

Why Do Some Societies Have Greater Subsistence Diversity? Exploring the Role of Natural Hazards, Other Resource Stressors, and Environmental Uncertainty

Carol R. Ember, Erik Ringen, and Jack Dunnington

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Research Questions

- **Broader project:** How have human cultural groups responded to, and been transformed by, climate hazards, particularly those with the potential to seriously destroy food supplies?
- **Our specific research question:** How do hazards and other indicators of resource stress affect subsistence diversity?
- **Overall method:** We use cross-cultural methods to explore and test hypotheses on over 90 societies from the Standard Cross-Cultural Sample




What is subsistence diversity?

- By subsistence diversity we mean the degree to which a society maximizes the number of different subsistence activities across both a range of activities and places.

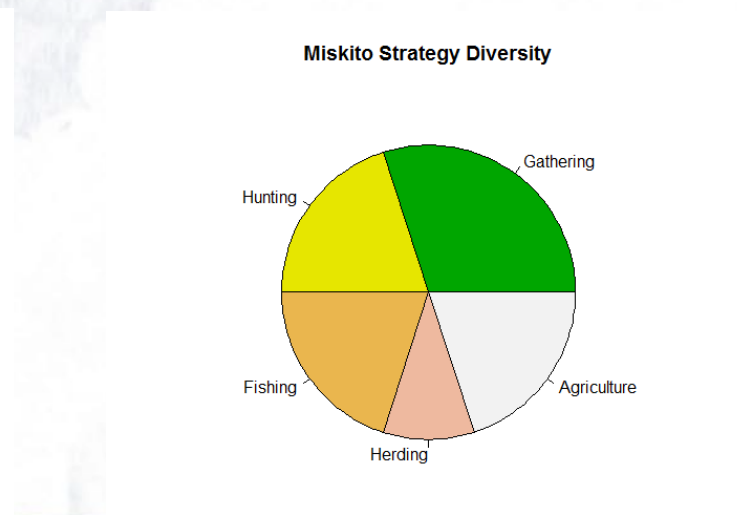
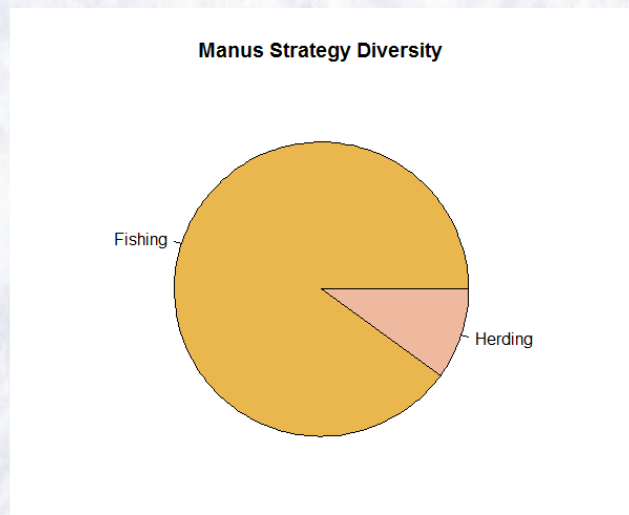


Why does subsistence diversity matter?

- Theory suggests that diversity is especially adaptive under conditions of environmental uncertainty
 - Ecological theory
 - Hutchinson 1957, Levins 1968, Hardesty 1975, Brown, 1984
 - Environmental science
 - Thrupp 2000, Altieri and Merrick 1987, Zimmerer and de Haan 2017
 - Uncertainty is increasing with climate change; therefore it may be prudent to have more, rather than less, diversification
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Measure of Activity Diversity

- Murdock's (1967) Ethnographic Atlas provides approximate measures of relative dependence on five subsistence categories: gathering, hunting, fishing, herding, and agriculture.
- Subsistence diversity for each group was measured as closeness to perfectly equal dependence on each subsistence practice. Any society with equal dependence on all activities would get the highest score.





Measure of Ecoregion Diversity

- The International Vegetation Classification (IVC) provides an index of ecological formations, sorted hierarchically at different levels of specificity according to physiognomic, floristic, and ecological characteristics. (Faber-Langendoen et al. 2016)
 - In this presentation we use the count of the number of **ecoregions utilized for subsistence**
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Level 1– Formation Class	Level 2 – Formation Subclass	Level 3 – Formation Wetland and aquatic formations marked with *
1. Forest & Woodland [Mesomorphic Tree Vegetation]	1.A. Tropical Forest & Woodland	1.A.1. Tropical Dry Forest & Woodland
		1.A.2. Tropical Lowland Humid Forest
		1.A.3. Tropical Montane Humid Forest
		1.A.4. Tropical Flooded & Swamp Forest *
		1.A.5. Mangrove*
	1.B. Temperate & Boreal Forest & Woodland	1.B.1. Warm Temperate Forest & Woodland
		1.B.2. Cool Temperate Forest & Woodland
		1.B.3. Temperate Flooded & Swamp Forest *
		1.B.4. Boreal Forest & Woodland
		1.B.5. Boreal Flooded & Swamp Forest *

Measurement of Resource Stress

Three measures of resource stress were used that had previously been coded for the Ember and Ember (1992) study of warfare—they were all coded for 25 years (-15/ plus 10) around the ethnographic present (EP) specified in the Standard Cross-Cultural Sample

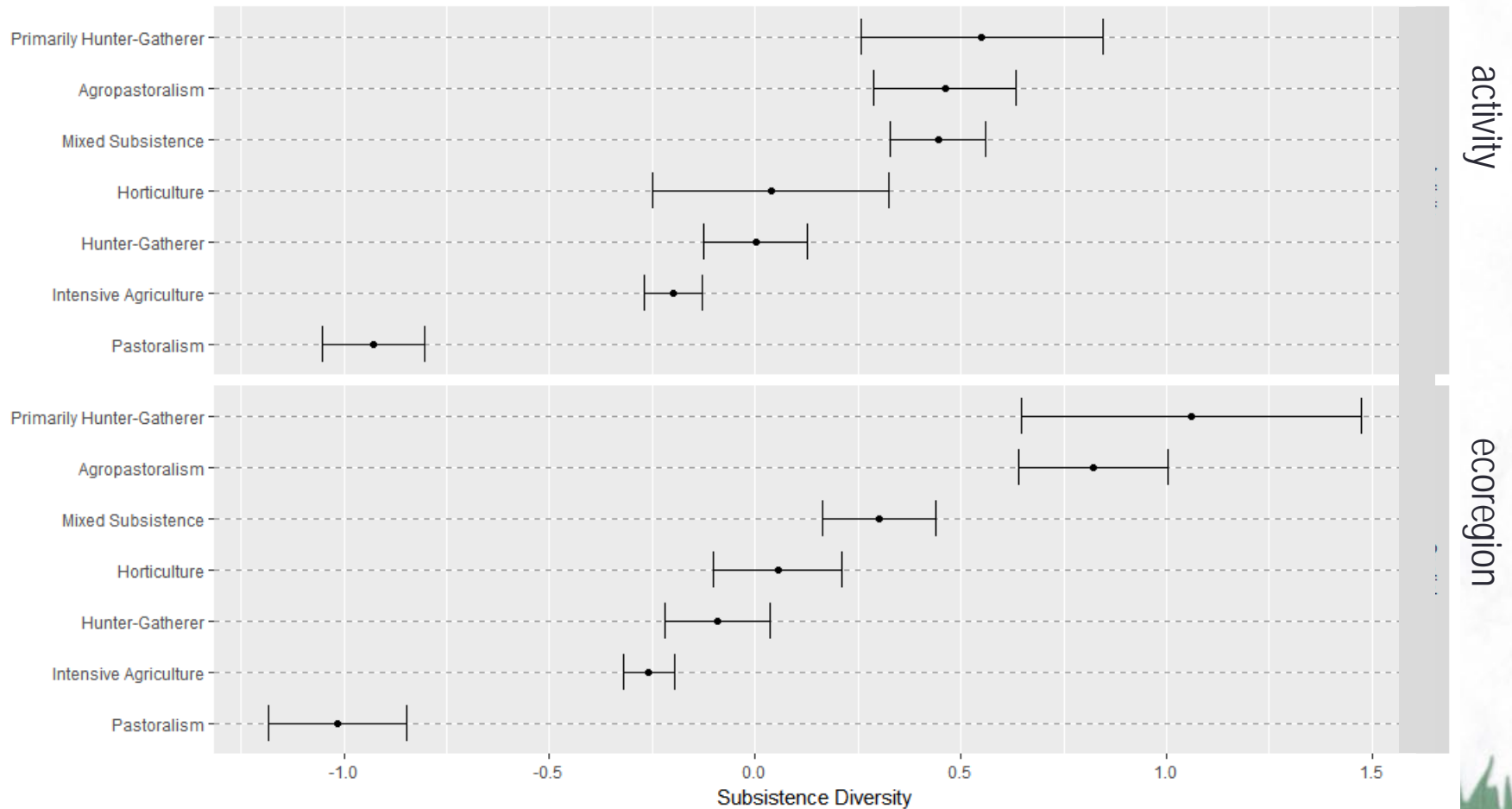
- Number of **natural hazards** that seriously destroyed food supplies (hazards, for brevity) during the time period—ordinal scale goes from none, “threat of,” one, and two or more.
- Number of **famines** during the time period (same scale as hazards)
- **Chronic scarcity** (“hungry months” or persistent hunger throughout the year)



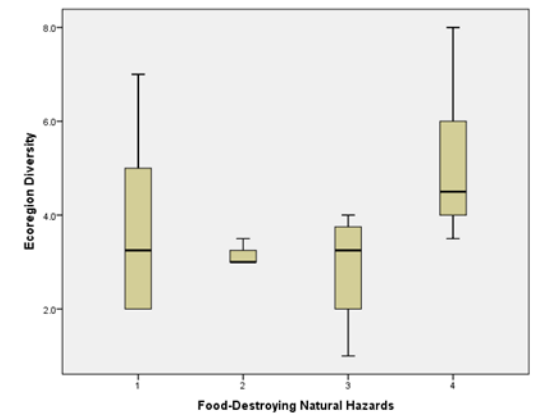
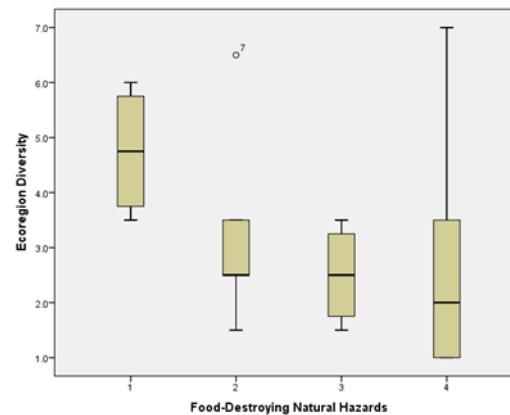
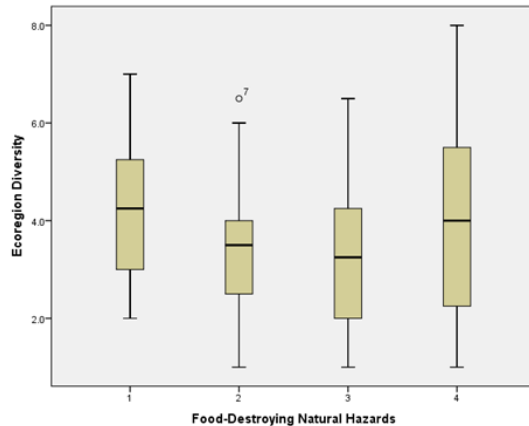
Environmental Uncertainty

- We also used more general measures of the environment constructed by Botero et al. (2014). These factor scores reflect:
- **Climate Stability**—we expected to find more subsistence diversity with less stability (or more unpredictability)
- **Resource Abundance**—we did not predict the direction in advance. It could be argued that more abundance decreases the need for diversification or, it could be argued that it makes diversification easier.

Relationships between dominant subsistence patterns and subsistence diversity



Do natural hazards predict more diversity?



a. All cases

b. Pastoralists or Agro-Pastoralists

$\rho = -.444$ (18), which is marginally significant, two tails (not in the predicted direction)

c. Hunter-Gatherers or Primarily Hunter-Gatherers

$\rho = .306$ (23) which is marginally significant, one tail, in the predicted (positive) direction.

Problem—relationship in different directions in different types of societies; similar patterns with famine

A similar pattern is shown for famine and chronic scarcity, but these latter results are significant.

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Do environmental measures predict more subsistence diversity?

- These bivariate results are clearer.
 - **More uncertainty** (that is, low stability) predicts **more subsistence diversity** as hypothesized
 - marginally significant for the activity measure
 - significant for the ecoregion measure
 - **Greater abundance** predicts **more diversity**
 - significant for both measures

Control for Societal Complexity

Societal complexity is one of the main predictors of variation in cultural traits

- Murdock and Provost (1973) have 10 measures of societal complexity, including traits such as density, political integration, and writing and records.
- Since we wanted to see if some aspects of complexity might have more effects than others, we chose to factor analyze the 10 measures. A principal components analysis (with varimax rotation) yielded two factors which we label
 - **“Technological Specialization”**—the high loading variables are writing and records, land transport, and technological specialization
 - Bivariately, more specialization significantly predicts less subsistence diversity
 - **“Density”**—has high loadings on density, fixity of residence, and agriculture.
 - Bivariately, marginally predicts more diversification for the ecoregion measure.

Evaluating the different predictors

	(1) Ecoregion Diversity	(2) Column 1, dropping two least sign vars
Herding Imp.	.155	
HGF Imp.	.518 [†]	.444 ^{†a}
Herd, x Hazards	.068	
HGF x Hazards	.513*	.498*
Hazards	-.530*	-.533**
Chronic Scarcity	.178	.200
Stability	-.320 [†]	-.311*
Abundance	.183	<u>.181</u>
Technological Specialization	-.154	
Density	.482 [†]	.410 [†]
R ²	.500*	.491*
N	35	35

Takeaways:

- Stability of climate predicts significantly less diversity as hypothesized
- Natural hazards only significantly predicts diversity with high dependence on HGF
- Otherwise, more hazards predicts less diversity
- Marginal findings that might be worth pursuing are between HGF and more diversity and Density and more diversity

[†]p < .10; *p < .05; **p < .01;
 ***p < .001 (two tails unless noted; superscript "a" indicates one-tail)



Possible Interpretations:

- Our prediction that natural hazard frequency would be positively associated with subsistence diversity **was not supported except amongst hunter-gatherers.**
- But a **less stable environment** does predict **more diversity**
 - **Why the differences?**
 - Why are hunter-gatherers apparently more responsive to natural hazards?
 - Why is the stability factor score more predictive than hazards?

Next Steps

- Account for hazards occurring within a broader timeframe.
- Examine other methods of diversifying livelihoods (e.g., craft production, wage labor, etc.)

Acknowledgements

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