

Visitors' trade-offs between physical and social factors of bark beetle impacted recreational forests

Arne Arnberger, Institute of Landscape Development, Recreation and Conservation Planning, University of Natural Resources and Life Sciences, Austria, arne.arnberger@boku.ac.at

Ingrid E. Schneider, University of Minnesota, USA

Stuart Cottrell, Human Dimensions of Natural Resources, Colorado State University, USA

Martin Ebenberger, Institute of Landscape Development, Recreation and Conservation Planning, University of Natural Resources and Life Sciences, Austria

Alexander Schlueter, University of Minnesota, USA

Renate Eder, Institute of Landscape Development, Recreation and Conservation Planning, University of Natural Resources and Life Sciences, Austria

Eick von Ruschkowski, NABU, Germany

Robert C. Venette, USDA Forest Service, Northern Research Station, USA

Stephanie Snyder, USDA Forest Service, Northern Research Station, USA

Paul Gobster, USDA Forest Service, Northern Research Station, USA

Introduction

Extensive outbreaks of both introduced and native forest insects are increasing across Europe and North America due to climate change and other factors. Extensive bark beetle outbreaks, in particular, can result in both tourism revenue and timber value losses. Further, if constraints to recreation—such as unattractive forest landscapes—prevent participation, its recreational and restorative benefits are not realized.

Landscape preference studies on insect-affected coniferous forests reveal beetle activities are not or hardly accepted by the public (Buhyoff & Leuschner, 1978; Flint, McFarlane, & Müller, 2009; Sheppard & Picard, 2006). As such, it seems forest insect-changed landscapes impact opportunities for outdoor recreation and nature-based tourism.

Despite the prevalence of forest insect outbreaks, little is known about the social impacts of these outbreaks and little research exists on visitor response to visual changes in forest recreation settings. Few, if any, studies have examined how forest visitors weigh trade-offs between social such as visitor numbers and physical factors of bark beetle-impacted forests and how these vary nationally or internationally. This study fills that research gaps and examines these trade-offs in two countries: Germany and the United States.

Method

This study used a stated preference approach to explore visitor perceptions of bark beetle outbreaks at two state parks in the USA and a national park in Germany. A visual discrete choice experiment (DCE) employed digitally calibrated images (Arnberger & Eder, 2011) to simulate forest stands with varying levels of bark beetle out-

breaks, different management practices, and varying visitor uses. Translated and back-translated on-site surveys were conducted in summer 2014 with convenience samples of visitors at State Forest State Park (n=200) in Colorado, USA, Bemidji State Park (n=228) in Minnesota, USA, and Harz National Park in Germany (n=208). Each site has a history of bark beetle infestation with varying management approaches.

Participants evaluated alternative scenarios of forest environments displayed as digitally-calibrated images of the DCE. Each photorealistic forest scenario depicted the same six physical and social attributes, but varied in level, characterization and configuration (Figure 1). The images showed different stages of a bark beetle outbreaks, ranging from a mature, unaffected commercial or natural forest to ones where the forest was largely brown and dead. Social factors were the number of visitors, varying visitor compositions and dog walkers' behavior. Respondents chose their most and least-preferred forest environment alternative out of a choice set consisting of four images. In total, they evaluated four choice sets, resulting in an evaluation of 16 different forest scenarios.



Figure 1. Example of a choice set consisting of six visual social and resource variables with varying attribute levels

Results and conclusions

Results revealed the condition of the immediate forest surrounding was the most important attribute for visitors' landscape choices. Visitors preferred vital, mature and mixed forest stands, and disliked forest scenarios with substantial dead wood. The number of visitors was the most important social factor for visitors' landscape choices. When the number of visitors exceeded four persons, preference for the for-

est recreation site decreased. Differences between study sites were observed for social and physical factors.

This study shows that forest insects have a negative impact on cultural ecosystem services, in this case, on landscape preferences (Daniel et al., 2012). This impact will probably concern more forest recreation managers on a global level because of the increasing outbreaks of forest insects due to climate change and global trade. If forested recreation sites are heavily-impacted by forest insects, then their attractiveness will diminish and visitors may avoid visiting such forest environments, leading to reductions or redistribution in tourism revenues.

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