Journal of Environmental Management (2002) **64**, 411–422
doi:10.1006/jema.2001.0513, available online at http://www.idealibrary.com on IDEAL®

Estimating the benefits and costs to mountain bikers of changes in trail characteristics, access fees, and site closures: choice experiments and benefits transfer

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Received 25 April 2000; accepted 10 September 2001

Mountain biking is an increasingly popular leisure pursuit. Consequences are trail degradation and conflicts with hikers and other users. Resource managers often attempt to resolve these problems by closing trails to mountain biking. In order to estimate the impact of these developments, a model has been devised that predicts the effects of changes in trail characteristics and introduction of access fees, and correlates these with biker preference on trail selection. It estimates each individual's per-ride consumer's surplus associated with implementing different policies. The surplus varies significantly as a function of each individual's gender, budget, and interest in mountain biking. Estimation uses stated preference data, specifically choice experiments. Hypothetical mountain bike trails were created and each surveyed biker was asked to make five pair-wise choices. A benefit-transfer simulation is used to show how the model and parameter estimates can be transferred to estimate the benefits and costs to mountain bikers in a specific area.

Keywords: choice experiments, mountain biking, benefits transfer, valuing trails, income effects.

Introduction

Tens of millions of North Americans and Europeans own mountain bikes and millions of them are avid trail riders. In the 1990s mountain biking was one of the fastest growing outdoor recreational activities. According to the Bicycle Institute of America, 25 million Americans owned mountain bikes in 1992, a 66% increase from 1990. The Executive Director of the International Mountain Bicycling Association (IMBA, 1994), estimated that in 1994 there were 2·5–3 million avid trail riders in the US. The numbers are much larger today. The growing popularity of mountain biking is also evident through the increased use of public lands by mountain bikers. For instance, the 13-mile Slickrock Trail in Moab, Utah was used by 1000 mountain bikers in 1983; 10 years later it was ridden by over 90 000 (IMBA, 1994).

The growing popularity of mountain biking in many areas has led to increased trail degradation and conflicts among users on single track. These trails, which are usually 12–24 inches wide, are preferred by many mountain bikers over wider four-wheel drive roads for their greater technical and physical challenge. The conflicts arise because mountain bikers travel at speeds much greater than those of hikers and equestrians. Bikers must slow down, and hikers and equestrians often need to get out of the way.

Resource managers have often handled trail degradation and user conflict by closing certain trails or entire sites to mountain biking. For example, in March of 1995, The City Council of Redmond, Washington voted to ban mountain bikes from the city's Watershed Preserve Area due to concerns of environmental damage (Sprung, 1995).

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Often the closures are at the request of hiking groups (Blumenthal, 1994).

In cases where land managers have not closed entire sites to mountain bikers, they have often moved mountain bikers from narrow, technical, single-track trails to wider, less technically challenging, double track. For instance, in 1992 the National Park Service imposed comprehensive restrictions on mountain bike use in the 13 000-acre Headlands area of Golden Gate National Recreation Area in Marin County, California, the birthplace of modern mountain biking. The restrictions closed about one-third of the land to mountain bikes and banned them from most of the single-track trails, leaving primary fire roads for mountain biking (Kelley, 1994).[1] Boulder, Colorado, a city with thousands of bikers and hundreds of miles of trails, has banned bikes from most of them.

Access fees are being increasingly discussed as tools of land use management. This is an important and controversial subject, made topical by the growing demands on public lands to provide multiple services. The introduction of access fees on public lands is a likely reality in light of the shrinking budgets to manage public lands.[2] Revenues from the access fees paid by mountain bikers may become an important factor in the provision and maintenance of trails. Access fees might also make private sites profitable.

Whether trail closures and access fees lead to more or less efficient use depends on the benefits and costs to the different user groups. As a step in estimating these benefits and costs, a discrete-choice random-utility model of mountain bike site-choice has been developed that predicts the effects that trail characteristics and access fees have on trail selection. Focus groups were used to identify relevant site and user characteristics. Estimation employed stated preference data. A set of hypothetical mountain bike trails was created and each individual asked to make five pairwise choices (choice experiments). The individual's choice decision is a function of trail characteristics, household budget, other characteristics of the individual, presence of other users, and access fees. The model and choice experiments can be used as a template to estimate benefits and costs to other users from land use policies.

A simulation demonstrates how the model and parameter estimates can be used to assess the benefits and costs to mountain bikers of changes in specific sites. In the example, two sites are assumed; the per-ride consumer's surplus is derived for changes in the first site's characteristics, including the introduction of an access fee. While these estimates can be used to assess the benefits and costs of a policy in a specific area, in our example the consumer's surplus cannot be transferred. Its magnitude depends on the characteristics of the choice set in the region of interest.

Louviere *et al*. (1991) developed and estimated a model of bike trail choice in Chicago. Fix and Loomis (1998) have used contingent valuation and a travel-cost count model to estimate the benefits of mountain bike trips to Moab, Utah. Neither study considered the specific impact of access fees on site selection, although Fix and Loomis found significant willingness to pay for access.

A discrete choice random utility model of mountain bike site choice

Assume the utility individual i receives from riding his mountain bike at site j is

$$U_{ij} = V_{ij} + \varepsilon_{ij} \tag{1}$$

where V_{ij} is assumed to be deterministic from both the researcher's and the individual's perspective. Given J sites to choose from, the individual chooses the site the maximizes his or her utility from the ride. The component ε_{ij} of utility is random from the researcher's perspective, but known by the individual. Assume that all the ε_{ij} are independent draws from an Extreme Value distribution. The result is a simple logit model of site choice.

V_{ij} is a function of a vector of the trail characteristics, Z_j, defining site j; the amount of money the individual has budgeted for all other goods after choosing to ride at site j, and other characteristics of individual i, S_i. The daily budget less the access fee at site j is represented by $(Budget_i - Fee_j)$. Therefore,

$$V_{ij} = V(Z_j, S_i, (Budget_i - Fee_j))\, i = 1, 2 \ldots, I.$$
$$j = 1, 2 \ldots J. \tag{2}$$

The vector S_i consists of common socioeconomic variables such as age and gender, in addition

[1] The Bicycle Trails Council of Marin and the International Mountain Bicycling Association filed suit against National Park Service in 1992, following the implementation of the restrictions.

[2] The 1996 Interior Appropriation bill included authorization for a 3-year recreation fee demonstration program. This program directs the US Forest Service, Bureau of Land Management, Fish and Wildlife Service and National Park Service to create a variety of projects to collects fees from recreationists who use facilities on public lands (Sprung, 1996).