



# Alternative to faith-based science

Finding myself in the company of a large group of researchers labeled as particularistic, atheoretical, and nonscientific by Gremillion et al. (1), I take issue with many of the assertions in their recent defense of the application of optimal foraging theory (OFT) to origins of agriculture (OA) research. First is the premise that regional-scale analyses can only identify more general evolutionary processes if they are explicitly situated with an “overarching framework for explaining the diversity of life,” which, according to Gremillion et al., is provided by OFT, held to be virtually synonymous with the larger disciplinary categories of human behavioral ecology (HBE) and evolutionary ecology (EE). In the absence of this overarching OFT framework, researchers working at this level of analysis are characterized as grasping at a “hodgepodge” of inductively derived just-so stories. Although Gremillion et al. acknowledge that OA will vary from region to region, our increasing ability to identify and monitor these regional contingencies is dismissed as making “trivial,” “common sense” observations.

While I and others using comparative regional-scale studies find that these contingent factors at the regional level play an essential role in illuminating general evolutionary trajectories in OA, I also see EE and HBE as offering promising general explanatory frameworks (2). I do not, however, share Gremillion et al.’s faith in the predictive power of OFT optimizing assumptions. A less myopic assessment of the efficacy of OFT at

the regional level reveals serious deficiencies: in the Neotropics, where the OFT explanation is largely based on hypothesized environmental conditions and human responses (3); in Eastern North America, where even Gremillion et al. admit their models fail (1); and in southwest Asia, where tests of OFT assumptions involve dizzying circularities that, for example, hold evidence of loss of mobility as proof of the causal connection between population packing and loss of mobility (2, 3). In these and other world areas, an increasingly rich set of empirical records does not conform to OFT predictions that place OA in the context of resource depression.

As a response to the lack of fit between OFT, and other Neo-Darwinian explanatory approaches, and the empirical record, researchers are now exploring models based on macroevolutionary theory (developed in critique of Neo-Darwinianism), especially niche construction theory (NCT) (2–4). Contrary to the assertions of Gremillion et al. and others (5), NCT cannot be subsumed within an asymmetrical view of adaptation that sees human ecosystem engineering as a response to selective pressures that limit the availability of higher ranking resources (4). Instead, niche constructing activities are recognized as drivers of evolution that, especially in resource rich environments, promote guiding goals of resource security and predictability (2, 4). As an alternative to the posturing and name calling that often constitute defenses of

OFT, a profitable way forward would be to require OFT to stand on its own, separate from the larger disciplinary categories of HBE and EE, and to undertake true tests of OFT explanations that explore alternatives to optimizing assumptions and admit to the possibility that these basic assumptions may not have the overarching explanatory value that true believers hold them to have.

**Melinda A. Zeder<sup>1</sup>**

*Program in Human Ecology and Archaeobiology, National Museum of Natural History, Smithsonian Institution, Washington, DC 20013*

- 
- 1 Gremillion KJ, Barton L, Piperno DR (2014) Particularism and the retreat from theory in the archaeology of agricultural origins. *Proc Natl Acad Sci USA* 111(17):6171–6177.
  - 2 Zeder MA (2010) *Evolutionary Biology and the Emergence of Agriculture: The Value of Co-Opted Models of Evolution in the Study of Culture Change. Macroevolution in Human Prehistory: Evolutionary Theory and Processual Archaeology*, eds Prentiss A, Kuijt I, Chatters J (Springer, London), pp 157–210.
  - 3 Zeder MA (2012) The broad spectrum revolution at 40: Resource diversity, intensification, and an alternative to optimal foraging explanations. *J Anthropol Archaeol* 31(3): 241–264.
  - 4 Smith BD (2011) A cultural niche construction theory of initial domestication. *Biol Theory* 6(3):260–271.
  - 5 Broughton JM, Cannon MD, Bartelink EJ (2010) Evolutionary ecology, resource depression, and niche construction theory: Applications to central California hunter-gatherers and Mimbres-Mogollon agriculturalists. *J Archaeol Method Theory* 17(4): 371–421.

---

Author contributions: M.A.Z. wrote the paper.

The author declares no conflict of interest.

<sup>1</sup>E-mail: zederm@si.edu.