



A Critical Analysis of Optimal Foraging Theory: Does Prey Choice Model Withstand Intensive Environmental Pressures?

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Introduction:

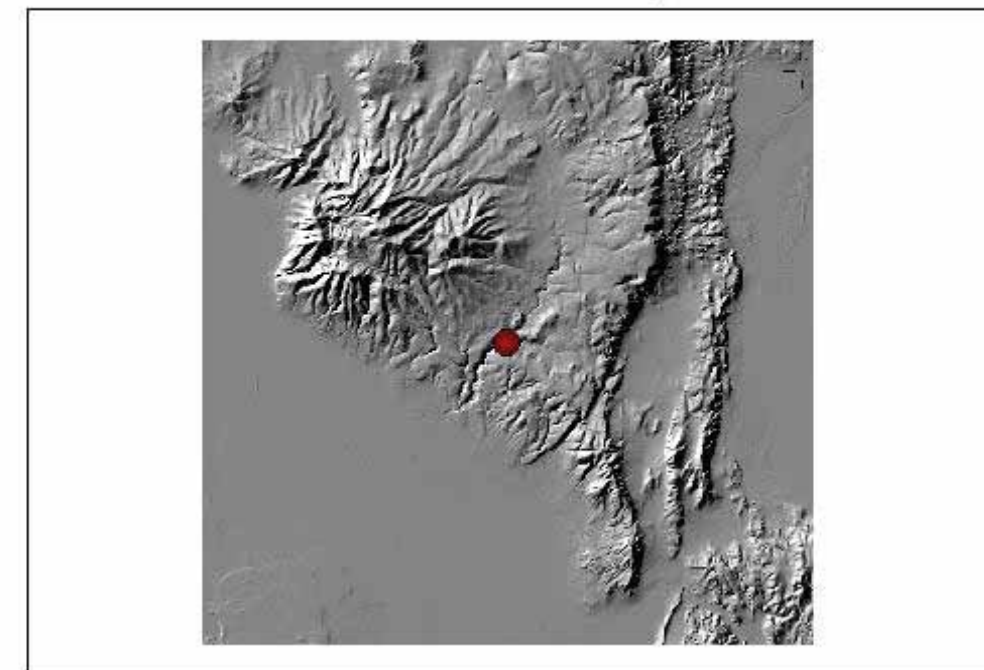
This poster emphasizes a known archaeological site situated in the traditional Paiute culture area, east of Susanville, California, known as 28.17.01.01. The theoretical framework utilized in this analysis falls under the guise of Human Behavioral Ecology (HBE).

- Optimal Foraging Theory (OFT) theoretically operates alongside HBE.
 - OFT assumes prehistoric hunters were actively engaged in the most optimal hunting and food gathering strategies.
- Prey Choice Model (PCM), a subset of OFT, expects that prehistoric hunters constructed mental hierarchies of the most desirable species based on optimal caloric intake.
 - PCM assumes that this hierarchy would have emphasized large bodied game. For instance, deer would have always been preferred over rabbits.
- However, PCM seems to neglect not only cultural preferences but the geographic constraints one might have faced while travelling across harsh terrain environments.

Hypothesis:

Is it possible that in certain contexts due to the rigorous terrain surrounding habitation sites that high ranking large bodied game would have been too costly to pursue, process, and transport back to the habitation site?

Hillshade Analysis



Site: 28.17.01.01

Hillshade Perspective

Value

High: 254

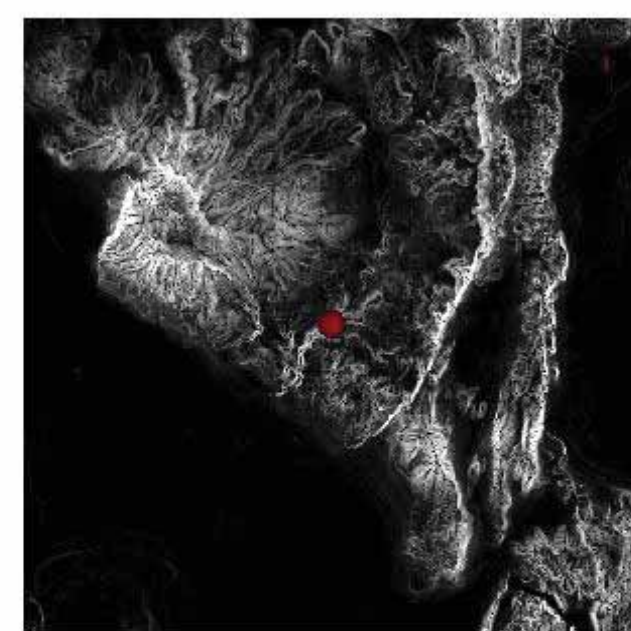
Low: 0

5/5/2014
Map By: Jake Martin
Source: US Geological Survey

Prehistoric Hunting

These two maps may serve as a good preliminary understanding of the severity of the terrain that some Native Americans inhabited. This type of terrain may not be suitable for long distance hunting excursions. Not only should one consider the trouble an individual would face simply walking across this environment but how challenging it would be to drag or carry a large prey item.

Slope Analysis



Site: 28.17.01.01

Slope Severity

Value

High: 58.7188

Low: 0

0 3.75 7.5 15
Kilometers

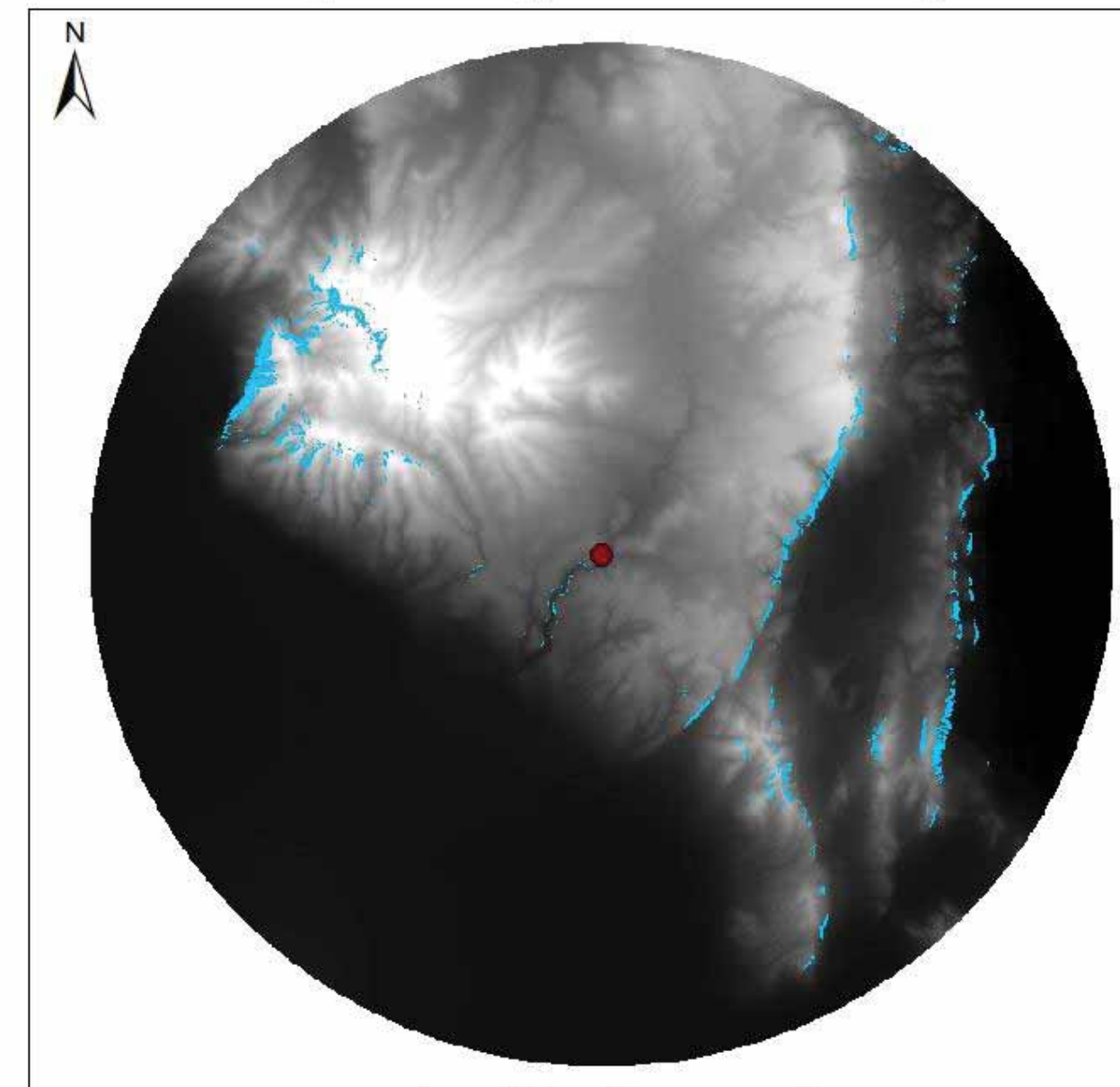
Methods:

Current research has argued that larger species were without a doubt the most logical subsistence choice for prehistoric hunters. However, Grimstead (2010) has argued that this train of thought does "not address the potentially unique effects of high travel costs." This emphasis will be used throughout the analysis along with the assumption that prehistoric hunters at site 28.17.01.01 were concerned with hunting trips only lasting a days time. This goes along with the Central Place Foraging Model highly utilized by Grimstead.

Analysis Tools:

- Tobler's Hiking Function : Walking Velocity (km/hr) = W. Slope of the terrain (dh/dx) = S.
 - Equation: $W = 6 * \exp\{-3.5 * \text{abs}(S + 0.05)\}$
 - Tobler's requires a Digital Elevation Model and a table depicting the significance of slope degrees influencing walking speed.

Digital Elevation Model: Representing Elevation Severity



Site: 28.17.01.01

Cliff Faces

DEM Analysis

Value

High: 2322.27

Low: 1172.07

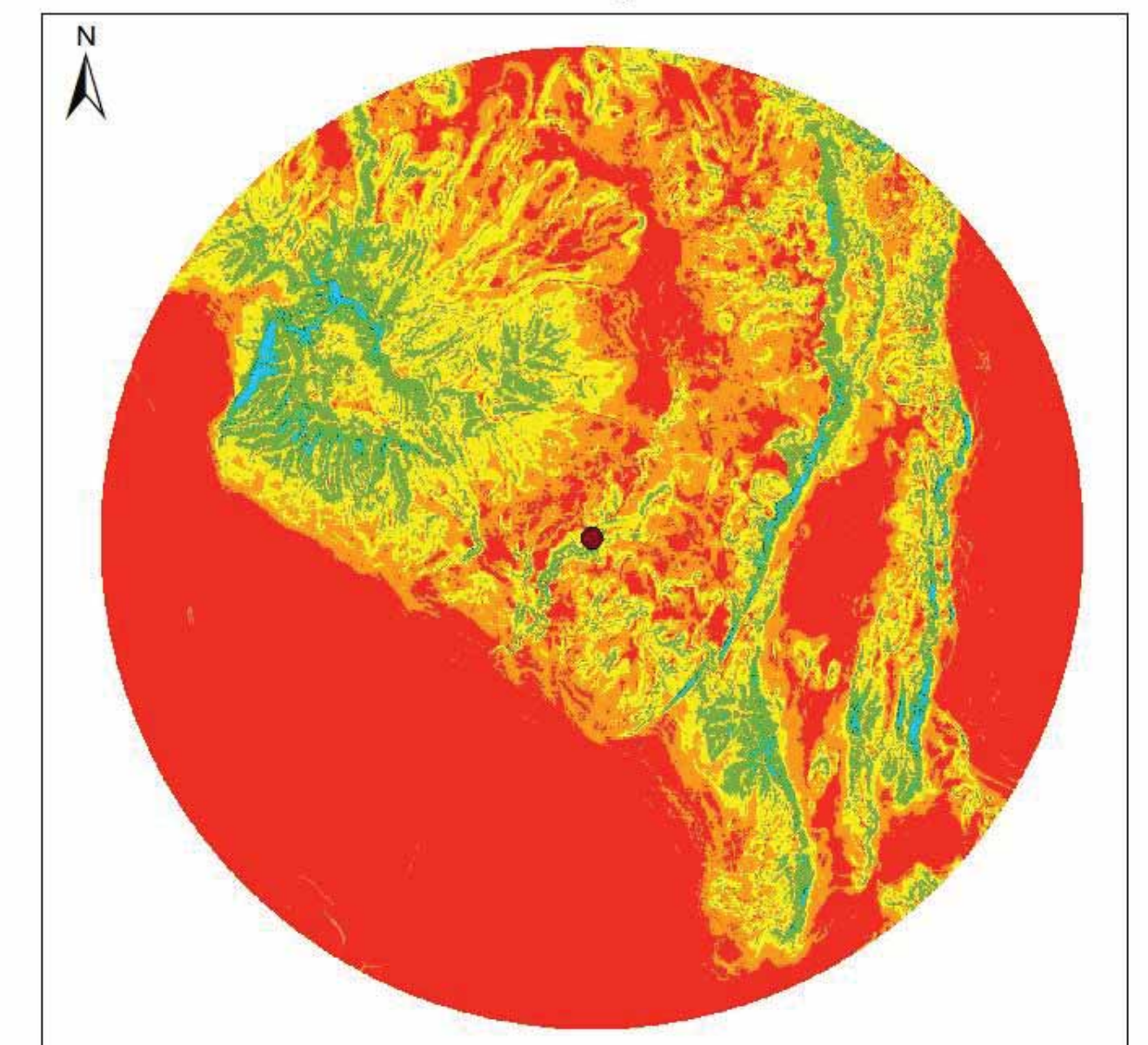
5/5/2014
Map By: Jake Martin
Source: US Geological Survey

Average Species Weight in Pounds:

Elk:	880lbs
Mule Deer:	300lbs
Bighorn Sheep:	300lbs
Black Bear:	250lbs
Pronghorn:	200lbs
Jackrabbit:	6lbs
Cottontail:	3lbs
Mallard Duck:	2.5lbs
Sage Grouse:	2.5lbs
Valley Quail:	2lbs
Trout:	2lbs



Tobler's Hiking Function: Severe Walking Conditions



Site: 28.17.01.01

Cliff Faces

Walking Speed

Kilometers Per Hour

0 - 0.651813698

0.651813698 - 1.935689163

1.935689164 - 3.140556908

3.140556909 - 4.226913071

4.226913072 - 5.03674221

5/5/2014
Map By: Jake Martin
Source: US Geological Survey

Results:

- Tobler's Hiking Function reveals that site 28.17.01.01 is within a highly intense geographic landscape exemplified by the map at the top right of the poster.
- On average an individual could travel across this landscape at about 3.7 kilometers per hour. However, a lot of this landscape, represents terrain that is even slower travelling speeds especially immediately around the site.
- The Digital Elevation Model, directly above, reveals the severe elevation transitions throughout the area. The blue areas on both maps reveals cliff faces that would have to be avoided and gone around.
- Considering a day long hunting trip one could hardly venture 8 miles from the habitation site.
- At an average speed of 3.7kph it would take approximately 4 hours to travel 8 miles.
- Considering a one hour processing time and the struggle to drag the prey item home one would barely make it back before dark.

Conclusion:

The aforementioned results seem to indicate that this area was extremely difficult to travel around. This would more than likely influence prehistoric hunters within this area to utilize opportunistic hunting strategies. All food resources within the area would have more than likely been pursued. This does not follow a strict adherence to the PCM which only emphasizes large bodied species. Generalizing the motives of prehistoric hunters solely based on the assumption that they would desire and pursue large bodied game for survival neglects many key cultural factors. This neglect ignores cultural preferences ranging from palatability to traditional notions regarding unique cultural specific foraging preferences and methods.

References Cited:

- Glassow A. Michael. Terry L. Joslin.
2012. Exploring Methods of Faunal Analysis: Insights from California Archaeology. The Cotsen Institute of Archaeology UCLA.
- Grimstead N. Deana.
2010. Ethnographic and Modeled Costs of Long-Distance, Big Game Hunting. American Antiquity 75(1):61-80.
- Tobler, W. R.
1993. Three Presentations on Geographical Analysis and Modeling: Non-isotropic Geographic Modeling, Speculations on the Geometry of Geography And, Global Spatial Analysis. National Center for Geographic Information and Analysis. Retrieved from http://www.ncgia.ucsb.edu/Publications/Tech_Reports/93/93-1.PDF

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Without the constant support and positive reinforcement offered by Dr. Fairbanks this project would have gone nowhere. The analyses tools we originally hoped to use failed. However, this did not stop the project from moving forward, thank you Dean. Further, I would like to thank the Spring 2014 Advanced GIS class who offered words of wisdom and support while we all struggled through the completion of our projects.

ToblerAway - Notepad

File	Edit	Format	View	Help
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-0.2	0.00019613			
-0.1	0.000197332			
0	0.000198541			
0.1	0.000199758			
0.2	0.000200982			
0.3	0.000202213			
0.4	0.000203452			
0.5	0.000204699			
0.6	0.000205953			

Directly above is the table that was utilized to depict the impact that slope degrees has on walking speed. The column on the left is slope degrees and the column on the right is hours per kilometer.