INVESTIGACIONES GEOGRÁFICAS
Una mirada desde el Sur

UNIVERSIDAD DE CHILE
FACULTAD DE ARQUITECTURA Y URBANISMO
DEPARTAMENTO DE GEOGRAFÍA

Last chance tourism in the Anthropocene: a systematic global mapping

Turismo de última oportunidad en el Antropoceno: un mapeo global sistemático

Historial del Artículo
Recibido:
20 de octubre de 2024
Revisado:
3 de junio de 2025
Aceptado:
21 de julio de 2025

Tatiane Ferrari do Vale, Universidad Estatal de Ponta Grossa, Brasil
Sandra Corbari, Universidad Estatal de Ponta Grossa, Brasil
Fernanda Haura, Universidad Estatal de Ponta Grossa, Brasil

*Contacto: tatianefdovale@gmail.com

Keywords
Culture, environmental crisis, last chance tourism

ABSTRACT
Last chance tourism presents an intrinsic paradox, while it provides visitors opportunities to experience tourist destinations threatened with disappearance, it also intensifies the impacts on these places, potentially accelerating their degradation. Such destinations, often linked to natural areas, suffer not only from the effects of climate change on the landscape and biodiversity but also have a significant impact on native peoples and local communities, adversely affecting socio-cultural aspects. The aim of this study was to identify and map tourist sites at risk of disappearing. Therefore, an exploratory methodological approach was adopted, complemented by the systematic mapping of scientific literature of a mixed nature, including both quantitative and qualitative analysis. The results revealed that most studies focus on tourist destinations in glacial regions directly related to the intensification of global warming. However, few studies address anthropogenic effects, such as threats to predominantly natural destinations and attractions. Additionally, it was observed that there are few publications from Global South countries and regions impacted by environmental crises. Finally, this study seeks to advance the ongoing debate on the touristification of vulnerable spaces and the ethical limits associated with their promotion and the encouragement of visitation.

Palabras clave
Crisis ambiental, cultura, turismo de última oportunidad

RESUMEN
El turismo de última oportunidad presenta una paradoja intrínseca: aunque ofrece a los visitantes la posibilidad de experimentar destinos turísticos amenazados por su desaparición, también intensifica los impactos en estos lugares, lo que potencialmente acelera su degradación. Estos destinos, a menudo asociados con áreas naturales, no solo sufren los efectos del cambio climático sobre el paisaje y la biodiversidad, sino que también generan un impacto significativo en los pueblos indígenas y las comunidades locales, afectando negativamente los aspectos socioculturales. El objetivo de este estudio fue identificar y mapear los sitios turísticos en riesgo de desaparecer. Para ello, se adoptó un enfoque metodológico exploratorio, complementado con el mapeo sistemático de la literatura científica, de naturaleza mixta, que incluyó análisis cuantitativo y cualitativo. Los resultados revelaron que la mayoría de los estudios se centran en destinos turísticos en regiones glaciales directamente relacionadas con la intensificación del calentamiento global. Sin embargo, pocos estudios abordan los efectos antropogénicos, como las amenazas a destinos y atracciones predominantemente naturales. Además, se observó que existen pocas publicaciones provenientes de países y regiones del Sur Global afectados por crisis ambientales. Finalmente, se espera que esta investigación contribuya con el debate sobre la turistificación de espacios vulnerables y los límites éticos implicados en su promoción e incentivo a la visitación.

Cómo citar: Ferrari do Vale, T., Corbari, S., & Haura, F. (2025). Last chance tourism in the Anthropocene: a systematic global mapping. *Revista de Investigaciones Geográficas: una mirada desde el Sur,* (69), 24-36. https://doi.org/10.5354/0719-5370.2025.77138

Introduction

The global imaginary surrounding the imminent disappearance or mischaracterization of tourist destinations, plant and animal species, and material and immaterial elements of some cultures is immersed in contradictions and ethical issues (Dawson et al., 2011). Therefore, in this context, tourism is a paradoxical phenomenon. On the other hand, Last Chance Tourism (LCT) can raise visitors' awareness and stimulate conservation efforts; on the other hand, it intensifies the risk factors threatening these vulnerable sites. A growing influx of tourists, eager to visit these locations "before it's too late" (Eijgelaar et al., 2010; Salim et al., 2022) is an example of the risks faced.

LCT, characterized by visits to endangered places, observing wildlife, or experiencing endangered cultures, has emerged as a prominent travel trend in the last five years (Corbari, 2021). This phenomenon is intrinsically linked to the Anthropocene, an era marked by significant human influence on the planet (Steffen et al., 2011). Human action, accelerating climate change, has put extreme pressure on the environment, contributing to the crossing of planetary boundaries (Guerra, 2009) and, consequently, jeopardizing unique tourism experiences.

Extreme weather events driven by climate change threaten life quality on the planet and can potentially cause irreversible damage to both nature and culture. Scientific consensus indicates that the melting of polar ice caps will impact biodiversity and geodiversity, changing landscapes (Salim et al., 2021) and worsening the conservation status of wildlife species such as polar bears (*Ursus maritimus*), emperor penguins (*Aptenodytes forsteri*) and Arctic and Pacific walruses (*Odobenus rosmarus*).

Wildlife tourism in remote areas is largely exclusive, accessible only to high-income individuals. This trend threatens to aggravate the disconnect between local communities and the environment, a setback for long-term conservation efforts. As environmental degradation intensifies and species face increasing risks, many of these areas may be designated as protected areas, with severely restricted access. Although aimed at mitigating negative impacts, these measures will restrict direct engagement with many natural environments and wildlife and will negatively affect local communities that depend on these territories for both physical and cultural subsistence.

Considering these challenges, the research question that guided the present study was: Which locations are most frequently identified as LCT destinations in the scientific literature? This study aimed to identify and map these locations, provide a comprehensive overview of the most threatened tourist attractions, and identify gaps in research concerning less explored areas and aspects of LCT. The analysis contributes to understanding the significance of these sites, particularly in the context of natural and cultural relations established in LCT destinations and attractions. Moreover, it encourages future research to address regions and aspects that have thus far been neglected.

This paper is structured into five sections. The first presents the theoretical framework, discussing development, the environmental crisis, the Anthropocene, and the interaction of LCT and planetary boundaries. The second section details the research methodology and techniques used in the study. Section three presents the bibliographic mapping, focusing on the scope, distribution, and characteristics of LTC. In section four, the practical and theoretical implications of our findings are discussed. Finally, the fifth section provides the concluding remarks.

Materials and methods

This study employed an exploratory approach, using the systematic mapping technique of mixed nature — quantitative and qualitative— to identify the distribution and scope of tourist destinations and attractions at imminent risk of disappearing, also known as "last chance tourism". Considering the objective of the present research, this data collection technique is appropriate, since systematic mapping differs from the traditional systematic review in terms of the scope of the study. In other words, while the latter analyzes and interprets all available evidence, the mapping investigates a topic on which little evidence is available in the literature (Kitchenham & Charters, 2007). Systematic mapping follows the same rigorous, objective, and transparent processes as other typologies of reviews, avoiding bias (James et al., 2016).

Following the systematic methodology outlined by Kitchenham & Charters (2007), this research was conducted in three phases. The first phase addressed the research planning; thus, the gap in current research was identified, a research question was formulated, and the research protocol was defined.

The second phase —the research execution— encompassed a search of scientific papers in six databases: Google Scholar, Capes Journals, SciELO, Science Direct, Scopus, and Web of Science. A comprehensive search was conducted in Portuguese, English, and Spanish using the keywords "turismo de última chance", "last chance tourism", and

"turismo de última oportunidad". The initial search corpus included publications containing the above-mentioned terms and a geographic focus such as a specific case study mentioned in the title, abstract, or keywords. Books and book chapters were not included due to their limited accessibility in online databases. The search was limited to scientific papers published until April 1, 2024. The data collected was cataloged in a database in an Excel® spreadsheet. This metadata is used to describe the amount and nature of research in a specific area or theme (James et al., 2016).

The next section presents the analysis, interpretation, and dissemination of the results, which is the third phase of systematic mapping.

Development, environmental crisis, and the Anthropocene

The exploitation of nature under the guise of 'development' has led to an environmental crisis. Thus, the environmental crisis can be understood as a symptom of a larger systemic crisis of a rapidly destabilizing relationship between anthropogenic activities and the environment, necessitating a rethinking of the human-nature relationship (Holden et al., 2022).

Hence, it should not be misconstrued as merely an ecological crisis, as its impacts are not limited to degradation, depletion, and extinction of natural resources or biodiversity. The crisis directly affects the social, political, and economic spheres (Guerra, 2009).

In the context of this global crisis, emerges the Anthropocene, a technical term coined to describe the impacts of human activities on the planet's biogeochemical systems and, consequently, a new geological era on Earth, succeeding the Holocene (Malhi, 2017; Steffen et al., 2007; Steffen et al., 2011). Although publications in the nineteenth century addressed the relationship between humans and the other components of nature (Steffen et al., 2007), the first definitions of Anthropocene and its impacts on Earth began to emerge in the 1980s (Steffen et al., 2011). The term became popular only in 1995, when Paul Crutzen published a series of works discussing the human influence on a supposed new geological era, named Anthropocene (Crutzen, 2002; Moore, 2016; Steffen et al., 2007; Steffen et al., 2011).

The concept of the Anthropocene was formally recognized by the International Union of Geological Sciences (IUGS) in 2017 (Ross, 2020), but it was rejected as epoch by the Subcommission on Quaternary Stratigraphy (SQS) of the International Commission on Stratigraphy (ICS) and the International Union of Geological Sciences (IUGS). The Anthropocene is considered "a major planetary event of Earth system transformation offers a promising way forward" (Edgeworth et al., 2024, p. 1). Geological events can encompass spatial and temporal heterogeneity and the diverse environmental and social processes that interact to produce global environmental changes (Bauer et al., 2021).

Zalasiewicz et al. (2010) identified various ways in which human activity influences the planetary health, including climate changes, ocean acidification, alteration of the phosphorus and nitrogen cycles, loss of stratospheric ozone, changes in land use, alterations in the integrity of the biosphere associated with biodiversity loss, misuse of water resources, presence of water-laden aerosol particles in the atmosphere, and the emergence of new elements of chemical pollution, among others. Recent studies (Elhacham et al., 2020) indicate that the anthropogenic mass now exceeds the total biomass of the planet.

Another aspect that deserves attention is the presence of microplastics (technofossils) on the planet, a trace that can be identified as a hallmark of geological change (Zalasiewicz et al., 2010). These materials are found in the air (Gasperi et al., 2018) and can modify the very chemistry of rocks (Wang et al., 2023). Several studies have demonstrated that microplastics affect the oceans and marine animals (Gola et al., 2021; López-Martínez et al., 2020), as well as ecosystem services (Sridharan et al., 2021), threatening the quality of life on the planet.

These factors draw attention to the limits of the planet, to changes at an unprecedented rate, and to the Sixth Great Mass Extinction (Ceballos et al., 2020; Zalasiewicz et al., 2010). Global processes associated with the Anthropocene are leading to the disappearance or increasing fragmentation of remote wilderness areas, threatening and leaving them unable to sustain themselves.

There is no consensus on the start of the Anthropocene. Some arguments supporting possible starting points include the significant increase in the use of coal after the Industrial Revolution. Some scholars argue that it began with European modernity, in the sixteenth century and the fossil fuel revolution in the second half of the eighteenth century, a period in which work and productivity advanced as never before (Altvater, 2016). Others place its beginnings in the nineteenth century, with the advent of the Industrial Revolution (Crutzen, 2002; Steffen et al., 2007; Steffen et al., 2011). Some point out that between

1450 and 1750, there was a significant transformation of the global landscape, driven by the exploration of the Americas and the advent of capitalism (Moore, 2016). However, authors such as Edgeworth et al. (2024) argue that this debate is irrelevant. Numerous starting points can be identified, small event effects can accumulate and not every emergent event or process has a clearly defined beginning.

Regardless of its precise beginnings, the concept of Anthropocene has rapidly shifted from a geological periodization proposal to a broad multidisciplinary debate (Moore, 2016), that is, from a geological argument to a historical argument. The Anthropocene has been adopted in cultural and political contexts (Malhi, 2017). It is "multi-scalar and manifests on all scales from nano to global. It concerns the future as well as the past. It involves a complex mix of hybrid human-natural processes. It needs social science and the humanities as well as natural science to help understand it" (Edgeworth et al., 2024, p. 3).

In this context, tourism, as an anthropogenic interaction with the environment, suffers negative impacts generated by the environmental crisis and the Anthropocene and also contributes to the panorama of global changes. Examples include the socio-spatial production driven by tourism, the air transport sector's share of responsibility in the environmental crisis. On the other hand, the tourist industry appropriates the idea of "disappearance" in a maneuver typical of "disaster capitalism" (Klein, 2020), a capitalist strategy to exploit crises created by capitalist processes themselves as opportunities for greater accumulation.

Last chance tourism: Anthropocene, planetary boundaries and other threats

The tourist experience and consumption of some regions - such as the Amazon Rainforest, Arctic and Antarctic - are shaped by ingrained imaginaries of "untouched" nature (Moore, 2019), which have proved remarkably strong despite the recognition of environmental degradation in the Anthropocene (Smith, 2023). The imagery linked to 'extinction' is one of the most influential frameworks through which tourists experience the world (Saarinen, 2018). Fletcher (2019) points out that the experience of getting in contact with untouched nature, 'fixed in time', becomes secondary to the experience of witnessing its potential loss.

Although research on the Anthropocene and its intersection with tourism is still incipient, scholarly research in this area has grown, especially after 2019 (Corbari, 2021). This phenomenon partly aligns with the concept of "tourism in changing natural environments", as described by Ooi et al. (2019) and other researchers. Such tourism involves travelers seeking experience and interaction with wildlife and environments at risk of disappearing (Denley et al., 2020). Piggott-McKellar & McNamara (2016) describe this trend as the "search for a last chance experience", while Varnajot & Salim (2024) propose reframing glacier tourism as a form of dark tourism, emphasizing the morbid fascination with vanishing landscapes.

The concept of glacial tourism emerged in the 1990s, within the scope of the press and tourism to describe the increased interest in visiting cold regions of the planet. These regions and their biodiversity are highly vulnerable to climate and environmental changes (Dawson et al., 2011). As highlighted by Lemelin et al. (2012), "tourism of this nature is for all intents and purposes a chance to observe ecocide first-hand".

Nevertheless, the idea of LCT is not restricted to ecological issues or natural environments. Over time, the concept was attributed to other vulnerable sites, including built environments and also cultures - especially indigenous ones - or specific traditions (Dawson et al., 2011; Finastiian et al., 2018). This is exemplified by Finnish Lapland, where anthropogenic tourism has developed around global imaginaries of the wilderness and traditional ways of life (Saarinen, 2018). Another example is Alaska, where native peoples are iconic, if not fundamental, to the experience of almost all tourists to America's "last frontier" - although only 8% of local tours involve natives (Thornton and Wanasuk, 2016). It is worth noting that the very idea of extinction concerns the biological process of species extinction, but also of human cultures, people, and languages (McBrien, 2016) from the process of cultural homogenization.

For Norum and Mostafanezhad (2016), in tourism, the perception of destinations excluded from global integration and their social representations are key signifiers of authenticity, but they also contribute to the discourse of their inevitable incorporation into global capital, compelling tourists to visit a place "before it's too late".

Addressing one of the interfaces between the Anthropocene and tourism, namely the relationship between tourism and climate change, Dannevig and Rusdal (2023) consider that melting glaciers act as charismatic "boundary objects" that trigger the public's emotion and imagination and allow tourism actors to raise awareness about climate change and encourage pro-environmental action. A survey on tourism carried out on melting glaciers, Salim (2023)

suggests three strategies for that touristic activity: the development of geotourism, the use of virtual reality to virtually reconstruct disappearing glaciers, and the transformation of LCT into dark tourism.

However, tourist destinations known for the contemplation of biodiversity, especially those that depend on specific habitats for the maintenance of their fauna, face an imminent threat of obsolescence due to significant environmental challenges. The progression of climate change imposes extinction risks on more than ten thousand species (IUCN, 2019), highlighting that the fish populations and other biological entities are fundamental for the support of trophic networks (Nagelkerken et al., 2023). In addition, more than 17 thousand tree species are threatened by climate change (Boonman et al., 2024). This disruption of ecological balances –which is not only the result of climate change, but also of other vectors– has the potential to trigger a trophic cascade, culminating in significant cascading effects through trophic levels (Dyer and Letourneau, 2013), including the marine food chain (Ullah et al., 2018). These ecological disruptions not only jeopardize biodiversity but also undermine the cultural and economic foundations of communities dependent on these ecosystems.

Species such as the polar bear (*Ursus maritimus*), the emperor penguin (*Aptenodytes forsteri*), the sea otter (*Enhydra lutris*) and ringed seals (*Pusa hispida*) are very important for tourism (Dawson et al., 2009; Jenouvrier et al., 2021). In addition, walruses face pressures due to thawing, but hunting is the main threat (Wiig et al., 2014). The blue whale (*Balaenoptera musculus*), which is the largest animal on the planet. Other endangered species include the Sumatran rhinoceros (*Dicerorhinus sumatrensis*), Parson's chameleon (*Calumma parsonii*), ring-tailed lemur (*Lemur catta*), Kakapo parrot (*Strigops habroptilus*), Komodo dragon (*Varanus komodoensis*) (Walpole & Willians, 2002).

LCT elucidates the intrinsic relationship between biodiversity and geodiversity, emphasizing the connection that these elements share with local cultures and peoples. On the other hand, researchers such as Fletcher (2019) critically address the "end of nature" as a strategy for exploring the landscape and territory and the accumulation of capital. Critics have also labeled this tourism as a short-term marketing ploy aimed at selling more or increasing profits from potentially endangered destinations. "After all, who would want to be the last individual to witness the tumble of the final glacier in Antarctica or Greenland; to observe the last breath of an emaciated polar bear in Churchill, Canada; to step on the last ice of Mt. Kilimanjaro?" (Lemelin et al., 2012).

The notion of disappearing species or changing landscapes has become a commercial strategy (Moore, 2019), leading to the creation of new products and the commodification of new spaces while simultaneously contributing to environmental degradation (Fletcher, 2019). Even ecotourism and sustainable tourism markets —typically seen as "eco-friendly" tourism typologies— have begun leveraging revised spatial imaginaries to brand Anthropocene space, as Moore (2019) points out. The ethical issues related to these types of trips have been discussed and investigated in different places. Denley et al. (2020) point out that there seems to be a misalignment between tourists' pro-environmental values and beliefs and their unsustainable behavior associated with visiting vulnerable destinations.

In this context, some authors, such as Fletcher (2019) claim that LCT is a paradox. Tourists visit a destination because of its possible disappearance status. However, these same tourists contribute to the deterioration of the site or its biodiversity (Dawson et al., 2009; Denley et al., 2020; Eijgelaar et al., 2010) and to the imminent disappearance or alteration of the site, its ecosystem, and its landscape. Figure 1 shows some destinations, such as Antarctica, the Yulong Glacier in China, Jasper National Park in Canada, the Great Barrier Reef in Australia, and the Fox Glacier in New Zealand.

Given these paradoxes, mapping the geographical distribution of last-chance tourism destinations provides

Figure 1. 1A: Antarctica; 1B: Yulong Glacier (China); 1C: Jasper National Park (Canada); 1D: Corals in the Great Barrier Reef (Australia); 1E: Fox Glacier (New Zealand)

Source: 1A - Renato Ramos; 1B - Wang Sougping; 1C - Mateus Oliveira; 1D - Nicole Russo Guerrato; 1E - Igor Gomes.

critical insights into how this phenomenon unfolds spatially. The next section will explore data analysis techniques applied to LCT, focusing on mapping studied areas.

Results

Fifty-five studies were identified that approach and incorporate LCT within their title, abstract, or keywords. The analysis revealed the absence of studies published in Portuguese or Spanish; all selected studies were authored in English. In terms of the object of the study, a diverse range of geographical and thematic areas were identified, including natural elements, protected areas, sites, and both material and immaterial cultural assets (Table 1).

The majority of these studies focus on polar regions, such as Antarctica and the Arctic, as well as Canadian, Russian, Finnish, Norwegian, and North American areas; as well as glaciers in other countries, such as France, Switzerland, Sweden, and New Zealand. This pattern corroborates the findings of Caetano & Menezes (2022), who highlight that the majority of literature in this field of study focuses on ice destinations. The analysis also confirmed that the primary threat to these areas is climate change, which increases the risk for glacial melting (Wang et al., 2020). These findings demonstrate that LCT, much like the Anthropocene, is predominantly associated with climate change and its effects (Corbari, 2021; Wang et al., 2020). In this context, climate change is transforming landscapes and altering mountaineering routes, with significant implications for outdoor activities (Salim et al., 2021). Figure 2 shows the location of the last chance tourism destinations identified in the literature.

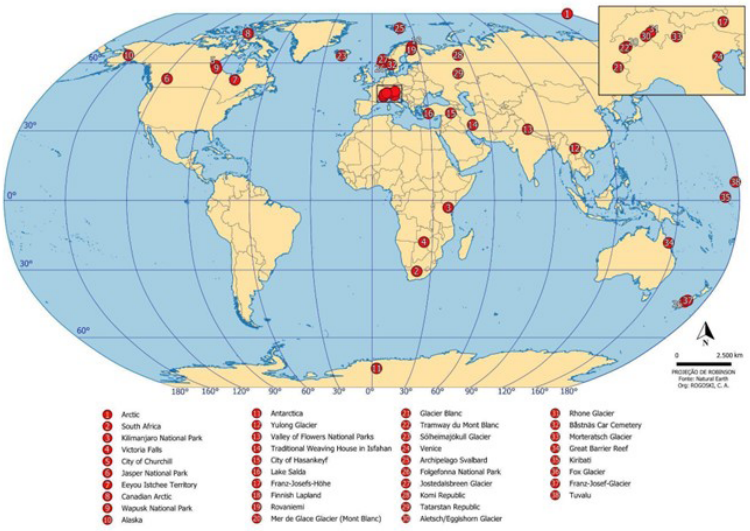
Paradoxically, the intensification of global warming has made accessible areas previously inaccessible, extending the sailing season and potentially increasing the environmental impact of tourism activities (Stewart et al., 2016). As a result, in the next two decades, new routes, such as the transpolar route, could be opened in the Arctic (Huntington et al., 2023). Although this may seem beneficial for tourism in the short term, it is important to consider the adverse impacts on biodiversity, local communities, and indigenous peoples.

Although the glacier retreat in glacial regions is clear evidence of climate change, it also presents an opportunity for the tourism sector to adapt and evolve. However, this adaptation should not be seen as a positive development; rather, it is a pragmatic response to the loss of traditional natural resources. The exposure of previously ice-covered terrains allows the development of geotourism initiatives

Table 1
Last-chance tourism destinations identified in the literature

America, Asia, Europe	Country	Sites	Number of mentions
Africa	Arctic	Arctic	3
	South Africa	South Africa	1
	Tanzania	Kilimanjaro National Park	1
	Zimbabwe	Victoria Falls	1
America	Canada	City of Churchill	9
		Jasper National Park	3
		Eeyou Istchee Territory (Cree people)	1
		Canadian Arctic	1
		Wapusk National Park	1
	United States	Alaska - Arctic	2
Antarctica	Antarctica	Antarctica	3
Asia	China	Yulong Glacier	1
	India	Valley of Flowers National Parks	1
	Iran	Traditional Weaving House in Isfahan	1
	Turkey	City of Hasankeyf	5
		Lake Salda	1
Europe	Austria	Franz-Josefs-Höhe	1
	Finland	Finnish Lapland	1
		Rovaniemi - Capital of Lapland	1
	France	Mer de Glace Glacier (Mont Blanc)	6
		Aletsch Glacier	1
		Glacier Blanc	1
		Nid d'Aigle Station - Tramway du Mont Blanc	1
	Iceland	Sólheimajökull Glacier	1
	Italy	Venice	1
	Norway	Archipelago Svalbard - Arctic	2
		Folgefonna National Park	1
		Jostedalsbreen Glacier	1
	Russian Federation/Komi Republic	Komi Republic	1
	Russian Federation/Tatarstan Republic	Tatarstan Republic	1
	Switzerland	Aletsch/Eggishorn Glacier	1
		Rhone Glacier	1
	Sweden	Båstnäs Car Cemetery	1
		Morteratsch Glacier	1
Oceania	Australia	Great Barrier Reef	2
	Kiribati	Kiribati	1
	New Zealand	Fox Glacier	1
		Franz Josef Glacier	1
	Tuvalu	Tuvalu	2

Figure 2. Geographic location of the last-chance tourism destinations



that emphasize the scientific and educational interpretation of ongoing geomorphological processes (Salim, 2023).

Climate change exacerbates existing social vulnerabilities, as in Eeyou Istchee, where the Cree people engage with ethno-tourism alongside wildlife tourism, particularly focused on polar bears (Lemelin & Dickson, 2012). Although climate change primarily impacts the physical, landscape, and biological characteristics of polar ice caps, these places are not entirely dissociated from the cultural dimension. As Wang et al. (2020) point out, Yulong Snow Mountains hold substantial cultural importance for the ancient city of Lijiang, a UNESCO-recognized cultural and intangible world heritage site. The region's economic and social development is closely linked to the existence of this landscape, making its threatened integrity a cause for concern regarding cultural aspects, such as local identity and heritage.

Alaska is another destination that suffers cultural and natural threats. Thawing permafrost threatens the unique culture of the indigenous Iñupiat of Kaktovik, characterized by subsistence practices such as whaling, which are central to the identity and community activities of the local population. Wilson (2019) investigated how tourists' contact with that culture can evoke moments of admiration and epiphany, suggesting a significant impact on visitors' perception of this culture.

Another destination mentioned in the LCT literature is the Virgin Forest of Komi in the Republic of Komi, Russia; it is one of the largest "virgin" forests in Europe. These areas are especially significant due to their intact biodiversity and preserved ecosystems, which include taiga and tundra. Knyazeva et al. (2023), when mentioning such relevance, also consider that, in addition to threatened ecosystems and landscapes, changes in the natural environment threaten the ways of life of local indigenous communities, such as the Komi. Activities such as reindeer herding, which are important to the local culture and economy, can be affected by changes in the ecosystem. The same occurs in Finnish Lapland, where indigenous peoples have practiced reindeer herding and subsistence hunting for centuries (Saarinen, 2018).

What is observed in most of the cases surveyed is that, although the focus is on biophysical elements, the cultural dimension is closely related and has been greatly affected by global anthropogenic processes. Thus, it is worth noting that the culture-nature dualism, especially when it comes to the idea of an acultural "wild nature", is a Western anthropocentric conception (Fletcher, 2019; Mostafanezhad & Norum, 2019; Saarinen, 2018).

Other studies focus on cultural elements such as the Traditional Weaving House in Isfahan (Finastiian et al., 2018) in Iran and the city of Hasankeyf in Turkey (Çakar & Seyitoğlu, 2023). In the latter, the construction of the Ilısu Dam threatens Neolithic caves, Roman ruins, and statues from the Middle Ages. Therefore, the city of Hasankeyf is characterized as one of the few cases in which disappearance is not linked to climate change, but to other vectors of space transformation.

In the case of the Traditional Weaving House, Finastiian et al. (2018) argue that museums can also be characterized as LTC destinations, since they house and demonstrate ancient, forgotten, or disappeared cultural practices. They argue that these cultural facilities are opportunities for endangered cultural practices and crafts to strengthen their chances of survival.

It is also worth noting that besides biomes, ecosystems, landscapes, and physical environments, some listed destinations are also notable for their fauna, which is threatened by climate change, land use, and other factors. As a result, it is highlighted that some studies evidence these impacts on biodiversity and how groups of people seek to visit these places, mainly because it is their last opportunity to see wildlife (D'Souza et al., 2021; Swartman, 2015). Churchill in Canada earned the nickname "Polar Bear Capital of the World" (D'Souza et al., 2021; Dawson, 2011), corroborating the possible extinction of the species, as highlighted by Dawson et al. (2009). Huntington et al. (2023) conducted a study in the Arctic Ocean and highlighted that the increase in marine traffic can significantly disrupt wildlife, especially mammals and birds, which are sensitive to noise and ships, in addition to introducing new species that can cause an ecological imbalance.

Addressing examples of animals from South Africa, Hoogendoorn (2021) points out that in the context of LCT, certain charismatic species such as white (*Ceratotherium simum*) and black (*Diceros bicornis*) rhinos stand out due to their critical conservation status and tourism value, while lesser-known species do not receive the same attention. The researcher suggests that growing awareness of endangered species could be a driving force behind the development of new tourism opportunities that not only help with conservation, but also promote the region's lesser-known biodiversity such as the African wild dog (*Lycaon pictus*), the African penguin (*Spheniscus demersus*), the blue crane (*Anthropoides paradiseus*) and the bearded vulture (*Gypaetus barbatus*).

The mapping also highlighted vulnerable areas such as Australia's Great Barrier Reef. Piggott-McKellar & McNamara (2016) point out that coral bleaching has aesthetic implications, but is mainly a symptom of rising sea temperatures, negatively affecting the tourist experience and marine biodiversity. Other vulnerable areas identified in the research are small Pacific island countries such as Kiribati (Huebner, 2011) and Tuvalu (Henry, 2019; Prideaux & McNamara, 2012). These territories are extremely vulnerable to extreme weather events and rising sea levels. Tuvalu, in particular, is the country of origin of the first "climate refugees"; although it has little infrastructure and is far from the main tourist destinations, Tuvalu has gained international attention for its vulnerability (Prideaux & McNamara, 2012).

Also related to rising sea levels, Hindley & Font (2015) examine the motivations and values that drive tourists to visit places such as Venice before they disappear. The authors coined the interesting expression "love that leads to an early death", which confirms the visitation paradigm in these locations. They also highlight that personal values, such as self-fulfillment, often take precedence over understanding the environmental consequences of travel, whether in mass destinations or less-visited places. Venice, a UNESCO World Heritage site, is an illustrative example of a place vulnerable to climate change and rising sea levels. In addition, the city is negatively impacted by the high daily flow of visitors. In this context, constructed cultural heritage, including secular monuments and structures, faces significant threats.

Another destination identified in the research is Lake Salda, located in a protected area in Turkey. The risk of the lake's disappearance, or de-characterization, is related to climate change and to other anthropogenic processes, such as the devastation of resources, the construction of dams and reservoirs, the exploitation of groundwater, agricultural activities, mining and other vectors that interfere with its biodiversity, water quality and landscape aesthetics (Kucukergin & Gürlek, 2020).

Finally, Blom and Nilsson (2021) discuss the Båstnäs Car Cemetery. The authors use the term "last chance tourism" to designate the tourist visits to this old junkyard in Sweden. Due to the action of time, the Båstnäs Car Cemetery is in symbiosis with nature and is on its way to disappearing due to the natural deterioration of vehicles. The study allows for reflection on the extent of LCT, which may not be linked to anthropogenic processes.

Moreover, it is noteworthy that the majority of institutions (77,5%) are affiliated with institutions located in countries of the Global North, while only 22,5% are based in the Global South (Table 2). These findings suggest that the geographical location of research institutions plays a significant role in shaping the development of studies on the topic under investigation.

It is also worth noting that Canada (19.4%) has the largest number of institutions among countries in the Global North, followed by Turkey (11.3%) and Australia (9.7%). In the

Table 2
Percentage distribution of institution by region (Global North and South)

Category	Nº of institutions	Percentage of Total (n=160)
North	62	77,5%
South	18	22,5%
Total	80	100%

Global South, the most representative countries were China (44.4%), South Africa (22.2%), and Tanzania (11.1%). This highlights a noticeable gap in research originating from institutions in Latin America, which are absent from the current mapping.

Conclusions

Based on the findings of this research, it is expected to contribute to the ongoing discussions regarding the impacts of anthropogenic actions on tourist destinations threatened by disappearance of these places. The study highlights not only the complexity of the phenomenon but also the importance of a holistic analytical approach that considers the interrelationships between natural and cultural elements within these territories. The analysis reinforces that such impacts are, to a large extent, inseparable and demand approaches that transcend disciplinary boundaries. Moreover, the study emphasizes the paradox inherent in the very logic of visitation sights: while promoting destinations as endangered sites can increase tourism demand, this process of touristification —often driven precisely by the notion of disappearance— may in fact accelerate their degradation. The perception of tourism as a "smokeless industry" and an environmentally "sustainable" activity proves to be fragile when confronted with its negative externalities, which frequently outweigh any claimed benefits.

The mapping carried out indicates that there is a predominance of studies in cold regions, with a focus on the intensification of global warming, subsequent thawing, and impacts on local fauna. It was also found that other studies, although in small numbers, present other anthropogenic factors such as the threat to destinations and attractions, mostly natural. In addition, it was observed that studies focused on the disappearance or de-characterization of cultural assets or cultural practices are less studied in the context of LCT. Nevertheless, the culture-nature dualism does not seem to be absent from the debates, since biophysical impacts threaten the physical and cultural subsistence of countless populations. Another finding is the lack of studies on places in Central and South America, including the Amazon, which has been one of the most important themes of transnational environmentalism since the 1970s (Zhouri, 2006) and is at the top of lists of "destinations to see before they disappear".

The absence of these locations in the research is in line with the findings of Corbari (2021), who found that there is a lack of research in Global South countries and in regions most affected by the impacts of the environmental crisis. Considering the exploratory nature of this research, there are limitations to the method used, given that some famous LCT destinations, such as the Everglades (United States) and the Maldives, were not identified in the mapping process. Therefore, it is important to undertake studies that go beyond the term "last chance tourism" and analyze in depth all publications, including books and book chapters, to provide new subsidies for the discussion on tourism and its interface with the global crisis.

In light of this, the need to broaden the debate on the ethical boundaries of tourism becomes even more pressing, particularly in contexts where the physical and cultural integrity of specific territories is under threat. No form of tourism use or benefit should ever justify or contribute to the degradation or extinction of these places.

Funding acquisition
The first author would like to thank the Postgraduate Program in Geography at Ponta Grossa State University, as well as the Coordination for the Improvement of Higher Education Personnel (CAPES) for the doctoral scholarship awarded.

Conflict of interests
The authors declare no conflict of interest.

Authorship statement
Tatiane Ferrari do Vale: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing.
Sandra Dalila Corbari: Conceptualization, Formal analysis, Methodology, Supervision, Writing – original draft, Writing – review & editing, Validation, Visualization.
Fernanda Karina Haura: Data curation, Investigation, Validation.

Acknowledgments
We would like to thank geologist Mayra Klôh and biologist Juliano Rodrigues Oliveira for their support during the survey. We also extend our thanks to Professor Renato Ramos from the Rio de Janeiro Federal University,

Director of Tourism of Tibet Wang Songping, civil engineer Matheus Oliveira, biologist Nicole Russo Guerrato, and geologist Igor Gomes for providing photos from their expeditions and studies. The authors are also grateful to the Academic Writing Center at Ponta Grossa State University for assistance with English language translation and developmental editing.

Bibliographic references

Altvater, E. (2016). The Capitalocene, or, Geoengineering against Capitalism's Planetary Boundaries. In *Anthropocene or Capitalocene? Nature, History, and the Crisis of Capitalism* (pp. 138-153). Oakland.

Bauer, A., Edgeworth, M., Edwards, L., Ellis, E., Gibbard, P. & Merritts, D. (2021). Anthropocene: event or epoch? *Nature, 597*, 332. https://doi.org/10.1038/d41586-021-02448-z

Blom, T. & Nilsson, M. (2021). Båstnäs car graveyard: A place that seems to live in its own "time and space bubble". *European Journal of Tourism Research, 27,* 1-15. https://doi.org/10.54055/ejtr.v27i.2121

Boonman, C. C. F., Serra-Diaz, J. M., Hoeks, S., Guo, W. Y., Enquist, B. J., Maitner, B., Malhi, Y., Merow, C., Buitenwerf, R. & Svenning, J. (2024). More than 17,000 tree species are at risk from rapid global change. *Nature, 15*(166). https://doi.org/10.1038/s41467-023-44321-9

Bordaworth, M., Bauer, S., Ellis, C., Finney, S., Gill, J., Gibbard, P, Maslin, M., Merritts, D. & Walker, M. (2024). The Anthropocene Is More Than a Time Interval. *Earth's Future, 12*(7), 1-5. https://doi.org/10.1029/2024EF004831

Caetano, C. & Menezes, M. C. (2022). Last Chance Tourism: principais aplicações e consequências para os destinos. *E3 Journal of Economics, Business and Entrepreneurship in the community of Portuguese-speaking countries, 8*(2), 89-105. https://doi.org/10.29073/e3.v8i2.556

Çakar, K & Seyitoğlu, F. (2021). Motivations and experiences of tourists visiting Hasankeyf as a last chance tourism destination. *Journal of Ecotourism, 22*(2), 237-259. https://doi.org/10.1080/14724049.2021.1965151

Ceballos, G., Ehrlich, P. R. & Raven, P. H. (2020). Vertebrates on the brink as indicators of biological annihilation and the sixth mass extinction. *Proceedings of the National Academy of Sciences, 117*(24), 13596-13602. https://doi.org/10.1073/pnas.1922686117

Corbari, S. D. (2021). Tourism, Anthropocene and Capitalocene: the state of the art of scientific production. *Servis v Rossii i za rubezhom [Services in Russia and Abroad], 15*(4), 67-80. https://sciup.org/tourism-anthropocene-and-capitalocenethe-state-of-the-art-of-scientific-140261090

Crutzen, P. J. (2002). Geology of mankind. *Nature, 415,* 23. http://dx.doi.org/10.1038/415023a

Dannevig, H. & Rusdal, T. (2023). Caring for melting glaciers. *Tourism Geographies, 25*(6), 1679-1695. https://doi.org/10.1080/14616688.2023.2278762

D'Souza, J., Dawson, J. & Groulx, M. (2021). Last chance tourism: a decade review of a case study on Churchill, Manitoba's polar bear viewing industry. *Journal of Sustainable Tourism, 31*(1), 14-31. https://doi.org/10.1080/09669582.2021.1910828

Dawson, J., Johnston, M. J., Stewart, E. J., Lemieux, C. J., Lemelin, R. H., Maher, P. T. & Grimwood, B. (2011). Ethical considerations of last chance tourism. *Journal of Ecotourism, 10*(3), 250-265. https://doi.org/10.1080/14724049.2011.617449

Dawson, J., Stewart, E. J., Lemelin, H. & Scott, D. (2009). The carbon cost of polar bear viewing tourism in Churchill, Canada. *Journal of Sustainable Tourism, 18*(3), 319-336. https://doi.org/10.1080/09669580903215147

Denley, T. J., Woosnam, K. M., Ribeiro, M. A., Boley, B. B., Hehir, C. & Abrams, J. (2020). Individuals' intentions to engage in last chance tourism: applying the value-belief-norm model. *Journal of Sustainable Tourism, 28*(11), 1-22. https://doi.org/10.1080/09669582.2020.1762623

Dyer, L. & Letourneau, D. (2013). Can Climate Change Trigger Massive Diversity Cascades in Terrestrial Ecosystems? *Diversity, 5*(3), 479-504. https://doi.org/10.3390/d5030479

Eijgelaar, E., Thaper, C. & Peeters, P. (2010). Antarctic cruise tourism: the paradoxes of ambassadorship, "last chance tourism" and greenhouse gas emissions. *Journal of Sustainable Tourism, 18*(3), 337-354. https://doi.org/10.1080/09669581003653534

Elhacham, E., Ben-Uri, L., Grozovski, J., Bar-On, Y. M. & Milo, R. (2020). Global human-made mass exceeds all living biomass. *Nature, 588,* 442-444. https://www.nature.com/articles/s41586-020-3010-5

Finastiian, M., Farsani, N, T. & Mortazavi, M. (2018). Traditional Weaving House in Isfahan as a museum for promoting last-chance tourism. *Museum Management and Curatorship, 34*(4), 448-461. https://doi.org/10.1080/09647775.2018.1562362

Fletcher, R. (2019). Ecotourism after nature: Anthropocene tourism as a new capitalist "fix." *Journal of Sustainable Tourism, 27*(4), 522-535. https://doi.org/10.1080/09669582.2018.1471084

Francou, B., Ramirez, E., Cáceres, B. & Mendoza, J. (2000). Glacier Evolution in the Tropical Andes during the Last Decades of the 20th Century: Chacaltaya, Bolivia, and Antizana, Ecuador. *AMBIO: A J. of the Human Environment, 29*(7), 416-422. https://doi.org/10.1579/0044-7447-29.7.416

Gasperi, J., Wright, S. L., Dris, R., Collard, F., Mandin, C., Guerrouache, M., Langlois., V., Kelly, F. & Tassin. B. (2018). Microplastics in air: Are we breathing it in? *Current Opinion in Environmental Science & Health, 1,* 1-5. https://doi.org/10.1016/j.coesh.2017.10.002

Gola, D., Kumar, Tyagi, P., Arya, A., Chauhan, N., Agarwal, M., Singh, S. K. & Gola, S. (2021). The impact of microplastics on marine environment: A review. *Environmental Nanotechnology, Monitoring & Management, 16,* 100552. https://doi.org/10.1016/j.enmm.2021.100552

Guerra, S. (2009). A crise ambiental na sociedade de risco. *Lex Humana, 1*(2), 177-215. https://seer.ucp.br/seer/index.php/LexHumana/article/view/27

Henry, T. M. (2019). *Exploring local perceptions on visual media representations of climate change and last chance tourism in Tuvalu* [Thesis to obtain the title of Master in Environment and Society (MEnvSoc), University of Waikato, Hamilton, New Zealand]. https://hdl.handle.net/10289/13307

Hindley, A. & Font, X. (2015). Values and motivations in tourist perceptions of last-chance tourism. *Tourism and Hospitality Research, 18*(1), 1-14. https://doi.org/10.1177/1467358415619674

Holden, A., Jamal, T. & Burini, F. (2022). The Future of Tourism in the Anthropocene. *Annual Review of Environment and Resources, 47,* 423-447. https://doi.org/10.1146/annurev-environ-120920-092529

Hoogendoorn, G. (2021). Last Chance Tourism in South Africa: Future Research Potential? *Tourism: An International Interdisciplinary Journal, 69*(1), 73-82. https://doi.org/10.37741/t.69.1.6

Huebner, A. (2011). Tourism and the (un)expected - A research note. *Pacific Geographies, 36,* 25-28. https://www.pacific-geographies.org/wp-content/uploads/sites/2/2017/06/PN36_Huebner.pdf

Huntington, H. P., Olsen, J., Zdor, E., Zagorskiy, A., Shin, H.C., Romanenko, O., Kaltenborn, B., Dawson, J., Davies, J. & Abou-Abbsi, E. (2023). Effects of Arctic commercial shipping on environments and communities: context, governance, priorities. *Transportation Research Part D: Transport and Environment, 118*(103731), 1-16. https://doi.org/10.1016/j.trd.2023.103731

International Union for Conservation of Nature (IUCN). (2019). *Species and Climate Change.* IUCN. https://www.iucn.org/sites/default/files/2022-04/species_and_climate_change_issues_brief-2019-12.pdf

James, K. L., Randall, N. P. & Haddaway, N. R. (2016). A methodology for systematic mapping in environmental sciences. *Environmental Evidence, 5*(1). https://environmentalevidencejournal.biomedcentral.com/articles/10.1186/s13750-016-0059-6

Jenouvrier, S., Che-Castaldo, J., Wolf, S., Holland, M., Labrousse, S., LaRue, M., Wienecke, B., Fretwell, P., Barbraud, C., Greenwald, N., Stroeve, J. & Trathan, P. (2021). The call of the emperor penguin: Legal responses to species threatened by climate change. *Global Change Biology, 27*(20), 5008-5029. https://doi.org/10.1111/gcb.15806

Kitchenham, B. & Charters, S. (2007). *Guidelines for performing Systematic Literature Reviews in Software Engineering.* Technical Report EBSE 2007-01.

Klein, N. (2010). La doctrina del shock. El auge del capitalismo del desastre. *Revista Invi, 25*(70), 225-227. http://dx.doi.org/10.4067/S0718-83582010000300007

Knyazeva, G. A., Porotnikova, N. A, Antipov, V. V. & Makukha, V. V. (2023). Arctic Tourism as a Driver of Sustainable Development of the Territory: Research of the Interest of Local Stakeholders in the Komi Republic. *Arctic and North, 52*, 152-167. https://www.arcticandnorth.ru/upload/iblock/b35/52_152_167.pdf

Ksenofontov, S., Backhaus, N. & Schaepman-Strub, G. (2017). "To fish or not to fish?": fishing communities of Arctic Yakutia in the face of environmental change and political transformations. *Polar Record, 53*(3), 289-303. https://doi.org/10.1017/S0032247417000134

Kucukergin, K.G. & Gürlek, M. (2020). "What if this is my last chance?": Developing a last-chance tourism motivation model. *Journal of Destination Marketing & Management, 18*(100491). https://doi.org/10.1016/j.jdmm.2020.100491

Lemelin, R. H. & Dickson, G. (2012). Examining the Potential for Wildlife Tourism in Eeyou Istchee, Northern Quebec, Canada. *The Northern Review, 35,* 176-192. https://scispace.com/pdf/examining-the-potential-for-wildlife-tourism-in-eeyou-xyw2lm9cs6.pdf

Lemelin, H., Stewart, E. J. & Dawson, J. (2011). *Last Chance Tourism. Adapting Tourism Opportunities in a Changing World*. Routledge. https://doi.org/10.4324/9780203828939

López-Martínez, S., Morales-Caselles, C., Kadar, J. & Rivas, M. L. (2020). Overview of global status of plastic presence in marine vertebrates. *Global Change Biology, 27*(4), 728-737. https://doi.org/10.1111/gcb.15416

Malhi, Y. (2017). The concept of the Anthropocene. *Annual Review of Environment and Resources, 42,* 77-104. https://doi.org/10.1146/annurev-environ-102016-060854

McBrien, J. (2016). Accumulating extinction: Planetary catastrophism in the Necrocene. In J. Moore (Ed.), *Anthropocene or Capitalocene? Nature, history, and the crisis of capitalism* (pp.116-137). PM Press.

Moore, A. (2019). Selling Anthropocene space: situated adventures in sustainable tourism. Journal of Sustainable Tourism, 27(4), 436-451. https://doi.org/10.1080/09669582.2018.1477783

Moore, J. (2016). The rise of cheap nature. In J. Moore (Ed.), *Anthropocene or Capitalocene? Nature, history, and the crisis of capitalism* (pp. 1-11). PM Press.

Mostafanezhad, M. & Norum, R. (2019). The anthropocenic imaginary: Political ecologies of tourism in a geological epoch. *Journal of Sustainable Tourism, 27*(4), 421-435. https://doi.org/10.1080/09669582.2018.1544252

Nagelkerken, I., Bridie, A., Booth, D. J., Donelson, J. M., Edgar, G. J. & Ravasi, T., Rummer, J., Vergés, A. & Mellin, C. (2023). The effects of climate change on the ecology of fishes. *PLOS Climate, 2*(8). https://doi.org/10.1371/journal.pclm.0000258

Ooi, N., Duke, E. A. & O'Leary, J. (2019). *Tourism in changing natural environments.* Routledge.

Piggott-McKellar, A. E. & McNamara, K. E. (2016). Last chance tourism and the Great Barrier Reef. *Journal of Sustainable Tourism, 25*(3), 397-415. https://doi.org/10.1080/09669582.2016.1213849

Prideaux, B. & McNamara, K. E. (2012). Turning a global crisis into a tourism opportunity: The perspective from Tuvalu. *International Journal of Tourism Research, 15*(6), 583-594. https://doi.org/10.1002/jtr.1883

Ross, S. (2020). Sightseeing the Anthropocene: Tourism, moorland management, and The Hound of the Baskervilles. *Nineteenth-Century Contexts, 42*(4), 449-465. https://doi.org/10.1080/08905495.2020.1782018

Saarinen, J. (2018). What are wilderness areas for? Tourism and political ecologies of wilderness uses and management in the Anthropocene. *Journal of Sustainable Tourism, 27(*4), 472-487. https://doi.org/10.1080/09669582.2018.1456543

Salim, E. (2023). Glacier tourism without ice: Envisioning future adaptations in a melting world. *Frontiers in Human Dynamics, 5*(1137551). https://doi.org/10.3389/fhumd.2023.1137551

Salim, E., Ravanel, L. & Deline, P. (2022). Does witnessing the effects of climate change on glacial landscapes increase pro-environmental behaviour intentions? An empirical study of a last-chance destination. *Current Issues in Tourism, 26*(6), 922-940. https://doi.org/10.1080/13683500.2022.2044291

Salim, E., Ravanel, L. & Gauchon, C. (2021). Aesthetic perceptions of the landscape of a shrinking glacier: Evidence from the Mont Blanc massif. *Journal of Outdoor Recreation and Tourism, 35*(100411). https://doi.org/10.1016/j.jort.2021.100411

Smith, S. P. (2023). The "untouched" frontier: an unsustainable imaginary in the anthropocene. *Journal of Sustainable Tourism, 31*(6), 1430-1446. https://doi.org/10.1080/09669582.2022.2051042

Sridharan, S., Kumar, M., Bolan, N. S., Singh, L., Kumar, S., Kumar, R. & Siming, Y. (2021). Are microplastics destabilizing the global network of terrestrial and aquatic ecosystem services? *Environmental Research, 198*(111243). https://doi.org/10.1016/j.envres.2021.111243

Steffen, W., Crutzen, P. J. & McNeill, J. R. (2007). The Anthropocene: Are humans now overwhelming the great forces of nature? *AMBIO: A Journal of the Human Environment, 36*(8), 614-621. https://doi.org/10.1579/0044-7447

Steffen, W., Persson, Å., Deutsch, L., Zalasiewicz, J., Williams, M., Richardson, K. & Rockström, J. (2011). The Anthropocene: From global change to planetary stewardship. *AMBIO: A Journal of the Human Environment, 40*(7), 739-761. https://doi.org/10.1007/s13280-011-0185-x

Stewart, E. J., Dawson, J. & Johnston, M. E. (2016). Growth and challenges in cruise tourism in Arctic Canada. *Northern Public Affairs*.

Thornton, T. F. & Wanasuk, P. (2016). Indigenous tourism as a sustainable social-environmental enterprise: The political ecology of tourism in Southeast Alaska. In S. Nepal & J. Saarinen, *Political Ecology and Tourism* (pp. 21-38). Routledge.

Ullah, H., Nagelkerken, I., Goldenberg, S. U. & Fordham, D. A. (2018). Climate change could drive marine food web collapse through altered trophic flows and cyanobacterial proliferation. *PLOS Biology, 16*(1), e2003446. https://doi.org/10.1371/journal.pbio.2003446

Varnajot, A. & Salim, E. (2024). The hauntology of climate change: Glacier retreat and dark tourism. *Tourism Geographies, 27*(1), 102-119. https://doi.org/10.1080/14616688.2024.2328607

Walpole, M. J. & Leader-Williams, N. (2002). Tourism and flagship species in conservation. *Biodiversity and Conservation, 11*(3), 543-547. https://link.springer.com/article/10.1023/A:1014864708777

Wang, L., Bank, M. S., Rinklebe, J. & Hou, D. (2023). Plastic–Rock Complexes as Hotspots for Microplastic Generation. *Environmental Science & Technology, 57*(17), 7009–-7017. https://doi.org/10.1021/acs.est.3c00662

Wang, S., Che, Y., Pang, H., Du, J. & Zhang, Z. (2020). Accelerated changes of glaciers in the Yulong Snow Mountain, Southeast Qinghai-Tibetan Plateau. *Regional Environmental Change, 20*(38), 1-13. https://link.springer.com/article/10.1007/s10113-020-01624-7

Wiig, Ø., Born, E. W. & Stewart, R. E. (2014). Management of Atlantic walrus (Odobenus rosmarus rosmarus) in the Arctic Atlantic. *NAMMCO Scientific Publications, 9,* 315-341. https://doi.org/10.7557/3.2855

Wilson, T. K. (2019). *Last Chance to See? Motivations and Outcomes of Last Chance Tourism Experiences in Arctic Alaska* [Thesis to obtain the title of Master in Science Parks, Recreation, and Tourism Management, Clemson University, South Carolina, United States].

Zalasiewicz, J., Williams, M., Steffen, W. & Crutzen, P. (2010). The New World of the Anthropocene. *Environmental Science & Technology, 44*(7), 2228-2231. https://doi.org/10.1021/es903118j

Zhouri, A. (2006). O ativismo transnacional pela Amazônia: Entre a ecologia política e o ambientalismo de resultados. *Horizontes Antropológicos, 12*(25), 139-169. https://doi.org/10.1590/S0104-71832006000100008