Hunter-Gatherer Foraging: Five Simple Models

Robert L. Bettinger
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Foraging models drawn from behavioral ecology have been directly applied to archaeological and ethnological problems for more than 25 years now. Any contemporary hunter-gatherer researcher or serious student is well aware of at least some of these models–e.g., diet breadth, patch choice, and linear programming, to name a few. Fewer people, however, are well acquainted with the math that underlies these applications and gives them much of their elegance. While we all employ many of the catch-phrases that have emerged from foraging theory—terms such as handling time, high (or low) cost resources, return rates and the like—many anthropologists have only an intuitive understanding of how these models work. It is just that problem that Bettinger hopes to remedy with this concise book. Writing in the Preface about his motivations for assembling the volume, he observes by analogy that "reading the recipe is not the same as cooking the dish," and goes on to say that one cannot truly understand how a foraging model works without engaging the math in relationship to a specific problem. And that is precisely what Bettinger does in this volume.

In keeping with the book's title, Bettinger tackles five "simple" foraging models, several of which he was originally involved in developing. Chapter 1 deals with the diet breadth model, by now familiar to nearly everyone, and lays it out via a straightforward consideration of three different resources and the question of which should be targeted by a prospective forager. He not only presents the mathematical solution clearly, but discusses some of the attendant issues, like the relative importance of energetic search and handling costs. Chapter 2 takes up linear programming and how to model foraging decisions with known constraints. As before, the examples used to illustrate the model are clear and precise, exploring solutions that are meant to both maximize and minimize different currency requirements.

Most readers will be less familiar with the models that follow. Chapter 3 deals with how to examine the differences between front- and back-loaded resources, those that require a heavy investment when collected and prepared for storage, versus those that accrue significant handling costs prior to consumption. These turn out to be important distinctions, and have implications for the emergence of caching and storing behaviors among foraging populations everywhere. In Chapter 4, Bettinger considers a model that measures the effects of technological investment; i.e., how the effort put into making a tool should be dependent upon its success in procuring resources. Such relationships help explain changes in extractive technologies generally, and offer insights into how some solutions can catch fire almost overnight. A derivative application shows how these same variables can be used to assess field transport, and when it makes sense to partially process a resource at the point of acquisition before transporting it home. In the last section, Chapter 5, Bettinger considers a separate field-processing model that makes fewer demands on known information. The utility of a processed load is higher, but it also requires more investment, and the trick is to determine the point at which travel costs (distance) predict such treatment. The math in these chapters is a bit more involved than in earlier sections, but Bettinger patiently walks the reader through the steps and provides plenty of examples of how the relationships operate.

There are two other issues that the book does not address–they are outside its intent–but which models of this kind invariably raise. The first has to do with how reliable the information that is plugged into these applications really is: how do we really know how long it took prehistoric hunter-gatherers to process a particular resource, or the time needed to reduce a cobble into a bifacial preform, or how to gauge the relative investments in different kinds of stone tools? Do we really believe that a weekend seed-gatherer or a once-a-year deer hunter is going to be as efficient at the task as someone who performed such activities on a regular, traditional basis? It probably does not matter in many cases, but where our estimates are way off or the models are

especially sensitive to slight quantitative changes, it could well bias the outputs a great deal. Researchers are, of course, endeavoring to refine these baseline data through experimentation and by conducting robust ethnographic research on extant foraging populations.

The other issue is more problematic. How can we most effectively apply these elegant models to actual archaeological contexts, where the record is heavily compromised and the linkage between behavioral predications and material consequences is often far from clear? Just what does it take to corroborate a model's predictions involving empirical zooarchaeological data or the technomorphological attributes of a stone tool sample? Far too often, it seems, the fit between our models and the real-world data is weak at best, but researchers still assume a reasonable concurrence and claim to have explained the phenomenon under scrutiny. Just because a mathematical model tells us that something should or could work in a certain way does not mean that it did. Otherwise, why do archaeology at all? Models of this sort provide an important guide to problems but are not ends in themselves.

But having said that, this is a fine volume that does just what it aims to do. The style is informal, often humorous, and it will clearly work well in a classroom with advanced undergraduate or graduate students. The flow and clarity of the discussions almost makes one forget that this is math that one is trying to master. Bettinger provides numerous additional exercises at the close of each chapter (with the correct answers), and includes eight appendices that further explicate the mathematics of particular model formulations. The volume is comparatively inexpensive for an academic book, and anyone with a serious interest in hunter-gatherers, prehistoric subsistence, and resource provisioning will want to own a copy. I, for one, look forward to the day when someone with Bettinger's theoretical insights will write a similar treatment on how to better link these simple models to an intransigent archaeological record.