



Risk perception and preferences of mountain tourists in light of glacial retreat and permafrost degradation in the Austrian Alps



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ARTICLE INFO

Article history:

Received 30 December 2015

Accepted 3 February 2016

Keywords:

Climate change

Risk perception

Risk-related trade-off

Mountain tourism

Choice experiment

ABSTRACT

Climate change is leading to new and increasing risks for mountain tourism in the European Alps. Beside the loss of glaciers as attractive landscape features, climate change will also lead to changes in environmental conditions due to increasing subsurface temperatures, increasing slope instability and mass movements, and will increase the likelihood of further glacial retreat. In order to study the risk perception and expected behaviour of mountain tourists, we used a web-based questionnaire including a choice experiment with a tour choice. The results show that risk taking is influenced by three main factors: 1) the experience, frequency of participation and commitment, 2) the perception of risky environmental conditions, and 3) the individual risk-related trade-off including information, the desired experience and other given constraints such as time management or weather conditions. A latent class analysis of the choice experiment revealed two distinct groups of participants: the experienced and the casual mountain tourists. The two distinct classes showed different risk behaviour and behavioural intentions with respect to the three main influencing factors. Perceptions of climate change and its possible effects on the alpine environment did not influence choices.

MANAGEMENT IMPLICATIONS

This study highlights four critical aspects that need to be considered by tourist destinations and Alpine Clubs providing services to mountain tourists and outdoor recreationists. Three aspects are crucial:

- Two classes can be distinguished according to their reaction to increasing risk in the mountains. Casual mountain tourists are more likely to avoid tours with increasing risks such as rock fall, whereas experienced mountain tourists are more tolerant of such risks.
- Curiously, neither class was at all affected by a lack of information about the potential for rock fall. This may indicate that all types of tourists, consider a lack of information to mean little risk. Therefore up to date information is crucial.
- Casual mountain tourists are attracted by the experience of untouched and unspoiled nature and less by the challenges of high mountainous areas or the improvement of technical skills. Therefore, this group is more affected by changes in the trail system due to rock fall, debris flow or other impacts and more likely to choose other destinations in the future.

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1. Introduction

In the cryosphere of the European Alps, glacial ice and permafrost respond sensitively to climate change (APCC, 2014; Aronson, 2003; Beniston, Diaz, & Bradley 1997; Davies, Hamza, & Harris 2001; Vilimek, Zapata, Klimes, Patzelt, & Santillan, 2005). In the year 1850, glaciers covered 20.6 km² along the main ridge of the Zillertaler Alps in Austria. Now they only span 7 km² of the

region, which amounts to a decrease of 65%. In the coming decades, only three glaciers are expected to remain in the region all of them with a limited spatial extent (Pröbstl & Damm, 2008). This decline in glacial extent is expected to have significant effects on outdoor recreation and tourism in the European Alps.

Besides the loss of glaciers as attractive landscape features, climate change will also lead to changes in environmental conditions due to increasing subsurface temperatures, increasing slope instability and mass movements, and will influence the likelihood of further glacial retreat. These conditions will affect the current and future potential for natural hazards to a considerable extent

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(Damm & Felderer 2013; Fischer, Käab, Huggel, & Noetzli 2006; Gruber, Hoelzle, & Haerberli 2004; Haerberli 1992, 1999, 2013; Haerberli et al., 1999; Käab, Reynold, & Haerberli, 2005).

Mass movement related to glacial retreat and the degradation of permafrost already affect high alpine tourism and outdoor recreation activities. Due to the extensive retreat of glacier tongues or complete meltdown of glacier surfaces, traditional high-alpine routes may lead tourists across new moraine fields or force them into less accessible mountain flanks. As a result, some of the traditional mountain routes in Austria have already become more challenging, time consuming and riskier, especially for mountain tourists with average skills. Many trails are affected by erosion and rock fall. The retreat of glacier tongues has also led to the exposure of steep terrain, and the substantial reduction of glacier thickness has resulted in the appearance of new rock faces and significant changes to the courses of glacial creeks. These changes are likely to have a considerable effect on the welfare and safety of the average mountain tourist or alpine hiker.

The impact of climate change on the Austrian landscape have made many high altitude trails, trails over passes, and access routes to alpine huts more expensive to maintain. In some instances, these structural changes have been incorporated into the landscape as new terrain features. In other cases, new infrastructure, such as creek crossings, was constructed to maintain tourist accessibility and keep up an attractive network of trails (Keller, 2007). The effects of climate change and subsequent alterations of the alpine landscapes on tourism and outdoor recreation activities are already widely discussed among mountaineers in online blogs and discussion forums (e.g., www.gipfel-treffen.at). While discussions on these platforms provide some insight into the perspectives of mountain users, it remains unclear how the average outdoor recreationist and tourist will react to such landscape level changes and the risks associated with them. It is therefore necessary to study these reactions in order to design appropriate adaptation and mitigation measures.

This paper analyses risk perception and intended behaviour of summer mountain tourists with respect to natural hazards affected by climate change and relative to their personal perceptions of climate change.

2. Background

2.1. Mountain tourism in Austria

Tourism is one of the most important economic sectors in Austria. Besides winter tourism, summer mountain tourism and mountaineering are crucial for Austria's tourism development. Mountain tourism accounts for about 20% of overall tourism in Austria (Helmenstein et al., 2007). Therefore every 5th tourist in Austria is a mountain tourist, searching for mountain experiences through activities such as mountain climbing, hiking and trekking in their various forms. In this paper, we use the general term "mountain tourist" to refer to tourists engaged in any of these activities in the mountains. Our definition also comprises simple forms of mountaineering, basic grades of rock climbing, and crossing glaciers.

Austria has considerable infrastructure in alpine areas for these activities, mainly maintained by alpine clubs. This infrastructure includes about 513 mountain huts, a network of marked mountain trails totaling more than 50,000 km, and numerous cable cars for quick and convenient access. According to the number of overnight stays, mountain tourism takes place mainly in the provinces of Tyrol, Salzburg, Styria and Carinthia (Austria Tourism, 2013). Whereas mountain tourism generates about 10% of the added value by tourism in Austria as a whole (Helmenstein et al., 2007),

its regional importance in the mountainous regions like Tyrol is much higher. The calculated employment effects of mountain tourism account for 50,000 full-time jobs per year (Helmenstein et al., 2007). Those participating in mountain tourism are generally well-educated (72% completed secondary schooling and more than 40% hold a university degree) and state accordingly higher incomes (Braun 2009; Muhar, Schuppenlehner, Brandenburg, & Arnberger, 2007; University of Trier, 2004).

The main motivations for individuals to participate in mountain tourism in Austria are "nature experience", "relaxation", "fitness", "stress reduction" and "health". It is important to note that "adventure" and "risk seeking" are not listed among the main motives (Braun 2009; Muhar et al., 2007). This is in line with findings from North America, where Ewert (1994) studied motivation and risk taking in the high-altitude wilderness of Alaska observing that "exhilaration", "excitement" and "accomplishment" appeared to be important motivating factors. Risk taking, however, did not generate a high level of motivational impetus in his findings.

Austrian statistics on mountain accidents and rescue efforts show that the probability of an accident is rather low for mountain tourism activities compared to other outdoor leisure activities such as horse-back riding, mountain-biking or snowboarding (Österreichisches Kuratorium Kuratorium für alpine Sicherheit, 2004). However, when accidents do occur, the likelihood of severe consequences is rather high. Besides swimming, mountain tourism activities have the highest number of accidents with deadly consequences among all recreation activities in Austria (Helmenstein et al. 2007; Österreichisches Kuratorium für alpine Sicherheit, 2004). The annual case-fatality rate in Austria is 3.9 fatal incidents per 100,000 participants. The vast majority of these fatalities are caused by accidents as only 25% are related to other health problems such as cardiovascular diseases (Gatterer et al., 2008). The Austrian statistics also reveal an increasing number of accidents in 2015, with more mountain tourists been involved than climbers. Most of these accidents in 2015 occurred on trails of medium difficulty or Via Ferratas (climbing routes with permanently installed steel cables for protection) (Österreichisches Kuratorium für alpine Sicherheit, 2014, 2015). These statistics highlight that alpine risks are a crucial consideration for summer tourism in Austria.

2.2. Risk behaviour in outdoor recreation

Risk, risk behaviour and the consequences of risk for tourism have been the subject of research within various disciplines, including sociology, psychology, tourism and sports sciences (Allmer, 1998; Apter, 1992; Aufmuth, 1986; Csikszentmihalyi & Jackson, 2000; Cube, 1990; Le Breton, 1995). Luhmann (1991) distinguishes between "risk" and "danger". "Risk" is defined as a consequence of individual decision making while "danger" exists due to specific environmental situations, such as thunderstorms, rock fall or avalanches. Opaschowski introduced the distinction between "objective risks" and "subjective risks" to the outdoor recreation literature (Opaschowski, 2000, p. 88–91). Following his definition objective risks relate to natural hazards that cannot be affected by users (such as rock fall). Subjective risks describe a situation in which a person is not able to judge their capability or fitness in accordance with the challenge lying ahead, whereas the former is the objectively quantifiable risk of certain dangerous situations or events occurring. Research on risk awareness shows, that it is strongly linked to experience and information (Cube, 1990; Luhmann, 1991; Örley, 2014).

Personal risk perception and the role of risk for a satisfying experience have been important research topics in outdoor recreation. Cube (1990, p. 13) describes risk perception in mountaineering with the following example: the perceived risk of a well-trained and physically fit mountaineer evaluating a path with

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