

**Estimating Accessibility to Natural Resources
Using a New Energy-based Travel-Cost Model
An Archaeological Case Study of Jomon Net-fishing
in Eastern Japan**

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Abstract

The author recently carried out a series of GPS-aided walking experiments in Japan to examine the validity of the present travel-cost models such as Tobler's hiking function, GRASS r.walk module, and van Leusen's metabolic expenditure model. The experiments revealed that the slope of the terrain significantly affected the walking speed, as expected by these models. In addition, the field of view and roadbed conditions influence it, but to a lesser extent. It has also been noted that travels in the past must be evaluated using energy-related units (calories) rather than time-related ones (speed and hours) because time may have been perceived differently in different societies and in different time periods. On the basis of these considerations, a new travel-cost model is developed to determine energetic expenditure from the perspective of three parameters: (1) the weight of a typical traveller, (2) MET values as an indicator of exercise intensity, and (3) the movement time, which is estimated by the slope-dependent functions. Then, the model is applied to an archaeological case study of the net-fishing activities of the Neolithic hunter-gatherer-fishers (Jomon people) in the Tokyo-Yokohama district, East Japan. Site-catchment analyses based on this model successfully illustrates their accessibility to fish resources from the settlements and their "common" territories of fishing activity.

Keywords: *Travel Cost Simulation, Energetic Expenditure, Net-fishing, Jomon Culture, Japan*