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Resource Scarcity and Monumental Architecture: Cost Signaling on Rapa Nui (Easter Island), Chile

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Resource Scarcity and Monumental Architecture: Cost Signaling on Rapa Nui (Easter Island), Chile

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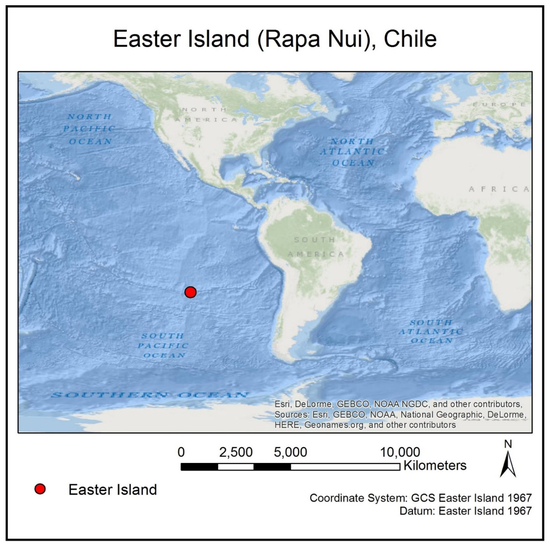
ABSTRACT

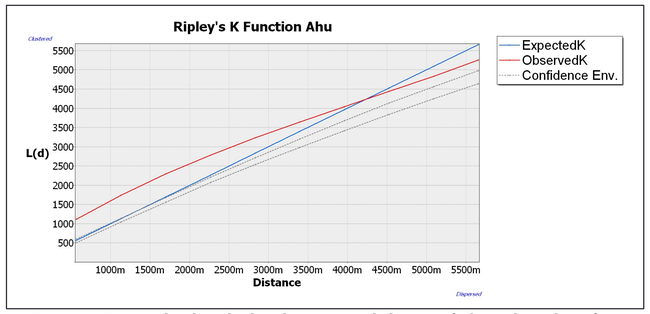
Costly signaling theory (CST) explains a variety of elaborate behavioral displays as a consequence of competition over resources when the risk of direct conflict is high. Within an archaeological context, monumental architecture is potentially explained as a facet of costly signaling between individuals and groups. On Rapa Nui, CST offers an explanation for the construction of labor-intensive monuments including massive statues (*moai*) and ceremonial platforms (*ahu*). Using hypotheses derived from CST and spatial data about the distribution of archaeological features, the degree to which CST accounts for the investment in prehistoric monumental architecture on Rapu Nui is evaluated.



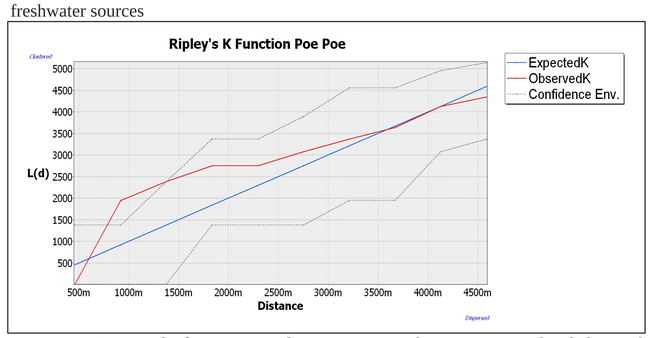
Geographic location of Rapa Nui

MATERIALS & METHODS

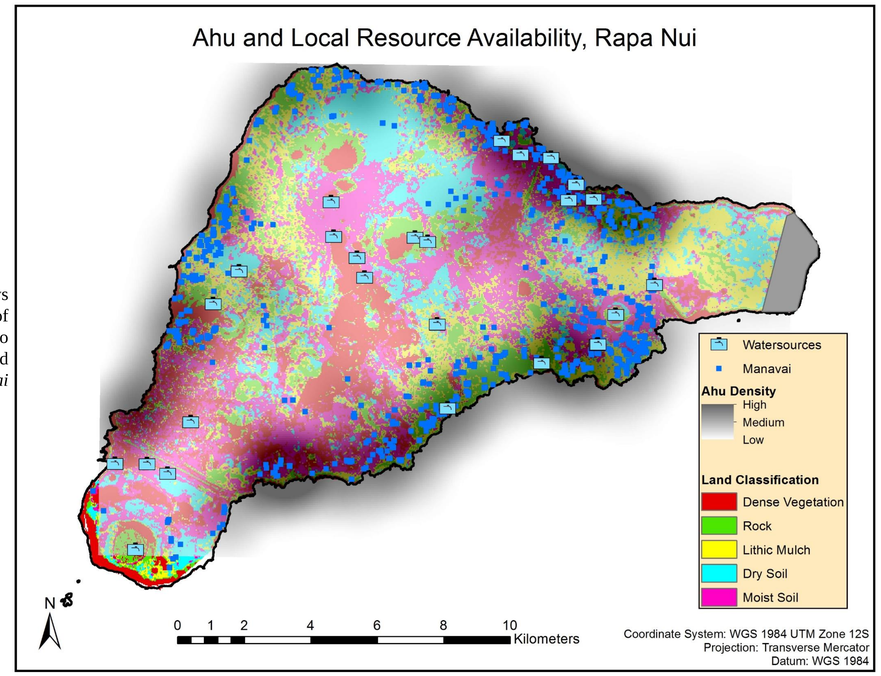
- Hydrology data collected by Cocquyt (1991), Dudgeon and Tromp (2014) and Herrera and Custodio (2008) were digitized in ArcGIS 10.3
- Hydrology data was mapped with archaeological features to conduct spatial tests
- Spatial statistical analyses (Ripley's K Function, Getis Ord Gi)
- Landscape Analysis
  - Landsat 8 SWIR imagery analyzed for soil moisture content using ENVI 4.7



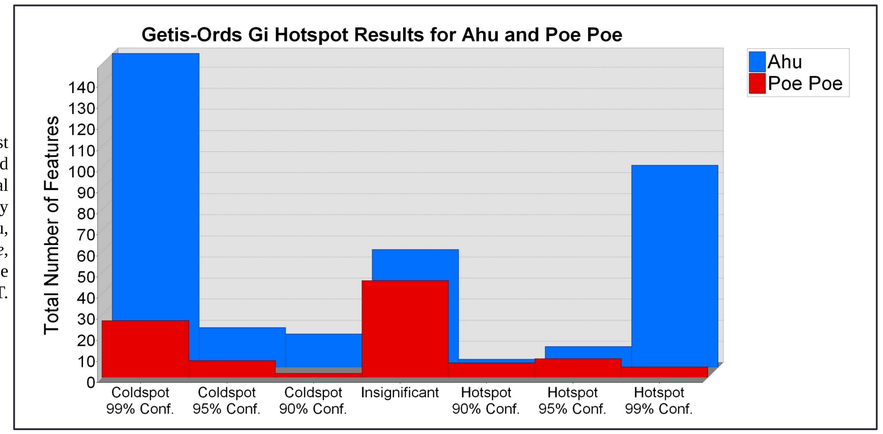
K-Function Test results show higher than expected clusters of *ahu* within 4 km of freshwater sources



K-Function Test results for *poe poe* indicate congruence between expected and observed values



Map shows kernel density of ahu in relation to freshwater and *manavai*



Graph of Gi test results for ahu and *poe poe*. Spatial location is highly clustered for ahu, but not *poe poe*, which can be attributed to CST.

EMPIRICAL EXPECTATIONS

- **Uneven distribution of *ahu* with the majority of monuments clustering within the immediate vicinity (<2 km) of freshwater sources**
- **Density of *ahu* should be greatest in locations with high soil moisture, close proximity to freshwater, and/or locations that are abundant with lithic mulching and *manavai***
- **Spatial statistics should reveal statistically significant results suggesting that the distribution of *ahu* are non-random, with the highest densities close to freshwater sources and lower densities further from freshwater sources**
- **Non-monumental archaeological features (i.e. *poe poe*) will have distinctively different spatial clustering patterns compared to *ahu***

RESULTS

- Majority of *ahu* are clustered within the immediate vicinity of freshwater sources (1 or 2 km).
- The greatest density of *ahu* occur in locations with high soil moisture, close proximity to freshwater sources, and/or in locations with lithic mulching and *manavai*. Areas lacking these resources also lack an abundance of *ahu*.
- Spatial analyses reveal statistically significant results (observed G = 0.0008, z = 4.11, p < 0.01), indicating that the distribution of *ahu* are non-random.
- Significantly, the presence of *poe poe* were unrelated to freshwater sources (observed G = 0.0004, z = 0.48, p > 0.5), indicating smaller scale constructions cannot be explained as costly signals, while monumental constructions can be explained by CST.

CONCLUSIONS

- **The results of this study indicate that the distribution of *ahu* can be attributed to environmental resource availability (i.e. water, *manavai*)**
- **The application of costly signaling theory is validated for use on Rapa Nui for the purpose of explaining monument distribution**
- **Future work should expand analyses to *moai*, which were intentionally left out of this study due to an immense amount of variability that must be taken into account. Additionally, tests should include water sources identified by Zeferjahn (2016) who conducted one of the most comprehensive surveys of freshwater features on the island to date.**

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