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The behaviour and diet breadth of central-place foragers: an application to human hunters and Neotropical game management

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ABSTRACT

Questions: When incorporating space, time, and attack limitation, how do predicted hunting strategies of Neotropical hunters differ from predictions based on classical diet-breadth models?

Mathematical methods: Dynamic state-variable models of central-place foragers implemented by stochastic dynamic programming.

Key assumptions: Neotropical hunters are central-place foragers who maximize their energetic return over the course of a single hunt with finite available ammunition. Encounters with game are sequential and hunters decide whether to attack each of nine Neotropical game species depending on (1) their own state variables including distance from home, time, number of attacks used, and meat already acquired, and (2) game-specific parameters such as encounter rate, kill rate, handling time, and body mass.

Predictions: Hunters expand their diet late in the hunt because there are few remaining encounter opportunities. Attack limitation restricts the diet breadth to large-bodied species with a high probability of being killed because ammunition can be used to hunt larger-bodied prey later in the hunt. Very late in the hunt, hunters will accept low-value game even if there are few attacks remaining. High-value prey with long handling times may be ignored late in the hunt if there is not time to pursue. When vulnerable game species are depleted, hunter return rates are lower but remain consistent (i.e. most hunts still result in moderate harvest levels that meet subsistence needs). Our results question the efficacy of using longitudinal records of the composition and proportion of prey items (the prey profile) to assess levels of wildlife depletion. When space is included in foraging models, prey profiles do not change substantially even when several high-value game species are locally extirpated.

Keywords: behavioural ecology, central-place forager, diet breadth, marginal value theorem, optimal foraging theory, state-variable models, stochastic dynamic programming.

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