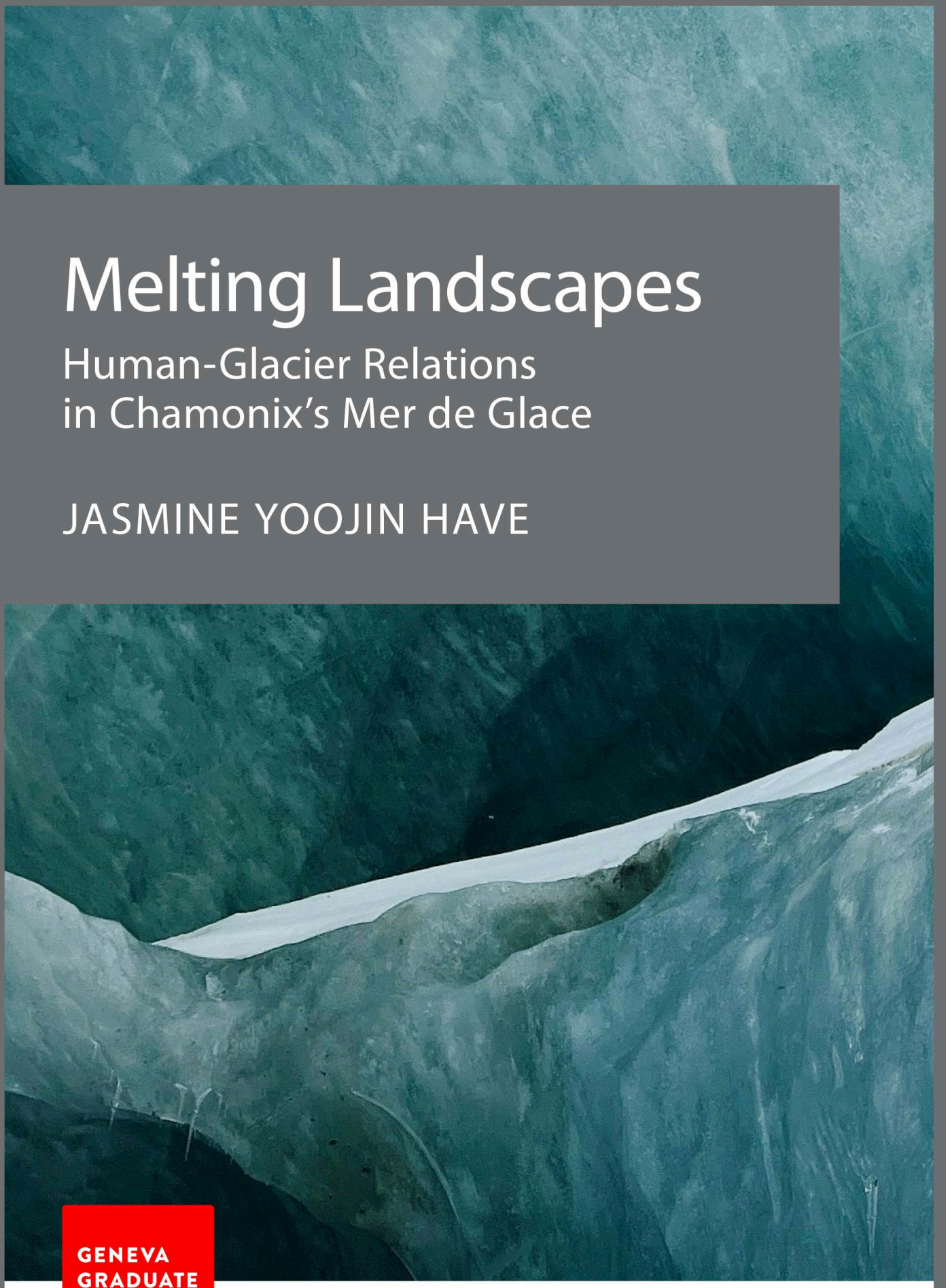

Melting Landscapes

Human-Glacier Relations in Chamonix's Mer de Glace

JASMINE YOOJIN HAVE

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ABSTRACT

This paper constitutes a comprehensive exploration of alpine glaciers. It is an anthropological inquiry delving into the socio-cultural dimensions of glacial retreat and melt, as part of the broader phenomena of environmental and climate change, in two regions of the French and Swiss Alps. Ice has been a formidable force throughout history, shaping the Earth and challenging humanity's capacity to thrive in its presence. However, recent years have witnessed Earth's rapid deglaciation due to human-induced factors like fossil fuel emissions, accelerating the disappearance of monumental glacial structures worldwide.

By being particularly attentive to the Mer de Glace glacier in Chamonix, the paper seeks to understand what emerges as glaciers in Europe's alpine regions retreat and disappear. As glaciers melt, it raises intriguing questions about what new markings are being created in the landscape and how they are either obscuring or erasing once meaningful features or leaving them open to new meanings and assemblages. The research takes deep inspiration from Anna Tsing's work on socioecological emergence in landscapes shaped and disturbed by capitalist processes, to ask what new socialities might emerge in a landscape characterized by melt and loss.

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JASMINE YOOJIN HAVE

Jasmine Yoojin Have holds a master's degree in Anthropology and Sociology from the Graduate Institute of International and Development Studies. Her dissertation –Melting Landscapes: Human-Glacier Relations in Chamonix's Mer de Glace– was recognized with an Honourable Mention Award. Jasmine's research delves into the intricate dynamics of human-nature interactions in the context of environmental change, a subject that continues to inform and inspire her professional pursuits. Currently, she is advancing her career in the international development sector at the United Nations Educational, Scientific and Cultural Organization (UNESCO) in Paris, France.

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1. Introduction

1 Ice has been a formidable force throughout history, shaping the earth and challenging humanity's capacity to thrive in its presence. Its icy grip has inspired both fear and respect, as it has the power to bring life to a standstill and lay waste to entire communities. Nevertheless, over the past few years, earth has been undergoing a process of deglaciation - the melting of ice sheets (Salim, 2023). It is a process exacerbated by human activities such as burning fossil fuels, which releases atmospheric greenhouse gases and contributes to global warming. As a result, giant glacial structures around the world are vanishing before our very eyes (Salim, 2023). And as glaciers melt into slow archives, ice has taken on a new, urgent meaning. It has become a symbol of the rapid changes taking place on our planet, a chronometer of the precariousness of our current moment. No longer a passive force to be contended with, ice now demands our attention and action as it reveals the true extent of our impact on the natural world.

2 On New Year's Day 2023, I found myself in the Rhône Alps in France witnessing the thermometers reach 20.2 degrees Celsius. It was yet another record-breaking heatwave, the highest ever January temperatures recorded north of the European Alps (France24, 2023). Amidst the heat and the sparse snowfall that blanketed the region's grassy terrain, my attention was drawn to the shrinking glaciers. Since 1850, glaciers in the Alps have lost between 30 and 40 per cent of their surface area and half of their volume, with a further 10 to 20 per cent of their volume having disappeared since 1980 (Salim, 2023). According to glaciologist Luc Moreau, the Mer de Glace, the largest glacier in the French Alps, ‘is melting at the rate of around 40 meters a year, and over the past two decades it has lost 80 meters in depth’. Glacial melt in the French Alps, exposing new rock, has also led to the installation of metal staircases and ladders for easier access to glaciers. Moreover, new estimates predict a continuing decrease in ice volume across Central Europe. As of 2017, it is predicted that the ice volume could drop by a staggering 33 to 60 per cent before the year 2100 (Bosson et al., 2019). These figures align with the two representative concentration pathway scenarios established by the Intergovernmental Panel on Climate Change (IPCC): Scenario 4.5 and Scenario 8.5 (IPCC, 2018, as cited in Bosson et al., 2019). The implications of these forecasts are profound, expecting a significant number of glaciers to melt into disappearance, including the

Mer de Glace. These changes within the Mer de Glace's landscape have garnered significant attention due to its accelerated rates of disappearance (Salim et al., 2021).

3 The unruliness of nature becomes ever-more present as the world faces increasingly intense floods, powerful storms and melting glacial formations. This era, which some might call the 'Anthropocene', has shifted the worlds of human and sentient beings, mountains, glaciers, rocks, and other socially agentive entities. (Berglund et al., 2019; Tsing, 2012). Icelandic author Andri Snaer Magnason (2021) captures the situation's urgency by highlighting how glaciers, which took aeons to form, now disappear within a single human lifetime. Moreover, as these types of global disasters dominate our mediated worlds as never before, Kaplan argues that they may also give rise to experiences of 'pre-trauma' (2020, 81). She suggests that pre-trauma encompasses both collective and personal experiences of the detrimental implications and concerns of our world and existence. However, the fate of glaciers and the possibility of an iceless world are *uncertain*. Describing it as a crisis may be seen as a 'blind spot' as Janet Roitman argues, suggesting that this perspective 'regulates narrative constructions' and selectively allows some questions while foreclosing others (2012, para. 44). Similarly, Jackson argues that 'narrating glaciers as climate change ruins normalises and predetermines a glacier-free world not yet in existence while reducing the range of imaginable climate change-influenced futures' (2015, 479). While the spread and intensity of such narratives serve as important reminders, I resist the inclination to succumb immediately to narratives of decay and dread. As Anna Tsing writes, 'Our time is the "Anthropocene," the age of human disturbance. The Anthropocene is an era of mass extinction; we must not forget that. Yet the Anthropocene is also an era of *emergence*' (2012, 95, italicised by author). Building on this, my study takes on this suggested framing. I expand my perspective to explore what new socialities might emerge in a landscape characterised by melt and loss. As I delve into the disturbed and transformative landscape of the Mer de Glace, my research is driven by key questions that illuminate the forms of human-nature interactions and assemblages unfolding within this context. These questions shape the core of my work: How do people in the landscape experience and dwell in a place that is being transformed so profoundly? What new assemblages, representations and meanings emerge through these encounters? What kinds of futures are being imagined and envisioned within these shifting socioenvironmental landscapes? By addressing these questions and focusing my study on the Mer de Glace landscape, I aim to shed light on the complex interactions and responses that arise in the face of environmental change. It thus seeks to contribute to a growing body of research on climate change and human-environment interactions and deepen our understanding of the potential pathways within these transforming landscapes.

Mapping the Chapters

4 A study on glacier landscapes is an expansive space involving the past, present and future relations between people and ice (Thompson, 2017). Before situating my research on the Mer de Glace context, the study will provide a comprehensive review of the historical and cultural significance of glaciers more broadly. It aims to shift the lens from glacial landscapes as mere visual scenery or material backdrop to understanding them as cultural phenomena deeply intertwined with the lives and experiences of their inhabitants. This exploration sets the stage for understanding the Mer de Glace

landscape. Drawing on Tim Ingold's ‘dwelling’ perspective and more-than-human anthropology, the following chapter establishes a conceptual framework that emphasises the dynamic and interconnected nature of the glacier landscape. Methodology and positionality are discussed before delving into the analysis in Chapter 5, *Activities and Encounters on a Melting Landscape*, which explores the transformative impact of ice melt on human engagements and activities in the Mer de Glace. Chapter 6, *The Ghostly Temporalities of the Mer de Glace,* examines the temporal dimensions of the changing landscape. By focusing on notions of memory and remembrance, I explore how the evolving nature of the landscape urges a sense of future imaginative thinking. In Chapter 7, *Beyond the Glacier’s Ends: Commodifying Disappearance*, Mer de Glace's tourism industry and the emergence of geotourism are analysed to illustrate how future imaginaries are brought in and actively pursued within the melting landscape. Finally, the last chapter, *The Speculative Times of Glaciers: Future Imaginaries,* explores creative art practices and their diverse engagements with the topic, showcasing the multitude of possibilities for interacting with melting ice.

2. Beyond Surface Aesthetics and Towards Cultural Meanings of Glaciers

1 Glaciers have held a central position in alpine culture due to their significant roles ‘as reservoirs for drinking water and power generation, as raw materials for commerce (in the time before refrigeration), as tourist destinations, as visible markers of environmental change, and as repositories for lost souls’ (Strauss, 2016, 167). In recent times, they have increasingly come to embody new social meanings, particularly as the most visible manifestation of anthropogenic climate change (Carey, 2010). While there is general agreement among scientists that glaciers worldwide are retreating, they have primarily been discussed, documented, and described in technological or scientific terms (Gagné et al., 2014). Glaciers have thus come to be understood by the articulations of their melt and loss in numbers and percentages. Moreover, Marin and Berkes (2013) highlight the discrepancy between media discourses surrounding climate change and local observations, often presenting a more globalised and less holistic narrative. Media coverage tends to label glaciers within a crisis narrative, particularly in the context of their shifting landscapes, emphasising urgency and sensationalism (Gagné et al., 2014; Marin & Berkes, 2013; Jackson, 2015). This sensationalist narrative often overlooks the nuanced complexities of these environmental transformations. In response to this phenomenon, Gagné, Rasmussen and Orlove propose the necessity of ‘place-based research [...] to discuss global environmental phenomena such as glacier recessions’ (2014, 793), which is helpful to build ‘a vocabulary that captures the subtle changes in people’s engagement with their environment’ (2014, 804). Following this, Mark Carey (2010) conceptualises glaciers as cultural landscapes, asserting that they are not solely geological and environmental features but also cultural artefacts that carry significant meanings and values for human communities. Correspondingly, Gagné et al. underscore that ‘as elements of the landscape, glaciers are strongly integrated to various societies around the world in ways that exceed their role as a provider of fundamental sources of water’ (2014, 793). The following section will explore the hidden depths of the often-overlooked complexities of glaciers more broadly and review their historically and globally circulating ideas and meanings. By going beyond

surface aesthetics, I will unravel the cultural significance and symbolism of glaciers, providing insights into their meaning beyond their physical attributes. While glaciers exist in various locations worldwide, the study's focus is on alpine glaciers more specifically.[1]

2 Until the eighteenth century, European glaciers were perceived as dangerous and inhospitable environments (Schrey, 2020). Early depictions of high-altitude landscapes reflected the unfavourable nature of these places. For instance, this is evident in the eerie and mysterious quality captured in some of William Turner's paintings of the Mer de Glace in 1812. These perceptions were further fuelled by the glacier's liquefying nature, which posed various perceived threats to nearby communities. The archival review conducted by Zumbühl and Nussbaumer (2018) reveals the destructive impact of the Mer de Glace's advancements during the sixteenth century on two nearby hamlets, Bonanay and Le Châtelard. From 1601 to 1610, the glacier advanced by 75 to 150 metres per year, resulting in significant disruption to cultivated lands in the Chamonix region. The substantial ice advancements during the Little Ice Age[2] (LIA) even prompted a religious procession in May 1644 to bless the glacier, underscoring the perceived dangers it posed to the surrounding communities (Zumbühl & Nussbaumer, 2018).

3 The periods of Enlightenment (seventeenth to eighteenth century) and Romanticism (late eighteenth to early nineteenth century) witnessed a shift in the cultural understandings of glaciers (Stibbon & Ferran, 2021). Once regarded as uninhabited, terrifying, and potentially deadly landscapes, they became intertwined with a captivating allure, drawing the interest and fascination of many (Carey, 2007; Vincent, 2021). This cultural movement emphasised the significance of the alpine regions' emotional experience and individual imagination, fostering a heightened awareness of the sublime in nature (Stibbon & Ferran, 2021). These regions were seen as embodying an untouched and untamed wilderness, disconnected from the mundane world, and offering a gateway to the divine. Depicted in the paintings of a prominent German Romantic painter, Caspar David Friedrich, the romanticised remoteness of the glacier landscape also evoked a profound sense of timelessness. The static idea of glaciers and high mountain regions arises from representations of its frozen wastelands and nature as a lifeless and motionless backdrop. It is as if the imagination can only wander into an eternal realm beyond the confines of ordinary existence (Stibbon & Ferran, 2021; Vincent, 2021).

4 Within the alpine context, the fascination with glaciers was not only driven by their aesthetic appeal but also rooted in a scientific obsession. This scientific pursuit was notably fuelled by initiatives in Switzerland, where pioneering work by Louis Agassiz and Johann von Charpentier significantly contributed to understanding alpine glaciers (Zumbühl & Nussbaumer, 2018). Their innovative investigations and observations sparked a strong interest in glacier studies among European geoscientists, resulting in what can only be described as a 'glacier fever' at the time (Nüsser & Baghel, 2014, 139). Parallel with glacier scientific explorations, another trend was on the rise: alpine tourism and recreational pursuits within these landscapes. In the 1920s and the 1930s, alpine sports and tourism experienced a considerable upswing in popularity across Europe (Agrawala, 2007; Zumbühl & Nussbaumer, 2018). This trend can be attributed to the significant advancements and innovations in transportation technologies. Accessing these high-mountain regions became much easier and quicker. In addition, the widespread dissemination of photographs, films, and travel literature pertaining to high-mountain regions, highlighting their natural wonder, fuelled interest in tourism

(Barker, 1982; Salim et al., 2021). This burgeoning trend was not necessarily confined to the winter months, traditionally associated with alpine tourism (usually between January and March) (Barker, 1982). Glacier tourism became highly popular in the summer months as well. This shift transformed glaciers into significant 'actors of national economies' (Gagné et al., 2014, 799). Gagné et al. (2014) note that tourist activities, including sightseeing and sports such as skiing and hiking, have allowed people to engage with glaciers in closer proximity, challenging past taboos in societies where glaciers were considered sacred or fearful. These mobilisations transformed the perceptions of these landscapes as they became increasingly understood through the tourism lens as cultural constructs with aesthetic and recreational value (Gagné et al., 2014).

5 Today, a number of scholars have highlighted how the cultural valence of glaciers is undergoing a transformative change due to the increasing vulnerability to human-induced climate impacts (Cruikshank, 2007). In *Darkening Peaks: Glaciers Retreat, Science and Society*, the book opens with an intriguing parallel between glacial retreat and the 2001 destruction of the Twin Towers, highlighting the prominence in the global perceptions of our built environment (Orlove et al., 2008). Much like the prominent infrastructural design of the World Trade Centre, glacial ice formations in the natural environment play a similar role, and their disappearance exerts a similar emotional impact. As such, the melting Alps have taken on an alarmist rendering, with research uncovering concerns about their retreat and the consequential risks of flooding disasters and disruptions to global water cycles. For instance, in the public lecture, *Of Flood and Ice*, held by the Society for the Humanities, two anthropologists, Cymene Howe (2019, 2022a) and Dominic Boyer (2022), were invited to speak about their research. Howe's research focuses on Iceland's melting glaciers, while Boyer delves into the experiences of Hurricane Harvey flood victims in the United States. Together, their collaborative work offers a fascinating insight into the interconnectedness of a global water system and the significant implications of glacier melt on sea level rise. Howe's (2022b) concept, 'hydrological globalisation', illuminates the social-material dimensions of ice and how its dynamic force is altering landscapes, disrupting ecosystems, and posing sociocultural challenges at local, national and global levels. As glacier melt transfers its once-frozen water to the swelling oceans, it is giving rise, quite literally, to a multitude of cultural impacts that extend beyond localised regions on a global scale. The romanticised depictions of alpine glaciers in nineteenth century paintings, which once evoked a sense of mystical admiration, now starkly contrast with the contemporary reality of the risks associated with glaciers. Today, glaciers worldwide are being draped with white cloths to preserve their melt, symbolising a limited visibility that has 'given way to the Alpine ecosystem's emblematic vulnerability' (Schrey, 2020, 152). Within this framework, glaciers have taken on an understanding of a newly appreciated animacy, which echoes earlier European framings of ice as villainous and mischievous. Only this time it is rooted in their retreat and melt rather than their advancements.

6 Mark Carey denotes how climate change has led to the recognition of glaciers as an 'endangered species' (2007, 519). Beyond their vulnerability, glaciers have also emerged as legitimate nonhuman entities that evoke public expressions of grief, signalling a change in our emotional connections with the natural world under climatic change. An illustrative example is the funeral held in 2019 commemorating the life of the disappeared Icelandic glacier Okjökull. The funeral, an act customarily reserved for the

‘living’, exemplifies the complexity of our response to the more-than-human world and its impact on us. In response to such losses, these practices indicate a captivating notion of granting personhood to glaciers, making them ‘grievable’ entities (Butler, 2004). However, Jeremy Schmidt (2021) cautions against analogies that treat glaciers as endangered species, as they might reinforce narratives that prioritise the preservation of certain landscapes based on their perceived value or significance to specific groups of people. As such, she expands on the idea of ‘loss’ within the context of glacier melt and their potential disappearance. Schmidt builds on Julie Cruikshank’s arguments, which underscore that glaciers have ‘interdependent relations with humans that also explain the contingent behaviour of glaciers’ (Schmidt, 2021, 293; Cruikshank, 2012). This perspective highlights that various types of loss can be experienced within these human-glacier interdependent relations. Some of these losses may be difficult to identify or fully comprehend, highlighting the need to expand our understanding of these complex dynamics. For instance, Cruikshank's (2007) detailing of Athabascan, Tlingit, and Eyak philosophies pertaining to glacial sentience and the long-held belief that glaciers are social actors that change physical, social, and spiritual landscapes is illuminating. This loss cannot be adequately captured by metrics such as ice melt and surface area exposure but testifies to the connections between ice and the lives of other species.

7 Other place-based research has explored the interdependent relations between glaciers and humans. Hayman et al. (2018) explore Tlingit and Tagish relationships with glaciers and their deep oral histories with these landscapes. Glaciers emerge as powerful entities within these oral traditions that have shaped the human and nonhuman world throughout history. The authors highlight how these oral traditions reveal glaciers as ‘sentient beings; glaciers that listen, glaciers that can smell, glaciers with attitude’ (2018, 80). They propose that such narratives provide an ‘alternative ontological water consciousness’ (ibid., 79) as they disrupt, challenge and redesign conventional understandings of the place of humans in the world. As they contend, ‘these understandings reflect a close observation of earth's own time that inscribes the human and nonhuman, and not necessarily an earth scripted solely by humans’ (ibid., 80). Such an ecologically interconnected perspective on human-glacier relations has the potential to inform and imagine contemporary international discourse on water ethics, law, governance, and management (Hayman et al., 2018).

8 In India’s northernmost state, Uttarakhand, lies the Gangotri-Gaumukh glacier, which is deeply identified with the deity of the Ganga River it feeds. Drew (2012) explores how Hindu practices and regional cosmology orientations imbue dynamic bodies of water and ice with distinct religious and cultural meanings, and how they are perceived as having varying levels of agency. The glacier, which has been receding for the last 200 years, and the water that flows from it have given rise to divergent views on the changes in the landscape. As a result, it is widely assumed that the glacier’s retreat is the consequence of Ganga's discontent caused by immoral human deeds such as pollution or moral corruption. The links between ice and morality erode the distinction between nature and culture, between glaciers and society, making such distinctions insignificant (Drew, 2012; Gagné et al., 2014).

9 For some South Tyrol villages in the Italian Alps, receding glaciers are attributed to various sorts of disruption caused by humans, including the use of technologies and practices associated with the ski industry. This growing concern about the ‘health’ of the glaciers reflects a deep-seated understanding of these landscapes as entities

capable of experiencing and responding to environmental changes. Additionally, Brugger et al. (2012) reveal how the glacier near the Stilfs municipality was the site of major combats during WWI, retaining valuable repositories of artefacts, stories, and memories that form an integral part of the community's collective history, identity and emotions. The potential loss of the glacier has led to the community's worries about preserving these deep cultural and historical elements tied to the region's past.

10 Glacier tourism around the world, including those in the Andes (Vergara et al., 2007), the Alps (Smiraglia et al., 2008) and China (Wang et al., 2010) has experienced reductions and even relocations as the landscape slowly transforms. The future impact of glacier retreats on tourism industries remains uncertain, as it is highly dependent on the specific touristic resources that may be affected by changes in the landscape. However, these changes are not limited to a reduction in ice cover but also include shifts in seasonality and accessibility (Scott et al., 2007). Safa (2019) examines these changes in the glacier landscapes of Peru's Cordillera Blanca. The impact of glacier retreat and its reducing ice coverage, have led to concerns being raised about the sustainability and authenticity of glacier tourism. Additionally, glacier melts and the changing cryosphere create new environmental realities characterised by various forms of natural hazards, including landslides, floods and avalanches. Local economies, particularly in the tourism and agriculture sectors, are significantly impacted by these hazards (Huggel et al., 2015). According to Carey's study (2010), the tourism industry in the Cordillera Blanca region experienced a significant decline not only because of its reduced ice but due to the increase in the perceived hazard risk related to the changing glacier landscape. The infamous mountaineering routes in the Mont-Blanc massif, renowned as the birthplace of mountaineering, are also under threat. The increased exposure of bedrock and steepening glacier slopes has resulted in several instances of rockfall, necessitating alternations to the course of these itineraries (Mourey et al., 2019).

11 Moreover, in the glacial regions of Austria, Nöbauer illustrates how the ski resort town of Sölden is grappling with the changes in its landscapes, especially within the tourism sector. Its impacts on the sector's workforce encompass dwindling job security, regional economic instability and even their sense of individual and regional identity. For example, skiing is a form of 'embodied knowledge' that is primarily conceived as 'a significant marker of regional difference in Austria' (2022, 229). However, the glacial melt has significantly limited the opportunities and accessibility for such identity performances. Communities around the world are taking a range of different approaches to adapt to these shifting conditions. Elixhauser (2015) explains how South Tyrol mountain communities are focusing on practical measures, such as changing agricultural practices or investing in renewable energy. Others are turning to more spiritual or cultural practices to cope with the loss and uncertainty associated with melting glaciers. For example, some people in South Tyrol are incorporating traditional Alpine folk songs into their responses to climate change to celebrate and preserve the region's cultural heritage.

12 Carey, French and O'Brien note how discussions surrounding glacier retreats have mainly focused on negative future scenarios, driven by the 'high confidence' in the detrimental impacts on global water systems (2012, 181). However, contrary to this narrative, several studies suggest that glaciers also present new opportunities despite their melting. As an example, glacier meltwater is feeding into hydropower infrastructures. In Norway, where 98 per cent of the electricity is generated from

hydropower, 15 per cent of that comes specifically from glacier watersheds (Gagné et al., 2014). Moreover, while different perspectives exist regarding the consequences of these practices, it is worth noting that melt has also exposed a new avenue of accessibility to lucrative resources. As a result, mining companies from various parts of the world are now actively pursuing extraction operations, envisioning a future where these newly accessible landscapes hold a newfound value (Blanchard, 2019).[3]

13 Glacier tourism is also responding in intriguing ways to the shifting and disappearing landscape. In the case of the Baishui Glacier No.1 in China's Yulong Snow Mountain terrain, there have been cautious efforts to invest in more environmental protective measures within the tourism industry. Wang, He and Song (2010) note the changes in local modes of transportation, for example, which are aimed at providing more scenic observations while expanding the use of environmentally friendly vehicles. The transformed landscape, shaped by the melting processes, represents an opening to a realm of untapped possibilities for various stakeholders. This transformation signals a shift towards a landscape where new forms of value can emerge. Within my exploration of the Mer de Glace, I will illustrate how the inherent value of its vanishing landscape has been harnessed through the creation of tourism products.

14 These explorations demonstrate that glaciers are not merely natural landscape features distinct from human existence. As their icy peaks face rapid transformations worldwide, their interconnectedness with human communities and dynamic relationships become ever more apparent, necessitating further investigation. The following section will delve into the unique characteristics of the Mer de Glace landscape and the circumstances surrounding its melting, setting the stage for my ethnographic analyses.

Situating Human-Glacier-Melt Explorations: Chamonix’s Mer de Glace

15 Having reviewed, more broadly, different cultural understandings of glaciers, I will now contextualise my research within the setting of France’s largest glacier, the Mer de Glace, where I conducted most of my fieldwork.[4] Nestled within the Haute Savoie Department of the Auvergne-Rhône-Alpes region, the French municipality of Chamonix-Mont-Blanc has a population of approximately 9,000 inhabitants (Salim et al., 2021). The town is surrounded by a high-altitude landscape, bordered by the Mont-Blanc chain, the highest peak in Western Europe soaring to an impressive 4,819.45 metres (Nussbaumer et al., 2007). The glacial valley stretches approximately 17 kilometres from its northernmost point at Col des Montets to the Taconnaz torrent. Enveloping this landscape is a body of ice, covering approximately 32 square kilometres, with elevations ranging from 1,500 to 4,000 metres above sea level (ASLASL). Standing out among this landscape is the renowned Mer de Glace glacier, the longest and largest in the French Alps (Nussbaumer et al., 2007; Salim et al., 2021).

16 During the LIA, a period characterised by widespread cooling roughly between 1300 to 1850AD, where average global temperatures decreased by up to two degrees Celsius, the glacier reached the bottom of the Chamonix valley, at 1000 metres ASL (Nussbaumer et al., 2007; Zumbühl & Nussbaumer, 2018). During this period yhe lower flanks of the Mer de Glace were called Glacier des Bois, named after the small village (Les Bois) that the glacier used to reach below. Today, the Glacier des Bois has completely disappeared

(Zumbühl & Nussbaumer, 2018). The Mer de Glace is a retreating body of ice. Since the beginning of the twentieth century, its ice thickness has decreased significantly by 23 per cent, and since 1860 it has reduced in length by 1.5 km (Salim et al., 2021, 1979). Salim et al (2021) measured the ice thickness at the Montenvers site between 1986 and 2020, which has decreased by 140 metres.

17 In 1781, the glacier in the valley was named 'Mer de Glace' ('Sea of Ice') by two English aristocrats, William Windham and Richard Pockcoke. The Montenvers-Mer-de-Glace subsequently became the first glacier tourist site in France and has remained a well-visited location, attracting people from all over the world. In the Montenvers site, a viewpoint at 1913 metres ASL allows visitors to enjoy a panoramic view of the glacier's terminal tongue and surrounding peaks, the Aiguille des Drus. The Montenvers site offers access to the Grotte de Glace, an ice cave specially carved out to provide an immersive experience within the glacier itself. To reach the cave, visitors can use a cable car service from the viewpoint, conveniently located next to the Montenvers railway station. After the cable car journey, visitors ascend a flight of stairs to reach the entrance of the cave. The Grotte de Glace also serves as a terminal point for those who have completed the Vallée Blanche skiing route. Skiers often remove their skis here before ascending towards the Montenvers railway station. From there, the Montenvers train departs every thirty minutes, providing transportation back to Chamonix, located down in the valley. There are other points of interest in Montenvers. For instance, the Grand Hotel du Montenvers and its accompanying restaurant invites guests to stay or dine while enjoying the unique view of the Mer de Glace. It advertises itself as a nice stopover for those visiting the Mer de Glace, and also a historical monument built in 1880 around the time when mountaineering and tourism gained significant traction. The hotel is described in the Mont-Blanc Natural Resort website as displaying 'a sober granite façade, dotted by many small windows. It is inside these walls that the history and the soul of the place are revealed, the echoes of epic writers, mountaineers and adventures of the late nineteenth century that contributed to its legendary story' (n.d.). Next to the refuge is the Glaciorium, a glacier interpretation centre which opened in 2012.

18 On 20 March I began my journey to the Mer de Glace by taking a bus from Geneva, Switzerland. The two-hour journey took me from the shores of Lake Geneva to the high-altitude and mountainous regions of Chamonix. The landscape captivated those around me, snapping pictures and documenting the topography that unfolded before us. The anticipation grew as we neared the centre of Chamonix, where the rich culture of mountain activities manifested itself in various ways. People wandered around the centre in their ski boots and held their skis over their shoulders. The town also thrived with a myriad of establishments such as sports stores, ski rentals, and tour guide centres catering to outdoor pursuits. It was evident that Chamonix's cultural fabric is intricately interwoven with the thread of mountain life. However, it was the ubiquitous presence of imagery depicting Mont Blanc's glacial strip that attracted my close attention, particularly those featuring the Mer de Glace depicted in postcards displayed outside some of Chamonix's bookstores. The series of images of the glacier possessed an almost extraterritorial quality that presented these topographies as so seemingly remote, venerating its compositional power with awe (see figures 2 and 3). These observations got me wondering about what was awaiting at the summit. Upon reaching Montenvers the spatial understanding of these awe-inspiring shapes and forms seen in the postcards was almost immediately disturbed by a disconcerting sight: the sight of

melt, disappearance, and the accumulation of dirt (Figure 4). This scenery shifted the perceived grandeur of the glacier.

19 The glacier's proximity to human settlements made it impossible to not notice its striking landscape, which, historically, captivated the attention of many. As a result, there exists a rich array of early and well-documented records of the Mer de Glace offering intriguing insights on the glacier's evolution (Kuhn, 2006; Salim et al., 2021). Early tourism pamphlets and promotional material, for example, offer a unique perspective on public perceptions and representations of the Mer de Glace throughout history (Salim et al., 2021). The glacier's dynamics were also recorded through scientific monitoring initiatives as early as in the eighteenth to nineteenth centuries (Kuhn, 2006). Additionally, a significant body of artworks has been dedicated to depicting the landscape of the Mer de Glace. For instance, Swiss artist Samuel Birmann (1793–1847) created several artworks that vividly illustrate the immense proximity and scale of the glacier as seen from the valley. His 1823 piece, 'Au village des Prats' (Pencil, pen, watercolour, opaque white, 44 × 58.3 cm, Basel, Kunstmuseum, Kupferstichkabinett), exemplifies this striking perspective. Moreover, written sources from early visitors also provide unique observations of how the landscape was experienced, shedding more light on the glacier's characteristics. For instance, captured prominently on the walls inside the Glaciorium is a quote by William Windham: 'Imagine a lake agitated by the sudden arrival of a bitter North wind.' Windham's words provided a captivating metaphorical description of the grandiosity of the Mer de Glace landscape as it was in 1741. It evokes a palpable imagery of a turbulent body of water held in a frozen state by the chilling influence of the northern winds. Such imagery contrasts starkly with the glacier's current state, whichI observed just outside the Glaciorium. The biting northern winds are replaced by the scorching sun, which people now enjoy on the terrace of the Restaurant du Montenvers. And the 'Sea of Ice' and its deep icy crevasses that Windham described seem to have been replaced by a meagre stream of ice.

20 During my conversations with two glacier scientists, Luc Moreau and Martin, they drew attention to the visible changes occurring in European glaciers and beyond. Glacier ice masses are not only retreating but they are also appearing 'dirtier'. The melting of ice and snow on the glacier causes an increased saturation of rocks and debris, leading to a less visually appealing appearance that contrasts with the pristine, white icy peaks seen on previously consumed representations. The striking visual scenery that I encountered made apparent the significant disruption and disturbance taking place within the natural landscape. Following this summary of the field site, the next section will introduce and discuss key theoretical concepts that will serve as the foundational framework for my research.

FOOTNOTES

1. European alpine glaciers are relatively smaller than the continental glaciers found in Greenland and Antarctica. Beyond the Alps, alpine glaciers are also found in other high

mountain areas such as the Andes, the Himalayas, the Rocky Mountains, the Caucasus, and Scandinavian Mountains.

2. During the Little Ice Age (LIA), the average global temperature decreased to approximately two degrees Celsius, particularly within the European and North American regions. This climatic shift had a profound impact on ecosystems, weather patterns and human societies (Zumbühl & Nussbaumer, 2018).

3. In the case of Greenland's icesheets for example, melt is uncovering several sought-after mineral resources, making them more available for mining. This has sparked major discussions on the future landscapes of Greenland, positioning the country as an emerging frontier for oil, gas and minerals (Blanchard, 2019).

4. I also took some of my observations and fieldwork to the Aletsch Glacier in Valais, Switzerland. While my research largely focuses on the Mer de Glace landscape, I incorporate key findings from my engagements with the Aletsch Glacier when it adds valuable insight. Renowned as one of the largest glaciers in the European Alps, the Aletsch Glacier also faces the process of melt and has attracted significant attention from researchers and generated a substantial body of literature and studies.

3. Conceptual Framework: Towards an Understanding of Glaciers and Melt

1 The research objective is to unpack human-glacier relationships within a changing and melting landscape in the Mer de Glace region. I therefore draw upon different theoretical approaches within anthropology to help me build upon received renderings of human-glacier relations. However, to comprehensively understand the impact of melt processes on these relationships, it is imperative to first explore 'water' as an anthropological subfield, particularly within the context of the Mer de Glace, a glacier known as the 'Sea of Ice'.

2 Scholars have explored water ethnographically beyond its mere physical substance (be it liquid, ice or steam) but have also explored how it shapes and acquires life, socially and culturally, across diverse historical and geographical settings. Ballestero describes water as an 'efficient theory machine' (2019, 404), which has helped equip the social sciences with analytical tools to explore socioenvironmental and political ideas such as circulation, fluidity, leakage and certainly, melting. These analytical tools have allowed researchers to investigate the social and cultural interpretations attributed to water. For instance, Carey, French and O'Brien capture this interplay between water as a natural phenomenon and social dynamics through the concept of 'hydro-social cycles' (2012, 182). Another example is how water-related environmental changes, such as climate-driven sea-level rise, have prompted scholars such as Nikhil Anand (2017) to examine how coastal communities respond by employing infrastructure such as sea walls and levees, and developing new policies and strategies for adaptation and mitigation. Anand's research highlights the broader cultural and social implications of water and how its movements are challenging traditional notions of citizenship and belonging in coastal areas. In the high Peruvian Andes, Inge Bolin's (2009) work focuses on severe water shortages resulting from the rapid glacier retreat. As a life-giving element embedded in the hydrological cycle, Bolin demonstrates the far-reaching implication these shifting water flows have on the daily lives of local communities. For instance, she discusses how indigenous Quencha communities are navigating these changes by revitalising ancient Incan water conservation practices in the twenty-first

century. Scholarly work on water, glaciers and ice landscapes reveals the significance of water as a 'substance that connects many realms of social life', going beyond its physical and resource properties (Orlove & Caton, 2010, 401). By challenging the false dichotomy of nature-culture, water (and ice) can no longer be reduced to its physical properties and is also 'as a process, a living entity with its own agency and even rights' (Sokolickova et al., 2023, 78).

3 By acknowledging the central role of water in socio-cultural life, this perspective prompts questions on how climate-induced changes in water dynamics reshape experiences, social structures and cultural values. Especially given the concern and sense of crisis about the environment, many scholars have examined the human-environment dynamics within cryosphere environments (Bolin, 2009; Henshaw, 2016; Strauss, 2016). These landscapes are experiencing significant changes, such as the melting of snow and ice, the retreat of glaciers, escalating temperatures, the depletion of biodiversity, rising sea levels, as well as the encroachment of capitalist forces and its implications for local and indigenous communities inhabiting these regions (Cruikshank 2007; Nöbauer, 2022; Berglund et al., 2019; Henshaw, 2016). Climate-related environmental hazards are undoubtedly altering how we sense and inhabit our environment (Henshaw, 2016; Nassauer, 2013). When reflecting on these changes, Berglund, Lounela, and Kallinnen aptly emphasise that 'landscapes [...] are increasingly perceived as not as what they used to be' (2019, 11). This study adopts a conceptual focus on the notion of anthropogenic 'melt' as an analytical framework. By doing so, it aims to investigate the transformative potential of melting processes and their influences on socioenvironmental interactions within the ever-changing landscape of the Mer de Glace.

4 A study on ice melt calls for a more-than-human anthropology approach. This perspective acknowledges that humans are intricately entwined in complex relationships with non-human entities, including glaciers and other natural landscapes. I therefore take a moment to register with the non-human world. In doing so, my research aligns with Donna Haraway's notion of 'response-ability': the affective capacity to recognise the interfolding of human lives among the multiplicity of beings and inanimate forms (2016, 28). With the more-than-human turn in anthropology and the attention to non-human agencies in Bruno Latour's (2007) actornetwork-theory (ANT), scholars have challenged the long-held notion of human exceptionalism and recognised the diverse agencies of human *and* non-human entities (Van Dooren et al., 2016). The traditional orientation that separates culture from nature in anthropology concentrated on the idea that the environment determines human livelihood systems and practices (Berglund et al., 2019). However, subsequent discussions dovetailed into perceiving the more-than-human as *active* agents rather than merely symbolic or passive projections of human meaning (Descola and Pálsson, 1996; Ingold 2000).

5 Donna Haraway (2008) advocates for a re-evaluation of human identities, considering humans as one among many 'companion species'. A relational frame of understanding between humans and non-humans is a reactive move against Western-traditional culture/nature dualisms. Instead, it captures how multiple entities interact, intertwine, overlap, and undergo transformations, ultimately shaping landscapes in intricate and multifaceted ways. Importantly, it foregrounds coexistence, conviviality and interactional encounters between humans and nonhumans. For example, Eduardo Kohn's (2013) work is attuned to the non-human world of forests and reveals that the ability to create meaning is not solely limited to humans. In his ethnographic account

of people's dwelling experience within the forests in Runa in Ecuador's Upper Amazon, he demonstrated that human worlds are constructed through relational interactions with other beings that also use forms of representation to communicate and engage with. I thus align my research with the emerging literature on more-than-human multispecies entanglements, acknowledging that humans, ice landscapes, and their various 'lifeways' (Tsing, 2015, 131) or 'intimacies' (Govind Rajan, 2018) are always in the process of mutually becoming. My study commits to a broader project of acknowledging 'our "situated connectivities" within collectivities of human and non-human life', to take Eben Kirksey and Stefan Helmreich's (2010, 549) words. This is especially urgent in the face of the transformative effects of anthropogenic climate change (Tsing, 2015).

6 To achieve this, I found Tim Ingold's phenomenological approach to landscape fruitful to comprehend the continuous movement and liveliness inherent in all forms of life including glacial ice and the surrounding built and material environment. His 'dwelling perspective' challenges the traditional view of the landscape as a passive backdrop or a pictorial stasis of the 'world at rest' (Ingold, 2017, 1). Instead, it prompts us to consider the dynamic interactions that shape our existence within a more-than-human anthropology (Tsing, 2013, 29). For Ingold, landscapes are produced through processes of dwelling and engaging in specific encounters. The 'pattern of dwelling activities' (Ingold, 1993, 153) which he terms as 'taskscape' is the ongoing everyday manifold practices of human and more-than-human entities that inhabit the land. He foregrounds the embodied, sensory, and temporal dimensions of these interactions, prompting us to consider how inhabitants, both human and nonhuman, experience, move, emerge, imagine and perceive their surroundings. In this context, Ingold states, 'it is to join with a world in which things do not so much exist as occur, each along its own trajectory of becoming. In the life of the imagination, the landscape is a bundle of such trajectories, forever ravelling here and ravelling there' (2012, 14).

7 In this sense, those inhabiting the landscape are not separate from it but actively shape and are shaped by their actions and engagements with it. The reciprocal relationship between inhabitants and the environment opens up the landscape as a dynamic arena for the emergence of new social-natural gatherings and relations (Ingold, 2011; Tsing, 2015; Salmi, 2019). Additionally, the concept of assemblage is a productive way of entangling a more-than-human world, especially within the context of the Mer de Glace. It denotes an entangled composition of diverse materials, bodies, ideas and phenomena that enter into intricate relationships with one another (Tsing, 2015; Deleuze and Guattari, 1988). As glaciers melt, it raises intriguing questions about what new markings are being created in the landscape, and how they are either obscuring or erasing once-meaningful features or leaving them open to new meanings and *assemblages*.

8 Through my ethnographic encounters, I delved into the dwelling activities within the specificity of Mer de Glace's shifting and *melting* landscape to reveal emerging (re)configurations of human and more-than-human interactions. The Mer de Glace landscape, bound up with global capitalist processes and environmental degradation, has been profoundly transformed, and its melt is a stark indicator of this. The increase in CO2 emissions, coupled with warmer summers and drier winters, has accelerated the melting of glaciers, leading to significant alterations in the entire glacier ecosystem. From an ecological and social standpoint, the entire glacier ecosystem has been experiencing severe *disturbances.* The concept of disturbance, introduced by Anna

Tsing, provides a valuable framework for anthropological research in understanding the complex interplay between human activities, environmental changes, and the resulting socioecological consequences:

> 'Disturbance is a change in environmental conditions that causes a pronounced change in an ecosystem. Floods and fires are forms of disturbance; humans and other living things can also cause disturbance. Disturbance can renew ecologies as well as destroy them. How terrible a disturbance is depends on many things, including scale' (Tsing, 2015, 160).

9 Moreover, Tsing's perspective on the fringes of environmental degradation offers a productive reframing of our understanding of human disturbance, viewing it not only as an end but also as a space for new possibilities and emergences. She highlights how 'industrial transformations turned out to be a bubble of promise followed by lost livelihoods and damaged landscapes'. She adds, 'if we end the story with decay, we abandon all hope – or turn our attention to other sites of promise and ruin' (2015, 18). By considering the melting landscape of the Mer de Glace as a disturbed landscape that is undergoing social and ecological transformations, we can expand the application of catastrophic narratives of melt and the Anthropocene. As Tsing asserts, 'Disturbance opens the terrain for transformative encounters, making new landscape assemblages possible' (2015, 160). For better and for worse, a melting glacier, and its disturbed and degrading terrain, can open itself to an emergence of new assemblages, possibilities and encounters.

10 Together, these theoretical framings interweave to provide a framework for my research on the melting landscape of the Mer de Glace. Through careful analysis of the shifting activities and interactions within the Mer de Glace landscape, which is brought about by melt, I pay particular attention to the 'new spaces of possibility such interactions can create' (Kohn, 2007, 4). In other words, by working through melt, my research on the Mer de Glace unveils how the new gatherings of different beings are emerging, how activities are taking on alternative forms and understandings, and how new markers of the past and future are becoming more visible. I argue that glacier ice melt holds significant power as it not only signifies a physical transformation, but also invites people into new types of relations and assemblages with(in) the landscape.

4. Methodology and Positionality

Data Collection

1 During the period between December 2022 and March 2023, I visited the Mer de Glace in Chamonix, France and the Great Aletsch Glacier in Valais, Switzerland. By immersing myself in these environments, I not only observed the landscape but also actively engaged in a myriad of activities. I took part in skiing, hiking, and participated in cultural events. In addition, my 'dwelling' and participation in this landscape allowed me to better engage with the 'situated connectivities' (Rose, 2009, 1) among those inhabiting it and observe the subtle nuances of human-glacier engagements through a sensorial and affective lens.

2 I had the chance to speak to Luc Moreau, a prominent glaciologist, who has done significant work on glaciers in the Mont-Blanc region. Luc's extensive expertise spans over thirty years, during which he has focused on examining glaciers' sliding velocity and hydrology. His work extends beyond scientific monitoring, as he also actively engages in teaching, mountain guiding, and advocacy work. Luc's fieldwork has taken him to diverse regions such as Iceland, Greenland, and the Himalayas, where he has witnessed first-hand the disheartening retreat of glaciers due to global temperature increase. The profound and unsettling changes he observes in these landscapes often leave him restless at night as he and his fellow glaciologists meticulously monitor and quantify this retreat. I also had the opportunity to engage in insightful conversations with Martin, a recent graduate in glaciology from the ETH University of Zurich.[1] He has conducted extensive fieldwork in Switzerland, Sweden, and Norway. Beyond his scientific research, he also dedicates his time working as a ski instructor in the Aletsch Glacier region. I recorded phone call interviews with Martin and Luc and manually transcribed them for analysis. Furthermore, I focused on amplifying the voices of those intimately connected to the Chamonix region, including long-time residents and frequent visitors. For instance, Pierre's deep ties to Chamonix, rooted in his grandparents' residency, provided valuable insights into the local dynamics. I also engaged with various individuals working in different capacities within the region, such as bookstore employees in Chamonix and personnel at Montenvers, including train operators, restaurant waiters, and experienced mountain and ski guides. In

addition to speaking with locals and professionals, I also had conversations with tourists, both first-time visitors to Chamonix and regular travellers. These conversations were informal and documented through sound recordings and detailed field notes. The transcription processes were done manually. Lastly, I also interviewed Charlotte Qin, an artist based in Geneva. Her artistic practice revolves around the mediation of water and performance in natural water bodies, inviting viewers to rethink our interdependencies with nature. Her work encompasses elements of her Chinese heritage and Western scientific training, seamlessly blending science, nature, and mysticism. While her artistic explorations primarily focus on water, including glaciers, Charlotte also delves into the realm of our 'inner waters', namely our emotions. Engaging in conversation with Charlotte proved insightful as it shed light on how the concept of melt has driven creative works like hers toward particular negotiations, languages, and ways of coping amidst environmental change. This resonates with Tsing's notion of coping with 'entangled ways of life', (2015, 4) where life on the fringes of glaciers, amidst their melting and disturbances, necessitates new imaginings of futures and alternative modes of existence. My conversations with Charlotte were conducted via an online call, and I transcribed our discussions manually for further analysis and reference in my research.

Positionality

3 As I set out on a study of human-glacier relations in the alpine region, my positionality played a crucial role in shaping the research and the knowledge I produced. Having spent most summers and winters in the French Alps, my deep connection with mountainous areas has made me acutely aware of the ongoing changes taking place. These experiences have fostered a deep interest in exploring these landscapes and studying the impacts of climate change on glacial ecosystems.

4 Undoubtedly, the 'process of climate change is a global phenomenon extending over centuries' (Siltoe, 2021). However, it also manifests as a local phenomenon with distinct impacts within circumstanced environments (Strauss, 2016). Different communities experience localised changes in temperatures, precipitation patterns, and extreme weather events, making the understanding of shifting climates context specific. In my approach to studying the Mer de Glace, I remained conscious of the dangers of imposing preconceived and universal narratives of climate change. I also strived to avoid romanticising local narratives related to glacier melt and climate change, instead centring the voices and experiences of those living near glaciers or with a strong connection to these landscapes. To achieve a more comprehensive understanding, I engaged with diverse perspectives, including glacier scientists, residents, holiday homeowners, and artists who intimately engage with glaciers in their explorations through interviews and participant observation. When engaging with glacier scientists, I had to carefully navigate the nuances of interdisciplinary dialogue, as my expertise is in the social sciences and not the natural sciences. For instance, Martin and Luc had to explain concepts without heavily relying on expert language and terminology, challenging me to grasp disciplinary perspectives outside my field. It reminded me of the limitations of my expertise, and I remained attentive and mindful of potential misunderstandings or lost nuances in translation throughout these conversations.

5 In my research I employed a more-than-human approach that goes beyond solely focusing on human perspectives. Drawing inspiration from Tsing's writings, I view

human knowledge not as a limitation but as a *starting point* for engaging with the more-than-human world. This approach emphasises the active participation of both humans and non-humans in shaping their environments and highlights the interconnectedness of all beings. As Ingold has cogently noted: 'We owe our very being to the world we seek to know. In a nutshell, participant observation is a way of knowing from the inside [...]. Only because we are already of the world, only because we are fellow travellers along with beings and things that command our attention, can we observe them' (2013, 5). This understanding informed my participant observation methodology, allowing me to immerse myself in the lived experiences of humans and nonhumans and to observe and explore the intricate relationships and assemblages that shape human-glacier interactions.

6 To capture the complexities of these interactions, I adopted a reflexive stance and made space for the more-than-human world. Lien and Pàlsson assert that more-than-human anthropology necessitates 'amplify[ing] signs of the more than human' (2019, 12). Similarly, Haraway (2016) uses the notion of 'response-ability' to underscore an affirmative ethics of interconnectedness that involves sensitively engaging with non-human modes of experience—this includes extending sensory and affective encounters beyond human boundaries. Inkeri Aula's (2021) study engages in such a multisensory ethnography during their transgenerational sensobiographic walks on the seaside city of Turku in southwest Finland. By focusing on multiple senses, they could 'provide tools for noticing local ways of relating to more-than-human and for bringing these particular encounters into social scientific knowledge practices' (Aula, 2021, 178; see also: Järviluoma, 2021). Therefore, I went beyond traditional interviews and incorporated a multimodal approach in my research methodology. As I dwelt in the landscape, I also engaged my senses of touch, smell, and hearing, immersing myself in the lively interactions, affective relations and communicative exchanges between human interlocutors and the companion glacier ice landscape. This allowed me to explore the intricate assemblages and relationships between humans and their environment.

7 Further, I recognised the value of visual materials, such as photographs, in providing additional insights into ethnographic production. Lien and Pàlsson assert that pictures can 'provide additional and highly useful insight into issues normally missed by the texts, including relations of ethnographic production that involve "other than human" companions' (2019, 12). I therefore took photographs of the landscape during my fieldwork and referred to them in my analysis. These visual representations complemented and enriched the textual analysis, allowing for a more nuanced understanding of the socioenvironmental shifts within the Mer de Glace landscape. Together these methodological approaches allowed me to uncover the agency and significance of glaciers as active actors within the socioenvironmental networks. By giving precedence to the natural world and embracing its inherent dynamics, my research framework acknowledges non-human ice landscapes' performative and affective nature, thereby providing a more comprehensive understanding of human-glacier interactions.

FOOTNOTES

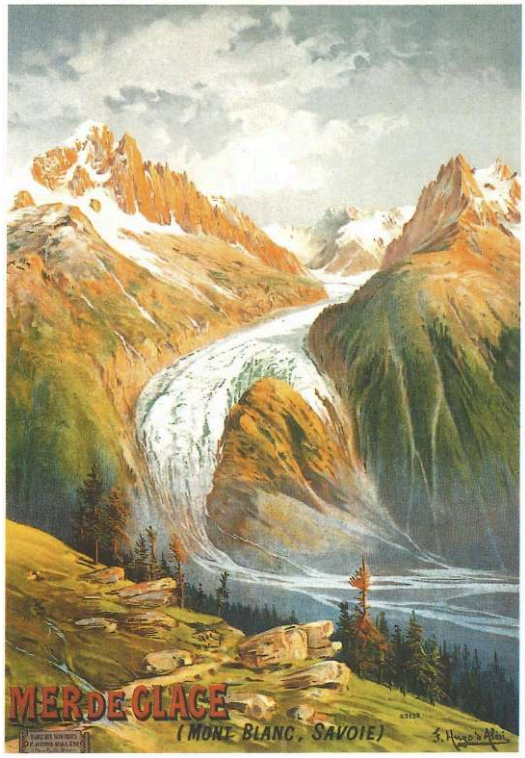
1. Eidengenössische Technische Hochschule (ETH) is the Swiss Federal Institute of Technology, a public research university in Zürich, Switzerland.

5. Activities and Encounters on a Melting Landscape

1 Upon reaching the Montenvers viewpoint, I was greeted with a bustling array of activities that animated the glacier landscape. People boarded the Montenvers train, eagerly exploring the surroundings. Others strolled along the viewpoint, making their way toward the Montenvers restaurant and Glaciorium while observing and contemplating the glacier's scenic presence. Some continued their journey down to the Grotte de Glace, descending via the cable car and navigating the winding stairs. I observed a mix of walkers, skiers, and guides, all climbing up and down these stairs and stopping ever so often to take another peek at the landscape. The glacier received visitors to its ice cave and skiers along its Vallée Blanche route. The warm sun of March cast its rays upon the terrain, causing the skiers, with their skis strapped to their backs, to break out in a sweat as they ascended back to Montenvers. The glacier , too, released a continuous flow of water, creating a symphony of streaming water that echoed across the landscape. As Luc, a glaciologist specialised in the Chamonix region, had described, the Mer de Glace is 'a very lively place'. This description contradicts the prominent perception of glaciers as static, sterile landscapes frozen in time. In fact, glaciers are dynamic and active entities, often described as 'conveyor belts' by glaciologists due to their continuous movement, flow, freezing and melting processes (Howe, 2022). Tim Ingold acknowledges the liveliness of landscapes, recognising them as ever-evolving and 'resonating spheres of activity' (Gruppuso & Whitehouse, 2020; Ingold, 2017). Drawing from Ingold, Allerton adds that environments are not built; rather, a landscape is understood as an enlivened and lived-in environment (2013, 97). The Mer de Glace is precisely such an animated environment. Juxtaposing the self-contained landscape void of haste and motion depicted in the postcards I had encountered earlier (Figures 1.1, 1.2 and 1.3), the reality of the Mer de Glace landscape is instead made up of an entangled and multi-layered interplay of activities between humans and nonhuman entities.

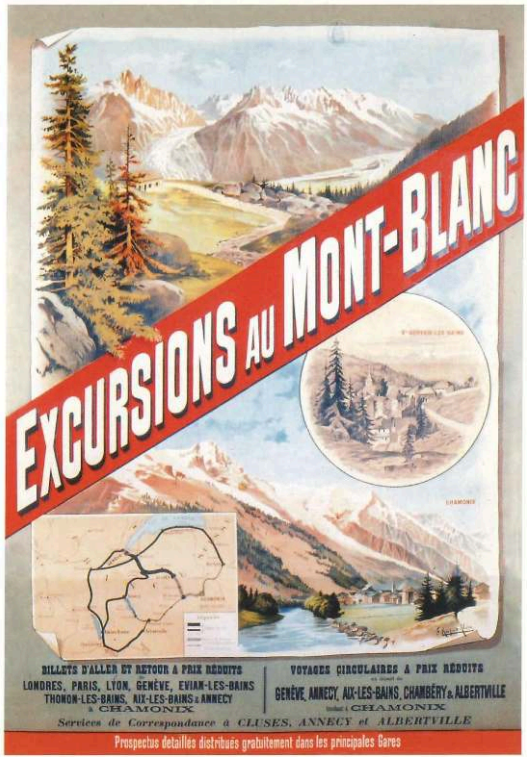
2 These elements come together, dissolve, and gather again to form a dynamic 'totality of rhythmic phenomena' (Ingold, 1993, 163).

Figure 1.1 Postcard depicting the Mer de Glace from Chamonix's bookstores.



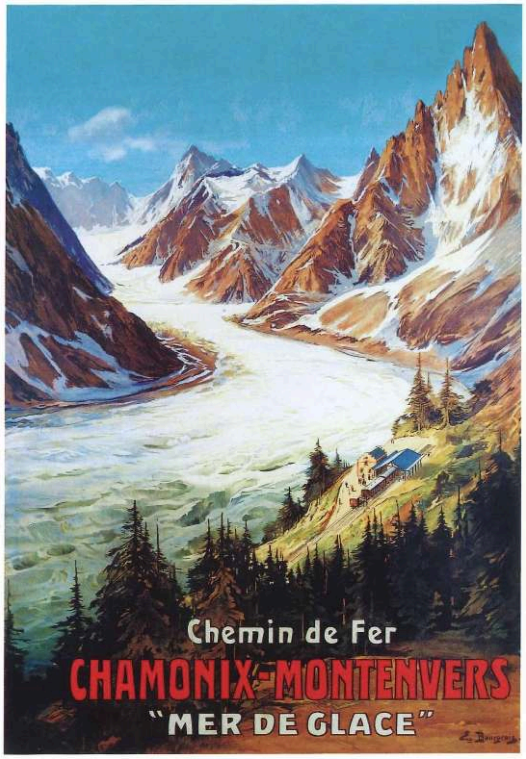
Source: photo taken by the author.

Figure 1.2 Postcard depicting the Mer de Glace from Chamonix's bookstores.



Source: photo taken by the author.

Figure 1.3 Postcard depicting the Mer de Glace from Chamonix's bookstores.



Source: photo taken by the author.

3 The landscape demanded a shift in my own perception of time. Moments in my dwelling, I felt the need to 'slow down' my thinking to align with the glacier's curious slow temporal rhythm (Stenger, 2005, 994). Yet paradoxically, at the same time, I experienced a sense of being amped up. This was especially evident when the glacier's slow processes clashed with the stream of modern civilization with its own itineraries and temporal demands. This layering of temporalities became apparent through technologically induced activities that operated at a much more rapid pace, such as the Montenvers train. Visitors can take the train from Chamonix, and within twenty minutes, they can reach the Montenvers viewpoint poised on a rocky ridge overlooking the Mer de Glace at 1913 metres. Meanwhile, the glacier itself appears seemingly motionless, or at least it appears so in a single human observation. The viewpoint, a carefully built structure, engenders a particular mode of 'viewing' of the glacier landscape that invites contemplation that also accentuates the very perception of the stillness of the glacier. Henceforth, a closer attunement to the resonance of dwelling activities within the landscape reveals the coexistence of multiple temporalities, intertwining the slow processes of the glacier with the more accelerated rhythms of human activities.

4 However, unprecedented melting rates, warmer sun rays, and meltwater gushing have *disturbed* this landscape, and it has led to significant changes in both the ecosystem and the social networks. In the following section, I will investigate the shifting temporalities of activities and movement that have been impacted by ice melt and its agential force. This includes examining the ways in which humans *move* through the glacier landscape, interact with it and how the built environment has also undergone transformations. Together, these encounters and responses contribute to co-creating

the shifting and melting landscape of the Mer de Glace, opening up new forms of activities, meanings and assemblages within its dynamic context.

Figure 2 Mer de Glace from the Montenvers viewpoint, Chamonix Mont-Blanc.

Source: Photo by the author, 21 March 2023.

Disturbance and Transformative Encounters

5 Before delving into the changing activities that arise from this disrupted landscape, it is first necessary to comprehend the nature of the disturbance within the Mer de Glace. In the following section, I will examine how this disturbance is particularly evident in the melting processes and the shifting temporal patterns of seasons. These changes not only affect the activities occurring within the Mer de Glace but also reshape the landscape and redefine the possibilities for engagement.

6 The intersection between temporality and landscape is well theorised by Ingold, who recognises temporality as a 'pattern of resonances' of interconnected rhythms (Ingold, 1993, 164). This understanding of temporality moves beyond the conventional notions of time that 'pivot around Euro-American / global framings of time and space, geopolitical wording and extractive capitalism' (Dodds & Smith, 2022, 8) to instead encapsulate 'how the passage of time is *experienced* in daily life activities' (Staring, 2022, 26). According to Ingold, a landscape is made up of 'constitutive acts of dwelling' (2000, 195), suggesting that it involves the intersection of different temporalities. This notion is resemblant to a musical ensemble where instruments follow their own rhythms, yet no one instrument alone marks the passage of time. Instead, it is through their congruence that social time emerges. Comparably, the temporality of the landscape emerges from the interplay of various social rhythmic patterns, interconnected and shaped by mutual awareness. In this context, resonance within the landscape involves

the interrelationships of the rhythmic activities of both human and more-than-human entities (such as ice). Such an understanding therefore recognises the shared and mutual influences that exists between humans and glaciers or ice. Consequently, disturbances, such as increased melting, impact the temporal dynamics of the landscape, thereby influencing the activities and engagements within the Mer de Glace landscape (Salmi, 2019).

7 Temporality particularly spoke to me through the rhythmic play of *seasons*, which also made more apparent the significance of melt within the Mer de Glace's changing landscape. A focus on seasonal temporality provides a powerful lens for analysing the landscape's environmental changes and disturbances on the activities that shape the Mer de Glace landscape. As highlighted by Krause (2013), seasons cannot be reduced merely as a series of ordered events but are embodied, enacted and an integral part of the activities and dwellings performed within a landscape. In the context of the Mer de Glace, the temporal patterns of visitors mirror the seasonal rhythms. Each season brings forth different conditions and opportunities, influencing the rhythmic activities. Winter seasonal periods offer snow-covered terrains that invite activities such as skiing, while summer periods offer opportunities for mountaineering and hiking. These seasonal temporalities are shifting though, as indicated by the *accelerated* temporality of anthropogenic melt. Winter seasons in Chamonix are becoming shorter, with more frequent rainfall and faster melting of ice and snow, limiting possibilities for skiing activities in the landscape. Summer seasons appear to be extending, with higher temperatures persisting throughout the year. In turn, these seasonal changes are undoubtedly altering the pathways, routes, and the availability as well as accessibility of certain areas within Mer de Glace.

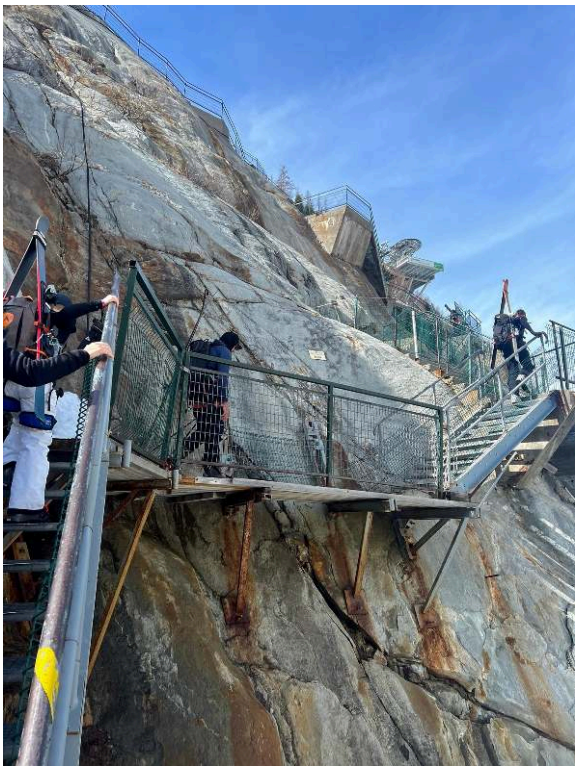
8 Amidst these shifts, however, Tsing underscores that disturbance also 'opens the terrain for transformative encounters, making new landscape assemblages possible' (2015, 160). Luc, with over thirty years of experience in this landscape, highlights the alarming visibility of the disturbance: 'Yes, glaciers have naturally fluctuated in the past, but the Mer de Glace has retreated and looks like this now due to unnatural causes'. Although his words may imply a negative sentiment (which I do not intend to undermine), I propose a more nuanced exploration of the disturbance within the Mer de Glace rather than hastily labelling it as synonymous with destruction. By adopting a critical approach, we can uncover deeper insights and understand the multifaceted nature of this transformation. Through my ethnographic work, I encountered a number of these transformative encounters and assemblages among those dwelling amidst the changing and melting landscape. The force of melt acts as a powerful agent of dissolution, seamlessly fusing assemblages, allowing them to flow together, take shape and ultimately emerge into novel and transformative configurations.

9 To provide an example, one significant assemblage came in the form of a territorial assessment of greenhouse gas (GHG) emissions in 2009, which significantly captured the attention of the authorities and several elected officials from the federation of Chamonix-Mont-Blanc municipalities, known as the Communauté de Communes de la Vallée de Chamonix Mont-Blanc (CCVVCMB).[1] The diagnostic highlighted the state of the region's emissions levels, emphasising the need for urgent action to address climate change and the impacts of the region's economic, tourism and transport activities on the natural environment. In 2012, after recognising the necessity to engage in initiatives to tackle the issue, the CCVVCMB adopted and launched the '*Plan Climat-Énergie Territorial*' (PCET), a regional climate and energy plan that sought to take

ownership of the climate issue on a valley-wide scale. This plan was pivotal in bringing together various stakeholders, including regional authorities, town councils and civil society, to collectively address the precarity of the landscape in the face of climate change. All of these groups were concerned about the destructive changes to the landscape, with direct acknowledgement of the retreat of the Mer de Glace and its accelerated rate of melt (CCVVCMB, 2012, 15). As such, the PCET plan represents a forging of new relations with a collaborative aim towards limiting greenhouse gas emissions and promoting sustainability in the Chamonix-Mont-Blanc region.

10 Through its strategic communication and action plan, the PCET provided a framework to transform public measures as well as individual behaviour across key sectors such as transportation and mobility, urban planning and buildings, equipment, and tourism. One notable example of such shifts included the gathering of new, environmentally cautious mobility alternatives (CCVVCMB, 2012). The Mont-Blanc bus service, which I took to travel around Chamonix, incorporates hybrid and fully electric buses, prioritising sustainable mobility and emission reduction. Its total fleet operating in the town includes six hybrid buses, two fully electric shuttle buses and six standard vehicles. Hence, the disturbed landscape of the Mer de Glace has become a fertile ground for transformative relationships and configurations. Building upon understanding the Mer de Glace landscape as a realm of disturbance and disrupted temporalities due to melting, I will now shift my focus to examining the shifting activities and forms of mobility that unfold within this dynamic landscape.

Figure 3 Skiers climbing the staircases, Chamonix-Mont-Blanc.



Source: Photo by the author, 21 March 2023.

Figure 4 Steps leading towards the Grotte de Glace, Chamonix-Mont-Blanc.

Source: Photo by the author, 21 March 2023.

580 Steps and Counting

11 The melting ice of the Mer de Glace has resulted in the glacier receding further up the mountain terrain, leading to transformative effects on the built surrounding environment and the ways in which people move through this space. These shifts in mobility have consequently shaped the experience of how humans encounter and understand the environment. In line with Ingold's perspective, how we dwell, the temporality of our movements and the sequences in which we encounter places along the way may be fundamental to how people experience landscapes and thus feel about them (Ingold, 2007, 201).

12 What was particularly striking were the multiple flights of stairs descending to the glacier which visitors use to be brought up close to the ice (Figures 3 and 4). However, with each passing year, new steps had to be added to accommodate the glacier's retreat. On these steps, I encountered Théo, a ski guide who had just taken his group of clients down the Vallée Blanche route. He explained how the staircase was not always this long. However, because the glacier has retreated so much in the last couple of years, new steps had to be added so that visitors and skiers could reach the glacier's terminal tongue. From just three steps initially, there are now 580 steps and counting. Something as seemingly fixed as a set of stairs has been reshaped by the forces of ice, suggesting the agential powers of the natural landscape. As Ingold asserts, landscapes are 'eternally under construction, never complete' (1993, 162). The material solution of adding new metal steps implies the constant (re)configurations taking place in this landscape – suggesting the very 'liveliness' that Luc had described to me earlier.

13 Moreover, there was something rather powerfully affective in the act of walking down the fleet of stairs towards the glacier. Although the glacier remains at a high altitude, to actually reach it, one would have to walk *down*. The experience of descending, rather than ascending, strips away the very understanding of glaciers as high alpine topographies. Ingold argues that 'the spaces of dwelling are not already given in the layout of the building but are created in movement. That is to say, they are *performed*' (2013, 83). The spaces we inhabit thus come into existence through our actions, movements, and performances, which brings a type of meaning and purpose to

the spaces we occupy. In the context of these stairs, each new step added to the descent unveils a new type of experience of the landscape, speaking to the glacier's melting and perishability. This sense was further intensified by the accompanying gushing of meltwater cascading along the sides as one descends the stairs (Figure 5). The constructed frames that were originally designed to hold snow now serve as channels for the flow of meltwater, as illustrated in Figure 5. Henceforth disturbance manifests in the disruption of typical temporalities of mobility. As people navigate through these ever-extending steps, a new form of embodied experience emerges, resulting in a re-envisioning of the Mer de Glace landscape; what was once perceived as a grand icy formation is now increasingly understood as something ephemeral and fleeting.

Figure 5 Melt water by the staircases, Mer de Glace, Chamonix-Mont-Blanc.

Source: Photo by the author, 21 March 2023.

Changing Routes on the Vallée Blanche

14 After descending the 580 steps, I reached the entrance of the Grotte de Glace. Its entrance was covered with white cloth, a measure taken to preserve the ice from melting and maintain access to the cave. Before entering, I noticed of a group of skiers next to the cave, who were busy removing their ski boots after having skied down the Vallée Blanche route (Figure 6.1 and 6.2). The ski route is a popular activity at the Mer de Glace. In 2018 alone, approximately 50,000 individuals engaged in skiing activities in the area, with the Vallée Blanche being the most popular site, as reported by the CCVVCMB. Having just skied down the route, one of the skiers shared with me their experience:

> 'I was curious to see the glacier. I'm an avid skier, and I had yet to ski down the Vallée Blanche route. But there was not enough snow, so we had to stop here to

> eventually take the Montenvers train later. Usually, it would also be possible to ski down to Les Planards in Chamonix, but I feel like, these days, you need to be lucky or come at the right time for that'.

15 In previous years, skiing down to Chamonix was possible until well into March. However, during my visit at the end of March, I discovered that this was no longer possible, as my informant explained. The shifting seasonal patterns have altered the possibilities for skiing activities on the glacier, primarily due to the diminishing snowfall. As a result, the window for engaging in seasonal activities has narrowed, providing a smaller timeframe for individuals seeking optimal skiing conditions and engagements. The accessibility of glacier skiing activities has been further hindered by the emergence of new 'obstacles' along the melting route, and to accommodate the receding glacier, there has been a need to shift and alter ski routes. Once again, these changing conditions require skiers to move and navigate through different paths in the evolving landscape.

16 The altering performance of skiing activities thus reveals a new dimension to the off-piste skiing experience. Instead of its usual reputation for unrestricted and free mobility, skiing in this context has become a constrained and manoeuvring endeavour. Another skier whom I had spoken to elaborated on this point:

> 'It was a nice experience. But, if you do decide to go, just be careful with all the rocks and debris on the glacier. We had to manoeuvre around them, which is a shame because it doesn't really give you the same sensation of freely skiing down off-piste'.

17 While skiing continues to be a popular activity in Chamonix, the altered circumstances have also prompted ski guides, like Théo, to adapt their approach when taking their clients out:

> 'Yes [the Vallée Blanche] is a ski route, but I find myself explaining more about the glacier and its changes. Because there is no snow, skiing is not as free anymore. As a guide, I want to make sure I give a nice and full experience on the route. But with little snow, it takes away from the experience of skiing. So, I find that I also show my clients other parts of the glacier, like the Grotte de Glace. I also speak a lot about the staircases to my customers, as now the stairs have basically become part of the Vallée Blanche route'.

18 The reduced snow cover and restricted skiing has prompted Théo to adapt his tour offerings by incorporating additional attractions and points of interest. He has integrated the Grotte de Glace and the staircases into his 'Vallée Blanche tour', serving as alternative focal points to enhance the overall experience for his customers. The need for diversifying skiing routes exemplifies the emergence of new mobility experiences within the Mer de Glace.

Figure 6.1 Skiers on the Vallée Blanche. Mer de Glace, Chamonix-Mont-Blanc

Source: photo by the author, 21 March 2023

Figure 6.2 Skiers on the Vallée Blanche. Mer de Glace, Chamonix-Mont-Blanc

Source: photo by the author, 21 March 2023

19 In conclusion, the melting Mer de Glace landscape has brought about a disturbance, introducing a new type of resonance of dwelling activities, offering new encounters, experiences and emotions for individuals engaging with it. On the one hand, technological advancements have made travel within the Mer de Glace landscape more convenient and streamlined, simplifying the terrain and allowing visitors to reach their destinations quickly. On the other hand, as the ice recedes further up the mountain, new routes emerge, expanding the landscape for continuous and enduring movement. This was observed with the extension of steps leading to the glacier. The melting ice

also creates new obstacles where once-connected paths separate and create challenges for navigation, particularly for activities such as skiing. The alternative activities and performances that have been explored in this chapter contribute to shaping the Mer de Glace landscape, infusing it with new meaning and purpose. Notably, it has revealed the melting landscape's diminished accessibility, its challenging nature, and its perishable character. While these environmental changes in the Mer de Glace occur more gradually and are not immediately noticeable in a single observation, it is crucial to recognise the role of melt in reconfiguring the temporalising activities within the landscape. As Elisabeth Povinelli reminds us, 'we think something is enduring because we can't see or don't experience the constant wobbling' (2017, 182). The ongoing ice melt, while not a fast-scale natural hazard, is indeed a dynamic force causing significant shifts and shaping new ways of dwelling in the landscape.

FOOTNOTES

1. The Communauté de Communes de la Vallée de Chamonix Mont-Blanc includes four of the Canton's municipalities including Chamonix-Mont-Blanc, Les Houches, Servooz, and Vallorcine.

6. The Ghostly Temporalities of the Mer de Glace

1 The melting Mer de Glace landscape is a fertile ground for the emergence of novel socioenvironmental assemblages, activities, and mobility. In this ever 'assembling' (Lounela, 2019, 23) landscape, new 'ways of looking at the landscape' (Mathews, 2017, G123) and 'acts of remembrance' (Ingold, 1993, 152) also emerge. As both Martin and Luc expressed to me, the glacier is heading in a troubling direction – it is melting, retreating, and gradually disappearing from befoe our very eyes. This acknowledgement of its impermanence raises an intriguing question: Is the Mer de Glace erasing its status as a recognisable landmark in the way that it once was? While this thought lingers in the minds of many of my informants, I have observed something else – a landscape of presence. However, it is an almost 'spectral presence' that has not been entirely erased but instead uncovered by the melting and disturbed nature of the Mer de Glace.

2 In their book, *Arts of Living in a Damaged Planet*, Anna Tsing, Nils Bubandt, Elaine Gan, and Heather Swason argue that disturbed landscapes possess a 'haunted quality' (2017, G3), where their history and past experiences continue to influence and shape the present. One can thus understand a landscape as a 'shared space' (Tsing et al., 2017, G12) where 'past ways of life' (ibid., G2) linger and influence the present-day experiences and understanding of a place. Similarly, Nico Staring recognises that the 'traces of older landscapes could very well influence the shaping and use(s) of the same places in the future' (2022, 20). In the case of the melting landscape of the Mer de Glace, the traces and absence of its ice extend itself as a 'ghostly' presence (Tsing et al., 2017, G12).

3 Glaciers carry a deep layer of memories and histories captured within their frozen formations, which are geological imprints of atmospheric molecules preserved to make up historical repositories of the Earth's past dynamics and processes. Schmidt suggests that glaciers are 'epistemic' because they 'carry histories of Earth's contingent dynamics, not simply evidence that water has been freezing for a long time' (2021, pp. 293294). This is evident in the case of the retreating glacier of Mont Miné, in Val d'Hérens in Switzerland, where significant discoveries have been made. For instance, pine wood dating back 5000 years was uncovered, shedding light on the existence of

past ecosystems. Melt processes have also unravelled series of past events. For example, in 2022, a mountain guide in the Aletsch Glacier stumbled upon the wreckage of a plane crash that occurred in 1968 (Steinmann, 2022). Further, evidence of human dwelling activities dating as far back as 8000 BC has been exposed due to glacial melt. For example, in the Brunni Glacier in the Swiss Alps, archaeologist Marcel Cornelissen and his research team discovered fragments of rock crystal tools and manufacturing waste, indicating regular extraction and processing of rock crystal during the Middle Stone Age, between 8000 and 5800 BC (Kulturen der Alpen, n.d.). As the ice continues to melt, more artefacts are expected to emerge, revealing the remnants of entangled socioenvironmental histories. In these examples, the glacier landscape becomes an archaeologist's backyard, an intriguing and developing material and historical assemblage where each new discovery adds another piece to the puzzle of an unknown past. These material discoveries offer a new 'practice of looking at ruined landscapes' (Mathews, 2017, G153). They provide recorded evidence of the glacier's past and invite us to engage with and question the glacier's past, present and future trajectories.

4 In a similar vein, Ingold's temporal understanding of landscape implies that the landscape, its physical features, ecological processes, and cultural imprints are a living memory of all who have dwelled in it. According to Ingold, 'to perceive the landscape is, therefore, to carry out an act of remembrance, and remembering is not so much a matter of calling up an internal image, stored in the mind, as of engaging perpetually with an environment that is itself pregnant with the past' (1993, 152). Therefore, the Mer de Glace landscape, with its multiple layers of history, memories, and ongoing transformations, unfolds as a story of activities and relationships in space. The following chapter explores how the melting and disturbed landscape of the Mer de Glace opens up new 'ways of looking at the landscape' (Mathews, 2017, G123) and 'acts of remembrance' (Ingold, 1993, 152) that ultimately give rise to new forms of understanding and engaging with the place. Specifically, I demonstrate how melt evokes a backwards-looking nostalgia as well as forward-looking imaginative thinking.

Traces of the Past and Acts of Remembrance

> The Mer de Glace landscape is not an isolated and memory-less present. Rather, landscapes are 'overlaid [with] arrangements of human and non-human' entities that allow us to attune to the 'traces' of the invisible past (Tsing et al., 2017. G1). As Tsing et al. argue, 'the winds of the Anthropocene carry ghosts – the vestiges and signs of past ways of life still charges in the present. [...] Our ghosts are the traces of more-than-human histories through which ecologies are made and unmade' (2017, G1).

5 The Mer de Glace landscape bears witness to a rich history and a repository of accumulated experiences, which is evident in various compelling ways. For instance, upon visiting the bookstores in Chamonix, I was immersed in a world of literature, with shelves offering an impressive book collection of historical narratives of both the glacier and the surrounding region. The striking, red-covered book that captured my gaze, entitled '*Le Roman de Chamonix*' (The Chamonix Novel) by Sophie Cuenot, dictates Chamonix's history of a community persisting in the face of challenges presented by the high-altitude's cold temperatures, glaciers and avalanches. The distinctive red covers of this book echo the red coloured socks, sweaters, and backpacks commonly worn by mountaineers in the region. Cuenot's historical account showcases Chamonix's deep attachment to its mountainous terrain that has also embraced those seeking to

enjoy its mountains, contributing to the region's flourishing tourism culture. The book is part of a larger collection of red-covered books I encountered in the bookstore, museum, and restaurant spaces of Chamonix and Montenvers. These books, published by Guérin, a publishing company founded by Michel Guérin and Frederik Paulsen in 2005, form a literary refuge within the Mer de Glace landscape. With over 130 fiction and nonfiction works, including biographies, investigations and explorations, they offer glimpses of Mer de Glace's historical markings and stories. With each turn of the page, I could see the fragments of the landscape that gave rise to the Mer de Glace's melting terrain. Through these literary treasures, readers are invited to delve into the captivating imprints of the landscape's past, further enriching their understanding and appreciation of the glacier's past ways of life. Beyond the confines of books, the Mer de Glace landscape's historical imprints were observed in museums and public display boards in Chamonix-Montenvers. These forms of exhibitions are dedicated to showcasing the history of the landscape, serving as curated spaces where individuals can encounter visual and interactive representations of the landscape's past. Importantly, they not only offer glimpses of the historical events and transformations that have shaped the Mer de Glace but also provide opportunities for visitors to actively participate in 'acts of remembrance' (Ingold, 1993, 152).

6 Melt introduces an intriguing layer to the interplay between memory and landscape. Upon closer inspection of the Mer de Glace landscape, the moraines of the glacier, as seen in Figure 8, represent the engravements of lost ice scraped upon the land as enduring 'traces' (Tsing et al., 2017) of a once larger ice formation. As the glacier moves, it carries with it debris from the mountains, resulting in the transportation of large boulders within its mobility. These boulders dig into the valley floor and are subsequently deposited along the edges of the glacier, giving rise to the parallel ridges known as moraines. These moraines or engravings represent the 'spectral presence' (Citton, 2018, 3) of the vanished ice landscape that once flourished in this very environment. When looking towards the Mer de Glace from the Montenvers viewpoint, one can observe the physical remnants of the ice, as though it had been 'dragged up' the mountain, leaving behind deep 'traces of absence' (Järvi, 2019, 136). Moreover, one visitor I encountered during my walk towards the Grotte de Glace pointed out the *sounds* he was hearing, which were somewhat unusual to him: the gushing sounds of meltwater along with the haunting echoes of rocks cascading from the moraines that once held the glacier's ice. The dynamic landscape engages the senses in a way that evokes a deeper understanding of the glacier's past and present state. Much like the 'winds that carry ghosts', as described by Tsing et al. (2017), the glacier's meltwater and moraine rocks that make up the Mer de Glace's acoustics resonate the vast emptiness, the absence of ice and the erasure of once meaningful features of the landscape.

7 These traces of ice left behind due to processes of melt continues to haunt the landscape. They in turn evoke recollections of memories and deep senses of *nostalgia* and *longing,* influencing the way people perceive and interact with the Mer de Glace landscape. As Aula argues, human-non-human entities and the landscape are in a constant state of 'becoming', where 'particular sensations and memories emerge together' (2021, 173). Aula suggests that some landscapes have the power to evoke memories and become 'inclusive spaces free to use' that also 'afford particular sensory experiences' for those who dwell in them (2021, 173). When recollecting memories and past stories of the once familiar landscape, a sense of nostalgia and yearning seep through my informants' narratives. From the Montenvers viewpoint, I met a group of

people from the region who were taking an excursion to see the glacier. One of them pointed to the rocks beside the viewpoint and remarked, 'that's the first time I've seen them bare and not covered in snow'. This comment highlights the changes in the once snowy and ice-covered terrain, which now appears more exposed than ever before. This disruption of the once-familiar landscape triggers a reflection on the past, discontinued as if the current state of the glacier disappoints the memories and expectations held from the past. Another woman traced her finger along a section of the glacier landscape, sharing her memories of skiing down that entire stretch of the mountain. Her words sparked a flood of memories in her as she continued, 'this whole area was full of snow, and it was, honestly, amazing with how much snow there used to be. Now look at it, it's just rocks.' Once again, the nostalgia in her description was palpable as she recalled past experiences and compared them to the present landscape.

8 During my conversations with my informants, phrases such as 'I remember' were frequently used, underscoring the importance of memory in shaping their engagements with the Mer de Glace landscape. These recollections build up a body of remembered and acknowledged stories of past events and activities connected to it, imbuing the landscape with its cultural meaning. This was evident in the way Pierre, a local resident of Chamonix, expressed his emotions regarding the Mer de Glace's shifting landscape:

> 'I remember when I was younger, visiting my grandparents' house down by the valley meant being able to see the glacier right from their balcony. It was so close. I could basically jump from their balcony and touch it. But now, every time I visit, the glacier seems further and further away, tucked away in the distance. It's a bittersweet feeling, knowing that something that once felt so close is now slowly slipping away. All I have left are memories of how it used to be, and even those memories are starting to feel distant. It's really sad, actually. It's almost like trying to remember a *dream* or an *old friend* from long ago'.

9 Pierre's recollections of his grandparents' home and the surrounding icy landscape evoked a sense of bittersweet nostalgia reminiscent of a dream or an old friend. Feelings of nostalgia are deeply rooted in one's sense of place. Boyom (2001) defines it as a sense of loss, displacement and a longing for a home that no longer exists. As the Mer de Glace retreats higher up the mountain, individuals like Pierre are confronted with a landscape that exudes these types of emotive energies, invoking a backwards-looking nostalgia.

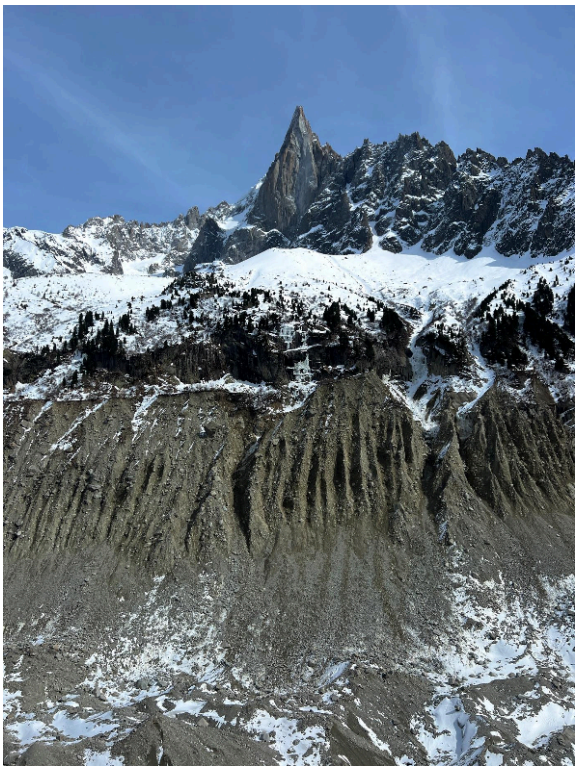
10 For some, these emotive energies of loss, nostalgia and yearning drive a particular type of engagement with the glacier that feels like 'meeting an old friend'. I observed this during my visit to the Aletsch Glacier. It was a warm and sunny afternoon when a man approached the ridge of the viewpoint, extending his hand to wave 'hello' to the Great Aletsch Glacier. Finding a bench overlooking the glacier, he sat down to eat his lunch, creating an intimate encounter between himself and the glacier – like having lunch between two friends. This encounter reminded me of Pierre's narrative of the Mer de Glace as reminiscent of an old friend. As the man finished his lunch, he bid farewell to the glacier. 'Bye, until next time,' he said aloud. He told me, '[the glacier has] been around for as long as I can remember, but each time I come to see it, he looks different'. This desire to meet the glacier, greet it and bid it farewell illustrates the powerful emotive energies that arise within a landscape undergoing disturbance and melt. It can also be seen as an act of remembrance, an intimate engagement that recognises the glacier's past and its retreating presence.

11 The act of remembrance and nostalgic yearning serves as a form of recognition of the fleeting nature of the disturbed landscape. In this context, Luc encouraged me to 'visit the glacier *now*' and emphasised that 'because in thirty years from now, you will have the chance to share with others that you saw the glacier in its current state'. While there is a 'constant unfolding of the world', as Järvi (2019, 150) suggests, where the future is never fully known, it is nonetheless evident that the glacier will continue its melting path for at least the next twenty years. As Martin explained, glaciers, such as the Great Aletsch Glacier, 'are working delayed' and are still experiencing the effects of events that occurred ten years ago. Each glacier has its unique response time to the climate, influenced by factors such as ice thickness, length, form, orientation, and geographic location. For the Mer de Glace, it is known to be 'lagging by 20 years', Luc explained to me. Even if climate warming were to stop today, the Mer de Glace would continue to retreat for the next fifteen to twenty years, given its response time. However the future unfolds for the landscape, one thing remains clear: the disturbed and melting terrain holds the essence of remembrance. For the inhabitants of Chamonix, the story of the landscape unfolds like losing an old friend, where its past ways, a glacier that once stood grand and shone in white snow, now seems irrevocably gone. As Luc had insisted to me, in these moments, melt calls for a preservation of the memories and emotions it elicits - a crucial act of remembrance and appreciation.

Figure 7 Time plaque indicating the level of the glacier in 1990. Mer de Glace, Chamonix-Mont-Blanc.

Source: Photo by the author, 21 March 2023

Figure 8 The moraines of the glacier. Mer de Glace, Chamonix-Mont-Blanc.



Source: Photo by the author, 21 March 2023.

Texts on the Vanishing and Anticipatory Remembrances

12 The spectre of the disappearing glacier, or its 'ghostly' presence, also appears in the time plaques that are etched across the rocky moraines of the Mer de Glace (as seen in Figure 7). As you walk along the stairs leading towards the glacier, a series of plaques of marked dates indicate where and when the glacier used to stand. They serve as material manifestations or indices of the retreating glacier. As recorded evidence of Mer de Glace's 'past ways of life', they represent what Mathews describes as 'material and linguistic ghosts' (2017, G146). As visitors passed by the time plaques, I noticed a distinct way in which they interpreted the landscape. The plaques, acting as linguistic markers of the glacier's historical existence, served as a form of 'bringing-to-presence,' as described by John Wylie (2009), whereby the juxtaposition of the presence of these plaques with the current position of the glacier made the absence of ice glaringly evident.

13 In a similar vein, Ludvig Papmehl-Dufay (2015) explores material remains and monuments and argues how they hold memories and narratives that shape our understanding of the past in relation to specific locations. Papmehl-Dufay reconceptualises Ingold's approach to landscape by using the term 'pastscape' to capture landscapes that are pregnant with the past and create 'stories that connect actors and sceneries in time and space' (2015, 146). Much like monuments or signposts in the fabric of time, the time plaques spread across the Mer de Glace landscape indicate the temporal tapestry of the glacier environment (Figure 7). In other words,

they materially signify and validate the past existence of the glacier formation, which has now vanished. This observation emphasises the impact of these plaques in shaping visitors' perception and understanding of the landscape, drawing attention to the absence of what was once a prominent natural feature.

14 Moreover, the time plaques, which operate as monumental objects or graves that commemorate the glacier's past life, also communicate 'prospective memories' (Papmehl-Dufay, 2015, 150). In 2020, Luc created a time plaque that marked French President Emmanuel Macron's visit to the Mer de Glace. He explained that this plaque served as a significant 'marker', capturing a distinct moment in time that can be revisited and reflected upon. However, it does more than just mark the present; it acts as a reference point for the *past* and aims to inform the *future*. Luc's intention in producing this marker was to preserve the significance of that moment and make it a useful reference for understanding and analysing the changes that occur throughout time. Although his intention was not necessarily to hold Macron personally accountable for the melting glacier, Luc recognised the importance of the president's visit in emphasising the severity of the landscape's condition. Putting signs and plaques at places where ice used to exist indicates how shadowing the absent and past landscapes serves as a reorientation towards the 'not yet'. In the words of Tim Ingold, paraphrasing Susan Küchler, we are 'creatures of the past abroad in the present' (Ingold 1996, 164; see also Küchler 1996). In these instances, the past converges with the present and works together, aligning their orientations to inform what is to come.

15 Such a reorientation captures Katja Uusihakala's description of nostalgic landscapes as 'site[s] in which the convergence of *space of experience* and the *horizon of expectation* can be observed' (2019, 230). The returning or reaching retrospectively to the past is paired with the reaching prospectively towards the future, encapsulating what Uusihakala terms 'the temporality of nostalgia' (2019, 230). Melt feeds into the nostalgic affect within the glacier landscape, bringing about anticipatory acts of remembrance. The distancing Mer de Glace, its ghostly traces, and the erasing of memories displayed in my informants' narratives pushes people like Luc to think about the uncertain future of the Mer de Glace. It is therefore not surprising that Luc felt compelled to install these plaques.

16 The Mer de Glace landscape bears the imprints of past modes of dwelling, and its melting processes have made visible the intertwined spaces of the landscape's spectres and memories. These haunting remnants continue to shape the present, prompting a profound act of remembrance that encompasses both the past and the prospective future. As a landscape characterised by constant change and disturbance, it exists as a tension-filled space. The tangible reminders of this haunting, such as the Mer de Glace's time plaques, serve as dark reminders of the glacier's precarious state while also inspiring a forward-thinking mindset as Luc demonstrated. Encounters within this melting terrain are not bound solely to what has transpired; it embodies an anticipatory awareness of the future. This profound 'sense in the future subjunctive', as Howe (2020, 166) articulates, enables us to break free from fixed notions and embrace alternative trajectories in the face of environmental change. In the forthcoming chapters, I will delve deeper into these imaginative futures within the context of the Mer de Glace and explore the possibilities that lie beyond the nightmares of an iceless world. Firstly, I will examine the close interplay between the thriving tourism industry and future imaginaries surrounding the Mer de Glace. The significant impact of anthropogenic melt on the development and representation of this iconic destination

will be explored. Additionally, I will explore various creative practices that actively engage with future imaginaries, inspiring open-ended envisioning of potential futures.

7. Beyond the Glacier's End: Commodifying Disappearance

1 Snow (and ice) have gained significant prominence in the realm of tourism as they have evolved into valuable commodities in the modern era. Denning (2015) uses the term 'white gold' to describe the economic value attributed to snow, a coveted and commercialised product across the European Alps. The abundance of snow covered on the peaks of high-altitude landscapes has always been a major attraction and holds immense cultural importance in the Chamonix region. As the birthplace of alpinism and a world heritage site, the region's mountain culture and way of life are inextricably tied to the presence of snow and ice. After the first ascent of Mont-Blanc in 1786, the reputation of the landscape spread quickly, attracting an ever-increasing number of visitors (Clivaz & Savioz, 2020). Carey describes this surge in interest in the second half of the nineteenth century as the 'Mont Blanc mania' (2007, 504), which played a central role in promoting the development of alpine tourism in the glacier valley. Between 1860 and 1890, the municipality of Chamonix intentionally fostered its alpine industry to 'increase the number of tourists [...]. To achieve this result, the municipality, and the entire population of Chamonix alongside it, had to adapt its vision of the surrounding mountain to that of the tourist clientele' (Debarbieux, 1993, 40, as cited in Clivax & Savioz, 2020, 7). Given this attention to tourism, Barker (1982) highlights the importance of sustaining the region's economic viability by ensuring a constant flow of visitors. One development that contributed to this sustained influx was the expansion of winter sports tourism year-round, namely, the provision of summer skiing on glaciers high enough for winter activities to take place. In the contemporary context, the availability of year-round tourist engagement in these regions remains vital to sustaining the appeal of the high-alpine regions such as the Mer de Glace and the Aletsch Arena resort. An illustrative example can be found on the tourism website for the Aletsch Arena ski resort, where it prides itself as a high-altitude destination (ranging from 1845 to 2869 metres ASL) that 'guarantees perfect winter sports conditions from December to April' (Aletsch Arena, n.d., para.1). Alongside this, their website presents a plethora of offered activities beyond the traditionally dominant winter months, diversifying their tourism products throughout the year.

2 However, as I have previously discussed, the continuous melting of the Mer de Glace has brought about significant socioenvironmental transformations in the landscape, greatly affecting tourist activities such as skiing in Chamonix. Martin, a ski guide with first-hand experience, expresses a sense of pessimism regarding the prospects. The future appears uncertain and prompts anxiety as we navigate through the possibilities and uncertainties that lie ahead. However, whether these reflections elicit fears, dreams, or hopes, Tsing reminds us that disturbances may also give rise to 'new landscape assemblages' (2015, 160) that are worth paying attention to. This phenomenon is evident in how Chamonix's tourism has developed a unique tourism product centred around the melting landscape. This representation and reimagining of the landscape, in response to the melt, aligns with Mostafanezhad and Norum's concept of incorporating 'Anthropocene imaginaries' within tourism products (2019, 423). The authors explain that this 'provide[s] opportunities for tourism development to facilitate a spatio-temporal fix for capitalism via the transformation of disaster into commodity form' (2019, 423). Such a discourse invites us to question whether the 'glacier graveyard' has become a new point of tourism attraction - blending awe, concern, and curiosity.

3 Moreover, the highly debated term 'Anthropocene' is becoming increasingly prevalent, with multiple takes on the term and various possible responses. Though as Moore argues, 'there are multiple Anthropocenes at work in the world today', and what 'matters here is the creative work of the idea (in all its guises from climate change to biodiversity loss to the global freshwater crisis) to raise awareness about anthropogenesis as a major component of our current reality' (2015, 4). In the following section, I demonstrate how the 'Anthropocene idea' has made its way into the cultural understanding of the Mer de Glace as a vulnerable, melting geological formation. However, interestingly, these understandings have animated the landscape with a new sense of 'value', one that supports human and nonhuman life in the face of anthropogenic change.

'Melt' as Commercial Potential

4 Melt has generated a focused awareness of the state of the Mer de Glace and its shifting circumstances due to climate change. The PCET was an indicative example of this collaborative effort towards acknowledging the changing landscape within Chamonix – Mont-Blanc. Melt has also made its way into the touristic narrative. As Mathieu Dechavanne, CEO of the CCVVCMB, remarked, 'the melting of the glacier is inevitable'. The acceptance of the inevitability of melt captured in Dechavanne's statement suggests that these environmental transformations are almost beyond control. This shift in understanding the landscape through its precarious state shapes how visitors engage with the glacier. Salim and Ravanel (2020) conducted a study and found that those who travelled to Montenvers to witness the Mer de Glace were already well aware of its retreat before their visits. One contributing factor to this awareness was the extensive media coverage of climate change and its impact on this renowned glacier landscape, which garners significant attention in the French Alps. The authors noted that, according to the *Europresse* database, since 2010, there have been 108 articles published in the French press that discuss both the 'Mer de Glace' and *'Changement climatique"*(Climate Change) in combination (Salim & Ravanel, 2020). With a simple online search, articles are filled with attention-grabbing titles such as 'Experience the

Mer de Glace before it vanishes' and 'Visit it while you still can'. This has undeniably caused an unsettling feeling about the landscape, prompting a re-evaluation of its cultural and economic foundations.

5 Moreover, Luc who, in addition to his work as a glaciologist, is a mountain guide, explained how some of the many reasons visitors express their motivations behind seeing the Mer de Glace is the impression that it is their 'last opportunity' to do so. As the precarity of the Mer de Glace becomes intimately experienced, visitors come to observe it with a desire to see it before it is 'too late'. On the Montenvers train, I met a couple from Brazil who were visiting Chamonix during their trip around Europe. The woman explained that 'visiting the Mer de Glace was an absolute must [for them]'. She continued, 'Since it has been an unusually warm winter this year, it felt even more urgent to go see it.' The Mer de Glace landscape thus becomes understood through its melt and the precarious state it is in, carrying a sense of urgency and the need to see and 'feel' it before it vanishes completely. This perspective aligns with Mark Carey's characterisation of glaciers as an 'endangered species', wherein the looming threat of extinction energises a heightened sense of urgency among individuals to visit and engage with them. Another individual, whom I met on the Montenvers viewpoint, expressed similar intentions:

> 'I knew that [the Mer de Glace] had shrunk considerably in size, but being here and seeing it first-hand, you can really feel it. It's crazy to think that future generations might not be able to see such a thing. It has changed so much, and I thought... well, I didn't want to miss this chance'.

6 Visiting and engaging with the Mer de Glace is thus understood as a *chance* that should not be *missed.*

7 While interacting with tourists, I observed that they did not necessarily characterise their experience of visiting the Mer de Glace as exclusively negative, despite expressing their 'deep sadness' towards the melting glacier. Surprisingly, the absence of ice was something they had already anticipated, and their expectations were indeed attained upon visiting the Montenvers viewpoint. For instance, a woman expressed to me that she 'wanted to come and see how much [the glacier had] actually retreated', reflecting her curiosity and desire to witness the glacier *and* its *melt*. The fleeting temporality of melting ice has thus afforded a newfound motive to engage with the landscape, illustrating what Lemelin et al. (2010) describe as 'lastchance tourism'. This concept has also led to a noticeable redefinition of tourism landscapes in other regions, such as the Peruvian Andes. The retreating Pastoruri glacier has been rebranded into a landmark that offers visitors to witness climate change up close. The trek known as the '*La Ruta del Cambio Climatico*' (The Route of Climate Change) takes visitors through the vast terrain that remains of the glacier, providing a glimpse of its entangled past and present states (Gagne, et al., 2014). While there are no official treks like this in the Mer de Glace, Chamonix's officials are exploring alternative approaches to engage with the changing landscape wrought by warming, where melt can be turned into a hidden opportunity rather than an ultimate loss. As Pierre had expressed, Chamonix is becoming a 'glacier graveyard' - a sombre yet intriguing destination for visitors to see.

8 Similar processes are happening in other disturbed and environmentally degrading landscapes. For instance, Amelia Moore (2019) explores tourism in the Bahamas and reveals how these paradise 'spaces' are being reimagined as mainstream brand components of tourism. While these landscapes are experiencing environmental degradation, some tourism ventures leverage these anthropogenic realities as

opportunities for further tourism-based enterprise. In doing so, fears of global anthropogenic change, including ice melt, are being rearticulated and translated into commercial ventures. Significant parallels can be drawn between the Bahamas and heavily touristed and disturbed landscapes such as Mer de Glace in Chamonix. In the subsequent section, I will illustrate how the unsettling reality of the Mer de Glace has prompted revaluations of its tourism foundations, serving as a means of exerting control over the natural forces of melting by adopting alternative tourism approaches and representations of the landscape. In the case of the Mer de Glace, this has manifested through foregrounding geology within the language of tourism.

From Pristine Landscapes to Geotourism

9 Peyaud et al. (2020) proposed that by the 2050s, the Mer de Glace glacier would no longer be visible from the Montenvers vantage point. Undoubtedly, this will profoundly impact Chamonix's tourism industry which accounts for 80 per cent of the valley's economic activity (Orange Business, n.d). However, innovative tourism approaches have emerged amidst melt that seek to coexist creatively with the transforming environment. One notable response has been creating new tourism products that focus on the geological and cultural history of the glacier landscape. This phenomenon reflects the emergence of 'geotourism' (Gordon, 2018). According to Bussard and Reynard geotourism is a form of tourism focused on geology that is 'developed in a context of heritage recognition of geological objects, whose heritage values are revealed by scientific research, and aims to encourage the protection of abiotic nature by raising visitors' awareness' (2022, 2).

10 Speaking with regard to Chamonix's forthcoming tourism developments, Eric Fournier, the mayor of Chamonix, stated: 'We believe that there is room here for a tourism that takes into account the issues of the moment, global warming, a tourism that adapts and makes sense' (Chanaron, 2023, para. 2, translated by author). Expanding on this perspective, I argue that the melting landscape has opened up new possibilities for dynamic assemblages between tourism and geology. This convergence redefines how the landscape is perceived, transforming it into a 'visitable landscape' within an 'Anthropocene imaginary' (Moore, 2019, 440). In particular, the struggle to preserve the ice and the activities associated with the landscape are intertwined with the recreation, redesign, and rebranding of the Mer de Glace as a marketable tourism product. Here, the language of sustainability, innovation, monitoring and environmentally friendly practices have become ubiquitous in discussions surrounding melting glacier landscapes. In turn, these new representations of the landscape shape people's experiences and engagements with it. I will explore three distinct features of the landscape that have been integrated into this touristic practice: firstly, the Glaciorium, a glacier interpretation centre established in 2012; secondly, the immersive experience provided by the Grotte de Glace, where visitors can venture inside the glacier itself; and thirdly, the forthcoming plans for a new interpretation centre scheduled to open in 2025.

The Glaciorium

11 Luc and his colleagues have gathered fifty years of velocity measurements of the Mer de Glace, providing invaluable data that informs and simulates the glacier's future. By

taking the estimated average temperature increase provided by the IPCC, Luc and his team anticipated the complete disappearance of the glacier at altitudes ranging from 3000 to 5000 metres before the end of this century. However, for people 'the end of the century means nothing'; it is too distant and detached from their immediate concerns. Luc emphasises the importance of translating such information into human terms—bridging the gap between scientific projections and the everyday realities that shape our present and future. 'We need to show what these numbers mean for them, for today and tomorrow', he explains. The Glaciorium is an educational space dedicated to glaciology that showcases the glacier's history, current state, and future predictions. It serves as a crucial assemblage between scientific knowledge and public awareness. It informs people about the significance of the Mer de Glace's geological heritage and the consequences of melt within a recreational experience. The information is communicated in an interactive and visually informative manner, opening up opportunities for dialogue and facilitating a shared understanding and collective engagement with the challenges posed by glacial melt.

12 The Glaciorium's visually displayed information of the melting landscape generates alternative forms of temporal experience by blurring the distinctions between human historical and geological timescales. Regarding the challenges of grasping these large-scale processes, Luc stated: 'The links are direct; we live in an interconnected world. Though these links are sometimes invisible'. He highlights that to comprehend and notice these linkages, it is necessary to utilise 'images and illustrations to make these connections *visible'*. Within the exhibition space of the Glaciorium, the Mer de Glace landscape is represented *visually* through various photographs, infographics and videos that make the melt processes and their impact more comprehensible to visitors. Through these visual tactics of representation, viewers can engage with the vastness of the landscape and its geological processes that are usually beyond the scope of a single human observation. For instance, the curious slowness of geological time and the gradual movements of the glacier are accelerated and condensed in sped-up films, distorting the perception of the glacier's rhythmicity. Additionally, the use of grid-like arrangements and side-by-side image comparisons create a sense of order and predictability. The seriality indicates a framing of the landscape within a comprehensible system of lines. These strategies create a poetic typology of glacier formations, dissecting, framing and reconstituting the phenomenal worlds for our perceptions. In doing so, they convey the impression that the Mer de Glace landscape is entirely knowable and calculable. By blurring the boundaries between these different temporal dimensions, it challenges our conventional understanding of time, particularly within the context of Western historical and linear frameworks. Through its careful landscape representation, the Glaciorium invites us to reconsider human time and question the human-centric narratives that dominate our understanding of history. It encourages us to recognise the cyclical nature of the natural processes of glaciers and the limits of human control.

13 The Glaciorium's exhibition space is thus a form of tourism that invites visitors back to 'our deep time, roots and permeant entanglement with Earth's history' (Tsing, 2015, 155). As Tsing states, 'we are not used to reading stories without human heroes', emphasising the conventional nature narratives that centre on the human that also hold tightly to 'dreams of progress' (2015, 155). A profound reorientation emerges by emphasising the significance of natural history and embracing diverse temporalities that extend beyond human and linear frameworks. This shift transcends human-

centric perspectives and places the natural landscape of the Mer de Glace at the core of attention. Correspondingly, Maria Bjornerud (2018) argues that we often lack 'a sense of temporal proportion—the durations of the great chapters in Earth's history, the rates of change during previous intervals of environmental instability, the intrinsic timescales of 'natural capital' like groundwater systems' (2018, 7). While these tactics speed up the natural slowness and rhythmicity of the glacier movements, it nonetheless allows the vastness of melt to become more comprehensible, where viewers can reflect on these histories in an understandable language.

14 Other forms of geotourism assume a slower rhythm to achieve similar outcomes: that is, to help us to 'fathom' deep time, which is arguably, 'geology's single greatest contribution to humanity', to use Bjornerud's words (2019, 16). For example, the Glaciorium employs videos of stories and information about the glacier to provide intimate storytelling that helps reappreciate Mer de Glace's geoheritage. These are further enhanced by incorporating real-life material artefacts, adding to the realness of these stories. In the Aletsch Glacier landscape context, tourism developments have also been refocusing their attention on foregrounding geoheritage (Salim, 2023). For example, the *ProNatura Association* in the Aletsch Arena resort is a Swiss nature conservation organisation that offers interpretation tours based on glaciology, geology and biodiversity – another way in which territorial geo-resources are incorporated into tourism practices (Salim, 2023).[1]

Caring in the Grotte de Glace

15 In addition to the Glaciorium, the Mer de Glace landscape offers a diverse range of tourism products, including informative on-site display boards, viewpoints, and captivating land art installations and sculptures such as ice caves. These attractions are designed to captivate visitors' interest while also providing them with valuable insights into the geological history of the glacier and the ongoing anthropogenic melt processes that shape it. The Grotte de Glace ice cave offers an immersive form of engagement with the ice landscape that foregrounds proximity. This form of engagement not only fosters cultural and aesthetic connections but also creates an emotional bond with the landscape and its geoheritage. As Rantala et al. highlight, the potential of proximity within tourism that is set in the Anthropocene lies in the ways it can 'intertwine non-living and living matter, science stories, history, local communities and tourism' (2020, 1).

16 As I entered the Grotte de Glace, there was an immediate perceptible drop in temperature, as though I were fully submerged in the 'hidden secrets' of the body of ice, to use Luc's words (Figure 9). The close physical proximity facilitates an intimate connection with the depths of the glacier's ice. Unlike the whiter ice perceived outside the cave, the innermost layers of the glacier radiate an ecstatic blue hue imitating the depths of the ocean. Upon a closer look, the frozen layers within the ice are visible, each capturing a unique chapter of the glacier's history. As one dwells further into the cavernous path, one can notice the walls of the cave animated with a series of infographics and pictures that explain its geological history and science. The visual narrative provided by these infographics works well in elucidating the glacier through a geological lens made accessible and comprehensible to visitors seeking a deeper understanding of the glacier's profound complexities.

17 One visitor expressed their experience: ‘It was really something. The whole thing was just so *moving* and beautiful at the same time’. The English term ‘move’ is rich in meaning and complexity, and its various connotations warrant exploration. On one level, ‘movement’ can refer to the physical act of travelling from one location to another. However, it can also encompass a much deeper mobilisation of consciousness that occurs when one is in close proximity to something, evoking profound emotional responses of care and love (Milligan & Wiles, 2010). Karine Gagné’s analysis of glaciers engages with the notion of *care*.

Figure 9 The Grotte de Glace (Ice-Cave), Chamonix-Mont-Blanc.

Source: Photo by the author, 22 March 2023.

18 For Gagné (2019), caring for glaciers extends beyond preserving them as natural resources. Instead, it involves much deeper sensibilities that demand cultivating a sense of empathy and responsibility towards them as something living. She writes, ‘caring for glaciers requires us to rethink our relationship with them, to recognise their inherent value as members of the community of life, and to cultivate a deeper sense of empathy and responsibility towards them’ (2019, 14). To elaborate, the notion of care highlights the importance of cultivating body-knowledges and sensibilities that enable us to attend to the needs of others, including the nonhuman ecologies surrounding us (Gagné, 2019). Inside the Grotte de Glace, visitors are invited to enter the glacier itself, where a vulnerable yet intimate space is carved into the body of ice for humans to enter, see, touch, and immerse in. While this carved out space may initially appear invasive, I argue that it also mediates an intimate encounter between human bodies and the ice. Extending my hand to physically engage with the glacier prompted a shift in my bodily sensibility, allowing me to perceive the glacier differently and attune to its existence. This type of material arrangement within the landscape manifests a form of care by allowing people to physically approach and touch the glacier, creating a

moment of pause that brings us closer to an awareness of the glacier's consciousness. Geotourism products like these immersive spaces create intimate assemblages between the human and glacier worlds. By bringing visitors in close proximity to the glacier and fostering a sense of care and affection, these endeavours introduce a new dimension to the concept of movement. They signify a mobilisation of consciousness, fostering stronger bonds and a heightened sense of accountability towards the world that surrounds us.

The New Glacier Interpretation Centre

19 Further tourism developments are unfolding within the Mer de Glace landscape. The Compagnie du Mont-Blanc is working to restructure Montenvers, following the adoption of an environmental territorial strategic plan for the Mont-Blanc cross-border region. The project includes constructing a new cable car further up the glacier and a new climate interpretation centre. With a projected budget of 53 million euros, the interpretation centre is set to be completed by December 2025. Matthieu Dechavanne, the CEO of Compagnie du Mont-Blanc, stated that the project intends to 'make this glacier and climate interpretation centre a world reference'. He explains further, 'the Montenvers welcomes over one million visitors per year, and our aim is to inform them, in a fun way, about everyday actions and the role we can all play in preserving this environment' (Chamonix Mont Blanc, 2021, para. 14).

20 Next to the Montenvers railway station is an array of display boards providing information about these new developments. At the core of the interpretation centre's design philosophy, the emphasis is placed on 'improv[ing] its integration into the natural landscape'. Through special architectural treatment and material choices, it aims to 'blend in with the landscape' rather than impose rigid linear structures upon it. The curved sweep of glass mirrors the contours of the natural terrain, allowing the built environment to coexist harmoniously with its surroundings. Such attentiveness exemplifies a reconsideration of the productive potential of a melting landscape, where co-creation can occur even in the face of the glacier's retreat. Melting landscapes typically hold connotations of disappearance and decay, yet here, the architects have designed a building that is not determined by its material lifespan but rather by its reversibility and conviviality within the natural landscape. As a design that instils such humility, the new interpretation centre embraces a fluid interlinking of human and geological temporalities within the environmentally changing world.

21 These plans lay the foundation for future dwellings and visitor experiences that prioritise the appreciation and conservation of both geological and cultural heritage. The interpretation centre marks a shift towards innovative scenography and a new vision of glaciers and climate. This is achieved, for example, through its planned immersive educational space that offers a higher viewpoint with a better vantage point to continue observing the receding ice. In addition, the plans include implementing a controlled visitor flow that will slow down the rhythmic activities of visitors in the landscape. This deliberate approach aims to cultivate a more careful and meaningful engagement with the surroundings, deepening the affective connection between humans and the glacier. Further studies and investigations are needed to uncover how these new dwelling experiences will play out in the future and how these configurations might impact visitors' perceptions and interactions with the glacier.

22 In summary, the examples presented demonstrate how visitors are actively seeking to connect with the changing, melting, and disturbed landscape of the Mer de Glace. A sense of urgency drives their motivation to witness and engage with a landscape that may soon disappear. This sense of urgency is rooted in an ‘Anthropocene imaginary’ (Moore, 2019, 440), which has also influenced tourism products. Geotourism practices that focus on geological heritage are coupled with a language of sustainability and innovation that work to revitalise the glacier landscape despite its ongoing retreat. By centring on the geological significance of the landscape, geotourism offers a meaningful way to re-establish a connection between visitors and the changing environment. Within the disturbed landscape of the Mer de Glace, such tourism practices emerge as a vehicle for an imaginative re-envisioning of a possible future in an iceless world. They challenge the prevailing certainties that define our current reality and encourage a shift in perspective towards a more sustainable and responsible approach to engaging with the natural world. In the next chapter, I shift my focus towards more peripheral and creative engagements with the Mer de Glace which offer alternative avenues for engaging with the uncertain future of the disturbed landscape.

FOOTNOTES

1. Other examples include tourism tours on the Pyramides d'Euseigne rock formations in Wallis, Switzerland and tours that trace the past glaciations of the ancient Heren Glacier in Norway.

8. The Speculative Time of Glaciers: Future Imaginaries

> I came across the words of Della Dora, who stated, ‘physically or imaginatively, high places mark the ends of the earth’ (2009, 8). Adding to this, Dan Yü suggested that ‘these ends are the beginnings of our realization of the fragility of the earth as they are barometers informing us of the results of environmental degradation’ (2015, pp 8-9). While glaciers have predominantly been regarded as significant geomorphological actors used as gauges for global warming (Orlove, 2004), Luc asserts that they also ‘speak a sort of language’. They communicate in their own unique way that goes beyond their representations as scientific indicators for global warming. He continues, ‘the terminal part of a glacier is known as the terminal ‘tongue’. That is an interesting term because it relates to language. As the glacier retreats, the glacier tongue speaks of its changes, its origin, and its creation. Perhaps it speaks with consciousness, though we can’t know for sure’.

1 The metaphorical language that Luc describes here suggests glaciers as possessing a level of communication and consciousness, which invites us to consider the significance of these formations in a more nuanced and holistic manner. In light of this, I found myself contemplating what other insights and messages glaciers have to share with the world.

2 Within the fringes of ecological destruction, researchers are discovering unique spaces that offer opportunities for engagement with the Anthropocene, even though these

spaces may not always provide full answers (Roux-Rosier et al., 2018; Rose, 2013; Tsing et al., 2017; Aula, 2021; see also: Kohn, 2013; Drew, 2012; Henshaw, 2016; Anand, 2017; Nüsser & Baghel, 2014). Roux-Rosier et al. stated that imaginative thinking of what lies ahead is a hallmark within the Anthropocene because such a practice 'arises out of spaces created in moments of crisis and uncertainty' (2018, 551). Given the possibly 'apocalyptic stories about environmental devastation' (Gibson & Venkateswar, 2015, 17), scholars recognise the importance of calling for 'social imaginaries' as they are 'important sources of organizing potential in response to the need to adapt in the face of the threat these potential futures pose' (Roux-Rosier et al., 2018, 551).

3 Robin and Muir characterise this imaginative thinking as the exploration of 'a cultural and physical space that has not previously been experienced' (2015, 2). On the one hand, it can be daunting to engage with and pin down. However, simultaneously, it encourages curiosity and recognition of the mutualities between the various species and forms of existence (Rose, 2013). Tsing et al. assert that 'to survive, we need to relearn multiple forms of curiosity. Curiosity is an attunement to multispecies entanglement, complexity, and the shimmer all around us' (2017, G11). To enact new forms of collective practice in the face of a changing world, Rose highlights that 'our ethical imaginations are called upon' (2013, 3). She contends for a particular ethics that imagines new ways of living *with* nature where we can better relate to what we share rather than what may make us different. Similarly, Tsing recognises the creative value that may emerge within landscapes of ruins and disturbances. And building on this, Howe highlights how a melting landscape is an 'invitation to imagine and to sense differently within the fissures and gaps that compose an unbalanced world' (2018, 907). Collectively, these arguments highlight the importance of embracing curiosity, relationality, and imaginative thinking in the face of ecological challenges. Within the gaps and ruins of the melting Mer de Glace landscape, there lies fertile ground for transformative action and the cultivation of ethical imaginations.

4 To explore these glacier narratives and imaginations, I intentionally moved beyond a purely scientific and geological framework and drew insights from the creative arts, aiming to broaden our understanding. According to Hulme (2011), relying solely on the sciences alone is not enough for addressing and articulating the deeper concerns of values, purpose, and meaning in a world facing environmental change. Similarly, building on Gagné, Rasmussen and Orlove's assertion that 'place-based research is fundamental to discuss a global environmental phenomenon such as glacier recession' (2014, 793), Waichler (2021) suggests that exploring creative interventions and interactions between communities and glacier landscapes is a place-based relationship worth exploring. Amidst the melting landscape, a multitude of voices and modes of creativity have emerged. These assemblages paint a holistic understanding of the ever-changing landscape and exemplify alternative ways of co-creation between people and glaciers. Ingold notes how anthropology is in a position that can offer space for such alternatives by drawing on 'what we learn from our education with other people' as this enables us 'to speculate on what the conditions and possibilities of life might be' (Ingold, 2018, 112). I found that the creative arts field that engages with glacier landscapes is one such productive avenue. Through my exploration of artistic expressions, I show how these practices work to respond to and capture the tensions and complexities of this contested time while revealing the multifaceted dimensions of melting landscapes.

Meet the Glaciers with Charlotte Qin

5 In Geneva, Switzerland, Charlotte Qin stands out as an artist whose work revolves around water as a central theme. Through her artistic expressions, particularly in her *Meet the Glaciers* performance, she delves into the affective and transformative qualities of water, offering viewers new points of orientation when engaging with the melting landscape. Charlotte's art deepens our understanding of the multidimensionality of this powerful agentive element. In her work, the glacier landscape extends into an exhibition location, providing space for an embodied process of 'scaling' the natural and geological to human experience. When discussing her artistic aim, she expressed her intention to cultivate a 'safe space' that embraces the expressions of 'all emotions'. This intention resonates well with Tsing's (2015) call to re-engage with the more-than-human world, fostering a sense of connection to our surroundings that compels us to 'want to look after it', especially in times of significant environmental transformations.

6 In Charlotte's *Meet the Glaciers* performance, a block of glacial ice stands alone in the middle of a circular canvas, surrounded by an audience. The sense of frailty and intimacy becomes acute in this space. The ice's radiant white shimmer is ever more prominent against the contrasting black backdrop, inviting the audience to loom in closer. As the ice slowly melts away on the canvas, pigments of ink that she drops intertwine with the fluid movements of its melt. Spread out as organic swells across the canvas, her art creation attests to natural rhythms and occurrences of the ice melt and its active role in co-producing the artwork. She describes her techniques as a way of 'honouring water', to 'treat it with liberation and respect, by understanding how they work and how to make them happy'. She explained further that 'water is not happy within strict and linear confines'. Attuning to the movements of glacier melt means to 'feel its expressions', which is why Charlotte often calls her art 'inner waters' or inner emotional landscapes – it is a landscape of fluid expression.

7 The attunement towards the potential of the nonhuman material entities that Charlotte demonstrates is similar to geologist Jan Zalasiewicz's handling of pebbles in his book *The Planet in a Pebble*. For Zalasiewicz, pebbles not only hold traces of historical and biological pasts but also allow him to dream of a different future at the brink of disaster - a future in which livelihood and good fortune do not come at the expense of devastation and death. Similarly, Charlotte's creative exploration of water and ice is a practice of imagination that offers a space for open-ended emotions to unfold. A fruitful reworking and affective response can occur within the inherent fragility of her work. As Nathalie Blanc reminds us, 'We want to open a space of anxiety to begin to become familiar with what scares us' (2016, para.7). As the audience is invited to observe melt intricately and introspectively, Charlotte fearlessly opens up a space of discomfort and friction. The impact of her work is such that it cannot be easily dismissed or disregarded. The anxiety one experiences while viewing and engaging with her creative exploration is not one of hopelessness; instead, it serves as an instigator for acknowledging the fragility of ice landscapes and cultivating new ways of collective thinking. This engenders a heightened sense of empowerment and potentiality from within.

8 Ranzo Toddai (2013) presents a compelling argument regarding how different conceptions of climate and the natural environment can shape individuals' agency and relationship with the natural world. Toddai highlights the limitations of linear and predictable weather forecasts, which construct an imaginative framework that restricts

the possibilities for creative and alternative ways of inhabiting the world. Along the same lines, Charlotte's artistic practice refuses a linear fashion and instead emphasises creative and unpredictable forms of expression. She explained how she challenges 'Western linear storytelling', which often prioritises a linear notion of 'positive' progress. Her circular storytelling is reflected in the round shape of her canvases and her creation of communal gathering that embraces a space for grievances. She emphasised the crucial need for creating spaces where people can openly express their emotions in relation to climate change, even those that might seem unproductive, an opportunity often 'lacking in Western societies'. She gave the example of climate conferences, where discussions about the future of our climate and world are consistently framed within a narrative of continuous progress. Alternatively, her performances, she describes, prepare 'for the future in a circular format'. Moreover, in contrast to the prevalent portrayal of melting glaciers through shock-inducing images and anxiety-inducing narratives that have gained a prominent online presence, Charlotte's work aligns with Tsing's call to acknowledge and 'stay with loss' rather than immediately looking towards the immediate promises of the future.

Co-relational Spaces

9 Waichler posits the concept of glaciers as a 'community', suggesting that within these landscapes, the potential exists for the co-creation of 'relational spaces' between individuals and glaciers (2021, 64). In line with this notion, Charlotte recognises the significant role of artists by asserting their 'responsibility' in fostering these connections. Charlotte's artistic approach deeply examines the glacier's materiality, inviting viewers to pause and attune to the nonhuman senses collectively. Through these purposeful engagements, she presents an evocative space that exudes an 'imaginary of a porous, integrative boundary' between humans and the glacier (Rout-Rosier et al., 2018, 563). This reimagining of 'nonhuman integration into humanized spaces' is a critical consideration in the context of the Anthropocene, as highlighted by Rout-Rosier et al. (2018, 563).

10 In the Aletsch Glacier, photographer Spencer Tunick's art installation orchestrated a similar thought-provoking work by photographing a community of six-hundred people on the glacier ice. Each person is seen standing barefoot and unclothed on the melting and darkening landscape, symbolising the collective vulnerability of glaciers and humanity to climate change (Vanishing Ice, n.d). Tunick purposely intertwines human presence with the glacier landscape, creating a juxtaposition that may initially strike the viewers as peculiar. In the past, glaciers have often been portrayed in isolation, without human presence, emphasising their grandeur and timelessness. However, his deliberate blend of humans, glaciers, and nature challenges the conventional perspective and speaks to the larger interconnected web of human-environment interactions. He employs glaciers as a key element of the social imaginary, as he explains: 'I want my images to go more than skin-deep. I want the viewers to feel the vulnerability of their existence and how it relates closely to the sensitivity of the world's glaciers' (Vanishing Ice, n.d., para. 2). Similarly, Luc pointed out that 'for our health, our daily activities, the food we eat, the water we drink, the air we breathe and the ground we stand on; it is all connected to the health of the glacier'. This underscores our position within a larger and interconnected system, where our futures are intertwined with the fate of glaciers and the broader interconnected web of life.

Sonic Intimacy

11 Another form of human-glacier engagement is the trend of producing glacier music. Sound artist Ludwig Berger, along with a team of researchers and students from the Chair of Landscape Architecture Christophe Girot, at ETH Zurich, uses a self-made contact microphone to record the sounds of the melting and moving ice from the Morteratsch Glacier in Switzerland. Hydrophone devices cultivate a sonic intimacy in the glacier's body, exploring its textures and resonances intricately (ETH Zurich, 2012). In a 2021 interview with *Deutsche Welle*, Berger explained that 'of course it is normal for glaciers to melt, and there's always fluctuations. But this extreme decline is made clearly through sound. Because the more the glacier melts, the louder the sound arise. And you can really hear this body dying' (Berger, 2021). Typically, when we think of glacier landscapes, the visual elements come to mind rather than their auditory character. Liz Gerring's dance choreography called *Glacier* engages with glacier soundscapes as well. The sound was produced by Michael J. Schumacher, recorded from the glaciers in Colorado. Here, the creative dance performance engages with the unpredictable, non-linear structures of natural sounds taken from the glacier landscape (Lizz Gerring Dance Company, n.d.). As these icy formations retreat into a minority presence, creative practices such as glacier music offer a unique way to engage and connect with these landscapes, where people, even those living further away from glaciers, can come to understand their transformations audibly. 'By listening to ice, it offers a diverse visceral experience that helps us consider the deeply entangled relations between human and nonhuman worlds through multisensory attentions' (Barry et al., 2021).

12 Together these creative explorations exemplify another form of assemblage that has emerged within the disturbed and melting landscape of glaciers, one filled with creative optimism when confronting the Anthropocene without necessarily succumbing to ideas of despair and catastrophe. These works open up spaces for meaningful engagement with the landscape. It is an offered space that disrupts 'the narrative of the inevitable world given to us in which we can only react' (O'Riordian, 2017, 3). They also evoke a cautious sense of hope towards new forms of observation, thinking and action in precarious times. As Jackson aptly points out, 'Given the proposition to name today's era as the Anthropocene, where the world is gradually increasing the cacophony of conflicting climate change narratives, it is imperative to understand the production of narratives and acknowledge the power they carry—and how climate change transforms them' (2015, 480). Amidst the melting of glaciers such as the Mer de Glace and the Great Aletsch Glacier, the range of possible futures narrows, and the prospect of a world without ice becomes a very real possibility. However, creative works discussed above propose alternative visions of ecological-human relations that mobilise the power of imagination to think about the more-than-human world and the futures we have in it, with it. Jackson further underscores the profound impact of narratives and storytelling on our ability to envision, embrace and make sense of the future. He quotes Joan Didion, who famously said, 'We tell ourselves stories in order to live' (2015, 480). Within 'the fissures and gaps' of the melting world, creative interventions and commemorative efforts like Charlotte's emerge, further emphasizing the cultural and introspective significance of these ice landscapes (Howe,

2019, 907). In this evolving narrative, we must continue to explore and reimagine our relationship with the changing world around us.

9. Conclusion

1 Glaciers such as the Mer de Glace have been under close documentation for decades and have been observed by artists, scientists and the general public in various ways throughout history (Jackson 2015, Carey, 2007). As these terrains retreat further away, and their ice flows transform into streams of meltwater, glaciers have taken on changing social meanings. They have now come to embody the prevalent narrative as the 'most tangible manifestation of anthropogenic climate change' (Jackson, 2015, 479). While glacier landscapes have often been understood as heading towards a ruined future, the disturbed and melting landscape of the Mer de Glace also offers evocative spaces for the reshaping and redefining of human and non-human relations and meaning. As Tsing (2015) reminds us, ending the story with 'decay' fails to capture the complexity of our current situation and hinders our ability to address these pressing issues effectively. My explorations of how people navigate and dwell in the Mer de Glace landscape, which have been undergoing profound transformations, reveal a vibrant interplay of new social and environmental assemblages, activities, and experiences. The melting and retreating glacier not only reshapes the physical features of the environment but also influences the activities and experiences of individuals within its environment. As the ice melts, it disrupts the customary temporalities of mobility. It has altered the accessibility to the landscape and its afforded possibilities while simultaneously providing new forms of embodied experiences. Whether it is the shortened skiing seasons or the changing routes and obstacles caused by the melting terrain, these shifts in embodied experiences shape the perception of the Mer de Glace landscape as ephemeral and fleeting. More so, the glacier valley is laden with 'traces' of an invisible past, whereby its ghostly presence continues to linger in the present, evoking memories, nostalgia, and a profound sense of longing for those who dwell in them (Tsing et al., 2017, G1). The historical imprints within its landscape, such as the time plaques and the remnants of lost ice features, connect people to the past and inspire visions of the future. These traces invite people to contemplate and envision the anticipated future of the Mer de Glace, urging them to engage in a prospective journey towards its transformation. In response to and in the face of the changing and disturbed landscape of the Mer de Glace, a new imaginative thinking of the glacier's future has emerged. My research has shown that the emergence of alternative utopian visions of its landscape is manifested in political, educational, tourism and creative spaces (Rout-Rosier et al., 2018). In the various examples I have examined in this study,

it is without a doubt evident that melting processes have prompted a pivotal discourse in our changing world. If anything, melt has underscored the urgency of deepening our appreciation for glaciers and their significance in our interconnected existence. Rather than immediately focusing on catastrophe and an iceless world, I follow and urge Anna Tsing's framework of constructively envisioning possible futures with the more-than-human world amidst environmental challenges.

2 Finally, the vast and ever-changing landscape of the Mer de Glace offers exciting prospects for future research, particularly in understanding the intricate socioenvironmental relations within this dynamic setting. Future investigations may explore how the discussed emerging tourism developments will unfold as the glacier melts. In this context, there are opening avenues to explore the types of experiences and social assemblages that may emerge. Additionally, studies can explore other multi-species entanglements by considering other dwelling activities of glacier landscapes, humans, local flora, and fauna. By attuning to the unique ecosystem of Chamonix and its surrounding areas, these research avenues offer opportunities to uncover new dimensions of socioenvironmental relations and contribute to our broader knowledge of the Mer de Glace landscape and its evolving significance.

References

1 Agrawala, S. (2007). Climate change in the European Alps: adapting winter tourism and natural hazards management. Organisation for Economic Cooperation and Development (OECD).

2 Aletsch Arena. (n.d.). The ski area for families and connoisseurs. Skiing in the Aletsch Arena. https://www.aletscharena.ch/en/activities/skiing

3 Allerton, C. (2013). Potent landscapes: place and mobility in Eastern Indonesia. University of Hawaii Press.

4 Anand, N. (2017). Hydraulic city: Water and the infrastructures of citizenship in Mumbai. Duke University Press.

5 Aula, I. (2021). Discovering Weedy Landscapes as Sensory Commons. Dimensions. Journal of Architectural Knowledge, 1(2), 165-182.

6 Ballestero, A. (2019). The anthropology of water. Annual Review of Anthropology, 48, 405-421.

7 Barker, M. L. (1982). Traditional landscape and mass tourism in the Alps. Geographical Review, 395-415.Chicago

8 Barker, M. L. (1982). Traditional landscape and mass tourism in the Alps. Geographical Review, 395-415.

9 Barry, K. (2019). More-than-human entanglements of walking on a pedestrian bridge. Geoforum, 106, 370-377

10 Barry, K., Duffy, M., & Lobo, M. (2021). Speculative listening: melting sea ice and new methods of listening with the planet. Global Discourse, 11(1-2), 115-129.

11 Berger, Ludwig 2021. Deutsche Welle - The sound of melting glaciers [Video file]. http://ludwigberger.com/index.php/01/melting-landscapes/

12 Bjornerud, M. (2019). Timefulness: How thinking like a geologist can help save the world. Princeton University Press.

13 Blanc, Nathalie. (2016, June 27). Frailty. New Materialism. Retrieved October 29, 2022, from https://newmaterialism.eu/almanac/f/frailty.html

14 Blanchard, A. (2019). Unearthing Greenland's resource frontier: Mineral resource extraction and Naalakkersuisut's bid for Greenlandic Independence (Doctoral dissertation).

15 Bolin, I. (2009). The glaciers of the Andes are melting: indigenous and anthropological knowledge merge in restoring water resources. Anthropology and climate change: From encounters to actions, 228, 239.
16 Boyer, D. (2022). Infrastructural Futures in the Ecological Emergency. Historical Social Research/Historische Sozialforschung, 47(4), 48-65.
17 Brugger J, Dunbar KW, Jurt C, Orlove B. Climates of anxiety: comparing experience of glacier retreat across three mountain regions. Emot Space Soc 2012:1–10. doi: 10.1016/j.emospa.2012.05.001.
18 Butler, J. (2004). Precarious Life: The Powers of Mourning and Violence. New York:Verso.
19 DOI: 10.1177/0196859907305159Carey, M. (2007), 'The History of Ice: How Glaciers Became an Endangered Species', Environmental History, Vol. 12, N°3, pp. 497-527.
20 Carey, M. (2010). In the shadow of melting glaciers: Climate change and Andean society. Oxford University Press.
21 Carey, M., French, A., & O'Brien, E. (2012). Unintended effects of technology on climate change adaptation: an historical analysis of water conflicts below Andean Glaciers. Journal of Historical geography, 38(2), 181-191.
22 Chamonix Mont Blanc. (2021). Montenvers : Past, present and future. Chamonix Mont Blanc. https://en.chamonix.com/infos-et-services/espace-pro-presse/le-montenvers-unehistoire-des-projets
23 Chanaron, S. (2023). La métamorphose du Montenvers Dévoilée !. Actumontagne https://www.actumontagne.com/sports/la-10e-echappee-belle-dans-les-starting-blocs/
24 Citton, Y. (2018). Nature's Ghosts: Environmentalism as Spectral Mediality.
25 Clivaz, C., & Savioz, A. (2020). Glacier retreat and perception of climate change by local tourism stakeholders: the case of Chamonix-Mont-Blanc in the French Alps. Peerreviewed article. Via. Tourism Review, (18).
26 Communauté de Communes de la Vallée de Chamonix-Mont-Blanc (CCVVCMB). (2012). Plan Climat-Energie Territorial (PCET) de la Communauté de Communes de la Vallée de Chamonix Mont-Blanc. (No. 1412_1341066419) MyCovenant, https://mycovenant.eumayors.eu/docs/seap/1412_1341066419.pdf
27 Crate, S. A., & Nuttall, M. (Eds.). (2016). Anthropology and climate change: from encounters to actions. Routledge.
28 Cruikshank, J. (2007). Do glaciers listen?: local knowledge, colonial encounters, and social imagination. ubc Press.
29 Cruikshank, J. (2012). Are glaciers 'good to think with'? Recognising indigenous environmental knowledge. In Anthropological Forum (Vol. 22, No. 3, pp. 239-250). Routledge.
30 Deleuze, G., & Guattari, F. (1988). A thousand plateaus: Capitalism and schizophrenia. Bloomsbury Publishing.
31 Denning, A. (2014). Skiing into Modernity: A Cultural and Environmental History (Vol. 3). University of California Press.
32 Descola, P., & Pálsson, G. (Eds.). (1996). Nature and society: anthropological perspectives. Taylor & Francis.
33 Drew, G. (2012). A Retreating Goddess? Conflicting Perceptions of Ecological Change near the Gangotri-Gaumukh Glacier. Journal for the Study of Religion, Nature & Culture, 6(3).

34 Elixhauser, S. (2015). Climate Change Uncertainties in a Mountain Community in South Tyrol. Reuter T., Averting a Global Environmental Collapse. The Role of Anthropology and Local Knowledge. Cambridge Scholars Publishing, Cambridge, 45-64.
35 ETH Zurich. (2022). Discover how landscapes sound. ETH Zurich. https://ethz.ch/en/newsand-events/eth-news/news/2022/10/podcast-discover-how-landscapes-sound.html
36 France24. (2023). Climate change: High temperatures, sparse snowfall in Europe's Alps worries Ski Industry. Climate change: High temperatures, sparse snowfall in Europe's Alps worries ski industry. https://www.france24.com/en/europe/20230104-climatechange-high-temperatures-sparse-snowfall-in-europe-s-alps-worries-ski-industry
37 Gabrys, J., & Yusoff, K. (2012). Arts, sciences and climate change: practices and politics at the threshold. Science as culture, 21(1), 1-24. Chicago
38 Gagné, K. (2019). Caring for glaciers: land, animals, and humanity in the Himalayas. University of Washington Press.
39 Gagné, K., Rasmussen, M. B., & Orlove, B. (2014). Glaciers and society: Attributions, perceptions, and valuations. Wiley Interdisciplinary Reviews: Climate Change, 5(6), 793-808.
40 Gan, E., Tsing, A., Swanson, H., & Bubandt, N. (2017). Introduction: Haunted landscapes of the Anthropocene. Arts of living on a damaged planet: Ghosts and monsters of the Anthropocene, 1-14.
41 Gibson, H., & Venkateswar, S. (2015). Anthropological engagement with the Anthropocene: A critical review. Environment and Society, 6(1), 5-27.
42 Ginn, F., Bastian, M., Farrier, D., & Kidwell, J. (2018). Introduction: unexpected encounters with deep time. Environmental Humanities, 10(1), 213-225.
43 Gordon, J. E. (2018). Geoheritage, geotourism and the cultural landscape: Enhancing the visitor experience and promoting geoconservation. Geosciences, 8(4), 136.
44 Govindrajan, R. (2018). Animal Intimacies. In Animal Intimacies. University of Chicago Press.
45 Gruppuso, P. (2020). Nature as a constellation of activities: movement, rhythm and perception in an Italian national park. Social Anthropology/Anthropologie sociale, 28(3), 629-645.
46 Gruppuso, P., & Whitehouse, A. (2020). Exploring taskscapes: an introduction. Social Anthropology/Anthropologie sociale, 28(3), 588-597.
47 Gumuchian Hervé. B. Debarbieux : Chamonix Mont Blanc : les coulisses de l'aménagement.. In: Revue de géographie alpine, tome 81, n°1, 1993. pp. 106-107.
48 Haraway, D. (2008). Companion species, mis-recognition, and queer worlding. Queering the non/human, xxiii-xxxvi.
49 Haraway, D. J. (2016). Staying with the trouble: Making kin in the Chthulucene. Duke University Press.
50 Hayman, E., James, C., & Wedge, M. (2018). Future rivers of the Anthropocene or whose Anthropocene is it? Decolonising the Anthropocene!. Decolonization: Indigeneity, Education & Society, 7(1), 77-92.
51 Henshaw, A (2016). Sea ice: the sociocultural dimensions of a melting environment in the Arctic. In Anthropology and Climate Change (pp. 153-165). Routledge.
52 Howe, C. (2019). Sensing asymmetries in other-than-human forms. Science, Technology, & Human Values, 44(5), 900-910.

53 Howe, C. (2020). Melt in the Future Subjunctive. Ecological Nostalgias: Memory, Affect and Creativity in Times of Ecological Upheavals, 26, 166.
54 Howe, C. (2022). Hydrological globalization. HELIOTROPE. https://www.heliotropejournal.net/helio/hydrological-globalization
55 Hulme, M. (2011). Reducing the future to climate: a story of climate determinism and reductionism. Osiris, 26(1), 245-266.
56 Ingold, T. (1993). The temporality of the landscape. World archaeology, 25(2), 152-174.
57 Ingold, T. (2000). The perception of the environment: essays on livelihood, dwelling and skill. Psychology Press.
58 Ingold, T. (2010), Footprints through the weather-world: walking, breathing, knowing. Journal of the Royal Anthropological Institute, 16: S121–S139.
59 Ingold, T. (2017). On human correspondence. Journal of the Royal Anthropological Institute, 23(1), 9-27.
60 Ingold, T. (2018). Anthropology: Why it matters. John Wiley & Sons.
61 Jackson. (2015). Glaciers and climate change: narratives of ruined futures. Wiley Interdisciplinary Reviews. Climate Change, 6(5), 479–492. https://doi.org/10.1002/wcc.351
62 Järviluoma, H. (2023). 6 Sensobiography as a mobile search for relational knowledge. Sensory Transformations: Environments, Technologies, Sensobiographies, 6.
63 Kaplan, E. A. (2015). Climate trauma: Foreseeing the future in dystopian film and fiction. Rutgers University Press.
64 Kaplan, E. A. (2020). Is climate-related pre-traumatic stress syndrome a real condition?. American Imago, 77(1), 81-104.
65 Kirksey, S. E., & Helmreich, S. (2010). The emergence of multispecies ethnography. Cultural anthropology, 25(4), 545-576.
66 Kohn, E. (2013). How forests think: Toward an anthropology beyond the human. Univ of California Press.
67 Krause, F. (2013). Seasons as rhythms on the Kemi River in Finnish Lapland. Ethnos, 78(1), 23-46.
68 Kulturen der Alpen. (n.d.). Mountain Ice. middle stone age rock crystals in the Alps. Institut 'Kulturen der Alpen', https://www.kulturen-der-alpen.ch/en/research/project/mountain-ice-middle-stone-age-rock-crystals-in-the-alps
69 Latour, B. (2007). Reassembling the social: An introduction to actor-network-theory. Oup Oxford.
70 Latour, B. (2017). Anthropology at the time of the Anthropocene: a personal view of what is to be studied. In The anthropology of sustainability (pp. 35-49). Palgrave Macmillan, New York.
71 Lemelin, H., Dawson, J., Stewart, E. J., Maher, P., & Lueck, M. (2010). Last-chance tourism: The boom, doom, and gloom of visiting vanishing destinations. Current Issues in Tourism, 13(5), 477-493.
72 Lien, M. E., & Pálsson, G. (2021). Ethnography beyond the human: the 'other-than-human'in ethnographic work. Ethnos, 86(1), 1-20.
73 Liz Gerring Dance Company. (n.d.). Glacier. Liz Gerring Dance Company. https://www.lizgerringdance.org/glacier
74 Lounela, A. K. (2019). Erasing memories and commodifying futures within the Central Kalimantan landscape. Dwelling in Political Landscapes.

75 Lounela, A., Berglund, E., & Kallinen, T. (2019). Dwelling in political landscapes: contemporary anthropological perspectives (p. 296). Finnish Literature Society/SKS
76 Lounela, A., Berglund, E., & Kallinen, T. (2019). Dwelling in political landscapes: contemporary anthropological perspectives (p. 296). Finnish Literature Society/SKS. Magnason, A. S. (2021). On time and water (Vol. 34). Biblioasis.
77 Marin, A., & Berkes, F. (2013). Local people's accounts of climate change: to what extent are they influenced by the media?. Wiley Interdisciplinary Reviews: Climate Change, 4(1), 1-8.
78 Mathews, A. S. (2017). Ghostly forms and forest histories. Arts of living on a damaged planet, G145-G156.
79 Milligan, C., & Wiles, J. (2010). Landscapes of care. Progress in Human Geography, 34(6), 736-754.
80 Moore, A. (2019). Selling Anthropocene space: situated adventures in sustainable tourism. Journal of Sustainable Tourism, 27(4), 436-451.
81 Mostafanezhad, M., & Norum, R. (2019). The anthropocenic imaginary: Political ecologies of tourism in a geological epoch. Journal of Sustainable Tourism, 27(4), 421-435.
82 Mourey, J., Marcuzzi, M., Ravanel, L., & Pallandre, F. (2019). Effects of climate change on high Alpine mountain environments: Evolution of mountaineering routes in the Mont Blanc massif (Western Alps) over half a century. Arctic, Antarctic, and Alpine Research, 51(1), 176-189.
83 Nassauer, J. (Ed.). (2013). Placing nature: culture and landscape ecology. Island Press.
84 Nöbauer, H. (2022). Our Existence Is Literally Melting Away. Cooling Down: Local Responses to Global Climate Change, 223.
85 Nussbaumer, S. U., Zumbühl, H. J., & Steiner, D. (2007). Fluctuations of the' Mer de Glace'(Mont Blanc area, France) AD 1500-2050. Part I: The history of the Mer de Glace AD 1570-2003 according to pictorial and written documents. Zeitschrift für Gletscherkunde und Glazialgeologie, 40, 5-140.
86 Nüsser, M., & Baghel, R. (2014). 5 The Emergence of the Cryoscape: Contested Narratives of Himalayan Glacier Dynamics and Climate Change. In Environmental and climate change in south and Southeast Asia (pp. 138-157). Brill.Chicago
87 O'Riordan, K. (2017). Unreal objects: Digital materialities, technoscientific projects and political realities.
88 Orange Business. (n.d.). The Compagnie du Mont-Blanc and the Chamonix Tourist Office count visitors. Orange Business. https://www.orange-business.com/en/casestudy/compagnie-du-mont-blanc-counts-visitors
89 Orlove, B. (2004). The place of glaciers in natural and cultural landscapes.
90 Orlove, B., Milch, K., Zaval, L., Ungemach, C., Brugger, J., Dunbar, K., & Jurt, C. (2019). Framing climate change in frontline communities: anthropological insights on how mountain dwellers in the USA, Peru, and Italy adapt to glacier retreat. Regional Environmental Change, 19, 1295-1309.
91 Orlove, B., Wiegandt, E., & Luckman, B. (2008). Darkening Peaks: Glacier Retreat, Science, and Society. University of California Press.
92 Orlove, B., & Caton, S. C. (2010). Water sustainability: Anthropological approaches and prospects. Annual Review of Anthropology, 39, 401-415.
93 Paphitis, T. (2020). Haunted landscapes: place, past and presence. Time and Mind, 13(4), 341-349.

94 Papmehl-Dufay, L. (2015). Places that matter: Megalithic monuments from a biographical perspective.
95 Petryna, A. (2022). Horizon Work: At the Edges of Knowledge in an Age of Runaway Climate Change. Princeton University Press.
96 Robin, L., & Muir, C. (2015). Slamming the Anthropocene: performing climate change in museums. ReCollections, 10(1).
97 Roitman, J. (2012). Crisis. Crisis', in Political Concepts: A Critical Lexicon (Tel Aviv, New York).
98 Rose, D. (2009). Introduction: writing in the Anthropocene. Australian Humanities Review, (47), N_A.
99 Salim, E. (2023). Glacier tourism without ice: Envisioning future adaptations in a melting world. Frontiers in Human Dynamics, 5, 1137551.
100 Salim, E., & Ravanel, L. (2020). Last chance to see the ice: Visitor motivation at Montenvers-Mer-de-Glace, French Alps. Tourism geographies, 1-23.
101 Salim, E., Mabboux, L., Ravanel, L., Deline, P., & Gauchon, C. (2021). A history of tourism at the Mer de Glace: Adaptations of glacier tourism to glacier fluctuations since 1741. Journal of Mountain Science, 18(8), 1977-1994.
102 Salmi, J. J. (2019). An Anthropology of Disturbed Landscapes. Ethnologia Fennica.
103 Schmidt, J. J. (2021). Glacial Deaths, Geologic Extinction. Environmental Humanities, 13(2), 281-300.
104 Schrey, D. (2020). Alpine Topographies of Loss: On the Media Temporality of Glaciers. The Journal of Media Art Study and Theory, 1(2), 148-172.
105 Scott, D., Jones, B., & Konopek, J. (2007). Implications of climate and environmental change for nature-based tourism in the Canadian Rocky Mountains: A case study of Waterton Lakes National Park. Tourism management, 28(2), 570-579.
106 Sillitoe, P. (Ed.). (2021). The Anthroposcene of Weather and Climate: Ethnographic Contributions to the Climate Change Debate. Berghahn Books.
107 Sokolickova, Z., Meyer, A., & Vlakhov, A. V. (2022). Changing Svalbard: Tracing interrelated socio-economic and environmental change in remote Arctic settlements. Polar Record, 58.
108 Staring, N. (2022). Exploring Landscape: Layerdness, Temporality, Authorship. In The Saqqara Necropolis through the New Kingdom (pp. 18-53). Brill.
109 Steinmann, D. (2022, August 9). Debris from 1968 plane crash found on Swiss Glacier. SWI swissinfo.ch. https://www.swissinfo.ch/eng/business/debris-from-1968-plane-crash-found-on-swiss-glacier/47807090
110 Stengers, I. (2005). Deleuze and Guattari's last enigmatic message. ANGELAKI journal of the theoretical humanities, 10(2), 151-167.
111 Stibbon, E., & Ferran, V. (2021). In Search of the Sublime: As the Alps undergo visible changes due to climate warming, the programme follows artist and Royal Academician Emma Stibbon to Chamonix-Mont-Blanc in France.
112 Strang, V. (2015). Water: Nature and culture. Reaktion Books.
113 Strauss, S. (2007). An ill wind: the Foehn in Leukerbad and beyond. Journal of the Royal Anthropological Institute, 13, S165-S181.
114 Strauss, S. (2016). Global Models, Local Risks: Responding to Climate Change in the Swiss Alps. In Anthropology and climate change (pp. 166-174). Routledge.

115 Swyngedouw, E. (2009). The political economy and political ecology of the hydro-social cycle. Journal of contemporary water research & education, 142(1), 56-60.
116 Taddei, R. (2013). Anthropologies of the future: on the social performativity of (climate) forecasts. In Environmental Anthropology (pp. 260-279). Routledge.
117 Thompson, L. G. (2007). Abrupt Climate Changes: Past, Present and Future. J. Land Resources & Envtl. L., 27, 101.Chicago
118 Thompson, L. G. (2017). Past, present, and future of glacier archives from the world's highest mountains. Proceedings of the american philosophical society, 161(3), 226-243.
119 Tsing, A. (2012). Contaminated Diversity in' Slow Disturbance' Potential Collaborators for a Liveable Earth. RCC Perspectives, (9), 95-98.
120 Tsing, A. L. (2015). The Mushroom at the End of the World. In The Mushroom at the End of the World. Princeton University Press.
121 Van Dooren, T., Kirksey, E., & Münster, U. (2016). Multispecies StudiesCultivating Arts of Attentiveness. Environmental Humanities, 8(1), 1-23.
122 Vanishing Ice. (n.d.). Spencer Tunick. VANISHING ICE. http://vanishingice.org/spencertunick/
123 Vergara, W., Deeb, A., Valencia, A., Bradley, R., Francou, B., Zarzar, A., ... & Haeussling, S. (2007). Economic impacts of rapid glacier retreat in the Andes. Eos, Transactions American Geophysical Union, 88(25), 261-264.
124 Vincent, P. (2021). Visitors' books and registers in nineteenth-century Chamonix: ordering the sublime. Studies in Travel Writing, 25(3), 403-420.
125 Waichler, C. E. (2021). Visualizing the Range of Glaciers: Science, Art and Narrative.
126 Yü, D. S. (2015). Mindscaping the Landscape of Tibet. In Mindscaping the Landscape of Tibet. De Gruyter.
127 Zalasiewicz, J. (2012). The planet in a pebble: A journey into earth's deep history. Oxford University Press.