Available online at www.sciencedirect.com

SCIENCE DIRECT®

Ecological Economics 57 (2006) 665–678

ECOLOGICAL ECONOMICS

www.elsevier.com/locate/ecolecon

ANALYSIS

Valuing ancient forest ecosystems: An analysis of backcountry hiking in Jasper National Park☆

Jeffrey E. Englin, Jered M. McDonald, Klaus Moeltner *

Department of Resource Economics, MS 204, University of Nevada, Reno, Reno, Nevada 89557, United States

Received 19 December 2004; received in revised form 30 May 2005; accepted 31 May 2005
Available online 11 July 2005

Abstract

This study examines backcountry visitors' preferences for truly ancient forest ecosystems. We find that visitors consider ancient forests a distinctly different ecosystem than mature, but younger forests dominated by the same tree types, and that the recreational value of forests continues to grow for several hundred years following a crown fire. By employing a random coefficients model of utility the analysis is able to provide measures of the variability in preferences for forest ecosystems across the population of users. The model also shows that site choice probabilities and welfare effects associated with ancient woodlands are sensitive to the mix of dominating tree types, and exhibit substantial fluctuation over trails.

Keywords: Random utility models; Random coefficients; Forest attributes; Backpacking; Ancient forests

1. Introduction

Forest managers have become increasingly aware in recent years that forestlands have the ability to generate substantial economic value to recreational users. At the same time, resource economists have attempted to link these predominantly non-market values to specific forest attributes. In general, the rationale for these efforts is to aid forest planners in categorizing forest types and ecosystems by their recreational value, and to optimize management strategies accordingly. Some of these valuation studies focus on bundled forest characteristics, such as evergreen versus mixed tree cover (Hanley et al., 1998), hardwood versus softwood (Pendleton et al., 1998), or conifers versus broadleaved trees (Scarpa et al., 2000). Other research efforts, in turn, examine recreationists' preferences for specific tree species, such as different types of fir (Englin and Mendel-

☆ This work was begun while Jeffrey Englin was a Visiting Scientist at the Northern Forestry Centre of the Canadian Forest Service and a Visiting Professor in the Department of Rural Economy at the University of Alberta, both in Edmonton, Alberta. The insights and support of David Watson, Bonnie McFarlane, Dieter Kuhnke and Bill White of the Northern Forestry Centre is gratefully acknowledged. This is Nevada Agricultural Experiment Station Publication #51042279.

* Corresponding author. Tel.: +1 775 784 4803; fax: +1 775 784 1342.
E-mail addresses: englin@unr.edu (J.E. Englin), moeltner@cabnr.unr.edu (K. Moeltner).

0921-8009/$ - see front matter © 2005 Elsevier B.V. All rights reserved.
doi:10.1016/j.ecolecon.2005.05.022

sohn, 1991), jack pine, black spruce, and aspen (Boxall et al., 1996), and douglas fir versus sitka spruce (Rensburg et al., 2002).

Perhaps one of the most important attributes both in terms of its effect on visitation benefits and its management implications is the age of a forest. On the one hand, there is economic evidence that older stands of trees have the potential to greatly enhance the recreational experience of the prototypical visitor (Englin and Mendelsohn, 1991; Boxall et al., 1996; Scarpa et al., 2000). On the other hand, higher forest age is generally associated with higher opportunity costs of foregone productive use. In addition, preserving old growth often requires costly fire management strategies (Englin et al., 2000). Balancing these competing uses of forests has been the focus of several analyses (Reed, 1984, 1993; Englin et al., 2000). An accurate assessment of the recreational value of old forest is an integral component to the formulation of economically efficient forest plans.

There are several challenges associated with estimating the economic value to forest visitors of "allowing a forest to grow old". First, the age of a stand of trees is directly associated with an entire bundle of attributes, such as diameter and height of trees, density of foliage and associated filtering of sunlight, type and density of undergrowth, and many more. In other words, stands of forest of different age constitute de facto different ecosystems and are likely experienced as such by visitors. In addition, these ecological conditions are likely dependent on the composition of tree species that form the canopy layer of a given forest.

To date, existing valuation studies have measured forest age along a single attribute dimension, such as diameter or height of trees (Englin and Mendelsohn, 1991; Boxall et al., 1996), or by a dichotomous cut-off value for age without distinction by tree type (Scarpa et al., 2000). However, one-dimensional attributes are likely an imprecise proxy for forest age, as they are also a function of tree species and environmental conditions. Choosing a cut-off value for age irrespective of species composition and other ecological considerations to define old growth, on the other hand, yields at best a crude aggregate measure of recreational value flowing from older stands of forest, masking the potentially high variability of such values over individual stands.

As noted in Boxall et al. (1996), geographical information on the fire history for a given forest can guide researchers in assessing the true age of a specific forest ecosystem. The authors employ such information in a random utility model of wilderness visits to identify areas where forests have reached rotation age. They classify tree stands at or beyond rotation age as "mature", and examine visitors' preferences for such woodlands. They find that the enhancement of visitors' experience through old growth is largely a function of the tree type that dominates a given stand. In fact, their results indicate that certain types of mature ecosystems are actually perceived as a disamenity by the visitors.

This analysis exploits a unique data set that includes the actual age of stands of trees rather than proxies for age. As a result, the analysis provides precise measures of value along two dimensions: first, employing information on fire history for a national park spanning several hundred years permits the identification of forest areas that have aged far beyond the age thresholds traditionally applied to define old stands of trees in the existing literature. This allows for an examination of visitors' ability to discern truly ancient forest ecosystems, and the added benefits they derive from such areas compared to younger woodlands. Second, recognizing the evidence presented in existing forest valuation studies of measurable heterogeneity in visitor preferences for a variety of forest attributes (Englin and Mendelsohn, 1991; Hanley et al., 1998; Rensburg et al., 2002), we augment a multivariate random utility model of forest visits with random coefficients for categories of ecosystems to capture such heterogeneity effects.

We find strong evidence that backcountry visitors assign different values to forest ecosystems of different age, and that preferences for these ecosystems vary widely over the population of users, sites, and dominating tree types. The ability of our estimation model to capture variability in recreational values along these multiple dimensions allows for the examination of the *distribution* of marginal economic benefits generated by individual trail segments over the target population of visitors. This, in turn, provides forest managers with additional tools to derive flexible management strategies geared towards optimizing the recreational experience for any desired sub-segment of users in any given part of the management area.