



Measuring outdoor recreationists' beliefs in climate change: Testing the Occurrence and Anthropogenic Causation Scale (OC-AN)[☆]



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ABSTRACT

Outdoor recreation areas are impacted by novel changes in climate. Consequently, nature centers and national parks often deliver climate change education. Recreationists' beliefs in climate change are important to understand because effective education relies on understanding an audience's beliefs. However, *measuring* beliefs in climate change is complicated because the phrase 'global climate change' elicits diverse meanings that are unstable across groups of outdoor recreationists. Without valid measures to identify outdoor recreationists' beliefs in climate change, it is difficult to understand their beliefs and deliver effective education. Therefore, researchers developed and tested two scales to create the Occurrence and Anthropogenic Causation Scale (OC-AN). This scale measures the two primary dimensions of climate change beliefs: (1) Occurrence (OC; belief that climate change is currently happening), and (2) Anthropogenic Causation (AN; belief that climate change is caused by humans). Researchers tested the scale's performance across three populations: (1) national park visitors in Alaska ($n=429$), (2) lake recreationists in the southeast U.S. ($n=210$), and (3) marine recreationists along the U.S. Atlantic Coast ($n=483$). The OC-AN maintained appropriate metric invariance, exhibited high validity, and demonstrated appropriate sensitivity across these diverse groups.

MANAGEMENT IMPLICATIONS

First, managers and researchers can use the OC-AN Scale to understand the levels of beliefs in Occurrence and Anthropogenic Causation, which can provide necessary baseline data for park managers and educators to understand their visiting audience. Second, the OC-AN can also be used to understand outcomes of a climate change education experience or outdoor recreationists' interactions with climate-influenced resources (e.g., Brownlee, Hallo, Wright, Moore, & Powell, 2013). Third, the OC-AN could also be applied longitudinally to track changes in a particular group's beliefs over time. Furthermore, although the OC-AN requires further testing, it is likely that the scale could be applied to the general public or other specialized groups who are not outdoor recreationists. Finally, the individual items that comprise the OC-AN and the mean responses may inform climate change messaging designed for a specific sub-population.

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1. Introduction

This article reports the psychometric performance of the newly developed Occurrence and Anthropogenic Causation Scale (OC-AN) used to assess outdoor recreationists' beliefs in the occurrence of climate change and human contributions to climate change. Such scales are important because climate-sensitive and climate-impacted resources are an experiential centerpiece at several frequently visited outdoor recreation areas. For example, visitors flock to Kenai Fjords National Park (KEFJ) in Alaska to view the 40 glaciers flowing from the Harding Icefield (700 square miles; Spencer & Irvine, 2005), which has decreased by 8 cubic miles

overall and has lost 21 m in elevation between 1950 and 1990 (Arendt, Echelmeyer, Harrison, Lingle, & Valentine, 2002). During the latter half of the 20th century, the terrestrial terminus of Exit Glacier (a main viewing and hiking attraction at KEFJ) retreated 500 m and thinned by 90 m (Aoalgeirsdottir, Echelmeyer, & Harrison, 1998).

In many outdoor recreation areas weather and climate may influence fire regimes, pest infestations, recreation levels, and visitor facilities or attraction sites directly linked to the outdoor recreation experience (NPCA, 2009). For example, at Joshua Tree National Park (U.S.A.), rare and endemic flora that serve as visitor attractions are being impacted by novel changes in climate. Specifically, Joshua Trees (*Yucca brevifolia*) at the park flourish only in areas with specific temperature ranges and precipitation amounts (Somerville, 1999).

In addition to glaciers and flora, water recreation resources can also be impacted by a changing climate (Dai, 2010). For example, Glen Canyon National Recreation Area experienced severe climatic changes influencing the visitor experience (e.g., intra-site displacement), the survival of endemic plants, and the behavior of animals (CCRP, 2010; GCNRA, 2007). Furthermore, the water resource impacts from climatic change, resulting from regional or sub-regional drought, are one of the most widespread and expensive meteorological phenomena in many nations (Dai, 2010; FEMA, 1995; Lott & Ross, 2006). As a result, management concerns regarding climate change impacts and its influence on outdoor recreationists' experience have risen considerably (Hansen & Hoffman, 2010). Additionally, researchers indicate the areas affected by changes in climate will likely increase substantially during the next century (Burke, Brown, & Christidis, 2006).

As a result of such impacts to iconic resources, outdoor recreation areas, such as national parks, have become a germane context to deliver climate change education to outdoor recreationists. Such an expansion of a park's educational use is logical because some outdoor recreationists interact with climate influenced resources and have the capacity to notice climate related biophysical impacts (Brownlee, Hallo, Wright, Moore, & Powell, 2013; Davis, 2014; Schweizer, Davis, & Thompson, 2013). Conversely, many impacts (e.g., increased temperatures, decreased water in the soil, species migration) from a changing climate remain relatively unnoticeable in heavily developed metropolitan areas where 80% of U.S. citizens reside (USCB, 2011). Therefore, parks and other outdoor areas provide unique opportunities for publics to 'experience,' notice, and respond to climate change impacts, which are perhaps much less apparent in the metropolitan environment.

1.1. The importance of understanding beliefs about climate change

Effective environmental education and interpretation, including climate change education in outdoor recreation areas, relies explicitly on understanding an audience's values, attitudes, and beliefs, particularly towards a specific issue, such as climate change (e.g., Beck & Cable, 2011; Knudson, Cable, & Beck, 2003; Heimlich and Ardoin, 2008; Powell & Ham, 2008). Many educators and managers at outdoor recreation areas use an audience's existing values, attitudes, and beliefs as a foundation to design curriculum and messages (CRED, 2010; Jacobson, 1999; Pike, Doppelt, & Herr 2010). Environmental policy decisions also require an understanding of constituents' underlying value orientations and attitudes (Baldwin and Judd, 2010; Jacobson, 1999; Ostrom, 1990). Outdoor recreation researchers often provide baseline information about an audience's attitudes, beliefs, values, and behaviors (Knudson et al., 2003) but this may require even more attention for researchers providing data to inform climate change education programming (Brownlee, Powell, & Hallo, 2013).

Although nature centers, national parks, and ecotourism venues often deliver education and communication focused on climate change (CCRP, 2010; Pruneau et al., 2001; Schweizer et al., 2013), outdoor recreationists' beliefs in climate change often vary between sub-populations and across settings (Brownlee, 2012; Davis, 2014). Additionally, understanding and *measuring* beliefs in climate change is complicated because the phrase 'global climate change' elicits diverse images, meanings, and powerful preconceptions that lack statistical stability across different groups of outdoor recreationists (Gochenaur & Brownlee, 2013). Without valid measures to identify outdoor recreationists' beliefs in climate change, it is difficult to understand their beliefs and ultimately design and deliver effective climate change education and communication.

To address this deficit, researchers developed and tested the 14 item OC-AN scale to measure the two primary dimensions of beliefs in climate change: (1) Occurrence (OC; belief that climate change is currently happening), and (2) Anthropogenic Causation (AN; belief that climate change is at least partially caused by humans). Researchers used standard measurement development processes outlined by Devellis (2012) and Noar (2003) to test OC-AN's psychometric performance across three distinct populations of outdoor recreationists: (a) national park visitors in Alaska, (b) lake recreationists in the southeast U.S., and (c) marine recreationists along the U.S. Atlantic Coast.

2. Literature review

Although research investigating responses to global environmental change stretches beyond three decades (e.g., Chen, Boulding, & Schneider, 1983; Reser & Swim, 2011; Stern & Gardner, 1981), recently researchers have increasingly studied perceptions of global climate change¹ and related climate issues (e.g., biophysical impacts to resources). For example, investigators have examined general climate change opinions (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2010; Maibach, Roser-Renouf, & Leiserowitz, 2009), specific knowledge levels (Leiserowitz et al., 2010), and attitudes and actions towards mitigation (Maibach, Roser-Renouf, Weber, & Taylor, 2008). Results of these empirical investigations indicate climate change perceptions vary substantially and are often related to value orientations, worldviews, perceptions of risk, exposure to media messaging, location of residency, and political ideology (Boyce & Lewis, 2009; Hulme, 2009; Weber, 2006; Weber & Stern, 2011).

Although researchers have documented public perceptions of climate change in many areas (e.g., risk perception, information salience, weather variability), most studies often include two main climate change constructs: (1) Occurrence, and (2) Anthropogenic Causation. The Occurrence construct represents a belief that the primary physical impacts from climate change are currently happening and the Anthropogenic Causation construct represents beliefs that human behaviors contribute to climate change. In the following literature review, the measurement approaches to assess these two constructs are described, followed by an overview of the opportunity to improve existing measures.

A majority of the literature regarding climate change perceptions is produced by national and international polling, which is

¹ The phrase 'perceptions of global climate change (or climate change perceptions)' is adopted from previous literature and is intended to be inclusive of attitudes, beliefs, ideas, opinions, and views, which may be influenced by sensory inputs, socio-cultural interactions and orientations, life history and specific experiences (Brody et al., 2008; Brownlee, Hallo, Wright, Moore, & Powell, 2013; Buzinde et al., 2010; Etkin & Ho, 2007; Gardner & Stern, 2002; Graham, Stephenson, & Smith, 2009; Navratil et al., 2011; O'Connor, Bord, & Fisher, 1999; O'Riordan, 1995; Rachlinski, 2000; Stedman, Davidson, & Wellstead, 2005).

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