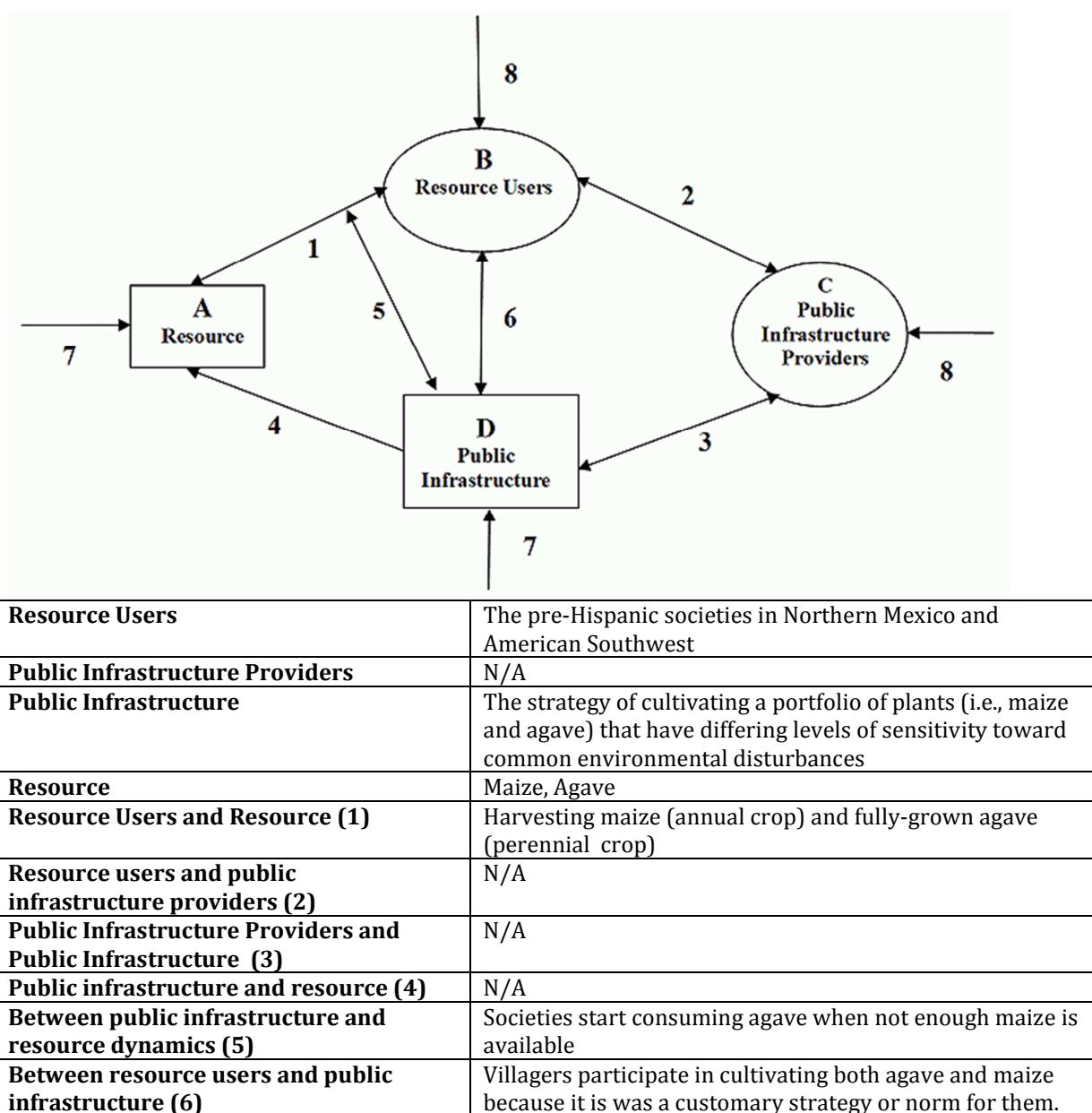
To ensure their subsistence, human societies in arid regions could choose from a number of different robustness strategies: irrigation, terracing, food sharing, mobility, and crop storage. Coupled with these strategies are provisions of necessary public goods such as operational rules, collective-choice rules, norms, physical infrastructure, and monitoring and sanctioning mechanisms. The case of agave cultivation in pre-Hispanic Northern Mexico illustrates the potential for another kind of strategy in addition to the above-mentioned ones – the cultivation of a portfolio of plants that have differing levels of sensitivity toward common environmental disturbances. The cultivation of annual plants like maize and perennial ones like agave may have played such a role. Because adult agave is less sensitive toward droughts than maize and are perennial, the combined cultivation strategy likely delivered the complementarity effect – when the cropping of maize failed, the pre-Hispanic Northern Mexico societies could resort to consuming agave as the backup source of caloric values. This strategy likely helped their sustenance in the arid Northern Mexico region.

However, is the agave cultivation and its associated social and physical infrastructure alone sufficient for actually delivering the complementarity effect? Can there be any 'hidden' biophysical geometry that actually determine whether or not the complementarity effect is actually realized? A simple mathematical model and its simulation provided in the models library illustrates that the cultivation of agave can complement the shortage of maize only when climatic conditions fall under a certain pattern. It turns out that this condition is met when the average rainfall is at intermediate levels with modest variance (e.g., variance at 20% of mean precipitation).

### **Robustness of the System**

The resource user is the pre-Hispanic societies in the Northern Mexico and the American Southwest. The resource is maize and agave. The public infrastructure is the strategy of cultivating both maize and agave, a portfolio of plants that have differing levels of sensitivity toward droughts. The public infrastructure providers are the users

themselves. The provision of the infrastructure and the participation by the users are almost guaranteed because it was customary to grow both agave and maize for the complementarity effect. The public infrastructure influences the resource dynamics through the following mechanisms: (1) when there is enough maize, harvest and store maize for subsistence and reap agave for other purposes (e.g., make clothing); (2) when there is not enough maize from droughts, resort to harvesting agave to complement the lacking maize production. The likely disturbance to the resource system and infrastructure is local droughts. The overall system is robust because the infrastructure provided (i.e., the strategy of cultivating both agave and maize) counter the consequences of droughts. However, this complementarity effect may only work if the rain fall pattern meets certain conditions (e.g., intermediate levels of rain fall with modest variance).



<b>External forces on public infrastructure and resource (7)</b>	Droughts
<b>External forces on social actors (8)</b>	N/A

## Citations

Anderies, J. M., Nelson, B. a., & Kinzig, A. P. (2008). Analyzing the Impact of Agave Cultivation on Famine Risk in Arid Pre-Hispanic Northern Mexico. *Human Ecology*, 36(3), 409-422. doi:10.1007/s10745-008-9162-9