


Winter-Human-Nature Interactions: A Scoping Review for a Neglected Season

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Badges for Good Research Practices:  Open Materials.

Abstract

Nature interactions are associated with numerous positive physical, social, and mental health benefits. However, most human-nature interaction research is conducted in spring and summer, with little insight into autumn or winter-human-nature interactions. We therefore conducted a concise scoping review to explore the current state of winter-human-nature interaction research by examining common emergent themes and types of winter-human-nature interaction. Few studies ($N = 28$) met the inclusion criteria of our review (i.e., primary studies that examined explicit human-nature interactions in winter that reported outcomes for participants). Three main winter-human-nature interaction research topics emerged in the course of this review: winter recreation and tourism, winter and health, and winter and culture. Regarding typology, most studies considered more immediate, conscious, and intentional winter-human-nature interactions. Additionally, few studies considered the outcomes of interactions for both people and nature. More broadly, the general lack of studies involving winter-human-nature interactions is concerning given the depth of research in other seasons connecting humans and nature. Winter-nature interactions are even more important to understand given the ongoing changes in the characteristics of winter due to climate change that are likely to affect people's relationships with nature in the winter and the potential nature-derived benefits of winter-human-nature interaction.

Keywords

health, human-nature interactions, outdoor, tourism, winter



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Non-Technical Summary

Background

Interacting with nature positively affects people in many ways and can benefit their physical, social, and mental health. Despite the positive role nature interaction can play in our day-to-day lives, human-nature interactions are primarily studied in spring and summer, while much less is known about human-nature interactions in winter. Climate change is significantly impacting the characteristics and qualities of winters around the globe, and as such influence winter-human-nature interactions. In order to understand what research needs to be done in the future, establishing the current state of winter-human-nature interaction literature is required.

Why was this study done?

Our aim was to summarize and provide a concise overview of the current state of human-nature interaction research conducted in winter by: 1) broadly characterizing the types of interactions within the identified area, 2) illuminating emergent themes of winter-human-nature interactions, and 3) identifying gaps for further research in the area.

What did the researchers do and find?

A scoping review of relevant literature in the area of winter-human-nature interactions was conducted. A total of 28 studies were included and were characterized by their types of interactions using the five dimensions of human-nature interaction proposed by Soga and Gaston (2020), as well as the main theme of each study. The typological characterization of interactions showed that for a large majority of interactions, people were physically present in nature, were aware of the interaction, and the interaction was purposeful. Additionally, most human-nature interactions reviewed indicated positive outcomes for humans while most did not include any measure of outcomes for nature. The emergent themes identified included: winter recreation and tourism, winter and health, and winter and culture. Our review revealed that there is a significant potential for future winter-human-nature interaction studies. Future studies should, for example, consider: (1) specific outcomes of human-nature interactions for both people and nature simultaneously, (2) additional ecosystem types, and (3) a more robust view of nature that examines specific aspects of human-nature interactions including how and with what kind of natural elements people interact and the specific outcomes of such interactions.

What do these findings mean?

Winter is a neglected season, and the potential for enhancing health and well-being in the season is significant if more work is done on understanding the unique complexities that come with the human-nature interactions that occur in wintertime. These complexities will increase especially in light of climate change, as changing winter weather patterns (like reduced snowfall) will affect how people interact with nature in the winter. Such changes will likely impact people's perceptions of self- and cultural identity, as well as

aspects related to well-being, health, economic security, and other non-material benefits like inspiration or learning and development. More research about human-nature interactions in this mostly overlooked season is necessary to ensure and maximize the potential benefits of winter-human-nature interactions in a changing world.

Highlights

- Nature interaction benefits people in many ways, however there is little research attention on human-nature interaction in winter.
- Three dominant themes emerged from winter-human-nature interaction literature: winter recreation and tourism, winter and health, and winter and culture.
- There are many facets of winter-human-nature interaction that should be examined more deeply and explicitly (e.g., specific types and forms of nature with which people interact, how qualities of winter like temperature and precipitation affect interaction).
- A more robust understanding of winter-human-nature interactions is necessary to support opportunities for potential nature-derived benefits year round.

“If winter be the color of our days,
then learn of winter to be still and clear.” (Nathan, 1940).

Interactions with nature elicit benefits for peoples’ mental and physical health, overall well-being, learning and development, and other outcomes across diverse individuals (Moll et al., 2022; van den Berg et al., 2015; among others). The importance of human contact with nature is especially crucial during times of crises like the COVID-19 pandemic and the ongoing effects of climate change where nature affords spaces for socialization, rest, relaxation, and respite (Lu et al., 2021; Venter et al., 2021). Despite the critical role of nature for human health and well-being, few studies have examined winter-human-nature interactions (Barnes et al., 2019). This neglect extends across disciplines with winter being “viewed as a burden for human systems and infrastructure,” limiting interest and engagement with the season (Contosta et al., 2020, p. 1). Therefore, a need exists to understand the state of human-winter-nature interactions. In other words, what do we know about how people interact with nature in the winter and what kind of benefits do they derive from such interactions? This is crucial given the importance of winter both socially and ecologically, as well as the significant impacts that climate change is having on the season globally (Contosta et al., 2020).

This review aims to summarize the current state of winter-human-nature interaction research. Our main questions were: 1) What are the typological dimensions of winter-human-nature interactions? 2) What are the main themes represented in winter-human-nature interaction literature? and subsequently 3) What broad gaps exist in winter-human-nature interaction literature? This review considers studies ($N = 28$) that range from

skiers' interactions with wildlife, the use of drones to measure park activity in winter, to children's learning experiences with ice and snow. Reviewed studies were published from 1998 to 2022, and were from Europe ($n = 16$), North America ($n = 8$), and Asia ($n = 4$). Studies were organized using a typological framework (Soga & Gaston, 2020) to understand common characteristics of winter-human-nature interactions that would be applicable across diverse disciplines then manually organized by theme and confirmed using a topic model (see Jakstis & Barnes, 2024, for complete methods and definitions). We organized this scoping review first around the *typological dimensions of winter-nature interactions* and then three emergent themes from the literature: *winter recreation and tourism*, *winter and health*, and *winter and culture*, with gaps in the literature identified and discussed throughout.

Dimensions and Themes of Winter-Human-Nature Interactions

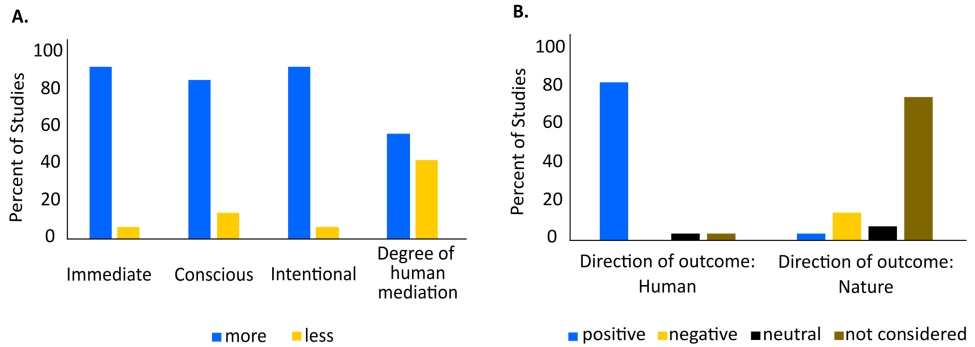
Typological Dimensions

The type of winter-human-nature interactions examined in the reviewed studies were analyzed using Soga and Gaston's (2020) five dimensions of human-nature interaction, whereby interactions were classified according to their outcome, level of immediateness, consciousness, intentionality, and degree of human mediation. This classification system brought together and provided insight into the types of winter-human-nature interactions examined in studies across multiple research disciplines. For a more detailed discussion of these typological dimensions, see Soga and Gaston (2020).

The reviewed studies generally examined winter-human-nature interactions that were more immediate (i.e., participants were physically present in nature), conscious (i.e., participants were aware of the interaction), and intentional (i.e., the interaction was purposeful; Figure 1A). There was no clear pattern regarding the degree of human mediation with interactions occurring both in areas with high and low influence of anthropogenic activities (e.g., cities and wilderness areas, respectively). This is likely because the level of urbanicity was not specified in our literature search. It would be interesting, however, to consider how the degree and type of human mediation impacts the outcome of interactions along the rural-urban continuum. Additionally, the majority of studies only considered outcomes for humans, most of which indicated positive situations or effects (e.g., stress reduction, supporting development and spirituality; $n = 27$). Only six studies examined outcomes of interactions for both humans and nature, four of which indicated negative outcomes for nature (e.g., animals fleeing; Figure 1B). Future research should consider outcomes from both human and nature perspectives to glean a more holistic view of winter-human-nature interactions, including potential feedback loops that may affect both people and nature.

Figure 1

The Type of Winter Nature Interactions Considered in Reviewed Studies (N = 28)



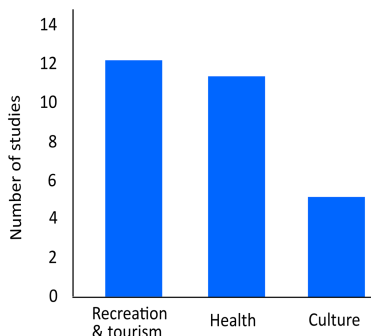
Note. Figure according to Soga and Gaston’s five typological dimensions of human-nature interactions (Soga & Gaston, 2020). Panel A depicts the percentage of studies with human-nature interactions that are classified according to the degree of immediateness, consciousness, intentionality, and human mediation. Panel B depicts the percentage of studies in which the outcome (for humans and nature) of winter-human-nature interactions were positive, negative, neutral, or not included. Because some studies include more than one type of winter-human-nature interaction, the total percentage of studies for some dimensions is greater than 100%.

Theme 1: Winter Recreation and Tourism

The majority of winter-human-nature interaction studies reviewed focused on recreation and tourism ($n = 12$, Figure 2). This category identifies the considerable overlap among studies that examine recreation in natural areas and explicitly nature-based tourism, especially considering protected areas like national parks that are often popular tourist locations (Reinius & Fredman, 2007).

Figure 2

The Number of Reviewed Studies (N = 28) Belonging to Each Emergent Theme: Winter Recreation and Tourism (n = 12), Winter and Health (n = 11), and Winter and Culture (n = 5).



Recreation studies generally examined winter-human-nature interactions with regard to physical and recreational activities occurring in urban greenspaces, as well as more remote settings. For example, Roberts et al. (2017) assessed the seasonal variation in physical activity across 46 urban greenspaces in Birmingham, England to better understand how year-round physical activity can be encouraged. Similarly, Xu and colleagues (2019) observed patterns and types of physical activity in which winter urban park users engaged, in Harbin, China. Both of these urban focused studies were framed from a public health orientation, focusing explicitly on physical activity rather than other aspects of nature-based recreation.

However, most of the recreation-focused studies were conducted in more natural places like protected areas and examined either interactions between recreationalists and wildlife (e.g., Borkowski et al., 2006) or behaviors of recreationalists like (im)proper trail usage (e.g., Coppes & Braunisch, 2013). These studies also considered outcomes for nature and were generally focused on the management-implications of winter-human-nature interactions to balance interests of humans and nature in protected areas. This contrasts with the urban-recreation studies, which were more anthropocentrically framed, focusing primarily on human implications. This is of consequence, because humans inevitably influence their environment with their actions, and each human-nature interaction has outcomes for nature that may impact future interactions. For example, leaving a trail in a protected area may be a positive experience for an outdoor recreationist, but the resulting damage to vegetation and potential wildlife habitat from such depreciative behavior may be negatively perceived by subsequent recreationalists, potentially degrading the value of their winter-nature interaction (Dorwart et al., 2009). This should be explored more thoroughly in future research, as such interactions could lead to feedback loops that negatively affect both people and nature and have consequences for winter recreation and tourism.

Excepting studies on specific human-wildlife interactions, 'nature' is primarily treated as a place where recreation occurs. Most studies did not consider specific aspects of human-nature interactions (e.g., how and with which natural elements people interact; motivations, perceptions, and outcomes of specific types of interactions). One study, however, examined the 'place' aspect of winter-human-nature interactions in how seasonality affects tourists' perceptions and experiences of popular natural areas in Iceland, considering beauty, safety, cleanliness, and naturalness (Sæþórsdóttir et al., 2019). Studies such as this offer valuable context-specific insight into how people perceive places where nature experiences occur, which can help facilitate the management of such areas to support meaningful winter-human-nature interactions. Future research should continue to examine deeper and more explicit aspects of place and how it relates to the quality, quantity, and outcomes of winter-human-nature interactions in various spatial, cultural, and socio-ecological contexts. Additionally, studies should examine human-nature inter-

actions that expand beyond a unidimensional view of nature as just a setting in which winter recreation and tourism occur.

The large proportion of tourism studies indicate the importance of this theme in winter-nature research. This may be largely attributed to the high economic value of winter tourism and recreation in many regions; previous research has found that mountain-region tourists and recreationalists generally spend more in winter than in summer (Mayer & Kraus, 2019). However, climate change will impact these snow-dependent industries, with projections indicating warmer temperatures and fewer days with snow cover in many areas (IPCC, 2022). For these industries to adapt to changing winter conditions, it's important to examine existing and changing patterns of motivations, perceptions, and outcomes of winter-human-nature interactions involving recreation and tourism.

Theme 2: Winter and Health

Eleven studies examined winter-human-nature interactions in the context of health (Figure 2). Commonly examined psychological aspects included: emotion/mood states, psychological restoration, stress, anxiety, and depression. Seven studies employed experimental designs where measures of such factors were compared among groups that were exposed to natural verses built environments. While most of these studies examined the effect of immediate human-nature interactions (i.e., participants were physically in the natural environment), one study conducted a photo-based experiment to assess the health effects of a non-immediate interaction with natural elements (Hidalgo, 2021).

Two studies considered how longer-term or more intensive winter-nature interactions may affect well-being. Løvoll et al. (2020), for example, used questionnaires and narratives of participants' nature experiences during a 5-day winter wilderness-training course to determine their feelings and aesthetic experiences, and ultimately how they connect to aspects of well-being. Additionally, Wiens et al. (2016) conducted in-depth interviews to understand how seasons and nature relate to girls' well-being in northern Finland.

While all studies in this category considered some aspect of mental health or well-being, there were two studies that examined both psychological and physiological factors (Janeczko et al., 2020; Song et al., 2013). Physiological measures like heart rate, salivary cortisol levels, and blood pressure are often used to measure the body's physical response to psychological distress like stress (Epel et al., 2018). Therefore, considering both objective physiological data and subjective psychological data in tandem, can help provide a fuller picture of how winter-nature interactions impact a person's health as previously done in other nature-based research.

We also identified a trend in the type of environments that are studied in health-related winter-nature interaction research with the majority focusing on either urban environments or forests. This may be because forests are simply a common ecosystem type in northern latitudes that experience winter. However, there is also a tradition in

some cultures of walking in forests as a type of meditation to support psychological health (e.g., Japanese Shinrin-yoku), which could also be the root of research interest in forests (Antonelli et al., 2019). Although many of the experimental studies compared built environments to more natural environments (e.g., urban parks, forests), few studies examined more than one natural ecosystem type. Janeczko et al. (2020), however, examined two types of built environments and two natural environments – deciduous and coniferous forests. The non-experimental studies in this category either considered nature more broadly or different landscape types within a natural area. Zhou et al. (2022) for example, studied the effect of blue and greenspaces within the same natural area on mental restoration. This was the only study that examined the effects of winter-human-nature interaction on health in bluespaces. Regardless of season, fewer studies examine relationships between humans and bluespaces than greenspaces; however, results of such studies indicate similar psychological benefits (Beute et al., 2020). The fluidity and visual openness of water may support such psychological benefits of bluespace (Beute et al., 2020), so it would be interesting to examine these relationships in winter, when the physical structure of the water is different (i.e., ice rather than liquid). In extension, winter-human-nature interactions should be studied in other ecosystem types like urban meadows whose character can change dramatically with snow cover (e.g., seasonally-dependent visual openness). Future research in this area should consider a variety of ecosystem types and landscape features across all themes, but particularly to better understand how winter-human-nature interactions may support mental health and well-being to complement the vast amount of research already done on the positive effects of nature in other seasons (Barnes et al., 2019).

Theme 3: Winter and Culture

Few studies ($n = 5$, Figure 2) examined socio-cultural aspects (i.e., spirituality, identity, aesthetics, and inspiration) of winter-human-nature interactions. Two of these studies analyzed photographs from social media (Speak et al., 2021) or supervised nature walks (Osawa et al., 2020) to examine aesthetic values and preferences associated with winter-nature experiences. Other studies used ethnographically inspired methods to gain a deeper understanding of how winter-nature experiences and interactions contribute to the development of identity. For example, Sanderud et al. (2020) studied kindergarten-aged children's interactions with ice and snow, and how these learning experiences contribute towards their familiarity with the natural environment and their developing identity of 'being-and-becoming winter children'. The final study examined the spirituality of winter-human-nature interactions where participants recalled their experiences of an outdoor winter recreation project; spiritual aspects were mentioned in seven of 19 identified themes, including in the theme of winter nature and naturalness (Jirásek et al., 2017).

Despite the few studies included in this category, there was a variety of socio-cultural aspects considered. The focal populations in these studies were also diverse, ranging from disabled schoolchildren in urban Japan to adults recalling an outdoor wilderness trip in the Bukovské hills of Eastern Europe to kindergarteners in suburban Scandinavia. These insights suggest that winter-human-nature interactions likely play a multifaceted role in many different people's lives, beyond recreation, tourism, and health. However, the socio-cultural effects of winter-human-nature interactions examined in these studies, and more broadly, are context-specific and likely differ according to the demographics and background of participants, as well as location- and environment-dependent factors. Researchers should continue to study the diverse socio-cultural implications of winter-human-nature interactions across contexts with diverse populations to enhance our understanding of this complex relationship. This is particularly relevant within the context of climate change, as changing winter conditions may impact people's interactions with nature. How people are affected by and perceive these interactions will likely impact their own self- and cultural identity, as well as other non-material benefits like inspiration or education, and will subsequently affect aspects related to all themes discussed in this review like health, well-being, and economic security.

Conclusion

Winter is largely overlooked in human-nature interaction research, despite the many benefits of human-nature interaction demonstrated in other seasons and the urgent need to understand such interactions more deeply in the context of climate change. Shifting winter conditions (e.g., less and fewer days with snow cover; IPCC, 2022) will likely impact human-nature interactions across all themes identified in this review as current focal points in winter-human-nature interaction research (i.e., recreation and tourism, health, culture). Most interactions examined were more immediate, conscious, and intentional according to Soga and Gaston's (2020) five dimensions of human-nature interactions and studies rarely considered outcomes of interactions for humans and nature. While this result is different from the assertions of Soga and Gaston (2020), it is unsurprising given the majority of reviewed studies involved some level of intervention by researchers in gathering data. It will be increasingly important to consider winter-human-nature interactions across all typological dimensions to better understand such interactions and the outcomes for both people and nature. In this regard, the examination of feedback loops that arise between human outcomes (e.g., nature-connectedness) and resultant attitudes and behaviors that can affect the quality of nature (pro-environmental action) is of interest. Finally, the current review findings are based on a majority of papers from Europe and North America, but because winter is place- and culturally dependent, more winter nature-interaction research needs to be context- and location-

specific and include research contexts that broaden the scope of the current body of work.

Openness and Transparency Statements

The present article has been checked by its handling editor(s) for compliance with the journal's open science and transparency policies. The completed *Transparency Checklist* is publicly available at:
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Author Contributions.

KRISTEN JAKSTIS: Conceptualization. Formal analysis. Methodology. Investigation. Visualization. Writing – original draft. Writing – review & editing.

MICHAEL R. BARNES: Conceptualization. Formal analysis. Methodology. Investigation. Visualization. Writing – original draft. Writing – review & editing.

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Supplementary Materials. The following table provides an overview of the accessibility of supplementary materials (if any) for this paper.

Type of supplementary materials	Availability/Access
Data	
Data is not available for this review.	–
Code	
No code was involved in the study.	–
Material	
Detailed methodology with key terminology and study table.	Jakstis & Barnes, 2023

Badges for Good Research Practices.

Open data: NO.

Open code: NO.

Open materials: YES.

Preregistration: NO.

Diversity statement: NO.

Note: YES = the present article meets the criteria for awarding the badge. NO = the present article does not meet the criteria for awarding the badge or the criteria are not applicable.

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